APPENDIX Y

DRAFT HIGHWAY ENGINEERING ASPECTS

Y-1 Final Draft Mine Traffic Impact Study
Y-2 Draft Preliminary Design Report: Highway 600 Re-alignment Dearlock to Blackhawk

Draft Reports Under Discussion with Ministry of Transportation

APPENDIX Y-1

FINAL DRAFT MINE TRAFFIC IMPACT STUDY

Rainy River Resources Mine
Traffic Impact Study (Revised Draft Final)

Prepared For
Rainy River Resources

Submitted By
MMM Group Limited

November 2013

5513099.161

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STANDARD LIMITATIONS

This report was prepared by MMM Group Limited (MMM) for the account of **Rainy River Resources** (the Client). The disclosure of any information contained in this report is the sole responsibility of the client. The material in this report reflects MMM's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. MMM accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this report.

1.0 INTRODUCTION

Rainy River Resources retained MMM Group Limited (MMM) to conduct a transportation impact study (TIS) as supporting material for an Environmental Assessment west of Fort Frances, Ontario. The proposed development will consist of an open pit and underground gold mining and processing complex, to be located between the intersections of Highway 71 at Korpi Road, and Highway 600 at Tait Road, as indicated in **Figure 1.1**. The TIS is focused on the intersection of Highway 71 at Korpi Road, as this intersection is proposed to be the only access point to the mine site once the mine is in operation. Construction mitigation on Highway 600 at Tait Road is also discussed due to the realignment of Highway 600 and additional construction traffic that will need to be accommodated. The Ministry of Transportation for Ontario (MTO) have indicated that a hybrid of a traffic impact study and a traffic impact statement is appropriate for the proposed development.

This study investigates the potential traffic impacts related to the proposed mine on the adjacent highway network and recommends any necessary upgrades to the proposed intersection and roadway. This study includes weekday a.m. and p.m. peak hour analysis for the peak year in 2022, as the mine workforce decreases in the following years due to decommissioning of the open pit mine and underground mine. The Highway 71 analysis also addresses summer traffic given the difference between summer and winter traffic volumes along Highway 71. The study follows the Ministry of Transportation for Ontario (MTO) *General Guidelines for the Preparation of Traffic Impact Studies*.

This draft document will be submitted to MTO as part of the PDR process associated with the proposed mine development.

Figure 1.1 illustrates the approximate location of the proposed Rainy River mine.

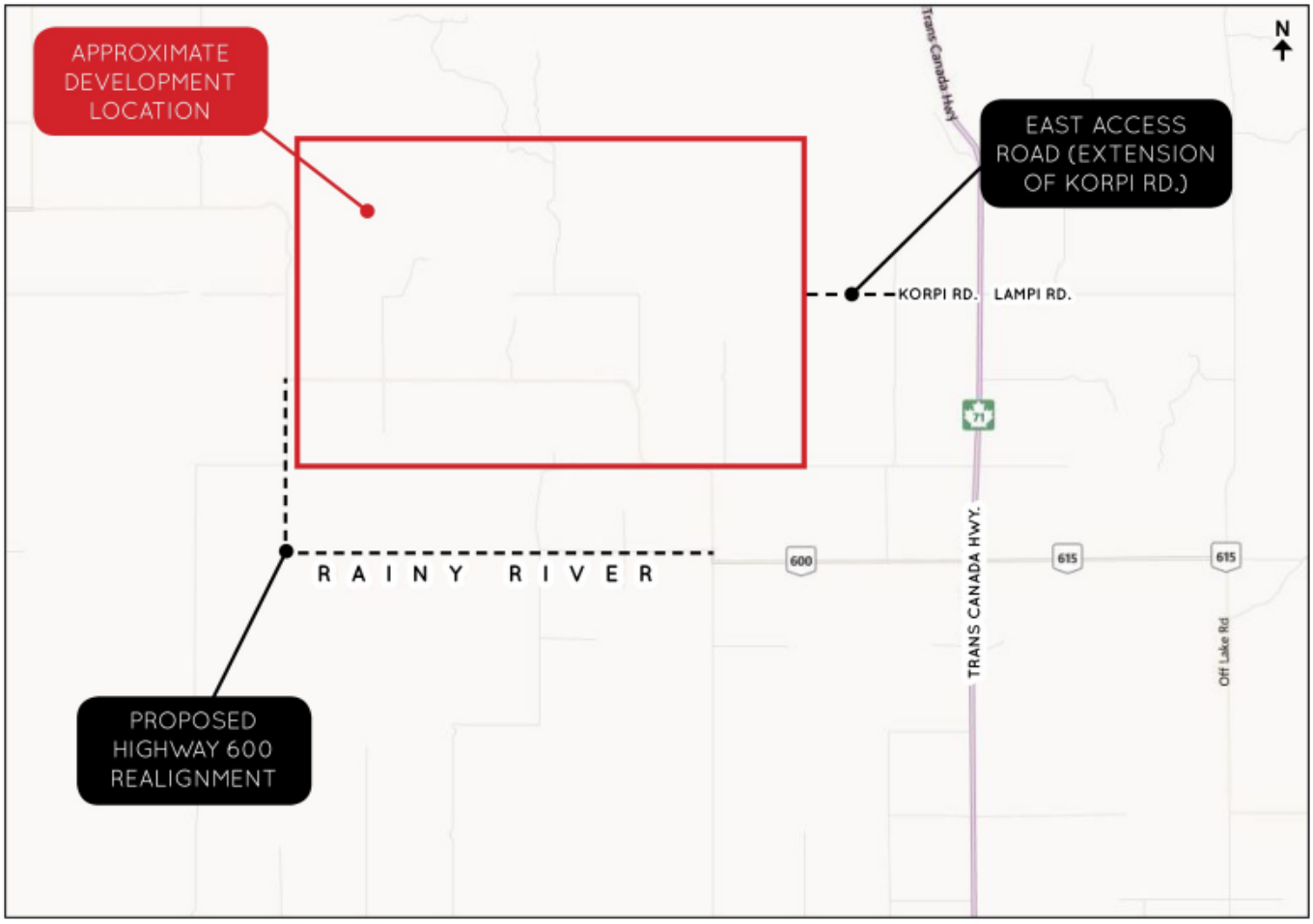


Figure 1.1: Development Location

2.0 HIGHWAY 71 AT KORPI ROAD / EAST ACCESS ROAD TIS

2.1 Study Area

The proposed mine site is located west of Fort Frances. Land use in the vicinity of the development includes farmland and forested areas. A convenience store/restaurant is located on the north-east corner of the Highway 71 at Korpi Road intersection. The development area is illustrated in **Figure 1.1**.

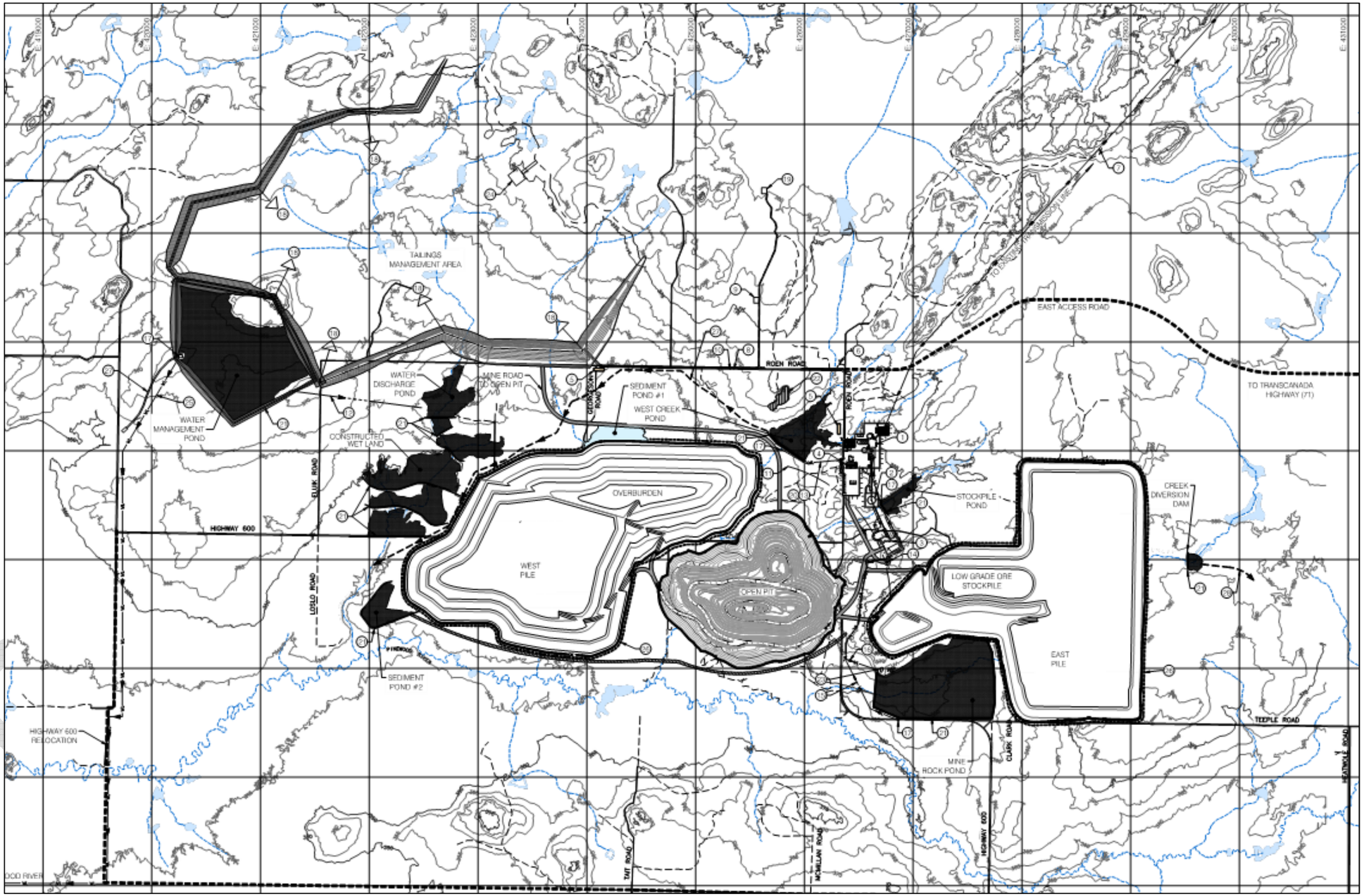
Highway 71 is a two-lane undivided paved roadway with gravel shoulders and a speed limit of 90 kilometres per hour adjacent to the proposed development. Highway 71 is classified as a Rural Collector road.

Korpi Road is a narrow two-lane undivided gravel roadway with no posted speed limit. It serves as an access road to the farms in the area. Korpi Road is classified as a Rural Local road.

The intersection of Highway 71 at Korpi Road is a two-way stop intersection, with Korpi Road and Lampi Road (the road adjacent to Highway 71 on the east side) being the roads with stop control. The shoulders on Highway 71 are paved at the intersection, and the condition of the roadway is good. There is currently no illumination at the intersection and there are no major intersections in the vicinity.

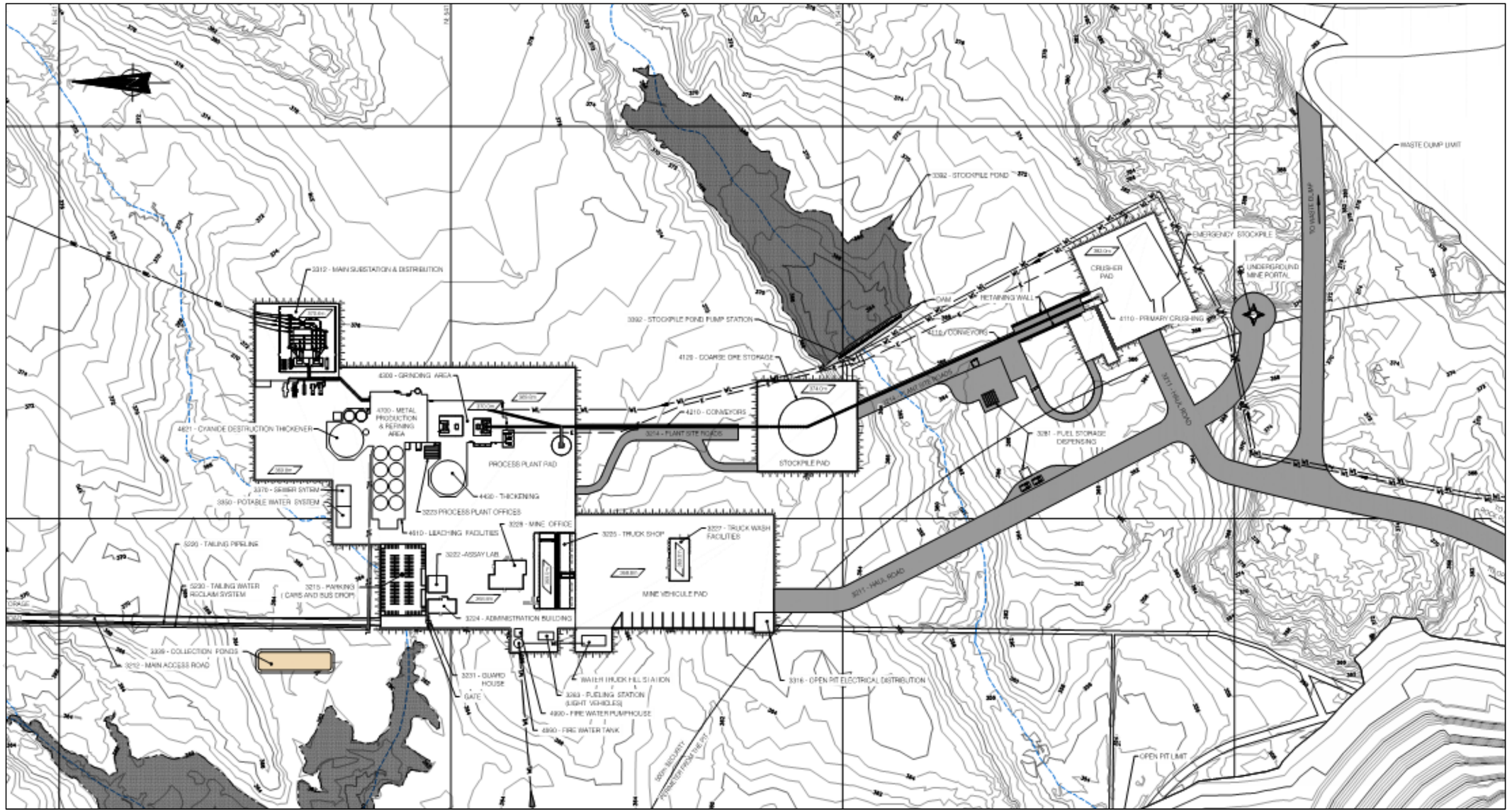
2.2 Proposed Development

The proposed development site plan is illustrated in **Figures 2.1** and **2.2**. Korpi Road is planned to be extended as the East Access Road by January 2015 and will provide the only access to the mine once construction is completed. The East Access Road will also provide access for traffic from Marrs Road to Highway 71. The development is anticipated to include an open pit mine and an underground mine, together with an associated processing area when it opens in 2016. The mine is expected to reach an employee peak in year 2022, and then to decrease in stages thereafter until mine decommissioning, expected to commence in 2032.



Source: BBA

Figure 2.1: Mine Site Plan



Source: BBA

Figure 2.2: Process Plant Site Plan

2.3 Traffic Volumes

2.3.1 Existing Traffic

The weekday a.m. and p.m. peak hours were selected for analysis in this study as they are busy time periods for through traffic, construction traffic and mine related traffic on Highway 71. However, the background traffic peak hours occur mid-morning and mid-afternoon, therefore the hours analyzed do not coincide with the background traffic peak hours. **Section 2.3.3** provides an explanation for this.

Daily traffic information for Highway 71 near the proposed development was obtained from the MTO website. MTO road segment traffic data is provided in the form of Annual Average Daily Traffic (AADT) and Summer Average Daily Traffic (SADT). A turning movement count was provided by MTO at a nearby intersection (Highway 71 at Highway 600), and a count was performed by MMM staff at the intersection of Highway 71 at Korpi Road on August 8th and 9th, 2013 for both the weekday a.m. and p.m. peak times. All traffic data is included in **Appendix A**.

The Highway 71 at Highway 600 turning movement count was primarily used to determine background volumes at Highway 71 at Korpi Road. The count was started at 8:00 a.m., and completed at 5:00 p.m., but background volumes are required for the analysis starting at 7:00 a.m. and ending at 8:00 p.m. The rate of change from the a.m. peak hour to the start time was calculated, with the hourly start times beginning in 15 minute intervals (for example; 9:00 to 10:00, then 8:45 to 9:45). The rates were averaged, and the average rate was used to extrapolate the hourly volumes to the hour being analysed. The same was done for the afternoon; the rate of change was calculated for each hour from the p.m. peak hour to the end of the count, the rates were averaged, and the average was applied to determine hourly volumes for the later times under consideration. These volumes are only slightly higher than the volumes observed by MMM staff at the intersection of Highway 71 at Korpi Road, so they provide a conservative estimate. To provide a more accurate estimate of the activity at the intersection being analysed, the ratio of each turning movement peak hour volume observed during the counts performed by MMM staff to the overall intersection peak hour volume was determined, and the ratios were applied to the extrapolated volumes from the MTO turning movement count.

The percent of heavy vehicles was provided in the Highway 71 at Highway 600 count. The percent trucks in the northbound and southbound directions on Highway 71 were averaged for both the a.m. and p.m. peak hours. The a.m. peak hour had 13.5 percent trucks, and the p.m.

peak hour had 16 percent trucks. It was assumed that the same would apply to Highway 71 at Korpi Road.

2.3.2 Future Traffic

Historical AADT and SADT counts mentioned in **Section 2.3.1** were used to determine the historical growth rate on Highway 71. This data is illustrated in **Figure 2.3**. **Table 2.1** summarizes the growth rates for the last five and 10 years of data.

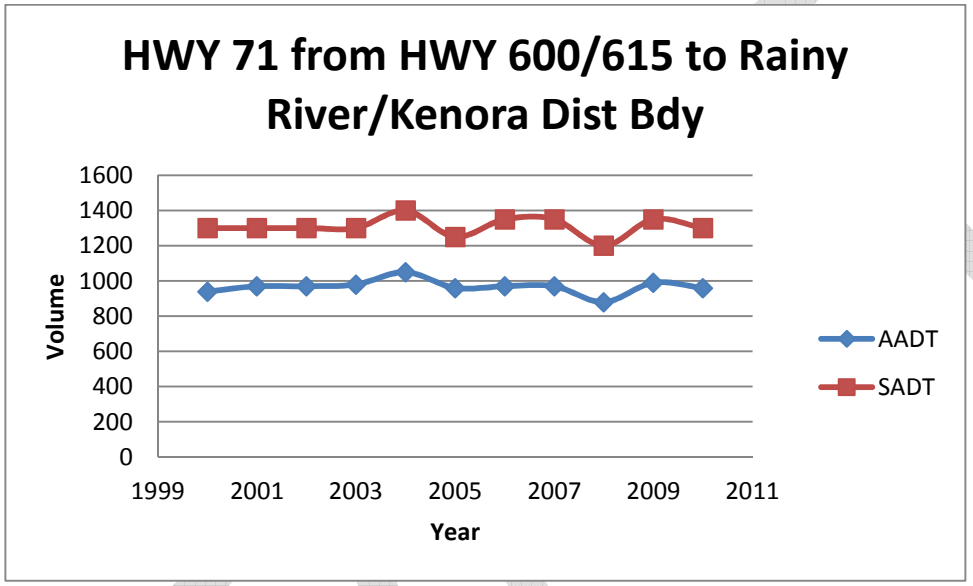


Figure 2.3: Historical Daily Traffic Information – Hwy 71

Table 2.1: Hwy 71 Growth Rates

	Five Year Growth Rate	Ten Year Growth Rate
AADT	0.0%	0.2%
SADT	0.8%	0.0%

Historical data indicates that traffic volumes have fluctuated over the past 10 years on Highway 71, with an overall minor increase in volumes. A conservative growth rate of one percent per year was selected for Highway 71 based on the historical data and because there has been minimal development near the proposed mine site in recent years.

Background traffic volumes for the weekday a.m. and p.m. peak hours and average daily traffic are illustrated in **Figures 2.4** to **2.7**.

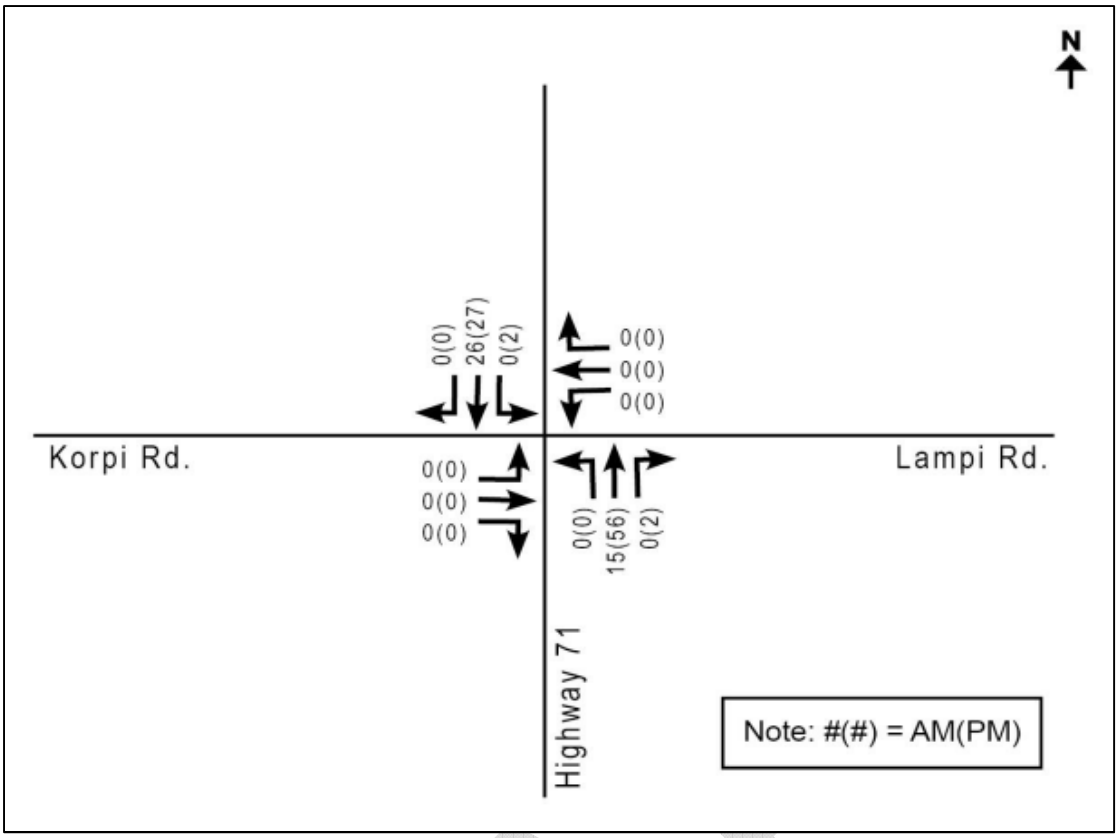


Figure 2.4: 2013 Peak Hour Background Traffic Volumes (6-7 a.m. & 7-8 p.m.)

Figure 2.5: 2022 Peak Hour Background Traffic Volumes (6-7 a.m. & 7-8 p.m.)

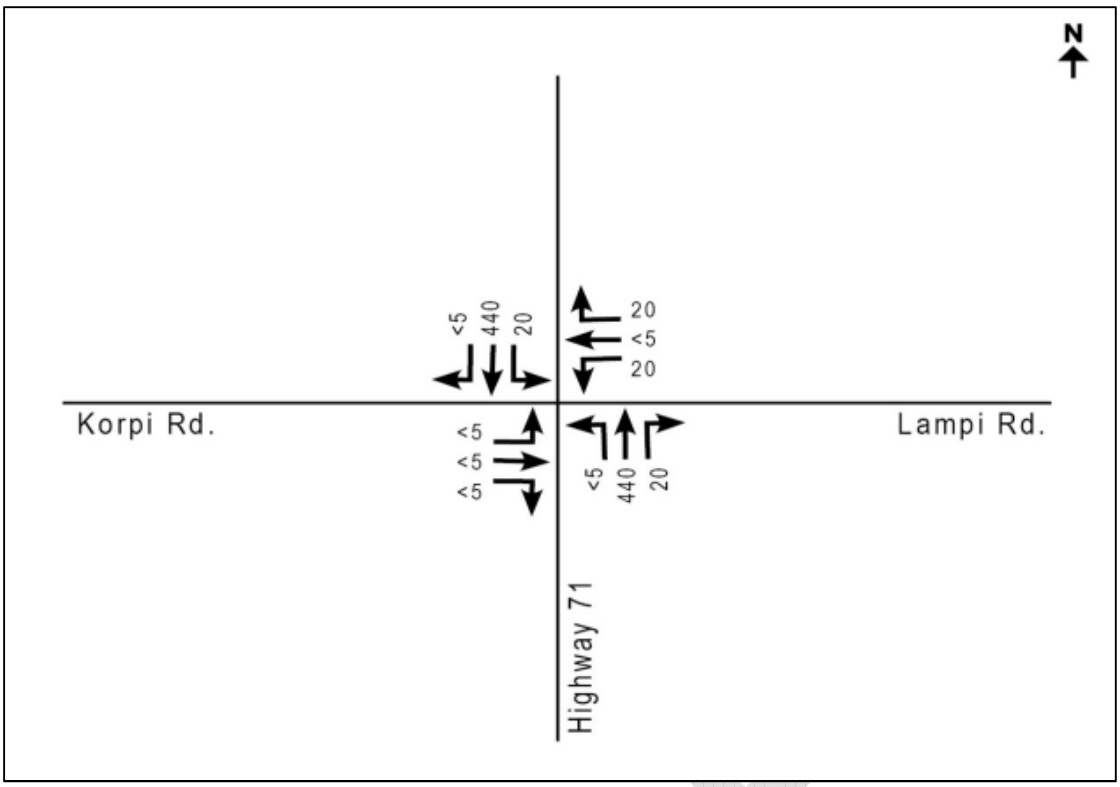


Figure 2.6: 2022 Average Daily Background Traffic Volumes (AADT)

Figure 2.7: 2022 Average Daily Background Traffic Volumes (SADT)

2.3.3 Diverted Traffic

Marrs Road is a local road in the area that currently connects to Highway 600 via other local roads. The construction of the mine will remove that connection, however, Marrs Road will connect to the Korpi Road / East Access Road once it is completed and have direct access to Highway 71. Based on an assessment of the surrounding area utilizing Google Earth, it appears that there are less than five properties along Marrs Road. It is therefore assumed that 10 trips are generated by the development on Marrs Road during the peak hour periods: five trips leaving in the a.m. peak hour and five trips returning in the p.m. peak hour. These trips would all use the intersection of Highway 71 at Korpi Road, and it was assumed that half would travel north and half would travel south. This applies to both the construction and the post development periods being analyzed, as the peak construction month occurs after the East Access Road is completed.

Figure 2.8: Diverted Traffic

2.3.4 Site Generated Traffic

Trip generation for the mine was provided by the mining engineering firm involved in the project (BBA). Approximately 360 trips per weekday are forecast to visit the mine at its peak in 2022.

The following assumptions used in this study were provided by BBA and Rainy River Resources:

- Salaried employees work Monday to Friday shifts, 9:00 a.m. to 5:00 p.m.;
- Hourly employees work 12 hour shifts from 7:00 a.m. to 7:00 p.m. and 7:00 p.m. to 7:00 a.m.;
- There are a total of 601 project personnel in the peak year of 2022, with 111 being salaried employees and 490 being hourly employees. All salaried employees work Monday to Friday, and approximately one quarter of all hourly employees (125 hourly personnel) work per shift;
- It was assumed that employees drive to work in a typical car, with no car-pooling; and
- All deliveries are made on weekdays, with an average of 5 trucks per weekday.

Higher volumes are generated by the hourly employees in the a.m. and p.m. peak hours than by the salaried employees. When one hourly shift is leaving another is arriving. Therefore, the hour before and after the daytime hourly shift was analysed. To be conservative, it was assumed that hourly employees leaving their nighttime shift would leave within the same hour as the hourly employees arriving to start their daytime shift, and vice versa.

MMM also analysed Highway 71 at Korpi Road based on the addition of construction traffic. As described in The Highway 600 Construction Traffic Mitigation Study in **Appendix D** prepared by TBT Engineering, construction of the East Access Road and the realignment of Highway 600 will coincide with the proposed mine development and is anticipated to continue over a period of six months. After this period, the additional traffic on Highway 600 will be removed, and all of the construction traffic will use the East Access Road (Korpi Road). During the six month construction of the East Access Road, traffic from Marrs Road will be diverted to Highway 600. Following the completion of the East Access Road, this traffic will use the East Access Road to access Highway 71. It was determined that the period of concurrent highway and mine construction is not the critical period with respect to traffic. Greater monthly workforce forecasts occur in the fall of 2015, with 400 workers required daily in October of 2015. The following assumptions were made by TBT Engineering and MMM Group:

- The construction traffic will access the sites via Highway 71. For the purpose of this analysis, it was assumed that all the construction related traffic would travel via Highway 71;

- Construction worker shifts are from 7:00 a.m. to 7:00 p.m.;
- All construction workers arrive to site within one hour (6:00 to 7:00 a.m.), and leave within one hour (7:00 to 8:00 p.m.);
- No carpooling was assumed, which is a very conservative assumption; and
- Although more trucks will be required during construction, their use will be dispersed throughout the day rather than being in use during shift change time. For this reason, truck traffic during the peak hours of construction traffic is assumed to be minimal.

It should be noted that the average number of construction workers required on site per day is approximately 215. Therefore, the peak month of 400 workers over-represents the average daily trips.

Trip generation for the proposed Rainy River Resources mine and the construction period are outlined in **Table 2.2**. The a.m. and p.m. peak periods for the hourly workers had higher trip generation than a.m. and p.m. peak periods for the salaried workers, and were therefore chosen to be analysed. In 2022 the mine is forecast to generate a total of 720 vehicles per day (360 inbound and 360 outbound), and 250 vehicles per hour (125 inbound and 125 outbound) during both the weekday peak hours. The peak construction month is forecast to generate a total of 890 vehicles per day (445 inbound and 445 outbound), 400 vehicles per hour in the a.m. peak hour (400 inbound and 0 outbound) and 400 vehicles per hour in the p.m. peak hour (0 inbound and 400 outbound).

It should be noted that the mine and construction peak hours vary from the background traffic peak hours. The background traffic peak hours occur mid-morning and mid-afternoon, whereas the mine and construction peak hours are earlier in the morning and later in the afternoon. The traffic volumes generated by the construction and mine during shift change time are higher than the background traffic volumes during the background peak hours, therefore the development peak hours were determined to be the critical hours and were analysed.

Table 2.2: Construction and Mine Trip Generation

Trip Generation		Peak Construction Month			Peak Year (2022)		
		Weekday AM Peak Hour (6-7)	Weekday PM Peak Hour (7-8)	Weekday	Weekday AM Peak Hour (6-7)	Weekday PM Peak Hour (7-8)	Weekday
Trip Direction	Inbound	100 %	0 %	50 %	50 %	50 %	50 %
	Outbound	0 %	100 %	50 %	50 %	50 %	50 %
Employee Trips	Inbound	400	0	400	125	125	360
	Outbound	0	400	400	125	125	360
	Total	400	400	800	250	250	720
Heavy Vehicle Trips	Inbound	0	0	~ 45	0	0	5
	Outbound	0	0	~ 45	0	0	5
	Total	0	0	~ 90	0	0	10
Total Trips	**Inbound**	**400**	**0**	**445**	**125**	**125**	**360**
	Outbound	**0**	**400**	**445**	**125**	**125**	**360**
	Total	**400**	**400**	**890**	**250**	**250**	**720**

2.3.5 Trip Distribution and Assignment

Trip distribution refers to the directional split of traffic entering and exiting the study area, and trip assignment refers to the assignment of distributed trips to the adjacent road network. Trip distribution for the construction and mine traffic is based on the surrounding communities that employees would likely live in, and was provided by the client. The following trip distribution was used:

- 20 percent to/from the north on Highway 71; and
- 80 percent to/from the south on Highway 71.

New trips generated by construction and the proposed mine were distributed and assigned to the road network based on the split noted above. Background traffic was combined with the diverted traffic and additional traffic generated, distributed and assigned to the road network to determine traffic projections for the peak construction and post development scenarios. Peak construction and post development traffic volumes for the weekday a.m. and p.m. peak hours and average daily traffic are illustrated in **Figures 2.9** to **2.12**.

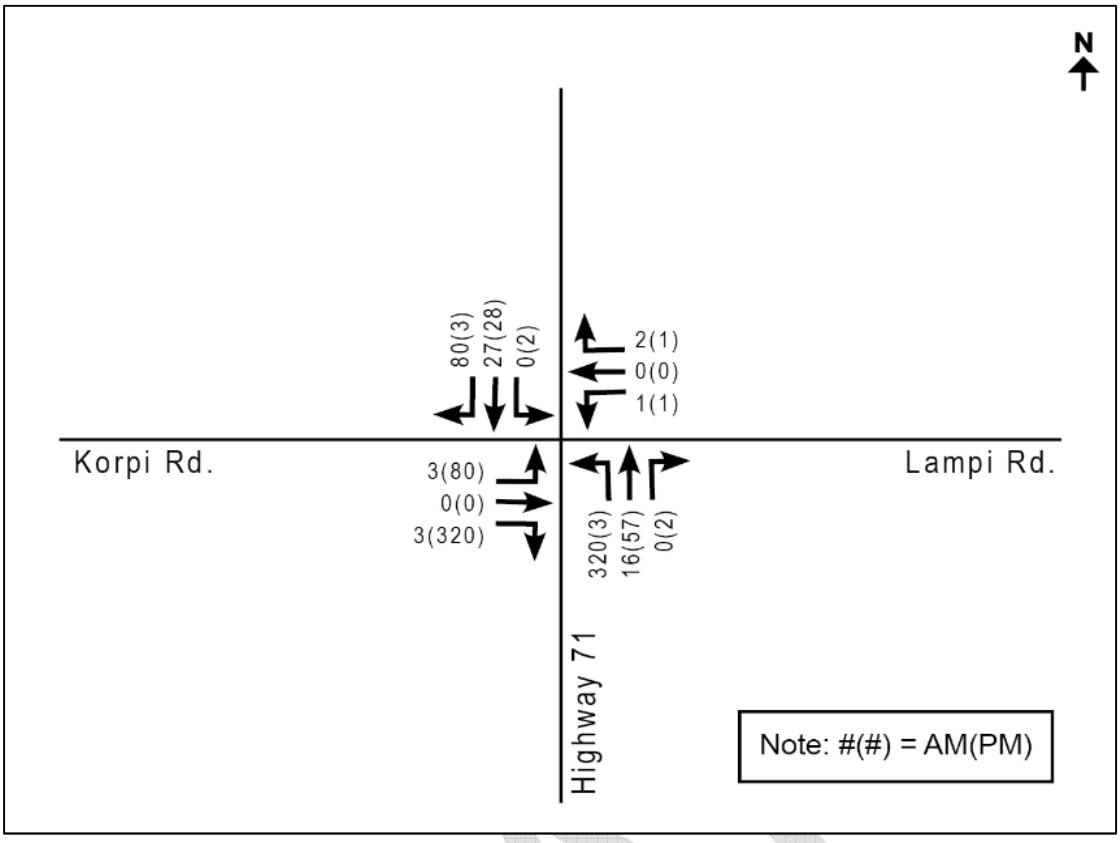


Figure 2.9: Peak Construction Period- Peak Hour Traffic Volumes

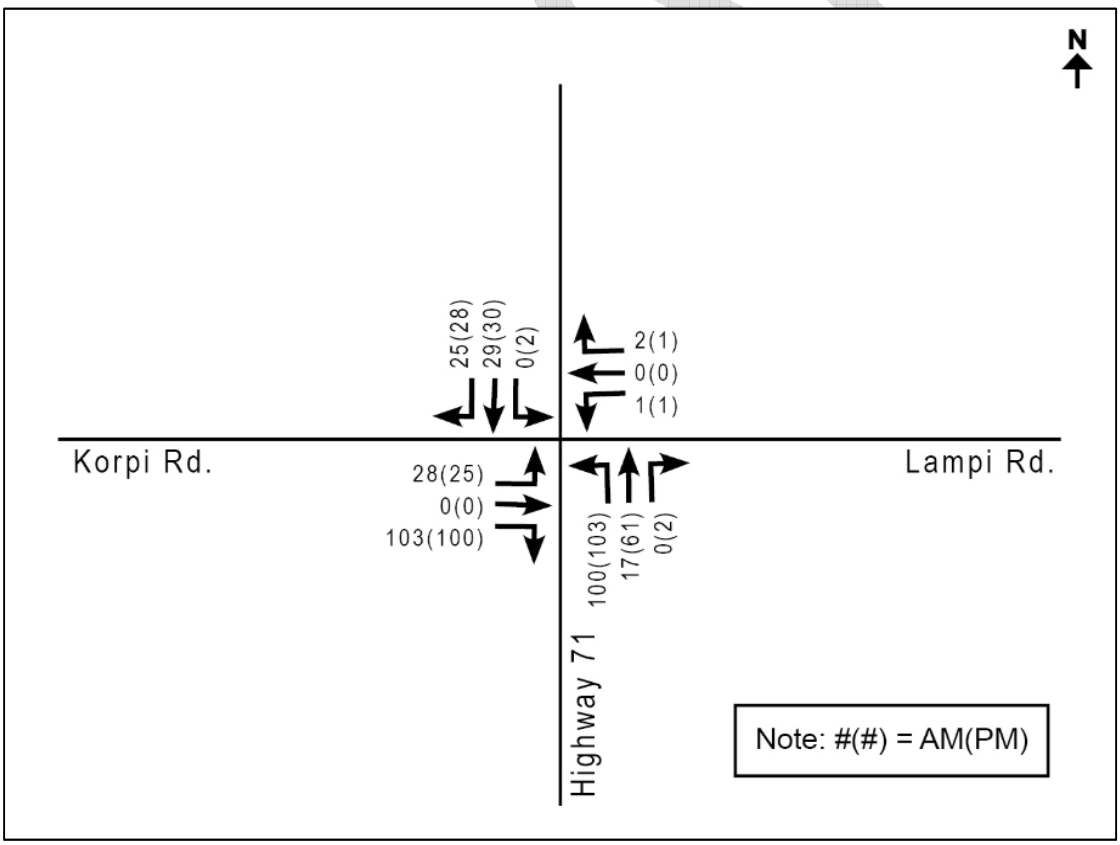


Figure 2.10: 2022 Peak Hour Post Development Traffic Volumes

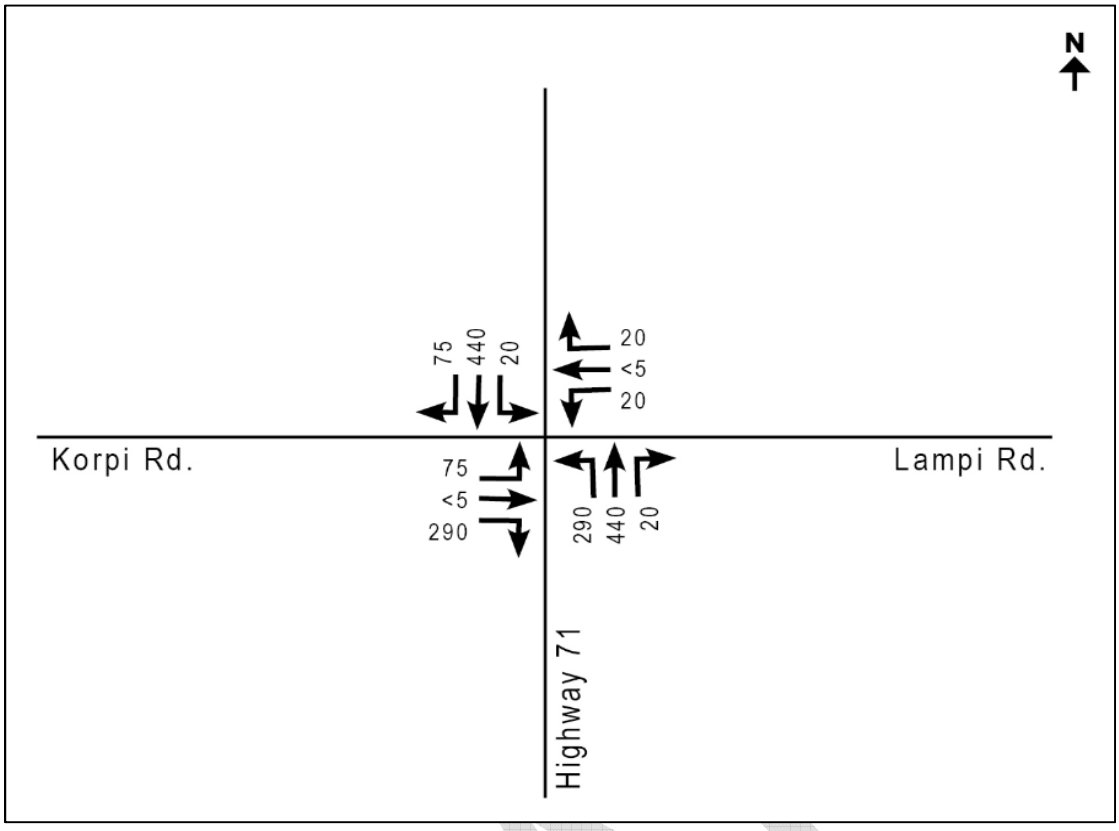


Figure 2.11: 2022 Average Daily Post Development Traffic Volumes (AADT)

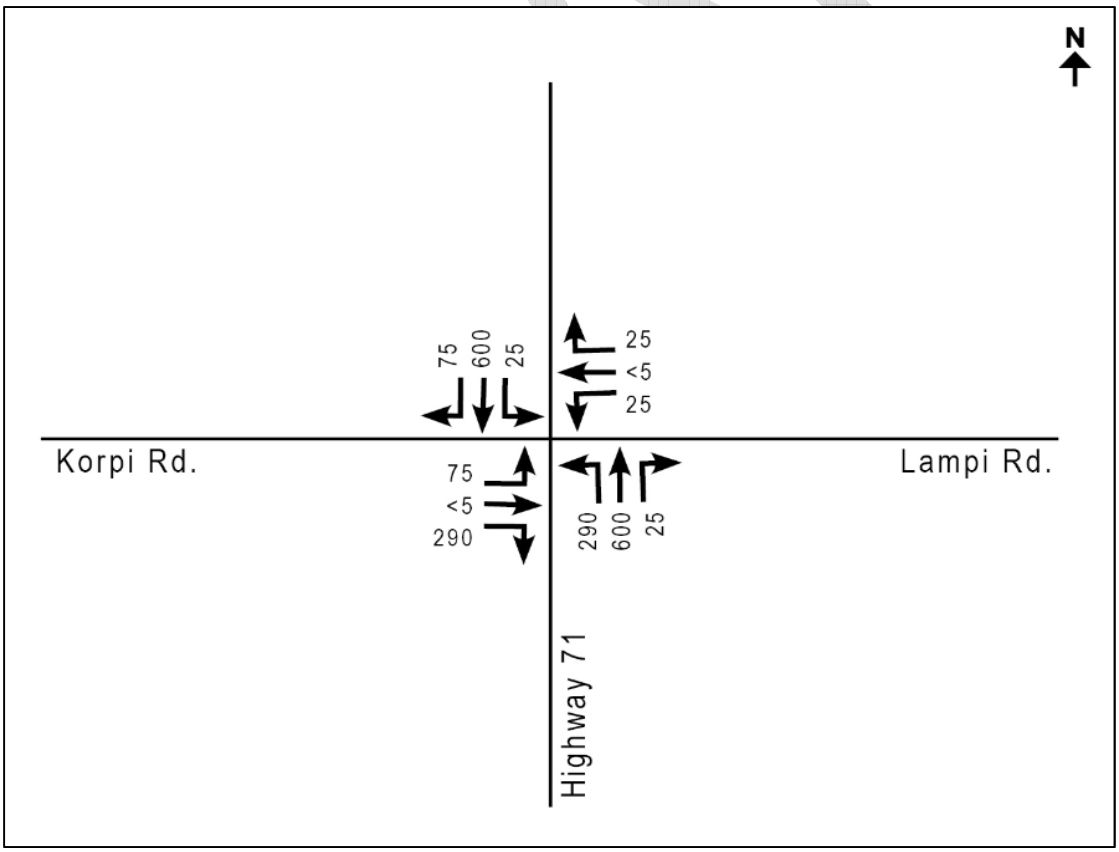


Figure 2.12: 2022 Average Daily Post Development Traffic Volumes (SADT)

2.4 Traffic Analysis

2.4.1 Intersection Analysis

The traffic analysis for the proposed development was undertaken using Synchro 8.0 traffic analysis software. The relative performance of an intersection is measured in terms of level of service (LOS). LOS ranges from A (excellent) to F (beyond capacity). In general, LOS E is considered to be at capacity. LOS for un-signalized intersections is defined in terms of delay. Delay is the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line. This includes the time required for the vehicle to travel from the last-in-queue position to the first.

LOS B or better for the overall intersection is widely considered desirable in a rural area during peak traffic periods. At un-signalized intersections, LOS C or better is generally considered acceptable for minor roads accessing major provincial roads and highways, with LOS B or better acceptable for through movements on the highway.

Intersection capacity utilization level of service (ICU LOS) provides additional insight into how an intersection is functioning and how much extra capacity is available to handle traffic fluctuations and incidents. ICU LOS ranges from A (excellent) to H (beyond capacity), with ICU LOS E generally considered to be at practical capacity.

For this analysis, it is assumed that the northbound and southbound approaches on Highway 71 will remain free-flowing while eastbound and westbound vehicles on Korpi Road and Lampi Road will remain under stop control at the intersection with Highway 71. All four approaches at the intersection were assumed to consist of a single approach lane.

Table 2.3 summarizes the results of the background, peak construction period, and post development intersection analyses for Highway 71 and Korpi Road. The detailed Synchro results are included in **Appendix B**.

Table 2.3: Hwy 71 and Korpi Road Intersection Analysis

Scenario	Overall Intersection			Critical Movement	
	Average Delay	ICU LOS	Intersection Utilization	Movement	LOS (Delay)
2022 AM Background	0 sec	A	13%	WB	A (9 sec)
2022 PM Background	0 sec	A	13%	WB	A (9 sec)
Peak Construction Period AM Peak (6-7)	6 sec	A	35%	EB	B (14 sec)
Peak Construction Period PM Peak (7-8)	9 sec	A	36%	WB	B (12 sec)
2022 AM Peak (6-7)	7 sec	A	29%	WB	A (10 sec)
2022 PM Peak (7-8)	6 sec	A	30%	WB	B (11 sec)

The data provided in **Table 2.3** indicates the following:

- All scenarios feature less than 10 seconds of average delay per vehicle for the overall intersection.
- All scenarios feature ICU LOS A for the overall intersection.
- The AM Peak Construction Period scenarios features LOS B and 14 seconds of delay for the eastbound movement.

2.4.2 Traffic Signal Warrant Analysis

Based on the low background and post development traffic volumes, it was concluded that traffic signals would not be warranted and a traffic signal warrant analysis was therefore not performed.

2.5 Improvement Analysis

2.5.1 Intersection Treatment Warrant

The intersection treatment warrant analysis was completed following the MTO *Geometric Design Standards for Ontario Highways, Chapter E- At-Grade Intersections*. Warrants were completed for the peak construction period, the average construction period, and 2022 post development traffic volumes. The detailed warrant analysis is included in **Appendix C**. The results of the warrant analysis are summarized in **Table 2.4.**

Table 2.4: Hwy 71 at Korpi Rd Intersection Treatment Warrant Analysis

Scenario	Highway 71		Korpi Road / East Access Road
	Left-turn Lane	Right-turn Channelization	Right-turn Channelization
Peak Construction Period	Warranted	Warranted	Warranted
Average Construction	Not Warranted	Not Warranted	Warranted
2022 Post Development	Not Warranted	Not Warranted	Warranted

The left-turn lane warrant analysis was performed based on the volumes in **Figure 2.8** and **Figure 2.9** (peak construction period and 2022 post development a.m. and p.m. peak hours), a design speed of 110 kilometers per hour and on 40 percent of the advancing traffic being left-turns, which is the maximum left-turn percentage available in the *Geometric Design Standards for Ontario Highways*. In reality, the percent of left-turns varied from 60 to 95 percent in the scenarios analysed. With the majority of traffic travelling northbound on Highway 71 making a left-turn it is unlikely that a vehicle travelling straight through the Highway 71 and Korpi Road intersection will encounter a vehicle waiting to turn left. See **Appendix C** for figures outlining the parameters involved in the intersection treatment warrant analyses.

A northbound left-turn lane is warranted for the month with 400 construction workers working on site. However, at approximately 350 workers the left-turn lane is no longer warranted, and there are only 4 months out of the 20 months of construction that have more than 350 workers. As mentioned in **Section 2.4.3**, the average number of construction workers employed over the construction period is 215, which is much lower than the peak period. The addition of a left turn lane is therefore not recommended.

The same methodology applies to the right-turn channelization warrant. MTO warrants right-turn channelization when 60 vehicles per hour make a right turn. This is warranted for the southbound direction in the peak construction period, and every month with 300 or more workers driving to site every day, which is a total of six months out of the entire construction period. It is not recommended that right-turn channelization be implemented based on the short time that it is warranted.

Right-turn channelization is warranted for the eastbound right-turn movement from Korpi Road onto Highway 71 in all scenarios. It is therefore recommended that eastbound right-turn channelization be constructed on Korpi Road at Highway 71.

The shoulders on Highway 71 at Korpi Road are currently paved, and it is recommended that they continue to be maintained as paved shoulders as vehicles making a right-turn from southbound Highway 71 onto Korpi Road will likely use the shoulder.

2.5.2 Illumination Warrant

An MTO illumination warrant was conducted for the intersection of Highway 71 at Korpi Road as per MTO Directives PLNG-B-05 and 06. A benefit / cost (B/C) ratio calculation template to determine the need for illumination has been developed by MTO for several highway categories. The category that applies to the Highway 71 / Mine access road intersection is "non-freeway intersection". MTO typically requires partial illumination at non-freeway intersections with a B/C ratio greater than 2:1. If the B/C is less than 2:1, a warrant analysis (also developed by MTO) is undertaken. If this analysis yields a result of 62 or more warrant points, illumination is required.

MMM utilized the B/C ratio calculation template for the "non-freeway intersection" category to determine the B/C ratio at the Highway 71 / Mine access road intersection. As actual values were unknown for several input items, default values were used (which are considered conservative). It was assumed that there would be one nighttime collision per year, two poles at the intersection, and 0 percent of the poles would be hit at night per year. The latter value was obtained from MTO. The analysis undertaken (see **Table 2.5**) calculated a B/C ratio of 11.14:1, resulting in the need for illumination at the intersection. It was therefore not necessary to complete a warrant analysis as the B/C calculation determined that illumination is required.

Table 2.5: Illumination Benefit / Cost Analysis

Factor	Input	MTO Suggestion/Description
Posted Speed (km/hr)	90	Enter your data
Number of nighttime collision per year	2	Enter your data
% Reduction in Nighttime Collision due to Illumination	30	Studies indicate that, in general, resulted in 30% reduction (i.e., CMF = 0.70)

% Expected growth in collision	1	1% to coincide with traffic growth rate
Time Horizon in years	20	say 20 years
Est. Construction Cost	$20,000.00	Approx. 80% of Capital Cost
Est. Capital Overhead Cost	$5,000.00	Approx. 20% of Capital Cost
Total Capital Cost (C)	$25,000.00	Sum of Construction and Overhead Cost
Annual Energy Cost per pole	$250.00	say $250.00 or better yet, the actual value
Ave. Annual Maintenance Cost per pole	$150.00	say $150.00 or better yet, the actual value
Total Annual Operating Cost per pole	$400.00	sum of the 2 values immediately above
% of Total poles (nighttime hit/year)	0	Enter your data
Replacement Cost/pole	$4,000.00	say $4,000/pole or better yet, the actual cost
Number of Poles	2	Enter your data
Pole collision results in a Property Damage Only (PDO) collision		
Average Vehicle Collision Cost	$35,000.00	Information from the "Miscellaneous Data" of HEIR
PDO Collision Cost	$8,000.00	Information from the "Miscellaneous Data" of HEIR
Discount (Interest) Rate (I)	0.05	Information from the "Miscellaneous Data" of HEIR
Traffic Growth Rate	0.01	1% used in study
Number of Years	20	say 20 years
Present Worth Factors (PWF) 0% Traffic Growth, Disbenefits	12.462210	Use when solving for Disbenefit (No Traffic Growth Rate)
Present Worth Factors (PWF), Benefits	13.503080	Use when solving for Benefit (this includes Traffic Growth Rate)
Annual Benefit	$21,000.00	Ave. Vehicle collision Cost x % Reduction in Nighttime Collision due to Illumination
Present Value Benefit (B)	$283,564.68	Annual Benefit x PWF
Total Annual Operating Cost per pole	$400.00	Same as above
Pole Replacement Cost	$0.00	% of Total hit/year x no. of poles x pole replacement cost
Social Cost	$0.00	% of total pole hit/yr x Number of poles x PDO Collision Cost
Total Annual Disbenefits	$400.00	Sum of the 3 values immediately above
Present Value of Disbenefits(D)	$4,984.88	Total Annual Disbenefit x PWFzero
Benefit Cost Ratio =	**11.14 : 1**	**(B - D) / C**

3.0 HIGHWAY 600 CONSTRUCTION MITIGATION

The Highway 600 Construction Traffic Mitigation Study done by TBT Engineering for Rainy River Resources was reviewed and is attached in **Appendix D**. MMM concurs with the assumptions and conclusions made by TBT, and the Township of Chapple is in agreement with the chosen detour alternative.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are made for the proposed Rainy River Resources mine based on the results of the analysis:

- During the peak construction period, construction activities are forecast to generate 400 new trips (400 entering and 0 exiting) during the a.m. peak hour, 400 new trips (0 entering and 400 exiting) during the p.m. peak hour, and 890 new daily trips (445 entering and 445 exiting).
- The proposed mine is forecast to generate 250 new trips (125 entering and 125 exiting) during both the weekday a.m. and weekday p.m. peak hours and 720 new daily trips (360 entering and 360 exiting).
- The proposed mine will remove access from Marrs Road to Highway 600, but the construction of the East Access Road (extension of Korpi Road) will provide access from Marrs Road to Highway 71. It was assumed that because of this diversion, five extra vehicles would enter the Highway 71 at Korpi Road intersection per peak hour. The trips would be distributed equally between the north and south directions on Highway 71, with the vehicles travelling away from Marrs Road in the a.m. peak, and returning in the p.m. peak.
- 80 percent of the construction and mine traffic is expected to access the site to/from the south on Highway 71 and 20 percent of the construction and mine traffic is expected to access the site to/from the north on Highway 71.
- The intersection of Highway 71 at Korpi Road is forecast to operate at an acceptable level of service with both the construction traffic and the proposed mine traffic. Northbound and southbound vehicles on Highway 71 will be free-flowing while westbound and eastbound traffic will approach a stop sign at the intersection.
- Traffic signals are not warranted at the Highway 71 and Korpi Road intersection based on the low forecast 2022 post development traffic volumes. However, it is recommended that “Trucks Turning Ahead” signs be installed on Highway 71 north and south of the intersection as an added safety measure.
- The intersection of Highway 71 at Korpi Road was analyzed to determine the need for upgrades utilizing the MTO warrant template. The results of the analysis indicated that upgrades are not warranted on Highway 71 except during the 30 day peak construction

period and are therefore not recommended. However, eastbound right-turn channelization from Korpi Road onto Highway 71 is warranted and recommended. It is recommended that the traffic volumes on Highway 71 at Korpi Road be monitored and that the intersection upgrade warrants be re-evaluated once activity at the mine is underway.

- Illumination is warranted and recommended at the intersection of Highway 71 at Korpi Road based on the benefit / cost analysis results.

APPENDIX A: Traffic Data

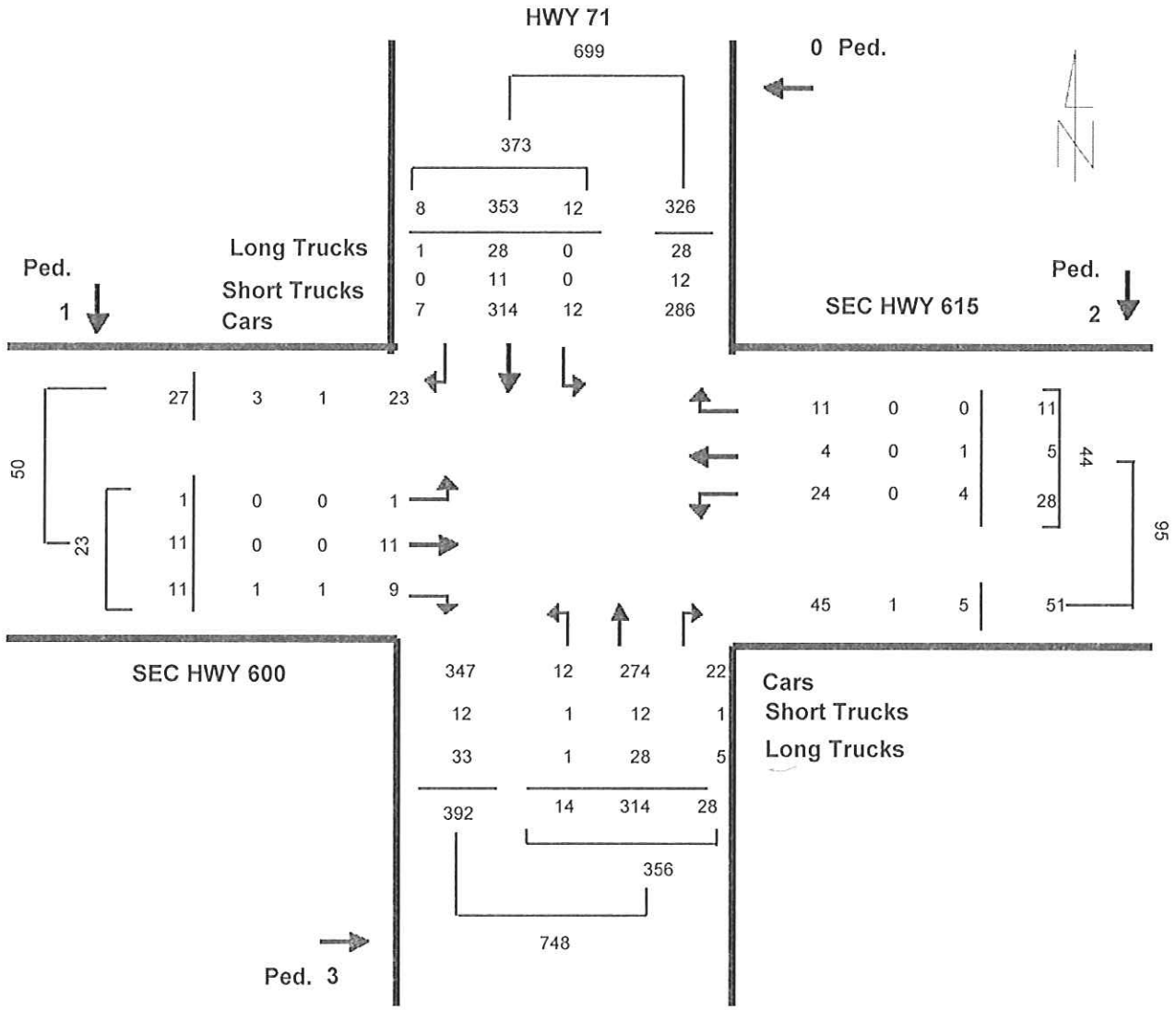
Traffic
Engineering
Software

8 HOUR COUNT TOTAL

HWY 71, HWY 600 (W) & HWY 615 (E)

Northwest

Intersection ID:36080 0.0 Date: Aug 16, 2012



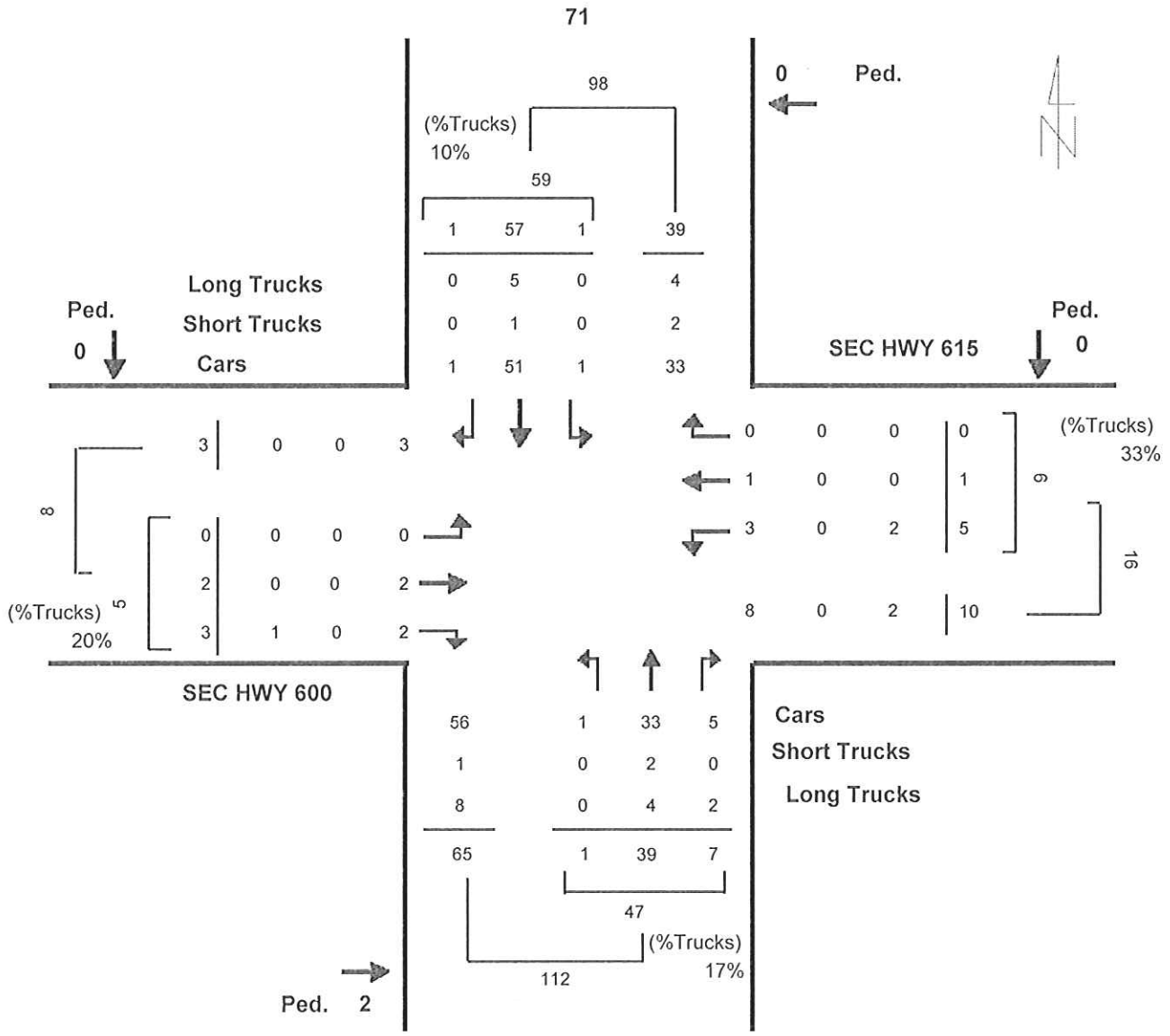
Traffic
Engineering
Software

AM Peak Hour Diagram

HWY 71, SEC HWY 600 (W) & HWY 615 (E)

Northwest

Intersection ID:36080 0.0 | PK HR End: 10:45 | Day: Thursday | Date:Aug 16, 2012



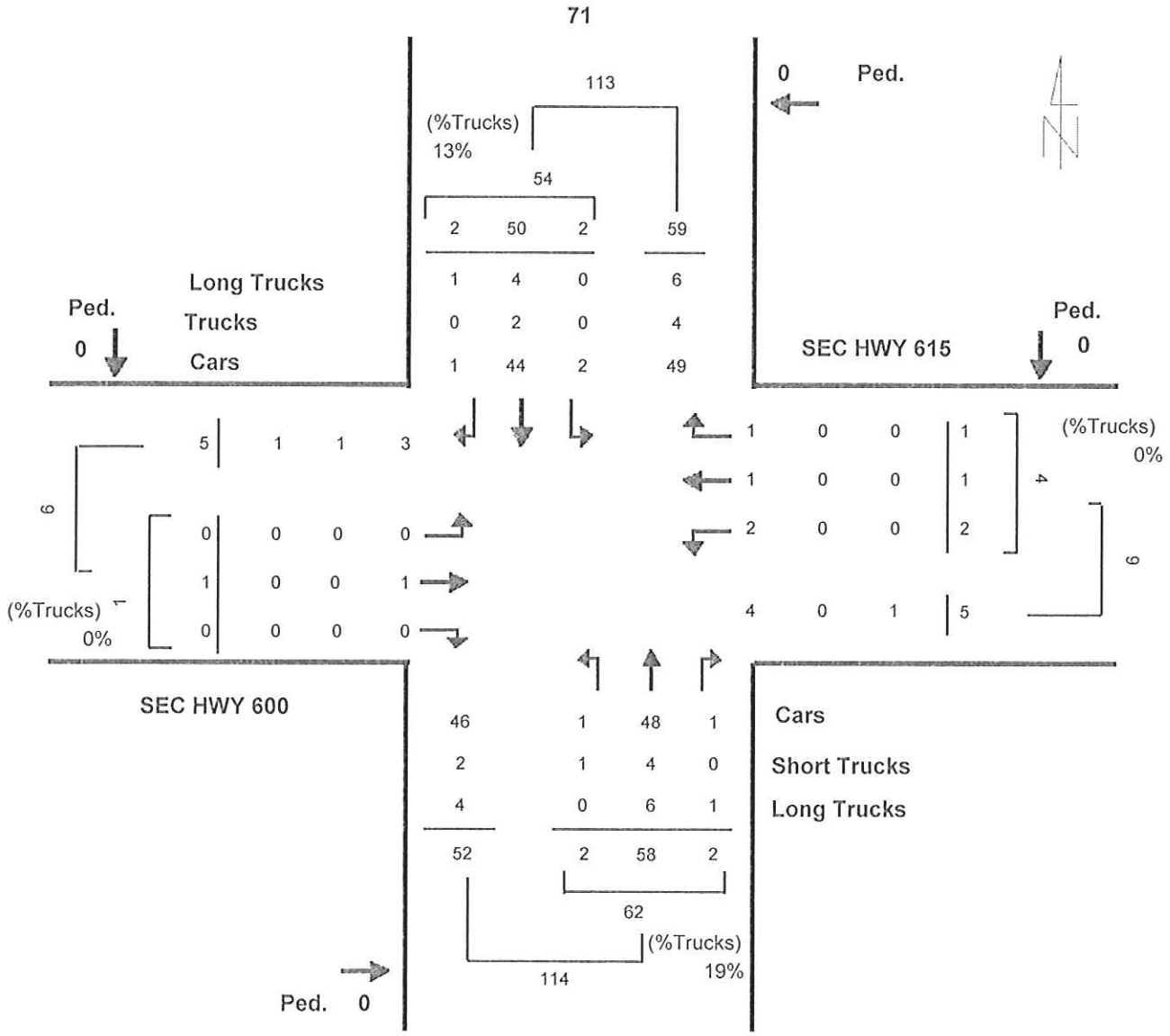
PM Peak Hour Diagram

Traffic Engineering Software

HWY 71, SEC HWY 600 (W) & HWY 615 (E)

Northwest

Intersection ID:36080 0.0 | PK HR End: 14:45 | Day: Thursday | Date:Aug 16, 2012



15 MIN REPORT

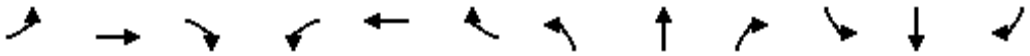
Intersection ID:36080 0.0 HWY 71, SEC HWY 600 (W) & HWY 615 (E) Municipality: Northwest Date: Aug 16, 2012

	NORTH APPROACH										EAST APPROACH										SOUTH APPROACH										WEST APPROACH										
Time	Cars			Trucks			Heavies			Ped	Cars			Trucks			Heavies			Ped	Cars			Trucks			Heavies			Ped	Cars			Trucks			Heavies			Ped	Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
Period1																																								
8:15	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	12
8:30	0	13	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19
8:45	0	4	1	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	7	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	19
9:00	0	11	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	1	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	24
9:15	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	9	3	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	24
9:30	1	10	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0	0	7	1	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	27
9:45	2	5	0	0	1	0	0	0	0	0	2	0	2	0	0	0	0	0	0	2	1	5	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	22
10:00	1	14	1	0	1	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	1	12	0	0	1	0	0	1	0	2	0	1	1	0	0	0	0	0	1	0	40
10:15	0	13	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	7	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	26
10:30	0	13	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	26
10:45	0	11	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	7	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	27
11:00	1	8	0	0	0	0	0	3	0	0	2	0	1	0	0	0	0	0	0	0	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22
11:15	0	15	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	2	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	30
11:30	0	8	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	8	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	23
11:45	0	12	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22
12:00	0	7	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	16
Period2																																									
13:15	0	7	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	9	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	20
13:30	0	7	0	0	0	0	0	4	0	0	2	0	1	0	0	0	0	0	0	0	0	8	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	26
13:45	2	9	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	8	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	23
14:00	0	12	1	0	0	0	0	2	1	0	0	0	1	0	0	0	0	0	0	0	1	11	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	32
14:15	0	9	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	14	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	31
14:30	1	14	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	1	0	3	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	33
14:45	1	9	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	25
15:00	0	6	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	10	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	22
15:15	1	12	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	12	0	0	0	0	0	2	0	1	0	0	2	0	0	0	0	0	0	0	33
15:30	0	12	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22
15:45	0	6	0	0	1	0	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	22
16:00	0	12	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	13	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
16:15	0	6	0	0	2	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	1	9	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	24
16:30	2	13	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	12	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	33
16:45	0	8	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	25
17:00	0	10	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22

	START TIME	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR	EBL	EBT	EBR
HWY 600 @ TAIT RD	8:00												
	8:15		2										
	8:30					1							
	8:45												
	PK HR VOLS	0	2	0	0	1	0	0	0	0	0	0	0
	9:00												
HWY 71 @ KORPI RD	9:15		10			13							
	9:30		10			12							
	9:45		6			16			1				
	10:00		9			18		1					
	10:15		5			11		1		2			
	10:30		12			22		1					
	10:45		11			12				2			
	PK HR VOLS	0	37	0	0	63	0	3	0	4	0	0	0
HWY 71 @ KORPI RD	2:30		8	1		7							
	2:45		7			11							
	3:00		10	1		10							
	3:15		13			6							
	3:30		14		1	4							
	3:45		14			4		1		1			
	4:00		12			10							
	4:15		11	2	1	7							
	PK HR VOLS	0	51	2	2	25	0	1	0	1	0	0	0
	4:30												
HWY 600 @ TAIT RD	4:45		1								1		
	5:00					1							
	5:15		1			1							
	5:30												
	PK HR VOLS	0	2	0	0	2	0	0	0	0	1	0	0

	TURNING MOVEMENT RATIOS TO TOTAL PEAK HOUR VOLUME											
	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR	EBL	EBT	EBR
AM PEAK	0%	35%	0%	0%	59%	0%	3%	0%	4%	0%	0%	0%
PM PEAK	0%	62%	2%	2%	30%	0%	1%	0%	1%	0%	0%	0%
AM PEAK	0%	67%	0%	0%	33%	0%	0%	0%	0%	0%	0%	0%
PM PEAK	0%	40%	0%	0%	40%	0%	0%	0%	0%	20%	0%	0%

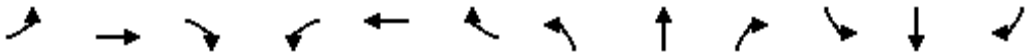
APPENDIX B: Synchro Results



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	1	0	2	0	17	0	0	29	25
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	1	0	2	0	18	0	0	32	27
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	66	64	45	64	77	18	59			18		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	66	64	45	64	77	18	59			18		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.3		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	926	827	1025	931	813	1060	1472			1523		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	3	18	59
Volume Left	0	1	0	0
Volume Right	0	2	0	27
cSH	1700	1013	1472	1523
Volume to Capacity	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.1	0.0	0.0
Control Delay (s)	0.0	8.6	0.0	0.0
Lane LOS	A	A		
Approach Delay (s)	0.0	8.6	0.0	0.0
Approach LOS	A	A		

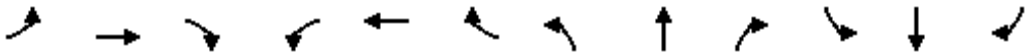
Intersection Summary				
Average Delay	0.3			
Intersection Capacity Utilization	13.3%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	1	0	1	0	61	2	2	30	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	1	0	1	0	66	2	2	33	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	105	105	33	104	104	67	33			68		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	105	105	33	104	104	67	33			68		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.3			4.3		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.3		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	872	783	1041	875	785	996	1493			1448		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	2	68	35
Volume Left	0	1	0	2
Volume Right	0	1	2	0
cSH	1700	931	1493	1448
Volume to Capacity	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.1	0.0	0.0
Control Delay (s)	0.0	8.9	0.0	0.5
Lane LOS	A	A		A
Approach Delay (s)	0.0	8.9	0.0	0.5
Approach LOS	A	A		

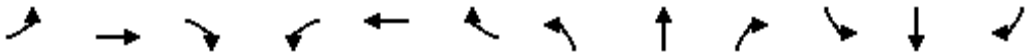
Intersection Summary				
Average Delay	0.3			
Intersection Capacity Utilization	13.3%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	28	0	103	1	0	2	100	17	0	0	29	25
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	30	0	112	1	0	2	109	18	0	0	32	27
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	283	281	45	393	295	18	59			18		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	283	281	45	393	295	18	59			18		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	100	89	100	100	100	93			100		
cM capacity (veh/h)	632	583	1025	477	573	1060	1545			1598		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	142	3	127	59
Volume Left	30	1	109	0
Volume Right	112	2	0	27
cSH	904	754	1545	1598
Volume to Capacity	0.16	0.00	0.07	0.00
Queue Length 95th (m)	4.5	0.1	1.8	0.0
Control Delay (s)	9.7	9.8	6.5	0.0
Lane LOS	A	A	A	
Approach Delay (s)	9.7	9.8	6.5	0.0
Approach LOS	A	A		

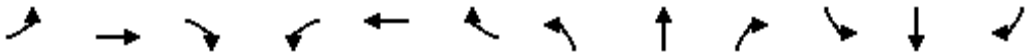
Intersection Summary				
Average Delay	6.8			
Intersection Capacity Utilization	28.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	3	0	3	1	0	2	320	17	0	0	29	80
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	3	1	0	2	348	18	0	0	32	87
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	791	789	75	792	833	18	118			18		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	791	789	75	792	833	18	118			18		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	100	100	100	100	76			100		
cM capacity (veh/h)	251	246	986	250	232	1060	1470			1598		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	7	3	366	118
Volume Left	3	1	348	0
Volume Right	3	2	0	87
cSH	400	509	1470	1598
Volume to Capacity	0.02	0.01	0.24	0.00
Queue Length 95th (m)	0.4	0.2	7.4	0.0
Control Delay (s)	14.2	12.1	7.9	0.0
Lane LOS	B	B	A	
Approach Delay (s)	14.2	12.1	7.9	0.0
Approach LOS	B	B		

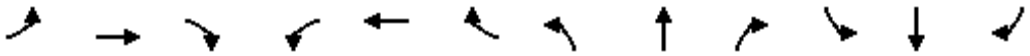
Intersection Summary				
Average Delay	6.1			
Intersection Capacity Utilization	35.3%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	0	100	1	0	1	103	61	2	2	30	28
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	0	109	1	0	1	112	66	2	2	33	30
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	345	345	48	452	359	67	63			68		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	345	345	48	452	359	67	63			68		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	100	89	100	100	100	93			100		
cM capacity (veh/h)	575	535	1021	436	526	996	1540			1533		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	136	2	180	65
Volume Left	27	1	112	2
Volume Right	109	1	2	30
cSH	884	607	1540	1533
Volume to Capacity	0.15	0.00	0.07	0.00
Queue Length 95th (m)	4.3	0.1	1.9	0.0
Control Delay (s)	9.8	11.0	4.9	0.3
Lane LOS	A	B	A	A
Approach Delay (s)	9.8	11.0	4.9	0.3
Approach LOS	A	B		

Intersection Summary				
Average Delay	5.9			
Intersection Capacity Utilization	30.2%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	80	0	320	1	0	1	3	61	2	2	30	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	87	0	348	1	0	1	3	66	2	2	33	3
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	114	114	34	460	114	67	36			68		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	114	114	34	460	114	67	36			68		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	100	67	100	100	100	100			100		
cM capacity (veh/h)	860	774	1039	339	773	996	1575			1533		

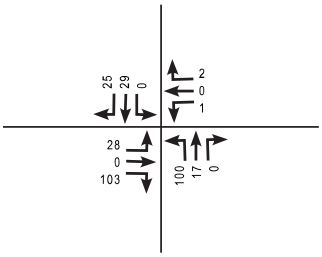
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	435	2	72	38
Volume Left	87	1	3	2
Volume Right	348	1	2	3
cSH	997	506	1575	1533
Volume to Capacity	0.44	0.00	0.00	0.00
Queue Length 95th (m)	18.0	0.1	0.0	0.0
Control Delay (s)	11.4	12.1	0.3	0.4
Lane LOS	B	B	A	A
Approach Delay (s)	11.4	12.1	0.3	0.4
Approach LOS	B	B		

Intersection Summary				
Average Delay	9.2			
Intersection Capacity Utilization	36.1%	ICU Level of Service	A	
Analysis Period (min)	15			

APPENDIX C: Intersection Treatment Warrant

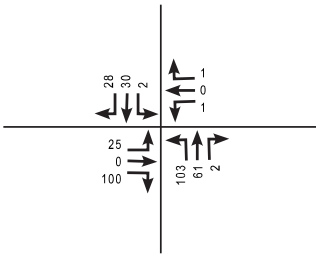
Intersection Treatment Warrants

2022 AM Peak PD



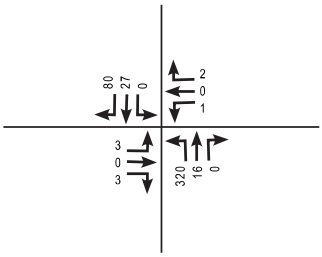
Northbound Left Turn:
Va = 117
Vo = 54
VL = 100; % VL = 86%
Vo<100, Not Warranted
Southbound Right Turn: <60, Not Warranted
Eastbound Right Turn: >60, Warranted

2022 PM Peak PD



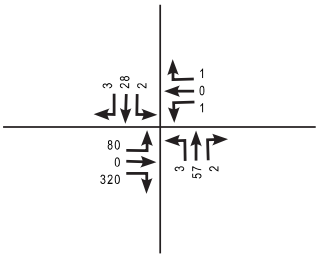
Northbound Left Turn:
Va = 166
Vo = 60
VL = 100; % VL = 61%
Vo<100, Not Warranted
Southbound Right Turn: <60, Not Warranted
Eastbound Right Turn: >60, Warranted

2015 Peak Construction Period - AM Peak



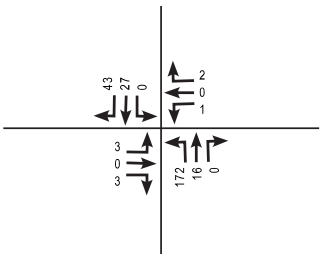
Northbound Left Turn:
Va = 336
Vo = 107
Vl = 320; % Vl = 95%
Warranted
Southbound Right Turn: >60, Warranted
Eastbound Right Turn: <60, Not Warranted

2015 Peak Construction Period - PM Peak



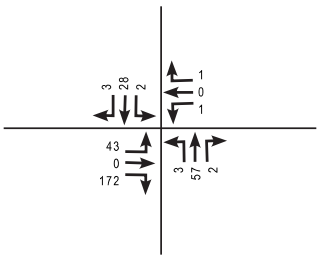
Northbound Left Turn:
Va=62
Vo=33
VL=3; %VL=5%
Vo<100, Not Warranted
Southbound Right Turn: <60, Not Warranted
Eastbound Right Turn: >60, Warranted

Average Construction Period - AM Peak



Northbound Left Turn:
Va = 188
Vo = 70
VL = 172; % VL = 91%
Vo<100, Not Warranted
Southbound Right Turn: <60, Not Warranted
Eastbound Right Turn: <60, Not Warranted

Average Construction Period - PM Peak



Northbound Left Turn:
Va=62
Vo=33
VL=3; %VL=5%
Vo<100, Not Warranted
Southbound Right Turn: <60, Not Warranted
Eastbound Right Turn: >60, Warranted

APPENDIX D: Highway 600 Construction Traffic Mitigation Study

Highway 600
Construction Traffic Mitigation Study

Prepared for
Rainy River Resources Limited

By TBT Engineering

May 1, 2013

1.0 Introduction

TBT Engineering Consulting Group (TBTE) was commissioned by Rainy River Resources Limited (RRR) to provide a Construction Traffic Mitigation Study for accommodating local and provincial highway traffic during the construction of a proposed realignment of Highway 600 in the District of Rainy River, Ontario.

The existing Highway 600 alignment traverses through a proposed mine development area near the community of Blackhawk. Following completion of a separate Feasibility Study in February 2012 and consultation with the Township of Chapple it was recommended to permanently relocate Highway 600 south of the proposed mine development area.

During the period when the new Highway 600 alignment is being constructed anticipated mine development is expected to result in a significant increase in local traffic volumes.

This current study will identify anticipated impacts associated with proposed construction activities, evaluate proposed alternatives for mitigating construction traffic impacts on local motorists, and provide recommendations for implementation of measures designed to safely accommodate local and provincial road users as well as construction personnel and equipment involved with development of the mine and the new highway alignment.

2.0 Study Area

Highway 600 is a minor secondary provincial highway running northerly from Rainy River for 27 km then generally easterly 62 km to Kings Highway 71.

The study area for this report includes Highway 600 from Highway 617 to Highway 71. Enclosure 1 identifies the section of Highway 600 included under this study.

This study area is larger than the proposed mine development and proposed realignment of Highway 600 to allow for evaluation of construction staging and detour options during construction.

3.0 Existing Conditions

Land uses along Highway 600 include agricultural, residential, recreational/hunting properties and timber extraction.

Highway 600 is classified as a rural local undivided (RLU) facility and within the study area has a granular surface with a posted speed limit of 80 km/hr.

TBT Engineering Limited 1918 Yonge Street, Thunder Bay, ON P7E 6T9 807-624-5160

Existing annual average daily traffic volumes (AADT) within the study area are 110 vehicles/day.

4.0 Proposed Development

Rainy River Resources is proposing to construct a new mine development along Highway 600 in the vicinity of Blackhawk.

To accommodate the proposed mine development a section of Highway 600 extending from Dearlock to Blackhawk is recommended for relocation. A feasibility study was completed that considered eight options for the Highway 600 relocation. The options were presented to the Township of Chapple and subsequently the Township of Chapple provided a correspondence letter indicating Alternate C was the preferred option.

Enclosure 2 identifies the proposed new (Alternate C) alignment for Highway 600 south of the proposed mine development area.

Ultimately a new access road will be constructed to the mine development from Highway 71. Enclosure 2 identifies the proposed location of the East Access Road.

5.0 Development Stages

Road Construction

This stage is anticipated to take approximately 6 months and is currently scheduled for the period from Aug 1, 2014 to Jan 31, 2015.

Construction of the East Access Road and the realignment of Highway 600 south of the proposed mine development will be coincidental with construction activities associated with the mine development.

Accordingly it is anticipated that significant increases over the existing traffic volume (AADT 110) will be experienced during this stage, and the increased number and nature of the construction vehicles working in vicinity of existing Highway 600 will result in a change in the character of the current traffic flow.

During this period construction traffic associated with the road construction and mine construction will access the development area via existing Highway 600, primarily from Highway 71.

Mine Construction

This stage is anticipated to take approximately 23 months and is currently scheduled for the period from Aug 15, 2014 to July 15, 2016.

After the new Highway 600 bypass is opened in February 2015 impacts to the local and provincial highway users on Highway 600 will be negligible.

Mine construction traffic will be primarily facilitated by the East Access Road from Highway 71 once that link is completed.

Mine Operation

During this stage mine traffic will primarily be facilitated via the East Access Road.

Mine Closure

This stage will extend from the mine closure date and extend until decommissioning is completed however ongoing monitoring requirements may result in periodic access to the development after completion of closure activities.

During this stage mine traffic will primarily be facilitated via the East Access Road.

6.0 Anticipated Traffic Generation

Anticipated traffic volumes associated with the development are estimated to result in a cumulative count of 4,272 personnel vehicles over a 23 month period resulting in an additional AADT of approximately 200 additional vehicles per day.

Anticipate construction traffic volumes associated with the development are estimated to result in a cumulative count of 1918 trucks/loads/deliveries over a 23 month period resulting in an additional AADT of approximately 90 vehicles per day.

Taken cumulatively it is estimated that the proposed development will result in an increase in the current AADT of 110 vehicles per day to an estimated 400 vehicles per day with 25% trucks.

It is noted that once the East Access Road is completed mine traffic will be limited to Highway 71 then access to the site along existing and new municipal roadways. At that time traffic volumes on Highway 600 are expected to return to current level.

7.0 Construction Traffic Mitigation Study

The purpose of this study is to identify methods of mitigating impacts of anticipated construction traffic associated with the development, with primary focus on the stage when road construction is occurring coincidentally with mine construction.

During this period of time accommodating existing road users along Highway 600 while safely conducting construction activities will require comprehensive construction traffic safety measures as Highway 600 through the proposed development area will remain open until the new Highway 600 alignment is completed and transferred to the Province.

Staging was considered as an option to mitigate potential impacts however current schedule constraints negate the opportunity to construct the bypass in advance of the mine development.

Construction of the new Highway 600 alignment has been included with the overall Mine EA process, and as such pre-construction of this new roadway cannot proceed until EA clearance and associated permitting for the mine development is achieved.

Delay of initiating mine construction to allow for construction of the new Highway 600 alignment is not feasible as mine development plans are contingent on construction of water retention facilities in 2014 to ensure sufficient process water is available for mine start-up in 2016.

Closing existing Highway 600 during the period is not feasible as there are local land owners who access their property and residences via this route. School buses, utility companies with existing plant along Highway 600 and emergency response vehicles may also continue to require access along this route.

Accordingly, although the road will remain open, the recommended means of mitigating potential traffic impacts during this initial stage will include a proposed detour of non-local road users along Highway 600.

It is recommended that a detour will be established along Highway 617, Highway 11 and Highway 71 to route non-local traffic around the development area for the road construction stage (Aug 15, 2014 – Feb 1, 2015).

Enclosures 3 and 4 provide details regarding the proposed detour route and signage.

Within the development area local road users will still be allowed access along Highway 600 and appropriate construction signage in accordance with OTM Book 7 are recommended as identified in Enclosures 3 and 4.

Once construction of the East Access Road is complete local road users within the development area will access Highway 71 via the newly constructed East Access Road. This will allow local traffic to bypass mine construction and eliminate the need for existing Highway 600 to provide local traffic access to Highway 71.

8.0 Recommendations and Conclusions

TBTE was commissioned by Rainy River Resources to complete a Construction Traffic Mitigation Study for the initial stage when construction of the new Highway 600 alignment and East Access Road are scheduled to occur coincidently with mine construction activities.

On the basis of this study a 6 month detour of non-local users of Highway 600 is recommended via provincial Highway 617, Highway 11 and Highway 71.

Consultation with Ministry of Transportation of Ontario, Township of Chapple, Municipality of Stratton, school bus operators, utility companies and emergency response groups will be completed upon approval of the recommendations of this study.

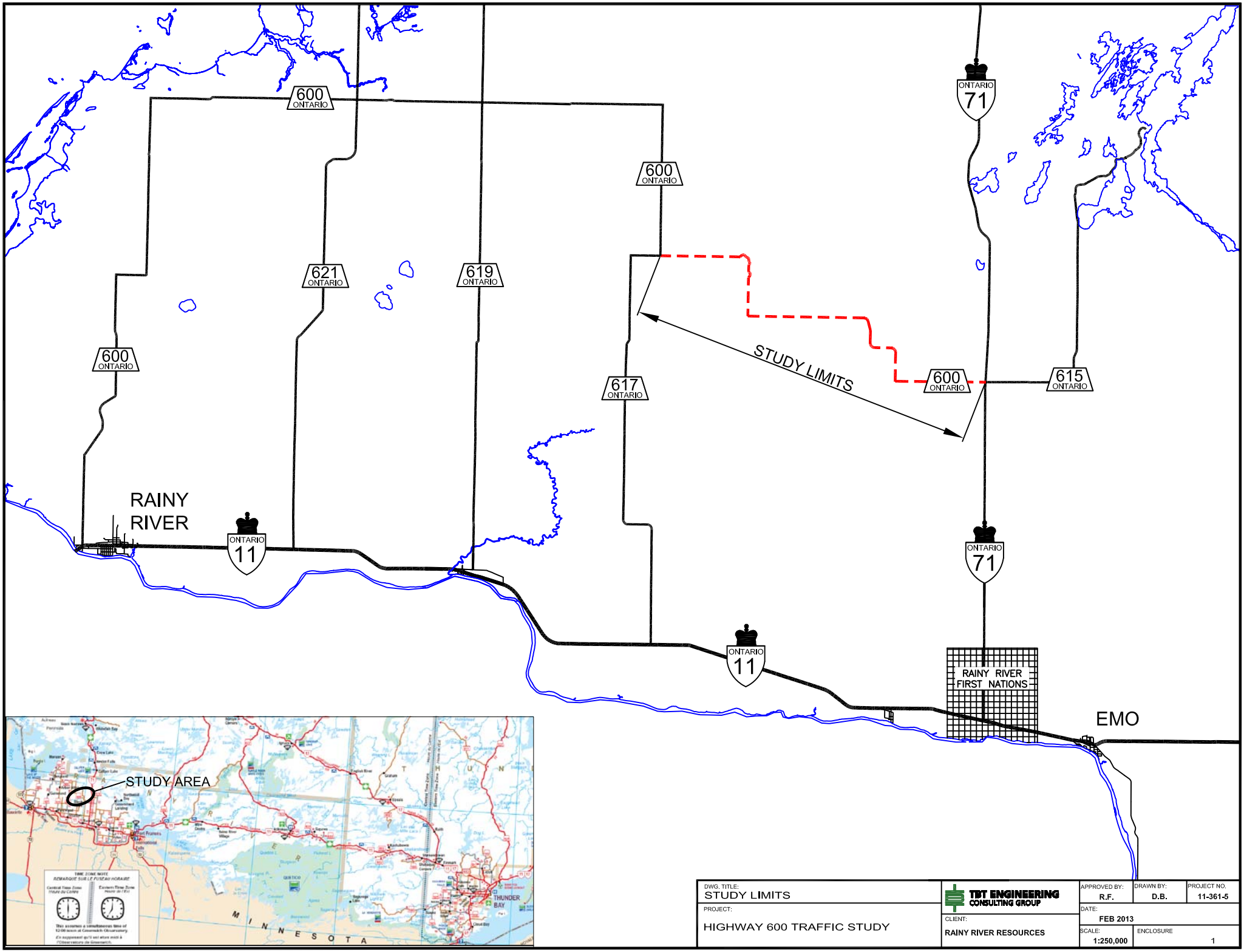
Prepared By:

Rob Frenette, P. Eng. President
TBT Engineering Consulting Group

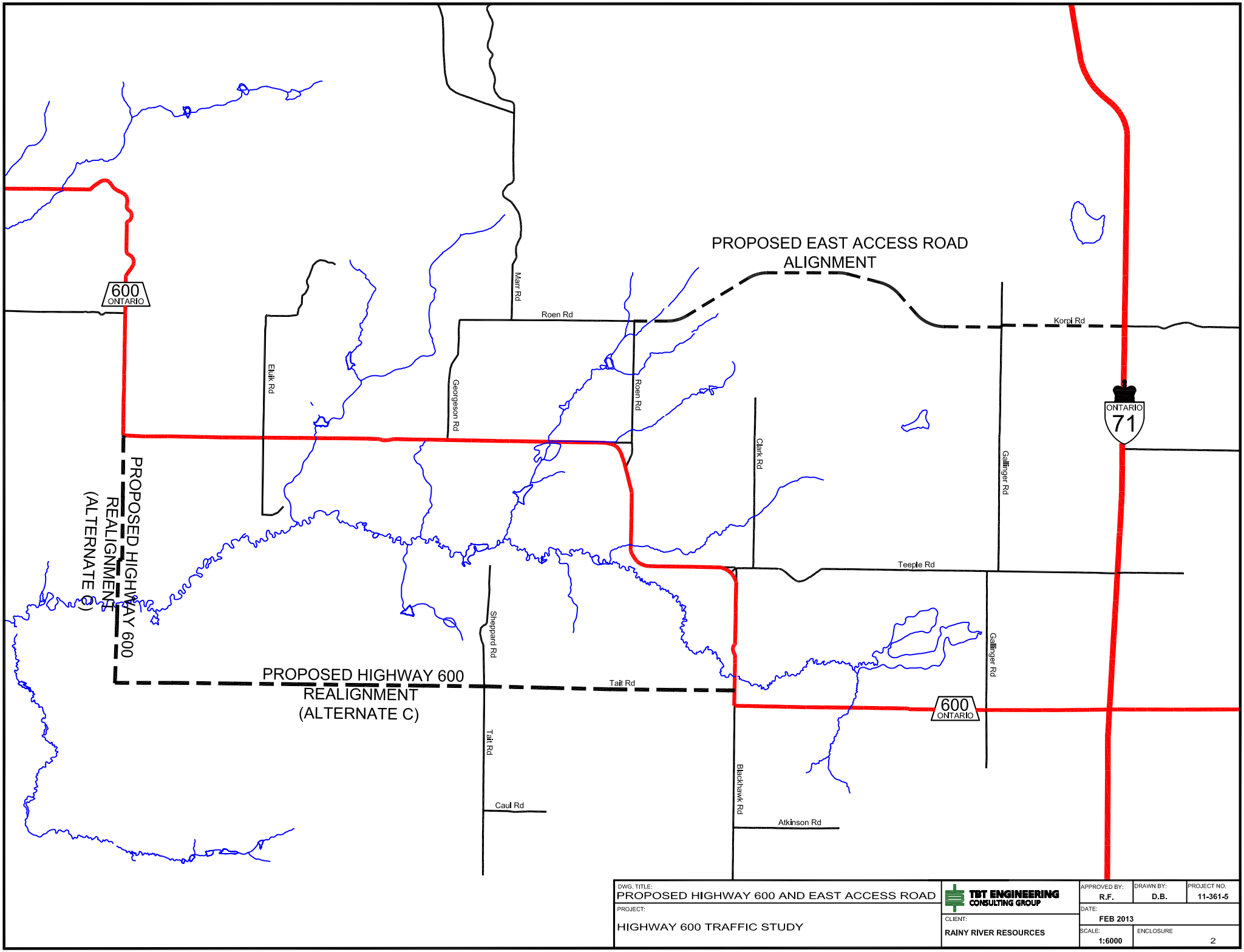
APPENDIX

Enclosures 1 – 4

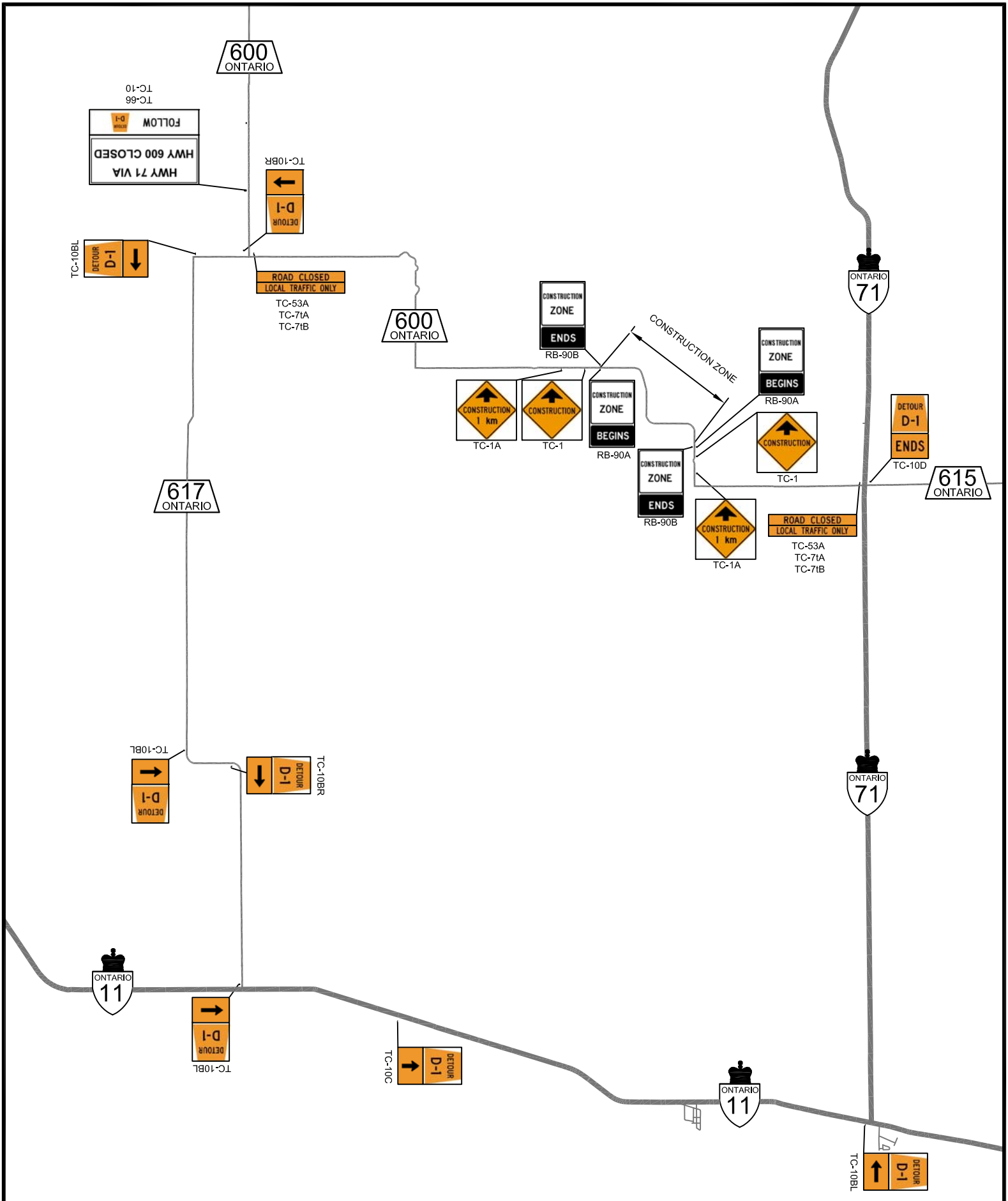
Estimated Traffic Volumes
Township of Chapple Correspondence Letter



DWG. TITLE: STUDY LIMITS	TBT ENGINEERING CONSULTING GROUP	APPROVED BY: R.F.	DRAWN BY: D.B.	PROJECT NO. 11-361-5
PROJECT: HIGHWAY 600 TRAFFIC STUDY	CLIENT: RAINY RIVER RESOURCES	DATE: FEB 2013		
		SCALE: 1:250,000	ENCLOSURE 1	



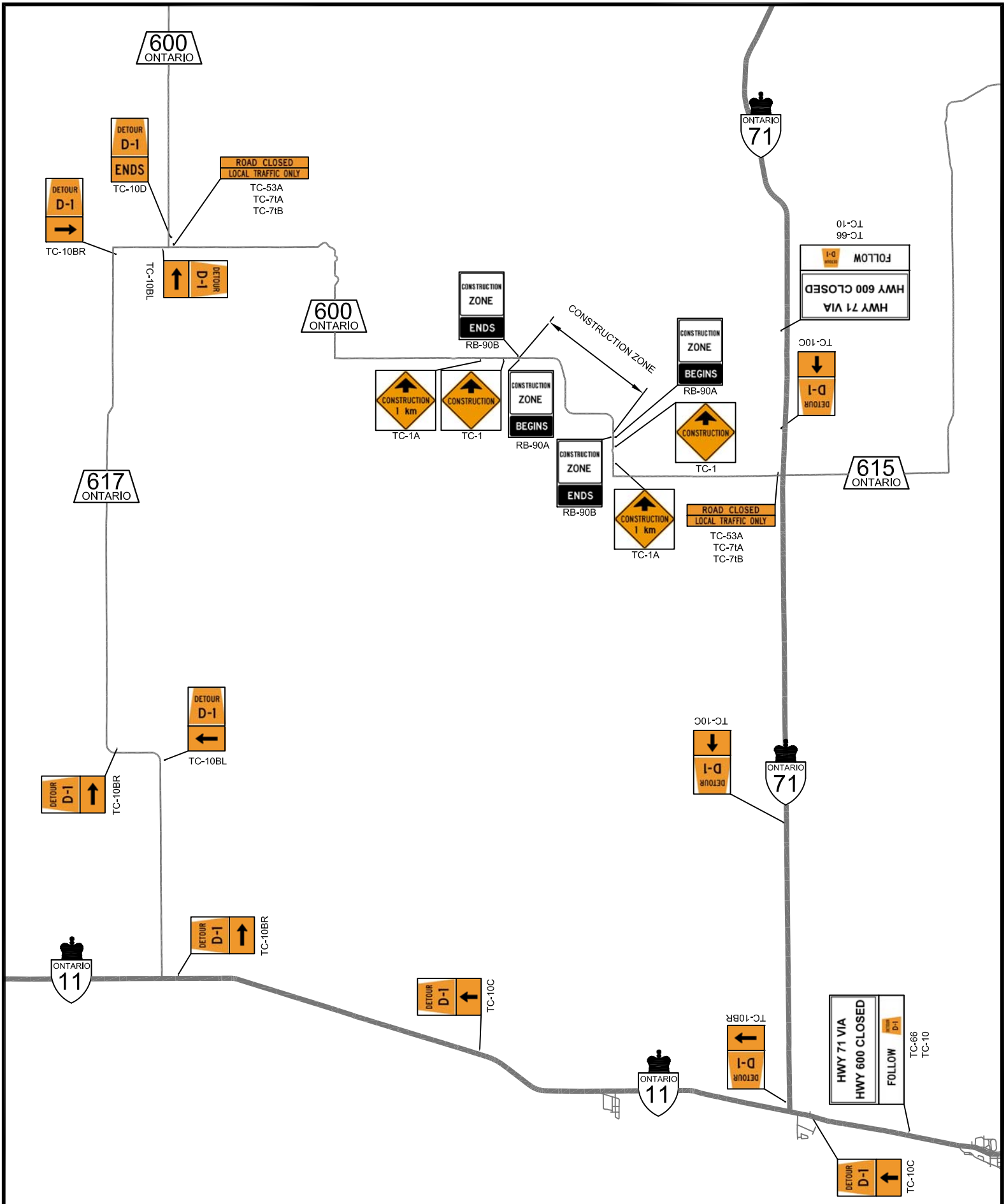
DWG. TITLE: PROPOSED HIGHWAY 600 AND EAST ACCESS ROAD	TBT ENGINEERING CONSULTING GROUP	APPROVED BY: R.F.	DRAWN BY: D.B.	PROJECT NO. 11-361-5
PROJECT: HIGHWAY 600 TRAFFIC STUDY	CLIENT: RAINY RIVER RESOURCES	DATE: FEB 2013		
		SCALE: 1:6000	ENCLOSURE 2	



NOTES:

1. DRAWING TO BE READ IN CONJUNCTION WITH OTM BOOK 7

DWG. TITLE: HIGHWAY 600 EAST DETOUR	TBT ENGINEERING CONSULTING GROUP	APPROVED BY: R.F.	DRAWN BY: D.B.	PROJECT NO. 11-361-5
PROJECT: HIGHWAY 600 TRAFFIC STUDY	CLIENT: RAINY RIVER RESOURCES	DATE: FEB 2013		
		SCALE: NTS	ENCLOSURE 3	



NOTES:

1. DRAWING TO BE READ IN CONJUNCTION WITH OTM BOOK 7

DWG. TITLE: HIGHWAY 600 WEST DETOUR

PROJECT: HIGHWAY 600 TRAFFIC STUDY

TBT ENGINEERING CONSULTING GROUP

CLIENT: RAINY RIVER RESOURCES

APPROVED BY:	DRAWN BY:	PROJECT NO.
R.F.	D.B.	11-361-5

DATE: FEB 2013

SCALE: NTS

ENCLOSURE: 4

1 **Construction Manpower Light Vehicles - Including CM Team (Assuming No Busing to Site)**

Duration Aug 2014 - April 2016

100% Construction Manpower

DATE	MANPOWER MONTHLY FORECAST	CUMULATIVE
Aug/14	145	145
Sep/14	248	393
Oct/14	309	702
Nov/14	172	874
Dec/14	131	1,005
Jan/15	90	1,095
Feb/15	35	1,130
Mar/15	38	1,168
Apr/15	117	1,285
May/15	247	1,532
Jun/15	298	1,830
Jul/15	368	2,198
Aug/15	356	2,554
Sep/15	383	2,937
Oct/15	400	3,337
Nov/15	326	3,663
Dec/15	228	3,891
Jan/16	171	4,062
Feb/16	147	4,209
Mar/16	63	4,272
Apr/16	1	4,273
TOTAL	4,272	

Assuming Construction Manpower use 25% Ride Share

DATE	MANPOWER MONTHLY FORECAST	CUMULATIVE	CM Vehicles	Total Personnel Vehicles
Aug/14	109	109	9	118
Sep/14	186	295	14	200
Oct/14	232	527	18	250
Nov/14	129	656	18	147
Dec/14	98	754	21	119
Jan/15	68	821	23	91
Feb/15	26	848	26	52
Mar/15	29	876	26	55
Apr/15	88	964	26	114
May/15	185	1,149	26	211
Jun/15	224	1,373	26	250
Jul/15	276	1,649	26	302
Aug/15	267	1,916	26	293
Sep/15	287	2,203	26	313
Oct/15	300	2,503	26	326
Nov/15	245	2,747	26	271
Dec/15	171	2,918	26	197
Jan/16	128	3,047	26	154
Feb/16	110	3,157	17	127
Mar/16	47	3,204	12	59
Apr/16	1	3,205	11	12
TOTAL	3,204			3,660

Construction Equipment, Trailers & Bulk Material Deliveries

2 Civil Bulk Earthworks (Excluding Pre Stripping)

Duration August 2014 - October 2015

Construction Equipment

Description	Quantity
Volvo EC460B Excavator c/w Hydraulic Thumb 1	1
John Deere 450 DLC c/w Coupler and Bucket 1	1
John Deere 350DLC c/w Hydraulic Thumb 1	1
Komatsu PC300LC-8 c/w Hydraulic Thumb 1	1
Komatsu PC300LC-8 c/w Hydraulic Thumb 1	1
Komatsu PC200LC-8 c/w Hydraulic Thumb 1	1
Komatsu WA470-6 Wheel Loader 2	2
John Deere 724J Wheel Loader 1	1
Komatsu WA250 PZ-6 Wheel Loader 1	1
Komatsu WA470-6 Wheel Loader 1	1
Caterpillar D8 2	2
Caterpillar D6 3	3
Komatsu HM350-2 Articulating Rock Truck 2	2
Komatsu HM300-1 Articulating Rock Truck 1	1
Terex TA30 Articulating Rock Truck 1	1
Volvo A25C 6X6 Articulating Rock Truck 2	2
Terex TA30 Articulating Rock Truck 4	4
Komatsu HM400 Articulating Rock Truck 5	5
John Deere 853G Feller/Buncher 1	1
John Deere 748GII Grapple Skidder 1	1
Bandit 2590 Chipper 1	1
Volvo G780 Grader 1	1
Superpac Ride-On Compactor 1	1
Ingersol Rand SD100D Smooth Drum 1	1

	Bomag Smooth Drum 1	1
	Total	38
	Site Facilities - Trailers	5
	Fuel Delivery (8 Tankers / month X 15 mo)	120
	Misc Service Trucks	30
	Total Heavy / Legal Loads for Civil Bulk Earthworkks	**193**
3	**Concrete Supply (On Site Batch Plant - Local Aggregates)**	
	Duration August 2014 - April 2016	
	Set Up Site Batch Plant	6
	Ancillary Equipment - Loaders / Cement Trucks	8
	Cement Powder Deliveries (Avg 275kg / m3 x 38,000 m3)	500
	Additives / Fly Ash Deliveries (Avg 100kg/m3)	190
	Site Facilities - Trailers	2
	Fuel Delivery (1 Tankers / month X 21 mo)	21
	Misc Service Trucks	30
	Total Concrete Supply	**757**
4	**Concrete Placement Contractor**	
	Duration August 2014 - April 2016	
	Concrete Pumpers	2
	Mobile Cranes (100T Hyd)	1
	Formwork Deliveries	30

	Scaffolding / Falseworks	10
	Construction Equipment - General	8
	C Cans - Storage / Warehousing	4
	Misc Metals, Embeds, Anchor Bolts etc	12
	Site Facilities - Trailers	6
	Fuel Delivery (2 Tankers / month X 21 mo)	42
	Misc Service Trucks	20
	Total Concrete Placement	**135**
5	**Structural Steel**	
	Duration October 2014 - March 2016	
	Mobile Cranes (100T Hyd)	2
	Fork Lift (20,000 lb)	2
	Compressors	3
	Diesel Welding Machines	6
	Construction Equipment - General	6
	C Cans - Storage / Warehousing	4
	Structural Steel Deliveries (Avg 20T / Load)	270
	Structural Bolt Deliveries (Est 400 Kegs)	16
	Siding & Roofing Deliveries	12
	Site Facilities - Trailers	6
	Fuel Delivery (2 Tankers / month X 20 mo)	40
	Misc Service Trucks	20
	Total Structural Steel	**387**
6	**Architectural**	
	Duration October 2014 - December 2015	
	Delivery of Purchased Packages by BBA	-

	Mobile Cranes (100T Hyd)	1
	Fork Lift (20,000 lb)	1
	Compressors	2
	Diesel Welding Machines	3
	Construction Equipment - General	3
	C Cans - Storage / Warehousing	2
	Truck Shop Steel Delivery (Assume 600 T)	30
	Structural Bolt Deliveries (Est 400 Kegs)	2
	Siding & Roofing Deliveries	6
	Site Facilities - Trailers	2
	Fuel Delivery (1 Tankers / month X 10 mo)	10
	Misc Service Trucks	14
	Total Architectural	**76**

7 Mechanical Installations

Duration August 2014 - April 2016

	Delivery of Purchased Packages by BBA	-
	Mobile Cranes (60T Hyd)	2
	Fork Lift (20,000 lb)	2
	Compressors	4
	Diesel Welding Machines	6
	Construction Equipment - General	8
	C Cans - Storage / Warehousing	5
	Site Facilities - Trailers	5
	Fuel Delivery (1 Tankers / month X 20 mo)	20
	Misc Service Trucks	30
	Total Mechanical	**82**

8 Piping Installations

Duration September 2014 - April 2016

Pipe Material Deliveries (Assume 50 lengths avg / load)	95
Valves, Fitting & Supports	12
Mobile Cranes (60T Hyd)	2
Fork Lift (20,000 lb)	2
Compressors	4
Diesel Welding Machines	6
Construction Equipment - General	10
C Cans - Storage / Warehousing	5
Site Facilities - Trailers	8
Fuel Delivery (1 Tankers / month X 20 mo)	20
Misc Service Trucks	30
Total Piping	**194**

9 Electrical & Instrumentation - Incl 230kV Powerline

Duration August 2014 - April 2016

Delivery of Purchased Packages by BBA	-
Cable & Tray Deliveries - Process Plant	10
Cable & Post Deliveries - 230kV Powerline	24
Mobile Cranes (75T Hyd)	1
Fork Lift (20,000 lb)	1
Compressors	2
Diesel Welding Machines	2
Construction Equipment - General	6
C Cans - Storage / Warehousing	4
Site Facilities - Trailers	4
Fuel Delivery (1 Tankers / month X 10 mo)	10
Misc Service Trucks	30
Total Electrical & Instrumentation	**94**

Summary For Construction Equipment, Trailers & Bulk Material Deliveries

2	Total Heavy / Legal Loads for Civil Bulk Earthworkks				193
3	Total Concrete Supply				757
4	Total Concrete Placement				135
5	Total Structural Steel				387
6	Total Architectural				76
7	Total Mechanical				82
8	Total Piping				194
9	Total Electrical & Instrunentation				94
	Total Hwy Loads				1918

CORPORATION OF THE TOWNSHIP OF CHAPPLE

P.O. Box 4
BARWICK, ONTARIO P0W 1A0
Phone 807-487-2354 Fax 807-487-2406

OFFICE OF THE CLERK-TREASURER
e-mail: chapple@tbaytel.net

January 16, 2012

Rainy River Resources Ltd.
1111 Victoria Avenue East
Thunder Bay, Ontario
P7C 1B7

Attention: Kyle Stanfield, P.Eng.
Director, Environment & Sustainability

Dear Kyle Stanfield:

Re: Highway 600 – Realignment Options

Please be advised after consideration of Council and Public Works Superintendent, Randy Both, the following ranking of options was agreed upon:

1) Alternative C

2) Alternative D, B or A

3) Alternative E

4) Alternative F

The Township of Chapple was in agreement that they prefer one of the southerly options to better accommodate local traffic. It was felt with Alternative C, there would be less impact to local landowners when obtaining land for the construction – that with this option the majority of highway would follow municipal road allowances. It was noted that there is the need to consider school bus routes and access to the Richardson landfill and gravel pit. As mentioned in your presentation, a portion of Alternative E would also be necessary to provide access to the Marr Road.

Thank you for your consideration in this matter.

Sincerely,

Peggy Johnson

Peggy Johnson, CMO
CAO/Clerk Treasurer