APPENDIX H:

SERVICING AND STORMWATER MANAGEMENT PLAN

2021-02-19

Mr. David Sajecki,
Sajecki Planning

Subject: 191-08340-00 HOMUN Addendum Letter for New Population Numbers

Dear Client:

WSP is pleased to present the following letter as an addendum to the previously submitted August 13th, 2020 servicing report for the water, wastewater and stormwater servicing of the proposed Health Oriented Mixed-Use Node (HOMUN) Intensification area. This memo serves to validate previously made recommendation and build on them to reflect updated population provided Feb 17/2021.

Water

As Shown in Table 1, the demand calculations were updated using the revised population density. Detailed calculation have been appended at the end of this letter. The updated population numbers results in lower demand requirements for all scenarios.

Table 1: HOMUN Neighbourhood Development Domestic Demands Update

	Persons	ADD (L/s)	MDD (L/s)	PHD (L/s)
August 13, 2020 Report	**19353**	**54**	**122**	**217**
February 24th, 2021	**17770**	**49**	**110**	**196**

The updated demands were applied in the model at the proper junctions, and updated simulations for pressures and fire flows were completed. The simulations show that expected pressure within the Hospital District Development site are expected to range between 41 psi and 58 psi and between 33 psi and 58 psi in 2016 and 2031 planning horizon respectively (for all scenarios considered). The simulated available fire flow within the site ranged between 123 L/s 2087 L/s under 2016 condition and between 122 L/s and 1812 L/s under 2031 condition. Comparing these results to the results presented in the August 13th 2020 submission, it can be concluded that the difference in demand is expected to cause less than 1% change in simulated pressure and fire flow.

Similarly, having verified the existing pressures throughout Zone O3 without the

proposed demands, and comparing them to the simulations of Zone O3 with the updated demands presented herein, we can confirm that the difference/change is insignificant and that Zone O3 will not significantly be impacted by the updated demands of the Hospital District site.

From the above findings, the sizing of the proposed Hospital District watermain infrastructure will not be impacted by the updated demands. Similarly, the Zone O3 infrastructure considered herein is consistent with the findings of the original report and will consequently not be impacted.

Wastewater

Similar to water, and as shown in Table 2, the total population change in the proposed catchments caused a decrease in expected wastewater flows. The change is therefore negative and negligible, and therefore the content of WSP's August 2020 report are still valid and are rather conservative, with one (1) exception as mentioned below.

Table 2: Density and Flow Comparison (detail provided at the end).

	Non-Res. Population	Res. Population	Persons	Total Design Flow=Peak +I/I (L/s)
August 13, 2020 Report	**10767**	**8585**	**19353**	**199.4**
February 24th, 2021	**11955**	**5815**	**17770**	**187.4**

Also, for the sub-catchment level there is a decrease in population except for sub-catchment 5. WSP has updated/run the model and recommends the proposed sewers: SMN56782 and SMN56813 suggested to service Sub-Catchment 5, should be upsized from 300mm to 400mm. Apart from this one and only change, the other proposed sewer infrastructure (proposed and/or existing) will remain unchanged.

Details of the population comparison and flow calculations are presented at the end of the letter. WSP has also updated the model provided with this letter.

Stormwater:

Stormwater remains fully unchanged from the aforementioned report.

Should you wish to discuss any aspect of this report, please do not hesitate to contact me.

Kind regards,

Asantha Fonseka, M.Eng., P.Eng.

Linear Infrastructure

WSP Canada Group Ltd.

Antoine Lahaie, B.Eng., E.I.T.

Project Manager, Hydraulics

WSP Canada Group Ltd.

Table 3: Flow per Sub-Catchment.

Parcel ID	Sub-Catchment	New Design Flow=Peak +I/I (L/s)	Previous Design Flow=Peak +I/I (L/s)	Change (New-Previous Design Flow)
11	1	24.6	25.1	-0.5
12				
13				
14				
15				
21	2	20.8	22.5	-1.7
22				
23				
24				
25	3	13.8	14.9	-1.1
26				
27				
31	4	25.9	27.2	-1.3
32				
33				
34				
35				
36				
53				
41	5	56.5	54.7	1.8
42				
43				
44				
51	6	45.8	55.1	-9.3
52				
	Total	**187.4**	**199.4**	**-12.0**

Table 4: Detailed Population Comparison per Parcel ID.

PARCEL ID	New Density (Residential)	New Density (Non-Residential)	New Density (Residential + Non-Residential)	Previously Reported Density (Aug 13, 2020 Report) (Residential)	Previously Reported Density (Aug 13, 2020 Report) (Non-Residential)	Previously Reported Density (Aug 13, 2020 Report) (Non-Residential + Residential)	Change (New Density minus Previously Reported Density) (Residential)	Change (New Density minus Previously Reported Density) (Non-Residential)	Change (New Density minus Previously Reported Density) (Residential and Non-Residential)
11	153	178	331	190	148	338	-37	30	-8
12	219	256	475	273	213	486	-54	43	-11
13	140	163	303	174	136	310	-34	27	-7
14	244	284	528	304	237	540	-60	47	-12
15	269	314	584	335	262	597	-66	52	-14
21	203	237	440	404	79	483	-201	158	-44
22	193	225	417	384	75	459	-191	150	-41
23	221	258	480	441	86	527	-220	172	-48
24	197	230	427	393	77	469	-196	153	-42
25	143	167	311	286	56	341	-142	111	-31
26	193	225	418	384	75	459	-191	150	-41
27	179	209	388	356	70	426	-178	139	-38
31	174	203	377	173	203	376	1	0	1
32	161	188	348	160	188	348	1	0	1
33	151	176	328	151	176	327	1	0	1
34	117	136	253	117	136	253	0	0	0
35	146	170	316	145	170	315	1	0	1
36	114	133	246	113	133	246	0	0	0
41	370	432	802	480	202	681	-109	230	121
42	700	817	1517	945	397	1342	-245	420	175
43	298	347	645	386	162	548	-88	185	97
44	1230	1434	2664	1991	837	2828	-761	598	-164
51	-	2637	2637	-	3390	3390	0	-753	-753
52	-	1992	1992	-	2561	2561	0	-569	-569
53	-	544	544	-	700	700	0	-156	-156
Total	**5,815**	**11,955**	**17,770**	**8,585**	**10,767**	**19,353**	**-2771**	**1188**	**-1583**

HOMUN Neighborhood Development

Average Demand			Peaking Factors	
Residential	265	L/Person/Day	Maximum Day	2.25
Non-Residential	225	L/Emp/Day	Peak Hour	4.0

Notes: Average Day Demand Rates taken from: Regional Municipality of Halton Water and Wastewater Linear Design Manual

Node	Parcel ID	Area	Land Use	Total No. of Jobs	Residential Population	Persons	Average Day (L/s)	Maximum Day (L/s)	Peak Hour (L/s)
HO-J0001	14	1	Urban Core	284	244	528	1.49	3.35	5.95
HO-J0003	31	1	Urban Core	203	174	377	1.06	2.39	4.25
HO-J0003	52	2	Institutional	1992	0	1992	5.19	11.67	20.75
HO-J0004	11	1	Urban Core	178	153	331	0.93	2.10	3.73
HO-J0004	15	1	Urban Core	314	269	584	1.64	3.70	6.58
HO-J0005	21	1	Urban Core	237	203	440	1.24	2.79	4.96
HO-J0006	32	1	Urban Core	188	161	348	0.98	2.21	3.93
HO-J0007	23	1	Urban Core	258	221	480	1.35	3.04	5.41
HO-J0007	51	2	Institutional	2637	0	2637	6.87	15.45	27.47
HO-J0008	24	1	Urban Core	230	197	427	1.20	2.71	4.81
HO-J0009	35	1	Urban Core	170	146	316	0.89	2.00	3.56
HO-J0010	22	1	Urban Core	225	193	417	1.18	2.65	4.70
HO-J0012	41	1	Urban Core	432	370	802	2.26	5.09	9.04
HO-J0013	43	1	Urban Core	347	298	645	1.82	4.09	7.27
HO-J0015	44	1	Urban Core	1434	1230	2664	7.51	16.89	30.03
HO-J0019	42	1	Urban Core	817	700	1517	4.28	9.62	17.10
HO-J0021	27	1	Urban Core	209	179	388	1.09	2.46	4.37
HO-J0022	25	1	Urban Core	167	143	311	0.87	1.97	3.50
HO-J0023	26	1	Urban Core	225	193	418	1.18	2.65	4.71
HO-J0025	12	1	Urban Core	256	219	475	1.34	3.01	5.36
HO-J0026	13	1	Urban Core	163	140	303	0.85	1.92	3.41
HO-J0026	34	1	Urban Core	136	117	253	0.71	1.61	2.86
HO-J0027	36	1	Urban Core	133	114	246	0.69	1.56	2.78
HO-J0028	33	1	Urban Core	176	151	328	0.92	2.08	3.69
HO-J0028	53	2	Institutional	544	0	544	1.42	3.19	5.67
Totals:				**11955**	**5815**	**17770**	**49**	**110**	**196**

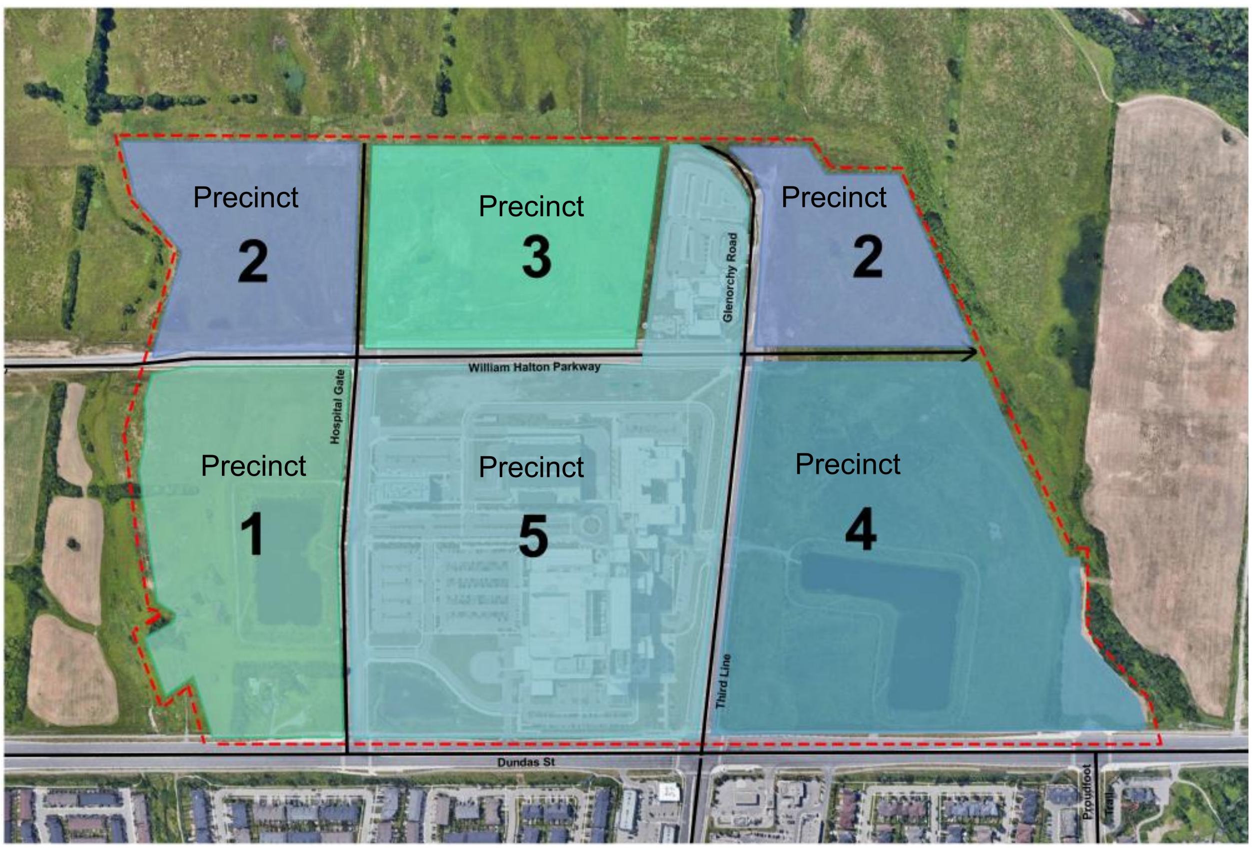
TOWN OF OAKVILLE

WSP REPORT NUMBER: 191-08340-00

HOMUN STUDY – SERVICING

WATER, WASTEWATER, & STORMWATER

AUGUST 13, 2020



HOMUN STUDY

SERVICING REPORT

TOWN OF OAKVILLE

FINAL REPORT

PROJECT NO.: 191-08340-00
DATE: AUGUST 13, 2020

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August 13, 2020

WSP Ref: 191-08340-00

Mr. David Sajecki,

Sajecki Planning

Dear Client:

Subject: Water, Wastewater, and Stormwater Servicing Study for the Health Oriented Mixed-Use Node Review in Oakville

WSP is pleased to provide this Final Report containing the hydraulic results of the water, wastewater and stormwater networks proposed to service the Health Oriented Mixed-Use Node Review in the Town of Oakville.

The analysis considers 2016 (existing) and 2031 (future) horizons for the three utilities, and presents recommendations required to overcome any capacity limitations of the current network as identified in the hydraulic models, as required to service the envisioned growth in the study area.

The results and recommendations are based on the Region's engineering guidelines and conform to the requirements set forth by Ontario Ministry of Environment as well as Conservation Halton.

Should you wish to discuss any aspect of this report, please do not hesitate to contact me.

Yours sincerely,

Asantha Fonseka, M.Eng., P.Eng.
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APPROVED[1] BY *(must be reviewed for technical accuracy prior to approval)*

Jean-Luc Daviau, M. Eng, P.Eng. 2020/10/30

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1 EXECUTIVE SUMMARY

This report contains the results of our analysis of water, sewer, and stormwater networks both available, and required, to service the needs of the envisioned growth of the Health Oriented Mixed-Use Node Review HOMUN) study area in the Town of Oakville, ON. A summary of findings is presented by utility, as follows:

WATER

The watermain analysis was completed using the Region's existing InfoWater models for the present (2016) and future (2031) planning horizons. From this review, WSP found that the simulated pressures for the existing conditions, for all relevant scenarios (2016 and 2031 Average Day, Maximum Day and Peak Hour) satisfied the pressure requirements set by Oakville and the MECP. Similarly, given the existing conditions, the network has significant fire flow availability throughout the study area while maintaining the minimum residual pressure requirements of 20psi set by Oakville and the Ministry of Environment Conservation and Parks (MECP).

As part of this, WSP simulated and evaluated pressure in both the study area and the entire O3 pressure district that will supply the HOMUN site for the baseline (existing) conditions and the proposed conditions with the intensified HOMUN site. Baseline simulation established that, given the pump status and reservoir levels in the model at the time of receipt, the network is expected to have some areas with pressures below 40 psi. This is particularly true for the Peak Hour Demand (PHD) scenarios. The simulations with the intensified HOMUN site show that these areas of pressure district O3 are not expected to get larger. We also not that the 8th Line Pumping station was not simulated with more than one (1) pump ON at a time, and therefore turning ON additional pumps during PHD conditions is expected to alleviate areas with pressures lower than 40 psi.

In this analysis, WSP proposed that the HOMUN district be serviced by a combination of 300mm and 200mm watermains. The existing main into the site (Third Line north of Dundas St. W.) is a 400mm main and brings in sufficient capacity to the site to supply water to a network of 300mm mains. With this servicing strategy, fire flows are expected to be at or above 200L/s at almost all points evaluated within the Study Area.

WASTEWATER

WSP analyzed the wastewater network in context of the proposed HOMUN development to assess the impact of the proposed design flow on the Region's wastewater network. This analysis required using the Region's InfoSewer model for the present (2016) and future (2031) planning horizons. Using the received model, WSP created three sub-models:

1) Model 1 is the existing model without the proposed development (as-is model from the Region),

2) Model 2, containing the Region's model reflecting existing sewers without the proposed intensification, and

3) Model 3, containing the model from the Region with the proposed intensification and upgrades to the existing infrastructure.

Conclusions and recommendation on the adequacy of the sewer network was based on the ratio of Actual Sewer Flow vs. Theoretical Sewer Capacity (q/Q) criteria in these models. From this, it is concluded that most of the existing infrastructure in the HOMUN Development (Study Area) requires upgrades to effectively convey the sewage from the study area to the North Sewage Pumping Station (located north of Bronte Rd. and QEW), as a result of the intensification. Infrastructure upgrades or improvements include but are not limited to increasing the slopes of some sewers and/or increasing the diameter of certain sewers. The upgrades are primarily located along the following roadways: William Halton Parkway and Third Line. Based on the simulation results of the proposed flows from the HOMUN development, no change is required to the 2400mm trunk sewer conveying the flow downstream to the North SPS.

STORMWATER

Health Oriented Mixed-Use Node (HOMUN) is identified in the North Oakville West Secondary Plan (NOWSP) as the Employment District designation, which is generally intended "to provide for, and establish a range of development opportunities for employment generating industrial, office and service employment uses". The stormwater management (SWM) plan for HOMUN has been reviewed to ensure that the existing development and the future development within the study area be conformances with the SWM design criteria set by Town of Oakville, Conservation Halton, and Ministry of Environment, Conservation, and Parks (MECP).

The SWM design criteria for HOMUN has been established through the North Oakville Creeks Subwatershed Study (NOCSS), and includes, 1) Water Balance – Maintain infiltration at the same level as pre-development with best efforts; 2) Water Quality – provide an Enhance Level (Level 1) of protection; 3) Erosion control – detain runoff from a 25 mm rainfall storm and release over a 24 to 48-hour period; 4) Quantity Control – control post-development peak flow rates to target release rate to Taplow Creek, Glen Oak Creek, and Tributary of Sixteen Mile Creek based on updated Ontario Municipal Board (OMB) mediated value and the pre-development drainage areas.

A comprehensive SWM plan has been developed for the HOMUN, which includes lot level controls, end-of-pipe controls, and diversion channel. Conveyance controls were not proposed for the developments within HOMUN.

Lot level SWMPs, proposed to address groundwater recharge and water balance, include but not limited to reduced lot grading, discharging clean roof runoff to pervious surfaces, infiltration swales, or soakaway pits, rain gardens, pervious/porous pavements, green roofs and reduced lot gradings.

Total three SWM wet facilities are in place to service the subject study area, which includes: Halton Healthcare Services (HHS) Stormwater Management Pond (SWMP), Glen Oak (GO) Regional Detention Facilities (RDF), and Taplow Creek (TC) Regional Detention Facilities (RDF). The development of HOMUN proceeds in phases with all SWM facilities in place.

A diversion channel is proposed to replicate pre-development conditions within the Sixteen Mile Creek tributary to the maximum extent possible to the benefit of the high constraint stream and Provincially Significant Wetland (PSW).

Significant recent and current development in the HOMUN includes Oakville – Trafalgar Memorial Hospital (2015), ErinoakKids Centre for Treatment and Development (2017), All Seniors Care, senior assisted living and care facility (approved in 2017 and not constructed yet), Halton Region Courthouse (under review), Health Sciences and Technology District.

SWM plan for HOMUN has been reviewed. All end-of-pipe SWM facilities – HHS SWMP, Glen Oak RDF, and Taplow RDF, are designed to provide required storage volume to meet quality, erosion and quantity control target for ultimate development conditions. With the Glenorchy Diversion Channel and SWM facilities, the overall stormwater management objectives outline in NOCSS are satisfied. No on-site quality and quantity control are required for future development provided that the overall imperviousness remain less than 85%.

2 INTRODUCTION

In the context of the Town of Oakville's Health Oriented Mixed-Use Node (HOMUN) Review, WSP was retained to complete study of the servicing requirements at and near the Study Area. The study includes a review of the water, wastewater, and stormwater management systems with the purpose of establishing a baseline performance for each servicing system and evaluate the impact of the intensification of the HOMUN site on each. Also included in this analysis is the addition of any new infrastructure for the site, and any upgrade recommendations that may be required to maintain an adequate level of service triggered by the intensification of the subject site.

2.1 STUDY AREA

Figure 1 identifies the Study Area Oakville Trafalgar Memorial Hospital, which is located at Third Line and Dundas Street W.

Figure 1 - Approximate HOMUN (Oakville Trafalgar Memorial Hospital) Study Area

This area is bounded by Dundas Street West to the south, extends to the northern boundary of the existing hospital lands and extends approximately from Proudfoot Trail to McCraney Creek to the west and east respectively. It is currently made up of a hospital (Oakville Trafalgar Memorial) and health-oriented service building.

3 WATER NETWORK

WSP analyzed the hydraulic capacity of the existing watermain network using the Region of Halton's InfoWater models received on April 30th 2019 (Halton's July 3rd, 2018 version). Two models were received: an "Existing Conditions" model which included the 2016 planning horizon (amongst others) and a "Future Conditions" model which included the 2031 planning horizon (amongst others).

Following the review of existing conditions, and the development of the planned HOMUN study area by others, WSP added the anticipated demands and proposed watermain for the planned HOMUN district to both models received. Scenarios were simulated under the existing and proposed cases, at which time WSP commented on the servicing capacity of the network and service performance given the intensification in the HOMUN District.

3.1 HYDRAULIC MODEL

WSP evaluated the hydraulic performance of the existing watermain network using the Region of Halton's InfoWater models received on April 30th 2019. Two models were received:

1) an "Existing Conditions" model which included the 2016 planning horizon (amongst others), and
2) a "Future Conditions" model which included the 2031 planning horizon (amongst others).

As part of the preliminary review of hydraulic conditions in the Study Area, WSP ran the Region of Halton's steady state InfoWater models for the 2016 and 2031 planning horizons. Note that these planning horizons are part of separate models.

The Study Area is located within Pressure Districts (PD) O3 of the Town of Oakville, Region of Halton, water distribution network. **Figure 2** and **Figure 3** show maps of the watermain network identifying the infrastructure added as part of this study and the watermain sizes in the area.

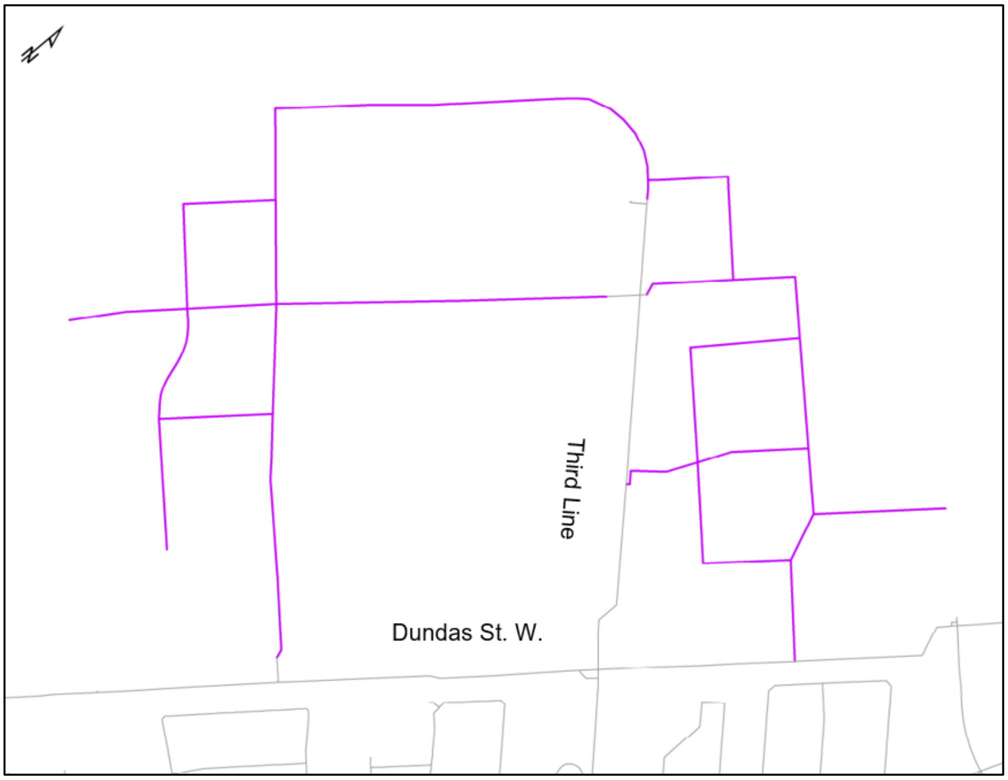

Figure 2 – New Watermains Proposed in the Study Area

Figure 3 - New Watermains Proposed in the Study Area with Pipe Diameter

3.2 DESIGN CRITERIA

3.2.1 PROPOSED DOMESTIC DEMAND

Demands for the development were calculated using the Regional Municipality of Halton Water and Wastewater Linear Design Manual. Populations were determined according to the HOMUN planning study and population densities provided by Sajecki Planning. Table 1 summarises the factors used to determine the demands for the development.

Table 1 - Demand Factors and Inputs

Demand Factors and Inputs	Value
Residential	265 L/Person/Day
Non-Residential	225 L/Employment/Day
Maximum Day Peaking Factor	2.25
Peak Hour Factor*	4.0

Note: Conservative peaking factors used for Non-Residential buildings.

The residential and non-residential demands of the development were included in the analysis. Detailed calculations of the domestic demands are shown in the appended material. Demands were calculated based on the planning density numbers provided by others and allocated to the closest node in the water model along the new watermains added along the proposed street layout. Demands outside the development were left unchanged.

A summary of added demands is presenter in the Appended table. This table summarizes the Average Day, Maximum Day and Peak Hour Demands added to the model, by parcel, as part of the intensification within the study area.

3.2.2 SYSTEM PRESSURE REQUIREMENTS

The Region of Halton, and the Ministry of Environment and Climate Change (MECP), pressure criterion stipulates a minimum of 40 psi (275 kPa) and maximum pressure of 100 psi (690 kPa) under normal conditions. Under fire flow conditions, pressures above 20 psi (140 kPa) must be maintained.

It is important to note that the Ontario Building Code (OBC) requires individual pressure regulating valves if pressures are above 80 psi (550 kPa).

3.2.3 FIRE FLOW REQUIREMENTS

To determine the Required Fire Flow (RFF), the Town of Milton and Region of Halton require specific fire flow calculations, following the guidelines of the Fire Underwriters Survey (FUS) 1999, be completed and considered.

In this planning study, WSP is presenting the Available Fire Flow (AFF) for information. Specific fire flow calculations will have to be completed at the time future Site Plan are available and applications are submitted in this Study Area.

3.3 BOUNDARY CONDITIONS

Table 2 through **Table 7** summarize boundary conditions during the steady state simulation of the 2016 and 2031 planning horizons.

Pressure District O3 is directly supplied by two water sources and 2 pump stations. The water sources include the R.J. Moore Reservoir located at Sixth Line and Burnhamthorpe Rd and the Kitchen supplies at the Kitchen Pump Station and is also augmented by the Headon Reservoir in Burlington (via the Dundas Crossing Interconnection in the future scenarios). In this analysis, the Kitchen Tanks were 80% full (Top Water Level) for all simulations and the R.J. Moore Reservoir was 69% full (Top Water Level) for all simulations.

Table 2 - PD-O3 Boundary Conditions: Kitchen Tank Levels

	Elevation (m)	Minimum Level1 (m)	Initial Level1 (m)	Maximum Level1 (m)
2016	252.0	0	5.2	6.5
2031	252.0	0	5.2	6.5

1) **These levels apply to all four cells and all demand conditions and represent 80% full levels**

Table 3 - PD-O3 Boundary Conditions: R.J. Moore Reservoir Levels (2016 & 2031)

	Elevation (m)	Minimum Level1 (m)	Initial Level1 (m)	Maximum Level1 (m)
2016	252.0	2	4.64	5.8
2031	252.0	2	4.64	5.8

1) **These levels apply to all four cells and all demand conditions and represent 69% full levels**

Two pump stations which feed Pressure District O3 are the Kitchen Pump Station at Bronte Rd. and Upper Middle and the Eight Line Booster Station at Eight Line and Upper Middle. The Kitchen Pump Station is supplied by the Kitchen tanks. The station has multiple sets of pumps, of which four (4) pumps feeds PD-O3 in the 2016 planning horizon and five (5) pumps feeds PD-O3 in the 2031 planning horizon. This pump station is rated for 75 ML/Day. The Eight Line Booster Pump Station boosts the hydraulic grade line from PD-O2 into PD-O3. It is equipped with four (4) pumps in both the 2016 and 2031 planning horizons. This pump station is rated for 41 ML.

Table 4 – PD-O3 Boundary Conditions: Pump Status at the Kitchen Pump Station for 2016

Pump ID	ADD	MDD	MDD+FF	PHD
Kitchen Zone 3 Pump 1	ON	ON	ON	ON
Kitchen Zone 3 Pump 2	off	off	off	off
Kitchen Zone 3 Pump 3	off	off	off	off
Kitchen Zone 3 Pump 4	off	off	off	off

Table 5 – PD-O3 Boundary Conditions: Pump Status at the Kitchen Pump Station for 2031

Pump ID	ADD	MDD	MDD+FF	PHD
Kitchen Zone 3 Pump 1	ON	off	off	off
Kitchen Zone 3 Pump 2	ON	Off	Off	Off
Kitchen Zone 3 Pump 3	ON	Off	Off	Off
Kitchen Zone 3 Pump 4	off	Off	Off	Off
U7238	off	ON	ON	ON

Table 6 – PD-O3 Boundary Conditions: Pump Status at the 8th Line Pump Station for 2016

	2016 Average Day Demand (ADD)	2016 Maximum Day Demand (MDD)	2016 Peak Hour Demand (PHD)
8THLINE-P1	ON	ON	ON
8THLINE-P2	off	off	off
8THLINE-P3	off	off	off
8THLINE-P4	off	off	off

Table 7 – PD-O3 Boundary Conditions: Pump Status at the 8th Line Pump Station for 2031

	2016 Average Day	2016 Maximum Day	2016 Peak Hour
8THLINE-P1	off	off	off
8THLINE-P2	off	off	off
8THLINE-P3	ON	off	off
8THLINE-P4	ON	off	off

Pumping conditions for the 2031 planning horizon show less pumps ON at the Kitchen and 8th Line pumping station as compared to the 2016 planning horizon. The tables above also show that the 2031 ADD scenario has more pumps ON than the 2031 MDD and/or 2031 PHD scenarios. This is not what we would expect since with demand intensification from 2016 to 2031, and again from ADD to MDD and PHD more pumps become necessary to pump more flows to satisfy the higher demands while maintaining pressures throughout the zone.

Considering this, WSP completed simulations with boundary conditions set at the time of the model receipt (as shown in **Table 4, Table 5, Table 6,** and **Table 7**). However, in any situation when pressure was below the acceptable lower limit of 275 kPa, pumps were turned ON all while respecting the firm capacity of each station. Pressure requirements are discussed further in section 3.2.2.

3.4 ANALYSIS

Included in this analysis are the simulation of hydraulic conditions for both the existing (baseline – without the intensified HOMUN district) and proposed (with intensified HOMUN district) demand conditions. The simulations were completed for the 2016 and 2031 planning horizons and included the following scenarios:

1. Average Day Demands (ADD);
2. Maximum Day Demands (MDD);
3. Maximum Day Demands + Fire Flows (MDD+FF); and,
4. Peak Hour Demands (PHD)

WSP simulated and mapped results for each scenario as to identify existing pressure deficient areas, excessive head loss through pipes and fire flow constraints in the Study Area and immediate surrounding mains. These areas have been presented in the subsequent sections

3.4.1 EXISTING CONDITIONS – 2016 PLANNING HORIZON

The 2016, existing conditions without the intensified HOMUN district was modeled considering the boundary conditions in the model at the time of receipt. Boundary conditions used in the model are summarized in **Section 3.3**.

Table 8 and **Table 9** summarizes the modeled service pressures and AFF respectively for the 2016 planning horizon considering watermain near the HOMUN site and the entire zone O3.

Table 8 –Simulated ADD, MDD and PHD for 2016

	ADD (psi)	MDD (psi)	PHD (psi)
HOMUN	50 - 58	50 - 58	47 - 55
O31	5 - 105	5 - 105	5 - 105

Note 1: Two junctions were simulated below 20psi. Both of these are at the north end of the 6th Line dead-ended watermain that connects to the storage. No services are on these junctions. All other junctions are above 30psi

Table 9 - Simulated Available Fire Flows for 2016 MDD +FF

Zone	Fire Flow Available (L/s)
HOMUN site	214 – 2196

Note: Simulated fire flow are theoretical fire flows based on the modeling. Fire flows shown in this table may not be available at the magnitude simulated and/or may require multiple hydrants to achieve.

A complete table of pipe and node data for all the simulated scenarios is included in the appended material. In addition to these tables, there are maps which show the pressure and available fire flow at all junctions and headloss gradient in all pipe, within the study area (to help identify capacity bottlenecks, if any).

The simulations of the 2016 planning horizon without the intensified HOMUN district show that the existing watermains along Third Line, north of Dundas, and along Dundas fronting the study area can maintain pressures within the acceptable pressure range for all simulated scenarios. Similarly, simulated fire flows were simulated above 200 L/s along these same watermains. These mains are mostly large 400mm and 600mm trunks that have high carrying capacity.

As part of this study, WSP also considered the pressure throughout all of the O3 zone to evaluate the impact the intensified HOMUN district will have across the pressure district. In the 2016 baseline runs, it has been established that a significant portion of the O3 zone can maintain adequate pressures but that a small area near Dundas Street St. W. and 6th Line that experiences pressures between 20psi and 40psi with two junctions below 20psi given the boundary conditions previously described.

This area is consistent throughout ADD, MDD and PHD and does not significantly increase in size as demands increase from ADD to PHD. In particular, junctions with pressures between 20psi and 40psi were simulated along Westfield Trail, Andover Rd, Red Maple Lane and along 6th Line north of Dundas St. W. The two (2) junction simulated below 20psi is the last junction at the north end of 6th Line near the storage.

The simulations also indicated that a non-significant number of watermains near the study area, or throughout Zone O3, are operating with a headloss greater than 1.5 m/km.

3.4.2 EXISTING CONDITIONS – 2031 PLANNING HORIZON

The 2031, existing conditions without the intensified HOMUN district planning horizon, was modeled considering the boundary conditions in the model at the time of receipt. Boundary conditions used in the model are summarized in **Section 3.3**.

Table 10 and **Table 11** summarizes the modeled service pressures and AFF respectively for the 2016 planning horizon considering watermain near the HOMUN site and the entire zone O3.

Table 10 - Summary of Simulated Pressures in the ADD, MDD and PHD Scenario for the 2031 Planning Horizon

	ADD (psi)	MDD (psi)	PHD (psi)
HOMUN Site	51 - 58	52 - 60	41 - 48
Zone O31	-4 - 365	5 - 1062	0 - 95

Note 1: Two junctions were simulated below 20psi. Both of these are at the north end of the 6th Line dead-ended watermain that connects to the storage. No services are on these junctions. All other junctions are above 30psi

Note 2: 2031 MDD was simulated with Pump U7283 ON

Table 11 - Summary of Simulated Available Fire Flows in the MDD+FF Scenario for the 2031 Planning Horizon

Zone	Fire Flow Available (L/s)
HOMUN site	212 – 1921

Note: Simulated fire flow are theoretical fire flows based on the modeling. Fire flows shown in this table may not be available at the magnitude simulated and/or may require multiple hydrants to achieve.

A complete table of pipe and node data for all the simulated scenarios is included in the appended material. In addition to these tables are maps which show the pressure and available fire flow at all junctions and headloss gradient in all pipe within the study area.

The simulations of the 2031 planning horizon without the intensified HOMUN district show that the existing watermains along Third Line, north of Dundas, and along Dundas fronting the study area can maintain pressures within the acceptable pressure range for all simulated scenarios. Similarly, simulated fire flows were simulated above 200 L/s along these same watermains. These mains are mostly large 400mm and 600mm trunks that have high carrying capacity.

In the 2031 baseline runs, it has been established that the O3 zone is expected to maintain an adequate minimum pressure throughout a significant portion of the zone but that a small area is expected to have pressure between 20psi and 40psi. This area is different than was simulated in 2016 due to the extra pump being ON. During the 2031 ADD and MDD scenarios, the junctions are localized to the intersection of Dundas St W and 6th Line and along the dead-end main that extends north of Dundas St W along 6th Line. However, during the 2031 PHD scenarios, the area extends along Dundas St W from Town Blvd. to 6th Line plus along Glenashton Dr. and some neighborhood south of Glenashton Dr.; mainly east of the Morrison Valley North and north of Upper Middle Rd E. Given the pumping capacity in zone O3, and the number of pumps ON during this analysis, having more pumps ON during this 2031 PHD scenario is expected to alleviate many low-pressure junctions from this area.

The simulations also indicated that some watermains throughout the O3 zone are expected to operate with headloss above 3m/km and up to 5m/km. These areas are mostly located on the discharge of the Kitchen and 8th Line pumps stations.

3.4.3 PROPOSED CONDITION – 2016 PLANNING HORIZON

The 2016 planning horizon was modelled considering the boundary conditions as described in 3.3 with addition of the proposed water demands for the intensification of the HOMUN district and the proposed watermains. This was done to compare the network's performance with and without the domestic demand intensification. These new watermains are identified in Figure 3.

Table 12 - Summary of Simulated Pressures in the ADD, MDD and PHD Scenario for 20165 under Proposed Condition

	ADD (psi)	MDD (psi)	PHD (psi)
HOMUN Site	49 - 58	49 - 57	43 - 53
Zone O31	-4 - 365	5 - 1062	0 - 95

Note 1: Two junctions were simulated below 20psi. Both of these are at the north end of the 6th Line dead-ended watermain that connects to the storage. No services are on these junctions. All other junctions are above 30psi

Note 2: 2031 MDD was simulated with Pump U7283 ON

Table 13 - Summary of Simulated Available Fire Flows in the MDD+FF Scenario for the 2016 Planning Horizon

Zone	Fire Flow Available (L/s)
HOMUN site	126 – 2112

Note: Simulated fire flow are theoretical fire flows based on the modeling. Fire flows shown in this table may not be available at the magnitude simulated and/or may require multiple hydrants to achieve.

A complete table of pipe and node data for all the simulated scenarios is included in the Appendix. In addition to these tables are maps which show the available fire flow at all junctions and headloss in all pipe within the study area.

The simulations of the 2016 planning horizon with the intensified HOMUN district show that the existing watermains along Third Line, north of Dundas, and along Dundas fronting the study area and along the proposed watermains within the study area can maintain pressures within the acceptable pressure range for all simulated scenarios.

Similarly, simulated fire flows were simulated above 126 L/s along these same watermains. The lower end of the range shown in Table 13 is lower than simulated for the existing conditions without the HOMUN intensified district – these fire flows however were simulated along the new watermains proposed in this study. All existing watermains were simulated to maintain fire flows greater than 200 L/s indicating that the demands from the intensified site are not expected to impact the networks capacity to deliver fire flows locally. We also note that the all new mains were simulated to maintain a fire flow above 200L/s except for two (2) junctions on dead end watermains.

The simulations of the 2016 planning horizon throughout all of the O3 zone indicate that the network is expected to maintain an adequate minimum pressure throughout a significant portion of the zone but that a small area is expected to have pressure between 20psi and 40psi. This area is the same as was simulated in 2016 during ADD and MDD. Simulations of the 2016 PHD with the intensified HOMUN district show that the area near Dundas St W and 6th Line will be slightly bigger – approximately doubling in size.

Given the pumping capacity in zone O3, and the number of pumps ON during this analysis, having more pumps ON during this 2031 PHD scenario is expected to alleviate many low-pressure junctions from this area.

The simulations also indicated that some watermains throughout the O3 zone are expected to operate with headloss below 1.5m/km during ADD and MDD scenarios. During the PHD scenario, headloss was simulated above between 3m/km and 5m/km with one (1) main above 5 m/km. These mains were sized as 200mm. When detailed studies for the sites are being done, we suggest that the main connecting to Dundas St W that was simulated with a headloss above 5m/km be sized as a 300mm.

3.4.4 PROPOSED CONDITIONS – 2031 PLANNING HORIZON

The 2031 planning horizon was modelled considering the boundary conditions as described in **Section 3.3** with addition of the proposed water demands for the intensification of the HOMUN district and the proposed watermains. This was done to compare the network's performance with and without the domestic demand intensification. These new watermains are identified in Figure 2.

Table 14 - Summary of Simulated Pressures in the ADD, MDD and PHD Scenario for 2031 under Proposed Condition

	ADD (psi)	MDD (psi)	PHD (psi)
HOMUN Site	49 - 58	50 - 59	36 - 45
Zone O31	-4 - 365	5 - 1062	0 - 95

Note 1: Two junctions were simulated below 20psi. Both of these are at the north end of the 6th Line dead-ended watermain that connects to the storage. No services are on these junctions. All other junctions are above 30psi

Note 2: 2031 MDD was simulated with Pump U7283 ON

Table 15: Summary of Simulated Available Fire Flows in the MDD+FF Scenario for the 2031 Planning Horizon

Zone	Fire Flow Available (L/s)
HOMUN site	126 – 1837

Note: Simulated fire flow are theoretical fire flows based on the modeling. Fire flows shown in this table may not be available at the magnitude simulated and/or may require multiple hydrants to achieve.

Complete table of pipe and node data for all the simulated scenarios is included in the appended material. In addition to these tables are maps which show the available fire flow at all junctions and headloss in all pipe within the study area.

The simulations of the 2031 planning horizon with the intensified HOMUN district show that the existing watermains along Third Line, north of Dundas, and along Dundas fronting the study area and along the proposed watermains within the study area can maintain pressures within the acceptable pressure range for all simulated scenarios with the exception of the Peak Hour scenario. We note however that these results reflect the boundary conditions in the model at the time of receipt. WSP ran additional simulation with Pumps 1 and 2 ON at the 8th Line pumping station, this results in a pressure range of 39 kPa to 48 kPa with only two (2) junctions simulated with less than 1 kPa below 40 psi. WSP expects that when demands within the site are revisited at the time of specific site plan applications, they will be lower and pressures will be higher.

Similarly, simulated fire flows were above 126 L/s along these same watermains. The lower end of the range shown in **Table 15** is lower than simulated for the existing conditions without the HOMUN intensified district – these fire flows however were simulated along the new watermains proposed in this study. All existing watermains were simulated to maintain fire flows greater than 200 L/s indicating that the demands from the intensified site are not expected to impact the networks capacity to deliver fire flows locally. We also note that the all new mains were simulated to maintain a fire flow above 200L/s except for two (2) junctions on dead end watermains.

The simulations of the 2031 planning horizon throughout all of the O3 zone indicate that the network is expected to maintain an adequate minimum pressure throughout a significant portion of the zone but that a small area is expected to have pressure between 20psi and 40psi. This area is the same as was simulated in 2016 during ADD and MDD. Simulations of the 2016 PHD with the intensified HOMUN district show that the area near Dundas St W and 6th Line will be slightly bigger – approximately doubling in size. That being said, when the two additional pumps were turned ON at the 8th Line pumping station, many of the junctions with pressure below 40 psi were simulated above 40psi and the pressure distribution is consistent with the existing conditions for the 2031 planning horizon.

The simulations also indicated that some watermains throughout the O3 zone are expected to operate with headloss below 1.5m/km during ADD and MDD scenarios. During the PHD scenario, headloss was simulated above between 3m/km and 5m/km with one (1) main above 5 m/km. These mains were sized as 200mm. When detailed studies for the sites are being done, we suggest that the main connecting to Dundas St W that was simulated with a headloss above 5m/km be sized as a 300mm.

3.5 RECOMMENDATIONS - WATER NETWORK

Based on the computer simulations conducted using the Region of Halton's hydraulic model, the hydraulic performance of the water system in and around the Study Area is as follows:

1) WSP recommends installing a watermain network with mains sized as 200mm and 300mm as shown in Figure 3. With these mains, service pressures for the 2016 and 2031 planning horizons, are expected to range between 43 and 59 psi. All domestic demand scenarios are expected to be within the standards established by the MECP, Town of Oakville and Region of Halton Guidelines. The existing network is anticipated to sustain adequate pressures after domestic demands are increased;

2) The pressures simulated in zone O3 reflect a 70% reservoir level at the R.J. Moore Reservoir and 80% reservoir level at the Kitchen reservoir. That being said, WSP recommends that PHD reservoir level stay at or above what was simulated in this anlaysis to maintain pressures throughout O3

   We also recommend that future simulations consider a lower reservoir level to reflect “typical” day to day reservoir levels. The “typical” reservoir level or for sensitivity analysis can be averaged from SCADA data collected at the reservoir;

3) Pump status in the model at the time of receipt were kept throughout all the simulations included in this analysis. That being said, WSP simulated the 2031 planning horizon during the PHD scenario with two additional pumps on at the 8^{th} Line Pump Station. With these two extra pumps ON, junctions in the HOMUN intensification area are above 40psi (with the exception of two that are above 39 psi) and junctions throughout the O3 zone can maintain their existing level or service. We recommend that during PHD conditions, pump station operate with more than one (1) pump ON;

4) Fire Flow are generally above 200 L/s. The few junctions that have simulated fire flows below 200 L/s are located along dead-end mains in the proposed development and were simulated with fire flows equal to are above 126 L/s.

4 SEWER NETWORK

Figure 4 shows the proposed HOMUN Development (Study Area). Based on the infrastructure in the project vicinity, sewage flows must be designed to travel south to the North Sewage Pumping Station (SPS), located north of QEW and Bronte Rd., via a system of 2400mm gravity trunk sewers.

WSP obtained the March 25, 2019 version of the Region of Halton's (Region's) InfoSewer model that included both the 2016 and 2031 planning horizons. It was used to evaluate the system performance and recommend upgrades to support the HOMUN development. This section outlines the conditions prior to adding the flows from the Study Area (pre-intensification condition), and post-intensification conditions with solutions that can be used to overcome the modelled bottlenecks in this system up to the 2031 design year horizon.

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Figure 4

STUDY AREA SHOWING EXISTING SANITARY SEWER SYSTEM (INFOSEWER)

4.1 HYDRAULIC MODEL

WSP obtained and used the March 25, 2019 version of the Region of Halton's (Region's) InfoSewer model for both the 2016 and 2031 planning horizons to evaluate the baseline conditions and provide recommendations for the existing and proposed infrastructures that can support this proposed development post intensification of the study area.

4.2 SEWAGE FLOW GENERATION

The proposed design sewage flow that is expected to be generated by the Study Area consists of the Dry Weather Flow (DWF) multiplied by a Peaking Factor (PF) and supplemented by a rain-induced Infiltration/Inflow (I/I). I/I is assumed to be similar for both existing and future scenarios. It is also assumed that construction of sewers will be carried out in a single phase.

The Study Area was broken into six (6) sub-catchments to provide more accurate flow distribution. The total sewage flow was allocated to each sub-catchment based on its area, residential and employment populations and assumed I/I. Flow is captured at Maintenance Holes (MH) and routed along sewers in the direction of lower elevations (governed by the Study Area grade).

Design flows were calculated using the Region's Water and Wastewater Linear Design Manual (Region's Manual), version 4.0, and any modification (deviation) has been highlighted in the calculations appended to this memo. A summary of these design flows calculations is presented in **Table 16** for Unit Rates and **Table 17** for the Design Flows.

Table 16 - Units Flow Rates and Area

Design Criteria	Rate
Residential (L/Person/Day)	275
Non-Residential (L/Emp/Day)	275[1]
I/I (L/ha/s)	0.286
Proposed Area (Ha)	110

Note 1: The Non-Residential Rate is based on the water rate; this assumption makes the calculated sewage flow conservative

Table 17 - Design Flow Rates from all 6 Sub-catchments

Sub-catchment	Lots	Total Persons	Design Flow (Peak + I/I) (L/s)
1	11-15	2,272	25.06
2	21-24	1,939	22.48
3	25-27	1,226	14.88
4	31-36; 53	2,565	27.22
5	41-44	5,399	54.68
6	51-52	5,951	55.10
7	**Total**	**19,353**	**199.42**

4.2.1 SEWER MODEL CRITERIA

The Study Area was assessed for sewerage capacity, bottlenecks and surcharge for the 2016 and 2031 planning horizon in terms of Sewer Flow vs. Theoretical Sewer Capacity (q/Q) criteria pre- and post-intensification conditions.

Based on Manning's equation, the q/Q ratio is a commonly used indicator of the allocated or 'in-use' capacity of the sewers. This ratio is a number ranging more than 0, calculated as the relationship between actual flow in the sewer to its maximum allowed flow. A number close to 1 denotes a pipe flowing full, a non-ideal situation for a gravity sewer because sewers can transition to/from full-pipe flow in chaotic 'bottleneck' flow regimes that can limit conveyance capacity.

For this analysis, sewer sections have been categorized based on the benchmarks for q/Q ratios provided in the section 3.4.4 of the Region's Manual.

At each MH, the simulated Hydraulic Grade Line (HGL) is provided to illustrate flow conditions. These levels should be checked against the Region's standards in terms of the margin required between the HGL and basements that could be flooded if the Region's sewer surcharges. The unfilled MH depth represents the space available for sewage to rise to the Ground Level (GL) from the liquid level in the MH (GL-HGL), where zero means the manhole is full and will flood to the surface.

By contrast, the surcharge depth is the difference between the HGL and the top (or "crown") of the highest elevation connecting conduit. A positive surcharge depth means the node water surface elevation is above the highest pipe crown, a negative depth means that the node depth is below the highest pipe crown.

4.3 ANALYSIS – EXISTING CONDITIONS

The model was run during the Wet Weather Flows (WWF) for both 2016 (existing) and 2031 (future) horizons, without (**section 4.3.1**) and with (**section 4.4.1**) the design flows from the proposed Study Area; to assess the conveyance capacity of the sewerage system in and around the Study Area.

Upgrades are suggested for the 2031 post-construction scenario that has the highest flows and thus it is the governing (design) scenario.

With the addition of design flows, majority of the existing sewers will need upgrades: upsizing and/or increase in slope. These upgrades for the existing sewers - either of which may require sewer and/or MH replacement(s).

Care was taken to ensure that only the minimal changes (upgrades) that can effectively improve the flow (design) conveyance such that the q/Q ratios of the sewers from the Study Area to the North SPS is maintained within the Region's standards. This should result in the most cost-effective and least-disruptive solution.

4.3.1 YEARS 2016 & 2031 – BASELINE CONDITIONS

This section describes the conditions before the intensification of the Study Area built and thus there is no sewage contribution from the Study Area. It will be used as a baseline to evaluate the impact of the additional flows from the new buildings under the HOMUN Development.

Figure 5 shows the existing sewer network that was designed to convey flows via a system of gravity sewers that ultimately discharges into the North SPS to the South of the Study Area via a 2400mm gravity trunk sewer.

During both the present and future planning horizons without the intensification at the Study Area, the existing sewers are able to convey the existing WWF effectively with good slopes and moderate relative q_{actual}/Q_{max} (q/Q) ratios.

Legend

- Sewer Pipe
- Manhole
- Study_Area

Sewer Pipe Diameter (mm)

- = 200
- = 250
- = 300
- = 375
- = 400
- = 450
- = 500
- = 2400

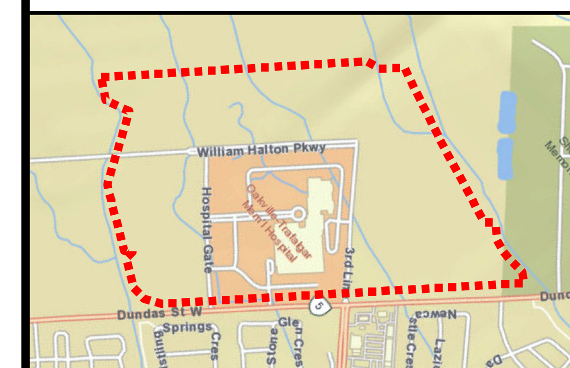

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Figure 5

EXISTING SEWERAGE NETWORK
WITH PIPE DIAMETERS

4.3.2 2016 WWF SCENARIO – BASELINE

WSP simulated the existing conditions using the 2016 model scenario to study the available carrying capacity (q/Q) of pipes and MH; as described in **Table 18**, **Table 19**, **Figure 6 and Figure 7**. The Study Area in the existing conditions comprise of conduit with diameters: 200mm, 300mm, 375mm and 450mm, ultimately conveying sewage to a 2400mm trunk sewer. The study area currently generates a combined total flow of up to 18.8L/s (via sewers connecting to the 2400mm sewer at three locations) in the existing scenario at a q/Q ratio between 0.0-0.2. These q/Q values tabulated in the report are only for the sewers internal to the Study Area, i.e., excluding the 2400mm trunk sewer.

The unfilled depths of the manholes range from 3.8m to 8.0m, indicating no basement flooding risk (>2.75m as per Region's guidelines; if services are connected to these segments). These results values for unfilled depth tabulated in the report are only for the manholes internal to the Study Area, i.e., excluding the 2400mm trunk sewer.

Table 18 - Pipe Summary Table for 2016 Scenario

Diameter (mm)	Length (m)	Slope	Total Flow (L/s)	Velocity (m/s)	d/D	q/Q	# sewers with high q/Q*
200-450	2.7 - 145.1	0.001 - 0.021	0 - 18.8	0 - 0.96	0 - 0.3	0 - 0.2	0

* Guideline calls for q/Q >0.7 for sewers more than 450mm and q/Q >0.8 for sewers equal or less than 450mm.

Table 19 - MH Summary Table for 2016 Scenario

Rim Elevation (m)	Total Flow (L/s)	Grade (m)	Surcharge Depth (m)	Unfilled Depth (m)
158.3-161.9	0-3.2	152.5-157.1	-0.4-(-0.2)	3.8-8

Figure 7, shows the hydraulic capacity (in terms of q/Q) of the sewers at the Study Area and also the 2400mm downstream trunk sewer up to North SPS.

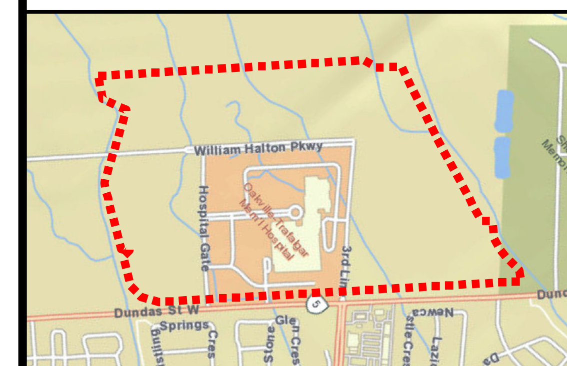

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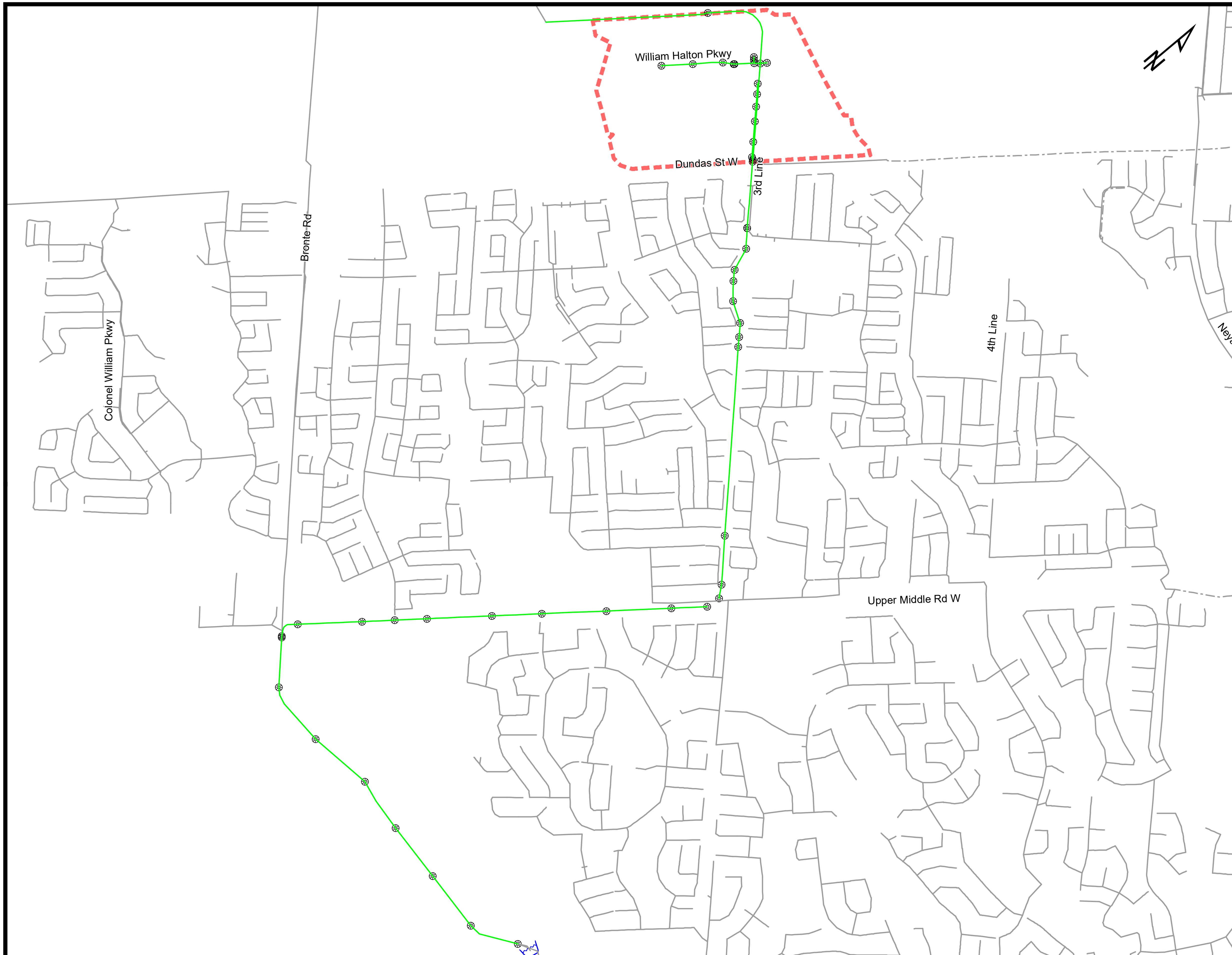
Figure 6

HYDRAULIC CAPACITY OF PIPES AND MANHOLES DURING 2016 WWF



Legend

- Sewer Pipe
- Forcemain
- Manhole
- WWPS
- Study_Area

q/Q ratio

- <= 0.5
- <= 0.6
- <= 0.7
- <= 0.8
- > 0.8

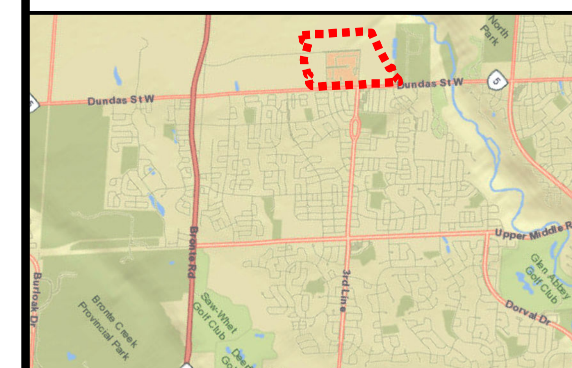


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Figure 7

HYDRAULIC CAPACITY OF PIPES AND MANHOLES DURING 2016 WWF INCLUDING THE 2400mm DOWNSTREAM TRUNK SEWER

4.3.3 2031 WWF SCENARIO - BASELINE

Baseline sanitary flows in the 2031 horizon are shown in **Table 20** and **Table 21** and range from 0L/s to 24.2L/s with velocities ranging from 0m/s to 1.0m/s. This is an increase from baseline flows from the 2016 (existing) horizon, highlighting the anticipated growth in the area not including the HOMUN initiative.

The range of q/Q ratio does not significantly increase for both existing and future scenarios: simulated results indicate the q/Q ratio ranging between 0.0 to 0.3, with more sections in the model flowing at a higher ratio.

Table 20 - Pipe Summary Table for 2031 Scenario

Diameter (mm)	Length (m)	Slope	Total Flow (L/s)	Velocity (m/s)	d/D	q/Q	# sewers with high q/Q *
200-450	2.7 - 145.1	0.001 - 0.021	0 - 24.2	0 - 1	0 - 0.3	0 - 0.3	4

* Guideline calls for q/Q >0.7 for sewers more than 450mm and q/Q >0.8 for sewers equal or less than 450mm.

Table 21 - MH Summary Table for 2031 Scenario

Rim Elevation (m)	Total Flow (L/s)	Grade (m)	Surcharge Depth (m)	Unfilled Depth (m)
158.3 - 161.9	0 - 4.1	152.5 - 157.1	(-0.4) - (-0.2)	3.8 - 8

Figure 8 and **Figure 9** show the q/Q based hydraulic capacity of the sewers at the Study Area upto the North SPS (first discharge point). Owing to the slope of the pipe these results show that a sewer closer to the North SPS, SMN29150, has a q/Q around 0.68. This is still within the Region’s standards of 80%.

Legend

- Sewer Pipe
- Manhole
- Study_Area

q/Q ratio

- <= 0.5
- <= 0.6
- <= 0.7
- <= 0.8
- \> 0.8

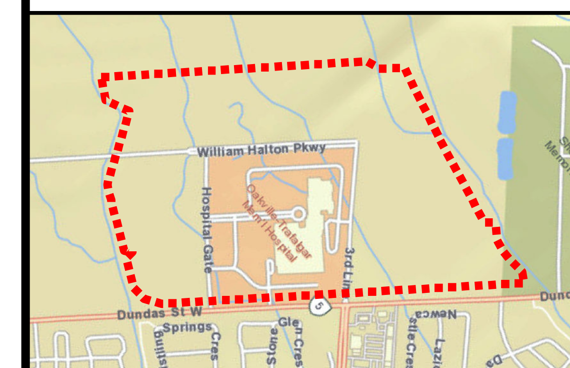

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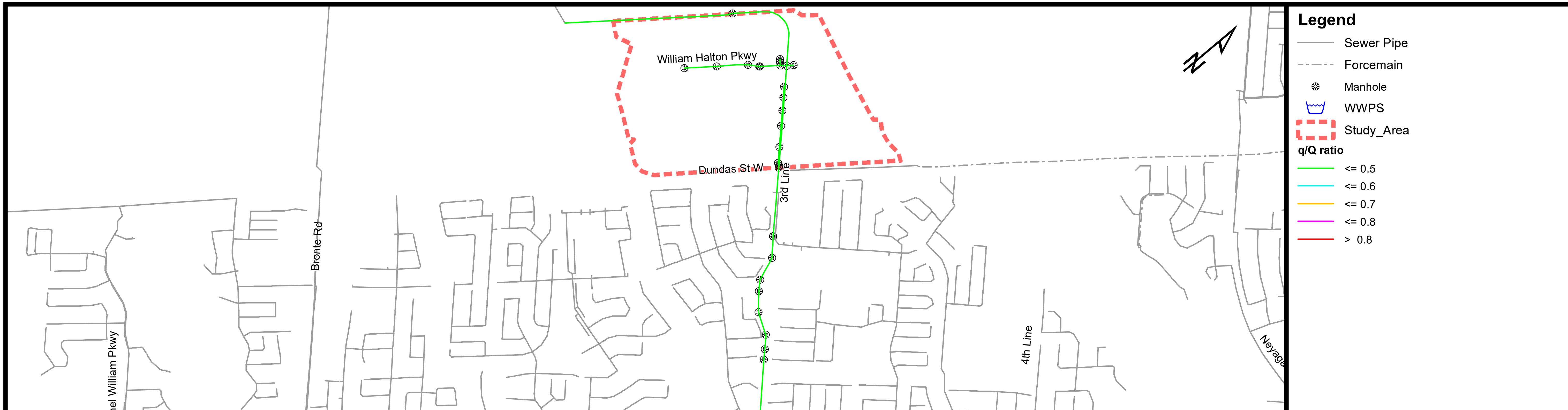
Figure 8

HYDRAULIC CAPACITY OF PIPES AND MANHOLES DURING 2031 WWF



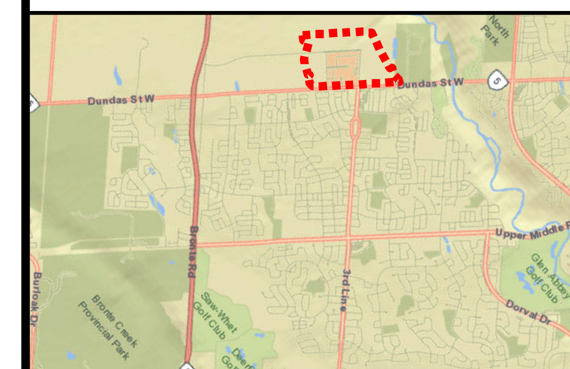


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Figure 9

HYDRAULIC CAPACITY OF PIPES AND MANHOLES DURING 2031 WWF INCLUDING THE 2400mm DOWNSTREAM TRUNK SEWER

4.4 ANALYSIS – PROPOSED CONDITIONS

This section presents the results of the InfoSewer model for both 2016 and 2031 horizons with the suggested upgrades to the existing infrastructure and with the proposed infrastructure within the study area required to service the HOMUN development. The sub-section that summarizes the conditions if no infrastructure upgrades are implemented to the existing system is only for discussion and comparison purposes. Based on this InfoSewer, WSP strongly recommends (**Section 4.5**) upgrades to the existing infrastructure to effectively convey the flow downstream from the proposed development without surcharging.

4.4.1 YEAR 2016 & 2031 CONDITIONS WITH THE INTENSIFIED HOMUN SITE

The proposed system with the new flows will also ultimately discharge into the North SPS via a set of existing and proposed sewers that will convey the design flow from the proposed buildings. These sewers are shown in **Figure 10**.

For better flow distribution, the Study Area was broken into smaller sub-catchments such that flows from the proposed buildings is distributed uniformly to the neighboring MH as shown in **Figure 11**. These catchments are based on the grading provided by the Client as a contour shapefile. To keep results conservative, the existing flows at these manholes were left unchanged and the proposed were added to the existing flows in the model

While designing the new sewers, care was taken to model the smallest diameter sewers first and then progressively increase sewer sizes to find the smallest (cost-effective) sewer that could convey the design flows via gravity (according to the current grading plan) and with minimal upgrades/ changes to the Region's existing sewers. A detailed summary of new manholes and sewers can be found in the **Appendix B.3**.

Legend

- Sewer Pipe
- Manhole
- Study_Area

Sewer Pipe Diameter (mm)

- = 200
- = 250
- = 300
- = 375
- = 400
- = 450
- = 500
- = 2400

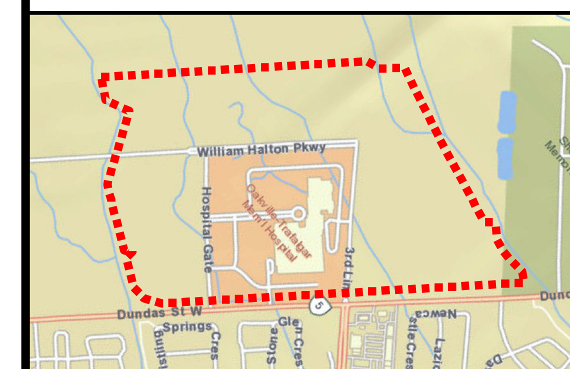

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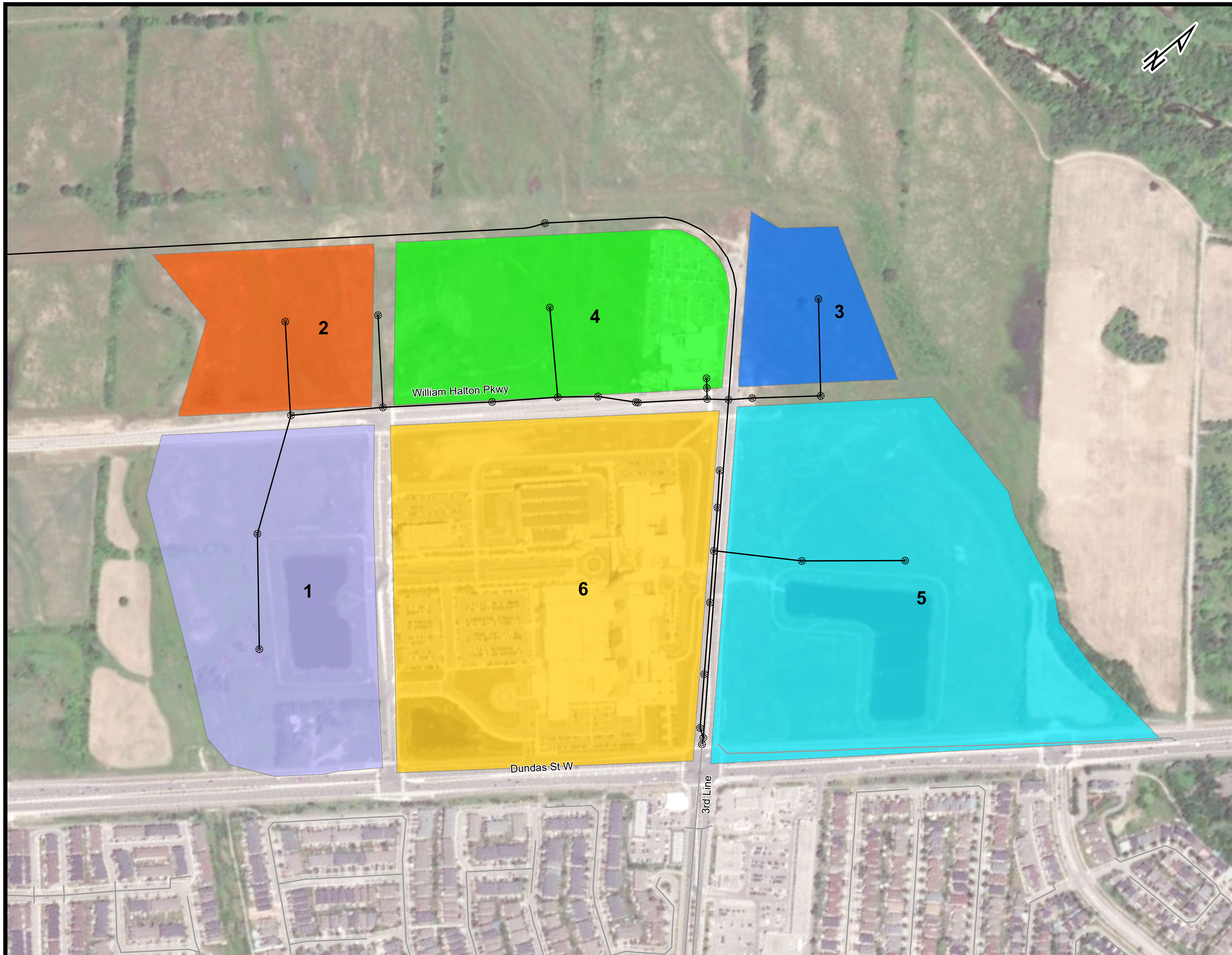
Figure 10

PROPOSED SEWERAGE SYSTEM
WITH PIPE DIAMETERS



Legend

Sewer (HOMUN Site)
Sewer Pipe
Manhole

Sub Catchment

1
2
3
4
5
6

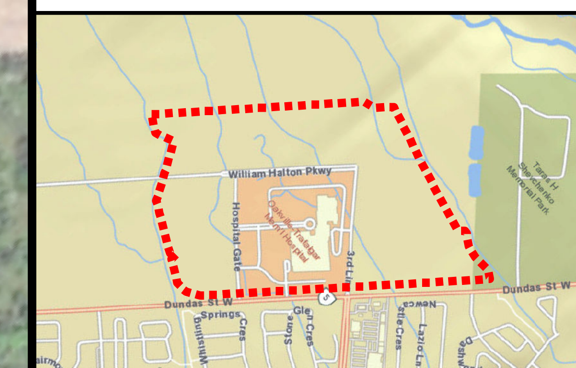


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Figure 11

SUB-CATCHMENTS and SEWER INFRASTRUCTURE AT THE STUDY AREA

4.4.2 2016 WWF SCENARIO – WITH PROPOSED HOMUN FLOWS

WSP simulated the existing planning horizon that included additional design flows from the intensified Study Area during the 2016 scenario to study the available carrying capacity (q/Q) of pipes and unfilled depths of manholes with the proposed design flows and the results have been described in **Table 22**, **Table 24**, **Table 25**, and **Figure 12**.

With the addition of the sewer flows from the intensified area, existing sewers along William Halton Pkwy have q/Q ratios that increased to above 0.7. WSP recommended some sewer upgrades in the study area that would be able to convey the flows with the maximum q/Q ratio of 0.60 that is within the guidelines set by the Region.

The unfilled depth of the manholes is governed by the invert of the downstream manhole and sewer. Since the new upstream level must backwater higher to drive gravity flow, and therefore the results show without upgrades this value is reduced to a range from 1.4m to 7.8m. However, with the recommended proposed infrastructure and upgrades this range will be increased to 2.84m to 10.56m (>2.75m; Region's guidelines).

Table 22 - Pipe Summary Table for 2016 Scenario (without upgrades)

Diameter (mm)	Length (m)	Slope	Total Flow (L/s)	Velocity (m/s)	d/D	q/Q	# sewers with high q/q*
200 - 450	2.7 - 162.7	0.001 - 0.021	9.1 - 128.6	0.68 - 1.87	0.3 - 1	0.16 - 1.89	4

* Guideline calls for q/Q >0.7 for sewers more than 450mm and q/Q >0.8 for sewers equal or less than 450mm.

Table 23 - Pipe Summary Table for 2016 Scenario (with upgrades)

Diameter (mm)	Length (m)	Slope	Total Flow (L/s)	Velocity (m/s)	d/D	q/Q	# sewers with high q/Q*
200-500	2.7-162.7	0.003-0.021	9.1-128.6	0.68-1.57	0.3-0.6	0.15-0.6	0

* Guideline calls for q/Q >0.7 for sewers more than 450mm and q/Q >0.8 for sewers equal or less than 450mm.

Table 24 - MH Summary Table for 2016 Scenario (without upgrades)

Rim Elevation (m)	Total Flow (L/s)	Hydraulic Grade Line (m)	Surcharge Depth (m)	Unfilled Depth (m)
158 - 162.3	0 - 58.3	152.6 - 158.4	-0.2 - 3.3	1.4 - 7.8

Table 25 - MH Summary Table for 2016 Scenario (with upgrades)

Rim Elevation (m)	Total Flow (L/s)	Hydraulic Grade Line (m)	Surcharge Depth (m)	Unfilled Depth (m)
158-162.3	0-58.3	150-158.4	-0.3--0.1	2.84-10.56

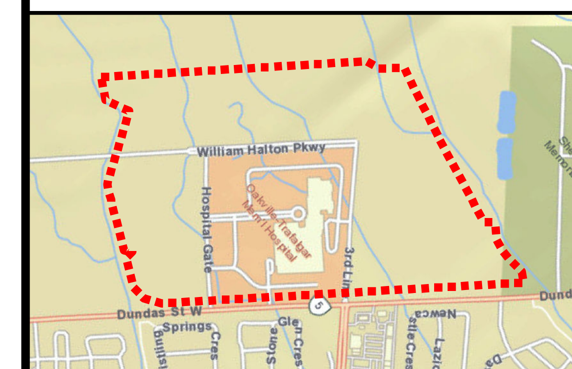

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Figure 12

HYDRAULIC CAPACITY OF PIPES AND MANHOLES DURING 2016 WWF (WITHOUT UPGRADES)

Legend

- Sewer Pipe
- Manhole
- Study_Area

q/Q ratio

- <= 0.5
- <= 0.6
- <= 0.7
- <= 0.8
- > 0.8

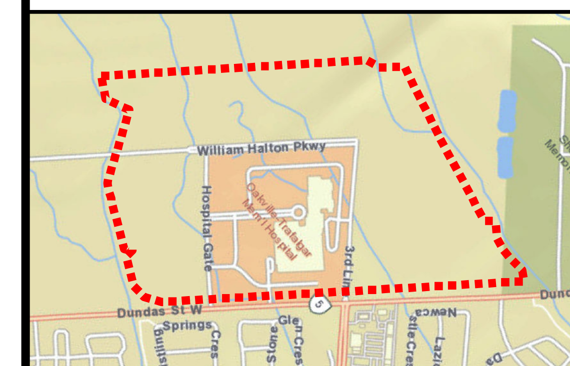

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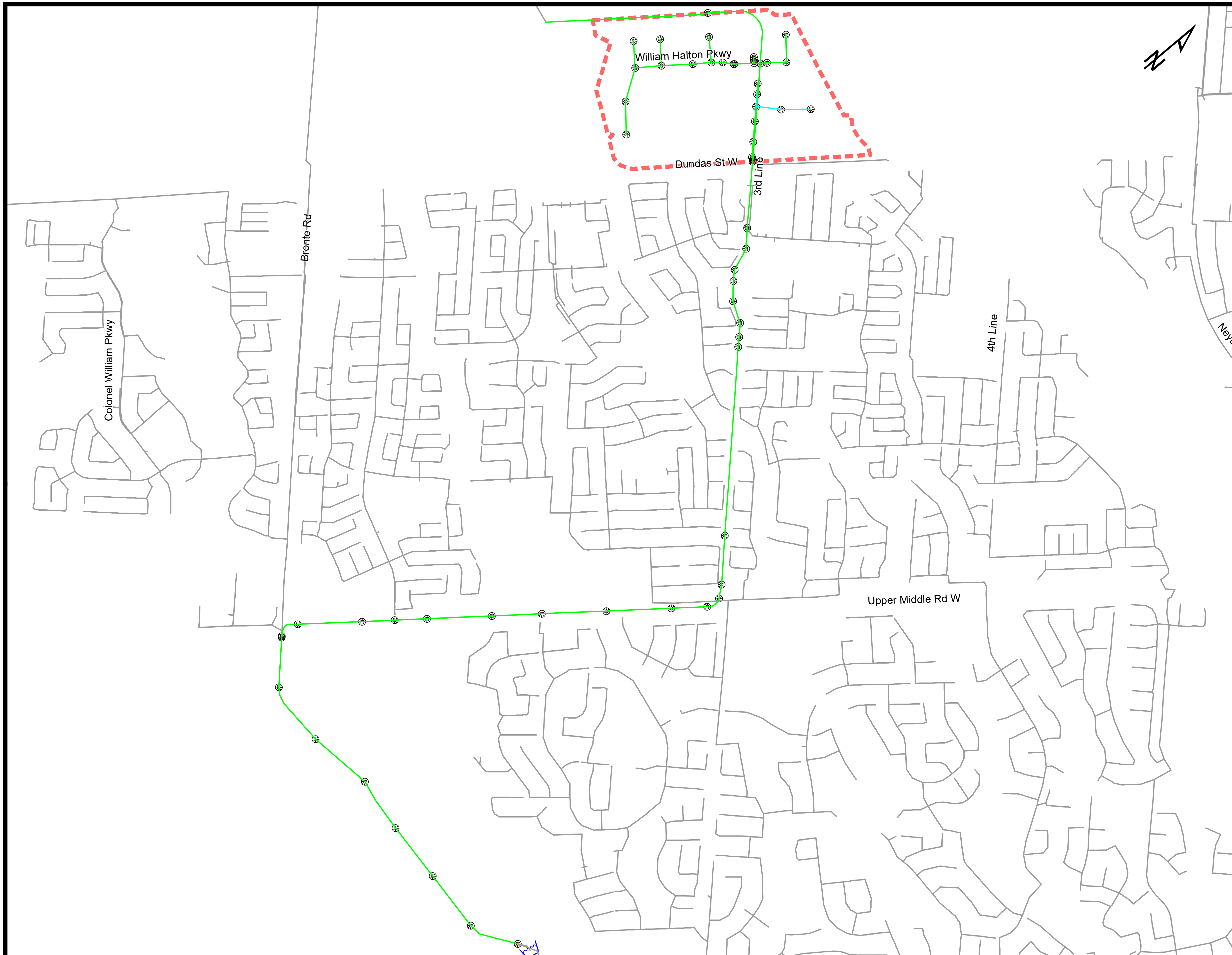
Figure 13

HYDRAULIC CAPACITY OF PIPES AND MANHOLES DURING 2016 WWF (WITH UPGRADES)



Legend

- Sewer Pipe
- Manhole
- WWPS
- Study_Area

q/Q ratio

- <= 0.5
- <= 0.6
- <= 0.7
- <= 0.8
- > 0.8

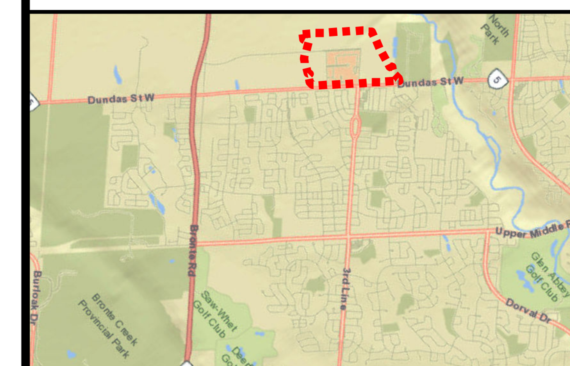


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Figure 14

HYDRAULIC CAPACITY OF PIPES AND MANHOLES DURING 2016 WWF (WITH UPGRADES) INCLUDING THE 2400mm DOWNSTREAM TRUNK SEWER

4.4.3 2031 WWF SCENARIO - WITH PROPOSED HOMUN FLOWS

The 2031 planning horizon has the highest flows of all the six (6) modelled scenarios. As can be seen from the **Table 26** and **Table 27**, the flows will 134L/s in one of the three legs proposed to discharge in the existing 2400mm trunk sewer. **Figure 15** and **Figure 16**, show q/Q ratios for sewers before and after the installation of suggested upgrades to the existing infrastructure (see appendix).

The maximum q/Q for any sewer with the recommended upgrades is 0.6, and the minimum unfilled depth for any manhole is 2.84m; both parameters are within the Region's guidelines.

Slope, velocity, d/D, and q/Q of the sewers for the scenario without upgrades to existing infrastructure is shown for discussion and comparison purposes. Since the slope and diameter requirements of the proposed sewers is influenced by the grading of the proposed development, some existing downstream sewers are above the upstream proposed sewers. Therefore, a significant number of existing sewers without upgrades will flow under pressurized conditions, that is the HGL will be above the pipes if the proposed recommendations to the existing sewers are not implemented.

As shown in **Figure 17**, similar to the results of 2031 scenario without the propoed flows, sewer: SMN29150 (close to the North SPS) has a q/Q of 0.706 (0.026 more than the scenario without the proposed flows). This is still within the Region's standards of 80%.

Table 26 - Pipe Summary Table for 2031 Scenario (Without upgrades)

Diameter (mm)	Length (m)	Slope	Total Flow (L/s)	Velocity (m/s)	d/D	q/Q	# sewers with high d/D*
200 - 450	2.7 - 162.7	0.001 - 0.021	9.1 - 134	0.68 - 1.87	0.3 - 1	0.16 - 1.95	4

* Guideline calls for q/Q >0.7 for sewers more than 450mm and q/Q >0.8 for sewers equal or less than 450mm.

Table 27 - Pipe Summary Table for 2031 Scenario (with upgrades)

Diameter (mm)	Length (m)	Slope	Total Flow (L/s)	Velocity (m/s)	d/D	q/Q	# sewers with high q/q*
200-500	2.7-162.7	0.003-0.021	9.1-134	0.68-1.59	0.3-0.6	0.16-0.6	0

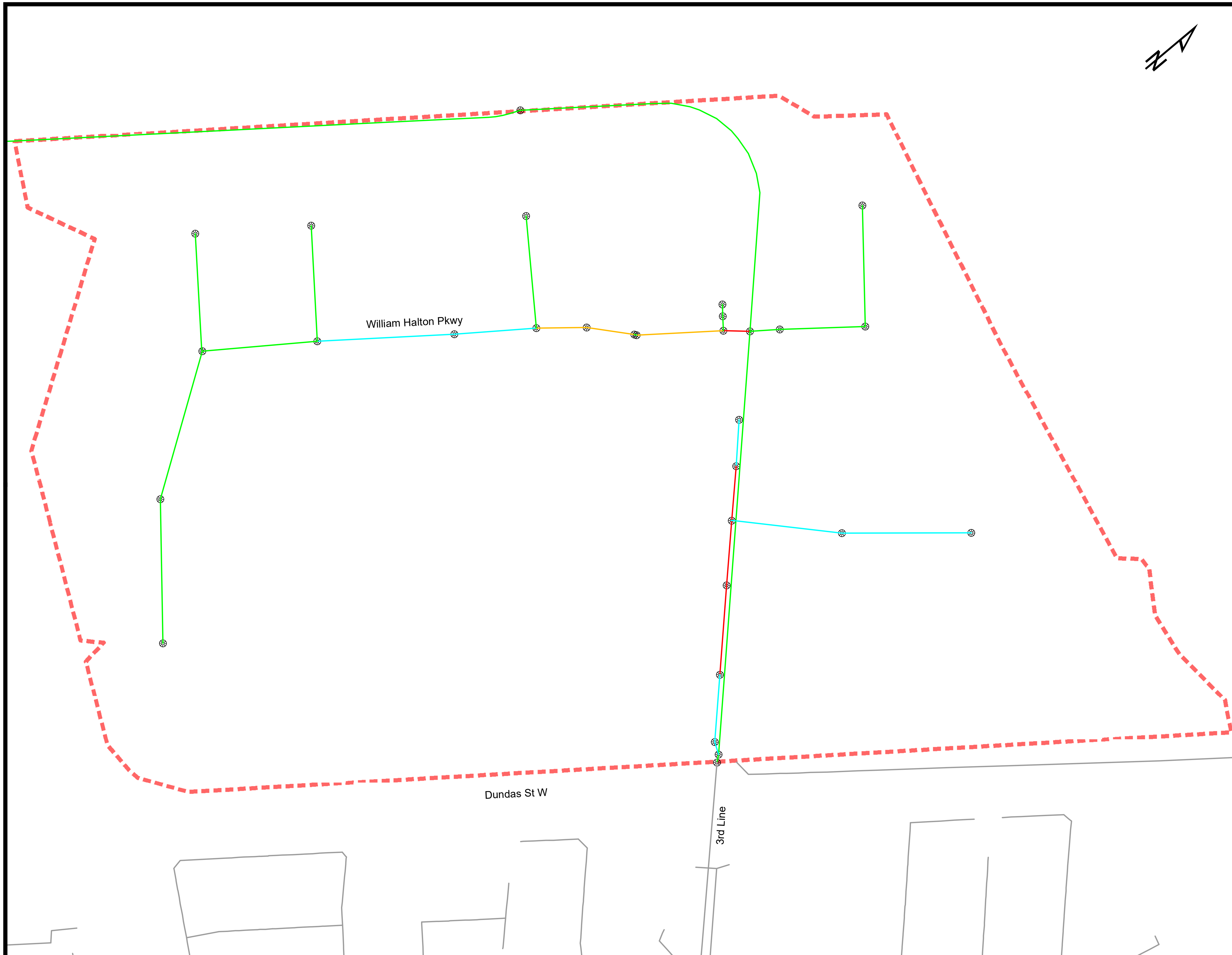
* Guideline calls for q/Q >0.7 for sewers more than 450mm and q/Q >0.8 for sewers equal or less than 450mm.

Table 28 - MH Summary Table for 2031 Scenario (without upgrades)

Rim Elevation (m)	Total Flow (L/s)	Hydraulic Grade Line (m)	Surcharge Depth (m)	Unfilled Depth (m)
158 - 162.3	0 - 59.2	152.6 - 158.4	(-0.2) -3.3	1.4 - 7.8

Table 29 - MH Summary Table for 2031 Scenario (with upgrades)

Rim Elevation (m)	Total Flow (L/s)	Hydraulic Grade Line (m)	Surcharge Depth (m)	Unfilled Depth (m)
158-162.3	0-59.2	150-158.4	-0.3-(-0.1)	2.84-10.56



Legend

- Sewer Pipe
- Manhole
- Study_Area

q/Q ratio

- <= 0.5
- <= 0.6
- <= 0.7
- <= 0.8
- > 0.8

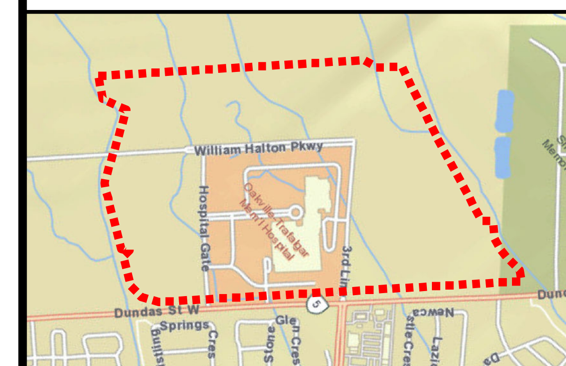


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Figure 15

HYDRAULIC CAPACITY OF PIPES AND MANHOLES DURING 2031 WWF (WITHOUT UPGRADES)

Legend

- Sewer Pipe
- Manhole
- Study_Area

q/Q ratio

- <= 0.5
- <= 0.6
- <= 0.7
- <= 0.8
- > 0.8

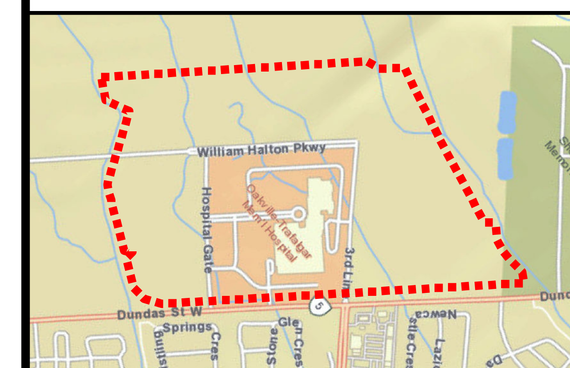

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Figure 16

HYDRAULIC CAPACITY OF PIPES AND MANHOLES DURING 2031 WWF (WITH UPGRADES) (WITHIN GUIDELINES)

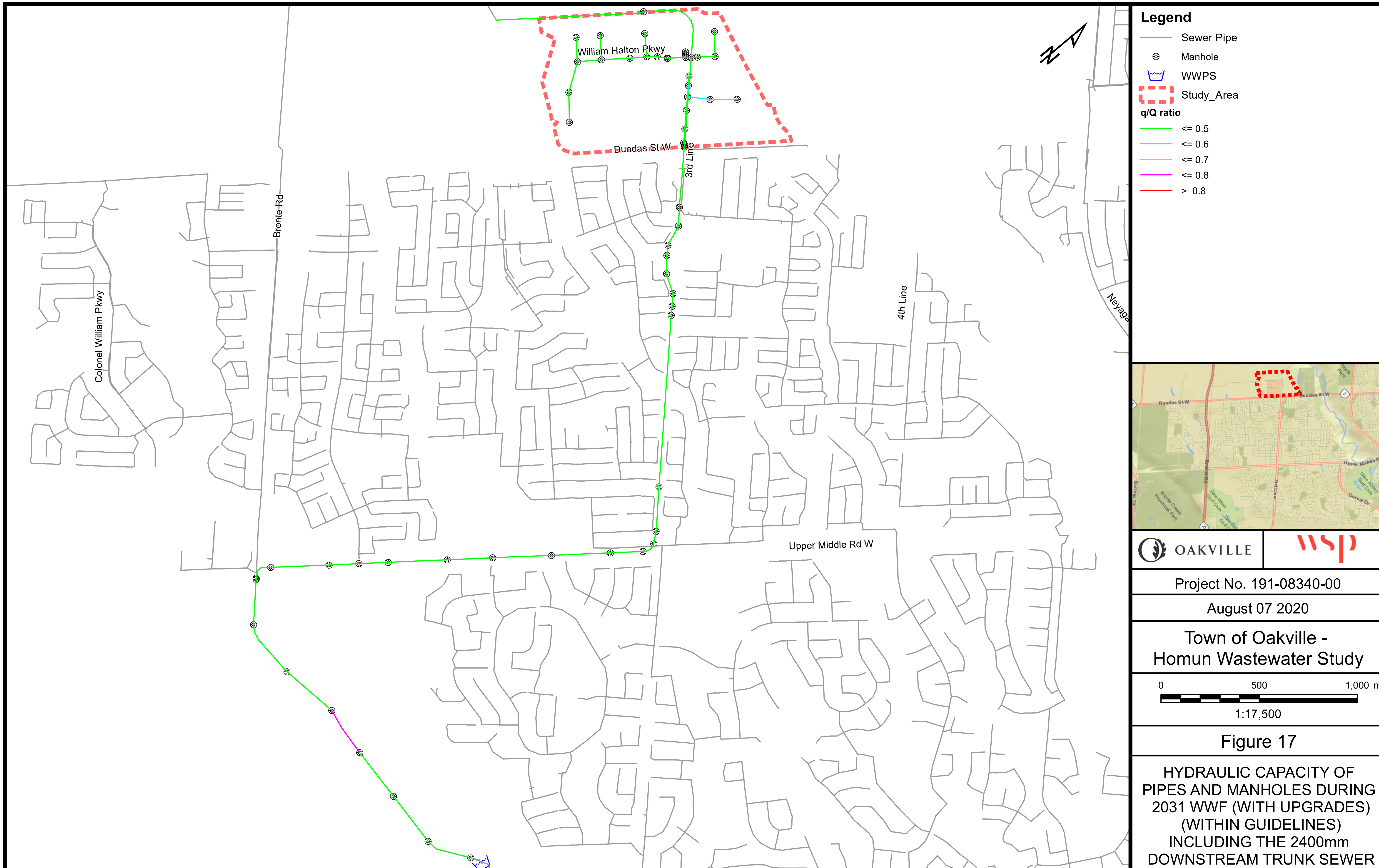

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Figure 17

HYDRAULIC CAPACITY OF PIPES AND MANHOLES DURING 2031 WWF (WITH UPGRADES) (WITHIN GUIDELINES) INCLUDING THE 2400mm DOWNSTREAM TRUNK SEWER

4.5 RECOMMENDATIONS – NETWORK UPGRADES

With the significant flow from the intensified HOMUN development, most of the existing sewers in the six catchments will flow full or near-full. That is, they will have a q/Q ratio greater than 0.7 for sewers more than 450mm and greater than 0.8 for sewers equal or less than 450mm. WSP suggests upgrades — increase of diameter and/or slope — to overcome these shortcomings in the existing sewerage network.

Upgrades to the Existing Infrastructure:

1) Along William Halton Pkwy (up to Third Line): existing 300mm sewer to 400mm for the entire length of 550m. Sewers. **Table 30,** shows the existing and proposed diameter for the existing sewer upgrades.

Table 30: Existing Sewers Recommended to be Upgraded along William Halton Pkwy (up to Third Line):

ID	FROM INVERT (M)	TO INVERT (M)	FROM NODE	TO NODE	LENGTH (M)	RECOMMENDED DIAMETER (M)	EXSITING DIAMETER (M)
SMN163751	150.38	150.37	SFT660333	SMH219548	3	400	300
SMN163752	150.36	149.81	SMH219548	SMH219547	92	400	300
SMN163753	149.81	149.64	SMH219547	SMH108253	28	400	300
SMN210608	152.95	152.08	SMH289660	SMH289661	145	400	300
SMN210609	152.08	151.55	SMH289661	SMH15122	87	400	300
SMN210610	150.71	150.39	SMH289662	SFT660333	54	400	300
SMN56817	151.55	150.71	SMH15122	SMH289662	140	400	300

Table 31, shows the sanitary sewer manhole structures that will be needed to upgrade this leg of the existing sewers.

Table 31: Existing Manhole Recommended to be Upgraded along William Halton Pkwy (up to Third Line)

Manhole	No. of Manholes
SFT660333, SMH219548, SMH219547, SMH289660, SMH289660, SMH289661,	8

SMH289662, SMH15122, SMH108253	

2) Along Third Line (up to Dundas St.): Existing 300mm, 375mm and 450mm sewers are recommended to be upsized. Sewers. Error! Reference source not found.**Table 32,** shows the ID of the recommended 400mm and 500mm sewers.

Table 32: Existing Sewers Recommended to be Upgraded Along Third Line (up to Dundas St.)

ID	FROM INVERT (M)	TO INVERT (M)	FROM NODE	TO NODE	LENGTH (M)	RECOMMENDED DIAMETER (M)	EXSITING DIAMETER (M)
SMN74500	151.10	151.00	SMH71053	SMH71054	14	500	450
SMN74501	155.32	154.79	SMH71063	SMH71061	49	400	300
SMN74502	154.76	154.60	SMH71061	SMH71059	58	400	300
SMN74503	152.60	152.36	SMH71059	SMH71057	69	500	300
SMN74504	152.36	151.64	SMH71057	SMH71055	95	500	375
SMN74505	151.64	151.11	SMH71055	SMH71053	71	500	450

Table 33: Existing Manhole Recommended to be Upgraded Along Third Line (up to Dundas St.)

Manhole	No. of Manholes
SMH71053, SMH71063, SMH71061, SMH71059, SMH71059, SMH71057, SMH71055, SMH71054	7

Proposed Infrastructure: To connect the proposed buildings from the six sub-catchments: existing 300mm sewer to 400mm for the entire length of 550m. **Table 34,** pipes of diameter: 250mm, 300mm, 400mm and 500mm will be needed.

Table 34: Proposed Sewers across the Study Area.

ID	FROM INVERT (M)	TO INVERT (M)	FROM NODE	TO NODE	LENGTH (M)	RECOMMENDED DIAMETER (M)
SMN56815	153.48	152.57	SMH14084	SFT545518	91	250
SMN56773	153.62	152.95	SMH14036	SMH289660	122	400
SMN56813	153.87	152.6	SMH14068	SMH71059	118	300
SMN56770	154.52	153.63	SMH14034	SMH14036	163	300
SMN56814	154.76	153.48	SMH14072	SMH14084	128	250
SMN56782	155.10	153.87	SMH14067	SMH14068	137	300
SMN56767	155.36	154.52	SMH14031	SMH14034	153	300
SMN56833	156.75	155.56	SMH14085	SMH15122	119	250
SMN56776	157.53	156.31	SMH14039	SMH14036	125	250
SMN56777	158.31	157.09	SMH14043	SMH289660	122	250

Table 35, shows ID for sanitary sewer manhole structures recommended.

Table 35: Proposed Manholes across the Study Area.

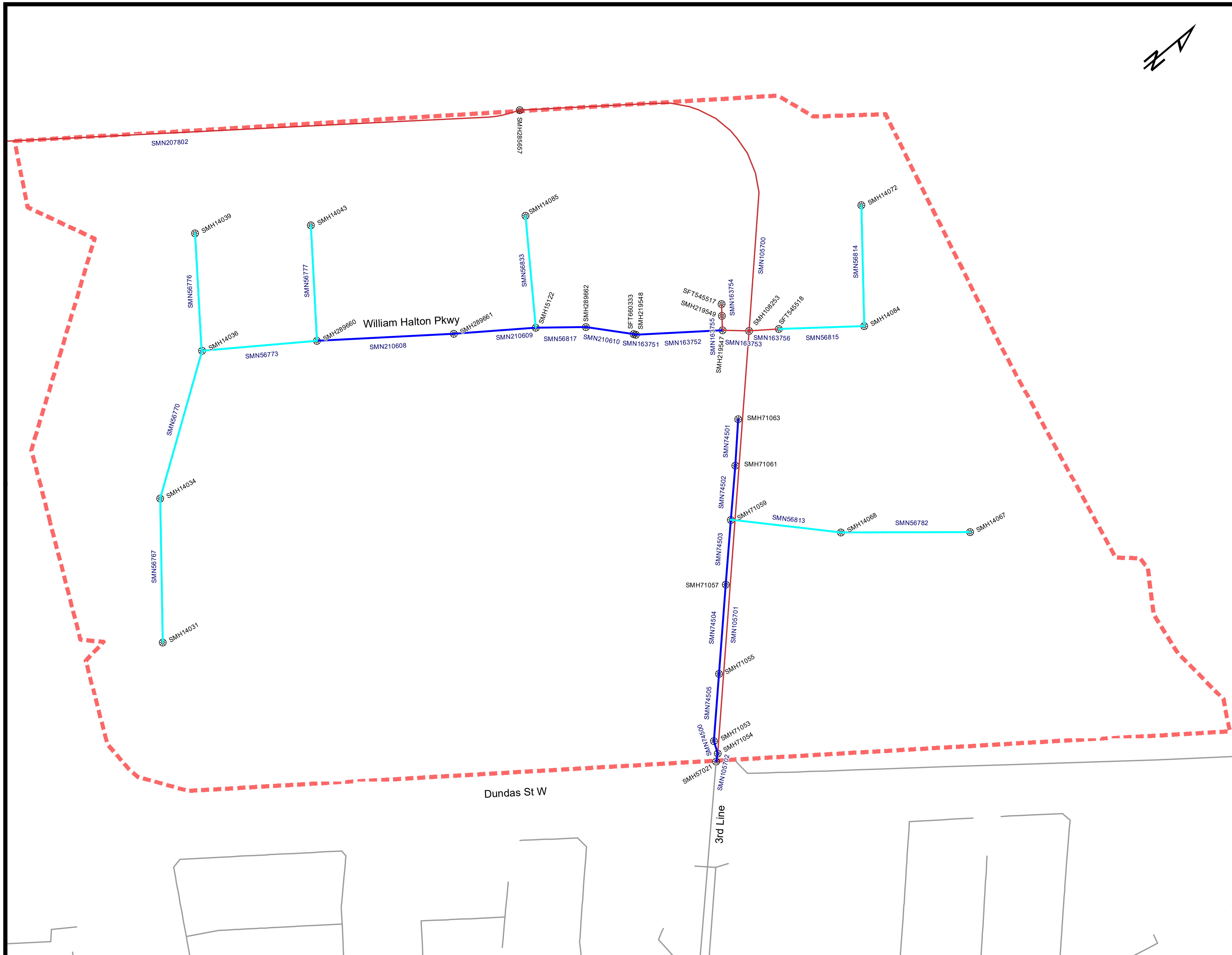
Manhole	Number of Manholes
SMH14084, SMH14036, SMH14068, SMH14034, SMH14034, SMH14072, SMH14067, SMH14031, SMH14085, SMH14039, SMH14043, SFT545518, SMH289660, SMH71059, SMH71059, SMH14036, SMH14084, SMH14068, SMH14034, SMH15122, SMH14036, SMH289660	20

A local I/I study may be considered to reduce uncertainty since it is currently estimated as roughly 10% of the proposed Study Area's design flow.

4.6 CONCLUSION - SEWER NETWORK

To service the Study Area, both upgrades to the existing infrastructure and installation of proposed infrastructure is required. The existing sewers upgrades will be made using sewers from 400mm to 500mm for a combined length of 0.9km whereas for the proposed infrastructure sewers with diameters ranging from 250 to 500mm and a total length of 1.3km are suggested.

Based on the analysis results, it is not necessary to perform upgrade to the 2400mm gravity trunk sewer conveying the proposed flows to North SPS. With just one length of this 2400mm sewer, SMN29150, close to the North SPS conveying a flow close to 70% full (Region's guidelines allow for 80% full for a sewer this size) during 2031 for both scenarios: with and without the flows from the proposed development.



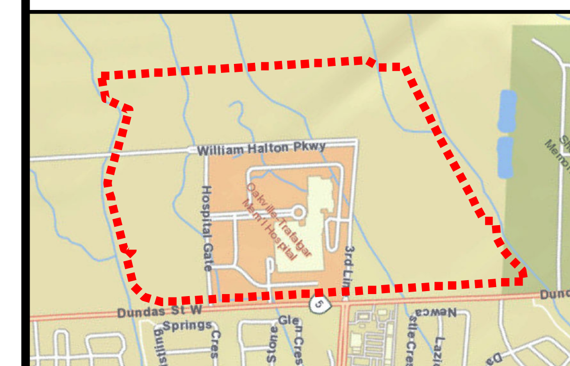


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Figure 18

EXISTING AS-IS, PROPOSED, EXISTING TO BE UPGRADED SEWERS

5 STORMWATER NETWORK

The site, Health Oriented Mixed-Use Node (HOMUN), is located in Town of Oakville. The study area drains to nearby Taplow Creek, Glen Oak Creek, and tributary of Sixteen Mile Creek, which are within the Conservation Halton's area of jurisdiction.

As indicated in the North Oakville Creeks Subwatershed Study (NOCSS), the Stormwater Management (SWM) related issues to be addressed, as applicable to each watercourse, include:

- Peak Runoff Quantity Control;
- Maintenance of Base Flow Rates/Water Balance;
- Volume of Surface Runoff;
- Groundwater Recharge/Discharge;
- Erosion Protection; and
- Runoff Water Quality Control.

5.1 BACKGROUND DOCUMENTS

The management of water resources for the proposed development within the study area follows the implementations by of North Oakville Creeks Subwatershed Study (NOCSS) Management Report (MR) and Implementation Report (IR), dated August 2006, and the standards and criteria set out in the Stormwater Management Planning and Design Manual, Ministry of Environment (now MECP), March 2003.

Section 6.0 of the NOCSS presents the recommended Management Strategy for the North Oakville Creeks Subwatershed. It includes strategies for land use management, SWM, terrestrial and wetland resources management, riparian corridor management, rehabilitation, remediation and monitoring plans. The goals, objectives, and targets of the Management Strategy are set out in NOCSS Section 6.2.

The NOCSS Section 6.3.6 discusses the SWM component of the Management Strategy. It includes discussion on hydrology, peak flow control, water quality, low impact development, source pollution prevention and various types of SWM measures.

The following background documents were referenced in preparation of this section:

- North Oakville Creeks Subwatershed Study (NOCSS), Town of Oakville, August 2006;
- North Oakville Creeks Subwatershed Study Addendum, Town of Oakville, September 2007;
- Stormwater Management Planning and Design Manual (SWMPDM), MECP, March 2003;
- Environmental Impact Report / Functional Service Study (EIR/FSS) Update and Halton Healthcare Services (HHS) Stormwater Management Pond Design, WalerFedy, May 2012;
- Environmental Compliance Approval (ECA) for Halton Healthcare Services (HHS) SWM Pond, Number: 6370-8UJNXY, Issue Date: May 30, 2012;
- Glen Oak Regional Detention Facility (RDF) Design Brief and Third Line Engineering, WalterFedy, May 2012;

- ❖ Environmental Compliance Approval (ECA) for Glen Oak Regional Detention Facility (RDF), Number: 6329-8UEH2X, Issue Date: May 30, 2012;
- ❖ Taplow Creek Regional Detention Facility (RDF) Design Brief and Western Road Engineering, WalterFedy, May 2012;
- ❖ Environmental Compliance Approval (ECA) for Taplow Regional Detention Facility (RDF), Number: 0891-8UJP3C, Issue Date: May 30, 2012;
- ❖ Amended Environmental Compliance Approval (ECA) for Taplow Regional Detention Facility (RDF) includes Drainage from All Seniors Care Living Centres, Number: 9714-BCVRFS, Issue Date: June 27, 2019;
- ❖ Glenorchy Diversion Channel Design Brief, WalterFedy, December 2011, Revised May 2012;
- ❖ Functional Servicing Report – HHS Pond Removal and Future Servicing Design Brief, January 2014, Revised June 2014;
- ❖ Preliminary Glen Oak & Sixteen Mile Creek Sormwater Management Plan, EIR/FSS Update for Health Sciences & Technology District, November 2016;
- ❖ Stormwater Management Report (SWMR) for All Seniors Care Living Centres, WalterFedy, November 2017.
- ❖ Preliminary Functional Servicing and Stormwater Management Report, EIR/FSS Update for Halton Region Courthouse, April 2018;

5.2 STORMWATER MANAGEMENT CRITERIA

A summary of the applicable SWM requirements for the HOMUN is provided below.

❖ **Water Quality**

Stormwater quality control will be required for all developments, in accordance with MECP's SWM Planning and Design Manual (2003). An Enhanced Level of water quality protection (Level 1) or a long-term 80% TSS removal on an annual loading basis shall be provided for the developments within HOMUN.

Enhanced quality control shall be provided via permanent pool and extended detention storage. As per the Town, this is considered sufficient to provide for the requisite level of phosphorous control.

Thermal mitigation can be provided in the form of a bottom draw pipes, as well as landscaping provisions that adhere to Conservation Halton's Stormwater Management and Landscaping Guidelines and MOE planting guidelines.

❖ **Water Balance**

Best effort must be made for all developments within HOMUN to maintain infiltration at the same level as pre-development levels.

❖ **Erosion Control**

Erosion control will be required for the development blocks where the erosion potential will be increased at the receiving water courses due to the development. This will be implemented so that existing channel erosion or aggradation will not be exacerbated by proposed development.

An industrial standard is to detain runoff volume from 25 mm design storm and release it over a 24-hour to 48-hour period.

❖ **Water Quantity / Flood Control**

As required by the NOCSS IR, post-development flows are to be controlled to unit release rates, up to and including the Regional event unless a downstream assessment is completed which indicates Regional-level controls are not required. The purpose of the stormwater quantity control is to provide runoff peak flow rate attenuation so as not to increase the risk to public safety, as well as to prevent property damage.

The target release rates for the study area are based on the updated Ontario Municipal Board (OMB) mediated values (Appendix B.2 of the Stantec Environmental Impact Report Functional Service Study (EIR/FSS)) and the pre-development drainage areas.

Outlets from the SWM facilities discharges to Taplow Creek, Glen Oak Creek, and tributary of Sixteen Mile Creek via culverts under Dundas Street. Through conversation with the Town of Oakville and Conservation Halton (CH) staff, the discharge from the Glen Oak RDF to Glen Oak Discharge 1 (GO-D1) during Hurricane Hazel storm shall be restricted to less than 1.2 m^3/s to prevent flooding downstream of Dundas Street. The culverts, Sixteen Miles Discharge 1 (SM-D1) and 1A (SM-D1A), and Taplow Creek Discharge 1 (TC-D1), have sufficient capacity to convey the OBM targets for regional storm event.

5.3 PROPOSED DEVELOPMENT

HOMUN is identified in the North Oakville West Secondary Plan (NOWSP) as the Employment District designation, which is generally intended "to provide for, and establish a range of development opportunities for employment generating industrial, office and service employment uses". In addition, the HONUM includes a hospital and may also include research and development facilities, medical and other offices, laboratories, clinics, supportive housing, long term care facilities, rehabilitation facilities, and other similar uses including retail and service commercial facilities related to the permitted uses.

The lands to the north of HONUM, consists of future community park and headwaters of Taplow Creek, Glen Oak Creek, and tributary of Sixteen Mile Creek. These areas contribute stormwater runoff to culverts TC-D1, GO-D1, SM-D1A, and SM-D1 under pre-development conditions and have been considered in the hydrologic analysis for the post-development conditions, as wells as detailed design of SWM facilities.

5.4 SWM MANAGEMENT PLAN

A comprehensive SWM plan has been developed for the HOMUN, which includes lot level controls, end-of-pipe controls, and diversion channel. Conveyance controls were not proposed for the developments within HOMUN

5.4.1 LOT LEVEL CONTROLS

Lot level SWMPs include reduced lot grading, discharging clean roof runoff to pervious surfaces, infiltration swales, or soakaway pits, rain gardens, pervious/porous pavements, green roofs and reduced lot gradings. These SWMPs encourage infiltration to groundwater; help to reduce the volume of water travelling to the major and minor systems and help to preserve hydrologic regime. Infiltration techniques are also effective for reducing runoff temperature increases and removing sediment, heavy metals and nutrients from runoff.

Generally, infiltration techniques are recommended in areas where the minimum infiltration rate is equal to or greater than 15 mm/hr. Where practical, this is a preferable SWMP.

Reduced lot grading involves the grading of individual lots at less than the 2% normally required by municipal standards. At grades approaching 0.5%, which are optimum for this type of control, it is generally recognized that consistent grading is not possible and that some short term, localized ponding and wet areas will occur on the lots; However, this localized ponding should not create any significant inconvenience for the landowners.

Lot level Low Impact Development (LID) Best Management practices (BMPs) are proposed to address groundwater recharge and water balance, and shall be evaluated in a site by site basis.

5.4.2 END-OF-PIPE CONTROLS

Total three SWM wet facilities are in place to service the subject study area, which includes: Halton Healthcare Services (HHS) Stormwater Management Pond (SWMP), Glen Oak (GO) Regional Detention Facilities (RDF), and Taplow Creek (TC) Regional Detention Facilities (RDF).

HHS SWMP

The HHS SWM Pond is located at southwest corner of the New Oakville Hospital (NOH) site and is constructed as per *Environmental Impact Report / Functional Service Study (EIR/FSS) Update and Halton Healthcare Services (HHS) Stormwater Management Pond Design* (WalterFedy, May 2012).

The HHS SWM pond comprised of an extended wet detention pond to ultimately serve a total drainage area of approximately 17.15 ha HHS lands, providing an Enhanced Level of Protection for habitat in the downstream receiving system, with inlet sewers discharging to a single sediment forebay for removal of sediment, and three pond maintenance access ramps, having approx.3,760 m^3 permanent pool volume and 19,922 m^3 of extended detention storage volume, with slow release of the 25-mm storm over a period of 24-48 hours, and to provide storage during storm events and with a pond outlet control structure discharging to existing culvert under Dundas Street West, referred to as the Taplow Creek Discharge 1 (TC-D1), at a combined release rate from the Taplow Regional Detention Facility and the Halton Healthcare Services (HHS) pond not to exceed a peak flow of 1.81 m^3/s during the regional storm event under ultimate development conditions per the Ontario Municipal Board target release rate (MECP ECA, 6370-8UJNXY, May 30, 2012).

Glen Oak RDF

Glen Oak RDF is located at southeast quadrant of the intersection of Dundas Street West and Third Line in the Town of Oakville, and is constructed as per *Glen Oak Regional Detention Facility (RDF) Design Brief and Third Line Engineering* (WalterFedy, May 2012).

Glen Oak RDF comprised of an extended wet detention pond to serve a total drainage area of approximately 43.41 ha with an overall imperviousness of 67% during ultimate development conditions, consisting of Employment lands" surrounding the facility and north of William Halton Parkway, as well as a future community park west of the diversion channel, providing an Enhanced Level of Protection for habitat in the two downstream receiving systems, with inlet sewers discharging to a single sediment forebay for removal of sediment, and three pond maintenance access ramps, having approx. 23,470 m^3 permanent pool volume and 88,052 m^3 of extended detention storage volume, with slow release of the 25-mm storm over a period of 24-48 hours, and to provide storage during storm events and with two (2) pond outlet control structures, one outlet structure discharging to existing culvert under Dundas Street West, referred to as the Glen Oak Discharge 1 (GO-D1), at a peak flow of 0.781 m^3/s during the regional storm event under ultimate development conditions (less than 1.2 m^3/s based on the desired downstream restriction identified by the Town of Oakville and less than 2.290 m^3/s per the Ontario Municipal Board (OMB) target release rate), and one outlet structure discharging to existing culvert under Dundas Street West, referred to as the 16 Mile Creek Discharge 1A (SM-D1A), flow shall not exceed the Ontario Municipal Board (OMB) target release rate of 0.608 m^3/s for the regional storm event under ultimate development conditions (less than the existing culvert capacity of 0.732 m^3/s).

Taplow RDF

Taplow RDF is located at southwest quadrant of the intersection of Dundas Street West and Hospital Gate in the Town of Oakville, and is constructed as per *Taplow Creek Regional Detention Facility (RDF) Design Brief and Western Road Engineering* (WalterFedy, May 2012).

Taplow RDF comprised of an extended wet detention pond to ultimately serve a total drainage area of approximately 28.06 ha of upstream lands with an overall imperviousness of 67% during ultimate development conditions, providing an Enhanced Level of Protection for habitat in the two downstream receiving systems, with inlet sewers discharging to a single sediment forebay for removal of sediment, and three pond maintenance access ramps, having approx. 12,252 m^3 permanent pool volume and 65,013 m^3 of extended detention storage volume, with slow release of the 25-mm storm over a period of 24-48 hours, and to provide storage during storm events and with a pond outlet control structure discharging to existing culvert under Dundas Street West, referred to as the Taplow Creek Discharge 1 (TC-D1) at a combined release rate from the Taplow RDF and the Halton Healthcare Services (HHS) pond not to exceed a peak flow of 1.81 m^3/s during the regional storm event under ultimate development conditions per the Ontario Municipal Board (OMB) target release rate (MECP ECA, 0891-8UJP3C, May 30, 2012).

The HHS SWMP, Glen Oak RDF, and Taplow RDF are designed to provide sufficient permanent pool volume and active volume with appropriately configured outlet structures to address water quality, erosion and quantity control

5.4.3 DIVERSION CHANNEL

The majority of the Glen Oak RDF is located within the Sixteen Mile Creek watershed, with contributing area to the Glen Oak RDF intercepting a portion of the Sixteen Mile Creek watershed. A land swap redirects runoff from Glenorchy lands and other lands into the Sixteen Mile Creek system via a diversion channel that is proposed to be located north of the future Glenorchy Road.

Detailed design of the diversion channel is provided in *Glenorchy Diversion Channel Design Brief* (WalterFedy, December 2011, Revised May 2012). The design of the Glenorchy diversion channel and Glen Oak RDF outlets to SM-D1A was optimized to replicate pre-development conditions within the Sixteen Mile Creek tributary to the maximum extent possible to the benefit of the high constraint stream and Provincially Significant Wetland (PSW).

5.5 RECENT AND CURRENT DEVELOPMENTS

The development of HOMUN proceeds in phases with all SWM facilities in place. The minor storm sewer system networks for each development site are designed with capacity to drain the site during all storm events up to and including 10-year storm. Major storm pathways are consistent with the overall SWM strategy developed in the EIR / FSS update prepared for the New Oakville Hospital (NOH).

Significant recent and current development in the HOMUN includes the following

Oakville – Trafalgar Memorial Hospital

The New Oakville Hospital (NOH) is first development within NOHUM and opened in December 2015. The NOH is located on Halton Healthcare Services (HHS) site, which is bounded by Dundas Street West to the south, Third Line to the east, William Halton Parkway to the north, and Hospital Gate to the west. The NOH provides a full range of health care services and functions as a teaching hospital as well. A separate medial office building is located on the northwest quadrant of the HHS site and occupied by medical service uses. Runoff from approximately 17.15 ha HHS site is conveyed to the privately owned and operated SWM pond – HHS SWMP for quality, erosion and quantity control.

ErinoakKids Centre for Treatment and Development

ErinoakKids is a child and family treatment centre and located at the northwest quadrant of the intersection of Third Line extension and William Halton Parkway. The ErinoakKids Centre is opened in 2017. The ErinoakKids site occupies an area of 2.10 ha with a typical imperviousness of 85%. Runoff from the site is conveyed to Glen Oak RDF for quality, erosion, and quantity control.

All Seniors Care, senior assisted living and care facility

The All Seniors Care site is bounded by Hospital Gate to the east, Dundas Street West to the south, Taplow RDF to the north, and vacant lands to the west. The proposed development has been approved in December 2017 and are not constructed yet. The development proposal is 1.226 ha land with an imperviousness of 64%. Runoff from the site shall be directed to Taplow Creek RDF for quality, erosion, and quantity control.

Halton Region Courthouse

Halton Region Courthouse site is bounded by the William Halton Parkway to the south, existing ErinoakKids to the east, future Glenorchy Avenue to the north, and future Hospital Gate extension to the west. The proposed development in under review process. Runoff from the majority of the 7.1 ha site will be drain to Glen Oak RDF, while 0.31 ha of frontage to Hospital Gate shall drain to Taplow RDF for quality, erosion and quantity control.

Health Sciences and Technology District

The Health Sciences and Technology District (HSTD) site is a 4.45 ha land located at the southeast corner of William Halton Parkway and Third Line, just north of existing Glen Oak RDF. The subject development proposes an innovation hub, with an associated hotel and conference centre, medical offices, and assisted living. Runoff from the HSTD site shall be directed to the Glen Oak RDF for quality, erosion, and quantity control.

Generally, the site overall imperviousness for all above development remains less than typical value of 85% used in the pond design and no additional on-site SWM controls are required. Hydrologic modelling was carried out during preparing the SWM reports and/or EIR / FSS updates for each individual development site to verify the quantity control performance of the SWM facilities under various interim conditions and ultimate development conditions.

5.6 CONCLUSIONS – STORM SYSTEM

With above reviews, the following conclusions can be drawn:

- ◊ All end-of-pipe SWM facilities – HHS SWMP, Glen Oak RDF, and Taplow RDF, are designed to provide required storage volume to meet quality, erosion and quantity control target for ultimate development conditions;
- ◊ With the Glenorchy Diversion Channel and SWM facilities, the overall stormwater management objectives outline in NOCSS are satisfied;
- ◊ Lot level Low Impact Development (LID) Best Management practices (BMPs) proposed for future development to address groundwater recharge and water balance shall be evaluated in a site by site basis.
- ◊ Minor and major storm sewer systems for future developments shall be designed as per Town of Oakville standards and should follow the drainage plan for the SWM facility design;
- ◊ No on-site quality and quantity control are required for future development provided that the overall imperviousness remain less than 85%.

APPENDIX

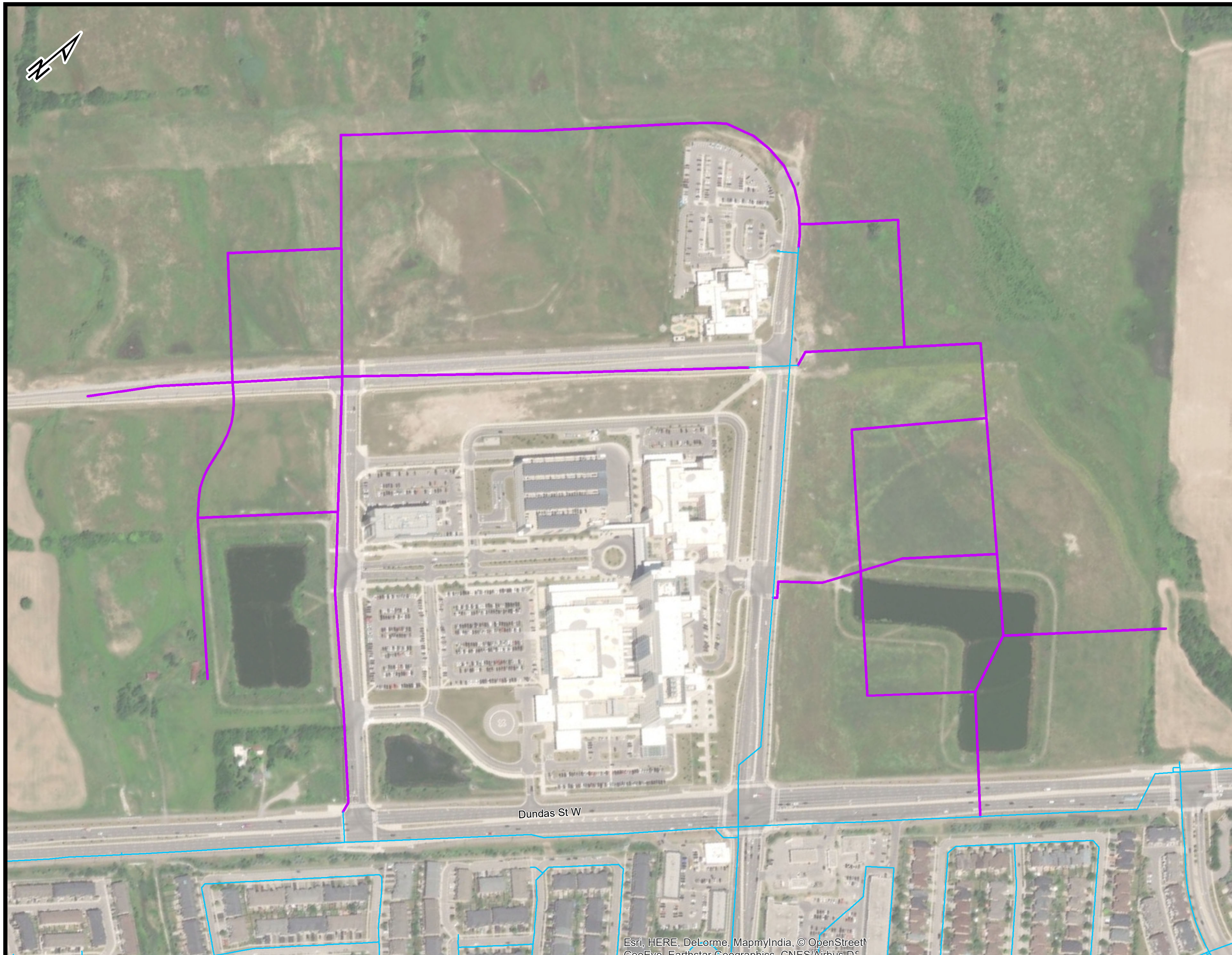
A WATERMAINS

HOMUN Neighborhood Development

Average Demand			Peaking Factors	
Residential	265	L/Person/Day	Maximum Day	2.25
Non-Residential	225	L/Emp/Day	Peak Hour	4.0

Notes: Average Day Demand Rates taken from: Regional Municipality of Halton Water and Wastewater Linear Design Manual

Node	Parcel ID	Precinct	Land Use	Total No. of Jobs	Residential Population	Persons	Average Day (L/s)	Maximum Day (L/s)	Peak Hour (L/s)
HO-J0004	11	1	Urban Centre - 1	148	190	338	0.97	2.18	3.88
HO-J0025	12	1	Urban Core - 1	213	273	486	1.39	3.13	5.57
HO-J0026	13	1	Urban Core - 1	136	174	310	0.89	2.00	3.55
HO-J0001	14	1	Urban Core - 1	237	304	540	1.55	3.48	6.19
HO-J0004	15	1	Urban Core - 1	262	335	597	1.71	3.85	6.84
HO-J0005	21	2	Urban Core - 2	79	404	483	1.45	3.25	5.78
HO-J0010	22	2	Urban Core - 2	75	384	459	1.37	3.09	5.49
HO-J0007	23	2	Urban Core - 2	86	441	527	1.58	3.55	6.31
HO-J0008	24	2	Urban Core - 2	77	393	469	1.40	3.16	5.62
HO-J0022	25	2	Urban Core - 2	56	286	341	1.02	2.30	4.08
HO-J0023	26	2	Urban Core - 2	75	384	459	1.37	3.09	5.49
HO-J0021	27	2	Urban Core - 2	70	356	426	1.27	2.87	5.10
HO-J0003	31	3	Urban Core - 3	203	173	376	1.06	2.39	4.24
HO-J0006	32	3	Urban Core - 3	188	160	348	0.98	2.20	3.92
HO-J0028	33	3	Urban Core - 3	176	151	327	0.92	2.07	3.69
HO-J0026	34	3	Urban Core - 3	136	117	253	0.71	1.60	2.85
HO-J0009	35	3	Urban Core - 3	170	145	315	0.89	2.00	3.55
HO-J0027	36	3	Urban Core - 3	133	113	246	0.69	1.56	2.77
HO-J0012	41	4	Urban Centre - 2	202	480	681	2.00	4.49	7.99
HO-J0019	42	4	Urban Core - 4	397	945	1342	3.93	8.85	15.73
HO-J0013	43	4	Urban Centre - 2	162	386	548	1.60	3.61	6.42
HO-J0015	44	4	Urban Core - 5	837	1991	2828	8.29	18.64	33.14
HO-J0007	51	5	Institutional	3390	0	3390	8.83	19.86	35.32
HO-J0003	52	5	Institutional	2561	0	2561	6.67	15.00	26.67
HO-J0028	53	5	Institutional	700	0	700	1.82	4.10	7.29
Totals:				**9051**	**4487**	**13538**	**37**	**84**	**149**



Legend

- S Storage Tank
- BPS Booster Pumping Station (BPS)
- Pipe (Existing)
- Pipe (New)

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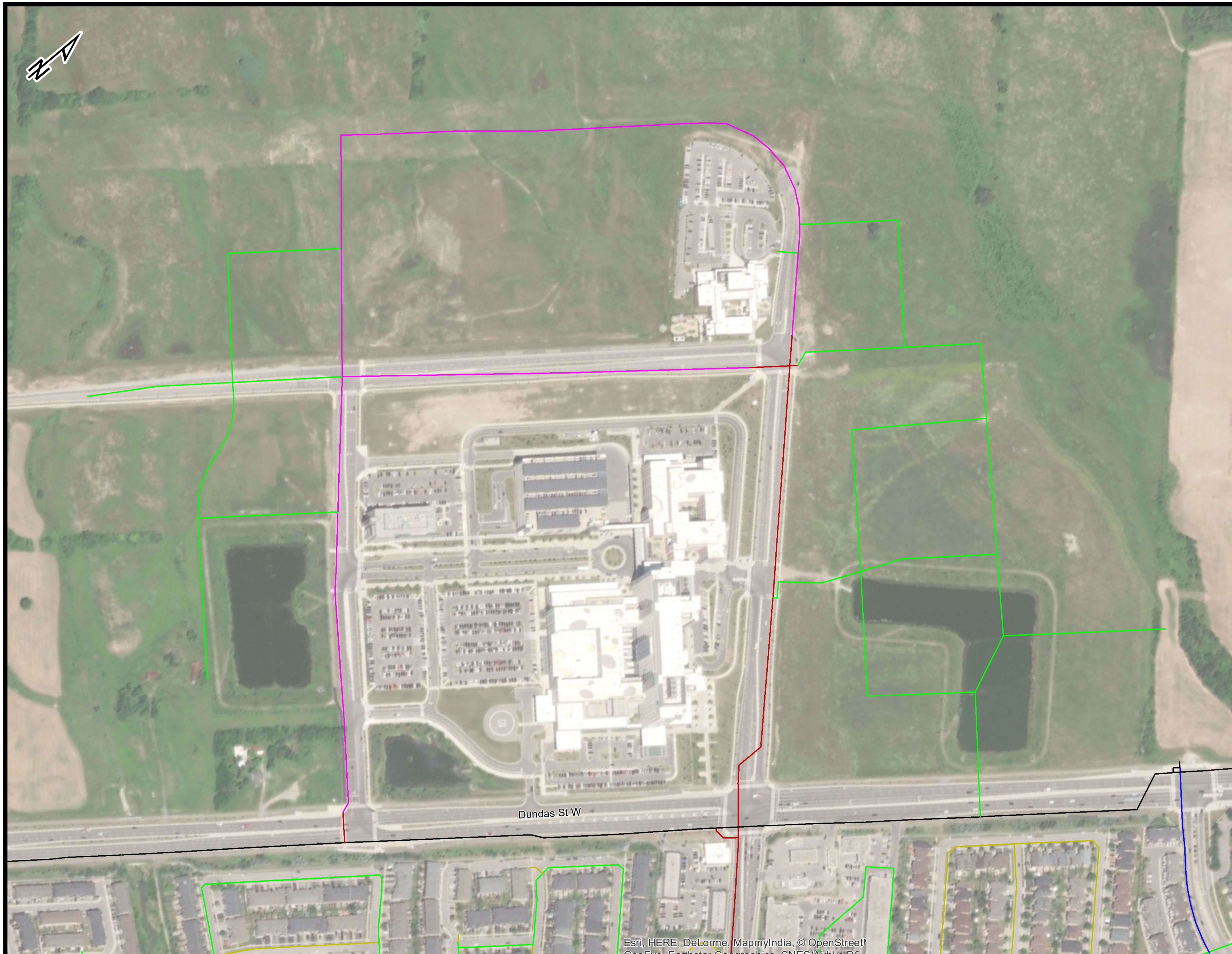
0 100 200 m

1:4,000

Map 1A

HOMUN Site Key Map



Legend

S Storage Tank

BPS Booster Pumping Station (BPS)

Pipe: Diameter (mm)

- <= 150
- <= 200
- <= 250
- <= 300
- <= 400
- <= 600
- > 600

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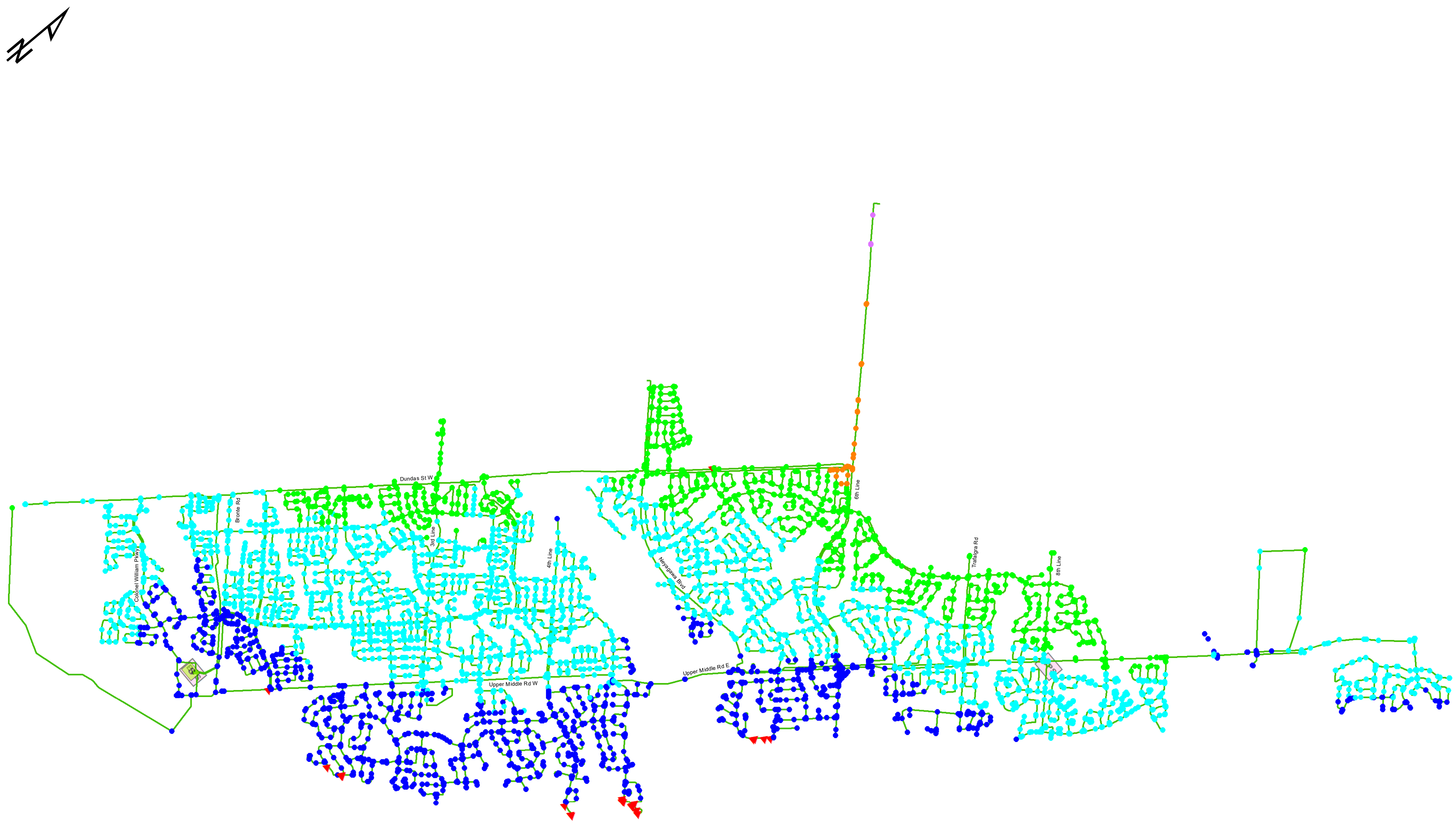
0 100 200 m

1:4,000

Map 1B

Pipe Diameter



Legend

S	Storage Tank
BPS	Booster Pumping Station (BPS)

Junction: Pressure (psi)

- <= 20
- <= 40
- <= 60
- <= 80
- <= 100
- > 100

Road_Name

Pipe: Headloss Gradient (m/km)

- <= 1.5
- <= 2.0
- <= 3.0
- <= 5.0
- > 5.0

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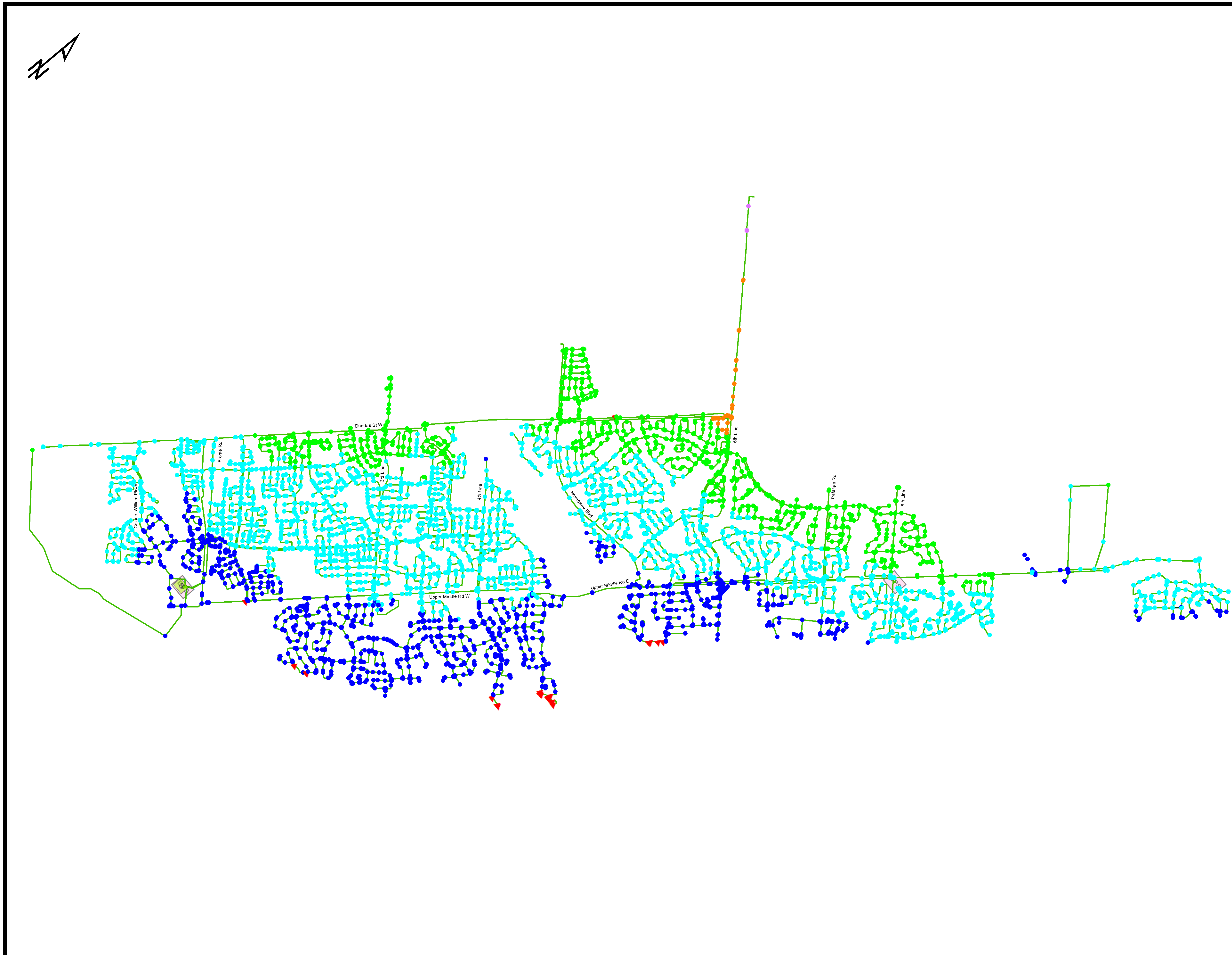
0 1,000 2,000 m

1:45,000

Map 1.1

Pressure and Headloss
(Without HOMUN Site)

2016 Average Day



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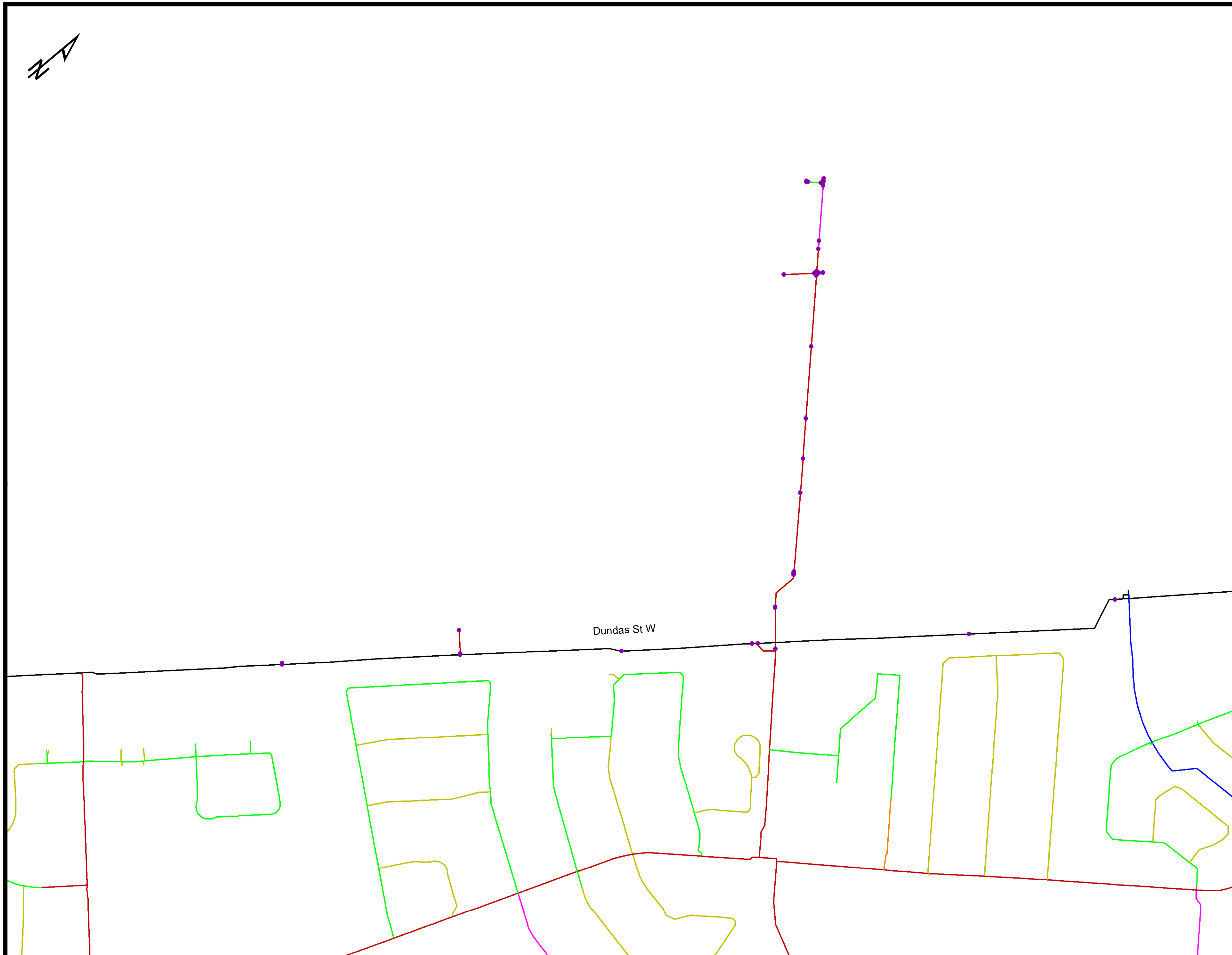
Map 1.2

Pressure and Headloss (Without HOMUN Site)

2016 Maximum Day



Legend

- Storage Tank
- Booster Pumping Station (BPS)
- Road_Name

Junction: Fire Flow (Available) (L/s)

- <= 0
- <= 100
- <= 200
- > 200

Pipe: Diameter (mm)

- <= 150
- <= 200
- <= 250
- <= 300
- <= 400
- <= 600
- > 600

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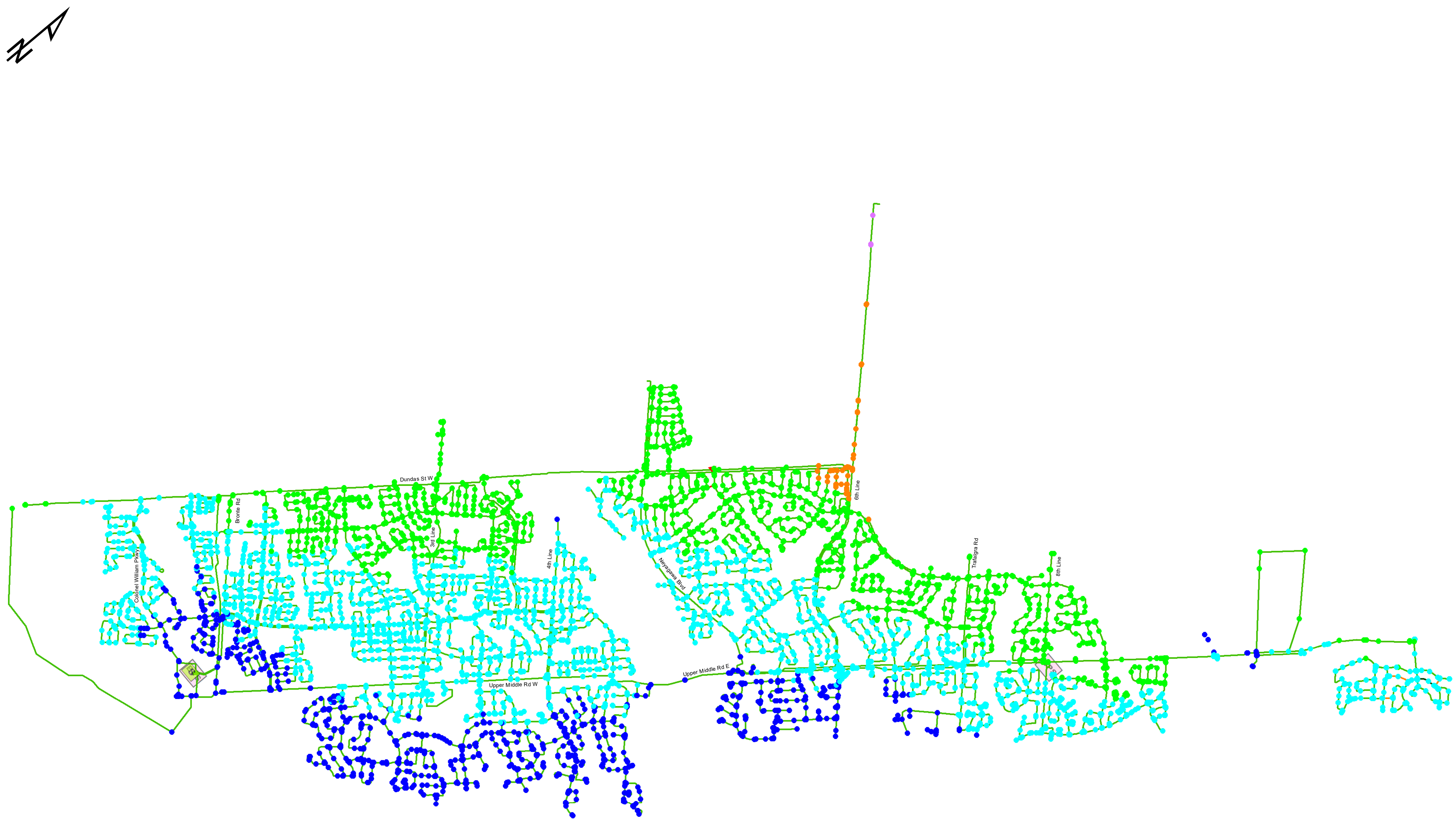
0 100 200 m

1:5,000

Map 1.3

Fire Flow Availability
(Without HOMUN Site)

2016 Maximum Day+FF



Legend

- S Storage Tank
- BPS Booster Pumping Station (BPS)

Junction: Pressure (psi)

- <= 20
- <= 40
- <= 60
- <= 80
- <= 100
- > 100

Road_Name

Pipe: Headloss Gradient (m/km)

- <= 1.5
- <= 2.0
- <= 3.0
- <= 5.0
- > 5.0

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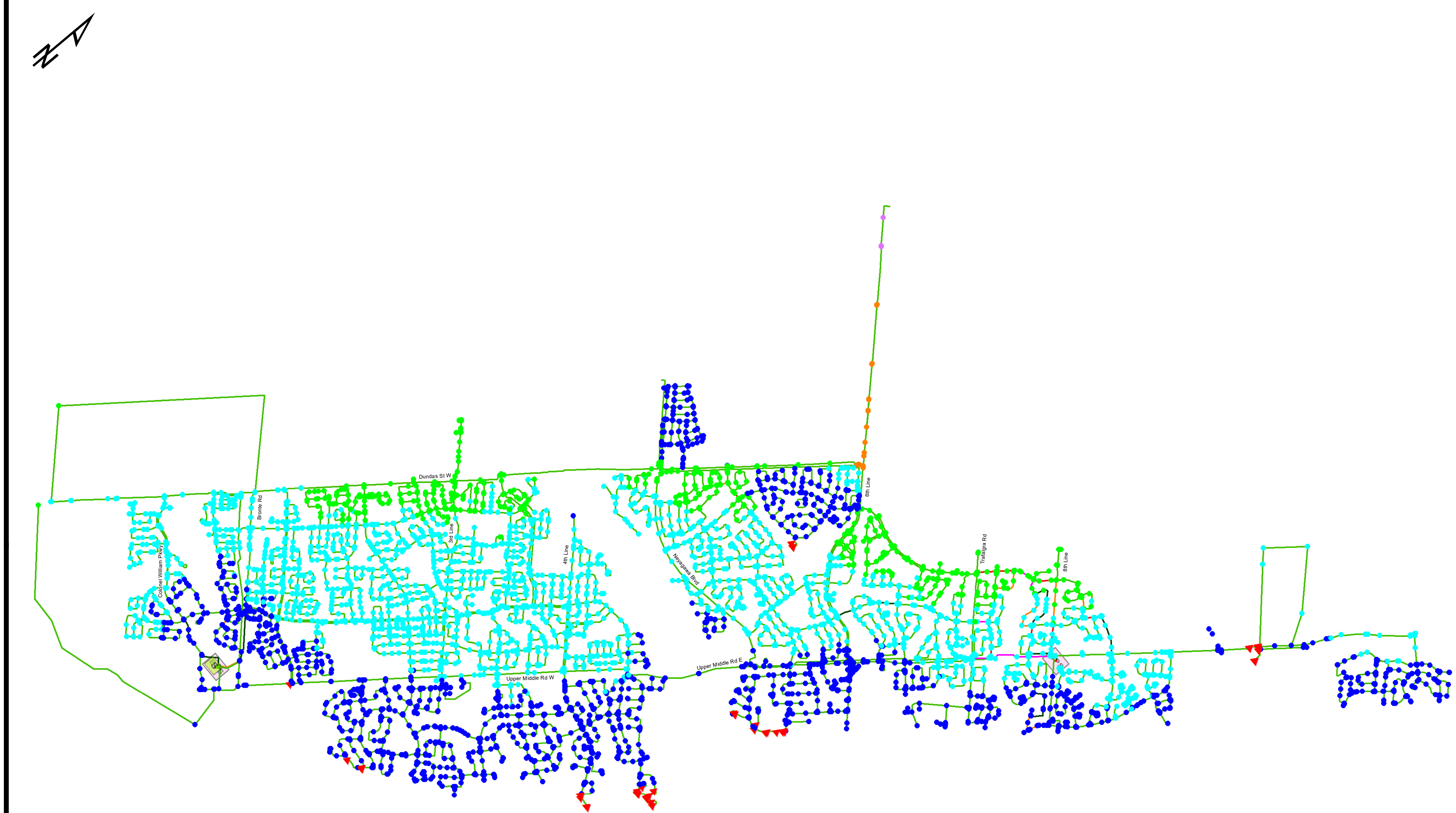
0 1,000 2,000 m

1:45,000

Map 1.4

Pressure and Headloss
(Without HOMUN Site)

2016 Peak Hour



Legend

- Storage Tank
- Booster Pumping Station (BPS)

Junction: Pressure (psi)

- <= 20
- <= 40
- <= 60
- <= 80
- <= 100
- > 100

Road_Name

Pipe: Headloss Gradient (m/km)

- <= 1.5
- <= 2.0
- <= 3.0
- <= 5.0
- > 5.0

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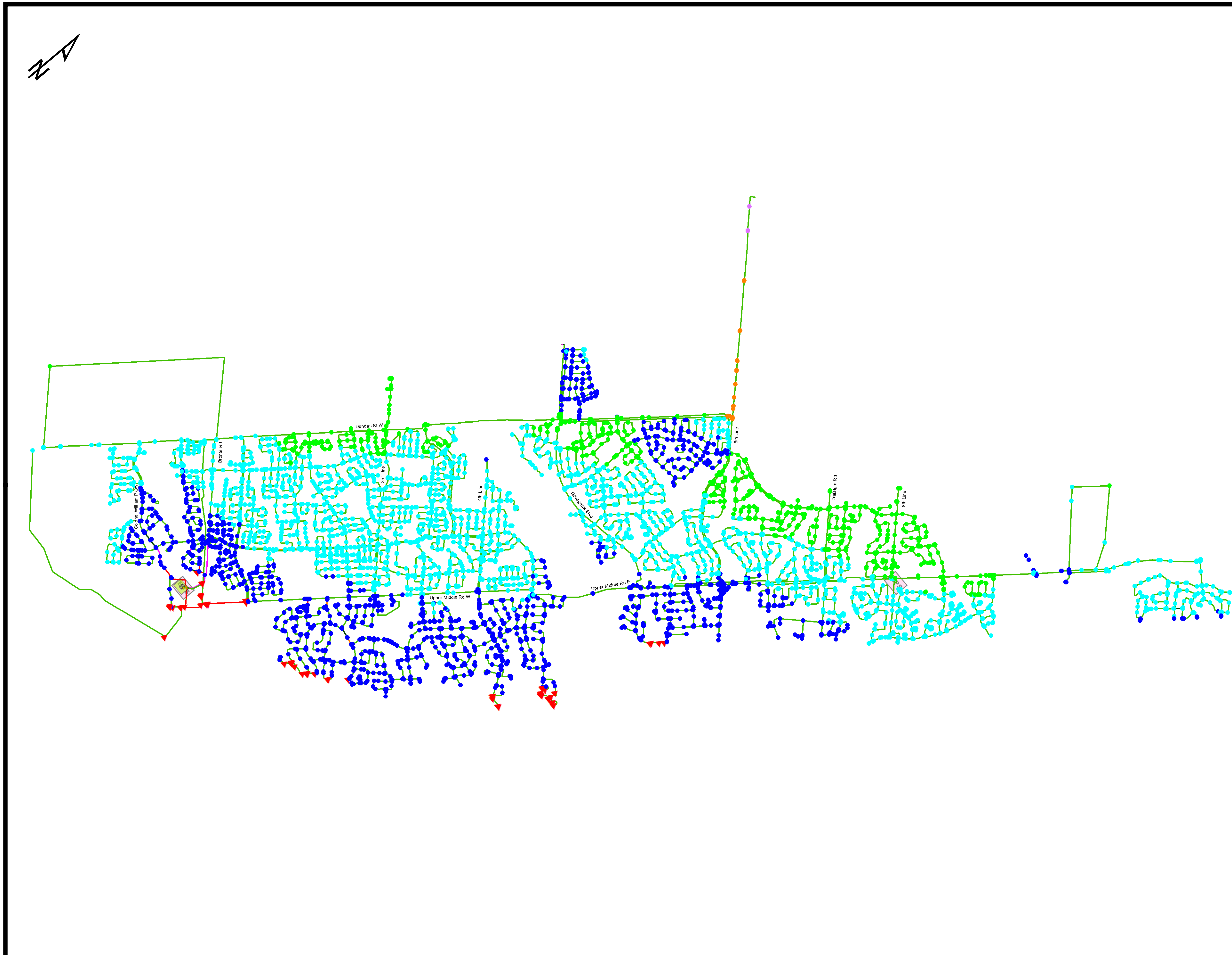
0 1,000 2,000 m

1:45,000

Map 2.1

Pressure and Headloss
(Without HOMUN Site)

2031 Average Day



Legend

S	Storage Tank
BPS	Booster Pumping Station (BPS)

Junction: Pressure (psi)

- <= 20
- <= 40
- <= 60
- <= 80
- <= 100
- > 100

Road_Name

Pipe: Headloss Gradient (m/km)

- <= 1.5
- <= 2.0
- <= 3.0
- <= 5.0
- > 5.0

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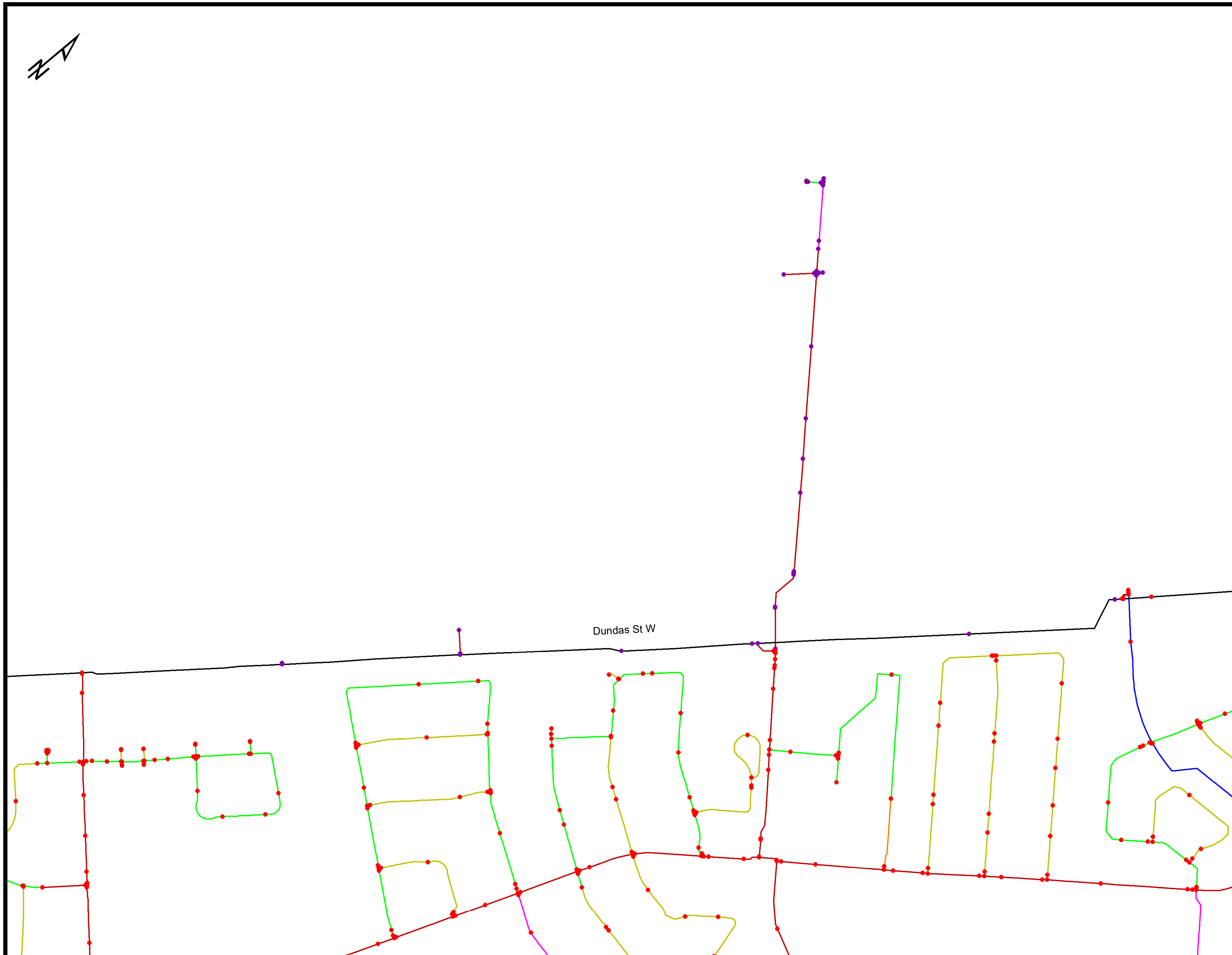
0 1,000 2,000 m

1:45,000

Map 2.2

Pressure and Headloss (Without HOMUN Site)

2031 Maximum Day



Legend

- Storage Tank
- Booster Pumping Station (BPS)
- Road_Name

Junction: Fire Flow (Available) (L/s)

- <= 0
- <= 100
- <= 200
- > 200

Pipe: Diameter (mm)

- <= 150
- <= 200
- <= 250
- <= 300
- <= 400
- <= 600
- > 600

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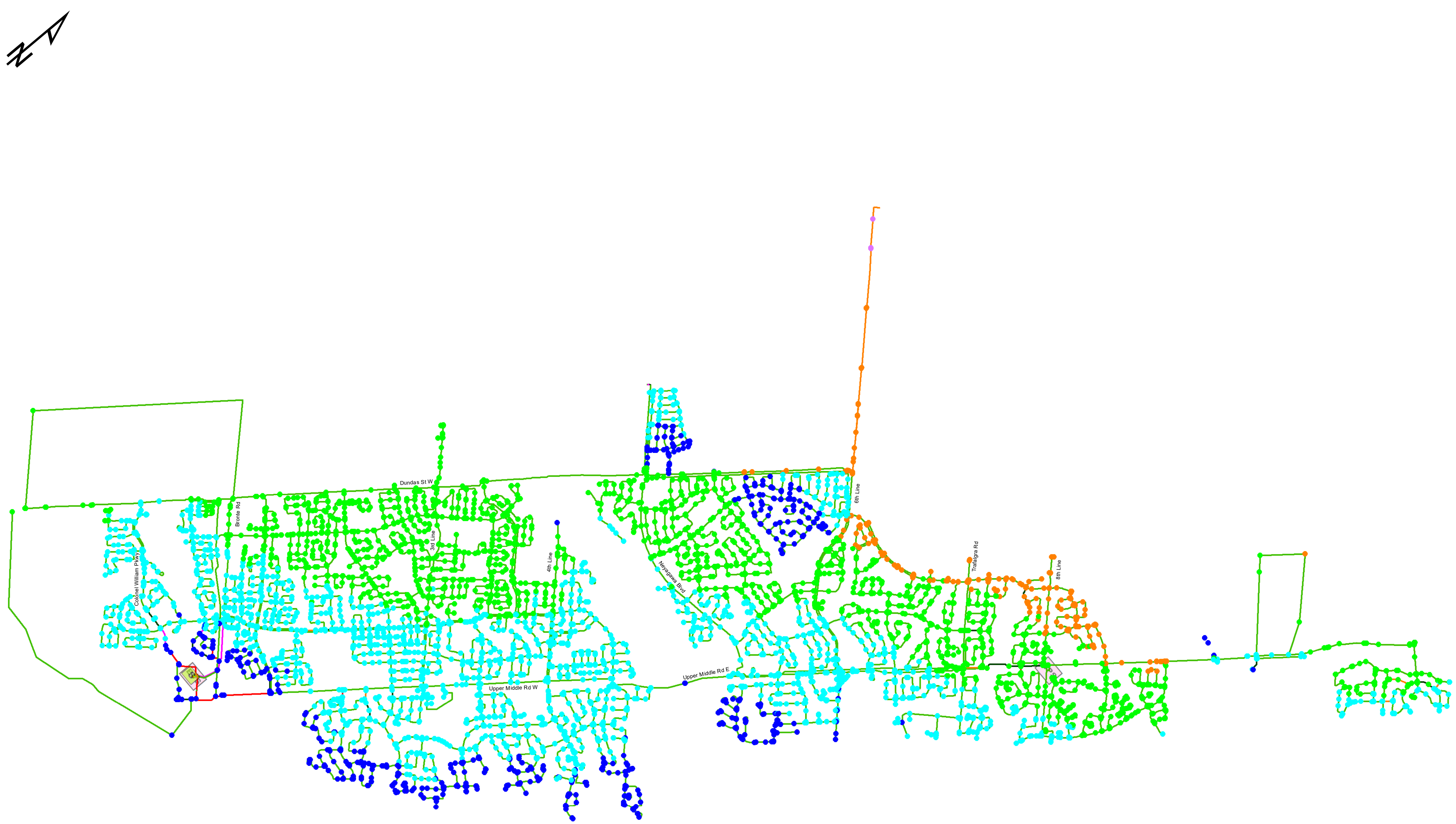
0 100 200 m

1:5,000

Map 2.3

Fire Flow Availability (Without HOMUN Site)

2031 Maximum Day+FF



Legend

- S Storage Tank
- BPS Booster Pumping Station (BPS)

Junction: Pressure (psi)

- <= 20
- <= 40
- <= 60
- <= 80
- <= 100
- > 100

Road_Name

Pipe: Headloss Gradient (m/km)

- <= 1.5
- <= 2.0
- <= 3.0
- <= 5.0
- > 5.0

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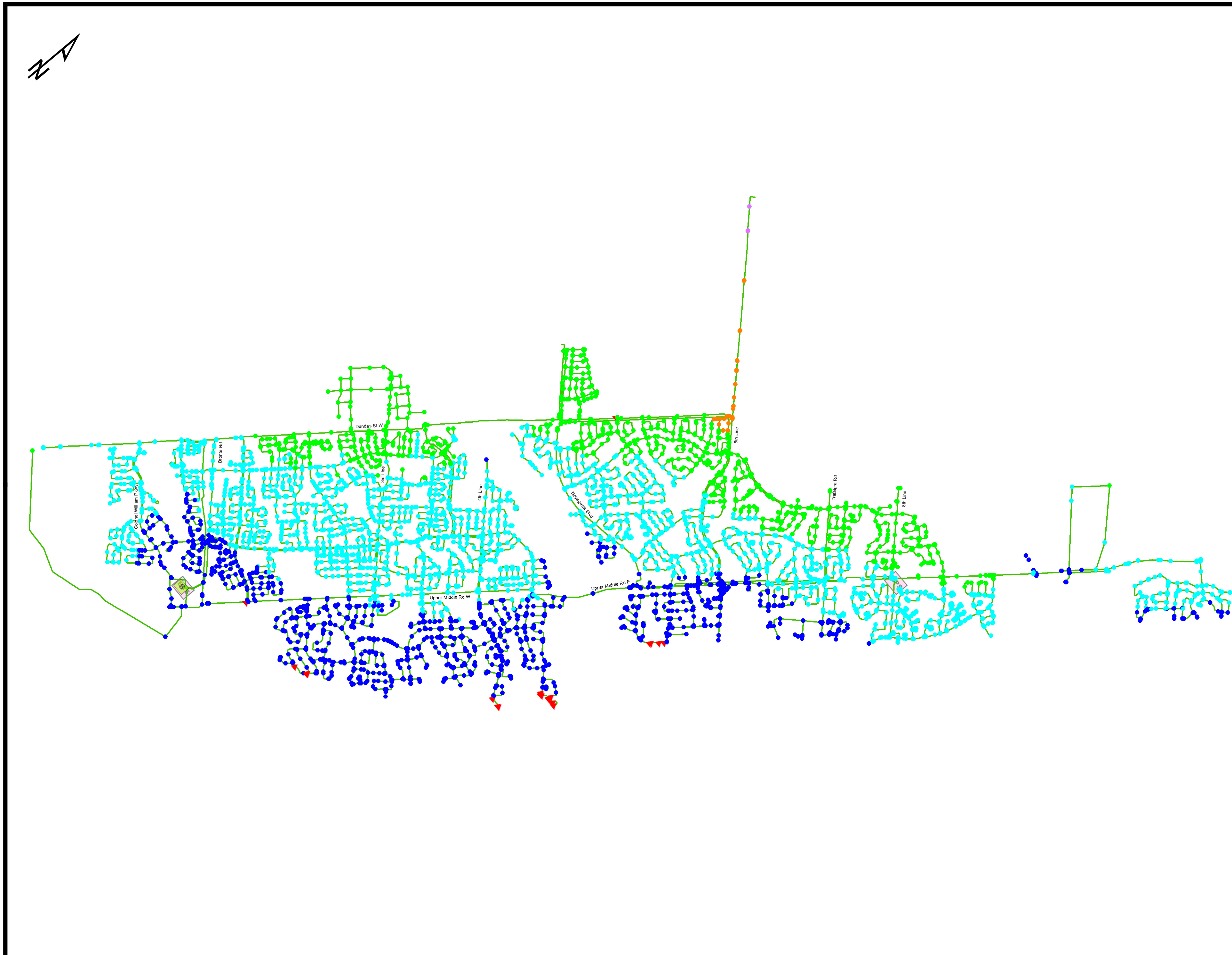
0 1,000 2,000 m

1:45,000

Map 2.4

Pressure and Headloss (Without HOMUN Site)

2031 Peak Hour



Legend

- S Storage Tank
- BPS Booster Pumping Station (BPS)

Junction: Pressure (psi)

- <= 20
- <= 40
- <= 60
- <= 80
- <= 100
- > 100

Road_Name

Pipe: Headloss Gradient (m/km)

- <= 1.5
- <= 2.0
- <= 3.0
- <= 5.0
- > 5.0

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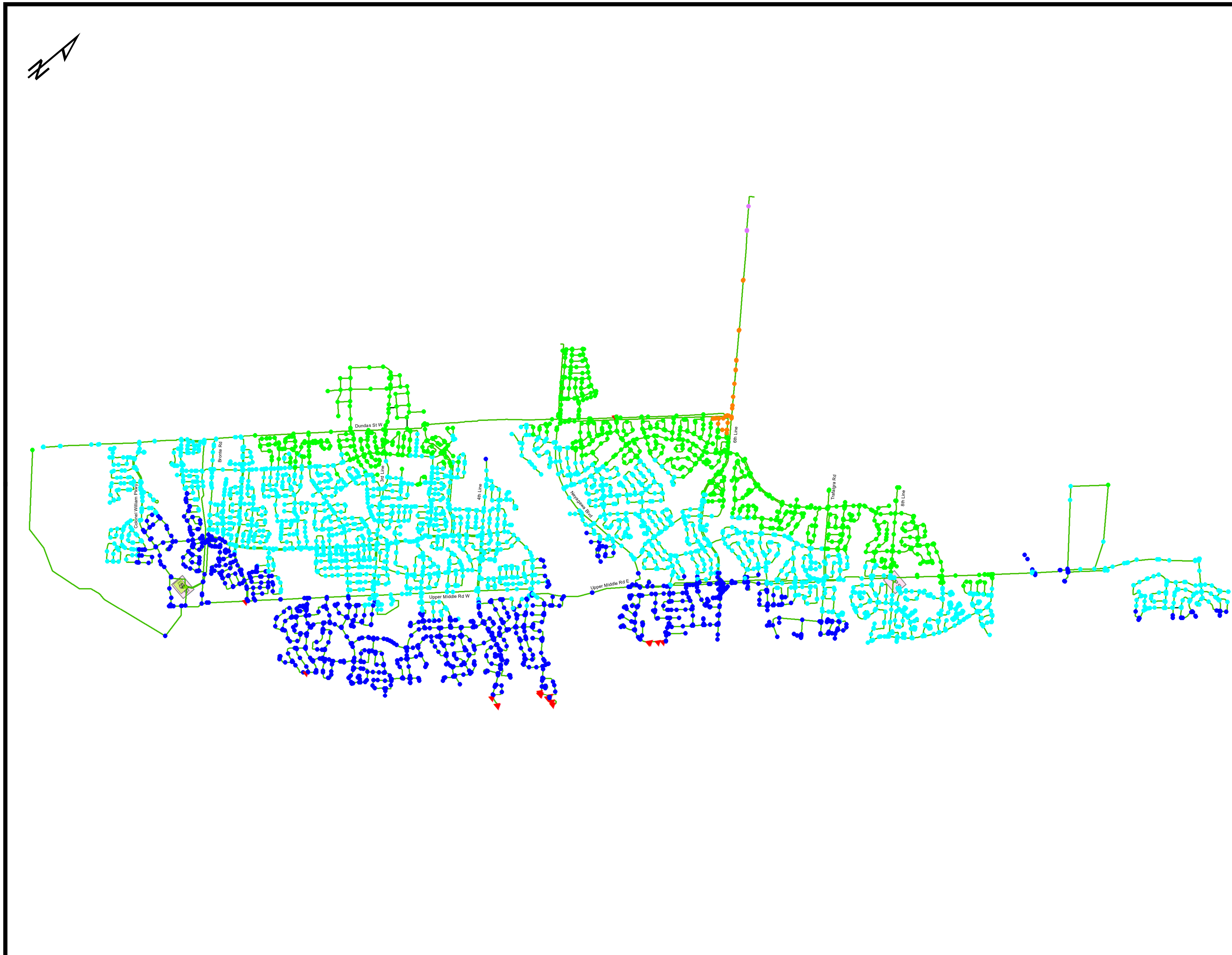
0 1,000 2,000 m

1:45,000

Map 3.1

Pressure and Headloss
(With HOMUN Site)

2016 Average Day



Legend

- S Storage Tank
- BPS Booster Pumping Station (BPS)

Junction: Pressure (psi)

- <= 20
- <= 40
- <= 60
- <= 80
- <= 100
- > 100

Road_Name

Pipe: Headloss Gradient (m/km)

- <= 1.5
- <= 2.0
- <= 3.0
- <= 5.0
- > 5.0

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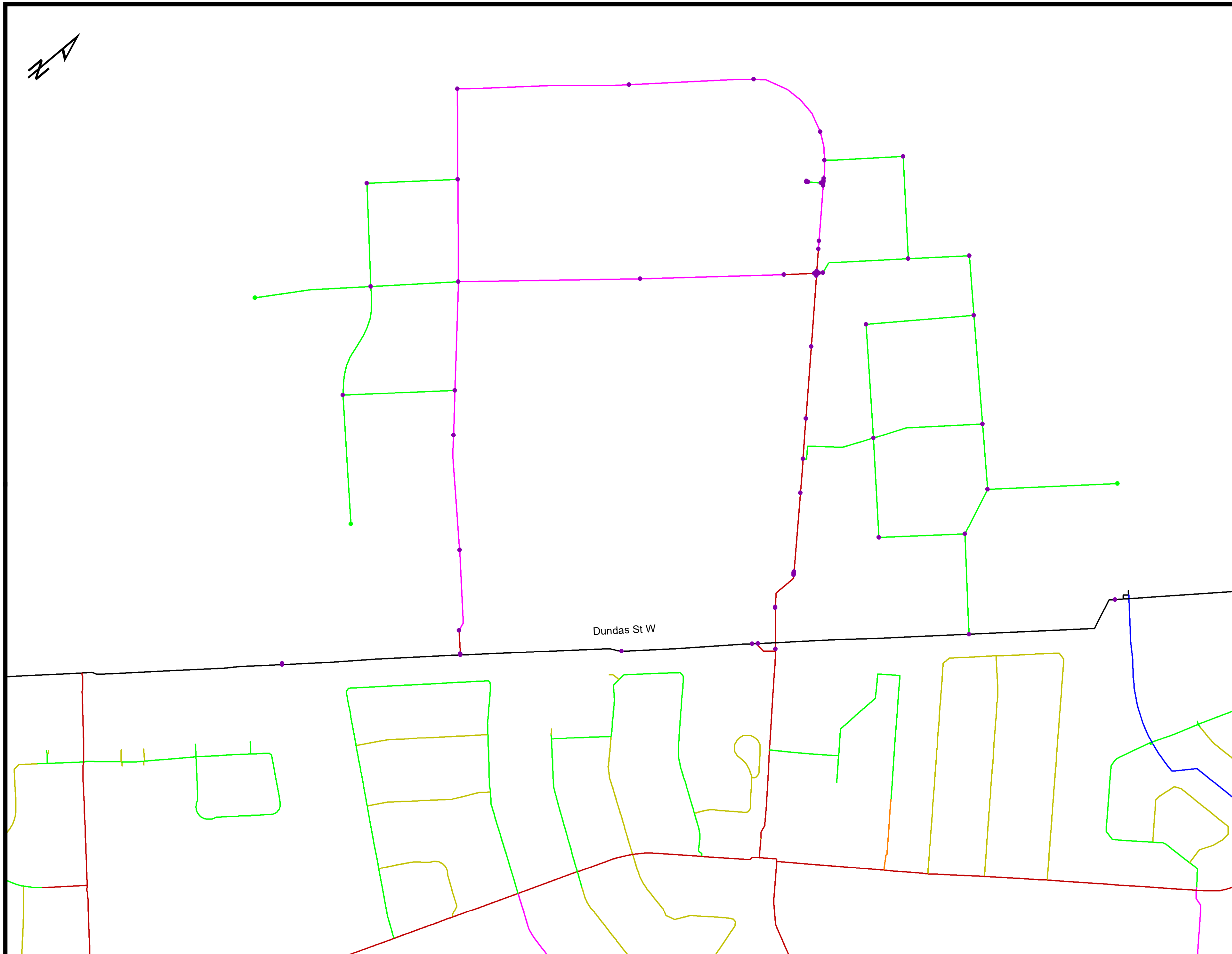
0 1,000 2,000 m
1:45,000

Map 3.2

Pressure and Headloss
(With HOMUN Site)

2016 Maximum Day



Legend

- S Storage Tank
- BPS Booster Pumping Station (BPS)
- Road_Name

Junction: Fire Flow (Available) (L/s)

- <= 0
- <= 100
- <= 200
- > 200

Pipe: Diameter (mm)

- <= 150
- <= 200
- <= 250
- <= 300
- <= 400
- <= 600
- > 600

OAKVILLE

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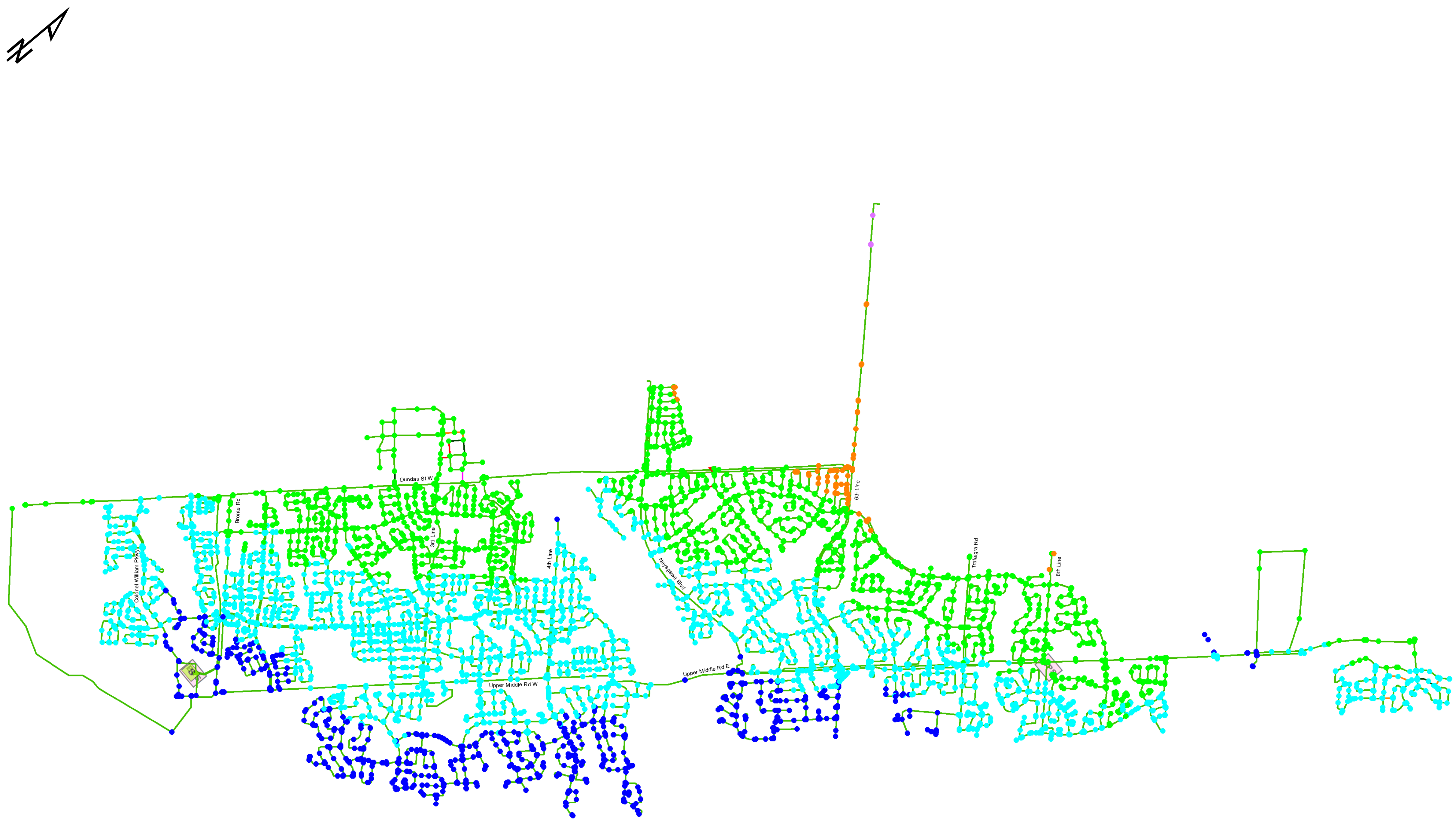
0 100 200 m

1:5,000

Map 3.3

Fire Flow Availability (With HOMUN Site)

2016 Maximum Day+FF



Legend

- S Storage Tank
- BPS Booster Pumping Station (BPS)

Junction: Pressure (psi)

- <= 20
- <= 40
- <= 60
- <= 80
- <= 100
- > 100

Road_Name

Pipe: Headloss Gradient (m/km)

- <= 1.5
- <= 2.0
- <= 3.0
- <= 5.0
- > 5.0

OAKVILLE

wsp

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Town of Oakville -
Oakville Homun Study

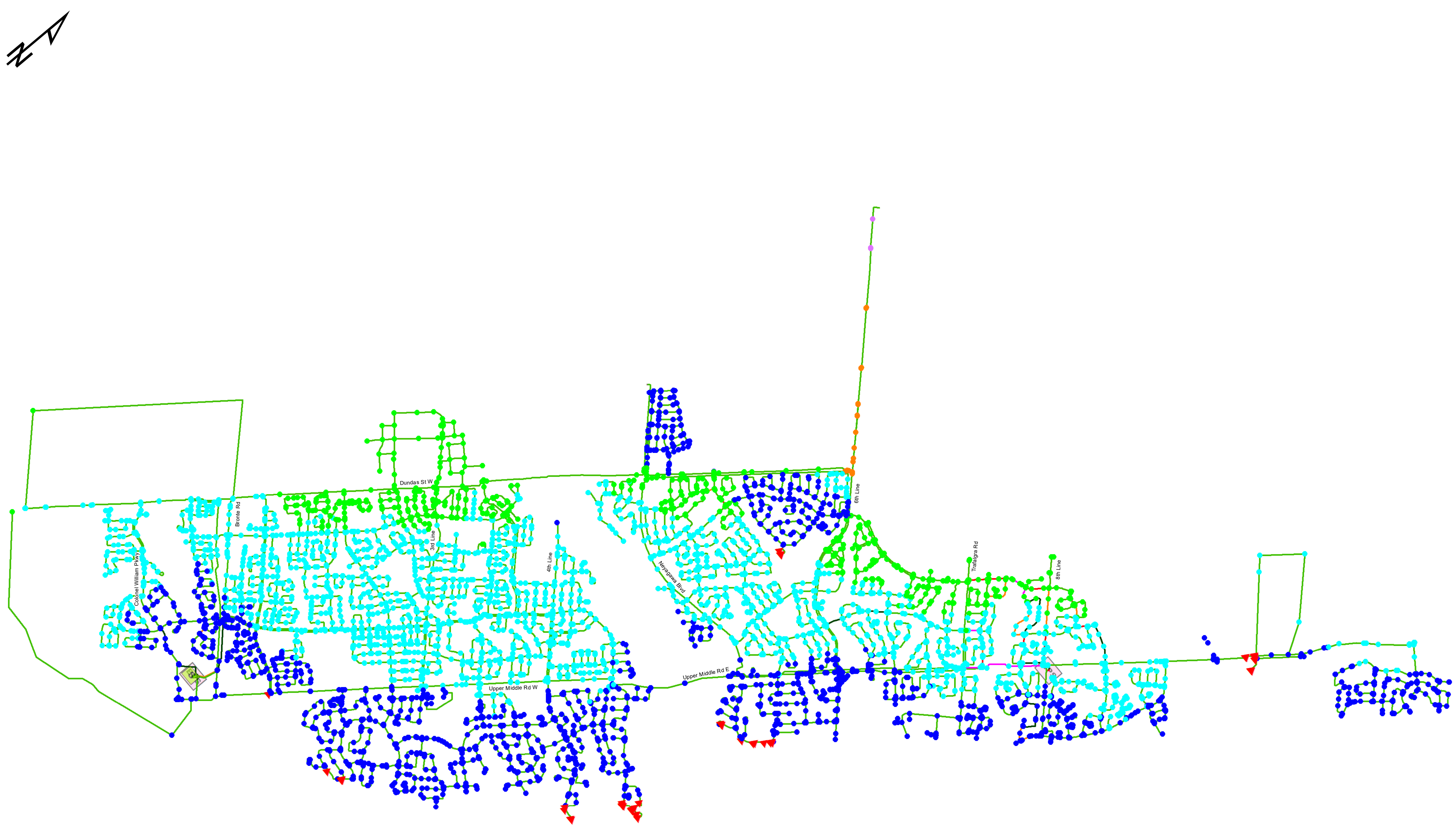
0 1,000 2,000 m

1:45,000

Map 3.4

Pressure and Headloss
(With HOMUN Site)

2016 Peak Hour



Legend

- S Storage Tank
- BPS Booster Pumping Station (BPS)

Junction: Pressure (psi)

- <= 20
- <= 40
- <= 60
- <= 80
- <= 100
- > 100

Road_Name

Pipe: Headloss Gradient (m/km)

- <= 1.5
- <= 2.0
- <= 3.0
- <= 5.0
- > 5.0

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wsp

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Oakville Homun Study

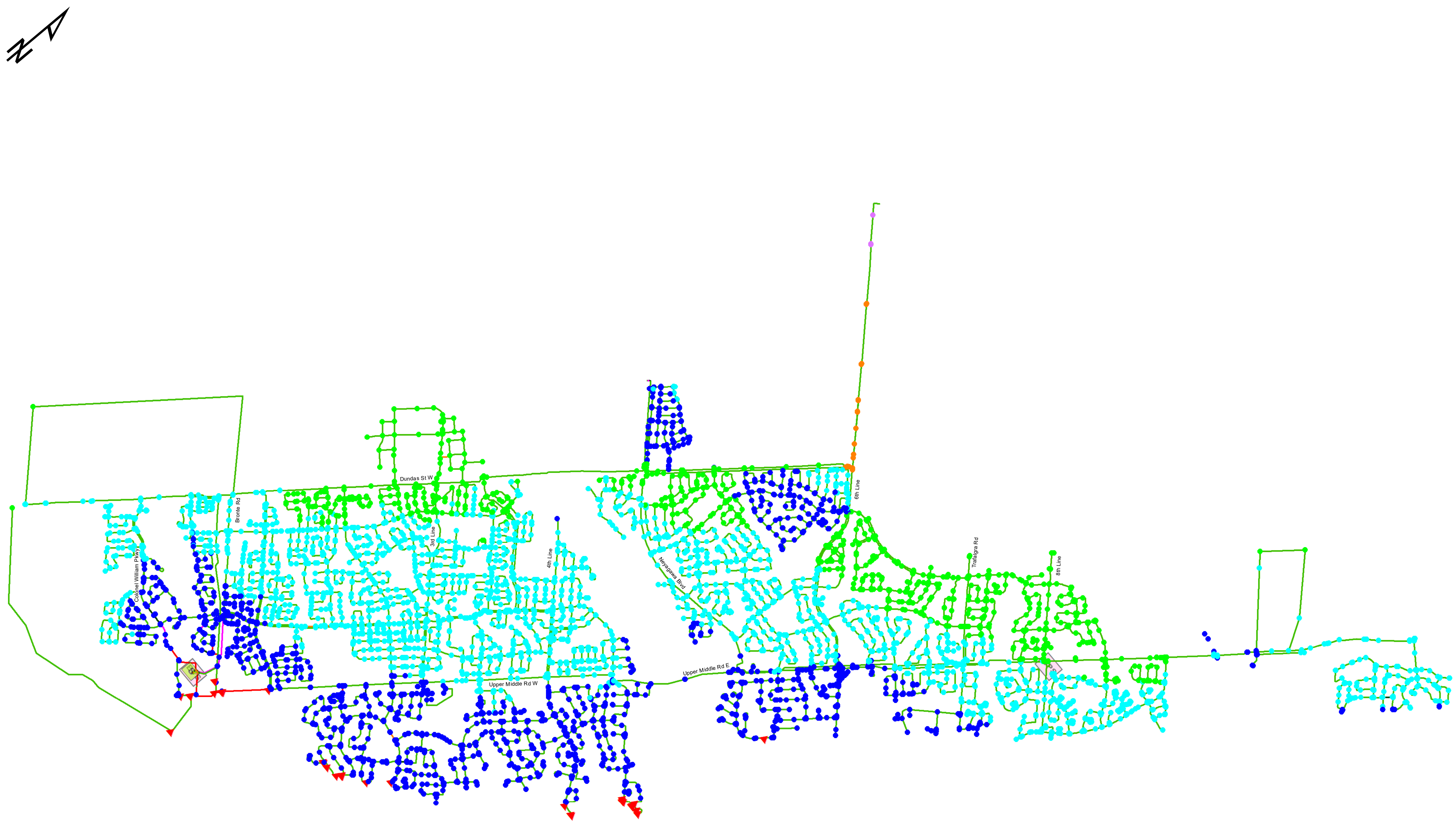
0 1,000 2,000 m

1:45,000

Map 4.1

Pressure and Headloss
(With HOMUN Site)

2031 Average Day



Legend

- S Storage Tank
- BPS Booster Pumping Station (BPS)

Junction: Pressure (psi)

- <= 20
- <= 40
- <= 60
- <= 80
- <= 100
- > 100

Road_Name

Pipe: Headloss Gradient (m/km)

- <= 1.5
- <= 2.0
- <= 3.0
- <= 5.0
- > 5.0

OAKVILLE

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July 23 2020

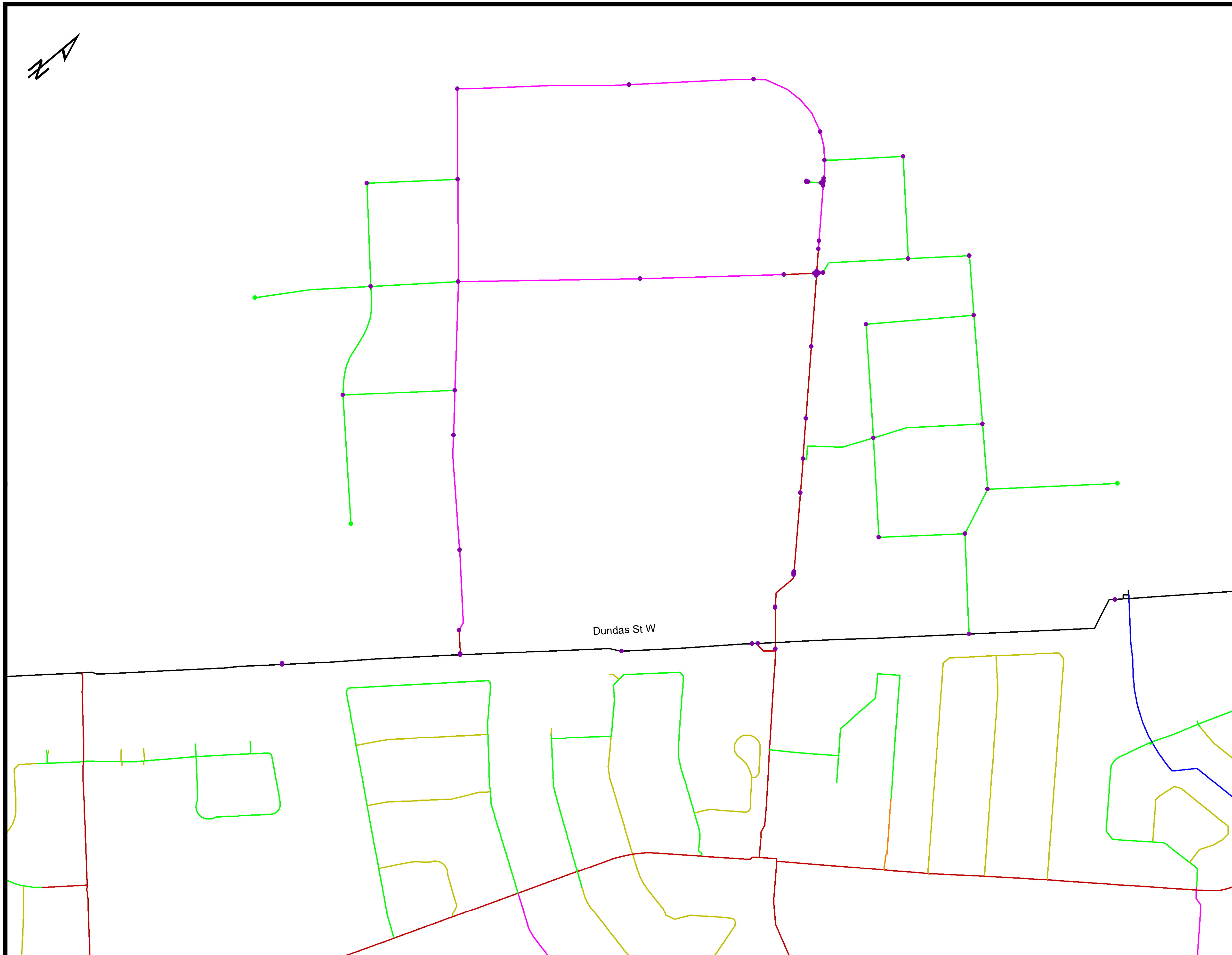
Town of Oakville -
Oakville Homun Study

0 1,000 2,000 m
1:45,000

Map 4.2

Pressure and Headloss
(With HOMUN Site)

2031 Maximum Day



OAKVILLE

wsp

Project No. 191-08340-00

July 23 2020

Town of Oakville - Oakville Homun Study

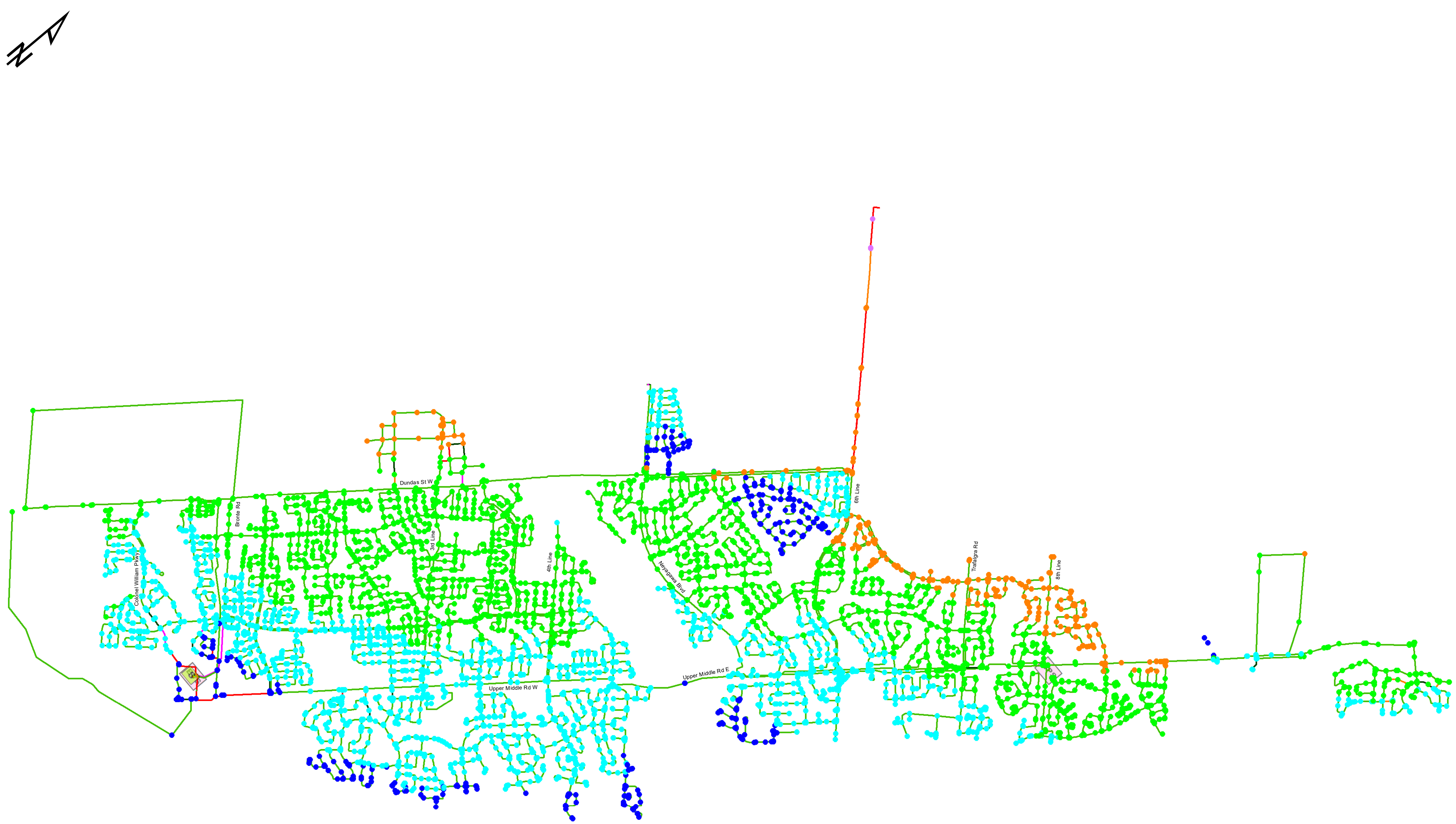
0 100 200 m

1:5,000

Map 4.3

Fire Flow Availability (With HOMUN Site)

2031 Maximum Day+FF



Legend

- S — Storage Tank
- BPS — Booster Pumping Station (BPS)

Junction: Pressure (psi)

- <= 20
- <= 40
- <= 60
- <= 80
- <= 100
- > 100

Road_Name

Pipe: Headloss Gradient (m/km)

- <= 1.5
- <= 2.0
- <= 3.0
- <= 5.0
- > 5.0

OAKVILLE

wsp

Project No. 191-08340-00

July 23 2020

Town of Oakville - Oakville Homun Study

0 1,000 2,000 m

1:45,000

Map 4.4

Pressure and Headloss (With HOMUN Site)

2031 Peak Hour

2016 ADD - Junction Table
Existing Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
WFT43576	O3	0.08	158.38	197	55
WFT43575	O3	0.08	158.37	197	55
WFT258234	O3	0.01	157.93	197	55
WFT259159	O3	0.01	158.12	197	55
WCV121079	O3	0.01	158.24	197	55
WFT258247	O3	0.04	156.35	197	58
WCV125586	O3	0.08	158.97	197	54
WCV131589	O3	0.08	160.10	197	52
WCV131586	O3	0.08	160.00	197	53
WCV131587	O3	0.08	159.97	197	53
WCV131588	O3	0.08	160.05	197	52
WCV132786	O3	0.08	158.19	197	55
WCV132787	O3	0.08	158.30	197	55
WFT277238	O3	0.97	158.35	197	55
WFT277239	O3	0.97	158.61	197	55
WFT277240	O3	0.08	158.43	197	55
WFT277241	O3	0.08	159.84	197	53
WFT277242	O3	0.08	160.02	197	53
WFT277243	O3	0.08	159.91	197	53
WFT285238	O3	0.08	161.22	197	51
WFT285240	O3	0.08	158.23	197	55
WFT627947	O3	0.04	160.13	197	52
WFT627949	O3	0.04	160.15	197	52
WFT627950	O3	0.08	160.23	197	52
WFT627946	O3	0.08	159.64	197	53
WFT627948	O3	0.04	160.11	197	52
WFT259179	O3	0.01	156.98	197	57
WFT258223	O3	0.01	157.32	197	56
WFT259182	O3	0.01	156.27	197	58
WFT258224	O3	0.08	157.87	197	56
WFT277244	O3	0.08	159.72	197	53
WCV252801	O3	0.08	160.17	197	52
WCV252802	O3	0.04	160.15	197	52
WCV196812	O3	0.01	157.81	197	56
WCV252800	O3	0.04	160.14	197	52
WSV538376	O3	0.08	160.25	197	52
WSV538377	O3	0.08	160.24	197	52
WDV88892	O3	0.01	157.34	197	56
HO-J0011	O3	0.00	157.12	197	57

2016 MDD - Junction Table
Existing Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
WFT43576	O3	0.15	158.38	197	55
WFT43575	O3	0.15	158.37	197	55
WFT258234	O3	0.01	157.93	197	55
WFT259159	O3	0.01	158.12	197	55
WCV121079	O3	0.01	158.24	197	55
WFT258247	O3	0.08	156.35	197	58
WCV125586	O3	0.15	158.97	197	54
WCV131589	O3	0.15	160.10	197	52
WCV131586	O3	0.15	160.00	197	52
WCV131587	O3	0.15	159.97	197	53
WCV131588	O3	0.15	160.05	197	52
WCV132786	O3	0.15	158.19	197	55
WCV132787	O3	0.15	158.30	197	55
WFT277238	O3	1.84	158.35	197	55
WFT277239	O3	1.84	158.61	197	54
WFT277240	O3	0.15	158.43	197	55
WFT277241	O3	0.15	159.84	197	53
WFT277242	O3	0.15	160.02	197	52
WFT277243	O3	0.15	159.91	197	53
WFT285238	O3	0.15	161.22	197	51
WFT285240	O3	0.15	158.23	197	55
WFT627947	O3	0.08	160.13	197	52
WFT627949	O3	0.08	160.15	197	52
WFT627950	O3	0.15	160.23	197	52
WFT627946	O3	0.15	159.64	197	53
WFT627948	O3	0.08	160.11	197	52
WFT259179	O3	0.03	156.98	197	57
WFT258223	O3	0.01	157.32	197	56
WFT259182	O3	0.01	156.27	197	58
WFT258224	O3	0.15	157.87	197	56
WFT277244	O3	0.15	159.72	197	53
WCV252801	O3	0.15	160.17	197	52
WCV252802	O3	0.08	160.15	197	52
WCV196812	O3	0.01	157.81	197	56
WCV252800	O3	0.08	160.14	197	52
WSV538376	O3	0.15	160.25	197	52
WSV538377	O3	0.15	160.24	197	52
WDV88892	O3	0.03	157.34	197	56
HO-J0011	O3	0.00	157.12	197	57

2016 PHD - Junction Table
Existing Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
WFT43576	O3	0.24	158.38	195	52
WFT43575	O3	0.24	158.37	195	52
WFT258234	O3	0.02	157.93	195	52
WFT259159	O3	0.53	158.12	195	52
WCV121079	O3	0.02	158.24	195	52
WFT258247	O3	0.63	156.35	195	54
WCV125586	O3	0.24	158.97	195	51
WCV131589	O3	0.24	160.10	195	49
WCV131586	O3	0.24	160.00	195	49
WCV131587	O3	0.24	159.97	195	49
WCV131588	O3	0.24	160.05	195	49
WCV132786	O3	0.24	158.19	195	52
WCV132787	O3	0.24	158.30	195	52
WFT277238	O3	2.90	158.35	195	52
WFT277239	O3	2.90	158.61	195	51
WFT277240	O3	0.24	158.43	195	51
WFT277241	O3	0.24	159.84	195	49
WFT277242	O3	0.24	160.02	195	49
WFT277243	O3	0.24	159.91	195	49
WFT285238	O3	0.24	161.22	195	47
WFT285240	O3	0.24	158.23	195	52
WFT627947	O3	0.12	160.13	195	49
WFT627949	O3	0.12	160.15	195	49
WFT627950	O3	0.24	160.23	195	49
WFT627946	O3	0.24	159.64	195	50
WFT627948	O3	0.12	160.11	195	49
WFT259179	O3	0.04	156.98	195	54
WFT258223	O3	0.02	157.32	195	53
WFT259182	O3	0.02	156.27	195	55
WFT258224	O3	0.24	157.87	195	52
WFT277244	O3	0.24	159.72	195	50
WCV252801	O3	0.24	160.17	195	49
WCV252802	O3	0.12	160.15	195	49
WCV196812	O3	0.02	157.81	195	52
WCV252800	O3	0.12	160.14	195	49
WSV538376	O3	0.24	160.25	195	49
WSV538377	O3	0.24	160.24	195	49
WDV88892	O3	0.04	157.34	195	53
HO-J0011	O3	0.00	157.12	195	53

2016 ADD - Pipe Table
Existing Infrastructure

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
WMN65440	WFT43576	WFT43575	1.29	400	120	0.32	0.03	0.00
WMN150543	WCV121079	WFT43576	53.95	400	120	0.33	0.03	0.00
WMN161674	WFT259182	WFT258234	172.76	1200	123	9.56	0.10	0.01
WMN161691	WFT258234	WFT259159	7.70	1200	123	9.56	0.10	0.01
WMN161347	WFT259159	HO-J0011	278.27	1200	123	8.82	0.09	0.01
WMN169515	WFT43575	WCV132786	53.16	400	130	0.31	0.03	0.00
WMN169516	WFT277238	WFT277239	104.51	400	130	0.21	0.02	0.00
WMN176315	WFT277239	WCV125586	45.20	400	130	0.13	0.01	0.00
WMN176316	WCV125586	WFT277240	53.57	400	130	0.12	0.01	0.00
WMN176317	WFT277240	WFT277241	95.65	400	130	0.11	0.01	0.00
WMN176318	WFT277241	WCV131589	93.73	400	130	0.11	0.01	0.00
WMN176319	WCV131586	WFT277243	5.43	400	130	0.01	0.00	0.00
WMN176320	WCV131587	WFT277244	29.50	400	130	0.06	0.01	0.00
WMN176321	WCV131588	WFT285238	40.24	400	130	0.01	0.00	0.00
WMN176322	WFT277242	WCV131586	3.01	400	130	0.01	0.00	0.00
WMN176323	WFT277242	WCV131587	2.93	400	130	0.07	0.01	0.00
WMN176324	WCV131589	WFT277242	3.19	400	130	0.10	0.01	0.00
WMN176325	WFT277242	WCV131588	3.14	400	130	0.01	0.00	0.00
WMN176326	WFT285240	WCV132787	1.52	400	130	0.30	0.03	0.00
WMN176327	WCV132786	WFT285240	1.45	400	130	0.31	0.03	0.00
WMN177515	WCV132787	WFT277238	1.49	400	130	0.29	0.03	0.00
WMN161350	WFT259157	WFT259179	265.47	1200	123	9.57	0.10	0.01
WMN161412	WDV88892	WFT259179	1.99	150	150	0.00	0.00	0.00
WMN161668	WFT259179	WFT258223	236.17	1200	123	9.57	0.10	0.01
WMN161672	WFT258223	WFT259182	213.83	1200	123	9.56	0.10	0.01
WMN161689	WCV196812	WFT258224	30.88	400	150	0.01	0.00	0.00
WMN265534	WFT258223	WCV196812	1.48	400	150	0.01	0.00	0.00
WMN369632	WFT277244	WFT627946	10.91	300	150	0.05	0.01	0.00
WMN369633	WFT627946	WCV252802	73.20	300	150	0.04	0.01	0.00
WMN369634	WCV252802	WFT627949	3.04	300	150	0.04	0.01	0.00
WMN369635	WFT627949	WCV252801	3.03	200	150	0.03	0.01	0.01
WMN369636	WCV252801	WFT627950	17.18	200	150	0.02	0.01	0.00
WMN369637	WFT627950	WSV538377	3.04	100	150	0.01	0.01	0.00
WMN369638	WFT627950	WSV538376	2.02	200	150	0.01	0.00	0.00
WMN369639	WFT627949	WCV252800	1.69	300	150	0.01	0.00	0.00
WMN369640	WCV252800	WFT627947	1.57	300	150	0.01	0.00	0.00
WMN369641	WFT627947	WFT627948	3.00	300	150	0.00	0.00	0.00
WMN161347_B	HO-J0011	WFT258247	218.17	1200	123	8.82	0.09	0.01

2016 MDD - Pipe Table
Existing Infrastructure

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
WMN65440	WFT43576	WFT43575	1.29	400	120	0.61	0.06	0.01
WMN150543	WCV121079	WFT43576	53.95	400	120	0.62	0.06	0.01
WMN161674	WFT259182	WFT258234	172.76	1200	123	17.67	0.18	0.03
WMN161691	WFT258234	WFT259159	7.70	1200	123	17.66	0.18	0.03
WMN161347	WFT259159	HO-J0011	278.27	1200	123	15.87	0.16	0.03
WMN169515	WFT43575	WCV132786	53.16	400	130	0.60	0.05	0.01
WMN169516	WFT277238	WFT277239	104.51	400	130	0.40	0.04	0.01
WMN176315	WFT277239	WCV125586	45.20	400	130	0.24	0.02	0.00
WMN176316	WCV125586	WFT277240	53.57	400	130	0.23	0.02	0.00
WMN176317	WFT277240	WFT277241	95.65	400	130	0.21	0.02	0.00
WMN176318	WFT277241	WCV131589	93.73	400	130	0.20	0.02	0.00
WMN176319	WCV131586	WFT277243	5.43	400	130	0.01	0.00	0.00
WMN176320	WCV131587	WFT277244	29.50	400	130	0.11	0.01	0.00
WMN176321	WCV131588	WFT285238	40.24	400	130	0.01	0.00	0.00
WMN176322	WFT277242	WCV131586	3.01	400	130	0.03	0.00	0.00
WMN176323	WFT277242	WCV131587	2.93	400	130	0.12	0.01	0.00
WMN176324	WCV131589	WFT277242	3.19	400	130	0.19	0.02	0.00
WMN176325	WFT277242	WCV131588	3.14	400	130	0.03	0.00	0.00
WMN176326	WFT285240	WCV132787	1.52	400	130	0.57	0.05	0.01
WMN176327	WCV132786	WFT285240	1.45	400	130	0.58	0.05	0.01
WMN177515	WCV132787	WFT277238	1.49	400	130	0.56	0.05	0.01
WMN161350	WFT259157	WFT259179	265.47	1200	123	17.69	0.18	0.03
WMN161412	WDV88892	WFT259179	1.99	150	150	0.00	0.00	0.00
WMN161668	WFT259179	WFT258223	236.17	1200	123	17.68	0.18	0.03
WMN161672	WFT258223	WFT259182	213.83	1200	123	17.67	0.18	0.03
WMN161689	WCV196812	WFT258224	30.88	400	150	0.01	0.00	0.00
WMN265534	WFT258223	WCV196812	1.48	400	150	0.01	0.00	0.00
WMN369632	WFT277244	WFT627946	10.91	300	150	0.10	0.02	0.00
WMN369633	WFT627946	WCV252802	73.20	300	150	0.09	0.01	0.00
WMN369634	WCV252802	WFT627949	3.04	300	150	0.08	0.01	0.01
WMN369635	WFT627949	WCV252801	3.03	200	150	0.05	0.02	0.00
WMN369636	WCV252801	WFT627950	17.18	200	150	0.04	0.01	0.00
WMN369637	WFT627950	WSV538377	3.04	100	150	0.01	0.02	0.01
WMN369638	WFT627950	WSV538376	2.02	200	150	0.01	0.00	0.00
WMN369639	WFT627949	WCV252800	1.69	300	150	0.02	0.00	0.00
WMN369640	WCV252800	WFT627947	1.57	300	150	0.01	0.00	0.00
WMN369641	WFT627947	WFT627948	3.00	300	150	0.01	0.00	0.00
WMN161347_B	HO-J0011	WFT258247	218.17	1200	123	15.87	0.16	0.03

2016 PHD - Pipe Table
Existing Infrastructure

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
WMN65440	WFT43576	WFT43575	1.29	400	120	0.96	0.09	0.03
WMN150543	WCV121079	WFT43576	53.95	400	120	0.98	0.09	0.03
WMN161674	WFT259182	WFT258234	172.76	1200	123	12.86	0.13	0.02
WMN161691	WFT258234	WFT259159	7.70	1200	123	12.85	0.13	0.02
WMN161347	WFT259159	HO-J0011	278.27	1200	123	9.73	0.10	0.01
WMN169515	WFT43575	WCV132786	53.16	400	130	0.94	0.09	0.03
WMN169516	WFT277238	WFT277239	104.51	400	130	0.63	0.06	0.01
WMN176315	WFT277239	WCV125586	45.20	400	130	0.38	0.03	0.00
WMN176316	WCV125586	WFT277240	53.57	400	130	0.36	0.03	0.00
WMN176317	WFT277240	WFT277241	95.65	400	130	0.34	0.03	0.00
WMN176318	WFT277241	WCV131589	93.73	400	130	0.32	0.03	0.00
WMN176319	WCV131586	WFT277243	5.43	400	130	0.02	0.00	0.00
WMN176320	WCV131587	WFT277244	29.50	400	130	0.17	0.02	0.00
WMN176321	WCV131588	WFT285238	40.24	400	130	0.02	0.00	0.00
WMN176322	WFT277242	WCV131586	3.01	400	130	0.04	0.00	0.00
WMN176323	WFT277242	WCV131587	2.93	400	130	0.20	0.02	0.00
WMN176324	WCV131589	WFT277242	3.19	400	130	0.30	0.03	0.01
WMN176325	WFT277242	WCV131588	3.14	400	130	0.04	0.00	0.00
WMN176326	WFT285240	WCV132787	1.52	400	130	0.90	0.08	0.02
WMN176327	WCV132786	WFT285240	1.45	400	130	0.92	0.08	0.03
WMN177515	WCV132787	WFT277238	1.49	400	130	0.88	0.08	0.02
WMN161350	WFT259157	WFT259179	265.47	1200	123	12.89	0.13	0.02
WMN161412	WDV88892	WFT259179	1.99	150	150	0.00	0.00	0.00
WMN161668	WFT259179	WFT258223	236.17	1200	123	12.88	0.13	0.02
WMN161672	WFT258223	WFT259182	213.83	1200	123	12.86	0.13	0.02
WMN161689	WCV196812	WFT258224	30.88	400	150	0.02	0.00	0.00
WMN265534	WFT258223	WCV196812	1.48	400	150	0.02	0.00	0.00
WMN369632	WFT277244	WFT627946	10.91	300	150	0.15	0.03	0.00
WMN369633	WFT627946	WCV252802	73.20	300	150	0.13	0.02	0.00
WMN369634	WCV252802	WFT627949	3.04	300	150	0.12	0.02	0.01
WMN369635	WFT627949	WCV252801	3.03	200	150	0.08	0.03	0.01
WMN369636	WCV252801	WFT627950	17.18	200	150	0.06	0.02	0.00
WMN369637	WFT627950	WSV538377	3.04	100	150	0.02	0.03	0.01
WMN369638	WFT627950	WSV538376	2.02	200	150	0.02	0.01	0.00
WMN369639	WFT627949	WCV252800	1.69	300	150	0.03	0.01	0.00
WMN369640	WCV252800	WFT627947	1.57	300	150	0.02	0.00	0.00
WMN369641	WFT627947	WFT627948	3.00	300	150	0.01	0.00	0.00
WMN161347_B	HO-J0011	WFT258247	218.17	1200	123	9.73	0.10	0.01

2016 MDD+FF - Available Fire Flows
Existing Infrastructure

Label	Zone	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
WFT43576	O3	0.15	55	197	54	1143	20
WFT43575	O3	0.15	55	197	54	1137	20
WFT258234	O3	0.01	55	197	55	2118	20
WFT259159	O3	0.01	55	197	55	2109	20
WCV121079	O3	0.01	55	197	54	1617	20
WFT258247	O3	0.08	58	197	57	2194	20
WCV125586	O3	0.15	54	197	53	718	20
WCV131589	O3	0.15	52	197	51	533	20
WCV131586	O3	0.15	52	197	51	531	20
WCV131587	O3	0.15	53	197	51	532	20
WCV131588	O3	0.15	52	197	51	531	20
WCV132786	O3	0.15	55	197	54	978	20
WCV132787	O3	0.15	55	197	54	968	20
WFT277238	O3	1.84	55	197	54	965	20
WFT277239	O3	1.84	54	197	53	778	20
WFT277240	O3	0.15	55	197	53	676	20
WFT277241	O3	0.15	53	197	51	586	20
WFT277242	O3	0.15	52	197	51	533	20
WFT277243	O3	0.15	53	197	51	530	20
WFT285238	O3	0.15	51	197	49	498	20
WFT285240	O3	0.15	55	197	54	973	20
WFT627947	O3	0.08	52	197	50	426	20
WFT627949	O3	0.08	52	197	50	428	20
WFT627950	O3	0.15	52	197	49	345	20
WFT627946	O3	0.15	53	197	51	509	20
WFT627948	O3	0.08	52	197	50	424	20
WFT259179	O3	0.03	57	197	56	2164	20
WFT258223	O3	0.01	56	197	56	2147	20
WFT259182	O3	0.01	58	197	57	2196	20
WFT258224	O3	0.15	56	197	55	1693	20
WFT277244	O3	0.15	53	197	51	522	20
WCV252801	O3	0.15	52	197	50	412	20
WCV252802	O3	0.08	52	197	50	431	20
WCV196812	O3	0.01	56	197	55	2099	20
WCV252800	O3	0.08	52	197	50	427	20
WSV538376	O3	0.15	52	197	49	339	20
WSV538377	O3	0.15	52	197	44	214	20
WDV88892	O3	0.03	56	197	55	925	20
HO-J0011	O3	0.00	57	197	56	2156	20

2016 ADD - Junction Table
Existing Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
WFT43576	O3	0.16	158.38	197	55
WFT43575	O3	0.16	158.37	197	55
WFT258234	O3	0.01	157.93	197	56
WFT259159	O3	0.01	158.12	197	55
WCV121079	O3	0.01	158.24	197	55
WFT258247	O3	0.49	156.35	197	58
WCV125586	O3	0.16	158.97	197	54
WCV131589	O3	0.16	160.10	197	52
WCV131586	O3	0.16	160.00	197	53
WCV131587	O3	0.16	159.97	197	53
WCV131588	O3	0.16	160.05	197	53
WCV132786	O3	0.16	158.19	197	55
WCV132787	O3	0.16	158.30	197	55
WFT277238	O3	1.05	158.35	197	55
WFT277239	O3	1.05	158.61	197	55
WFT277240	O3	0.16	158.43	197	55
WFT277241	O3	0.16	159.84	197	53
WFT277242	O3	0.16	160.02	197	53
WFT277243	O3	0.16	159.91	197	53
WFT285238	O3	0.16	161.22	197	51
WFT285240	O3	0.16	158.23	197	55
WFT627947	O3	0.49	160.13	197	52
WFT627949	O3	0.49	160.15	197	52
WFT627950	O3	0.16	160.23	197	52
WFT627946	O3	0.16	159.64	197	53
WFT627948	O3	0.49	160.11	197	52
WFT259179	O3	0.02	156.98	197	57
WFT258223	O3	0.01	157.32	197	57
WFT259182	O3	0.01	156.27	197	58
WFT258224	O3	0.16	157.87	197	56
WFT277244	O3	0.16	159.72	197	53
WCV252801	O3	0.16	160.17	197	52
WCV252802	O3	0.49	160.15	197	52
WCV196812	O3	0.01	157.81	197	56
WCV252800	O3	0.49	160.14	197	52
WSV538376	O3	0.16	160.25	197	52
WSV538377	O3	0.16	160.24	197	52
WDV88892	O3	0.02	157.34	197	57
HO-J0011	O3	0.00	157.12	197	57

2016 MDD - Junction Table
Existing Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
WFT43576	O3	0.31	158.38	198	57
WFT43575	O3	0.31	158.37	198	57
WFT258234	O3	0.02	157.93	198	57
WFT259159	O3	0.02	158.12	198	57
WCV121079	O3	0.02	158.24	198	57
WFT258247	O3	0.94	156.35	198	59
WCV125586	O3	0.31	158.97	198	56
WCV131589	O3	0.31	160.10	198	54
WCV131586	O3	0.31	160.00	198	54
WCV131587	O3	0.31	159.97	198	54
WCV131588	O3	0.31	160.05	198	54
WCV132786	O3	0.31	158.19	198	57
WCV132787	O3	0.31	158.30	198	57
WFT277238	O3	2.00	158.35	198	57
WFT277239	O3	2.00	158.61	198	56
WFT277240	O3	0.31	158.43	198	56
WFT277241	O3	0.31	159.84	198	54
WFT277242	O3	0.31	160.02	198	54
WFT277243	O3	0.31	159.91	198	54
WFT285238	O3	0.31	161.22	198	53
WFT285240	O3	0.31	158.23	198	57
WFT627947	O3	0.94	160.13	198	54
WFT627949	O3	0.94	160.15	198	54
WFT627950	O3	0.31	160.23	198	54
WFT627946	O3	0.31	159.64	198	55
WFT627948	O3	0.94	160.11	198	54
WFT259179	O3	0.04	156.98	199	59
WFT258223	O3	0.02	157.32	198	58
WFT259182	O3	0.02	156.27	198	60
WFT258224	O3	0.31	157.87	198	58
WFT277244	O3	0.31	159.72	198	55
WCV252801	O3	0.31	160.17	198	54
WCV252802	O3	0.94	160.15	198	54
WCV196812	O3	0.02	157.81	198	58
WCV252800	O3	0.94	160.14	198	54
WSV538376	O3	0.31	160.25	198	54
WSV538377	O3	0.31	160.24	198	54
WDV88892	O3	0.04	157.34	199	59
HO-J0011	O3	0.00	157.12	198	58

2016 PHD - Junction Table
Existing Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
WFT43576	O3	0.49	158.38	190	45
WFT43575	O3	0.49	158.37	190	45
WFT258234	O3	0.02	157.93	190	46
WFT259159	O3	0.02	158.12	190	46
WCV121079	O3	0.02	158.24	190	45
WFT258247	O3	1.48	156.35	190	48
WCV125586	O3	0.49	158.97	190	44
WCV131589	O3	0.49	160.10	190	43
WCV131586	O3	0.49	160.00	190	43
WCV131587	O3	0.49	159.97	190	43
WCV131588	O3	0.49	160.05	190	43
WCV132786	O3	0.49	158.19	190	45
WCV132787	O3	0.49	158.30	190	45
WFT277238	O3	3.15	158.35	190	45
WFT277239	O3	3.15	158.61	190	45
WFT277240	O3	0.49	158.43	190	45
WFT277241	O3	0.49	159.84	190	43
WFT277242	O3	0.49	160.02	190	43
WFT277243	O3	0.49	159.91	190	43
WFT285238	O3	0.49	161.22	190	41
WFT285240	O3	0.49	158.23	190	45
WFT627947	O3	1.48	160.13	190	43
WFT627949	O3	1.48	160.15	190	43
WFT627950	O3	0.49	160.23	190	42
WFT627946	O3	0.49	159.64	190	43
WFT627948	O3	1.48	160.11	190	43
WFT259179	O3	0.07	156.98	190	48
WFT258223	O3	0.02	157.32	190	47
WFT259182	O3	0.02	156.27	190	48
WFT258224	O3	0.49	157.87	190	46
WFT277244	O3	0.49	159.72	190	43
WCV252801	O3	0.49	160.17	190	43
WCV252802	O3	1.48	160.15	190	43
WCV196812	O3	0.02	157.81	190	46
WCV252800	O3	1.48	160.14	190	43
WSV538376	O3	0.49	160.25	190	42
WSV538377	O3	0.49	160.24	190	42
WDV88892	O3	0.07	157.34	190	47
HO-J0011	O3	0.00	157.12	190	47

2016 ADD - Pipe Table
Existing Infrastructure

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
WMN65440	WFT43576	WFT43575	1.29	400	120	7.81	0.06	0.01
WMN150543	WCV121079	WFT43576	53.95	400	120	7.97	0.06	0.02
WMN161674	WFT259182	WFT258234	172.76	1200	123	520.24	0.46	0.18
WMN161691	WFT258234	WFT259159	7.70	1200	123	520.23	0.46	0.18
WMN161347	WFT259159	HO-J0011	287.40	1200	123	538.91	0.48	0.19
WMN169515	WFT43575	WCV132786	53.16	400	130	7.65	0.06	0.01
WMN169516	WFT277238	WFT277239	104.51	400	130	6.11	0.05	0.01
WMN176315	WFT277239	WCV125586	45.20	400	130	5.06	0.04	0.01
WMN176316	WCV125586	WFT277240	53.57	400	130	4.90	0.04	0.01
WMN176317	WFT277240	WFT277241	95.65	400	130	4.74	0.04	0.01
WMN176318	WFT277241	WCV131589	93.73	400	130	4.57	0.04	0.01
WMN176319	WCV131586	WFT277243	5.43	400	130	0.16	0.00	0.00
WMN176320	WCV131587	WFT277244	29.50	400	130	3.44	0.03	0.00
WMN176321	WCV131588	WFT285238	40.24	400	130	0.16	0.00	0.00
WMN176322	WFT277242	WCV131586	3.01	400	130	0.32	0.00	0.00
WMN176323	WFT277242	WCV131587	2.93	400	130	3.60	0.03	0.01
WMN176324	WCV131589	WFT277242	3.19	400	130	4.41	0.04	0.01
WMN176325	WFT277242	WCV131588	3.14	400	130	0.32	0.00	0.00
WMN176326	WFT285240	WCV132787	1.52	400	130	7.32	0.06	0.01
WMN176327	WCV132786	WFT285240	1.45	400	130	7.49	0.06	0.01
WMN177515	WCV132787	WFT277238	1.49	400	130	7.16	0.06	0.01
WMN161350	WFT259157	WFT259179	265.47	1200	123	520.47	0.46	0.18
WMN161412	WDV88892	WFT259179	1.99	150	150	-0.02	0.00	0.00
WMN161668	WFT259179	WFT258223	236.17	1200	123	520.42	0.46	0.18
WMN161672	WFT258223	WFT259182	213.83	1200	123	520.24	0.46	0.18
WMN161689	WCV196812	WFT258224	30.88	400	150	0.16	0.00	0.00
WMN265534	WFT258223	WCV196812	1.48	400	150	0.17	0.00	0.00
WMN369632	WFT277244	WFT627946	10.91	300	150	3.28	0.05	0.01
WMN369633	WFT627946	WCV252802	73.20	300	150	3.11	0.04	0.01
WMN369634	WCV252802	WFT627949	3.04	300	150	2.62	0.04	0.01
WMN369635	WFT627949	WCV252801	3.03	200	150	0.65	0.02	0.00
WMN369636	WCV252801	WFT627950	17.18	200	150	0.49	0.02	0.00
WMN369637	WFT627950	WSV538377	3.04	100	150	0.16	0.02	0.01
WMN369638	WFT627950	WSV538376	2.02	200	150	0.16	0.01	0.00
WMN369639	WFT627949	WCV252800	1.69	300	150	1.48	0.02	0.00
WMN369640	WCV252800	WFT627947	1.57	300	150	0.99	0.01	0.00
WMN369641	WFT627947	WFT627948	3.00	300	150	0.49	0.01	0.00
WMN161347_B	HO-J0011	WFT258247	209.04	1200	123	538.91	0.48	0.19

2016 MDD - Pipe Table
Existing Infrastructure

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
WMN65440	WFT43576	WFT43575	1.29	400	120	14.84	0.12	0.06
WMN150543	WCV121079	WFT43576	53.95	400	120	15.15	0.12	0.06
WMN161674	WFT259182	WFT258234	172.76	1200	123	1129.81	1.00	0.74
WMN161691	WFT258234	WFT259159	7.70	1200	123	1129.79	1.00	0.74
WMN161347	WFT259159	HO-J0011	287.40	1200	123	1143.11	1.01	0.76
WMN169515	WFT43575	WCV132786	53.16	400	130	14.53	0.12	0.04
WMN169516	WFT277238	WFT277239	104.51	400	130	11.61	0.09	0.03
WMN176315	WFT277239	WCV125586	45.20	400	130	9.61	0.08	0.02
WMN176316	WCV125586	WFT277240	53.57	400	130	9.30	0.07	0.02
WMN176317	WFT277240	WFT277241	95.65	400	130	9.00	0.07	0.02
WMN176318	WFT277241	WCV131589	93.73	400	130	8.69	0.07	0.02
WMN176319	WCV131586	WFT277243	5.43	400	130	0.31	0.00	0.00
WMN176320	WCV131587	WFT277244	29.50	400	130	6.53	0.05	0.01
WMN176321	WCV131588	WFT285238	40.24	400	130	0.31	0.00	0.00
WMN176322	WFT277242	WCV131586	3.01	400	130	0.62	0.00	0.00
WMN176323	WFT277242	WCV131587	2.93	400	130	6.84	0.05	0.01
WMN176324	WCV131589	WFT277242	3.19	400	130	8.38	0.07	0.02
WMN176325	WFT277242	WCV131588	3.14	400	130	0.62	0.00	0.00
WMN176326	WFT285240	WCV132787	1.52	400	130	13.91	0.11	0.04
WMN176327	WCV132786	WFT285240	1.45	400	130	14.22	0.11	0.04
WMN177515	WCV132787	WFT277238	1.49	400	130	13.61	0.11	0.05
WMN161350	WFT259157	WFT259179	265.47	1200	123	1130.25	1.00	0.74
WMN161412	WDV88892	WFT259179	1.99	150	150	-0.04	0.00	0.00
WMN161668	WFT259179	WFT258223	236.17	1200	123	1130.17	1.00	0.74
WMN161672	WFT258223	WFT259182	213.83	1200	123	1129.83	1.00	0.74
WMN161689	WCV196812	WFT258224	30.88	400	150	0.31	0.00	0.00
WMN265534	WFT258223	WCV196812	1.48	400	150	0.32	0.00	0.00
WMN369632	WFT277244	WFT627946	10.91	300	150	6.22	0.09	0.03
WMN369633	WFT627946	WCV252802	73.20	300	150	5.92	0.08	0.03
WMN369634	WCV252802	WFT627949	3.04	300	150	4.98	0.07	0.02
WMN369635	WFT627949	WCV252801	3.03	200	150	1.23	0.04	0.01
WMN369636	WCV252801	WFT627950	17.18	200	150	0.92	0.03	0.01
WMN369637	WFT627950	WSV538377	3.04	100	150	0.31	0.04	0.02
WMN369638	WFT627950	WSV538376	2.02	200	150	0.31	0.01	0.00
WMN369639	WFT627949	WCV252800	1.69	300	150	2.81	0.04	0.00
WMN369640	WCV252800	WFT627947	1.57	300	150	1.87	0.03	0.01
WMN369641	WFT627947	WFT627948	3.00	300	150	0.94	0.01	0.00
WMN161347_B	HO-J0011	WFT258247	209.04	1200	123	1143.11	1.01	0.76

2016 PHD - Pipe Table
Existing Infrastructure

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
WMN65440	WFT43576	WFT43575	1.29	400	120	23.43	0.19	0.12
WMN150543	WCV121079	WFT43576	53.95	400	120	23.92	0.19	0.13
WMN161674	WFT259182	WFT258234	172.76	1200	123	955.27	0.84	0.54
WMN161691	WFT258234	WFT259159	7.70	1200	123	955.25	0.84	0.54
WMN161347	WFT259159	HO-J0011	287.40	1200	123	944.53	0.84	0.53
WMN169515	WFT43575	WCV132786	53.16	400	130	22.94	0.18	0.10
WMN169516	WFT277238	WFT277239	104.51	400	130	18.33	0.15	0.07
WMN176315	WFT277239	WCV125586	45.20	400	130	15.18	0.12	0.05
WMN176316	WCV125586	WFT277240	53.57	400	130	14.69	0.12	0.05
WMN176317	WFT277240	WFT277241	95.65	400	130	14.21	0.11	0.04
WMN176318	WFT277241	WCV131589	93.73	400	130	13.72	0.11	0.04
WMN176319	WCV131586	WFT277243	5.43	400	130	0.49	0.00	0.00
WMN176320	WCV131587	WFT277244	29.50	400	130	10.31	0.08	0.02
WMN176321	WCV131588	WFT285238	40.24	400	130	0.49	0.00	0.00
WMN176322	WFT277242	WCV131586	3.01	400	130	0.97	0.01	0.00
WMN176323	WFT277242	WCV131587	2.93	400	130	10.80	0.09	0.03
WMN176324	WCV131589	WFT277242	3.19	400	130	13.23	0.11	0.04
WMN176325	WFT277242	WCV131588	3.14	400	130	0.97	0.01	0.00
WMN176326	WFT285240	WCV132787	1.52	400	130	21.97	0.17	0.10
WMN176327	WCV132786	WFT285240	1.45	400	130	22.46	0.18	0.10
WMN177515	WCV132787	WFT277238	1.49	400	130	21.48	0.17	0.09
WMN161350	WFT259157	WFT259179	265.47	1200	123	955.97	0.85	0.54
WMN161412	WDV88892	WFT259179	1.99	150	150	-0.07	0.00	0.00
WMN161668	WFT259179	WFT258223	236.17	1200	123	955.83	0.85	0.54
WMN161672	WFT258223	WFT259182	213.83	1200	123	955.29	0.84	0.54
WMN161689	WCV196812	WFT258224	30.88	400	150	0.49	0.00	0.00
WMN265534	WFT258223	WCV196812	1.48	400	150	0.51	0.00	0.00
WMN369632	WFT277244	WFT627946	10.91	300	150	9.83	0.14	0.07
WMN369633	WFT627946	WCV252802	73.20	300	150	9.34	0.13	0.06
WMN369634	WCV252802	WFT627949	3.04	300	150	7.86	0.11	0.04
WMN369635	WFT627949	WCV252801	3.03	200	150	1.95	0.06	0.02
WMN369636	WCV252801	WFT627950	17.18	200	150	1.46	0.05	0.01
WMN369637	WFT627950	WSV538377	3.04	100	150	0.49	0.06	0.06
WMN369638	WFT627950	WSV538376	2.02	200	150	0.49	0.02	0.00
WMN369639	WFT627949	WCV252800	1.69	300	150	4.44	0.06	0.02
WMN369640	WCV252800	WFT627947	1.57	300	150	2.96	0.04	0.00
WMN369641	WFT627947	WFT627948	3.00	300	150	1.48	0.02	0.01
WMN161347_B	HO-J0011	WFT258247	209.04	1200	123	944.53	0.84	0.53

2016 MDD+FF - Available Fire Flows
Existing Infrastructure

Label	Zone	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Residual Pressure (psi)
HO-J0011	O3	0.00	58	198	57
WCV121079	O3	0.02	57	198	55
WCV125586	O3	0.31	56	198	54
WCV131586	O3	0.31	54	198	51
WCV131587	O3	0.31	54	198	51
WCV131588	O3	0.31	54	198	51
WCV131589	O3	0.31	54	198	51
WCV132786	O3	0.31	57	198	55
WCV132787	O3	0.31	57	198	55
WCV196812	O3	0.02	58	198	56
WCV252800	O3	0.94	54	198	50
WCV252801	O3	0.31	54	198	50
WCV252802	O3	0.94	54	198	50
WDV88892	O3	0.04	59	199	57
WFT258223	O3	0.02	58	198	57
WFT258224	O3	0.31	58	198	56
WFT258234	O3	0.02	57	198	56
WFT258247	O3	0.94	59	198	58
WFT259159	O3	0.02	57	198	56
WFT259179	O3	0.04	59	199	58
WFT259182	O3	0.02	60	198	58
WFT277238	O3	2.00	57	198	55
WFT277239	O3	2.00	56	198	54
WFT277240	O3	0.31	56	198	54
WFT277241	O3	0.31	54	198	52
WFT277242	O3	0.31	54	198	51
WFT277243	O3	0.31	54	198	52
WFT277244	O3	0.31	55	198	52
WFT285238	O3	0.31	53	198	50
WFT285240	O3	0.31	57	198	55
WFT43575	O3	0.31	57	198	55
WFT43576	O3	0.31	57	198	55
WFT627946	O3	0.31	55	198	52
WFT627947	O3	0.94	54	198	50
WFT627948	O3	0.94	54	198	50
WFT627949	O3	0.94	54	198	50
WFT627950	O3	0.31	54	198	49
WSV538376	O3	0.31	54	198	49
WSV538377	O3	0.31	54	198	45

2016 ADD - Junction Table
Existing Propose Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
HO-J0001	O3	1.72	158.52	197	55
HO-J0002	O3	0.00	159.28	197	53
HO-J0003	O3	1.20	159.73	197	53
HO-J0004	O3	1.08	160.09	197	52
HO-J0005	O3	1.54	158.79	197	54
HO-J0006	O3	1.11	160.89	197	51
HO-J0007	O3	1.68	161.21	197	51
HO-J0008	O3	1.49	161.77	197	50
HO-J0009	O3	1.00	160.62	197	51
HO-J0010	O3	1.46	161.49	197	50
HO-J0012	O3	2.17	157.32	197	56
HO-J0013	O3	1.74	158.10	197	55
HO-J0014	O3	0.00	158.37	197	55
HO-J0015	O3	9.00	159.43	197	53
HO-J0016	O3	0.00	157.89	197	55
HO-J0017	O3	0.00	157.09	197	56
HO-J0018	O3	0.00	158.22	197	55
HO-J0019	O3	4.27	158.69	197	54
HO-J0020	O3	0.00	159.31	197	53
HO-J0021	O3	1.36	159.29	197	53
HO-J0022	O3	1.09	160.38	197	52
HO-J0023	O3	1.46	160.21	197	52
HO-J0024	O3	0.00	160.42	197	52
HO-J0025	O3	1.55	160.96	197	51
HO-J0026	O3	0.99	161.47	197	50
HO-J0027	O3	0.78	162.24	197	49
HO-J0028	O3	1.04	160.01	197	52
WFT43576	O3	0.08	158.38	197	55
WFT43575	O3	0.08	158.37	197	55
WFT258234	O3	0.01	157.93	197	55
WFT259159	O3	0.01	158.12	197	55
WCV121079	O3	0.01	158.24	197	55
WFT258247	O3	0.04	156.35	197	58
WCV125586	O3	0.08	158.97	197	54
WCV131589	O3	0.08	160.10	197	52
WCV131586	O3	0.08	160.00	197	52
WCV131587	O3	0.08	159.97	197	52
WCV131588	O3	0.08	160.05	197	52
WCV132786	O3	0.08	158.19	197	55
WCV132787	O3	0.08	158.30	197	55
WFT277238	O3	0.97	158.35	197	55
WFT277239	O3	0.97	158.61	197	54
WFT277240	O3	0.08	158.43	197	55
WFT277241	O3	0.08	159.84	197	53
WFT277242	O3	0.08	160.02	197	52
WFT277243	O3	0.08	159.91	197	52
WFT285238	O3	0.08	161.22	197	51
WFT285240	O3	0.08	158.23	197	55
WFT627947	O3	0.04	160.13	197	52
WFT627949	O3	0.04	160.15	197	52
WFT627950	O3	0.08	160.23	197	52
WFT627946	O3	0.08	159.64	197	53
WFT627948	O3	0.04	160.11	197	52
WFT259179	O3	0.01	156.98	197	57
WFT258223	O3	0.01	157.32	197	56
WFT259182	O3	0.01	156.27	197	58
WFT258224	O3	0.08	157.87	197	55
WFT277244	O3	0.08	159.72	197	53
WCV252801	O3	0.08	160.17	197	52
WCV252802	O3	0.04	160.15	197	52
WCV196812	O3	0.01	157.81	197	56
WCV252800	O3	0.04	160.14	197	52

2016 ADD - Junction Table
Existing Propose Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
WSV538376	O3	0.08	160.25	197	52
WSV538377	O3	0.08	160.24	197	52
WDV88892	O3	0.01	157.34	197	56
HO-J0011	O3	0.00	157.12	197	57

2016 MDD - Junction Table
Existing Propose Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
HO-J0001	O3	3.87	158.52	197	54
HO-J0002	O3	0.00	159.28	197	53
HO-J0003	O3	2.70	159.73	197	52
HO-J0004	O3	2.42	160.09	196	52
HO-J0005	O3	3.46	158.79	196	54
HO-J0006	O3	2.49	160.89	196	51
HO-J0007	O3	3.78	161.21	196	50
HO-J0008	O3	3.36	161.77	196	49
HO-J0009	O3	2.26	160.62	196	51
HO-J0010	O3	3.29	161.49	196	50
HO-J0012	O3	4.88	157.32	196	56
HO-J0013	O3	3.92	158.10	196	54
HO-J0014	O3	0.00	158.37	196	54
HO-J0015	O3	20.25	159.43	196	52
HO-J0016	O3	0.00	157.89	196	55
HO-J0017	O3	0.00	157.09	196	56
HO-J0018	O3	0.00	158.22	196	54
HO-J0019	O3	9.61	158.69	196	53
HO-J0020	O3	0.00	159.31	196	53
HO-J0021	O3	3.05	159.29	196	53
HO-J0022	O3	2.44	160.38	196	51
HO-J0023	O3	3.29	160.21	196	52
HO-J0024	O3	0.00	160.42	196	51
HO-J0025	O3	3.48	160.96	196	50
HO-J0026	O3	2.22	161.47	196	50
HO-J0027	O3	1.76	162.24	196	49
HO-J0028	O3	2.34	160.01	196	52
WFT43576	O3	0.15	158.38	197	54
WFT43575	O3	0.15	158.37	197	54
WFT258234	O3	0.01	157.93	197	55
WFT259159	O3	0.01	158.12	197	55
WCV121079	O3	0.01	158.24	197	55
WFT258247	O3	0.08	156.35	197	57
WCV125586	O3	0.15	158.97	197	53
WCV131589	O3	0.15	160.10	196	52
WCV131586	O3	0.15	160.00	196	52
WCV131587	O3	0.15	159.97	196	52
WCV131588	O3	0.15	160.05	196	52
WCV132786	O3	0.15	158.19	197	55
WCV132787	O3	0.15	158.30	197	54
WFT277238	O3	1.84	158.35	197	54
WFT277239	O3	1.84	158.61	197	54
WFT277240	O3	0.15	158.43	197	54
WFT277241	O3	0.15	159.84	197	52
WFT277242	O3	0.15	160.02	196	52
WFT277243	O3	0.15	159.91	196	52
WFT285238	O3	0.15	161.22	196	50
WFT285240	O3	0.15	158.23	197	55
WFT627947	O3	0.08	160.13	196	52
WFT627949	O3	0.08	160.15	196	52
WFT627950	O3	0.15	160.23	196	52
WFT627946	O3	0.15	159.64	196	52
WFT627948	O3	0.08	160.11	196	52
WFT259179	O3	0.03	156.98	197	56
WFT258223	O3	0.01	157.32	197	56
WFT259182	O3	0.01	156.27	197	57
WFT258224	O3	0.15	157.87	197	55
WFT277244	O3	0.15	159.72	196	52
WCV252801	O3	0.15	160.17	196	52
WCV252802	O3	0.08	160.15	196	52
WCV196812	O3	0.01	157.81	197	55
WCV252800	O3	0.08	160.14	196	52

2016 MDD - Junction Table
Existing Propose Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
WSV538376	O3	0.15	160.25	196	51
WSV538377	O3	0.15	160.24	196	52
WDV88892	O3	0.03	157.34	197	56
HO-J0011	O3	0.00	157.12	197	56

2016 PHD - Junction Table
Existing Propose Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
HO-J0001	O3	6.88	158.52	193	49
HO-J0002	O3	0.00	159.28	193	48
HO-J0003	O3	4.79	159.73	193	47
HO-J0004	O3	4.31	160.09	193	46
HO-J0005	O3	6.15	158.79	193	48
HO-J0006	O3	4.43	160.89	193	45
HO-J0007	O3	6.71	161.21	193	45
HO-J0008	O3	5.98	161.77	193	44
HO-J0009	O3	4.01	160.62	193	46
HO-J0010	O3	5.84	161.49	193	44
HO-J0012	O3	8.67	157.32	193	50
HO-J0013	O3	6.97	158.10	192	49
HO-J0014	O3	0.00	158.37	192	48
HO-J0015	O3	36.00	159.43	192	46
HO-J0016	O3	0.00	157.89	192	49
HO-J0017	O3	0.00	157.09	192	50
HO-J0018	O3	0.00	158.22	192	49
HO-J0019	O3	17.09	158.69	192	48
HO-J0020	O3	0.00	159.31	192	47
HO-J0021	O3	5.42	159.29	193	47
HO-J0022	O3	4.35	160.38	193	46
HO-J0023	O3	5.85	160.21	193	46
HO-J0024	O3	0.00	160.42	193	46
HO-J0025	O3	6.19	160.96	193	45
HO-J0026	O3	3.94	161.47	193	44
HO-J0027	O3	3.13	162.24	193	43
HO-J0028	O3	4.16	160.01	193	47
WFT43576	O3	0.24	158.38	193	49
WFT43575	O3	0.24	158.37	193	49
WFT258234	O3	0.02	157.93	193	50
WFT259159	O3	0.53	158.12	193	50
WCV121079	O3	0.02	158.24	193	50
WFT258247	O3	0.63	156.35	193	52
WCV125586	O3	0.24	158.97	193	48
WCV131589	O3	0.24	160.10	193	46
WCV131586	O3	0.24	160.00	193	47
WCV131587	O3	0.24	159.97	193	47
WCV131588	O3	0.24	160.05	193	46
WCV132786	O3	0.24	158.19	193	50
WCV132787	O3	0.24	158.30	193	49
WFT277238	O3	2.90	158.35	193	49
WFT277239	O3	2.90	158.61	193	49
WFT277240	O3	0.24	158.43	193	49
WFT277241	O3	0.24	159.84	193	47
WFT277242	O3	0.24	160.02	193	47
WFT277243	O3	0.24	159.91	193	47
WFT285238	O3	0.24	161.22	193	45
WFT285240	O3	0.24	158.23	193	50
WFT627947	O3	0.12	160.13	193	46
WFT627949	O3	0.12	160.15	193	46
WFT627950	O3	0.24	160.23	193	46
WFT627946	O3	0.24	159.64	193	47
WFT627948	O3	0.12	160.11	193	46
WFT259179	O3	0.04	156.98	193	52
WFT258223	O3	0.02	157.32	193	51
WFT259182	O3	0.02	156.27	193	53
WFT258224	O3	0.24	157.87	193	50
WFT277244	O3	0.24	159.72	193	47
WCV252801	O3	0.24	160.17	193	46
WCV252802	O3	0.12	160.15	193	46
WCV196812	O3	0.02	157.81	193	50
WCV252800	O3	0.12	160.14	193	46

2016 PHD - Junction Table
Existing Propose Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
WSV538376	O3	0.24	160.25	193	46
WSV538377	O3	0.24	160.24	193	46
WDV88892	O3	0.04	157.34	193	51
HO-J0011	O3	0.00	157.12	193	51

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
HO-P0001	WFT258224	HO-J0001	108.03	300	120	1.03	0.17	0.15
HO-P0002	HO-J0001	HO-J0002	152.58	300	120	0.89	0.14	0.11
HO-P0003	HO-J0002	HO-J0003	59.13	300	120	0.89	0.14	0.11
HO-P0004	HO-J0003	HO-J0009	143.44	300	120	0.53	0.09	0.04
HO-P0005	HO-J0003	HO-J0004	148.60	200	110	0.25	0.09	0.09
HO-P0006	HO-J0004	HO-J0005	170.73	200	110	0.13	0.05	0.03
HO-P0007	HO-J0004	HO-J0006	151.72	200	110	0.02	0.01	0.00
HO-P0008	HO-J0006	HO-J0007	154.22	200	110	0.15	0.05	0.03
HO-P0009	HO-J0006	HO-J0009	116.20	200	110	-0.20	0.07	0.06
HO-P0010	HO-J0009	HO-J0010	135.71	300	120	0.38	0.06	0.02
HO-P0011	HO-J0008	HO-J0006	137.03	200	110	0.02	0.01	0.00
HO-P0012	HO-J0010	HO-J0008	120.54	200	110	0.15	0.05	0.03
HO-P0013	HO-J0010	HO-J0027	119.64	300	120	0.10	0.02	0.00
HO-P0014	HO-J0011	HO-J0012	132.46	200	110	0.59	0.22	0.44
HO-P0015	HO-J0012	HO-J0013	113.98	200	110	0.20	0.07	0.06
HO-P0016	HO-J0013	HO-J0014	131.99	200	110	0.05	0.02	0.00
HO-P0017	WCV125586	HO-J0014	110.59	200	110	0.52	0.19	0.34
HO-P0018	HO-J0018	HO-J0014	146.50	200	110	-0.10	0.04	0.02
HO-P0019	HO-J0012	HO-J0016	66.24	200	110	0.21	0.08	0.06
HO-P0020	HO-J0016	HO-J0017	172.27	200	110	0.00	0.00	0.00
HO-P0021	HO-J0016	HO-J0018	86.86	200	110	0.21	0.08	0.06
HO-P0022	HO-J0014	HO-J0015	150.24	200	110	0.46	0.17	0.28
HO-P0023	HO-J0015	HO-J0019	142.93	200	110	-0.32	0.12	0.14
HO-P0024	HO-J0018	HO-J0019	144.14	200	110	0.31	0.11	0.13
HO-P0025	HO-J0019	HO-J0020	79.41	200	110	-0.37	0.14	0.19
HO-P0026	HO-J0021	HO-J0020	80.81	200	110	0.37	0.14	0.19
HO-P0027	WFT277243	HO-J0021	121.00	200	110	0.34	0.12	0.16
HO-P0028	HO-J0021	HO-J0022	135.15	200	110	-0.15	0.06	0.04
HO-P0029	HO-J0022	HO-J0023	104.38	200	110	-0.25	0.09	0.09
HO-P0030	WFT627948	HO-J0023	24.23	300	120	0.56	0.09	0.05
HO-P0031	HO-J0024	HO-J0023	38.14	300	120	-0.18	0.03	0.01
HO-P0032	HO-J0025	HO-J0024	119.59	300	120	-0.18	0.03	0.01
HO-P0033	HO-J0026	HO-J0025	165.50	300	120	-0.05	0.01	0.00
HO-P0034	HO-J0027	HO-J0026	227.05	300	120	0.04	0.01	0.00
HO-P0035	WFT285238	HO-J0028	190.29	300	120	0.22	0.04	0.01
HO-P0036	HO-J0028	HO-J0009	240.28	300	120	0.13	0.02	0.00
WMN65440	WFT43576	WFT43575	1.29	400	120	1.95	0.18	0.12
WMN150543	WCV121079	WFT43576	53.95	400	120	1.96	0.18	0.12
WMN161674	WFT259182	WFT258234	172.76	1200	123	8.86	0.09	0.01
WMN161691	WFT258234	WFT259159	7.70	1200	123	8.86	0.09	0.01
WMN161347	WFT259159	HO-J0011	278.27	1200	123	6.80	0.07	0.01
WMN169515	WFT43575	WCV132786	53.16	400	130	1.94	0.18	0.10
WMN169516	WFT277238	WFT277239	104.51	400	130	1.84	0.17	0.09
WMN176315	WFT277239	WCV125586	45.20	400	130	1.76	0.16	0.08
WMN176316	WCV125586	WFT277240	53.57	400	130	1.23	0.11	0.04
WMN176317	WFT277240	WFT277241	95.65	400	130	1.23	0.11	0.04
WMN176318	WFT277241	WCV131589	93.73	400	130	1.22	0.11	0.04
WMN176319	WCV131586	WFT277243	5.43	400	130	0.34	0.03	0.00
WMN176320	WCV131587	WFT277244	29.50	400	130	0.61	0.06	0.01
WMN176321	WCV131588	WFT285238	40.24	400	130	0.23	0.02	0.00
WMN176322	WFT277242	WCV131586	3.01	400	130	0.35	0.03	0.01
WMN176323	WFT277242	WCV131587	2.93	400	130	0.62	0.06	0.01
WMN176324	WCV131589	WFT277242	3.19	400	130	1.21	0.11	0.04
WMN176325	WFT277242	WCV131588	3.14	400	130	0.23	0.02	0.00
WMN176326	WFT285240	WCV132787	1.52	400	130	1.93	0.18	0.10
WMN176327	WCV132786	WFT285240	1.45	400	130	1.94	0.18	0.10
WMN177515	WCV132787	WFT277238	1.49	400	130	1.92	0.18	0.10
WMN161350	WFT259157	WFT259179	265.47	1200	123	9.91	0.10	0.01
WMN161412	WDV88892	WFT259179	1.99	150	150	0.00	0.00	0.00
WMN161668	WFT259179	WFT258223	236.17	1200	123	9.91	0.10	0.01
WMN161672	WFT258223	WFT259182	213.83	1200	123	8.86	0.09	0.01
WMN161689	WCV196812	WFT258224	30.88	400	150	1.04	0.10	0.02
WMN265534	WFT258223	WCV196812	1.48	400	150	1.04	0.10	0.03
WMN369632	WFT277244	WFT627946	10.91	300	150	0.61	0.10	0.04
WMN369633	WFT627946	WCV252802	73.20	300	150	0.60	0.10	0.04
WMN369634	WCV252802	WFT627949	3.04	300	150	0.60	0.10	0.04
WMN369635	WFT627949	WCV252801	3.03	200	150	0.03	0.01	0.00
WMN369636	WCV252801	WFT627950	17.18	200	150	0.02	0.01	0.00
WMN369637	WFT627950	WSV538377	3.04	100	150	0.01	0.01	0.01
WMN369638	WFT627950	WSV538376	2.02	200	150	0.01	0.00	0.00
WMN369639	WFT627949	WCV252800	1.69	300	150	0.57	0.09	0.03
WMN369640	WCV252800	WFT627947	1.57	300	150	0.56	0.09	0.02
WMN369641	WFT627947	WFT627948	3.00	300	150	0.56	0.09	0.03
WMN161347_B	HO-J0011	WFT258247	218.17	1200	123	6.21	0.06	0.00

2016 MDD - Pipe Table
Existing Propose Infrastructure

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
HO-P0001	WFT258224	HO-J0001	108.03	300	120	2.30	0.38	0.64
HO-P0002	HO-J0001	HO-J0002	152.58	300	120	1.97	0.32	0.48
HO-P0003	HO-J0002	HO-J0003	59.13	300	120	1.97	0.32	0.48
HO-P0004	HO-J0003	HO-J0009	143.44	300	120	1.18	0.19	0.19
HO-P0005	HO-J0003	HO-J0004	148.60	200	110	0.55	0.20	0.39
HO-P0006	HO-J0004	HO-J0005	170.73	200	110	0.30	0.11	0.12
HO-P0007	HO-J0004	HO-J0006	151.72	200	110	0.05	0.02	0.00
HO-P0008	HO-J0006	HO-J0007	154.22	200	110	0.33	0.12	0.15
HO-P0009	HO-J0006	HO-J0009	116.20	200	110	-0.46	0.17	0.27
HO-P0010	HO-J0009	HO-J0010	135.71	300	120	0.84	0.14	0.10
HO-P0011	HO-J0008	HO-J0006	137.03	200	110	0.04	0.01	0.00
HO-P0012	HO-J0010	HO-J0008	120.54	200	110	0.33	0.12	0.15
HO-P0013	HO-J0010	HO-J0027	119.64	300	120	0.22	0.04	0.01
HO-P0014	HO-J0011	HO-J0012	132.46	200	110	1.34	0.49	2.00
HO-P0015	HO-J0012	HO-J0013	113.98	200	110	0.45	0.17	0.26
HO-P0016	HO-J0013	HO-J0014	131.99	200	110	0.11	0.04	0.02
HO-P0017	WCV125586	HO-J0014	110.59	200	110	1.16	0.43	1.53
HO-P0018	HO-J0018	HO-J0014	146.50	200	110	-0.23	0.09	0.08
HO-P0019	HO-J0012	HO-J0016	66.24	200	110	0.47	0.17	0.29
HO-P0020	HO-J0016	HO-J0017	172.27	200	110	0.00	0.00	0.00
HO-P0021	HO-J0016	HO-J0018	86.86	200	110	0.47	0.17	0.29
HO-P0022	HO-J0014	HO-J0015	150.24	200	110	1.04	0.38	1.24
HO-P0023	HO-J0015	HO-J0019	142.93	200	110	-0.71	0.26	0.62
HO-P0024	HO-J0018	HO-J0019	144.14	200	110	0.70	0.26	0.60
HO-P0025	HO-J0019	HO-J0020	79.41	200	110	-0.84	0.31	0.85
HO-P0026	HO-J0021	HO-J0020	80.81	200	110	0.84	0.31	0.85
HO-P0027	WFT277243	HO-J0021	121.00	200	110	0.76	0.28	0.70
HO-P0028	HO-J0021	HO-J0022	135.15	200	110	-0.35	0.13	0.16
HO-P0029	HO-J0022	HO-J0023	104.38	200	110	-0.56	0.21	0.39
HO-P0030	WFT627948	HO-J0023	24.23	300	120	1.26	0.21	0.21
HO-P0031	HO-J0024	HO-J0023	38.14	300	120	-0.42	0.07	0.03
HO-P0032	HO-J0025	HO-J0024	119.59	300	120	-0.42	0.07	0.03
HO-P0033	HO-J0026	HO-J0025	165.50	300	120	-0.12	0.02	0.00
HO-P0034	HO-J0027	HO-J0026	227.05	300	120	0.07	0.01	0.00
HO-P0035	WFT285238	HO-J0028	190.29	300	120	0.51	0.08	0.04
HO-P0036	HO-J0028	HO-J0009	240.28	300	120	0.31	0.05	0.02
WMN65440	WFT43576	WFT43575	1.29	400	120	4.30	0.40	0.51
WMN150543	WCV121079	WFT43576	53.95	400	120	4.31	0.40	0.51
WMN161674	WFT259182	WFT258234	172.76	1200	123	17.06	0.17	0.03
WMN161691	WFT258234	WFT259159	7.70	1200	123	17.06	0.17	0.03
WMN161347	WFT259159	HO-J0011	278.27	1200	123	12.02	0.12	0.02
WMN169515	WFT43575	WCV132786	53.16	400	130	4.29	0.39	0.43
WMN169516	WFT277238	WFT277239	104.51	400	130	4.09	0.38	0.40
WMN176315	WFT277239	WCV125586	45.20	400	130	3.93	0.36	0.37
WMN176316	WCV125586	WFT277240	53.57	400	130	2.76	0.25	0.19
WMN176317	WFT277240	WFT277241	95.65	400	130	2.75	0.25	0.19
WMN176318	WFT277241	WCV131589	93.73	400	130	2.73	0.25	0.19
WMN176319	WCV131586	WFT277243	5.43	400	130	0.77	0.07	0.02
WMN176320	WCV131587	WFT277244	29.50	400	130	1.37	0.13	0.05
WMN176321	WCV131588	WFT285238	40.24	400	130	0.52	0.05	0.01
WMN176322	WFT277242	WCV131586	3.01	400	130	0.79	0.07	0.02
WMN176323	WFT277242	WCV131587	2.93	400	130	1.39	0.13	0.05
WMN176324	WCV131589	WFT277242	3.19	400	130	2.72	0.25	0.19
WMN176325	WFT277242	WCV131588	3.14	400	130	0.54	0.05	0.01
WMN176326	WFT285240	WCV132787	1.52	400	130	4.26	0.39	0.43
WMN176327	WCV132786	WFT285240	1.45	400	130	4.27	0.39	0.42
WMN177515	WCV132787	WFT277238	1.49	400	130	4.25	0.39	0.42
WMN161350	WFT259157	WFT259179	265.47	1200	123	19.39	0.20	0.04
WMN161412	WDV88892	WFT259179	1.99	150	150	0.00	0.00	0.00
WMN161668	WFT259179	WFT258223	236.17	1200	123	19.38	0.20	0.04
WMN161672	WFT258223	WFT259182	213.83	1200	123	17.06	0.17	0.03
WMN161689	WCV196812	WFT258224	30.88	400	150	2.32	0.21	0.11
WMN265534	WFT258223	WCV196812	1.48	400	150	2.32	0.21	0.11
WMN369632	WFT277244	WFT627946	10.91	300	150	1.36	0.22	0.16
WMN369633	WFT627946	WCV252802	73.20	300	150	1.35	0.22	0.16
WMN369634	WCV252802	WFT627949	3.04	300	150	1.34	0.22	0.15
WMN369635	WFT627949	WCV252801	3.03	200	150	0.05	0.02	0.00
WMN369636	WCV252801	WFT627950	17.18	200	150	0.04	0.01	0.00
WMN369637	WFT627950	WSV538377	3.04	100	150	0.01	0.02	0.01
WMN369638	WFT627950	WSV538376	2.02	200	150	0.01	0.00	0.00
WMN369639	WFT627949	WCV252800	1.69	300	150	1.28	0.21	0.14
WMN369640	WCV252800	WFT627947	1.57	300	150	1.28	0.21	0.14
WMN369641	WFT627947	WFT627948	3.00	300	150	1.27	0.21	0.14
WMN161347_B	HO-J0011	WFT258247	218.17	1200	123	10.69	0.11	0.01

2016 PHD - Pipe Table
Existing Propose Infrastructure

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
HO-P0001	WFT258224	HO-J0001	108.03	300	120	4.02	0.66	1.81
HO-P0002	HO-J0001	HO-J0002	152.58	300	120	3.43	0.56	1.35
HO-P0003	HO-J0002	HO-J0003	59.13	300	120	3.43	0.56	1.35
HO-P0004	HO-J0003	HO-J0009	143.44	300	120	2.04	0.33	0.51
HO-P0005	HO-J0003	HO-J0004	148.60	200	110	0.98	0.36	1.11
HO-P0006	HO-J0004	HO-J0005	170.73	200	110	0.53	0.20	0.36
HO-P0007	HO-J0004	HO-J0006	151.72	200	110	0.07	0.03	0.01
HO-P0008	HO-J0006	HO-J0007	154.22	200	110	0.58	0.21	0.42
HO-P0009	HO-J0006	HO-J0009	116.20	200	110	-0.81	0.30	0.80
HO-P0010	HO-J0009	HO-J0010	135.71	300	120	1.47	0.24	0.28
HO-P0011	HO-J0008	HO-J0006	137.03	200	110	0.08	0.03	0.01
HO-P0012	HO-J0010	HO-J0008	120.54	200	110	0.59	0.22	0.44
HO-P0013	HO-J0010	HO-J0027	119.64	300	120	0.37	0.06	0.02
HO-P0014	HO-J0011	HO-J0012	132.46	200	110	2.39	0.88	5.84
HO-P0015	HO-J0012	HO-J0013	113.98	200	110	0.80	0.30	0.77
HO-P0016	HO-J0013	HO-J0014	131.99	200	110	0.20	0.07	0.06
HO-P0017	WCV125586	HO-J0014	110.59	200	110	2.05	0.76	4.42
HO-P0018	HO-J0018	HO-J0014	146.50	200	110	-0.41	0.15	0.22
HO-P0019	HO-J0012	HO-J0016	66.24	200	110	0.84	0.31	0.84
HO-P0020	HO-J0016	HO-J0017	172.27	200	110	0.00	0.00	0.00
HO-P0021	HO-J0016	HO-J0018	86.86	200	110	0.84	0.31	0.84
HO-P0022	HO-J0014	HO-J0015	150.24	200	110	1.84	0.68	3.61
HO-P0023	HO-J0015	HO-J0019	142.93	200	110	-1.27	0.47	1.80
HO-P0024	HO-J0018	HO-J0019	144.14	200	110	1.25	0.46	1.75
HO-P0025	HO-J0019	HO-J0020	79.41	200	110	-1.49	0.55	2.45
HO-P0026	HO-J0021	HO-J0020	80.81	200	110	1.49	0.55	2.45
HO-P0027	WFT277243	HO-J0021	121.00	200	110	1.35	0.50	2.03
HO-P0028	HO-J0021	HO-J0022	135.15	200	110	-0.61	0.23	0.47
HO-P0029	HO-J0022	HO-J0023	104.38	200	110	-0.99	0.36	1.14
HO-P0030	WFT627948	HO-J0023	24.23	300	120	2.27	0.37	0.63
HO-P0031	HO-J0024	HO-J0023	38.14	300	120	-0.78	0.13	0.09
HO-P0032	HO-J0025	HO-J0024	119.59	300	120	-0.78	0.13	0.09
HO-P0033	HO-J0026	HO-J0025	165.50	300	120	-0.24	0.04	0.01
HO-P0034	HO-J0027	HO-J0026	227.05	300	120	0.10	0.02	0.00
HO-P0035	WFT285238	HO-J0028	190.29	300	120	0.95	0.16	0.12
HO-P0036	HO-J0028	HO-J0009	240.28	300	120	0.59	0.10	0.05
WMN65440	WFT43576	WFT43575	1.29	400	120	7.58	0.70	1.44
WMN150543	WCV121079	WFT43576	53.95	400	120	7.60	0.70	1.45
WMN161674	WFT259182	WFT258234	172.76	1200	123	14.32	0.15	0.02
WMN161691	WFT258234	WFT259159	7.70	1200	123	14.32	0.15	0.02
WMN161347	WFT259159	HO-J0011	278.27	1200	123	5.25	0.05	0.00
WMN169515	WFT43575	WCV132786	53.16	400	130	7.56	0.70	1.24
WMN169516	WFT277238	WFT277239	104.51	400	130	7.25	0.67	1.14
WMN176315	WFT277239	WCV125586	45.20	400	130	7.00	0.64	1.07
WMN176316	WCV125586	WFT277240	53.57	400	130	4.93	0.45	0.56
WMN176317	WFT277240	WFT277241	95.65	400	130	4.91	0.45	0.55
WMN176318	WFT277241	WCV131589	93.73	400	130	4.89	0.45	0.55
WMN176319	WCV131586	WFT277243	5.43	400	130	1.37	0.13	0.05
WMN176320	WCV131587	WFT277244	29.50	400	130	2.45	0.23	0.15
WMN176321	WCV131588	WFT285238	40.24	400	130	0.97	0.09	0.03
WMN176322	WFT277242	WCV131586	3.01	400	130	1.39	0.13	0.06
WMN176323	WFT277242	WCV131587	2.93	400	130	2.47	0.23	0.15
WMN176324	WCV131589	WFT277242	3.19	400	130	4.87	0.45	0.55
WMN176325	WFT277242	WCV131588	3.14	400	130	0.99	0.09	0.03
WMN176326	WFT285240	WCV132787	1.52	400	130	7.52	0.69	1.22
WMN176327	WCV132786	WFT285240	1.45	400	130	7.54	0.69	1.23
WMN177515	WCV132787	WFT277238	1.49	400	130	7.50	0.69	1.22
WMN161350	WFT259157	WFT259179	265.47	1200	123	18.38	0.19	0.03
WMN161412	WDV88892	WFT259179	1.99	150	150	0.00	0.00	0.00
WMN161668	WFT259179	WFT258223	236.17	1200	123	18.37	0.19	0.03
WMN161672	WFT258223	WFT259182	213.83	1200	123	14.32	0.15	0.02
WMN161689	WCV196812	WFT258224	30.88	400	150	4.04	0.37	0.30
WMN265534	WFT258223	WCV196812	1.48	400	150	4.05	0.37	0.30
WMN369632	WFT277244	WFT627946	10.91	300	150	2.42	0.40	0.47
WMN369633	WFT627946	WCV252802	73.20	300	150	2.40	0.39	0.46
WMN369634	WCV252802	WFT627949	3.04	300	150	2.39	0.39	0.46
WMN369635	WFT627949	WCV252801	3.03	200	150	0.08	0.03	0.01
WMN369636	WCV252801	WFT627950	17.18	200	150	0.06	0.02	0.00
WMN369637	WFT627950	WSV538377	3.04	100	150	0.02	0.03	0.01
WMN369638	WFT627950	WSV538376	2.02	200	150	0.02	0.01	0.00
WMN369639	WFT627949	WCV252800	1.69	300	150	2.30	0.38	0.42
WMN369640	WCV252800	WFT627947	1.57	300	150	2.29	0.38	0.43
WMN369641	WFT627947	WFT627948	3.00	300	150	2.28	0.37	0.41
WMN161347_B	HO-J0011	WFT258247	218.17	1200	123	2.86	0.03	0.00

2016 MDD+FF - Available Fire Flows
Existing Propose Infrastructure

Label	Zone	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
HO-J0011	O3	0.00	56	197	56	2072	20
HO-J0001	O3	3.87	54	197	53	721	20
HO-J0002	O3	0.00	53	197	51	575	20
HO-J0003	O3	2.70	52	197	50	558	20
HO-J0004	O3	2.42	52	196	45	249	20
HO-J0005	O3	3.46	54	196	30	126	20
HO-J0006	O3	2.49	51	196	46	308	20
HO-J0007	O3	3.78	50	196	30	131	20
HO-J0008	O3	3.36	49	196	43	252	20
HO-J0009	O3	2.26	51	196	49	550	20
HO-J0010	O3	3.29	50	196	47	466	20
HO-J0012	O3	4.88	56	196	51	349	20
HO-J0013	O3	3.92	54	196	47	262	20
HO-J0014	O3	0.00	54	196	50	364	20
HO-J0015	O3	20.25	52	196	43	240	20
HO-J0016	O3	0.00	55	196	49	285	20
HO-J0017	O3	0.00	56	196	34	133	20
HO-J0018	O3	0.00	54	196	49	305	20
HO-J0019	O3	9.61	53	196	47	301	20
HO-J0020	O3	0.00	53	196	47	281	20
HO-J0021	O3	3.05	53	196	49	356	20
HO-J0022	O3	2.44	51	196	46	285	20
HO-J0023	O3	3.29	52	196	49	560	20
HO-J0024	O3	0.00	51	196	49	513	20
HO-J0025	O3	3.48	50	196	48	445	20
HO-J0026	O3	2.22	50	196	47	410	20
HO-J0027	O3	1.76	49	196	46	415	20
HO-J0028	O3	2.34	52	196	49	516	20
WFT43576	O3	0.15	54	197	53	1221	20
WFT43575	O3	0.15	54	197	53	1215	20
WFT258234	O3	0.01	55	197	54	2033	20
WFT259159	O3	0.01	55	197	54	2026	20
WCV121079	O3	0.01	55	197	54	1614	20
WFT258247	O3	0.08	57	197	57	2110	20
WCV125586	O3	0.15	53	197	52	876	20
WCV131589	O3	0.15	52	196	50	713	20
WCV131586	O3	0.15	52	196	50	711	20
WCV131587	O3	0.15	52	196	50	712	20
WCV131588	O3	0.15	52	196	50	711	20
WCV132786	O3	0.15	55	197	54	1078	20
WCV132787	O3	0.15	54	197	53	1070	20
WFT277238	O3	1.84	54	197	53	1067	20
WFT277239	O3	1.84	54	197	53	924	20
WFT277240	O3	0.15	54	197	53	841	20
WFT277241	O3	0.15	52	197	51	755	20
WFT277242	O3	0.15	52	196	50	714	20
WFT277243	O3	0.15	52	196	50	707	20
WFT285238	O3	0.15	50	196	48	663	20
WFT285240	O3	0.15	55	197	53	1074	20
WFT627947	O3	0.08	52	196	50	581	20
WFT627949	O3	0.08	52	196	50	583	20
WFT627950	O3	0.15	52	196	48	409	20
WFT627946	O3	0.15	52	196	51	676	20
WFT627948	O3	0.08	52	196	50	579	20
WFT259179	O3	0.03	56	197	56	2080	20
WFT258223	O3	0.01	56	197	55	2063	20
WFT259182	O3	0.01	57	197	57	2112	20
WFT258224	O3	0.15	55	197	54	1673	20
WFT277244	O3	0.15	52	196	50	696	20
WCV252801	O3	0.15	52	196	49	543	20
WCV252802	O3	0.08	52	196	50	585	20
WCV196812	O3	0.01	55	197	55	2017	20
WCV252800	O3	0.08	52	196	50	582	20
WSV538376	O3	0.15	51	196	48	398	20
WSV538377	O3	0.15	52	196	44	224	20
WDV88892	O3	0.03	56	197	55	901	20

2031 ADD - Junction Table
Existing Proposed Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
HO-J0001	O3	1.72	158.52	197	55
HO-J0002	O3	0.00	159.28	197	53
HO-J0003	O3	1.20	159.73	197	53
HO-J0004	O3	1.08	160.09	197	52
HO-J0005	O3	1.54	158.79	197	54
HO-J0006	O3	1.11	160.89	197	51
HO-J0007	O3	1.68	161.21	197	51
HO-J0008	O3	1.49	161.77	197	50
HO-J0009	O3	1.00	160.62	197	51
HO-J0010	O3	1.46	161.49	197	50
HO-J0012	O3	2.17	157.32	197	56
HO-J0013	O3	1.74	158.10	197	55
HO-J0014	O3	0.00	158.37	197	55
HO-J0015	O3	9.00	159.43	197	53
HO-J0016	O3	0.00	157.89	197	55
HO-J0017	O3	0.00	157.09	197	56
HO-J0018	O3	0.00	158.22	197	55
HO-J0019	O3	4.27	158.69	197	54
HO-J0020	O3	0.00	159.31	197	53
HO-J0021	O3	1.36	159.29	197	53
HO-J0022	O3	1.09	160.38	197	52
HO-J0023	O3	1.46	160.21	197	52
HO-J0024	O3	0.00	160.42	197	52
HO-J0025	O3	1.55	160.96	197	51
HO-J0026	O3	0.99	161.47	197	50
HO-J0027	O3	0.78	162.24	197	49
HO-J0028	O3	1.04	160.01	197	52
WFT43576	O3	0.16	158.38	197	55
WFT43575	O3	0.16	158.37	197	55
WFT258234	O3	0.01	157.93	197	55
WFT259159	O3	0.01	158.12	197	55
WCV121079	O3	0.01	158.24	197	55
WFT258247	O3	0.49	156.35	197	57
WCV125586	O3	0.16	158.97	197	54
WCV131589	O3	0.16	160.10	197	52
WCV131586	O3	0.16	160.00	197	52
WCV131587	O3	0.16	159.97	197	52
WCV131588	O3	0.16	160.05	197	52
WCV132786	O3	0.16	158.19	197	55
WCV132787	O3	0.16	158.30	197	55
WFT277238	O3	1.05	158.35	197	55
WFT277239	O3	1.05	158.61	197	54
WFT277240	O3	0.16	158.43	197	55
WFT277241	O3	0.16	159.84	197	53
WFT277242	O3	0.16	160.02	197	52
WFT277243	O3	0.16	159.91	197	53
WFT285238	O3	0.16	161.22	197	51
WFT285240	O3	0.16	158.23	197	55
WFT627947	O3	0.49	160.13	197	52
WFT627949	O3	0.49	160.15	197	52
WFT627950	O3	0.16	160.23	197	52
WFT627946	O3	0.16	159.64	197	53
WFT627948	O3	0.49	160.11	197	52
WFT259179	O3	0.02	156.98	197	57
WFT258223	O3	0.01	157.32	197	56
WFT259182	O3	0.01	156.27	197	58
WFT258224	O3	0.16	157.87	197	56
WFT277244	O3	0.16	159.72	197	53
WCV252801	O3	0.16	160.17	197	52
WCV252802	O3	0.49	160.15	197	52
WCV196812	O3	0.01	157.81	197	56
WCV252800	O3	0.49	160.14	197	52

2031 ADD - Junction Table
Existing Proposed Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
WSV538376	O3	0.16	160.25	197	52
WSV538377	O3	0.16	160.24	197	52
WDV88892	O3	0.02	157.34	197	56
HO-J0011	O3	0.00	157.12	197	56

2031 MDD - Junction Table
Existing Proposed Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
HO-J0001	O3	3.87	158.52	198	55
HO-J0002	O3	0.00	159.28	197	54
HO-J0003	O3	2.70	159.73	197	53
HO-J0004	O3	2.42	160.09	197	53
HO-J0005	O3	3.46	158.79	197	55
HO-J0006	O3	2.49	160.89	197	52
HO-J0007	O3	3.78	161.21	197	51
HO-J0008	O3	3.36	161.77	197	50
HO-J0009	O3	2.26	160.62	197	52
HO-J0010	O3	3.29	161.49	197	51
HO-J0012	O3	4.88	157.32	197	56
HO-J0013	O3	3.92	158.10	197	55
HO-J0014	O3	0.00	158.37	197	55
HO-J0015	O3	20.25	159.43	197	53
HO-J0016	O3	0.00	157.89	197	56
HO-J0017	O3	0.00	157.09	197	57
HO-J0018	O3	0.00	158.22	197	55
HO-J0019	O3	9.61	158.69	197	54
HO-J0020	O3	0.00	159.31	197	54
HO-J0021	O3	3.05	159.29	197	54
HO-J0022	O3	2.44	160.38	197	52
HO-J0023	O3	3.29	160.21	197	53
HO-J0024	O3	0.00	160.42	197	52
HO-J0025	O3	3.48	160.96	197	52
HO-J0026	O3	2.22	161.47	197	51
HO-J0027	O3	1.76	162.24	197	50
HO-J0028	O3	2.34	160.01	197	53
WFT43576	O3	0.31	158.38	197	55
WFT43575	O3	0.31	158.37	197	55
WFT258234	O3	0.02	157.93	197	56
WFT259159	O3	0.02	158.12	197	56
WCV121079	O3	0.02	158.24	197	56
WFT258247	O3	0.94	156.35	197	58
WCV125586	O3	0.31	158.97	197	54
WCV131589	O3	0.31	160.10	197	53
WCV131586	O3	0.31	160.00	197	53
WCV131587	O3	0.31	159.97	197	53
WCV131588	O3	0.31	160.05	197	53
WCV132786	O3	0.31	158.19	197	56
WCV132787	O3	0.31	158.30	197	55
WFT277238	O3	2.00	158.35	197	55
WFT277239	O3	2.00	158.61	197	55
WFT277240	O3	0.31	158.43	197	55
WFT277241	O3	0.31	159.84	197	53
WFT277242	O3	0.31	160.02	197	53
WFT277243	O3	0.31	159.91	197	53
WFT285238	O3	0.31	161.22	197	51
WFT285240	O3	0.31	158.23	197	56
WFT627947	O3	0.94	160.13	197	53
WFT627949	O3	0.94	160.15	197	53
WFT627950	O3	0.31	160.23	197	53
WFT627946	O3	0.31	159.64	197	53
WFT627948	O3	0.94	160.11	197	53
WFT259179	O3	0.04	156.98	198	58
WFT258223	O3	0.02	157.32	198	57
WFT259182	O3	0.02	156.27	198	59
WFT258224	O3	0.31	157.87	198	57
WFT277244	O3	0.31	159.72	197	53
WCV252801	O3	0.31	160.17	197	53
WCV252802	O3	0.94	160.15	197	53
WCV196812	O3	0.02	157.81	198	57
WCV252800	O3	0.94	160.14	197	53

2031 MDD - Junction Table
Existing Proposed Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
WSV538376	O3	0.31	160.25	197	53
WSV538377	O3	0.31	160.24	197	53
WDV88892	O3	0.04	157.34	198	58
HO-J0011	O3	0.00	157.12	197	57

2031 PHD - Junction Table
Existing Proposed Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
HO-J0001	O3	6.88	158.52	188	42
HO-J0002	O3	0.00	159.28	188	40
HO-J0003	O3	4.79	159.73	188	40
HO-J0004	O3	4.31	160.09	187	39
HO-J0005	O3	6.15	158.79	187	41
HO-J0006	O3	4.43	160.89	187	38
HO-J0007	O3	6.71	161.21	187	37
HO-J0008	O3	5.98	161.77	187	36
HO-J0009	O3	4.01	160.62	187	38
HO-J0010	O3	5.84	161.49	187	37
HO-J0012	O3	8.67	157.32	187	42
HO-J0013	O3	6.97	158.10	187	41
HO-J0014	O3	0.00	158.37	187	41
HO-J0015	O3	36.00	159.43	187	39
HO-J0016	O3	0.00	157.89	187	42
HO-J0017	O3	0.00	157.09	187	43
HO-J0018	O3	0.00	158.22	187	41
HO-J0019	O3	17.09	158.69	187	40
HO-J0020	O3	0.00	159.31	187	39
HO-J0021	O3	5.42	159.29	187	40
HO-J0022	O3	4.35	160.38	187	38
HO-J0023	O3	5.85	160.21	187	39
HO-J0024	O3	0.00	160.42	187	38
HO-J0025	O3	6.19	160.96	187	38
HO-J0026	O3	3.94	161.47	187	37
HO-J0027	O3	3.13	162.24	187	36
HO-J0028	O3	4.16	160.01	187	39
WFT43576	O3	0.49	158.38	188	42
WFT43575	O3	0.49	158.37	188	42
WFT258234	O3	0.02	157.93	188	43
WFT259159	O3	0.02	158.12	188	42
WCV121079	O3	0.02	158.24	188	42
WFT258247	O3	1.48	156.35	188	45
WCV125586	O3	0.49	158.97	188	41
WCV131589	O3	0.49	160.10	187	39
WCV131586	O3	0.49	160.00	187	39
WCV131587	O3	0.49	159.97	187	39
WCV131588	O3	0.49	160.05	187	39
WCV132786	O3	0.49	158.19	188	42
WCV132787	O3	0.49	158.30	188	42
WFT277238	O3	3.15	158.35	188	42
WFT277239	O3	3.15	158.61	188	41
WFT277240	O3	0.49	158.43	188	41
WFT277241	O3	0.49	159.84	188	39
WFT277242	O3	0.49	160.02	187	39
WFT277243	O3	0.49	159.91	187	39
WFT285238	O3	0.49	161.22	187	37
WFT285240	O3	0.49	158.23	188	42
WFT627947	O3	1.48	160.13	187	39
WFT627949	O3	1.48	160.15	187	39
WFT627950	O3	0.49	160.23	187	39
WFT627946	O3	0.49	159.64	187	40
WFT627948	O3	1.48	160.11	187	39
WFT259179	O3	0.07	156.98	188	45
WFT258223	O3	0.02	157.32	188	44
WFT259182	O3	0.02	156.27	188	45
WFT258224	O3	0.49	157.87	188	43
WFT277244	O3	0.49	159.72	187	39
WCV252801	O3	0.49	160.17	187	39
WCV252802	O3	1.48	160.15	187	39
WCV196812	O3	0.02	157.81	188	43
WCV252800	O3	1.48	160.14	187	39

2031 PHD - Junction Table
Existing Proposed Infrastructure

Label	Zone	Demand (L/s)	Elevation (m)	Hydraulic Grade (m)	Pressure (psi)
WSV538376	O3	0.49	160.25	187	39
WSV538377	O3	0.49	160.24	187	39
WDV88892	O3	0.07	157.34	188	44
HO-J0011	O3	0.00	157.12	188	44

2031 ADD - Pipe Table
Existing Proposed Infrastructure

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
HO-P0001	WFT258224	HO-J0001	108.03	300	120	17.36	0.25	0.29
HO-P0002	HO-J0001	HO-J0002	152.58	300	120	15.64	0.22	0.24
HO-P0003	HO-J0002	HO-J0003	59.13	300	120	15.64	0.22	0.24
HO-P0004	HO-J0003	HO-J0009	143.44	300	120	10.74	0.15	0.12
HO-P0005	HO-J0003	HO-J0004	148.60	200	110	3.70	0.12	0.14
HO-P0006	HO-J0004	HO-J0005	170.73	200	110	1.54	0.05	0.03
HO-P0007	HO-J0004	HO-J0006	151.72	200	110	1.08	0.03	0.01
HO-P0008	HO-J0006	HO-J0007	154.22	200	110	1.68	0.05	0.03
HO-P0009	HO-J0006	HO-J0009	116.20	200	110	-2.13	0.07	0.05
HO-P0010	HO-J0009	HO-J0010	135.71	300	120	5.42	0.08	0.03
HO-P0011	HO-J0008	HO-J0006	137.03	200	110	-0.43	0.01	0.00
HO-P0012	HO-J0010	HO-J0008	120.54	200	110	1.06	0.03	0.01
HO-P0013	HO-J0010	HO-J0027	119.64	300	120	2.90	0.04	0.01
HO-P0014	HO-J0011	HO-J0012	132.46	200	110	4.84	0.15	0.23
HO-P0015	HO-J0012	HO-J0013	113.98	200	110	1.08	0.03	0.01
HO-P0016	HO-J0013	HO-J0014	131.99	200	110	-0.66	0.02	0.01
HO-P0017	WCV125586	HO-J0014	110.59	200	110	7.28	0.23	0.49
HO-P0018	HO-J0018	HO-J0014	146.50	200	110	-1.45	0.05	0.02
HO-P0019	HO-J0012	HO-J0016	66.24	200	110	1.59	0.05	0.03
HO-P0020	HO-J0016	HO-J0017	172.27	200	110	0.00	0.00	0.00
HO-P0021	HO-J0016	HO-J0018	86.86	200	110	1.59	0.05	0.03
HO-P0022	HO-J0014	HO-J0015	150.24	200	110	5.17	0.16	0.26
HO-P0023	HO-J0015	HO-J0019	142.93	200	110	-3.83	0.12	0.15
HO-P0024	HO-J0018	HO-J0019	144.14	200	110	3.04	0.10	0.10
HO-P0025	HO-J0019	HO-J0020	79.41	200	110	-5.07	0.16	0.25
HO-P0026	HO-J0021	HO-J0020	80.81	200	110	5.07	0.16	0.25
HO-P0027	WFT277243	HO-J0021	121.00	200	110	4.35	0.14	0.19
HO-P0028	HO-J0021	HO-J0022	135.15	200	110	-2.07	0.07	0.05
HO-P0029	HO-J0022	HO-J0023	104.38	200	110	-3.16	0.10	0.10
HO-P0030	WFT627948	HO-J0023	24.23	300	120	5.04	0.07	0.03
HO-P0031	HO-J0024	HO-J0023	38.14	300	120	-0.42	0.01	0.00
HO-P0032	HO-J0025	HO-J0024	119.59	300	120	-0.42	0.01	0.00
HO-P0033	HO-J0026	HO-J0025	165.50	300	120	1.13	0.02	0.00
HO-P0034	HO-J0027	HO-J0026	227.05	300	120	2.11	0.03	0.01
HO-P0035	WFT285238	HO-J0028	190.29	300	120	-1.14	0.02	0.00
HO-P0036	HO-J0028	HO-J0009	240.28	300	120	-2.18	0.03	0.01
WMN65440	WFT43576	WFT43575	1.29	400	120	23.34	0.19	0.13
WMN150543	WCV121079	WFT43576	53.95	400	120	23.50	0.19	0.13
WMN161674	WFT259182	WFT258234	172.76	1200	123	510.76	0.45	0.17
WMN161691	WFT258234	WFT259159	7.70	1200	123	510.75	0.45	0.17
WMN161347	WFT259159	HO-J0011	287.40	1200	123	514.88	0.46	0.17
WMN169515	WFT43575	WCV132786	53.16	400	130	23.17	0.18	0.11
WMN169516	WFT277238	WFT277239	104.51	400	130	21.64	0.17	0.09
WMN176315	WFT277239	WCV125586	45.20	400	130	20.59	0.16	0.08
WMN176316	WCV125586	WFT277240	53.57	400	130	13.15	0.10	0.04
WMN176317	WFT277240	WFT277241	95.65	400	130	12.98	0.10	0.04
WMN176318	WFT277241	WCV131589	93.73	400	130	12.82	0.10	0.04
WMN176319	WCV131586	WFT277243	5.43	400	130	4.51	0.04	0.00
WMN176320	WCV131587	WFT277244	29.50	400	130	8.48	0.07	0.02
WMN176321	WCV131588	WFT285238	40.24	400	130	-0.98	0.01	0.00
WMN176322	WFT277242	WCV131586	3.01	400	130	4.67	0.04	0.01
WMN176323	WFT277242	WCV131587	2.93	400	130	8.64	0.07	0.01
WMN176324	WCV131589	WFT277242	3.19	400	130	12.66	0.10	0.03
WMN176325	WFT277242	WCV131588	3.14	400	130	-0.82	0.01	0.00
WMN176326	WFT285240	WCV132787	1.52	400	130	22.85	0.18	0.10
WMN176327	WCV132786	WFT285240	1.45	400	130	23.01	0.18	0.10
WMN177515	WCV132787	WFT277238	1.49	400	130	22.69	0.18	0.10
WMN161350	WFT259157	WFT259179	265.47	1200	123	528.35	0.47	0.18
WMN161412	WDV88892	WFT259179	1.99	150	150	-0.02	0.00	0.00
WMN161668	WFT259179	WFT258223	236.17	1200	123	528.30	0.47	0.18
WMN161672	WFT258223	WFT259182	213.83	1200	123	510.77	0.45	0.17
WMN161689	WCV196812	WFT258224	30.88	400	150	17.52	0.14	0.05
WMN265534	WFT258223	WCV196812	1.48	400	150	17.53	0.14	0.05
WMN369632	WFT277244	WFT627946	10.91	300	150	8.32	0.12	0.05
WMN369633	WFT627946	WCV252802	73.20	300	150	8.15	0.12	0.05
WMN369634	WCV252802	WFT627949	3.04	300	150	7.66	0.11	0.04
WMN369635	WFT627949	WCV252801	3.03	200	150	0.65	0.02	0.01
WMN369636	WCV252801	WFT627950	17.18	200	150	0.49	0.02	0.00
WMN369637	WFT627950	WSV538377	3.04	100	150	0.16	0.02	0.01
WMN369638	WFT627950	WSV538376	2.02	200	150	0.16	0.01	0.00
WMN369639	WFT627949	WCV252800	1.69	300	150	6.52	0.09	0.03
WMN369640	WCV252800	WFT627947	1.57	300	150	6.03	0.09	0.02
WMN369641	WFT627947	WFT627948	3.00	300	150	5.53	0.08	0.02
WMN161347_B	HO-J0011	WFT258247	209.04	1200	123	510.04	0.45	0.17

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
HO-P0001	WFT258224	HO-J0001	108.03	300	120	38.02	0.54	1.24
HO-P0002	HO-J0001	HO-J0002	152.58	300	120	34.15	0.48	1.02
HO-P0003	HO-J0002	HO-J0003	59.13	300	120	34.15	0.48	1.02
HO-P0004	HO-J0003	HO-J0009	143.44	300	120	23.30	0.33	0.50
HO-P0005	HO-J0003	HO-J0004	148.60	200	110	8.15	0.26	0.61
HO-P0006	HO-J0004	HO-J0005	170.73	200	110	3.46	0.11	0.12
HO-P0007	HO-J0004	HO-J0006	151.72	200	110	2.26	0.07	0.06
HO-P0008	HO-J0006	HO-J0007	154.22	200	110	3.78	0.12	0.15
HO-P0009	HO-J0006	HO-J0009	116.20	200	110	-4.83	0.15	0.23
HO-P0010	HO-J0009	HO-J0010	135.71	300	120	11.89	0.17	0.14
HO-P0011	HO-J0008	HO-J0006	137.03	200	110	-0.83	0.03	0.01
HO-P0012	HO-J0010	HO-J0008	120.54	200	110	2.53	0.08	0.07
HO-P0013	HO-J0010	HO-J0027	119.64	300	120	6.07	0.09	0.04
HO-P0014	HO-J0011	HO-J0012	132.46	200	110	11.30	0.36	1.11
HO-P0015	HO-J0012	HO-J0013	113.98	200	110	2.68	0.09	0.08
HO-P0016	HO-J0013	HO-J0014	131.99	200	110	-1.24	0.04	0.02
HO-P0017	WCV125586	HO-J0014	110.59	200	110	16.08	0.51	2.14
HO-P0018	HO-J0018	HO-J0014	146.50	200	110	-3.19	0.10	0.11
HO-P0019	HO-J0012	HO-J0016	66.24	200	110	3.75	0.12	0.14
HO-P0020	HO-J0016	HO-J0017	172.27	200	110	0.00	0.00	0.00
HO-P0021	HO-J0016	HO-J0018	86.86	200	110	3.75	0.12	0.14
HO-P0022	HO-J0014	HO-J0015	150.24	200	110	11.64	0.37	1.18
HO-P0023	HO-J0015	HO-J0019	142.93	200	110	-8.61	0.27	0.67
HO-P0024	HO-J0018	HO-J0019	144.14	200	110	6.94	0.22	0.45
HO-P0025	HO-J0019	HO-J0020	79.41	200	110	-11.28	0.36	1.11
HO-P0026	HO-J0021	HO-J0020	80.81	200	110	11.28	0.36	1.11
HO-P0027	WFT277243	HO-J0021	121.00	200	110	9.69	0.31	0.84
HO-P0028	HO-J0021	HO-J0022	135.15	200	110	-4.64	0.15	0.21
HO-P0029	HO-J0022	HO-J0023	104.38	200	110	-7.08	0.23	0.47
HO-P0030	WFT627948	HO-J0023	24.23	300	120	11.76	0.17	0.14
HO-P0031	HO-J0024	HO-J0023	38.14	300	120	-1.39	0.02	0.00
HO-P0032	HO-J0025	HO-J0024	119.59	300	120	-1.39	0.02	0.00
HO-P0033	HO-J0026	HO-J0025	165.50	300	120	2.09	0.03	0.01
HO-P0034	HO-J0027	HO-J0026	227.05	300	120	4.31	0.06	0.02
HO-P0035	WFT285238	HO-J0028	190.29	300	120	-1.98	0.03	0.01
HO-P0036	HO-J0028	HO-J0009	240.28	300	120	-4.32	0.06	0.02
WMN65440	WFT43576	WFT43575	1.29	400	120	50.39	0.40	0.52
WMN150543	WCV121079	WFT43576	53.95	400	120	50.70	0.40	0.52
WMN161674	WFT259182	WFT258234	172.76	1200	123	1106.80	0.98	0.71
WMN161691	WFT258234	WFT259159	7.70	1200	123	1106.79	0.98	0.71
WMN161347	WFT259159	HO-J0011	287.40	1200	123	1087.25	0.96	0.69
WMN169515	WFT43575	WCV132786	53.16	400	130	50.08	0.40	0.44
WMN169516	WFT277238	WFT277239	104.51	400	130	47.16	0.38	0.39
WMN176315	WFT277239	WCV125586	45.20	400	130	45.17	0.36	0.36
WMN176316	WCV125586	WFT277240	53.57	400	130	28.78	0.23	0.16
WMN176317	WFT277240	WFT277241	95.65	400	130	28.47	0.23	0.15
WMN176318	WFT277241	WCV131589	93.73	400	130	28.16	0.22	0.15
WMN176319	WCV131586	WFT277243	5.43	400	130	10.00	0.08	0.02
WMN176320	WCV131587	WFT277244	29.50	400	130	18.29	0.15	0.07
WMN176321	WCV131588	WFT285238	40.24	400	130	-1.67	0.01	0.00
WMN176322	WFT277242	WCV131586	3.01	400	130	10.31	0.08	0.02
WMN176323	WFT277242	WCV131587	2.93	400	130	18.60	0.15	0.08
WMN176324	WCV131589	WFT277242	3.19	400	130	27.85	0.22	0.15
WMN176325	WFT277242	WCV131588	3.14	400	130	-1.36	0.01	0.00
WMN176326	WFT285240	WCV132787	1.52	400	130	49.47	0.39	0.43
WMN176327	WCV132786	WFT285240	1.45	400	130	49.78	0.40	0.44
WMN177515	WCV132787	WFT277238	1.49	400	130	49.16	0.39	0.42
WMN161350	WFT259157	WFT259179	265.47	1200	123	1145.26	1.01	0.76
WMN161412	WDV88892	WFT259179	1.99	150	150	-0.04	0.00	0.00
WMN161668	WFT259179	WFT258223	236.17	1200	123	1145.18	1.01	0.76
WMN161672	WFT258223	WFT259182	213.83	1200	123	1106.82	0.98	0.71
WMN161689	WCV196812	WFT258224	30.88	400	150	38.33	0.30	0.21
WMN265534	WFT258223	WCV196812	1.48	400	150	38.34	0.31	0.21
WMN369632	WFT277244	WFT627946	10.91	300	150	17.98	0.25	0.21
WMN369633	WFT627946	WCV252802	73.20	300	150	17.68	0.25	0.20
WMN369634	WCV252802	WFT627949	3.04	300	150	16.74	0.24	0.18
WMN369635	WFT627949	WCV252801	3.03	200	150	1.23	0.04	0.01
WMN369636	WCV252801	WFT627950	17.18	200	150	0.92	0.03	0.01
WMN369637	WFT627950	WSV538377	3.04	100	150	0.31	0.04	0.02
WMN369638	WFT627950	WSV538376	2.02	200	150	0.31	0.01	0.00
WMN369639	WFT627949	WCV252800	1.69	300	150	14.57	0.21	0.13
WMN369640	WCV252800	WFT627947	1.57	300	150	13.63	0.19	0.13
WMN369641	WFT627947	WFT627948	3.00	300	150	12.70	0.18	0.11
WMN161347_B	HO-J0011	WFT258247	209.04	1200	123	1075.95	0.95	0.68

2031 PHD - Pipe Table
Existing Proposed Infrastructure

Label	Start Node	Stop Node	Length (Scaled) (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
HO-P0001	WFT258224	HO-J0001	108.03	300	120	53.66	0.76	2.35
HO-P0002	HO-J0001	HO-J0002	152.58	300	120	46.78	0.66	1.83
HO-P0003	HO-J0002	HO-J0003	59.13	300	120	46.78	0.66	1.83
HO-P0004	HO-J0003	HO-J0009	143.44	300	120	29.61	0.42	0.78
HO-P0005	HO-J0003	HO-J0004	148.60	200	110	12.38	0.39	1.32
HO-P0006	HO-J0004	HO-J0005	170.73	200	110	6.15	0.20	0.36
HO-P0007	HO-J0004	HO-J0006	151.72	200	110	1.92	0.06	0.04
HO-P0008	HO-J0006	HO-J0007	154.22	200	110	6.71	0.21	0.42
HO-P0009	HO-J0006	HO-J0009	116.20	200	110	-9.28	0.30	0.77
HO-P0010	HO-J0009	HO-J0010	135.71	300	120	19.56	0.28	0.36
HO-P0011	HO-J0008	HO-J0006	137.03	200	110	-0.06	0.00	0.00
HO-P0012	HO-J0010	HO-J0008	120.54	200	110	5.92	0.19	0.34
HO-P0013	HO-J0010	HO-J0027	119.64	300	120	7.80	0.11	0.07
HO-P0014	HO-J0011	HO-J0012	132.46	200	110	26.46	0.84	5.38
HO-P0015	HO-J0012	HO-J0013	113.98	200	110	8.58	0.27	0.67
HO-P0016	HO-J0013	HO-J0014	131.99	200	110	1.60	0.05	0.03
HO-P0017	WCV125586	HO-J0014	110.59	200	110	24.74	0.79	4.75
HO-P0018	HO-J0018	HO-J0014	146.50	200	110	-5.04	0.16	0.25
HO-P0019	HO-J0012	HO-J0016	66.24	200	110	9.21	0.29	0.76
HO-P0020	HO-J0016	HO-J0017	172.27	200	110	0.00	0.00	0.00
HO-P0021	HO-J0016	HO-J0018	86.86	200	110	9.21	0.29	0.76
HO-P0022	HO-J0014	HO-J0015	150.24	200	110	21.31	0.68	3.60
HO-P0023	HO-J0015	HO-J0019	142.93	200	110	-14.69	0.47	1.81
HO-P0024	HO-J0018	HO-J0019	144.14	200	110	14.24	0.45	1.71
HO-P0025	HO-J0019	HO-J0020	79.41	200	110	-17.53	0.56	2.51
HO-P0026	HO-J0021	HO-J0020	80.81	200	110	17.53	0.56	2.51
HO-P0027	WFT277243	HO-J0021	121.00	200	110	15.90	0.51	2.09
HO-P0028	HO-J0021	HO-J0022	135.15	200	110	-7.06	0.22	0.47
HO-P0029	HO-J0022	HO-J0023	104.38	200	110	-11.40	0.36	1.13
HO-P0030	WFT627948	HO-J0023	24.23	300	120	22.72	0.32	0.48
HO-P0031	HO-J0024	HO-J0023	38.14	300	120	-5.47	0.08	0.03
HO-P0032	HO-J0025	HO-J0024	119.59	300	120	-5.47	0.08	0.03
HO-P0033	HO-J0026	HO-J0025	165.50	300	120	0.73	0.01	0.00
HO-P0034	HO-J0027	HO-J0026	227.05	300	120	4.67	0.07	0.03
HO-P0035	WFT285238	HO-J0028	190.29	300	120	7.41	0.10	0.06
HO-P0036	HO-J0028	HO-J0009	240.28	300	120	3.24	0.05	0.01
WMN65440	WFT43576	WFT43575	1.29	400	120	94.20	0.75	1.63
WMN150543	WCV121079	WFT43576	53.95	400	120	94.69	0.75	1.66
WMN161674	WFT259182	WFT258234	172.76	1200	123	929.82	0.82	0.52
WMN161691	WFT258234	WFT259159	7.70	1200	123	929.79	0.82	0.52
WMN161347	WFT259159	HO-J0011	287.40	1200	123	857.06	0.76	0.44
WMN169515	WFT43575	WCV132786	53.16	400	130	93.71	0.75	1.40
WMN169516	WFT277238	WFT277239	104.51	400	130	89.10	0.71	1.28
WMN176315	WFT277239	WCV125586	45.20	400	130	85.95	0.68	1.20
WMN176316	WCV125586	WFT277240	53.57	400	130	60.72	0.48	0.63
WMN176317	WFT277240	WFT277241	95.65	400	130	60.23	0.48	0.62
WMN176318	WFT277241	WCV131589	93.73	400	130	59.74	0.48	0.61
WMN176319	WCV131586	WFT277243	5.43	400	130	16.39	0.13	0.05
WMN176320	WCV131587	WFT277244	29.50	400	130	33.03	0.26	0.20
WMN176321	WCV131588	WFT285238	40.24	400	130	7.89	0.06	0.01
WMN176322	WFT277242	WCV131586	3.01	400	130	16.87	0.13	0.06
WMN176323	WFT277242	WCV131587	2.93	400	130	33.52	0.27	0.21
WMN176324	WCV131589	WFT277242	3.19	400	130	59.26	0.47	0.60
WMN176325	WFT277242	WCV131588	3.14	400	130	8.38	0.07	0.02
WMN176326	WFT285240	WCV132787	1.52	400	130	92.74	0.74	1.37
WMN176327	WCV132786	WFT285240	1.45	400	130	93.23	0.74	1.40
WMN177515	WCV132787	WFT277238	1.49	400	130	92.25	0.73	1.36
WMN161350	WFT259157	WFT259179	265.47	1200	123	984.18	0.87	0.57
WMN161412	WDV88892	WFT259179	1.99	150	150	-0.07	0.00	0.00
WMN161668	WFT259179	WFT258223	236.17	1200	123	984.04	0.87	0.57
WMN161672	WFT258223	WFT259182	213.83	1200	123	929.84	0.82	0.52
WMN161689	WCV196812	WFT258224	30.88	400	150	54.15	0.43	0.39
WMN265534	WFT258223	WCV196812	1.48	400	150	54.17	0.43	0.39
WMN369632	WFT277244	WFT627946	10.91	300	150	32.54	0.46	0.62
WMN369633	WFT627946	WCV252802	73.20	300	150	32.06	0.45	0.60
WMN369634	WCV252802	WFT627949	3.04	300	150	30.58	0.43	0.55
WMN369635	WFT627949	WCV252801	3.03	200	150	1.95	0.06	0.02
WMN369636	WCV252801	WFT627950	17.18	200	150	1.46	0.05	0.01
WMN369637	WFT627950	WSV538377	3.04	100	150	0.49	0.06	0.06
WMN369638	WFT627950	WSV538376	2.02	200	150	0.49	0.02	0.00
WMN369639	WFT627949	WCV252800	1.69	300	150	27.15	0.38	0.44
WMN369640	WCV252800	WFT627947	1.57	300	150	25.67	0.36	0.39
WMN369641	WFT627947	WFT627948	3.00	300	150	24.19	0.34	0.36
WMN161347_B	HO-J0011	WFT258247	209.04	1200	123	830.60	0.73	0.42

2031 MDD+FF - Available Fire Flows
Existing Proposed Infrastructure

Label	Zone	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Residual Pressure (psi)	Available Flow at Hydrant (L/s)	Available Flow Pressure (psi)
HO-J0001	O3	3.87	55	198	53	657	20
HO-J0002	O3	0.00	54	197	51	532	20
HO-J0003	O3	2.70	53	197	50	516	20
HO-J0004	O3	2.42	53	197	45	243	20
HO-J0005	O3	3.46	55	197	30	126	20
HO-J0006	O3	2.49	52	197	46	297	20
HO-J0007	O3	3.78	51	197	31	130	20
HO-J0008	O3	3.36	50	197	43	246	20
HO-J0009	O3	2.26	52	197	49	506	20
HO-J0010	O3	3.29	51	197	47	435	20
HO-J0012	O3	4.88	56	197	51	335	20
HO-J0013	O3	3.92	55	197	47	255	20
HO-J0014	O3	0.00	55	197	50	348	20
HO-J0015	O3	20.25	53	197	43	235	20
HO-J0016	O3	0.00	56	197	49	276	20
HO-J0017	O3	0.00	57	197	34	132	20
HO-J0018	O3	0.00	55	197	49	294	20
HO-J0019	O3	9.61	54	197	47	291	20
HO-J0020	O3	0.00	54	197	47	272	20
HO-J0021	O3	3.05	54	197	49	340	20
HO-J0022	O3	2.44	52	197	46	276	20
HO-J0023	O3	3.29	53	197	49	514	20
HO-J0024	O3	0.00	52	197	49	474	20
HO-J0025	O3	3.48	52	197	48	417	20
HO-J0026	O3	2.22	51	197	47	386	20
HO-J0027	O3	1.76	50	197	46	390	20
HO-J0028	O3	2.34	53	197	50	479	20
WFT43576	O3	0.31	55	197	54	1119	20
WFT43575	O3	0.31	55	197	54	1114	20
WFT258234	O3	0.02	56	197	55	1750	20
WFT259159	O3	0.02	56	197	54	1740	20
WCV121079	O3	0.02	56	197	54	1424	20
WFT258247	O3	0.94	58	197	56	1828	20
WCV125586	O3	0.31	54	197	52	775	20
WCV131589	O3	0.31	53	197	50	639	20
WCV131586	O3	0.31	53	197	50	638	20
WCV131587	O3	0.31	53	197	50	639	20
WCV131588	O3	0.31	53	197	50	637	20
WCV132786	O3	0.31	56	197	54	983	20
WCV132787	O3	0.31	55	197	53	973	20
WFT277238	O3	2.00	55	197	53	971	20
WFT277239	O3	2.00	55	197	53	820	20
WFT277240	O3	0.31	55	197	53	749	20
WFT277241	O3	0.31	53	197	51	674	20
WFT277242	O3	0.31	53	197	50	640	20
WFT277243	O3	0.31	53	197	50	635	20
WFT285238	O3	0.31	51	197	48	596	20
WFT285240	O3	0.31	56	197	54	979	20
WFT627947	O3	0.94	53	197	50	531	20
WFT627949	O3	0.94	53	197	50	533	20
WFT627950	O3	0.31	53	197	48	385	20
WFT627946	O3	0.31	53	197	51	611	20
WFT627948	O3	0.94	53	197	50	530	20
WFT259179	O3	0.04	58	198	56	1806	20
WFT258223	O3	0.02	57	198	56	1786	20
WFT259182	O3	0.02	59	198	57	1837	20
WFT258224	O3	0.31	57	198	55	1474	20
WFT277244	O3	0.31	53	197	51	626	20
WCV252801	O3	0.31	53	197	49	499	20
WCV252802	O3	0.94	53	197	50	535	20
WCV196812	O3	0.02	57	198	55	1741	20
WCV252800	O3	0.94	53	197	50	532	20
WSV538376	O3	0.31	53	197	48	376	20
WSV538377	O3	0.31	53	197	44	219	20
WDV88892	O3	0.04	58	198	56	815	20
HO-J0011	O3	0.00	57	197	55	1789	20

HOMUN - Watermain Extension Class D Cost Estimates

XX - Water Servicing Capital Cost Estimates					
Item	**Quantity**	**Unit**	**Unit Price**	**Cost Estimated**	**Notes**
Water Supply Servicing					
1 - Supply and install watermain pipe including all fittings, restraints and special pipes					
200 mm dia. PVC DR 18 Class 150	2918.01491	m	$ 434	$ 1,266,000	
300 mm dia. PVC DR 18 Class 150	1724	m	$ 722	$ 1,244,000	
375 mm dia. PVC DR 18 Class 150		m	$ 980	$ -	
450 mm dia. PVC DR 18 Class 150		m	$ 1,350	$ -	
525 mm dia. PVC DR 18 Class 150		m	$ 1,770	$ -	
750 mm dia. PVC DR 18 Class 150		m	$ 2,330	$ -	
1200 mm dia. PVC DR 18 Class 150		m	$ 300	$ -	
3 - Supply and install valve chamber frame and cover					
(a) Valve Chamber	5	ea	$ 30,000	$ 150,000	
		Sub-Total		**$ 2,660,000**	
		Contingency (35%)		*$ 931,000*	
		Total		**$ 3,591,000**	

Notes

1. Minimum Trench Width = Outer Diameter (OD) + 2X
   where X = 0.25 m for 300 to 600 mm pipe
   and X = 0.35 m for 750 mm and larger diameter pipe
2. Excavation: use a 1:1 slope above the trench box
   Excavatio for 3 m depth to invert, use a 2.4 m trench box
3. Cost of excavation: $42.00/m^3 includes stockpile and disposal of excess material for excavation within trench box.
   Cost of bulk excavation: $12.00/m^3 includes stockpile and disposal of excess material for excavation outside of trench box.
4. Cost of bedding/pipe surround: $42.50/m^3 includes supply and place of material
5. Backfill trench: $12.00/m^3 includes replacement of native material and compaction
6. Restoration: $7/m^3 includes topsoil and sod
7. Additional restoration in Dense Urban land use area includes restoration of the road within the trench width (incl. Granular A, Granular B and Asphalt)
8. Pipe cost: PVC for 300 mm watermain and concrete pressure pipe (CPP) for 400 to 1200 mm watermains
9. CPP pipe cost includes 15% above material cost for installation (no additional 15% installation cost applied for the 300 mm PVC pipe)
10. Dewatering costs based on recent construction cost information
11. Liner pipe unit costs based on previous experience for a bore and jack installation
12. Construction Factor: Rural 1.00
13. 2.3 m Frost Cover Urban 1.25
    Dense Ur 1.50

APPENDIX

B SEWERS

2016 as-is scenario: no proposed flows or upgrades

Conduit Table

ID	From ID	To ID	Diameter (mm)	Length (m)	Slope	Total Flow (L/s)	Velocity (m/s)	d/D	q/Q
SMN74501	SMH71063	SMH71061	300	49.2	0.011	3.2	0.6	0.12	0.03
SMN74502	SMH71061	SMH71059	300	57.7	0.003	6.3	0.5	0.24	0.13
SMN74503	SMH71059	SMH71057	300	68.6	0.006	9.5	0.7	0.24	0.12
SMN74504	SMH71057	SMH71055	375	95.0	0.001	12.6	0.5	0.30	0.20
SMN74500	SMH71053	SMH71054	450	13.7	0.008	18.8	1.0	0.18	0.07
SMN210610	SMH289662	SFT660333	300	53.6	0.01	0.0	0.0	0.00	0.00
SMN163752	SMH219548	SMH219547	300	91.6	0.01	0.0	0.0	0.00	0.00
SMN163753	SMH219547	SMH108253	300	28.3	0.009	0.0	0.0	0.00	0.00
SMN163754	SFT545517	SMH219549	200	12.7	0.005	0.0	0.0	0.00	0.00
SMN163755	SMH219549	SMH219547	200	15.0	0.021	0.0	0.0	0.00	0.00
SMN163756	SFT545518	SMH108253	300	31.4	0.01	0.0	0.0	0.00	0.00
SMN163751	SFT660333	SMH219548	300	2.7	0.018	0.0	0.0	0.00	0.00
SMN210608	SMH289660	SMH289661	300	145.1	0.01	0.0	0.0	0.00	0.00
SMN210609	SMH289661	SMH289662	300	140.0	0.01	0.0	0.0	0.00	0.00
SMN74505	SMH71055	SMH71053	450	71.3	0.007	15.7	0.8	0.18	0.07

Manhole Table

ID	Rim Elevation (m)	Total Flow (L/s)	Grade (m)	Surcharge Depth (m)	Unfilled Depth (m)
SMH71063	160.1	3.2	155.4	-0.26	4.70
SMH71053	158.3	3.2	153.2	-0.37	5.11
SMH71055	158.4	3.2	153.6	-0.37	4.79
SMH71057	159.2	3.2	154.2	-0.26	5.00
SMH71061	158.8	3.2	154.8	-0.23	3.97
SMH71059	158.8	3.2	154.6	-0.23	4.20
SFT545518	159.6	0.0	152.6	-0.30	7.00
SMH219547	160.6	0.0	152.5	-0.30	8.03
SMH219549	160.7	0.0	156.6	-0.20	4.03
SFT545517	160.5	0.0	156.7	-0.20	3.84
SMH219548	160.0	0.0	153.5	-0.30	6.43
SFT660333	159.9	0.0	153.6	-0.30	6.35
SMH289662	160.2	0.0	154.1	-0.30	6.07
SMH289661	160.6	0.0	155.6	-0.30	5.03
SMH289660	161.9	0.0	157.1	-0.30	4.81

2031 as-is scenario: no proposed flows or upgrades

Conduit Table

ID	From ID	To ID	Diameter (mm)	Length (m)	Slope	Total Flow (L/s)	Velocity (m/s)	d/D	q/Q
SMN74501	SMH71063	SMH71061	300	49.2	0.011	4.1	0.7	0.14	0.04
SMN74502	SMH71061	SMH71059	300	57.7	0.003	8.2	0.5	0.27	0.16
SMN74503	SMH71059	SMH71057	300	68.6	0.006	12.2	0.8	0.27	0.16
SMN74504	SMH71057	SMH71055	375	95.0	0.001	16.2	0.5	0.34	0.25
SMN74505	SMH71055	SMH71053	450	71.3	0.007	20.2	0.9	0.20	0.09
SMN74500	SMH71053	SMH71054	450	13.7	0.008	24.2	1.0	0.21	0.09
SMN210610	SMH289662	SFT660333	300	53.6	0.01	0.0	0.0	0.00	0.00
SMN163752	SMH219548	SMH219547	300	91.6	0.01	0.0	0.0	0.00	0.00
SMN163753	SMH219547	SMH108253	300	28.3	0.009	0.0	0.0	0.00	0.00
SMN163754	SFT545517	SMH219549	200	12.7	0.005	0.0	0.0	0.00	0.00
SMN163755	SMH219549	SMH219547	200	15.0	0.021	0.0	0.0	0.00	0.00
SMN163756	SFT545518	SMH108253	300	31.4	0.01	0.0	0.0	0.00	0.00
SMN163751	SFT660333	SMH219548	300	2.7	0.018	0.0	0.0	0.00	0.00
SMN210608	SMH289660	SMH289661	300	145.1	0.01	0.0	0.0	0.00	0.00
SMN210609	SMH289661	SMH289662	300	140.0	0.01	0.0	0.0	0.00	0.00

Manhole Table

ID	Rim Elevation (m)	Total Flow (L/s)	Grade (m)	Surcharge Depth (m)	Unfilled Depth (m)
SMH71053	158.3	4.1	153.2	-0.36	5.10
SMH71055	158.4	4.1	153.6	-0.36	4.78
SMH71057	159.2	4.1	154.2	-0.25	4.99
SMH71059	158.8	4.1	154.6	-0.22	4.19
SMH71061	158.8	4.1	154.8	-0.22	3.96
SMH71063	160.1	4.1	155.4	-0.26	4.69
SMH219547	160.6	0.0	152.5	-0.30	8.03
SMH219548	160.0	0.0	153.5	-0.30	6.43
SMH219549	160.7	0.0	156.6	-0.20	4.03
SMH289662	159.7	0.0	154.1	-0.30	5.62
SFT545517	160.5	0.0	156.7	-0.20	3.84
SFT545518	159.6	0.0	152.6	-0.30	7.00
SFT660333	159.9	0.0	153.6	-0.30	6.35
SMH289661	160.6	0.0	155.6	-0.30	5.03
SMH289660	161.9	0.0	157.1	-0.30	4.81

2016 with proposed flows but without upgrades

Conduit Table

ID	From ID	To ID	Diameter (mm)	Length (m)	Slope	Total Flow (L/s)	Velocity (m/s)	d/D	q/Q
SMN74501	SMH71063	SMH71061	300	49.2	0.011	58.3	1.5	0.55	0.577
SMN74502	SMH71061	SMH71059	300	57.7	0.003	61.4	0.9	1.00	1.24
SMN74503	SMH71059	SMH71057	300	68.6	0.006	119.3	1.7	1.00	1.53
SMN74504	SMH71057	SMH71055	375	95.0	0.001	122.4	1.1	1.00	1.89
SMN74505	SMH71055	SMH71053	450	71.3	0.007	125.5	1.5	0.52	0.54
SMN74500	SMH71053	SMH71054	450	13.7	0.008	128.6	1.6	0.49	0.49
SMN210610	SMH289662	SFT660333	300	53.6	0.010	65.7	1.5	0.60	0.67
SMN163752	SMH219548	SMH219547	300	91.6	0.010	65.7	1.5	0.59	0.66
SMN163753	SMH219547	SMH108253	300	28.3	0.009	74.8	1.4	0.69	0.82
SMN163754	SFT545517	SMH219549	200	12.7	0.005	9.1	0.7	0.44	0.40
SMN163755	SMH219549	SMH219547	200	15.0	0.021	9.1	1.2	0.30	0.19
SMN163756	SFT545518	SMH108253	300	31.4	0.010	14.9	1.0	0.26	0.15
SMN163751	SFT660333	SMH219548	300	2.7	0.018	65.7	1.9	0.50	0.50
SMN210608	SMH289660	SMH289661	300	145.1	0.010	56.6	1.4	0.54	0.57
SMN210609	SMH289661	SMH15122	300	87.1	0.010	56.6	1.4	0.55	0.58
SMN56767	SMH14031	SMH14034	300	152.6	0.006	25.1	0.9	0.41	0.35
SMN56770	SMH14034	SMH14036	300	162.7	0.006	25.1	0.9	0.41	0.35
SMN56773	SMH14036	SMH289660	400	121.9	0.005	47.5	1.1	0.38	0.31
SMN56776	SMH14039	SMH14036	250	124.5	0.010	22.5	1.1	0.43	0.38
SMN56777	SMH14043	SMH289660	250	122.2	0.010	9.1	0.9	0.26	0.15
SMN56782	SMH14067	SMH14068	300	136.6	0.009	54.7	1.4	0.56	0.60
SMN56813	SMH14068	SMH71059	300	118.5	0.011	54.7	1.5	0.53	0.55
SMN56814	SMH14072	SMH14084	250	128.3	0.010	14.9	1.0	0.34	0.25
SMN56815	SMH14084	SFT545518	250	90.5	0.010	14.9	1.0	0.34	0.25
SMN56817	SMH15122	SMH289662	300	52.9	0.010	65.7	1.5	0.60	0.68
SMN56833	SMH14085	SMH15122	250	119.0	0.010	9.1	0.9	0.26	0.15

Manhole Table

ID	Rim Elevation (m)	Total Flow (L/s)	Grade (m)	Surcharge Depth (m)	Unfilled Depth (m)
SMH71053	158.3	3.2	153.3	-0.23	4.97
SMH71055	158.4	3.2	153.8	-0.22	4.63
SMH71057	159.2	3.2	154.8	0.33	4.41
SMH71059	158.8	3.2	155.8	1.01	2.96
SMH71061	158.8	3.2	156.1	1.02	2.73
SMH71063	160.1	58.3	156.3	0.63	3.80
SMH219547	160.6	0.0	152.7	-0.09	7.82
SMH219548	160.0	0.0	153.7	-0.12	6.25
SMH219549	160.7	0.0	156.7	-0.14	3.97
SMH289662	160.2	0.0	154.3	-0.12	5.89
SFT545517	160.5	9.1	156.8	-0.11	3.75
SFT545518	159.6	0.0	152.6	-0.22	6.92
SFT660333	159.9	0.0	153.7	-0.15	6.20
SMH289661	160.6	0.0	155.7	-0.14	4.87
SMH289660	161.9	0.0	157.3	-0.14	4.64
SMH14031	159.0	25.1	157.5	1.87	1.44
SMH14034	160.5	0.0	157.4	2.61	3.09
SMH14036	161.0	0.0	157.3	3.30	3.63
SMH14039	161.0	22.5	157.6	-0.14	3.34
SMH14043	162.3	9.1	158.4	-0.18	3.89
SMH14067	158.1	54.7	156.7	1.56	1.45
SMH14068	158.8	0.0	156.2	2.15	2.61
SMH14072	158.5	14.9	154.8	-0.17	3.63
SMH14084	158.0	0.0	153.6	-0.17	4.47
SMH14085	160.1	9.1	156.8	-0.18	3.25
SMH15122	160.9	0.0	154.9	-0.12	6.03

2031 with proposed flows but without upgrades

Conduit Table

ID	From ID	To ID	Diameter (mm)	Length (m)	Slope	tal Flow (L	elocity (m/	d/D	q/Q
SMN74501	SMH71063	SMH71061	300	49.2	0.011	59.2	1.5	0.55	0.586
SMN74502	SMH71061	SMH71059	300	57.7	0.003	63.3	0.9	1.00	1.27
SMN74503	SMH71059	SMH71057	300	68.6	0.006	122.0	1.7	1.00	1.57
SMN74504	SMH71057	SMH71055	375	95.0	0.001	126.0	1.1	1.00	1.95
SMN74505	SMH71055	SMH71053	450	71.3	0.007	130.0	1.5	0.53	0.55
SMN74500	SMH71053	SMH71054	450	13.7	0.008	134.0	1.7	0.51	0.51
SMN210610	SMH289662	SFT660333	300	53.6	0.010	65.7	1.5	0.60	0.67
SMN163752	SMH219548	SMH219547	300	91.6	0.010	65.7	1.5	0.59	0.66
SMN163753	SMH219547	SMH108253	300	28.3	0.009	74.8	1.4	0.69	0.82
SMN163754	SFT545517	SMH219549	200	12.7	0.005	9.1	0.7	0.44	0.40
SMN163755	SMH219549	SMH219547	200	15.0	0.021	9.1	1.2	0.30	0.19
SMN163756	SFT545518	SMH108253	300	31.4	0.010	14.9	1.0	0.26	0.15
SMN163751	SFT660333	SMH219548	300	2.7	0.018	65.7	1.9	0.50	0.50
SMN210608	SMH289660	SMH289661	300	145.1	0.010	56.6	1.4	0.54	0.57
SMN210609	SMH289661	SMH15122	300	87.1	0.010	56.6	1.4	0.55	0.58
SMN56767	SMH14031	SMH14034	300	152.6	0.006	25.1	0.9	0.41	0.35
SMN56770	SMH14034	SMH14036	300	162.7	0.006	25.1	0.9	0.41	0.35
SMN56773	SMH14036	SMH289660	400	121.9	0.005	47.5	1.1	0.38	0.31
SMN56776	SMH14039	SMH14036	250	124.5	0.010	22.5	1.1	0.43	0.38
SMN56777	SMH14043	SMH289660	250	122.2	0.010	9.1	0.9	0.26	0.15
SMN56782	SMH14067	SMH14068	300	136.6	0.009	54.7	1.4	0.56	0.60
SMN56813	SMH14068	SMH71059	300	118.5	0.011	54.7	1.5	0.53	0.55
SMN56814	SMH14072	SMH14084	250	128.3	0.010	14.9	1.0	0.34	0.25
SMN56815	SMH14084	SFT545518	250	90.5	0.010	14.9	1.0	0.34	0.25
SMN56817	SMH15122	SMH289662	300	52.9	0.010	65.7	1.5	0.60	0.68
SMN56833	SMH14085	SMH15122	250	119.0	0.010	9.1	0.9	0.26	0.15

Manhole Table

ID	Rim Elevation (m)	Total Flow (L/s)	Grade (m)	Surcharge Depth (m)	Unfilled Depth (m)
SMH71053	158.3	4.1	153.3	-0.22	4.96
SMH71055	158.4	4.1	153.8	-0.21	4.63
SMH71057	159.2	4.1	154.8	0.36	4.38
SMH71059	158.8	4.1	155.9	1.09	2.89
SMH71061	158.8	4.1	156.2	1.11	2.64
SMH71063	160.1	59.2	156.3	0.73	3.71
SMH219547	160.6	0.0	152.7	-0.09	7.82
SMH219548	160.0	0.0	153.7	-0.12	6.25
SMH219549	160.7	0.0	156.7	-0.14	3.97
SMH289662	159.7	0.0	154.3	-0.12	5.44
SFT545517	160.5	9.1	156.8	-0.11	3.75
SFT545518	159.6	0.0	152.6	-0.22	6.92
SFT660333	159.9	0.0	153.7	-0.15	6.20
SMH289661	160.6	0.0	155.7	-0.14	4.87
SMH289660	161.9	0.0	157.3	-0.14	4.64
SMH14031	159.0	25.1	157.5	1.87	1.44
SMH14034	160.5	0.0	157.4	2.61	3.09
SMH14036	161.0	0.0	157.3	3.30	3.63
SMH14039	161.0	22.5	157.6	-0.14	3.34
SMH14043	162.3	9.1	158.4	-0.18	3.89
SMH14067	158.1	54.7	156.7	1.64	1.37
SMH14068	158.8	0.0	156.3	2.23	2.53
SMH14072	158.5	14.9	154.8	-0.17	3.63
SMH14084	158.0	0.0	153.6	-0.17	4.47
SMH14085	160.1	9.1	156.8	-0.18	3.25
SMH15122	160.9	0.0	154.9	-0.12	6.03

2016 With Proposed Flows and Upgrades

Conduit Table

ID	From ID	To ID	Diameter (mm)	Length (m)	Slope	Total Flow (L/s)	Velocity (m/s)	d/D	q/Q
SMN74501	SMH71063	SMH71061	400	49.2	0.011	58.3	1.5	0.35	0.27
SMN74502	SMH71061	SMH71059	400	57.7	0.003	61.4	0.9	0.54	0.57
SMN74503	SMH71059	SMH71057	500	68.6	0.004	119.3	1.2	0.52	0.53
SMN74504	SMH71057	SMH71055	500	95.0	0.008	122.4	1.5	0.42	0.37
SMN74505	SMH71055	SMH71053	500	71.3	0.008	125.5	1.6	0.43	0.38
SMN74500	SMH71053	SMH71054	500	13.7	0.008	128.6	1.6	0.44	0.39
SMN210610	SMH289662	SFT660333	400	53.6	0.006	65.7	1.2	0.44	0.41
SMN163752	SMH219548	SMH219547	400	91.6	0.006	65.7	1.2	0.44	0.41
SMN163753	SMH219547	SMH108253	400	28.3	0.006	74.8	1.3	0.48	0.46
SMN163754	SFT545517	SMH219549	200	12.7	0.005	9.1	0.7	0.44	0.40
SMN163755	SMH219549	SMH219547	200	15.0	0.021	9.1	1.2	0.30	0.19
SMN163756	SFT545518	SMH108253	300	31.4	0.010	14.9	1.0	0.26	0.15
SMN163751	SFT660333	SMH219548	400	2.7	0.006	65.7	1.2	0.44	0.41
SMN210608	SMH289660	SMH289661	400	145.1	0.006	56.6	1.2	0.41	0.35
SMN210609	SMH289661	SMH15122	400	87.1	0.006	56.6	1.2	0.41	0.35
SMN56767	SMH14031	SMH14034	300	152.6	0.006	25.1	0.9	0.41	0.35
SMN56770	SMH14034	SMH14036	300	162.7	0.006	25.1	0.9	0.41	0.35
SMN56773	SMH14036	SMH289660	400	121.9	0.006	47.5	1.1	0.38	0.31
SMN56776	SMH14039	SMH14036	250	124.5	0.010	22.5	1.1	0.43	0.38
SMN56777	SMH14043	SMH289660	250	122.2	0.010	9.1	0.9	0.26	0.15
SMN56782	SMH14067	SMH14068	300	136.6	0.009	54.7	1.4	0.56	0.60
SMN56813	SMH14068	SMH71059	300	118.5	0.011	54.7	1.5	0.53	0.55
SMN56814	SMH14072	SMH14084	250	128.3	0.010	14.9	1.0	0.34	0.25
SMN56815	SMH14084	SFT545518	250	90.5	0.010	14.9	1.0	0.34	0.25
SMN56817	SMH15122	SMH289662	400	140.0	0.006	65.7	1.2	0.44	0.41
SMN56833	SMH14085	SMH15122	250	119.0	0.010	9.1	0.9	0.26	0.15

Manhole Table

ID	Rim Elevation (m)	Total Flow (L/s)	Grade (m)	Surcharge Depth (m)	Unfilled Depth (m)
SMH71053	158.3	3.2	151.3	-0.28	6.98
SMH71055	158.4	3.2	151.9	-0.29	6.55
SMH71057	159.2	3.2	152.6	-0.29	6.63
SMH71059	158.8	3.2	152.9	-0.24	5.94
SMH71061	158.8	3.2	155.0	-0.18	3.83
SMH71063	160.1	58.3	155.5	-0.26	4.59
SMH219547	160.6	0.0	150.0	-0.21	10.56
SMH219548	160.0	0.0	150.5	-0.22	9.42
SMH219549	160.7	0.0	156.7	-0.14	3.97
SMH289662	160.2	0.0	150.9	-0.22	9.32
SFT545517	160.5	9.1	156.8	-0.11	3.75
SFT545518	159.6	0.0	152.6	-0.22	6.92
SFT660333	159.9	0.0	150.6	-0.22	9.37
SMH289661	160.6	0.0	152.2	-0.24	8.35
SMH289660	161.9	0.0	153.1	-0.24	8.79
SMH14031	159.0	25.1	155.5	-0.18	3.48
SMH14034	160.5	0.0	154.6	-0.18	5.88
SMH14036	161.0	0.0	153.8	-0.25	7.18
SMH14039	161.0	22.5	157.6	-0.14	3.34
SMH14043	162.3	9.1	158.4	-0.18	3.89
SMH14067	158.1	54.7	155.3	-0.13	2.84
SMH14068	158.8	0.0	154.0	-0.14	4.80
SMH14072	158.5	14.9	154.8	-0.17	3.63
SMH14084	158.0	0.0	153.6	-0.17	4.47
SMH14085	160.1	9.1	156.8	-0.18	3.25
SMH15122	160.9	0.0	151.7	-0.22	9.17

2031 With Proposed Flows and Upgrades

Conduit Table

ID	From ID	To ID	Diameter (mm)	Length (m)	Slope	Total Flow (L/s)	Velocity (m/s)	d/D	q/Q
SMN74501	SMH71063	SMH71061	400	49.2	0.011	59.2	1.5	0.36	0.27
SMN74502	SMH71061	SMH71059	400	57.7	0.003	63.3	0.9	0.55	0.59
SMN74503	SMH71059	SMH71057	500	68.6	0.004	122.0	1.2	0.53	0.54
SMN74504	SMH71057	SMH71055	500	95.0	0.008	126.0	1.6	0.43	0.38
SMN74505	SMH71055	SMH71053	500	71.3	0.008	130.0	1.6	0.44	0.40
SMN74500	SMH71053	SMH71054	500	13.7	0.008	134.0	1.6	0.45	0.41
SMN210610	SMH289662	SFT660333	400	53.6	0.006	65.7	1.2	0.44	0.41
SMN163752	SMH219548	SMH219547	400	91.6	0.006	65.7	1.2	0.44	0.41
SMN163753	SMH219547	SMH108253	400	28.3	0.006	74.8	1.3	0.48	0.46
SMN163754	SFT545517	SMH219549	200	12.7	0.005	9.1	0.7	0.44	0.40
SMN163755	SMH219549	SMH219547	200	15.0	0.021	9.1	1.2	0.30	0.19
SMN163756	SFT545518	SMH108253	300	31.4	0.010	14.9	1.0	0.26	0.15
SMN163751	SFT660333	SMH219548	400	2.7	0.006	65.7	1.2	0.44	0.41
SMN210608	SMH289660	SMH289661	400	145.1	0.006	56.6	1.2	0.41	0.35
SMN210609	SMH289661	SMH15122	400	87.1	0.006	56.6	1.2	0.41	0.35
SMN56767	SMH14031	SMH14034	300	152.6	0.006	25.1	0.9	0.41	0.35
SMN56770	SMH14034	SMH14036	300	162.7	0.006	25.1	0.9	0.41	0.35
SMN56773	SMH14036	SMH289660	400	121.9	0.006	47.5	1.1	0.38	0.31
SMN56776	SMH14039	SMH14036	250	124.5	0.010	22.5	1.1	0.43	0.38
SMN56777	SMH14043	SMH289660	250	122.2	0.010	9.1	0.9	0.26	0.15
SMN56782	SMH14067	SMH14068	300	136.6	0.009	54.7	1.4	0.56	0.60
SMN56813	SMH14068	SMH71059	300	118.5	0.011	54.7	1.5	0.53	0.55
SMN56814	SMH14072	SMH14084	250	128.3	0.010	14.9	1.0	0.34	0.25
SMN56815	SMH14084	SFT545518	250	90.5	0.010	14.9	1.0	0.34	0.25
SMN56817	SMH15122	SMH289662	400	140.0	0.006	65.7	1.2	0.44	0.41
SMN56833	SMH14085	SMH15122	250	119.0	0.010	9.1	0.9	0.26	0.15

Manhole Table

ID	Rim Elevation (m)	Total Flow (L/s)	Grade (m)	Surcharge Depth (m)	Unfilled Depth (m)
SMH71053	158.3	4.1	151.3	-0.28	6.98
SMH71055	158.4	4.1	151.9	-0.28	6.54
SMH71057	159.2	4.1	152.6	-0.29	6.63
SMH71059	158.8	4.1	152.9	-0.24	5.94
SMH71061	158.8	4.1	155.0	-0.18	3.82
SMH71063	160.1	59.2	155.5	-0.26	4.59
SMH219547	160.6	0.0	150.0	-0.21	10.56
SMH219548	160.0	0.0	150.5	-0.22	9.42
SMH219549	160.7	0.0	156.7	-0.14	3.97
SMH289662	159.7	0.0	150.9	-0.22	8.86
SFT545517	160.5	9.1	156.8	-0.11	3.75
SFT545518	159.6	0.0	152.6	-0.22	6.92
SFT660333	159.9	0.0	150.6	-0.22	9.37
SMH289661	160.6	0.0	152.2	-0.24	8.35
SMH289660	161.9	0.0	153.1	-0.24	8.79
SMH14031	159.0	25.1	155.5	-0.18	3.48
SMH14034	160.5	0.0	154.6	-0.18	5.88
SMH14036	161.0	0.0	153.8	-0.25	7.18
SMH14039	161.0	22.5	157.6	-0.14	3.34
SMH14043	162.3	9.1	158.4	-0.18	3.89
SMH14067	158.1	54.7	155.3	-0.13	2.84
SMH14068	158.8	0.0	154.0	-0.14	4.80
SMH14072	158.5	14.9	154.8	-0.17	3.63
SMH14084	158.0	0.0	153.6	-0.17	4.47
SMH14085	160.1	9.1	156.8	-0.18	3.25
SMH15122	160.9	0.0	151.7	-0.22	9.17

HOMUN Development

Unit Rates and Area					
Residential	275	L/Person/Day	Population Density (Residential)	285	Person/ha
Non-Residential	275	L/Emp/Day	Population Density (Commercial)	90	Person/ha
I/I	0.286	L/ha/s			
Proposed Area	110	Ha			

Notes: Average Day Demand Rates taken from: Regional Municipality of Halton Water and Wastewater Linear Design Manual

Node	Parcel ID	Precinct	Sub-Catchment	Land Use	Total No. of Jobs	Residential Population	Persons	Dry Weather Flow (L/s)	Proposed Area (Ha)	Ar (Ha)	Ac (Ha)	Kav	P (in 1000)	Pe (in 1000)	Peaking Factor	*Modified Peaking Factor*	Peak Flow (L/s)	I/I (L/s)	Design Flow=Peak +I/I (L/s)
SMH14031	11	1	1	Urban Centre - 1	148	190	338	1.08	2.0	1.0	1.0	0.90	2.27	2.50	2.94	*2.94*	21.24	3.81	25.06
	12	1		Urban Core - 1	213	273	486	1.55	2.9	1.4	1.4								
	13	1		Urban Core - 1	136	174	310	0.99	1.8	0.9	0.9								
	14	1		Urban Core - 1	237	304	540	1.72	3.2	1.6	1.6								
	15	1		Urban Core - 1	262	335	597	1.90	3.5	1.8	1.8								
SMH14039	21	2	2	Urban Core - 2	79	404	483	1.54	2.6	2.1	0.5	0.96	1.94	2.61	3.15	3.15	19.45	3.03	22.48
	22	2		Urban Core - 2	75	384	459	1.46	2.5	2.0	0.5								
	23	2		Urban Core - 2	86	441	527	1.68	2.9	2.3	0.6								
	24	2		Urban Core - 2	77	393	469	1.49	2.6	2.1	0.5								
SMH14072	25	2	3	Urban Core - 2	56	286	341	1.09	1.9	1.5	0.4	0.96	1.23	1.65	3.32	3.32	12.96	1.92	14.88
	26	2		Urban Core - 2	75	384	459	1.46	2.5	2.0	0.5								
	27	2		Urban Core - 2	70	356	426	1.36	2.3	1.9	0.5								
SMH14085, SMH14043, SFT545517	31	3	4	Urban Core - 3	203	173	376	1.20	2.3	0.9	1.4	0.86	2.57	2.24	2.80	2.80	22.87	4.34	27.22
	32	3		Urban Core - 3	188	160	348	1.11	2.1	0.8	1.3								
	33	3		Urban Core - 3	176	151	327	1.04	2.0	0.8	1.2								
	34	3		Urban Core - 3	136	117	253	0.81	1.5	0.6	0.9								
	35	3		Urban Core - 3	170	145	315	1.00	1.9	0.8	1.1								
	36	3		Urban Core - 3	133	113	246	0.78	1.5	0.6	0.9								
	53	5		Institutional	700	0	700	2.23	4.0	0.0	4.0								
SMH14067	41	4	5	Urban Centre - 2	202	480	681	2.17	3.9	2.5	1.3	0.93	5.40	6.62	2.67	2.67	45.94	8.74	54.68
	42	4		Urban Core - 4	397	945	1342	4.27	7.6	4.9	2.7								
	43	4		Urban Centre - 2	162	386	548	1.74	3.1	2.0	1.1								
	44	4		Urban Core - 5	837	1991	2828	9.00	16.0	10.4	5.6								
SMH71063	51	5	6	Institutional	3390	0	3390	10.79	19.2	0.0	19.2	0.80	5.95	3.03	2.40	2.40	45.47	9.63	55.10
	52	5		Institutional	2561	0	2561	8.15	14.5	0.0	14.5								
					10767	**8585**	**19353**	**62**	**110**	**45**	**65**								**199.42**

Sewer Infrastructure Costing

Upgrades to the Existing Infrastructure:

1) Along William Halton Pkwy (up to Third Line): existing 300mm sewer to 400mm for the entire length of 550m. Sewers. **Table 1**, shows the tentative cost for supplying and installing pipe including all fittings, restraints and special pipes for DR 18 PVC Class 150 pipe @ $1325/m.

Table 1: Infrastructure Cost ($): Sewers

ID	FROM INVERT (M)	TO INVERT (M)	FROM NODE	TO NODE	LENGTH (M)	RECOMMENDED DIAMETER (M)	EXSITING DIAMETER (M)	TENTATIVE COST $
SMN163751	150.38	150.37	SFT660333	SMH219548	3	400	300	3,592
SMN163752	150.36	149.81	SMH219548	SMH219547	92	400	300	121,430
SMN163753	149.81	149.64	SMH219547	SMH108253	28	400	300	37,492
SMN210608	152.95	152.08	SMH289660	SMH289661	145	400	300	192,207
SMN210609	152.08	151.55	SMH289661	SMH15122	87	400	300	115,425
SMN210610	150.71	150.39	SMH289662	SFT660333	54	400	300	71,049
SMN56817	151.55	150.71	SMH15122	SMH289662	140	400	300	185,540
SUB-TOTAL ($)								**726,735**

Table 2, shows the cost for supplying and installing std. 1050mm-1800mm sanitary sewer manhole structures including frame & cover.

Table 2: Infrastructure Cost ($): Manhole

MANHOLE	UNIT	UNIT COST ($)	TENTATIVE COST ($)
SFT660333, SMH219548, SMH219547, SMH289660, SMH289660, SMH289661, SMH289662, SMH15122, SMH108253	8	9,000	**72,000**

With 35% contingency the total cost will be **$1,078,292.**

2) Along Third Line (up to Dundas St.): Existing 300mm, 375mm and 450mm sewers are recommended to be upsized. Sewers. Error! Reference source not found.**,** shows the tentative cost for supplying and installing pipe including all fittings, restraints and special pipes for 400mm DR 18 PVC Class 150 pipe @ $1325/m and 500mm DR 18 PVC Class 150 pipe @ $1770/m.

Table 3: Infrastructure Cost ($): Sewers

ID	FROM INVERT (M)	TO INVERT (M)	FROM NODE	TO NODE	LENGTH (M)	RECOMMENDED DIAMETER (M)	EXSITING DIAMETER (M)	TENTATIVE COST $
SMN74500	151.10	151.00	SMH71053	SMH71054	14	500	450	24,169
SMN74501	155.32	154.79	SMH71063	SMH71061	49	400	300	65,161
SMN74502	154.76	154.60	SMH71061	SMH71059	58	400	300	76,502
SMN74503	152.87	152.36	SMH71059	SMH71057	69	500	300	121,495
SMN74504	152.36	151.64	SMH71057	SMH71055	95	500	375	168,102
SMN74505	151.64	151.11	SMH71055	SMH71053	71	500	450	126,217
SUB-TOTAL ($)								**471,028**

Table 4, shows the cost for supplying and installing std. 1050-1800mm sanitary sewer manhole structures including frame & cover.

Table 4: Infrastructure Cost ($): Manhole

MANHOLE	UNIT	UNIT COST ($)	TENTATIVE COST ($)
SMH71053, SMH71063, SMH71061, SMH71059, SMH71059, SMH71057, SMH71055, SMH71054	7	9,000	**63,000**

With 35% contingency the total cost will be $**720,938**.

Proposed Infrastructure: To connect the proposed buildings from the six sub-catchments: existing 300mm sewer to 400mm for the entire length of 550m. Sewers. Table 5**,** shows the tentative cost for supplying and installing pipe including all fittings, restraints and special pipes for DR 18 PVC Class 150 pipe of diameter: 250mm, 300mm, 400mm and 500mm @ $598/m, $722/m, $1325/m, and $1770/m respectively.

Table 5: Infrastructure Cost ($): Sewers

ID	FROM INVERT (M)	TO INVERT (M)	FROM NODE	TO NODE	LENGTH (M)	RECOMMENDED DIAMETER (M)	TENTATIVE COST $
SMN56815	153.48	152.57	SMH14084	SFT545518	91	250	54,144
SMN56773	153.62	152.95	SMH14036	SMH289660	122	400	161,549
SMN56813	153.77	152.88	SMH14068	SMH71059	118	300	85,556
SMN56770	154.52	153.63	SMH14034	SMH14036	163	300	117,451
SMN56814	154.76	153.48	SMH14072	SMH14084	128	250	76,707
SMN56782	154.79	153.77	SMH14067	SMH14068	137	300	98,645
SMN56767	155.36	154.52	SMH14031	SMH14034	153	300	110,182
SMN56833	156.75	155.56	SMH14085	SMH15122	119	250	71,162
SMN56776	157.53	156.31	SMH14039	SMH14036	125	250	74,461
SMN56777	158.31	157.09	SMH14043	SMH289660	122	250	73,059
SUB-TOTAL ($)							**922,917**

Table 6, shows the cost for supplying and installing std. 1050mm-1800mm sanitary sewer manhole structures including frame & cover.

Table 6: Infrastructure Cost ($): Manhole

MANHOLE	UNIT	UNIT COST ($)	TENTATIVE COST ($)

SMH14084, SMH14036, SMH14068, SMH14034, SMH14034, SMH14072, SMH14067, SMH14031, SMH14085, SMH14039, SMH14043, SFT545518, SMH289660, SMH71059, SMH71059, SMH14036, SMH14084, SMH14068, SMH14034, SMH15122, SMH14036, SMH289660	20	9,000	**180,000**

With 35% contingency the total cost will be **$ 1,488,938.**