APPENDIX F

BUSINESS AS USUAL IMPLICATIONS

IBI GROUP

Don Drackley, IBI Group – February 3, 2011

Memorandum

To/Attention	Don Drackley, IBI Group	**Date**	February 3, 2011
From	Scott Johnston	**Project No**	20193
cc	Chris Hodgson, City of Waterloo	**Steno**	SJ
Subject	Waterloo Transportation Master Plan - Comparing Forecasted Transit Business As Usual (BAU) and Transit-Oriented Scenario Levels of Service		

Introduction

The purpose of this memo is to present traffic levels-of-service (LOS) for 2031 under a sensitivity analysis. The draft TMP (October 2009) included a traffic assessment of strategic intersections in Waterloo, based on the Region's demand model. The demand model, termed the Transit-Oriented Scenario, included rapid transit lines and transit share approaching 29% for trips to central Waterloo. This sensitivity scenario is based on maintaining base-year transit mode split through 2031, and is referred to herein as the Business-As-Usual (BAU) scenario.

The same 'strategic intersections' assessed within the draft TMP are carried forward for analysis under the BAU scenario as detailed below.

Network Performance

The prior analysis applied the Region's demand model without modification (and included the rapid transit network). In order to estimate BAU traffic volumes, the Region's demand model was updated to provide traffic forecasts without the rapid transit network in place. The approach undertaken was to apply the base year (2006) mode split to the 2031 total demand. The revised 2031 auto demand was factored to represent auto drivers and assigned to the 2031 road network.

Appendix Exhibit A.1 illustrates the revised screenlines under BAU conditions, and Exhibit A.2 provides the prior Base Scenario (with transit) for comparison. The BAU table illustrates that several locations will operate with higher v/c ratio compared to Base, including Westmount Road, south of University Ave and King Street.

Exhibit 1 illustrates the change in lane-km of congested roadway between the two scenarios, based on roadway links with v/c ratio greater than 0.9. In 2031, the BAU scenario results in a 28% increase in congested lane-km of roadway to 172 lane-km. The congested lane-km is an indicator of the amount of lane-km of roadway needed to reduce congestion below v/c ratio of 0.9 in the city.

Exhibits 2 and 3 illustrate the recommended improvements to the road network on a screenline level for the BAU and Base scenarios. As illustrated, the BAU scenario results in a requirement for additional lanes of travel at University Ave and at the CN Rail.

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Exhibit 1: Lane-km of Congested Roadway

Horizon Period		Congested Lane-Km		
		Base	BAU	% Change
2016	AM	87	104	19%
	PM	108	113	4%
2031	AM	127	152	20%
	PM	135	172	28%

Exhibit 2: Additional Lanes Required in 2031 - BAUScenario

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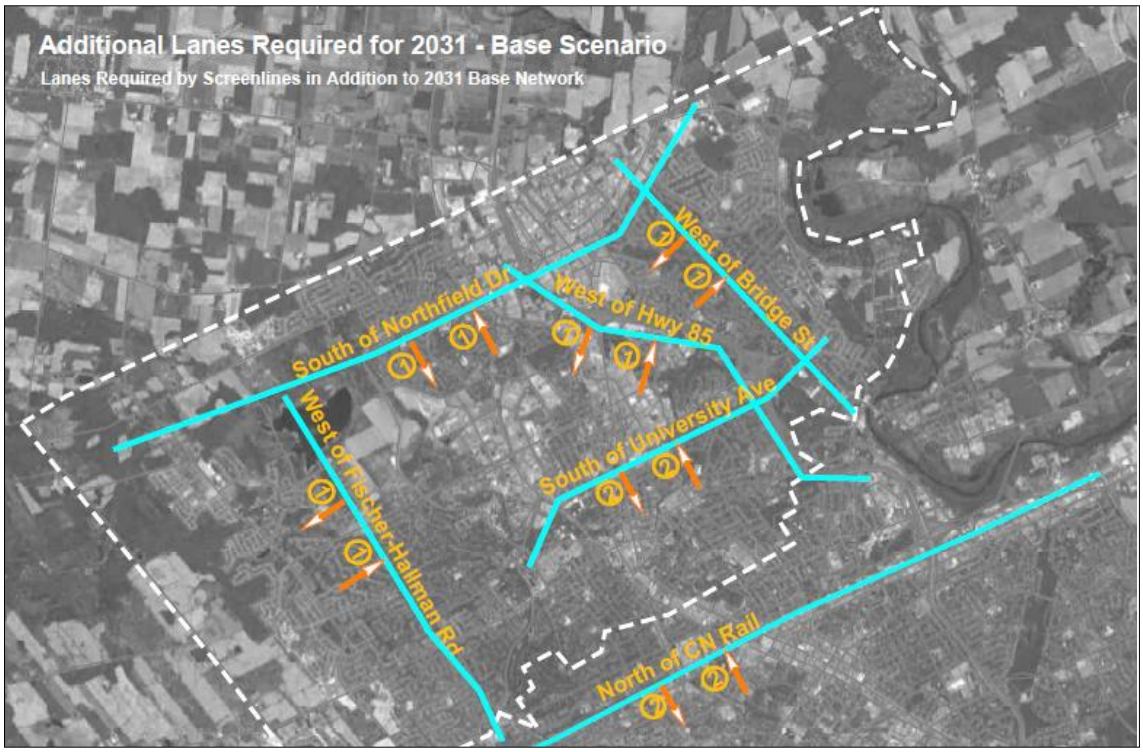
Exhibit 3: Additional Lanes Required in 2031 - Base Scenario



Intersection Performance

Resulting traffic forecasts at the 47 critical intersections in Waterloo were assessed using the Synchro platform.

In 2031, 29 intersections operate worse under BAU than under the Base (transit) scenario. Of the 29, 4 deteriorate from LOS D or better to LOS E/F, suggesting a need for significant improvements. The BAU scenario also resulted in 6 intersections operating better in 2031, due to a change in travel patterns, of which 2 improved from E/F to D or better. The five intersections that operated at E/F in BAU but not Base are:

- Columbia St W and Albert St
- Fischer-Hallman Rd N and Keats Way
- University Ave W and King St N
- Columbia St W and Marsland Dr (unsignalized)

In total, 38 of the 47 intersections analyzed deteriorated from 2006 to 2031 in the BAU scenario, compared to 30 in the base scenario.

Appendix A.7 provides a complete table of overall intersection LOS by horizon and scenario.

In addition to the appendix, the roundabout at Laurelwood Drive and Beaver Creek Road was analyzed using Synchro's roundabout capability. The existing geometry was observed to provide

acceptable v/c ratios through 2031 with a max v/c ratio of 0.57 in the westbound direction in the PM peak hour, compared to 0.52 in the 2009 PM peak hour.

In 2016, 22 intersections operate worse under BAU than under the Base (transit) scenario. Of the 22, 4 deteriorate from LOS D or better to LOS E/F. The BAU scenario also resulted in 14 intersections operating better in 2016, of which 2 improved from E/F to D or better. The four intersections that operated at E/F in BAU but not Base are:

- Columbia St W and Fischer-Hallman Rd N
- Columbia St W and Erbsville Rd
- Columbia St W and Marsland Dr (unsignalized)
- Laurelwood Dr and Beaver Creek Rd (unsignalized)

In total, 28 of the 47 intersections analyzed deteriorated from 2006 to 2016 in both Base and BAU scenarios in 2016.

Summary and Key Results

Based on the above and a review of the maps (2031 AM and PM), the following corridors appear most affected by the BAU scenario:

- **King Street from Northfield Drive to Kitchener-boundary** - King Street will experience significant additional traffic flow under the BAU scenario since it operates parallel to the proposed rapid transit corridor. Both 2016 and 2031 conditions indicate that King Street operates worse in BAU conditions at LOS D and lower.
- **Columbia Street from Erbsville Road to King Street –** This stretch of Columbia Street experiences the most consecutive intersection deteriorating when comparing the base to BAU scenarios and operates at LOS C and lower.
- **Fischer Hallman Road from Laurelwood Drive to Erb St –** The Fischer Hallman Road corridor operates at LOS D and lower in 2016 p.m. and both peak periods in 2031. Three levels of deterioration, the most for any intersection/corridor, was observed in this corridor during the 2031 p.m. peak period.

A summary of intersection performance for BAU is attached in table format.

Appendix

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Exhibit A.1: V/C Ratio at Screenline Locations, BAU Scenario

Screenline ID	Description	Road	2006 V/C Ratios (AM Peak)			2016 V/C Ratios (AM Peak)			2031 V/C Ratios (AM Peak)		
			NB/EB	SB/WB	MAX	NB/EB	SB/WB	MAX	NB/EB	SB/WB	MAX
9A	West of										
	Highway 85	Northfield Dr. WO Hwy. 85	0.67	0.39	0.67	0.92	0.60	0.92	1.02	0.82	1.02
		King St. WO Hwy. 85	0.71	0.69	0.71	0.77	0.83	0.83	0.78	0.87	0.87
		Columbia St. E. WO Hwy. 85	0.10	0.53	0.53	0.14	0.64	0.64	0.61	0.61	0.61
		University Ave. WO Hwy. 85	0.41	0.61	0.61	0.45	0.69	0.69	0.52	0.77	0.77
		Bridgeport Rd. WO Hwy. 85	0.53	0.71	0.71	0.67	0.93	0.93	0.66	1.05	1.05
10	North of										
	CN Rail	Weber St. N/S CN Rail	0.29	0.23	0.29	0.35	0.41	0.41	0.40	0.59	0.59
		Bearinger St. N/S CN Rail	0.77	0.12	0.77	0.89	0.20	0.89	0.88	0.88	0.88
		Columbia St. N/S CN Rail	0.41	0.49	0.49	0.48	0.64	0.64	0.43	0.73	0.73
		Erb St. N/S CN Rail	1.34	0.41	1.34	1.00	0.59	1.00	1.05	1.05	1.05
		William St. N/S CN Rail	1.14	0.55	1.14	0.91	0.30	0.91	1.06	0.35	1.06
		John St. N/S CN Rail	0.86	0.16	0.86	0.66	0.26	0.66	0.74	0.74	0.74
		Union Blvd. N/S CN Rail	1.03	0.67	1.03	1.20	0.37	1.20	1.20	0.35	1.20
13	South of										
	University Ave.	Westmount Rd. SO University Ave.	0.71	0.43	0.71	0.82	0.52	0.82	1.09	0.52	1.09
		Albert St. SO University Ave.	0.67	0.70	0.70	0.67	0.70	0.70	0.82	0.82	0.82
		King St. SO University Ave.	0.38	0.48	0.48	0.55	0.45	0.55	0.74	0.51	0.74
		Regina St. SO University Ave.	0.11	0.53	0.53	0.22	0.38	0.38	0.43	0.43	0.43
		Weber St. SO University Ave.	0.64	0.50	0.64	0.95	0.55	0.95	1.05	1.05	1.05
		Lincoln Rd. SO University Ave.	0.90	0.81	0.90	1.08	0.86	1.08	1.17	0.85	1.17
		Highway 85 SO University Ave.	0.68	0.57	0.68	0.84	0.62	0.84	0.97	0.63	0.97
21	West of										
	Fischer-Hallman	Laurelwood Dr	0.86	0.48	0.86	1.02	0.48	1.02	1.04	1.04	1.04
	Rd N	Columbia St	0.83	0.34	0.83	0.76	0.12	0.76	0.93	0.93	0.93
		Keats Way	0.31	0.14	0.31	0.46	0.08	0.46	0.70	0.13	0.70
		Erb St	0.80	0.33	0.80	0.94	0.31	0.94	0.96	0.42	0.96
		University Ave W	0.29	0.11	0.29	0.37	0.16	0.37	0.36	0.12	0.36
22	South of										
	Northfield Dr W &	Erbsville Rd	0.09	0.13	0.13	0.18	0.20	0.20	0.38	0.38	0.38
	Conservation Dr	Beaver Creek Rd	0.08	0.02	0.08	0.33	0.13	0.33	0.71	0.71	0.71
		Westmount Rd N	0.26	0.24	0.26	0.53	0.33	0.53	0.72	0.72	0.72
		Weber St	0.13	0.25	0.25	0.27	0.45	0.45	0.64	0.64	0.64
		Parkside Dr	0.49	0.76	0.76	0.58	0.81	0.81	0.96	0.96	0.96
		Conestoga Expressway	0.58	0.62	0.62	0.65	0.72	0.72	0.65	0.79	0.79
		King St N	0.40	0.40	0.40	0.90	0.80	0.90	1.04	0.85	1.04
		Davenport Rd	0.07	0.02	0.07	0.23	0.06	0.23	0.30	0.30	0.30
		Bridge St	0.48	0.24	0.48	0.76	0.19	0.76	0.87	0.87	0.87
		University Ave	0.28	0.01	0.28	0.10	0.13	0.13	0.19	0.19	0.19
23	West of Bridge St										
		Northfield Dr	0.45	0.72	0.72	0.89	1.03	1.03	0.60	0.81	0.81
		Lexington Rd	0.34	0.75	0.75	0.41	0.91	0.91	0.91	0.91	0.91
		University Ave	0.61	1.12	1.12	0.83	1.30	1.30	0.75	1.19	1.19

Exhibit A.2: V/C Ratio at Screenlines, Base Scenario

Screenline ID	Description	Road	2006 V/C Ratios (AM Peak)			2016 V/C Ratios (AM Peak)			2031 V/C Ratios (AM Peak)		
			NB/EB	SB/WB	MAX	NB/EB	SB/WB	MAX	NB/EB	SB/WB	MAX
9A	West of										
	Highway 85	Northfield Dr. WO Hwy. 85	0.67	0.39	0.67	0.86	0.60	0.86	0.97	0.76	0.97
		King St. WO Hwy. 85	0.71	0.69	0.71	0.69	0.74	0.74	0.76	0.77	0.77
		Columbia St. E. WO Hwy. 85	0.10	0.53	0.53	0.16	0.62	0.62	0.17	0.58	0.58
		University Ave. WO Hwy. 85	0.41	0.61	0.61	0.44	0.62	0.62	0.48	0.65	0.65
		Bridgeport Rd. WO Hwy. 85	0.53	0.71	0.71	0.62	0.92	0.92	0.62	1.00	1.00
10	North of										
	CN Rail	Weber St. N/S CN Rail	0.29	0.23	0.29	0.31	0.41	0.41	0.28	0.60	0.60
		Bearinger St. N/S CN Rail	0.77	0.12	0.77	1.03	0.36	1.03	0.94	0.54	0.94
		Columbia St. N/S CN Rail	0.41	0.49	0.49	0.45	0.61	0.61	0.42	0.65	0.65
		Erb St. N/S CN Rail	1.34	0.41	1.34	0.98	0.60	0.98	1.02	0.73	1.02
		William St. N/S CN Rail	1.14	0.55	1.14	1.00	0.27	1.00	1.03	0.34	1.03
		John St. N/S CN Rail	0.86	0.16	0.86	0.62	0.17	0.62	0.65	0.18	0.65
		Union Blvd. N/S CN Rail	1.03	0.67	1.03	1.27	0.51	1.27	1.33	0.49	1.33
13	South of										
	University Ave.	Westmount Rd. SO University Ave.	0.71	0.43	0.71	0.78	0.54	0.78	0.93	0.56	0.93
		Albert St. SO University Ave.	0.67	0.70	0.70	0.68	0.84	0.84	0.72	0.81	0.81
		King St. SO University Ave.	0.38	0.48	0.48	0.47	0.39	0.47	0.63	0.39	0.63
		Regina St. SO University Ave.	0.11	0.53	0.53	0.32	0.50	0.50	0.42	0.53	0.53
		Weber St. SO University Ave.	0.64	0.50	0.64	0.98	0.54	0.98	1.06	0.57	1.06
		Lincoln Rd. SO University Ave.	0.90	0.81	0.90	0.99	0.78	0.99	1.08	0.79	1.08
		Highway 85 SO University Ave.	0.68	0.57	0.68	0.75	0.51	0.75	0.88	0.57	0.88
21	West of										
	Fischer-Hallman	Laurelwood Dr	0.86	0.48	0.86	1.10	0.55	1.10	1.14	0.60	1.14
	Rd N	Columbia St	0.83	0.34	0.83	0.78	0.20	0.78	0.86	0.19	0.86
		Keats Way	0.31	0.14	0.31	0.44	0.12	0.44	0.73	0.40	0.73
		Erb St	0.80	0.33	0.80	0.92	0.28	0.92	0.94	0.30	0.94
		University Ave W	0.29	0.11	0.29	0.40	0.21	0.40	0.38	0.19	0.38
22	South of										
	Northfield Dr W &	Erbsville Rd	0.09	0.13	0.13	0.26	0.23	0.26	0.25	0.42	0.42
	Conservation Dr	Beaver Creek Rd	0.08	0.02	0.08	0.26	0.16	0.26	0.53	0.32	0.53
		Westmount Rd N	0.26	0.24	0.26	0.50	0.27	0.50	0.69	0.31	0.69
		Weber St	0.13	0.25	0.25	0.23	0.33	0.33	0.45	0.45	0.45
		Parkside Dr	0.49	0.76	0.76	0.60	0.89	0.89	0.53	1.03	1.03
		Kitchener - Waterloo Expressway	0.58	0.62	0.62	0.60	0.64	0.64	0.62	0.75	0.75
		King St N	0.40	0.40	0.40	1.04	0.73	1.04	1.14	0.85	1.14
		Davenport Rd	0.07	0.02	0.07	0.23	0.07	0.23	0.31	0.14	0.31
		Bridge St	0.48	0.24	0.48	0.74	0.19	0.74	0.86	0.26	0.86
		University Ave	0.28	0.01	0.28	0.10	0.12	0.12	0.10	0.17	0.17
23	West of Bridge St										
		Northfield Dr	0.45	0.72	0.72	0.87	1.01	1.01	0.63	0.78	0.78
		Lexington Rd	0.34	0.75	0.75	0.44	0.96	0.96	0.42	0.93	0.93
		University Ave	0.61	1.12	1.12	0.86	1.27	1.27	0.81	1.17	1.17

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Exhibit A.3: BAU Versus Base Scenario – 2016 AM

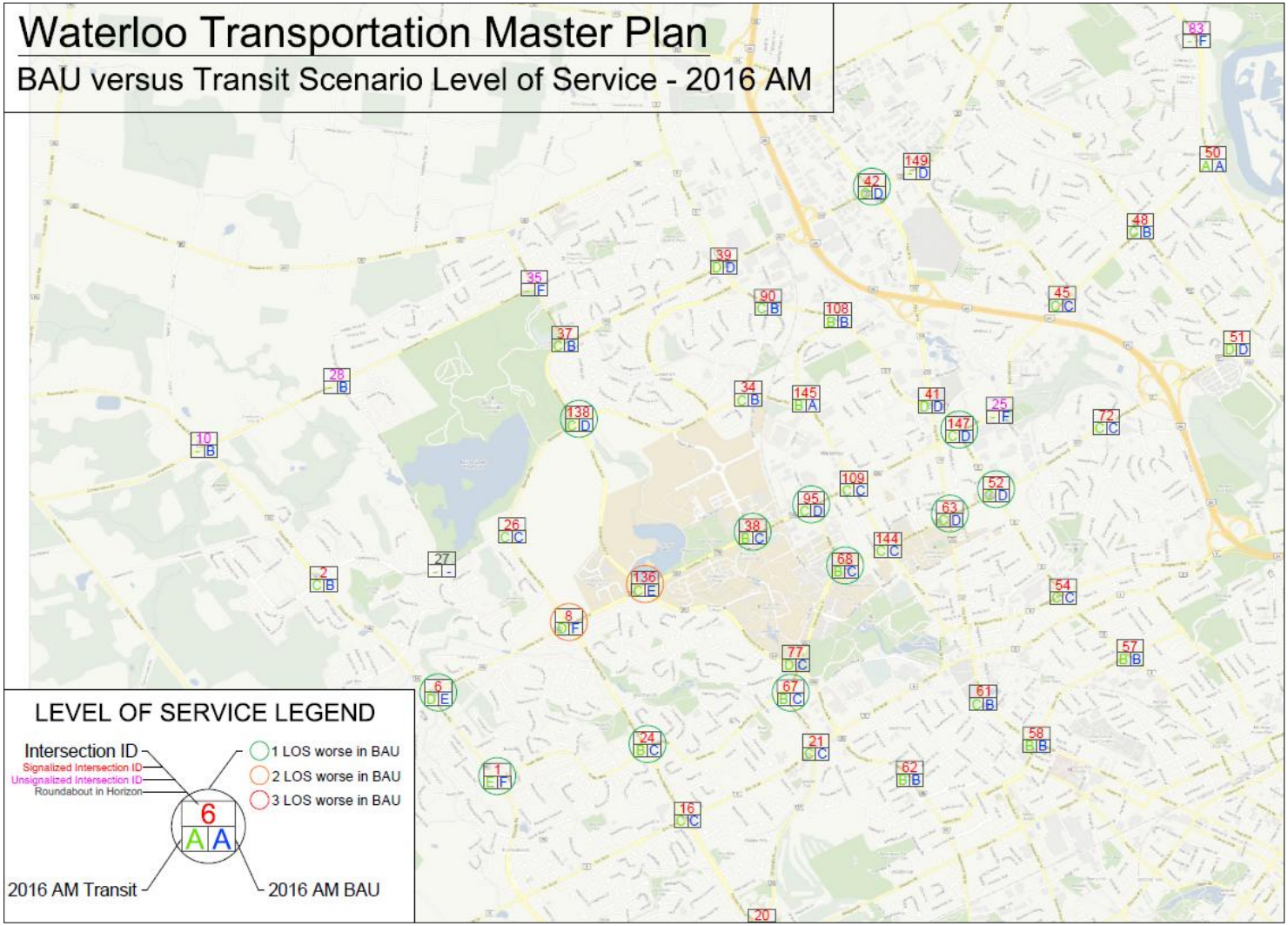

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Exhibit A.4: BAU Versus Base Scenario – 2016 PM

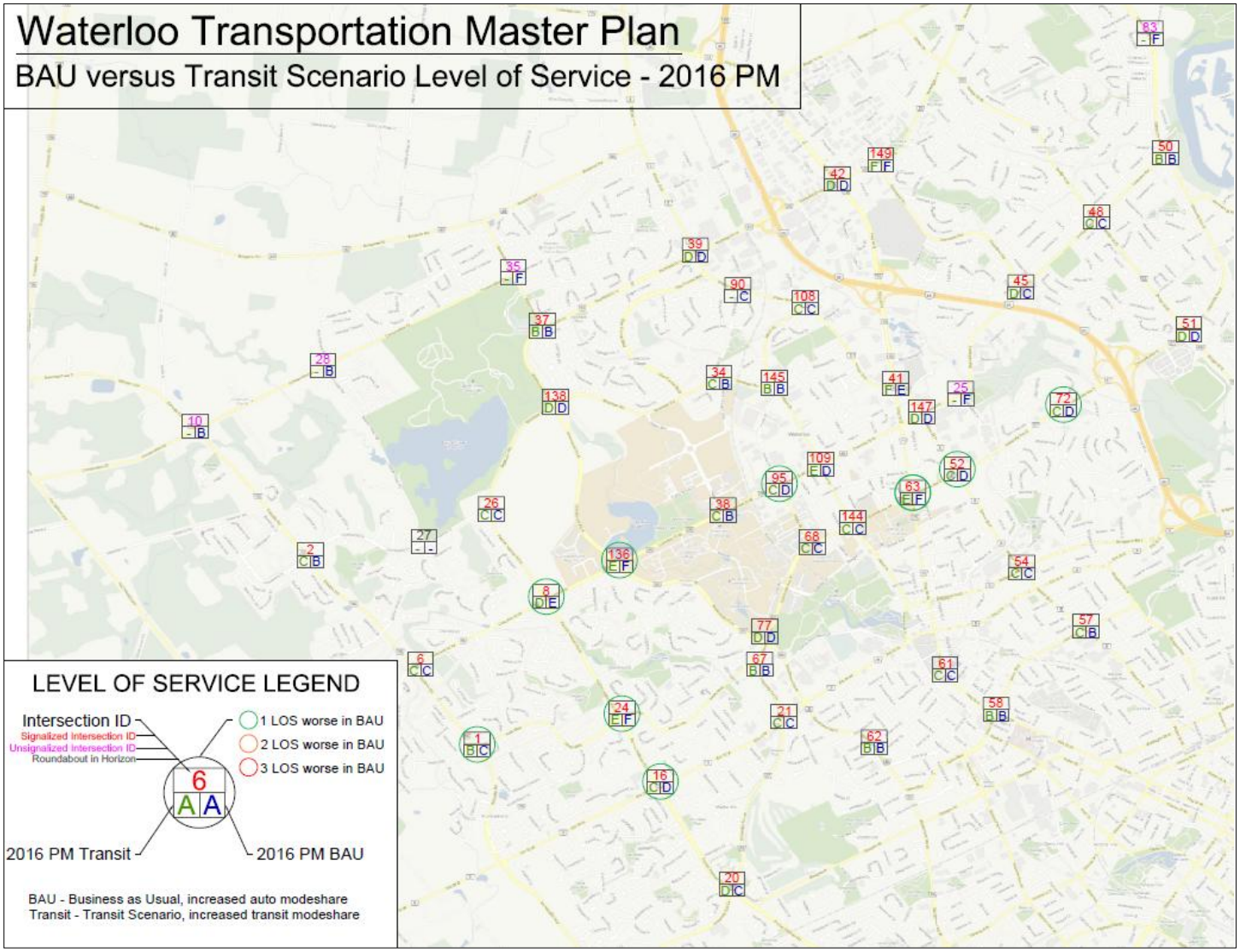

Exhibit A.5: BAU Versus Base Scenario – 2031 AM

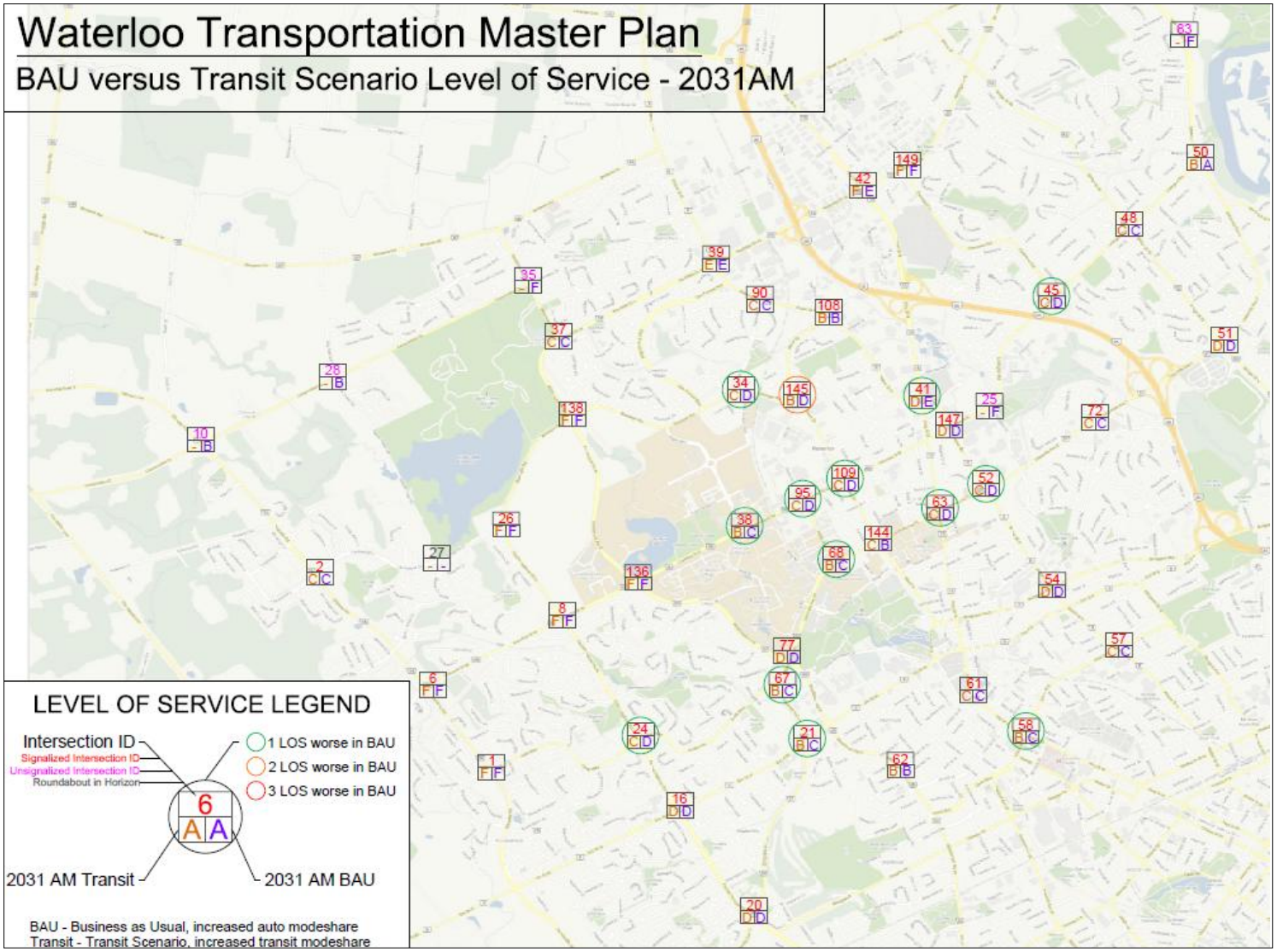

Exhibit A.6: BAU Versus Base Scenario – 2031 PM

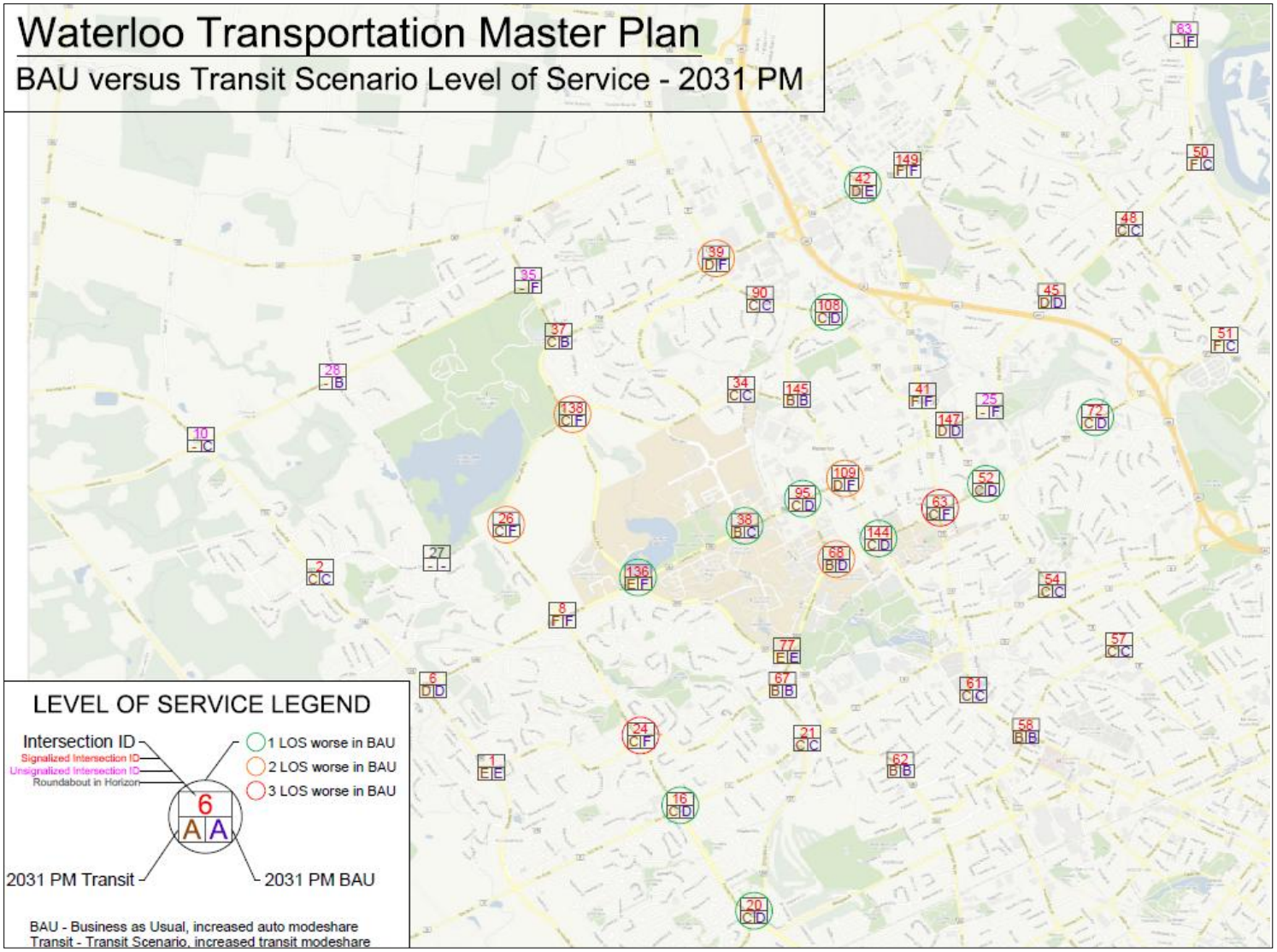

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Exhibit A.7: LOS Summary

ID	Street 1 Name	Street 2 Name	2006 AM	2006 PM	Base				BAU			
					2016 AM	2016 PM	2031 AM	2031 PM	2016 AM	2016 PM	2031 AM	2031 PM
Signalized Intersections												
145	Albert	Phillip	A	B	B	B	B	B	A	B	D	B
144	Albert	University	C	C	C	C	C	C	C	C	B	D
48	Bridge	Lexington	C	B	C	C	C	C	B	C	C	C
51	Bridge	University	C	D	D	D	D	F	D	D	D	C
109	Columbia	Albert	C	D	C	E	C	D	C	D	D	F
95	Columbia	Phillip	C	D	C	C	C	C	D	D	D	D
32	Columbia	Hagey Blvd	C	C	B	C	B	B	C	B	C	C
147	Columbia	Weber	C	D	C	D	D	D	D	D	D	D
136	Columbia	Westmount	C	C	C	E	F	E	E	F	F	F
16	Erb	Fisher-Hallman	C	C	C	C	D	C	C	D	D	D
21	Erb	University	C	C	C	C	B	C	C	C	C	C
6	Erbsville	Columbia	C	C	D	C	F	D	E	C	F	D
1	Erbsville	Keatsway	B	B	E	B	F	E	F	C	F	E
2	Erbsville	Laurelwood	B	B	C	C	C	C	B	B	C	C
8	Fischer Hallman	Columbia	D	C	D	D	F	F	F	E	F	F
24	Fischer Hallman	Keatsway	C	C	B	E	C	C	C	F	D	F
26	Fischer Hallman	Laurelwood	C	B	C	C	F	C	C	C	F	F
20	Fischer Hallman	University	C	D	C	D	D	C	C	D	C	D
42	King	Northfield	C	D	C	D	F	D	D	D	E	E
41	King	Weber	C	D	D	F	D	F	D	E	E	F
58	King	Union	C	C	C	C	C	C	B	C	C	C
61	King	William	B	C	B	B	B	B	B	B	C	B
45	Lexington	Davenport	C	C	C	D	C	D	C	C	D	D
149	Northfield	Davenport	C	D	N/A	F	F	F	D	F	F	F
37	Northfield	Westmount	B	C	C	B	C	C	B	B	C	B
67	University	Keatsway	C	B	B	B	B	B	C	B	C	B
63	University	King	D	D	C	E	C	C	D	F	D	F
50	University	Lexington	A	A	A	B	B	F	A	B	A	C
72	University	Lincoln	C	D	C	C	C	C	C	D	C	D
77	University	Westmount	C	C	D	D	D	E	C	D	D	E
68	University	Phillip	C	B	B	C	B	B	C	C	C	D
108	Weber	Albert	B	B	B	C	B	C	B	C	B	D
90	Weber	Parkside	B	B	C	N/A	C	C	B	C	C	C
54	Weber	Bridgeport	C	C	C	C	D	C	C	C	D	C
57	Weber	Union	B	B	B	C	C	C	B	B	C	C
52	Weber	University	C	D	C	C	C	C	D	D	D	D
39	Weber	Northfield	C	D	D	D	E	D	D	D	E	F
138	Westmount	Bearinger	C	C	C	D	F	C	D	D	F	F
34	Bearinger	Parkside/Wes Graham Way	B	B	C	C	C	C	B	B	D	C
62	Westmount	William	B	B	B	B	B	B	B	B	B	B
Unsignalized Intersections - Worst Movement												
25	Columbia	Marsland	F	F	C	B	C	B	F	F	F	F
35	Conservation	Westmount	A	A	C	F	F	F	F	F	F	F
10	Conservation	Erbsville	A	A	A	A	A	A	B	B	B	C
28	Conservation	Beavercreek	A	A	A	A	B	A	B	B	B	B
83	Woolwich	University	A	A	B	F/H	E	D	F	F	F	F
LEGEND:	Improved in BAU	Deteriorated in BAU										