Traffic Impact Study

St. Marys Future Solid Waste Disposal Needs Environmental Assessment

Town of St. Marys

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

January 2016
300032339.0000

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Record of Revisions

Revision	Date	Description
0	January 2016	Initial Draft Submission to Town

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Executive Summary

Previous efforts completed for the St. Marys Future Solid Waste Disposal Needs Environmental Assessment have determined that expansion of the St. Marys Landfill is preferred over other waste disposal alternatives. On this basis, Burnside completed this Traffic Impact Study to review how continued landfill use will impact on traffic. The proposed expansion is forecast to generate total two-way traffic (by 2059) of about 74 vehicles per hour (vph) in the a.m. peak hour on Saturdays, 24 vph in the a.m. peak hour on weekdays, and 18 vph in the p.m. peak hour on weekdays. Impacts have been assessed at the Perth Road 123/St. Marys Landfill Access intersection, as well as along Perth Road 123 and Water Street South. Traffic impacts have been assessed for horizon years 2039 and 2059. Forecast 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:

- A left turn lane is not warranted at the Perth Road 123/St. Marys Landfill Access intersection through horizon year 2059.
- A right turn lane or taper is not warranted at the Perth Road 123/St. Marys Landfill Access intersection through the horizon year 2059.
- The stopping sight distances and decision sight distances at the Perth Road 123/St. Marys Landfill Access intersection meets the MTO guidelines and is acceptable.
- The Perth Road 123 / St. Marys Landfill Access intersection is forecast to operate with good Level of Service (LOS) and short delays through the horizon year 2059. Therefore, no operational improvements are required to accommodate the landfill expansion.
- It is forecast that the ultimate traffic demands (year 2059) on Perth Road 123 will be less than 25% of its link capacity. Therefore, no capacity improvements are required to the roads in the study area to accommodate the landfill expansion.

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1.0 Introduction

The Town of St. Marys has retained R.J. Burnside & Associates Limited (Burnside) to undertake an Individual Environmental Assessment (EA) study to identify a solution that addresses the Town's post-diversion municipal solid waste disposal needs. The preliminary preferred solution has been identified as an expansion to the existing landfill site. This Traffic Impact Study (TIS) identifies the transportation impacts associated with the proposed expansion and demonstrates how the subject lands can be serviced with transportation infrastructure to meet this expansion.

1.1 Site Description

The landfill location is shown on Figure A1 (St. Marys Landfill Site Location, Appendix A) and the landfill site plan is shown on Figure A2 (Appendix A), showing the existing facility and the property boundary within which the future expansion is to be accommodated. The Town of St. Marys proposes to expand the existing landfill to accommodate approximately 700,000 to 800,000 cubic metres of landfill volumes over the next 40 years. The site presently has a landfill volume demand of approximately 16,000 cubic metres per year, with the yearly volume forecast to grow to about 26,000 cubic metres by the end of the 40 year horizon.

There is presently one access to the landfill that is located on the east side of Perth Road 123.

To the north and to the east the property is bounded by Extractive Industrial lands (St. Marys Cement plant/operations). A short section of Water Street South also abuts the north part of the site.

To the south the property is bounded by farmland that is located within the adjacent Township of Perth South. The south boundary of the landfill is coincident with the south boundary of the Town.

To the west the property is bounded by Perth Road 123 and Water Street South. A small number of residential estate lots are located along the west side of Perth Road 123 in this area, within the Township of Perth South.

1.2 Background Information

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

- Official Plan of the Town of St. Marys (Town of St. Marys, October 2007).
- Town of St. Marys 2011 Development Charge Background Study (Watson & Associates, December 2011).
- Proposed Terms of Reference, St. Marys Future Solid Waste Disposal Needs Environmental Assessment (Amended), dated December 2013.

- St. Marys Engineering Design Guidelines and Supplemental Specifications for Municipal Services – draft (Town of St. Marys, March 2013).
- Town of St. Marys Road Assessment Study Asset Management Plan (R.J. Burnside & Associates Limited, October 2014).
- County of Perth Official Plan (County of Perth, consolidated April, 2015).
- Public Information Centre (PIC) #1, Summary Report – St. Marys Future Solid Waste Disposal Needs Environmental Assessment (Burnside & Associates, October 2015).

2.0 Existing Conditions

2.1 Landfill Site Operations

The existing landfill property has an area of approximately 37 hectares, of which approximately 8 hectares are currently approved as a fill area (see Figure A2, Appendix A).

The existing landfill site has the following operations:

- Monday, Thursday, Sunday Closed
- Tuesday, Wednesday, Friday 8:00 a.m. to 4:30 p.m.
- Saturday 8:00 a.m. to 12:30 p.m.

The Bluewater Recycling Association provides curbside waste collection weekly on Tuesday and Friday, and recycling biweekly on the same days. Approximately half of the (mainly) residential waste and recycling is collected on each of the two collection days. For the purposes of this TIS it is assumed that this collection schedule will continue to apply throughout the life of the expanded landfill. While it is possible that the Town will decide to reduce the number of days that the landfill will be open, compressing the traffic over a short timeframe will not likely have a significant impact on the traffic operations, given the relatively low traffic generated at the site during the peak periods.

Waste and recyclables are also delivered to the landfill by private haulers and some residents during all operating days. The recyclable waste that is brought to the site is removed periodically by trucks (typically roll-off trucks). Recyclables that are collected at curbside (by BRA) are delivered elsewhere.

2.2 Site Area Road Network

The study area includes the transportation facilities linking the landfill to the adjacent arterial roads. The following intersection is included in this study:

- Perth Road 123/St. Marys Landfill Access.

The landfill access operates under stop control at its intersection with Perth Road 123.

The terms of reference (TOR) for the overall Environmental Assessment for the landfill site expansion listed roads within the broader study area including Perth Road 123, Water Street South, Third Line Road, Fifth Line Road and Thomas Street. Perth Road 123 and Water Street are the arterial roads that provide the primary access to the landfill site (i.e., the primary haul route for waste). The relatively small volume of traffic generated from the landfill site expansion will have a minimal impact on the other roads listed in the TOR and therefore no further consideration is made to impacts on those other roads in this TIS.

Perth Road 123 is a two lane arterial road under the jurisdiction of the County of Perth. It has a posted speed of 80 km/h in the area of the landfill access.

Perth Road 123 becomes Water Street, a road under the jurisdiction of the Town of St. Marys, at a location about 470 m to the north of the landfill access. Water Street has a posted speed of 50 km/h.

St. Marys Landfill Access is a gravel driveway, located on the east side of Perth Road 123. The landfill site access is stop-sign controlled and forms a T-intersection with Perth Road 123.

The existing traffic controls and lane configurations at the Perth Road 123 and St. Marys Landfill Access intersection are shown on Figure A3 (Appendix A).

2.3 Other Developments and Proposed Road Improvements

There are no new developments or planned road improvements in the study area that may impact traffic on Perth Road 123. Traffic from developments proposed in the broader area of St. Marys are accounted for in the overall background growth rate assumed, as discussed in a subsequent section of this report.

3.0 Background Traffic Forecasts

3.1 Study Horizon Periods

Considering the scope of the proposed landfill expansion, the following study horizons (cumulatively) are considered appropriate for consideration of traffic impacts:

- Horizon year 2015 – Existing Traffic Conditions
  - Existing background conditions.

- Horizon year 2019 – Total Traffic Conditions (landfill expansion opening in 2019)
  - Addition of background growth
  - Addition of partial development of the landfill (growth of landfill site traffic to 2019).

- Horizon year 2039 – Total Traffic Conditions - Twenty Year Horizon (i.e., 20 years after landfill expansion opening)
  - Addition of background traffic growth
  - Addition of partial development of the landfill (growth of landfill site traffic to 2039).

- Horizon year 2059 – Total Traffic Conditions - Forty Year Horizon (i.e., 40 years after landfill expansion opening)
  - Addition of background traffic growth
  - Addition of full development of the landfill (growth of landfill site traffic to 2059).

3.2 Road Connections and Phasing of Development

For the purpose of this study it has been assumed that the proposed expanded landfill will be operational by 2019. It will continue to generate more traffic as the population of St. Marys grows. A full 40-year planning period has been considered, since the landfill is proposed to operate for a 40 year period, which will represent the worst-case condition for traffic impacts on the adjacent roadways (i.e., highest growth potential for both landfill traffic and background traffic).

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 landfill site impacts, include the a.m. peak hour and the p.m. peak hour of the traffic on the adjacent roadways on weekdays and the peak hour of the landfill site generated traffic on Saturdays. The peak periods considered capture the variability of the operating conditions at the landfill.

3.4 Seasonal Fluctuations of Traffic Volumes

The Town of St. Marys provided the following landfill operational data for review:

- Weekly tonnage summaries from January 2, 2015 through December 5, 2015.
- Daily vehicular summaries from January 2, 2015 through March 3, 2015.
- Daily vehicular summaries from September 1, 2015 through December 9, 2015.

In addition peak period traffic counts were undertaken by Ontario Traffic Inc. at the landfill access on Saturday November 7, 2015 and on Tuesday November 10, 2015.

A review of the traffic data provided by the Town indicates that the traffic counts taken by the consultant represent peak seasonal conditions and therefore these counts have been used for analysis purposes within this TIS.

3.5 Traffic Growth Factors

Traffic growth on Perth Road 123 and at the landfill site access will primarily be based on growth in St. Marys. There are no development plans within Perth County or within the Township of Perth South that will have any significant impact on traffic growth in the study area.

Section 3.1 of the Town of St. Marys' *Official Plan (2007)* forecasts that population growth of 1% per annum is expected to continue in the Town. The Town's *2011 Development Charges Background Study (Watson and Associates, December 2011)* also assumes a population growth rate of 1% per annum in its calculations. The forecasts for volume increases at the landfill site have been based on this population growth. On this basis, a growth rate of 1.0% per annum (compounded) has been used to forecast the future background traffic for the various horizon periods considered in this study. This growth rate is applied to the background traffic on Perth Road 123 and to the traffic generated by the landfill site.

3.6 Forecast Background Traffic

As noted previously the turning movements at the landfill site access have been based on the traffic counts taken by the consultant. However, to be conservative, the peak hour of the landfill site operations was applied for the site traffic for the p.m. peak hour, rather than the site traffic experienced during the p.m. peak hour of the adjacent roadway (i.e. since the landfill closes prior to the peak hour of the adjacent roadway).

The forecast background traffic volumes (weekday/Saturday a.m. and p.m. peak hours, horizon year 2015) are summarized on Figure A4 (Appendix A). The forecast future background traffic volumes, for horizon years 2039 and 2059, are summarized on Figures A5, A6 and A7 (Appendix A), 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 assumption that the 1% annual growth rate in waste quantities will correlate with a traffic growth rate of 1% per annum (compounded) being generated from the landfill expansion. The following table summarizes the trip generation results for the 2039 and 2059 horizons:

Table 4.1 – Forecast of Trip Generation from Proposed Development

Annual Growth Rate % (Compounded)	Horizon Year	a.m. Peak Hour (vph)		p.m. Peak Hour (vph)	
		In	Out	In	Out
Perth Road 123 / St. Marys Landfill Access - WEEKDAY					
1.0%	2019	9	9	7	7
	2039	10	10	8	8
	2059	12	12	9	9
Perth Road 123 / St. Marys Landfill Access – SATURDAY					
1.0%	2019	25	25	N/A	N/A
	2039	30	30	N/A	N/A
	2059	37	37	N/A	N/A

As shown in the table, the total trip generation (two-way) for the landfill expansion on a weekday in 2059 is forecast to be 24vehicles per hour (vph) in the a.m. peak hour, 18 vph in the p.m. peak hour, and 74 vph in the Saturday peak hour.

4.2 Trip Distribution

The forecast development traffic has been distributed over the road network, according to origin/destination considerations. The traffic entering and exiting the landfill has been distributed according to existing traffic patterns at the site (i.e., as per the November 2015 traffic counts).

The forecast development traffic volumes (Saturday a.m. peak hour; and weekday a.m. and p.m. peak hours) are summarized on Figures A8, A9 and A10 (Appendix A) for horizon years 2019, 2039 and 2059, respectively.

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 (Saturday a.m. peak hour; and weekday a.m. and p.m. peak hours) are summarized on Figures A11, A12 and A13, for horizon years 2019, 2039 and 2059, respectively.

5.0 Traffic Impact Analysis

5.1 Analysis Criteria and Approach

The traffic operations at the landfill access have been assessed based on the following criteria:

- Turning lane requirements based on Ministry of Transportation (MTO) warrant nomographs and criteria.
- Level of Service (LOS), delay and volume-to-capacity (v/c) ratio. The LOS is based on criteria in the Highway Capacity Manual, analyzed using Synchro software.
- Geometric constraints (sight distances, intersection spacing, etc.).
- Link volume considerations.

5.2 Left Turn Lane Warrant for Landfill Site Access

The warrant for a left turn lane, at the unsignalized landfill site access, has been assessed based on MTO nomographs. The analysis is based on design speed of 20 km/h over the posted speed. The results of the left turn lane warrant analysis for the Perth Road 123/St. Marys Landfill Access intersection, for Total Traffic conditions in horizon year 2059, is summarized below.

Table 5.1 – Left Turn Lane Warrant for Perth Road 123/St. Marys Landfill Access Unsignalized Intersection

Left Turn Storage Lane Warrants			
Location: Perth Road 123/St. Marys Landfill Access			
Design Speed = 100 km/h			Time Period = 2059 Total Traffic
Approach Day/Direction	Weekday/Southbound		Saturday/Southbound
Peak Hours	Morning	Afternoon	Morning
Advancing Traffic	142	158	193
Opposing Traffic	145	150	99
Left Turning Traffic	12	9	37
Percentage of Left Turning Traffic	8.4%	5.6%	19.2%
Figure Used (MTO Geometric Design Standards, 1994)	EA-22	EA-22	EA-23
Storage Length Required	**0 meters**		**0 meters**

Based on the analysis, it is concluded that a left turn lane is not required on Perth Road 123 at the landfill site access through horizon year 2059.

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 Perth Road 123/St. Marys Landfill Access intersection, are minimal (1 vph) through the life of the landfill. Therefore a right turn lane/taper is not warranted at the landfill site access.

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 the St. Marys Landfill Access onto Perth Road 123 (unsignalized intersection). The LOS is a measure qualifying the amount of delay experienced by motorists. The delays associated with various LOS are summarized in the following table:

Table 5.2 – Level of Service Delay 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 LOS E, or better, and within their capacity.

The Synchro analysis for the subject intersection is included in Appendix B (background traffic conditions) and Appendix C (total traffic conditions), and the results are summarized in the following table:

Table 5.3 – Intersection Operations

Intersection	Year	Traffic	Critical Movement	Level of Service (volume/capacity)		
				Weekday a.m. Peak Hour	Weekday p.m. Peak Hour	Saturday a.m Peak Hour
Perth Road 123 / St. Marys Landfill Access	2015	Background	Westbound Left / Right	A (0.01)	A (0.01)	A (0.03)
	2019	Total		A (0.01)	A (0.01)	A (0.03)
	2039	Total		A (0.01)	A (0.01)	A (0.03)
	2059	Total		A (0.01)	A (0.01)	A (0.04)

The above table shows that the existing intersection at Perth Road 123/St. Marys Landfill Access is forecast to continue to have acceptable traffic operations through horizon year 2059 and that the addition of the traffic from the landfill expansion will only have a minor effect on these operations.

5.5 Geometric Considerations

The available sight distances have been reviewed for the intersection of Perth Road 123 / Landfill Access. The analysis is based on a design speed of 20 km/h over the posted speed (i.e. design speed of 100 km/h on Perth Road 123).

The *Geometric Design Standards for Ontario Highways (GDS)* (Ministry of Transportation Ontario, 1994) recommends the following sight distances for road with 100 km/h design speeds:

- a minimum stopping sight distance (SSD) of 185 metres
- decision sight distances between 300 m (minimum) to 400 m (desirable) for turning movements.

The available sight distance provided at the existing Perth Road 123/St. Marys Landfill Access meets these recommendations, with over 400 m of sight distance in both the north and south directions.

5.6 Link Volume Considerations

Perth Road 123 and Water Street South are arterial roads that have an assumed capacity of 900 vehicles per hour per lane (vphpl) and are designed to accommodate the full range of traffic types. The forecast peak hour volumes on Perth Road 123 and Water Street South in the study area are 193 vphpl southbound (Saturday peak hour) and 150 vphpl northbound (p.m. peak hour) in 2059. These traffic volumes equate to a utilization of about 21% of the roadway capacity southbound and 17% of the roadway capacity northbound. Therefore, Perth Road 123 and Water Street South have sufficient reserve capacity to accommodate the proposed landfill expansion.

6.0 Conclusions and Recommendations

This Traffic Impact Study has reviewed the traffic impacts of expanding the existing St. Marys Landfill in the Town of St. Marys. The proposed expansion is forecast to generate total two-way traffic (by 2059) of about 74 vph in the a.m. peak hour on Saturdays, 24 vph in the a.m. peak hour on weekdays, and 18 vph in the p.m. peak hour on weekdays. Impacts have been assessed at the Perth Road 123/St. Marys Landfill Access intersection, as well as along Perth Road 123 and Water Street South. Traffic impacts have been assessed for horizon years 2039 and 2059. Forecast 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:

- A left turn lane is not warranted at the Perth Road 123/St. Marys Landfill Access intersection through horizon year 2059.

- A right turn lane or taper is not warranted at the Perth Road 123/St. Marys Landfill Access intersection through the horizon year 2059.

- The stopping sight distances and decision sight distances at the Perth Road 123/St. Marys Landfill Access intersection meets the MTO guidelines and is acceptable.

- The Perth Road 123/St. Marys Landfill Access intersection is forecast to operate with good Level of Service (LOS) and short delays through the horizon year 2059. Therefore, no operational improvements are required to accommodate the landfill expansion.

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[THE DIFFERENCE IS OUR PEOPLE]

Appendix A

Figures

Map Data: Copyright 2015 Google

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Figure Title

ST. MARYS WASTE MANAGEMENT LONG-TERM CAPACITY EXPANSION

ST. MARYS LANDFILL SITE LOCATION

Client

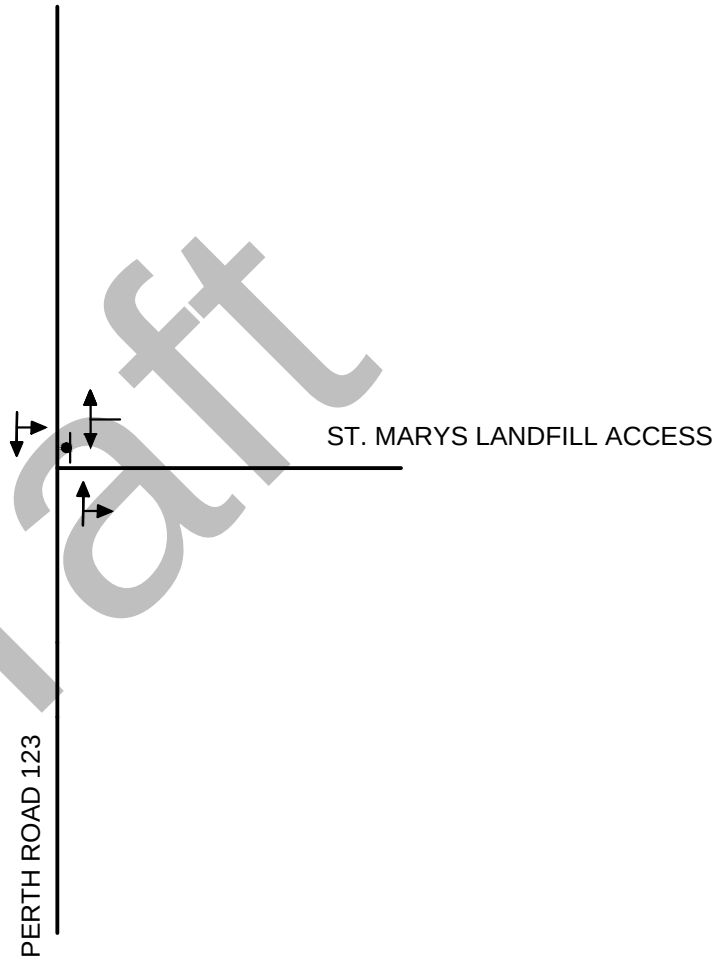
TOWN OF ST. MARYS

Drawn	Checked	Date	Figure No.
CJR	HC	NOVEMBER 2015	**A1**
Scale		Project No.	
NTS		300032339	

File: P:\Transportation\Traffic\Synchro Files\032339 - St. Mary's Landfill\AutoCAD Drawings\032339_ST_MARYS_LANDFILL_SITE_LOCATION.dwg Date Plotted: December 22, 2015 - 11:14 AM


WATER STREET SOUTH
ST. MARYS CEMENT WORKS
PHASE I
CEMENT KILN DUST PILE
DROP OFF AREA
2015 FILL AREA
PHASE II/III
COMPOST PILE
COUNTY ROAD 123
100m
LEGEND
PROPERTY BOUNDARY
100m SETBACK
APPROXIMATE WASTE AREA
DRAINAGE SWALE
SATELLITE IMAGE: GOOGLE EARTH 2013
N
0
30
60
90
120
Metres
BURNSIDE
TOWN OF ST. MARYS
LANDFILL SITE PLAN
Scale
1:1,500
Project No.
300032339.2014
Figure No.
1

FIGURE A2



LEGEND

- STOP SIGN CONTROL
- TURN LANE
- THROUGH LANE

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Client

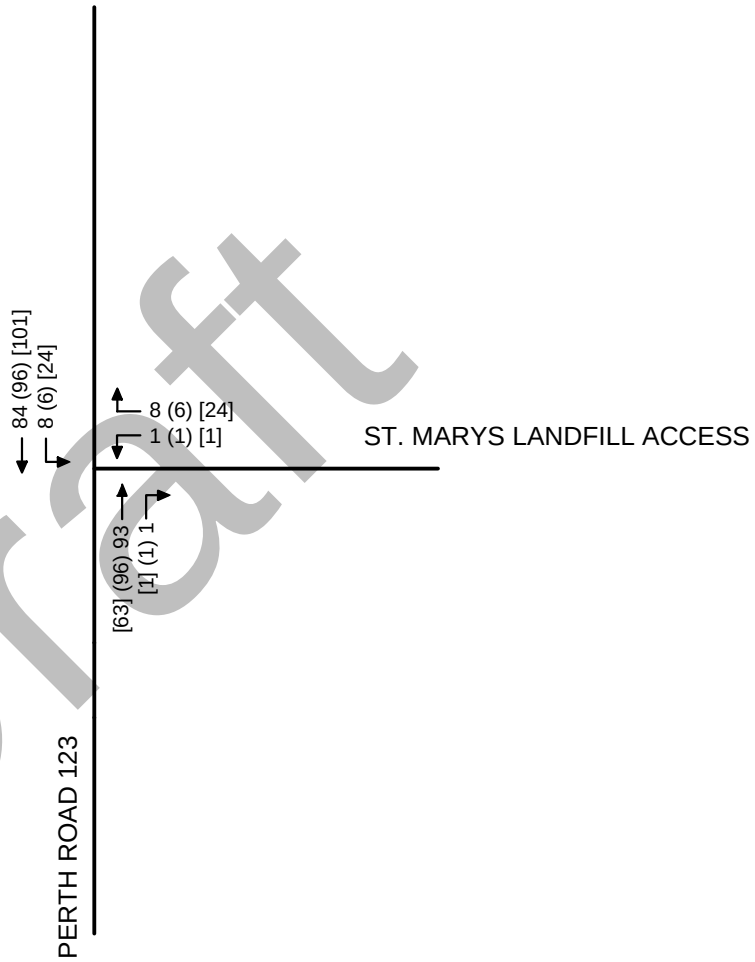
TOWN OF ST. MARYS

Figure Title

ST. MARYS WASTE MANAGEMENT
LONG-TERM CAPACITY EXPANSION

ST. MARYS LANDFILL ACCESS
EXISTING TRAFFIC CONTROLS AND LANE CONFIGURATIONS

Drawn	Checked	Date	Figure No.
CJR	HC	NOVEMBER 2015	**A3**
Scale		Project No.	
NTS		300032339	



LEGEND

100 - WEEKDAY AM PEAK HOUR (vph)
(100) - WEEKDAY PM PEAK HOUR (vph)
[100] - SATURDAY AM PEAK HOUR (vph)

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Figure Title

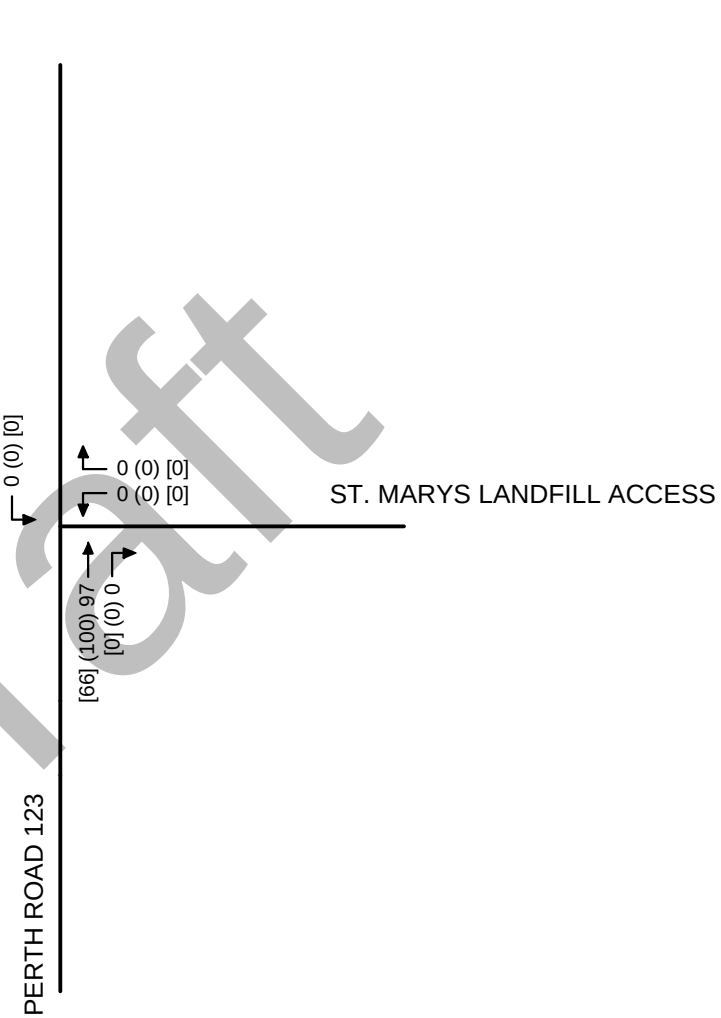
ST. MARYS WASTE MANAGEMENT LONG-TERM CAPACITY EXPANSION

ST. MARYS LANDFILL ACCESS
EXISTING TRAFFIC VOLUMES (2015)

Client

TOWN OF ST. MARYS

Drawn	Checked	Date	Figure No.
CJR	HC	NOVEMBER 2015	**A4**
Scale		Project No.	
NTS		300032339	



LEGEND

100 - WEEKDAY AM PEAK HOUR (vph)
(100) - WEEKDAY PM PEAK HOUR (vph)
[100] - SATURDAY AM PEAK HOUR (vph)

BURNSIDE

Figure Title

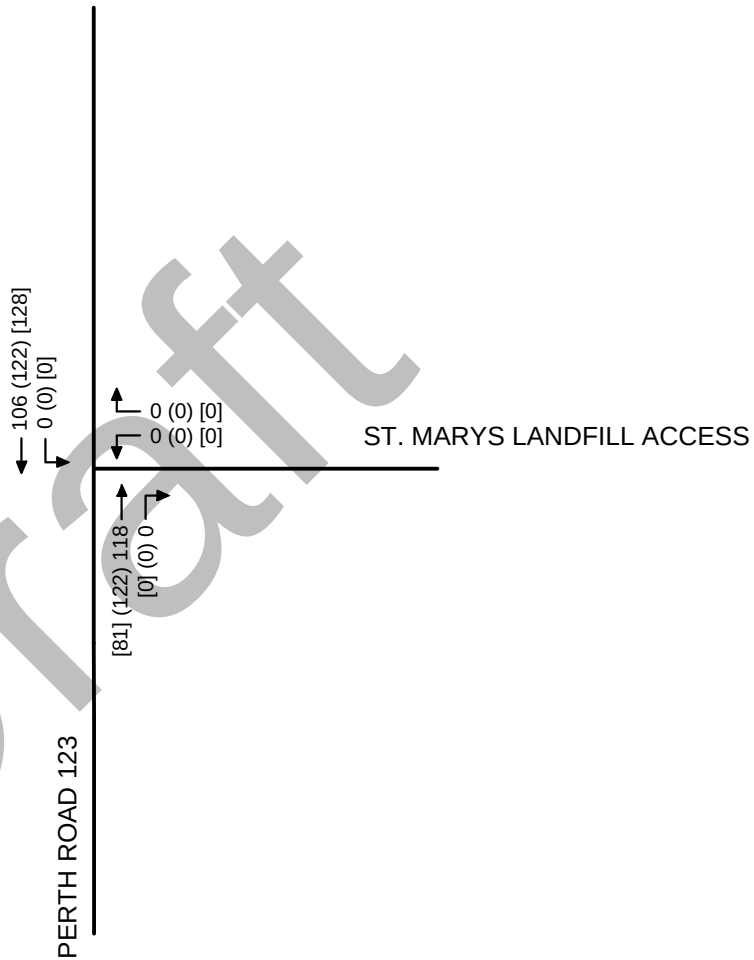
ST. MARYS WASTE MANAGEMENT LONG-TERM CAPACITY EXPANSION

ST. MARYS LANDFILL ACCESS
2019 BACKGROUND TRAFFIC VOLUMES

Client

TOWN OF ST. MARYS

Drawn	Checked	Date	Figure No.
CJR	HC	NOVEMBER 2015	**A5**
Scale		Project No.	
NTS		300032339	



LEGEND

100 - WEEKDAY AM PEAK HOUR (vph)
(100) - WEEKDAY PM PEAK HOUR (vph)
[100] - SATURDAY AM PEAK HOUR (vph)

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Figure Title

ST. MARYS WASTE MANAGEMENT LONG-TERM CAPACITY EXPANSION

ST. MARYS LANDFILL ACCESS
2039 BACKGROUND TRAFFIC VOLUMES

Client

TOWN OF ST. MARYS

Drawn	Checked	Date	Figure No.
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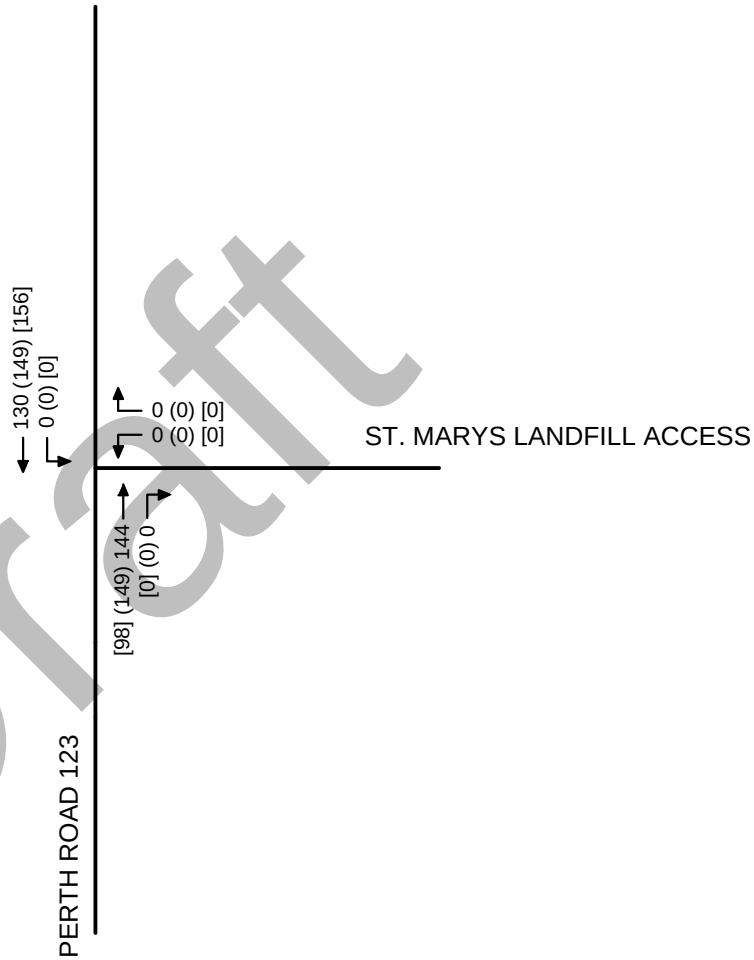
Scale		Project No.	
NTS		300032339	



LEGEND

100 - WEEKDAY AM PEAK HOUR (vph)
(100) - WEEKDAY PM PEAK HOUR (vph)
[100] - SATURDAY AM PEAK HOUR (vph)

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Figure Title

ST. MARYS WASTE MANAGEMENT LONG-TERM CAPACITY EXPANSION

ST. MARYS LANDFILL ACCESS
2059 BACKGROUND TRAFFIC VOLUMES

Client

TOWN OF ST. MARYS

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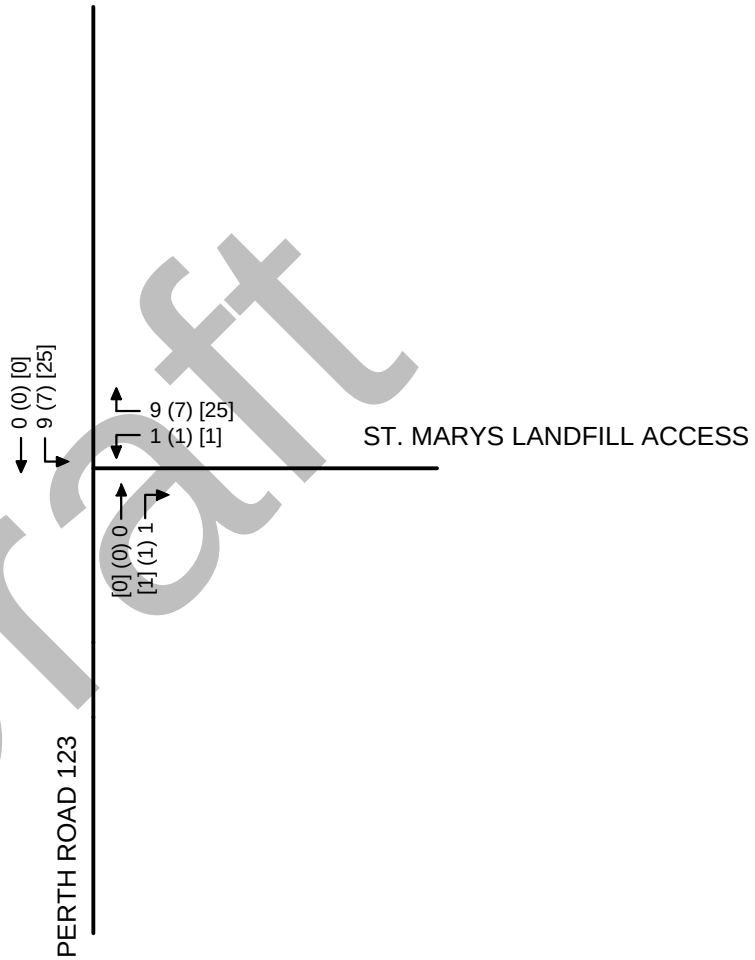
Scale		Project No.	
NTS		300032339	



LEGEND

100 - WEEKDAY AM PEAK HOUR (vph)
(100) - WEEKDAY PM PEAK HOUR (vph)
[100] - SATURDAY AM PEAK HOUR (vph)

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Figure Title

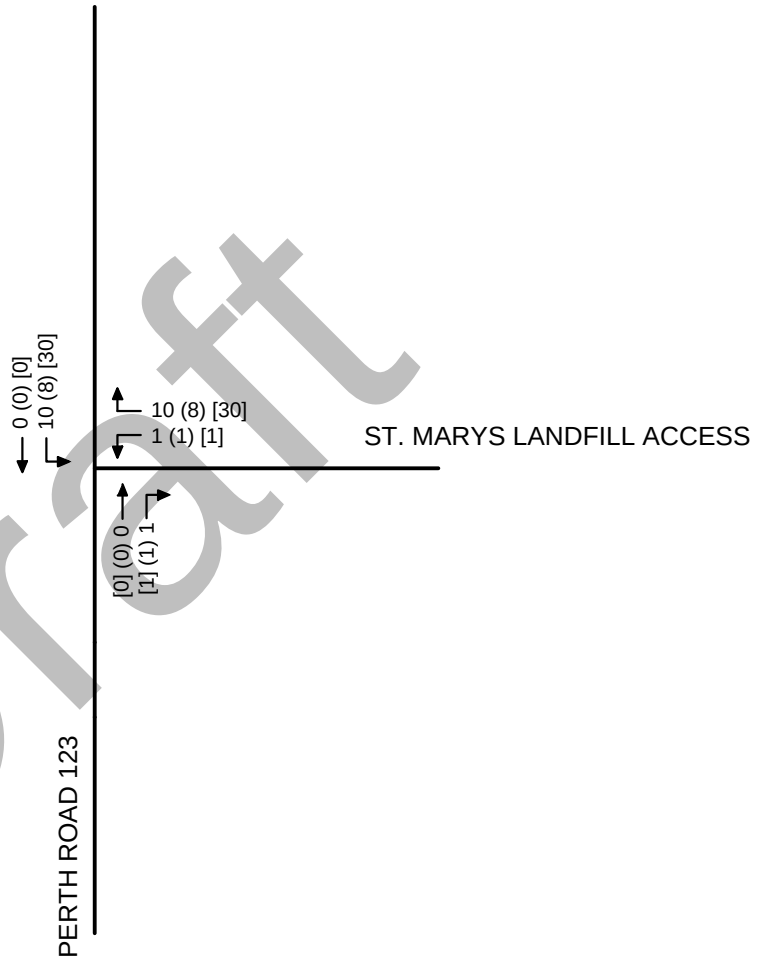
ST. MARYS WASTE MANAGEMENT LONG-TERM CAPACITY EXPANSION

ST. MARYS LANDFILL ACCESS
TRAFFIC GENERATION (2019)

Client

TOWN OF ST. MARYS

Drawn	Checked	Date	Figure No.
CJR	HC	NOVEMBER 2015	**A8**
Scale		Project No.	
NTS		300032339	



LEGEND

100 - WEEKDAY AM PEAK HOUR (vph)
(100) - WEEKDAY PM PEAK HOUR (vph)
[100] - SATURDAY AM PEAK HOUR (vph)

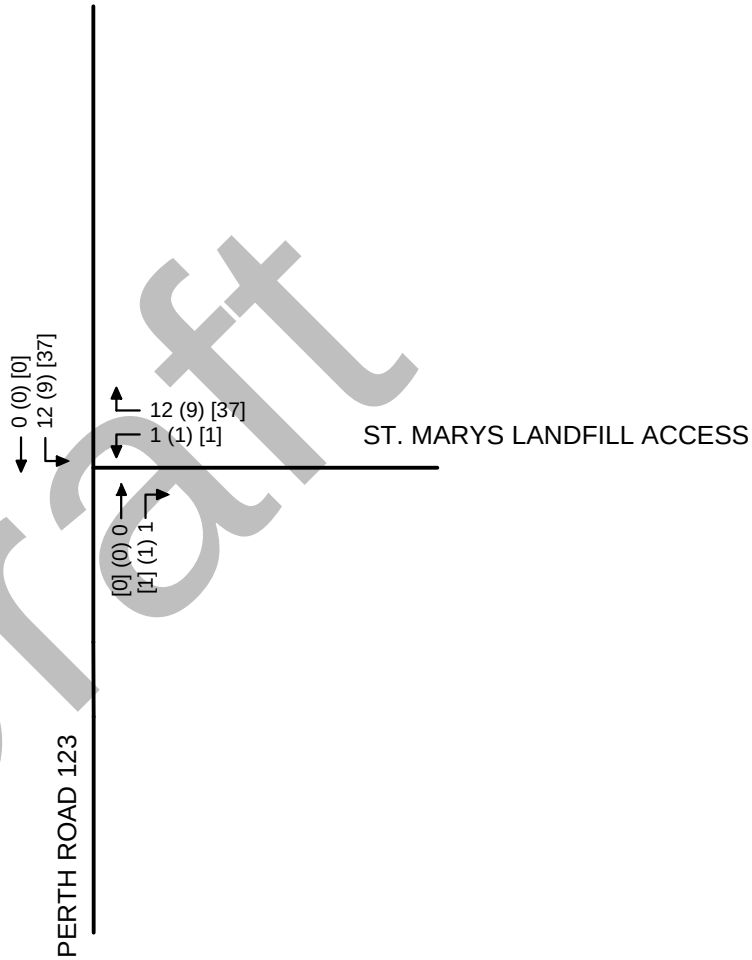
BURNSIDE

Client: **TOWN OF ST. MARYS**

Figure Title: **ST. MARYS WASTE MANAGEMENT LONG-TERM CAPACITY EXPANSION**

ST. MARYS LANDFILL ACCESS
TRAFFIC GENERATION (2039)

Drawn	Checked	Date	Figure No.
CJR	HC	NOVEMBER 2015	**A9**
Scale: NTS		Project No.: 300032339	



LEGEND

100 - WEEKDAY AM PEAK HOUR (vph)
(100) - WEEKDAY PM PEAK HOUR (vph)
[100] - SATURDAY AM PEAK HOUR (vph)

BURNSIDE

Figure Title

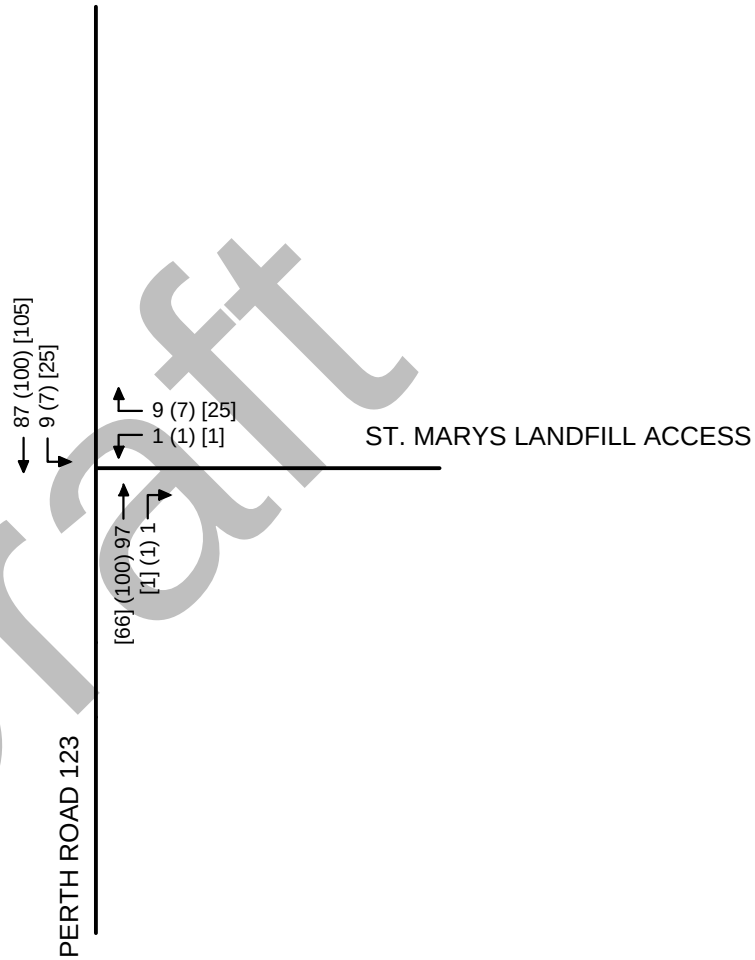
ST. MARYS WASTE MANAGEMENT LONG-TERM CAPACITY EXPANSION

ST. MARYS LANDFILL ACCESS
TRAFFIC GENERATION (2059)

Client

TOWN OF ST. MARYS

Drawn	Checked	Date	Figure No.
CJR	HC	NOVEMBER 2015	**A10**
Scale		Project No.	
NTS		300032339	



LEGEND

100 - WEEKDAY AM PEAK HOUR (vph)
(100) - WEEKDAY PM PEAK HOUR (vph)
[100] - SATURDAY AM PEAK HOUR (vph)

BURNSIDE

Figure Title

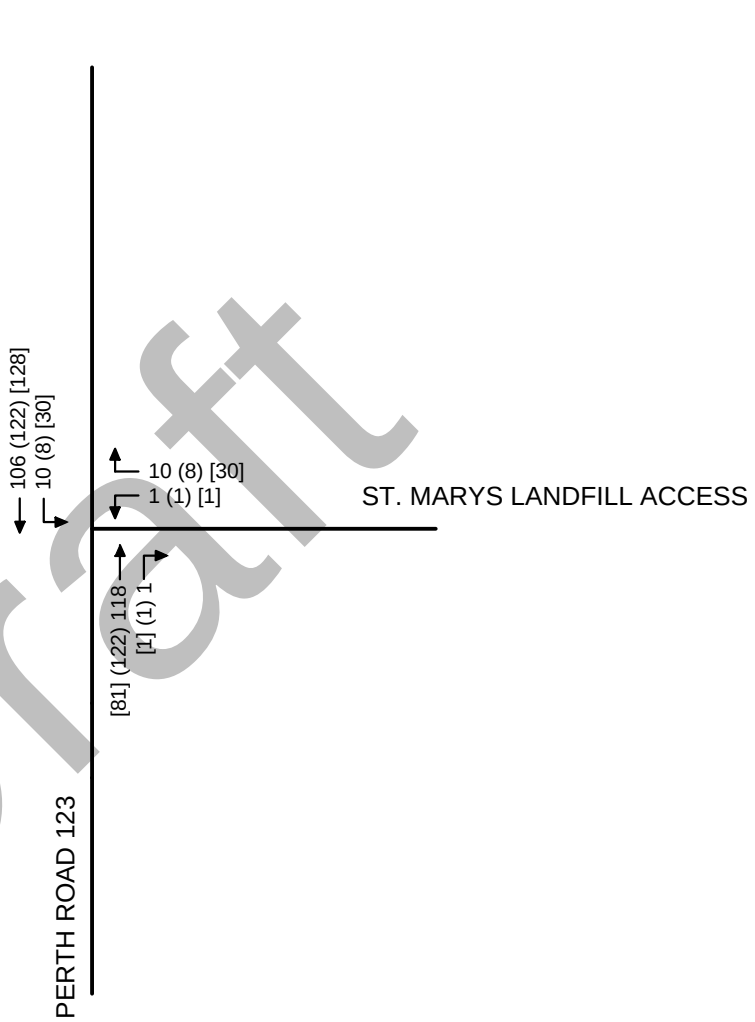
ST. MARYS WASTE MANAGEMENT
LONG-TERM CAPACITY EXPANSION

ST. MARYS LANDFILL ACCESS
2019 TOTAL TRAFFIC VOLUMES

Client

TOWN OF ST. MARYS

Drawn	Checked	Date	Figure No.
CJR	HC	NOVEMBER 2015	**A11**
Scale		Project No.	
NTS		300032339	



LEGEND

100 - WEEKDAY AM PEAK HOUR (vph)
(100) - WEEKDAY PM PEAK HOUR (vph)
[100] - SATURDAY AM PEAK HOUR (vph)

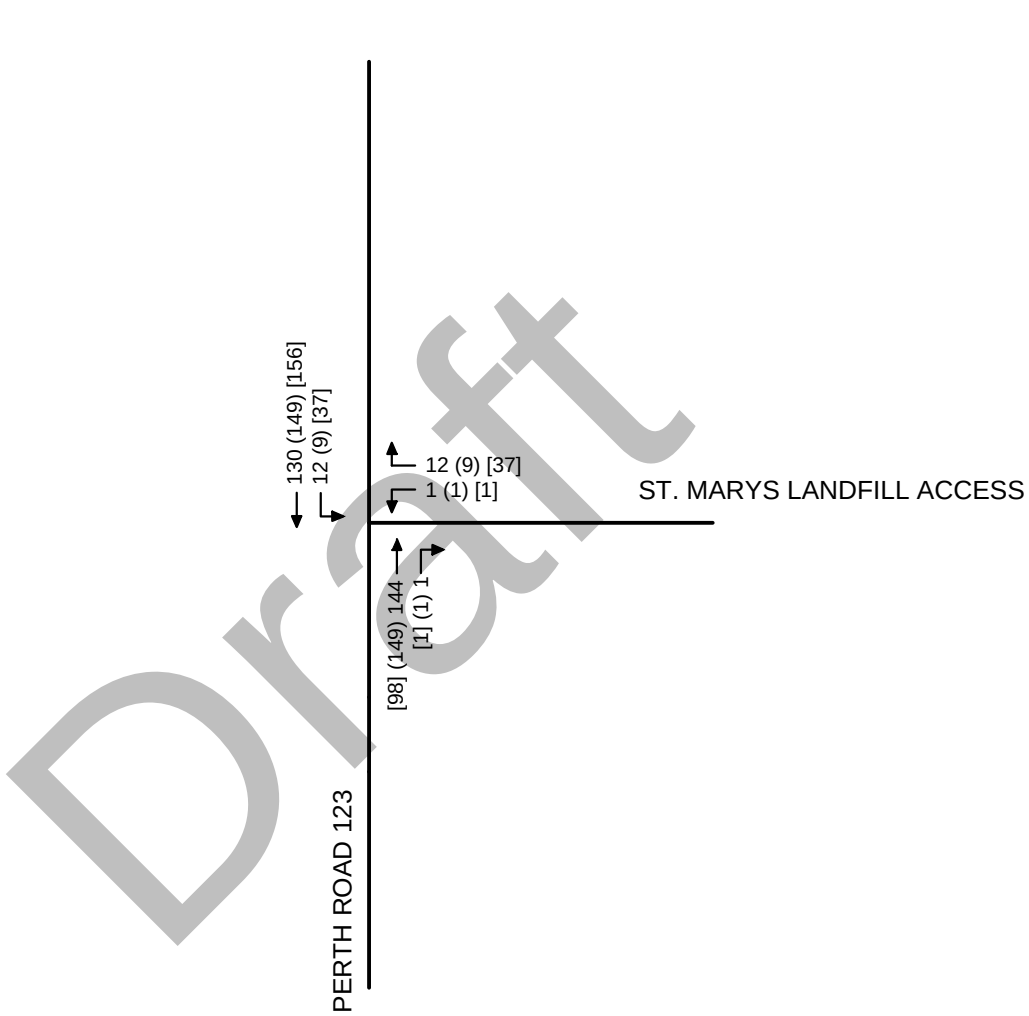
BURNSIDE

Client: **TOWN OF ST. MARYS**

Figure Title: **ST. MARYS WASTE MANAGEMENT LONG-TERM CAPACITY EXPANSION**

ST. MARYS LANDFILL ACCESS
2039 TOTAL TRAFFIC VOLUMES

Drawn	Checked	Date	Figure No.
CJR	HC	NOVEMBER 2015	**A12**
Scale: NTS		Project No.: 300032339	



LEGEND

100 - WEEKDAY AM PEAK HOUR (vph)
(100) - WEEKDAY PM PEAK HOUR (vph)
[100] - SATURDAY AM PEAK HOUR (vph)

BURNSIDE

Figure Title

ST. MARYS WASTE MANAGEMENT LONG-TERM CAPACITY EXPANSION

ST. MARYS LANDFILL ACCESS
2059 TOTAL TRAFFIC VOLUMES

Client

TOWN OF ST. MARYS

Drawn	Checked	Date	Figure No.
CJR	HC	NOVEMBER 2015	**A13**
Scale		Project No.	
NTS		300032339	

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Appendix B

Traffic Operations
Background Traffic (Synchro)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	6	93	1	8	84
Future Volume (Veh/h)	1	6	93	1	8	84
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)	1	7	101	1	9	91
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	210	102			102	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	210	102			102	
tC, single (s)	7.4	6.2			4.2	
tC, 2 stage (s)						
tF (s)	4.4	3.3			2.3	
p0 queue free %	100	99			99	
cM capacity (veh/h)	598	959			1430	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	8	102	100
Volume Left	1	0	9
Volume Right	7	1	0
cSH	892	1700	1430
Volume to Capacity	0.01	0.06	0.01
Queue Length 95th (m)	0.2	0.0	0.1
Control Delay (s)	9.1	0.0	0.7
Lane LOS	A		A
Approach Delay (s)	9.1	0.0	0.7
Approach LOS	A		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	21.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	6	96	1	6	96
Future Volume (Veh/h)	1	6	96	1	6	96
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)	1	7	104	1	7	104
Pedestrians	1					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.1					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	224	106			106	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	224	106			106	
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	99			100	
cM capacity (veh/h)	765	953			1496	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	8	105	111
Volume Left	1	0	7
Volume Right	7	1	0
cSH	925	1700	1496
Volume to Capacity	0.01	0.06	0.00
Queue Length 95th (m)	0.2	0.0	0.1
Control Delay (s)	8.9	0.0	0.5
Lane LOS	A		A
Approach Delay (s)	8.9	0.0	0.5
Approach LOS	A		

Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization		20.0%	ICU Level of Service A
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	22	63	1	24	101
Future Volume (Veh/h)	1	22	63	1	24	101
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)	1	24	68	1	26	110
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	68			69	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	230	68			69	
tC, single (s)	6.4	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.3	
p0 queue free %	100	98			98	
cM capacity (veh/h)	749	975			1495	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	25	69	136
Volume Left	1	0	26
Volume Right	24	1	0
cSH	964	1700	1495
Volume to Capacity	0.03	0.04	0.02
Queue Length 95th (m)	0.6	0.0	0.4
Control Delay (s)	8.8	0.0	1.5
Lane LOS	A		A
Approach Delay (s)	8.8	0.0	1.5
Approach LOS	A		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	23.3%	ICU Level of Service	A
Analysis Period (min)	15		

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Appendix C

Traffic Operations
Total Traffic (Synchro)

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	8	97	1	8	87
Future Volume (Veh/h)	1	8	97	1	8	87
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)	1	9	105	1	9	95
Pedestrians	1					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.1					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	220	106			107	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	220	106			107	
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	99			99	
cM capacity (veh/h)	768	952			1495	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	10	106	104
Volume Left	1	0	9
Volume Right	9	1	0
cSH	930	1700	1495
Volume to Capacity	0.01	0.06	0.01
Queue Length 95th (m)	0.2	0.0	0.1
Control Delay (s)	8.9	0.0	0.7
Lane LOS	A		A
Approach Delay (s)	8.9	0.0	0.7
Approach LOS	A		

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		21.2%	ICU Level of Service A
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	6	100	1	6	100
Future Volume (Veh/h)	1	6	100	1	6	100
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)	1	7	109	1	7	109
Pedestrians	1					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.1					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	234	110			111	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	234	110			111	
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	99			100	
cM capacity (veh/h)	755	947			1490	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	8	110	116
Volume Left	1	0	7
Volume Right	7	1	0
cSH	918	1700	1490
Volume to Capacity	0.01	0.06	0.00
Queue Length 95th (m)	0.2	0.0	0.1
Control Delay (s)	9.0	0.0	0.5
Lane LOS	A		A
Approach Delay (s)	9.0	0.0	0.5
Approach LOS	A		

Intersection Summary			
Average Delay		0.5	
Intersection Capacity Utilization		20.2%	ICU Level of Service
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	28	66	1	24	105
Future Volume (Veh/h)	1	28	66	1	24	105
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)	1	30	72	1	26	114
Pedestrians	1					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.1					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	240	74			74	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	240	74			74	
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	97			98	
cM capacity (veh/h)	740	993			1537	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	31	73	140
Volume Left	1	0	26
Volume Right	30	1	0
cSH	982	1700	1537
Volume to Capacity	0.03	0.04	0.02
Queue Length 95th (m)	0.7	0.0	0.4
Control Delay (s)	8.8	0.0	1.5
Lane LOS	A		A
Approach Delay (s)	8.8	0.0	1.5
Approach LOS	A		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	23.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	8	118	1	10	106
Future Volume (Veh/h)	1	8	118	1	10	106
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)	1	9	128	1	11	115
Pedestrians	1					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.1					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	266	130			130	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	266	130			130	
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	99			99	
cM capacity (veh/h)	721	925			1467	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	10	129	126
Volume Left	1	0	11
Volume Right	9	1	0
cSH	899	1700	1467
Volume to Capacity	0.01	0.08	0.01
Queue Length 95th (m)	0.3	0.0	0.2
Control Delay (s)	9.0	0.0	0.7
Lane LOS	A		A
Approach Delay (s)	9.0	0.0	0.7
Approach LOS	A		

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		22.8%	ICU Level of Service
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	8	122	1	8	122
Future Volume (Veh/h)	1	8	122	1	8	122
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)	1	9	133	1	9	133
Pedestrians	1					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.1					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	286	134			135	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	286	134			135	
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	99			99	
cM capacity (veh/h)	704	919			1460	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	10	134	142
Volume Left	1	0	9
Volume Right	9	1	0
cSH	892	1700	1460
Volume to Capacity	0.01	0.08	0.01
Queue Length 95th (m)	0.3	0.0	0.1
Control Delay (s)	9.1	0.0	0.5
Lane LOS	A		A
Approach Delay (s)	9.1	0.0	0.5
Approach LOS	A		

Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization		23.0%	ICU Level of Service A
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	28	81	1	29	128
Future Volume (Veh/h)	1	28	81	1	29	128
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)	1	30	88	1	32	139
Pedestrians	1					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.1					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	292	90			90	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	292	90			90	
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	97			98	
cM capacity (veh/h)	687	973			1516	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	31	89	171
Volume Left	1	0	32
Volume Right	30	1	0
cSH	960	1700	1516
Volume to Capacity	0.03	0.05	0.02
Queue Length 95th (m)	0.8	0.0	0.5
Control Delay (s)	8.9	0.0	1.5
Lane LOS	A		A
Approach Delay (s)	8.9	0.0	1.5
Approach LOS	A		

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	25.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	9	144	1	12	130
Future Volume (Veh/h)	1	9	144	1	12	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)	1	10	157	1	13	141
Pedestrians	1					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.1					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	326	158			159	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	326	158			159	
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	99			99	
cM capacity (veh/h)	666	891			1431	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	11	158	154
Volume Left	1	0	13
Volume Right	10	1	0
cSH	865	1700	1431
Volume to Capacity	0.01	0.09	0.01
Queue Length 95th (m)	0.3	0.0	0.2
Control Delay (s)	9.2	0.0	0.7
Lane LOS	A		A
Approach Delay (s)	9.2	0.0	0.7
Approach LOS	A		

Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization		26.8%	ICU Level of Service A
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	9	149	1	9	149
Future Volume (Veh/h)	1	9	149	1	9	149
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)	1	10	162	1	10	162
Pedestrians	1					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.1					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	346	164			164	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	346	164			164	
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	99			99	
cM capacity (veh/h)	650	886			1425	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	11	163	172
Volume Left	1	0	10
Volume Right	10	1	0
cSH	857	1700	1425
Volume to Capacity	0.01	0.10	0.01
Queue Length 95th (m)	0.3	0.0	0.2
Control Delay (s)	9.3	0.0	0.5
Lane LOS	A		A
Approach Delay (s)	9.3	0.0	0.5
Approach LOS	A		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	25.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	35	98	1	36	156
Future Volume (Veh/h)	1	35	98	1	36	156
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)	1	38	107	1	39	170
Pedestrians	1					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.1					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	356	108			109	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	356	108			109	
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	96			97	
cM capacity (veh/h)	628	950			1493	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	39	108	209
Volume Left	1	0	39
Volume Right	38	1	0
cSH	937	1700	1493
Volume to Capacity	0.04	0.06	0.03
Queue Length 95th (m)	1.0	0.0	0.6
Control Delay (s)	9.0	0.0	1.6
Lane LOS	A		A
Approach Delay (s)	9.0	0.0	1.6
Approach LOS	A		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	26.9%	ICU Level of Service	A
Analysis Period (min)	15		