

# **Queanbeyan City Council TRACKS Model**

South Jerrabomberra and Queanbeyan Traffic Analysis 2014

Part 1 – South Jerrabomberra Network Transportation Assessment Report

December 2014

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## Part 1 - South Jerrabomberra Network Transportation Assessment Report Quality Assurance Statement

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#### Appendix B

Option 2 – Four Lane One Access – Tompsitt Dr - South Jerrabomberra Flows and LOS

#### Appendix C

Option 3 – Two Access – Tompsitt Dr / Sheppard St - South Jerrabomberra Flows and LOS

#### Appendix D

Option 4 – Two Access – Tompsitt Dr / Isabella Dr - South Jerrabomberra Flows and LOS

#### Appendix E

Option 5 – Three Access – Tompsitt Dr / Sheppard St / Isabella Dr - South Jerrabomberra Flows and LOS



## 1. Executive Summary

This report documents the transport modelling of various potential access arrangements for the proposed South Jerrabomberra Development. This development proposes creating 2348 households and 5337 jobs in the area to the west of the ACT / QCC rail corridor and south of Tompsitt Dr.

The access scenarios analysed for South Jerrabomberra were:

- One access Tompsitt Drive (when does the single lane dual carriageway require duplication);
- One access Tompsitt Drive (dual lane dual carriageway when required);
- Two accesses Tompsitt Drive and Sheppard Street (single lane dual carriageway to Tompsitt Drive and Sheppard Street connection when required);
- Two accesses Tompsitt Drive and Isabella Drive (single lane dual carriageway to Tompsitt Drive and Isabella Drive connection when required);
- Three accesses Tompsitt Drive, Sheppard Street and Isabella Drive.

The analysis was undertaken for the AM and PM peak periods for the modelled future years of 2014, 2016, 2018, 2020, 2022, 2024, 2026 and 2031.

The transport modelling used the current QCC TRACKS strategic transportation model of Queanbeyan. The model area covers the region contained within the Queanbeyan and Australian Capital Territory (ACT) LGAs. ACT was included in the model to help reproduce the cross border interaction that occurs between Queanbeyan and ACT. The road network used in the analysis includes all roads within the Queanbeyan area and all roads of collector or higher status in the ACT.

ACT provided a list of infrastructure improvements that are expected to occur within the region from 2011-2016, 2016-2021 and 2021-2031 for inclusion in the future models.

The primary requirement of this analysis was to recommend which of the access options considered in this analysis "best serves the Queanbeyan and ACT community". This was taken as meaning which access option has the least impact on the surrounding QCC and ACT networks and best distributes the additional traffic travelling to and from the proposed South Jerrabomberra development.

This South Jerrabomberra Traffic Analysis concentrated on the area surrounding the development in its assessment. It included assessments of the differences in Level of Service (LOS) and overall network performance indicators between each of the access options in order to determine the preferred access arrangement.

Based on both the analysis of the local network Level of Service and the overall network performance for each access option, Access Option 5 (Tompsitt / Sheppard / Isabella) produces the best future local and overall network operation of the access options investigated.



## 2. Introduction

The purpose of this report is to document the transport modelling of the South Jerrabomberra access assessment, taking into account the newly updated South Jerrabomberra Development land use and concept plan provided by the developers. Previous modelling of Queanbeyan futures included preliminary South Jerrabomberra land use which was different to the quantity and distribution of land use now being proposed.

The developer of the site has indicated that they will set aside a road corridor suitable for a single lane dual carriageway heading north to Tompsitt Drive as well as include traffic signals for their connection onto Tompsitt Drive as the primary means of access to the whole development. This assessment was to look at this proposal and other options in terms of its ability to carry the overall traffic volume to and from the proposed South Jerrabomberra development and assess its effects on the surrounding road network. The site location of the development is shown in Figure 1.

The scenarios that were to be analysed for South Jerrabomberra were:

- One access Tompsitt Drive (when does the single lane dual carriageway require duplication);
- One access Tompsitt Drive (dual lane dual carriageway when required);
- Two accesses Tompsitt Drive and Sheppard Street (single lane dual carriageway to Tompsitt Drive and Sheppard Street connection when required);
- Two accesses Tompsitt Drive and Isabella Drive (single lane dual carriageway to Tompsitt Drive and Isabella Drive connection when required);
- Three accesses Tompsitt Drive, Sheppard Street and Isabella Drive.

The report is to make recommendations for the types of improvements required on the surrounding network with particular reference to Isabella Dr / Monaro Hwy, Lanyon Dr / Tompsitt Dr, Tompsitt Dr / Jerrabomberra Pkwy / ELP and Lanyon Dr / Monaro Hwy. These intersection improvement recommendations are to ensure the level of service (LOS) is maintained at LOS D or better for all four access options. It is also expected that the assessment will provide advice as to which access option best serves the Queanbeyan and ACT community overall. This information will assist Queanbeyan City Council during negotiations with the South Tralee developer and ACT government.

The analysis was required for the AM and PM peak periods for 2014, 2016, 2018, 2020, 2022, 2024, 2026 and 2031.

This report documents the methodology used in the analysis; the land use inputs for the development, QCC and ACT; lists the road infrastructure improvements included in the future year models; provides LOS and volume plots for the surrounding area and details overall network travel statistics. These outputs will provide a means of comparing the effectiveness of each access option for each of the future years.





Site Location



1



## 3. Model Summary

### 3.1 2011 Base Model

A detailed account of the Queanbeyan City Council (QCC) traffic model is provided in the "Queanbeyan Transport Plan 2011 Model Building Report – February 2013".

The model area covers the region contained within the Queanbeyan and Australian Capital Territory (ACT) LGAs. ACT was included in the model to help reproduce the cross border interaction that occurs between Queanbeyan and ACT. The road network used in the analysis was obtained directly from QCC and ACT GIS systems and includes all roads within the Queanbeyan area and all roads of collector or higher status in the ACT. The ACT area of the model was "broadly" validated but as the model is intended to represent the operation of the QCC network, only flows within the QCC area and in the immediate area of the ACT border were fully validated to required modelling standards.

The model is broken up into zones to represent the land use throughout the model area. The model zone system covers the entire ACT and Queanbeyan model area. The zone system used within the ACT portion of the model is identical to that used in the existing ACT transport model except the Queanbeyan part of the model is detailed in more detail.

The Queanbeyan area of the model is divided into 270 zones with the ACT area divided into approximately 750 zones. In total there are 1200 zones represented in the model with the approximately 180 zones designated as "spares" to provide for future development both within QCC and ACT. The land use used in the base 2011 model was provided by the Australian Bureau of Statistics for the 2011 census year.

Table 1 is a summary of the total 2011 ACT and QCC land use used in the model.

2011 MODEL LAND USE					
Land Use	Queanbeyan	ACT	Entire Model Area		
Households	14,086	129,401	143,487		
Employees	21,095	194,766	215,861		
Vehicles	25,180	218,467	243,647		
Primary School Roll	3,204	32,904	36,108		
Secondary School Roll	1,532	31,332	32,864		
Tertiary Roll	331	31,101	31,432		
Retail Jobs	1,200	15,203	16,403		
Finance Jobs	128	3,738	3,866		
Community Jobs	1,154	21,572	22,726		
Manufacturing Jobs	1,430	5,149	6,579		
Other Jobs	5,635	151,482	157,117		
Total Jobs	9,546	197,198	206,744		

Table 1: 2011 Model Land Use

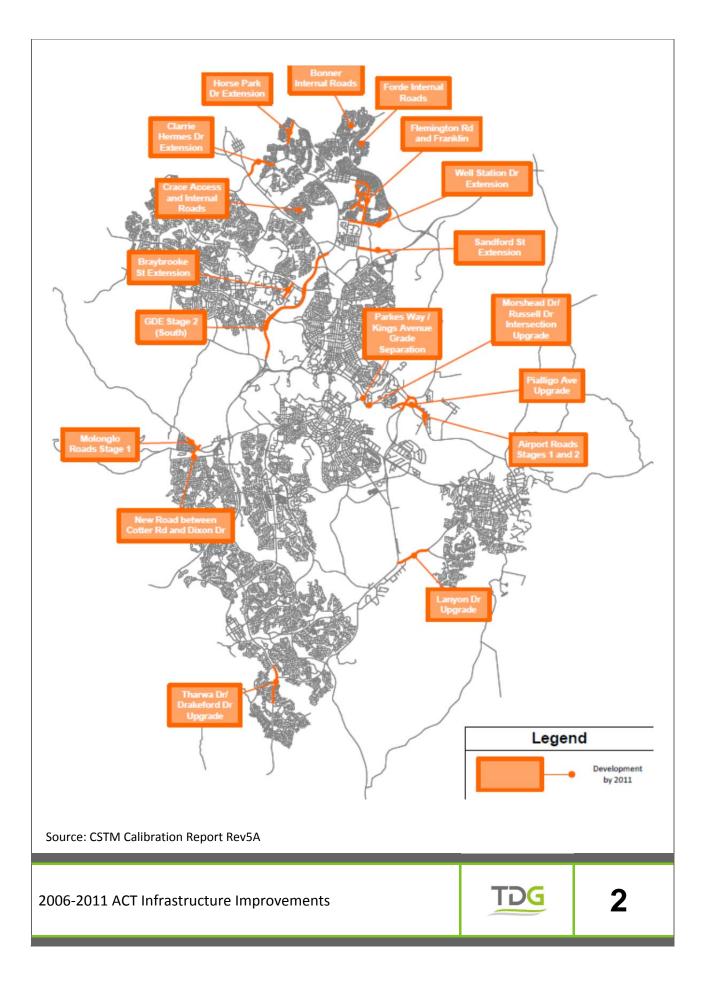


ACT provided a list of infrastructure improvements that had occurred between 2006 and 2011 for inclusion in the validated base 2011 model. Those improvements are detailed in Table 2 and shown in Figure 2.

2006-2011 ACT INFRASTRUCTURE IMPROVEMENTS					
ltem	Description				
Cotter Road and Dixon Drive	New road from Cotter Road to Dixon Drive				
Molonglo Road Stage 1	New roadway providing access to residential developments				
	Duplication from Beltana Road to Brindabella Cct				
	Widening of Sylvia Curley Bridge				
Dialling Assessed the searches	Duplication of Fairbairn Ave (Morshead Dr to Pialligo Ave)				
Pialligo Avenue Upgrades	Duplication of Morshead Dr (Fairbairn Ave to Dairy Rd)				
	New Signals at Pialligo/Fairbairn				
	New Signals at Monaro/Pialligo				
	Extension from Barton Hwy to Glenloch Interchange				
Gungahlin Drive Extension Stage 2	Duplication from Barton Hwy to Glenloch Interchange				
	Upgrade of Glenloch Interchange				
Sandford Street Extension	Connect Sandford Street to Federal Highway				
Well Station Drive Extension	Connect Well Station Drive to Horse Park Drive				
	Duplication of Flemington Rd				
	Extension of Nullarbor Avenue to connect to Flemington Rd				
Flemington Road Upgrades	Extension of Well Station Drive to connect to Flemington Rd				
	Extension of Mapleton Ave to connect to Flemington Rd				
	Other Franklin internal roads				
Horse Park Drive Extension	Extension of sections east and west of Moncrieff				
	Extension from Arrabri Street to Burrumarra Avenue				
Forde Internal Roads	New roadway providing access to residential developments				
East Lake Internal Roads	New roadways providing access to residential developments				
Crace Access (Abena Ave)	New Roundabout on Gundaroo Road to access Crace				
Nudurr Drive Extension	Connect Nudurr Drive to Gungahlin Drive				
Braybrooke Street Extension	Completion of link from Battye St to Ginninderra Dr				
Lanyon Drive Upgrade	Duplication from Monaro Highway to Tompsitt Drive				
Tharwa Drive / Drakeford Drive	Upgrade Duplication from Box Hill Ave to Johnson Drive				
Clarrie Hermes Drive Extension	Connect Clarrie Hermes Dr to Barton Highway				
Morshead Drive – Russell Drive	Intersection Upgrade				
Sutton Road Stage 2	Road upgrade				
Parkes Way – Kings Avenue	Grade separation of existing roundabout				

Table 2: 2006-2011 ACT Infrastructure Improvements Included in TRACKS Model







Clearly, it is important that the validated base 2011 QCC model replicates surveyed 2011 volumes throughout the QCC model area and around the ACT border to ensure that future changes in land use around the South Jerrabomberra area have realistic impacts on the surrounding network.

Tables 3 and 4 provide summaries of the 2011 flow validation along the QCC/ACT border for both the AM Peak (8-9am) and PM Peak (5-6pm).

2011 AMP FLOW VALIDATION						
ACT Downdows	Into QCC			Out of QCC		
ACT Boundary	Count	Model	GEH	Count	Model	GEH
Yass Rd – ACT Border	538	644	4.4	825	746	2.8
McEwan Ave	106	162	4.8	333	365	1.7
Uriara Rd	490	541	2.2	950	850	3.3
Canberra Dr – Nth of Kendall	591	641	1.3	1878	1973	2.2
Lanyon Dr – ACT Border	950	960	0.3	1365	1339	0.7
Old Cooma Rd – Sth of Thoroughbread	32	35	0.5	100	152	4.6
Total	2707	2964	4.8	5451	5425	0.4

Table 3: 2011 AMP Flow Validation

2011 PMP FLOW VALIDATION							
ACT Poundom.		Into QCC			Out of QCC		
ACT Boundary	Count	Model	GEH	Count	Model	GEH	
Yass Rd – ACT Border	792	681	4.1	554	555	0.0	
McEwan Ave	419	416	0.1	145	181	2.8	
Uriara Rd	940	951	0.4	461	507	2.1	
Canberra Dr – Nth of Kendall	1757	1630	3.1	828	886	2.0	
Lanyon Dr – ACT Border	1406	1346	1.6	969	1034	2.1	
Old Cooma Rd – Sth of Thoroughbread	98	116	1.7	49	68	2.5	
Total	5412	5140	3.7	3006	3231	4.0	

Table 4: 2011 PMP Flow Validation

In addition to the above border flows, flows were compared within the ACT near South Jerrabomberra using count flows taken from the latest CSTM Recalibration Report. It appears that the majority of the counts used in the report have been rounded to the nearest 50 vehicles per hour (vph) and may have been taken from SCATS traffic signal information. The use of SCATS data is not as accurate as counts provided by dedicated count sites or tube counts. It is also unclear if the counts have been adjusted for vehicle classification as a high Heavy Goods Vehicle (HGV) content may significantly overestimate the number of vehicles counted.



These flows are only available in the report for the AM Peak but it is not indicated which hour of the two hour peak period they refer to. The AMP flow comparisons are shown in Table 5.

2011 AMP LOCAL ACT FLOW VALIDATION						
ACT Boundame	North / East			South / West		
ACT Boundary	Count	Model	GEH	Count	Model	GEH
Tharwa Dr – Sth of Johnson	1000	1011	0.3	250	191	4.0
Johnson Dr – West of Tharwa	500	357	6.9	250	253	0.2
Isabella Hwy	1350	2225	20.7	650	516	5.5
Erindale Dr	2300	2190	2.3	550	426	5.6
Mugga Ln – West of Monaro	200	189	0.8	500	548	2.1
Hindmarsh Dr – West of Mugga	1700	1611	2.2	1100	1087	0.4
Lanyon Dr – ACT Border	950	960	0.3	1365	1339	0.7
Magga Ln – Sth of Hindmarsh	500	519	0.8	200	307	6.7
Monaro Hwy – Nth of Lanyon	3550	2709	15.0	700	532	6.8
Canberra Dr – Nth of Kendall	591	622	1.3	1878	1973	2.2
Total	12641	12393	2.2	7443	7172	3.2

Table 5: 2011 AMP Local ACT Flow Validation

It should be noted that the only locations in the above table where there is a significant difference between count and model flows are for Isabella Hwy and Monaro Hwy. The modelled flow for Isabella Hwy is high for the Eastbound flow and low for the Westbound flow. The modelled Monaro Hwy flow is low for the Northbound direction.

Given how well other flows validate in the area, as shown in Tables 3 and 5, these large differences of 800-900 vph are difficult to explain. If the modelled Eastbound flow along Isabella Hwy were to be reduced to conform with the ACT count, it would result in a significant reduction in flows along Mugga Ln, Monaro Hwy and Lanyon Dr. Additionally, if the modelled flow Northbound on Monaro Hwy were to be increased, to conform with its ACT count, it would result in a significant increase in flow along Mugga Ln, Monaro Hwy, Lanyon Dr and possible Tompsitt Dr.

It should be noted that the CSTM also underestimates the Northbound Monaro Hwy flow and overestimates the Eastbound Isabella Hwy flow to almost identical levels as the QCC TRACKS model. Such consistency of results between the two independent models indicates that the two counts reported in the CSTM may be atypical.



#### 3.2 Future Years Land Use

The background future year land use for this analysis was based on the established 2011, 2016, 2021, 2026 and 2031 land use information provided by QCC and ACT. The land use for the intermediate future years of 2014, 2018, 2020, 2022 and 2024 was generated by interpolation of the above primary land use information and assuming that development occurred at a uniform rate between years.

This new analysis however includes the reconfiguration of the proposed South Jerrabomberra development area both in location of activity and the level of housing and employment activity. The rate of development at Googong was also adjusted to the new rate of development provided by the Googong developers.

The following details the assumed sequence of the South Jerrabomberra development:

■ Stage 1 – South Tralee

- Years of Development: 2016-2026

Dwellings: 1,348

Commercial Land: 11.75Ha

Commercial Employment: 360 jobs

- Primary School: 1,000 pupils, 100 jobs

■ Stage 2 – The Poplars

Years of Development: 2016-2031

Commercial Land: 7.61Ha

Commercial Employment: 233 jobs

General Employment land: 31.03Ha

General Employment: 3,103 jobs

■ Stage 3 – Morrison, Forrest, Walsh (MFW)

Years of Development: 2018-2028

- Dwellings: 1,000

■ Stage 4a – North Tralee

- Years of Development: 2017-2050

- General Employment Land: 15.0Ha (13.2Ha at 2031)

General Employment: 480 jobs (422 jobs at 2031)

Stage 4b – Environa

Years of Development: 2017-2050

General Employment Land: 77.0Ha (34.8Ha at 2031)

General Employment: 2,450 jobs (1,107 jobs at 2031)



The Googong development was assumed to have the following development staging:

Stage 1a – Neighbourhood 1A

- Years of Development: 2012-2016

- Dwellings: 1,117

- Commercial employment: 208 jobs

■ Stage 1b – Neighbourhood 1B

- Years of Development: 2016-2017

- Dwellings: 345

■ Stage 2 – Neighbourhood 2

Years of Development: 2018-2023

Dwellings: 1,462

Commercial employment: 1,905 jobs

- Primary Schools: 800 pupils, 59 jobs

Secondary School: 400 pupils, 30 jobs

Stage 3 – Neighbourhood 3

- Years of Development: 2023-2026

- Dwellings: 633

Commercial employment: 985 jobs

■ Stage 4 – Neighbourhood 4

- Years of Development: 2026-2030

- Dwellings: 1,101

- Commercial Employment: 13 jobs

- Primary School: 450 pupils, 33 jobs

- Secondary School: 1,200 pupils, 90 jobs

■ Stage 5 – Neighbourhood 5

- Years of Development: 2031-2034

- Dwellings: 651 (217 at 2031)

Commercial Employment: 14 jobs

Tables 6 and 7 show the assumed breakdown of the total households and jobs, for each of the future years, throughout the Queanbeyan area. The South Jerrabomberra development was modelled using 33 individual zones for this analysis.



	FUTURE MODEL HOUSEHOLDS							
	Stage 1 Sth Tralee	Stage 2 Poplars	Stage 3 MFW	Stage 4a Nth Tralee	Stage 4b Environa	Googong	Rest of Queanbeyan	Rest of Model Area
2014	0	0	0	0	0	366	14258	120060
2016	135	0	0	0	0	1117	14438	123135
2018	405	0	100	0	0	1709	14577	126153
2020	675	0	300	0	0	2197	14716	129121
2022	945	0	500	0	0	2685	14855	131795
2024	1215	0	700	0	0	3244	14994	134399
2026	1348	0	900	0	0	3782	15133	136467
2031	1348	0	1000	0	0	4880	15480	168204

**Table 6: Future Household Totals** 

				FUTURE M	ODEL JOBS			
	Stage 1 Sth Tralee	Stage 2 Poplars	Stage 3 MFW	Stage 4a Nth Tralee	Stage 4b Environa	Googong	Rest of Queanbeyan	Rest of Model Area
2014	0	5	0	0	0	145	9617	203462
2016	0	212	0	0	0	465	9617	212082
2018	72	657	0	56	149	907	9693	217569
2020	144	1102	0	114	296	1263	9769	221407
2022	266	1547	0	170	444	1630	9844	225172
2024	388	1992	0	226	593	2071	9920	228844
2026	460	2438	0	284	740	2488	10109	231450
2031	460	3341	0	425	1111	3336	10299	262761

Table 7: Future Job Totals



#### 3.3 Future Years Networks

A number of network improvements were included in the future models at various years to ensure that proposed infrastructure upgrades, by ACT in particular, were included. These infrastructure upgrades could have large impacts on both trip distribution throughout the network and the routes traffic takes between areas.

It was agreed with QCC that the only infrastructure upgrades within Queanbeyan to be included in the future year models would be the local development infrastructures, the Option access arrangements and the four laning of Old Cooma Rd from Googong Rd to Edwin Land Parkway. The four laning of Old Cooma Rd was included once it reached performance along Old Cooma Rd dropped to LOS E so as to ensure that the reduced speed along Old Cooma Rd, as a result of congestion, did not suppress travel between Googong and the rest of the network.

ACT provided a list of infrastructure improvements that are expected to occur the region from 2011-2016, 2016-2021 and 2021-2031 for inclusion in the future models. Those improvements are detailed in Tables 8, 9, 10 and shown in Figures 3, 4 and 5.

2011-2016 ACT INFRASTRUCTURE IMPROVEMENTS					
Item	Description				
Majura Barkuyay	Connect Monaro Highway to Federal Highway				
Majura Parkway	Intersection changes on Pialligo Ave and Fairbairn Ave				
Constitution Avenue Duplication	Duplication including all intersection upgrades				
Parkes Way Widening	Extra Lane on Parkes Way (Glenloch to Edinburgh Ave)				
Monaro Highway Duplication	Duplication over Canberra Ave through Fyshwick				
Cotter Road Upgrade	Duplication from Adelaide Avenue to Molonglo North-South Arterial				
Barry Drive – Clunies Ross Street	Intersection Upgrade				
Bus Lane Connection	Kingsley Street and Rudd Street				
Horse Park Drive Extension	Complete missing section of Horse Park Drive				
Bonner and Jacka Boundary Road	Access to Bonner Area from the Horse Park Drive – Katherine Avenue Intersection				
40km/hr Zones in Town Centres	Civic, Gungahlin, Woden, Belconnen and Tuggeranong				

Table 8: 2011-2016 ACT Infrastructure Improvements Included in the QCC Transportation Model

2016-2021 ACT INFRASTRUCTURE IMPROVEMENTS				
Item	Description			
Clunies Ross Street Upgrade	Duplication of Clunies Ross Street			
William Slim Drive Upgrade	Duplication from Baldwin Drive to Barton Highway			
Gundaroo Drive Upgrade	Duplication from Barton Highway to Gungahlin Drive			
Horse Park Drive Duplication	Duplication from Katherine Ave to Federal Highway			



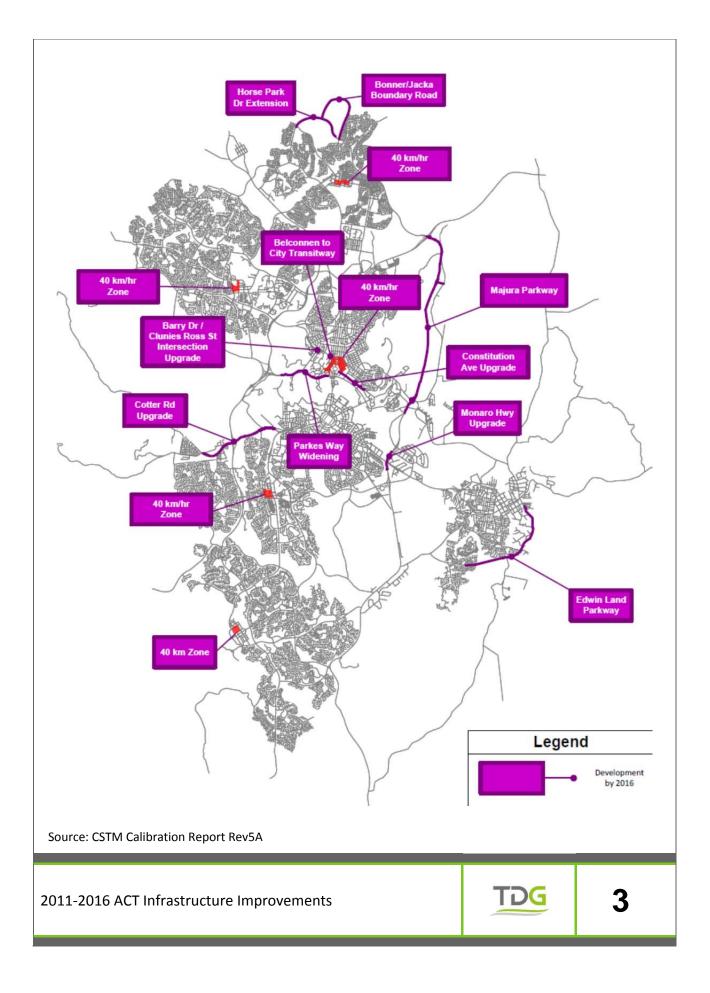
2016-2021 ACT INFRASTRUCTURE IMPROVEMENTS				
ltem	Description			
Clunies Ross - Parkes Interchange	Completion of diamond interchange			
Airport Northern Access Road	Connect Glenora Dr to Majura Road (Northern Access to RAAF Fairbairn)			
Molonglo Roads Stage 2	New roadways providing access to residential development			
Fyshwick - Pialligo Link *	Connect Tennant Street to Gladstone Street and Kallaroo Road (Undecided alignment)			
Abattoir Redevelopment	Access Roads for development of Abattoir (Near Harman)			
East Lake Internal Roads	Connection to Newcastle Street / Dairy Road			
East Lake Internal Roads	Connection of Mundaring Drive to Newcastle Street			
Tennant Street Extension	Connect Tennant Street to Beaconsfield Street			
Jerrabomberra Avenue Extension	Connect Jerrabomberra Avenue to Canberra Avenue			
Googong / Tralee Link	Connect Googong/Tralee area to Lanyon Dr West of Tompsitt St			
Barry Drive - Clunies Ross Street Intersection	Intersection Upgrade			
Northbourne Avenue - London Circuit Intersection	Intersection Upgrade			
Northbourne Avenue Transit Lane	From London Circuit to Federal Highway, Kerb side; new additional exclusive lane			

Table 9: 2016-2021 ACT Infrastructure Improvements Included in the QCC Transportation Model

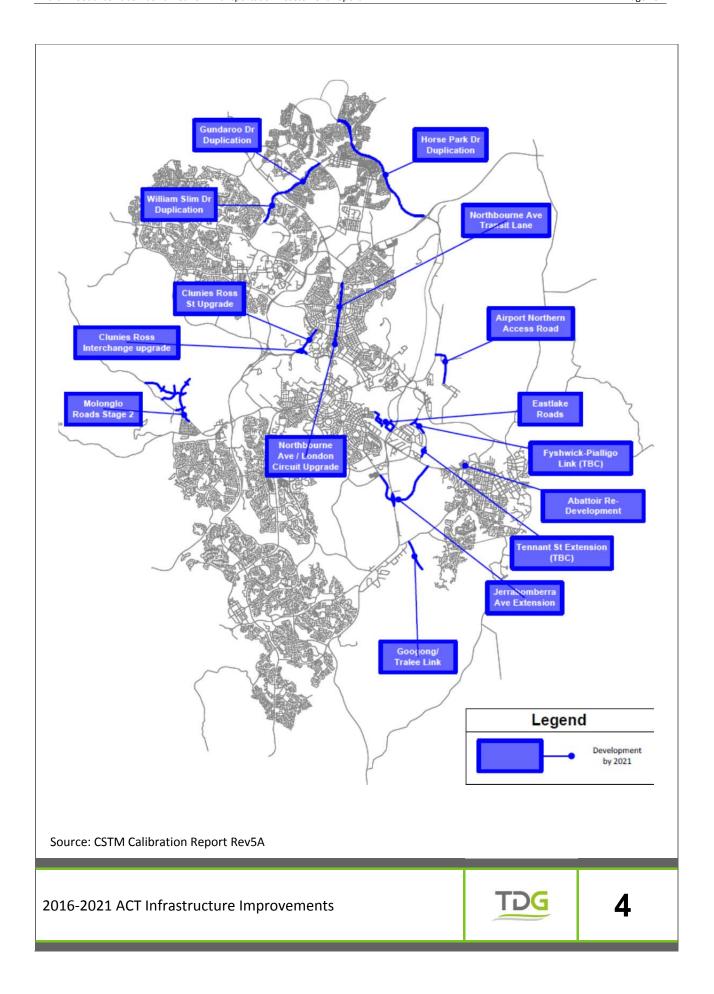
2021-2031 ACT INFRASTRUCTURE IMPROVEMENTS								
Item	Description							
William Slim Drive Upgrade	Duplication from Baldwin Drive to Ginninderra Drive							
Molonglo Roads Stage 3	New roadways providing access to residential development							
East Lake Bridges	Two bridges over Jerrabomberra Creek							
Monaro Highway Interchange	Diamond Interchange at Monaro Highway - Isabella Drive / Mugga Lane							
Pialligo Avenue Realignment	For airport runway extension							

Table 10: 2021-2031 ACT Infrastructure Improvements Included in the QCC Transportation Model

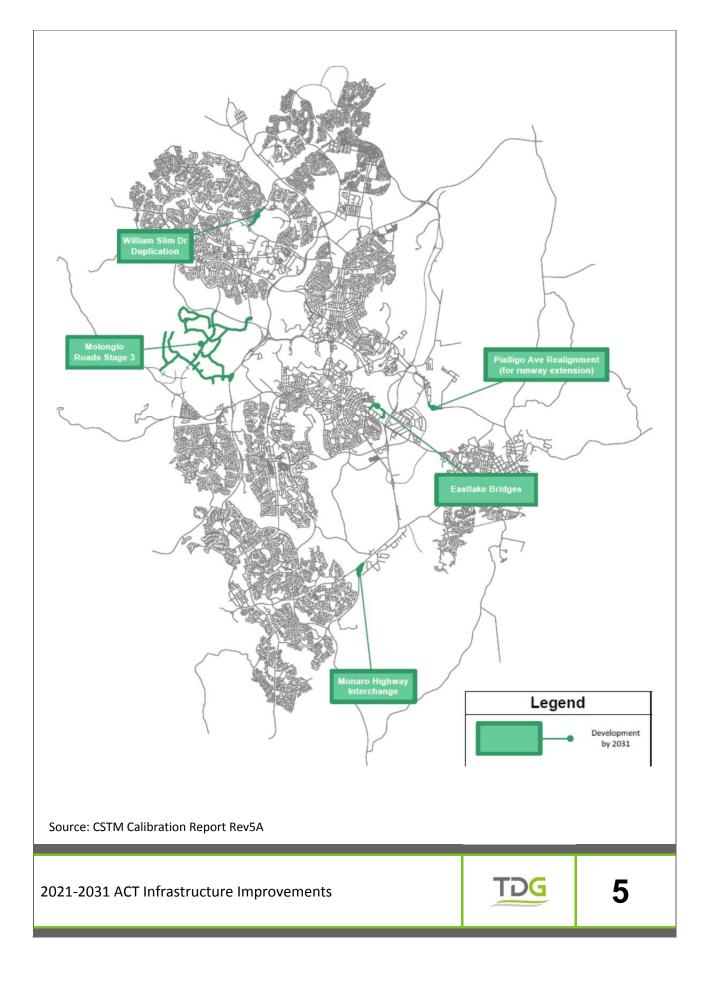














## 3.4 Analysis Methodology

The process used for analysing the Sth Jerrabomberra Access Options involved the following process:

- Create the South Jerrabomberra and Googong land use for each year of 2014, 2016, 2018, 2020, 2022, 2024, 2026 and 2031 utilising the development data provided by QCC;
- Update the base 2014, 2016, 2018, 2020, 2022, 2024, 2026 and 2031 future year networks with the new South Jerrabomberra development structure plan and general ACT network improvements;
- Converge each future year AM and PM peak model using each year's base future networks until travel patterns for each year have settled into a converged and consistent distribution. The base networks include a single lane dual carriageway connection to Tompsitt Drive for the South Jerrabomberra Development with traffic signals at its intersection with Tompsitt Drive;
- Create four new access arrangement option networks for each future year and assign respective future year flows to each to determine network performance for each access option. The additional three options were:
  - One access Four Lane access to Tompsitt Dr
  - Two accesses Tompsitt Dr and Sheppard St
  - Two accesses Tompsitt Dr and Isabella Dr
  - Three accesses Tompsitt Dr, Sheppard St and Isabella Dr
- Create Level of Service (LOS) and volume plots for each access option. Network travel totals in the form of vehicle kilometres, vehicle minutes and network operating speeds will be obtained for each option to help determine which access arrangement best serves the Queanbeyan and ACT communities;
- Recommend any additional intersection or road improvements in the surrounding network that may be required for each of the access options to maintain at least a LOS D standard.



## 4. Access Option LOS Results

## 4.1 Option 1 – Two Lane One Access – Tompsitt Dr

## 4.1.1 LOS Comparisons

Appendix A contains AMP and PMP volume and Level of Service (LOS) plots for the South Jerrabomberra One Access Option with a single lane dual carriageway connection to Tompsitt Drive for the South Jerrabomberra Development with traffic signals at its intersection with Tompsitt Drive.

The volume plots show modelled hourly flow for each direction separately.

The LOS plots show a combination of link LOS, average intersection LOS (circles) and individual approach LOS (short lines).

The modelled LOS values at various critical locations in the South Jerrabomberra area are summarised in Tables 11 and 12 for AMP and PMP periods respectively.

	AMP LOS AT CRITICAL LOCATIONS												
Location	2014	2016	2018	2020	2022	2024	2026	2031					
Monaro Hwy nth of Lanyon	Е	Е	Е	Е	Е	Е	Е	E					
Monaro Hwy nth of Isabella	F	F	F	F	F	F	F	F					
Monaro Hwy nth of Mugga	Е	Е	Е	Е	Е	Е	Е	E					
Isabella Dr wst of Monaro	D	D	D	D	D	D	D	D					
Sth Jerrabomberra Access Rd	-	-	-	-	С	D	Е	E					
Isabella / Monaro Roundabout (worst approach)	F	F	F	F	F	F	F	F					
Monaro / Mugga (worst approach)	F	F	F	F	F	F	F	F					
Monaro / Sheppard (worst approach)	F	F	F	F	F	F	F	F					
Monaro / Lanyon (worst approach)	D	D	D	D	E	Е	E	E					
Lanyon / Tompsitt (worst approach)	С	С	D	E	E	F	F	F					
Tompsitt / ELP (worst approach)	-	-	-	-	-	-	-	-					
Tompsitt / Sth Jerrabomberra Access Rd (worst approach)	-	D	D	D	Е	E	F	F					

Table 11: AMP LOS at Critical Location



	PMP LOS AT CRITICAL LOCATIONS												
Location	2014	2016	2018	2020	2022	2024	2026	2031					
Monaro Hwy nth of Lanyon	Е	Е	E	E	Е	Е	Е	Е					
Monaro Hwy nth of Isabella	F	F	F	F	F	F	F	F					
Monaro Hwy nth of Mugga	Е	Е	Е	Е	Е	Е	F	F					
Isabella Dr wst of Monaro	С	С	С	С	С	С	С	С					
Sth Jerrabomberra Access Rd	-	-	-	-	С	D	D	Е					
Isabella / Monaro Roundabout (worst approach)	F	F	F	F	F	F	F	F					
Monaro / Mugga (worst approach)	С	С	С	С	С	С	С	С					
Monaro / Sheppard (worst approach)	E	E	E	F	E	E	E	F					
Monaro / Lanyon (worst approach)	D	D	D	D	D	D	D	D					
Lanyon / Tompsitt (worst approach)	E	E	F	F	F	F	F	F					
Tompsitt / ELP (worst approach)	-	-	-	-	-	-	-	-					
Tompsitt / Sth Jerrabomberra Access Rd (worst approach)	-	D	Е	E	E	F	F	F					

Table 12: PMP LOS at Critical Location

#### 4.1.2 Discussion

It is clear that many of the links and intersection approaches at critical locations around the South Jerrabomberra area are already at LOS E/F, or are expected to be by 2014. This is especially true for the Monaro Hwy corridor where the corridor is already operating at LOS E/F and most of the intersections along the corridor have approaches at LOS E/F during either peak period.

The LOS deficiency at the Monaro / Sheppard traffic signals appears to relate to the merging of traffic with the northbound carriageway in the AM peak and the Sheppard St left turn Give Way in the PM Peak rather than the operation of the traffic signals.

The modelling of the southbound slip lane from Lanyon Dr onto the Monaro Hwy indicates that it is already operating at LOS F during the PM peak. Only the signal operation LOS has been reported in the LOS tables.

As the land use throughout the model increases over time, the LOS throughout the area generally worsens. Those locations already operating at LOS F cannot attain a worse LOS but delay and speeds do continue to deteriorate. Intersections operating at LOS E move to LOS F generally by 2020, particularly in the PMP. This is especially true for intersections along Tompsitt Dr where approaches already operating at LOS E in the PMP deteriorate to LOS F by 2018. During the AMP, the Tompsitt Dr intersections are expected to cope better with projected traffic flows but still deteriorate to LOS E at around 2022/2024.



The single lane dual carriageway access road to the South Jerrabomberra development is expected to maintain a link LOS of D or better until approximately 2026 when predicted directional vehicle flow exceeds 1200 vehicles per lane (vph).

However, from 2018 onwards, a number of individual approaches at the signalised intersection with Tompsitt Dr are expected to have approach delays that exceed LOS E conditions even though the intersection has an overall satisfactory performance. The signalised intersection has been assumed to have dual lanes for all critical movements to take advantage of the four lane Tompsitt Dr carriageway. However, during the PM peak the eastbound flow dominates the signal operation resulting in large delays for other movements.

It is therefore expected that an option with an additional access will be needed to maintain a reasonable LOS at the Tompsitt Dr / Sth Jerrabomberra Access Rd intersection from approximately 2020 assuming the proposed rate of development.

## 4.1.3 Possible Network Improvements

The study brief indicated that recommendations were to be made for improvements required to return the surrounding network to LOS D or better. These recommended improvements have not been modelled and are suggested as possible improvements for each network element in isolation. It is possible that local operational improvements may be obtained by other means such as upgrading alternative routes elsewhere to redistribute traffic flow away from the area. It is also possible that no reasonable solution may be available to return some elements of the local network back to LOS D or better.

The suggested improvements are shown Table 13.

РОТ	ENTIAL CRITICAL L	OCATIO	N IMP	ROVEN	IENTS				
Location	Possible Improvement	2014	2016	2018	2020	2022	2024	2026	2031
Monaro Hwy nth of Lanyon	Six Lane	х							
Monaro Hwy nth of Isabella	Six Lane	Х							
Monaro Hwy nth of Mugga	Six Lane	Х							
Isabella Dr wst of Monaro	-								
Sth Jerrabomberra Access Rd	Four Lane							Х	
Isabella / Monaro Roundabout	Traffic Signals	Х							
Monaro / Mugga TS	Reconfigure	Х							
Monaro / Sheppard TS	Reconfigure	Х							
Monaro / Lanyon TS	Reconfigure					Х			
Lanyon / Tompsitt Roundabout	Traffic Signals			Х					
Tompsitt / ELP Roundabout	-								
Tompsitt / Access Rd TS	Reconfigure			Х					

Table 13: Potential Critical Location Improvements



## 4.2 Option 2 – Four Lane One Access – Tompsitt Dr

### 4.2.1 LOS Comparisons

Appendix B contains AMP and PMP volume and Level of Service (LOS) plots for the South Jerrabomberra One Access Option with a dual lane dual carriageway connection to Tompsitt Drive for the South Jerrabomberra Development with traffic signals at its intersection with Tompsitt Drive. The four lanes have been assumed to be in place for Stages 1 and 3 of the access road alignment from Tompsitt Dr. However, the four lanes may need to be constructed further to include parts of Stage 2 depending on the final development layout.

Analysis of this option is undertaken for the years after the need to upgrade the operation of the Tompsitt Dr / Sth Jerrabomberra Access Rd intersection i.e. from 2020-2031.

The volume plots show modelled hourly flow for each direction separately.

The LOS plots show a combination of link LOS, average intersection LOS (circles) and individual approach LOS (short lines).

The modelled LOS values at various critical locations in the South Jerrabomberra area are summarised in Tables 14 and 15 for AMP and PMP periods respectively.

	AMP LOS AT CRITICAL LOCATIONS												
Location	2014	2016	2018	2020	2022	2024	2026	2031					
Monaro Hwy nth of Lanyon	Е	Е	Е	Е	Е	Е	Е	E					
Monaro Hwy nth of Isabella	F	F	F	F	F	F	F	F					
Monaro Hwy nth of Mugga	Е	Е	Е	Е	Е	Е	Е	Е					
Isabella Dr wst of Monaro	D	D	D	D	D	D	D	D					
Sth Jerrabomberra Access Rd	-	-	-	-	С	С	D	D					
Isabella / Monaro Roundabout (worst approach)	F	F	F	F	F	F	F	F					
Monaro / Mugga (worst approach)	F	F	F	F	F	F	F	F					
Monaro / Sheppard (worst approach)	F	F	F	F	F	F	F	F					
Monaro / Lanyon (worst approach)	D	D	D	Е	E	Е	Е	Е					
Lanyon / Tompsitt (worst approach)	С	С	D	Е	Е	F	F	F					
Tompsitt / ELP (worst approach)	-	-	-	-	-	-	-	-					
Tompsitt / Sth Jerrabomberra Access Rd (worst approach)	-	D	D	Е	E	E	F	F					

Table 14: AMP LOS at Critical Location



PMP LOS AT CRITICAL LOCATIONS											
Location	2014	2016	2018	2020	2022	2024	2026	2031			
Monaro Hwy nth of Lanyon	Е	Е	Е	Е	E	Е	Е	Е			
Monaro Hwy nth of Isabella	F	F	F	F	F	F	F	F			
Monaro Hwy nth of Mugga	Е	Е	Е	Е	Е	Е	F	F			
Isabella Dr wst of Monaro	С	С	С	С	С	С	С	С			
Sth Jerrabomberra Access Rd	-	-	-	-	С	С	D	D			
Isabella / Monaro Roundabout (worst approach)	F	F	F	F	F	F	F	F			
Monaro / Mugga (worst approach)	С	С	С	С	С	С	С	С			
Monaro / Sheppard (worst approach)	Е	Е	Е	F	Е	Е	Е	F			
Monaro / Lanyon (worst approach)	D	D	D	D	D	D	D	D			
Lanyon / Tompsitt (worst approach)	Е	Е	F	F	F	F	F	F			
Tompsitt / ELP (worst approach)	-	-	-	-	-	-	-	-			
Tompsitt / Sth Jerrabomberra Access Rd (worst approach)	-	D	Е	Е	Е	F	F	F			

Table 15: PMP LOS at Critical Location

As expected, the operation of the local network is almost identical to the operation of the base Option 1. As the only difference between Option 1 and Option 2 is the four laning of the South Jerrabomberra Access Rd it was expected that the only appreciable difference between the options was the LOS along the Access Rd.

This option creates a dual lane dual carriageway along the Access Rd south from Tompsitt Dr. The four lane access road is expected to maintain a LOS of D or better throughout the analysis period for both peak periods.

However as shown in Option 1, from 2018 onwards, a number of individual approaches at the signalised intersection with Tompsitt Dr are expected to have approach delays that exceed LOS E conditions. As in Option 1, the signalised intersection has been assumed to have dual lanes for all critical movements to take advantage of the four lane Tompsitt Dr carriageway. However, during the PM peak the eastbound flow again dominates the signal operation resulting in large delays for other movements.

## 4.2.2 Possible Network Improvements

The study brief indicated that recommendations were to be made for improvements required to return the surrounding network to LOS D or better. These recommended improvements have not been modelled and are suggested as possible improvements for each network element in isolation. It is possible that local operational improvements may be obtained by other means such as upgrading alternative routes elsewhere to redistribute



traffic flow away from the area. It is also possible that no reasonable solution may be available to return some elements of the local network back to LOS D or better.

The suggested improvements are shown Table 16.

РОТ	ENTIAL CRITICAL L	OCATIO	N IMP	ROVEN	IENTS				
Location	Possible Improvement	2014	2016	2018	2020	2022	2024	2026	2031
Monaro Hwy nth of Lanyon	Six Lane	х							
Monaro Hwy nth of Isabella	Six Lane	х							
Monaro Hwy nth of Mugga	Six Lane	х							
Isabella Dr wst of Monaro	-								
Sth Jerrabomberra Access Rd	-								
Isabella / Monaro Roundabout	Traffic Signals	х							
Monaro / Mugga TS	Reconfigure	Х							
Monaro / Sheppard TS	Reconfigure	Х							
Monaro / Lanyon TS	Reconfigure				Х				
Lanyon / Tompsitt Roundabout	Traffic Signals			Х					
Tompsitt / ELP Roundabout	-								
Tompsitt / Access Rd TS	Reconfigure			Х					

**Table 16: Potential Critical Location Improvements** 



## 4.3 Option 3 – Two Accesses – Tompsitt Dr / Sheppard St

## 4.3.1 LOS Comparisons

Appendix C contains AMP and PMP volume and Level of Service (LOS) plots for the South Jerrabomberra Two Access Option with a single lane dual carriageway connection to Tompsitt Drive and to Sheppard Rd for the South Jerrabomberra Development. The Tompsitt Dr access will include traffic signals at its intersection with Tompsitt Drive.

Analysis of this option is undertaken for the years after the need to upgrade the operation of the Tompsitt Dr / Sth Jerrabomberra Access Rd intersection i.e. from 2020-2031.

The volume plots show modelled hourly flow for each direction separately.

The LOS plots show a combination of link LOS, average intersection LOS (circles) and individual approach LOS (short lines).

The modelled LOS values at various critical locations in the South Jerrabomberra area are summarised in Tables 17 and 18 for AMP and PMP periods respectively.

	AMP LOS AT CRITICAL LOCATIONS												
Location	2014	2016	2018	2020	2022	2024	2026	2031					
Monaro Hwy nth of Lanyon	Е	E	Е	Е	Е	Е	Е	E					
Monaro Hwy nth of Isabella	F	F	F	F	F	F	F	F					
Monaro Hwy nth of Mugga	Е	Е	Е	Е	Е	Е	Е	E					
Isabella Dr wst of Monaro	D	D	D	D	D	D	D	D					
Sth Jerrabomberra Access Rd	-	-	-	-	-	-	С	D					
Isabella / Monaro Roundabout (worst approach)	F	F	F	F	F	F	F	F					
Monaro / Mugga (worst approach)	F	F	F	F	F	F	F	F					
Monaro / Sheppard (worst approach)	F	F	F	F	F	F	F	F					
Monaro / Lanyon (worst approach)	D	D	D	D	D	Е	Е	D					
Lanyon / Tompsitt (worst approach)	С	С	D	С	D	D	D	D					
Tompsitt / ELP (worst approach)	-	-	-	-	-	-	-	-					
Tompsitt / Sth Jerrabomberra Access Rd (worst approach)	-	D	D	D	D	D	D	E					

Table 17: AMP LOS at Critical Location



PMP LOS AT CRITICAL LOCATIONS											
Location	2014	2016	2018	2020	2022	2024	2026	2031			
Monaro Hwy nth of Lanyon	Е	Е	Е	Е	Е	Е	Е	Е			
Monaro Hwy nth of Isabella	F	F	F	F	F	F	F	F			
Monaro Hwy nth of Mugga	Е	Е	Е	Е	Е	Е	F	F			
Isabella Dr wst of Monaro	С	С	С	С	С	С	С	С			
Sth Jerrabomberra Access Rd	-	-	-	-	-	-	С	D			
Isabella / Monaro Roundabout (worst approach)	F	F	F	F	F	F	F	F			
Monaro / Mugga (worst approach)	С	С	С	С	С	С	С	С			
Monaro / Sheppard (worst approach)	Е	Е	Е	Е	Е	Е	F	F			
Monaro / Lanyon (worst approach)	D	D	D	Е	Е	E	Е	E			
Lanyon / Tompsitt (worst approach)	Е	Е	F	E	Е	Е	E	E			
Tompsitt / ELP (worst approach)	-	-	-	-	-	-	-	-			
Tompsitt / Sth Jerrabomberra Access Rd (worst approach)	-	D	Е	E	E	D	D	D			

Table 18: PMP LOS at Critical Location

This access option does not alter the link LOS along either the Monaro Hwy or Isabella Dr. However, the single lane dual carriageway access road to the South Jerrabomberra development from Tompsitt Dr is expected to maintain a link LOS of D or better during peak periods throughout the analysis period.

Intersections along Monaro Hwy between Lanyon Dr and Isabella Dr are again expected to have approaches that operate at LOS F during the AM peak. Those intersections are also expected perform in a similar fashion to Options 1 and 2 during the PM peak.

The Lanyon / Monaro intersection is expected to operate slightly worse during the PM peak but slightly better during the AM peak when compared to Options 1 and 2. The degrading of the PM peak LOS operation of the intersection is due to changes in directional flow through the intersection as a result of the additional access. This change in flow balance results in a change in signal operation which in turn changes the delay balance for some movements.

The additional access onto Sheppard St reduces the demand for the Sth Jerrabomberra Development Access Rd. This in turn results in an improvement in future intersection operation for the Lanyon / Tompsitt and Tompsitt / Sth Jerrabomberra Access Rd intersections when compared to Options 1 and 2.

The Lanyon / Tompsitt roundabout is expected to maintain LOS D during the AM peak and no worse than LOS E on one approach during the PM peak until 2031. The Tompsitt / Sth Jerrabomberra Access Rd signals are expected to generally operate at LOS D on its worst approach. This is substantially better than either Access Options 1 or 2.



## 4.3.2 <u>Possible Network Improvements</u>

The study brief indicated that recommendations were to be made for improvements required to return the surrounding network to LOS D or better. These recommended improvements have not been modelled and are suggested as possible improvements for each network element in isolation. It is possible that local operational improvements may be obtained by other means such as upgrading alternative routes elsewhere to redistribute traffic flow away from the area. It is also possible that no reasonable solution may be available to return some elements of the local network back to LOS D or better.

The suggested improvements are shown Table 19.

РОТ	ENTIAL CRITICAL L	OCATIO	N IMP	ROVEN	IENTS				
Location	Possible Improvement	2014	2016	2018	2020	2022	2024	2026	2031
Monaro Hwy nth of Lanyon	Six Lane	х							
Monaro Hwy nth of Isabella	Six Lane	х							
Monaro Hwy nth of Mugga	Six Lane	х							
Isabella Dr wst of Monaro	-								
Sth Jerrabomberra Access Rd	-								
Isabella / Monaro Roundabout	Traffic Signals	Х							
Monaro / Mugga TS	Reconfigure	Х							
Monaro / Sheppard TS	Reconfigure	Х							
Monaro / Lanyon TS	Reconfigure				Х				
Lanyon / Tompsitt Roundabout	Traffic Signals				Х				
Tompsitt / ELP Roundabout	-								
Tompsitt / Access Rd TS	Reconfigure								Х

**Table 19: Potential Critical Location Improvements** 



## 4.4 Option 4 – Two Accesses – Tompsitt Dr / Isabella Dr

## 4.4.1 LOS Comparisons

Appendix D contains AMP and PMP volume and Level of Service (LOS) plots for the South Jerrabomberra Two Access Option with a single lane dual carriageway connection to Tompsitt Drive and to Isabella Dr for the South Jerrabomberra Development. The Tompsitt Dr access will include traffic signals at its intersection with Tompsitt Drive.

This option requires the replacement of the Isabella / Monaro roundabout with traffic signals in order to allow access from the east. The current roundabout includes a dual lane uninterrupted slip lane from north to south which bypasses the roundabout. Preliminary tests show that removing the slip lane to allow access to the roundabout from the east results in unacceptable delay to the northern approach during the PM peak.

Analysis of this option is undertaken for the years after the need to upgrade the operation of the Tompsitt Dr / Sth Jerrabomberra Access Rd intersection i.e. from 2020-2031. Volume plots show modelled hourly flow for each direction separately. LOS plots show a combination of link LOS, average intersection LOS (circles) and individual approach LOS (short lines).

The modelled LOS values at various critical locations in the South Jerrabomberra area are summarised in Tables 20 and 21 for AMP and PMP periods respectively.

	AMP LOS AT CRITICAL LOCATIONS												
Location	2014	2016	2018	2020	2022	2024	2026	2031					
Monaro Hwy nth of Lanyon	Е	Е	Е	Е	E	Е	Е	Е					
Monaro Hwy nth of Isabella	F	F	F	F	F	F	F	F					
Monaro Hwy nth of Mugga	Е	Е	E	Е	Е	Е	Е	Е					
Isabella Dr wst of Monaro	D	D	D	С	С	С	С	С					
Sth Jerrabomberra Access Rd	-	-	-	-	-	-	D	Е					
Isabella / Monaro Signals (worst approach)	F	F	F	Е	Е	Е	Е	F					
Monaro / Mugga (worst approach)	F	F	F	F	F	F	F	F					
Monaro / Sheppard (worst approach)	F	F	F	F	F	F	F	F					
Monaro / Lanyon (worst approach)	D	D	D	С	D	D	D	D					
Lanyon / Tompsitt (worst approach)	С	С	D	С	E	Е	E	E					
Tompsitt / ELP (worst approach)	-	-	-	-	-	-	-	-					
Tompsitt / Sth Jerrabomberra Access Rd (worst approach)	-	D	D	D	D	D	Е	E					

Table 20: AMP LOS at Critical Location



	PMP LOS AT CRITICAL LOCATIONS												
Location	2014	2016	2018	2020	2022	2024	2026	2031					
Monaro Hwy nth of Lanyon	Е	Е	E	E	Е	Е	Е	E					
Monaro Hwy nth of Isabella	F	F	F	F	F	F	F	F					
Monaro Hwy nth of Mugga	Е	Е	E	E	E	Е	F	F					
Isabella Dr wst of Monaro	С	С	С	С	С	С	С	С					
Sth Jerrabomberra Access Rd	-	-	-	-	-	-	С	С					
Isabella / Monaro Signals (worst approach)	F	F	F	E	F	F	F	F					
Monaro / Mugga (worst approach)	С	С	С	С	С	С	С	С					
Monaro / Sheppard (worst approach)	Е	Е	Е	Е	Е	E	Е	F					
Monaro / Lanyon (worst approach)	D	D	D	Е	Е	E	Е	Е					
Lanyon / Tompsitt (worst approach)	E	E	F	E	E	E	E	E					
Tompsitt / ELP (worst approach)	-	-	-	-	-	-	-	-					
Tompsitt / Sth Jerrabomberra Access Rd (worst approach)	-	D	E	F	E	E	E	E					

Table 21: PMP LOS at Critical Location

This access option does not alter the link LOS along the Monaro Hwy. However, Isabella Dr is expected to improve to LOS C as a result of modelled traffic from the southwestern areas diverting from Isabella Dr onto the Monaro Hwy due to the operation of the new traffic signals.

The single lane dual carriageway access road to the South Jerrabomberra development from Tompsitt Dr is expected to maintain a link LOS of D or better until approximately 2031 when predicted directional vehicle flow exceeds 1200 vehicles per lane (vph) in the AM peak.

Intersections along Monaro Hwy between Lanyon Dr and Isabella Dr are again expected to have approaches that operate at LOS F during the AM peak. Those intersections are also expected perform in a similar fashion to Options 1 and 2 during the PM peak. However, the Isabella / Monaro traffic signals do appear to operate slightly better than the existing roundabout. It is expected that the operation of the traffic signal could be improved further depending on the final intersection configuration and phase arrangements.

The Lanyon / Monaro intersection is again expected to operate slightly worse during the PM peak and slightly better during the AM peak when compared to Option 1 and 2. Modelling suggests however that it is expected to operate similarly to Option 3.

The additional access onto Isabella Dr also reduces the demand for the Sth Jerrabomberra Development Access Rd but to a lesser level than the Sheppard St Access Option 3. Whilst this also results in an improvement in future intersection operation for the Lanyon / Tompsitt and Tompsitt / Sth Jerrabomberra Access Rd intersections, it is not as great as Option 3.



The Lanyon / Tompsitt roundabout is expected to maintain LOS D during the AM peak until 2024 and no worse than LOS E on one approach during the PM peak. The Tompsitt / Sth Jerrabomberra Access Rd signals are expected to generally operate at LOS E on its worst approach.

## 4.4.2 <u>Possible Network Improvements</u>

The study brief indicated that recommendations were to be made for improvements required to return the surrounding network to LOS D or better. These recommended improvements have not been modelled and are suggested as possible improvements for each network element in isolation. It is possible that local operational improvements may be obtained by other means such as upgrading alternative routes elsewhere to redistribute traffic flow away from the area. It is also possible that no reasonable solution may be available to return some elements of the local network back to LOS D or better.

The suggested improvements are shown Table 22.

POTENTIAL CRITICAL LOCATION IMPROVEMENTS									
Location	Possible Improvement	2014	2016	2018	2020	2022	2024	2026	2031
Monaro Hwy nth of Lanyon	Six Lane	х							
Monaro Hwy nth of Isabella	Six Lane	Х							
Monaro Hwy nth of Mugga	Six Lane	х							
Isabella Dr wst of Monaro	-								
Sth Jerrabomberra Access Rd	Four Lane								Х
Isabella / Monaro Roundabout	Traffic Signals	х							
Monaro / Mugga TS	Reconfigure	х							
Monaro / Sheppard TS	Reconfigure	Х							
Monaro / Lanyon TS	Reconfigure				Х				
Lanyon / Tompsitt Roundabout	Traffic Signals					Х			
Tompsitt / ELP Roundabout	-								
Tompsitt / Access Rd TS	Reconfigure								Х

**Table 22: Potential Critical Location Improvements** 



## 4.5 Option 5 – Three Accesses – Tompsitt Dr / Sheppard Rd / Isabella Dr

#### 4.5.1 LOS Comparisons

Appendix E contains AMP and PMP volume and Level of Service (LOS) plots for the South Jerrabomberra Three Access Option with a single lane dual carriageway connection to Tompsitt Drive, Isabella Dr and Shepperd Rd for the South Jerrabomberra Development. The Tompsitt Dr access will include traffic signals at its intersection with Tompsitt Drive.

This option also requires the replacement of the Isabella / Monaro roundabout with traffic signals in order to allow access from the east. The current roundabout includes a dual lane uninterrupted slip lane from north to south which bypasses the roundabout.

Analysis of this option is undertaken for the years after the need to upgrade the operation of the Tompsitt Dr / Sth Jerrabomberra Access Rd intersection i.e. from 2020-2031. Volume plots show modelled hourly flow for each direction separately. LOS plots show a combination of link LOS, average intersection LOS (circles) and individual approach LOS (short lines).

The modelled LOS values at various critical locations in the South Jerrabomberra area are summarised in Tables 23 and 24 for AMP and PMP periods respectively.

AMP LOS AT CRITICAL LOCATIONS									
Location	2014	2016	2018	2020	2022	2024	2026	2031	
Monaro Hwy nth of Lanyon	Е	Е	Е	Е	Е	Е	Е	E	
Monaro Hwy nth of Isabella	F	F	F	F	F	F	F	F	
Monaro Hwy nth of Mugga	Е	Е	Е	Е	Е	Е	Е	Е	
Isabella Dr wst of Monaro	D	D	D	С	С	С	С	С	
Sth Jerrabomberra Access Rd	-	-	-	-	-	-	С	D	
Isabella / Monaro Signals (worst approach)	F	F	F	E	E	E	Е	Е	
Monaro / Mugga (worst approach)	F	F	F	F	F	F	F	F	
Monaro / Sheppard (worst approach)	F	F	F	F	F	F	F	F	
Monaro / Lanyon (worst approach)	D	D	D	D	D	D	D	D	
Lanyon / Tompsitt (worst approach)	С	С	D	С	D	D	D	D	
Tompsitt / ELP (worst approach)	-	-	-	-	-	-	-	-	
Tompsitt / Sth Jerrabomberra Access Rd (worst approach)	-	D	D	D	D	D	D	E	

Table 23: AMP LOS at Critical Location



PMP LOS AT CRITICAL LOCATIONS										
Location	2014	2016	2018	2020	2022	2024	2026	2031		
Monaro Hwy nth of Lanyon	Е	Е	Е	E	Е	Е	E	E		
Monaro Hwy nth of Isabella	F	F	F	F	F	F	F	F		
Monaro Hwy nth of Mugga	Е	Е	Е	Е	Е	Е	F	F		
Isabella Dr wst of Monaro	С	С	С	С	С	С	С	С		
Sth Jerrabomberra Access Rd	-	-	-	-	-	-	С	D		
Isabella / Monaro Signals (worst approach)	F	F	F	E	Е	E	Е	Е		
Monaro / Mugga (worst approach)	С	С	С	С	С	С	С	С		
Monaro / Sheppard (worst approach)	Е	E	E	Е	Е	E	Е	F		
Monaro / Lanyon (worst approach)	D	D	D	Е	Е	E	Е	Е		
Lanyon / Tompsitt (worst approach)	Е	Е	F	E	Е	E	F	E		
Tompsitt / ELP (worst approach)	-	-	-	-	-	-	-	-		
Tompsitt / Sth Jerrabomberra Access Rd (worst approach)	-	D	Е	E	Е	D	D	E		

Table 24: PMP LOS at Critical Location

This access option does not alter the link LOS along the Monaro Hwy. However, Isabella Dr is again expected to improve to LOS C as a result of modelled traffic from the southwestern areas diverting from Isabella Dr onto the Monaro Hwy.

The single lane dual carriageway access road to the South Jerrabomberra development from Tompsitt Dr is expected to maintain a link LOS of D or better during peak periods throughout the analysis period.

The intersections along Monaro Hwy between Lanyon Dr and Isabella Dr are again expected to operate at LOS F during the AM peak. Those intersections are also expected perform in a similar fashion to Options 1 and 2 during the PM peak. However, the Isabella / Monaro traffic signals do appear to operate slightly better than both the roundabout and Option 4 signals. The modelled traffic signals appear to maintain LOS E throughout the analysis period and it is expected that the operation of the traffic signal could be improved further depending on the final intersection configuration and phase arrangements

The spreading of the development traffic demand between three accesses appears to result in the Lanyon / Monaro, Lanyon / Tompsitt and Tompsitt / Sth Jerrabomberra Access intersections all operating as well as both Options 3 and 4. The Lanyon / Tompsitt roundabout is expected to maintain LOS D during the AM peak and no worse than LOS E on one approach during the PM peak. The Tompsitt / Sth Jerrabomberra Access Rd signals are expected to generally operate at LOS D on its worst approach.



## 4.5.2 <u>Possible Network Improvements</u>

The study brief indicated that recommendations were to be made for improvements required to return the surrounding network to LOS D or better. These recommended improvements have not been modelled and are suggested as possible improvements for each network element in isolation. It is possible that local operational improvements may be obtained by other means such as upgrading alternative routes elsewhere to redistribute traffic flow away from the area. It is also possible that no reasonable solution may be available to return some elements of the local network back to LOS D or better.

The suggested improvements are shown Table 25.

POTENTIAL CRITICAL LOCATION IMPROVEMENTS										
Location	Possible Improvement	2014	2016	2018	2020	2022	2024	2026	2031	
Monaro Hwy nth of Lanyon	Six Lane	х								
Monaro Hwy nth of Isabella	Six Lane	Х								
Monaro Hwy nth of Mugga	Six Lane	х								
Isabella Dr wst of Monaro	-									
Sth Jerrabomberra Access Rd	-									
Isabella / Monaro Roundabout	Traffic Signals	х								
Monaro / Mugga TS	Reconfigure	х								
Monaro / Sheppard TS	Reconfigure	Х								
Monaro / Lanyon TS	Reconfigure				х					
Lanyon / Tompsitt Roundabout	Traffic Signals				Х					
Tompsitt / ELP Roundabout	-									
Tompsitt / Access Rd TS	Reconfigure								Х	

**Table 25: Potential Critical Location Improvements** 



## 5. Access Option Operational Results

In order to show how each option network is performing overall and in QCC in particular, a network operation analysis of each option for each year has been undertaken. This analysis provides overall operational indicators for travel times, distances, delays and fuel consumption.

Tables 26-35 detail these indicators for each access option, for each year from 2020-2031 and for the AMP and PMP separately. Analyses were only undertaken for years in which Access Options were necessary in order to show any differences between Options.

Performance indicators are shown for the QCC and ACT model areas separately as well as the combined model area. Results that are the "best" for each indicator are highlighted in red. For the vehicle kilometres, vehicle minutes and fuel use the "best" result is the lowest figure. For mean network speed the highest figure among the options is highlighted.

The performance indicators indicate the following general trends:

- Access options that provide multiple access routes consistently produce better network performance for the QCC than the single access options;
- (ii) Access options that provide a single access route only generally produce better network performance for the ACT than the multiple access options;
- (iii) Access Options 3, 4 and 5 all produce very similar overall network performance results for both peak periods;
- (iv) Overall, Option 5 (Tompsitt/Sheppard/Isabella) produces the best future network performance of all the access options for both peak periods. Option 3 (Tompsitt / Sheppard) is consistently a close second best performer.



2020 AMP PERFORMANCE INDICATORS							
QCC Area Only	Option 1	Option 2	Option 3	Option 4	Option 5		
Vehicle Kilometres	113631	113631	111168	112026	111159		
Vehicle Minutes	143462	143437	138805	140121	138751		
Mean Network Speed kph	47.5	47.5	48.1	48.0	48.1		
Fuel Use '000 litres	11.65	11.65	11.36	11.45	11.36		
ACT Area Only							
Vehicle Kilometres	1133199	1133199	1133735	1133677	1133600		
Vehicle Minutes	1645007	1645084	1647905	1646677	1643979		
Mean Network Speed kph	41.3	41.3	41.3	41.3	41.4		
Fuel Use '000 litres	120.04	120.04	120.14	120.16	120.05		
Total Model Area							
Vehicle Kilometres	1246830	1246830	1244903	1245703	1244759		
Vehicle Minutes	1788469	1788521	1786710	1786798	1782730		
Mean Network Speed kph	41.8	41.8	41.8	41.8	41.9		
Fuel Use '000 litres	131.69	131.69	131.50	131.61	131.41		

Table 26: 2020 AMP Performance Indicators

2020 PMP PERFORMANCE INDICATORS							
QCC Area Only	Option 1	Option 2	Option 3	Option 4	Option 5		
Vehicle Kilometres	121607	121607	119134	120100	119193		
Vehicle Minutes	154015	154003	149850	151266	149974		
Mean Network Speed kph	47.4	47.4	47.7	47.6	47.7		
Fuel Use '000 litres	12.49	12.49	12.22	12.32	12.22		
ACT Area Only							
Vehicle Kilometres	1240430	1240430	1241041	1240565	1240504		
Vehicle Minutes	1743656	1743655	1742070	1745543	1745502		
Mean Network Speed kph	42.7	42.7	42.7	42.6	42.6		
Fuel Use litres	130.11	130.11	130.12	130.23	130.21		
Total Model Area							
Vehicle Kilometres	1362037	1362037	1360175	1360665	1359697		
Vehicle Minutes	1897671	1897658	1891920	1896809	1895476		
Mean Network Speed kph	43.1	43.1	43.1	43.0	43.0		
Fuel Use '000 litres	142.60	142.60	142.34	142.55	142.43		

Table 27: 2020 PMP Performance Indicators



Part 1 - South Jerrabomberra Network Transportation Assessment Report	t

2022 AMP PERFORMANCE INDICATORS							
QCC Area Only	Option 1	Option 2	Option 3	Option 4	Option 5		
Vehicle Kilometres	112129	112127	109127	110160	109088		
Vehicle Minutes	143577	143526	138161	140067	138117		
Mean Network Speed kph	46.9	46.9	47.4	47.2	47.4		
Fuel Use '000 litres	11.55	11.54	11.20	11.32	11.19		
ACT Area Only							
Vehicle Kilometres	1172976	1172976	1173660	1173431	1173623		
Vehicle Minutes	1704346	1704346	1708394	1705390	1701935		
Mean Network Speed kph	41.3	41.3	41.2	41.3	41.4		
Fuel Use '000 litres	124.33	124.34	124.49	124.43	124.36		
Total Model Area							
Vehicle Kilometres	1285105	1285103	1282787	1283591	1282711		
Vehicle Minutes	1847923	1847872	1846555	1845457	1840052		
Mean Network Speed kph	41.7	41.7	41.7	41.7	41.8		
Fuel Use '000 litres	135.88	135.88	135.69	135.75	135.55		

Table 28: 2022 AMP Performance Indicators

2022 PMP PERFORMANCE INDICATORS							
QCC Area Only	Option 1	Option 2	Option 3	Option 4	Option 5		
Vehicle Kilometres	121548	121550	118186	119449	118225		
Vehicle Minutes	157943	157914	152101	153902	152129		
Mean Network Speed kph	46.2	46.2	46.6	46.6	46.6		
Fuel Use '000 litres	12.62	12.62	12.24	12.37	12.24		
ACT Area Only							
Vehicle Kilometres	1284403	1284384	1285371	1284820	1284626		
Vehicle Minutes	1807169	1807306	1808911	1811091	1805958		
Mean Network Speed kph	42.6	42.6	42.6	42.6	42.7		
Fuel Use '000 litres	134.71	134.71	134.83	134.88	134.70		
Total Model Area							
Vehicle Kilometres	1405951	1405934	1403557	1404269	1402851		
Vehicle Minutes	1965112	1965220	1961012	1964993	1958087		
Mean Network Speed kph	42.9	42.9	42.9	42.9	43.0		
Fuel Use '000 litres	147.33	147.33	147.07	147.25	146.94		

Table 29: 2022 PMP Performance Indicators



2024 AMP PERFORMANCE INDICATORS							
QCC Area Only	Option 1	Option 2	Option 3	Option 4	Option 5		
Vehicle Kilometres	118614	118615	115101	116168	114982		
Vehicle Minutes	153534	153435	146629	148489	146341		
Mean Network Speed kph	46.4	46.4	47.1	46.9	47.1		
Fuel Use '000 litres	12.26	12.26	11.83	11.95	11.82		
ACT Area Only							
Vehicle Kilometres	1200538	1200539	1201384	1201354	1201278		
Vehicle Minutes	1765280	1765221	1767901	1771916	1766319		
Mean Network Speed kph	40.8	40.8	40.8	40.7	40.8		
Fuel Use '000 litres	128.02	128.02	128.17	128.31	128.14		
Total Model Area							
Vehicle Kilometres	1319152	1319154	1316485	1317522	1316260		
Vehicle Minutes	1918814	1918656	1914530	1920405	1912660		
Mean Network Speed kph	41.2	41.3	41.3	41.2	41.3		
Fuel Use '000 litres	140.28	140.28	140.00	140.26	139.96		

Table 30: 2024 AMP Performance Indicators

2024 PMP PERFORMANCE INDICATORS							
QCC Area Only	Option 1	Option 2	Option 3	Option 4	Option 5		
Vehicle Kilometres	129081	129075	124985	126416	124964		
Vehicle Minutes	169460	169417	161756	163820	161700		
Mean Network Speed kph	45.7	45.7	46.4	46.3	46.4		
Fuel Use '000 litres	13.45	13.45	12.97	13.12	12.96		
ACT Area Only							
Vehicle Kilometres	1311102	1311107	1312245	1311836	1311604		
Vehicle Minutes	1893106	1892798	1894705	1897098	1893986		
Mean Network Speed kph	41.6	41.6	41.6	41.5	41.6		
Fuel Use '000 litres	139.28	139.27	139.41	139.48	139.37		
Total Model Area							
Vehicle Kilometres	1440183	1440182	1437230	1438252	1436568		
Vehicle Minutes	2062566	2062215	2056461	2060918	2055686		
Mean Network Speed kph	41.9	41.9	41.9	41.9	41.9		
Fuel Use '000 litres	152.73	152.72	152.38	152.60	152.33		

Table 31: 2024 PMP Performance Indicators



2026 AMP PERFORMANCE INDICATORS							
QCC Area Only	Option 1	Option 2	Option 3	Option 4	Option 5		
Vehicle Kilometres	124314	124309	120527	121602	120332		
Vehicle Minutes	162911	162633	154679	156520	154158		
Mean Network Speed kph	45.8	45.9	46.8	46.6	46.8		
Fuel Use '000 litres	12.92	12.91	12.44	12.56	12.41		
ACT Area Only							
Vehicle Kilometres	1224933	1224936	1225838	1225852	1225695		
Vehicle Minutes	1833348	1833446	1833820	1835614	1832592		
Mean Network Speed kph	40.1	40.1	40.1	40.1	40.1		
Fuel Use '000 litres	131.77	131.76	131.86	131.93	131.83		
Total Model Area							
Vehicle Kilometres	1349247	1349245	1346365	1347454	1346027		
Vehicle Minutes	1996259	1996079	1988499	1992134	1986750		
Mean Network Speed kph	40.6	40.6	40.6	40.6	40.7		
Fuel Use '000 litres	144.69	144.67	144.30	144.49	144.24		

Table 32: 2026 AMP Performance Indicators

2026 PMP PERFORMANCE INDICATORS							
QCC Area Only	Option 1	Option 2	Option 3	Option 4	Option 5		
Vehicle Kilometres	135610	135636	131295	132760	131216		
Vehicle Minutes	180123	180053	171234	173575	171034		
Mean Network Speed kph	45.2	45.2	46.0	45.9	46.0		
Fuel Use '000 litres	14.21	14.20	13.67	13.83	13.66		
ACT Area Only							
Vehicle Kilometres	1335353	1335329	1336530	1335793	1335982		
Vehicle Minutes	1971182	1971880	1974875	1978537	1975812		
Mean Network Speed kph	40.6	40.6	40.6	40.5	40.6		
Fuel Use '000 litres	143.26	143.29	143.48	143.54	143.48		
Total Model Area							
Vehicle Kilometres	1470963	1470965	1467825	1468553	1467198		
Vehicle Minutes	2151305	2151933	2146109	2152112	2146846		
Mean Network Speed kph	41.0	41.0	41.0	40.9	41.0		
Fuel Use '000 litres	157.47	157.49	157.15	157.37	157.14		

Table 33: 2026 PMP Performance Indicators



2031 AMP PERFORMANCE INDICATORS							
QCC Area Only	Option 1	Option 2	Option 3	Option 4	Option 5		
Vehicle Kilometres	133455	133438	130039	131121	129909		
Vehicle Minutes	179633	177176	168726	170947	168460		
Mean Network Speed kph	44.6	45.2	46.2	46.0	46.3		
Fuel Use '000 litres	14.03	13.94	13.49	13.62	13.47		
ACT Area Only							
Vehicle Kilometres	1282791	1282777	1283476	1283541	1283580		
Vehicle Minutes	1982405	1981476	1984223	1984173	1981622		
Mean Network Speed kph	38.8	38.8	38.8	38.8	38.9		
Fuel Use '000 litres	139.89	139.86	139.98	140.03	139.96		
Total Model Area							
Vehicle Kilometres	1416246	1416215	1413515	1414662	1413489		
Vehicle Minutes	2162038	2158652	2152949	2155120	2150082		
Mean Network Speed kph	39.3	39.4	39.4	39.4	39.4		
Fuel Use '000 litres	153.92	153.80	153.47	153.65	153.43		

Table 34: 2031 AMP Performance Indicators

2031 PMP PERFORMANCE INDICATORS							
QCC Area Only	Option 1	Option 2	Option 3	Option 4	Option 5		
Vehicle Kilometres	145831	145969	141877	143373	141903		
Vehicle Minutes	196902	196770	187640	190067	187493		
Mean Network Speed kph	44.4	44.5	45.4	45.3	45.4		
Fuel Use '000 litres	15.40	15.39	14.87	15.03	14.86		
ACT Area Only							
Vehicle Kilometres	1400901	1400978	1401939	1401001	1401202		
Vehicle Minutes	2138900	2137953	2139924	2141350	2137389		
Mean Network Speed kph	39.3	39.3	39.3	39.3	39.3		
Fuel Use '000 litres	152.66	152.63	152.76	152.75	152.65		
Total Model Area							
Vehicle Kilometres	1546732	1546947	1543816	1544374	1543105		
Vehicle Minutes	2335802	2334723	2327564	2331417	2324882		
Mean Network Speed kph	39.7	39.8	39.8	39.7	39.8		
Fuel Use '000 litres	168.06	168.02	167.63	167.78	167.51		

Table 35: 2031 PMP Performance Indicators



## 6. Discussion

The primary requirement of this analysis is to recommend which of the access options considered in this analysis "best serves the Queanbeyan and ACT community". This is taken as meaning which access option has the least impact on the surrounding QCC and ACT networks and best distributes the additional traffic travelling to and from the proposed South Jerrabomberra development.

This analysis evaluated the South Jerrabomberra development as part of the overall QCC/ACT network area and therefore took into account changing background travel patterns as a result of other development throughout the area. This background development included developments at Googong and Jumping Creek, expected general infill housing throughout Queanbeyan and expected changes in housing and employment throughout the greater ACT.

The analysis of the 5 access options used the latest 2011 Queanbeyan Transportation Model for both the AM and PM peak periods. Every effort was made to ensure that the future models included the latest available land use projections as well proposed network infrastructure changes throughout the QCC and ACT areas.

The TRACKS model uses an assignment procedure that includes the calculation of intersection behaviour in its analysis. The QCC model is by definition a strategic model and whilst the intersection modelling is detailed, it is not expected to replace a detailed assessment of intersection behaviour using specialist intersection or microsimulation programs. However, efforts have been made throughout the analysis to ensure that modelled intersection behaviour was as realistic as possible.

This South Jerrabomberra Traffic Analysis concentrated on the area surrounding the development in its assessment. It included assessments of the differences in Level of Service (LOS) and overall network performance indicators between each of the access options.

Overall the analysis indicated the following:

- Many of the links and intersection approaches at critical locations around the South Jerrabomberra area are already at LOS E/F during peak periods, or are expected to be by 2014. This is especially true for the Monaro Hwy corridor and most of the intersections along the corridor which appear to be operating at LOS E/F during either peak period;
- The single lane dual carriageway access road to the South Jerrabomberra development is expected to maintain a link LOS of D or better until approximately 2026 when predicted directional vehicle flow exceeds 1200 vehicles per lane (vph);
- For the single access route options (Option 1 and 2), from 2018 onwards a number of individual approaches at the Access Rd signalised intersection with Tompsitt Dr are expected to have approach delays that exceed LOS E conditions;
- Access options that involve an Isabella Dr access require the need for the existing roundabout to be replaced with traffic signals;
- The Lanyon / Tompsitt roundabout may require upgrading to traffic signals by 2018/2020 if a single access route option is used i.e. Options 1 and 2;



- The Monaro / Sheppard and Monaro / Mugga traffic signals may need reconfiguration to reduce calculated LOS issues on various movements irrespective of which access option is chosen;
- Access Option 5 (Tompsitt / Sheppard / Isabella) appears to produce the best overall LOS conditions for local roads and intersections;
- Access options that provide multiple access routes consistently produce better network performance results for the QCC than the single access options;
- Access options that provide a single access route only, generally produce better network performance results for the ACT than the multiple access options;
- Access Options 3, 4 and 5 all produce very similar overall network performance results for both peak periods;
- Overall, Option 5 (Tompsitt / Sheppard / Isabella) produces the best future network performance results of all the access options for both peak periods. Option 3 (Tompsitt / Sheppard) is consistently a close second best performer.



## 7. Recommendation

Based on the strategic model analysis undertaken, Access Option 5 (Tompsitt / Sheppard / Isabella) produces the best future overall network performance and local operation of the access options investigated.

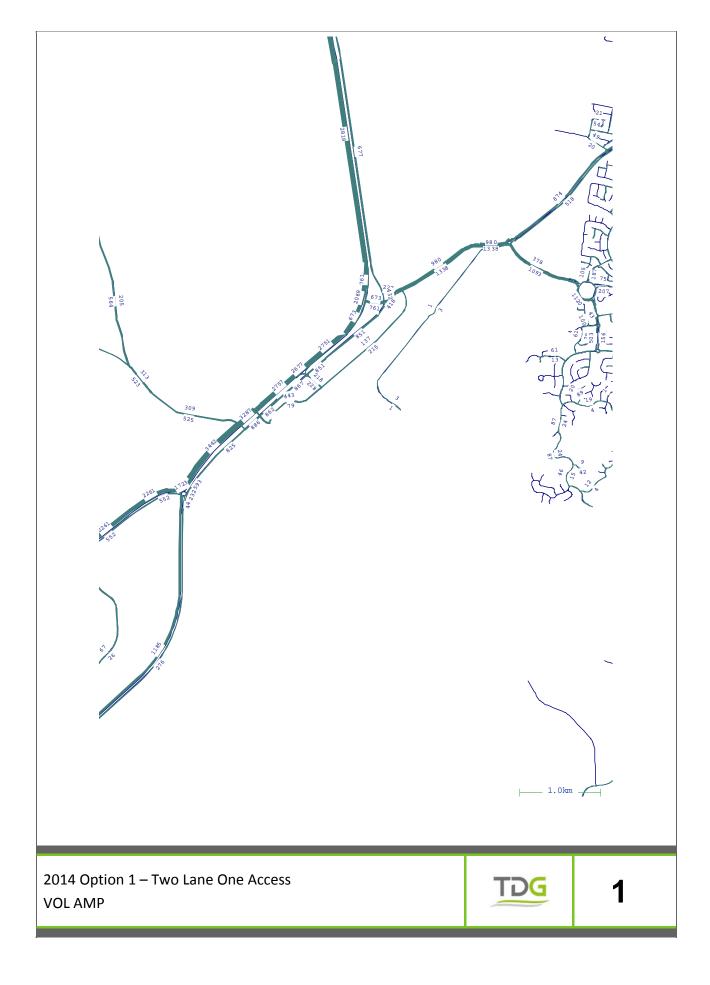
Traffic Design Group Ltd



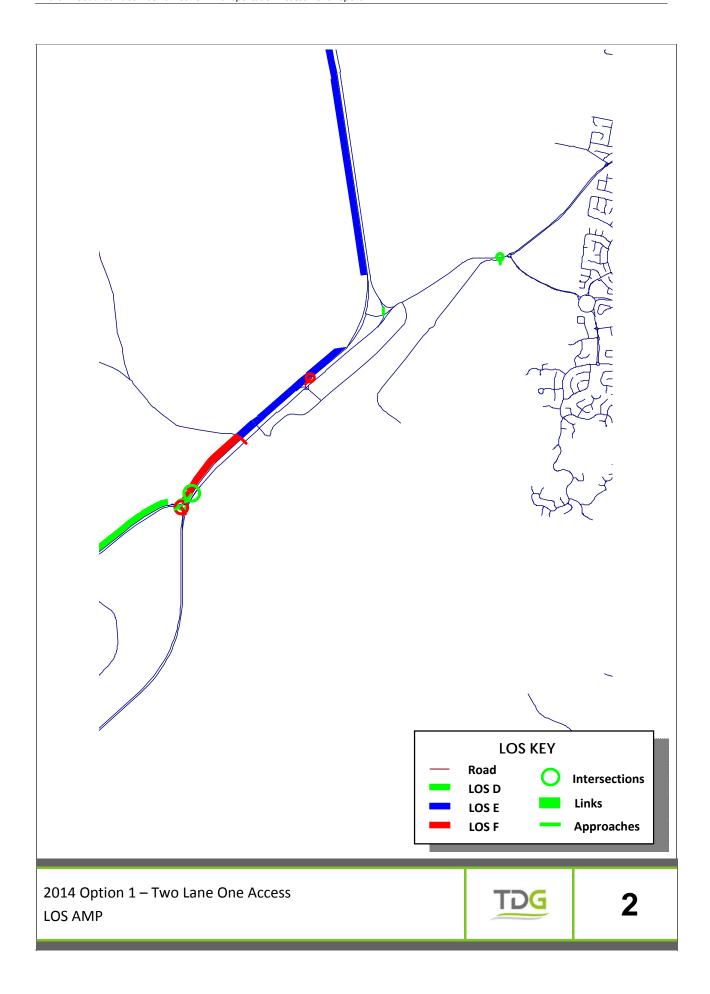
## **Appendix A**

Option 1 – Two Lane One Access – Tompsitt Dr - South Jerrabomberra Flows and LOS

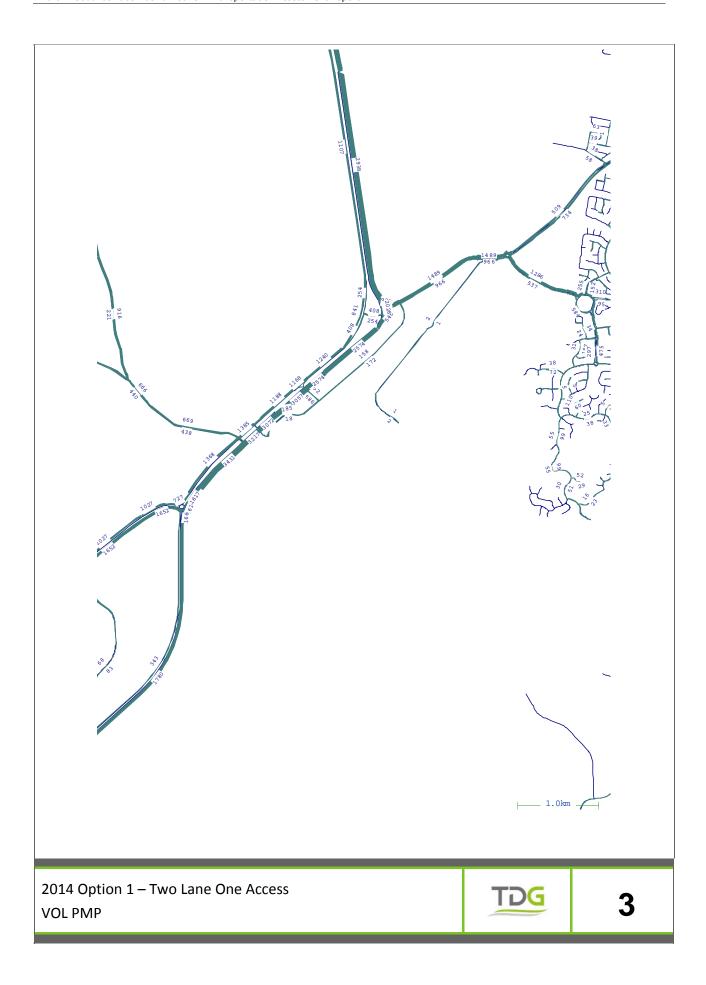




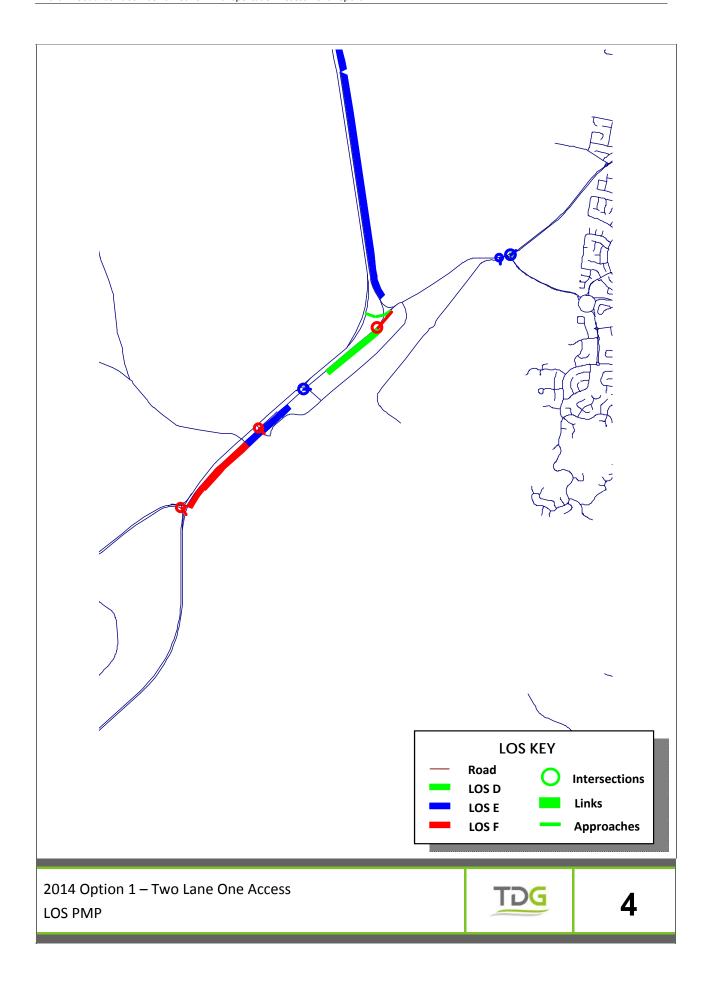




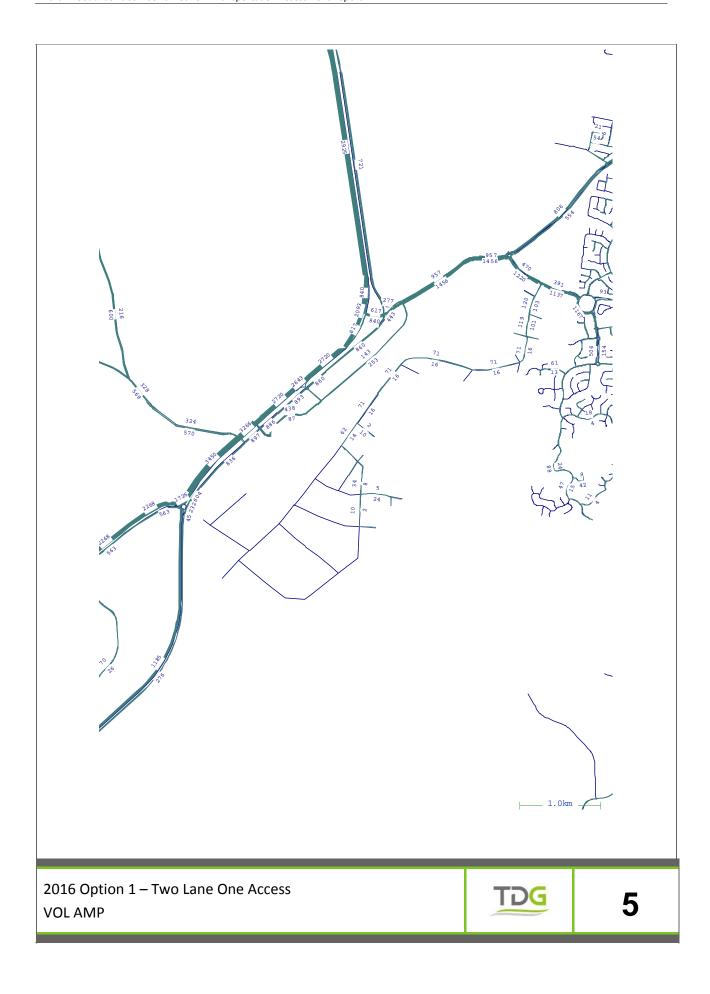




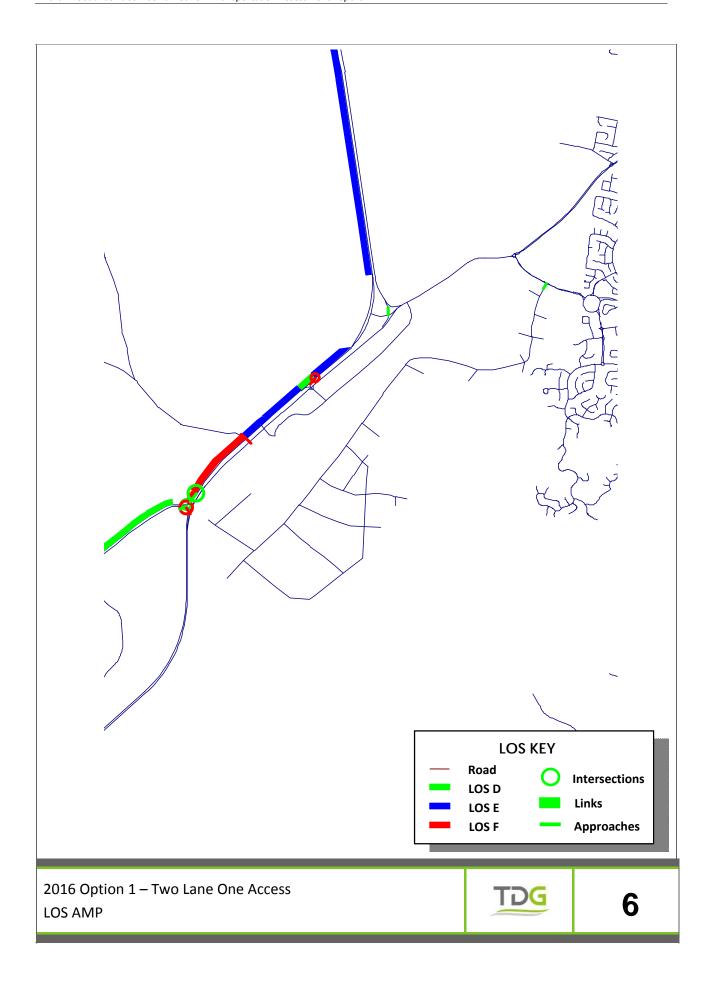




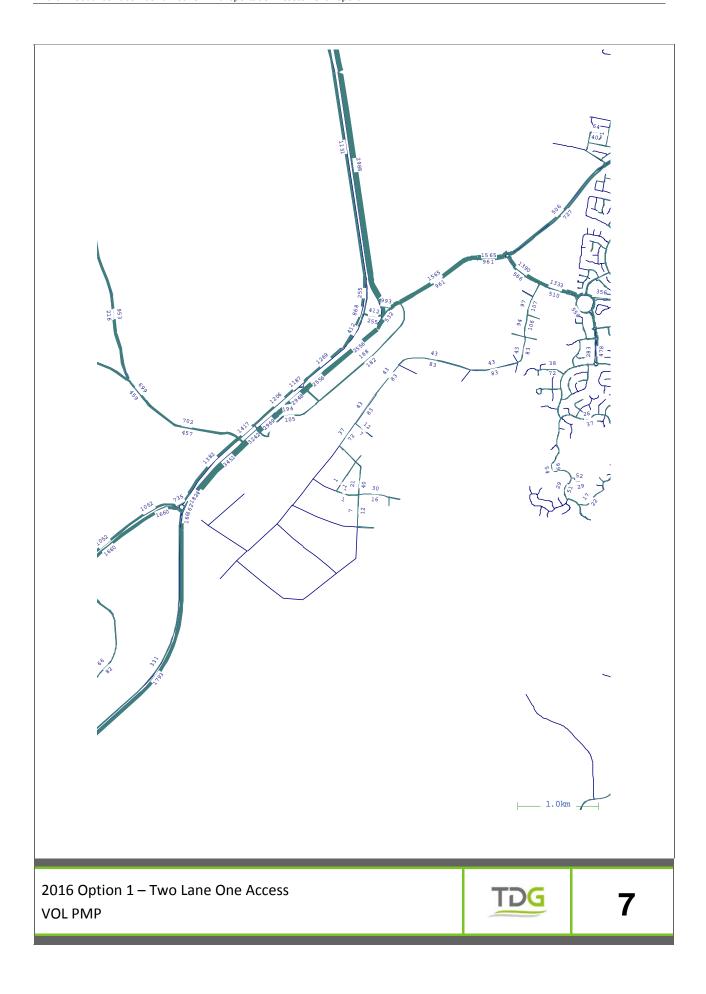




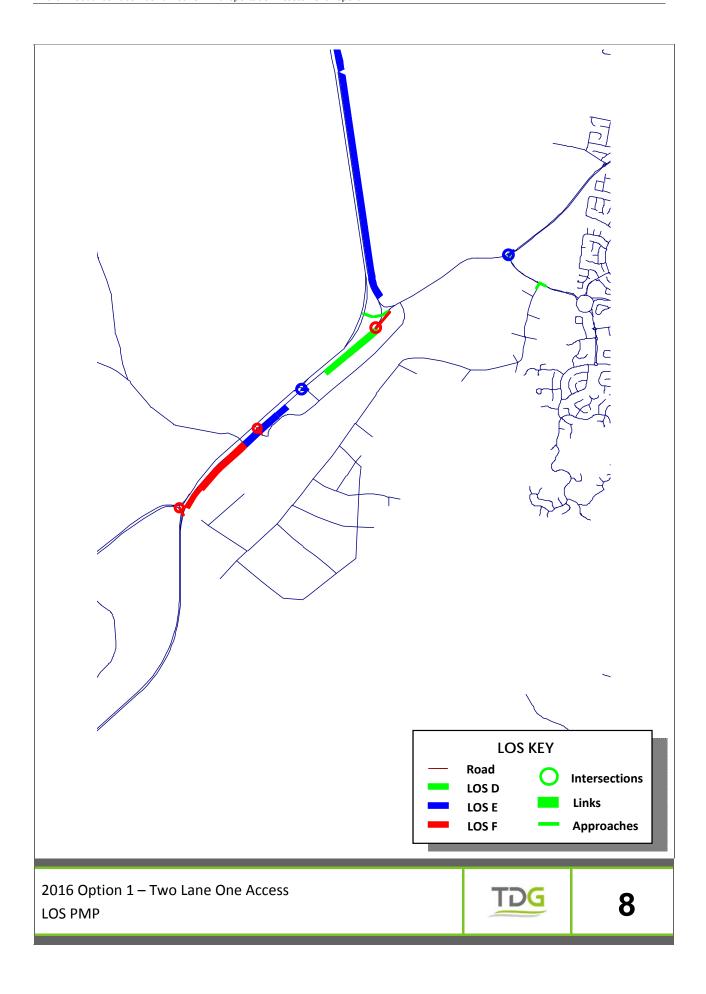




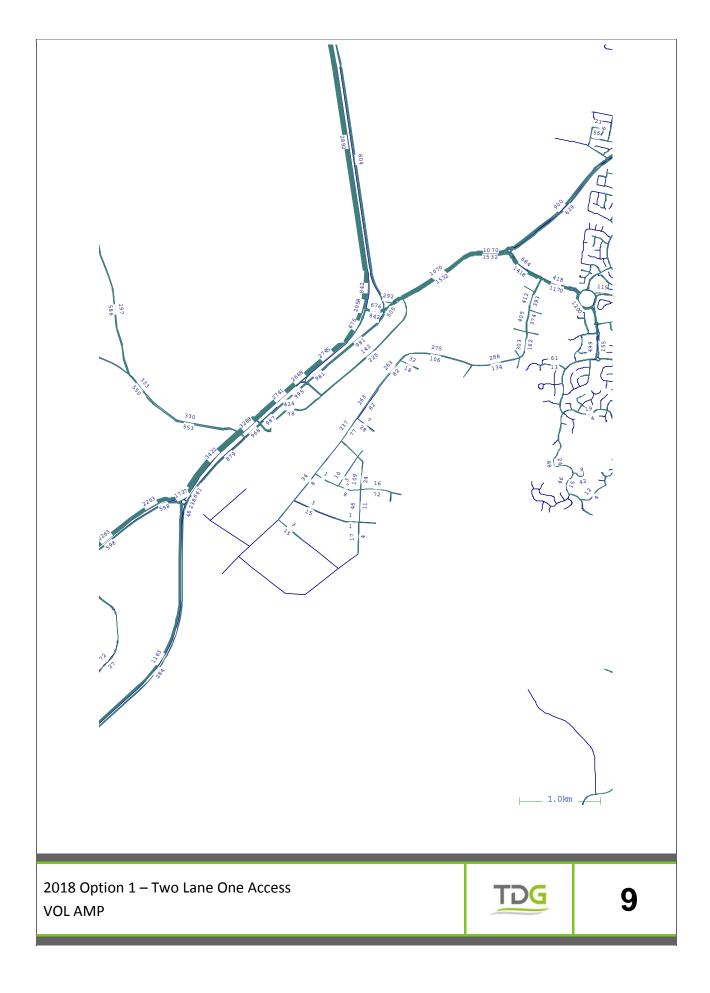




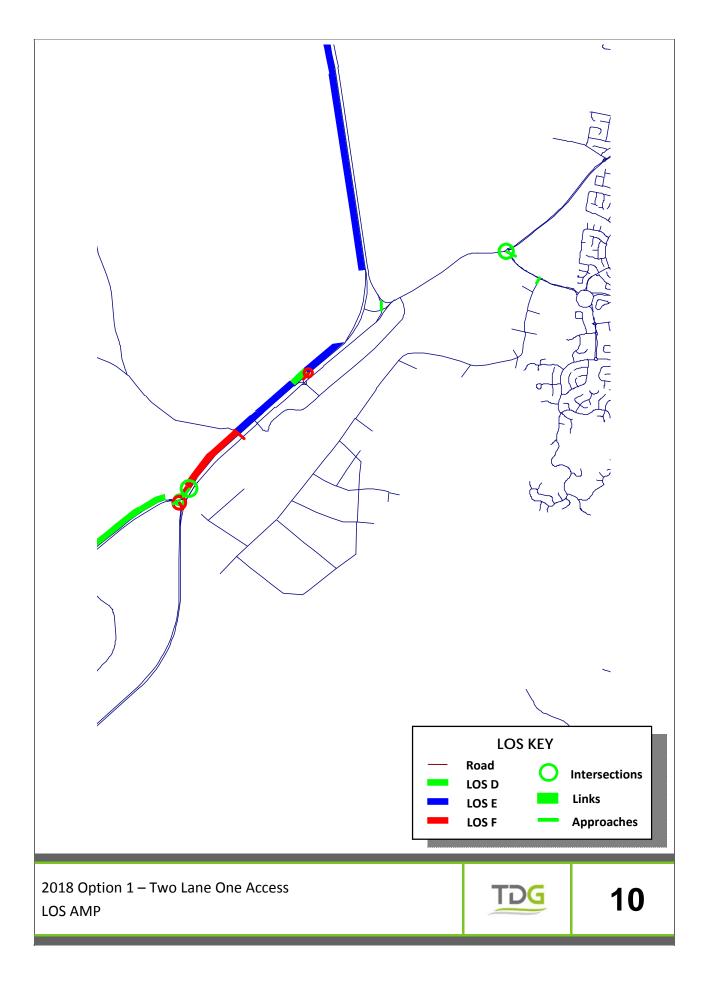




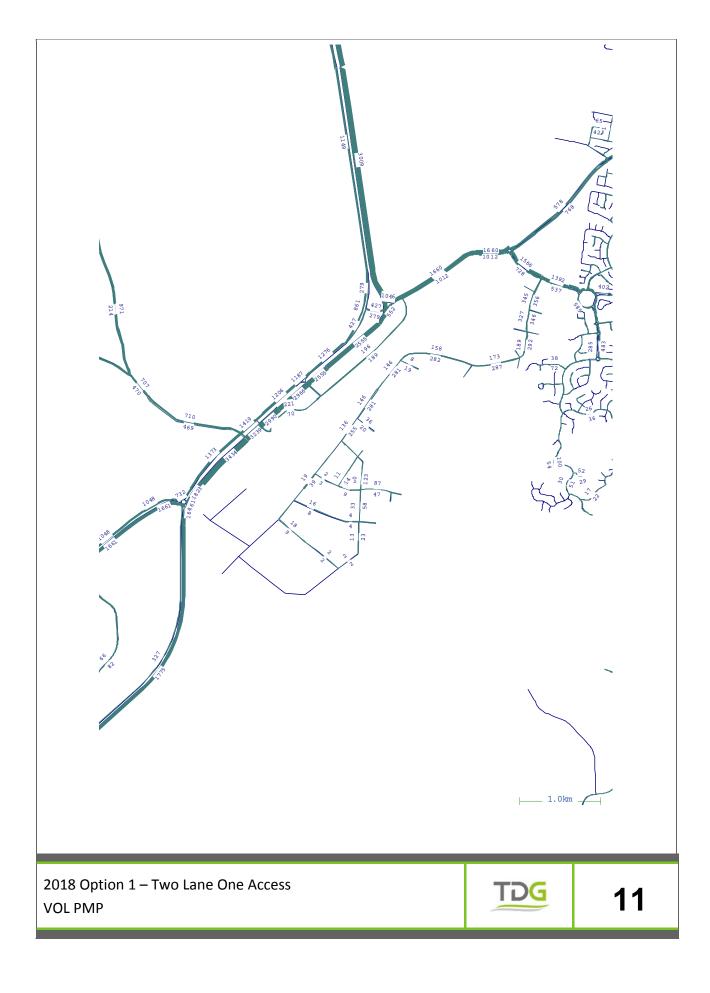




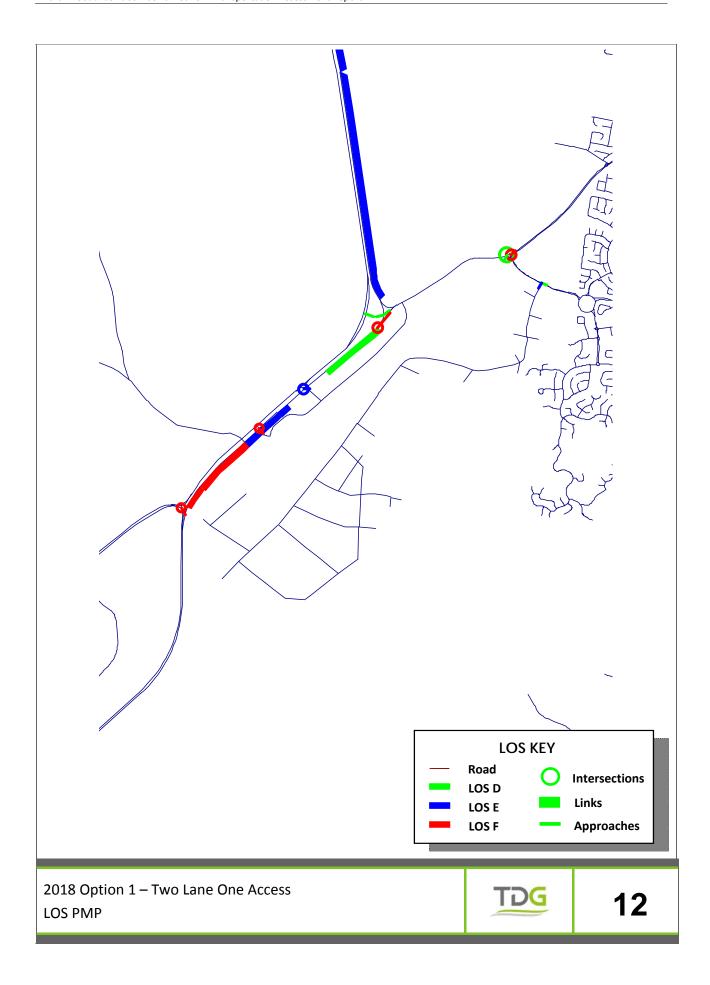




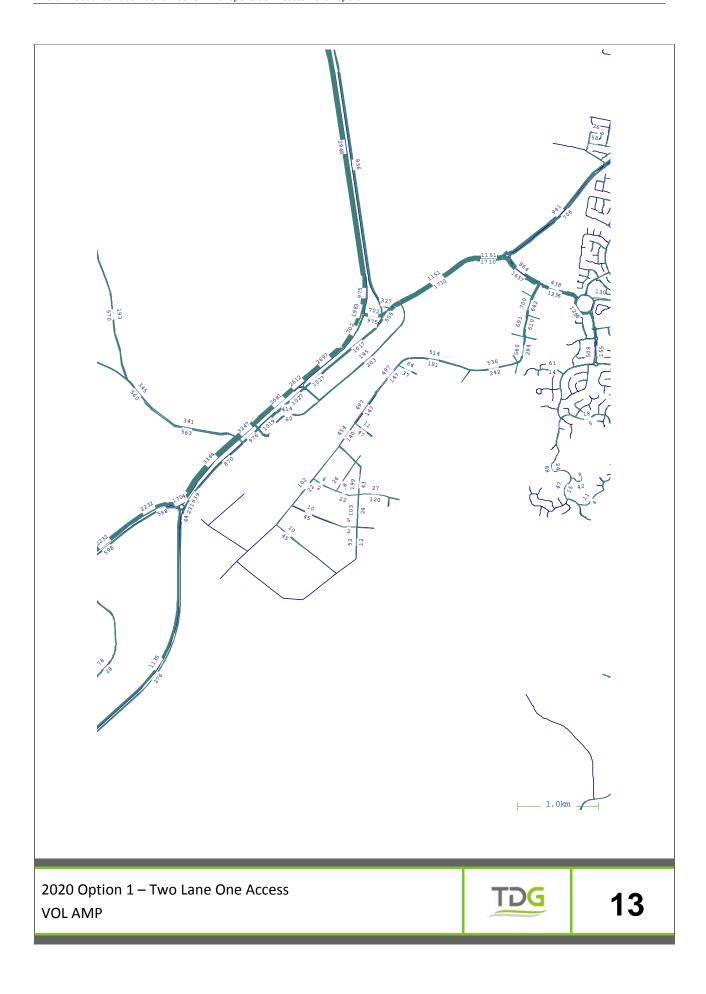




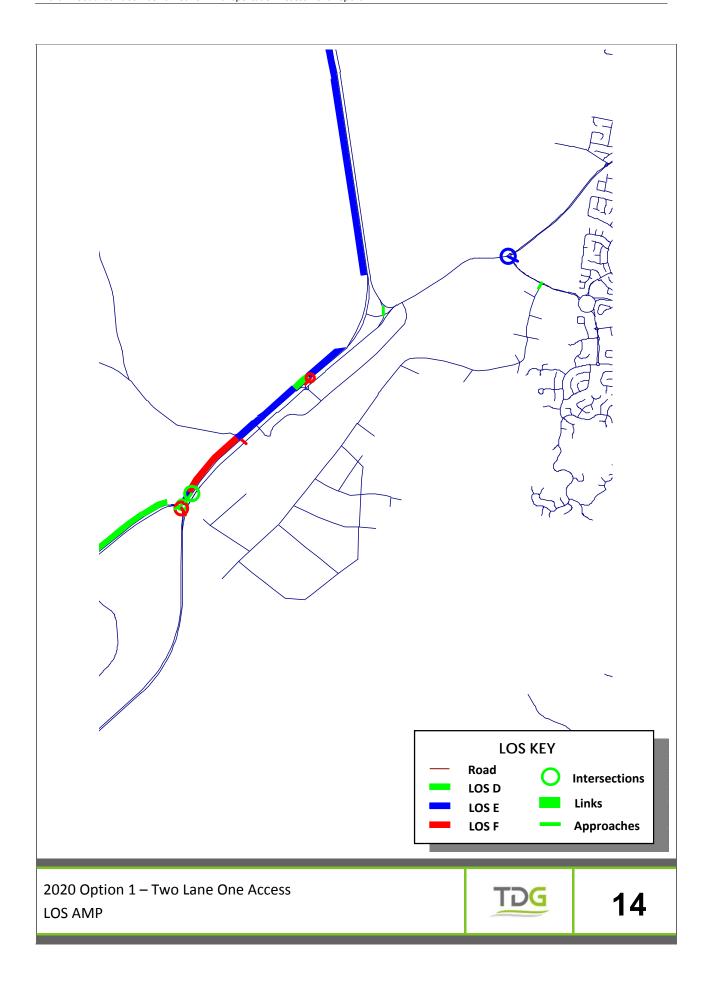




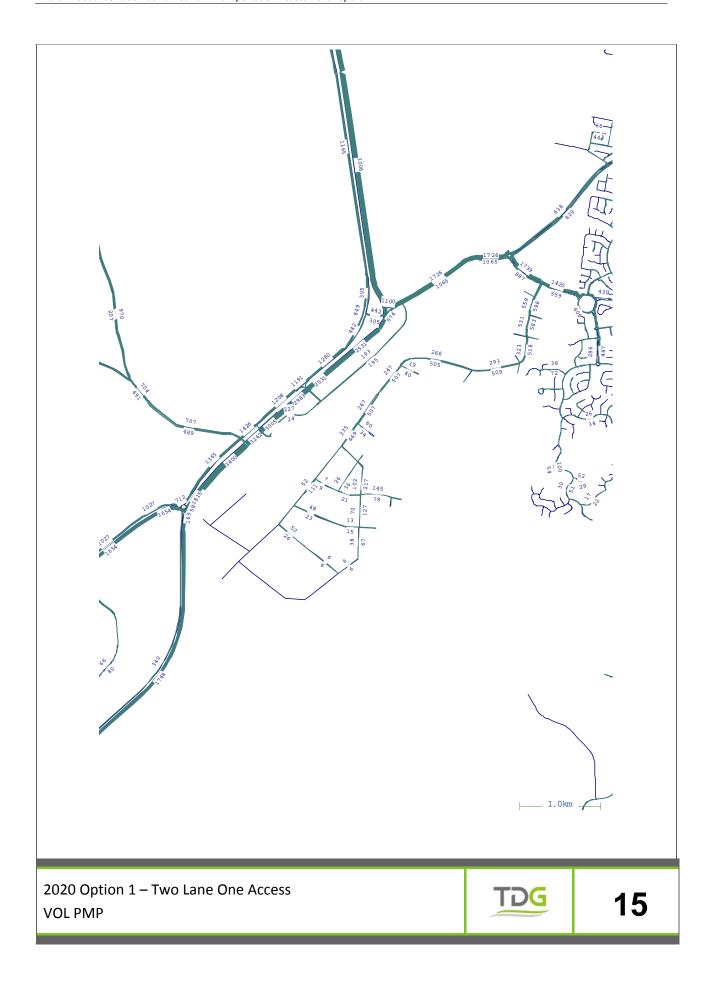




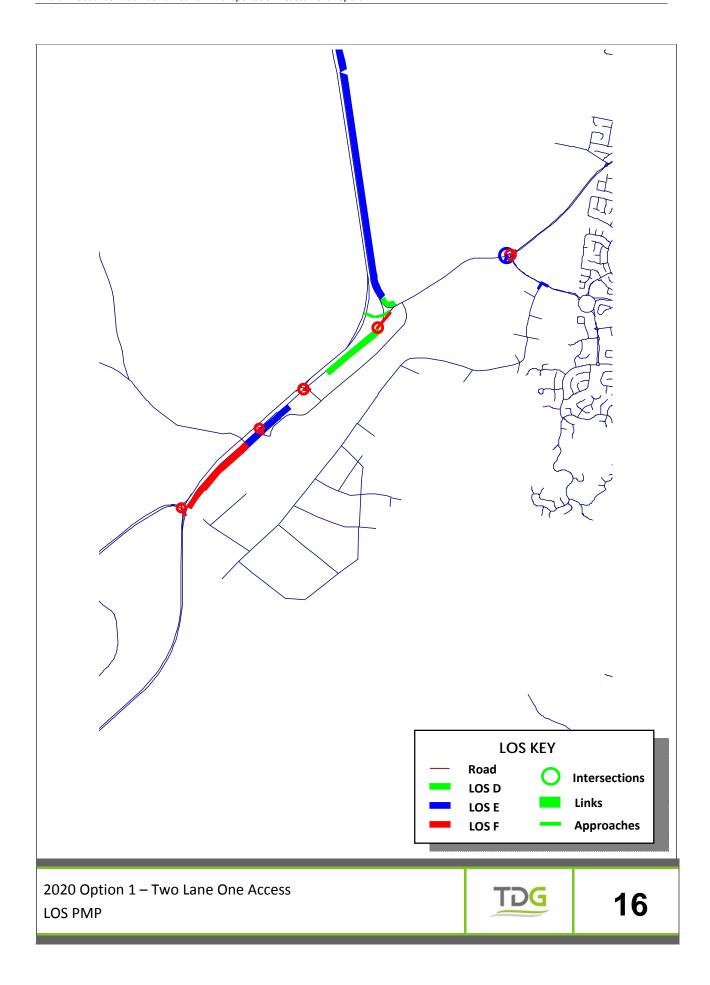




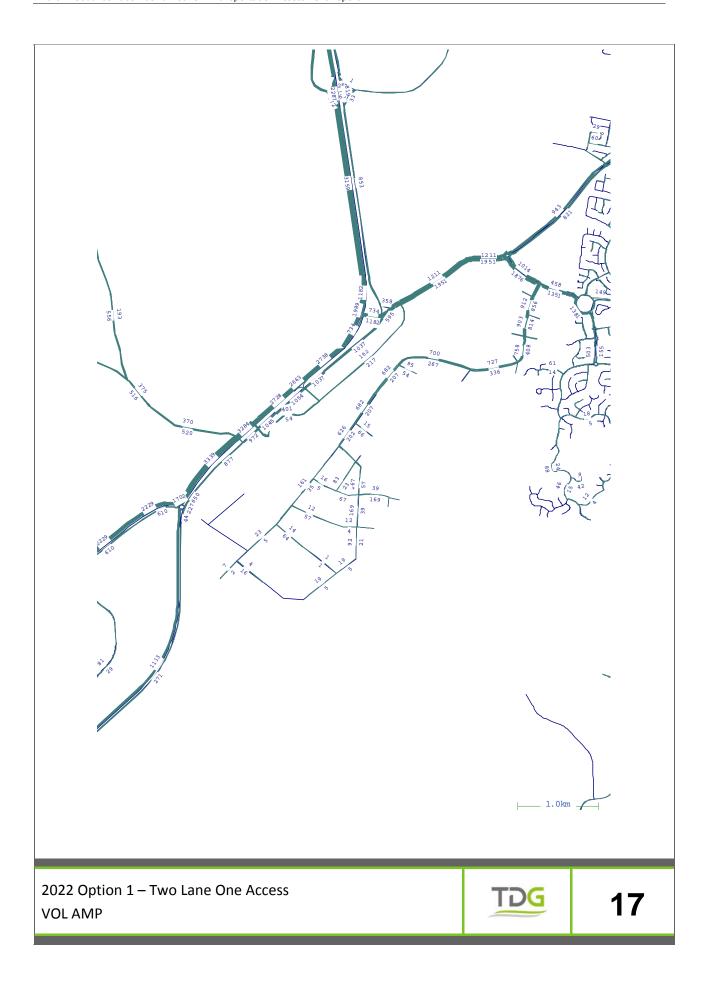




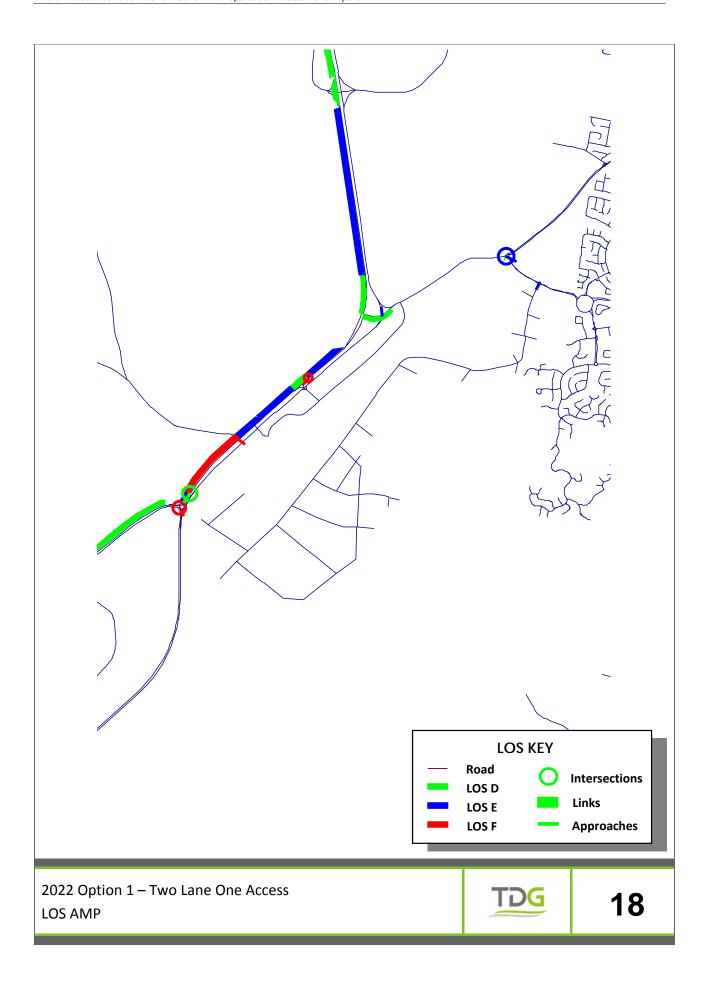




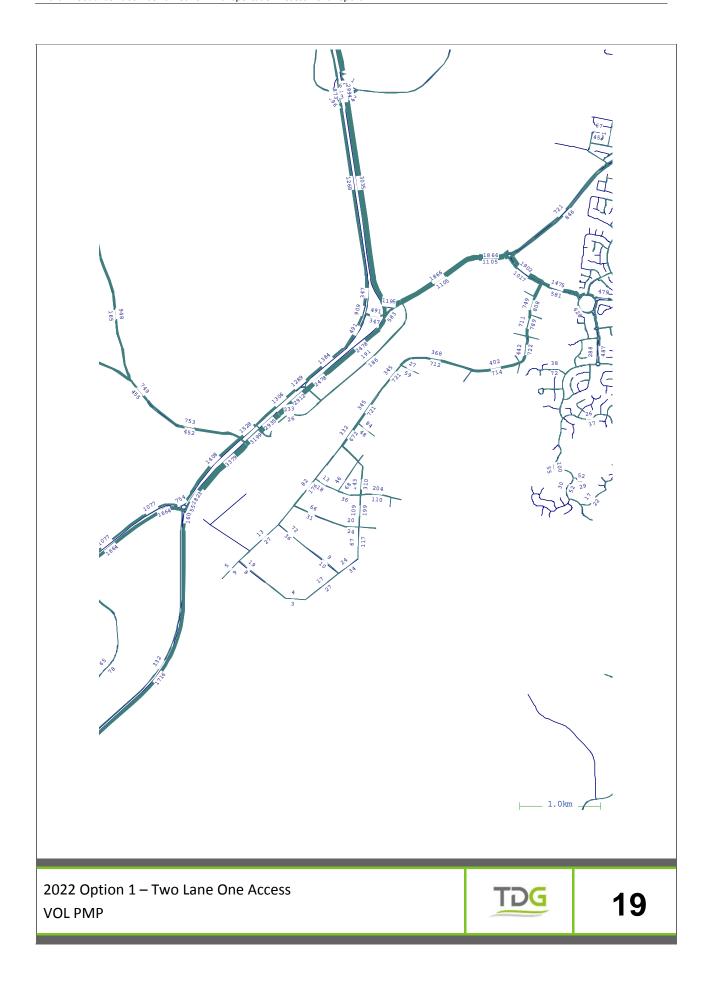




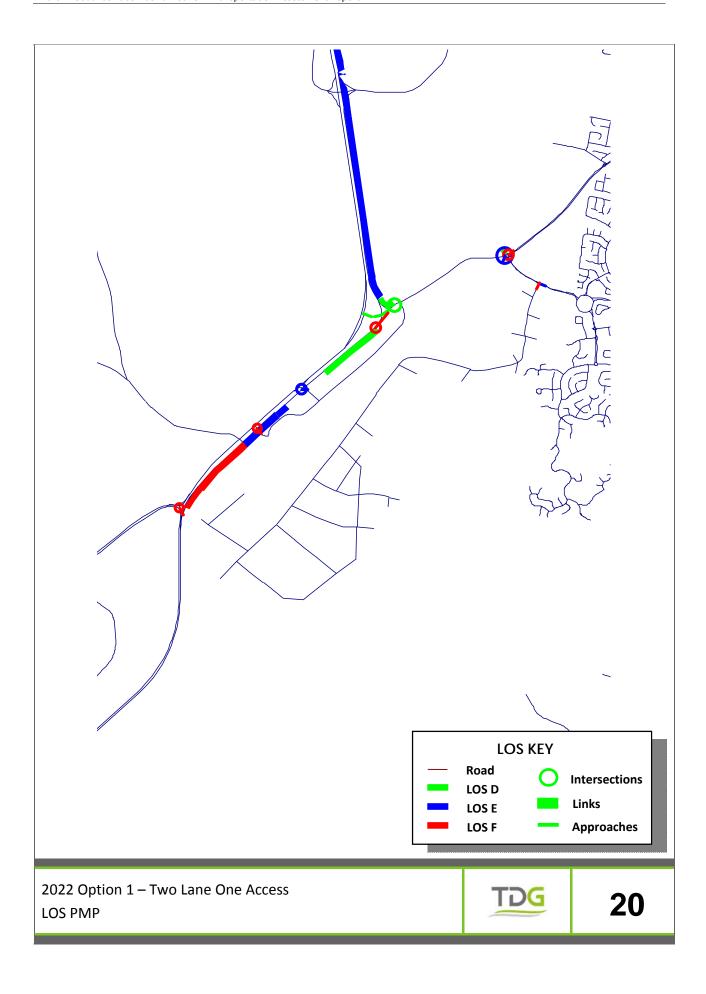




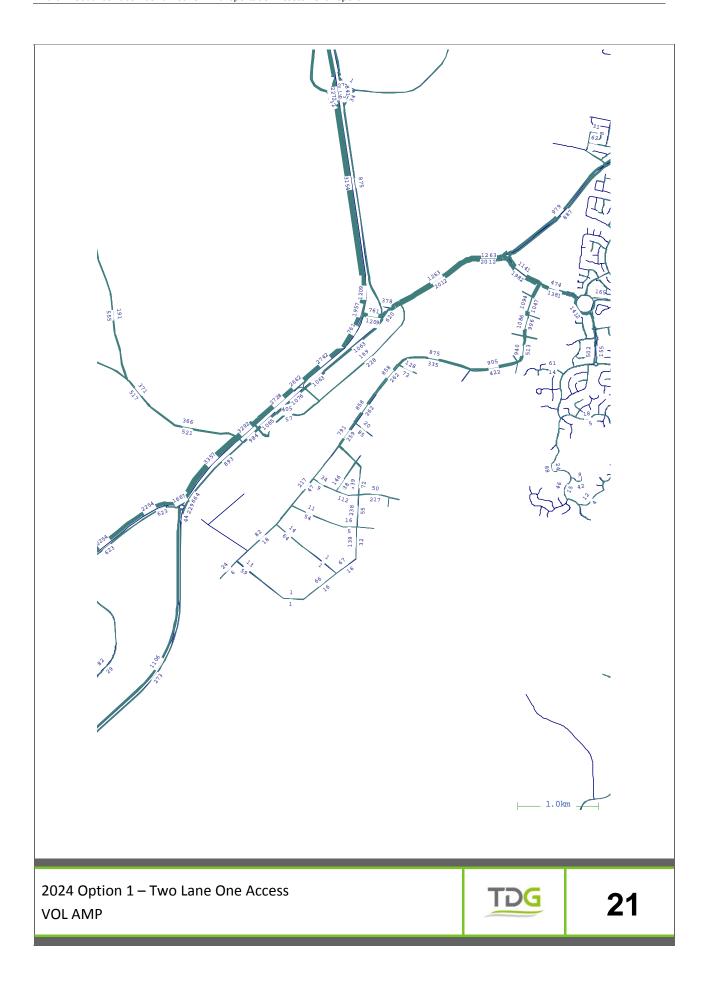




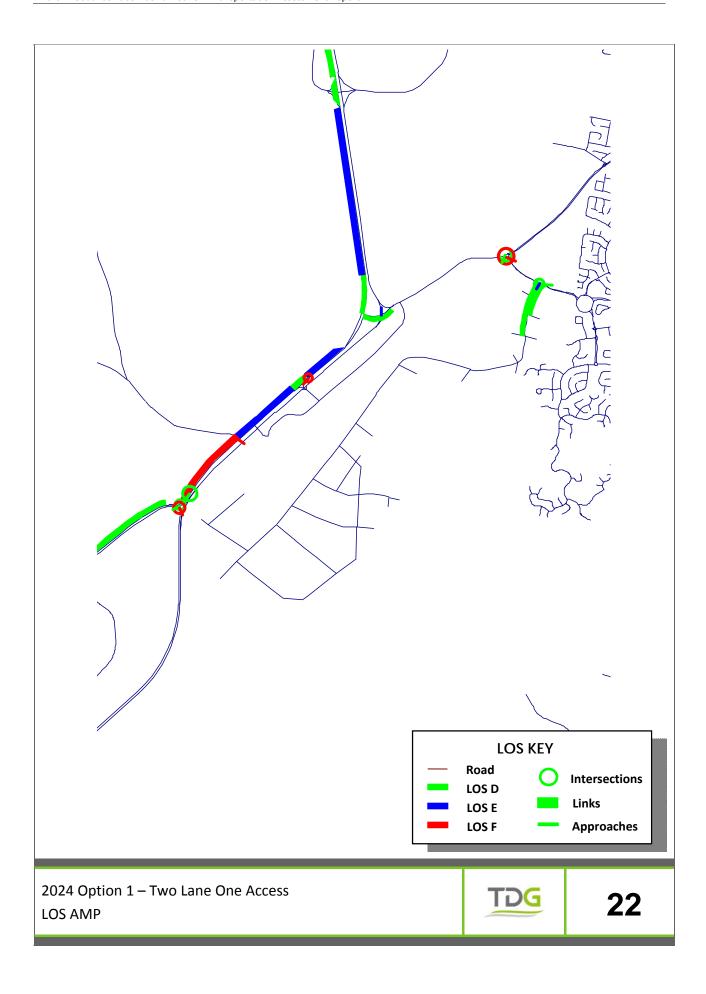




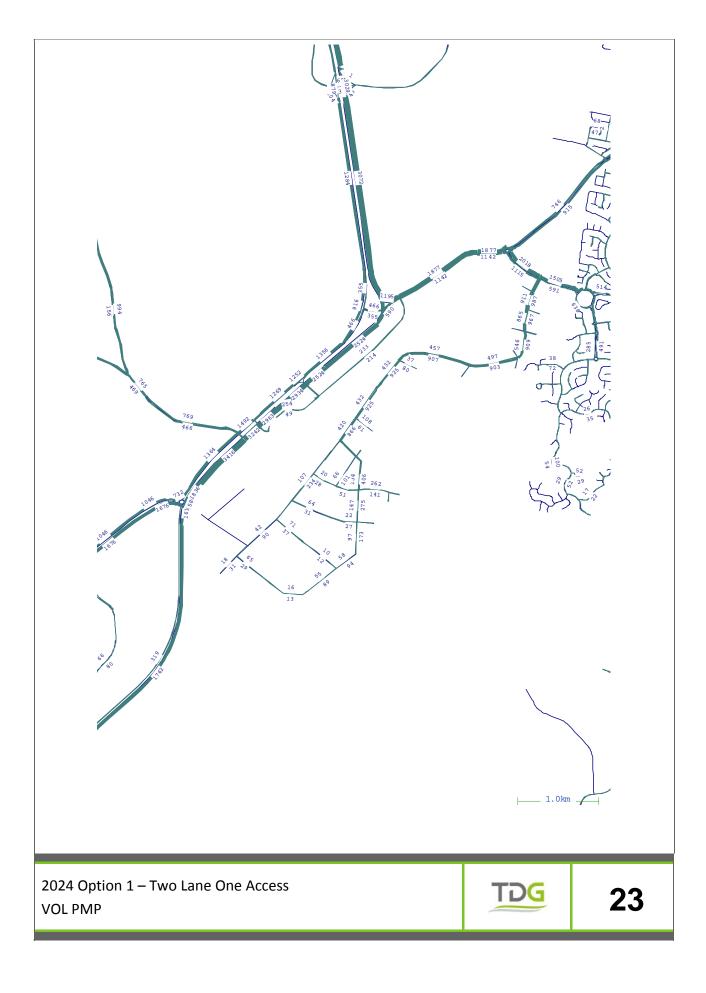




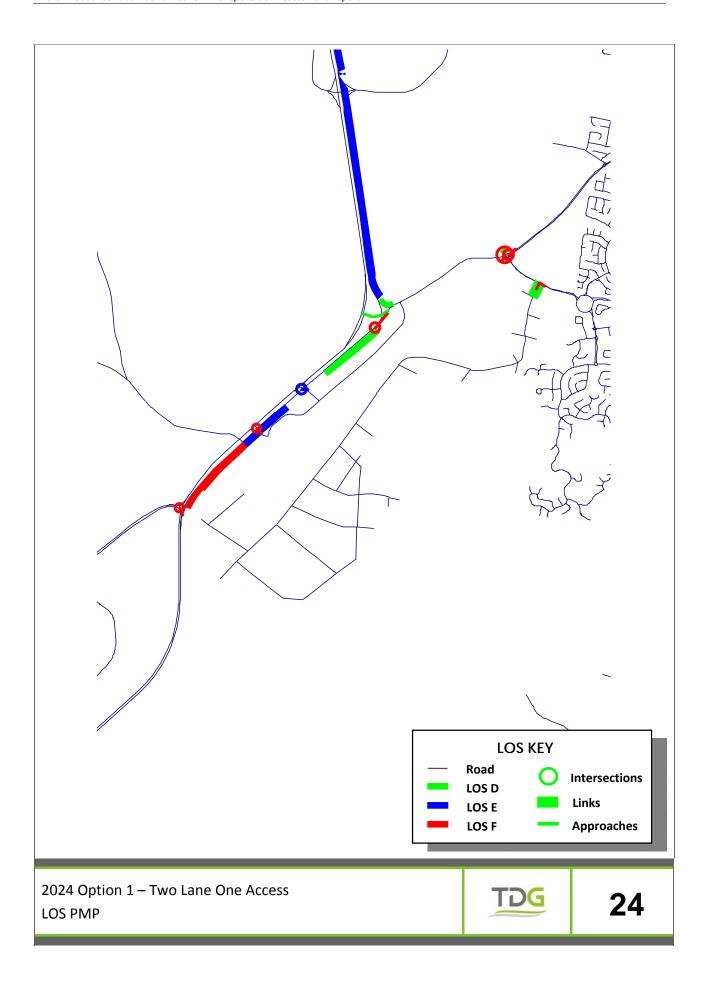




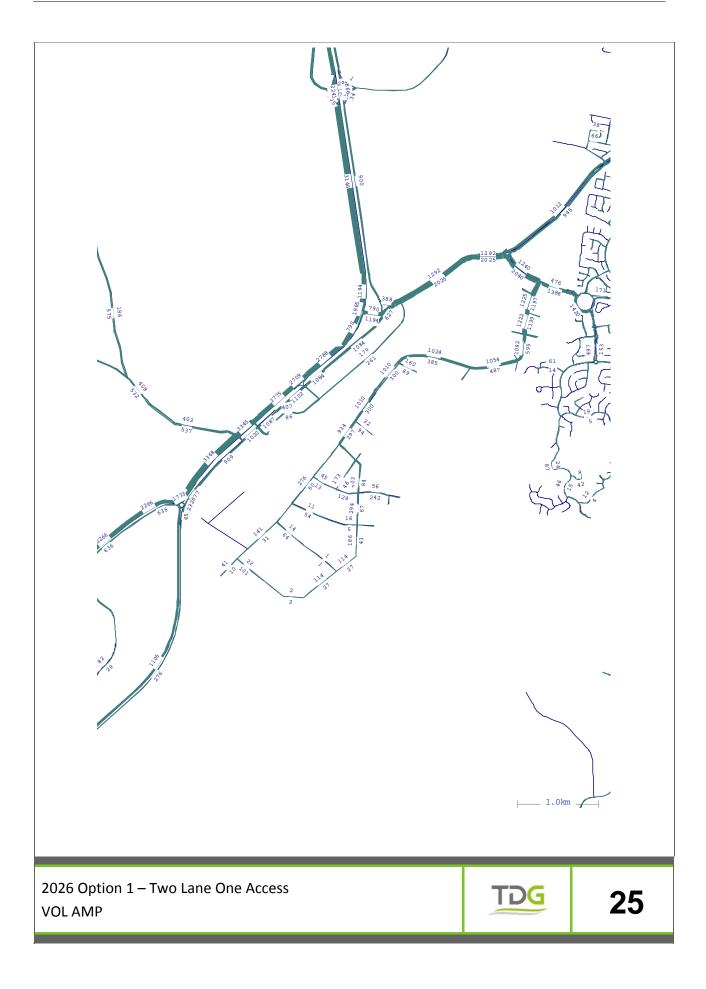




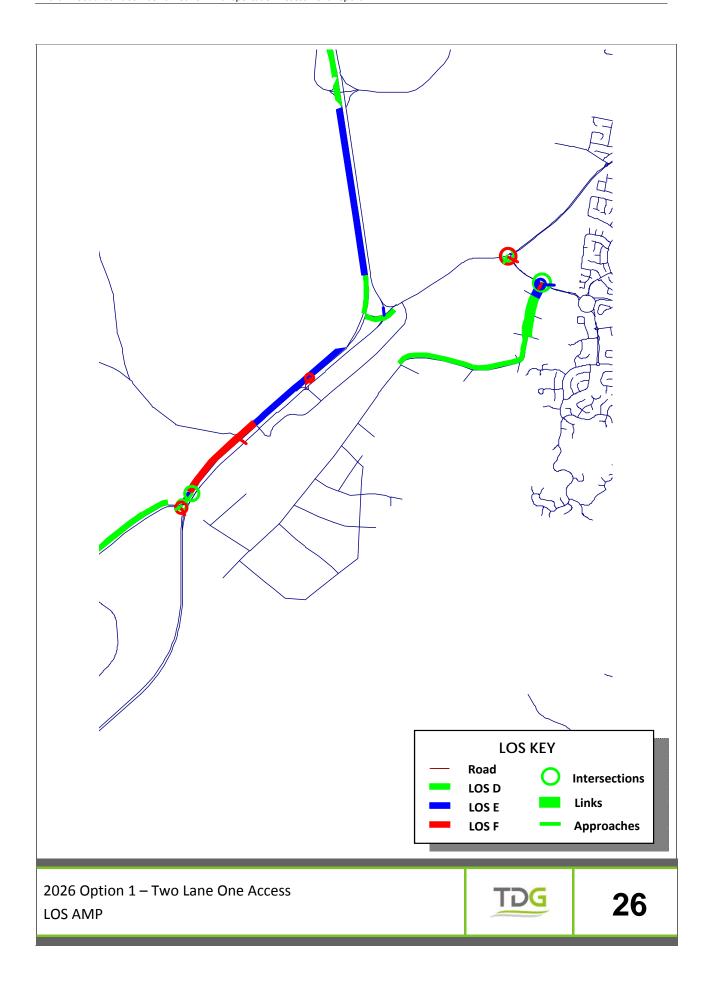




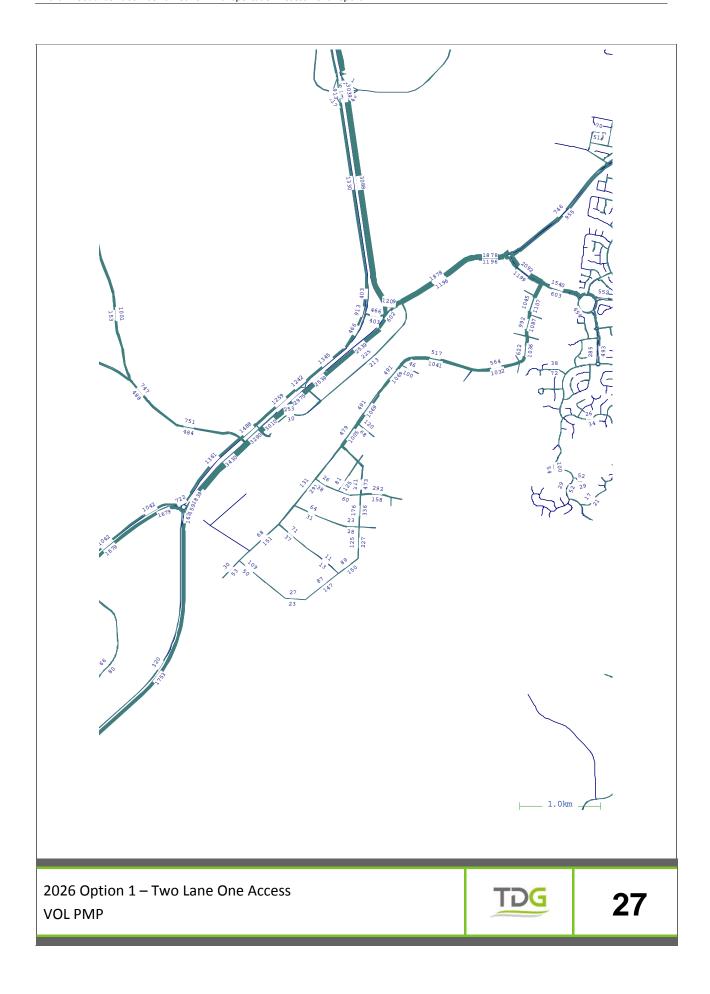




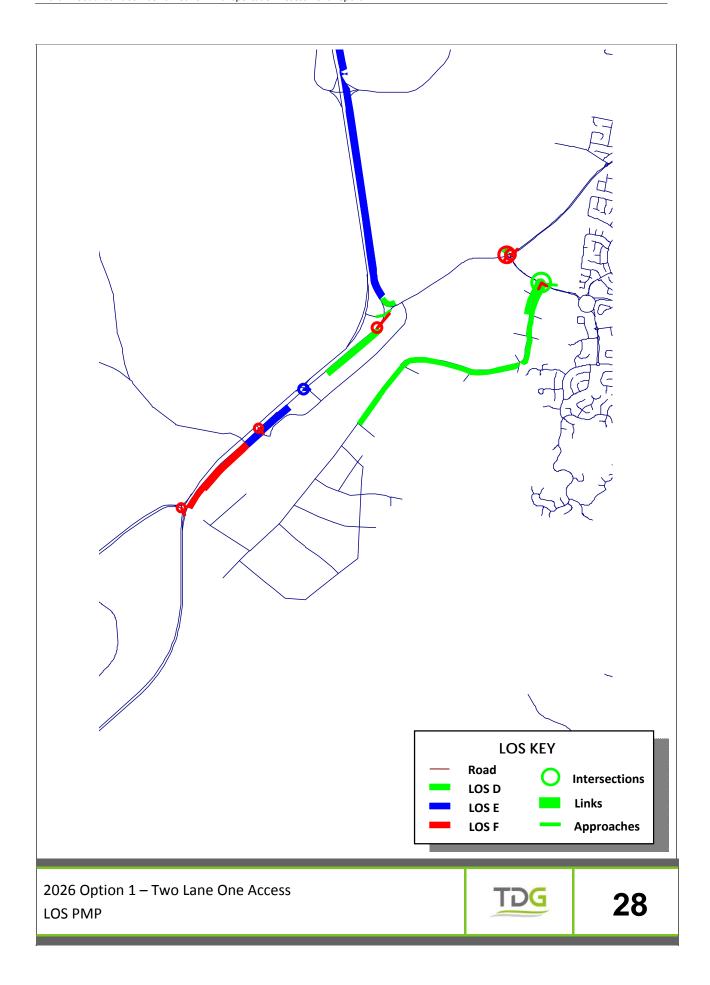




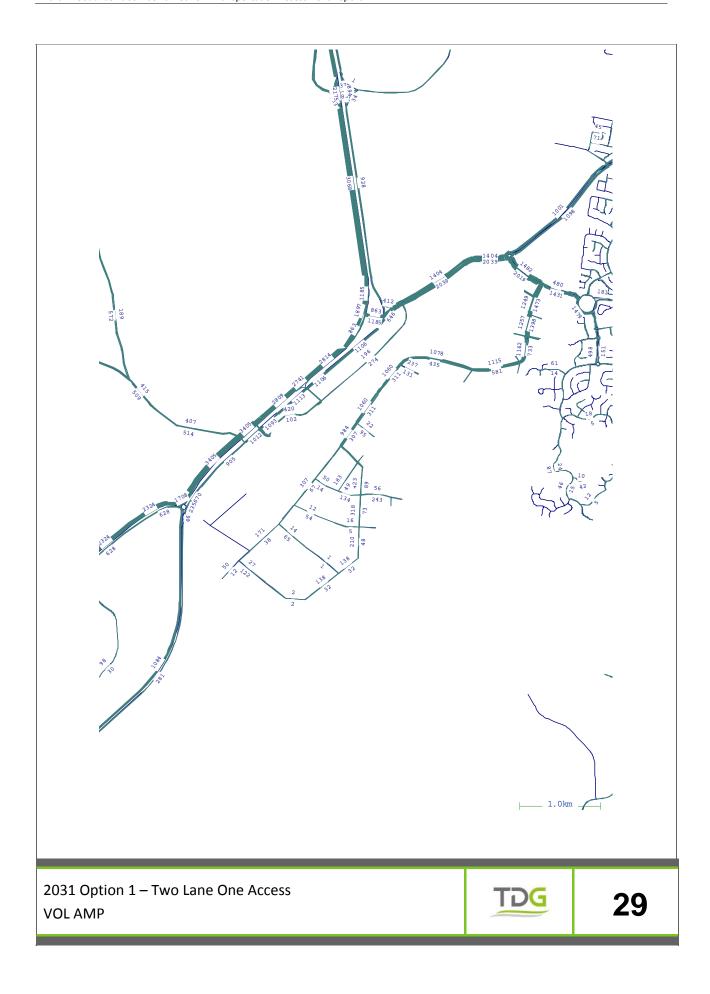




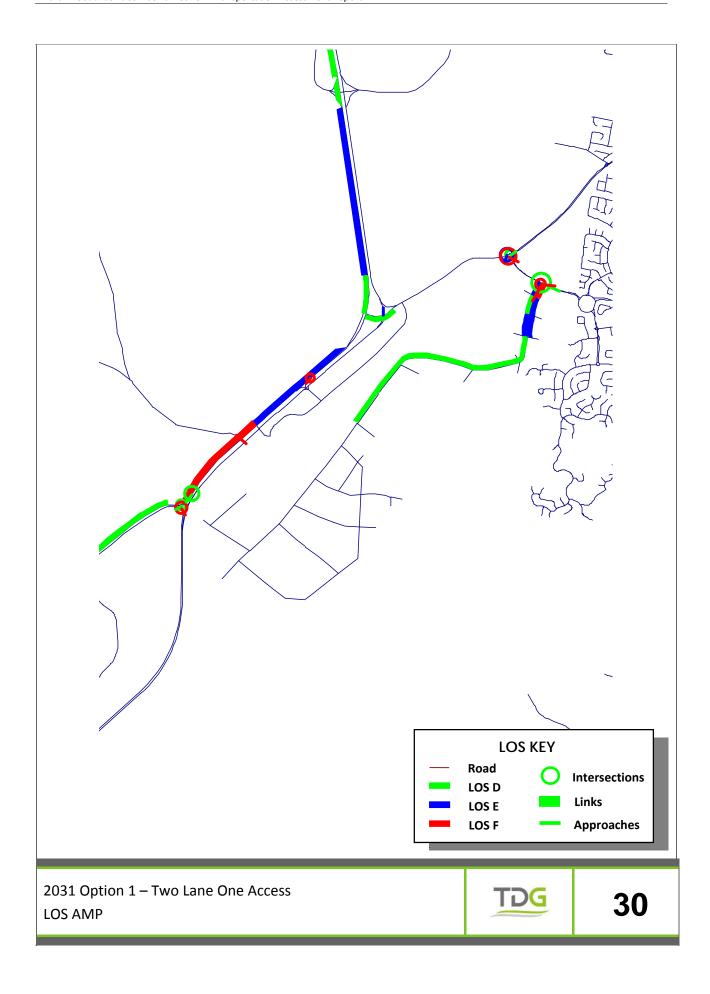




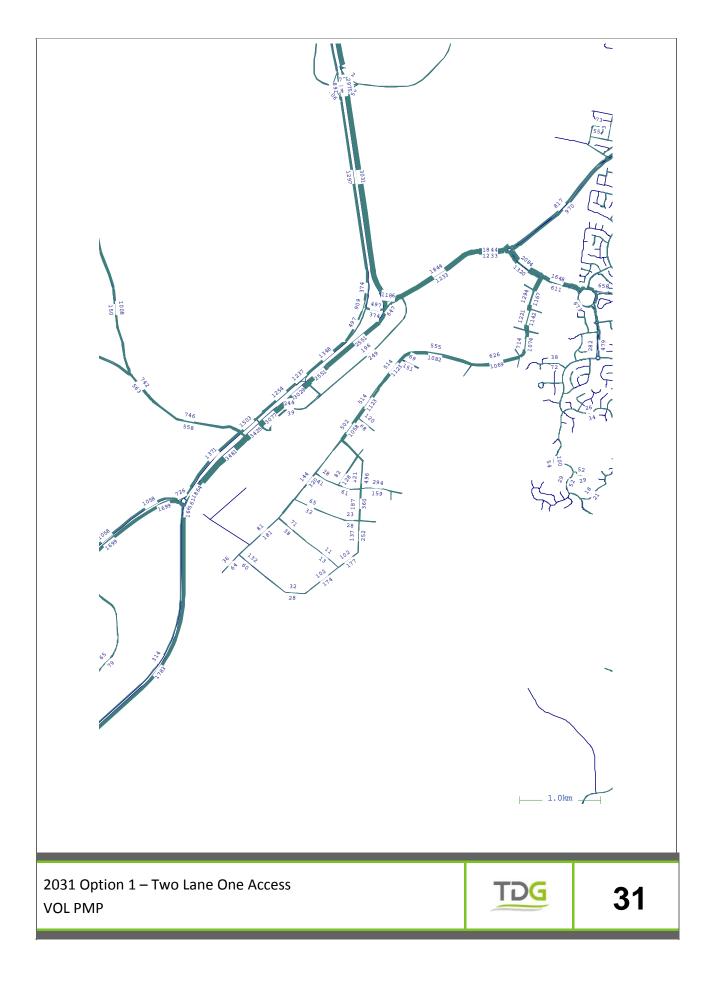




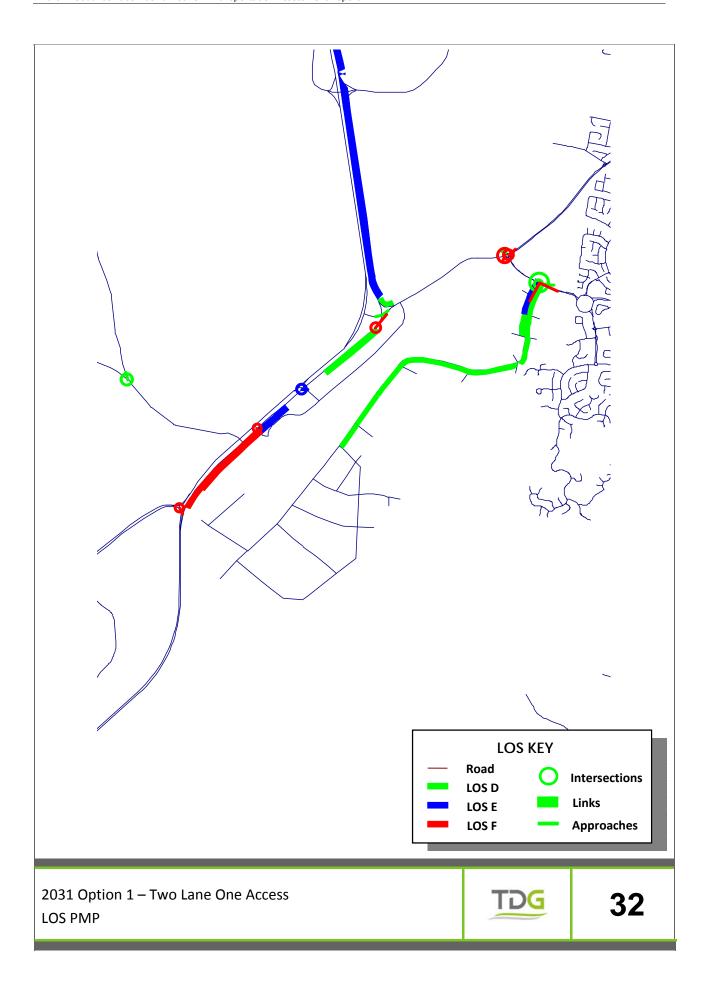










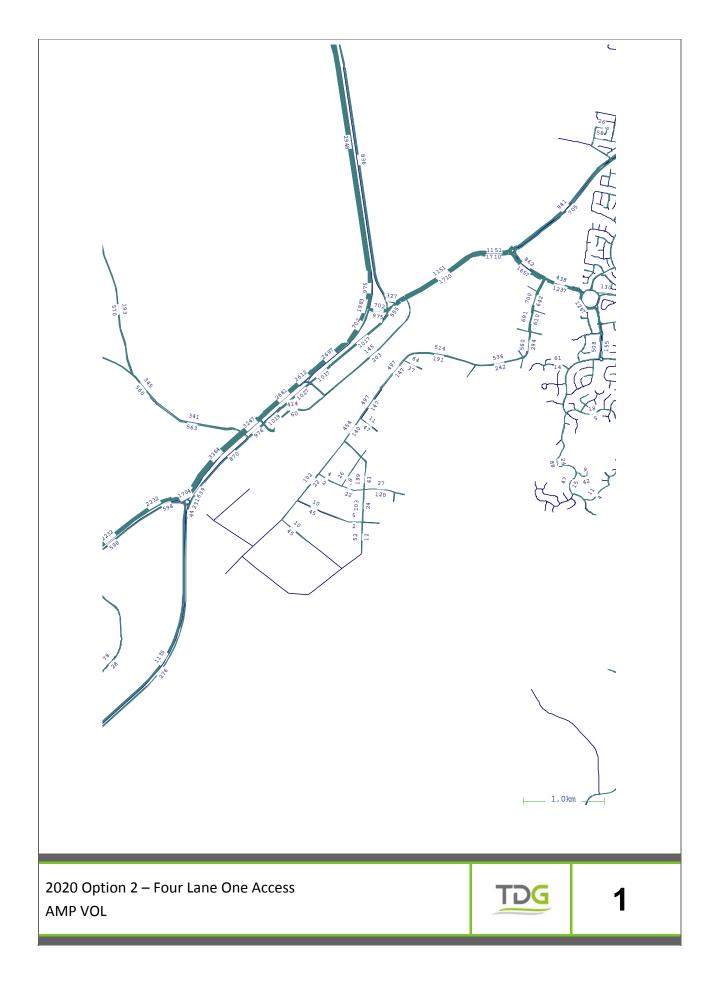




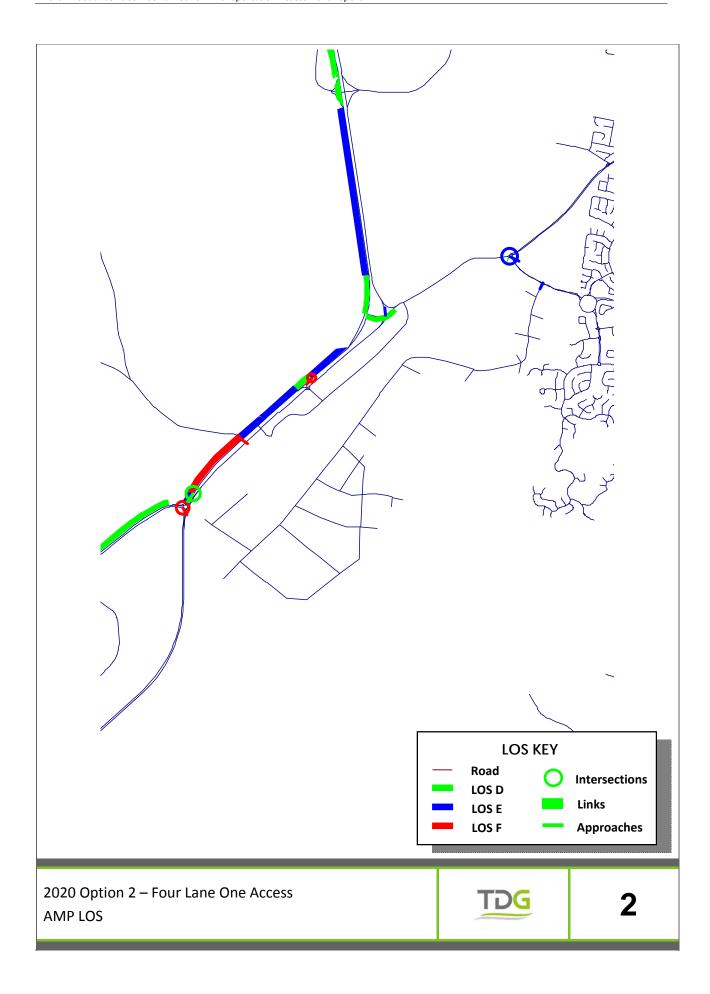
## **Appendix B**

Option 2 – Four Lane One Access – Tompsitt Dr - South Jerrabomberra Flows and LOS

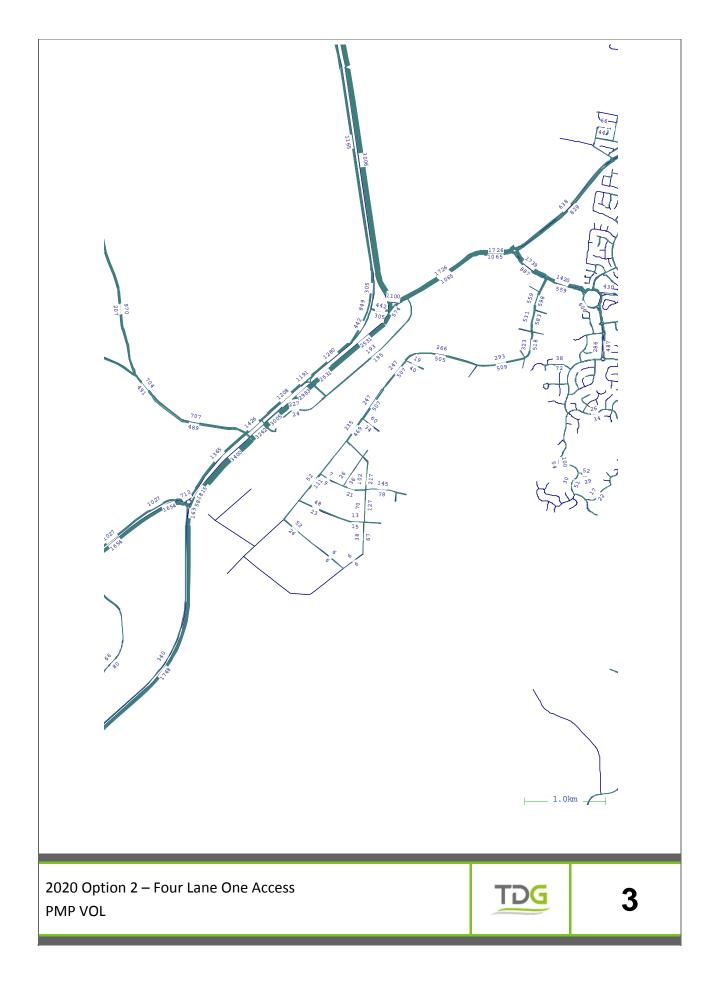




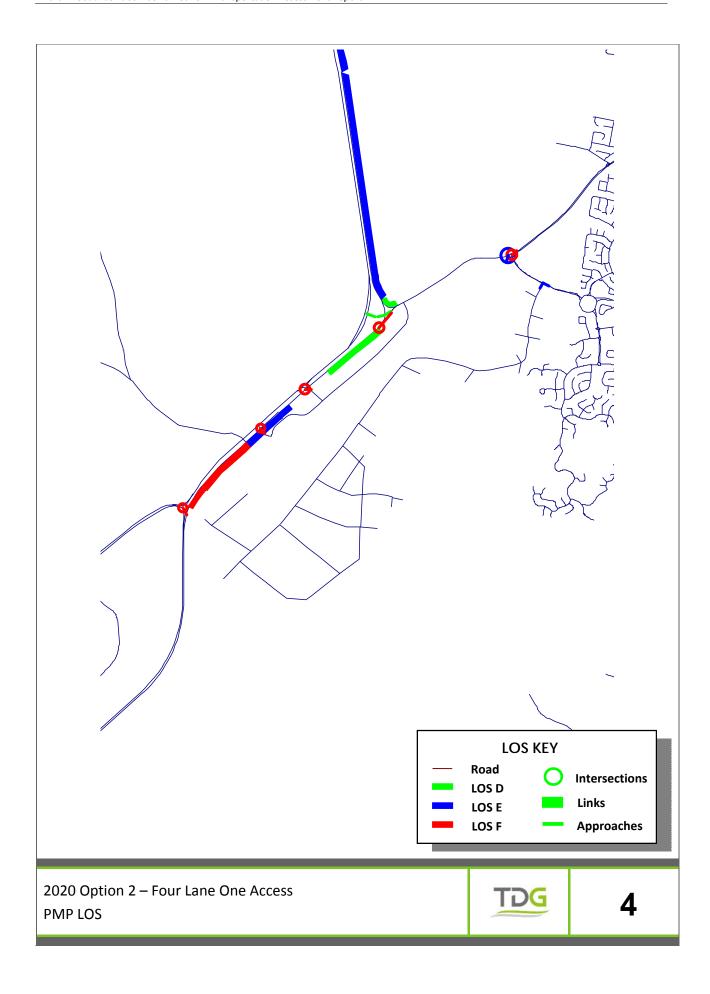




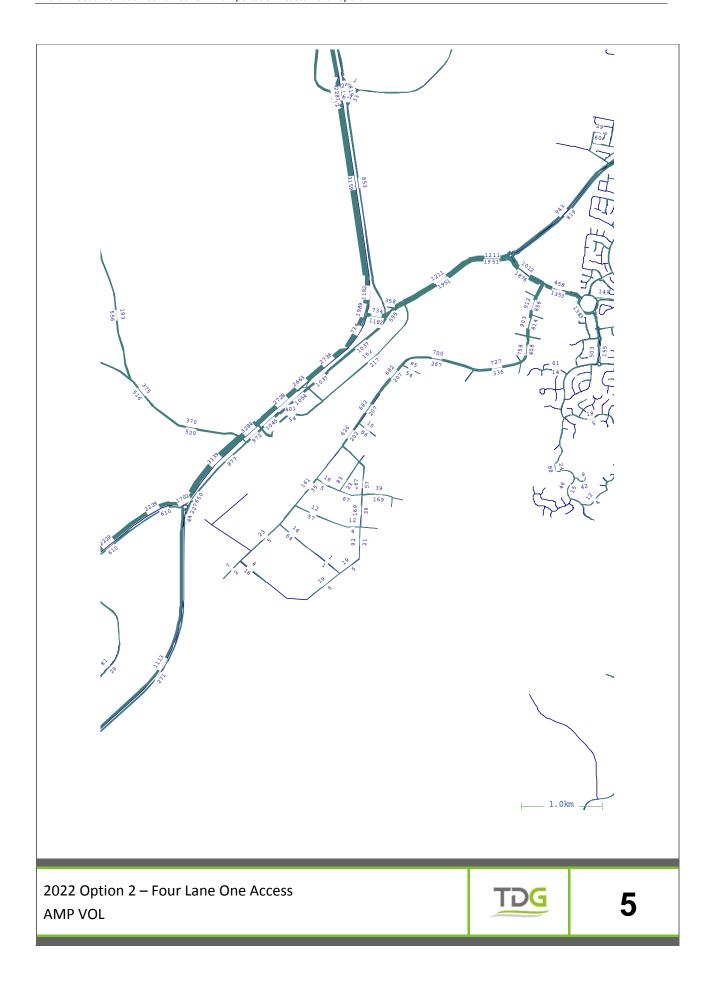




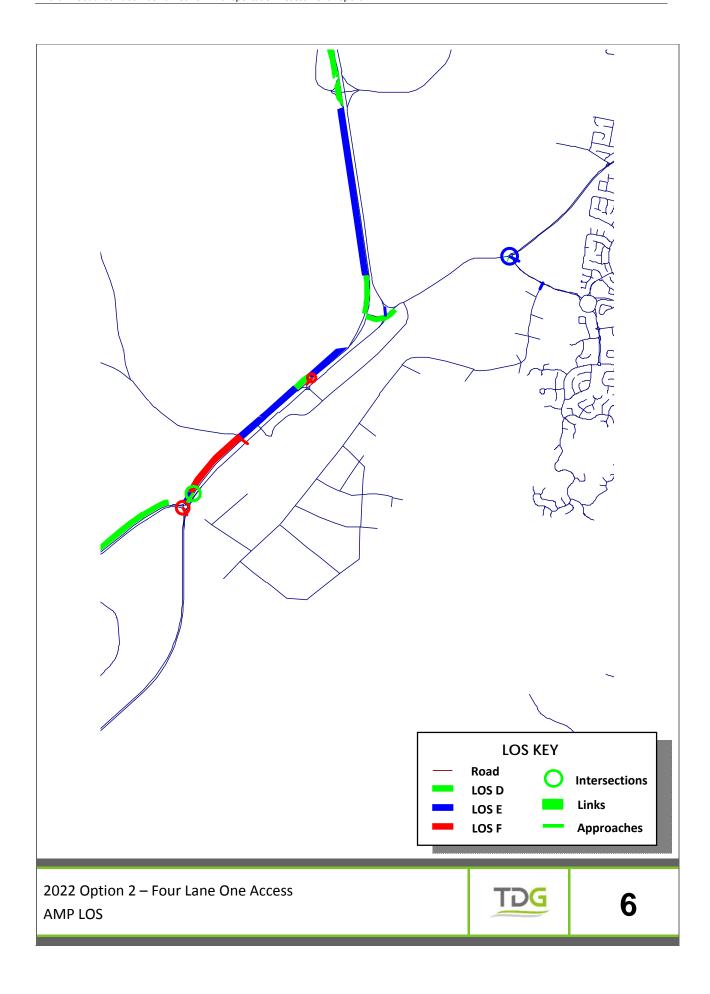




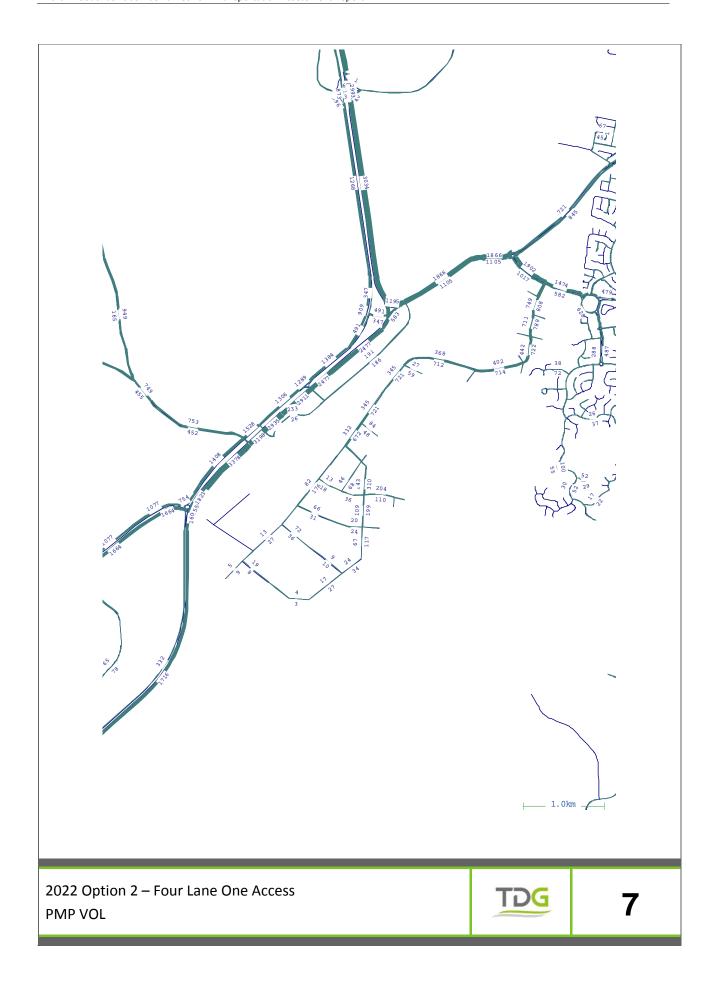




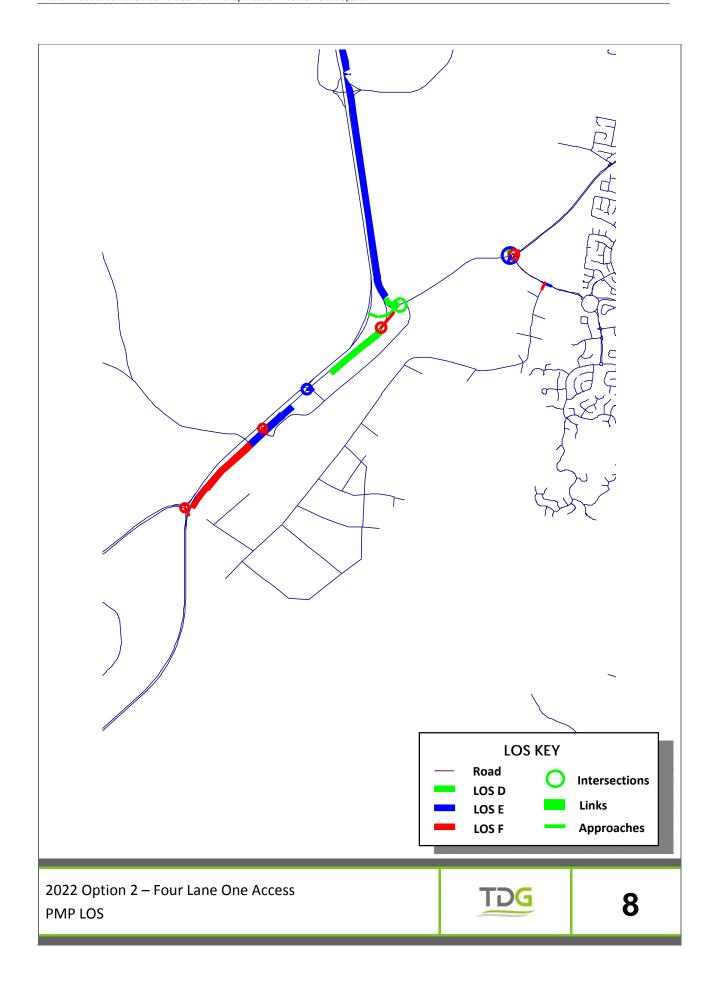




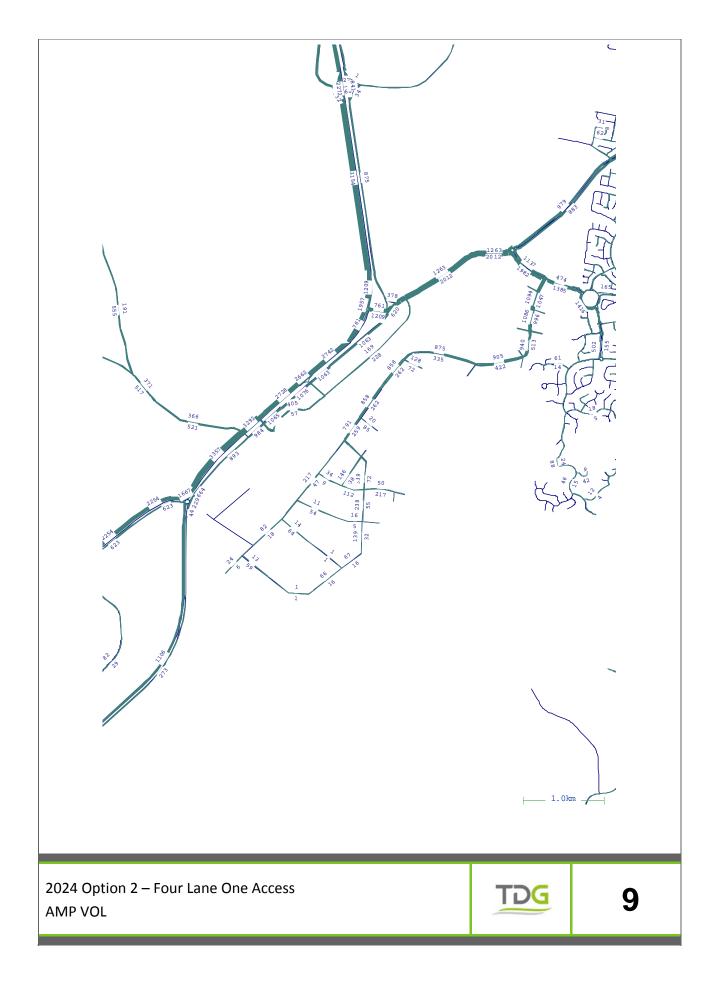




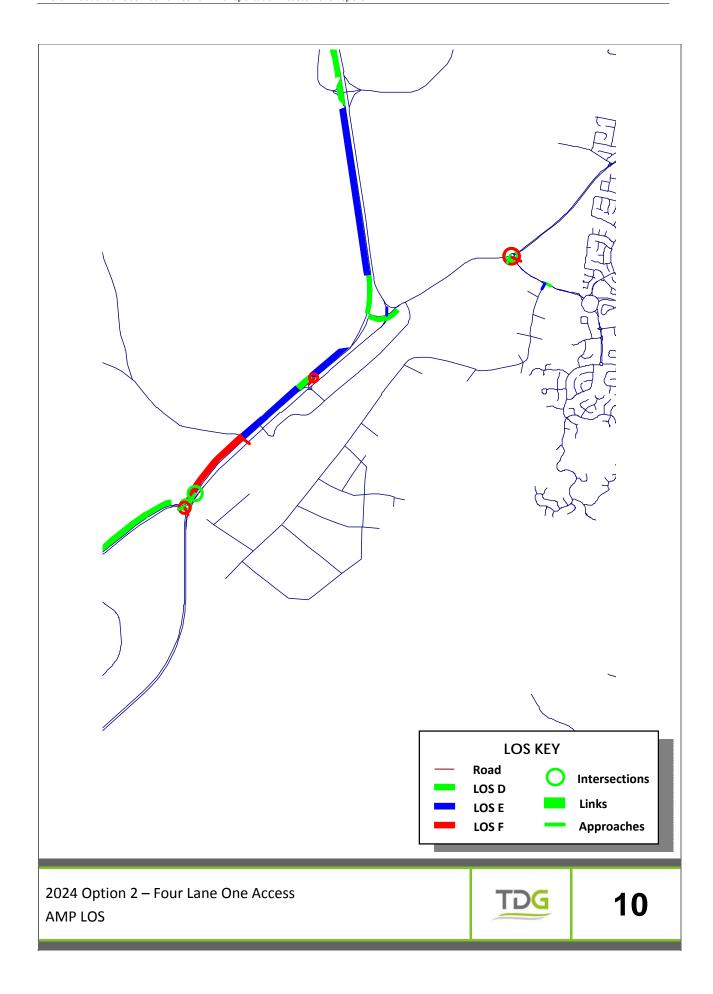




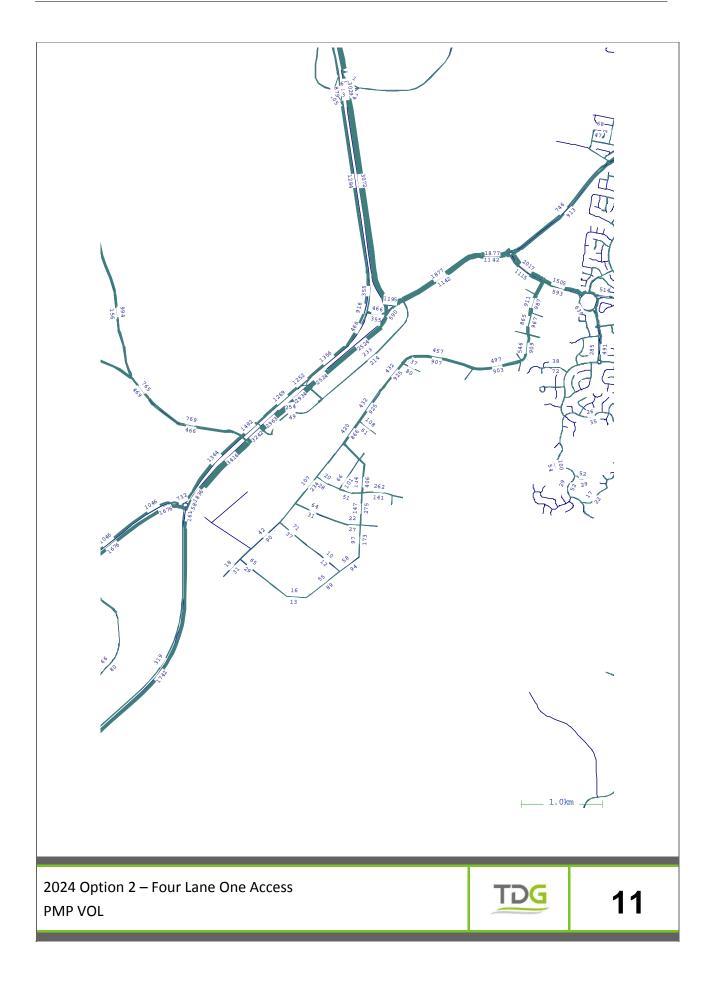




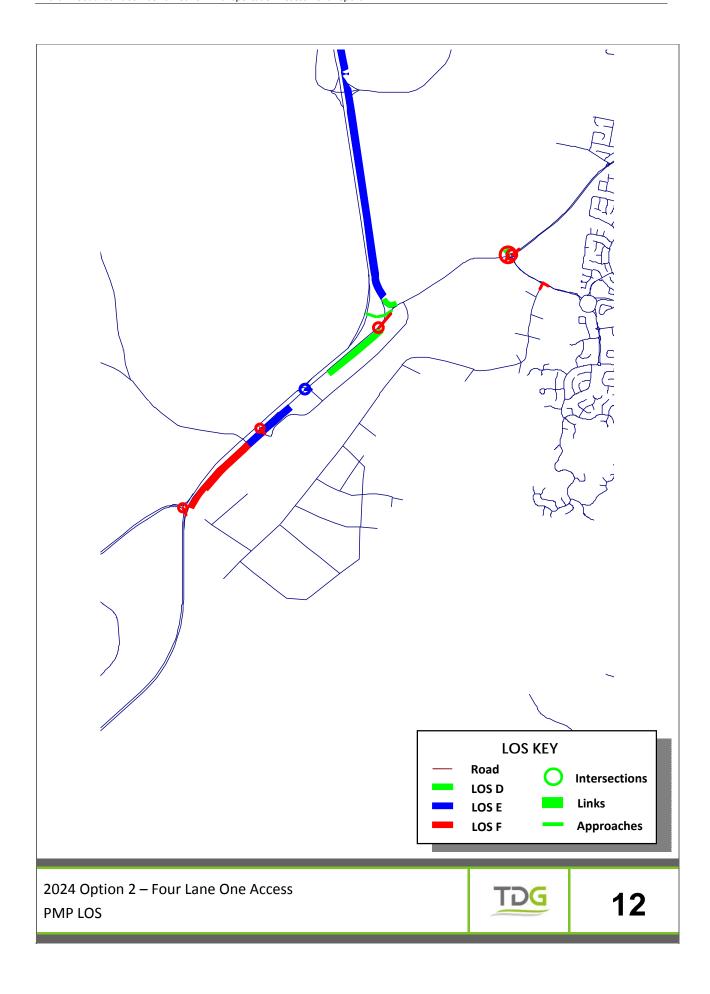




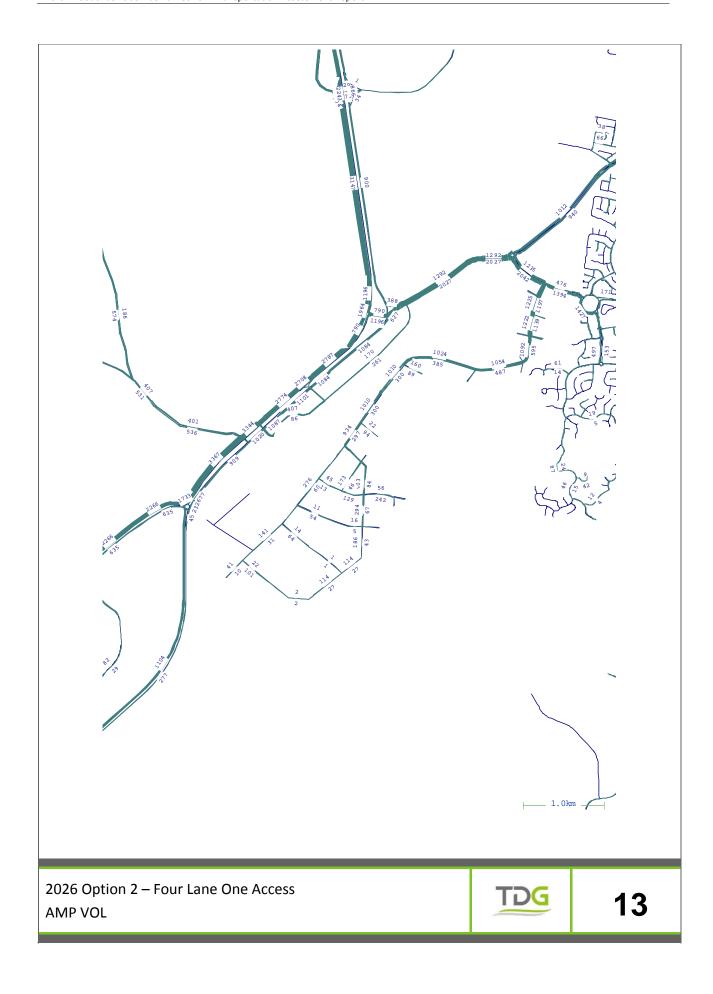




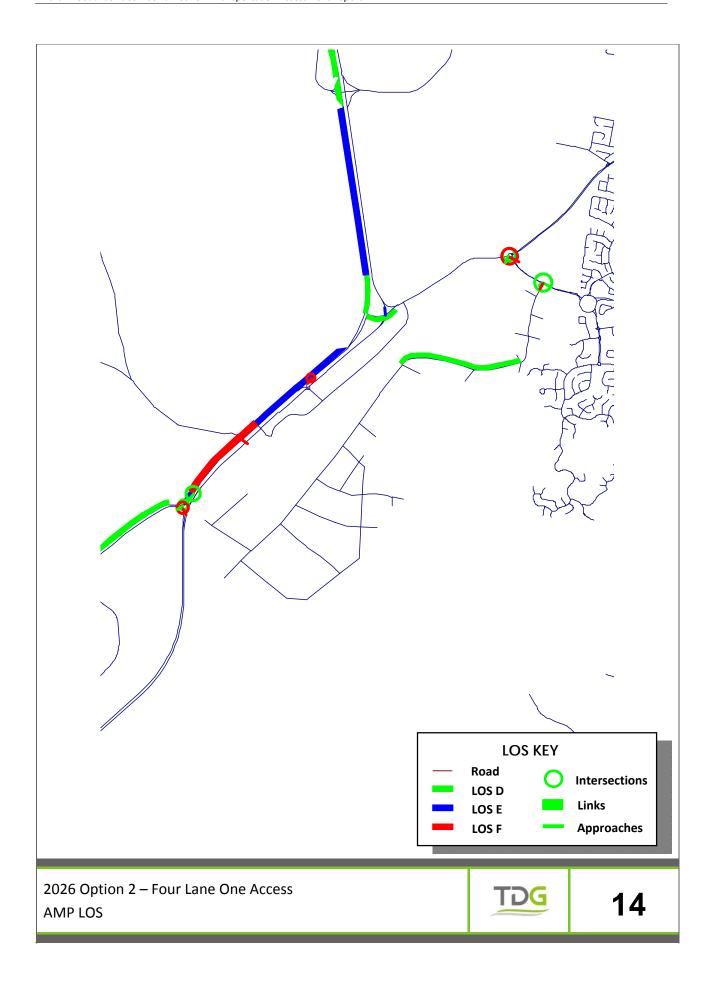




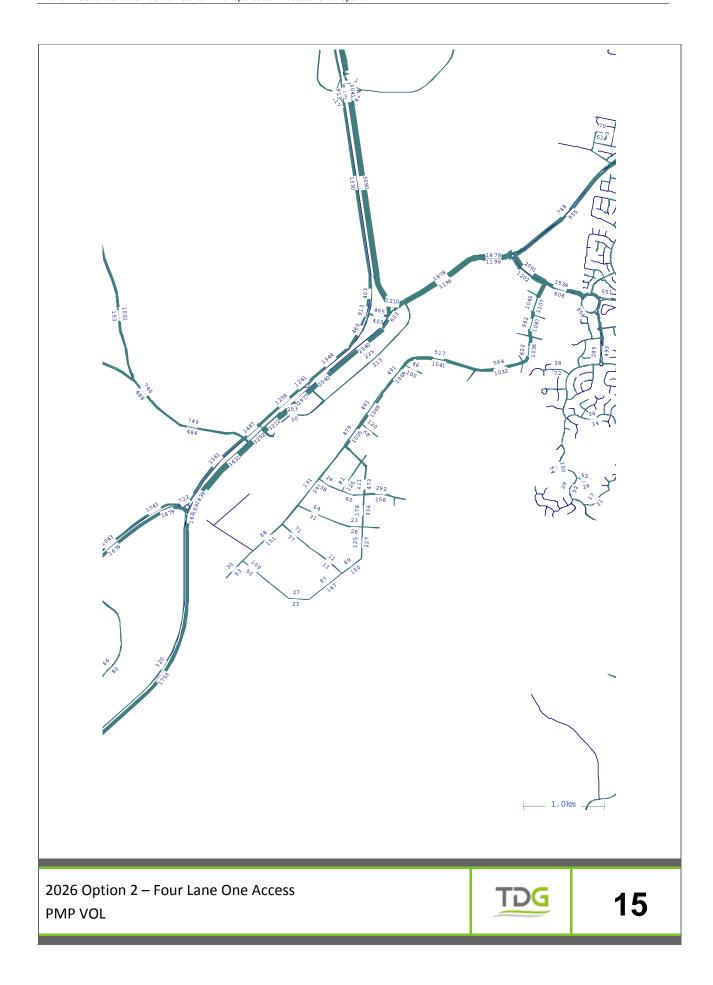




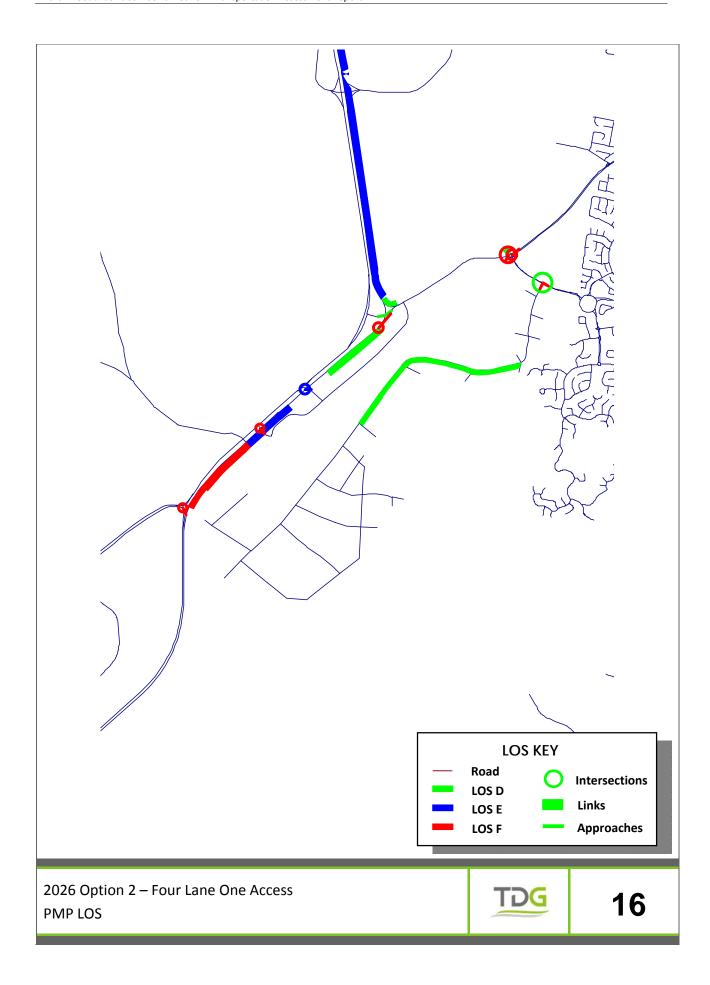




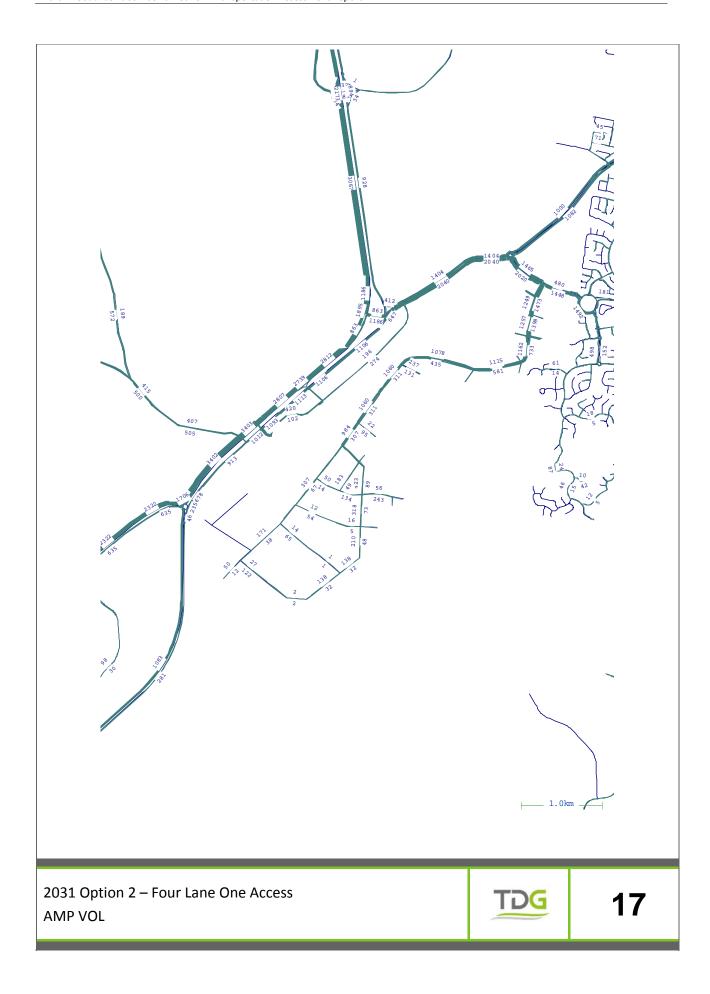




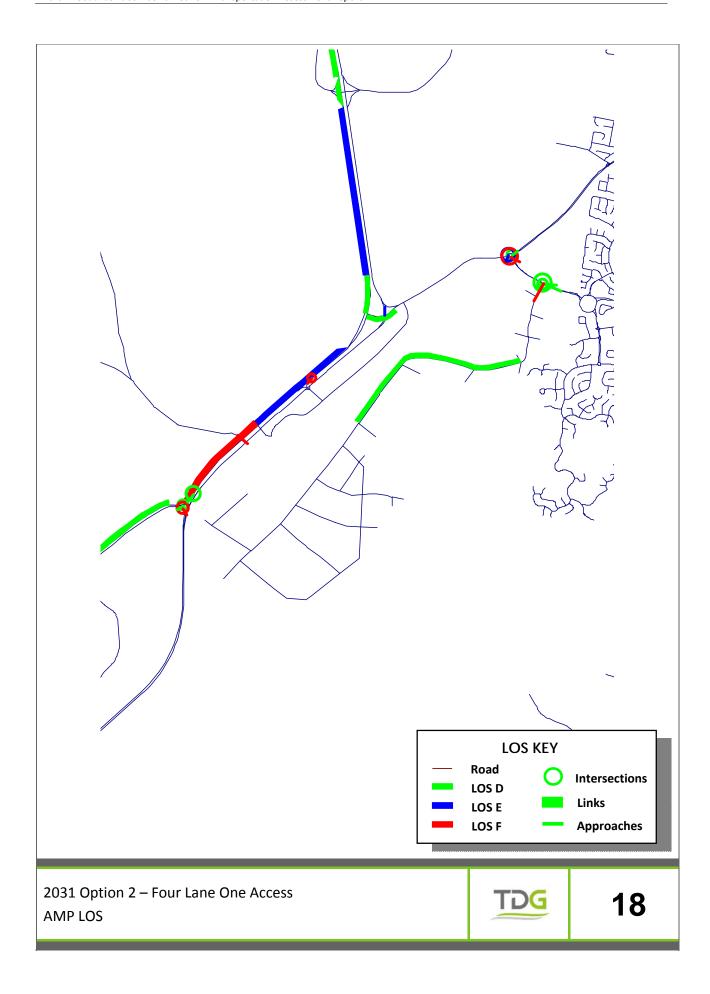




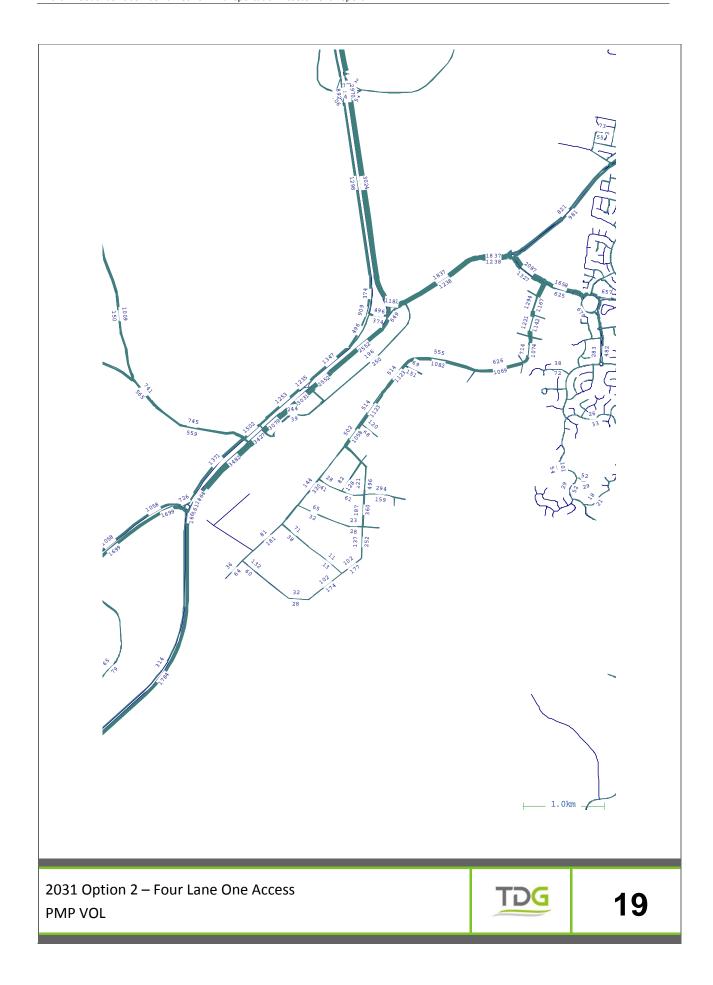




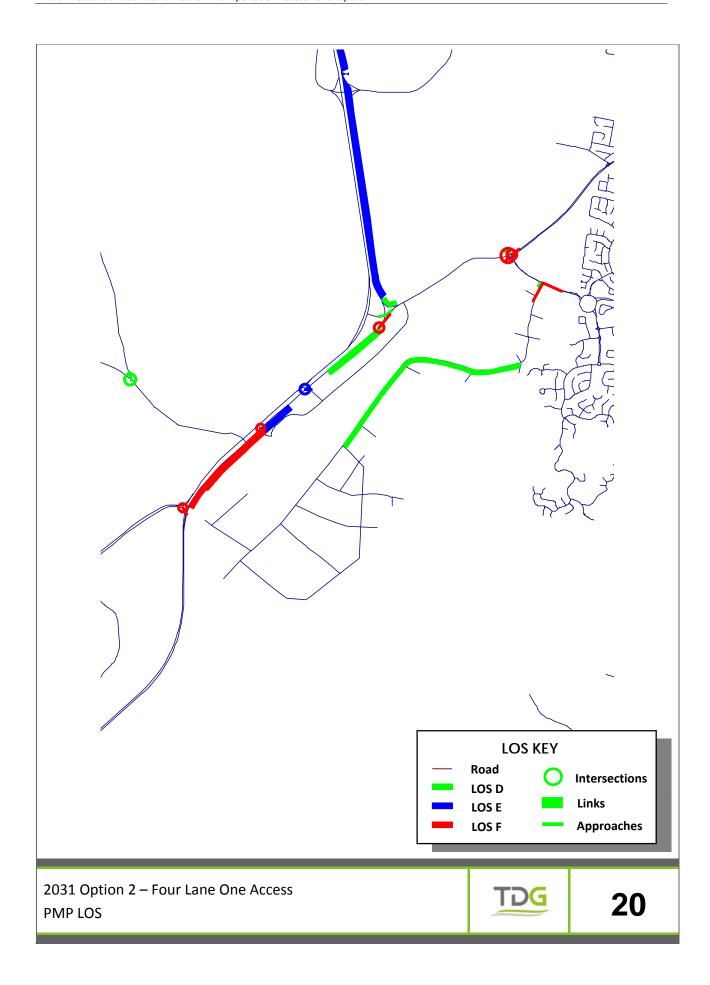










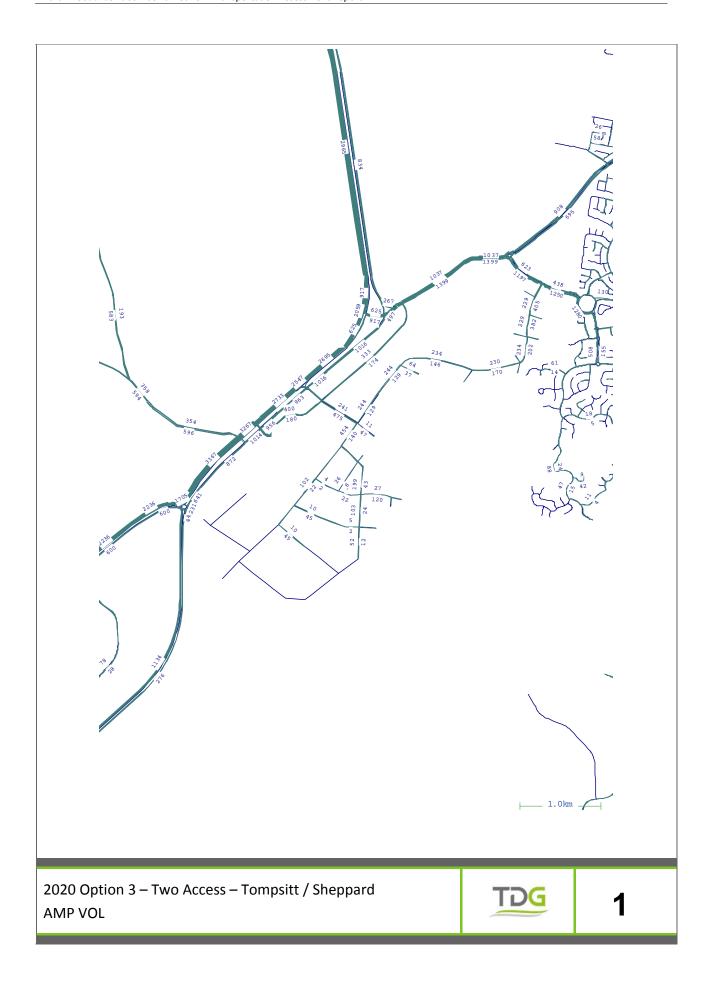




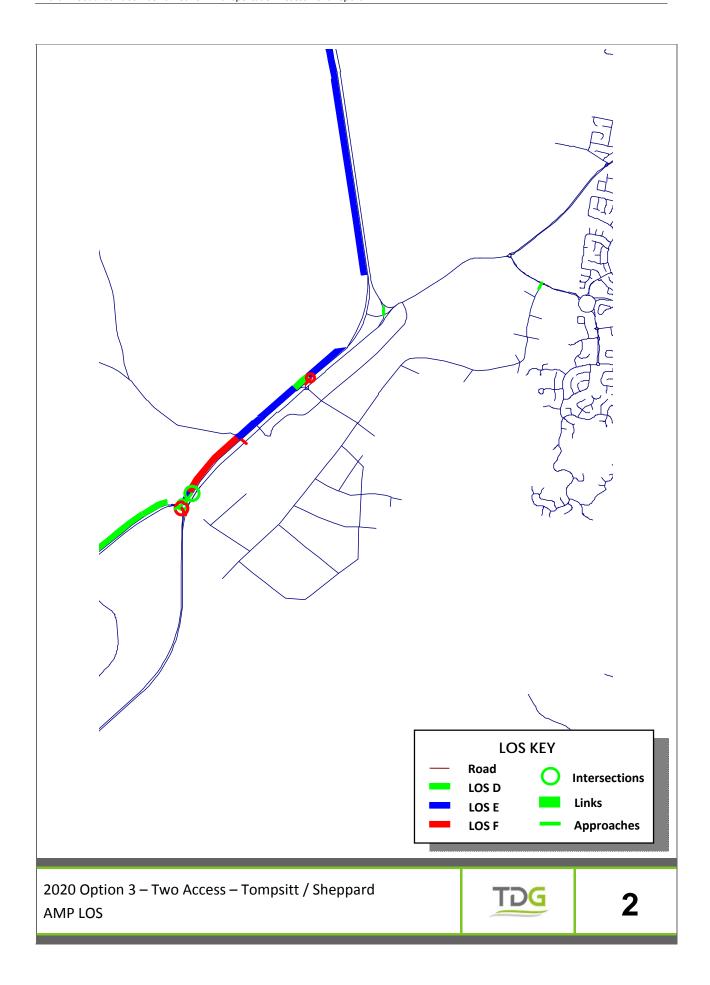
## **Appendix C**

Option 3 – Two Access – Tompsitt Dr / Sheppard St - South Jerrabomberra Flows and LOS

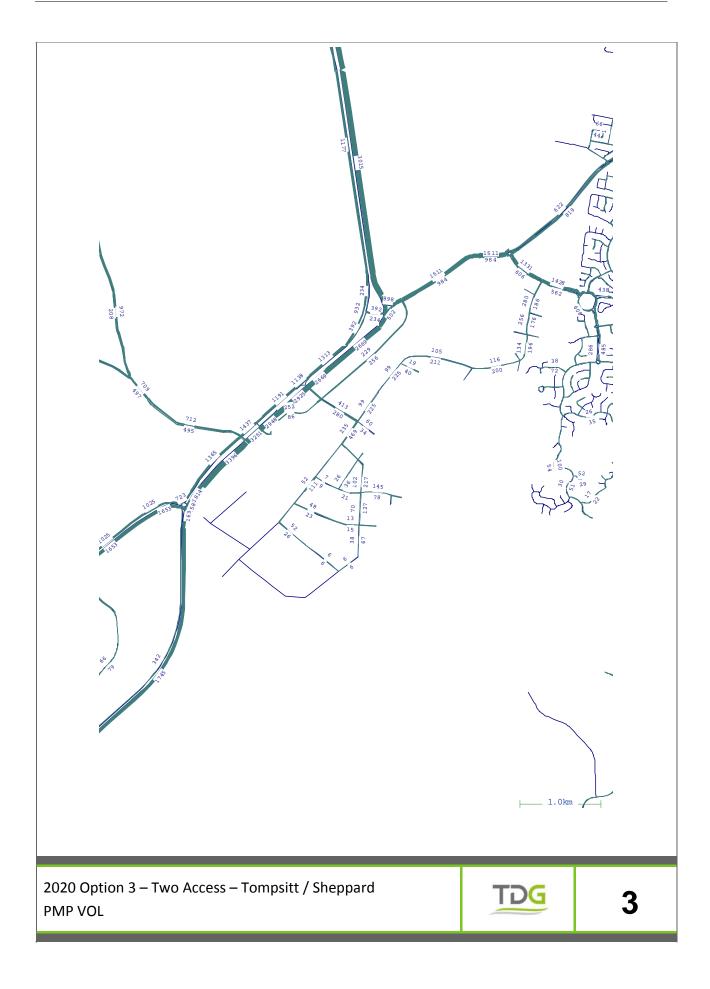




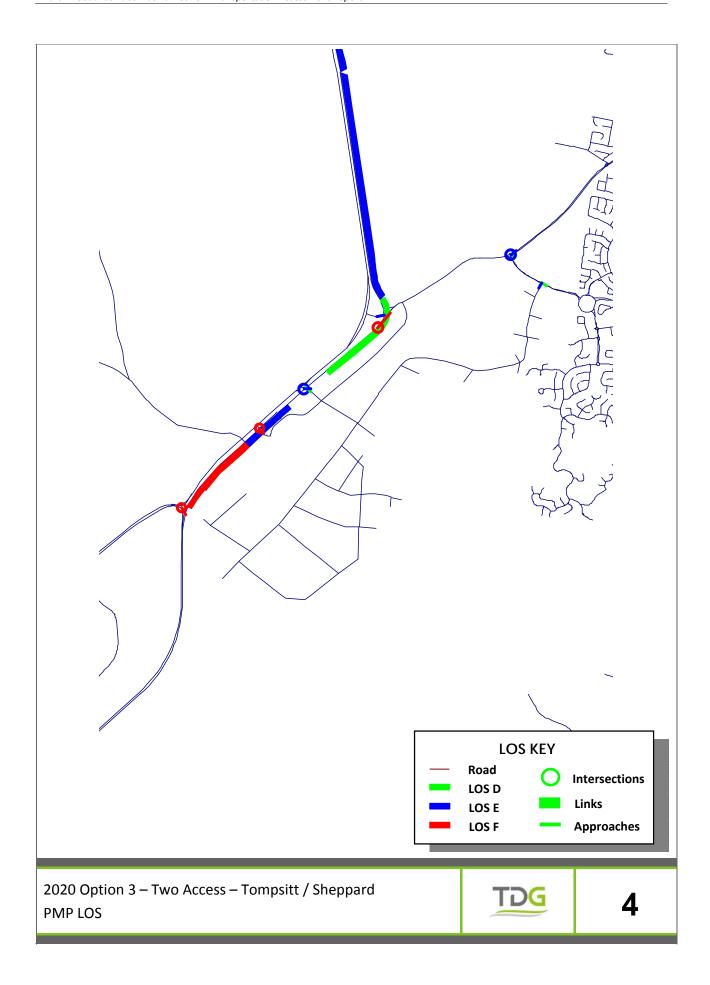




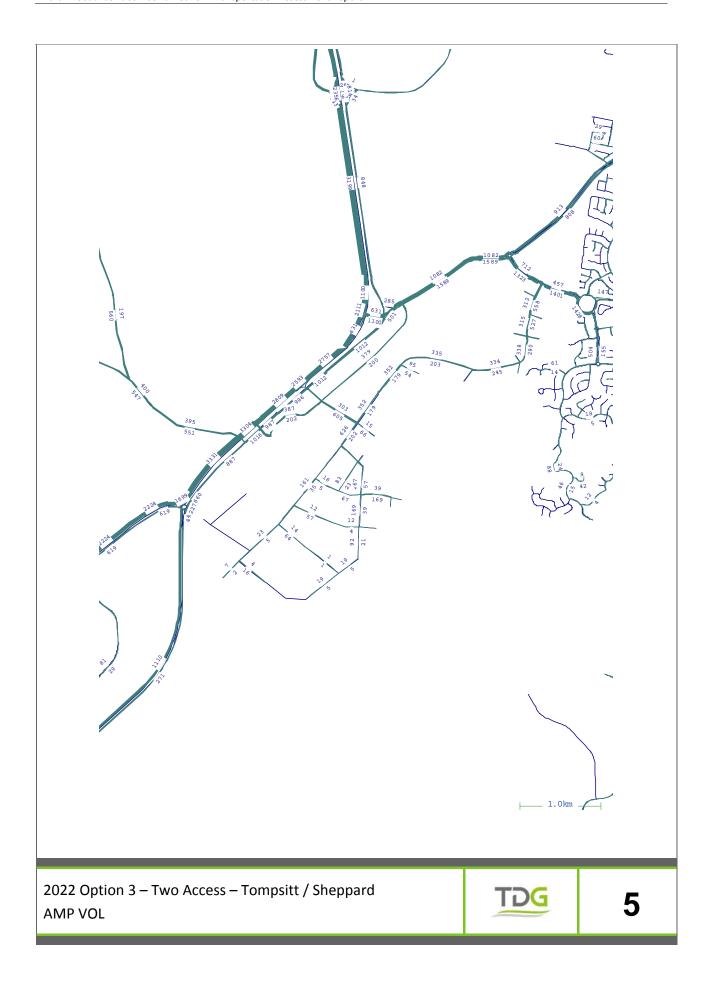




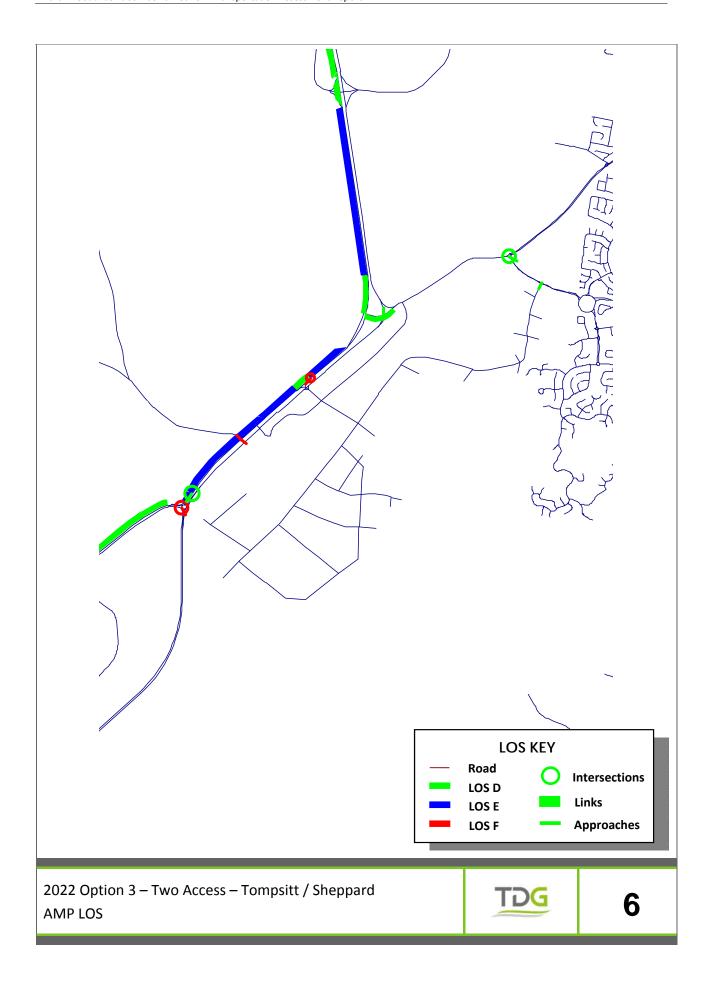




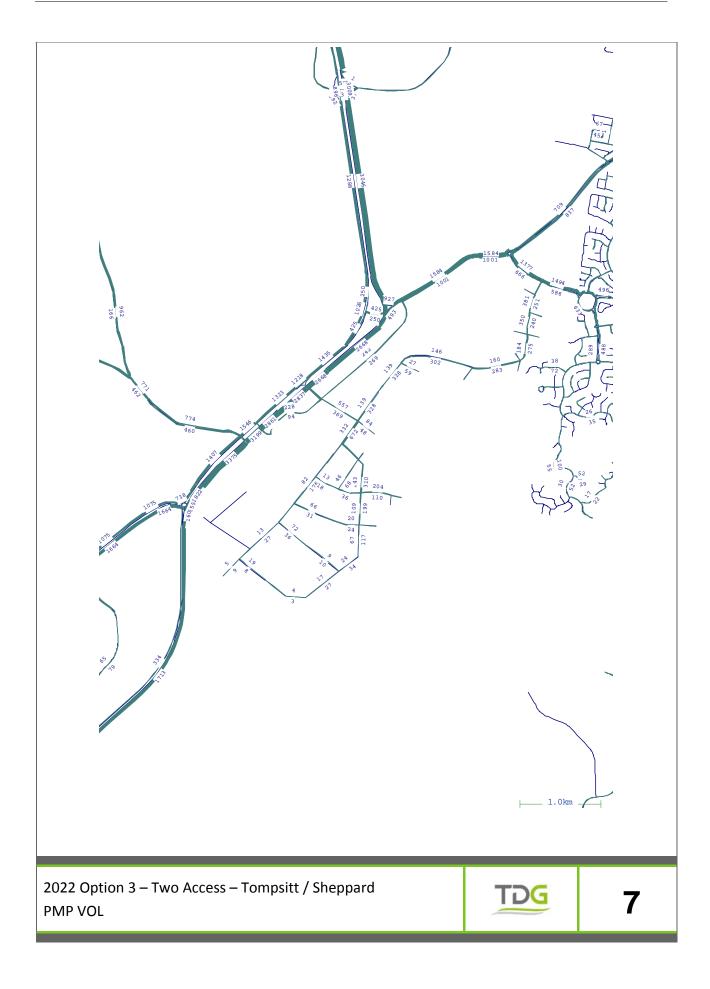




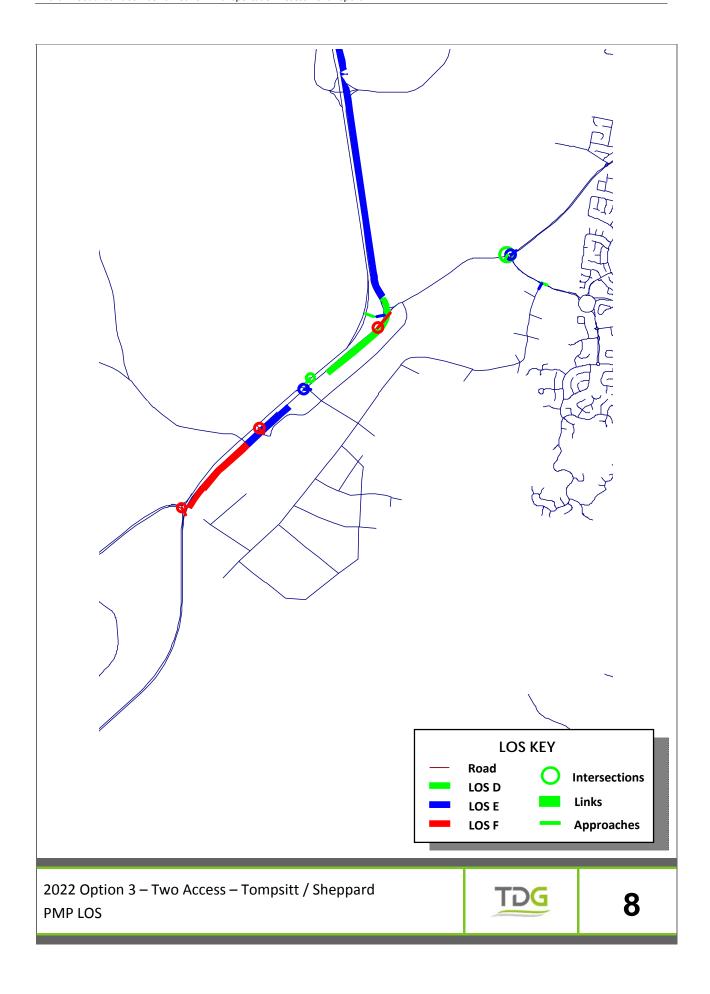




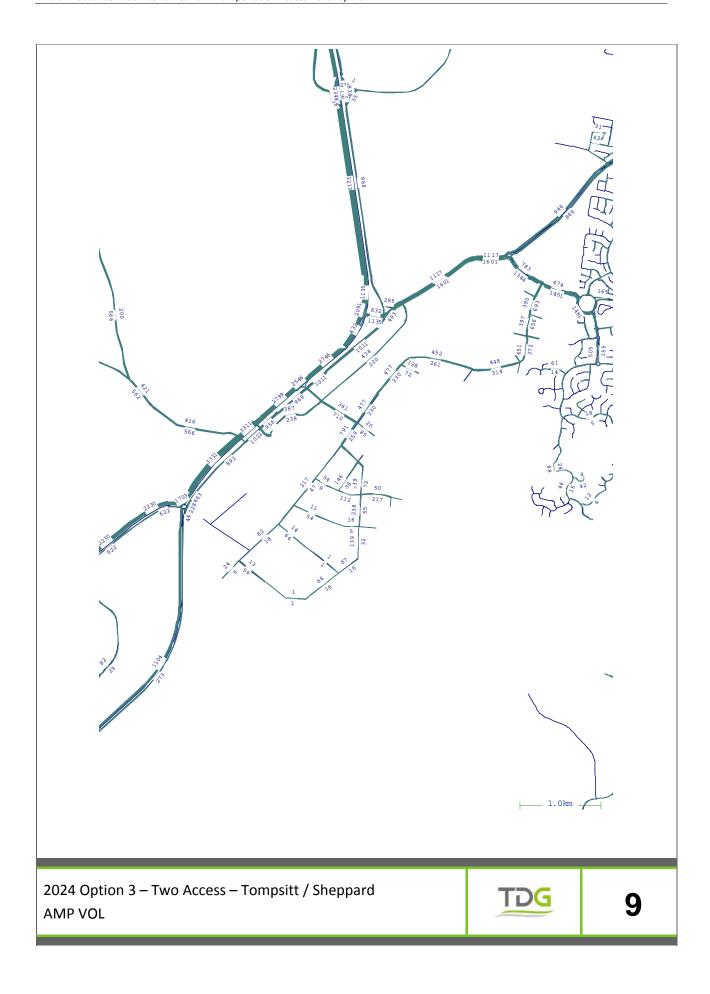




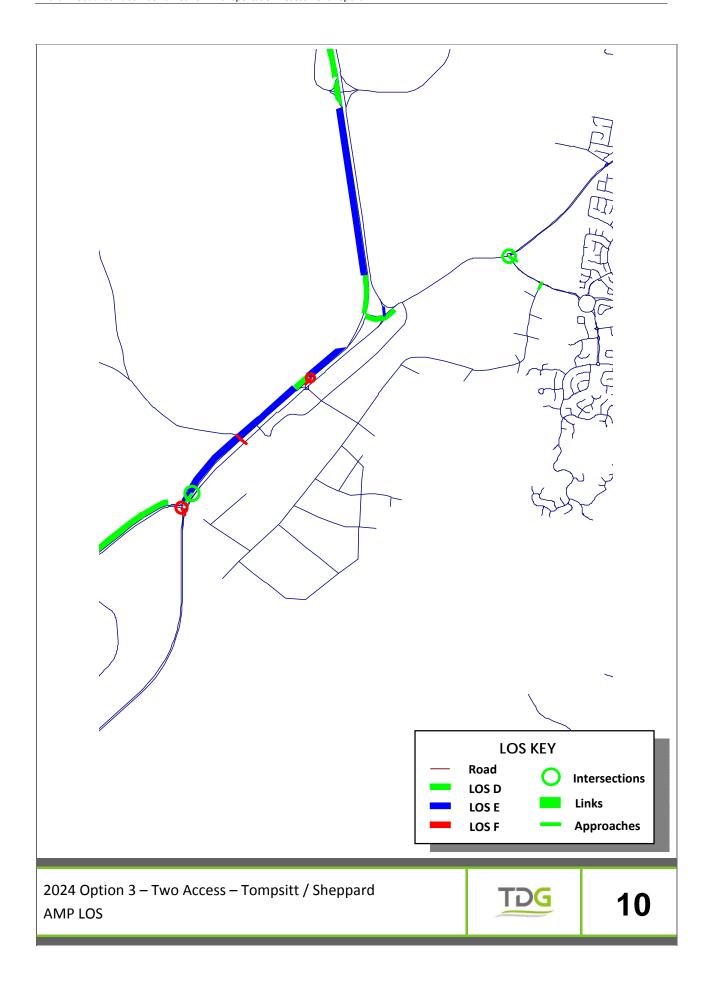




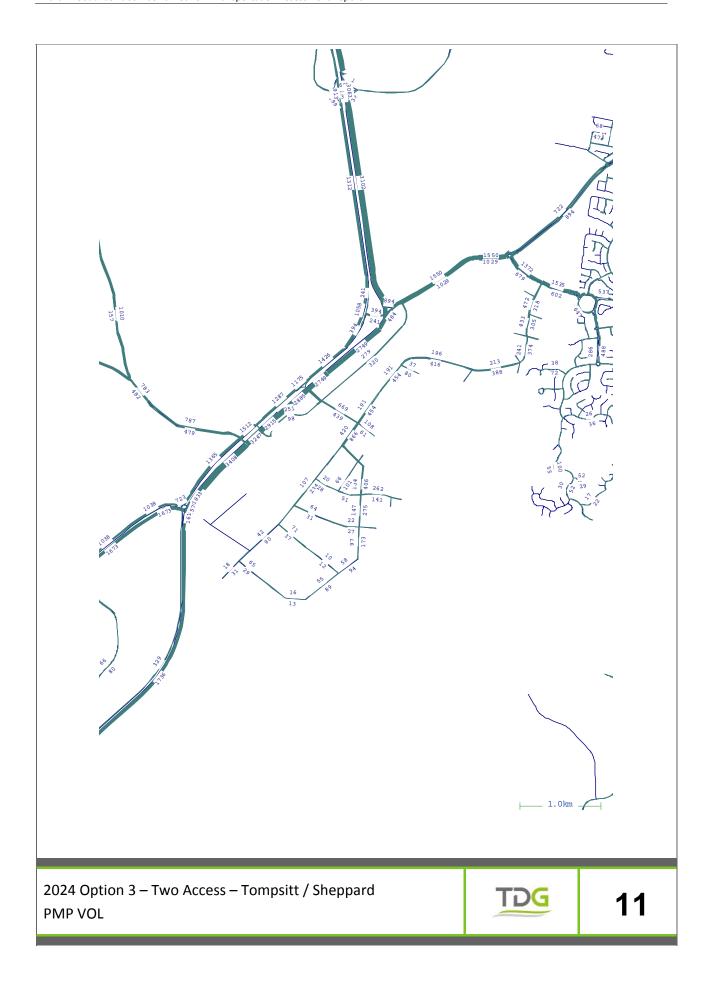




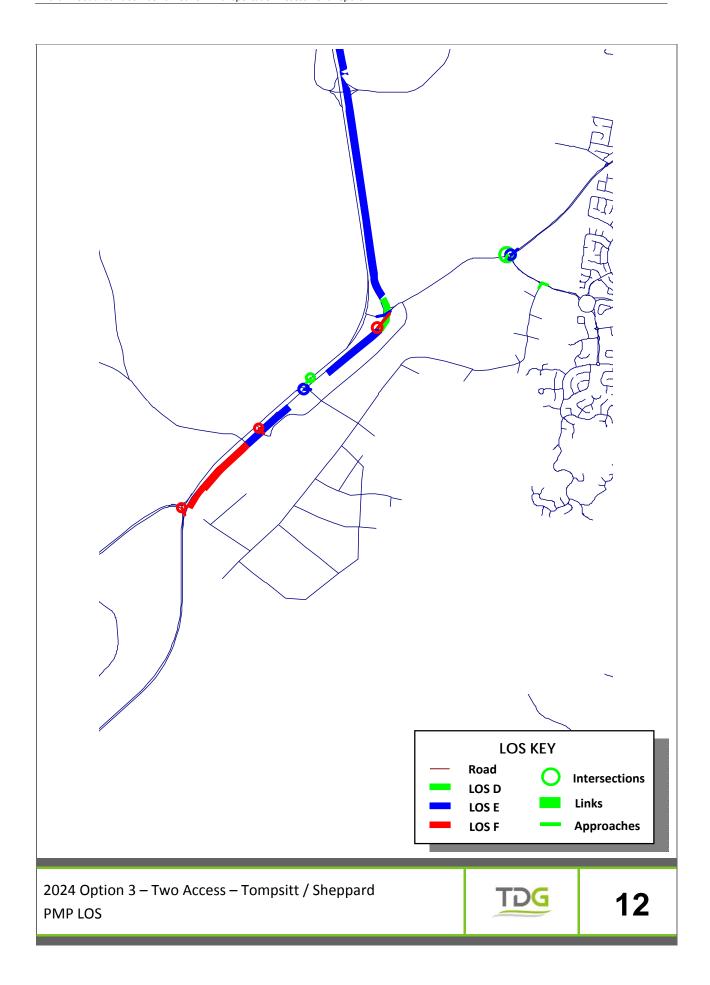




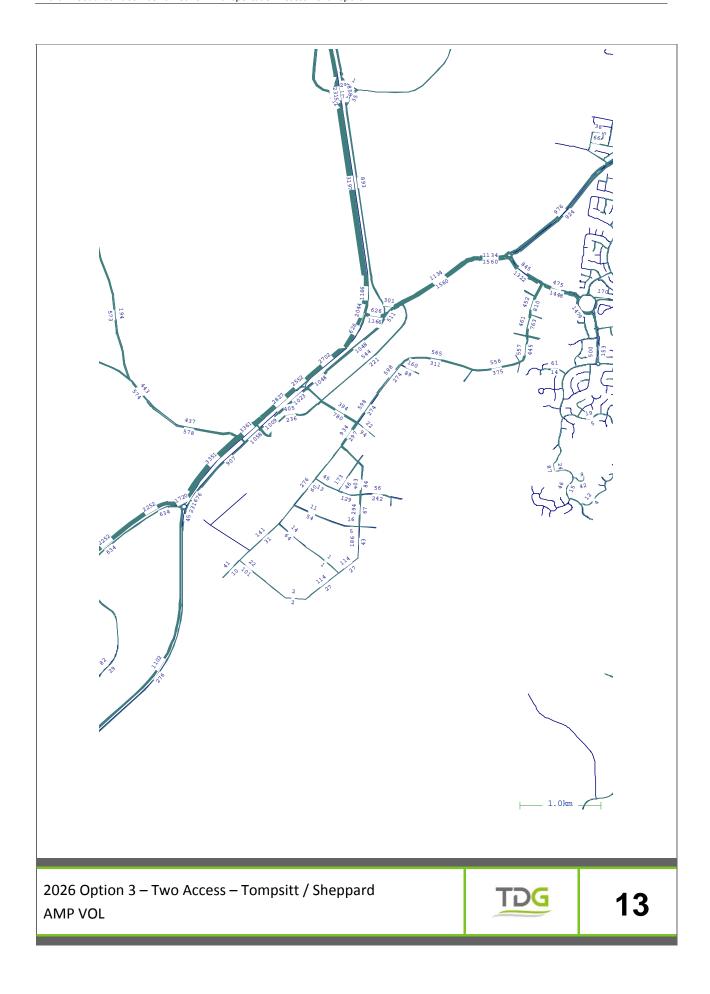




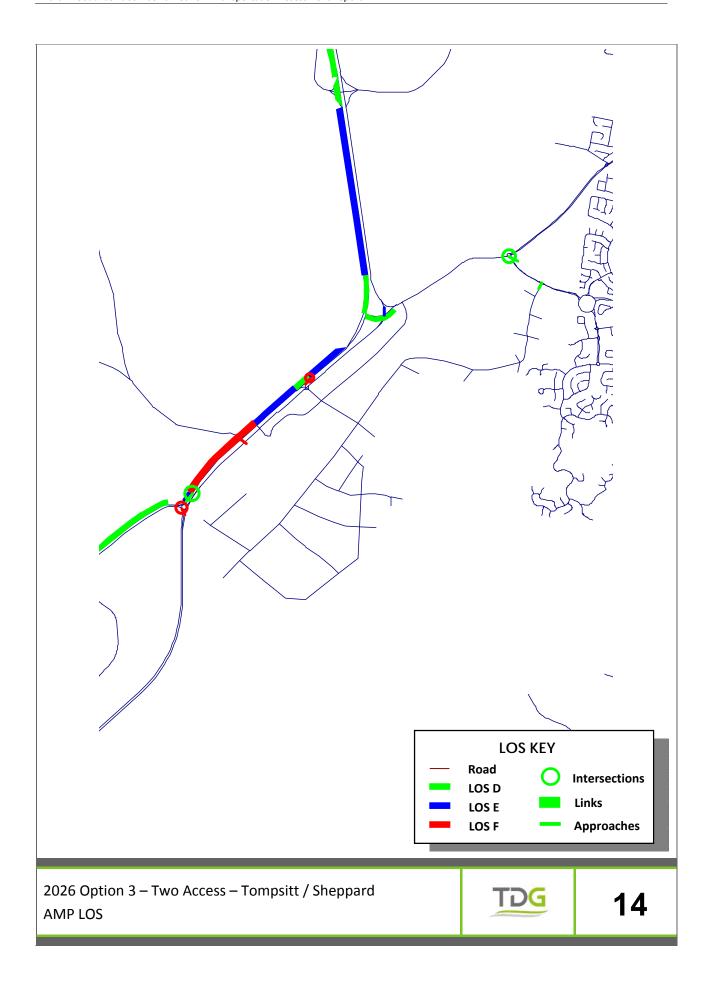




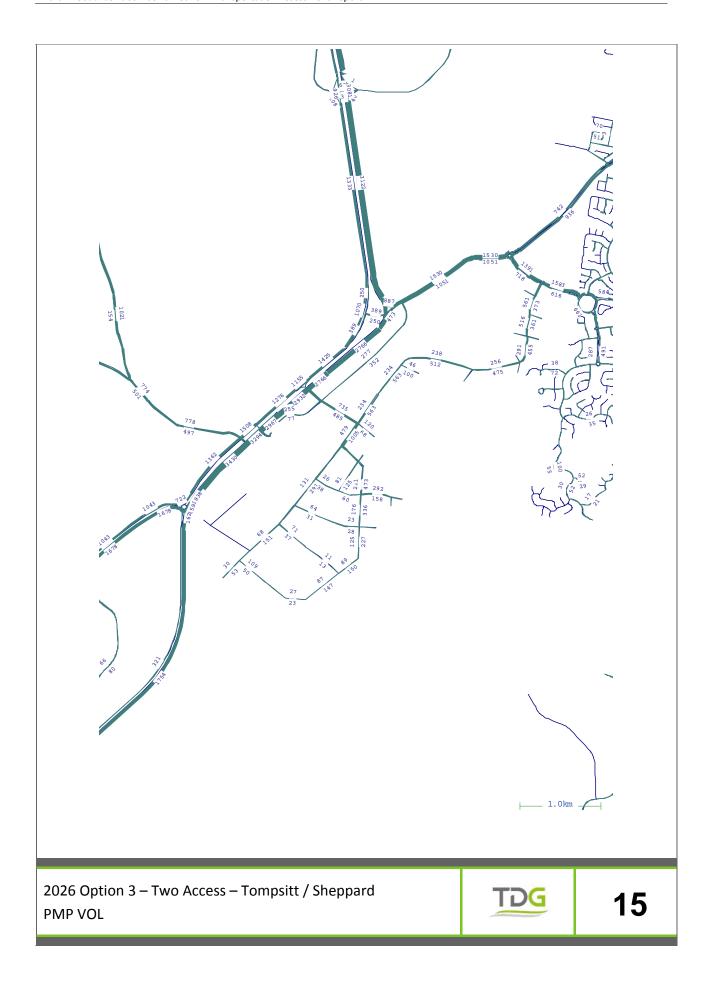




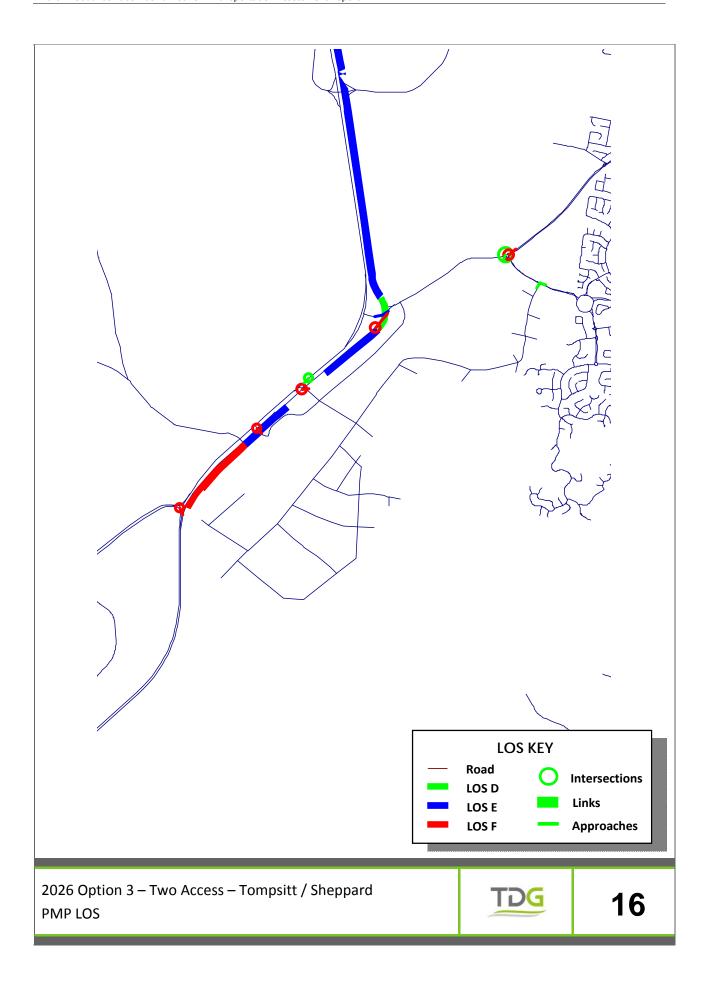




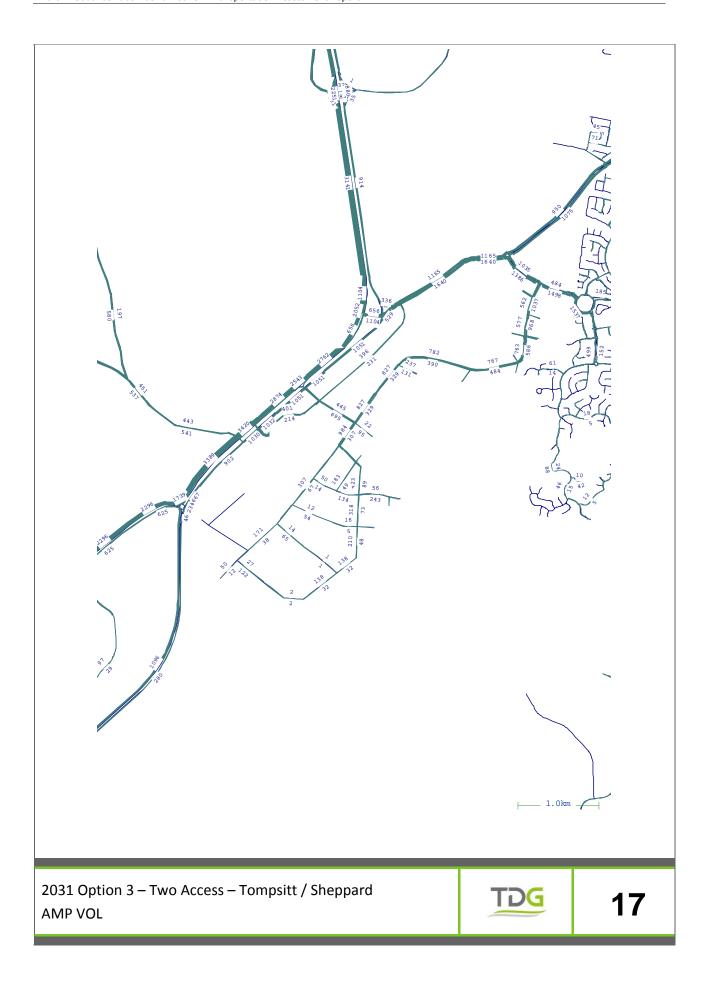




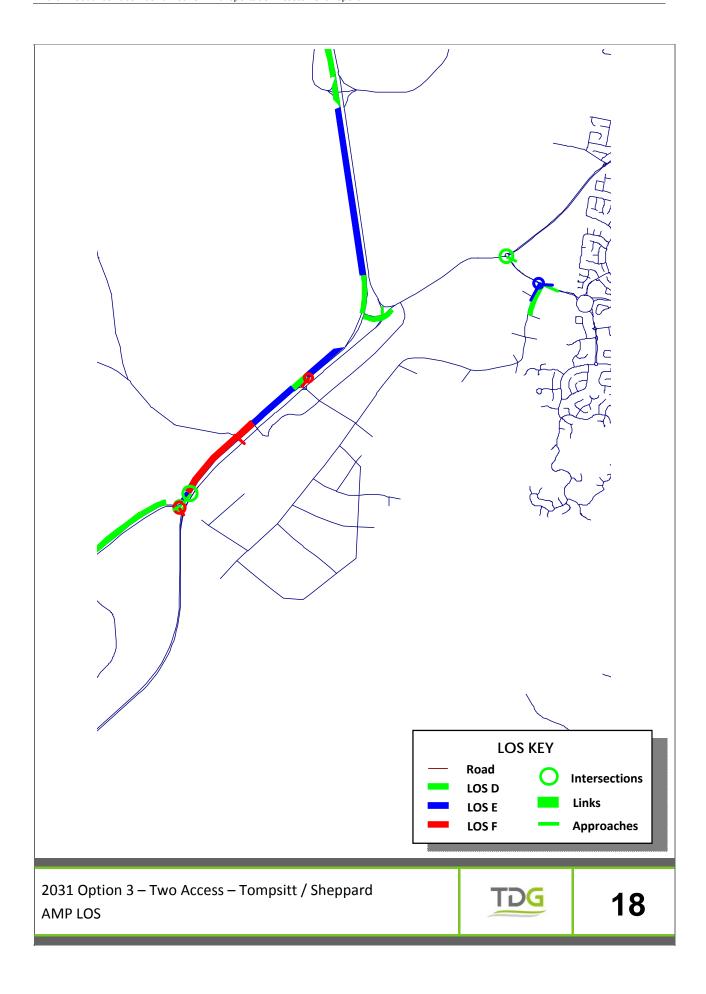




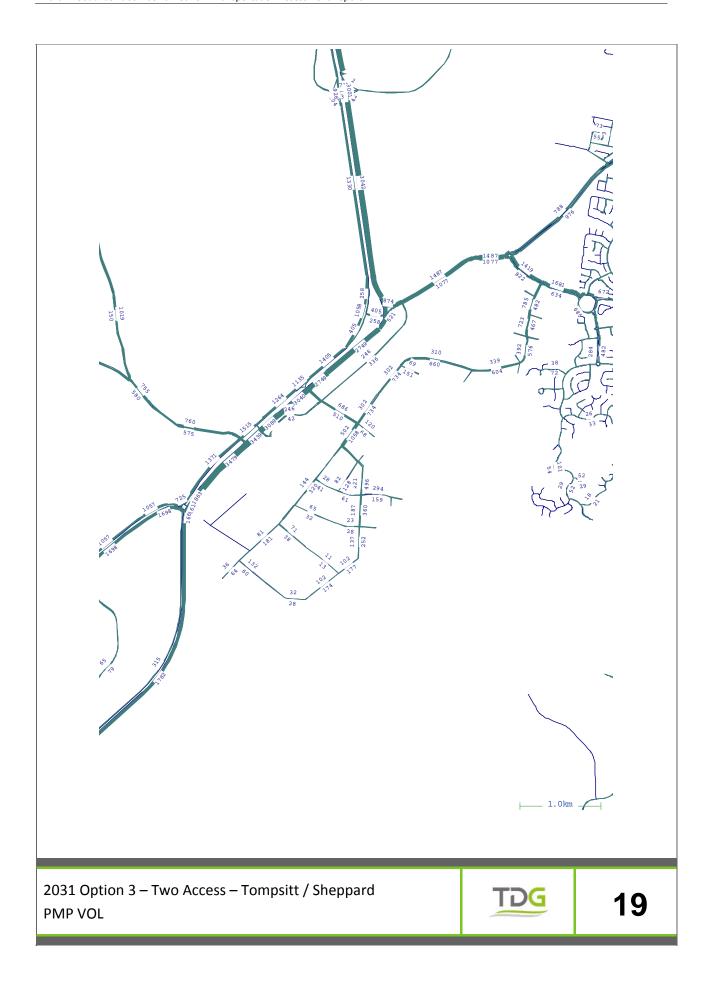




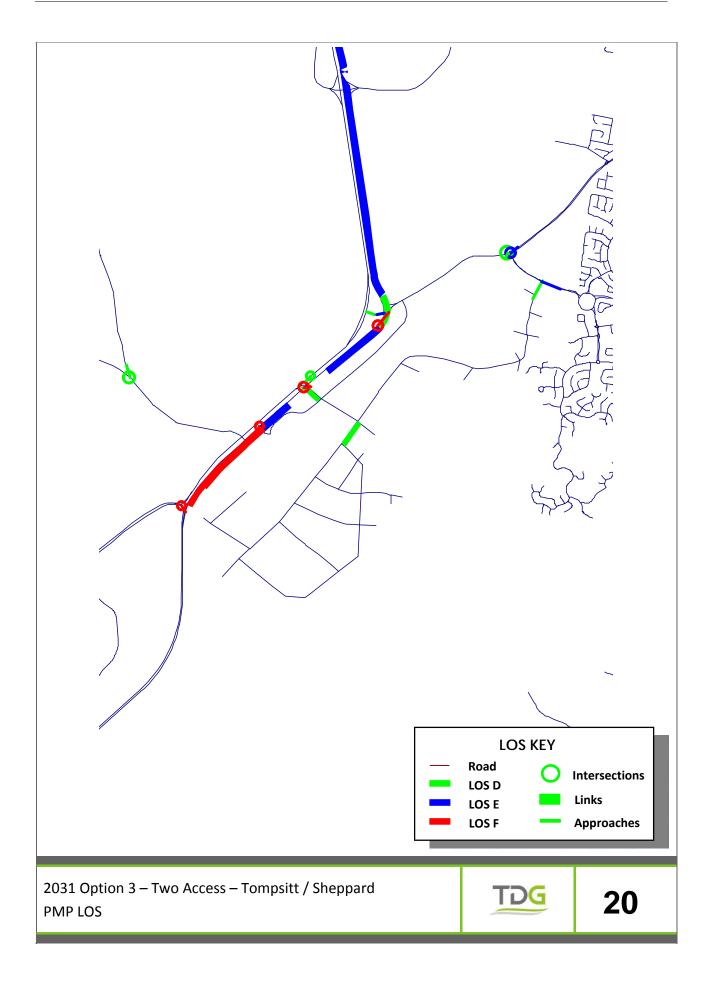










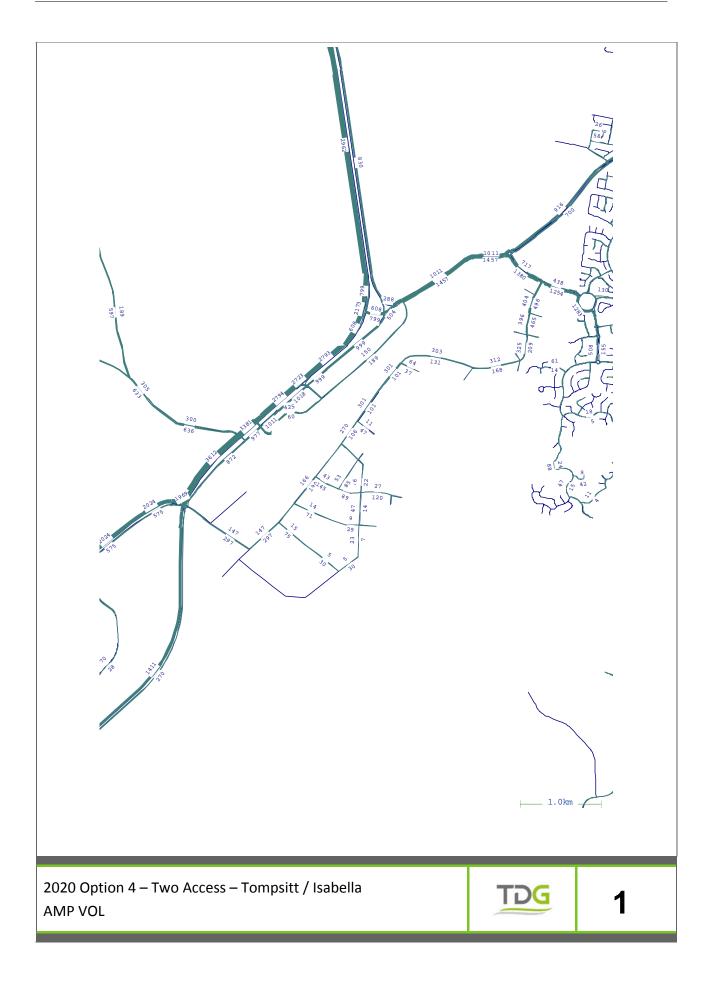




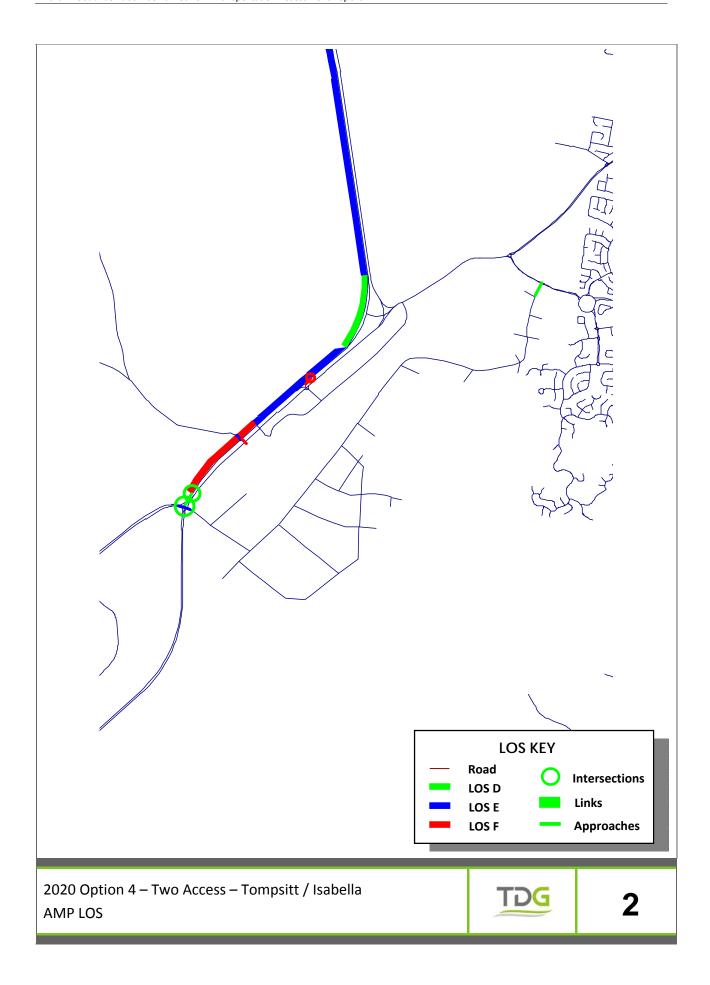
## **Appendix D**

Option 4 – Two Access – Tompsitt Dr / Isabella Dr - South Jerrabomberra Flows and LOS

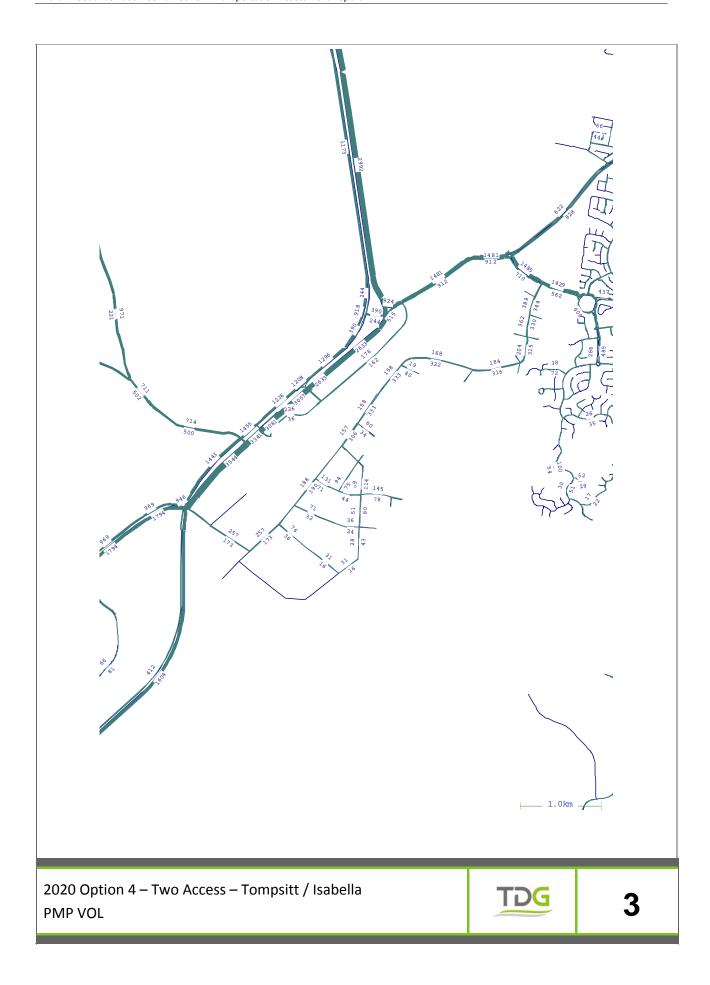




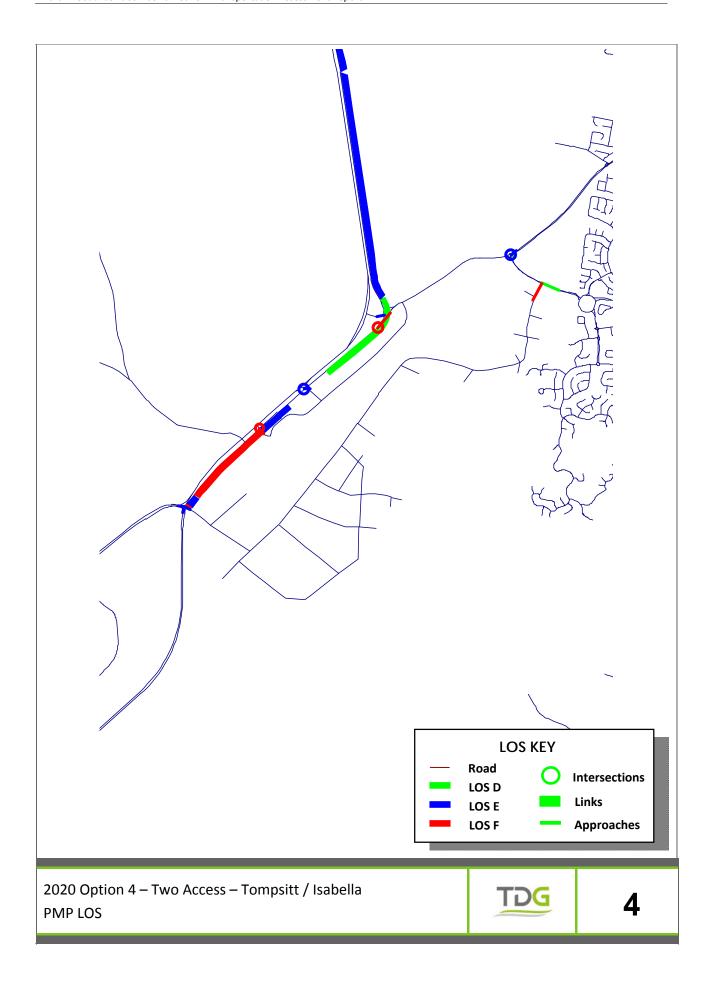




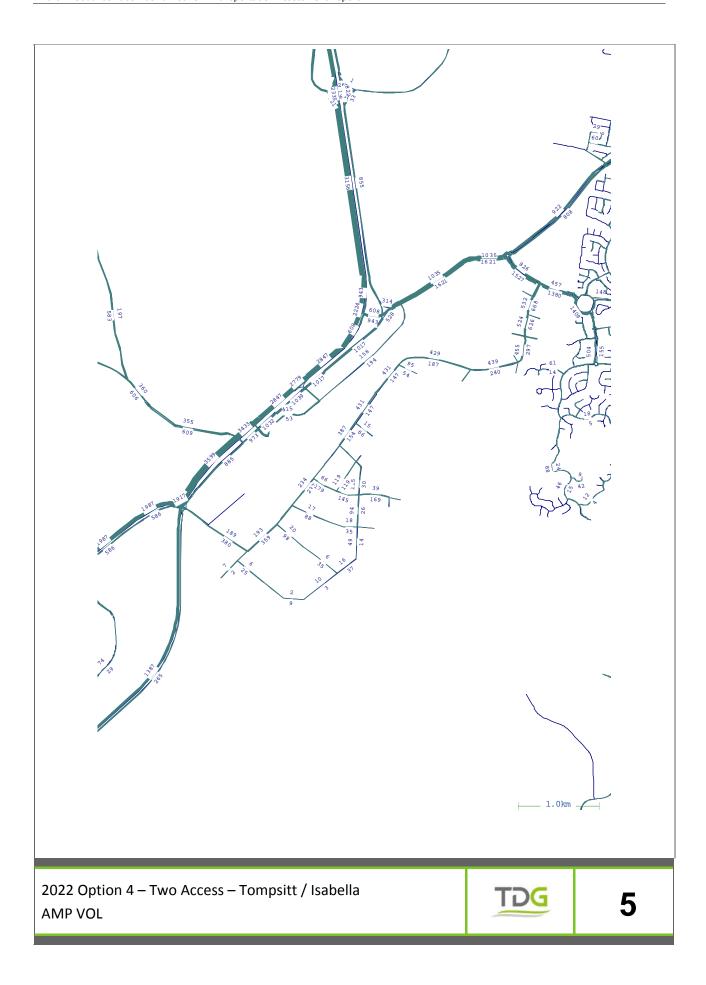




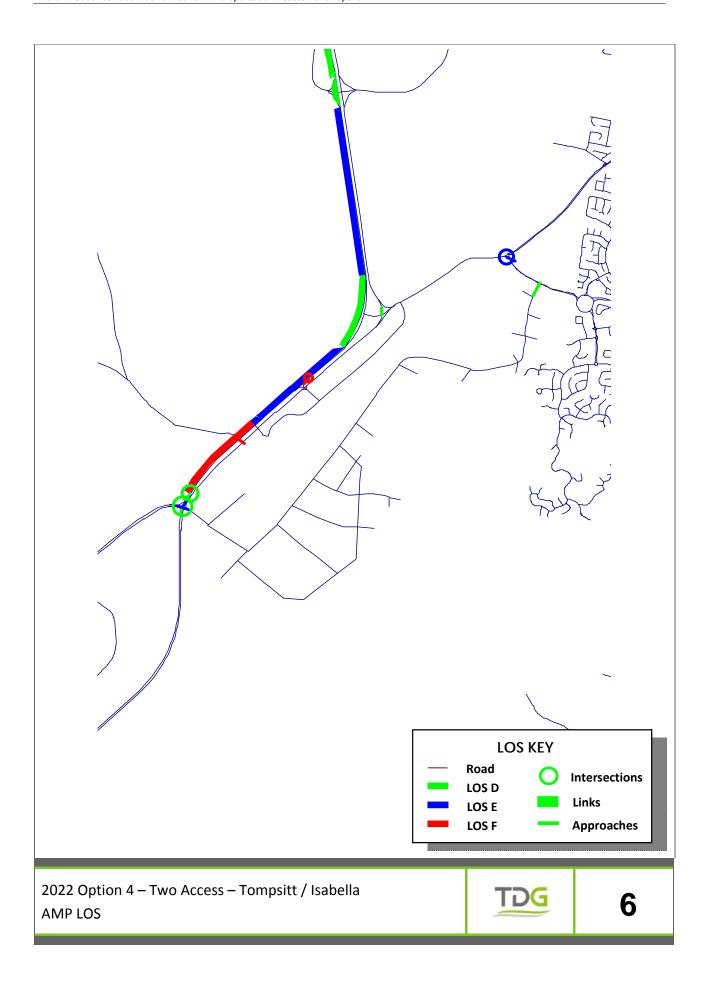




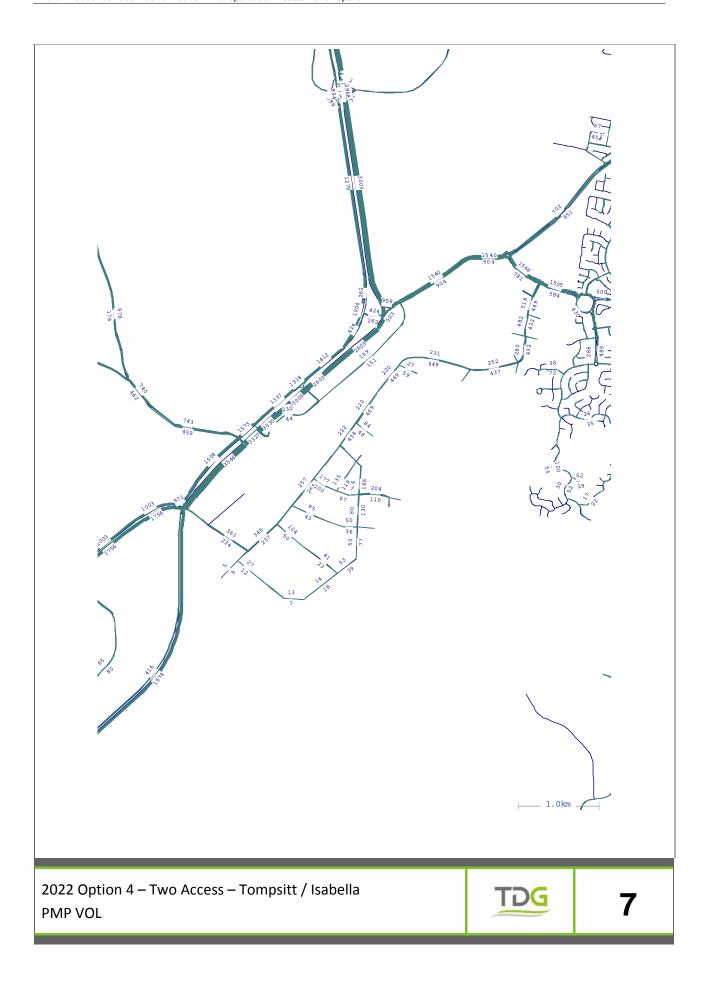




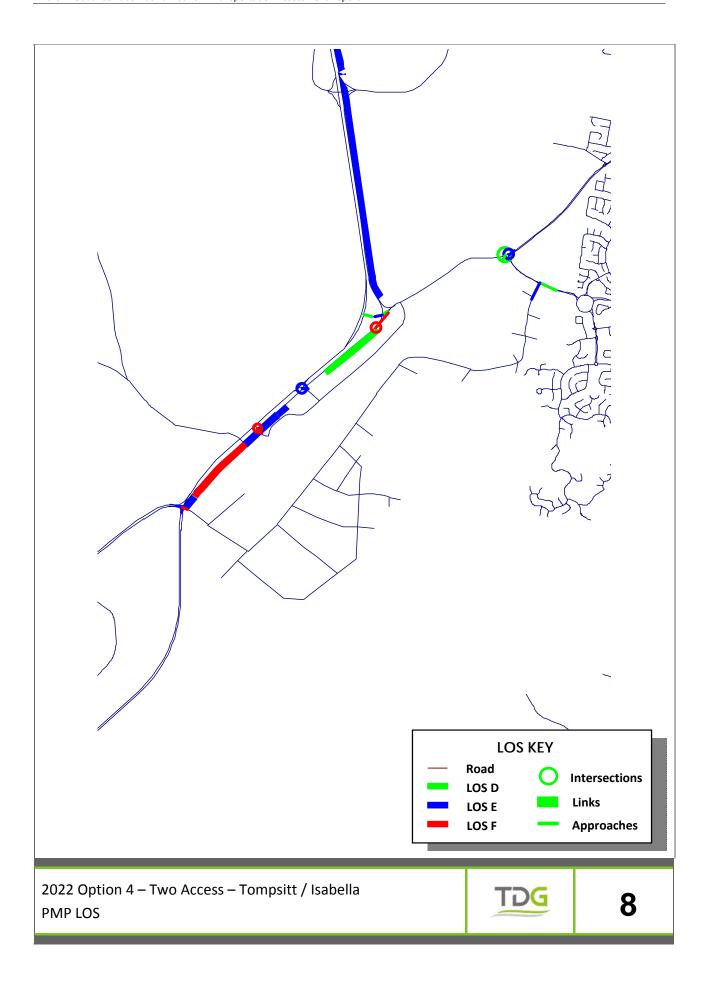




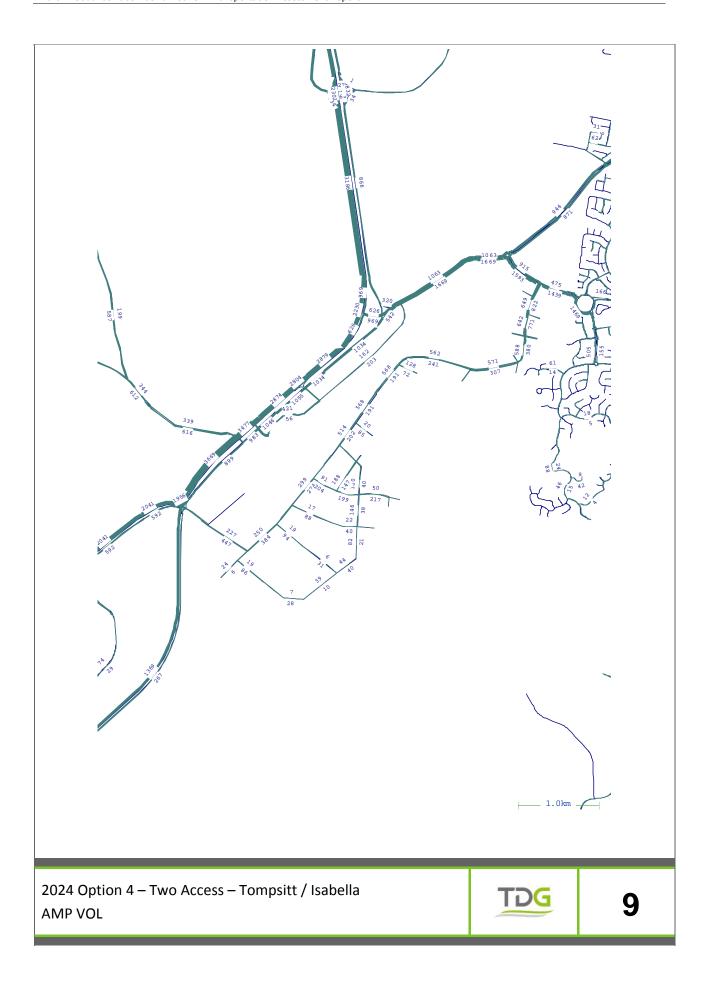




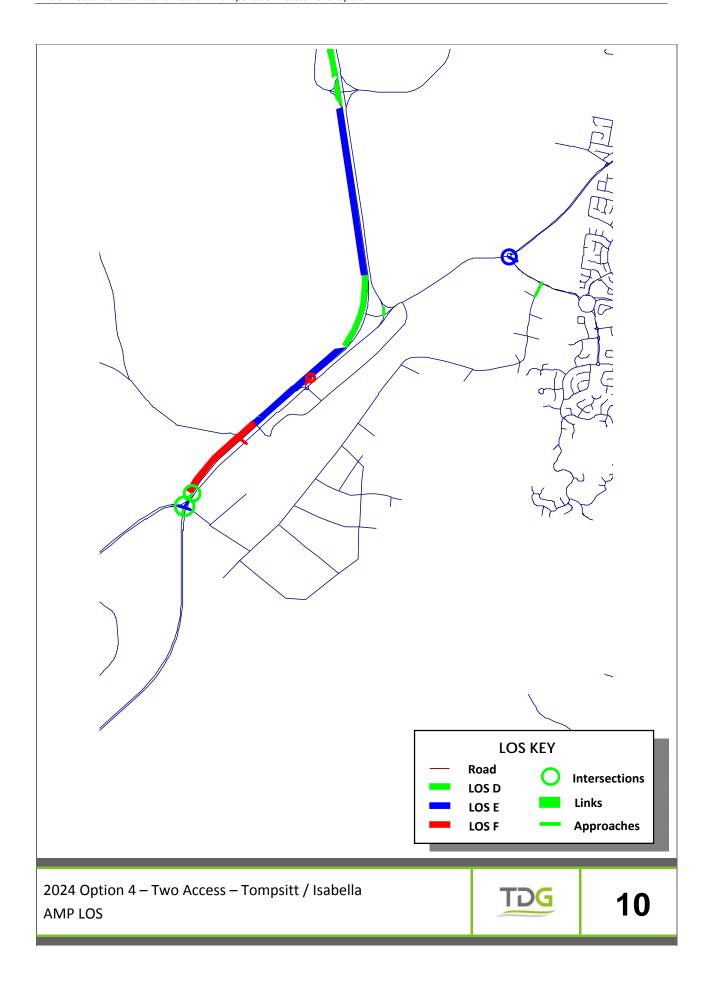




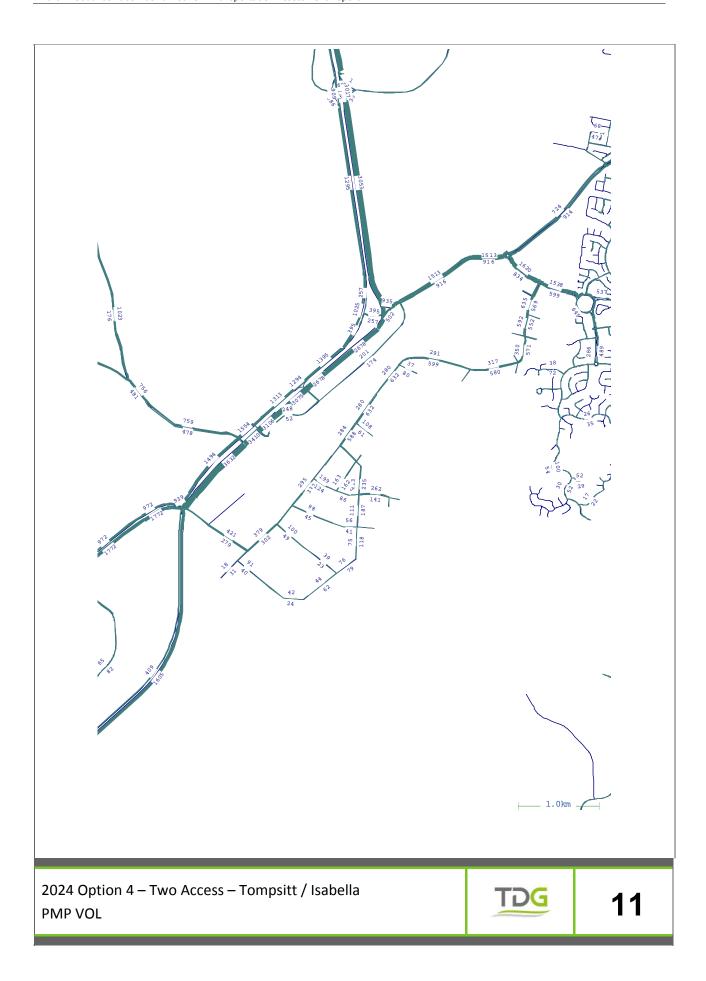




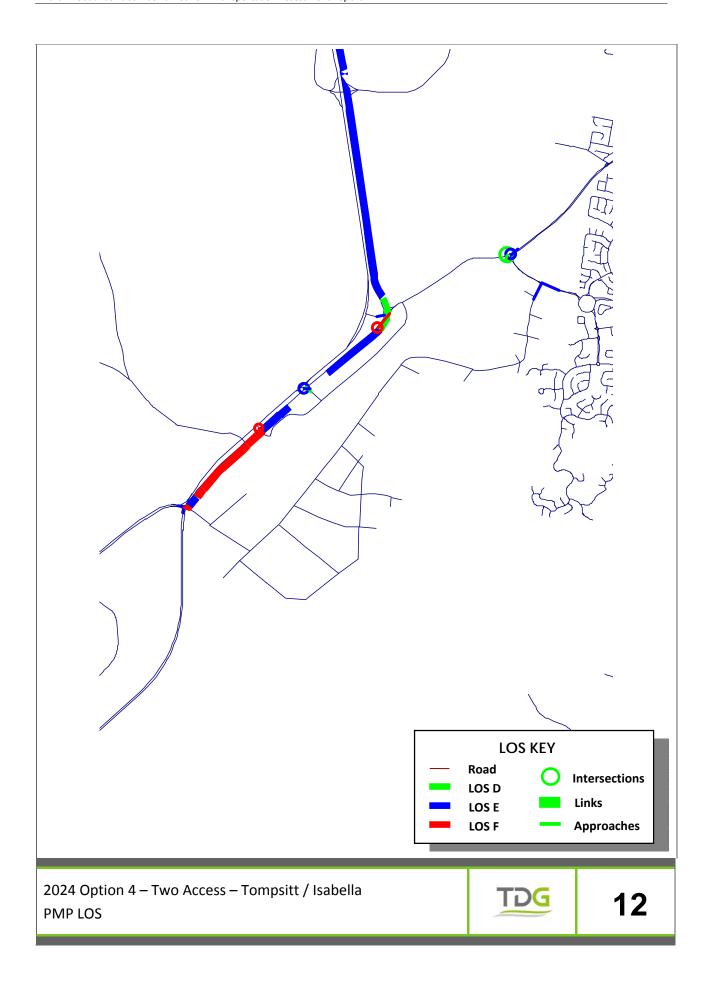




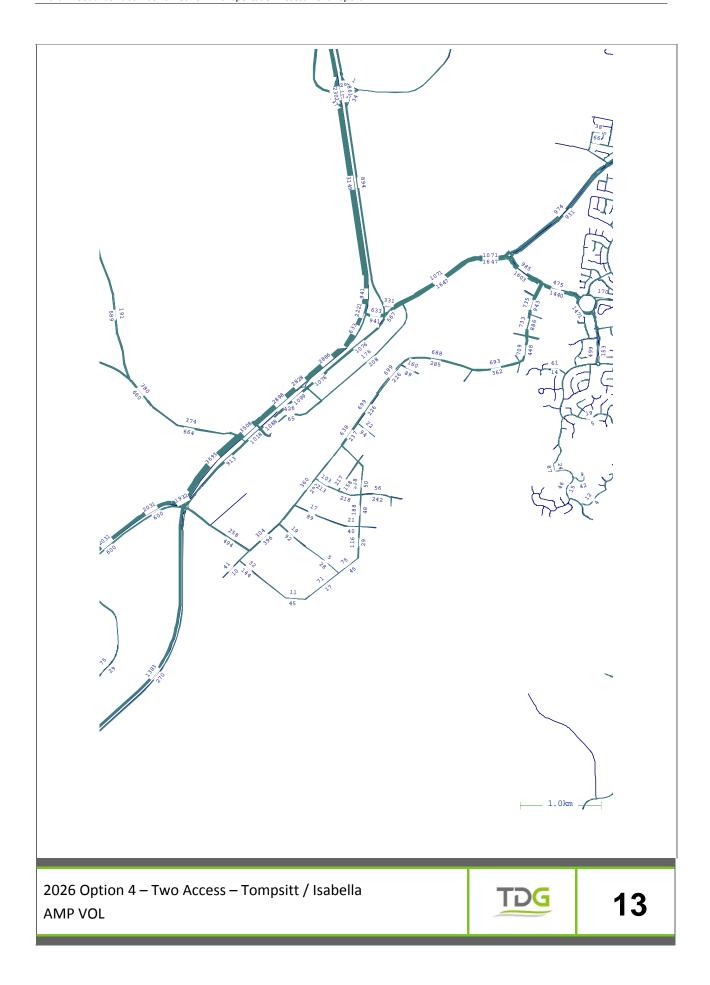




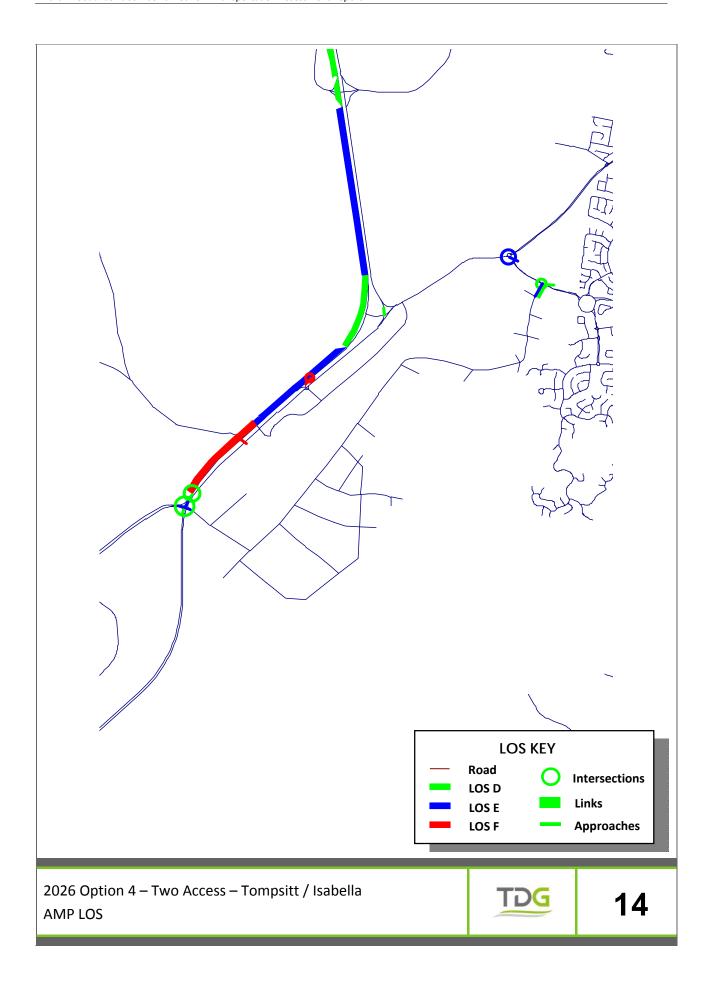




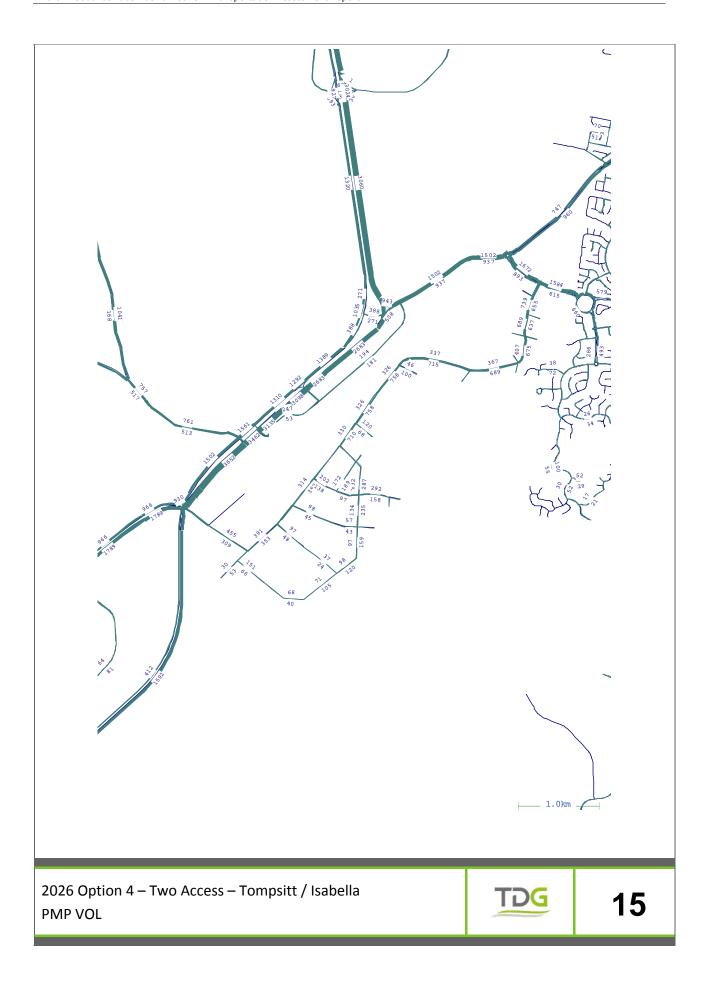




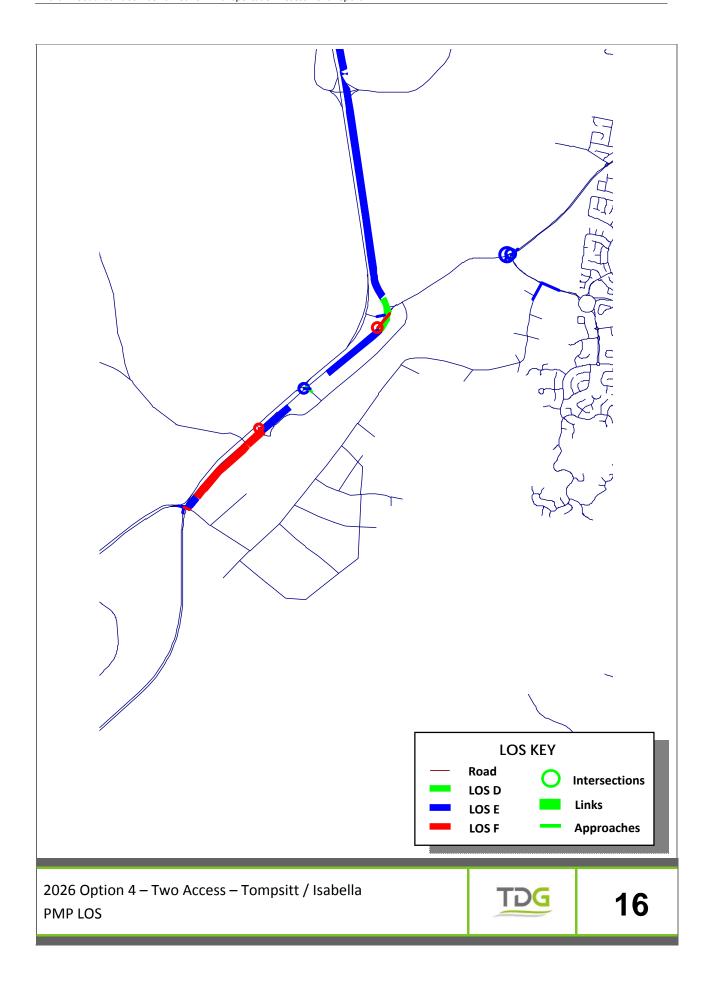




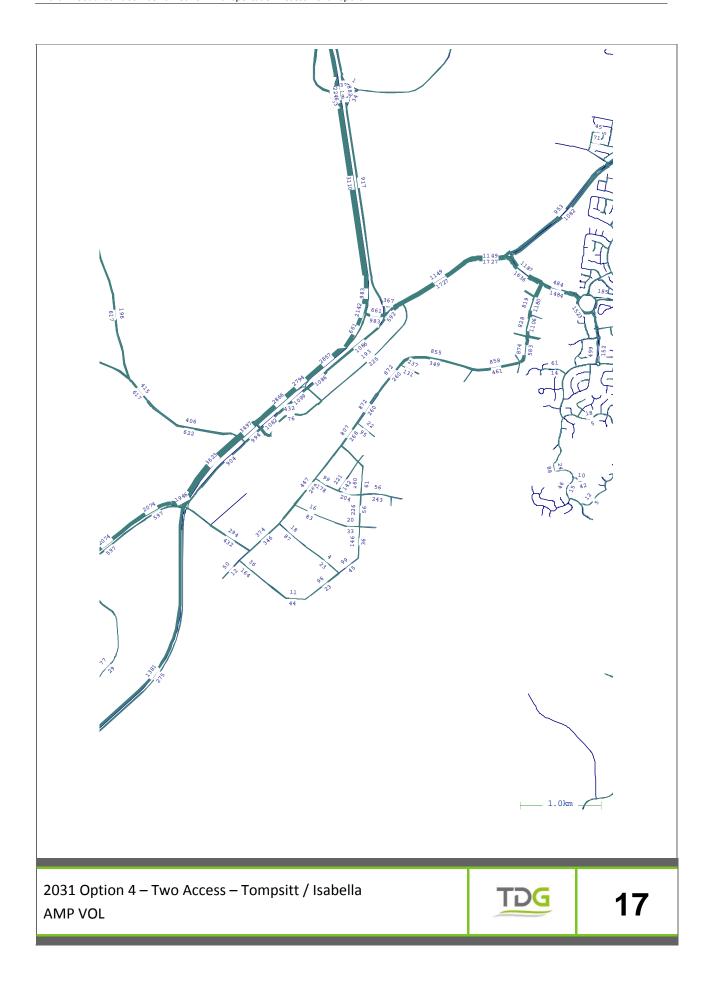




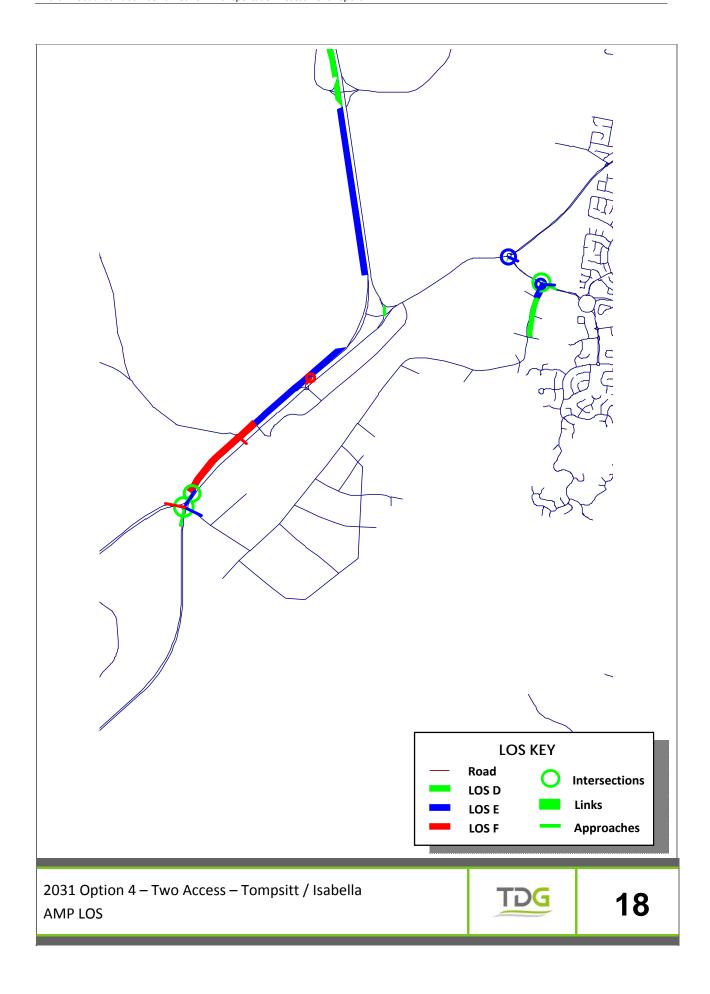




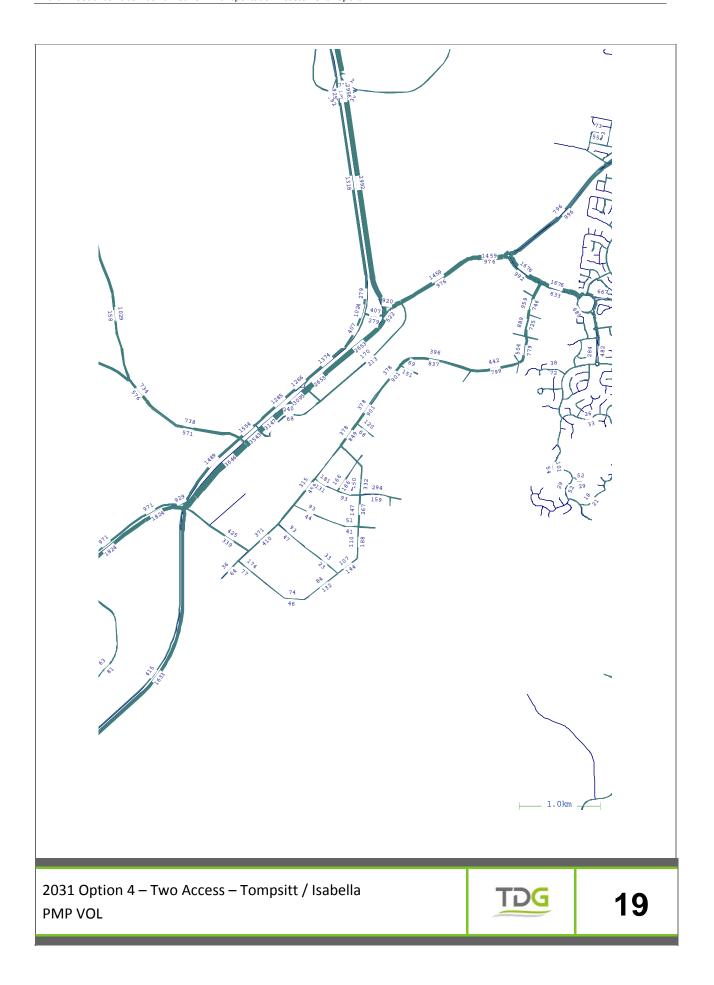




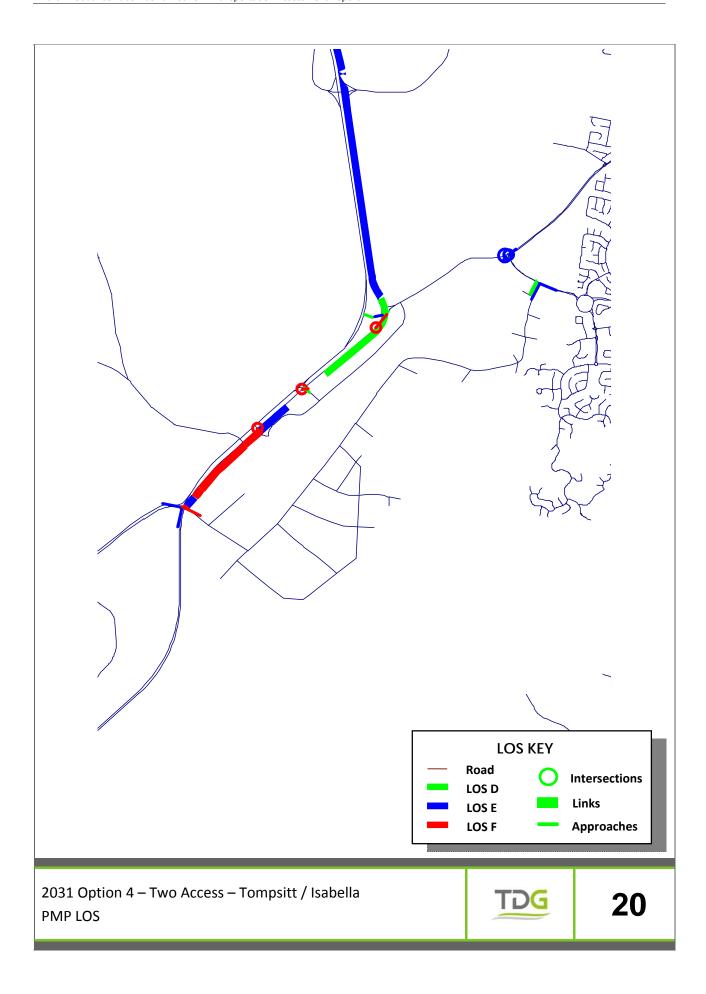














## **Appendix E**

Option 5 – Three Access – Tompsitt Dr / Sheppard St / Isabella Dr - South Jerrabomberra Flows and LOS



