12. ROADS AND TRANSPORT

This chapter summarises the findings of the supplementary roads and transport assessment undertaken to address updates to the project description made since the Surat Gas Project Environmental Impact Statement (EIS) (Coffey Environments, 2012b) was finalised.

The Supplementary Roads and Transport Assessment prepared by Cardno (Qld) Pty Ltd (Cardno), is included in Appendix 10. The study supplements the Road Impact Assessment, which was also conducted by Cardno, presented in Appendix M of the EIS, the main findings of which are summarised in Chapter 19 of the EIS.

The revised project description is provided in Chapter 3, Project Description, however aspects relevant to roads and transport are also discussed in this chapter. In addition to the study findings, a list of key issues raised in submissions is presented, with responses to all issues provided in Part B, Chapter 19, Submission Responses.

12.1 Studies and Assessments Completed for the EIS

This section provides an overview of the roads and transport impact assessment completed for the EIS and the main conclusions from that assessment.

The EIS roads and transport impact assessment presented the roads and transport values within and surrounding the project development area (within the former Darling Downs region road network). The assessment included the potential for these values to be affected by direct and indirect impacts associated with the construction, operation and decommissioning phases of the project. The roads and transport impact assessment constitutes a strategic assessment of the significance of the potential road impacts associated with the Surat Gas Project. The following tasks were conducted to complete the assessment:

- Identification of key environmental values of roads in the former Darling Downs region road network to be protected, based on background research and desktop analysis of existing road conditions.
- Determination of the traffic-related impacts of the project from traffic generation on the key environmental values using a significance assessment approach that considered the sensitivity of environmental values. This significance assessment method is described in detail in Chapter 7 of the EIS. Details on the assumptions that were used in modelling to determine traffic-related impacts are provided in Appendix B of Appendix M of the EIS.
- Consideration for the Guidelines for Assessment of Road Impacts of Development (GARID) (DMR, 2006) through development of a profile of estimated traffic generation across the road network resulting from project activities, over the life of the project. This information was also used to assess the project-related traffic volumes against the existing (2009) traffic volumes, as a measure of the significance of the estimated increase on the roads.
- Development of management strategies informed by current industry practice, to achieve the identified environmental protection objective (to avoid, minimise and manage adverse effects on the efficiency, safety and amenity of existing road networks) and to inform future planning.

Management measures to protect road environmental values identified in the EIS aimed to reduce the sensitivity of the road network types. This is achieved by avoiding or minimising and managing adverse effects on the efficiency, safety and amenity of existing road networks.

Highways were anticipated to have a low sensitivity both pre- and post-implementation of management strategies. Regional connecting roads were anticipated to have a sensitivity ranging from moderate to high, reducing to low, after management measures are implemented. Lower order roads, rural connecting roads and rural access roads, were anticipated to have moderate to high sensitivity, reducing to moderate following the implementation of management measures.

At a strategic level, it was determined that there would be no high residual impacts post-implementation of management measures on the road network. It was anticipated that local impacts would be managed via consultation with road authorities, through the preparation of road use management plans and other transport studies as conditioned by the state government, and potentially through infrastructure agreements.

Road transportation has been assessed as the key mode of transport for the Surat Gas Project. The transport of all people and materials by road represents the worst-case scenario in terms of potential impacts. The use of existing rail networks to transport some materials (specifically during construction activities) is an option being investigated by Arrow, but has not been assessed. Preliminary logistics plans contemplate the use of rail to reduce traffic. Detailed logistics planning to be carried out in conjunction with front-end engineering design will further investigate the feasibility of rail as a mode of transport for project materials. Consequently, no changes to the project description have been made in relation to potential impacts from the use of rail or other alternative modes of transport.

A number of commitments relating to roads and transport impacts were developed based on the assessment and advice from Cardno. The commitments presented in the EIS are listed in Table 12.1.

Table 12.1 Roads and transport commitments presented in the EIS

No.	Commitment
C031	Maintain the integrity of private roads and tracks and minimise dust generation, where appropriate, in consultation with relevant landowners and council.
C033	Confine project traffic to designated roads and access tracks, where practicable.
C284	Assess and identify works required to manage the increased traffic volumes and road safety issues associated with the project in road use management plans prepared and regularly reviewed in consultation with the relevant council or the Department of Transport and Main Roads.
C285	Assess and identify the need to upgrade unsealed roads or widen sealed roads where project activities and traffic will create road safety issues. Such works will be done in consultation with the relevant council (if a local government road) or DTMR (if a state road).
C286	Undertake threshold assessments to determine whether upgrading of rail crossings is warranted.
C287	Implement driver training and fatigue awareness for employees and contractors.
C288	Implement an in-vehicle monitoring system for project vehicles.
C289	Schedule roster changes to avoid peak traffic times.
C290	Develop project logistics plans to provide safe movement of people and materials, as well as to minimise traffic volumes.
C291	Develop journey management plans in consideration of high-risk roads.
C292	Use heavy-vehicle routes that avoid unsuitable bridges.
C293	Where assessed necessary, provide protected turning lanes for entry to permanent facilities to address road safety issues.
C294	Ensure access driveways to project facilities and infrastructure have appropriate sight distances.

Table 12.1 Roads and transport commitments presented in the EIS (cont'd)

No.	Commitment
C295	Implement traffic controls, including signage (e.g., reduced speed limits, warning signs) and restrictions of movements (e.g., no travel during school bus pick-up and drop-off times).
C296	Limit project traffic on school bus routes during pick-up and drop-off times on school days or install appropriate school bus infrastructure, e.g., signage or pull-over areas where necessary.
C297	Make workers aware of school bus routes, as well as typical pick-up and drop-off times in the vicinity of the work sites.
C298	Coordinate with local law enforcement for movement of heavy or oversized loads.
C299	Implement journey management plans.
C300	Manage project-related activities in the vicinity of existing stock routes in accordance with the Land Protection (Pest and Stock Route Management) Act.
C308	Routinely monitor integrity and amenity on project-related roads.
C314	Monitor compliance with the project's road safety requirements through regular review of reports generated by the in-vehicle monitoring system.
C315	Conduct regular safety inspections of project vehicles.

12.2 Study Purpose

The supplementary roads and transport assessment was undertaken to address updates to the project description and to take account of updated traffic volume data made available since publication of the EIS, as described below.

12.2.1 Project Description Updates

The main changes to the project description presented in the EIS, which have the potential to affect the roads and transport impact assessment, are as follows.

Project Development Area

Due to the relinquishment of parcels of land within Arrows' exploration tenements, the project development area has reduced from 8,600 km^2 to 6,100 km^2. The majority of these relinquishments were made in the Goondiwindi development region.

Production Wells and Facilities

With a smaller project development area, there has been a reduction in the number of production wells anticipated to be drilled, from 7,500 to approximately 6,500. In addition to single wells, multi-well pads will also be drilled. Multi-well pads may comprise up to 12 wells per pad but will commonly comprise 9 wells.

The field development plan has advanced, with the project development area described in terms of 11 drainage areas as opposed to the 5 development regions that were presented in the EIS. Drainage areas correspond with the gas reserves that will be fed into each central gas processing facility (CGPF). It is currently expected that eight of these drainage areas will be initially developed for the Surat Gas Project with each drainage area containing wells, a water and gas gathering network and a CGPF. This constitutes a reduction in the number of CGPFs from 12 described in the EIS, including the 6 CGPFs co-located with water treatment facilities that were termed 'integrated processing facilities', to 8. The CGPFs have been identified by the drainage area in which they will be built, e.g., CGPF2 is located in drainage area 2. A further three drainage areas may be developed with favourable reservoir outcomes and future market conditions. Six

field compression facilities (FCFs), which will improve compression at sites where wellhead pressure is not sufficient to transport the gas directly from the wells to a CGPF, have been retained in the revised project description as a contingency option.

Siting of Facilities

It is intended that all properties identified for major facilities, i.e., CGPFs, water treatment facilities and temporary workers accommodation facilities (TWAFs), will either be owned by Arrow, or leased under a long-term arrangement. Since publication of the EIS, Arrow has identified properties on which to site four CGPFs (CGPF2, CGPF7, CGPF8, CGPF9) and a TWAF (TWAF F). The specific locations of the CGPFs and TWAF on the identified properties have not been determined. The final location of infrastructure will be guided by site-specific technical, environmental and social features.

Water Treatment Facilities

The estimated number of water treatment facilities required has been reduced from six, described in the EIS to two, co-located with CGPF2 and CGPF9. Arrow has committed not to dispose of brine, stored at water treatment facilities, to the registered landfill site at Swanbank. However, disposal to landfill remains the base case for the management of brine. Arrow expects other landfill sites to be developed in response to the demand created by the coal seam gas industry and to be available to accept brine produced in its operations.

For the purposes of assessing the maximum expected vehicle movements, the EIS assumed transport and disposal of brine to Swanbank, originating from six indicative water treatment (and brine storage) facilities. Vehicle movements associated with the transport of brine to landfill were assessed in the supplementary assessment, as originating from both of the two water treatment facilities. A conceptual landfill location east of Toowoomba was expected to present the worst-case scenario for transport and disposal of brine and has been adopted for the supplementary roads and transport assessment.

Depots

It is now expected that two (as opposed to three) depots are required to accommodate administration, engineering and production, stores, workshops, laboratories and associated personnel. One depot is planned for the township of Dalby, servicing the Dalby and Kogan regions, and the second depot is to be located in the township of Miles, servicing the Wandoan and Chinchilla regions. A depot is not expected to be required in Millmerran as originally considered. Some materials, such as aggregate, are expected to be transported directly from suppliers to project sites.

Aggregate

The project construction activities will require foundation aggregate for the construction of camps, access tracks, wells and facilities. The estimated volume of aggregate to be transport to the project development area has been revised in-line with updates to the project design, i.e., the reduction in the anticipated total number of wells, temporary aggregate requirements for construction, which expand on the hardstand material footprint, and provision for access roads based on nominal lengths and widths (which will be verified once well and facility locations are known).

Conceptual Development Sequence

The revised rate of development for the Surat Gas Project is faster than that which was presented in the EIS. Commissioning of eight CGPFs is anticipated to occur over six years from the commencement of the project. This compares with the indicative development sequence that was

proposed in the EIS, which predicted that only six CGPFs would be commissioned over the same period. The workforce numbers for the project have been revised in response to the increased rate of development.

Workforce

The revised construction workforce is projected to peak at approximately 2,300 workers in 2017, which constitutes 1,660 more personnel than was presented in the EIS. In contrast, there has been a decrease in the peak operations workforce from 460 to 400. The decommissioning workforce remains the same as presented in the EIS.

Accommodation

The estimated number of TWAFs required to accommodate the construction workforce has been revised from five to approximately six. Sites for the remaining five TWAFs will be located adjacent to CGPFs, as presented in the EIS.

12.2.2 Additional Information

Since publication of the EIS, traffic volume data for state-controlled roads has been updated and is included in AADT Segment Reports for Darling Downs South West Region (DTMR, 2011). This dataset presents the DTMR's 2011 traffic volumes for all state-controlled roads and was used to update the supplementary roads and transport assessment.

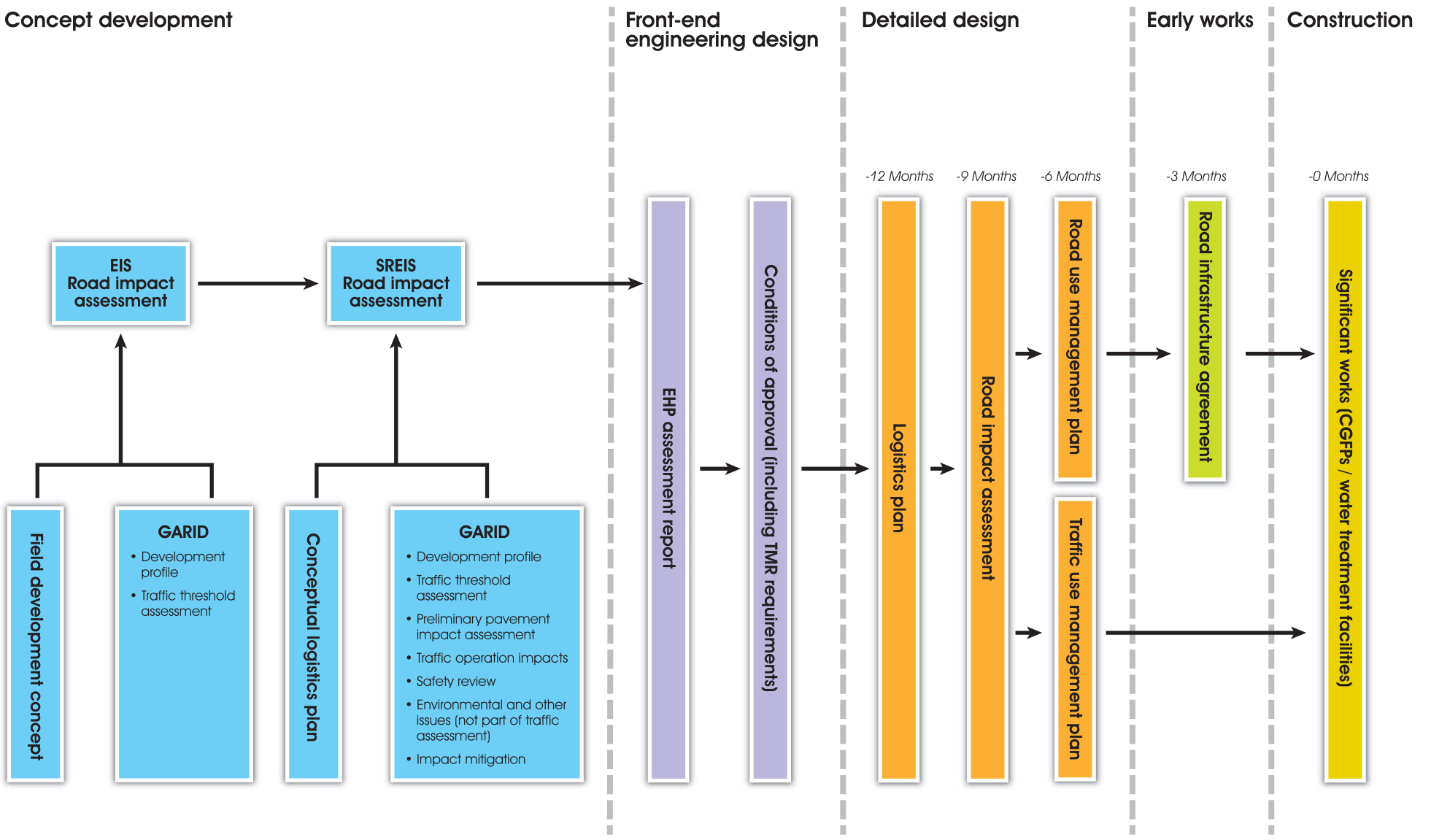
12.3 Legislative Update

The policies, guidelines and legislation in relation to roads and transport presented in the EIS remain current. However, at the time of preparing the supplementary report to the EIS (SREIS), it is understood that the DTMR is currently reviewing transport policies in relation to the planning and design of new and upgraded roads in Queensland. Arrow will comply with legislative and policy requirements that are applicable.

12.4 Study Method

The method for both the EIS and SREIS roads and transport assessments was developed with consideration for the legislative framework that guides traffic-generating development projects in Queensland. The framework recognises the strategic level of assessment conducted during the EIS (and SREIS) phase, necessitating a more detailed road impact assessment to be completed once the project has developed its logistics plan. Figure 12.1 highlights the components of the GARID that informed the EIS and the additional GARID steps that were carried out for the SREIS. Figure 12.1 also outlines the process that governs the ongoing legislative requirements that follow after completion of the SREIS, including preparation of a detailed road impact assessment, road use management plan, logistics plan and traffic use management plan.

The supplementary roads and transport assessment adopted the same method that was used for the roads and transport impact assessment in the EIS. Both assessments described the project development profile, i.e., traffic generation for each year of the project. The GARID assessment defines a significant impact from project-related traffic, as traffic exceeding 5% of existing traffic volumes. The EIS and SREIS assessed traffic volumes from project-related traffic against this threshold (traffic threshold assessment). Additionally, an assessment of the effectiveness of the management measures informed by current industry practice and proposed in the EIS, to reduce potential impacts on road environmental values, was undertaken using a significance assessment approach.



	coffey environments	Date: 21.06.2013	Arrow Energy	arrow energy go further	Infrastructure agreement development process	Figure No: 12.1
		File Name: 7040_12_F12.01_FT	Surat Gas Project			

GARID also requires traffic impacts to be considered at intersections that provide access to state-controlled roads. The supplementary roads and transport assessment presented theoretical case studies that involved the application of GARID to a greater level of detail (including pavement, intersection and traffic operation impact assessments and a safety review), afforded by the identification of properties at which five project facilities will be sited. Further explanation of the study method is presented below.

12.4.1 Existing Road Conditions

A review was undertaken of the road types in the vicinity of the project development area using the functional road hierarchy adopted in the EIS. The hierarchy classifies roads as highways, regional connecting roads, rural connecting roads or rural access roads. The spatial extents of the road network assessed are those bound by the former Darling Downs region for the DTMR, referred to as the Darling Downs region road network. This boundary has been adopted for the SREIS to ensure consistency with the spatial definitions adopted for the Road Impact Assessment conducted for the EIS.

Updated road condition data was collected from road authorities describing the latest traffic volumes (2011) for all state-controlled roads, multi-combination vehicle routes, school bus routes, rail crossings, stock routes, motorist rest areas and vehicle crash history (all supplied by DTMR in 2013).

12.4.2 Baseline Traffic Growth

A review was undertaken of historical traffic growth patterns and potential future traffic growth. The cumulative impacts of other projects in the vicinity of the Surat Gas Project were considered as part of this investigation.

12.4.3 Project Traffic Generation

Strategic traffic modelling was conducted to revise the predicted project traffic generation to account for changes to the project description. Strategic traffic modelling considered the type of vehicles likely to be used by the project, conceptual travel routes, the period over which each travel route would be used and the anticipated volume of traffic. The project's traffic generation for each road link (where a link comprises a certain length of road defined for strategic modelling purposes), was predicted based on the conceptual development schedule and the traffic generation potential of the project activities anticipated to be carried out in each year of the project. The method for strategic traffic modelling was consistent with the EIS.

12.4.4 Validation of Management Measures

Following the identification of potential impacts associated with predicted traffic generation, the management strategies outlined in the EIS, which aimed to avoid, minimise or mitigate the potential impacts, were reviewed. The effectiveness of these management measures was assessed using a significance assessment approach that considered the sensitivity of environmental road values and the magnitude of the impacts, consistent with the roads and transport impact assessment for the EIS. The significance assessment method is described in detail in Chapter 7 of the EIS.

12.4.5 Case Studies

The supplementary roads and transport assessment includes three case studies over five locations, afforded by the identification of the five properties at which four CGPFs and one TWAF are proposed to be sited. The first case study considered roads in proximity to CGPF2, the second case study considered roads in proximity to CGPF7 and the third case study considered

roads in proximity to CGPF8, CGPF9 and TWAF F. The case studies were prepared to demonstrate the effectiveness of management measures proposed in the EIS. The case studies also allow the GARID to be applied at a more detailed level.

Given that the exact locations for each of the five facilities is not yet known, a scoping assessment was conducted to determine the sections of the road network associated with each case study location that would inform each case study. Sections of roads on which project traffic is expected to increase existing (2011) annual average daily traffic (AADT) demands by at least 5%, were identified as part of the scoping assessment.

Each of the case studies comprised a fitness for use and an intersection assessment for the sections of the road network identified in the scoping assessment. A pavement impact assessment was also conducted on three representative higher order road segments.

For each assessment (fitness for use, intersection and pavement impact assessment) conducted in proximity to the five facility locations, site-specific management measures were developed based on two methods:

- Application of current industry practice management strategies proposed in the EIS.
- Application of the GARID, which was informed by a field investigation.

The resultant management strategies (derived from current industry practice and GARID) were compared to determine their applicability to the specific locations. This verified whether the proposed management measures in the EIS would produce site-specific measures of equal suitability to management measures determined through the application of GARID.

Fitness for Use Assessments

Arrow has committed to assess and identify works required to manage the increased traffic volumes and road safety issues associated with the project, in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR [C284]. Road use management plans typically include fitness for use assessments that identify roads suitable to accommodate project traffic demands. The effectiveness of the management measures proposed in the EIS was verified through a high-level fitness for use assessment for nominal routes that connect the case study locations to highways. The fitness for use assessment for each route involved identification of the following:

- Existing peak-hour and AADT demands (derived from peak-hour intersection surveys undertaken in the field in March 2013).
- Peak-hour and AADT demands in the final year of construction, first year of operation and the period of sustained gas production at the peak demand (estimated from outputs of the strategic traffic modelling).
- Peak design AADT (estimated AADT in the peak year of the project, including both project and background traffic volumes).

With an understanding of the AADT volumes identified, the likely required infrastructure upgrades were determined for each road section in the case studies based on the management strategies developed in the EIS. In addition, field investigations of the same nominal road sections informed a GARID-based assessment to determine likely infrastructure upgrade requirements.

Intersection Assessments

Road use management plans are typically informed by assessments of specific impacts on intersections where traffic volumes will increase existing traffic volumes by 5% or more as a result of project traffic. Each case study included an assessment at the intersection of the first point of access from the property to the state-controlled road (using the potential routes considered for the fitness for use assessments).The intersection assessments were conducted to determine the estimated capacity and performance of each intersection, in terms of the proportion of traffic entering the intersection relative to its capacity, including queues and delays. The assessments were conducted with consideration of industry recognised tools; SIDRA Intersection 5.1, the degree of saturation (the ratio of traffic entering an intersection to the intersection capacity) and delay thresholds outlined in GARID and the Guide to Traffic Generating Developments (Roads and Maritime Services, 2002). Appropriate upgrades for each intersection were then determined by Austroads (2010a) turn warrants, which provide guidance on where deceleration lanes and turning lanes should be used.

As per the method used for the fitness for use assessments, the type of infrastructure works that would be required at each intersection have been determined through application of the management measures proposed in the EIS and through the application of the GARID.

Pavement Impact Assessments

Pavement impact assessments were undertaken to demonstrate the application of the GARID pavement impact assessment method on three representative road segments:

- Warrego Highway (between Chinchilla and Miles).
- Millmerran Cecil Plains Road.
- Moonie Highway (between Dalby and Nandi).

The extent to which project-related heavy vehicle traffic may reduce the estimated service life for the pavement associated with the three roads sections was determined. In accordance with GARID, a significant impact to the extent and timing of pavement maintenance activities was defined as the scenario where pavement maintenance requirements are accelerated by more than one year.

12.5 Study Findings, Impacts and Management Measures

This section describes key findings of the supplementary roads and transport assessment as well as management measures identified from the strategic traffic modelling and the case studies.

12.5.1 Existing Road Conditions

Data collected from road authorities, including road types, multi-combination vehicle routes, school bus routes, rail crossings, stock routes and motorist rest areas, is generally consistent with the data presented in Appendix M of the EIS. While generally consistent, the updated data on crash rates exhibits greater variability between road links than presented in the EIS. The majority of state-controlled roads in the region road network generally exhibit lower crash rates than typically expected, according to Austroads Road Safety Engineering Risk Assessment Part 7: Crash Rates Database (Austroads, 2010b).

12.5.2 Baseline Traffic Growth

Review of historical annual traffic volumes for the roads that are likely to service the project revealed that volumes have typically changed by between -1% per annum (decline) and 3% per

annum (increase) between 2001 and 2011. Higher growth has generally been observed in more recent years.

In terms of cumulative impacts, seven other projects proposed or underway in the vicinity of the project development area were identified in addition to those considered in Chapter 28 of the EIS. The additional two years of traffic volume data (collected between 2009 and 2011) includes the traffic associated with the construction and operations of other recent projects in the region. The updated count data confirms the previous assumption documented in the EIS that overall road network volumes will steadily increase.

In consideration of both historical traffic growth and cumulative impacts from other projects, a 3% traffic growth rate over the long term was adopted for the supplementary roads and transport assessment as a reasonable assumption to allow for sufficient increases in traffic volumes. This growth rate is consistent with the range of 2 to 8% presented in the EIS for the total increase in traffic from all developments in the region.

12.5.3 Project Traffic Generation

The estimated traffic volumes generated by project activities during the three project phases, as predicted by the strategic traffic modelling, are presented in Table 12.2.

Table 12.2 Estimated traffic generation by key project activities

Activity	Quantity	Activity Duration	Traffic Generation (Two-way Trips)		
			Heavy Vehicle Trips	Bus Trips	Light Vehicle Trips
Construction Phase					
Production Wells	6,500 wells	15 days	142	–	444
Gathering Infrastructure	6,500 sections	8 days	22	–	182
CGPF	6 facilities	55 weeks	3,760	27,720	46,200
CGPF with water treatment facility	2 facilities	60 weeks	4,380	30,240	50,400
FCF	6 facilities	28 weeks	556	1,100	1,830
TWAF	6 facilities	4 weeks	8,186	–	–
Operations Phase					
Production Wells	6,500 wells	15 years	12	–	48
Gathering Infrastructure	6,500 sections	15 years	–	–	–
CGPF	6 facilities	18-31 years	624	–	7,800
CGPF with water treatment facility	2 facilities	41 years	9,384	–	10,400
FCF	6 facilities	12-34 years	20	–	104
TWAF	6 facilities	26-43 years	5,616	1024	27,302
Decommissioning Phase					
Production Wells	6,500 wells	2 days	48	–	32

Table 12.2 Estimated traffic generation by key project activities (cont'd)

Activity	Quantity	Activity Duration	Traffic Generation (Two-way Trips)		
			Heavy Vehicle Trips	Bus Trips	Light Vehicle Trips
Decommissioning Phase (cont'd)					
Gathering Infrastructure	6,500 sections	2 days	8	–	–
CGPF	6 facilities	8 months	3,760	244	14,700
CGPF with water treatment facility	2 facilities	8 months	4,280	720	43,008
FCF	6 facilities	4 months	556	60	3,570
TWAF	6 facilities	3 months	8,186	–	3,734

The predicted total vehicle kilometres that will be travelled over the project lifetime in the EIS case and SREIS case are shown in Table 12.3.

Table 12.3 Total vehicle kilometres travelled over the project life – EIS and SREIS case

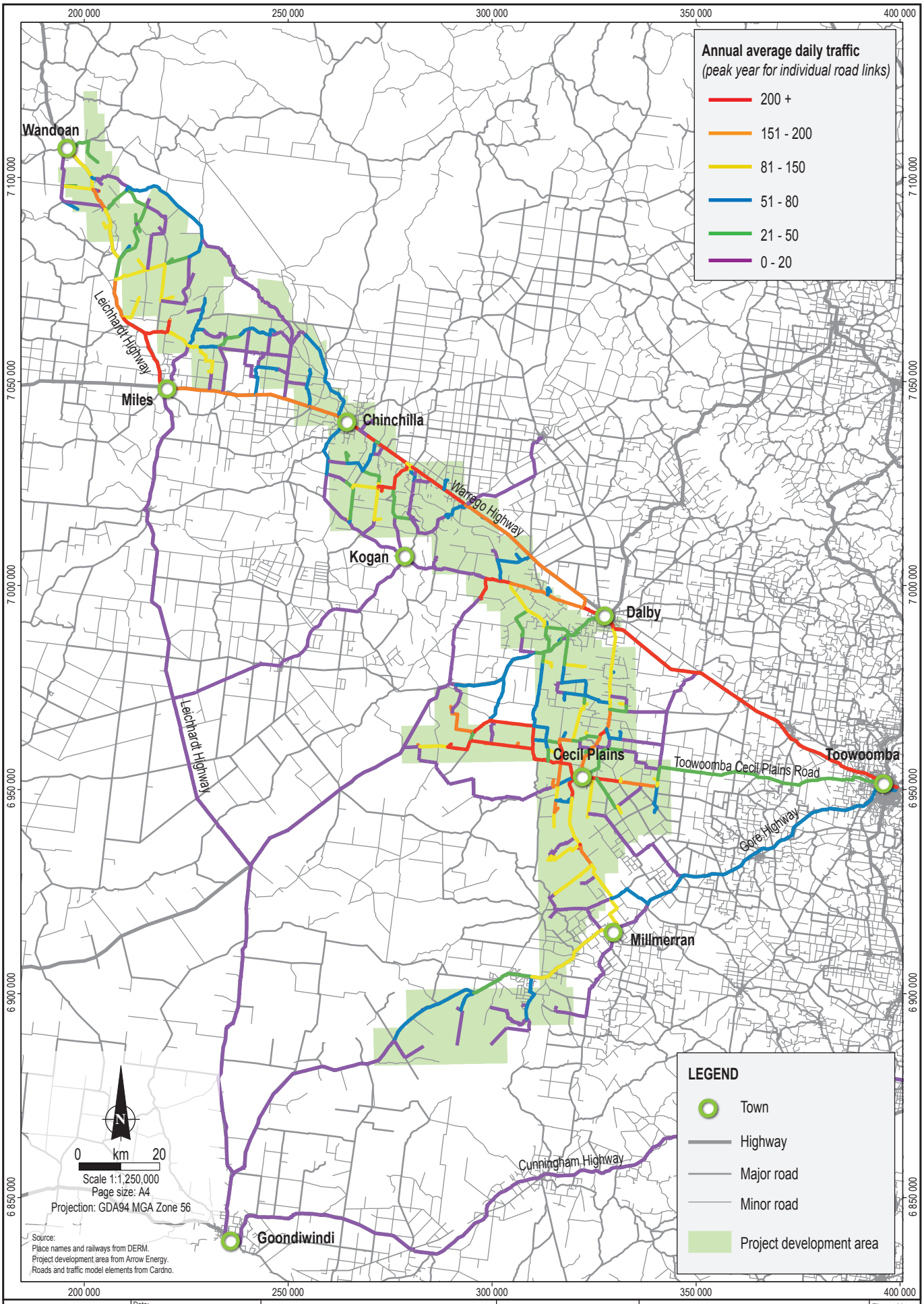
Vehicle	EIS Distance Travelled (km)	SREIS Distance Travelled (km)
Light vehicles	224 million	595 million
Heavy vehicles including buses	392 million	513 million
Total	**616 million**	**1,108 million**

The increase in the estimate of total vehicle kilometres travelled for the project since preparation of the EIS, is largely driven by the increased rate of development, the reduction in number and subsequent centralisation of water treatment (and brine storage) facilities and depots and the increase in the estimated aggregate volumes required.

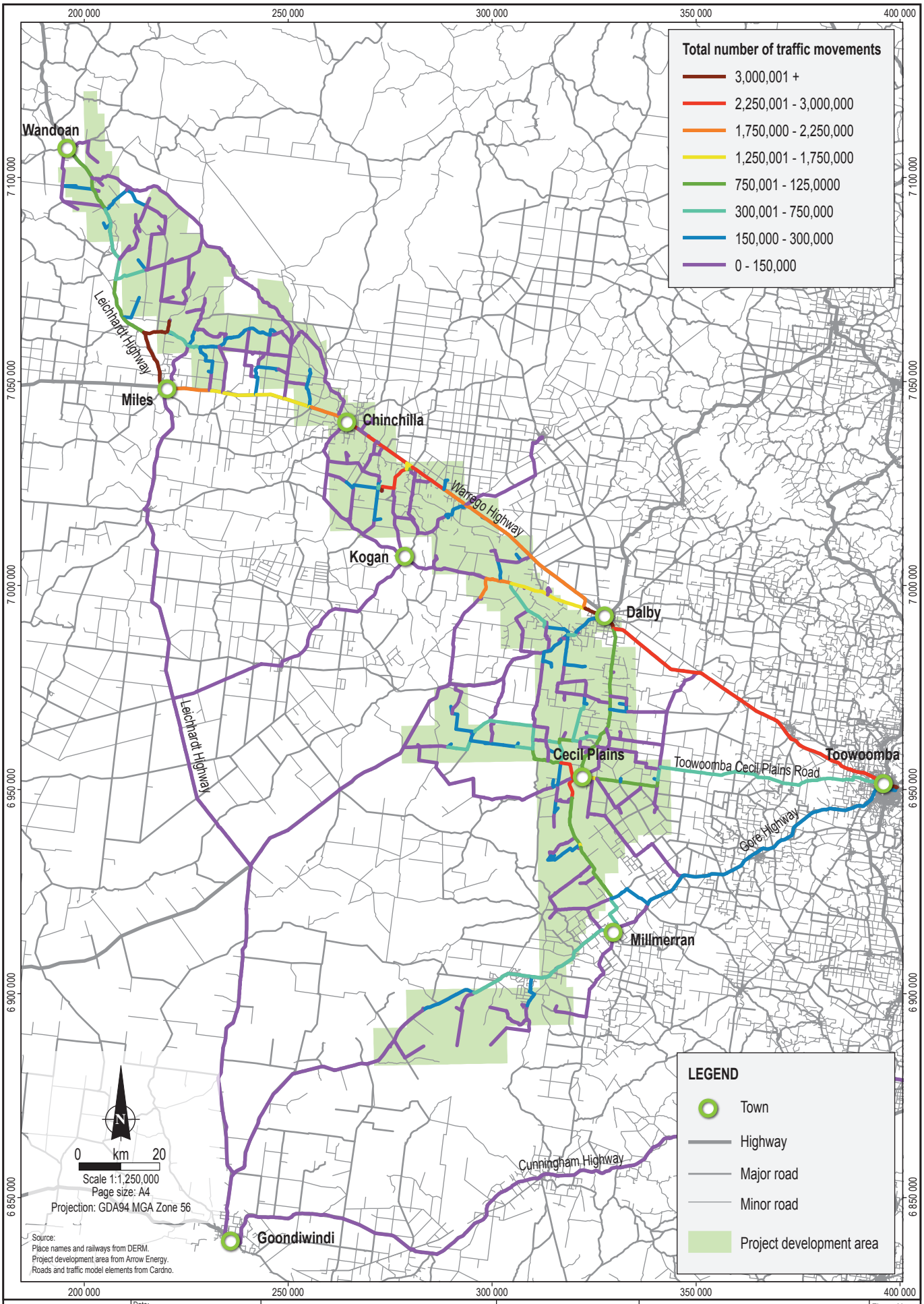
Project-generated traffic is anticipated to peak in 2031 with approximately 28,400,000 vehicle kilometres travelled. In this year, the project is expected to increase the level of total travel occurring on the former Darling Downs region road network by approximately 1.5% above the total travel currently occurring (i.e., the total travel that occurred across the network in 2011). The extent of light vehicle travel is anticipated to increase by approximately 1% of existing (2011) levels in the same year. The extent of heavy vehicle travel occurring on the road network is expected to peak earlier, in 2023. In this year, the project is anticipated to increase the extent of heavy vehicle travel occurring on the road network by approximately 4.2% of current (2011) levels. Figures depicting vehicle kilometres travelled over each are included in Appendix 10, Supplementary Roads and Transport Assessment.

The project's AADT in the peak year of the project is expected to be up to 697 vehicles per day, in comparison to the 330 presented in the EIS. The AADT in the peak year of the project on individual road links is shown in Figure 12.2.

Whilst the findings of the supplementary roads and transport assessment represent a higher estimate of total vehicle kilometres travelled compared to the EIS, the net increase in daily traffic volumes (described by AADT) at a road link level is relatively minor. The estimated project-generated traffic for key roads within the project development area indicates that the greatest vehicle movements are associated with highways and the main roads servicing townships. Figure 12.3 shows the total transport task for the project, i.e., the total number of traffic movements for the full project life for individual road links.



coffey environments	Date: 11.06.2013 MXD: 7040AE_12_GIS084_v0_2 File Name: 7040_12_F12.02_GIS_GL	Arrow Energy Surat Gas Project	arrow energy go further	Maximum project annual average daily traffic (peak year for individual road links)	Figure No: 12.2



coffey environments	Date: 11.06.2013 MXD: 7040AE_12_GIS084_v0_2 File Name: 7040_12_F12.03_GIS_GL	Arrow Energy Surat Gas Project	arrow energy go further	Total number of traffic movements for the full project life (for individual road links)	Figure No: 12.3

Modelling of AADT as an average across the project life, shows that the highest volumes of project-related traffic occur on roads that link production facilities to the state-controlled road network, consistent with the EIS (Figure 12.4). On certain road links, the AADT is expected to be up to 323 vehicles on average over the project life, in comparison to the 104 predicted in the EIS. The AADT on roads in the vicinity of the water treatment facilities has increased. Activity in the vicinity of Millmerran has decreased due to the relinquishment of parcels and absence of the depot at Millmerran.

The absence of the Millmerran depot has resulted in a shift in project traffic demands from the Gore Highway to traffic demand along the Toowoomba Cecil Plains Road, which was not identified in the EIS as a road that would potentially be affected by project activities. Traffic demand along this road is also a result of the anticipated transport of some materials from Toowoomba directly to project sites around Cecil Plains, rather than via marshalling yards, to avoid double handling.

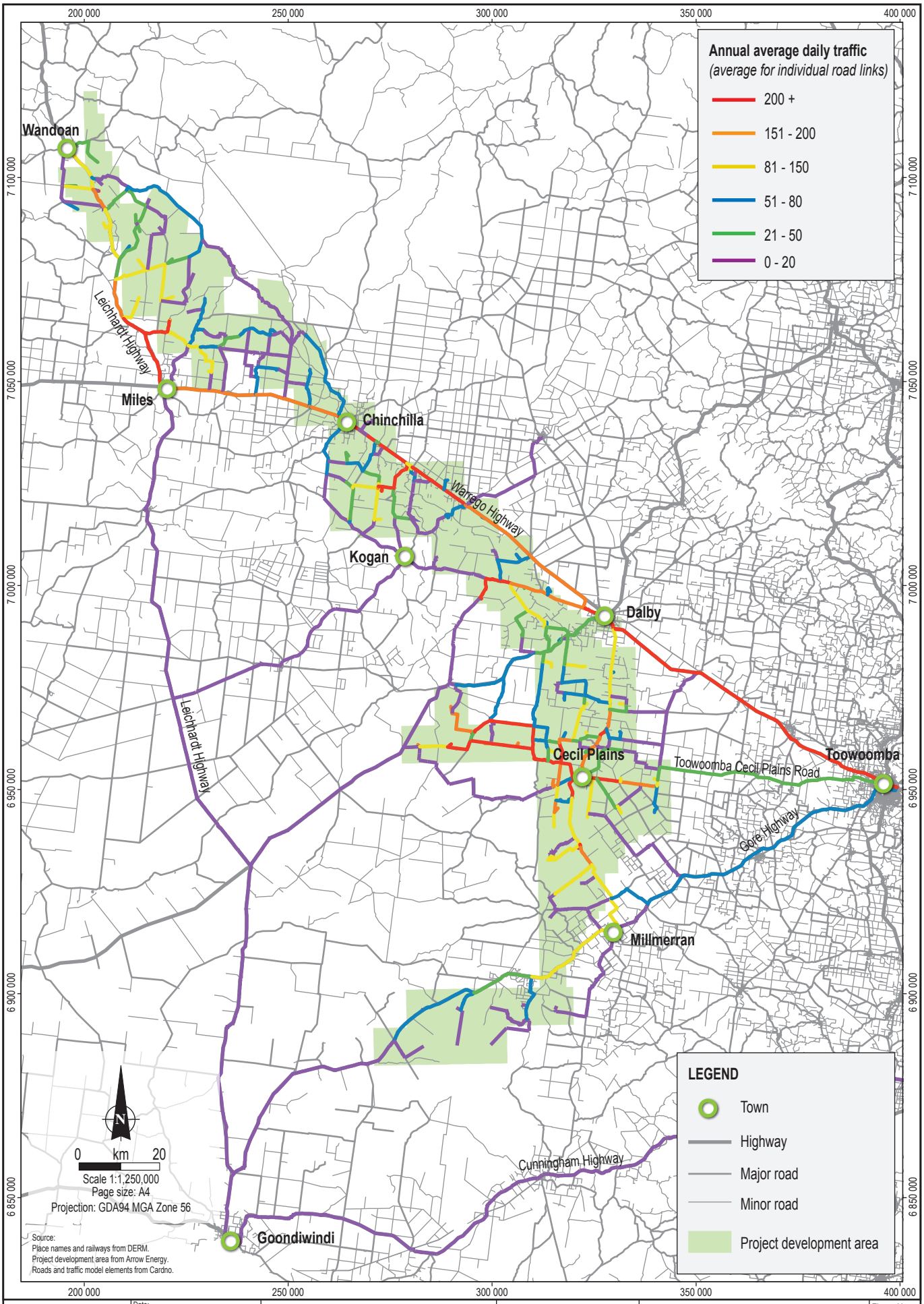
Although the overall increase in total vehicle kilometres travelled is less than 5%, the project AADT predicted on some of the road links is at least 5% of existing (2011) traffic volumes. Using the data describing the maximum AADT volumes, sections of the road network on which project traffic was expected to increase existing (2011) AADT traffic demands by at least 5% were identified (Figure 12.5). These sections were targeted as part of the scoping assessment to determine which roads would be considered as part of the case studies.

12.5.4 Validation of Management Measures

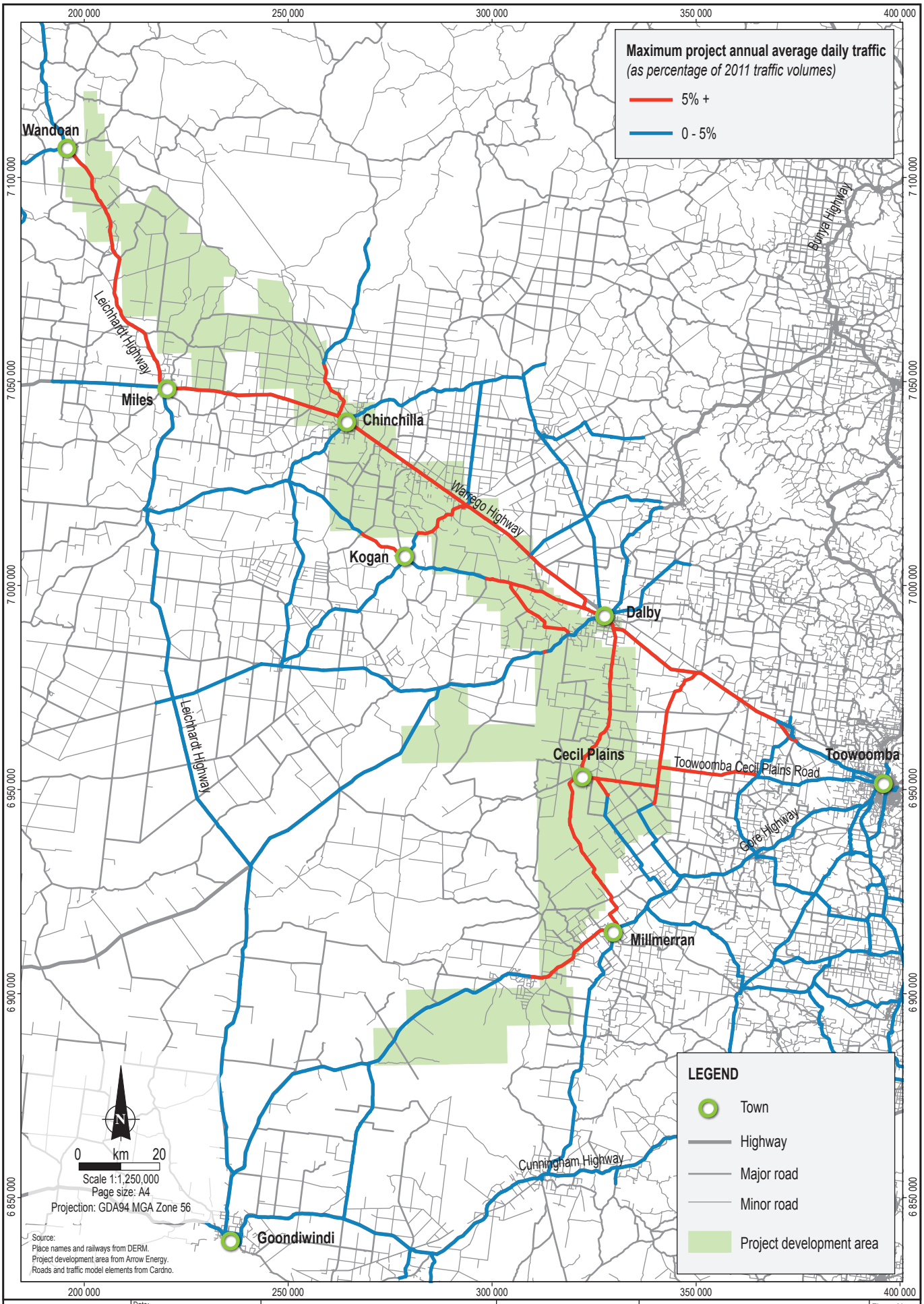
Management measures presented in the roads and transport impact assessment for the EIS remain valid in consideration of the findings of the supplementary roads and transport assessment. Only two additional strategies were included as discussed below.

The supplementary roads and transport assessment highlighted the need to clarify that road use management plans would include fitness for use assessments. In the EIS, Arrow committed to assess and identify works required to manage the increased traffic volumes and road safety issues associated with the project in road use management plans prepared and regularly reviewed in consultation with the relevant council or the DTMR [C284]. Acknowledging that a typical component of road use management plans is a fitness for use assessment, such assessments will be conducted where necessary. As a result, the existing commitment captures the latest recommendations.

The supplementary assessment also highlighted the necessity for agreements to be formed with council regarding the condition of affected local roads. Commitment C284 captures this recommendation, as infrastructure agreements typically follow the development of road use management plans, as shown in Figure 12.1. Infrastructure agreements developed with relevant councils will identify contributions towards any necessary new roads, road maintenance and upgrades identified in the finalised road use management plan. Therefore, where applicable, Arrow will enter into infrastructure agreements with councils following the development of road use management plans.



coffey environments	Date: 11.06.2013 MXD: 7040AE_12_GIS087_v0_2 File Name: 7040_12_F12.04_GIS_GL	Arrow Energy Surat Gas Project	arrow energy go further	Project annual average daily traffic (averaged over the project life for individual road links)	Figure No: 12.4



coffey environments	Date: 11.06.2013 MXD: 7040AE_12_GIS086_v0_2 File Name: 7040_12_F12.05_GIS_GL	Arrow Energy Surat Gas Project	arrow energy go further	Maximum project annual average daily traffic as percentage of existing (2011) traffic volumes	Figure No: 12.5

The assessment of the significance of project impacts based on the sensitivity of road environmental values is consistent with that presented in the EIS. The significance of road impacts both pre- and post-implementation of management measures is consistent between the EIS and SREIS for all road types. It is expected that all impacts can be effectively managed using the management measures outlined in the EIS. Additionally, the management strategies are considered to provide the principles upon which future road use management plans and infrastructure agreements can be developed.

12.5.5 Case Studies

Sections of roads on which project traffic was expected to increase existing (2011) AADT traffic demands by at least 5% are shown in Figure 12.5. During the scoping assessment, parts of these identified sections of the road network were selected for the fitness for use, intersection and pavement impact assessments undertaken in the case studies. The five case study locations, selected potential routes considered for the fitness for use and pavement impact assessments and intersections considered for the intersection assessments are shown in Figure 12.6. The findings of the case study assessments are provided below.

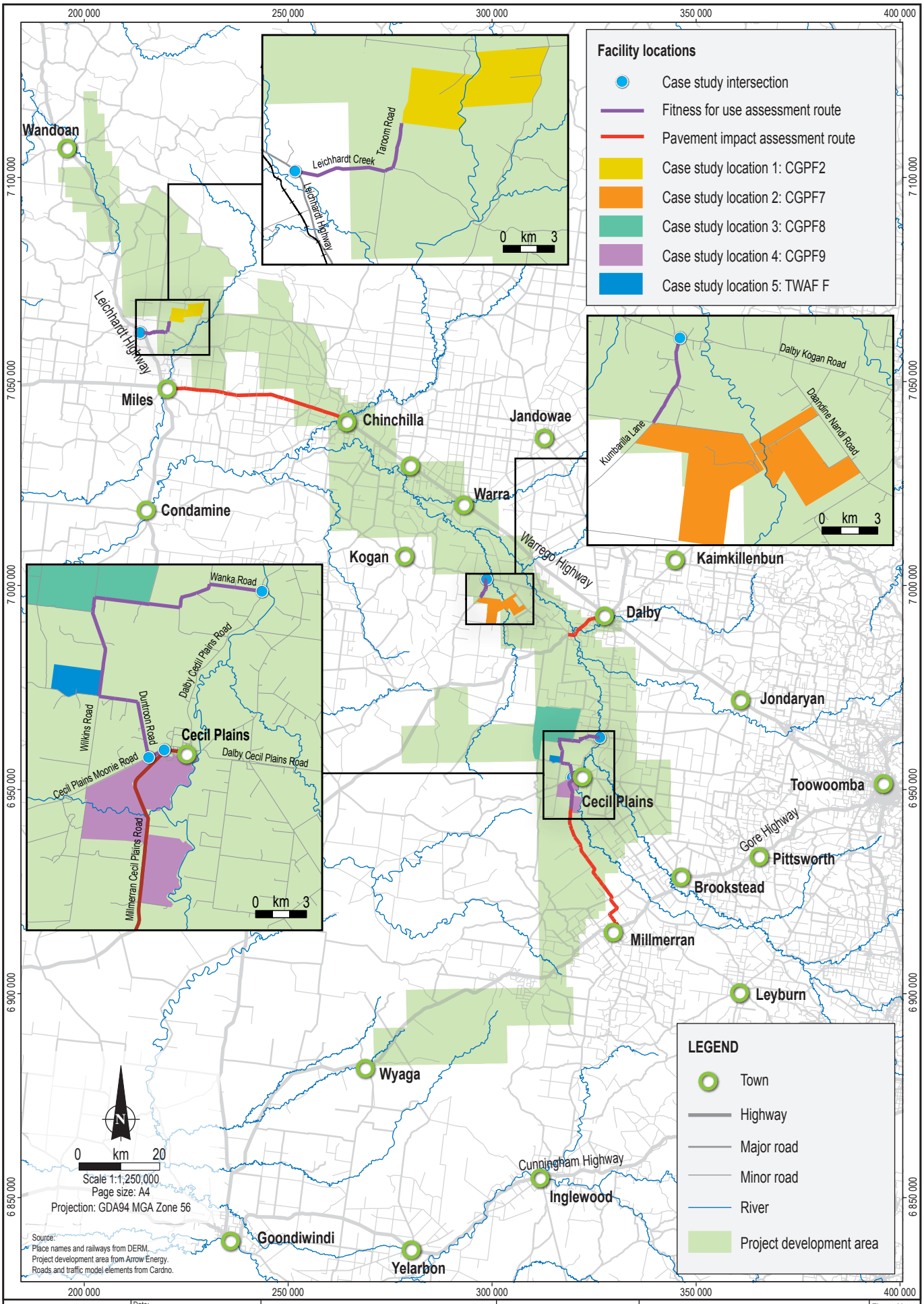
Fitness for Use

Of the road sections identified in Figure 12.5, routes linking the case study locations with highways, that were considered for the fitness for use assessments, are presented in Table 12.4.

Table 12.4 Nominal routes connecting the case study locations with the closest highway

Case Study Location	Facility	Route Assessed
1	CGPF2	Leichhardt Creek Taroom Road
2	CGPF7	Kumbarilla Lane
3	CGPF8	Wanka Road
4	CGPF9	Millmerran Cecil Plains Road
5	TWAF F	Duntroon Road/Wilkins Road

The AADT for existing volumes, the predicted peak project year and the peak design (i.e., AADT estimated for the peak year including both project and background traffic volumes), is presented for each of the assessed routes in Table 12.5. The type of infrastructure works that would be required, determined from the application of management measures in the EIS and through the application of the GARID, are also presented in the table.



coffey environments	Date: 11.06.2013 MXD: 7040AE_12_GIS086_v0_2 File Name: 7040_12_F12.06_GIS_GL	Arrow Energy Surat Gas Project	arrow energy go further	Case study locations, routes and intersections	Figure No: 12.6

Table 12.5 Infrastructure upgrade requirements identified in the fitness for use assessments

Case Study Location	Facility	Route Assessed	Existing AADT	Predicted Peak Project AADT	Estimated Peak Design AADT	Likely Infrastructure Works	
						EIS Management Measures Approach	GARID Approach
1	CGPF2	Leichhardt Creek Taroom Road	80	300	390	Upgrade to a two lane sealed road, sealed shoulders, appropriate line marking.	Sealing typically warranted.
2	CGPF7	Kumbarilla Lane	785	312	1,217	Widen to a two lane sealed road, sealed shoulders, appropriate line marking.	Sealed traffic lane width of 7 m plus 2 m total shoulder width.
3	CGPF8	Wanka Road	65	10	100	Upgrade to a two lane sealed road, sealed shoulders, appropriate line marking.	Economic benefit assessment of sealing warranted.
4	CGPF9	Millmerran Cecil Plains Road	220	260	610	Widen to a two lane sealed road, sealed shoulders, appropriate line marking.	Sealed traffic lane width of 7 m plus 1.5 m total shoulder width.
5	TWAF F	Duntroon Road/Wilkins Road	40	351	396	Upgrade to a two lane sealed road, sealed shoulders, appropriate line marking.	Sealing typically warranted.

Table 12.5 demonstrates that the site-specific management strategies recommended using the strategic-level management measures outlined in the EIS, are generally consistent with those identified using the generic GARID approach informed by field work. This indicates that the management measures outlined in the EIS will be appropriate in effectively managing identified potential road impacts.

Intersection Assessments

The intersections of the first point of access from each case study location to the state-controlled road, using the potential routes identified in Table 12.4 are presented in Table 12.6.

Table 12.6 Intersections assessed as part of case studies

Case Study Location	Facility	Intersection Assessed
1	CGPF2	Leichhardt Highway/Leichhardt Creek Taroom Road
2	CGPF7	Dalby Kogan Road/Kumbarilla Lane
3	CGPF8	Dalby Cecil Plains Road/Wanka Road
4	CGPF9	Cecil Plains Moonie Road/Millmerran Cecil Plains Road
5	TWAF F	Cecil Plains Moonie Road/Duntroon Road

The likely required upgrades for each intersection (i.e., turn treatments) recommended using the management measures proposed in the EIS and the GARID approach (determined through Austroads turn warrants) are presented in Table 12.7.

Table 12.7 Infrastructure works anticipated to be required for intersections considered in intersection assessments

Case Study Location	Facility	Intersection Assessed	Likely Infrastructure Works	
			EIS Management Measures Approach	GARID Approach
1	CGPF2	Leichhardt Highway/Leichhardt Creek Taroom Road	Auxillary left turn lane and channelised right turn lane.	Basic left turn lane and channelised right turn lane.
2	CGPF7	Dalby Kogan Road/Kumbarilla Lane	Auxillary left turn lane and channelised right turn lane.	Basic left turn lane and channelised right turn lane(s).
3	CGPF8	Dalby Cecil Plains Road/Wanka Road	Auxillary left turn lane and channelised right turn lane.	Basic left turn lane and basic right turn lane.
4	CGPF9	Cecil Plains Moonie Road/Millmerran Cecil Plains Road	Auxillary left turn lane and channelised right turn lane.	Basic left turn lane and channelized right turn lane(s).
5	TWAF F	Cecil Plains Moonie Road/Duntroon Road	Auxillary left turn lane and channelised right turn lane.	Basic left turn lane and basic right turn lane.

The site-specific management strategies recommended through the application of the strategic-level management strategies proposed in the EIS, are generally conservative in nature in comparison to those identified using the GARID approach. This indicates that the management measures outlined in the EIS will be appropriate in effectively managing identified potential road impacts.

Pavement Impact Assessments

Road segments for which pavement maintenance activities are likely to be accelerated by more than one year as a result of heavy vehicle traffic generated by the project were identified. These results are presented in Appendix F of Appendix 10, Supplementary Roads and Transport Assessment.

Typically, the proponent contributes to the additional maintenance costs associated with increases in heavy vehicle traffic in consultation with road authorities. As the exact locations for infrastructure are unknown, monetary contributions have not yet been identified for the project. Maintenance contributions will be formalised in road infrastructure agreements developed in consultation with road authorities (as shown in Figure 12.1).

12.6 Conclusion

The supplementary roads and transport assessment focused on potential impacts to the former Darling Downs region road network. Updated data collected on existing traffic conditions is generally consistent with that presented in the EIS and was used to determine the potential impacts that project-generated traffic would have on the existing road network.

In consideration of both historical traffic growth and cumulative impacts from proposed projects in the region, a 3% traffic growth rate over the long-term was adopted for the supplementary roads and transport assessment. This adopted value is consistent with the range presented in the EIS as the total increase in traffic from developments in the region.

The strategic traffic modelling for the supplementary roads and transport assessment presented an increase in the estimated total project vehicle kilometres travelled compared to the EIS, however the net increase in daily traffic volumes on individual roads is relatively minor. Changes to the project description have resulted in increased traffic demand along the Toowoomba Cecil Plains Road.

The supplementary roads and transport assessment expands on the work previously undertaken for the EIS by applying both a significance impact assessment approach and a GARID-style approach, informed by field work at specific locations, to verify the appropriateness and effectiveness of the planned management strategies. The case study assessments confirmed that planned management strategies outlined in the EIS will result in the mitigation of significant project impacts in accordance with the GARID.

12.7 Issues Raised in Submissions

Submissions on the EIS raised a range of issues relating to roads and transport. The issues fall into broad topics, which are listed below:

- Aggregate volumes required by the project.
- Coexistence of coal seam gas and farming industries (on state, local and private roads).
- Consultation with road authorities and councils.
- Cumulative impacts on roads.
- Current road conditions.

- Functional road hierarchy classification.
- Heavy and oversize vehicle impacts.
- Management measures.
- Rail transportation.
- Road maintenance, upgrades and financial contributions.
- Road safety considerations (e.g., school-bus routes, crashes).
- Significance assessment method (environmental values).
- Strategic traffic modelling method and inputs.
- Transport of waste other than brine.
- Traffic congestion.
- Transport of brine by truck to landfill.
- Vehicle washdown procedures.

Responses to issues raised in the submissions relating to roads and transport are included in Part B, Chapter 19, Submission Responses.