Lake Macquarie City Council

Development Contributions Plan

Traffic and Transportation Background Study

Toronto Contributions Catchment

2015 – 2030

Contents

1 Traffic and Transportation Background Study

1.1 Introduction

Traffic and transport infrastructure is essential to support the future growth anticipated within the Toronto development contributions catchment. The Toronto catchment is bounded by the Glendale catchment to the north, the Morisset Catchment to the south, Lake Macquarie in the east and the Cessnock Local Government Area in the west.

Council's Transportation Planning Section has been commissioned to prepare the Toronto Contributions Catchment Development Contributions Plan. This report focuses on traffic and transport infrastructure required for the catchment until 2030.

The study includes a review of previous traffic investigations completed for a number of development and rezoning proposals, and has included assessment of key local road intersections, Sub-arterial and Collector Council roads, and public transport facilities required to support the community as development intensifies within the catchment.

1.1.1 Purpose of Study

The study identifies the traffic and transport infrastructure that is required to meet the transport demands of increased population and workforce within the Toronto catchment, anticipated to occur over the 15-year period, from 2015 to 2030.

The estimated increased population and workforce is based on an economic and development scenario prepared by Council's Integrated Planning Section, with further detail given in Section 1.4 of this report.

1.1.2 Objectives

The study includes the following tasks, with a focus on traffic and transport matters:

- Review of existing studies for a number of rezoning and planning proposals, and development application submissions in the Toronto Contributions Catchment;
- Review of existing Levels of Service (LoS) of key intersections (non-state roads) within the Toronto catchment, and projected LoS in line with the anticipated growth;
- Need for road and intersection upgrades to support future development in the area based on projected growth impacts;
- Need for upgrades to local bus infrastructure.

The overall traffic and transport objectives to be achieved were to provide a cost effective, safe and efficient transport system that addresses the expected increase in demand for private car travel, goods movement and public transport, due to the anticipated increased development across the study area.

1.1.3 The Study Area

The study area covers the Toronto Development Contributions Catchment, divided into two sub-catchments, Figure 1.1.

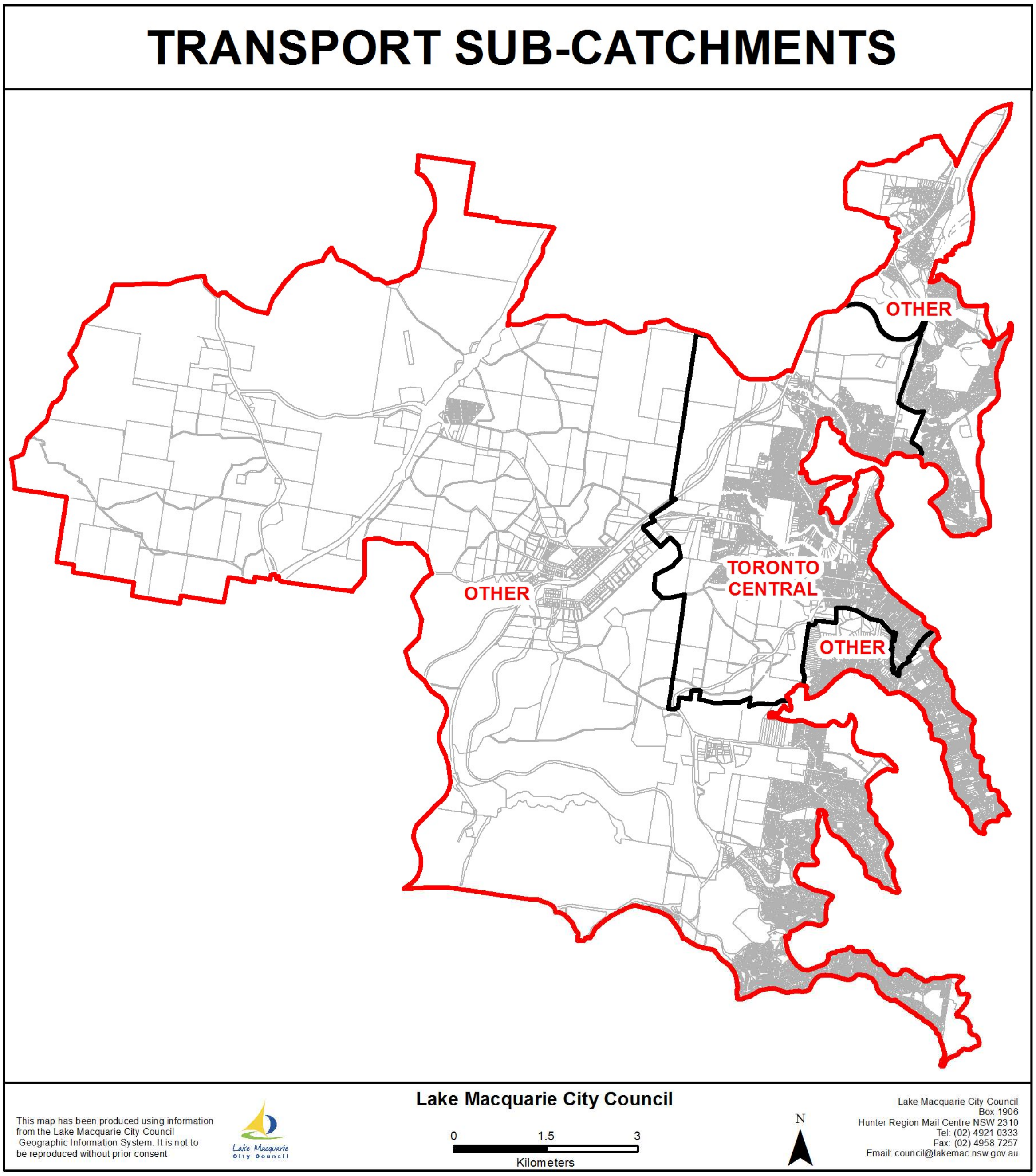


Figure 1.1: Toronto Development Contributions Catchment, split into the two sub-catchments

The sub-catchments are:

- Toronto Central (Toronto, Blackalls Park, Fassifern, Fennell Bay)
- Other

1.1.4 Approach to the Study

The emphasis is on the provision of acceptable service levels on local infrastructure. The following approach to technical assessment of performance has been adopted.

- Agreement on Acceptable Performance Standards (Levels of Service, LoS)
- Agreement on Acceptable Minimum Service Levels (MSL's)
- Assessment of existing performance
- Upgrade of the existing situation (intersection or road segment) to meet the acceptable performance standard (where required)
- Assessment of the Agreed Growth Scenarios against the Base Facilities
- Assessment of the Upgrade Scenarios to meet Acceptable Performance Standards (where applicable).

The emphasis in the analysis has been to test threshold or incremental upgrades to facilities so that over design (and hence over investment) of facilities is minimised. This approach has been particularly important in the assessment of local road upgrades required to satisfy the adopted minimum service levels.

1.2 Discussion on Performance Standards

1.2.1 Introduction

An integral component to planning infrastructure requires the adoption of specific performance standards with regard to the operation of the transport network. The adoption requires consideration of the Levels of Service (LoS) at intersections and road segments, where it is possible to achieve a range of passenger and vehicle flow scenarios depending on the capacity and delay considerations adopted. The following sections discuss the issue of performance standards and guidelines in relation to the adopted performance criteria.

1.2.2 Level of Service (LoS) Assumptions

The concept of Level of Service (LoS) has been applied in transport planning for many years. Austroads has defined a range of traffic conditions with a scale of A to F for urban and suburban arterial roads with uninterrupted flow conditions, based on average travel speeds when related to free flow conditions.

For Council infrastructure (road segments and intersections), the Level of Service of D is the proposed maximum limit, which is considered the boundary between stable and unstable flow. It is considered appropriate to examine each differing segment of a road to assess its function, operating conditions and traffic carrying capacity, and each intersection to determine the worst movement LoS.

The ‘RMS Guide to Traffic Generating Developments’ is a guide that evaluates the impact of developments on traffic. It references the Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis, which states that lane capacities may increase under ideal conditions to between 1,200 and 1,400 vehicles per hour. The analysis of critical road segments in the Toronto catchment has taken these limits and LoS criteria into consideration.

It should be noted that for roundabouts and sign controlled intersections (give way and stop signs), examining the highest individual average delay can be misleading. The size of the movement with the highest average delay per vehicle will also be taken into account. An intersection where all movements are operating at a LoS A, except one, which is at LoS E, may not necessarily define the intersection LoS as E if that movement is minimal. That is, longer delays to a small number of vehicles may not justify upgrading an intersection unless a safety issue occurred, or unless strategically it is the most appropriate intersection to upgrade. This would occur where an intersection offered a better outcome, and the alternative intersections (if currently operating outside the acceptable service levels) could have movements banned to improve the LoS and safety of those intersections.

1.2.3 Road Capacity Thresholds

As mentioned in the previous section, for urban arterial roads with interrupted flow the recommended traffic volumes per lane per hour are in the range of 1,200 to 1,400 vehicles.

There are many examples within the Hunter where such lane flows are observed, mostly on State roads. The flows on these roads are achieved through higher capacities relating to their physical design, but also with traffic management such as parking restrictions, signal coordination and flaring at intersections. Due to the costs associated with widening and upgrading roads, there is a consideration that a poor LoS (E) is an acceptable outcome, however where possible motorists will take the perceived fastest route, leading to local areas being infiltrated by traffic meant for the higher order roads.

The Austroads Guide quotes typical mid-block capacities with interrupted flow and without intersection flaring and with interruptions from cross and turning traffic at minor intersections. The guide continues to explain this matter of capacity as follows:

“Peak period mid-block traffic volumes may increase to between 1,200 and 1,400 vehicles per lane per hour on any approach road when the following conditions exist or can be implemented:

- *Adequate flaring at upstream junctions*
- *Uninterrupted flow from a wider carriageway upstream of an intersection approach and flowing at capacity*

- *Control or absence of crossing or entering traffic at minor intersections by major road priority controls*
- *Control or absence of parking*
- *Control or absence of right turns by banning turning at difficult intersection, or banning turning into driveways*
- *High volume flows of traffic from upstream intersections occurs during more than one phase of a signal cycle*
- *Good co-ordination of traffic signals along the route"*

In practical terms, it is possible to achieve lane capacities of up to 1,400 vehicles per lane per hour if some or all of the above conditions apply to a particular stretch of road. As not all of these conditions can be met on the investigated roads, the capacity of principle traffic carrying routes in the study area was taken as 1,300 vehicles per hour per lane.

With the limit agreed and set at 1,300 vehicles per hour, the existing peak hour traffic volumes on Council's sub-arterial roads were obtained from peak hour counts, and indexed by the anticipated percentage growth within the sub-catchment that the road is located. Where the predicted future traffic volume exceeds capacity, the year of failure is determined and the appropriate solution is determined. It is considered for most cases, where possible, increasing the number of trafficable lanes is appropriate. Where it is not possible to increase the number of lanes, restricting right turn movements into streets and having separate deceleration lanes for left turns may assist traffic flow. Table 1.1 from the RMS and Austroads Guides shows lane capacity thresholds under various scenarios.

Table 1.1: Lane Capacity Thresholds

Typical mid-block capacities for urban roads with interrupted flow

Type of Road	One-Way Mid-block Lane Capacity (pcu/hr)	
Median or inner lane:	Divided Road	1,000
	Undivided Road	900
Outer or kerb lane:	With Adjacent Parking Lane	900
	Clearway Conditions	900
	Occasional Parked Cars	600
4 lane undivided:	Occasional Parked Cars	1,500
	Clearway Conditions	1,800
4 lane divided:	Clearway Conditions	1,900

Urban road peak hour flows per direction

Level of Service	One Lane (veh/hr)	Two Lanes (veh/hr)
A	200	900
B	380	1400
C	600	1800
D	900	2200
E	1400	2800

Source: RMS, Austroads

1.2.4 Environmental Capacity of Local Roads

The RMS Guide recognises that *"the Environmental Capacity of an area is determined by the impact of traffic, roads and various aspects of the location".*

Characteristics recognised as having influence include:

Traffic

- Traffic volume
- Percentage of heavy vehicles
- Speed

Road

- Road reserves and carriageway width
- Number of traffic lanes
- Grade
- Road pavement condition

Locality

- Distance from road carriageway to property boundary
- Nature of intervening surfaces
- Setback of building from property boundary
- Type and design of building

The Environmental Capacity of Council roads (local and collector roads) is most easily assessed by comparing the existing and predicted future traffic volume to Table 1.2, which is extracted from the RMS Guide and sourced from the AMCORD Guidelines.

Table 1.2: Environmental capacity of Local Roads

<table>
<tr><th>Road class</th><th>Road type</th><th>Maximum Speed (km/hr)</th><th>Maximum peak hour volume (veh/hr)</th></tr>
<tr><td rowspan="3">Local</td><td>Access way</td><td>25</td><td>100</td></tr>
<tr><td rowspan="2">Street</td><td rowspan="2">40</td><td>200 environmental goal</td></tr>
<tr><td>300 maximum</td></tr>
<tr><td rowspan="2">Collector</td><td rowspan="2">Street</td><td rowspan="2">50</td><td>300 environmental goal</td></tr>
<tr><td>500 maximum</td></tr>
</table>

Source: RMS

For this study, the environmental capacity is not reviewed on sub-arterial roads.

1.2.5 Intersections

The capacity of an intersection impacts the operation of the roads it is intersects. Requirements for intersection upgrades are generally determined using traffic modelling tools such as SIDRA intersection modelling, with the limit for upgrade or change required where there is a LoS D or worse. SIDRA calculates the average delay to vehicles at an intersection and gives a LoS rating (Table 1.3), which indicates the relative performance of the intersection control.

The LoS is defined in terms of delay, which is a measure of a driver's delay, frustration and lost travel time. There are six LoS measures ranging from A (very low delay, very good operating conditions) to F (over-saturation, arrival rate exceeds capacity).

Table 1.3: Intersection Level of Service Criteria

Level of service	Average delay per vehicle (d) in seconds			
	Unsignalised intersections	Roundabouts[(1)]	Signalised intersections	All intersection types
	HCM 2000 and 2010; SIDRA INTERSECTION	SIDRA INTERSECTION Recommended values	HCM 2000 and 2010; SIDRA INTERSECTION	RTA (1993)
A	d ≤ 10	d ≤ 10	d ≤10	d ≤ 14.5
B	10 < d ≤ 15	10 < d ≤ 20	10 < d ≤ 20	14.5 < d ≤ 28.5
C	15 < d ≤ 25	20 < d ≤ 35	20 < d ≤ 35	28.5 < d ≤ 42.5
D	25 < d ≤ 35	35 < d ≤ 50	35 < d ≤ 55	42.5 < d ≤ 56.5
E	35 < d ≤ 50	50 < d ≤ 70	55 < d ≤ 80	56.5 < d ≤ 70.5
F	50 < d	70 < d	80 < d	70.5 < d

Source: Austroads

1.2.6 Public Transport Facilities

Development contributions can provide for the provision of public transport infrastructure to satisfy the demands generated by new development and increased population. This can include associated infrastructure such as bus or taxi infrastructure compliance, and will exclude the provision or operation of public transport.

In order to encourage the use of public transport, it will be necessary to provide a sustainable public transport service to the new areas of development. At least 80% of new development areas should be within 400m of a bus stop.

In terms of local public transport facilities, bus shelters will be provided at a rate of one per 1,000 additional persons in the Toronto catchment. It is anticipated that this Plan will provide 12 shelters in the higher growth areas of the catchment between 2015 and 2030. Alternative funding for shelters are available per annum in Council’s Capital Works budget, and can be achieved from successful grant funding (for example, CPTIGS, Country Passenger Transport Infrastructure Grants Scheme).

1.2.7 Cycling Facilities

The standard of cycling facilities can vary, as with public transport facilities, depending on the importance of the location (such as at shops or schools) and its patronage levels. Council has considered the overall needs of the Lake Macquarie area in its Cycling Strategy, which was adopted by Council in 2012. Cycling facilities are not considered as part of this transportation study, and are included in the Toronto Recreation and Land Plan.

1.2.8 Pedestrian Facilities

Council adopted the Footpath Strategy in 2013, applying over the 10 year period to 2023. All footpath facilities required as part of any development consent conditions will be assessed in accordance with the objectives of the Footpath Strategy and Council's guidelines.

Pedestrian footpath facilities have not been considered as part of this transportation study, and instead the shared paths have been evaluated and included in the Toronto Recreation and Land Plan.

1.3 Existing Transportation Situation

1.3.1 Introduction

Council's strategic estimate of population growth within the Toronto catchment estimates an additional 2,433 dwellings will be required over the 15-year period to 2030, increasing the population by 5,412 persons and the Peak Vehicle Traffic (PVT's) by 2,736 trips per peak hour throughout the catchment.

1.3.2 Roads

The existing road network comprises of a series of arterial, sub arterial, collector and local roads. The Council controlled roads are the subject of this report, and State roads are not considered.

There are no Council controlled arterial or sub-arterial roads within the catchment. There are several collector roads that travel through the residential catchments on either side of the State road network, which runs between the northern and southern limits of the catchment. The main collector road routes that make up the Toronto road network include:

1. First Street, Marmong Street, George Street, The Ridgeway, Quigley Road, Bay Road through Marmong Point and Bolton Point
2. Macquarie Road, Fassifern Street, South Street, Railway Parade, Cook Street through Fennell Bay, Fassifern, Blackalls Park and Toronto
3. Victory Parade, Brighton Avenue, Ambrose Street, Excelsior Parade, Amelia Street, Skye Point Road, Coal Point Road, Barina Avenue, Jarret Street through Toronto, Coal Point and Kilaben Bay
4. Dorrington Road, Fishing Point Road, Sealand Road, Letchworth Parade, Clydebank Road, Ilford Avenue, Alexander Parade through Rathmines, Fishing Point, and Arcadia Vale
5. Donnelly Road, Dobell Drive, Watkins Road, Summerhill Road through Arcadia vale and Wangi Wangi

1.3.3 Intersections

The following intersections were identified as having potential capacity limitations. They have been reviewed to assess the provision of adequate capacity for the infrastructure and development upgrades. Further details and results of the analysis are included in section 2. No roads intersecting with State roads were included as part of the investigations.

1. The Boulevard and Pemell Street, Toronto
2. Brighton Avenue and Victory Parade, Toronto
3. Pemell Street and Brighton Avenue, Toronto
4. Park Street and Marmong Street, Booragul
5. Bay Road and Quigley Road, Bolton Point
6. Hayden Brook Drive and Enterprise Way, Woodrising
7. Dorrington Road, Clydebank Road and Rosemary Row, Rathmines
8. First Street and Fourth Street, Booragul
9. York Street and Anzac Parade, Teralba
10. Summerhill Drive, Dobell Drive and David Street, Wangi Wangi
11. Fassifern Road and Tucker Close, Fassifern

1.3.4 Public Transport

The Toronto catchment is serviced by Hunter Valley Buses. The bus interchange is located in Victory Parade, Toronto. The bus routes that service the Toronto catchment are 269, 270, 271, 273, 275, and 276.

The Toronto catchment also contains the Sydney to Newcastle rail line, with railway stations located at Fassifern and Awaba.

1.4 Future Situation

1.4.1 Demographics

Council's Integrated Planning section has undertaken extensive demographic assessment into the future population characteristics that can be expected within the Toronto catchment. The increase in population can be converted into Peak Vehicle Trips (PVT's), which will be used to determine the growth in traffic within the relevant sub-catchments and how this affects the roads and intersections.

1.4.2 Expected growth in Peak Vehicle Trips

Table 1.4 below shows the growth in PVT's within the Toronto Catchment from the current 14,894 trips to 17,629 trips by the year 2030.

Table 1.4: Peak Vehicle Trip (PVT's) increase per sub-catchment

Estimated projected PVT's in Toronto catchment sub-catchments 2015 to 2030				
Sub-catchment	**Existing (2015)**	**Projects PVT's**	**2030 estimate**	**Percentage Increase**
Toronto Central	**6,527**	**1,344**	**7,871**	**20.6%**
Other	**8,367**	**1,392**	**9,758**	**16.6%**
Total	**14,894**	**2,736**	**17,629**	**18.4%**

The Toronto Central catchment includes the suburbs of Fennell Bay, Fassifern, Blackalls Park and Toronto. The RMS Guide to Traffic Generating Developments, with updated information from RMS Technical Direction TDT 2013/04a, provides estimated peak hour traffic generation of developments based on use. The rates from this guide are given in Table 1.5.

Table 1.5: Land Use Traffic Generation Rates

PVT Rates		
Residential	**Quantity**	**PVT**
Dwelling House / Lot	Per dwelling	0.85
Residential Accommodation with 1 bedroom / bedsit	Per dwelling	0.15
Residential Accommodation with 2 bedrooms	Per dwelling	0.30
Residential Accommodation with 3 or more bedrooms	Per dwelling	0.450
Seniors Housing	Per dwelling	0.40
Residential Care Facility	Per bed	0.15
Moveable Dwelling (Long-term)	Per site	0.40
Moveable Dwelling (Short-term)	Per site	0.40
Hostel/ Backpackers/ Boarding House/ Group Home/ Hospital	Per bed	0.40
Educational Establishment (residential component)	Per bed	0.40
Hotel or Motel Accommodation / Serviced Apartment (includes 85% occupancy)	Per bed	0.34
Employment Generating		
Bed and Breakfast Accommodation	Per bed	0.40
Bulky Goods Premises	Per 100m² GLFA	2.70
Business Premises and Office Premises	Per 100m² GFA	1.20
Childcare Centre	Per Child	
Light Industry	Per 100m² GFA	0.78
Industry – Storage	Per 100m² GFA	0.50
Industry – Warehousing/Manufacturing	Per 100m² GFA	0.50
Medical Centre		
Retail Premises	Per 100m² GLFA	7.00
Supermarket	Per 100m² GLFA	12.30

Source: NSW RTA Guide to Traffic Generating Developments Version 2.2 October 2002

1.4.3 Alternate Development Contribution Methods

The methods available for funding local infrastructure have been amended to include:

- Voluntary Planning Agreements (VPA's).
  Within the current Toronto Contributions Catchment (2004), there are examples of two methods currently in existence:
- Section 94 developer contributions - the subject of this study
- Section 94 levy

  This study focuses on the calculation of Section 94 developer contributions, with other methods considered on a case-by-case basis.

1.4.4 Determining Nexus

Nexus means the relationship between the expected types of development within an area and the demand for additional facilities generated. In terms of transport facilities, it is the relationship between the expected types of development and the demand for additional traffic and transport facilities generated.

1.4.5 Determining Apportionment

Intersections and road segments within the Toronto catchment have been investigated as part of Section 2, analysis.

For intersections or road lengths that have been modelled and currently do not fail (LoS D or better), but fail prior to the horizon year of the study (2030), any upgrade will be required as a direct result of the future growth and therefore all costs should therefore be borne by these future developments.

For intersections or road lengths that have been modelled and currently represent a LoS of E or F, this is considered the point when alternative traffic arrangements should be considered. For this case, the cost of the infrastructure upgrade will be apportioned between the new development and the existing development. The 'existing development' apportionment will most likely be funded by Council. The 'new development' is funded through contribution collections, and is related to the anticipated increase in traffic volume over time.

Table 1.6 shows the apportionment for each facility proposed in the Toronto catchment. Of the intersections and road lengths analysed, only one location currently operated at a poor LoS, which is the Fassifern Rail Underpass, Fassifern Road between Tucker Close and Wallsend Road.

Table 1.6: Table of apportionment between catchments and new or existing development

Intersection	Development	
	Existing	New
Fassifern rail underpass	79.4%	20.6%

1.4.6 Threshold Analysis

The approach to determining the requirement for new or upgraded infrastructure uses a threshold analysis approach, whereby the capacity of an item (road or intersection) is reached by triggering the requirement for provision of more capacity, or alternate infrastructure.

The threshold analysis was completed for the existing design year (2015) and the horizon year 2030. Sensitivity testing was also undertaken to determine the actual year, if applicable, where each intersection reaches a LoS E on any one leg. Further analysis was then undertaken for a projected time of ten years (for signals) or 20 years (for a roundabout) to determine the appropriate life of the intersection upgrade. An additional sensitivity test of 20% was loaded for significant infrastructure improvements to ensure that if traffic on the route increases above the anticipated growth anticipated, then the facility will be able to handle to an acceptable level.

1.5 Assessment of Future Traffic and Transport Requirements

1.5.1 Introduction

This section considers the performance of the local transport network under the future demand scenarios, comments on adequacy of existing facilities, and makes recommendations on improvements to meet the adopted performance criteria.

1.5.2 Roads

The analysis of mid-block capacities across the network has applied the LoS criteria and capacity thresholds identified and adopted in Section 1.2.2 and 1.2.3. The following process has been undertaken to determine the future traffic volumes per lane on a road segment to determine if upgrade is required:

1. Surveyed traffic volumes are indexed by percentage growth anticipated to be experienced by the sub-catchment.
2. Compare these volumes against agreed service level criteria as follows:

i. As arterial and sub-arterial roads, using the mid-block capacities outlined in Section 1.2.3 of this report.

ii. In residential areas, using the mid-block Environmental Capacity outlined in the RMS Guide to Traffic Generating Development, as discussed in Section 1.2.4 of this report.

1.5.3 Intersections

Intersection analysis has been undertaken for the anticipated growth on a range of intersections within the Toronto Contributions Catchment, refer to Section 1.3.3. The study has adopted the strategic development growth and applied the percentage growth to the surveyed traffic volumes at the intersections being analysed.

The intersections were analysed in the following way:

1. Existing situation analysis is considered as base
2. Add forecast development flows to existing
3. Confirm LoS
4. Apply upgrade where necessary to achieve acceptable LoS, and demonstrate options
5. Confirm acceptable LoS
6. Apply additional future time base factor to ensure viability
7. Apply sensitivity

The analysis in relation to points 4 and 5 above are iterated until a solution is achieved that delivers an acceptable LoS and an acceptable outcome for the road network.

1.5.4 Recommendation

Through the analysis of the proposed intersections, Table 1.7 shows the proposed intersections and roads for upgrade. Further detail is given in Section 2, Table 2.3.

Table 1.7: Summary of Identified Works and Capital Cost Estimates

Toronto Central sub-catchment			
Location	**Proposal**	**Total cost incl. land**	**Cost to Toronto Plan**
Fassifern Road, Fassifern	Traffic signals	$826,896	$170,341

1.5.5 Public Transport Infrastructure

Bus shelters:

The assessment of local public transport facilities has been undertaken. The rationale considered appropriate is as follows:

- Adopt rate of one shelter per 1,000 residents (or part thereof). This will be considered the Minimum Service Level (MSL) benchmark.
- Population in the Toronto Contributions Catchment is 31,487 people.
- There are 41 shelters in the Toronto Contributions Catchment
- There is a current oversupply of 9 shelters based on this information.
- Anticipated population increase over 15 years of 5,412 people, total population of 36,899, which is an increase of 17.2%.
- At 1 shelter per 1,000 people, 37 shelters are required, and therefore no additional shelters will be required within the Toronto catchment to be funded by this Plan.

Other bus infrastructure:

The Disability Standards for Accessible Public Transport (DSAPT) 2002 require Council to have reached 90% compliance for accessible bus stops by 31 December 2017, and 100% compliance by 31 December 2022. The Toronto Contributions Catchment has approximately 232 existing bus stops (not including hails and ride bus stops which are being replaced with formal bus stops over time). It is estimated that around 41 (17.7%) of these existing bus stops comply with the DSAPT requirements.

Council's current Disability Action Plan states the following regarding disability:

1. In June 2011, statistics provided by the RMS showed that Lake Macquarie had the highest number of Mobility Parking Scheme holders in NSW at 13,073.
2. Lake Macquarie has a slightly older population than the NSW average. 34,846 people are aged 65+ years, which is 18% of the LGA's population. 24,953 people are aged 55-64 years, which is 13.2% of the LGA's population.
3. 11,572 people need assistance with core activities, which is 6% of the LGA's population (this covers mainly people with severe to profound disabilities).

It is estimated that currently 17% of Lake Macquarie residents are considered to have a disability where access is made difficult. The current service level provision in the Toronto Catchment of 41 compliant stops of the overall 232 stops results in 17.5% compliance. The population is projected to increase 17.2% over the next 15 years, then an additional 17% of the current service level is required to be upgraded. This results in an additional 7 stops requiring the minimum upgrade. The minimum upgrade is considered to be a concrete pad, seat, Tactile Ground Service Indicators and path connecting to a service such as a shop, school, or other facility. The list of upgrades are included in Section 3.2.

1.6 Proposed Works

The Proposed Works Schedule for roads and intersection improvements have been shown in Table 1.7, are detailed and worked in full in Table 2.3, with a plan and cost estimate contained in Section 3.

A cost estimate has been developed for each item within the proposed work schedule. The approach taken to developing the concept design and estimate for the basis of developing contributions is described below.

1.6.1 Concept Designs

For the purpose of this study, a concept design is at a minimum a general arrangements plan, with sufficient detail to allow calculation of concept stage engineering estimates based on Council's Schedule of Rates or using similar constructed projects as a basis. It does not allow for any detailed consideration of ground conditions including underground or overhead service relocations, drainage calculations or any detailed level of geometric design or earthworks calculations. It relies on the principle of deriving strategic estimates for engineering road works and intersection facilities as illustrated in Figure 1.2 below.

1.6.2 Criteria for Concept Estimates

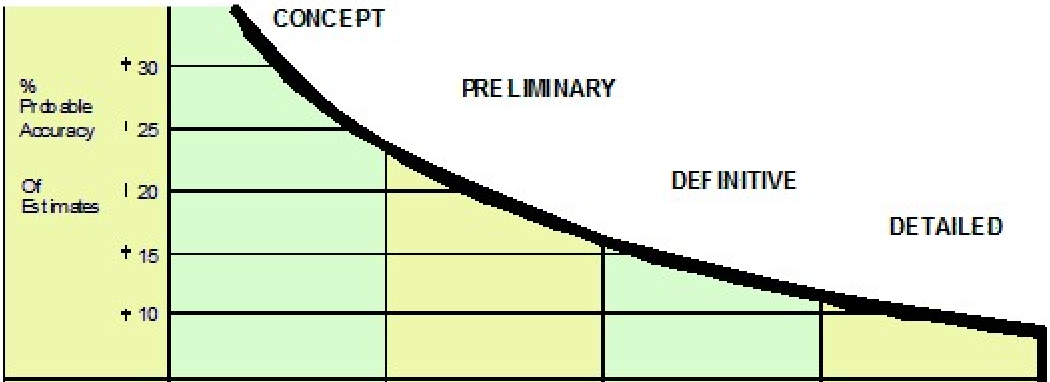
The accuracy of estimates at each stage of the design process is reflected by the extent of detailed knowledge of site conditions known at the time.

The process of preparing engineering estimates is iterative, and dependent on the level of detail information available. Types of information that can affect the estimate include the following items;

1. Existing services information
2. Relocation of existing services
3. Earthworks
4. Pavement design
5. Prepare a basic drainage layout for pipes and pit details
6. Type of traffic control (signals, priority, roundabout)
7. Traffic management control during construction
8. Cost of survey
9. Cost of design and project management
10. Cost of geotechnical investigations
11. Project management

Road Infrastructure Cost Planning

- Concept
- Preliminary
- Definitive
- Detailed



Type of Estimate	Order of Magnitude	Preliminary	Definitive	Detailed
Documentation Provided	• Project capacity and Location • Cost Data on Similar Projects • Major Component List	• Preliminary Bill of Quantities • Engineering Line Diagram • General Arrangement • Maps and Surveys • Bench Test Results • Nature of Facilities	• Equipment Specifications and Vendor Quotations • Construction Schedule • Electrical One Lines • Piping and Instrumentation Flow Diagrams • Soil Data and Architect Features • Site Survey and Labour Complete	• Bulk Material Specifications and Vendor Quotes • Construction Specification and Sub Contractor Quotations • Engineering Advanced Approximately 10%
Definition of Scope of Work	Conceptual	Approximate	Clearly Described Essentially Complete	Complete. Well Detailed
Estimating Procedure	Factoring	Combination of Factoring and Quantity Take-Off	Most Quantity Take-Off. Very little Factoring	Complete Quantity Take-Off
Use of Study	Comparison/ Rejection	Final Feasibility	Budget	Funding

Figure 1.2: Cost Estimating Criteria

The estimating process can be staged as follows:

1. **Concept Development -** based on initial considerations such as capacity and functional requirements, costs generated from strategic estimates from comparable works.
2. **Preliminary Design Costing -** based on the existing concept layouts. No further design but enquiries to utility providers, basic appraisal of ground conditions, drainage network estimates and a basic layout added to the concept. Use standard cost rates and surface area measurements.
3. **Detailed Design** - this will cover services information, geotechnical investigation and pavement design, survey, roads and drainage design, utilities relocation agreements with providers, traffic signal design, road safety audit of design, design certification, and preparation of bills of quantities.

4. **Contract Stage -** will require preparation of tender documents, inviting tenders, assessment of tenders, negotiations and arranging signing the contract, negotiations and agreement with RMS and Council on certifying and approving procedures, contract administration and inspections, Contract Completion procedures and Works as Executed drawings.

Using Figure 1.2 as a guide for engineering cost estimates, the confidence limit and therefore contingency are outlined in Table 1.8 below

Table 1.8: Engineering Works Cost Estimations

Stage	Confidence Limits	Comments
Concept Design	**+ 40% to – 20%**	Scope of works defined in outline & global estimates made for groups of elements.
Preliminary Design	**+ 25% to – 15%**	Most works identified & sized; global estimates made for some groups of elements; a detailed bill prepared for other elements.
Detailed Design Review	**+ 20% to - 10%**	All works sized & identified with some quantities at preliminary level, and some work methods not specified; a detailed estimate made for all elements.
Pre tender	**+ 15% to - 5%**	All elements, which have been designed & identified, are quantified. A cost is estimated for each element taking into account issues related to methods of construction.
Contract Agreement	**+ 10%**	Prices for all identified works agreed between owner & constructor
Construction completed	**+/- 0%**	All costs known & agreed & works accepted by owner

Notes

- The confidence limit is interpreted as the contingency range applicable to the project at that stage of design. It is considered at concept design stage, the contingency is in the order of 20 to 40%. Based on previous experience, for roundabouts a contingency of 35% has been allowed for, and for all other projects a contingency of 20% has been applied.
- The actual cost of works can only be known when the works have been finished and accepted as meeting the requirements specified.
- If an element of the works is identified, it can be quantified and an estimate of cost applied to this element. Not all elements can be identified during the design stages resulting in omissions from the estimates. As the design is developed in detail, the accuracy of identifying and estimating each element increases.

- If the opinion of cost is derived from the elements of the works, it will usually only have plus errors of estimate. Minus errors (reductions) are rare because it is rare to identify elements, which are later not, required as part of the works.
- In presenting the opinion of cost, the actual amount to be stated should be the total amount including the contingency.

1.6.3 Basis of Applied Unit Rates for Construction

For the purpose of this study, concept estimates have been derived from available data and a comparison of unit rates / comparable constructions for civil engineering works.

This approach provides for reasonable average costs estimates. Final costs determined at contract stage may be higher or lower but overall will be consistent with the average costs so that individual contribution rates for transport facilities are appropriately determined.

1.6.4 Land Value

Where an item of upgrade works identifies the need for land acquisition as part of the design process, Council’s Property Services Department will provide land valuations to enable land costs to be incorporated into the relevant works schedules and contributions calculations.

There is no land acquisition required for intersection or road upgrades within the Toronto Contributions catchment.

1.7 Monitoring and Review

1.7.1 Review Requirements

The Legislation governing the application of s94 Contribution Plans require plans to apply to 'reasonable' timeframes, and to include review mechanisms to ensure contributions collected and works planned are delivered with the prescribed timeframe of the plan. Council has therefore proposed regular reviews of the plan, so that any time and monetary adjustments can be made.

1.7.2 Indexation

All contribution rates will be subject to indexation, the rate to be agreed with Council as appropriate for application to the proposed works.

1.8 References

- Lake Macquarie Cycling Strategy 2012 to 2022
- Lake Macquarie Footpath Strategy 2013 to 2023
- Lake Macquarie City Council Development Control Plan 2014
- LMCC Section 94 Contributions Plan Citywide 2004
- RMS Guide to Traffic Generating Developments 2002 and update Technical Direction TDT 2013/04a

2 Analysis – Assessment of Traffic and Transportation requirements

The intersections evaluated in the Toronto Contributions catchment are listed in Table 2.1.

Table 2.1: Intersections investigated within the Toronto Contributions Catchment

	Location	Worst movement				Comments
		2015 LoS		2030 LoS		
		AM	PM	AM	PM	
1	The Boulevard and Pemell Street, Toronto	A	A	A	A	No works required
2	Brighton Avenue and Victory Parade, Toronto	A	A	A	A	No works required
3	Pemell Street and Brighton Avenue, Toronto	A	A	A	A	No works required
4	Park Street and Marmong Street, Booragul	A	A	A	A	No works required
5	Bay Road and Quigley Road, Bolton Point	A	A	A	A	No works required
6	Hayden Brook Drive and Enterprise Way, Woodrising	A	A	A	A	No works required
7	Dorrington Road, Clydebank Road and Rosemary Row, Rathmines	A	A	A	A	No works required
8	First Street and Fourth Street, Booragul	A	A	A	A	No works required
9	York Street and Anzac Parade, Teralba	A	A	A	A	No works required
10	Summerhill Drive, Dobell Drive and David Street, Wangi Wangi	A	A	A	A	No works required
11	Fassifern Road and Tucker Close, Fassifern	F	E	B	B	Section 2.1

The Works Schedule (Table 2.2) details the works required at intersections and road lengths within the Toronto Contributions Catchment.

Table 2.2: Works Schedule – Toronto Contributions Catchment

Suburb	Location	Existing	Proposal	Year upgrade required	Existing PVT's	PVT's to failure	Land acquisition area	Total Facility Cost	Cost apportioned to this Plan
Fassifern	Fassifern Road north of one lane underpass	Stop sign	Installation of traffic signals	2015	603	Failed	0	$826,896	$170,341

Total	$170,341

2.1 Fassifern Road, Fassifern, at the Fassifern Rail underpass

2.1.1 Background

Fassifern Road is part of a Collector road route connecting (via Macquarie Road, South Parade, Railway Parade and Cook Street) the State Roads of Main Road and The Boulevard. The route is not the most direct route between the two State roads, however provides access to the Fassifern Rail Station, Charleton Christian College (regional school), western areas mines, as well as a significant residential catchment. Fassifern Road carries approximately 6,000 vehicles per day. Fassifern Road at the rail underpass is constrained by the heritage listed tunnel which limits traffic to one lane, with the northbound traffic requiring to stop when approaching the tunnel. The southbound traffic has right of way.

Figure 2.1: Fassifern Road rail underpass

The underpass is described as follows in the heritage register:

Rail overbridge (1910): The rail overbridge is a reinforced concrete arched structure immediately east of the elevated platform at Fassifern Station, which is only wide enough to allow one lane of pedestrian and vehicular traffic. A modern steel balustrade and concrete deck has been installed above.

Significance: The overbridge is an integral part of the Fassifern to Toronto Branch Railway Line. This line was a major reason for the development of Toronto as a lakeside resort, and for many years made it possible for people to visit Toronto easily, for regattas, picnics and holidays, and later, for people to live in Toronto and commute to Newcastle to work. The overbridge at present serves as an official shared pedestrian and cycle path.

It has the potential for viable continuing use if the Toronto line is ever re-opened as a light railway/tramway, or if the line became part of a network of heritage trails around Lake Macquarie.

LEVEL of SIGNIFICANCE - 1993: Regional Significance - high (as part of the Branch Line) Local Significance - high

2.1.2 Projected Growth

The underpass is located in the Toronto Central sub-catchment. This sub-catchment comprises the suburbs of Toronto, Fassifern, Fennell Bay, and Blackalls Park. Residents and businesses from these suburbs are most likely to use Fassifern Road to access residential areas, schools, shops, businesses, employment and so on. This catchment has a 15-year growth projection (2015 to 2030) of 20.6%.

Due to the heritage listing of the underpass, widening involving demolition works will not be considered. Installation of an additional tunnel will be cost prohibitive, and will involve realignment of the road, replacement of the shared path that runs over the Toronto to Fassifern rail line, retention of the former heritage listed rail infrastructure, relocation of services, and land acquisition.

2.1.3 Analysis

Fassifern Road in the northbound direction currently operates at a LoS F in the AM peak (Table 2.3), and LoS E in the PM peak (Table 2.4).

Table 2.3: Fassifern Road AM 2015

STOP **Site: Fassifern rail underpass AM 2015**

Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: north approach											
2	T1	272	0.0	0.407	6.4	LOS A	3.1	22.0	0.70	0.70	54.3
Approach		272	0.0	0.407	6.4	NA	3.1	22.0	0.70	0.70	54.3
North: south approach											
8	T1	331	0.0	0.864	64.1	LOS F	23.7	165.9	1.00	1.86	29.2
Approach		331	0.0	0.864	64.1	LOS F	23.7	165.9	1.00	1.86	29.2
All Vehicles		603	0.0	0.864	38.1	NA	23.7	165.9	0.86	1.33	36.9

Table 2.4: Fassifern Road PM school peak 2015

Site: Fassifern rail underpass PM 2015

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: north approach											
2	T1	302	0.0	0.357	2.9	LOS A	2.4	16.5	0.58	0.43	57.2
Approach		302	0.0	0.357	2.9	NA	2.4	16.5	0.58	0.43	57.2
North: south approach											
8	T1	210	0.0	0.611	37.1	LOS E	8.1	56.4	0.93	1.30	37.3
Approach		210	0.0	0.611	37.1	LOS E	8.1	56.4	0.93	1.30	37.3
All Vehicles		512	0.0	0.611	16.9	NA	8.1	56.4	0.72	0.79	46.9

The AM peak is the critical peak, with the queuing extending from the tunnel to the school entrance. Due to the heritage listed tunnel that the road travels through, the most feasible option is for the installation of traffic signals either side to rationalise the traffic flow, by giving each side green time.

Sidra modelling was undertaken, which showed that the installation of traffic signals improves the intersection with a worst movement of LoS B for the 2015 and 2030 scenarios.

Table 2.5: Fassifern Road AM 2015 signalised

Site: Fassifern rail underpass AM 2015

Signals - Fixed Time Isolated   Cycle Time = 30 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: north approach											
2	T1	272	0.0	0.523	10.9	LOS B	3.6	25.5	0.90	0.74	50.9
Approach		272	0.0	0.523	10.9	LOS B	3.6	25.5	0.90	0.74	50.9
North: south approach											
8	T1	331	0.0	0.509	9.2	LOS A	4.1	28.9	0.85	0.71	52.1
Approach		331	0.0	0.509	9.2	LOS A	4.1	28.9	0.85	0.71	52.1
All Vehicles		603	0.0	0.523	9.9	LOS A	4.1	28.9	0.87	0.72	51.5

Table 2.6: Fassifern Road AM 2015 signalised

MOVEMENT SUMMARY

Site: Fassifern rail underpass AM 2030 + 20.6%

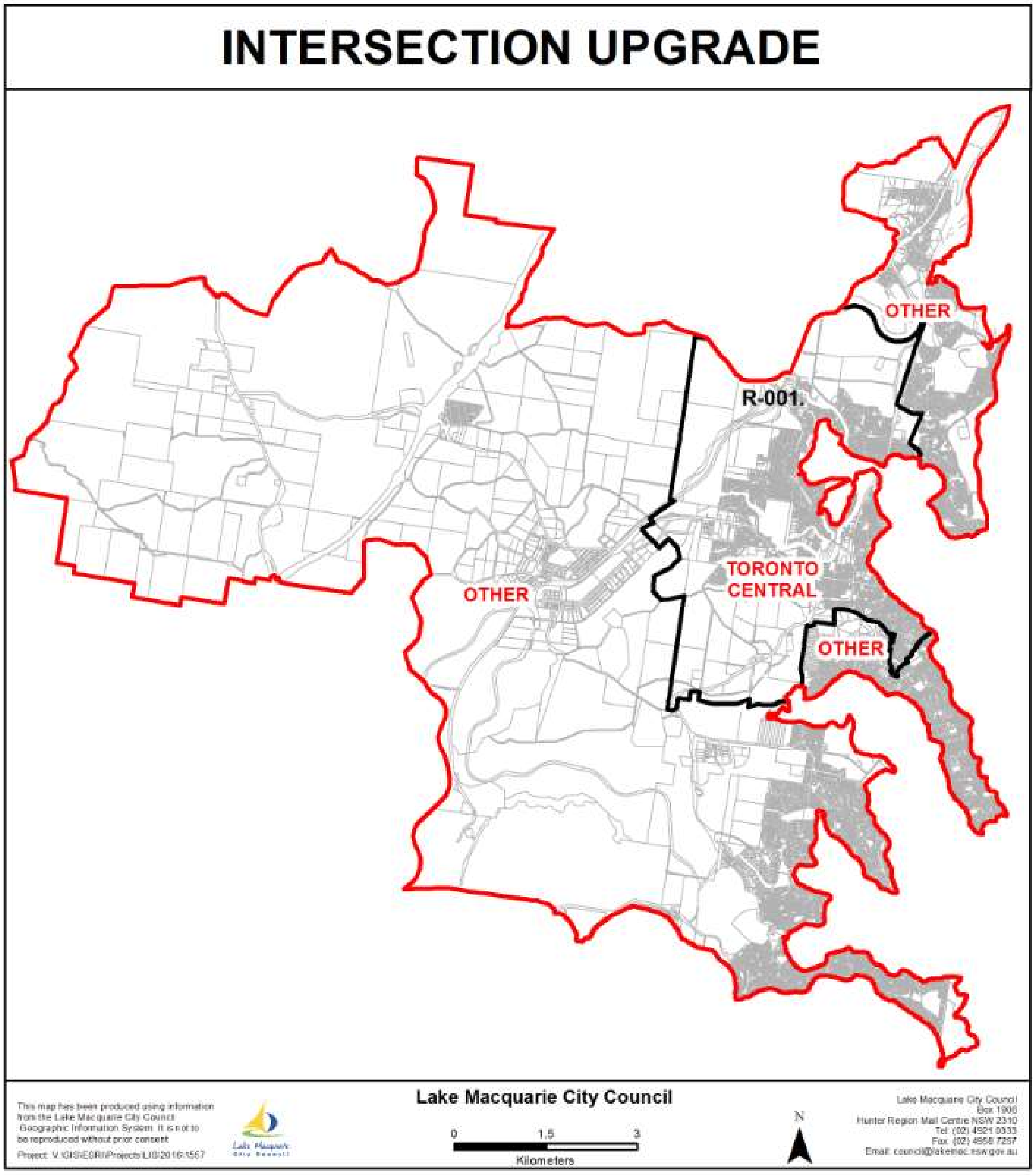
Signals - Actuated Isolated   Cycle Time = 39 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: north approach											
2	T1	328	0.0	0.505	12.2	LOS B	5.2	36.6	0.83	0.70	50.0
Approach		328	0.0	0.505	12.2	LOS B	5.2	36.6	0.83	0.70	50.0
North: south approach											
8	T1	400	0.0	0.571	11.8	LOS B	6.4	44.9	0.84	0.71	50.2
Approach		400	0.0	0.571	11.8	LOS B	6.4	44.9	0.84	0.71	50.2
All Vehicles		728	0.0	0.571	12.0	LOS B	6.4	44.9	0.83	0.71	50.1

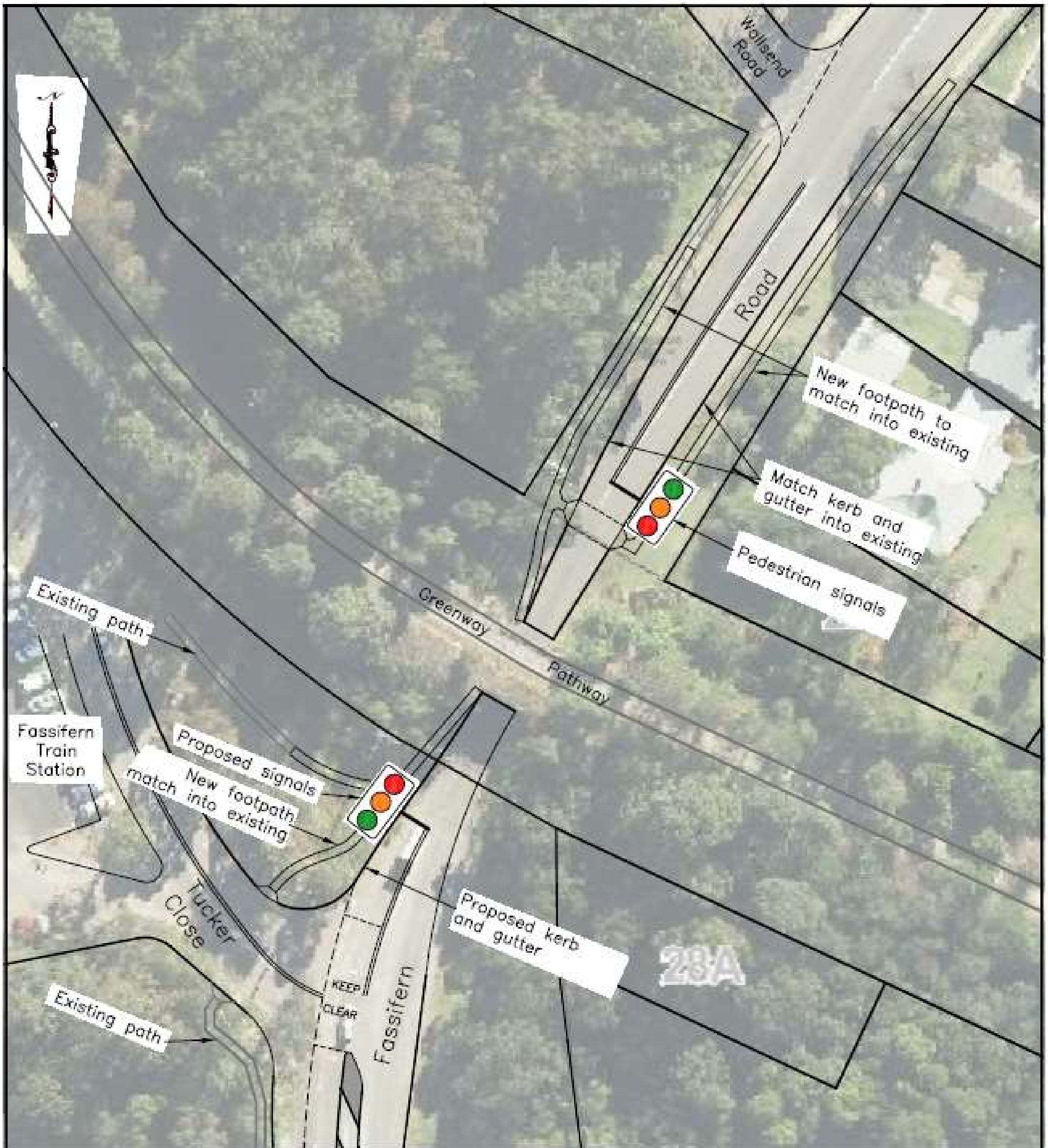
2.1.4 Conclusion

It is recommended that traffic signals be provided at the Fassifern rail underpass to improve the queuing and delay experienced by northbound motorists, and to improve the worst movement LoS from F to B.

3 Proposed Upgrades and Cost Estimates



3.1 R-001: Fassifern Road, Fassifern – Traffic Signals

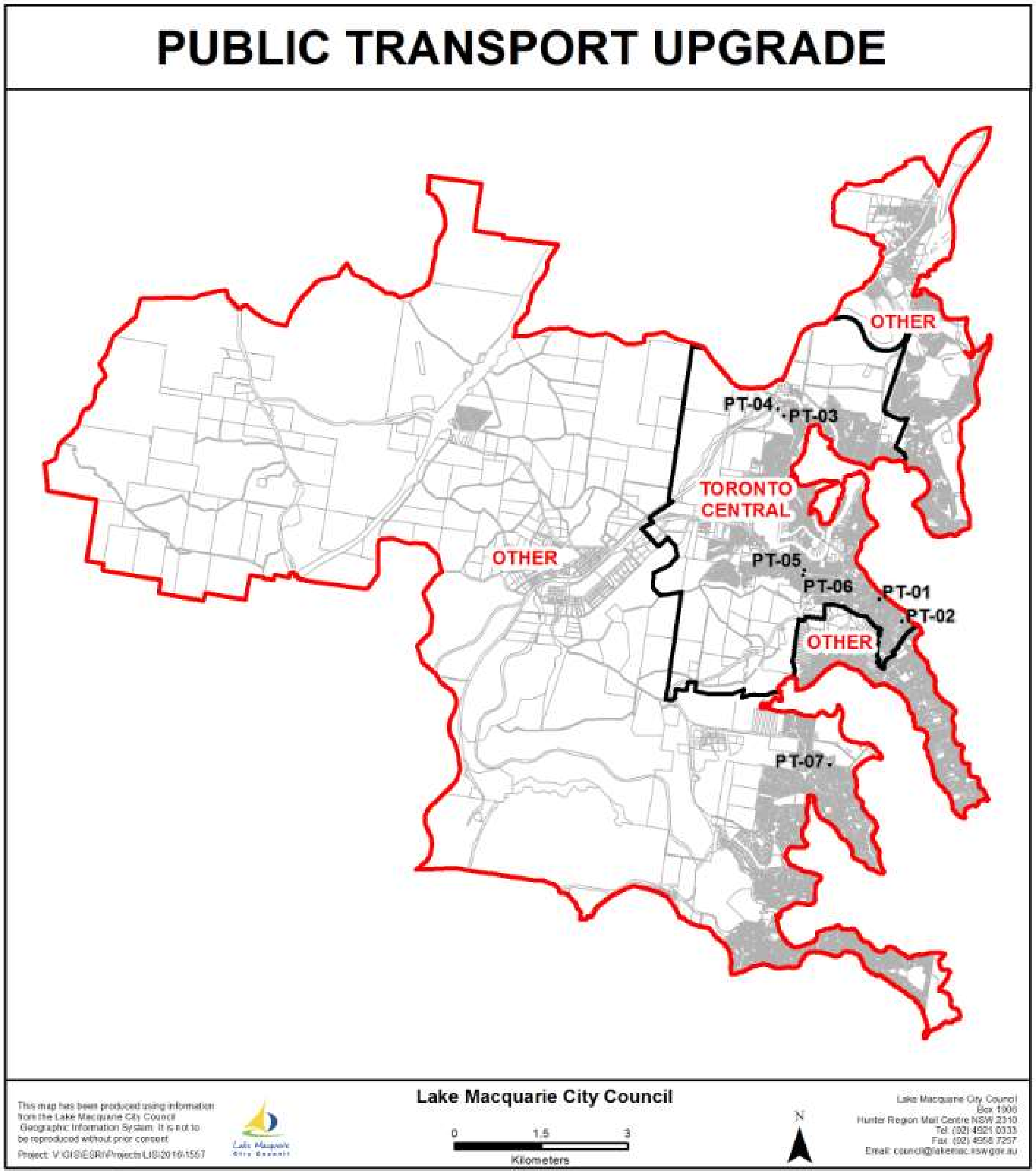


NOT TO SCALE

Lake Macquarie City Council	PREPARED BY: Asset Management – Transportation Planning 126-138 Main Road Speers Point Ph. (02) 4921 0333	PROPOSED TRAFFIC SIGNALS AND TRAFFIC FACILITIES UPGRADE ON FASSIFERN ROAD AT THE FASSIFERN RAILWAY OVERBRIDGE, FASSIFERN.	
PROJECT NUMBER: TBA			
Drawn By: RAJ	Original Sheet Size A4	All Dimensions in metres (m) unless otherwise noted	Sheet 1 of 1
Scale: : NA	Date: 01/04/2016	Cad File: T:\Assets\TransportationPlanning\Plans and Sketches for TP\Fassifern - Fassifern Road-Fassifern Railway Overbridge.dwg	

Item	Quantity	Rate	Cost estimate	Funding source
Administration	duration		$30,000	
Traffic Control	duration		$40,000	
Investigations and Design	1 off	Lump sum	$40,000	
Road pavement	480 m²	$150 per m²	$72,000	
Kerb and gutter	200 metres	$350 per lineal metre	$70,000	
Footpath (one side)	160 metres	$350 per lineal metre	$56,000	
Drainage	30 metres	$1175 per lineal metre	$36,000	
Electrical services –power, street lights, traffic control signals		Estimate based on similar projects	$300,000	
Sub total			**$644,000**	
Contingency		20%	$128,800	
Project Management		7% of total project construction cost	$54,096	
Total cost estimate – design and construction			**$826,896**	
		S94 (20.6%)	$170,341	

3.2 Toronto Catchment – Proposed Public Bus Infrastructure Upgrade



The following bus stops are proposed to be upgraded to comply with the minimum standard as part of the Plan. The minimum upgrade will cost and estimated average of $15,000 per stop.

PT-01. Toronto – Brighton Avenue, north side between Wharf Road and Jarrett Street

PT-02. Toronto – Brighton Avenue, south side between Wharf Road and Jarrett Street

PT-03. Fassifern - Fassifern Road Fassifern, east side south of Tucker Close

PT-04. Fassifern - Fassifern Road Fassifern, west side south of Tucker Close

PT-05. Toronto – Awaba Road at William Street, north side

PT-06. Toronto – Awaba Road at William Street, south side

PT-07. Rathmines – Rosemary Row, south side fronting school

Total Section 94 funding required: $105,000

Lake Macquarie
City Council