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Wollondilly Shire Council

Wollondilly Bike Plan

Final Report

May 2011

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

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1. Introduction

1.1 The Commission

GHD Pty Ltd (GHD) was engaged by Wollondilly Shire Council to undertake the *Wollondilly Bike Plan*. This report documents the outcomes of the study.

1.2 Study Background

Wollondilly Shire Council is a rural focused Council on the south western fringe of the Sydney metropolitan area. The Shire is comprised of a number of isolated townships connected by significant lengths of road. Council has a long term focus on improving 'green' transport options, including bicycle facilities, to provide more transport choices for the community. Council seeks to update the original adopted Bike Plan (1993) and the adopted Shared Cycleway Strategy (2009).

This study forms one of the first steps in providing new cycling facilities across Wollondilly Shire.

1.3 Scope

The scope of this study is to provide Wollondilly Shire Council with a local-level understanding of:

- The existing cycling network across the Shire;
- The key issues of concern with regard to existing cycling activities, safety and demographics; and
- Recommendations of potential improvements to the existing cycle network infrastructure, catering for various user groups.

1.4 Objectives of the Study

The objectives of the study are to review the current cyclist needs in Wollondilly Shire and to provide a consistent standard of facilities for cyclists within the Shire. Through the implementation of the Bike Plan, it is hoped that cyclist activity will increase and thereby improve the amenity for all local residents and visitors to the Shire.

Cycling is also important from a sustainability perspective as it is a viable alternative to the use of private cars or public transport, and are emission free forms of getting from 'A' to 'B'. With walking, cycling is the only readily available mode of transport that produces no emissions. When considered in conjunction with the low cost of walking and cycling and the health benefits, there are several positive impacts.

1.4.1 Bike Plan Objectives

The specific objectives for the Bike Plan are to:

1. Provide an overarching strategy for provision of cycle facilities within the Shire;
2. Increase use of bicycles within the community;
3. Encourage alternative methods of transport;
4. Improve community health and provide safer routes to school;
5. Reduce the number of missing links and severance within the existing bicycle network;

6. Reduce the number of bicycle accidents;
7. Improve connectivity of the cycle network with other transport modes, primarily bus, car, train and pedestrians; and
8. Complement existing and planned cycleways.

This study has focused upon extending the existing network of bicycle facilities. It is assumed that Wollondilly Shire Council has existing programs for the maintenance and upgrade of existing facilities. This study therefore aims to add greatest value to Council's strategies and works programs by identifying the gaps in existing networks and extending the networks where appropriate.

1.5 The Study Area

1.5.1 Wollondilly Shire

Wollondilly Shire is located at the south western fringe of the Sydney metropolitan area approximately 75 kilometres from the Sydney CBD, and has a resident population of approximately 40,000 (2006)[1]. Wollondilly is predominantly a national park and rural area, with urban areas in fifteen towns and villages. The Shire encompasses a land area of approximately 2,500 square kilometres, of which about 90% is national park, bushland, water catchment or rural. Two-thirds of the population live in the urban centres, and one-third in the rural areas.

The major townships are shown in Figure 1 with brief descriptions provided below.

1.5.2 Appin

Appin currently has a population of approximately 1,400 and is located in the south-eastern corner of the shire. The main road runs through the centre of the township linking to Campbelltown in the north, Wilton in the southwest and Wollongong to the southeast.

1.5.3 Bargo

Bargo has a population of approximately 3,300. The majority of the town lies to the west of Remembrance Driveway and the rail line. A significant proportion of the town amenities such as the shopping centre, sports ground and sports club are also on the western side with the exception of the primary school.

1.5.4 Buxton

Buxton, located in the south of the shire, has a population of approximately 1,700. The township is divided in by the railway line, with parallel roads on both sides. The road located on the western side is the through road connecting Buxton to Thirlmere and Wingecarribee, while the road on the eastern side is a local access road to residential streets and the primary school. The east and west sides of Buxton are connected by a railway bridge south of the station.

[1] http://profile.id.com.au/Default.aspx?id=248&pg=138&gid=10&type=enum

1.5.5 Douglas Park

Douglas Park is a township of approximately 800, and is clustered around the train station, to the west of the Hume Highway. The primary school is located to the north of the township while the sports ground is located south of the rail line.

1.5.6 Oakdale

Oakdale is situated in the western part of the populated region of Wollondilly and has a population of approximately 1,000. The primary school and park are located together although they are divided by Burragorang Road.

1.5.7 Picton

Picton is the administrative centre of the Shire and has a population of approximately 3,000. The town is dispersed spatially in a north-south direction resulting in potentially lengthy distances between different destinations. The Botanical Gardens in the north provide a traffic-free recreational area along the river, while the shopping centre and primary school are located in the administrative centre of the town. Wollondilly's only high school is located on the southern periphery, on Remembrance Driveway, in the same vicinity as the leisure centre and the industrial park.

1.5.8 Tahmoor

Tahmoor is located to the south of Picton on Remembrance Driveway and has a population of approximately 4,200. The majority of the amenities such as the primary school, community centre and shopping precinct are located on the eastern side of the rail line.

1.5.9 The Oaks

The Oaks township is located on the main route that connects Picton to Warragamba and Silverdale and has a population of approximately 1,500. Several community facilities such as the shopping centre, primary school and playground are clustered together in the centre of the township, with a large sports ground located to the west of the town.

1.5.10 Thirlmere

Located to the west of Picton, Thirlmere has a population of approximately 2,900. Towards the southern periphery of the town there is the historic railway museum. The rail line runs through the town and is crossed by road just north of the museum. The primary school, sports ground and shopping centre are located close by to the west of museum.

1.5.11 Warragamba and Silverdale

In the north of the Shire, together Warragamba and Silverdale have the largest township population of approximately 4,500. A significant proportion of the population live in Silverdale although the majority of the amenities such as the swimming pool, sports ground, shops and primary school are located in Warragamba.

1.5.12 Wilton

Wilton is currently one of the smaller townships within Wollondilly, with a population of approximately 800, and can be bypassed by through traffic on Picton Road. Aside from a residential area, Wilton has a small cluster of shops and a recreation area. The Bingara Gorge development just to the north west of Wilton has been earmarked for future residential development, some of which has already begun.

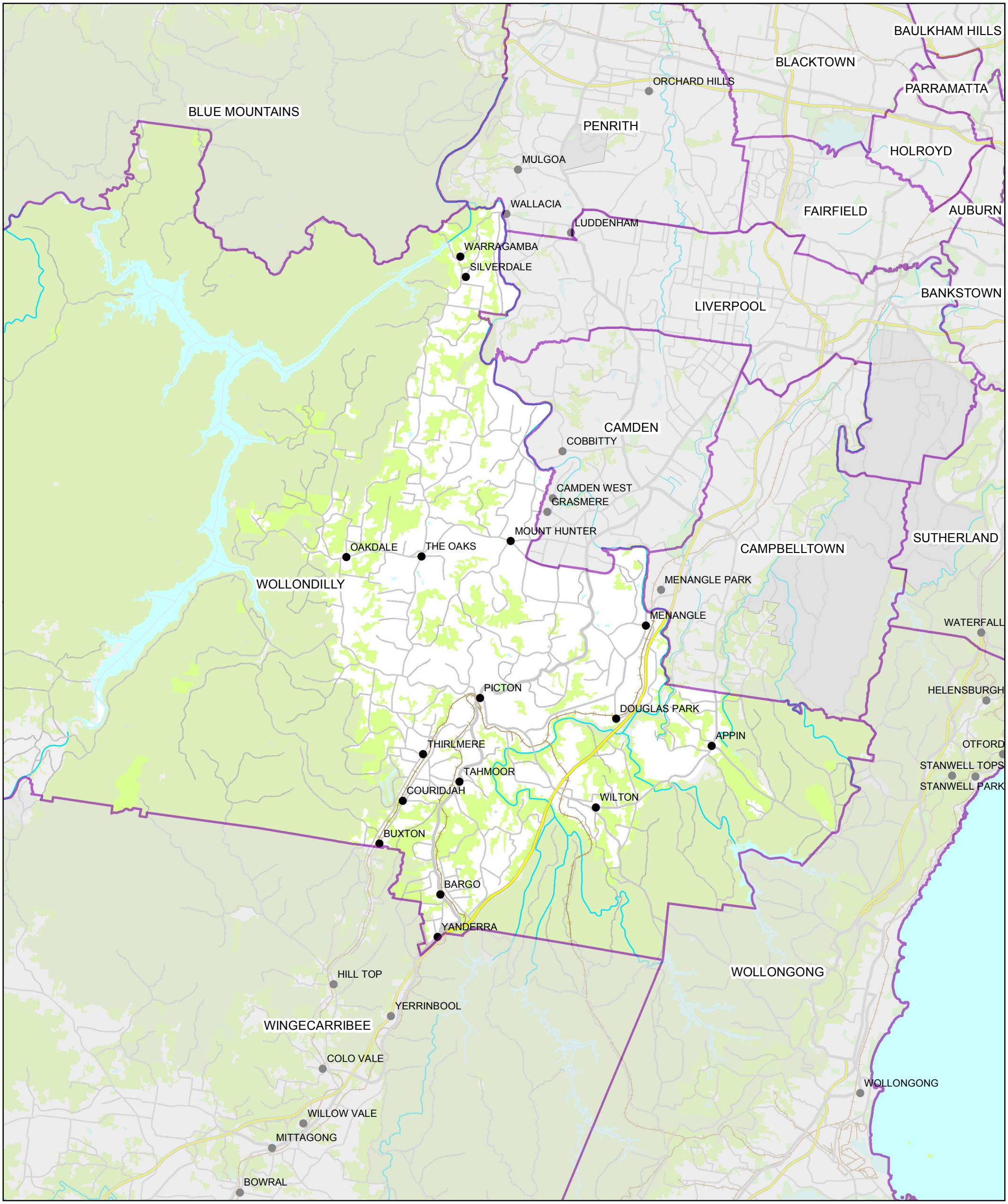
1.5.13 Yanderra

Yanderra is a small township with a population of approximately 550 close to the southern shire boundary with Wingecarribee. It is bypassed by Remembrance Driveway and the Hume Highway, resulting in minimal through traffic. It has a primary school located in the heart of the residential area which is linked by a bike path to Bargo.

1.6 Report Structure

This report details background information, site observations, recommended treatments and the likely cost of such treatments. Each are dealt with in detail in various sections of the report.

- Section 2 provides a review of background information including existing documents and an assessment of crash data;
- Section 3 provides some introductory guidance on planning for cyclists and describes the methodology used for identifying cyclist needs;
- Section 4 describes the consultation process undertaken for this project;
- Section 5 outlines the existing status of cycling conditions in Wollondilly;
- Section 6 provides details of the proposed improvements to cycling facilities by both town and priority;
- Section 7 outlines further considerations for bicycle users, such as maintenance, potential monitoring criteria, bicycle parking and other measures to increase cycle use in Wollondilly; and
- Section 8 provides a short summary of the Bike Plan.



Legend

- Populated Place
- LGA's
- Wollondilly LGA
- Roads
- Railways

1:250,000 (at A3)

5 2.5 0 5 Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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Wollondilly Shire Council
Wollondilly Bike Plan

Locality Map

Job Number 21-20163
Revision A
Date 13 MAY 2011

Figure 1

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133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.

2. Background Information

2.1 Existing Travel Characteristics

Travel within the shire of Wollondilly is currently dominated by the use of private cars. This type of behaviour is typical in localities characterised by a dispersed, low density population where residents frequently travel out of the area for school and work opportunities. Such areas find public transport is incompatible with travel destinations such as home and work and many trips to work are also combined with travel to school.

Wollondilly Shire Council's *Growth Management Strategy 2010* identified the need to create opportunities within the district for employment and schooling with the potential to reduce the travel distance to work and school.

2.2 National, State and Local Reports and Strategies

The initial stages of this study included a document collation and review exercise, in order understand guidelines and outcomes from previous strategies and studies. The review of such studies serves two purposes:

- To ensure the Wollondilly Bike Plan aligns with regional, state and national policy directions in relation to the development of not only bike plans but also the wider context of transport and urban planning; and
- To help the study team identify any deficiencies within the current network and strategy that may hinder its success.

These should ensure that the bike network succeeds in so far as it encourages and supports cycling activity within, to and from the region.

A brief summary of key points from existing reports has been provided below. These summaries are intended to be used a reference points throughout the project to ensure the bike plan remains focused on the strategic directions and addresses key deficiencies within the network.

2.2.1 National

National Cycling Strategy 2011-16 (AUSTROADS, 2010)

The strategy outlines an aspiration for step change in the future attitude to cycling. The strategy believes that the increased use of bicycles could dramatically increase the health benefits and therefore quality of life of many Australians. The benefits of cycling do not stop at personal health, they also include:

- Reduction in transport costs; and
- Reduction in road congestion leading to a cleaner environment.

Key statistics quoted from the Australian Bureau of Statistics show a decline in individuals using cycling a mode of transport to either work of study, which is why the strategy has outlined cycling promotion as a key priority of the strategy. It states that in conjunction with the promotion of cycling as a safe and viable method of transport the improvement of connectivity and end-of-route facilities should encourage a growth in regular cycling.

2.2.2 State

NSW Bike Plan (NSW Government, 2010)

The plan sets out an objective that by 2016, 5% of all journeys under 10 kilometres will be by bike. It commits $158 million over 10 years to fill gaps in Sydney's network of cycleways. This plan complements and builds on the *Metropolitan Transport Plan 2010* by looking at methods of implementation and delivery. The plan focuses on the need for education to support the development of such a network such as weekly cycling and ride to school groups. The plan emphasises the need of connectively not only to key community facilities but also within the network.

Key objectives include:

- The use of cycle ways to access local amenities;
- Increased awareness of existing routes;
- Encouragement of safe cycling for school children;
- Promotion of recreational cycling and cycling tourism; and
- Inclusion of cycleway provisions in future road development.

The plan does not outline any proposed routes internally or for external cycle access to Wollondilly Shire. The strategy does propose to extend a bike route south west out of Sydney through Liverpool down to Campbelltown. However the plan does not indicate that a link will be extended into Wollondilly Shire.

Metropolitan Plan for Sydney 2036 (NSW Government, 2010)

The *Metropolitan Plan* builds on the *Metropolitan Strategy* (NSW Government, 2005) 'City of Cities' approach and the *Metropolitan Transport Plan* (NSW Government, 2010) which focus on transforming Sydney from a single-centred city to a more connected, multi-centred city.

For the first time the Plan includes an active transport target to raise the mode share of bicycle trips in the greater Sydney region at a local and district level to 5% by 2016 (currently at 1%).

The Plan itself does not outline any specific plans for cycleway development in Wollondilly Shire. However it does identify the 'missing links' identified in the NSW Bike Plan (2010) as a priority for action.

South West Subregion – Draft Subregional Strategy (NSW Department of Planning, 2007)

The draft strategy has been developed in part as an aid to local governments to help inform and guide them in the development of Local Environmental Plans (LEPs). The sub-region incorporates Wollondilly Shire which is currently predominantly rural, most of which is national park.

It sets out a number of objectives that it feels will help the area flourish with the continued developed of the South West Growth Centre. These goals include:

- Planning of major housing growth;
- Encourage growth in areas with good public transport links;
- Connection of new growth centres to existing urban areas;
- Recognition of the regions rural character; and
- Protection of the natural resources.

As part as of one of the seven strategies outlined in the draft document, the development of a cycleway at Warragamba has been identified to improve everyday inter-neighbourhood access. This location is one of three that the report has identified for the RTA and local Government that requires upgrading work.

Sydney Metropolitan – Regional Recreation Trails Framework Final Report (NSW Department of Infrastructure, Planning and Natural Resources, 2005)

Trends have shown an increase in recreational cycling. This document was intended to identify missing links and develop them into opportunities and priorities for spending. The documents were developed as a strategic overview and recommended the use of guidelines to ensure consistent delivery of ground works in parallel with the promotion of cycling via a range of streams such as; brochures, internet sites and through government departments.

The document identifies the existing Lake Burragorang – Picton – Georges River trail, which runs through Wollondilly Shire. The trail is currently not continuous throughout the Shire, with a break in the trail between the tourist railway line and the southern railway line. The report identifies this link as a long-term priority with a suggested completion timeframe of 15 years or more.

2.2.3 Local

Wollondilly Council Precinct Cycleway Study Final Report (Cycleway Planning Consulting Services, 1993)

This study provided a number of recommendations within a 10-year framework, which included:

- The provision of smooth shoulders on all new roads and off-road facilities to link residential areas;
- The provision of bicycle parking;
- Ongoing maintenance of cycle ways;
- Increased awareness in bicycle safety through proficiency schemes; and
- Encouragement of cycle tourism through the production of cycle route pamphlets.

The report's compendium of proposed cycle ways was categorised into suggested stages of implementation which provides an indication to the level of priority that each route was awarded. After reviewing the proposed routes in conjunction with the current existing shared bike path maps (provided by Council for this study), it became clear that only a small proportion of the routes have been constructed, notably the Picton Botanical Garden shared pathway.

Wollondilly Shire Shared Cycleway Routes (Wollondilly Shire Council, 2009)

The report provides an extensive shared cycleway network within each urban locality as well as cycle ways that link each town or village. Although the study provides an indication of what a desirable network would look like, it does not provide any suggestion of priorities nor appear to take cost estimates into consideration.

2.3 Outline of Development Plans

Wollondilly Development Contributions Plan (Wollondilly Shire Council, 2010)

Summary

This Developer Contributions Plan describes the forecast future demands for public facilities and amenities in the Wollondilly Local Government Area (LGA), the program of works which will be implemented to meet these demands, the anticipated costs of these programs, and the basis for determining a reasonable apportionment of the costs to the incoming resident populations.

The primary purpose of the Contributions Plan is to enable Council to require a contribution towards the provision, extension or augmentation of public amenities and public services that will, or are likely to be, required as a consequence of development in the LGA.

In relation to the Bike Plan, the *Section 94 Works Schedule* indicates cycleway works to be undertaken in a precinct based approach (totalling $2.2 million) to implement the *Shared Cycleway Routes Study*.

In the *Section 94A Schedule of Works*, there is a total of $1.5 million to implement the Picton Shared Cycleway adjacent to Stonequarry Creek (consisting of land acquisition, path construction & bridging with beautification).

Recommendation

In light of this, this Bike Plan is intended by Council to supersede the *Shared Cycleway Routes Study*, which is referenced in the Contributions Plan. Therefore, drawbacks of the current Contributions Plan are that there is no provision for a Shire Wide approach relating to a bicycle plan, nor does the current Contributions Plan provide for any works in the Warragamba and Silverdale precinct. It is recommended that the Contributions Plan be updated to include this Bike Plan and to include all precincts to ensure that appropriate bicycle facilities can be provided across the Shire.

Draft Growth Management Strategy (Wollondilly Shire Council, 2010)

In recognition of expected growth from a population of 42,000 to over 60,000 in 25 years, the council recognises the need for sound development strategies to enable sustainable development to avoid rapid, ad hoc developments in the response to housing pressure. The Draft Growth Management Strategy outlines potential developments in the majority of townships which range from draft residential rezoning, potential residential growth areas, potential employment areas (industrial) and low density residential areas which are currently undeveloped.

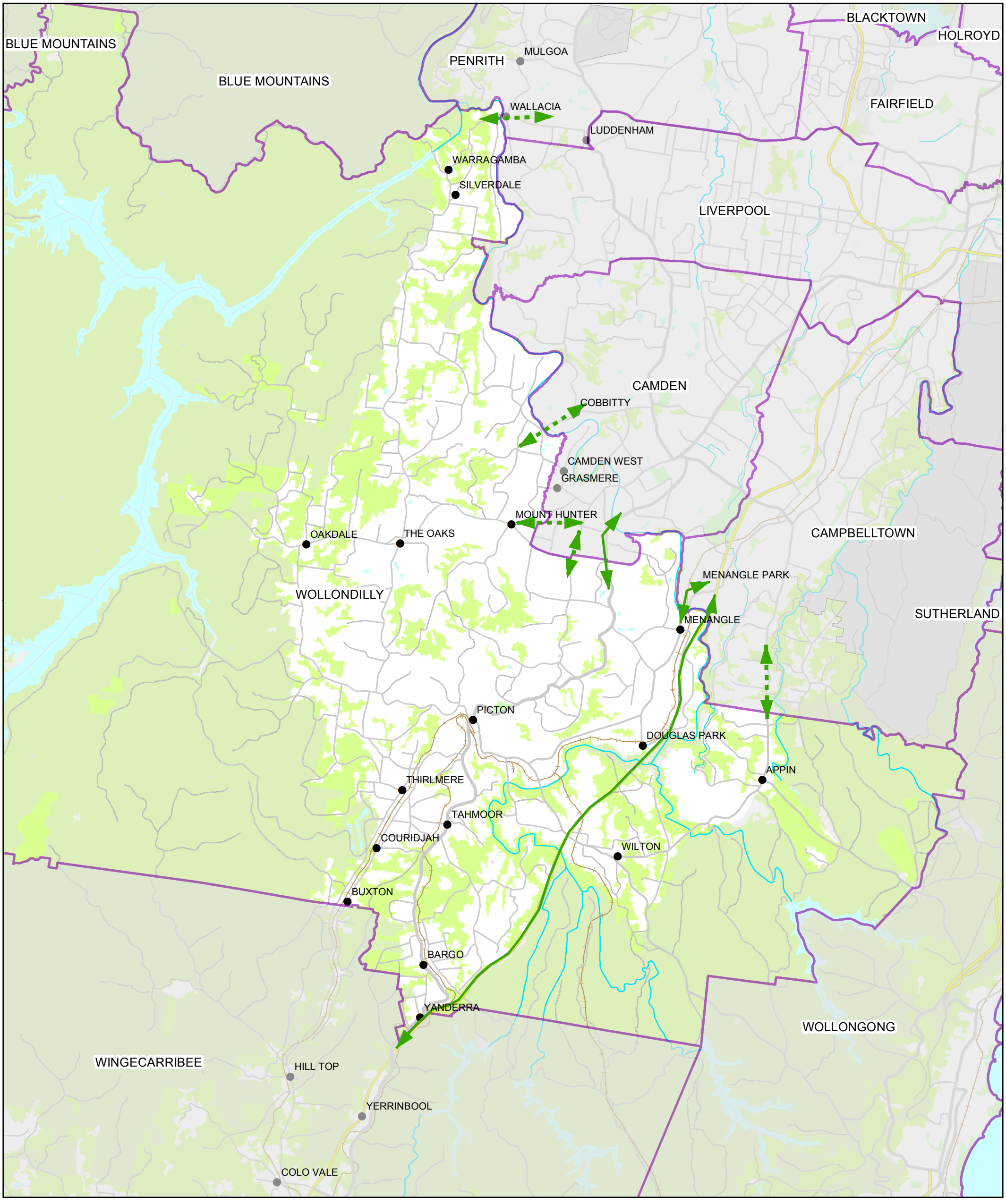
2.4 External Cycle Links

A review of relevant bike plans from council areas adjacent to Wollondilly is summarised in Table 1 and presented schematically in Figure 2.

It can be seen that several links exist to Campbelltown and Camden, while there are other proposed links to other LGAs such as Penrith. These cycle links were considered when undertaking the process of developing the proposed routes as part of this Bike Plan.

Table 1 External Cycle Links

Adjacent LGA	Bicycle Route	Status
Campbelltown	Menangle Road	Existing
Campbelltown / Wingecarribee	Hume Highway	Existing
Campbelltown	Appin Road South	Proposed
Camden	Cawdor Road	Existing
Camden	Burragorang Road	Existing
Camden	Remembrance Driveway	Existing
Camden	Cobbitty Road	Proposed
Penrith	Mulgoa Road / Park Road	Proposed



Legend

External Links

- Existing Links
- Proposed Links

- LGA's
- Wollondilly LGA
- Roads
- Railways

1:200,000 (at A3)

4 2 0 4 Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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Wollondilly Shire Council
Wollondilly Bike Plan

External Cycle Links

Job Number 21-20163
Revision A
Date 25 MAR 2011

Figure 2

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133 Castlereagh Street Sydney NSW 2000 Australia **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com **W** www.ghd.com

Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.

2.5 Crash Data Review

Cyclist incident data for the Wollondilly area for the years 2005 to 2009 originally sourced from the RTA were obtained from Council. Summarised in Table 2, the crash records indicate that there were 10 reported crashes involving cyclists over this period. Each of these crashes resulted in injury. However there were no fatalities recorded from these crashes over this period.

Table 2 Crashes Involving Cyclists in Wollondilly Shire LGA (2005-2009)

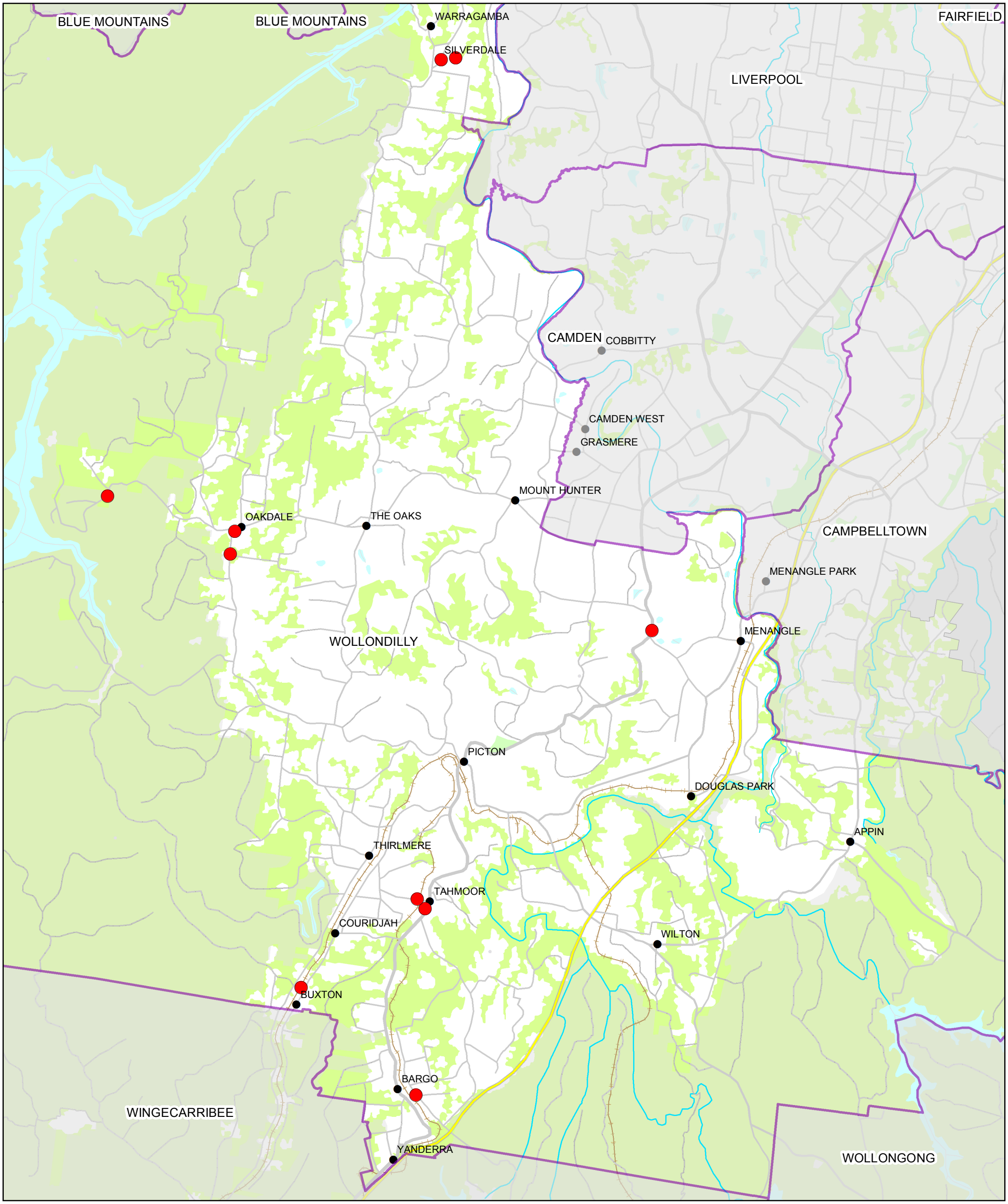
Date	Town	Location	Cyclist Injuries	Cyclist Fatalities	Comments
January 2005	Bargo	Hawthorne Road	1	0	
March 2006	Buxton	East Parade	1	0	Cycleway completed at this location after this crash.
January 2007	Nattai	Burragorang Road	1	0	
February 2007	Oakdale	Kerry Place	1	0	
May 2007	Silverdale	Silverdale Road	1	0	
August 2007	Tahmoor	Remembrance Driveway	1	0	Cycleway completed at this location after this crash.
April 2008	Silverdale	Billett Street	1	0	
July 2008	Oakdale	Russell Lane	1	0	
February 2009	Tahmoor	Castlereagh Street	1	0	
January 2009	Razorback	Remembrance Driveway	1	0	

Source: Wollondilly Shire Council (from RTA).

Overall, Table 2 and Figure 3 show no dramatic increase in cyclist incidents over the considered time frame, neither is there any specific geographic clustering of the incidents, with sites ranging from Bargo in the south of the Shire to Silverdale in the north.

However, Table 2 and Figure 3 do indicate that 80% of considered incidents occurred in urban areas with only two crashes in Nattai and Razorback occurring in less urbanised areas.

It should additionally be noted that the crash data is based on NSW Police reports, which generally under-represents the incidence of cyclist related crashes. This is due to the fact that many minor cyclist incidents do not result in tow-away crashes where police are called and the incident therefore goes unrecorded.



Legend

- Cycle Crashes
- LGA's
- Wollondilly LGA
- Roads
- Railways

1:150,000 (at A3)

3 1.5 0 3 Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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Wollondilly Shire Council

Wollondilly Bike Plan

Cycle Crashes (2005-2009)

Job Number	21-20163
Revision	A
Date	25 MAR 2011

Figure 3

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133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.

3. Project Approach and Considerations

This section presents the approach taken and factors considered in developing the Bike Plan.

3.1 Creating a Safe and Attractive Environment for Cycling

3.1.1 Background

Cycling is a highly efficient, environmentally benign form of transport. As with walking, cyclists are improving their health and contributing to an active environment at a human scale.

Cyclists move around the public domain in various ways, largely depending on the trip purpose and rider characteristics. For example, children will tend to use the footpath and cycle at low speeds, while an adult on the way to work will ride along the fastest and most direct route available (on- or off-road).

Cyclists therefore move through an "environment" in a similar way to pedestrians, although the speed and distance which they travel mean that they identify more with the concept of a network. Attention to cycling facilities should not be confined to one or two "routes" or "links" in an area, as trip origins and destinations are diverse. Every street must be a safe route for cyclists and be designed in accordance with the function, traffic volume and width of the street.

Infrastructure for cycling can be designed in a similar way to other vehicles, through consideration of speed, sight distance, priority at intersections etc. However, bicycles have a degree of manoeuvrability that makes them somewhat unpredictable to motorists and pedestrians. Therefore, the design of both on- and off-road facilities should aim to encourage predictability and clear priority at all conflict points.

3.1.2 Cyclist Needs

As for pedestrians, the provision of cyclist infrastructure should not only aim to fulfil the requirements of existing users, but to increase the number of cycling trips in the area. Such an outcome would likely result in fewer car trips (particularly for shorter travel distances), healthier residents and a more active (and safe) streetscape.

A number of elements are required in order to provide a high quality cycling environment. These include:

Coherence

Coherence refers to the extent of coverage and completeness of the bicycle facilities. Within built-up areas, coherence can be characterised by the completeness of the network. Outside built-up areas, it is characterised by the completeness of connecting routes.

Coherence also can refer to how the bicycle routes and network matches with the need to travel, offering a consistent quality across individual paths, continuity of paths and routes, and the ability to provide users with freedom of route choice.

Safety

Cyclists are particularly vulnerable road users. They are slower and smaller than the dominant vehicles in traffic, making them less likely to be seen. Furthermore, cyclists have little protection at times of collisions.

When approaching an intersection, cyclists are rarely in a position that motorists expect. Cyclists are positioned close to cars and are not often in view of drivers. This can lead to conflict.

Intersections present a danger for cyclists due to the many movements from different directions. Clear guidance is needed on the approach, through and exit from the intersection for both cyclists and motorised traffic.

Off-road paths reduce the risk of collision with vehicles, but still endanger cyclists at intersections with roads. Also, cyclists can collide with pedestrians with potentially fatal outcomes. The general principles of predictability and clear priority remain important for off-road paths, including directional segregation and high visibility for all users.

Personal security for cyclists is perhaps less critical than for pedestrians. However, narrow and dark areas remain dangerous for cyclists and should be avoided.

Directness

As for pedestrians, cyclists dislike significant deviations to their route. However, some flexibility can be expected where a better cycling environment is provided on a minor deviation from the most direct route. A careful balance must be found between providing a direct route and also one free of delays or safety concerns.

Amenity

People will more be likely to cycle in a pleasant environment. The route should be scenic, quiet, and free of heavy traffic and traffic travelling at high speeds. The best cycling environment is often found in areas that have been traffic calmed.

Suitable for all users

Cyclists cover a large range of user skill levels and trip purposes. While skill level often depends on age, other factors such as frequency of cycling and carrying heavy loads can affect a user's actions. Trip purposes often dictate the preferred cycling facility.

Best practice aims to provide for all users on a particular cycle route, ensuring that no users are excluded from using the facility. If one type of bicycle facility is unable to provide for all users of that route, a duplicate (both on and off-road facilities) facility should be provided.

End of trip facilities

As noted above, bicycle users need to know that their bike is safe from theft while it is not attended. This can be achieved through the provision of bike racks and lockers in areas that are well lit, in view of the public and protected from the weather. Where possible, Council should also encourage the provision of shower and change rooms in new buildings such as offices through planning controls.

3.1.3 Cycling Strategies

Council should support and encourage cycling through the following actions:

- Actively promote cycling through the provision of quality cycling facilities and the establishment of an attractive and amenable cycling environment;
- Build a network of primary cycle routes within major towns in the Shire. These should serve key local and regional cycling demand and provide direct and convenient links between commuting, social and recreational destinations;
- Bicycle access to this network should be promoted through the establishment of an ambient traffic environment that makes local roads bicycle-friendly;
- Provide secure parking and 'end-of-trip' facilities for cyclists;
- Utilise traffic calming and reduction of speed limits (to 40-50 km/h) where necessary to lower the speed environment on local roads; and
- Develop policies, guidelines, training and assessment measures to ensure that the needs of cyclists are considered when planning and designing traffic facilities and other elements of the urban environment.

3.2 User Types

Cycling attracts a large variety of participants, a selection of which is outlined in Figure 4, many of which have very different motivations for participating. It is particularly important to recognise the needs of each user type to ensure facilities cater and encourage use of current, new and proposed routes.

Many non-cyclists lack the self-efficacy to cycle, even if they are willing to try it. There is a substantial body of evidence which reveals that there is also a difference in what non-cyclist and cyclists consider as the necessary "enablers" for cyclists, particularly for were infrastructure is concerned. For example, non-cyclists place more importance on segregated bicycle lanes, whereas regular cyclists, particularly males, are more willing to share the road with motorist (even if motorists do not share the same view).

Figure 4 Different Bicycle User Types

3.2.1 Recreational Cyclists

Recreational cyclists ride mainly for leisure and place a high value on enjoying the experience. They are usually less constrained by time and vary widely in skill and experience.

Popular recreation cycling destinations include routes along rivers, natural corridors and reserves, as well as attractive routes with low traffic volume and speed.

Recreational cyclists prefer:

- Comfort;
- Good surfaces;
- Minimal gradients;
- A high degree of safety and personal security;
- Routes that are pleasant, attractive and interesting;
- Circuitous routes with multiple route options;
- Screening from weather and wind; and
- Parking facilities where they dismount to use facilities or visit attractions along the journey.

3.3 Methodology for Identifying Cyclist Needs

3.3.1 Identification of Activity Generators and Primary Routes

The following approach was adopted in developing a hierarchy of cyclist needs.

Primary Activity Zone

This is typically the main commercial street in the township. Throughout the day, pedestrians and cyclists are attracted to this zone from surrounding residential areas. It is therefore an important trip attractor. Also, there are high levels of activity occurring within this zone, making it an important area for short trips. The provision of bicycle parking should also be considered in primary activity zones.

Secondary Activity Generators

These include shops, schools, sporting facilities, clubs, hospitals and community facilities such as churches that are not located within the Primary Activity Zone. These land uses will attract people, but possibly only at certain times of the day or week.

Tertiary Activity Generators

These include the above land uses from the Secondary Activity Generators, but differentiate them based on a lower level of activity. Again, these are not located within the Primary Pedestrian Activity Zone.

Primary Cyclist Routes

These are routes from residential areas to the Primary, Secondary and Tertiary Activity Zones and Generators. They are trunk or collector level routes, which do not reach every property but instead form a network of routes that are accessible to a significant catchment of population. These routes

take account the existing street network and topographical constraints, aiming to provide a direct and convenient route to the major trip generators. The demographic use of connecting generators is considered when defining the routes (i.e. schools and playing fields, aged care facilities and return service league clubs).

3.3.2 Identification of Infrastructure Provision Goals

The hierarchy above provides a basis for applying standard treatments in each town, ensuring the development of a comprehensive and structured cycle network. Specific treatments may be required in some of these areas to accommodate the user needs or where other community suggestions are made.

These treatments form the basis of the proposed improvements. While this standard may not be achievable in the short-term due to the capital investment required, it is nevertheless a useful guide to work towards.

Desirable scenarios for potential infrastructure responses are outlined in Table 3.

Table 3 Infrastructure Provision Goals for Wollondilly

Hierarchy Feature	Desirable Route Infrastructure	Minimum Route Infrastructure
Primary Activity Zone	On-street cycle lane (min 1.5m width) in both directions in traffic calmed environment. Bike parking provided throughout the Primary Activity Zone.	Cyclists integrated into general traffic lanes in a traffic calmed environment.
Secondary Activity Generators	Low speed cyclists to share 2-2.5m path with pedestrians adjacent to the Activity Generators, to be marked as two way with a centreline. Higher speed cyclists to use cycle lanes or share general traffic lanes. Cycle parking provided near the entrance of the Activity Generators.	Cyclists integrated into general traffic lane.
Tertiary Activity Generators	Cyclists integrated into general traffic lane.	Cyclists integrated into general traffic lane.
Primary Cyclist Routes	Low speed cyclists to share 2-2.5m path with pedestrians (to be marked as two way with a centreline). Higher speed cyclists to use on-street cycle lanes (min 1.5m width).	Cyclists integrated into general traffic lane.

3.3.3 Aims in the Development of Infrastructure Recommendations

Major aims of the proposed improvement works, in decreasing order of priority, are:

- Fill any shortcomings in the Primary Activity Zone areas of each town through new cycle paths and footpaths;

- Establish a network of key pedestrian and cycle routes in the town centre and between major trip generators including schools. Prioritised routes are those that serve a wide range of community users and can remove pedestrians from unsafe environments;
- Broaden the extent of the network to areas outside of the Primary Activity Zones; and
- Provide additional cycle routes for primarily recreational or tourism purposes.

3.4 Selecting the Appropriate Path Type

3.4.1 Types of Cycle Paths

A number of path types have been described in various technical guidelines to assist decision-makers in selecting the appropriate treatment to suit local conditions. Bicycle paths can either be on-road, which are essentially "bicycle lanes" alongside motor vehicle traffic on a roadway within the road corridor, or off-road paths, which are separated from the road corridor.

The selection of the appropriate path type treatment depends on a combination of factors, which may include the level of demand for the cycle path, the conditions present in the surrounding environment, the availability of space in which to provide the path, and whether path usage is for exclusive cycle use or shared use with pedestrians.

3.4.2 Separation Treatment

A key concern in the design of bicycle facilities following the alignment of roads is whether warrants exist for providing bicycle paths separated from vehicular traffic, or whether a mix of bicycle and vehicular traffic may be acceptable.

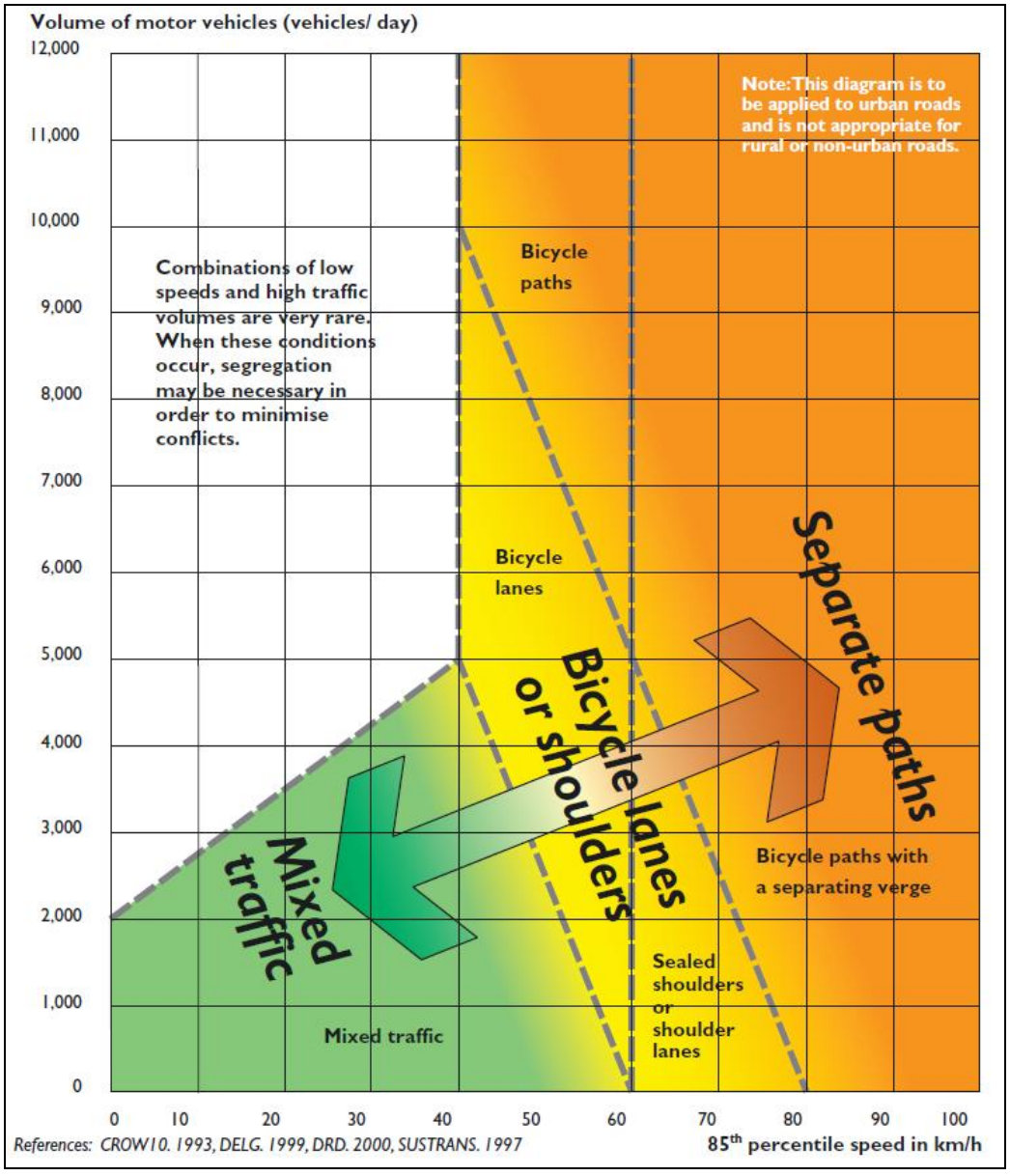
The *NSW Bicycle Guidelines*[2] provide for conditions when a separated cycle facility may be required, or when cycles operating in mixed traffic conditions may be acceptable. These are based on bicycle research in the Netherlands and other studies.

The traffic separation treatment will depend on the volume of vehicles on the road, and the vehicle speed environment.

Figure 5 provides a general guide in determining traffic separation treatment. In essence, separated paths are needed when the vehicle speed environment is 80 km/hour or faster, or when vehicle volumes are high enough even at lower vehicle speeds (e.g. 10,000 vehicles per day, even at 40 km/hour, will require separated facilities).

[2] *NSW Bicycle Guidelines*, Roads and Traffic Authority (2005)

Figure 5 Guide for Determining Separation of Bicycles and Motor Vehicles



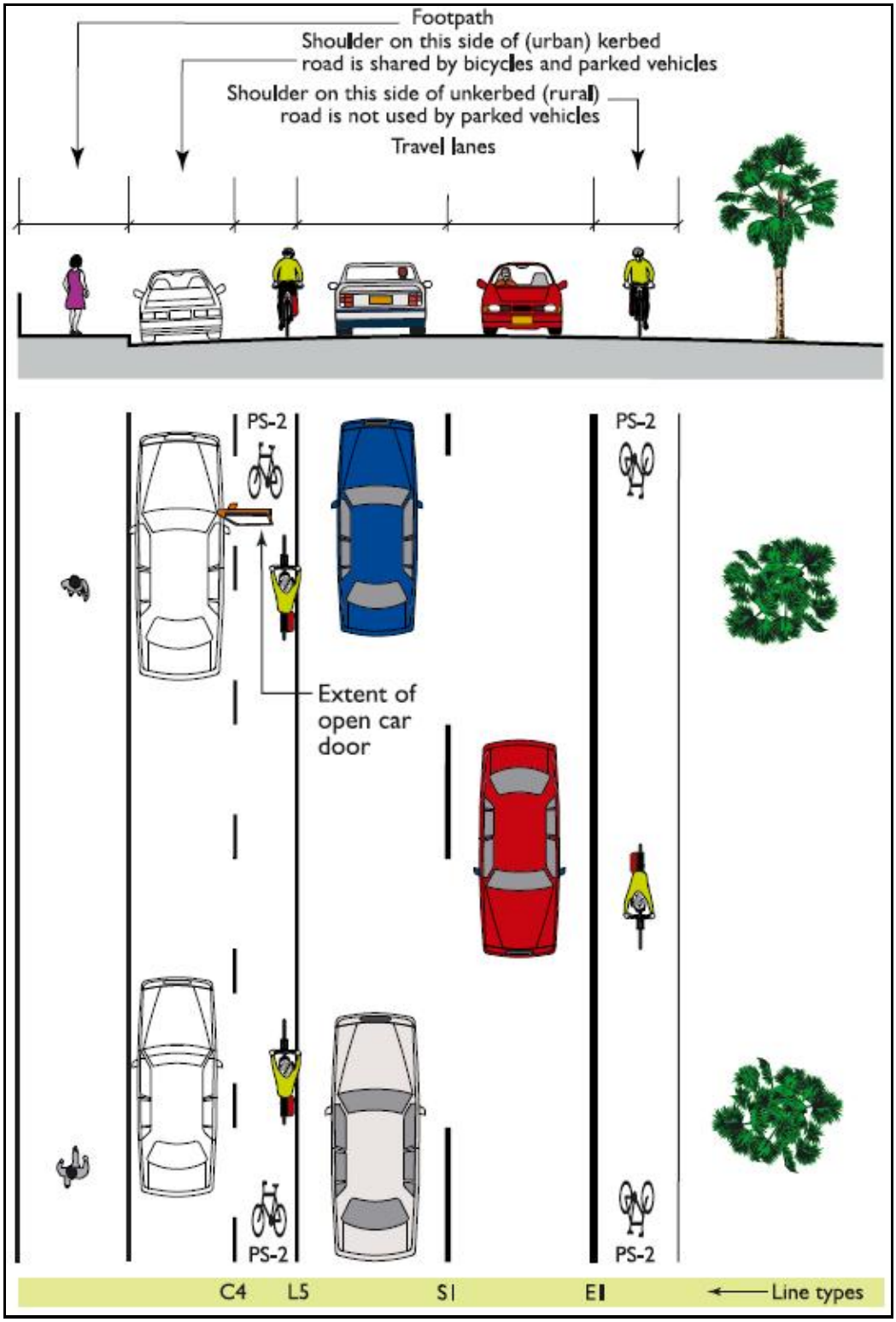
Source: *NSW Bicycle Guidelines*, Roads and Traffic Authority (2005).

3.4.3 On-Road Path Types

A number of different path treatments can be applied for on-road cycle facilities. These are presented and discussed in the *NSW Bicycle Guidelines* (RTA, 2005). The different on-road path types may provide physical or visual separation from the adjacent roadway, or allow for mixed bicycle-motor vehicle traffic.

In the context of the Wollondilly Bike Plan, on-road bicycle paths would typically be provided with some form of physical or visual separation from the adjacent traffic lane. The on-road paths considered in this Plan are typically of the layout and cross section as shown in Figure 6.

Figure 6 Typical Plan and Cross-Section for On-Road Bicycle Paths



Source: *NSW Bicycle Guidelines*, RTA 2005.

On-Road Bicycle Lane Widths

The width for bicycle lanes will vary depending on the number of cyclists, the speed of motor vehicles, the volume of large vehicles and the space available given the needs of other road user groups, physical constraints and budgetary constraints (AUSTROADS, *Part 14 – Bicycles*, 1999). Recommended widths are summarised below and shown in Table 4.

Overall, the following widths are recommended:

- 3.0 metres is the absolute maximum width and is desirable where the motor traffic is moving at high speeds (100 km/h);
- At least 2.0 metres is desirable where the motor traffic is moving at high speeds (100 km/h) or where speeds are moderate (80 km/h);
- 1.5 metres is the desirable width to be used in 60 km/h speed zones; and
- 1.2 metres is the absolute minimum width to be used along the length of the lane and should only be used where the provision of a wider lane is impractical.

Table 4 Recommended On-Road Bicycle Lane Widths

	Lane Width (m)		
Road Speed	60 km/h	80 km/h	100 km/h
Desirable	1.5 m	2.0 m	2.5 m
Accepted Range	1.2 – 2.5 m	1.8 – 2.7 m	2.0 – 3.0 m

Source: *Guide to Traffic Engineering Practice*, *Part 14 – Bicycles* (AUSTROADS,1999).

A 1.0m width may also be acceptable where the speed environment is less than 60 km/h and space is severely restricted.

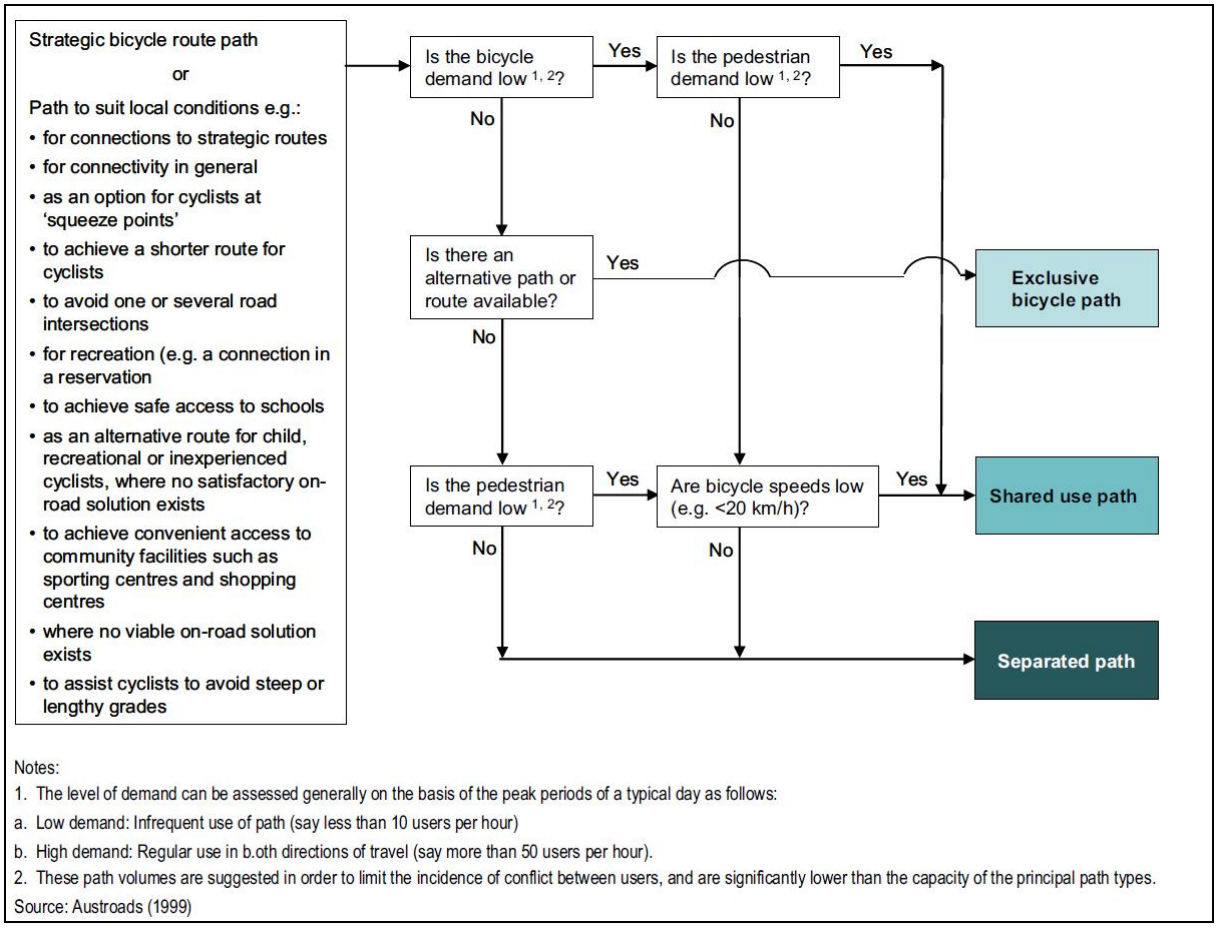
3.4.4 Off-Road Cycle Paths

Off-road cycle paths are typically physically separated from adjacent parking or traffic lanes. Off-road paths can be of three basic types:

- Exclusively for bicycle use;
- Shared cyclist and pedestrian use; and
- Separate paths provided for cyclists and for pedestrians.

The *Guide to Road Design Part 6A: Pedestrian and Cyclist Paths* (AUSTROADS 2009) presents a guide on selecting the treatment type for off-road paths. This is shown in Figure 7.

Figure 7 Selection Guide for Off-Road Path Types



Source: *Figure 2.1, Guide to Road Design Part 6A: Pedestrian and Cyclist Path (AUSTROADS 2009)*.

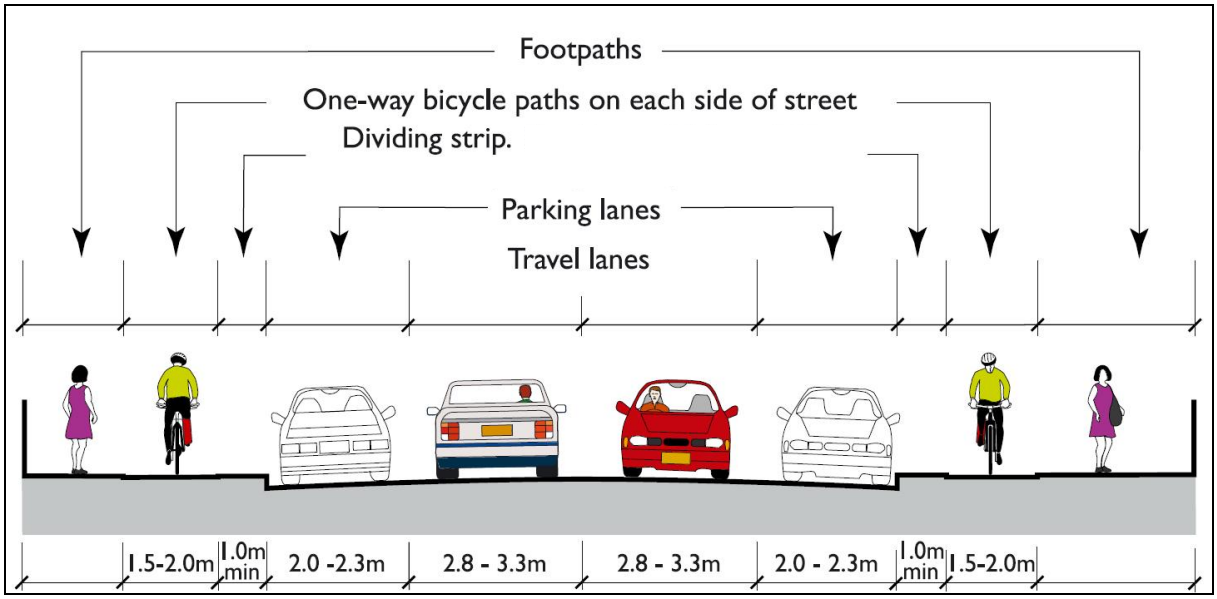
Exclusive Cycle Paths

According to the AUSTROADS Guide, exclusive bicycle paths are most appropriate under the following conditions:

- *There is a significant cycling demand and very few pedestrians desire to use the path or a separate footpath is provided;*
- *There is very limited motor vehicle access across the path; or*
- *It is possible to achieve an alignment that generally allows cyclists uninterrupted and safe travel at a relatively high constant speed (say 30 km/h).*

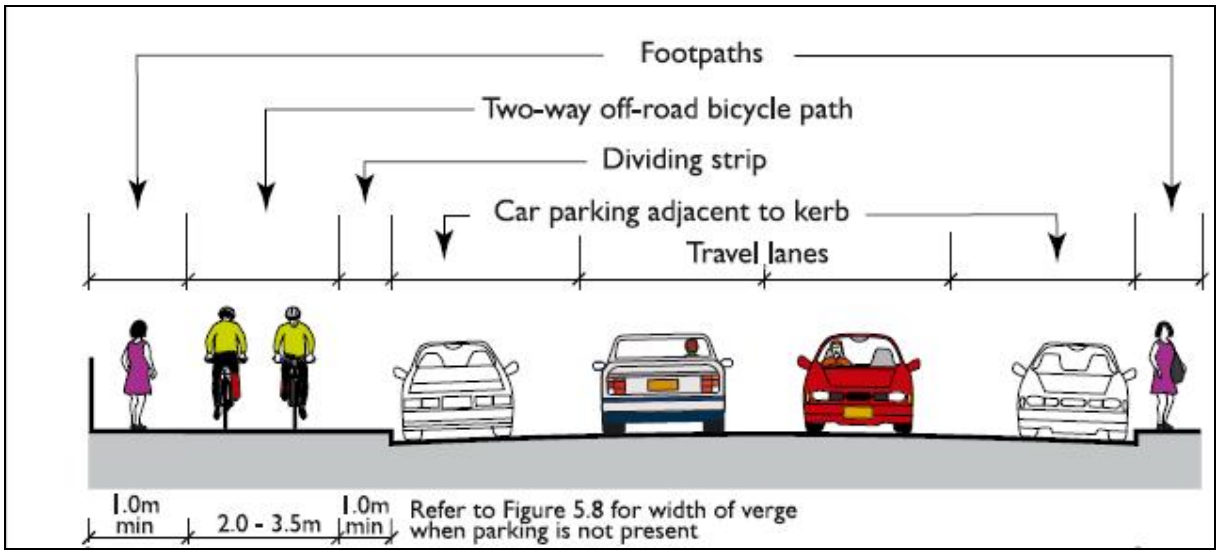
Figure 8 presents a typical road cross section for a one-way pair of off-road cycle paths, while Figure 9 shows the same for a two-way off-road exclusive cycle path on one side of the road. For local conditions where kerbside parking is not present, the dividing strip or separating verge would not be required.

Figure 8 Typical Cross-Section - One-Way Pair of Off-Road Bicycle Paths



Source: *NSW Bicycle Guidelines*, RTA 2005.

Figure 9 Typical Cross-Section - Two- Way Off -Road Bicycle Path on One Side of Road



Source: *NSW Bicycle Guidelines*, RTA 2005.

The AUSTROADS Guide also prescribes the design widths for exclusive cycle paths. These are shown in Table 5.

Table 5 Path Widths – Exclusive Bicycle Paths

	Path Width	
	Local Access Path	Major Path
Desirable Minimum Width	2.5 m	3.0 m
Minimum width – typical maximum	2.5 – 3.0 m [a]	2.5 – 4.0 m [b]

a: A lesser width should only be adopted where cyclist volumes and operations speeds will remain low.

b: A greater width may be required where the number of cyclists are very high.

Source: *Guide to Road Design Part 6A: Pedestrian and Cyclist Path (AUSTROADS, 2009)*.

Shared Use Paths

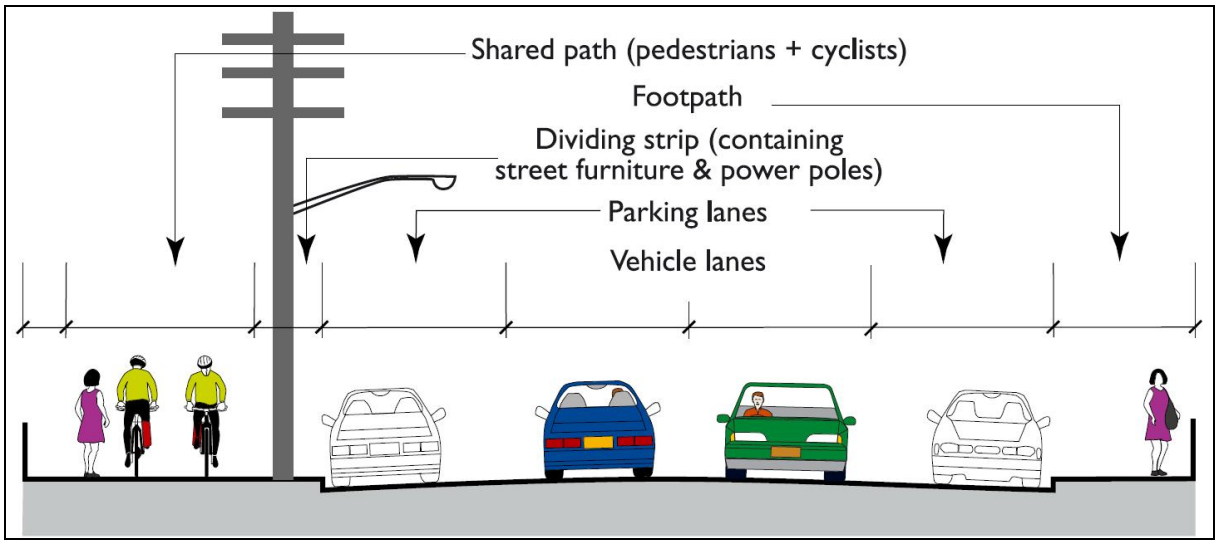
Shared use paths, or shared paths, are a type of off-road facility that allows common use of the facility by both cyclists and pedestrians.

According to the AUSTROADS Guide, a shared use path may be appropriate where:

- *Demand exists for both a pedestrian path and a bicycle path but where the intensity of use is not expected to be sufficiently great to provide separate facilities;*
- *An existing low-use footpath can be modified to provide for cyclists by satisfying legal requirements and as necessary upgrading the surface, width and kerb ramps; or*
- *There is an existing road nearby which caters well for faster cyclists (e.g. has on-road bicycle lanes), to limit the extent of user conflict on the shared path.*

A typical cross section of a shared path (two-way) is shown in Figure 10 (left hand portion of drawing).

Figure 10 Typical Cross-Section for a Two-Way Off-Road Shared Path



Source: *NSW Bicycle Guidelines*, RTA 2005.

Table 6 provides an indication of widths for shared paths.

Table 6 Shared Path Widths

	Path Width		
	Local Access Path	Commuter Path	Recreational Path
Desirable Minimum Width	2.5 m	3.0	3.5
Minimum width – typical maximum	2.5[a] – 3.0 m[b]	2.5[a] – 4.0 m[b]	3.0[a] – 4.0 m[b]

a: A lesser width should only be adopted where cyclist volumes and operations speeds will remain low.

b: A greater width may be required where the number of cyclists and pedestrians are very high or there is a high probability of conflict between users.

Source: *Guide to Road Design Part 6A: Pedestrian and Cyclist Path (AUSTROADS, 2009)*.

Separate Paths

Where there are significant volumes of both pedestrians and cyclists, separate paths for each may need to be provided to minimise conflict issues associated with shared use of paths. Typically, separate paths would require a minimum of 3.0 metres on each side of the road for one-way paths, and 4.5-metre wide off-road paths for separated two-way paths.

The AUSTROADS *Guide to Road Design Part 6A: Pedestrian and Cyclist Paths* notes that such separated paths are rarely provided. Such is the case in Wollondilly, where pedestrian and cyclist volumes are still at levels which will not require separated paths to be provided.

Rail Trails

A key feature of a number of cycling strategies around Australia and in other countries is to convert former or disused rail tracks into cycleways, commonly referred to as *rail trails*.

Through correspondence received as part of this study, Railtrails Australia, in conjunction with Bicycle NSW, have indicated that they support the development of rail trails in NSW, where there is agreement between all parties – Council, rail / track authority, and bicycle user groups.

The disused rail line south of Picton through Thirlmere and Buxton is disused (except for a short section at the Thirlmere Railway Museum), which would link southwards to Mittagong, is of particular interest in this study.

However, there is currently no general agreement on the future direction of the Thirlmere to Mittagong rail corridor, and its use as an active railway corridor is unclear. Railtrails Australia has further indicated that after having inspected a number of sections along the Thirlmere to Mittagong rail corridor with undulating terrain, numerous cuttings and embankments, there would likely not be enough space for an adjacent trail to the rail line.

Nevertheless, Railtrails Australia has indicated that if the rail tracks were ever decommissioned, potentially south of Buxton, the corridor would present a significant opportunity for a rail trail.

3.4.5 Potential Future Inter Town Connection

In the context of coherence, regional connections between townships also comprise part of the strategic cycle network. These will be typically on-road bicycle lanes along the shoulders of existing road corridors. As such, the design for these potential future connections may follow the design for on-road bicycle paths on-road shoulders.

Dependent on future road and traffic conditions, and other associated factors such as new developments, it may also be possible for these connections to be either off-road or shared paths. Cycling facility requirements should be considered when any of these nominated roads are being upgraded in the future.

3.5 Prioritisation Methodology

3.5.1 Bike Plan Prioritisation & Methodology

The RTA guidelines from *How to Prepare a Bike Plan* (2002) indicate that future bicycle routes should be based on a set of priorities, including:

- Safety;
- Community needs and expectations;
- Council commitment;
- Available funding and future planning opportunities; and
- Rectification / maintenance programs.

Overall, this set of priorities is considered to be rather general in nature and does not provide specific guidance on prioritising one route above another. However, specific guidance does exist from the related RTA publication *How to Prepare a Pedestrian Access and Mobility Plan* (PAMP) (2002), which can be adopted to suit a prioritisation methodology for bicycle routes.

3.5.2 PAMP Prioritisation & Methodology

As most of the general priorities from the *How to Prepare a Bike Plan* (RTA, 2002) publication are covered in the PAMP guidelines, *How to Prepare a Pedestrian Access and Mobility Plan* (RTA, 2002), GHD has adapted the PAMP Weighted Criteria Scoring System with slight modifications to enable them to be applied in prioritising the proposed cycling improvements.

Scores were derived for each of the recommended improvements for the purpose of prioritising works both within and across different towns in the Shire. It should be noted that the prioritisation of works presented in this plan is intended to support decision making, not replace decision making.

Prioritisation of the proposed routes, based on a slight modification to the Weighted Criteria Scoring System, is covered in Sections 6.4 and 6.5.

4. Consultation

4.1 Aims

The consultation process included stakeholders and community group representatives from across the Shire, as it is important to include the community in the development of a Bike Plan that seeks to address local issues. Overall, the aims of the consultation process were to:

- Assist in understanding community needs for the each town centre and the Shire as a whole;
- Provide information about the project process to the community; and
- Involve the community in the planning process to increase the sense of ownership of the project outcomes.

4.2 Process

4.2.1 Consultation #1

Consultation for the Bike Plan was undertaken in two stages. The first consultation stage involved GHD, Council and community group representatives attending a pre-arranged meeting on the 9th of December 2010.

Representatives from the following organisations attended:

- Wollondilly Shire Council;
- Wollondilly Shire Council Alternative Transport Committee;
- Bargo Bicycle User Group (BARBUG);
- Macarthur Collegians Cycling Club;
- Local bicycle business owner; and
- GHD.

The aim of this meeting was to receive input on potential route options to address any issues, gaps or opportunities that were of concern to the community. A summary of the key issues is shown in Appendix A.

4.2.2 Consultation #2

The second round of consultation was held on the 21st of February 2011, with the primary aim being to facilitate the review of proposed bike routes by the community. The consultation was broken down into two parts.

Part one consisted of an office-based review of maps prepared by GHD outlining the proposed routes in each of the townships within the Shire, which had been developed in response to issues identified in the first round of consultation. Part two comprised of an organised site visit by community bus to four representative townships where new bike routes had been proposed. The sites visited were Picton, Bargo, Tahmoor and Thirlmere.

These sites were selected in conjunction with Council due to complexities in route selection and to enable GHD to further refine proposed routes in regards to local issues and knowledge, including safety concerns, and potential construction issues and maintenance ideas.

At Council's request, the participants from the first round of consultation also attended the site visit in the second consultation round.

4.3 Outcomes of the Consultation Process

The consultation process resulted in a broad range of issues being raised and discussed both from the community groups and Council, they included:

- Facility provision for a variety of users such as recreational cyclists, school children and the elderly;
- Maintenance challenges;
- Safety issues; and
- Network connectivity.

These issues were carefully considered when reviewing and proposing new cycle routes within the Shire of Wollondilly.

5. Existing Facilities Audit

5.1 Process

An audit of existing cycle conditions in towns across the Shire was undertaken for the study. The audit focused on identifying existing facilities, land uses, any shortcomings in relating to cycling facilities and potential safety issues. The audit was undertaken at three levels and they are as follows:

- Based on the provision of available data relating to the existing situation, a drive through of the study area was carried out to ascertain the extent of the built cycle network and the general traffic environment and conditions;
- Walking in key locations of high activity within the study area to understand conditions for cyclists "on the ground"; and
- A walk over of critical locations to log deficiencies with existing cycle facilities.

5.2 Existing Facilities

The Shire's townships currently have a variety of cycle facilities, in varying conditions. The following section provides an overview of those facilities.

5.2.1 Appin

Appin currently has two unconnected shared paths. The first connects Appin Road with Winton Street and the second is located at the southern end of the town and runs through William Woods Reserve (seen in the figure below) connecting Toggerai Street and McNamara Place. Both routes are relatively short and are intended for local recreational use.

Indicative Photo of Bicycle Facilities in Appin

5.2.2 Bargo

Bargo's existing cycle facilities are located to the south of the township. There is an off-road path from the sports ground, south along Silica Road connecting Bargo to Yanderra. There are currently no cycle facilities located in the centre of the town. The photo below provides an example of the existing conditions outside the school.

Existing conditions in Bargo

5.2.3 Buxton

Buxton's existing cycle way links the primary school, in the north of the town, to the shopping centre at the heart of the township. The link is via an off-road cycle way however, it terminates just south of the shops and in doing so provides no bike network for the southern part of the town. The existing off-road path can be seen in the photo below.

Existing conditions in Buxton

5.2.4 Douglas Park

The primary school in Douglas Park is on Camden Road and has a new off-road bike path. It however does not continue to the centre of the township, where the train station is located. The path can be seen on the left hand side of the photo below in addition to other traffic calming measures, which is immediately outside the school.

Existing conditions in Douglas Park

5.2.5 Oakdale

Oakdale currently has no cycling facilities. The photo below provides an indication of the traffic and pedestrian environment in the centre of the township.

Existing conditions in Oakdale

5.2.6 Picton

Picton's cycle way network is currently the largest in the shire. Existing facilities currently include an extensive shared path following the creek through the Botanical Gardens and to Hume Oval, which adequately caters for recreational users. There is also an off-road cycle path on Remembrance Driveway starting at Antil Street, travelling past Picton High School then converting into an on-road cycle facility as it exits Picton. Picton High School currently operates a "no bike" policy due to safety and security issues.

Existing conditions in Picton

5.2.7 Tahmoor

Tahmoor's existing cycle facilities constitute two separate off-road bike paths. The off-road cycle paths are provided on the busy main roads that converge at the centre of the township. One path enters Tahmoor, from Thirlmere, on Thirlmere Way however it terminates at Pitt Street before entering the shopping precinct. The second cycle path runs down Remembrance Driveway past the shopping centre to the primary school and community centre. The photo below provides an example of the bike route on Remembrance Driveway.

Existing conditions in Tahmoor

5.2.8 The Oaks

While bike facilities exist in The Oaks, they are not connected. The on-road cycleway on McIntosh Street connects the sports ground to Montpelier Drive, at the junction near the town shops. The Oaks also has an off-road cycle path at the southern end of the township, running along an access path connecting to the Wollondilly Heritage Centre.

Existing conditions in The Oaks

5.2.9 Thirlmere

While there are no existing bike facilities in the centre of Thirlmere, there is an old off-road bike path connecting the township to Tahmoor. While Turner Street is designated as having an on-road facility, the street has little supporting infrastructure, but rather provides an opportunity for cyclists on a wide road with low traffic volumes.

Existing conditions in Thirlmere

5.2.10 Warragamba and Silverdale

Warragamba and Silverdale do not currently have an extensive network of cycle paths, despite the two towns being one of the larger urban areas within the Shire. The primary school in Warragamba is currently linked to the north of Silverdale via an off-road bike path on Warradale Road, which can be seen in the photo below.

Existing conditions in Warragamba and Silverdale

5.2.11 Wilton

Wilton currently has no cycle facilities. The roads are typically wide with a mixture of kerb and guttering. The new Bingara Gorge development to the north-west of Wilton has a new off-road bike path.

Existing conditions in Wilton

5.2.12 Yanderra

Yanderra, located in the southern part of the Shire, has an off-road cycle path (shown in the photo below), linking many of the residents to the primary school, and to the southern part of Bargo.

Existing conditions in Yanderra

5.3 Summary of Findings

Table 7 provides a brief overview of existing conditions within the townships in the Shire.

Table 7 Overview of Existing Conditions

Town	Summary
Appin	Shared paths intended for short distance recreational use.
Bargo	No provision of intra-town links however an inter town link exists to Yanderra.
Buxton	One existing off road cycle path linking the school and main town centre.
Douglas Park	Limited off road cycleway provision.
Oakdale	No current bicycle facilities.
Picton	Mixture of recreational routes and on road cycle paths.
Tahmoor	Two off road cycle paths with an inter town connection to Thirlmere.
The Oaks	Short sections of cycle path provision, predominantly for recreational use.
Thirlmere	Current off road inter town connection to Tahmoor.
Warragamba and Silverdale	Current off road link between the urban centres and the primary school.
Wilton	Cycle path provision has been developed for the new Bingara Gorge development, although no facilities in Wilton itself.
Yanderra	Primary school is linked via an off road inter town connection to Bargo.

6. Proposed Cycle Improvements

6.1 Introduction

The identified locations for cycle improvements are presented in Table 9 and Appendix B. These recommendations have been developed through an iterative process between GHD, Council, stakeholders and the community.

As discussed in Section 3.5, the priorities are based on a slightly modified RTA methodology.

6.2 Reference System

The recommendations are intended to guide the development of new cycling facilities for the existing towns but they are also intended to fit within the wider context of Council's aims, objectives and planning for anticipated future developments.

The recommended works conform to a referencing system as follows:

- Categorisation numbers for works within each town are preceded with the town name (i.e. Picton01, Picton02, etc. for works in Picton).
- The various routes proposed in each town are classified by numbers (but are arranged in no particular order); and
- The proposed routes are prioritised later in this section.

It is noted the Council may wish to alter the priority of some works depending on the timing and construction of future developments.

6.3 Strategic Cost Estimate Assumptions

The strategic cost estimates are at a level of detail sufficient to inform and guide Council in securing appropriate funds to take the proposed routes forward to a more detailed level. The strategic cost estimates have been based on guidance from Council in relation to indicative unit rates, and would be subject to further refinement at a later stage.

The following assumptions were made as part of the strategic cost estimation process:

- No allowance has been made for any property acquisition;
- No allowance for contingencies are included;
- No allowance has been made for any kerbing works as part of the estimates. It has been assumed that where kerbing is required, the works will be undertaken prior to (or in tandem with) footpath works;
- No allowance has been made for implementation of wearing course across partially sealed carriageways where pedestrian crossings are proposed. It has been assumed that where bitumen is required, the works will be undertaken prior to (or in tandem with) footpath and drop kerb works;
- No allowance has been made for labour costs;
- Cycleway lengths have been measured from GIS information provided by Council and as such their accuracy is dependent on the accuracy of the GIS information provided;

- Where parking is currently permitted across existing and/or proposed pram ramps (or drop kerbs) and crossing points, it has been assumed the signage will be adjusted to ensure these areas are no standing zones. However, there has been no allowance for these works in the estimates;
- No allowance for tactile paving has been included;
- No allowance has been made for pathway lighting;
- Shared paths have been costed as being constructed with concrete, where appropriate; and
- On-road cycle path costs have been costed based upon line markings on-road shoulders. The costs do not include any allowance for construction of new shoulders for cycle paths. Many shoulders and streets are very rough and not necessarily suitable for cycles. There may be opportunities to profile and seal a specific narrow section before line marking a cycle path. The costs associated with these works, however, were excluded from the strategic cost estimates.

For comparison purposes, a low-end and a high-end unit cost have been developed and used in the strategic cost estimates. These reflect relative construction difficulties for different cycle facility types. For example, for on-road pathways, the low-end cost principally incorporates line-marking, pavement symbols and signage, while the high-end cost allows for additional pavement on the road shoulders.

6.4 Proposed Cycle Routes for Wollondilly

The following section presents three key tables for the Wollondilly Bike Plan:

- Table 8 provides an overview of the modified Weighted Criteria Scoring System;
- Table 9 shows the proposed cycle improvements for Wollondilly; and
- Table 10 shows the priority ranking for each of the proposed cycle improvements.

6.4.1 Outline of Prioritisation Criteria

As described earlier in the study, the proposed cycle facilities were prioritised based on modifying the weighted criteria scoring system relating to PAMPs.

Table 8 presents an overview of the criteria used in Table 10.

The guidelines define the overall work prioritisation as:

- High (100 – 70);
- Medium (<70 – 40); and
- Low (<40).

Table 8 Weighted Criteria Scoring System

Category	Criteria
Land Use [maximum of 35%]	Number of Attractors/Generators
	Land Use Type
	Proximity to Attractors/Generators
	Future Development with Attractors/Generators
Traffic Impact [maximum of 15%]	Road Hierarchy
Safety [maximum of 25%]	Identified as Hazardous Area (from Consultation)
	Identified Cyclist Crashes
Facility Benefits [maximum of 10%]	Demonstrated Path
Continuity of Routes [maximum of 10%]	Addition to Existing Facility
Priority [maximum of 5%]	Route Hierarchy

Note: Modified from RTA publication *How to Prepare a Pedestrian Access and Mobility Plan* (2002).

6.4.2 Proposed Cycle Routes

Maps corresponding to the proposed cycle routes shown in Table 9 are provided in Appendix B. It should be noted that the reference numbers in Table 9 are shown in no particular order. Prioritised routes are shown in Table 10.

Table 9 Proposed Cycle Improvements for Wollondilly

Town / Label Reference	Route Type	Location	Indicative Length (m)	Relevant Authority	Indicative Low End Cost	Indicative High End Cost
Appin01	Off Road	Appin Road	250	Council	$45,000	$65,000
Appin02	Shared Path	Market/Kennedy Street	430	Council	$91,000	$133,000
Appin03	Shared Path	Appin Road	1,230	Developer	$260,000	$380,000
Bargo01	On Road	Marshall Ave	670	Council	$11,000	$174,000
Bargo02	Off Road	Avon Dam Road	600	Council	$106,000	$154,000
Bargo03	Off Road	Great Southern Road	640	Council	$113,000	$165,000
Bargo04	Off Road	Great Southern Road	385	Council	$68,000	$99,000
Bargo05	On Road	Remembrance Driveway / Noongah St / Radnor Rd	755	Council	$12,000	$196,000
Bargo06	Shared Path	Bargo Sports Ground	215	Council	$46,000	$66,000
Buxton01	Off Road	East Parade	700	Council	$123,000	$180,000
Buxton02	On Road / Off Road	Eurelia Road / Access lanes / Southwell Road	1,000	Council	$69,000	$261,000
DouglasP01	Off Road	Camden Road	285	Council	$50,000	$73,000

Town / Label Reference	Route Type	Location	Indicative Length (m)	Relevant Authority	Indicative Low End Cost	Indicative High End Cost
DouglasP02	On Road	Camden Road	490	Council	$8,000	$127,000
Oakdale01	Off Road	Burragorang Road	480	Council	$85,000	$123,000
Picton01	On Road	Lumsdaine Street	1,240	Council	$20,000	$321,000
Picton02	On Road	Heathcote/Wild/Hill Street	1,200	Council	$19,000	$311,000
Picton03	On Road	Prince Street	485	Council	$8,000	$126,000
Picton04	Shared Path	Access track	215	Council and RailCorp / ARTC	$46,000	$66,000
Picton05	On Road	Remembrance Driveway	1,040	Council	$17,000	$270,000
Picton06	Shared Path	Stonequarry Creek	1,580	Council	$334,000	$488,000
Tahmoor01	Shared Path	Railway Overbridge	60	Council and RailCorp / ARTC	$13,000	$19,000
Tahmoor02	Shared Path	Railway	50	Council and RailCorp / ARTC	$11,000	$15,000
Tahmoor03	Off Road	Remembrance Driveway	1,130	Council	$199,000	$291,000
Tahmoor04	Off Road	Remembrance Driveway	2,400	Council	$423,000	$617,000
TheOaks01	On Road	John Street	570	Council	$9,000	$148,000
TheOaks02	Shared Path	John Street	200	Council	$42,000	$62,000
TheOaks03	Off Road	John Street	155	Council	$27,000	$40,000
TheOaks04	Off Road	Montpelier Drive	490	Developer	$86,000	$126,000

Town / Label Reference	Route Type	Location	Indicative Length (m)	Relevant Authority	Indicative Low End Cost	Indicative High End Cost
Thirlmere01	On Road	Oaks Street	500	Council	$8,000	$130,000
Thirlmere02	Off Road / On Road	Thirlmere Way / Bridge Street	775	Council	$97,000	$200,000
Thirlmere03	Off Road	Turner Street	810	Council	$143,000	$208,000
Warragamba01	Shared Path	Fourth Street / Weir Street	390	Council	$83,000	$120,000
Warragamba02	On Road	Silverdale Road	1,265	Council	$20,000	$328,000
Warragamba03	On Road	Warradale Road	535	Council	$9,000	$139,000
Wilton01	Off Road	Hornby Street	195	Developer	$34,000	$50,000
Wilton02	On Road / Shared Path	Camden Street / Track / pathway	625	Developer	$34,000	$169,000
Wilton03	Off Road	Hornby Street	740	Developer	$130,000	$190,000
Wilton04	Off Road	Bingara Gorge	1,380	Developer	$243,000	$355,000
Wilton05	Off Road	Broughton Street	620	Council	$109,000	$159,000
Total					**$3,251,000**	**$7,144,000**

6.5 Priority Levels for Cycle Improvements

Table 10 ranks the proposed bicycle routes for Wollondilly based on the modified Weighted Criteria Scoring System.

Table 10 Priority Levels for Wollondilly Proposed Cycle Improvements

	Land Use				Traffic Impact		Safety	Facility Benefits		Continuity of Routes	Priority		
Town / Label Reference	Number of generators	Land use type	Proximity to generators	Future development	Road hierarchy	Hazardous area	Cycle crashes	Demonstrated path	Addition to existing facility	Route hierarchy	Total Score	Priority Rating	Priority Rank
Appin03	8	10	10	5	15	8	0	5	8	3	72	High	1
Picton05	8	10	10	3	10	8	0	10	5	5	69	Medium	2
Thirlmere01	10	10	10	1	8	8	0	8	8	5	68	Medium	3
Appin01	8	10	10	1	15	8	0	8	0	5	65	Medium	4
Warragamba01	5	10	10	1	8	8	0	8	8	5	63	Medium	5
Tahmoor03	8	5	10	3	10	5	0	8	8	3	60	Medium	6
TheOaks02	8	10	10	1	10	8	0	8	0	5	60	Medium	7
DouglasP01	5	8	10	1	8	8	0	8	8	3	59	Medium	8
Bargo05	8	8	10	1	10	8	0	8	0	5	58	Medium	9
TheOaks03	5	8	10	1	10	8	0	5	8	3	58	Medium	10
Thirlmere02	5	8	10	1	10	8	0	5	8	3	58	Medium	11

	Land Use				Traffic Impact		Safety	Facility Benefits		Continuity of Routes	Priority		
Town / Label Reference	Number of generators	Land use type	Proximity to generators	Future development	Road hierarchy	Hazardous area	Cycle crashes	Demonstrated path	Addition to existing facility	Route hierarchy	Total Score	Priority Rating	Priority Rank
Thirlmere03	5	8	10	5	8	5	0	5	8	3	57	Medium	12
Appin02	8	8	10	1	8	5	0	5	8	3	56	Medium	13
Bargo04	8	10	10	1	8	5	0	8	0	5	55	Medium	14
Picton06	8	8	10	3	5	5	0	5	8	3	55	Medium	15
TheOaks01	8	10	10	1	10	8	0	5	0	3	55	Medium	16
Tahmoor01	5	5	10	5	8	8	0	8	0	5	54	Medium	17
Oakdale01	8	10	10	1	8	8	0	5	0	3	53	Medium	18
TheOaks04	5	5	8	5	10	5	0	5	8	1	52	Medium	19
Wilton03	5	5	8	5	8	5	0	5	10	1	52	Medium	20
Wilton05	5	5	10	3	8	5	0	5	8	3	52	Medium	21
Buxton01	5	5	10	1	10	0	5	5	8	1	50	Medium	22
Picton01	5	10	10	1	8	5	0	8	0	3	50	Medium	23
Tahmoor04	5	0	5	3	10	8	0	5	10	3	49	Medium	24
Bargo03	5	10	10	1	8	5	0	8	0	1	48	Medium	25
Buxton02	5	5	10	1	8	0	5	5	8	1	48	Medium	26

	Land Use				Traffic Impact		Safety	Facility Benefits		Continuity of Routes	Priority		
Town / Label Reference	Number of generators	Land use type	Proximity to generators	Future development	Road hierarchy	Hazardous area	Cycle crashes	Demonstrated path	Addition to existing facility	Route hierarchy	Total Score	Priority Rating	Priority Rank
Picton03	5	5	10	1	8	8	0	8	0	3	48	Medium	27
DouglasP02	5	8	10	1	8	8	0	5	0	1	46	Medium	28
Warragamba03	0	5	5	1	8	8	0	5	8	3	43	Medium	29
Wilton02	5	8	10	1	8	5	0	5	0	1	43	Medium	30
Bargo06	5	5	10	1	5	0	0	5	8	3	42	Medium	31
Warragamba02	0	5	5	1	10	8	5	5	0	3	42	Medium	32
Wilton01	5	5	10	3	8	5	0	5	0	1	42	Medium	33
Bargo01	5	0	8	1	8	5	0	5	8	1	41	Medium	34
Bargo02	5	0	10	1	8	5	5	5	0	1	40	Medium	35
Picton02	0	5	5	1	8	5	0	5	8	3	40	Medium	36
Tahmoor02	5	10	10	1	0	5	5	0	0	3	39	Medium	37
Wilton04	5	5	8	5	5	0	0	0	10	1	39	Medium	38
Picton04	5	0	10	1	0	5	0	0	0	3	24	Low	39

7. Further Considerations

7.1 Maintenance

7.1.1 Maintenance Considerations

Maintaining bicycle paths to be in a suitable condition is a key requirement to ensuring the plan's objectives are achieved. If the bicycle facilities are not adequately maintained to a suitable level of service, cyclists are discouraged from using them. Worse, cyclists may have the tendency to swerve into the path of vehicular traffic in order to avoid sections of deteriorated surface conditions, posing a safety hazard to both themselves and general traffic.

The importance of maintaining road assets and the financial impacts of not doing so is well known to most road authorities, including Councils. However, maintenance of bicycle paths after construction is less commonly incorporated into asset management programs.

At a minimum, Council's maintenance program for its bicycle network infrastructure should follow the standards it keeps for maintaining its road assets. An important consideration to make is to incorporate bicycle path maintenance within the overall road network asset management program.

7.1.2 Maintenance Items

As indicated in the *Guide to Traffic Engineering Practice, Part 14: Bicycles* (AUSTROADS, 1999), regular maintenance activities on bicycle paths should include:

- Filling of cracks;
- Trimming or removal of grass;
- Sweeping of paths;
- Re-painting of pavement markings;
- Cleaning of signs; and
- Trimming of trees and shrubs to maintain safe clearances and sight distances.

Other considerations may include regular audits of railroad crossings and storm drain grates to ensure they are safe for cyclists.

7.2 Monitoring

The success of a plan or strategy can only be assessed if adequate monitoring or performance measures are included. The monitoring process will identify if the plan is achieving the desired behaviour change or facilitating the increased use of bicycles in the Shire. Such indicators also ensure that throughout the development of the plan, or program of works, the initiatives align with national, state and local planning objectives.

Identifying a monitoring method appropriate to a plan or strategy is critical to ensure time and resources are not misspent on processes that result in un-useful or irrelevant data collection and/or analysis. The measures outlined below present a range of options that could be easily tracked by Council officers and have been successfully used in previous Bike Plans.

7.2.1 Modal Split

This measure provides an indication of demand for various modes of transport at an aggregate level. Typically modes would be broken down into; private vehicle; train; bus and other (which would include cyclists).

This type of data can provide an indication of the overall level of cycling use in the Shire. The percentage of cyclists can be obtained from the journey to work component of the Census or through the Household Travel Survey.

7.2.2 Vehicle Kilometres Travelled (VKT)

This measure also provides an indication as to the quality of the transport system within the region. Less vehicle kilometres travelled would imply that more residents utilise either active transport or public transport services in the Shire.

7.2.3 Road Injuries

Road injury monitoring, and in particular for cyclists and pedestrians, provides a reasonably accurate indication as to the levels of safety that new strategies and plans have instigated, and as to whether targets are being achieved. Such statistics also highlight high risk zones that require further attention and planning.

7.2.4 Cycleway Usage

Performing regular cyclist counts is a highly effective way of determining the usage of cycle ways. Measurement methods would have to be standardised to ensure valid data is collected and is comparable across time periods. Consistent increases in usage would imply new cycle routes and improved conditions have provided a more efficient, safer network which is suitable for a larger proportion of the population.

7.2.5 Data Availability

It should also be noted that data availability is one of the key criteria for evaluating a projects success. Before one or more monitoring methods are adopted, the quality and quantity of data required must be carefully considered in the context of existing data sets and potential data sets.

7.3 Bicycle Parking

The provision of appropriate bicycle parking facilities will encourage people to ride to their destination. Bicycle parking needs to be safe, secure, convenient and meet the needs of a wide range of cyclists. Two key factors to consider are the type of facility required and the location.

Table 11 identifies the most common locations where bicycle parking facilities are required and indicates an appropriate type of bicycle parking facility that should be provided.

Table 11 Bicycle Parking Facilities

Location	Appropriate Parking Facility
◗ Shopping centres or business districts.	◗ Individual and small clusters of bicycle parking rails.
◗ Shopping complexes. ◗ Swimming pools. ◗ Libraries. ◗ Markets.	◗ Clusters of bicycle parking rails at main entrances.
◗ Work places. ◗ Primary and Secondary schools.	◗ Groups of bicycle parking rails within an enclosure.
◗ Train stations.	◗ Groups of bicycle parking rails within an enclosure or individual bicycle lockers.
◗ Apartments or residential complexes.	◗ Groups of bicycle parking rails within an enclosure such as a car park.

To ensure the continued use of bicycle parking facilities, they must be maintained. Poorly maintained facilities will have an adverse effect on patronage and the wider use of bicycles as a means of transport. Maintenance costs should also be factored in to ongoing budgeting.

Section 10 of the *Guide to Traffic Engineering Practice, Part 14 – Bicycles* (AUSTROADS, 1999) provides further information on bicycle parking and end-of-trip facilities suitable for low volume parking locations, typically suitable for most main street and trip generating locations.

7.4 Signage

Signage for the bicycle network should be provided in conjunction with new facilities where possible. The main functions of signage for bicycle network facilities are:

- To assist users to find their way around the network; and
- To warn users of identifiable potential hazards within the riding environment.

The most important function of directional signage is to help users find their way around the network. Directional signage reinforces network connectivity and coherence and provides high visibility and recognition to the collection of routes which make up the wider cycle network.

In order to avoid ambiguity and conflict with motorised road users and bicycle riders, a completely independent system of signage for cyclists should be used. Council officers are recommended to consult with bicycle network officers from the RTA and adjacent councils to ensure a consistent, logical and useable set of destinations are selected.

Yellow diamond shaped warning signs are used to alert riders to changed or potentially hazardous path or road conditions. This type of signage is similarly used to alert other road users of intersecting or merging bicycle movements.

7.5 Supporting Increased Bicycle Use

A number of initiatives could be pursued by Council and other parties to assist in increasing bicycle use across the Shire.

Table 12 shows that there are a range of potential initiatives that Council could introduce to support and encourage cycling. This includes improving the skills of new and existing bicycle riders of all ages, while other initiatives provide practical information such as maps and guides, while other initiatives encourage cycling in the region through sponsored events and activities.

These initiatives could be directly undertaken by Council, in partnership with external organisations and the community, or others could be undertaken by third parties with support from Council.

Table 12 Initiatives to Support Increased Bicycle Use

Goals / Outcomes	Potential Initiatives
To increase community and visitor information, education, awareness and basic skills	◗ Provide cycling information online. ◗ Provide maps of the Wollondilly Bike Plan to the community and visitors. ◗ Guided bicycle tours. ◗ Car driver education.
To encourage practical use of the bicycle as transport to school and work	◗ Support Ride to Work and Ride to School days. ◗ Provision of adequate end-of-trip facilities for bicycles. ◗ Work with schools to develop safe cycling policies.
To provide opportunities for the community to ride in Wollondilly	◗ Bike rides organised by local Bicycle User Groups (BUGs).
To improve and expand bicycle parking and supporting infrastructure	◗ Increase bicycle parking facilities. ◗ Include community input into bicycle parking facility design.
Promote Bicycle Tourism, Sport and Events	◗ Council to encourage and support different bicycle related events.
To integrate support for the Bicycle Strategy into all areas of Council operation	◗ Integrate the Bike Plan into other Council documents and policies.

8. Summary

GHD has undertaken this Bike Plan for Wollondilly Shire Council. Based upon a review of existing facilities and conditions, consultation with various bicycle user groups and an investigation into planned and proposed developments, the Bike Plan has recommended potential improvements to the existing cycle facilities across the towns in the Shire covered in this study.

The proposed improvements have also incorporated comments received from two consultation sessions with different community groups and have been based on indications of Council's available budget over a 10-year timeframe.

The Bike Plan also provides guidance on additional measures to support increased bicycle use in the Shire including maintenance, potential monitoring criteria, bicycle parking and other 'softer' initiatives.

Appendix A

Consultation Notes

Wollondilly Shire Bike Plan

Consultation Workshop #1 Notes – 9th December 2010

INITIAL DISCUSSION

Key issues raised in introduction:

- Tahmoor to Picton (primarily for high school access) grant approved – construction to start soon.
- Remembrance Drive has many constraints.
- Suggestion: Add sufficient 'edge' to all roads will allow for safe cycle use.
- Stakeholders thought that cycle ways connect to schools should be improved.
- Long term strategy to link Appin (and region) to Campbelltown.
- Thirlmere National Park has great off road routes – a link would be desirable.

Current/Future developments:

- Xstrata to re-do bitumen as part of community engagement
- Developers of new land release area in Appin to provide cycleway from development to Appin shops.
- Peabody Energy - $25,000 annually as part of community engagement which could be used for cycle ways in Appin.

Wish lists:

- Popular ride over Razor Back Mountain could be improved.
- Old Picton Road could be improved – spectacular route and fewer safety issues for cyclists.
- Road maintenance to increase road side safety.

APPIN

- Key destinations include: school and park.
- Path needs to link to traffic lights near the school.
- There is a proposed Appin by-pass to consider.
- Appin primarily has local cyclists.

BARGO

- Key destinations include: school, primary school and caravan park.
- Preference for a route out to the Lake Nepean dam.
- Limited number of bridges over the rail line are a major problem for cyclists.

- Road verges are poorly maintained from Bargo to Tahmoor, with excess gravel on shoulder pushed down from driveways.

BUXTON

- Existing internal link to school.
- Rail track is a tourist attractor.
- The village is very much a through route apart from the school.

DOUGLAS PARK

- Need to identify community access/egress to school.
- Potential for more kerb and gutter maintenance.
- Connection to sports ground – wider path suggested.
- Route to Camden passes through the village.

OAKDALE

- School could be linked better – provision of wider paths for children suggested.
- Danger is low due to low traffic volumes.
- Future growth in the neighbourhood will be natural as the Warragamba region has restricted development policies in place.

PICTON

- Current cycle way to high school is poorly marked – linked to Tahmoor.
- Picton High School currently has a 'no bike' policy due to security issues.
- Pedestrians accessing the school currently walk on road shoulder – which could cause conflict with cyclists.
- Community animal centre well used by community – suggested that those visiting the centre may also want to use environmentally friendly access.
- Seniors development with 127 units has been approved – they are required to provide a shared pathway link.

THE OAKS

- Rezoning process – the developer has agreed to provide a link to the shopping centre.
- Link to primary school would be preferred.
- Issue raised with path outside shop fronts – preference against not mixing pedestrians and cyclists at this location.

THIRLMERE

- Seniors development approved to south east of town.

WARRAGAMBA & SILVERDALE

- Paths around the school in Warragamba need to be finished.
- Difficult to get around Warragamba and Silverdale – need to look at local transport and signage within the locality.
- Extension of path down to Wallacia and access to the dam visitor centre are potential options.

WILTON

- Community centre and sports facility are destinations.

YANDERRA

- Potential to link through to other villages.
- Better road shoulders would be advantageous for regional cyclists.

Appendix B

Existing, Planned and Proposed Cycle Routes

BLUE MOUNTAINS
BLUE MOUNTAINS
WARRAGAMBA
SILVERDALE
LIVERPOOL
CAMDEN
COBBITTY
CAMDEN WEST
GRASMERE
MOUNT HUNTER
OAKDALE
THE OAKS
CAMPBELLTOWN
MENANGLE PARK
MENANGLE
WOLLONDILLY
PICTON
DOUGLAS PARK
APPIN
THIRLMERE
TAHMOOR
COURIDJAH
WILTON
BUXTON
BARGO
WINGECARRIBEE
YANDERRA
WOLLONGONG

Legend

- Potential Future Inter Town Connections
- Existing Links
- Proposed Links
- Specific Study Areas
- LGA's
- Wollondilly LGA
- Roads
- Railways

1:150,000 (at A3)

3 1.5 0 3 Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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CLIENTS | PEOPLE | PERFORMANCE

Wollondilly Shire Council
Wollondilly Bike Plan

Potential Regional Links & Study Areas

Job Number 21-20163
Revision B
Date 13 MAY 2011

Overview

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133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.

Appin North Development
Appin03
Sportsground
Primary School
Appin01
Park
MARKET ST
Town Centre
Appin02
APPIN
APPIN RD
William Wodds Reserve
WILTON RD
BULLI APPIN RD

Legend

- Existing On-Road
- Existing Off-Road
- Existing Shared Path
- Planned On-Road
- Planned Off-Road
- Planned Shared Path
- Proposed On-Road
- Proposed Off-Road
- Proposed Shared Path
- Potential Future Inter Town Connection

Generators

- Primary
- Secondary
- Tertiary
- Planned Development

- Roads

1:10,000 (at A3)

0 50 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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GHD

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WOLLONDILLY SHIRE COUNCIL

Wollondilly Shire Council
Wollondilly Bike Plan

Appin
Existing, Planned & Proposed Routes

Figure 1

Job Number 21-20163
Revision A
Date 13 MAY 2011

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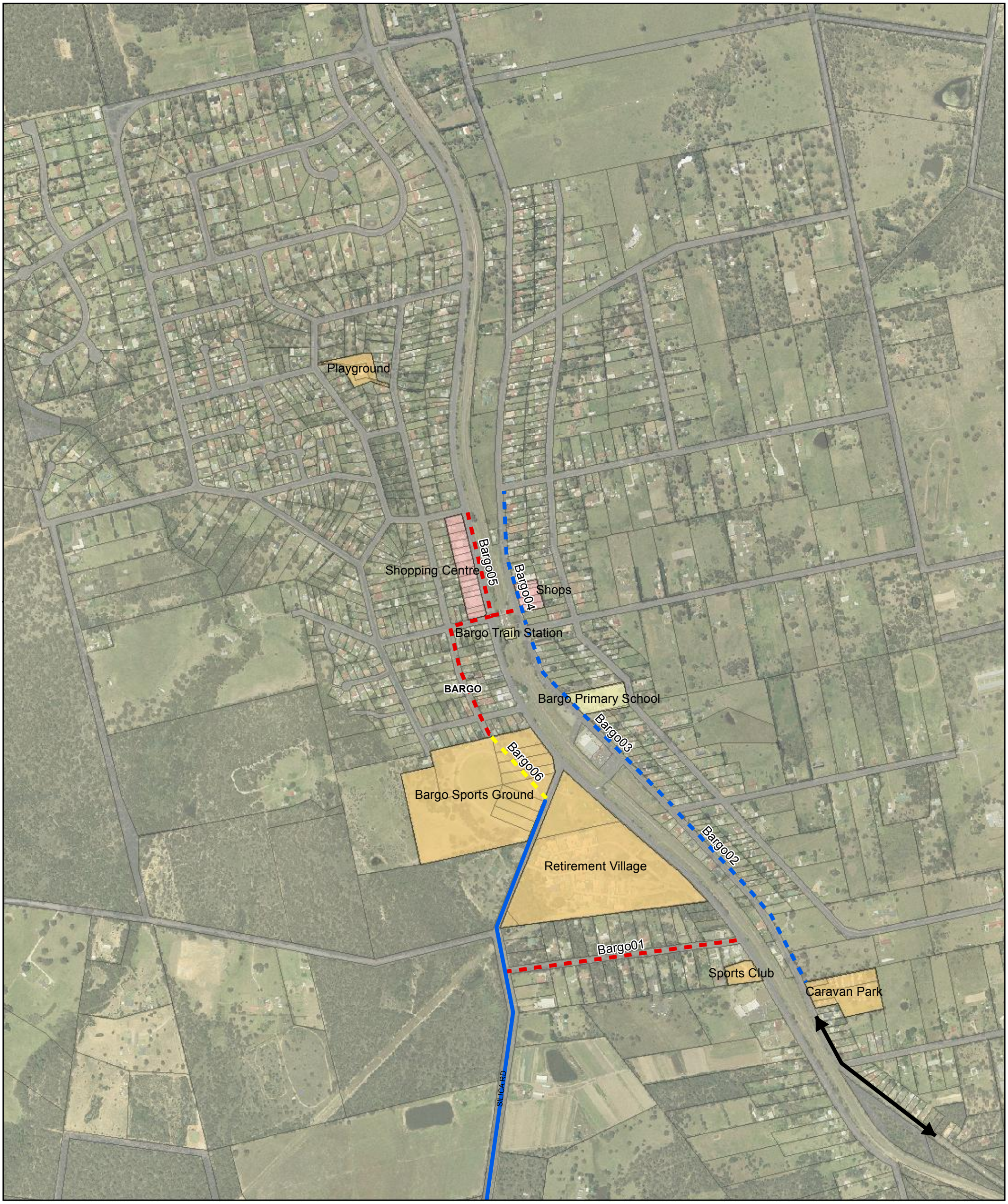
133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.



Legend

- Existing On-Road
- Existing Off-Road
- Existing Shared Path
- Planned On-Road
- Planned Off-Road
- Planned Shared Path
- Proposed On-Road
- Proposed Off-Road
- Proposed Shared Path
- Potential Future Inter Town Connection

Generators

- Primary
- Secondary
- Tertiary
- Planned Development

- Roads

1:10,000 (at A3)

0 50 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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CLIENTS | PEOPLE | PERFORMANCE

Wollondilly Shire Council
Wollondilly Bike Plan

Bargo
Existing, Planned & Proposed Routes

Figure 2

Job Number	21-20163
Revision	A
Date	13 MAY 2011

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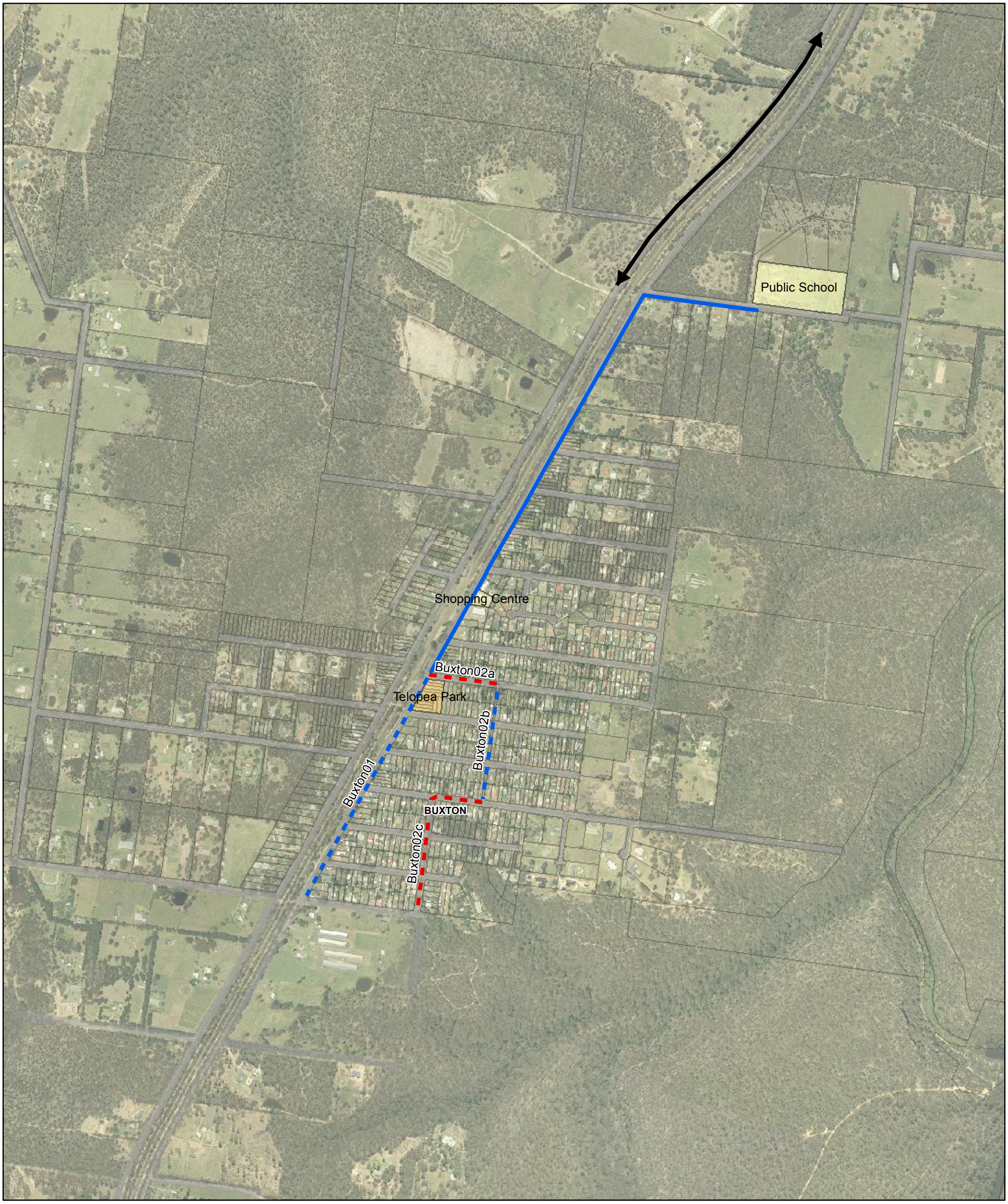
133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.



Legend

- Existing On-Road
- Existing Off-Road
- Existing Shared Path
- Planned On-Road
- Planned Off-Road
- Planned Shared Path
- Proposed On-Road
- Proposed Off-Road
- Proposed Shared Path
- Potential Future Inter Town Connection

Generators

- Primary
- Secondary
- Tertiary
- Planned Development

- Roads

1:10,000 (at A3)

0 50 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

N

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Wollondilly Shire Council
Wollondilly Bike Plan

Buxton
Existing, Planned & Proposed Routes

Job Number 21-20163
Revision A
Date 13 MAY 2011

Figure 3

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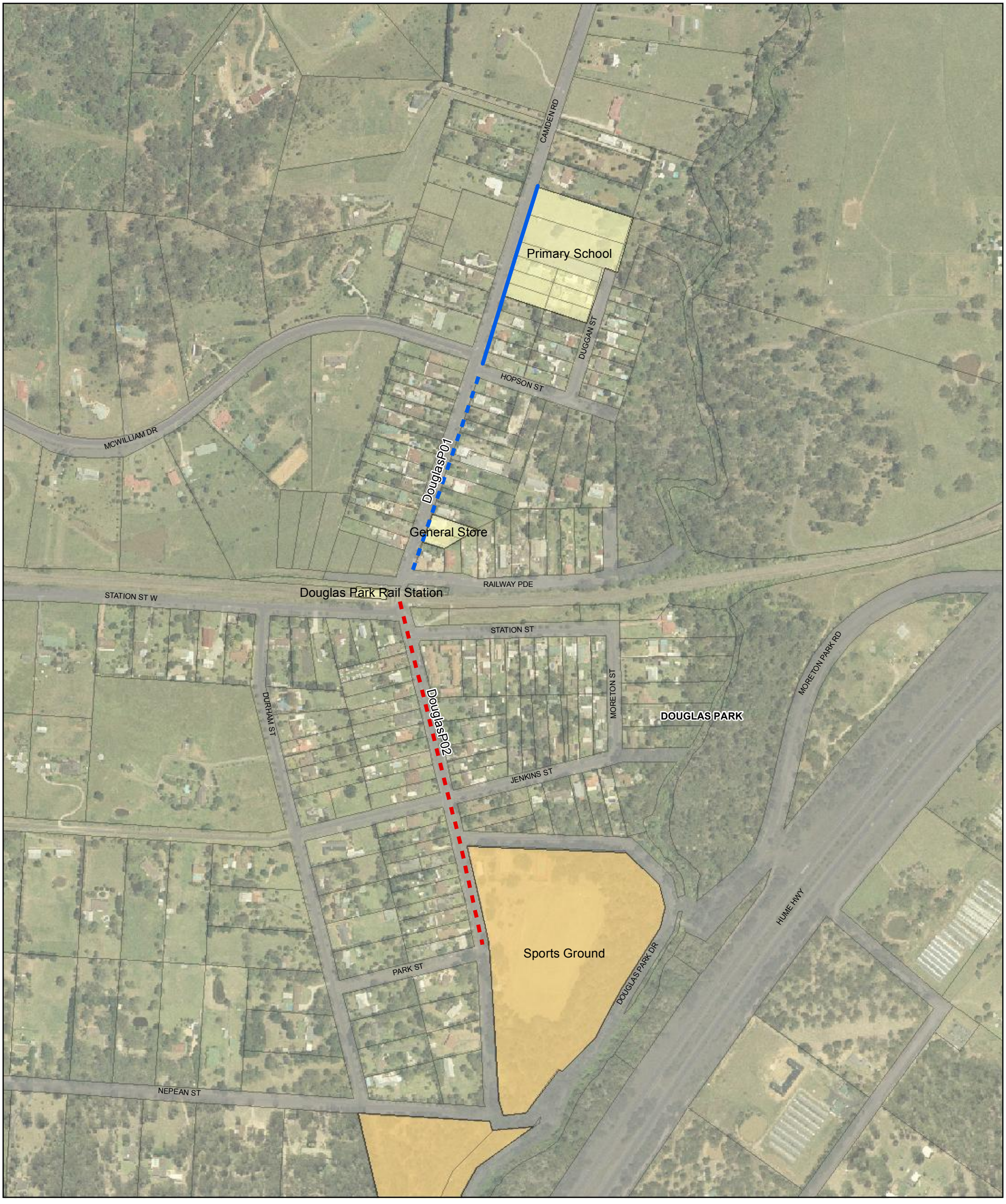
Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.



Legend

- Existing On-Road
- Existing Off-Road
- Existing Shared Path
- Planned On-Road
- Planned Off-Road
- Planned Shared Path
- Proposed On-Road
- Proposed Off-Road
- Proposed Shared Path
- Potential Future Inter Town Connection

Generators

- Primary
- Secondary
- Tertiary
- Planned Development

- Roads

1:5,000 (at A3)

0 25 50 100 150 200 250

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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Wollondilly Shire Council
Wollondilly Bike Plan

Douglas Park
Existing, Planned & Proposed Routes

Job Number 21-20163
Revision A
Date 13 MAY 2011

Figure 4

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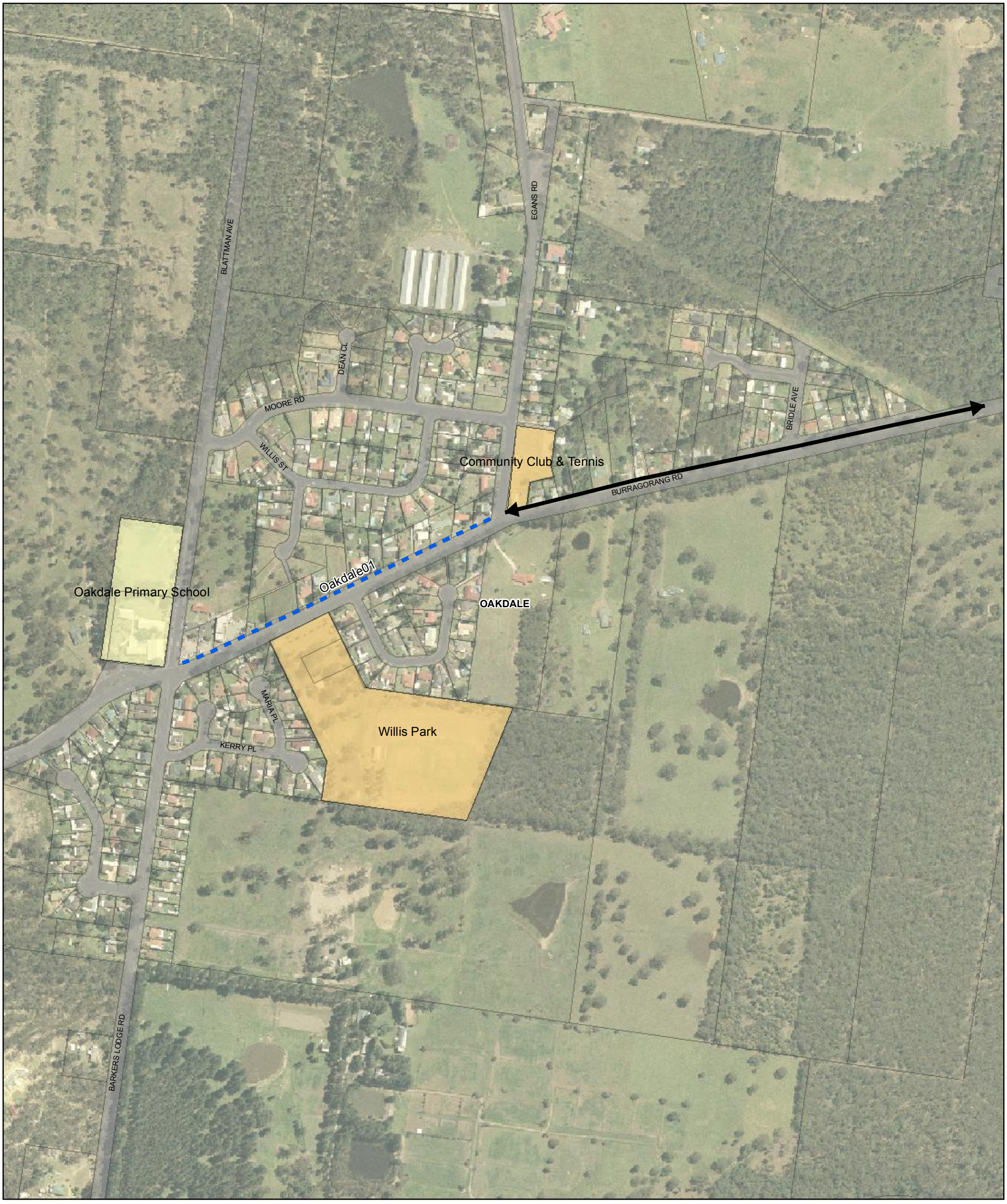
Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.



Legend

- Existing On-Road
- Existing Off-Road
- Existing Shared Path
- Planned On-Road
- Planned Off-Road
- Planned Shared Path
- Proposed On-Road
- Proposed Off-Road
- Proposed Shared Path
- Potential Future Inter Town Connection

Generators

- Primary
- Secondary
- Tertiary
- Planned Development

- Roads

1:5,000 (at A3)

0 25 50 100 150 200 250

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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Wollondilly Shire Council
Wollondilly Bike Plan

Oakdale
Existing, Planned & Proposed Routes

Job Number 21-20163
Revision A
Date 13 MAY 2011

Figure 5

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Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.

Botanical Gardens
Hume Oval
Picton06
Town Centre
PICTON
St Anthonys Primary
Showground
Picton Primary
Victoria Park
Picton01
Picton04
Picton03
Picton Rail Station
Picton02
Glenrock Reserve
Redbank Reserve
Community Leisure Centre
Industrial Park
Picton05
Picton High School
Tahmoor04

Legend

- Existing On-Road
- Existing Off-Road
- Existing Shared Path
- Planned On-Road
- Planned Off-Road
- Planned Shared Path
- Proposed On-Road
- Proposed Off-Road
- Proposed Shared Path
- Potential Future Inter Town Connection

Generators

- Primary
- Secondary
- Tertiary
- Planned Development

- Roads

1:15,000 (at A3)

0 75 150 300 450 600 750

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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Wollondilly Shire Council
Wollondilly Bike Plan

Job Number 21-20163
Revision A
Date 13 MAY 2011

Picton
Existing, Planned & Proposed Routes

Figure 6

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Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.

Legend

- Existing On-Road
- Existing Off-Road
- Existing Shared Path
- Planned On-Road
- Planned Off-Road
- Planned Shared Path
- Proposed On-Road
- Proposed Off-Road
- Proposed Shared Path
- Potential Future Inter Town Connection

Generators

- Primary
- Secondary
- Tertiary
- Planned Development

- Roads

1:10,000 (at A3)

0 50 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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Wollondilly Shire Council
Wollondilly Bike Plan

Tahmoor
Existing, Planned & Proposed Routes

Figure 7

Job Number	21-20163
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Date	13 MAY 2011

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Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.

Legend

- Existing On-Road
- Existing Off-Road
- Existing Shared Path
- Planned On-Road
- Planned Off-Road
- Planned Shared Path
- Proposed On-Road
- Proposed Off-Road
- Proposed Shared Path
- Potential Future Inter Town Connection

Generators

- Primary
- Secondary
- Tertiary
- Planned Development

- Roads

1:5,000 (at A3)

0 25 50 100 150 200 250

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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Wollondilly Shire Council
Wollondilly Bike Plan

The Oaks
Existing, Planned & Proposed Routes

Figure 8

Job Number 21-20163
Revision A
Date 13 MAY 2011

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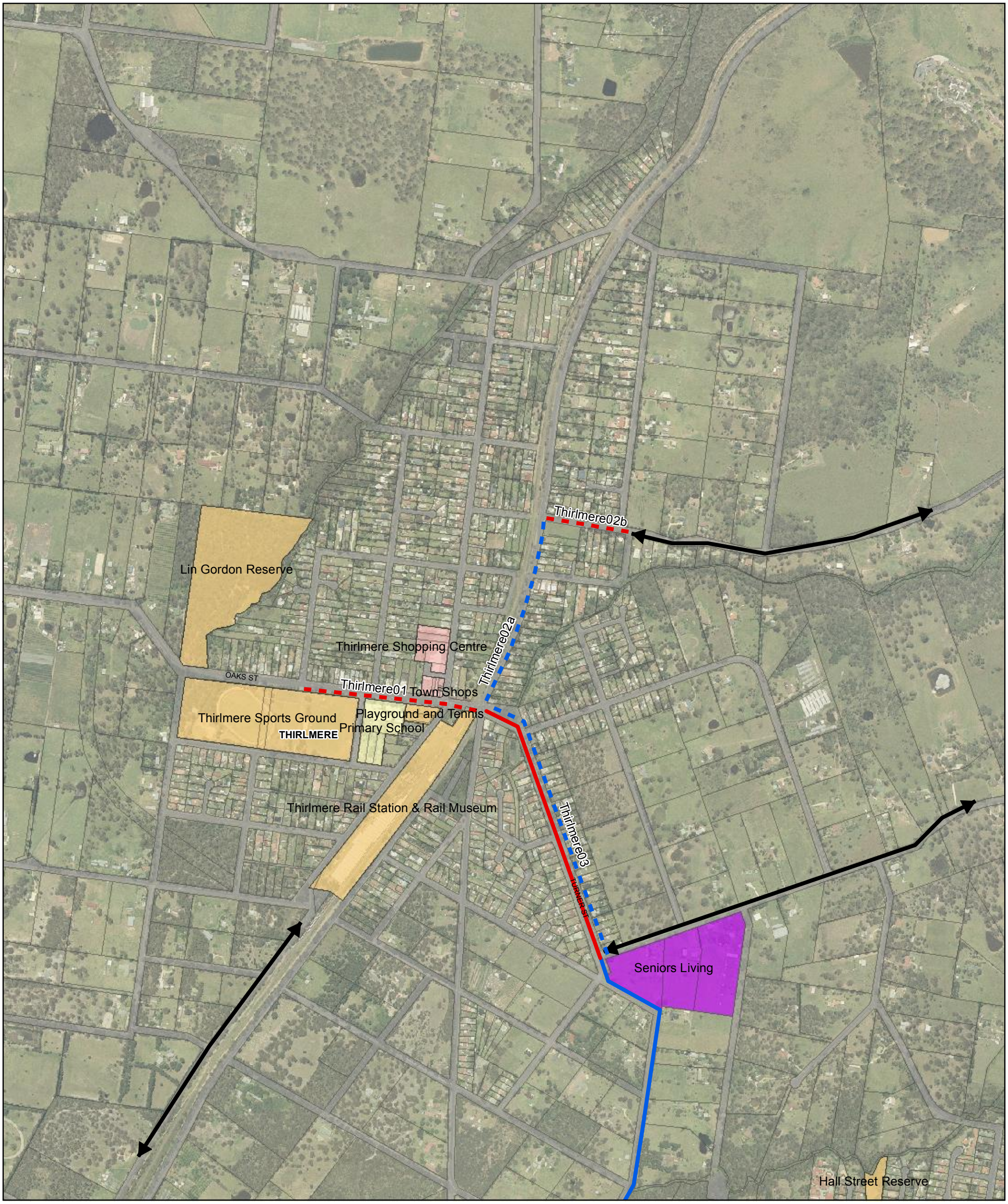
Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.



Legend

- Existing On-Road
- Existing Off-Road
- Existing Shared Path
- Planned On-Road
- Planned Off-Road
- Planned Shared Path
- Proposed On-Road
- Proposed Off-Road
- Proposed Shared Path
- Potential Future Inter Town Connection

Generators

- Primary
- Secondary
- Tertiary
- Planned Development

- Roads

1:10,000 (at A3)

0 50 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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Wollondilly Shire Council
Wollondilly Bike Plan

Thirlmere
Existing, Planned & Proposed Routes

Figure 9

Job Number	21-20163
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Date	13 MAY 2011

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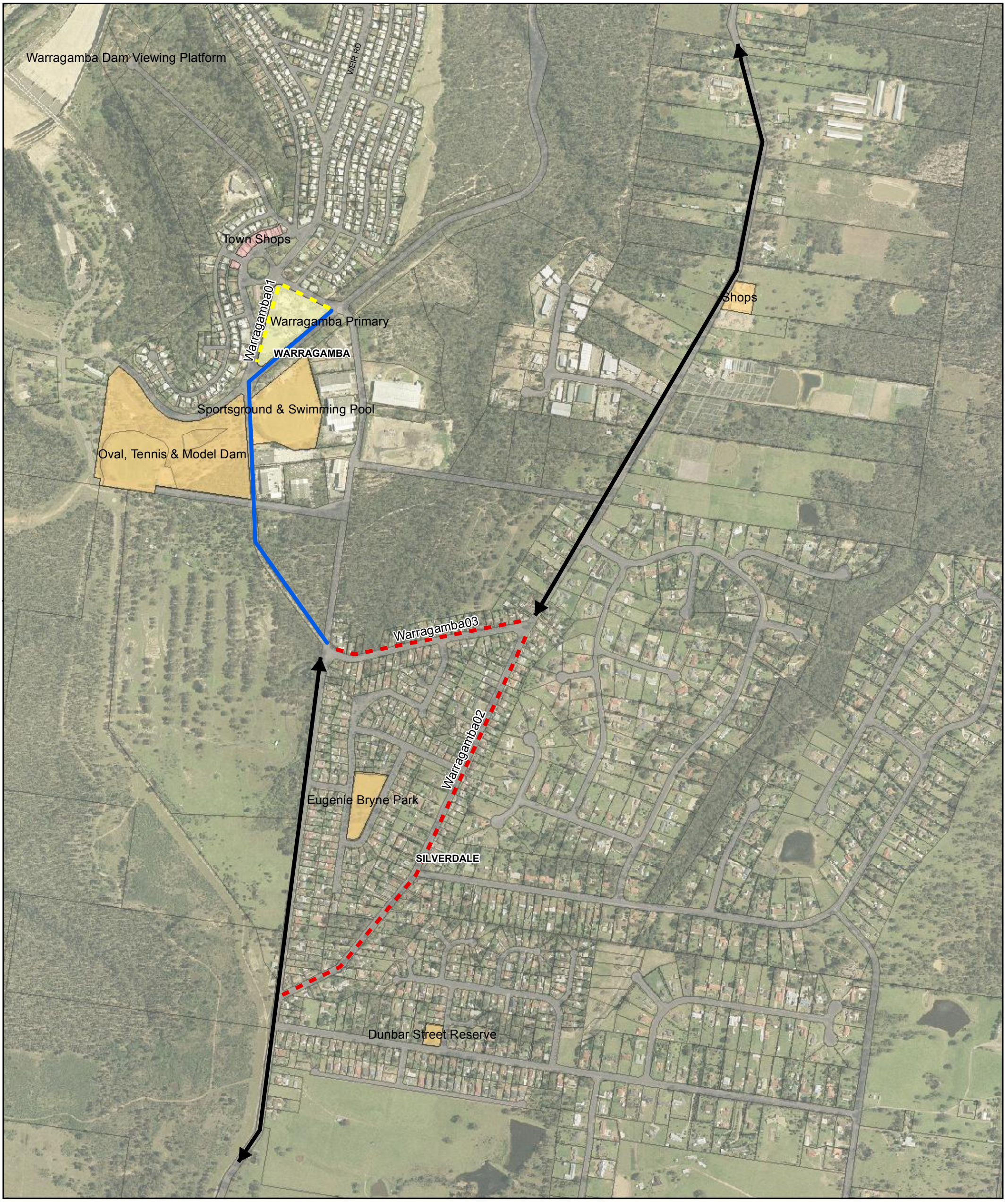
133 Castlereagh Street Sydney NSW 2000 Australia **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com **W** www.ghd.com

Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.



Legend

- Existing On-Road
- Existing Off-Road
- Existing Shared Path
- Planned On-Road
- Planned Off-Road
- Planned Shared Path
- Proposed On-Road
- Proposed Off-Road
- Proposed Shared Path
- Potential Future Inter Town Connection

Generators

- Primary
- Secondary
- Tertiary
- Planned Development

- Roads

1:10,000 (at A3)

0 50 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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Wollondilly Shire Council
Wollondilly Bike Plan

Warragamba and Silverdale Existing, Planned & Proposed Routes

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Revision A
Date 13 MAY 2011

Figure 10

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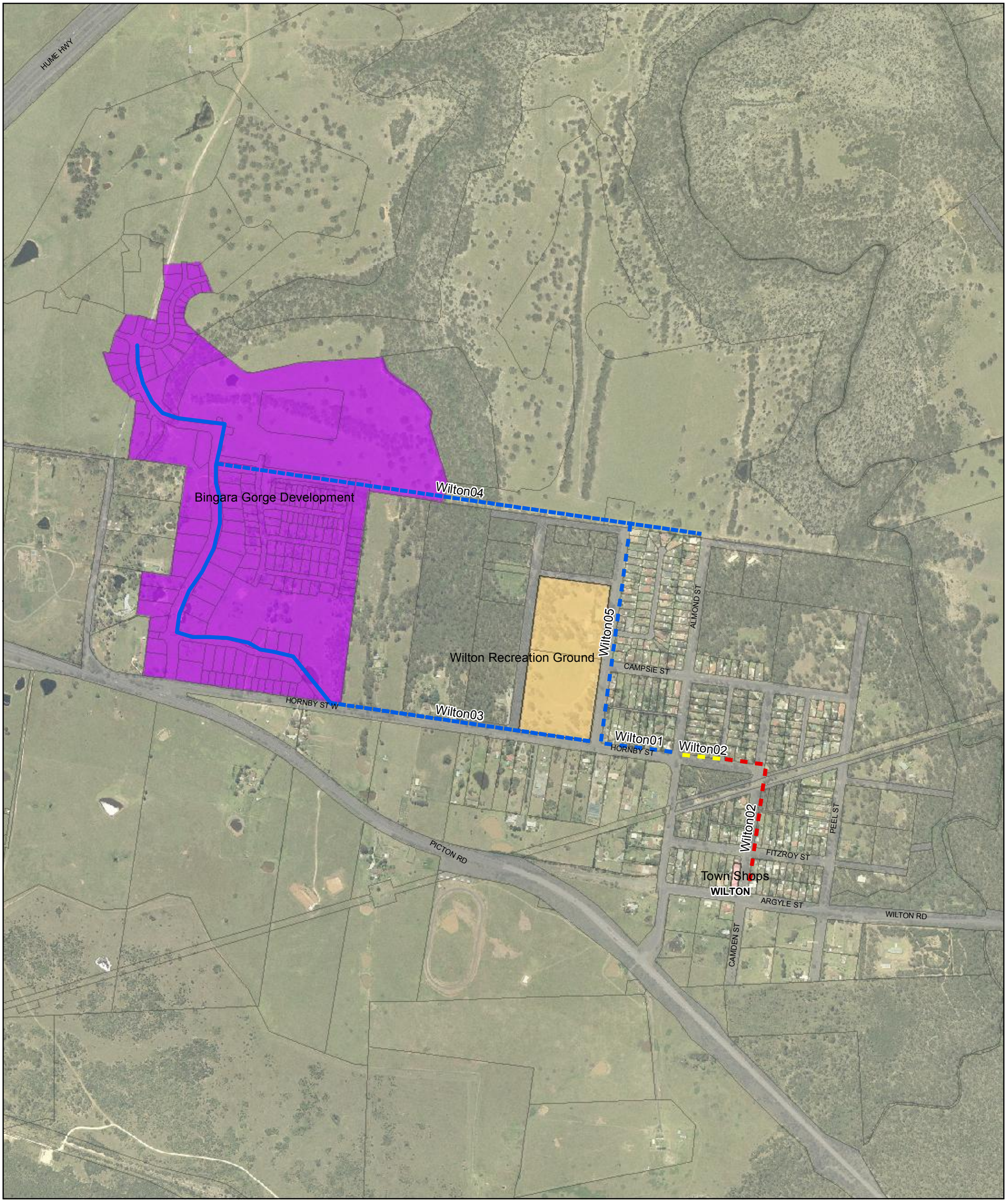

Legend

- Existing On-Road
- Existing Off-Road
- Existing Shared Path
- Planned On-Road
- Planned Off-Road
- Planned Shared Path
- Proposed On-Road
- Proposed Off-Road
- Proposed Shared Path
- Potential Future Inter Town Connection

Generators

- Primary
- Secondary
- Tertiary
- Planned Development

- Roads

1:10,000 (at A3)

0 50 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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Wollondilly Shire Council
Wollondilly Bike Plan

Wilton
Existing, Planned & Proposed Routes

Figure 11

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Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.

Legend

- Existing On-Road
- Existing Off-Road
- Existing Shared Path
- Planned On-Road
- Planned Off-Road
- Planned Shared Path
- Proposed On-Road
- Proposed Off-Road
- Proposed Shared Path
- Potential Future Inter Town Connection

Generators

- Primary
- Secondary
- Tertiary
- Planned Development

- Roads

1:5,000 (at A3)

0 25 50 100 150 200 250

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 56

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Wollondilly Shire Council
Wollondilly Bike Plan

Yanderra
Existing, Planned & Proposed Routes

Figure 12

Job Number	21-20163
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Date	13 MAY 2011

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Data source: Based on data provided by Wollondilly Shire Council and GHD. Created by: N Buchanan.

GHD

133 Castlereagh St Sydney NSW 2000

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1	R Leonard / N Buchanan	N Buchanan R Manahan	*R Manahan*	R Manahan	*R Manahan*	30/3/11
2	N Buchanan	R Manahan	*R Manahan*	R Manahan	*R Manahan*	13/5/11