Traffic Impact Study
Masters Lane Extension Development
Town of Wasaga Beach

TPC Marlwood Inc.
31 Marlwood Avenue
Wasaga Beach, ON L9Z 1S8

R.J. Burnside & Associates Limited
332 Lorne Avenue East
Stratford ON N5A 6S4 CANADA

August 2016
300037815.1000

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1	Yes	Yes	TPC Marlwood Inc.
6	Yes	Yes	Loft Planning

Record of Revisions

Revision	Date	Description
0	August 2016	Initial Draft Submission for Client Review
1	July 7, 2017	Final Submission

R.J. Burnside & Associates Limited

Report Prepared By:

Cody Raposo, EIT
Transportation Engineering Intern
CR:ls

Report Reviewed By:

Henry Centen
Senior Transportation Engineer
HC:ls

Executive Summary

This Traffic Impact Study has reviewed the traffic impacts of developing a residential development in the Town of Wasaga Beach. Impacts have been assessed at the Marlwood Avenue and Proposed Development Access intersections on Golf Course Road, as well as along these roads. Traffic impacts have been assessed for horizon years 2023 and 2028. Forecasted traffic volumes have also included growth in background traffic in this area.

Based on the analysis completed, the following primary conclusions and recommendations are made in this study:

- The proposed development is forecast to generate about 56 vehicles per hour (vph) in the a.m. peak hour and 73 vph in the p.m. peak hour.
- The intersections of Golf Course Road/Marlwood Avenue and Golf Course Road/Proposed Development Access are forecast to operate with excellent Level of Service (LOS) and short delays through horizon year 2028. Therefore, no operational improvements are required to accommodate the proposed development.
- Left-turn lanes are not warranted at the intersections in the study area through horizon year 2028.
- Right-turn lanes are not warranted at the intersections in the study area through horizon year 2028.
- The location of the Proposed Development Access/Golf Course Road intersection meets the requirements for stopping sight distance and turning sight distance. The location results in 47 lots being located on the 425 metre cul-de-sac, which is slightly higher than typically preferred without a secondary emergency access. There is potential to shift the access location a short distance to the south (i.e. about 30 metres), which would reduce the number of lots on the cul-de-sac by two, while maintaining the required sight distance. Any benefit from such a modification should be considered against the reduction in sight distance that would result.
- It is recommended that the vegetation along Golf Course Road be cleared at the Proposed Development Access location in order to meet the sight triangle specified in the *Town of Wasaga Beach Engineering Standards* (Town of Wasaga Beach, 2015), which is 4 metres along the local right-of-way and 10 metres along the collector road right-of-way, as well as to maintain the required turning sight distances.
- Golf Course Road is forecast to operate at about 57% of its capacity, based on its AADT, through horizon year 2028.
- The Town may consider an extension of the existing transit ‘Route 2’ to provide better service to the proposed development, as well as to the existing residential subdivisions on Golf Course Road.

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1.0 Introduction

R.J. Burnside & Associates Limited (Burnside) has been retained by TPC Marlwood Inc. to prepare a Traffic Impact Study (TIS) in support of a proposed residential development in the Town of Wasaga Beach. This TIS will support the planning level approvals that are required prior to the development of the property, by demonstrating how the subject lands can be serviced with transportation infrastructure and identifying the impacts on the broader transportation network.

1.1 Site Description

The development location is shown in Figure A1 (Appendix A). TPC Marlwood Inc. proposes to extend Masters Lane in the Town of Wasaga Beach (Simcoe County) in order to service 66 single-family detached homes. In addition to the proposed 66 lots on Masters Lane, there are an additional 10 lots proposed to be developed on Golf Course Road immediately north of Marlwood Avenue. Although the 10 lots proposed on Golf Course Road are not within the scope of this TIS, they are considered as background traffic on Golf Course Road, for trip generation purposes. An additional access to Golf Course Road will be constructed from the extended Masters Lane. The development will be constructed on the existing Marlwood Golf & Country Club.

To the north, the property is bounded by the existing subdivision east of Golf Course Road (consisting of Marlwood Avenue and Masters Lane).

To the west, the property is bounded by Golf Course Road.

To the south, the property is bounded by The Boardwalk, which is a private road in the Park Place Retirement Community.

To the east, the property is bounded by the Marlwood Golf & Country Club.

A Potential Lotting Layout has been prepared for the development, which proposes 66 residential units, as shown in Figure A2 (Appendix A).

1.2 Background Information

The following documents have been reviewed as background for this TIS:

- 2012 Transportation Study Update, Town of Wasaga Beach (Ainley Group, December 2012)
- Active Transportation Plan for the Town of Wasaga Beach (Meridian Planning Consultants, August 2008)
- Official Plan for the Town of Wasaga Beach, amended to September 2013

- Zoning By-Law 2003-60 for the Town of Wasaga Beach, amended to September 2014
- Town of Wasaga Beach Engineering Standards (Town of Wasaga Beach, March 2015)
- Road Needs Study 2013, Town of Wasaga Beach (C.C. Tatham & Associates Limited, September 2013).

2.0 Existing Conditions

2.1 Study Area Road Network

The study area includes the transportation facilities linking the proposed development to the adjacent collector and local roads. The following local or collector road intersections were included in this study:

- Golf Course Road/ Marlwood Avenue
- Golf Course Road/ Proposed Development Access.

The proposed roadway being constructed to service the 66 proposed lots will be an extension of the existing Masters Lane (currently a cul-de-sac). Masters Lane is a north-south paved local road with an assumed posted speed limit of 50 km/h.

Marlwood Avenue is a north-south paved local road with an assumed posted speed limit of 50 km/h.

Golf Course Road is a north-south two-lane collector road with a posted speed limit of 50 km/h.

The Golf Course Road/Marlwood Avenue intersection is an existing stop-controlled T-intersection, with Golf Course Road operating freely through the intersection. Marlwood Avenue (east leg of the T-intersection) has a dual-carriageway access in order to travel to/from the existing subdivision east of Golf Course Road. The length of the dual-carriageway median is approximately 27 metres.

The Golf Course Road/Proposed Development Access is a proposed T-intersection that will provide a second access to the development off of Golf Course Road. It is assumed that the intersection will be stop-controlled, with Golf Course Road operating freely.

2.2 Other Developments and Proposed Road Improvements

Consideration has been made to the existing subdivision being serviced by Masters Lane and Marlwood Avenue. The existing subdivision contains the only clubhouse for the Marlwood Golf & Country Club, as well as 63 single-family homes. Traffic generated from the residential units and the golf course has been distributed according to the logical routing between the Marlwood Avenue/Golf Course Road and Proposed Development Access/Golf Course Road intersection.

As mentioned previously, the 10 proposed residential lots to be constructed on Golf Course Road immediately north of the Marlwood Avenue/Golf Course Road intersection will be considered in this TIS. Forecasted traffic from the 10 proposed lots has been determined and added as background traffic to the through traffic on Golf Course Road in future horizon years.

There are no other new developments or proposed road improvements that have been identified for the study area within the time period considered in this study.

3.0 Background Traffic Forecasts

3.1 Study Horizon Periods

Considering the scope of the proposed development, as well as the assumption that the development will be completed by 2018, the following study horizons (cumulatively) are considered appropriate for consideration of traffic impacts:

- Horizon Year 2016 – Existing Conditions
  - Existing background conditions, taking into consideration peak summer traffic volumes.
- Horizon Year 2023 – Five Year Horizon (i.e., 5 years post build-out)
  - Addition of background traffic growth
  - Addition of full development (66 units).
- Horizon Year 2028 – Ten Year Horizon (i.e., 10 years post build-out)
  - Addition of background traffic growth.

3.2 Road Connections and Phasing of Development

For the purposes of this study it has been assumed that the proposed development will build-out by 2018. Full build-out conditions are considered, since these represent the worst-case scenario for traffic impacts on the adjacent roadways.

The final development plan has not been established to date; however, the Potential Lotting Layout has been prepared for the purpose of planning approvals. At this time the development contains 66 units.

The internal development Masters Lane will service 66 single-detached lots. The existing Marlwood Avenue/Golf Course Road intersection may be used to access the development, as well as the proposed new access to Golf Course Road (see Figure A2, Appendix A).

It is expected that phasing plans, if required, will be developed as part of the detailed designs and agreements for this development.

3.3 Time Period for Traffic Analysis

The time periods selected for traffic analysis are based on the type of development proposed. The peak traffic periods considered in this study, for residential development impacts, include the AM peak hour and PM peak hour of the adjacent roadways. Both peak hours are considered for weekday conditions.

3.4 Seasonal Adjustments for Traffic Volumes

The study area is affected by seasonal traffic fluctuations, due to the development being located immediately southwest of the Marlwood Golf & Country Club as well as the beach areas of the Town attracting many residents/tourists in summer months. This was taken into account in this study by utilizing traffic volumes taken from turning movement counts completed in the summer (June 29, 2016) and using these in the analysis.

3.5 Traffic Growth Factors

Based on the traffic forecasts in the *Road Needs Study* prepared for the Town of Wasaga Beach (C.C. Tatham & Associates Ltd., 2013), it is forecast that the traffic on Golf Course Road will grow by 4.0% per annum (compounded) between 2012 and 2032. This growth rate has been used to forecast future background traffic for the various horizon periods considered in this study. Traffic to be generated from the proposed development on Golf Course Road immediately north of Marlwood Avenue (10 single-family units) will be added in addition to the background growth rate.

3.6 Forecast Background Traffic

A turning movement traffic count was obtained for Golf Course Road at Marlwood Avenue. The count was taken by Ontario Traffic Inc. on June 29, 2016. Since the count already reflects peak summer conditions, no further adjustments were required.

Traffic volumes to be generated from the proposed 10 single-family units on Golf Course Road immediately north of Marlwood Avenue have been estimated based on trip rate information in the Institute of Transportation Engineers (ITE) *Trip Generation Manual 9th Edition*, and is summarized in the following table:

Table 3.1 – Forecast of Trip Generation from Development North of Marlwood Ave.

Land Use	ITE Code	a.m. Peak Hour (vph)		p.m. Peak Hour (vph)	
		In	Out	In	Out
Single-Family Detached Housing (10 units)	210	2	6	6	4

As shown in the above table, the total trip generation (two-way) for the 10 proposed lots on Golf Course Road north of Marlwood Avenue is forecast to be 8 vehicles per hour (vph) in the a.m. peak hour and 10 vph in the p.m. peak hour. According to the traffic count done at the Golf Course Road/Marlwood Avenue intersection in June 2016, approximately 70% of the vehicles entering/exiting Marlwood Avenue in the a.m. peak hour travel to/from the north (on Golf Course Road). Approximately the same traffic distribution occurs for traffic entering Marlwood Avenue during the p.m. peak hour;

however, approximately 90% of traffic exiting Marlwood Avenue during the p.m. peak hour travel to the north. Thus, traffic from the proposed 10 lots fronting Golf Course Road was distributed as follows:

- a.m. peak hour – 70% to/from the north on Golf Course Road
- p.m. peak hour – 70% from the north and 90% to the north on Golf Course Road.

As a result of the proposed new access to Golf Course Road from the extended Masters Lane, it can be assumed that this will affect the distribution of traffic to/from Marlwood Avenue since there will be a more logical distribution between Marlwood Avenue and the Proposed Development Access. Thus, the existing (2016) distributions at the Marlwood Avenue/Golf Course Road intersection need to be revised/re-distributed for future background conditions in order to accurately reflect the impact that the Proposed Development Access will have on the subdivision. The forecasted distributions applied to all traffic (existing and proposed) travelling to/from the subdivision in horizon years 2023 and 2028 are the following:

Table 3.2 – Background (2023 & 2028) Trip Distribution on Golf Course Road

Intersection	To/From the North	To/From the South
Marlwood Avenue & Golf Course Road	50%	15%
Proposed Development Access & Golf Course Road	0%	35%

The forecasted background traffic volumes (weekday a.m. and p.m. peak hours, horizon year 2016) are summarized on Figure A3 (Appendix A). The forecast future background traffic volumes, for horizon years 2023 and 2028, are summarized on Figures A4 and A5, respectively.

4.0 Development Traffic Forecasts and Total Traffic Forecasts

4.1 Development Traffic Generation

Site generated traffic volumes, from the proposed development, have been estimated based on trip generation information contained in the ITE *Trip Generation Manual 9th Edition*, and is summarized in the following table:

Table 4.1 – Forecast of Trip Generation from Proposed Development – Full Build-Out

Land Use	ITE Code	a.m. Peak Hour (vph)		p.m. Peak Hour (vph)	
		In	Out	In	Out
Single-Family Detached Housing (66 units)	210	14	42	46	27

As shown in the above table, the total new trip generation (two-way) for the development is forecast to be 56 vph in the a.m. peak hour and 73 vph in the p.m. peak hour.

4.2 Trip Distribution

The forecast development traffic has been distributed over the road network, according to logical routing to adjacent collector and arterial roads and origin/destination considerations. Considering the development will be solely located immediately east of Golf Course Road, all of the trips are distributed to/from Golf Course Road. Golf Course Road provides the collector road function in this area.

The forecast traffic generated from the proposed development was distributed with the following allocations:

Table 4.2 –Trip Distribution on Golf Course Road

Intersection	To/From the North	To/From the South
Marlwood Avenue & Golf Course Road	10%	0%
Proposed Development Access & Golf Course Road	60%	30%

The forecast turning movement volumes from the proposed development is shown on Figure A6 (Appendix A).

4.3 Forecast Total Traffic

The development traffic is added to the background traffic plus growth in background traffic to obtain the forecast total turning movement volumes. The forecast total traffic volumes (weekday a.m. and p.m. peak hours) are summarized on Figures A7 and A8, for horizon years 2023 and 2028, respectively.

5.0 Traffic Impact Analysis

5.1 Analysis Criteria and Approach

The traffic operations at the subject intersections have been assessed based on the following criteria:

- Turning lane requirements based on MTO warrant nomographs and criteria (Geometric Design Standards for Ontario Highways).
- Level of Service (LOS, delay) and volume-to-capacity (v/c) ratio for intersections with collector roads, or for specific movements at these intersections. The LOS is based on criteria in the Highway Capacity Manual, analyzed using Synchro software.
- Geometric constraints (sight distances, intersection spacing, etc.).
- Golf Course Road Considerations.

5.2 Left-Turn Lane Warrants for Collector Road Intersections

The warrants for left-turn lanes, at the unsignalized intersections of local/collector roads, have been assessed based on MTO nomographs. The analysis is based on design speeds of 20 km/h over the posted speeds. The results of the left-turn lane warrant analysis is summarized below in Tables 5.1 and 5.2.

Table 5.1 – Left-Turn Lane Warrants for Golf Course Road & Marlwood Avenue Unsignalized Intersection

Left Turn Storage Lane Warrants		
Location: Golf Course Road & Marlwood Avenue		
Design Speed = 70 km/h		Time Period = 2028 Total Traffic
Approach Direction	Southbound	
Peak Hours	Morning	Afternoon
Advancing Traffic	154	314
Opposing Traffic	183	357
Left Turning Traffic	17	14
Percentage of Left Turning Traffic	11.0%	4.5%
Figure Used (MTO Geometric Design Standards for Ontario Highways)	EA-10	EA-10
Storage Length Required	**0 meters**	**0 meters**

Table 5.2 – Left-Turn Lane Warrants for Golf Course Road & Proposed Development Access Unsignalized Intersection

Left Turn Storage Lane Warrants		
Location: Golf Course Road & Proposed Development Access		
Design Speed = 70 km/h		Time Period = 2028 Total Traffic
Approach Direction	Southbound	
Peak Hours	Morning	Afternoon
Advancing Traffic	138	301
Opposing Traffic	164	358
Left Turning Traffic	8	28
Percentage of Left Turning Traffic	5.8%	9.3%
Figure Used (MTO Geometric Design Standards for Ontario Highways)	EA-10	EA-10
Storage Length Required	**0 meters**	**0 meters**

Based on the analysis, it is concluded that left-turn lanes are not required on Golf Course Road in the study area through horizon year 2028.

5.3 Right-Turn Lane Requirements

MTO guidelines (Geometric Design Standards for Ontario Highways) note that right-turn lanes or tapers may be considered, where right-turn volumes exceed 60 vph and where right-turning vehicles create a hazard or reduce capacity at the intersection.

The forecast right-turn movements at the intersections on Golf Course Road (turning right into the proposed development access and Marlwood Avenue), for the peak hour with the higher right-turning volume (worst case), are summarized in the following table:

Table 5.3 – Forecast of Right Turn Traffic Volumes (Peak Hour)

Intersection	Traffic	2016 (vph)	2023 (vph)	2028 (vph)
Golf Course Road & Marlwood Avenue	Total	6	2	2
Golf Course Road & Proposed Development Access	Total		17	17

As shown in the above table, neither existing nor forecast right-turn movements for any of the horizon years exceed 60 vph. Therefore, none of the intersections in the study area warrant consideration for right-turn lanes or tapers based on volume criteria.

5.4 Operational Level of Service

The intersections within the study area have been analyzed using Synchro software, which uses methodologies based on the Highway Capacity Manual. The Level of Service (LOS) and volume-to-capacity (v/c) ratio were determined for the egress movements from local roads onto the collector road (unsignalized intersections). The Level of Service (LOS) is a measure qualifying the amount of delay experienced by motorists. The delays associated with various Level of Service (LOS) are summarized in the following table:

Table 5.4 – Level of Service Criteria

Level of Service	Unsignalized Intersection Average Total Delay (seconds/vehicle)
A	0-10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

It is desirable that turning movements operate at Level of Service (LOS) E, or better, and within their capacity.

The Synchro analyses for the subject intersections are included in Appendix B (background traffic conditions) and Appendix C (total traffic conditions), and the results are summarized in the following table.

Table 5.5 – Intersection Operations

Intersection	Year	Traffic	Movement	Level of Service (volume/capacity)	
				a.m. Peak Hour	p.m. Peak Hour
Golf Course Road & Marlwood Avenue	2016	Existing	WB Left / Right	A (0.02)	A (0.04)
	2023	Background	WB Left / Right	A (0.01)	B (0.04)
	2028	Background	WB Left / Right	A (0.01)	B (0.04)
	2023	Total	WB Left / Right	A (0.02)	B (0.04)
	2028	Total	WB Left / Right	A (0.02)	B (0.05)
Golf Course Road & Proposed Development Access	2023	Background	WB Left / Right	A (<0.01)	B (<0.01)
	2028	Background	WB Left / Right	B (<0.01)	B (<0.01)
	2023	Total	WB Left / Right	A (0.05)	B (0.05)
	2028	Total	WB Left / Right	A (0.06)	B (0.05)

The above table shows that the Marlwood Avenue and Proposed Development Access intersections on Golf Course Road are forecast to operate excellently through horizon year 2028 and that the addition of traffic from the development will only have a minimal effect on these operations.

5.5 Geometric Considerations

Golf Course Road is a two lane collector road running north/south through the Town of Wasaga Beach. The section of Golf Course Road studied is relatively flat, however the Proposed Development Access is located between two horizontal curves on Golf Course Road (one to the north and one to the south). Since the exact location of the Proposed Development Access has not yet been determined, this TIS will determine the location of the Access on Golf Course Road that will meet all sight distance requirements. Golf Course Road has a speed of 50 km/h throughout the area studied; therefore all geometric considerations will be based on a design speed of 70 km/h.

The minimum stopping sight distance required along the area of Golf Course Road studied is 110 metres. This requirement is based on the Ministry of Transportation Ontario (MTO) criteria (*Geometric Design Standards for Ontario Highways*). The Proposed Development Access/Golf Course Road intersection requires a safe turning sight distance of approximately 160 metres based on MTO criteria. The preliminary location for the new Proposed Development Access/Golf Course Road intersection provides a sight distance of about 190 metres to the south and 310 metres to the north, which meets the sight distance requirements. This location results in about 47 lots being located on a cul-de-sac that has a length of about 425 metres. The Engineering Standards for the Town of Wasaga Beach do not prescribe the maximum number of units or maximum length of road for cul-de-sacs. However the proposed 47 lots is only slightly higher than typical cul-de-sac standards in other municipalities (i.e., 40 lots is

typical before an emergency access is required. While it is possible to shift the access slightly to south, while still maintaining the required turning sight distance, the benefit to be derived would need to be considered against the reduction in sight distance to determine if this is preferred.

The *Town of Wasaga Beach Engineering Standards* (Town of Wasaga Beach, 2015) specifies that intersections provide a minimum sight distance triangle of 4 metres along the local right-of-way, and 10 metres along the collector right-of-way. Based on the existing conditions along the section of Golf Course Road studied, it is recommended that the vegetation along Golf Course Road be cleared at the Proposed Development Access intersection to meet the sight triangle specified in the Town's Standards, as well as to maintain the required sight distances noted above.

5.6 Golf Course Road Considerations

According to the Town's *Road Needs Study* (C.C. Tatham & Associates Limited, 2013), Golf Course Road currently has an asphalt surface with a width of 7.0 metres, with 1.5 metres gravel shoulders on each side. The *Road Needs Study* also forecasts the annual average daily traffic (AADT) on this road to be 4,975 vehicles per day (vpd) by 2022, with the capacity of this collector road being 12,000 vpd. Applying the 4.0% annual growth rate used for background traffic forecasts to the 2022 AADT volume, a 2028 AADT volume of approximately 6,295 vpd is forecasted. Based on the trip generation forecast in this TIS, it is estimated that the AADT on Golf Course Road may increase by about 495 vpd due to the proposed Masters Lane development as well as the additional proposed 10 units on Golf Course Road (immediately north of Marlwood Avenue). Therefore, the AADT on Golf Course Road is forecasted to be 6,790 vpd, which equates to about 57% of its capacity under total traffic conditions in 2028. It is concluded that no improvements are required on Golf Course Road to accommodate the increased traffic volumes from the proposed development.

6.0 Alternate Travel Modes

6.1 Pedestrian and Cyclist Road Considerations

There are currently no sidewalks on the section of Golf Course Road being studied. In the existing subdivision, there are no sidewalks on Marlwood Avenue or Masters Lane. It is assumed that Masters Lane, upon its extension to accommodate the proposed development, will have the same urban road cross section (i.e., mountable curb) as the existing internal subdivision roads and thus will not include any sidewalks. The low traffic volumes, low speeds and low pedestrian volumes do not warrant sidewalk facilities on these local roads.

There is a partially paved shoulder on the west side of Golf Course Road throughout the study area that may accommodate bicycle travel. This partially paved shoulder extends from River Road West to Klondike Park Road. The internal local roads of the development provide sufficient width to accommodate shared vehicular/bicycle traffic, considering the low speeds and low traffic volumes.

The *Active Transportation Plan for the Town of Wasaga Beach* (Meridian Planning Consultants, August 2008) has identified that the Wasaga Beach Provincial Park, which is located within the open space under tree cover west of Golf Course Road in the study area, contains several existing ski trails.

There is a proposed community trail that will run along the south, east, and north sides of Marl Lake approximately 650 metres east of the proposed development. The trail is proposed to connect Ryther Road south of the proposed development to Bells Park Road north of the proposed development.

There are no other existing or proposed pedestrian/cyclist connections in the study area.

6.2 Transit Considerations

The Town of Wasaga Beach operates conventional transit services. There are currently two bus routes operating in the Town. Both routes operate Monday to Saturday from 7:00 a.m. to 9:00 p.m., and on Sunday from 7:00 a.m. to 7:00 p.m. Wasaga Beach transit also links with Collingwood transit on a continuous loop.

It should be noted that Route 2 has an existing bus stop located at Wasaga Stars Arena approximately 1.9 kilometres northeast of the proposed development. This is the closest bus stop to the proposed development. The bus service area typically assumes a preferred 400 metre maximum walking distance to bus stops, and therefore the subject lands do not fall within this service area. The Town of Wasaga Beach may want to consider extending the existing route to better service the proposed development, as well as the many other residential subdivisions on Golf Course Road.

7.0 Conclusions and Recommendations

This Traffic Impact Study has reviewed the traffic impacts of developing a residential development in the Town of Wasaga Beach. Impacts have been assessed at the Marlwood Avenue and Proposed Development Access intersections on Golf Course Road, as well as along these roads. Traffic impacts have been assessed for horizon years 2023 and 2028. Forecasted traffic volumes have also included growth in background traffic in this area.

Based on the analysis completed, the following primary conclusions and recommendations are made in this study:

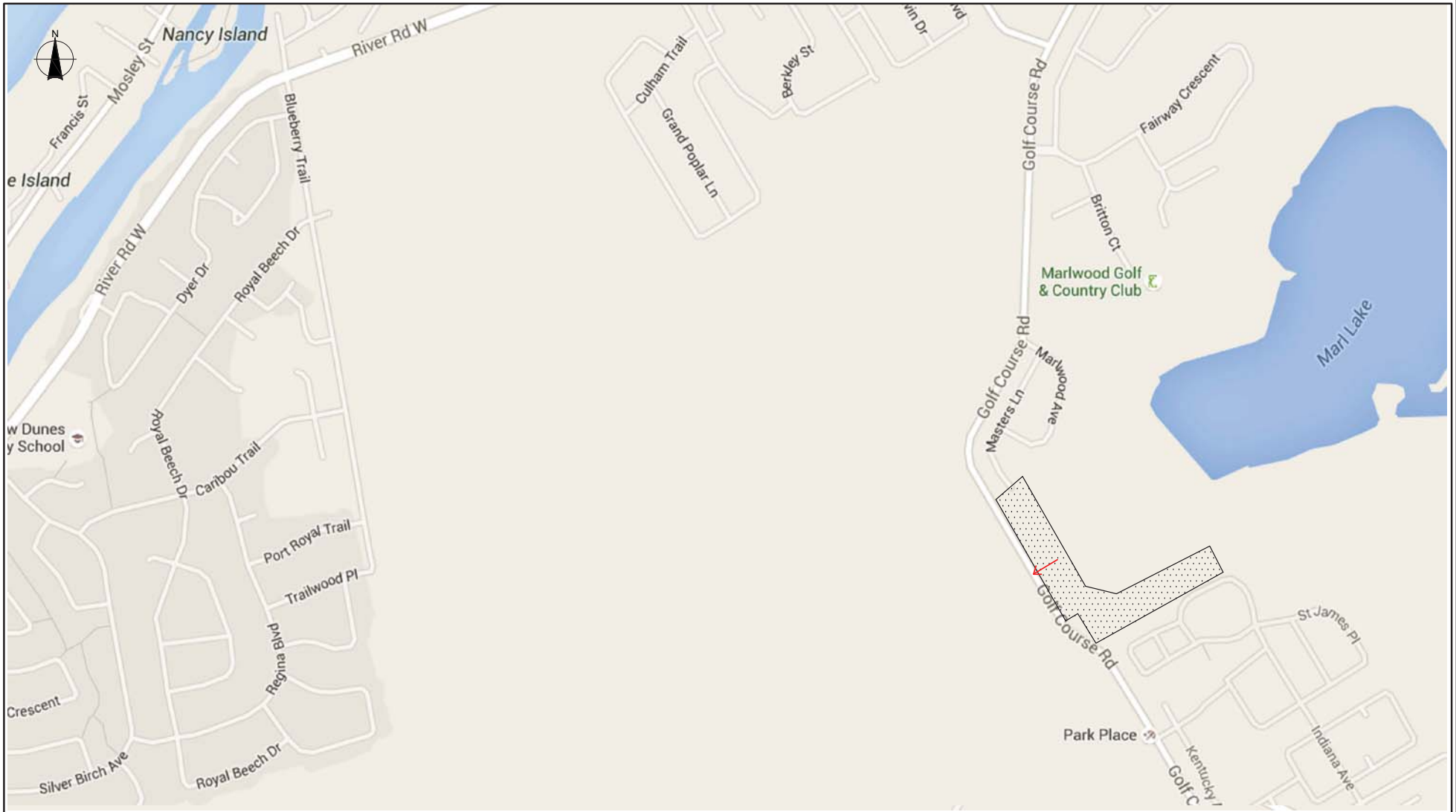
- The proposed development is forecast to generate about 56 vehicles per hour (vph) in the a.m. peak hour and 73 vph in the p.m. peak hour.
- The intersections of Golf Course Road/Marlwood Avenue and Golf Course Road/Proposed Development Access are forecast to operate with excellent Level of Service (LOS) and short delays through horizon year 2028. Therefore, no operational improvements are required to accommodate the proposed development.
- Left-turn lanes are not warranted at the intersections in the study area through horizon year 2028.
- Right-turn lanes are not warranted at the intersections in the study area through horizon year 2028.
- The location of the Proposed Development Access/Golf Course Road intersection meets the requirements for stopping sight distance and turning sight distance. The location results in 47 lots being located on the 425 metre cul-de-sac, which is slightly higher than typically preferred without a secondary emergency access. There is potential to shift the access location a short distance to the south (i.e., about 30 metres), which would reduce the number of lots on the cul-de-sac by two, while maintaining the required sight distance. Any benefit from such a modification should be considered against the reduction in sight distance that would result.
- It is recommended that the vegetation along Golf Course Road be cleared at the Proposed Development Access location in order to meet the sight triangle specified in the *Town of Wasaga Beach Engineering Standards* (Town of Wasaga Beach, 2015), which is 4 metres along the local right-of-way and 10 metres along the collector road right-of-way, as well as to maintain the required turning sight distances.
- Golf Course Road is forecast to operate at about 57% of its capacity, based on its AADT, through horizon year 2028.
- The Town may consider an extension of the existing transit ‘Route 2’ to provide better service to the proposed development, as well as to the existing residential subdivisions on Golf Course Road.

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix A

Figures



LEGEND

- DEVELOPMENT SITE
- APPROXIMATE PROPOSED DEVELOPMENT ACCESS LOCATION

BURNSIDE

Client

TPC MARLWOOD INC.

Figure Title

MARLWOOD MASTERS LANE EXTENSION TRAFFIC IMPACT STUDY

SITE LOCATION

Drawn	Checked	Date	Figure No.
CJR	HC	JULY 2016	**A1**
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NTS		300037815.1000	

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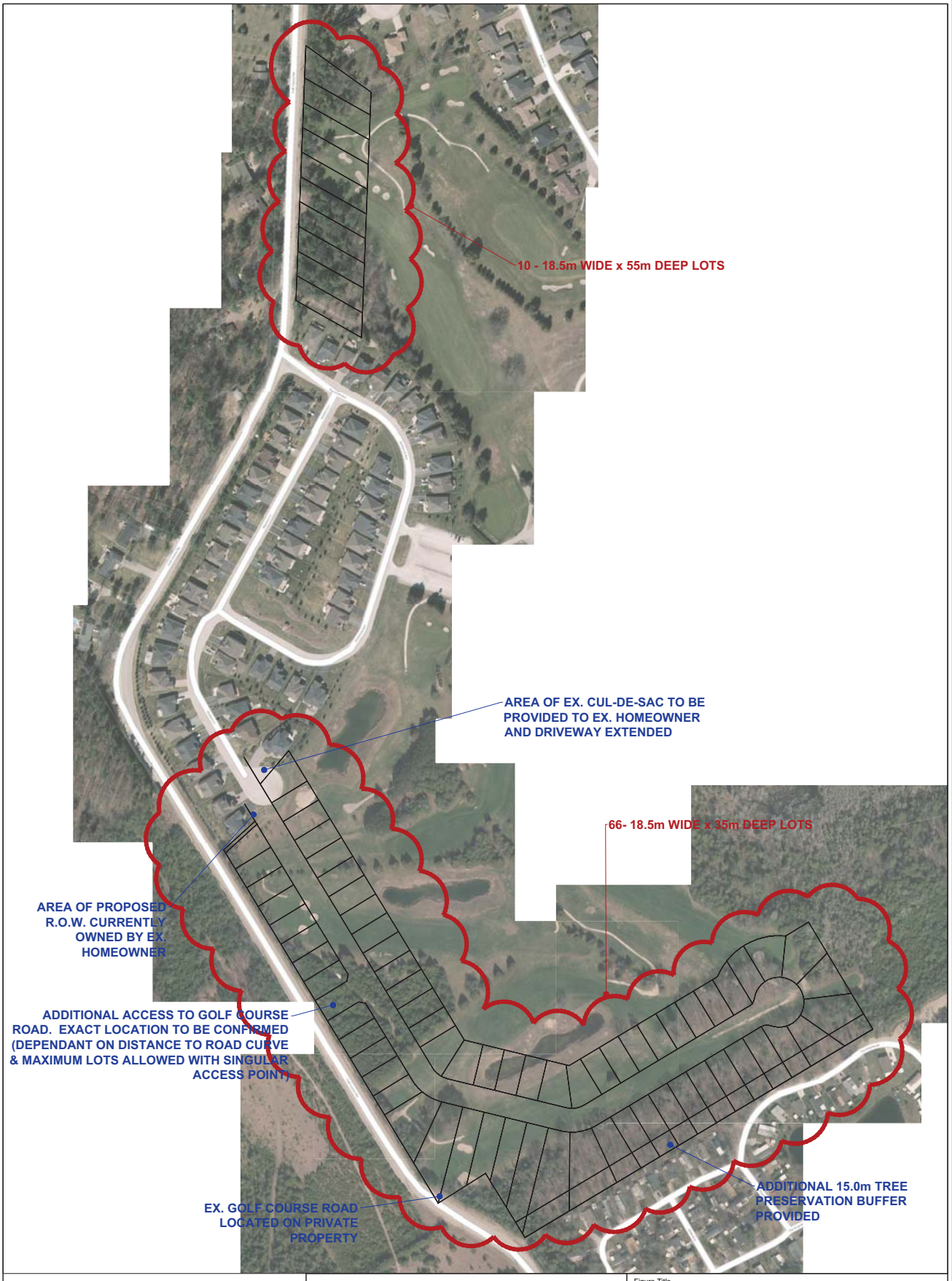

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0 60 120 180 240

Metres

BURNSIDE

Figure Title

MARLWOOD

POTENTIAL LOTTING LAYOUT

Client

LOFT PLANNING

Drawn	Checked	Date	Figure No.
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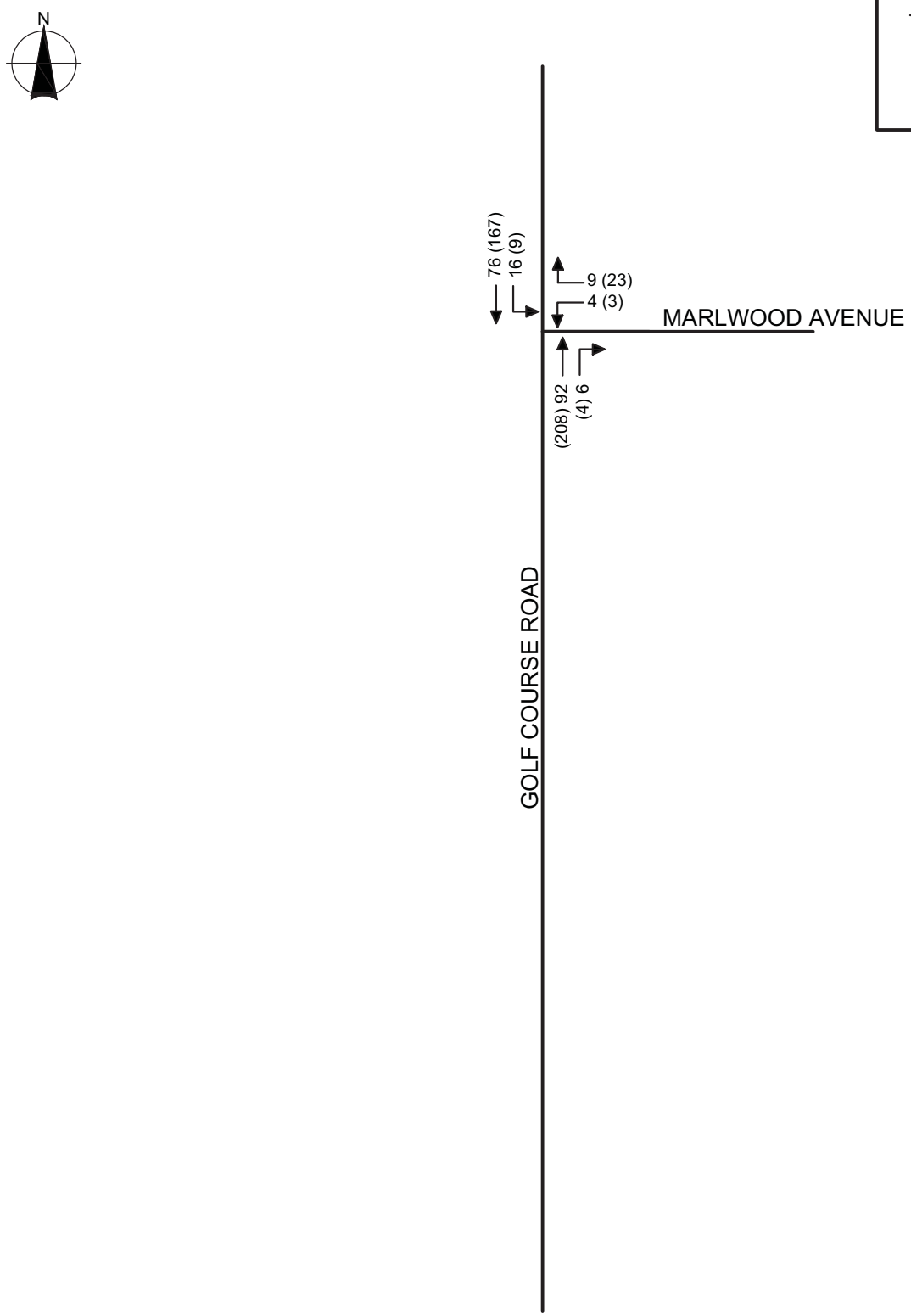

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Figure Title

MARLWOOD MASTERS LANE EXTENSION
TRAFFIC IMPACT STUDY

EXISTING TRAFFIC (2016)

Client

TPC MARLWOOD INC.

Drawn	Checked	Date	Figure No.
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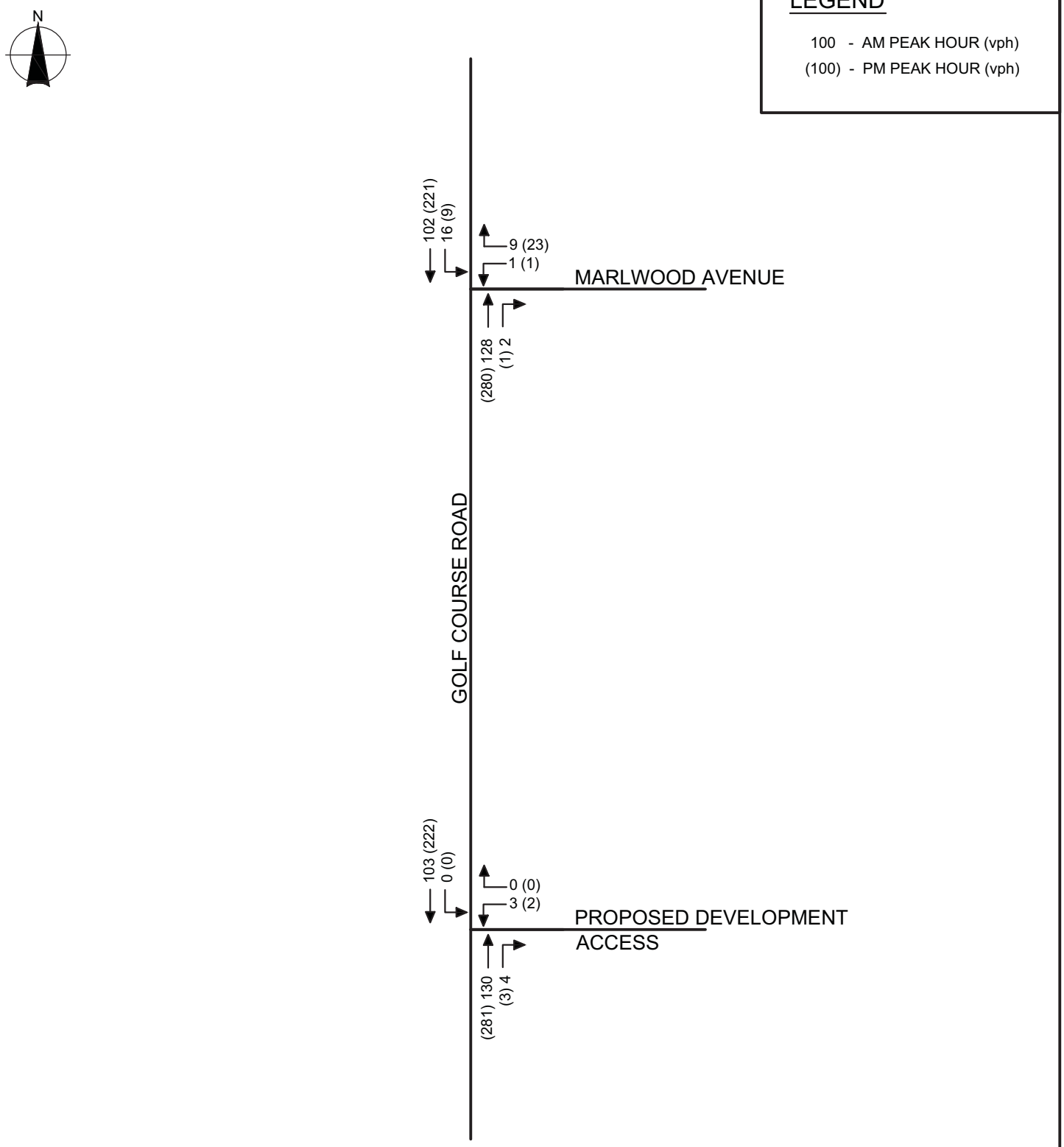


BURNSIDE

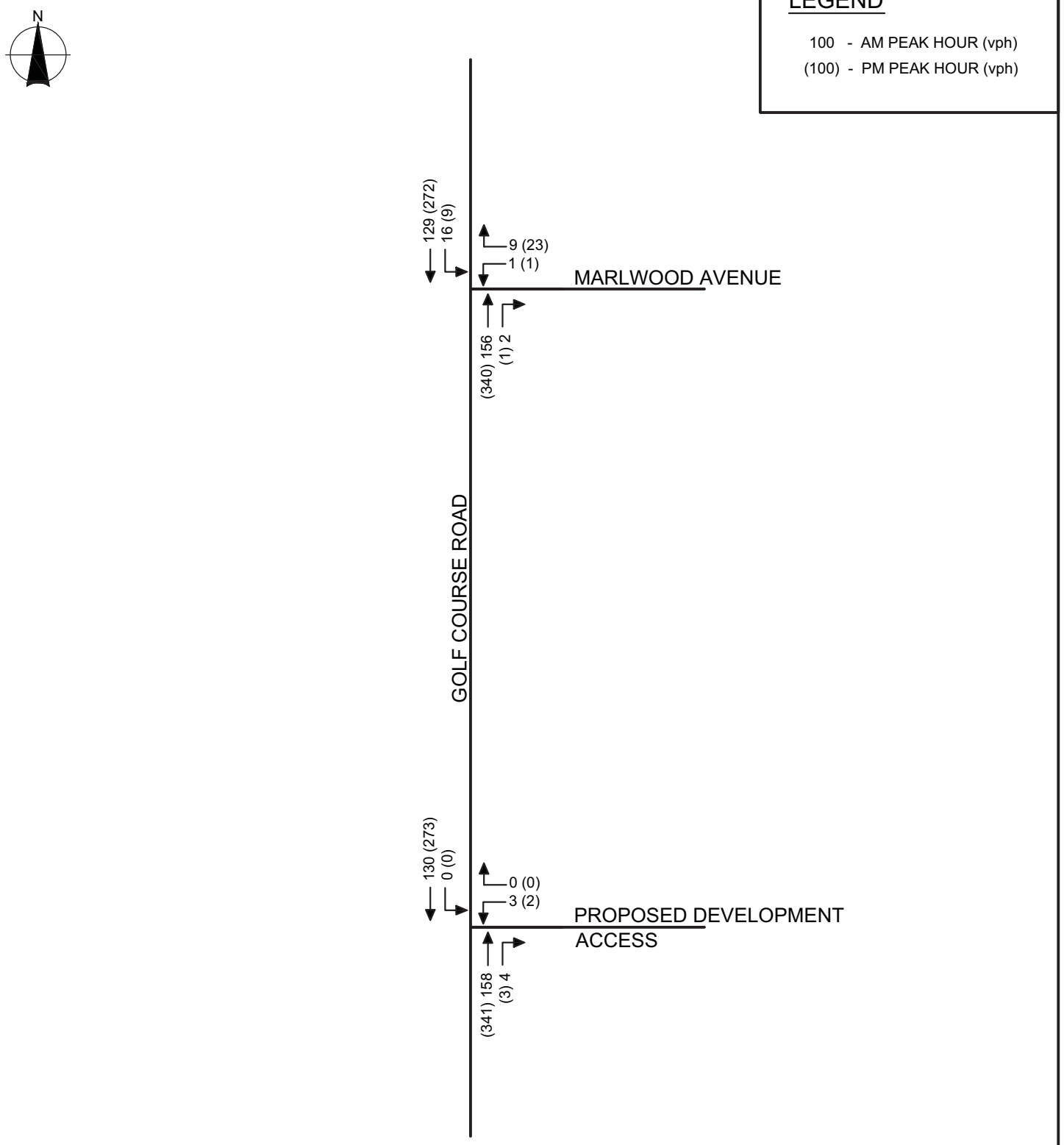
Figure Title

MARLWOOD MASTERS LANE EXTENSION TRAFFIC IMPACT STUDY

BACKGROUND TRAFFIC (2023)

Client	Drawn	Checked	Date	Figure No.
TPC MARLWOOD INC.	CJR	HC	JULY 2016	**A4**
	Scale: NTS		Project No.: 300037815.1000	

File Name: 037815_TIS_FIGURES.dwg Date Plotted: August 3, 2016 - 12:07 PM



BURNSIDE

Figure Title

MARLWOOD MASTERS LANE EXTENSION TRAFFIC IMPACT STUDY

BACKGROUND TRAFFIC (2028)

Client	Drawn	Checked	Date	Figure No.
TPC MARLWOOD INC.	CJR	HC	JULY 2016	**A5**
	Scale: NTS		Project No.: 300037815.1000	

File Name: 037815_TIS_FIGURES.dwg Date Plotted: August 3, 2016 - 12:07 PM

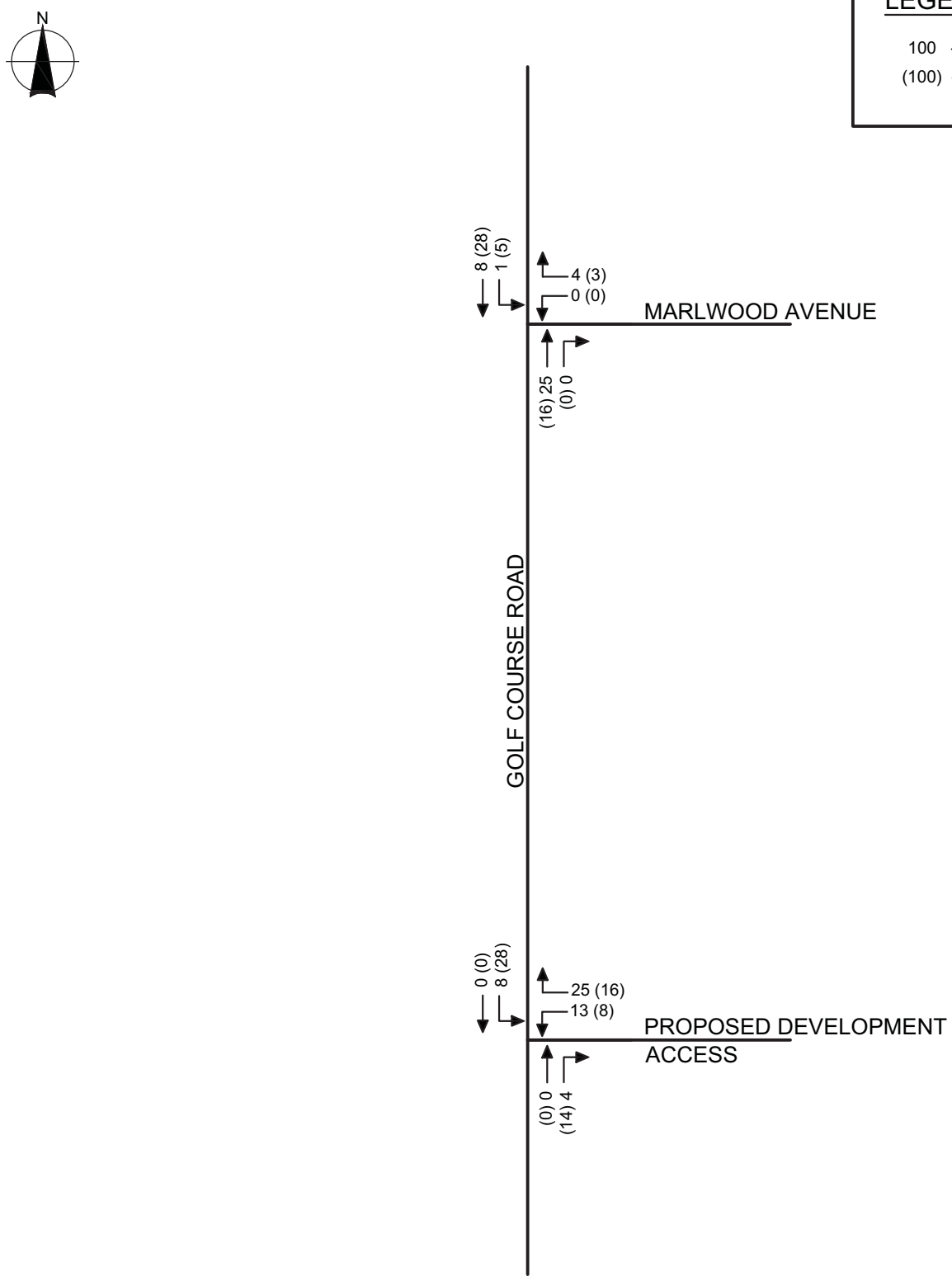


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Figure Title

MARLWOOD MASTERS LANE EXTENSION TRAFFIC IMPACT STUDY

DEVELOPMENT TRAFFIC

Client	Drawn	Checked	Date	Figure No.
TPC MARLWOOD INC.	CJR	HC	JULY 2016	**A6**
	Scale		Project No.	
	NTS		300037815.1000	

File Name: 037815_TIS_FIGURES.dwg Date Plotted: August 3, 2016 - 12:07 PM

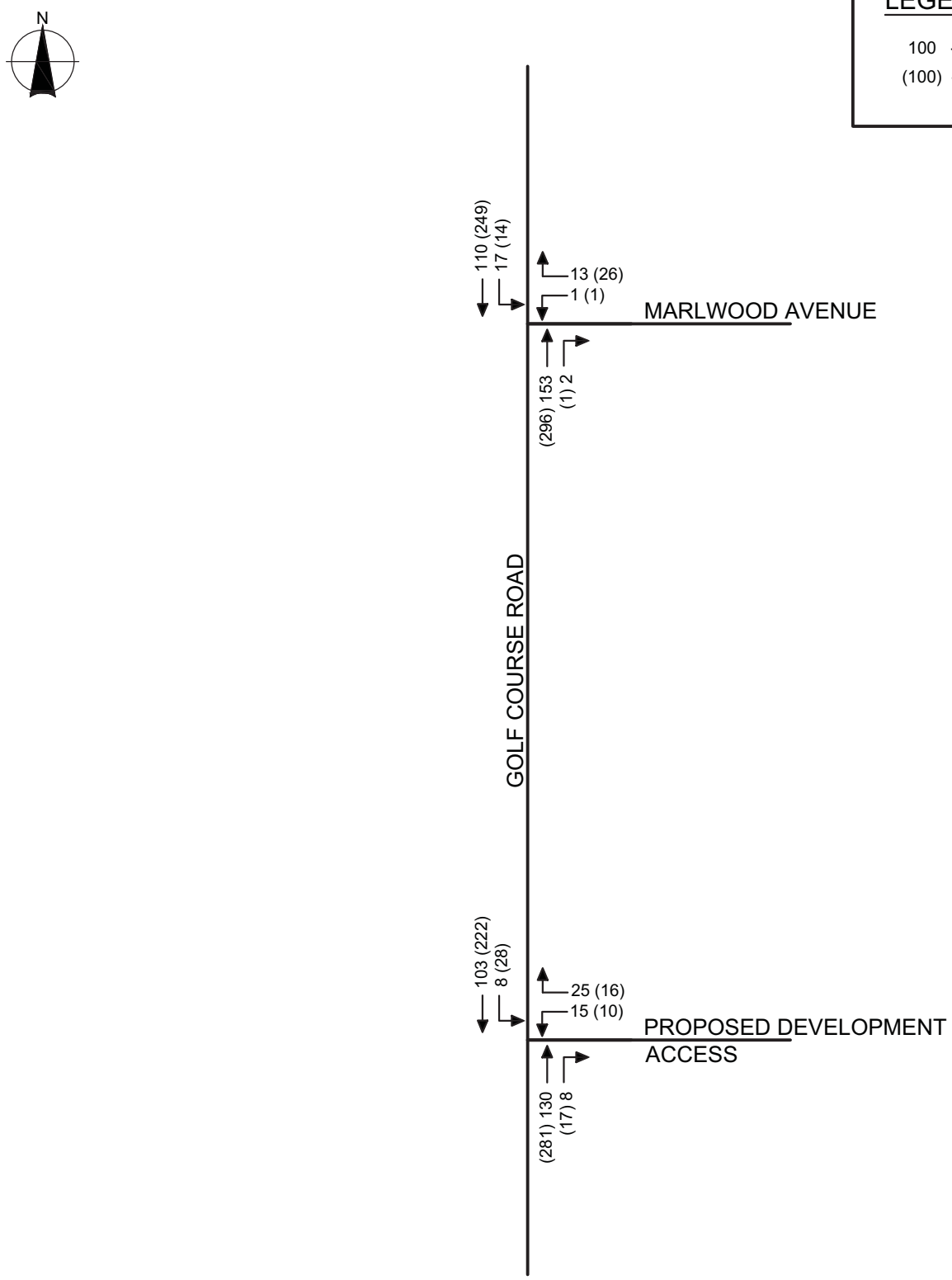

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Figure Title

MARLWOOD MASTERS LANE EXTENSION
TRAFFIC IMPACT STUDY

TOTAL TRAFFIC (2023)

Client	Drawn	Checked	Date	Figure No.
TPC MARLWOOD INC.	CJR	HC	JULY 2016	**A7**
	Scale		Project No.	
	NTS		300037815.1000	

File Name: 037815_TIS_FIGURES.dwg Date Plotted: August 3, 2016 - 12:07 PM

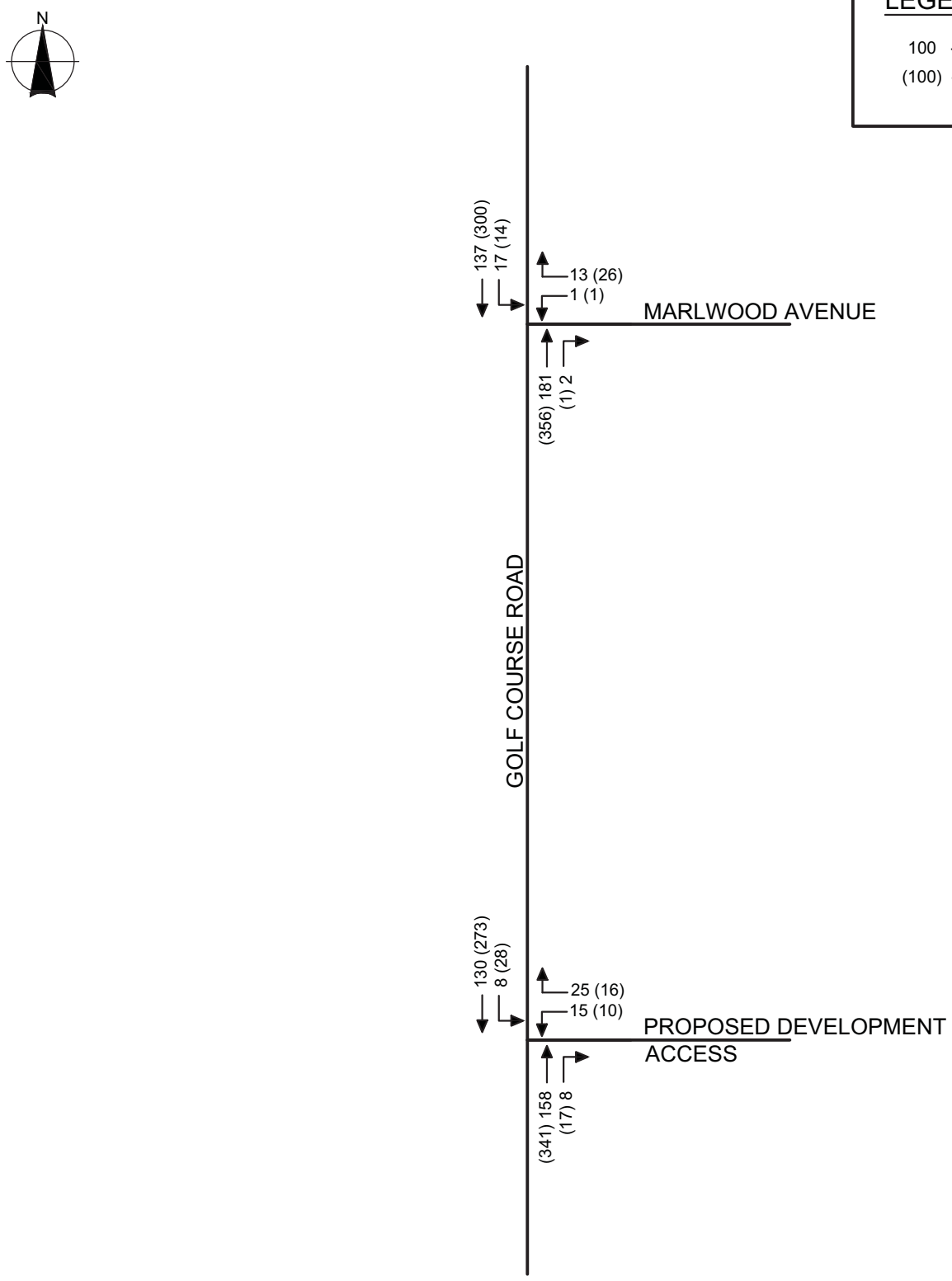

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Figure Title

MARLWOOD MASTERS LANE EXTENSION TRAFFIC IMPACT STUDY

TOTAL TRAFFIC (2028)

Client	Drawn	Checked	Date	Figure No.
TPC MARLWOOD INC.	CJR	HC	JULY 2016	**A8**
	Scale		Project No.	
	NTS		300037815.1000	

File Name: 037815_TIS_FIGURES.dwg Date Plotted: August 3, 2016 - 12:07 PM

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Appendix B

Traffic Operations, Background Traffic (Synchro)

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	92	6	16	76	4	9
Future Volume (Veh/h)	92	6	16	76	4	9
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	100	7	17	83	4	10
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			107		220	104
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			107		220	104
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		99	99
cM capacity (veh/h)			1484		759	951

Direction, Lane #	NB 1	SB 1	NW 1
Volume Total	107	100	14
Volume Left	0	17	4
Volume Right	7	0	10
cSH	1700	1484	887
Volume to Capacity	0.06	0.01	0.02
Queue Length 95th (m)	0.0	0.3	0.4
Control Delay (s)	0.0	1.3	9.1
Lane LOS		A	A
Approach Delay (s)	0.0	1.3	9.1
Approach LOS			A

Intersection Summary			
Average Delay		1.2	
Intersection Capacity Utilization		21.6%	ICU Level of Service
Analysis Period (min)		15	

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	208	4	9	167	3	23
Future Volume (Veh/h)	208	4	9	167	3	23
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	226	4	10	182	3	25
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			230		430	228
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			230		430	228
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		99	97
cM capacity (veh/h)			1338		578	811

Direction, Lane #	NB 1	SB 1	NW 1
Volume Total	230	192	28
Volume Left	0	10	3
Volume Right	4	0	25
cSH	1700	1338	778
Volume to Capacity	0.14	0.01	0.04
Queue Length 95th (m)	0.0	0.2	0.9
Control Delay (s)	0.0	0.5	9.8
Lane LOS		A	A
Approach Delay (s)	0.0	0.5	9.8
Approach LOS			A

Intersection Summary			
Average Delay		0.8	
Intersection Capacity Utilization		26.1%	ICU Level of Service A
Analysis Period (min)		15	

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	128	2	16	102	1	9
Future Volume (Veh/h)	128	2	16	102	1	9
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	139	2	17	111	1	10
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			141		285	140
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			141		285	140
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	99
cM capacity (veh/h)			1442		697	908

Direction, Lane #	NB 1	SB 1	NW 1
Volume Total	141	128	11
Volume Left	0	17	1
Volume Right	2	0	10
cSH	1700	1442	884
Volume to Capacity	0.08	0.01	0.01
Queue Length 95th (m)	0.0	0.3	0.3
Control Delay (s)	0.0	1.1	9.1
Lane LOS		A	A
Approach Delay (s)	0.0	1.1	9.1
Approach LOS			A

Intersection Summary			
Average Delay		0.9	
Intersection Capacity Utilization		26.4%	ICU Level of Service
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	0	130	4	0	103
Future Volume (Veh/h)	3	0	130	4	0	103
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	141	4	0	112
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	255	143			145	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	255	143			145	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	734	905			1437	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	3	145	112
Volume Left	3	0	0
Volume Right	0	4	0
cSH	734	1700	1437
Volume to Capacity	0.00	0.09	0.00
Queue Length 95th (m)	0.1	0.0	0.0
Control Delay (s)	9.9	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.9	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay		0.1	
Intersection Capacity Utilization		17.1%	ICU Level of Service
Analysis Period (min)		15	

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	280	1	9	221	1	23
Future Volume (Veh/h)	280	1	9	221	1	23
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	304	1	10	240	1	25
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			305		564	304
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			305		564	304
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	97
cM capacity (veh/h)			1256		483	735

Direction, Lane #	NB 1	SB 1	NW 1
Volume Total	305	250	26
Volume Left	0	10	1
Volume Right	1	0	25
cSH	1700	1256	721
Volume to Capacity	0.18	0.01	0.04
Queue Length 95th (m)	0.0	0.2	0.9
Control Delay (s)	0.0	0.4	10.2
Lane LOS		A	B
Approach Delay (s)	0.0	0.4	10.2
Approach LOS			B

Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization		28.9%	ICU Level of Service
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	0	281	3	0	222
Future Volume (Veh/h)	2	0	281	3	0	222
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	0	305	3	0	241
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	548	306			308	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	548	306			308	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	498	733			1253	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	2	308	241
Volume Left	2	0	0
Volume Right	0	3	0
cSH	498	1700	1253
Volume to Capacity	0.00	0.18	0.00
Queue Length 95th (m)	0.1	0.0	0.0
Control Delay (s)	12.3	0.0	0.0
Lane LOS	B		
Approach Delay (s)	12.3	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	25.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	156	2	16	129	1	9
Future Volume (Veh/h)	156	2	16	129	1	9
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	170	2	17	140	1	10
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			172		345	171
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			172		345	171
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	99
cM capacity (veh/h)			1405		644	873

Direction, Lane #	NB 1	SB 1	NW 1
Volume Total	172	157	11
Volume Left	0	17	1
Volume Right	2	0	10
cSH	1700	1405	845
Volume to Capacity	0.10	0.01	0.01
Queue Length 95th (m)	0.0	0.3	0.3
Control Delay (s)	0.0	0.9	9.3
Lane LOS		A	A
Approach Delay (s)	0.0	0.9	9.3
Approach LOS			A

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		29.3%	ICU Level of Service
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	0	158	4	0	130
Future Volume (Veh/h)	3	0	158	4	0	130
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	172	4	0	141
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	315	174			176	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	315	174			176	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	678	869			1400	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	3	176	141
Volume Left	3	0	0
Volume Right	0	4	0
cSH	678	1700	1400
Volume to Capacity	0.00	0.10	0.00
Queue Length 95th (m)	0.1	0.0	0.0
Control Delay (s)	10.3	0.0	0.0
Lane LOS	B		
Approach Delay (s)	10.3	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay		0.1	
Intersection Capacity Utilization		18.6%	ICU Level of Service A
Analysis Period (min)		15	

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	340	1	9	272	1	23
Future Volume (Veh/h)	340	1	9	272	1	23
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	370	1	10	296	1	25
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			371		686	370
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			371		686	370
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	96
cM capacity (veh/h)			1188		409	675

Direction, Lane #	NB 1	SB 1	NW 1
Volume Total	371	306	26
Volume Left	0	10	1
Volume Right	1	0	25
cSH	1700	1188	659
Volume to Capacity	0.22	0.01	0.04
Queue Length 95th (m)	0.0	0.2	0.9
Control Delay (s)	0.0	0.3	10.7
Lane LOS		A	B
Approach Delay (s)	0.0	0.3	10.7
Approach LOS			B

Intersection Summary			
Average Delay		0.5	
Intersection Capacity Utilization		31.6%	ICU Level of Service
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	0	341	3	0	273
Future Volume (Veh/h)	2	0	341	3	0	273
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	0	371	3	0	297
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	670	372			374	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	670	372			374	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	423	673			1184	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	2	374	297
Volume Left	2	0	0
Volume Right	0	3	0
cSH	423	1700	1184
Volume to Capacity	0.00	0.22	0.00
Queue Length 95th (m)	0.1	0.0	0.0
Control Delay (s)	13.6	0.0	0.0
Lane LOS	B		
Approach Delay (s)	13.6	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	28.1%	ICU Level of Service	A
Analysis Period (min)	15		

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Appendix C

Traffic Operations, Total Traffic (Synchro)

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	153	2	17	110	1	13
Future Volume (Veh/h)	153	2	17	110	1	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	166	2	18	120	1	14
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			168		323	167
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			168		323	167
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	98
cM capacity (veh/h)			1410		662	877

Direction, Lane #	NB 1	SB 1	NW 1
Volume Total	168	138	15
Volume Left	0	18	1
Volume Right	2	0	14
cSH	1700	1410	859
Volume to Capacity	0.10	0.01	0.02
Queue Length 95th (m)	0.0	0.3	0.4
Control Delay (s)	0.0	1.1	9.3
Lane LOS		A	A
Approach Delay (s)	0.0	1.1	9.3
Approach LOS			A

Intersection Summary			
Average Delay		0.9	
Intersection Capacity Utilization		28.2%	ICU Level of Service A
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	15	25	130	8	8	103
Future Volume (Veh/h)	15	25	130	8	8	103
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	27	141	9	9	112
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	276	146			150	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	276	146			150	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	97			99	
cM capacity (veh/h)	710	902			1431	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	43	150	121
Volume Left	16	0	9
Volume Right	27	9	0
cSH	819	1700	1431
Volume to Capacity	0.05	0.09	0.01
Queue Length 95th (m)	1.3	0.0	0.1
Control Delay (s)	9.6	0.0	0.6
Lane LOS	A		A
Approach Delay (s)	9.6	0.0	0.6
Approach LOS	A		

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	22.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	296	1	14	249	1	26
Future Volume (Veh/h)	296	1	14	249	1	26
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	322	1	15	271	1	28
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			323		624	322
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			323		624	322
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	96
cM capacity (veh/h)			1237		444	718

Direction, Lane #	NB 1	SB 1	NW 1
Volume Total	323	286	29
Volume Left	0	15	1
Volume Right	1	0	28
cSH	1700	1237	703
Volume to Capacity	0.19	0.01	0.04
Queue Length 95th (m)	0.0	0.3	1.0
Control Delay (s)	0.0	0.5	10.3
Lane LOS		A	B
Approach Delay (s)	0.0	0.5	10.3
Approach LOS			B

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		34.5%	ICU Level of Service A
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	10	16	281	17	28	222
Future Volume (Veh/h)	10	16	281	17	28	222
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	17	305	18	30	241
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	615	314			323	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	615	314			323	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	98			98	
cM capacity (veh/h)	444	726			1237	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	28	323	271
Volume Left	11	0	30
Volume Right	17	18	0
cSH	581	1700	1237
Volume to Capacity	0.05	0.19	0.02
Queue Length 95th (m)	1.2	0.0	0.6
Control Delay (s)	11.5	0.0	1.1
Lane LOS	B		A
Approach Delay (s)	11.5	0.0	1.1
Approach LOS	B		

Intersection Summary			
Average Delay		1.0	
Intersection Capacity Utilization		42.4%	ICU Level of Service
Analysis Period (min)		15	

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	181	2	17	137	1	13
Future Volume (Veh/h)	181	2	17	137	1	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	197	2	18	149	1	14
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			199		383	198
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			199		383	198
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	98
cM capacity (veh/h)			1373		611	843

Direction, Lane #	NB 1	SB 1	NW 1
Volume Total	199	167	15
Volume Left	0	18	1
Volume Right	2	0	14
cSH	1700	1373	822
Volume to Capacity	0.12	0.01	0.02
Queue Length 95th (m)	0.0	0.3	0.4
Control Delay (s)	0.0	0.9	9.5
Lane LOS		A	A
Approach Delay (s)	0.0	0.9	9.5
Approach LOS			A

Intersection Summary			
Average Delay		0.8	
Intersection Capacity Utilization		31.1%	ICU Level of Service A
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	15	25	158	8	8	130
Future Volume (Veh/h)	15	25	158	8	8	130
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	27	172	9	9	141
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	336	176			181	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	336	176			181	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	97			99	
cM capacity (veh/h)	656	867			1394	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	43	181	150
Volume Left	16	0	9
Volume Right	27	9	0
cSH	774	1700	1394
Volume to Capacity	0.06	0.11	0.01
Queue Length 95th (m)	1.3	0.0	0.1
Control Delay (s)	9.9	0.0	0.5
Lane LOS	A		A
Approach Delay (s)	9.9	0.0	0.5
Approach LOS	A		

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	23.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	356	1	14	300	1	26
Future Volume (Veh/h)	356	1	14	300	1	26
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	387	1	15	326	1	28
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			388		744	388
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			388		744	388
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	96
cM capacity (veh/h)			1170		377	661

Direction, Lane #	NB 1	SB 1	NW 1
Volume Total	388	341	29
Volume Left	0	15	1
Volume Right	1	0	28
cSH	1700	1170	644
Volume to Capacity	0.23	0.01	0.05
Queue Length 95th (m)	0.0	0.3	1.1
Control Delay (s)	0.0	0.5	10.9
Lane LOS		A	B
Approach Delay (s)	0.0	0.5	10.9
Approach LOS			B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	37.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	10	16	341	17	28	273
Future Volume (Veh/h)	10	16	341	17	28	273
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	17	371	18	30	297
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	737	380			389	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	737	380			389	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	97			97	
cM capacity (veh/h)	376	667			1170	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	28	389	327
Volume Left	11	0	30
Volume Right	17	18	0
cSH	511	1700	1170
Volume to Capacity	0.05	0.23	0.03
Queue Length 95th (m)	1.3	0.0	0.6
Control Delay (s)	12.4	0.0	1.0
Lane LOS	B		A
Approach Delay (s)	12.4	0.0	1.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		