



Queanbeyan City Council TRACKS Model

South Jerrabomberra and
Queanbeyan Traffic Analysis 2014

Part 2 – Selected Road Network Improvements Transportation Assessment Report

December 2014

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1. Introduction

Part 2 of the South Jerrabomberra and Queanbeyan Traffic Analysis 2014 involved the analysis of a limited number of 2031 network improvement scenarios. These scenario analyses have been undertaken to provide a Traffic Economist with the modelling data necessary to advise the Queanbeyan City Council as which improvement scenario offers the best outcome for the Council.

The review and modelling analyses were undertaken using the 2031 QCC Transportation Model based on agreed land use data provided by QCC and ACT. This land use included all expected household and job growth up to 2031 for the ACT, expected infill development in Queanbeyan and the planned developments at Jumping Creek, Googong and South Jerrabomberra.

The base 2031 network was used as the base for all of the selected network scenarios. It included all planned infrastructure upgrades throughout the ACT area, updated trunk road network for Googong and proposed two access options for South Jerrabomberra with accesses to Tomsitt Dr and Isabella Dr. It also included all the Queanbeyan infrastructure improvements required up to 2026. The distribution of trips around Queanbeyan as a result of these improvements was kept constant for this analysis.

The selected road network scenarios analysed were as follows:

- (i) Scenario 1 - Do nothing – No QCC infrastructure improvements;
- (ii) Scenario 2 – Do nothing with Ellerton Dr Extension with associated traffic signals at Yass / Bungendore / Ellerton;
- (iii) Scenario 3 – All required Queanbeyan infrastructure upgrades;
- (iv) Scenario 4 – All required Queanbeyan infrastructure upgrades without the Ellerton Dr Extension.

2. Model Summary

2.1 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.

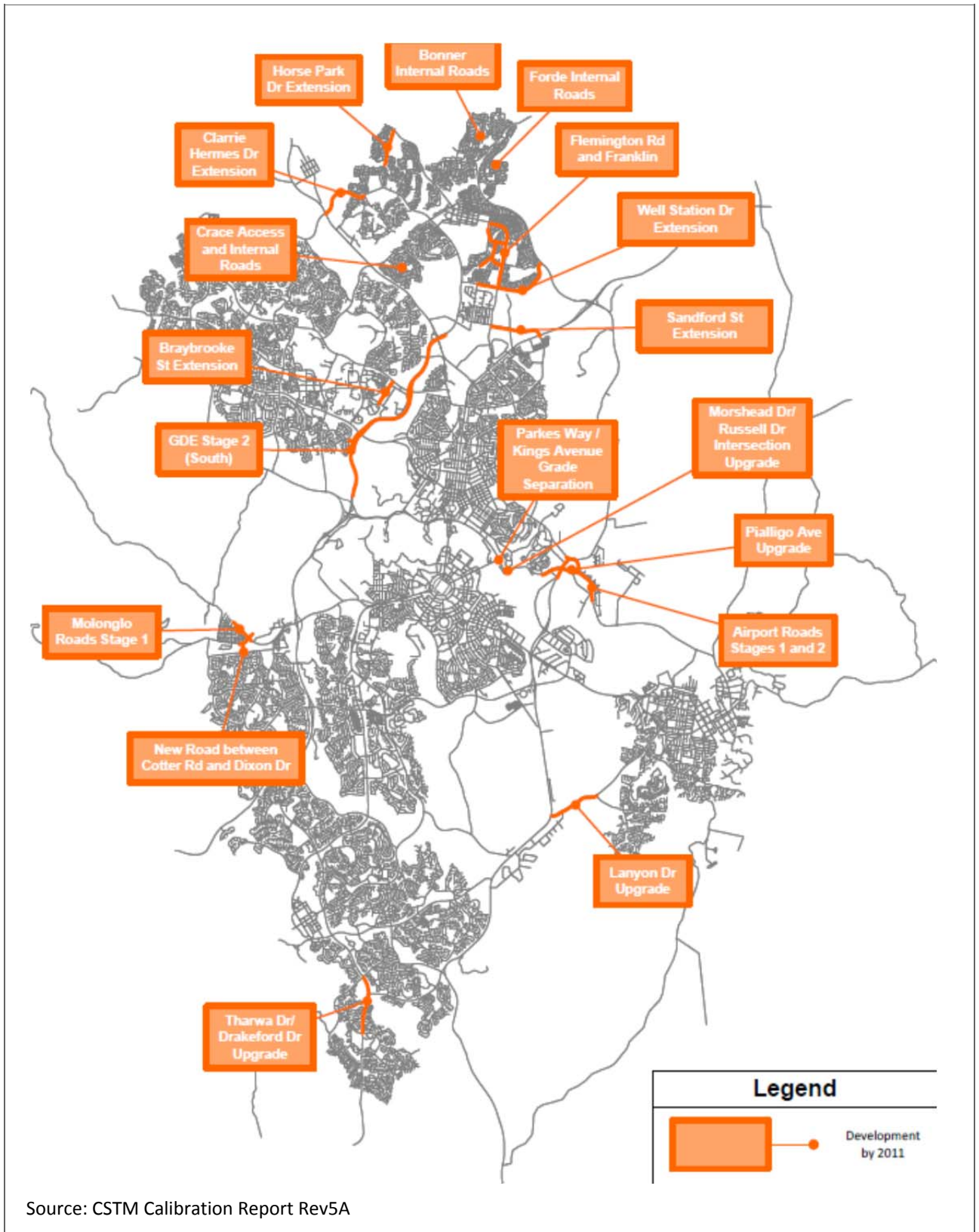
2011 MODEL LAND USE			
Land Use	Queanbeyan	ACT	Entire Model Area
Households	14,086	129,401	143,487
Employees	21,095	194,766	215,861
Vehicles	25,180	218,467	243,647
Primary School Roll	3,204	32,904	36,108
Secondary School Roll	1,532	31,332	32,864
Tertiary Roll	331	31,101	31,432
Retail Jobs	1,200	15,203	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 1.

2006-2011 ACT INFRASTRUCTURE IMPROVEMENTS	
Item	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
Pialligo Avenue Upgrades	Duplication from Beltana Road to Brindabella Cct
	Widening of Sylvia Curley Bridge
	Duplication of Fairbairn Ave (Morshead Dr to Pialligo Ave)
	Duplication of Morshead Dr (Fairbairn Ave to Dairy Rd)
	New Signals at Pialligo/Fairbairn
	New Signals at Monaro/Pialligo
Gungahlin Drive Extension Stage 2	Extension from Barton Hwy to Glenloch Interchange
	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
Flemington Road Upgrades	Duplication of Flemington Rd
	Extension of Nullarbor Avenue to connect to Flemington Rd
	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



2006-2011 ACT Infrastructure Improvements



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2.2 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

Table 3 and Table 4 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 3: Future Household Totals

FUTURE MODEL 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 4: Future Job Totals

2.3 Future Years Networks

A number of base 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 base infrastructure upgrades within Queanbeyan to be included in the future year models would be the local development infrastructures and the development access arrangements.

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 Table 5, Table 6 and Table 7 and shown in Figures 2, 3 and 4.

2011-2016 ACT INFRASTRUCTURE IMPROVEMENTS	
Item	Description
Majura Parkway	Connect Monaro Highway to Federal Highway
	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 5: 2011-2016 ACT Infrastructure Improvements Included in the QCC Transportation Model

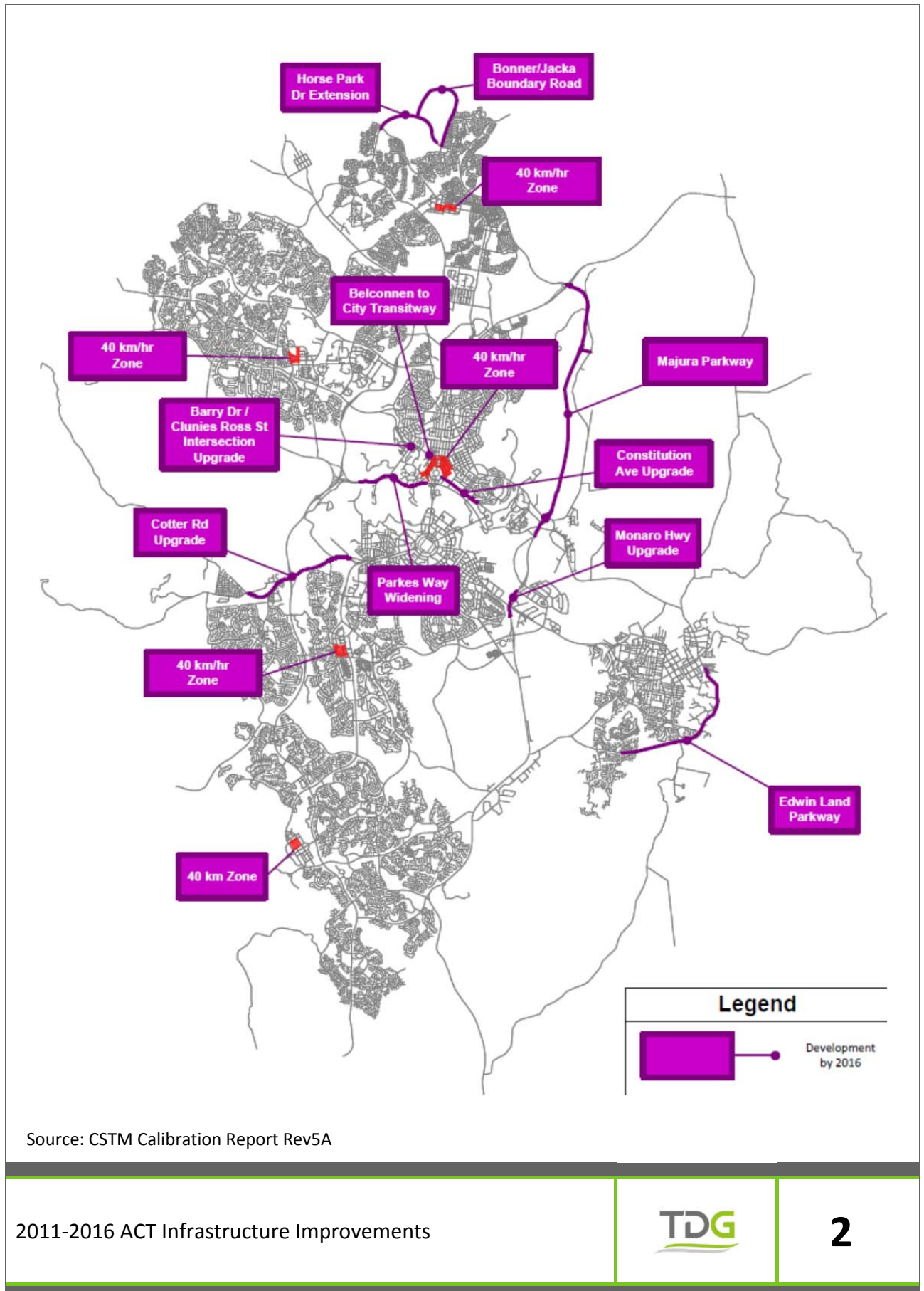
2016-2021 ACT INFRASTRUCTURE IMPROVEMENTS	
Item	Description
Clunies Ross Street Upgrade	Duplication of Clunies Ross Street
William Slim Drive Upgrade	Duplication from Baldwin Drive to Barton Highway
Gundaroo Drive Upgrade	Duplication from Barton Highway to Gungahlin Drive
Horse Park Drive Duplication	Duplication from Katherine Ave to Federal Highway
Clunies Ross - Parkes Interchange	Completion of diamond interchange
Airport Northern Access Road	Connect Glenora Dr to Majura Road (Northern Access to RAAF Fairbairn)

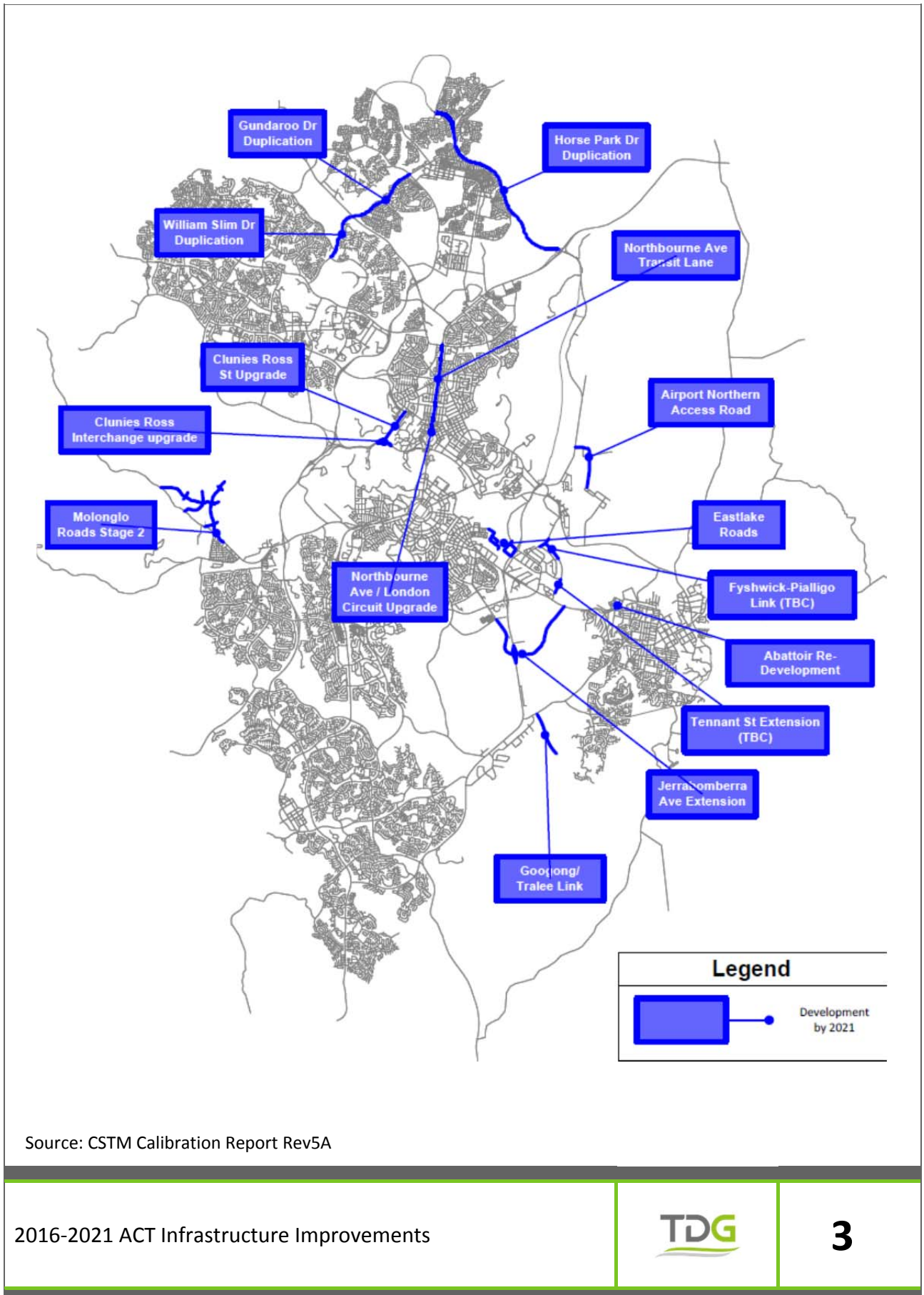
2016-2021 ACT INFRASTRUCTURE IMPROVEMENTS	
Molonglo Roads Stage 2	New roadways providing access to residential development
Fyshwick - Pialligo Link *	Connect Tennant Street to Gladstone Street and Kallaroo Road (Undecided alignment)
Abattoir Redevelopment	Access Roads for development of Abattoir (Near Harman)
East Lake Internal Roads	Connection to Newcastle Street / Dairy Road
	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 Tomsitt 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

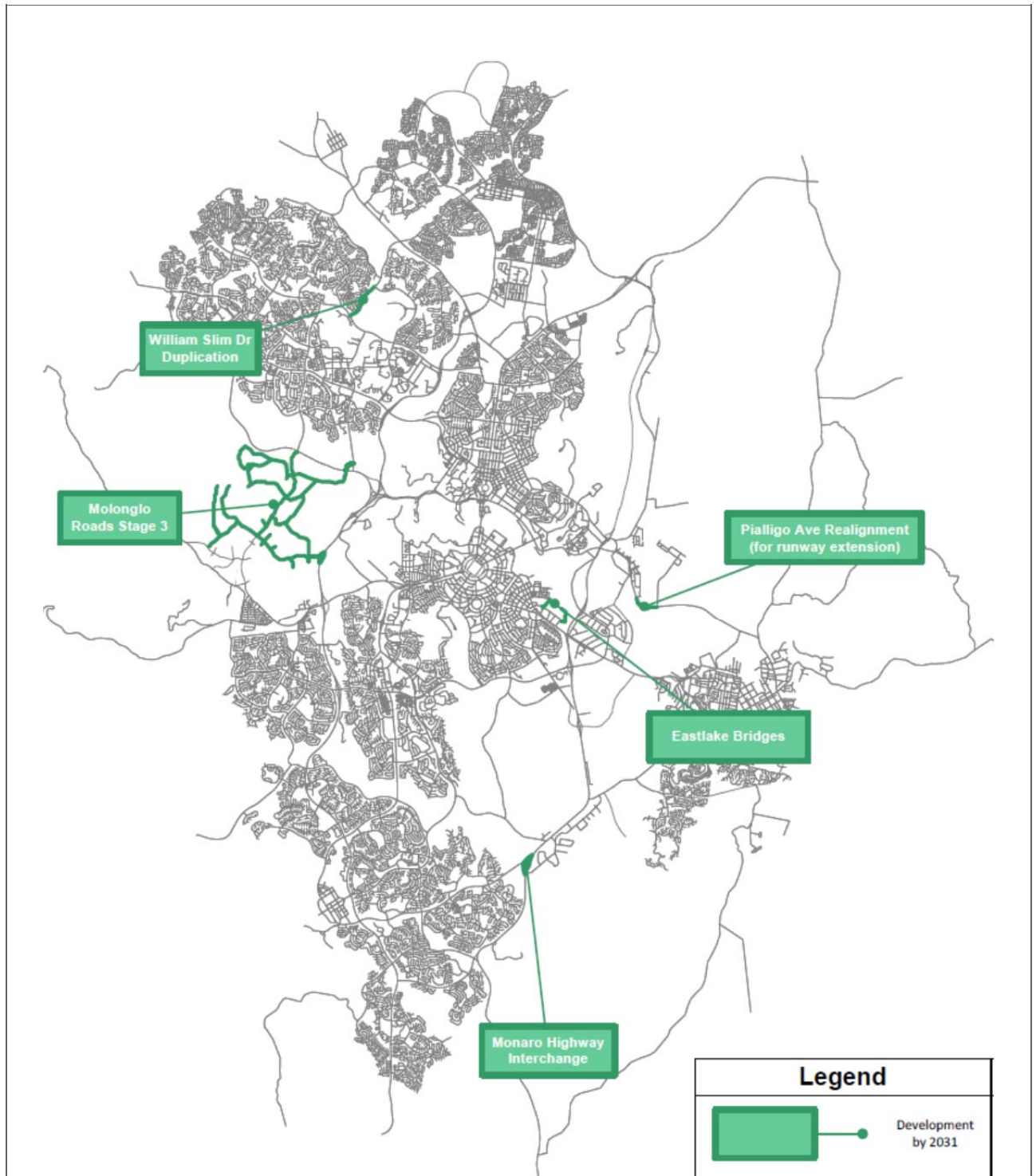
Table 6: 2016-2021 ACT Infrastructure Improvements Included in the QCC Transportation Model

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 7: 2021-2031 ACT Infrastructure Improvements Included in the QCC Transportation Model







Source: CSTM Calibration Report Rev5A

3. Updated Timeline of Required Network Improvements

The timing of future works analysis assessed the appropriate timing for the implementation of improvement works. Many of the improvements were proposed to upgrade a road or intersection suffering from a poor level of service. However, several new routes were also proposed as a means of creating additional capacity thereby relieving other areas of congestion. An iterative process was used to add additional works at each year of the analysis to address deficiencies as they arose.

When a level of service (LOS) of E or worse was predicted for an intersection or length of road at the end of each two to five year period, it indicated the likely need for construction of an improvement work aimed at resolving that deficiency within that two to five year period. Based on this premise, improvement works were progressively added to the Queanbeyan network for each period until deficiencies in the network were fixed.

The timing of a number of improvements has changed since the August 2013 report. This is primarily due to changes in the land use potential and release sequencing for both the South Jerrabomberra and Googong developments. Both developments are approximately 500 households each behind the rate of release previously used in the 2013 analysis.

Table 8 and Table 9 show the updated implementation timing of each of the proposed improvement works as a result of this analysis.

INTERSECTION IMPROVEMENT TIMING								
Location	By 2014	By 2016	By 2018	By 2020	By 2022	By 2024	By 2026	By 2031
Lanyon Dr/Canberra Ave			✓					
Lanyon Dr/Gilmore Rd				✓				
Kings Hwy/Yass Rd/Bungendore Rd			✓					
Old Cooma Rd/Googong Rd				✓				
Tomsitt Dr/Sth Jerrabomberra Rd						✓		
Canberra Ave/Cameron Rd								✓
Lanyon Dr/Tomsitt Dr			✓					
Yass Rd/Shropshire St								✓
Yass Rd/Hinckman St							✓	
Yass Rd/Silva Ave							✓	
Yass Rd/Thuralilly St								✓

Table 8: Intersection Improvement Timing

ROAD IMPROVEMENT TIMING								
Location	By 2014	By 2016	By 2018	By 2020	By 2022	By 2024	By 2026	By 2031
4L Old Cooma Rd (Googong to ELP)					✓			
2L Ellerton Extension			✓					
4L Cooma St (ELP to Southbar)								✓
4L Sth Jerrabomberra Northern Access Rd to 3 rd Roundabout								✓

Table 9: Road Improvement Timing

4. Overall Analysis Results

Each network scenario was analysed using the same base set of projected 2031 light and heavy vehicle trip matrices so that each of the individual analyses could be compared directly. The ultimate decision for which of the four scenarios will be taken forward as the preferred future network will be made by an independent Traffic Economist. This report simply presents the overall Level of Service (LOS) and traffic volume results for each scenario.

4.1 Level of Service

An LOS analysis was undertaken for each of the four scenarios. The differences in 2031 LOS results at various locations throughout the Queanbeyan area are summarised in Table 10 to Table 13 for the AM and PM peaks respectively. The LOS results tabulated are for link and the worst approach LOS. In some instances the overall intersection performance (designated by circles in the attached LOS Plots) is better than the worst approach.

2031 AMP LOS AT CRITICAL LOCATIONS				
Location	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Old Cooma Rd – Googong Rd to ELP	F	F	-	-
Cooma St – ELP to Southbar Rd	F	E	-	-
Cooma St – North of Southbar Rd	E	-	-	E
Kings Hwy Bridge	E	D	D	E
South Jerrabomberra Access Rd	E	E	-	-
Uriarra Rd Kendall Rd To Canberra Ave	-	-	D	D
Old Cooma / ELP Traffic Signals	D	E	E	D
Tomsitt / Sth Jerrabomberra Traffic Signals	F	F	F	F
Tomsitt / Lanyon Roundabout	E	E	D	D
Isabella / Monaro Intersection	F	F	F	F
Lanyon / Monaro Traffic Signals	D	D	D	D
Lanyon / Canberra Roundabout	F	F	D	D
Yass / Bungendore / Ellerton	E	D	-	-

Table 10: AMP LOS at Critical Locations

2031 PMP LOS AT CRITICAL LOCATIONS				
Location	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Old Cooma Rd – Googong Rd to ELP	F	F	-	-
Cooma St – ELP to Southbar Rd	F	E	-	-
Cooma St – North of Southbar Rd	E	D	D	E
Kings Hwy Bridge	E	D	D	E
South Jerrabomberra Access Rd	D	D	-	-
Uriarra Rd Kendall Rd To Canberra Ave	D	D	D	D
Old Cooma / ELP Traffic Signals	E	E	E	E
Tomsitt / Sth Jerrabomberra Traffic Signals	F	F	D	D
Tomsitt / Lanyon Roundabout	F	E	E	E
Isabella / Monaro Intersection	F	F	F	F
Lanyon / Monaro Traffic Signals	E	E	E	E
Lanyon / Canberra Roundabout	F	F	E	E
Yass / Bungendore / Ellerton	D	D	D	D

Table 11: PMP LOS at Critical Locations

The LOS analysis at critical locations shows the following:

- In general improvement scenarios that involve the 4 laning of both Old Cooma Rd and Cooma St (south of Southbar Rd) produce the best LOS results;
- Scenarios involving the constructing the Ellerton Dr Extension are the only scenarios that provide relief to Cooma St (north of Southbar Rd) and the Kings Hwy Bridge;
- A number of major locations will need improving irrespective of which improvement scenario is selected. Intersections along Tomsitt Dr and Lanyon Dr in particular, will need further investigation into potential configuration changes or replacement;
- The LOS of the modelled traffic signals at Old Cooma / ELP / Ellerton Extension has approaches operating at LOS E/F however consistently operates at LOS D overall.

In addition to the critical locations, a number of minor intersections throughout Queanbeyan are expected to operate at LOS E or worse by 2031. These deficiencies all occur on the minor low volume approaches at intersections along major routes.

2031 AMP LOS AT MINOR LOCATIONS				
Location	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Lanyon / Gilmore Intersection	E	E	-	-
Lanyon / Southbar Intersection	D	D	D	D
Canberra / Kealman Intersection	-	-	D	-
Canberra / Kendall Intersection	E	F	E	E
Canberra / Donald Intersection	-	-	-	-
Canberra / Cameron Intersection	E	F	-	-
Monaro / Crawford Intersection	D	-	-	E
Monaro / Atkinson Intersection	D	-	D	E
Yass / Shropshire Intersection	-	-	-	-
Yass / Endurance Intersection	-	-	-	-
Yass / Thurrallilly Intersection	D	D	D	D
Yass / Silva Intersection	-	D	D	-
Bungendore / Thurrallilly Intersection	-	-	D	-

Table 12: AMP LOS at Minor Locations

2031 PMP LOS AT MINOR LOCATIONS				
Location	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Lanyon / Gilmore Intersection	F	F	-	-
Lanyon / Southbar Intersection	D	-	-	-
Canberra / Kealman Intersection	-	-	D	D
Canberra / Kendall Intersection	E	E	E	E
Canberra / Donald Intersection	-	F	F	F
Canberra / Cameron Intersection	D	E	D	-
Monaro / Crawford Intersection	-	-	-	-
Monaro / Atkinson Intersection	D	-	-	E
Yass / Shropshire Intersection	-	D	-	-
Yass / Endurance Intersection	D	E	-	-
Yass / Thurrallilly Intersection	D	D	D	D
Yass / Silva Intersection	D	E	D	D
Bungendore / Thurrallilly Intersection	D	D	D	D

Table 13: PMP LOS at Minor Locations

The LOS analysis at minor locations shows the following:

- The minor legs of intersections along Yass Rd are expected to decline to LOS D/E for each scenario. Scenario 2, which builds the Ellerton Extension on the Do-nothing base for 2031, decreases minor leg LOS to E generally as a result of additional flow using Yass Rd to access the Ellerton Extension;

- The minor legs of various intersections along Canberra Avenue are expected to need attention by 2031.

4.2 Network Operation Indicators

In order to show how each scenario performs overall, a network operation analysis of each scenario was undertaken. This analysis provides overall operational indicators for travel times, distances, number of vehicles delayed, delays, network speed, fuel consumption and emissions.

The indicators are as follows:

- Vehicle kms (TKM) is a measure of vehicle kilometres travelled for all road vehicles considered in this study. TKM is a direct indicator of the pressure from road transport on the environment and as a basis for the calculation of vehicle emissions when combined with levels of service;
- Link Vehicle Minutes (TVM) is an aggregate measure of how long people are spending travelling in their cars along links. It does not include time spent by vehicles waiting at intersections;
- Link Mean Running Speed is a measure of the average speed of vehicles travelling along a link. It does not include delays encountered by vehicles at intersections;
- Vehicles subject to intersection delay is a measure of how many vehicles experience any kind of delay at intersections;
- Total intersection vehicle delay in minutes is a measure of the total amount of intersection delay experience by all vehicles on the network;
- Intersection Delay per Vehicle is a measure of average delay experience by all vehicles at all intersections. This indicator provides a way to measure vehicle conflicts;
- Network Total Vehicle Minutes is a measure of the total amount of time vehicles spend on the network. This includes time spent waiting at intersections;
- Network Mean Network Speed is a measure of the average speed of vehicles travelling through the network. It includes delays experienced by vehicles at intersections;
- Fuel Use;
- Total Carbon Monoxide in kg emitted by vehicles in the period;
- Total Hydrocarbons in kg emitted by vehicles in the period;
- Total Nitrous Oxides in kg emitted by vehicles in the period;
- Total Particulate Matter in kg emitted by vehicles in the period.

Table 14 and Table 15 detail these indicators for each scenario for the AMP and PMP separately. 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.

2031 AMP PERFORMANCE INDICATORS				
	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Vehicle Kilometres (km)	134797	135099	134304	134127
Link Vehicle Minutes (min)	143895	140130	136968	138881
Mean Link Running Speed (kph)	56.2	57.8	58.8	57.9
Vehicles Subject to Delay	168736	163754	160952	164237
Total Intersection Delay (min)	35573	35189	32885	34647
Intersection Delay Per veh (min)	12.6	12.9	12.3	12.7
Total Network Minutes (min)	179468	175319	169853	173529
Mean Network Speed (kph)	45.1	46.2	47.4	46.4
Fuel Use ('000 litres)	14.195	14.035	13.769	13.894
CO (kg)	1015.2	1000.6	953.6	972.7
Hx (kg)	141.5	139.6	133.8	135.8
NOx (kg)	302.8	303.9	304.5	303.0
PM10 (kg)	11.2	11.1	11.0	10.9

Table 14: 2031 AMP Performance Indicators

2031 PMP PERFORMANCE INDICATORS				
	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Vehicle Kilometres (km)	148503	148792	148595	148297
Link Vehicle Minutes (min)	181360	175830	153304	158043
Mean Link Running Speed (kph)	49.1	50.8	58.2	56.3
Vehicles Subject to Delay	186743	180518	179896	185491
Total Intersection Delay (min)	41135	40059	37866	41172
Intersection Delay Per veh (min)	13.2	13.3	12.6	13.3
Total Network Minutes (min)	222495	215889	191170	199216
Mean Network Speed (kph)	40.0	41.4	46.6	44.7
Fuel Use ('000 litres)	16.620	16.362	15.363	15.637
CO (kg)	1143.6	1113.1	1076.9	1098.1
Hx (kg)	159.5	155.8	150.7	153.5
NOx (kg)	330.4	333.2	333.9	332.4
PM10 (kg)	12.1	12.2	11.9	11.9

Table 15: 2031 PMP Performance Indicators

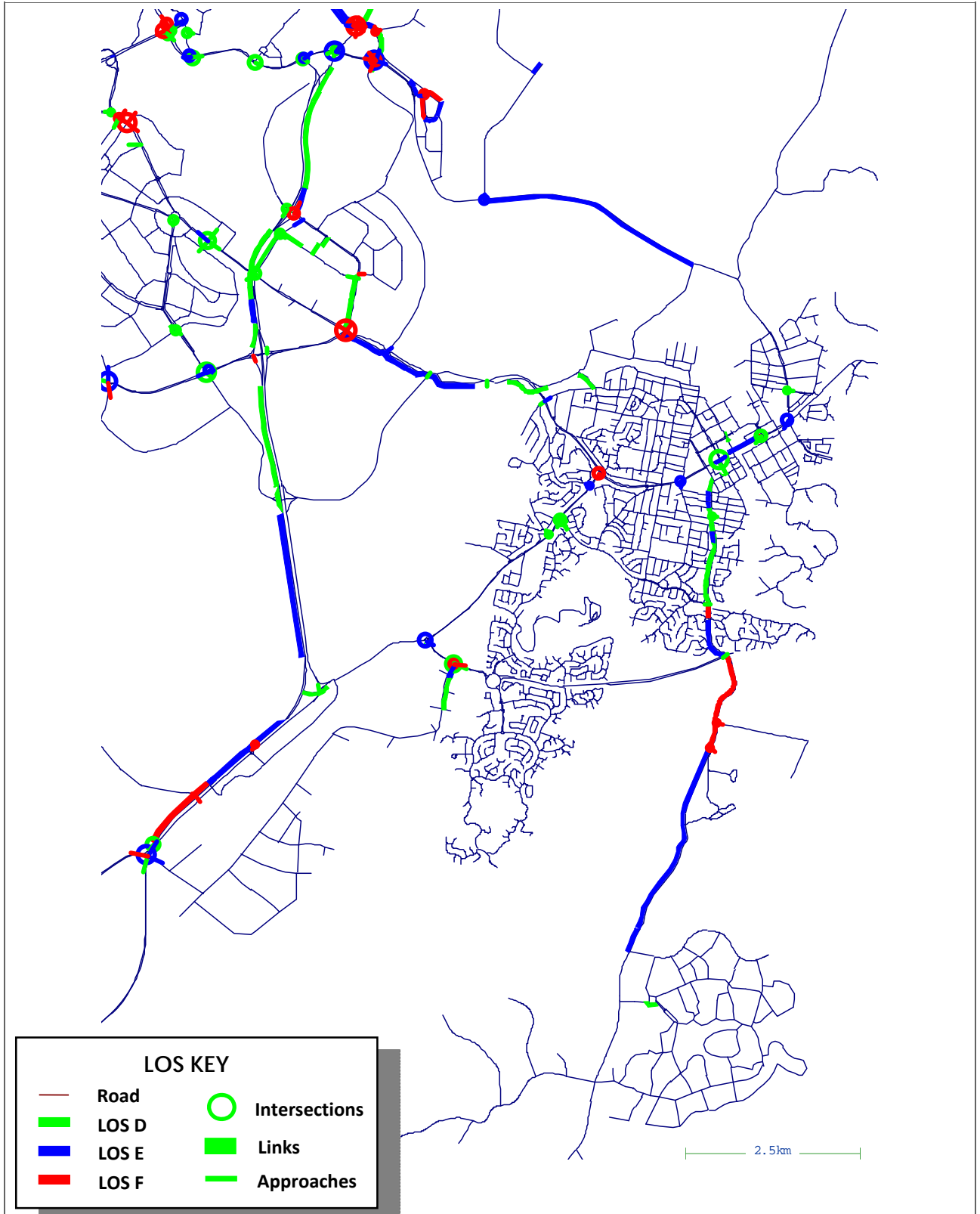
5. Conclusions

The initial analyses of Level of Service and Operation Performance throughout Queanbeyan indicates that the scenario with the best LOS and operational response overall was Scenario 3 – All Infrastructure Improvements.

Traffic Design Group Ltd

Appendix A

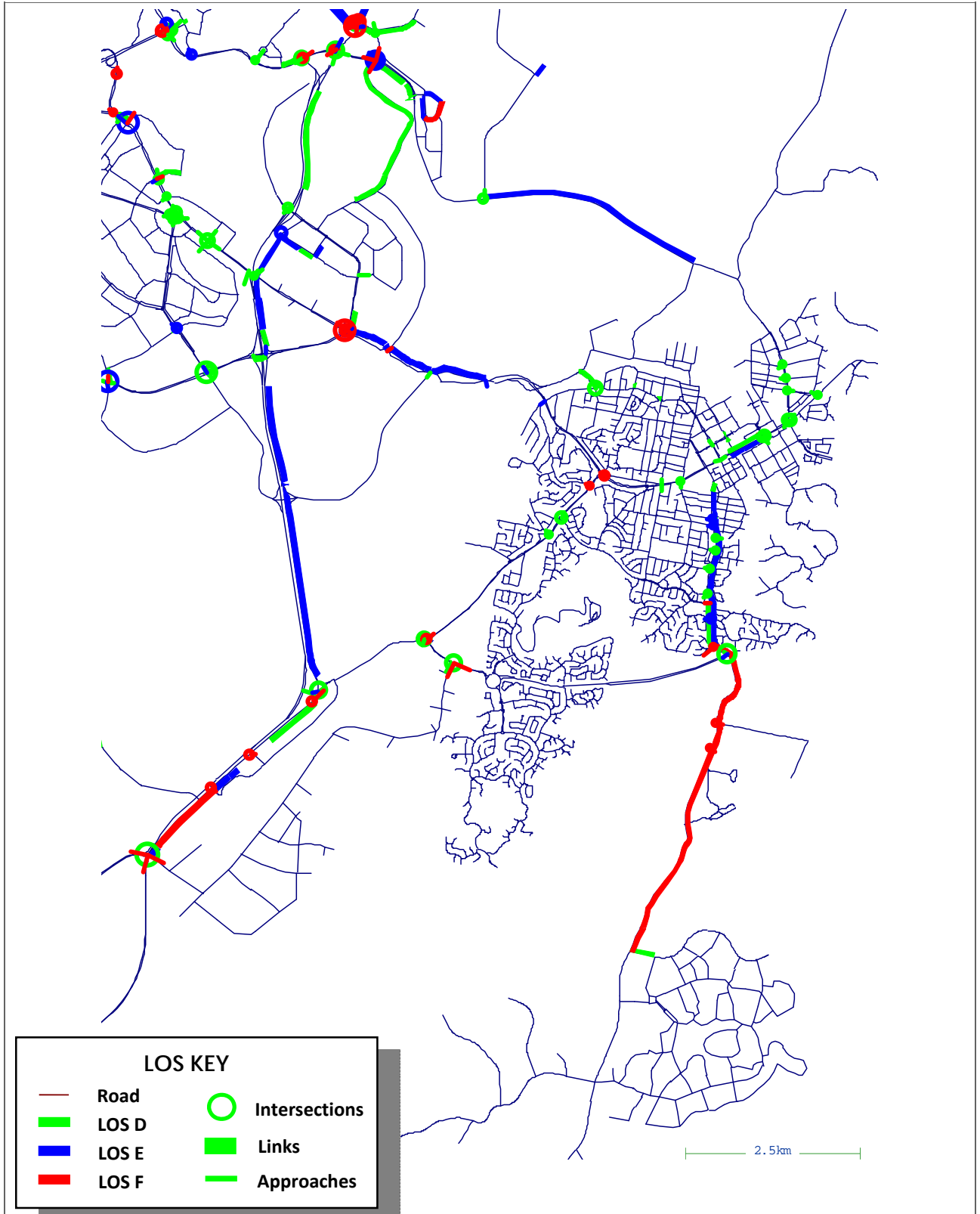
2031 Scenario LOS Plots



Scenario 1 - Do Nothing
2031 AMP LOS

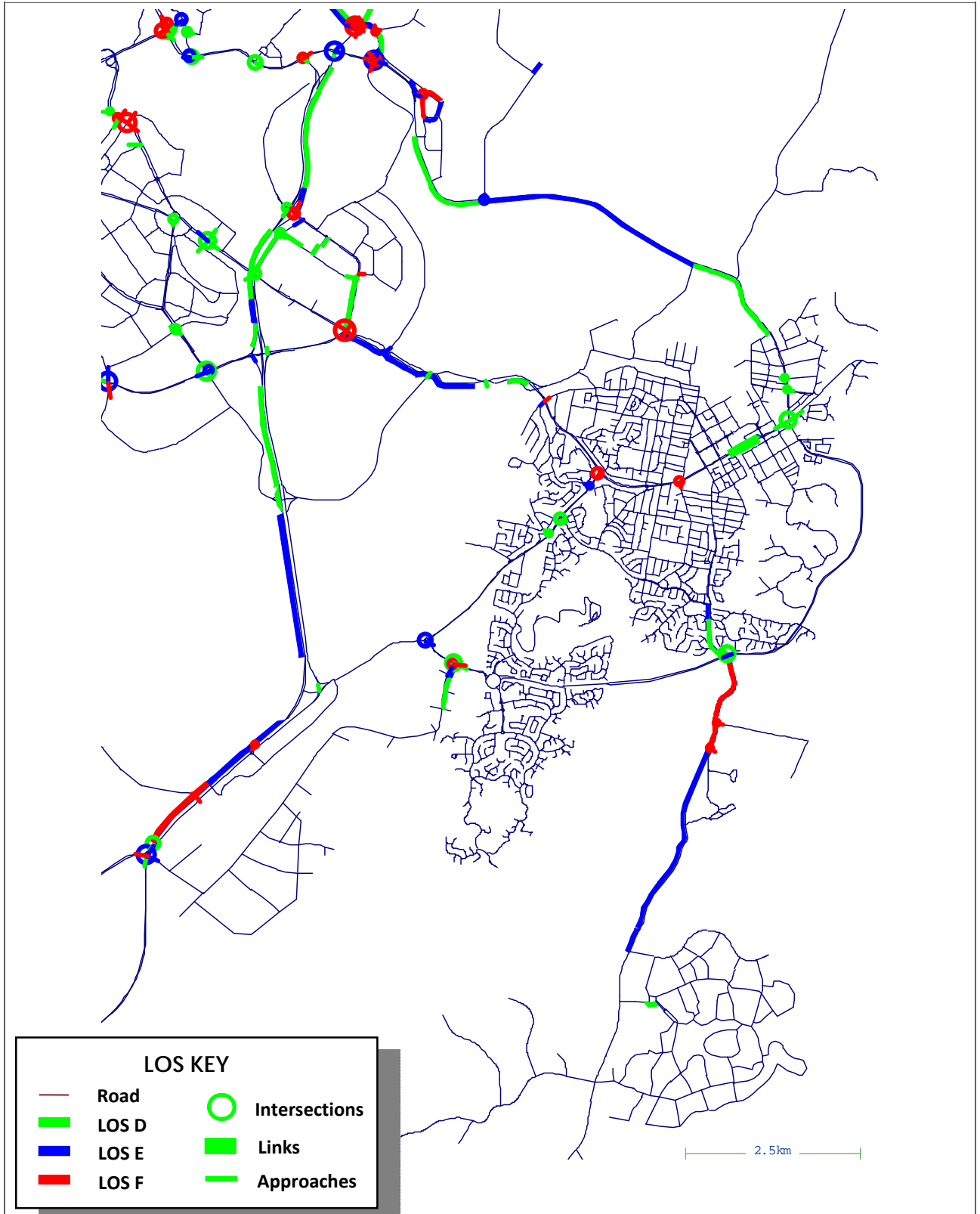


1



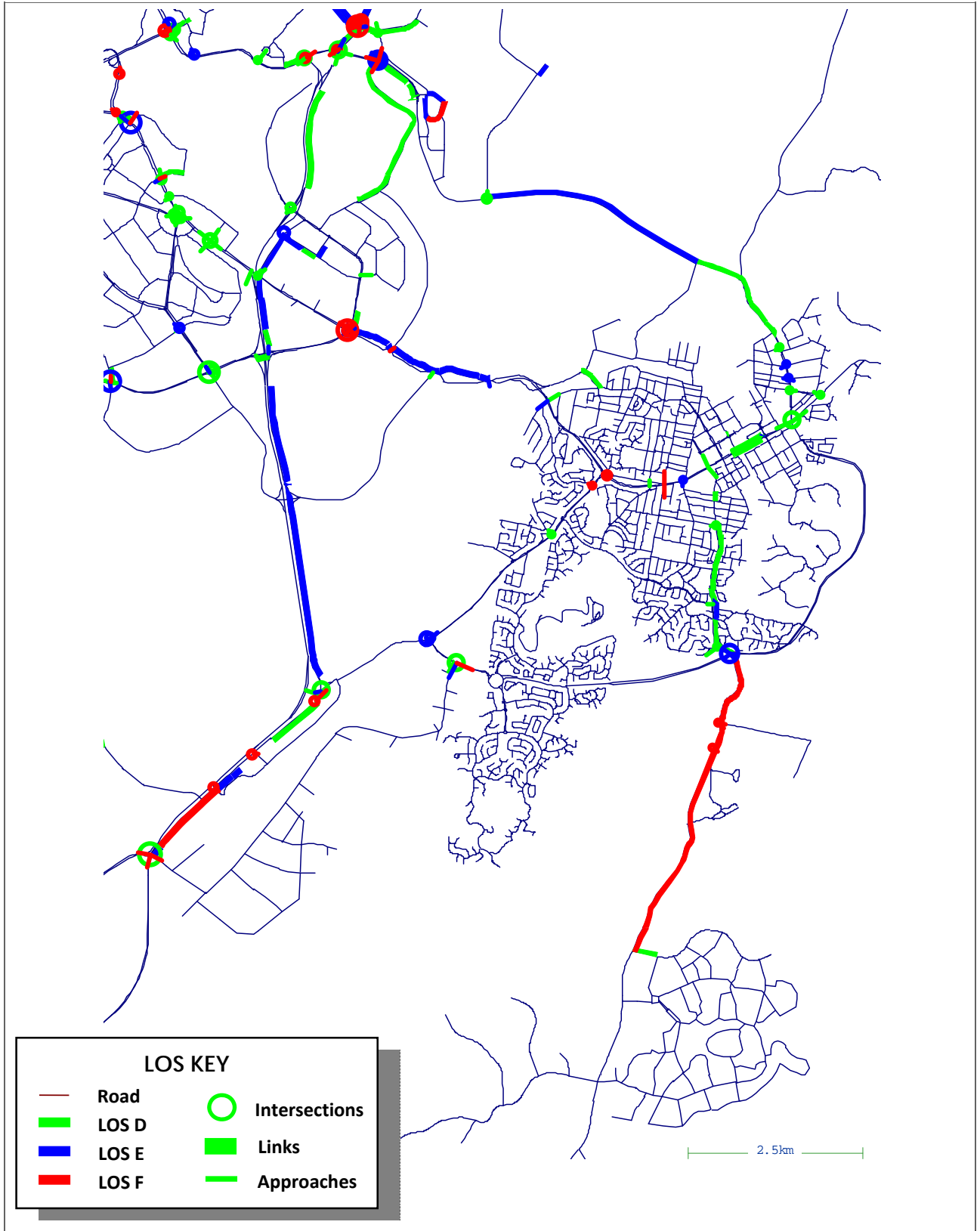
Scenario 1 - Do Nothing
2031 PMP LOS





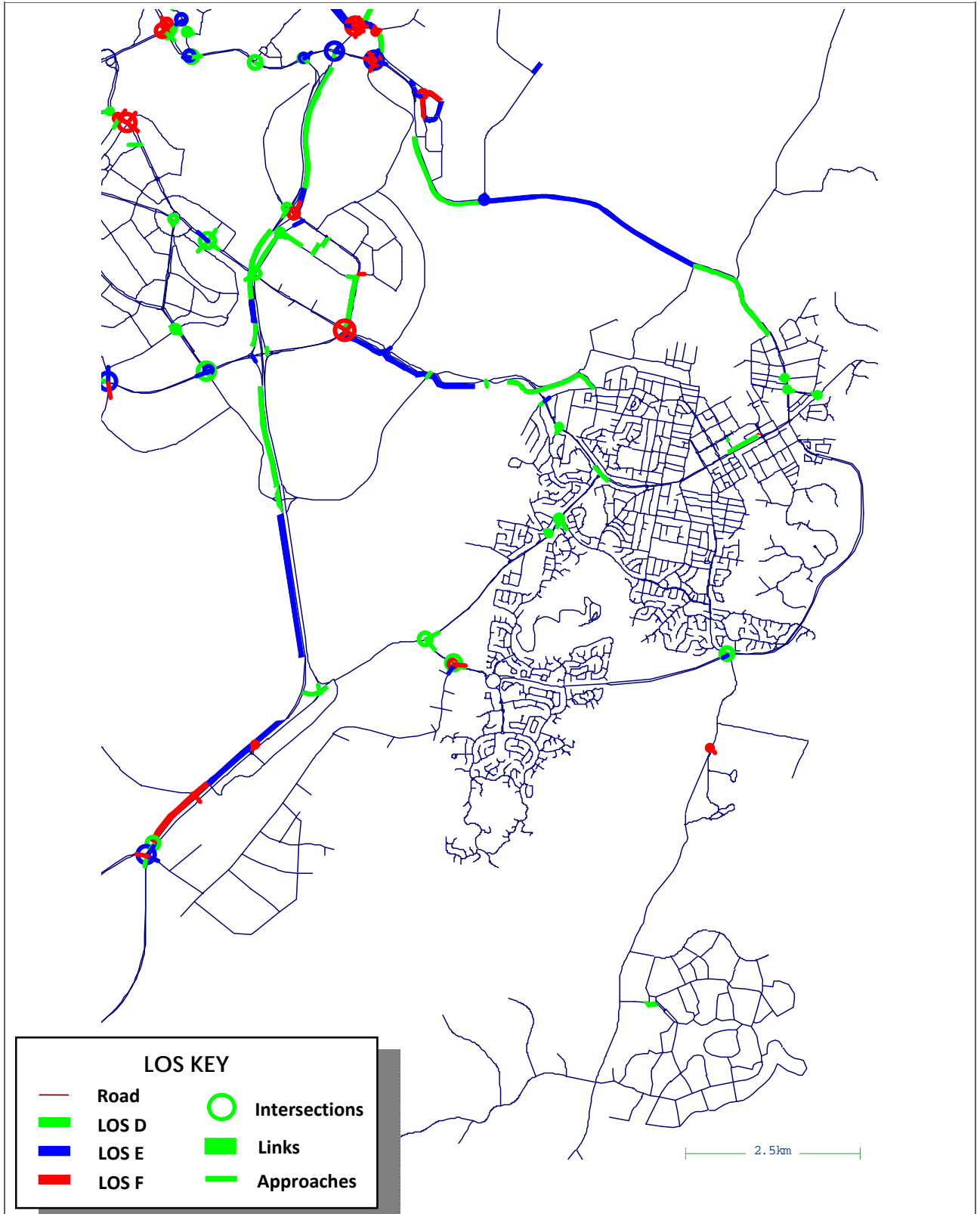
Scenario 2 – Ellerton Extension Only
 2031 AMP LOS

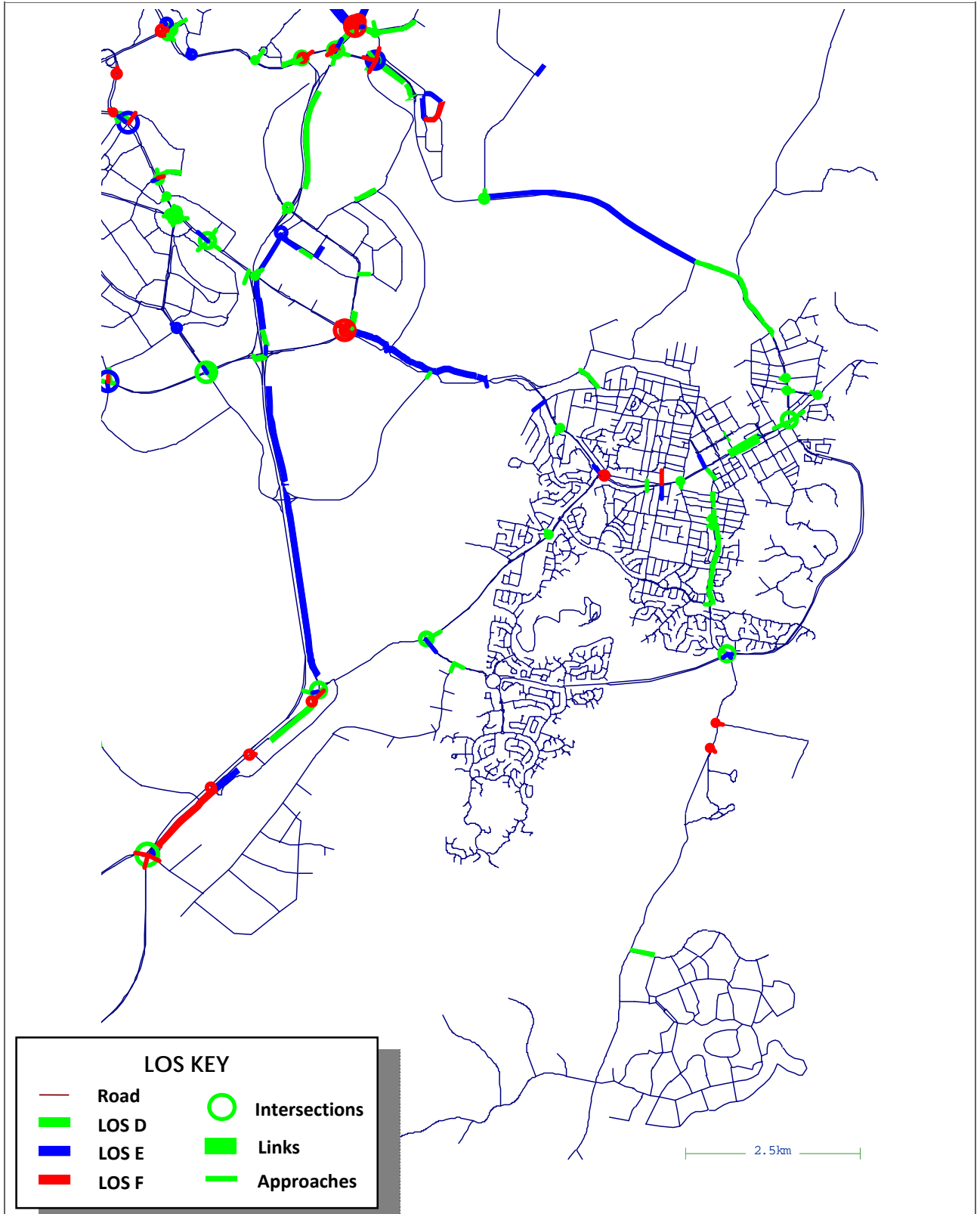


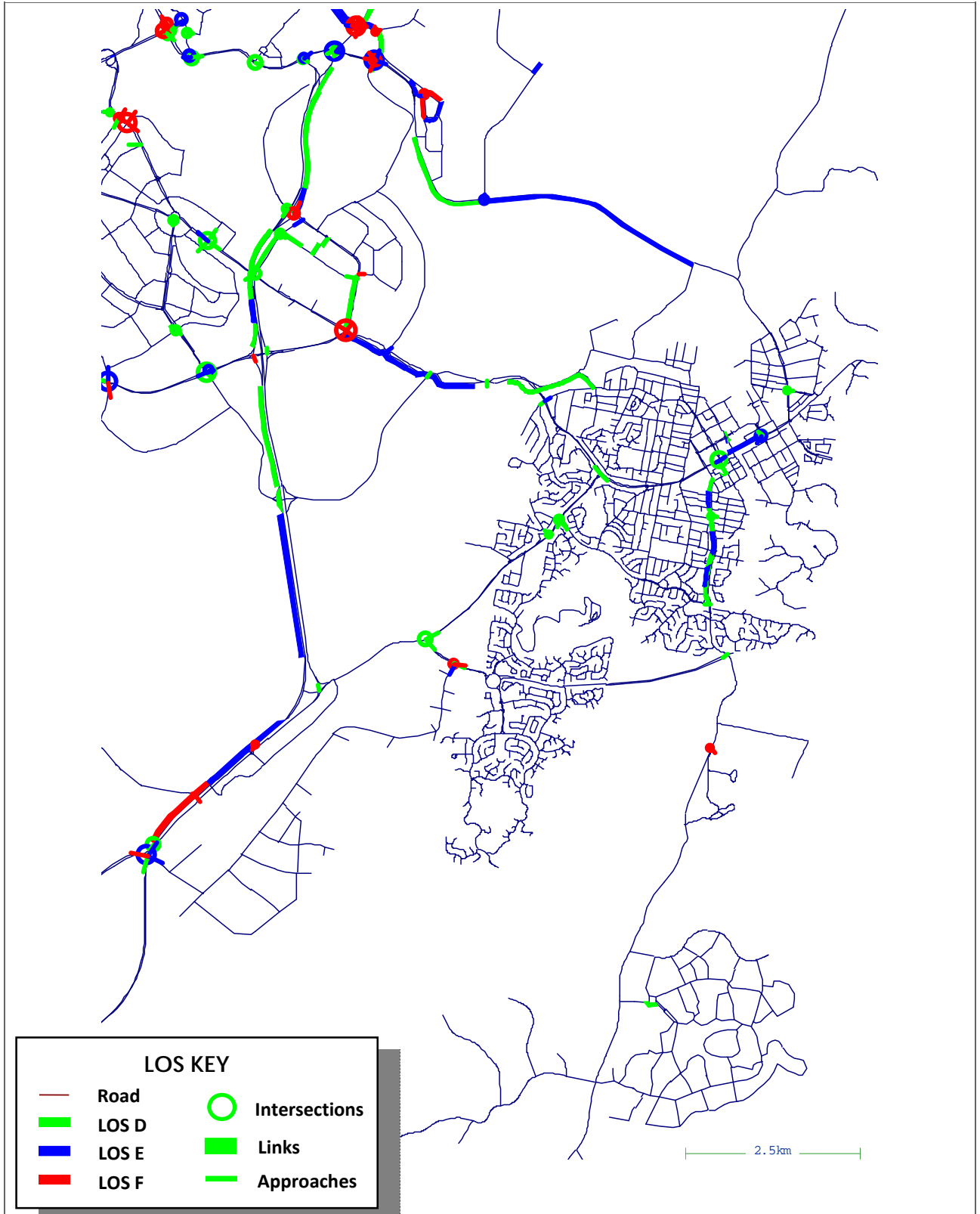


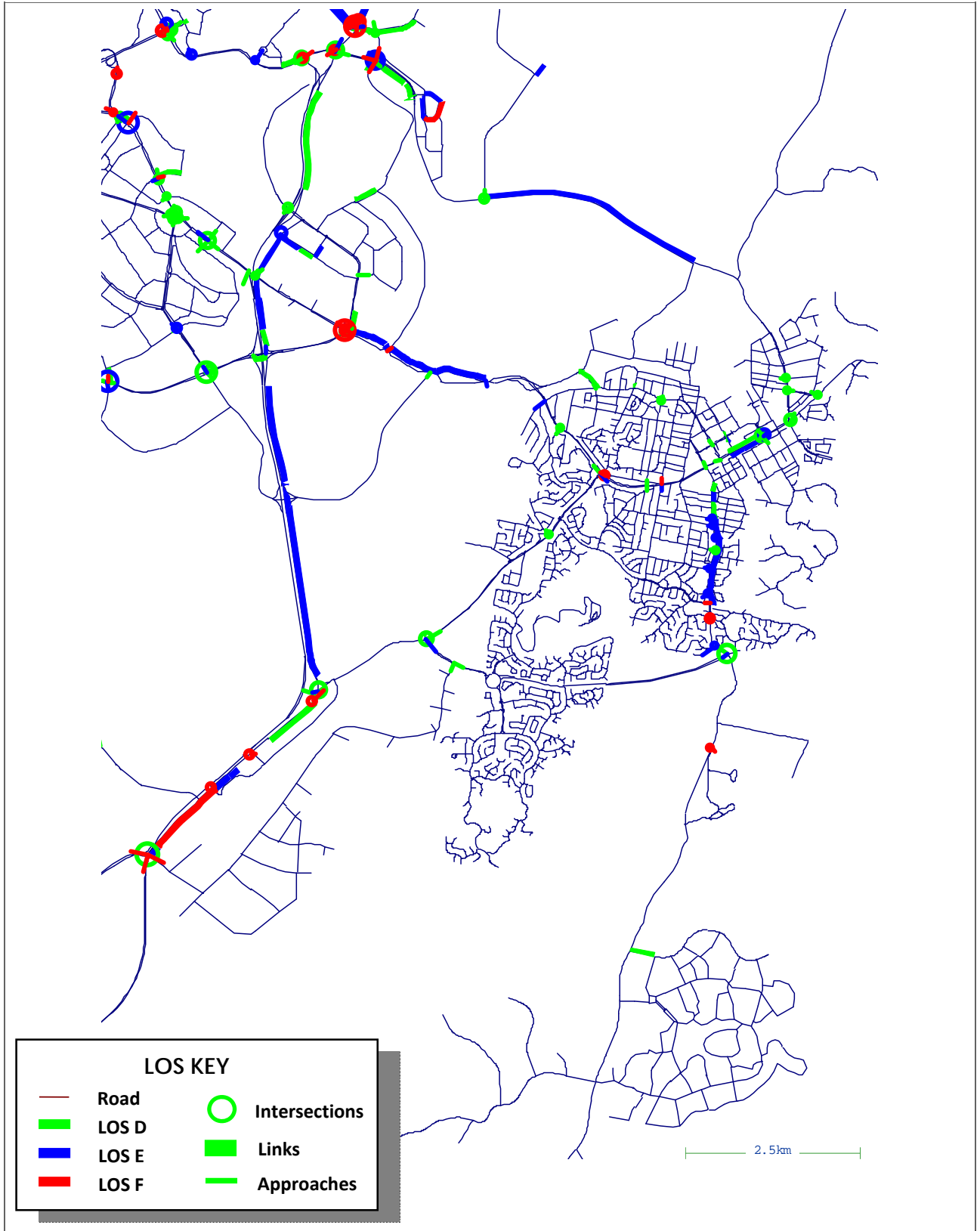
Scenario 2 – Ellerton Extension Only
 2031 PMP LOS











Scenario 4 – All Infrastructure Improvements Less Ellerton Ext
 2031 PMP LOS



Appendix B

2031 Scenario Directional Volume Plots



Scenario 1 - Do Nothing
2031 AMP Volume



1



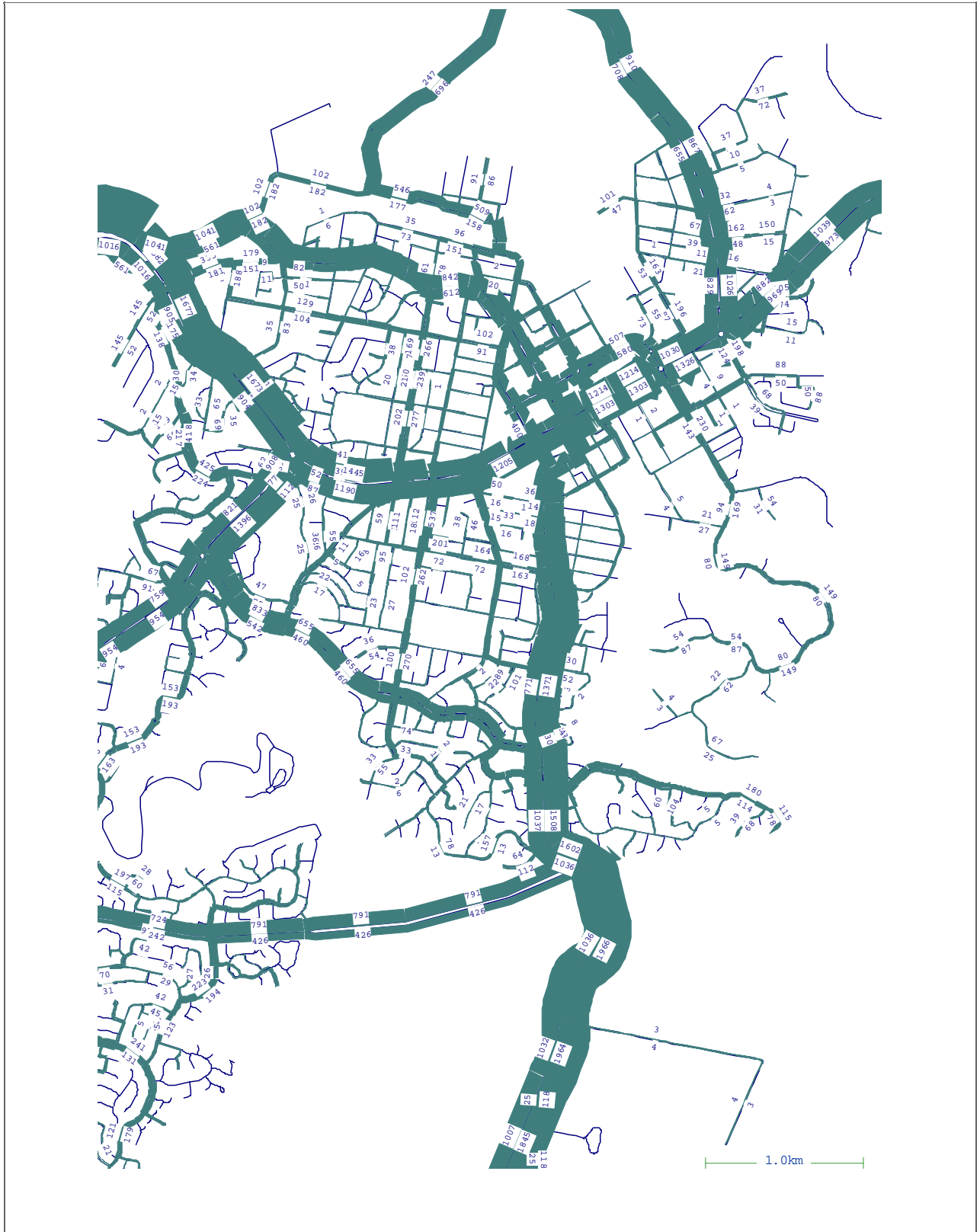
Scenario 1 - Do Nothing
2031 PMP Volume





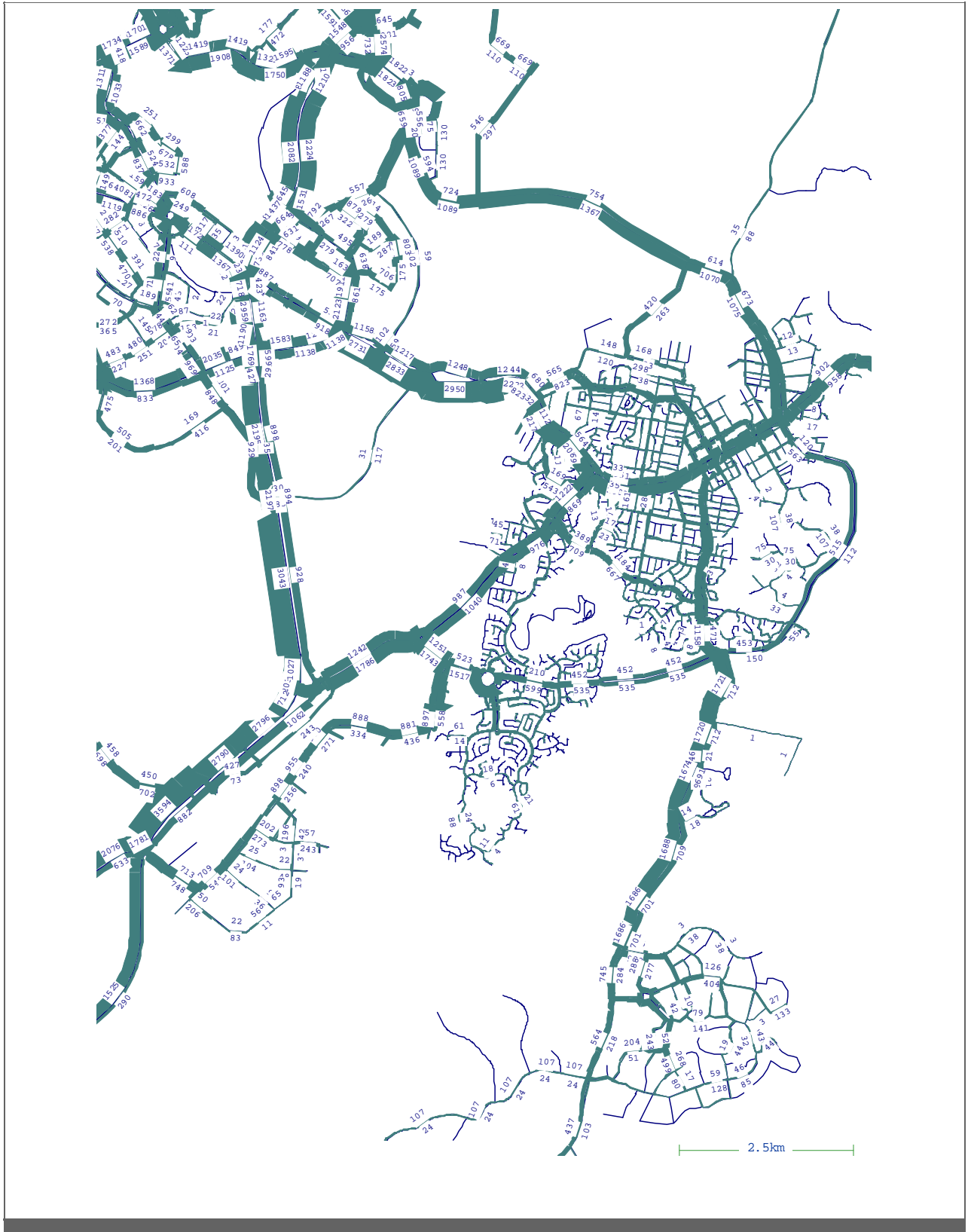
Scenario 1 - Do Nothing
2031 AMP Volume - Inset





Scenario 1 - Do Nothing
2031 PMP Volume - Inset





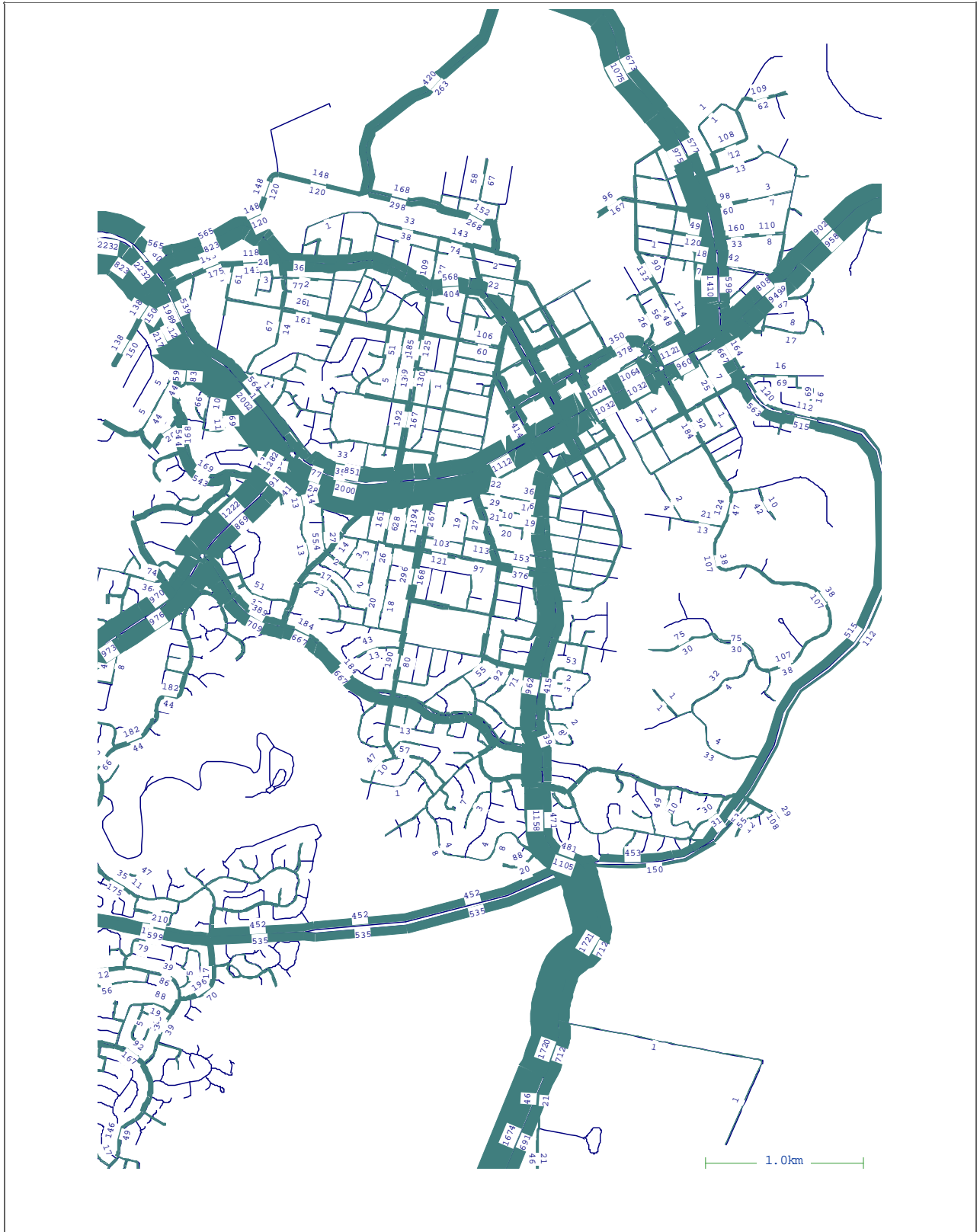
Scenario 2 – Ellerton Extension
2031 AMP Volume





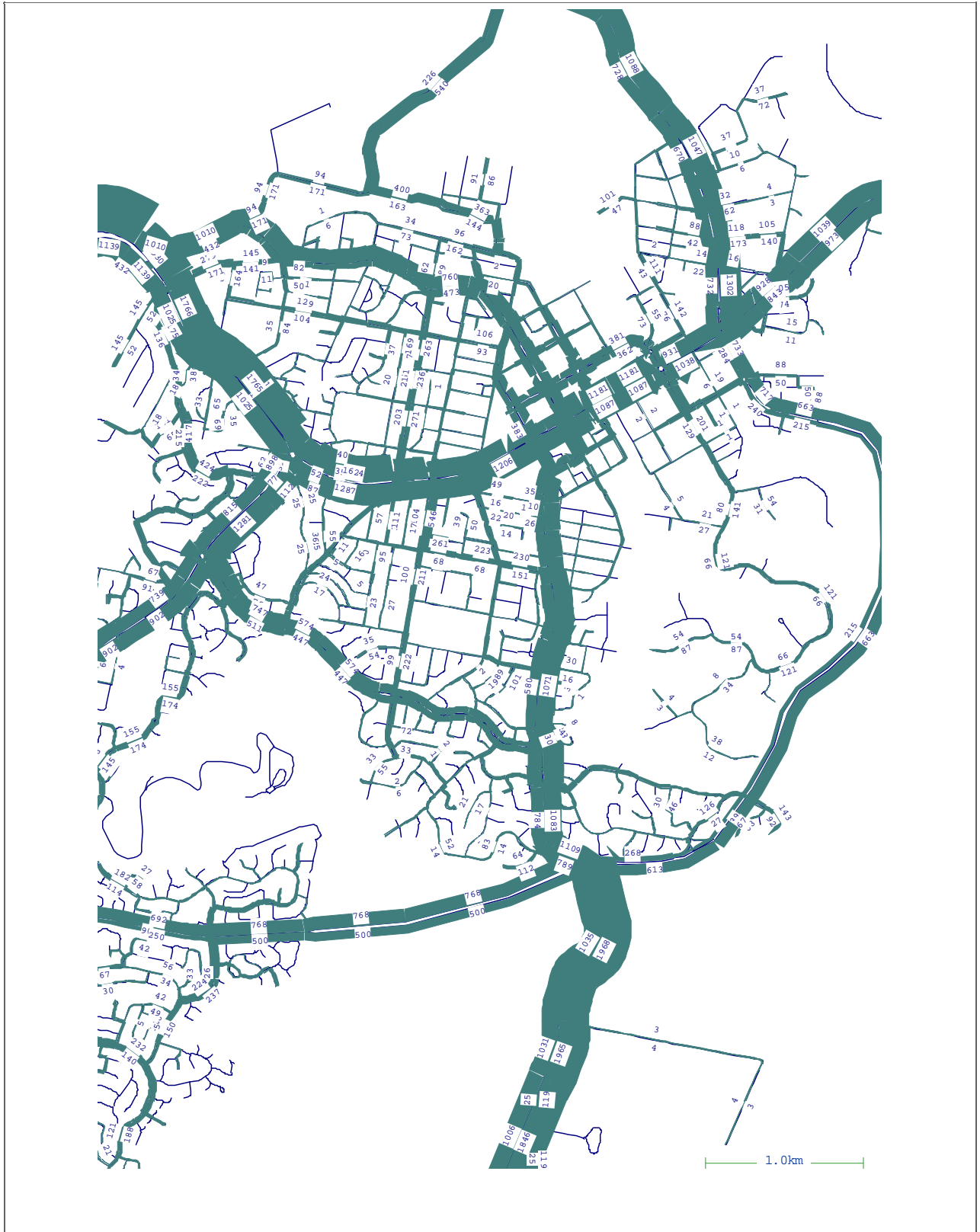
Scenario 2 – Ellerton Extension
2031 PMP Volume





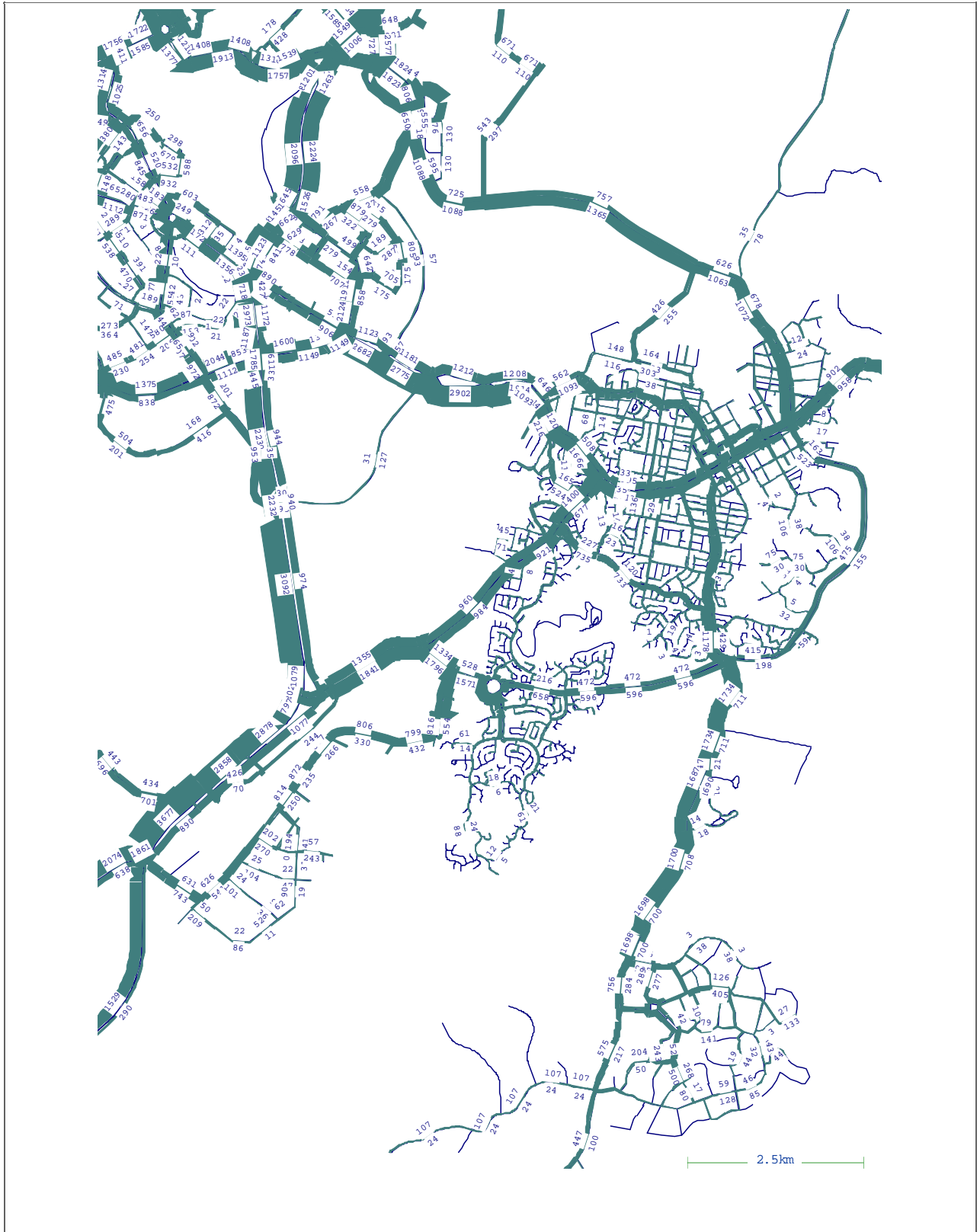
Scenario 2 – Ellerton Extension
2031 AMP Volume - Inset





Scenario 2 – Ellerton Extension
2031 PMP Volume - Inset





Scenario 3 – All Infrastructure Improvements
2031 AMP Volume

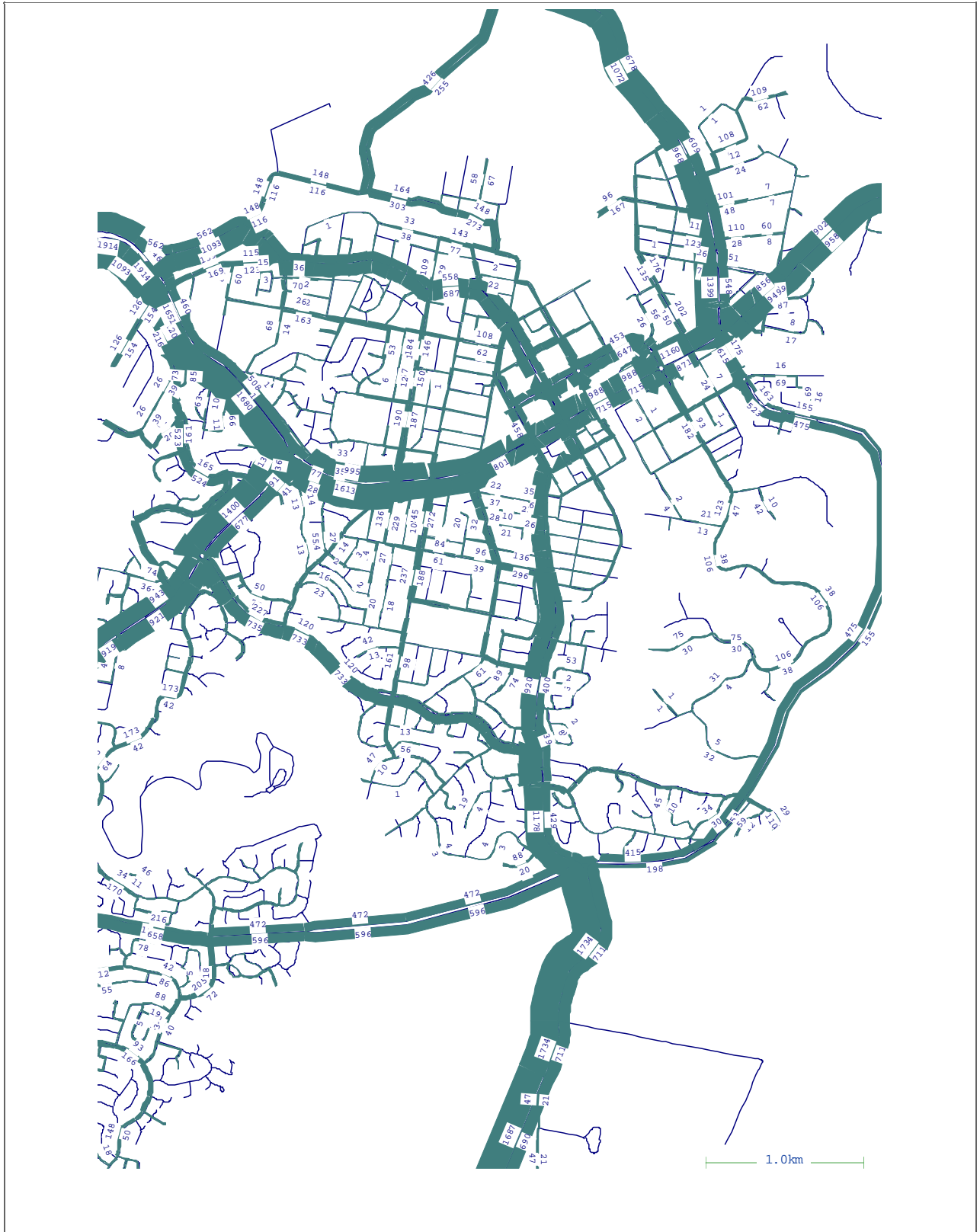




Scenario 3 – All Infrastructure Improvements
2031 PMP Volume

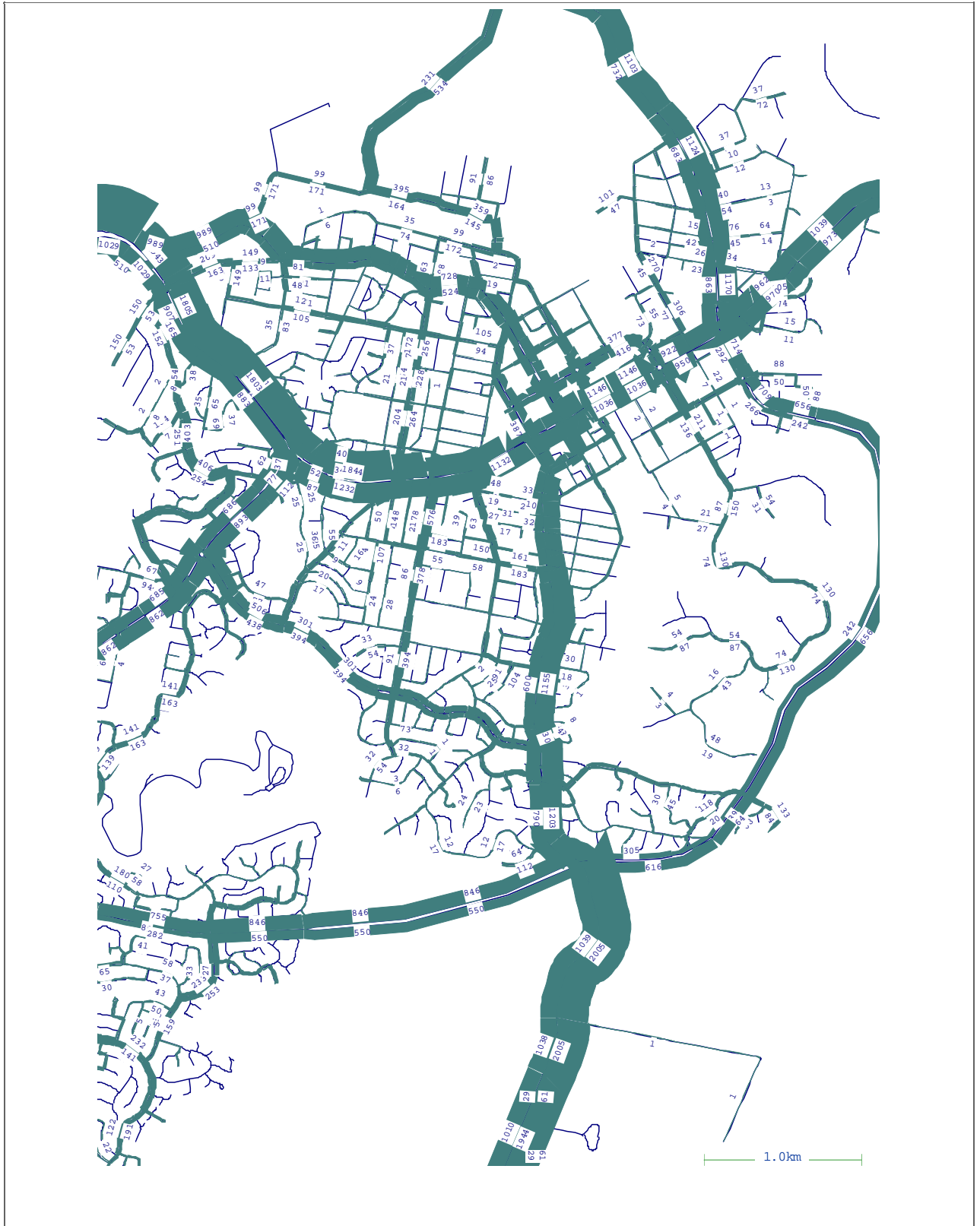


10



Scenario 3 – All Infrastructure Improvements
2031 AMP Volume - Inset





Scenario 3 – All Infrastructure Improvements
2031 PMP Volume - Inset





Scenario 4 – All Infrastructure Improvements Less Ellerton Ext
2031 AMP Volume





Scenario 4 – All Infrastructure Improvements Less Ellerton Ext
2031 PMP Volume





Scenario 4 – All Infrastructure Improvements Less Ellerton Ext
2031 AMP Volume - Inset





Scenario 4 – All Infrastructure Improvements Less Ellerton Ext
2031 PMP Volume - Inset

