
Technical Memorandum

To: Bryce Tupper, BPP
From: Donna Howes, P.Eng., FEC, Howes Technical Advantage Ltd.
Date: September 27, 2019
Re: **Rodgers Creek Traffic Impact Study - Update**

1. Introduction

This memorandum provides an update to the Rodgers Creek Traffic Impact Study, March 2008¹ which was submitted as part of the original rezoning for Rodgers Creek. Howes Technical Advantage Ltd. has been retained to provide an update to this report for a rezoning application based on a change in land use and road access for the area.

This memorandum provides the detail requested by the District of West Vancouver (the District) as part of the updated Rodgers Creek Rezoning application. The areas that are in consideration are Area 5 and Area 6.

2. Scope of work

The Rodgers Creek development areas and road network is shown in **Figure 1**.

The work includes the following:

- An update of the background traffic data which was undertaken with new counts in October 2018 and March 2019.
- New land use numbers for Area 5 and 6.
- A new access road to Area 6 (referred to as Uplands Road) connecting to Cypress Bowl Road (CBR) at the access road to Area 5, Road J, creating a four-legged intersection.
- New forecast traffic volumes and traffic operations analysis at four key locations: CBR and Chippendale; CBR and new Uplands Road; CBR and Cypress Lane; and CBR and Highway 1 interchange (north ramp terminal).
- Conclusions and recommendations.

3. Context

The Rodgers Creek development is planned to be complete by 2028. This report assumes a future full build out by that time. The Cypress Village (Village) development has been considered as a separate application and any impact of the Village will be dealt with as part of that process. As such, no Village traffic has been included as part of this analysis.

4. Road Network

The existing road network with future connections is shown in **Figure 1**. Two new roads have been completed and are open to traffic – Chippendale Connector and Burfield Place. Some units on Burfield Place are completed and occupied and some are still under construction. Some units on Chippendale are completed and occupied. At Cypress Lane, a westbound right turn pocket lane approximately 110m long has been added on CBR. A new access to Area 6, Uplands Road, will connect with CBR at the main access for Area 5, referred to as Road J.

¹ Rodgers Creek Traffic Impact Study, Final Report, March 2008, iTRANS Consulting Inc.

5. Traffic Analysis Assumptions and Information

The Synchro software suite² was used for the traffic analysis for the existing and the future horizon. This analysis is based on the procedure and methods of the Highway Capacity Manual (HCM) for signalized and unsignalized intersections.

Operations of roadway facilities are described in terms of Level of Service (LOS). LOS is a qualitative description of traffic flow based on factors such as speed, travel time, delay, and freedom to manoeuvre. Six service levels are defined ranging from LOS A, the best operating conditions, to LOS F, the worst operating conditions. LOS E corresponds to “at or near capacity” operations. When volumes exceed capacity, stop-and-go conditions result and operations are designated LOS F. The delay thresholds and corresponding LOS are presented in **Table 1**.

Another method to describe the operation is in terms of the volume to capacity (v/c) ratio. The v/c ratio is defined as the volume for a movement divided by the capacity for that movement. The v/c ratio for an intersection can be calculated by summing the volume for all critical movements and dividing by the sum of the capacity for those critical movements. The v/c ratio can also be described in terms of LOS A-F as well. Generally, a movement or intersection with a v/c less than 0.85 is operating under capacity, 0.85-0.95 is operating near capacity, 0.95-1.00 flow is becoming unstable (improvements will be required to avoid excessive delays), and greater than 1.00 the demand exceeds the available capacity. The v/c ratio thresholds and the corresponding LOS are presented in **Table 1**.

The calculated 95th percentile queue length has also been reported in terms of length (m) where the space for a car is approximately 7m.

Table 1: Level of Service Criteria

Level of service (LOS)	Average delay for Unsignalized intersection movements (seconds per vehicle)	Average delay for Signalized intersection movements (seconds per vehicle)	v / c Ratio
A	0-10	0-10	< 0.60
B	10-15	10-20	> 0.60 to 0.69
C	15-25	20-35	> 0.70 to 0.79
D	25-35	35-55	> 0.80 to 0.89
E	35-50	55-80	> 0.90 to 0.99
F	> 50	> 80	> 1.00

The following assumptions were used for this study update:

- Time horizons:
 - 2018 Existing
 - 2028 Future build out
- Growth rate:
 - 1% background for all traffic in the study area
 - No growth for Mulgrave School

² Synchro Software – Version 10

- Peak hour factors (PHF): This is the ratio of the total hourly volume to the maximum 15-min rate of flow within the hour. $PHF = \text{Hourly volume} / (4 \times \text{peak 15 min volume})$. A ratio closer to 1 indicates a steady stream of traffic over the hour.
 - For the existing data (2018/2019) the intersection PHF from the counts was used
 - For future analysis 0.92 was used to reflect a more congested network.
- Heavy vehicles: 2% was used for the main roads.
- Speed limit: 60km/h on CBR; 50km/h on all other roads.
- Lane widths: 3.6m

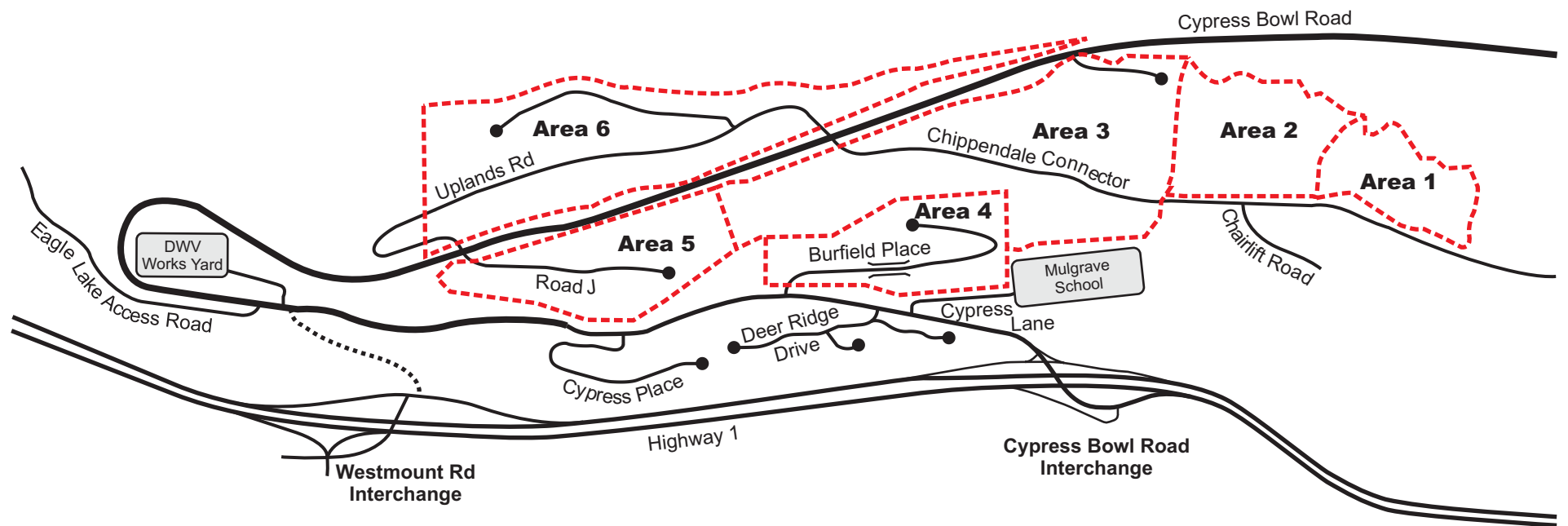


Figure 1
Rodgers Creek Planned Development

6. Existing Conditions

Existing Traffic Counts:

New traffic counts were undertaken in October 2018 and March 2019. These volumes were checked against the recent previous traffic data collected in 2015. Most volumes compared well taking into account that the Chippendale Connector is now open to traffic, some development is complete and occupied, and general background growth. However, it was noted that the PM volumes on CBR east of Cypress Lane were much higher than expected. On review, it is understood that this additional traffic can be attributed to the construction on Burfield Place. The PM peak hour through traffic on CBR was reduced more in line with 2015 plus general growth in that area. It was also noted that the PM peak hour numbers into and out of Mulgrave School at Cypress Lane appeared lower than normal. These numbers were increased to be more in line with the previous data collection. The adjusted Existing Traffic Volumes are shown in **Figure 2** and were used as the basis for further analysis.

The peak hours on the road network in the study area are 7:45-8:45AM and 4:15-5:15PM. There is a School Peak Hour in the afternoon which is a result of Mulgrave School. However it is anticipated that, in the future, the PM peak hour of the study area road network will be greater than the School Peak Hour. The student numbers have increased from 750 students in 2008 to 915 in 2019, a 22% increase. In addition, the total traffic to and from Mulgrave School in the AM peak hour has increased by approximately 50% since 2008.

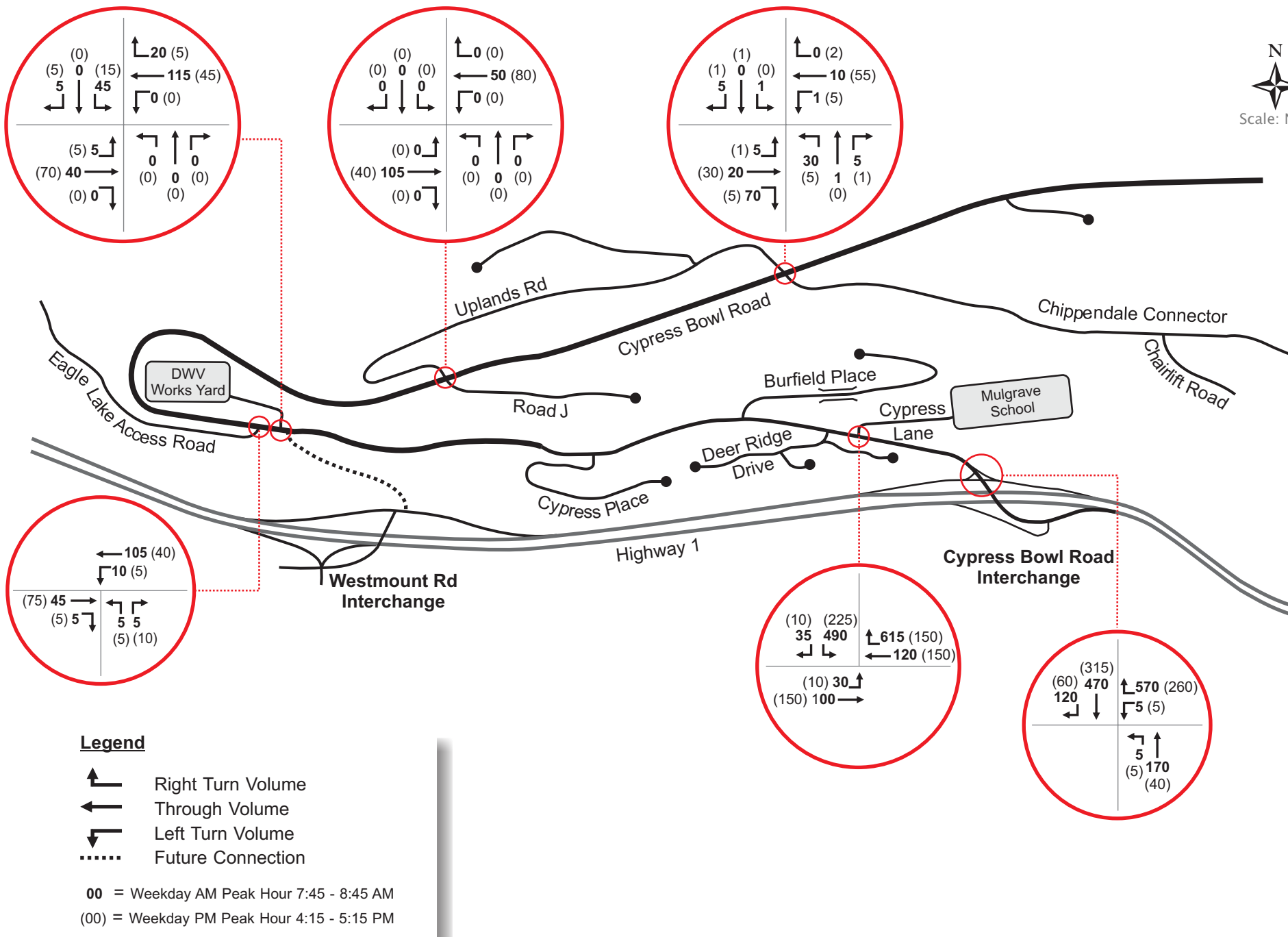


Figure 2
Existing Traffic Volumes - Adjusted

Existing Traffic Analysis:

The existing network two main intersections were analyzed using Synchro. The results are shown in **Table 2**.

Table 2: Existing Intersection Operation

Intersection	Movement	AM Pk Hr			PM Pk Hr		
		LOS	95% Q (m)	v/c	LOS	95% Q (m)	v/c
Highway 1 / CBR	WB R	C	57	0.75	A	10	0.28
- <i>CBR runs north-south</i>	WB L	C	1	0.02	B	1	0.01
	NB	A	1	0.01	A	1	0.01
	SB			0.43			0.28
Cypress Lane / CBR	EB L	A	2	0.05	A	1	0.01
- <i>CBR runs east-west</i>	EB T			0.07			0.11
	WB R			0.39			0.10
	WB T			0.09			0.11
	SB R+L	F	140	1.04	C	22	0.48

As a result in the increase in traffic accessing Mulgrave School in the AM peak, there is a decrease in LOS for the westbound right turn off Highway 1 and the southbound left turn at Cypress Lane. Mulgrave School currently uses trained traffic control personnel at peak times to regulate the delays and associated queuing at the intersection of CBR at Cypress Lane. Site observations have indicated that this operation allows the southbound movement to operate more effectively than shown in the Synchro analysis above.

At Highway 1, the current operation for the westbound right operates more like a merge movement. The PM peak operates well and all movements are at LOS C or better.

7. Future Background Conditions

Future Background Traffic Volumes for 2028:

The future full build out date is 2028, as noted previously. The future background was developed using 1% growth rate for CBR. This assumption was derived from a review of historical data and to allow for some growth other than Rodgers Creek. From 2018 to 2028, the increase is 10%. The Mulgrave School traffic was separated from the other traffic and no growth rate was applied to this traffic. The trip distribution for Mulgrave School traffic at Highway 1 was split according to the general traffic splits with 80% to and from the east and 20% to and from the west. The forecast background traffic for 2028 is shown in **Figure 3**. It has been assumed that with time, Mulgrave School will continue to work at spreading the peak demand especially in the AM peak. In doing so, this will allow for better traffic operation on Cypress Lane as through traffic increases on CBR.

Future Background Traffic Analysis for 2028:

The future Background traffic operations for the two main intersections were analyzed using Synchro. The results are shown in **Table 3**.

Table 3: Future Background Intersection Operation

Intersection	Movement	AM Pk Hr			PM Pk Hr		
		LOS	95% Q (m)	v/c	LOS	95% Q (m)	v/c
Highway 1 / CBR	WB R	C	55	0.74	A	10	0.29
- CBR runs north-south	WB L	C	1	0.04	B	1	0.02
	NB	A	1	0.01	A	1	0.01
	SB			0.39			0.25
Cypress Lane / CBR	EB L	A	1	0.04	A	1	0.01
- CBR runs east-west	EB T			0.07			0.11
	WB R			0.39			0.10
	WB T			0.09			0.11
	SB R+L	E	85	0.88	B	16	0.41

The PHF was adjusted for the future trips which assume that there would be a more steady flow of traffic in the peak hour to Mulgrave School. As a result, the southbound operation at Cypress Lane is slightly better than the Existing operation even though there is more traffic approaching the intersection. All other movements are LOS C or better. The PM peak operates well and all movements are at LOS B or better.

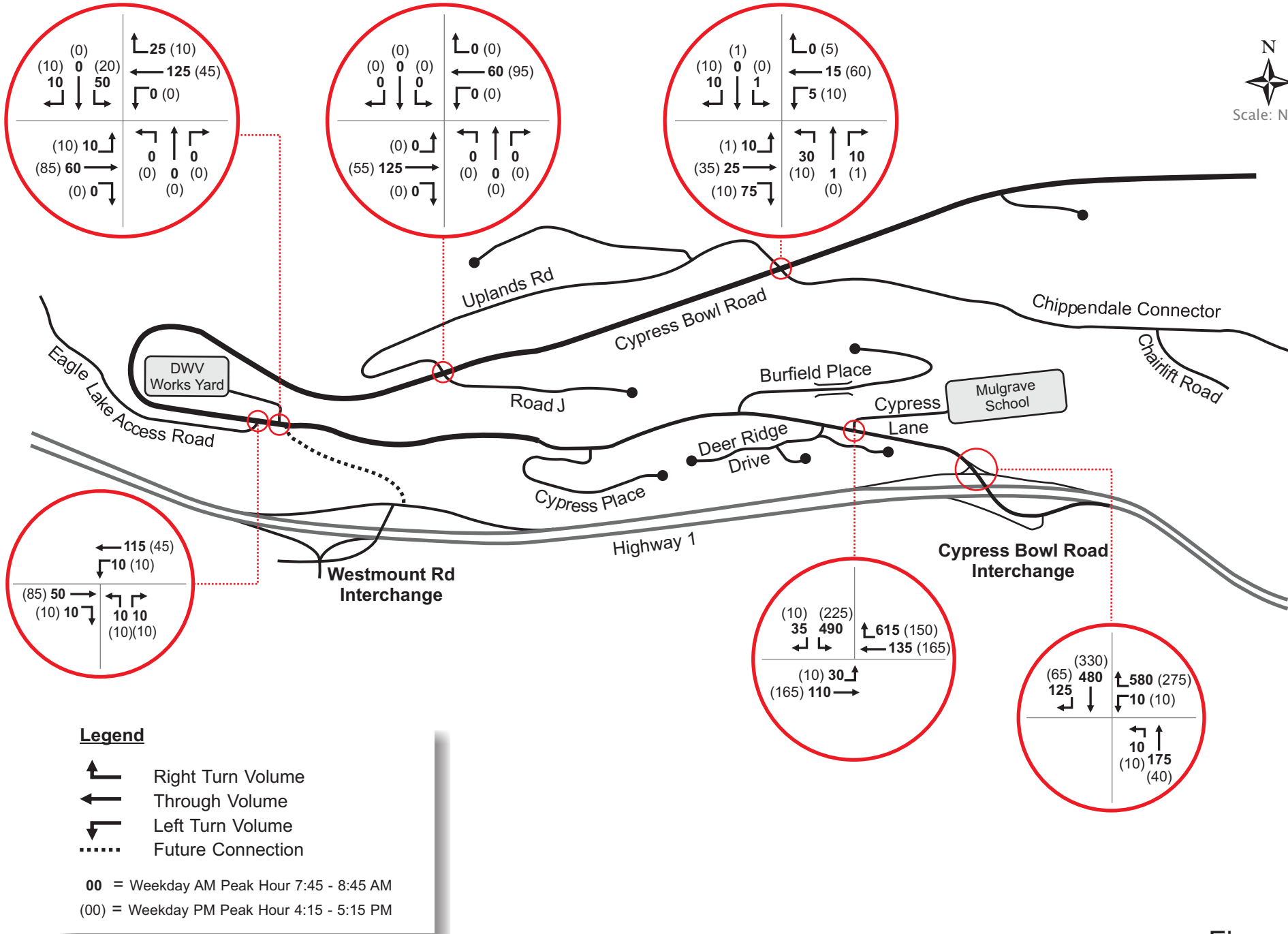


Figure 3
Background 2028 Traffic Volumes

8. Proposed Development

Proposed Land Use:

The land use proposed is shown in **Table 4**. The total number of units for the full Rodgers Creek development is 1,217. In the previous application, there were 736 units. This represents an increase of 481 units. There are 47 units which have been built and are occupied. Therefore the balance of **1,170** units will be part of this future analysis. The changes to the land use from the previous study are shown in blue.

Trip Generation:

Project trip generation is based on current rates from the Institute of Transportation Engineers Handbook (ITE) and adjusted if appropriate based on relevant local data. This project was studied in 2008 and the trip generation rates used were based on ITE's 7th edition at that time. For the 2008 study, the higher luxury townhouse/condo rate was used based on the assumed land use and demographics of the future residents. For this current assessment of the revised Rodgers Creek development, the latest 10th edition of the Institute of Transportation Engineers (ITE) Trip Generation Handbook has been used. For the mid-rise and high-rise categories, the new trip rates are lower than the luxury rates by a range of 18% to 35%.

The trip rates used for the land use type are shown in **Table 5**. The general urban suburban rate was used for all categories. This represents a more conservative approach as this is the highest current rate for this category. No trip reduction factors have been used based on the location and that there is no transit service at this time. There is likelihood of future transit with the development of the Village. Any trips reductions will be assessed as part of that future application.

Site Trips:

The site trips for the AM and PM peak hour were developed by applying the trip generation to the number of units per area. The new built and occupied units of Rodgers Creek (47 units) are included in the Existing Traffic. The net total trips for the proposed development are approximately **420** in the AM peak hour and approximately **500** in PM peak hour. The resulting trips per area are detailed in **Table 6**.

For the 2008 report, the estimated total site trips were approximately 430 in the AM peak hour and approximately 450 in PM peak hour. The total site trips for the Rodgers Creek updated development, including those already built and occupied, are approximately 455 in the AM peak hour and approximately 550 in PM peak hour. In comparison with the previous report, the incremental increase in trips with the extra units is small because of the different trip rates used in the two studies.

Trip Distribution:

The trip distribution is exactly the same as the previous study except slightly more traffic was distributed to CBR (South) from Area 3 as shown in

Table 7. For Area 6, the traffic distributed to CBR (South) is based on the development location within the area with the 90% split divided with 54% traffic to use Uplands Road (S) and 36% to use Chippendale.

The trip distribution for site trips at Highway 1 was split with 90% to and from the east and 10% to and from the west. This is based on the location of main employment and activity centres in relation to the development. This is consistent with other analysis in the area and current traffic patterns.

The site traffic for the full Rodgers Creek build out is shown in **Figure 4**.

Table 4: Proposed land Use

Area	Original Land Use			Built and Occupied – Oct 2018			Proposed					Summary	
	Single Family	Multi Family	TOTAL	Single Family	Multi Family	TOTAL	Single Family	Multi Family Low Rise (1-2 levels)	Multi Family Mid Rise (3-10 levels)	Multi Family Mid Rise (over 10 levels)	TOTAL	GRAND TOTAL	Change from Original
1	11	18	29	11	0	11	0	0	18	0	18	29	0
2	16	24	40	16	0	16	0	24	0	0	24	40	0
3	54	32	86	6	0	6	48	12	20	0	80	86	0
4	17	71	88	14	0	14	3	18	53	0	74	88	0
5	0	224	224	0	0	0	0	36	0	318	354	354	130
6	0	269	269	0	0	0	10	50	72	488	620	620	351
Sub-Total	98	638	736	47	0	47	61	140	163	806	1170	1217	481
Total units	736			47			1,170						

Table 5: ITE Trip Generation Rates - 10th Edition

DESCRIPTION	ITE REF #	ITE Description		AM PEAK HOUR			PM PEAK HOUR		
				RATE IN	RATE IN	TOTAL RATE	RATE IN	RATE IN	TOTAL RATE
Single family	10th 210	Gen Urban Suburban	Detached						
				Directional dist.	25%	75%		63%	37%
Multifamily Housing (Low Rise)	10th 220	Gen Urban Suburban	1-2 levels						
				Directional dist.	23%	77%		63%	37%
Multifamily Housing (Mid Rise)	10th 221	Gen Urban Suburban	3-10 levels						
				Directional dist.	26%	74%		61%	39%
Multifamily Housing (High Rise)	10th 222	Gen Urban Suburban	10 plus levels						
				Directional dist.	24%	76%		61%	39%

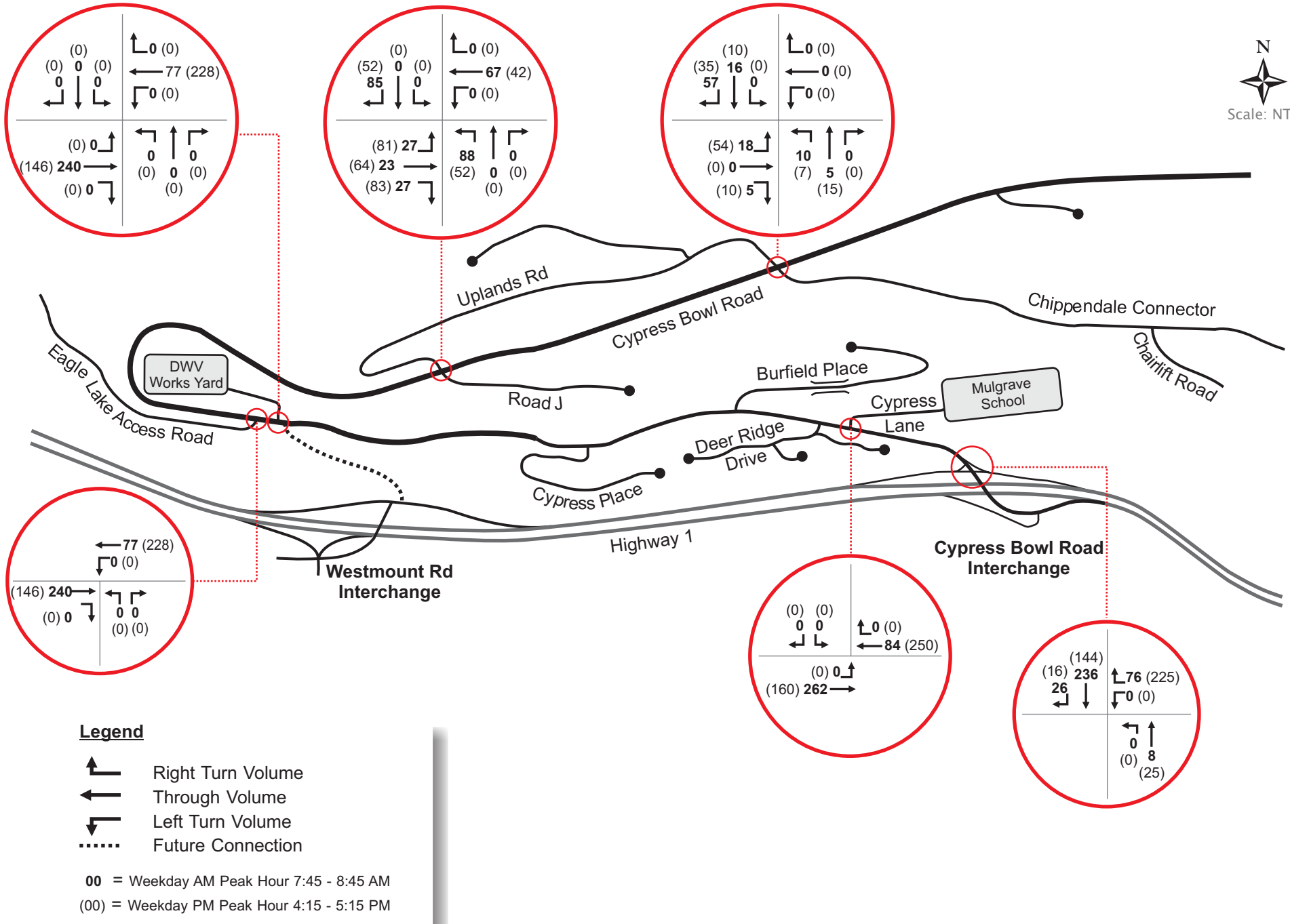
Table 6: Site Trips Per Area

AREA	UNITS	AM PEAK HOUR			PM PEAK HOUR		
		TRIPS IN	TRIPS OUT	TRIPS	TRIPS IN	TRIPS OUT	TRIPS
1	18	2	5	6	5	3	8
2	24	3	9	11	8	5	13
3	80	12	36	48	40	24	63
4	74	7	22	30	22	14	36
5	354	27	88	115	83	52	135
6	620	50	157	208	150	95	245
TOTAL	1,170	101	317	418	308	192	501

Table 7: Percentage of Trips Distributed by Area

AREA	Highway 1 by Cypress Bowl Road (South)	Highway 1 by Chippendale Road (West)	Chairlift Road	Chippendale Road (East)
1		10%	45%	45%
2		10%	45%	45%
3		20%*	45%	35%*
4	100%			
5	100%			
6	90%		5%	5%

* Adjusted from previous report.



Legend

- Right Turn Volume
- Through Volume
- Left Turn Volume
- Future Connection

00 = Weekday AM Peak Hour 7:45 - 8:45 AM
 (00) = Weekday PM Peak Hour 4:15 - 5:15 PM

Figure 4
Site Traffic Volumes

9. Future Total Conditions

Future Total Traffic Volumes for 2028:

The future total traffic is the combination of the future background traffic for 2018 with the site traffic. This is the expected future traffic on the network. The volumes were rounded to the nearest 5 and as a result there are some cases where volumes are not balanced. These volumes are illustrated in **Figure 5**.

Future Total Traffic Analysis for 2028:

The future total traffic operations for the four main intersections were analyzed using Synchro, as shown in **Table 8**.

Table 8: Future Total Traffic Intersection Operation

Intersection	Movement	AM Pk Hr			PM Pk Hr		
		LOS	95% Q (m)	v/c	LOS	95% Q (m)	v/c
Highway 1 / CBR <i>- CBR runs north-south</i>	WB R	D	82	0.85	B	28	0.55
	WB L	C	2	0.06	B	1	0.03
	NB	A	1	0.01	A	1	0.01
	SB			0.55			0.35
Cypress Lane / CBR <i>- CBR runs east-west</i>	EB L	A	2	0.04	A	1	0.01
	EB T			0.24			0.21
	WB R			0.39			0.10
	WB T			0.14			0.27
	SB R+L	F	236	1.43	E	46	0.74
CBR/Uplands Road <i>- CBR runs east-west</i>	EB L	A	1	0.02	A	2	0.06
	EB T+R			0.06			0.08
	WB L			0.00			0.00
	WB T+R			0.07			0.08
	NB	C	7	0.23	C	5	0.16
	SB	A	3	0.10	A	2	0.07
CBR/Chippendale <i>- CBR runs east-west</i>	EB L	A	1	0.02	A	1	0.04
	EB T+R			0.01			0.02
	WB L	A	1	0.00	A	1	0.01
	WB T+R			0.01			0.04
	NB	B	3	0.09	B	2	0.07
	SB	A	3	0.10	A	2	0.07

Because the peak hours for Mulgrave School coincide with the AM peak hour and overlap the PM peak hour for the study area road network, the level of service for traffic egressing from Mulgrave School remains poor in the future. With the addition of Rodgers Creek site traffic, delays increase for traffic on Cypress Lane.

Future signalization for Cypress Lane at CBR will be required at some point in the future and this requires further discussion with the Ministry of Transportation and Infrastructure (MoTI). Signalization will decrease the delay for egress from Mulgrave School and there will be some increase in delay on CBR. However the volumes are such that the intersection will operate effectively.

It is proposed that Mulgrave School continue to explore options to reduce vehicle demand and spread the peak volume especially in the AM peak hour.

In the AM Peak hour, the westbound movements on the Highway 1 off-ramp will experience more delay than in 2018. However the LOS is D is acceptable with a queue length of approximately 80m. This queue does not spill back to affect traffic on Highway 1. All other movements in the AM and PM peak hours are LOS B or better.

The analysis for the intersections of Uplands Road and the Chippendale Connector with CBR show that all movements are operating at LOS C or better. The analysis did not take into account future pedestrian crossings at these locations and this should be monitored with time.

The intersection of Chippendale Road and CBR has been pre-ducted for possible future signalization.

With the design of Uplands Road and CBR, pre-ducting this intersection for signalization should be included in the design. Early installation of a full signal at this location would benefit construction access, allow for safer crossings for future pedestrian demand based on the multi-use pathway locations, and reduce delays for left turning vehicles exiting Area 5. This would also allow for safe pedestrian crossings to possible future transit routes on CBR.

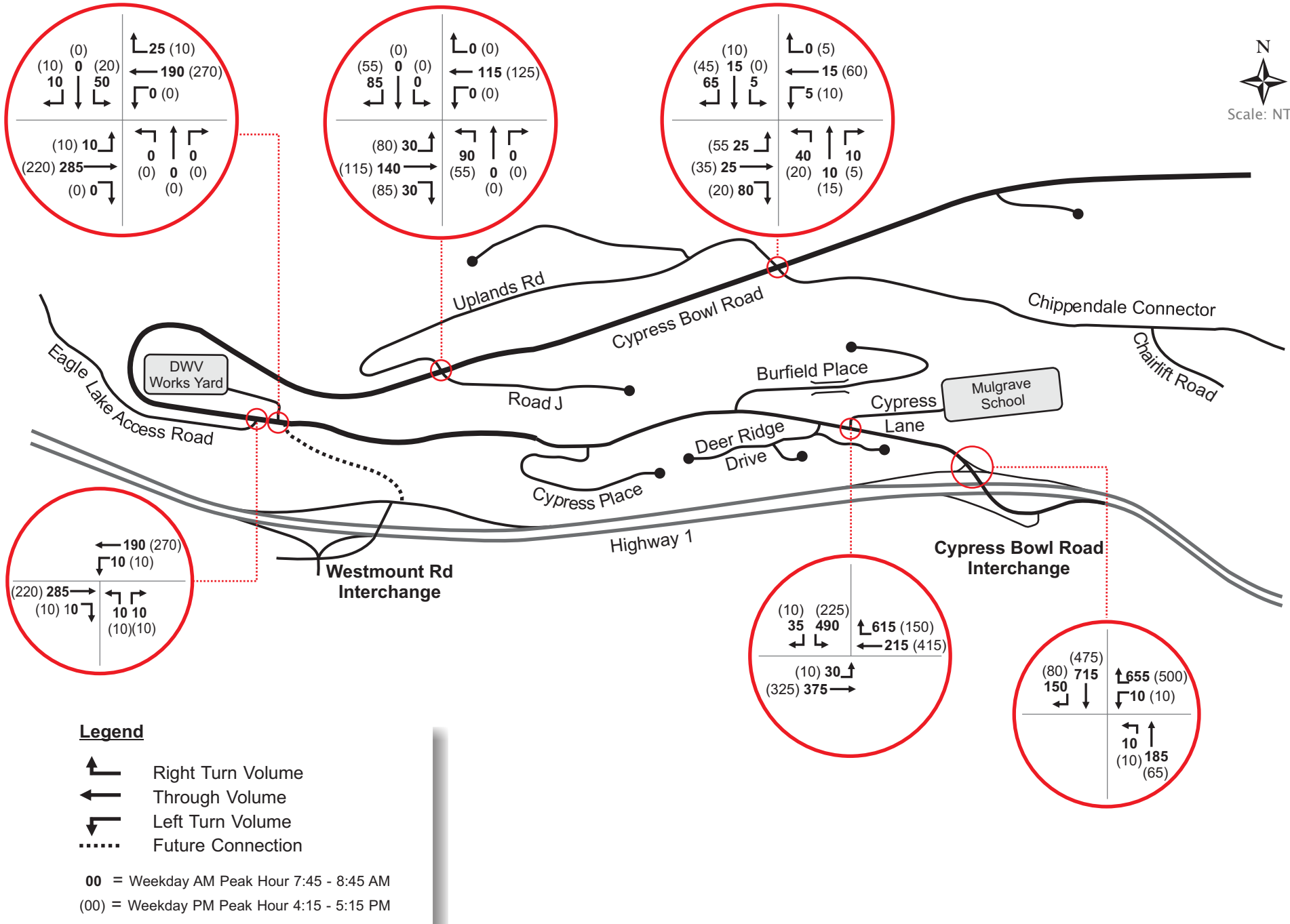


Figure 5
Total 2028 Traffic Volumes

10. Conclusions

This section provides conclusions based on the analysis undertaken for Existing conditions, the Future Background traffic, Site Trips and the Future Total Traffic.

Existing Conditions:

- The Existing conditions at Highway 1 and CBR operate under capacity and at a LOS C or better.
- There has been a 50% increase in traffic accessing Mulgrave School in the AM peak hour since 2008.
- At Cypress Lane, the traffic control personnel manage the existing demand and associated queues. This has improved this operation since the last review. Site observations have indicated that this operation allows the southbound movement to operate more effectively than shown in the Synchro analysis.
- All other movements operate at acceptable levels of service.

Future Background Conditions:

- The Future Background conditions at Highway 1 and CBR operate under capacity and at a LOS C or better.
- The southbound operation of Cypress Lane at CBR continues to have delays and queues.

Site Trips:

- The Rodgers Creek net future development is estimated to include **1,170** units. Currently there are **47** units that have already been built and are occupied and the associated traffic is included in the existing counts. The net total trips for the proposed development are approximately **420** in the AM peak hour and approximately **500** in PM peak hour.
- For the 2008 report, the estimated site trips for the whole of Rodgers Creek were approximately 430 in the AM peak hour and approximately 450 in PM peak hour. The updated estimated total trips for the whole development is 455 trips in the AM peak hour and 550 trips in the PM peak hour. The incremental increase in trips is small because of the different trip rates used in the two studies.

Future Total Conditions:

- The peak hours for Mulgrave School coincide with the AM peak hour and overlap the PM peak hour for the study area road network, the level of service for traffic egressing from Mulgrave School remains poor in the future. With the addition of Rodgers Creek site traffic, delays increase for traffic on Cypress Lane.
- The use of traffic control personnel to regulate the queues at the Cypress Lane intersection is likely to become more difficult with the addition of more traffic on CBR.
- Future signalization for Cypress Lane at CBR will decrease the delay for egress from Mulgrave School and there will be some increase in delay on CBR. However the volumes are such that the intersection will operate effectively. This requires further discussion with BC MoTI.
- In the AM Peak hour, the westbound movements on the Highway 1 off-ramp will experience more delay than in 2018. However the LOS is D which is acceptable with a queue length of approximately 80m. This queue does not spill back to affect traffic on Highway 1. All other movements in the AM and PM peak hours are LOS B or better.
- The analysis for the intersections of Uplands Road and Chippendale with CBR show that all movements are operating at LOS C or better. The analysis did not take into account future pedestrian crossings at these locations and this should be monitored with time.
- The intersection of Chippendale Road and CBR has been pre-ducted for possible future signalization.
- With the design of Uplands Road and CBR, pre-ducting this intersection should be included in the design. Early

installation of a full signal at this location would benefit construction access and reduce delays for left turning vehicles exiting Area 5. This would also allow for safer crossings for future pedestrian demand based on connections to multi-use pathway locations, and to possible future transit routes on CBR.

11. Recommendations

This section provides recommendations for further consideration. They are listed below:

- MoTI and DWV should continue to monitor the operation of Cypress Lane and CBR. At some point in the future, an actuated signal needs to be considered to manage the demand for the School in relation to that on CBR.
- Consideration by Mulgrave School to explore more effective ways in the short term to reduce vehicle demand and to continue to find ways to spread the peak demand.
- Monitor the operation of the intersection of Chippendale and CBR.
- Include pre-ducting for future signalization for Uplands Road and CBR.
- Early installation of a full signal at Uplands Road and CBR would benefit construction access, would reduce delays for left turning vehicles exiting Area 5, allows for safer crossings for future pedestrian demand to trails and to possible future transit on CBR.

