Kirkwood Road South Structure Plan

KIRKWOOD ROAD SOUTH STRUCTURE PLAN - SUMMARY OF INVESTIGATIONS

- Final
- 2/5/2004

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1. Introduction

Sinclair Knight Merz has been engaged by Gladstone City Council to prepare a Structure Plan for the area south of the proposed Kirkwood Road. The Structure Plan identifies a preferred future land use pattern for the area south of the proposed Kirkwood Road alignment (Kirkwood Road South).

The Kirkwood Road South Structure Plan has been prepared based on the investigation of existing and future land use, topography, traffic and infrastructure requirements, as well as consultation with property owners, agency stakeholders and Council staff.

This report provides a summary of the key outcomes of investigations. It includes:

- An overview of the study area;
- A preferred land use pattern for Kirkwood Road South;
- The outcomes of the infrastructure needs assessment; and
- An outline of the traffic needs assessment.

1.1 Background

The Gladstone region has experienced significant population growth and development in recent years with the development of several major projects. Numerous major industrial projects have also recently been proposed for Gladstone, placing increasing pressure on the residential land bank.

In response to these demands, there has been increasing interest in developing the area south of the Kirkwood Road corridor. Council has recently received applications for development in the study area. In response to this increased developer interest, Council has initiated development of the Kirkwood South Structure Plan. The outcomes of the structure plan, as outlined in the project brief are to:

- Provide an overall plan for development of the area identifying preferred land uses, including residential, open space and commercial uses;
- Integrate the structure plan within the overall fabric of the City;
- Accommodate the different time of development by individual developers;
- Identify development constraints and barriers to development and also describe the potential capacity of the area to provide residential land to accommodate the growth of the City;
- Recommend improvements to the road system necessary to service the area together with recommendations in regard to the priorities that should be given to the recommended improvements;

- Recommend improvements and extensions to the water and sewerage reticulation systems necessary to service the area, taking into account the need for such information to be readily included in an overall review of Water Supply and Sewerage for the City;
- Examine the need for and capacity of the electricity reticulation system to accommodate the recommended land uses; and
- Recommend an approach and network for Stormwater Drainage and its development in a manner consistent with the draft Curtis Coast Regional Coastal Management Plan and the Gladstone Harbour Protection and Enhancement Strategy.

2. Kirkwood Road South Study area

This section provides an overview of the Kirkwood Road South study area including location, geography, land tenure and existing land uses.

2.1 Location

The Kirkwood Road South study area adjoins the southern boundary of the City of Gladstone, south of the residential areas of Clinton, New Auckland and Glen Eden, as shown in **Figure 1**.

The study area is bound by the proposed Kirkwood Road alignment to the north, the City of Gladstone/ Calliope Shire Council boundary and open space area to the south, the Dawson Highway to the west, and Auckland Creek to the east.

2.2 Geography

The study area covers an area of about 5.74 km^2 (574 ha). It includes areas of steeply sloping land, with some parts of the study area exceeding a 30% slope. Also, the study area is crossed by a number of creek systems and drainage lines, including Briffney Creek, Cathurbie Creek and Auckland Creek. The study area also includes remnant vegetation along the Briffney and Auckland Creeks.

2.3 Land Tenure

The study area is held in freehold title by a number of different landowners. A large proportion of the study area (approximately 60%) is held by four landowners (refer **Figure 2**). They include:

- Lib Management Pty Ltd who own approximately 112 ha (20%);
- John and Wendy Davies whose land comprises 86 ha (15%);
- FKP Limited who own approximately 39 ha (7%); and
- Parksville Holdings Pty Ltd, whose land comprises about 106 ha (18%).

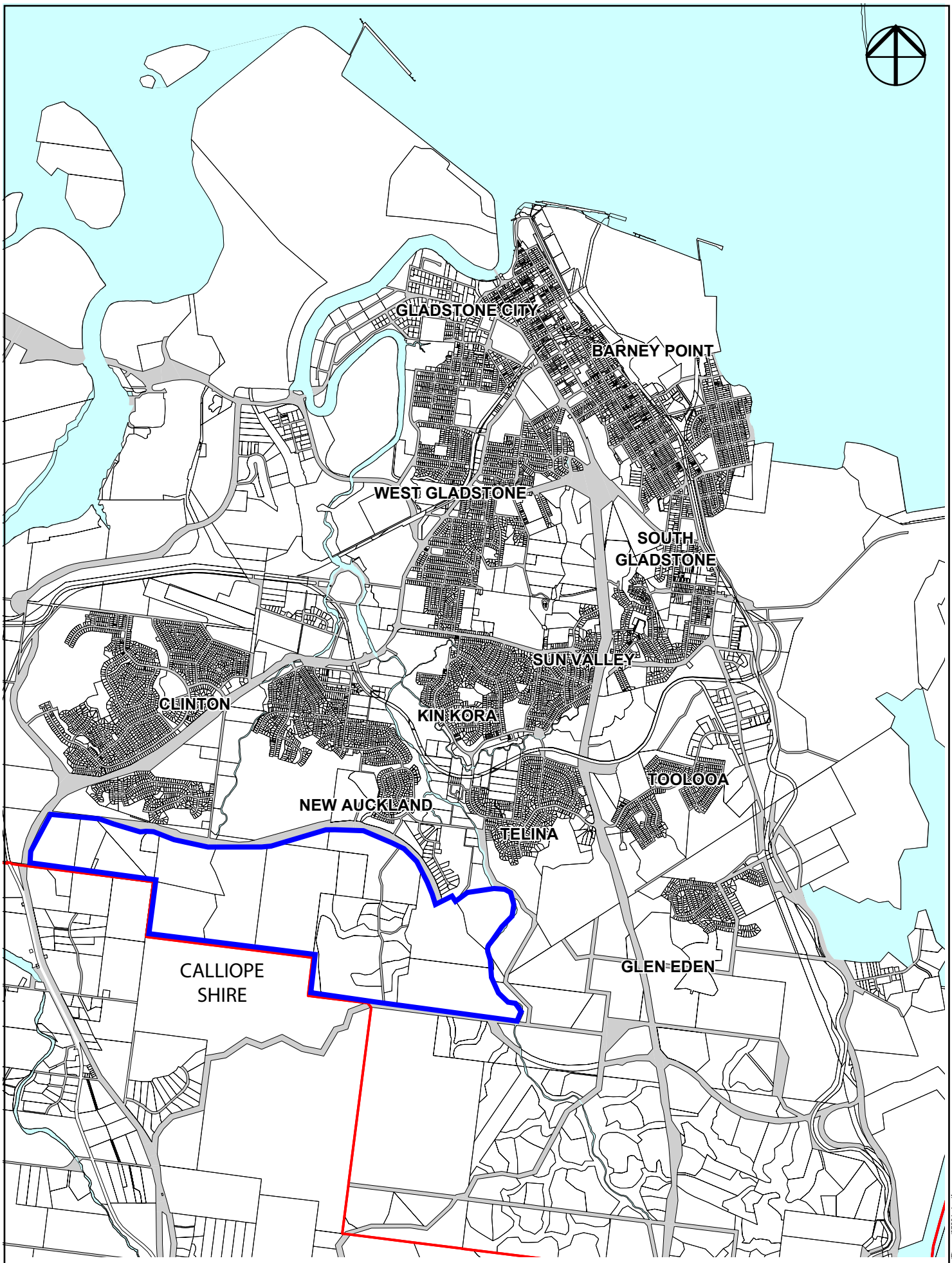
The remaining land in the study area is held by a number of individual property owners, with properties ranging in size from about 2 ha upwards.

2.4 Existing Land Uses

The study area consists largely of undeveloped land including rural, rural residential and open space. The study area also includes major infrastructure corridors, including high voltage overhead electricity transmission lines. Surrounding land uses include residential development to the north with the subdivisions of Kaleentha, Emmadale, Telina and Parksville. These developments consist generally of detached dwellings on allotments ranging in size from about 700 m^2 to 1,200 m^2. A

subdivision of park residential allotments is also located in the Parksville Estate with allotment sizes of approximately 2,700 m^2 to 4,300 m^2.

South of the study area (Calliope Shire), land uses include a State Forest, and rural residential uses.



Kirkwood Road South Study Area

Figure 1

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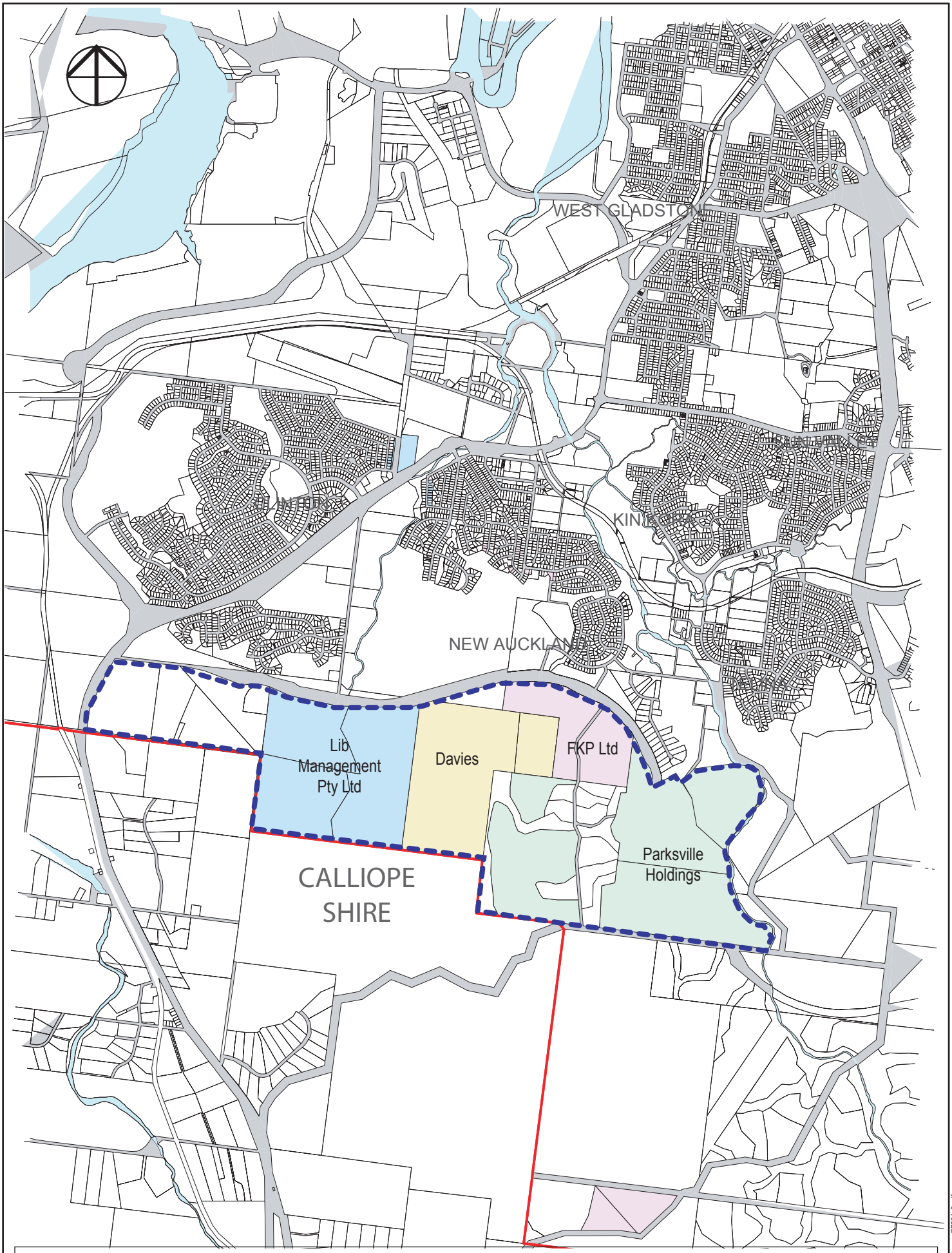

Legend

Study area

City / Shire Boundary

Property Owners

Figure 2

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3. Constraints on Development

Development of the study area is constrained by a range of topographic, environmental, land ownership and infrastructure factors. These include:

- Areas of steeply sloping land, with some areas of slope greater than 30%;
- Creek lines and drainage areas subject to flooding from 1 in 100 year flood events;
- Areas of endangered remnant vegetation;
- A range of land holders, with different time lines for development; and
- Major infrastructure corridors, including for high voltage electricity transmission lines.

Details on each of these constraints is provided below.

3.1 Topography

Development can be constrained by steeply sloping land, particularly in regard to the high costs of providing services and preparing suitable building areas. A digital terrain model was prepared to show the topography of the study area (**Figure 3**).

As **Figure 3** indicates, the study area is characterised by areas of steeply sloping land with a number of ridgelines across the middle of the study area in a north-south direction. The steeply sloping land includes areas with slopes greater than 30%. The eastern section of the study area includes the drainage lines for two creek systems comprising more gently slopes of less than 15%. A slope analysis was undertaken of the study area to identify those areas constrained by excessive slope and to provide an indicative development potential for the study area. The results of this analysis are shown in **Table 3-1** along with an indicative development potential of these areas.

- **Table 3-1 Slope Analysis**

Slope	Area (ha)	Area (%)	Development Potential
<15%	366.8	64.08	10 allotments/ ha
15% - 25%	119.7	20.91	7 allotments/ ha
25% - 30%	34.3	5.99	2 allotments/ ha
>30%	51.6	9.01	Unsuitable for development

Legend

- Proposed Kirkwood Road Alignment
- Water Courses
- Drainage Catchment Lines
- Study Area
- Cadastre

0 0.5 1
kilometres

N

Kirkwood Road South Structure Plan

Figure 3
Digital Terrain Model

3.2 Infrastructure

Infrastructure can constrain development in relation to both the capacity of the existing infrastructure to cater for new development, and the physical constraints resulting from easements protecting existing infrastructure.

The study area incorporates major infrastructure easements, including easements for high voltage overhead electricity transmission lines. The transmission line easement traverses the western portion of the study area. The easement is 250 m wide and covers an area of about 38 ha. Development is prohibited within the transmission line easement apart from roadways, which are permitted to cross the easement corridor.

The study area also includes easements for low voltage overhead transmission lines and road access to properties. These do not provide an excessive constraint on development in the study area.

Areas within the study area over 70 m AHD are also constrained, including the incapacity of the current water supply system to provide water above 70 m AHD

3.3 Remnant Vegetation

Parts of the Kirkwood Road South study area are constrained by the location of endangered remnant vegetation. These locations coincide generally with the Briffney Creek and Auckland Creek corridors and should be incorporated into open space areas to ensure that they are protected from development.

3.4 Flooding

The study area is affected by flooding during a 1 in 100 year flood event in the Cathurbie Creek, Briffney Creek and Auckland Creek catchments. The impact of flooding is minor and is confined to areas immediately adjacent to the creeks. Impact on development within the study area can be minimised by incorporating flood prone areas within open space.

3.5 Land Use Zoning

The study area is included in the Rural/Non-urban zone within the current Gladstone Transitional Town Planning scheme. Land use zoning currently proposed in the revised IPA Planning Scheme includes Major Industry and Infrastructure (for the transmission line easement), Open Space and Rural. Future development is constrained by these Open Space and Major Industry Zones.

3.6 Land Ownership

Land in the study area is held by a number of landowners. Approximately 60% of the study area is held by four landowners, with the remaining land held by various property owners in small holdings (from 2ha).

Land ownership and differing time lines by individual landowners to undertake development is a constraint on the coordinated development of the study area, potentially resulting in “out of sequence” and inefficient development of the study area. Of the four major landowners in the study area, development applications for residential development have been received from two. Other landowners have indicated a desire to develop their properties, but have not yet submitted an application to Council.

3.7 Kirkwood Road South Study Area Constraints Map

Figure 4 shows the constraints on development for the study area. It includes:

- Land subject to flooding during a 1 in 100 year flood event;
- Land above 70 m AHD which is restricted in relation to water supply;
- Areas of slope greater than 30%;
- Areas of endangered remnant vegetation;
- Land zoned for open space; and
- Land within easements, including high voltage electricity transmission lines, which are restricted from being developed.

Legend

- Flood Extent (100yr ARI)
- Areas above 70m AHD
- Slope Greater than 30 Percent
- Endangered Remnant Vegetation
- Open Spaces
- Easements
- Water Courses
- Proposed Kirkwood Road Alignment
- Drainage Catchment Lines
- Study Area
- Cadastre

Calliope Shire

0 0.5 1
kilometres

N

Kirkwood Road South Structure Plan

Figure 4
Constraints Plan

4. Population Capacity

An investigation of the development capacity of the study area has been undertaken for the assessment of future traffic generation and infrastructure needs. This analysis was based on discussions with property owners, Council staff and an analysis of the study area's constraints.

4.1 Land Supply

4.1.1 Future Development Applications

Council has recently received a number of applications for residential development in the study area. These include applications for development by FKP Limited and by Parksville Pty Ltd. In addition, discussions with other major landowners in the study area indicate an intention to develop their properties for residential development generally within the next 5-10 years.

Table 4-1 provides an overview of current and potential future residential land development applications for the study area. These have been obtained from discussions with landowners and an analysis of GIS information.

Table 4-1 Proposed Development in the Study Area

Landowner	Proposed Number of Lots	Comment
Lib Management	800	Estimated using an analysis of key constraints
Davies	600	Proposed
FKP Limited	335	Development Applications for 201 allotments and 134 allotments has been lodged for Council consideration.
Telina (east of Kirkwood Road)	250	Development Application for 170 allotments has been lodged for Council consideration. Future development area identified south of the application area with potential for approximately 80 allotments.
Parksville (South and west of Kirkwood Road)	470	Proposed
Total	**2,455**	

Discussions with developers indicate that the majority of allotments proposed consist of residential development with lot sizes range from about 700 m^2 to 1,200 m^2. However, there are some areas that are to be developed for larger lot, rural residential development.

4.2 Population Capacity

A broad population capacity was calculated for the potential number of allotments in the study area, shown in **Table 4-2** using 2001 ABS Census data for the City of Gladstone. It is recognised that there will be some variations over time in the proportion of dwelling type and number of persons per dwelling.

Table 4-2 Population Capacity

Dwelling Type	% Dwelling Type (2001)	Persons/ Dwelling (2001)	Proposed Lots	Est Pop
Separate house	75.5	2.91	1,854	5,394
Semi-detached, row or terrace house, townhouse, etc.	2.4	1.91	59	113
Flat, unit or apartment:	8.3	1.59	204	324
Other dwelling:	3.9	1.71	96	164
Not stated	1.5	1.79	37	66
Unoccupied private dwellings	8.4	n/a	206	0
Total	**100.0**	**2.47**	**2,455**	**6,064**

Based on the development potential of 2,455 allotments, the study area has a population capacity of approximately 6,100 residents. This information relates to the four major land holdings only, which incorporate about 60% of the study area. It is anticipated that the remaining land will generally be developed for rural residential development or be retained for open space, which will not generate significant residential populations. Therefore, for the purposes of this study, the figure of 2,455 allotments is considered an appropriate indication of development potential for the whole study area.

5. Infrastructure Needs

5.1 Existing Infrastructure

A review of the existing infrastructure in the study area was undertaken to assess the capacity of the infrastructure and to identify future infrastructure needs and development. The infrastructure review included consultation with various authorities including Gladstone City Council (water supply, sewerage and drainage), Origin Energy (gas), Telstra (telecommunications), and Ergon Energy (electricity).

5.2 Future Infrastructure Needs

Based on the investigations of the existing services, the potential population generated by development of the study area has been used to assess future infrastructure needs. This assessment has involved examining the services needed for the ultimate development of the study area and if there are any milestones or significant staging of the infrastructure works.

5.3 Water Supply

The water reticulation system that currently services Emmadale and Kaleentha Estates is capable of servicing at least an additional 600 allotments. The installation of a section of a planned 375 mm main from Harvey Road to Emmadale Drive, together with a connection from the existing 375 mm main leading from the Dawson Highway to the current 150 mm main in Carinya Drive, would probably provide an adequate service with full development of the Study Area. The conclusion is that there are no physical or financial concerns in respect of the supply of water to the Study Area.

5.4 Sewerage

The study area drains into the South Gladstone and South Trees sewer catchment areas. The study area is currently unsewered. To allow development to proceed, road crossings as identified on the sewer layout plan will be installed as Kirkwood Road construction proceeds. Extensions of existing trunk gravity sewers and up-grades to pump stations will be required in the South Gladstone Catchment to take the future sewage flows.

For the area draining to the South Trees Catchment, major works will have to be constructed to take the flows to the South Trees treatment plant. Both the South Trees and Calliope (Gladstone??) treatment plants will eventually be upgraded to allow for the future flows from the study area.

5.5 Stormwater Drainage

5.5.1 Water Flows

The studies undertaken for the three main watercourses (ie Briffney Creek, Police Creek and Cathurbie Creek) report results based on the future developed case. The future developed case was

based on the then current (2000-2001) *Gladstone City Council Development Control Plan.* The *Development Control Plan* has not changed significantly since the time of these studies[1].

In order to obtain developed condition flows, it is necessary to be aware of the catchment areas relating to each land use category. Therefore, it is reasonable to assume that the developed cases do not differ greatly because they are not reliant on details such as the assumed number of allotments. The assumptions made of the catchment characteristics in the Cox Andrews reports for the three watercourse are consistent for the development areas proposed in this study.

In light of this conclusion, the results reported in the existing reports (Cox Andrews 2000, 2001) are considered to be applicable to this study.

5.5.2 Water Quality

The *Gladstone Harbour Protection and Enhancement Strategy* identified urban stormwater run-off as a high priority for further investigation and action due to the potential adverse effects on the water quality in the Gladstone Harbour from this source. Stormwater is the first issue addressed in the Strategy with the primary goal *being "to manage and improve the quality of stormwater entering Gladstone Harbour"*.

A number of options can be implemented to ensure satisfactory quality of stormwater from the land use change within the study area. It will be necessary to identify solutions such as gross pollutant traps, Stormwater Quality Improvement Devices, treatment wetlands, and grass swales, which all work to improve the quality of urban stormwater. The exact solution is dependent on the specific development area being designed. Council would normally impose conditions on development approval based on no worsening of the existing downstream situation. An educational campaign to raise awareness within the community can also be very effective. This would focus on reducing litter and reducing the use of chemicals that would decrease water quality when released in the stormwater.

5.6 Electricity

Following discussions with Ergon Energy, Ergon suggests a combination of 11 kV and 66 kV distribution feeders to service the study area. The low voltage (240 / 415 V) lines will generally follow the road reserves in underground conduits.

5.7 Telecommunications

Telstra have no planning in place for the future servicing of the study area. They have in place a Universal Service Obligation for residential developments whereby Telstra is obliged to provide

[1] pers. Comm Ross Paroz 03.12.2003

telecommunications services to residences other than those designated as Premium developments, in which case an Enterprise project is created and the developer has to pay a contribution for the service provision.

5.8 Gas

Origin Energy have no planning in place for the future gas supply to the area. They would assess any development application on a case by case basis and calculate any contribution required to supply gas to the site. Unless there is a future industrial or commercial development that would be a major gas consumer, it is unlikely that gas supply to residential developments would be financially viable due to the distance from existing gas mains.

It would be prudent to allow for a gas trunk main along the Kirkwood Road reserve cross section to cover the possibility of a major gas link across that part of the City.

5.9 Community Infrastructure

Future community infrastructure to be provided in the study area will include local open space and recreation areas and a small scale neighbourhood shopping centre to serve the day to day needs of local residents. This should be located in an area that provides easy access and connection to residential areas and the transport network.

It is suggested provision of a school is not required in the study area. The provision of schools in Gladstone is considered to be broader than the requirements of this study and will need further investigation between Gladstone City Council and the Department of Education, in association with industries in the Gladstone region.

6. Traffic and Road Network

Preparation of the Kirkwood South Structure Plan involved investigation of traffic and road network issues for the south western part of Gladstone. Of particular importance is the access to the proposed developments in the area, general amenity and mobility.

The overall aim of the traffic investigations was to maintain both long and short term general mobility in the study area, improve general traffic safety and improve residential amenity through the reduction of adverse impacts of vehicular traffic.

6.1 Existing Traffic and Transport Network

An assessment of the existing traffic and transport situation for the Kirkwood Road study area and surrounding area included a review of existing demographics, traffic levels, growth rates, road provisions, incident history and adequacy together with identification of any existing deficiencies. The key conclusions from the assessment of existing traffic and transport situation in the core area of interest include:

- The operation of the intersections in the study area is satisfactory, with acceptable degrees of saturation, minimal delays and good levels of service for both the AM and PM peak;
- The intersection of Dawson Highway and Philip Street has a relatively high number of reported crash incidents over the last ten years. It also has the highest degree of saturation of any of the intersections analysed, although it is well within its practical capacity;
- As would be expected, census data has reported a high growth rate of residential population in the Kirkwood area over recent years. This has continued in specific areas since the 2001 census;
- Heavy vehicle movements are not above the expected average for the AM or PM peak due to freight operators generally avoiding travel during the busy traffic periods;
- Based on current traffic operations, all roads in the study area currently perform functions consistent with their classification;
- The only road in the area which is close to its practical traffic capacity is the two lane section of the Dawson Highway between Penda Avenue and Harvey Road; and
- All the collector streets within the core area of interest are either above or close to their desirable environmental capacity.

6.2 Road and Street Capacity

A major aspect of the assessment is the consideration of the environmental capacity of residential streets as well as the traffic capacity.

The traffic capacity of a typical urban "traffic carrying" two way road (eg arterial or sub arterial) is in the order of 18,000 to 22,000 vehicles per day (vpd). This capacity is affected by factors such as the extent of parking on the road, the number and importance of intersections, the proportion of traffic which occurs in the peak hour (the peak hour factor or PHF) and the directionality of the peak hour flow (ie the percentage of the two way flow which occurs in the peak flow direction). It is the capacity beyond which excessive congestion and delays occur. For a lower order road, these factors have a higher impact and the traffic capacity is likely to be in the range 10,000 to 13,000 vpd.

On the other hand, documents such as the Australian Model Code for Residential Development (AMCORD) and Queensland Streets have identified the concept of environmental capacity for residential streets. This can be regarded as the capacity of an urban residential street (ie with residential driveways) beyond which the amenity of the residents is significantly adversely affected. It can also be regarded as the traffic levels beyond which complaints to the roads authorities about traffic volumes and speeds increase considerably.

A daily two way flow in the order of about 3,000 vpd is widely regarded as a suitable design standard for new residential streets. Existing residential streets with similar traffic flows may not result in significant levels of complaints until a daily flow of about 4,000 vpd is reached. This latter figure has been used for consideration of the existing urban residential streets south of Philip Street. Wider road carriageways and straighter roads tend to reduce the environmental capacity of a street, rather than increase it. This is due to higher speeds which tend to occur. Narrow road carriageways and wide road reserves, with significant house set backs can increase the environmental capacity of a street but this is not practical for existing streets. Local Area Traffic Management can increase the environmental capacity somewhat but this effect is included in the use of a capacity of 4,000 vpd.

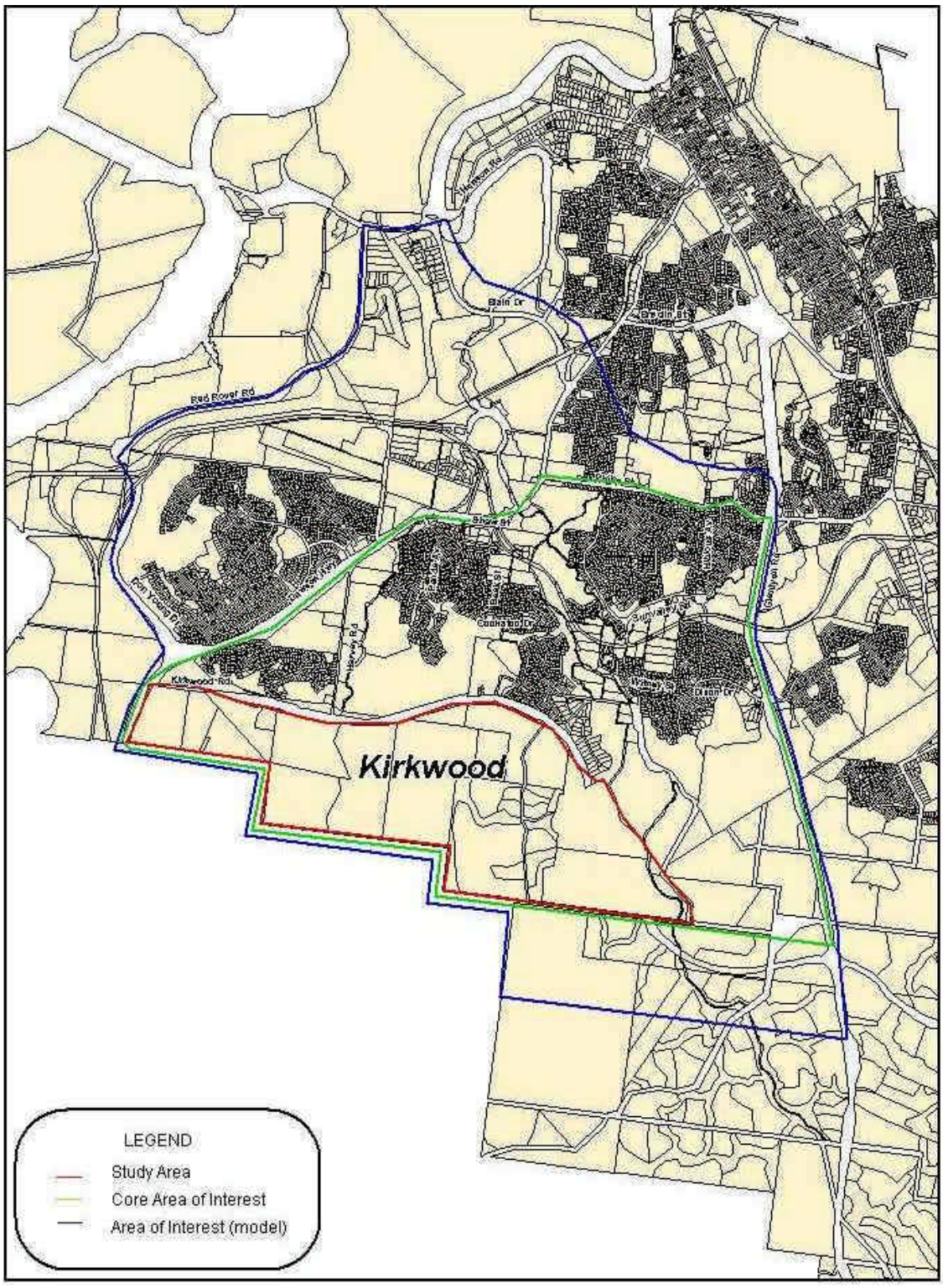
6.3 Computer Modelling

A basic computer transport model has been established for the area, using the "Buffer Network" mode in the SATURN package. This version of the model incorporates a matrix estimation package, using traffic counts to estimate origins and destinations of vehicle trips. It does not include intersection analysis. It is noted that the Queensland Department of Main Roads (DMR) is about to create a comprehensive transport model of the Gladstone City area. Refinement of that more comprehensive model in the Kirkwood area will allow a more robust assessment than the use of the basic model in this study.

The traffic generation of the area and its distribution in Gladstone and to the external road network was forecast initially by the use of a spreadsheet model. The resultant trip generation and distribution patterns were then refined in a SATURN computer transport model to reflect existing traffic counts.

The traffic generation zones used in the modelling are shown in **Figure 5**. The calibrated model estimated daily weekday flows that closely match the traffic counts, although the basic nature of the model results in some simplifications along the lengths of a number of roads. For all model runs, the residential streets have been modelled with a free flow speed of 40 km/h while major traffic roads have been modelled at their sign posted speed limits. This will result in the maximum practical use of major roads and represents a situation with appropriate traffic management in place on residential streets.

- **Figure 5 Traffic Generation Zones**



6.4 Scenario A - Transport Infrastructure Policy

The number of dwellings in the area south of Philip Street between Dawson Highway and Glenlyon Road is expected to more than double in the foreseeable future. A Transport Infrastructure Policy was developed in 2002 which showed this growth being accommodated by:

- A number of intersection upgrades,
- The construction of a new road (Kirkwood Road) between the Dawson Highway and the Gladstone-Benaraby Road,
- The linking of Penda Avenue and Beak Street with Emmadale Drive and Kirkwood Road and
- The extension and connection of Dixon Drive to Kirkwood Road.

In light of the uncertainty (caused by the upgrading of Calliope River Road) of extending Glenlyon Road to become the primary Gladstone-Benaraby Road, the models do not include the Glenlyon Road to the existing Gladstone-Benaraby Road section of Kirkwood Road. If that section is built within the time horizon of the models, there would be a transfer of traffic from the Philip Street (east) external node to the Kirkwood Road (east) external node.

Two growth scenarios were prepared. The first (natural growth scenario) is a continuation of the existing patterns, as estimated from the existing traffic counts. This involves a growth in traffic volumes but no major changes in traffic patterns. The second (rapid growth scenario) assumes that a number of the proposed major projects to the north west of Gladstone happen in the near to medium future. Under this scenario, 10% extra growth is assumed to occur on the Gladstone-Benaraby road to allow for industrial growth in that area as well as the “dormitory” effect of Boyne Island/Tannum Sands. Traffic growth to other destinations (eg CBD) was then limited to the extent that no destinations had negative growth in traffic. This resulted in a growth factor of about 60% being applied to traffic to/from the north west.

Both scenarios are to the point in time when the study area reaches its forecast number of dwellings. They thus each have the same number of generated trips and are not associated with specific years. More information on the implementation program for the major industrial projects would be needed to attach years to the scenarios. Given the relatively small difference between the scenarios, other networks at this stage have been compared with the rapid growth scenario, which has the most potential to attract trips to Kirkwood Road. A more refined assessment of implications of the impacts of the above various developments in the larger Gladstone area would be a logical investigation topic when the DMR model is available.

Of concern are the forecast flows on the major collector streets in the area. While all of these would be within their traffic capacity, all of them are forecast to have daily traffic flows well over their environmental capacity (see **Table 6-1**).

Table 6-1 Summary of Traffic Volumes

Road/Street	Forecast Daily Weekday Traffic Flows (vpd)		
	2003	A1 (Natural)	A1 (Rapid)
Harvey Road	2 700	6 300	5 700
Penda Avenue	2 874	7 400	7 500
Shaw Street	4 900	10 700	10 100
Beak Street	4 934	8 900	8 300
Cockatoo Drive	3 486	4 800	4 800
Witney Street	2 546	5 700	5 500
Sun Valley Road	4 241	5 200	5 500
Dixon Drive	3 200	5 200	5 100
Emmadale Drive		8 500	8 500
Kirkwood Rd (Beak – Dixon)		7 700	7 600
Dixon Drive Connection		4 800	4 800
E-W Road thru Kaleentha			

Of particular note is that, with Kirkwood Road in place between Beak Street and the extension of Dixon Drive, Witney Street and Dixon Drive will join Sun Valley Road in being over their environmental capacity in both natural and rapid growth scenarios. However, Kirkwood Road will not enable Penda Avenue, Shaw Street, Beak Street, Cockatoo Drive or Emmadale Drive to operate within their environmental capacities.

These results are considered valid because, unless strong measures are taken, drivers do not perceive environmental capacities as they are still able to use the streets in question without any congestion. If a residential street represents the shortest route in time terms, a high proportion of regular users will use that street in preference to a longer route along major roads. For measures to be adequate to deter regular drivers requires elements such as a good alternative route, very extensive traffic management, low speed limits and noticeably indirect routes. Without most of these elements in place, drivers will use the more direct residential street routes, leading to increased complaints from residents.

6.5 Further Modelling

Given that Scenario A produces very undesirable results, three further Scenario's were developed and modelled. One Scenario represented the best improvement. However, this was far from ideal and a further analysis (Scenario E) was undertaken, as described in the following sections.

6.6 Development of Preferred Network

Land ownership in the study area is strongly associated with specific developers with development intentions. A scenario (Scenario E), with three variations, has therefore been developed which takes this constraints into account, as well as addressing the undesirable aspects of earlier scenario's.

6.6.1 Scenario E1

- All intersections along Kirkwood Road to be all movements;
- Western Lib Management connection to Kirkwood Road and Harvey Road extension to Kirkwood Road to be separate intersections;
- Emmadale Drive to be connected to Beak Street;
- Telina to have single connection to Kirkwood Road; and
- Beak Street to be connected to Olsen Avenue.

This is shown in **Figure 6**.

6.6.2 Scenario E2

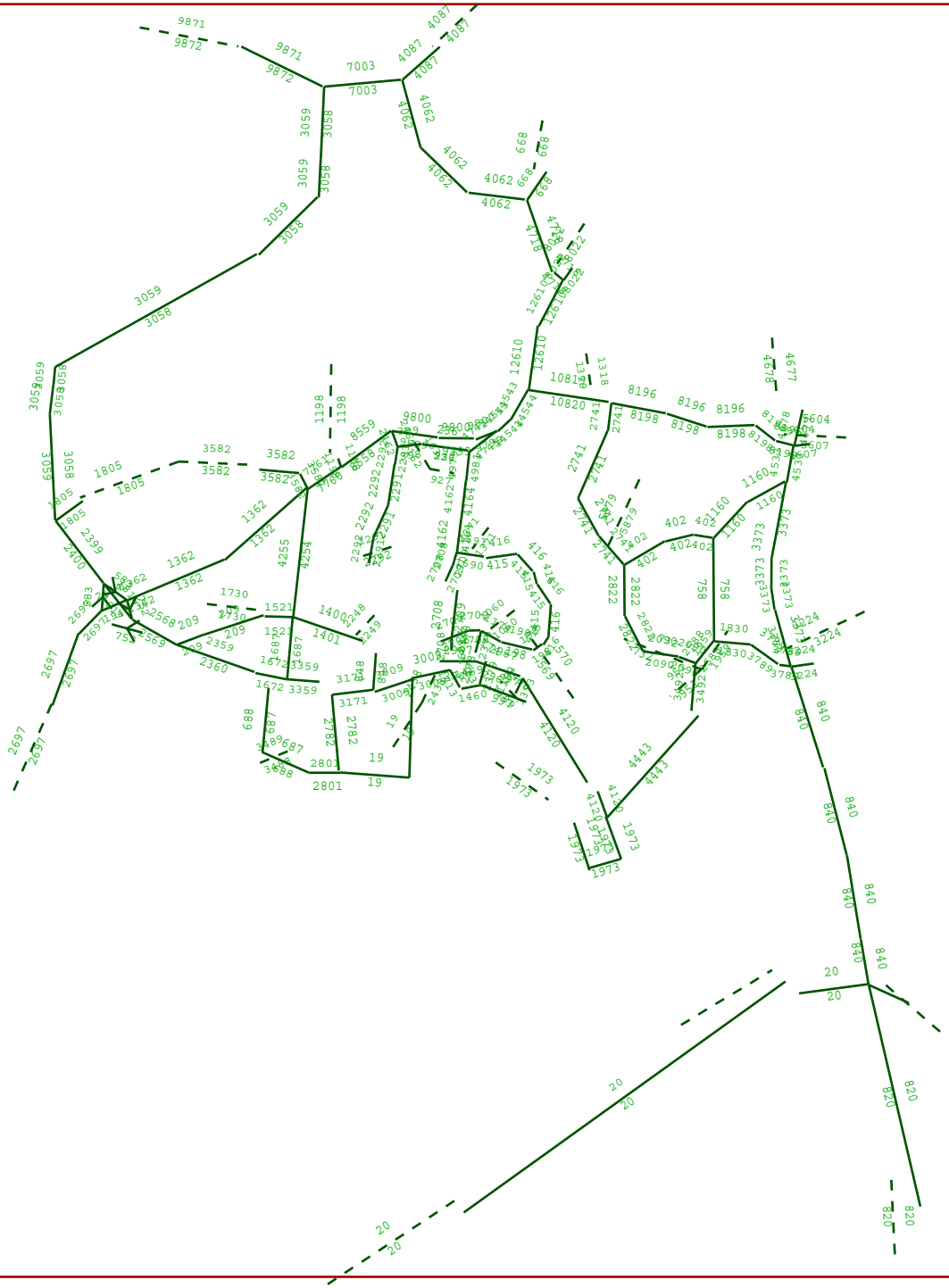
- All intersections along Kirkwood Road to be all movements;
- Western Lib Management connection to Kirkwood Road and Harvey Road extension to Kirkwood Road to be separate intersections;
- Emmadale Drive NOT to be connected to Beak Street;
- Telina to have single connection to Kirkwood Road; and
- Beak Street NOT to be connected to Olsen Avenue.

This is shown in **Figure 7**.

6.6.3 Scenario E3

- Intersections along Kirkwood Road to be all movements except for Kaleentha connection and shared Lib Management/FKP access, which will be left in/left out only;
- Western Lib Management connection to Kirkwood Road and Harvey Road extension to Kirkwood Road to be a single intersection;
- Emmadale Drive NOT to be connected to Beak Street;
- Telina to have two connections to Kirkwood Road; and
- Beak Street NOT to be connected to Olsen Avenue.

This is shown in **Figure 8**.



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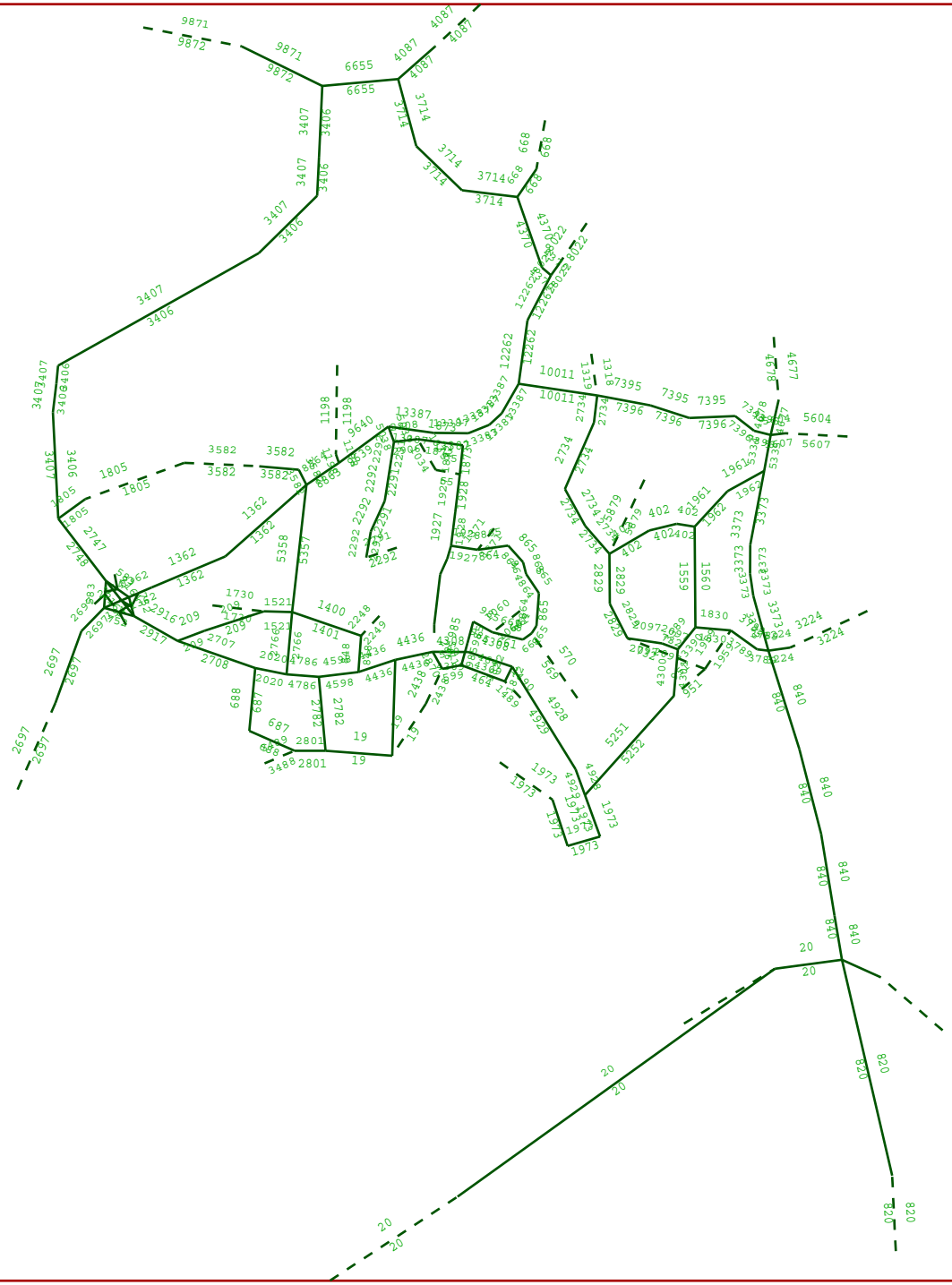
Demand flow

SINCLAIR KNIGHT MERZ
SKM

South Kirkwood Daily Buffer Model - Future Scenario E1 13- 1-04

Figure 6



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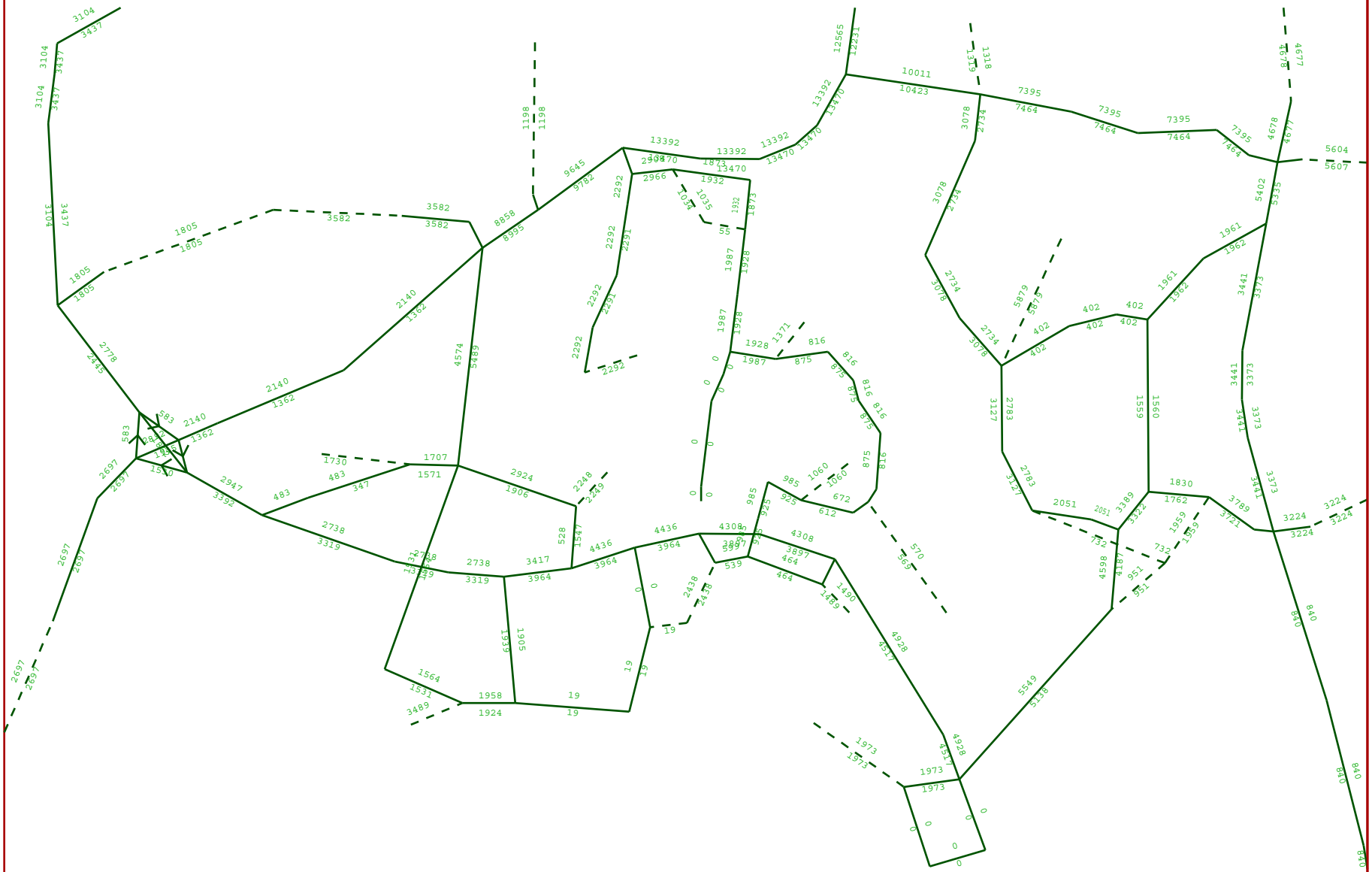
Demand flow

SINCLAIR KNIGHT MERZ
SKM

South Kirkwood Daily Buffer Model - Future Scenario E2 14- 1-04

Figure 7



SATURN

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SINCLAIR KNIGHT MERZ
SKM

South Kirkwood Daily Buffer Model - Future Scenario E3 22- 1-04

Figure 8

6.6.4 Outcome of Modelling

The SATURN model was run to represent each of the sub scenarios. A summary of flows on the critical streets is provided in **Table 6.2**, compared to the existing flows and the Transport Infrastructure Policy (Scenario A) All the runs are for the situation in which a number of major projects occur to the north west of Gladstone. This situation has similar ultimate road needs to a more gradual development of Gladstone but the needs occur somewhat sooner. It is therefore considered that this should be the basis for future planning, with specific dates dependant on the progress of housing development in the area.

- **Table 6-2 Summary of Traffic Volumes**

	Forecast Daily Weekday Traffic Flows (vpd)				
Road/Street	**2003**	**A**	**E1**	**E2**	**E3**
Harvey Road	2 700	5 700	8 500	10 700	10 200
Penda Avenue	2 874	7 500	4 600	4 600	4 600
Shaw Street	4 900	10 100	800	5 800	5 900
Beak Street	4 934	8 300	8 300	3 900	3 900
Cockatoo Drive	3 486	4 800	3 400	2 700	3 900
Witney Street	2 546	5 500	5 600	5 700	5 900
Sun Valley Road	4 241	5 500	5 500	5 500	5 800
Dixon Drive	3 200	5 100	7 400	6 800	7 500
Emmadale Drive		8 500	5 400	1 900	1 900
Kirkwood Rd (Beak – Dixon)		7 600	8 200	9 900	9 400
Dixon Drive Connection		4 800	8 900	10 500	10 700
E-W Road thru Kaleentha			2 800	2 800	4 800
Beak St – Olsen Av Link			9 500		

It can be seen that the Beak Street – Olsen Avenue connection in Scenario E1 significantly reduces flows in Shaw Street and will assist in reducing flows through the Dawson Highway/Beak Street intersection but has little other impact on flows in the system. Not connecting Emmadale Drive to Beak Street (Scenario E2) reduces flows on Emmadale Drive, Cockatoo Drive and Beak Street. This traffic would instead use Kirkwood Road to access Harvey Road and the Dixon Drive connection, which is a preferable result.

Changes due to aligning Harvey Road and the western Lib Management access and to making two of the Harvey Road intersections left in/left out (scenario E3) are more subtle. Harvey Road flows drop slightly while flows on Cockatoo Drive increase somewhat but are still within the environmental capacity. However, due to the bans on right turns at Kirkwood Road, flows on the

east-west road through Kaleentha would increase from 2,800 vpd to 4,800 vpd, above the environmental capacity. This can be addressed by local network planning to divide these flows amongst at least two roads. More detailed modelling and assessment would be needed than is practical at this time.

The extension of Carinya Drive to Kirkwood Road in each of the sub-scenarios carries little traffic. Apart from the possibility of providing an alternative access for this area, it is not considered important in traffic capacity terms. Scenario E3 is thus recommended as the preferred basis for more detailed network planning for the area.

6.7 Preferred Road Network

Of the three sub-scenarios (E1, E2 and E3) modelled, Scenario E3 was considered the most suitable. It featured:

- Intersections along Kirkwood Road to be all movements except for Kaleentha connection and shared Davies/FKP Limited access, which will be left in/left out only;
- Western Lib Management connection to Kirkwood Road and Harvey Road extension to Kirkwood Road to be a single intersection;
- Carinya Drive connected to Kirkwood Road;
- Harvey Road used as a traffic route with suitable facilities provided for the Clinton Primary School;
- No direct connection between Emmadale and Kaleentha Estates;
- Apart from pre-existing approvals, no new houses should be connected to the southern end of Penda Avenue;
- Skyline Drive underpass constructed;
- The Lib Management, Davies and FKP Limited properties south of Kirkwood Road to each have two accesses to Kirkwood Road. One of the accesses (at the eastern extremity of the Davies land) to be shared by Davies and FKP Limited;
- Parksville land west of Kirkwood Road to be connected to Kirkwood Road but not to the other developments; The connection between Dixon Drive and Kirkwood Road should not have residential access driveways;
- Emmadale Drive should not be connected to Beak Street;
- Telina to have two connections to Kirkwood Road; and
- Beak Street should not be connected to Olsen Avenue.

7. Preferred Land Use Structure

The preferred land use structure for the Kirkwood Road South study area is shown in **Figure 9**. This was identified following consideration of the land use and potential population capacity, traffic and access needs and infrastructure requirements.

The land use structure plan provides a mix of residential, rural residential, commercial and open space land uses. The structure plan also includes the major infrastructure easement for the high voltage electricity transmission line.

Low density, single allotment residential is the predominant land use proposed for the study area. This use incorporates 186 ha and provides for approximately 1860 allotments. Residential uses are generally located in those areas of slope less than 25 %.

Rural residential land incorporates about 120 ha of the study area, providing 240 allotments. This is located in areas of steeply sloping land which are difficult to service for residential allotments. Rural residential uses are also identified adjacent to the electricity transmission line easement to provide a buffer between the transmission line easement and higher density residential uses. The western end of the study area adjacent to the Dawson Highway has also been identified for rural residential allotments, as this area can not be connected to reticulated services such as the sewerage system.

An area has been identified on the land use structure plan for a neighbourhood shopping facility to provide for the day to day needs of local residents. This has been identified at the intersection of Harvey Road and Kirkwood Road to provide adequate access from residential areas north and south of Kirkwood Road.

The structure plan seeks to retain and enhance the study area's existing landscape and environmental values. Open space corridors are provided along creek lines, including Auckland Creek and Briffney Creek, which include areas of remnant vegetation, and Cathurbie Creek. The structure plan also retains the landscape backdrops provided by ridgelines across the study area. In addition, it is expected that local parks and open space areas will be provided within residential developments.

The preferred land use structure identifies an indicative primary road layout for the study area and connections to Kirkwood Road. Eight connections are identified from the study area to Kirkwood Road. This includes four connections for the eastern end of the study area, one connection to service the rural residential development at the western end of the study area and three connections to provide access to the central section of the study area, including an extension of Harvey Road. In

addition to connections with Kirkwood Road, an underpass has been identified connecting the Emmadale developments north and south of Kirkwood Road.

Connections onto Kirkwood Road should be separated by at least 500 m to enable Kirkwood Road to provide an 80 km/hr speed limit. To achieve this separation, Harvey Road will require realignment north of Kirkwood Road.

The primary road network also allows for connections between the Lib Management Pty Ltd and Davies properties as well as the FKP Limited and Davies properties. A connection between the proposed FKP Limited Emmadale development, and Parksville is not provided to allow for an open space corridor to be provided along Cathurbie Creek in this area.

KIRKWOOD ROAD SOUTH STRUCTURE PLAN

PREFERRED STRUCTURE PLAN & ROAD NETWORK

SKM

CLINTON

NEW AUCKLAND

CALLIOPE SHIRE

Highway

Dawson

Harvey Road

Carinya Dr

Briffney Creek

Kirkwood Road

Fenda Ave

Beak St

Cockatoo Dr

Emmadale Dr

Sun Valley Rd

Dixon Dr

Cathurbie Creek

Auckland Creek

LEGEND

- Traffic Network
- Residential
- Park Residential
- Commercial
- Open Space

NORTH

0 100 250 500m

Scale 1:10,000 @ A2

QE07231 06:02:04

Note: This plan is indicative only & has no legal status

8. Development Strategy

This section outlines a strategy for the implementation and future development of the Kirkwood Road South structure plan.

8.1 Infrastructure

The major roadworks and the sequence of construction are discussed below in Section 8.2. The installation of services will generally follow the Kirkwood corridor except for the sewerage works that will be based on the drainage catchments of the different development areas. It is essential that the road crossings of the gravity sewers be installed as part of the Kirkwood corridor construction.

The installation of the 375 mm diameter trunk water main along Kirkwood Road will be from west to east, eventually linking up with a 450 mm diameter main in Glenlyon Road. This means that the section of Kirkwood Road from the Dawson Highway to Harvey Road must at least be to earthworks formation to allow the water main to be installed to the correct levels.

In the interim, the extension of the existing water mains in Harvey Road and Emmadale Drive to the south across the Kirkwood Rd reserve can allow development of these areas to commence. When the 375 mm diameter water main is installed the entire demand from the study area can be supplied.

The major works for sewerage are to the east of the study area, in the South Trees catchment. Approximately 1,000 allotments will drain to the pump stations ST5, ST4 and T02, which pumps to ST1. This represents major expenditure for the pumping stations, pressure mains and trunk sewers. In the interim, pump station S04 and its pressure mains can be upgraded to take the first part of the development south of Kirkwood Road by FKP Limited.

The western sector of the study area drains to pump stations S03, S04 and the Briffney Creek trunk sewer. The expected flows have been allowed for in the sewerage planning scheme so development is not hindered in the western sector.

All the gravity sewer road crossings of Kirkwood Road must be installed at time of road construction regardless of development need.

8.2 Road Network

8.2.1 Phase One

There is an existing need to minimise increases in traffic flows on the residential streets of Penda Avenue, Beak Street, Shaw Street and Cockatoo Drive. It is considered that this can best be achieved by connecting a new internal connector road in Kaleentha to Harvey Road. This

connection would be clearly useful in off peak periods but there are two provisos attached to its use:

- The Clinton Primary School at the northern end of Harvey Road would require off road pick up and set down facilities, together with improved turning facilities in order to be able to accommodate the additional traffic.
- The Dawson Highway, the two lane section of which is already at its deficiency volume north of Harvey Road would need widening to four lanes. It is understood that this is proposed in the near future

This would involve the provision of the above school facilities and construction of:

- An extension of Harvey Road to Kirkwood Road,
- Kirkwood Road between the shared Davies/FKP Limited access and Harvey Road,
- The Skyline Drive link on the alignment of the proposed underpass; and
- The connection between that road (Skyline Drive) and the shared Davies/FKP Limited access.

This part of the road network would also provide the opportunity for access to the Davies and Lib Management property and would provide an alternative access for the majority of existing and planned dwellings. This section is required as soon as possible.

From a safety and delay minimisation, a conversion of the Penda Street/Shaw Street intersection to a roundabout is also recommended, although this is an improvement that will increase convenience rather than being critical to managing traffic flows within the traffic network.

8.2.2 Phase Two

It is considered that the second phase of Kirkwood Road should be between the shared Davies/FKP Limited access and the connection to Dixon Drive. This would require the construction of this section of Kirkwood Road (including creating an underpass for the extension of Skyline Drive) and the connection between Dixon Drive and Kirkwood Road.

The modelling shows that this connection (Dixon Drive) should not have residential driveways. Subject to the preferences of the developer, it may be feasible to divide the traffic on to two separate roads. However, for this to be successful the road network within the Telina Estates, both east and west of Kirkwood Road, would have to be rigidly divided between a northern section and a southern section. This section would be required either when the Telina Estate is further developed or when the FKP Limited property south of Kirkwood Road approaches completion.

Additional traffic should not be added to the existing Dixon Drive without an alternative access (ie Kirkwood Road and the Dixon Drive connection) in place.

8.2.3 Future Additions

The third phase would then be the section from Harvey Road to the Dawson Highway. It is likely that this would be driven by the extent of new major industry projects to the north west.

The final section of Kirkwood Road would be from the Dixon Drive connection to the Gladstone-Benaraby Road. It is understood that there are long term plans for Glenlyon Road to become the Gladstone-Benaraby Road. If that occurs, Kirkwood Road could terminate at what is now Glenlyon Road. Otherwise, it would need to continue to the existing Gladstone-Benaraby Road. This need would be driven by regional requirements that will be best defined with the aid of the upcoming Gladstone Strategic Transport Model.

It is anticipated that other roads shown in the Scenario E3 network (Figure 6) would be built in accordance with development requirements. The indicative program can thus be summarised as shown in **Table 8-1**.

Table 8-1 Indicative Road Network Implementation Program

Phase	Timing	Actions
1	As soon as possible	• Clinton Primary School Access, • Harvey Road extension, • Kirkwood Rd (Harvey Rd to shared Davies/FKP access), • connection of Skyline Dr to shared Davies/FKP access • Conversion of Beak St/Shaw St intersection to a roundabout
2	Commencement of Telina Estate or (say) 50% of Emmadale South	• Kirkwood Road (shared Davies/FKP access to Dixon Dr connection) • Connection between Dixon Drive and Kirkwood Road
2a	When traffic causes capacity problems at Dawson Highway/Beak Street despite above actions	• Beak Street to Olsen Avenue connection
3	When major projects NW of area create significant traffic demands	• Kirkwood Road between Dawson highway and Harvey Road
4	When required due to regional needs	• Kirkwood Road (Dixon Drive extension to Gladstone-Benaraby Road.

8.3 Planning

Land in the study area should be retained in large allotments until required for future development. The structure plan should be implemented through the planning scheme and provide a basis for decisions on development applications made by developers.

9. Conclusion

The Kirkwood Road South Structure Plan identifies a preferred future land use structure for the Kirkwood Road South study area. It is based on an analysis of current and future infrastructure, traffic and planning needs. The plan has also been prepared following consultation with landowners and developers in the study area.