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QGC – A BG Group Business

Queensland Curtis LNG Project

Gladstone Infrastructure Audit CTR

June 2009

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

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Executive Summary

QGC – A BG Group Business has commissioned this report to assess the impact of the construction of its Queensland Curtis Liquid Natural Gas (QCLNG) project on the infrastructure of mainland Gladstone. This assessment has been based on the assumption that 2000 workers are required for the construction of the plant and 200 workers are required for the operation of the plant.

Generally, it is suggested that there will not be adequate domestic residential accommodation to house all workers in Gladstone, and it is therefore suggested that worker's camps will be required to house the majority of construction workers that do not have an existing domicile in Gladstone. Three possible workers camp sites have been considered of which two have been investigated, one located on Curtis Island and the other at Calliope River Road. It would appear that housing construction staff and their families would be difficult if the QCLNG plant was to proceed on its own, but very difficult if other projects proceed at the same time.

This report has generally examined the larger items of infrastructure that have significant lead times to bring on line to meet demand. For a dispersed population loading over the residential areas of Gladstone, the infrastructure systems will generally cope as follows:

- Landfill with capacity until 2050;
- Waste transfer contractors able to draw on national vehicle resources;
- Sewage Treatment Plants running on average at 50% capacity;
- Potable water treatment plant running at 50% capacity;
- Bulk water storage is at 75% of allocation, pumps running at 40% capacity;
- Telecommunications are linked to the coastal high capacity optical network;
- Electricity substations on average operating between 34% and 59% capacity; and
- Airport currently undergoing upgrade with sufficient capacity with additional flights.

Given that one workforce of 2000 people is approximately 7% of the current Gladstone population, the above infrastructure would likely be able to cope with a number of projects being constructed concurrently particularly if a large proportion of the 2,000 originates from Gladstone. The above conclusions do not take into consideration the bulk draw on the piped and wired services associated with other major industries establishing in Gladstone as the scale of their demands warrants individual agreements with the infrastructure providers to meet their demands.

The cost of augmenting reticulation of services to the point of use for domestic dwellings is generally incorporated into the cost of providing the infrastructure to the development or recovered through the consumption charge.

The worker's camp proposed for Curtis Island will be self-contained in the provision of potable water, electricity and sewage disposal infrastructure and thus will not impact mainland infrastructure.

A second possible workers camp located on Calliope River Road has preliminary approvals in place to be self-contained, however QGC has requested that a connection to reticulated water be assessed. A connection to Council's water reticulation from Mt Elizabeth at Calliope is estimated to cost in the order of $4 million to $5 million. A connection to the Calliope sewage treatment plant would likely be of a similar magnitude. Electricity supply to this camp would come from a substation in Calliope, the costs of which are currently not available from Ergon without lodging an application for supply to the site.

1. Background

GHD has been commissioned to undertake an audit assessment of current system capacity and reserve margin (gross and equivalent person), for Gladstone City, Calliope, Boyne Island and Tannum Sands to provide a baseline against which their ability to cope with the construction phase (i.e. workers camp and fly-in, fly-out) and operational phase (permanently housed) activities for the Queensland Curtis LNG (QCLNG) Plant to be located on Curtis Island, off Gladstone. Infrastructure assessed includes:

- Waste Water
- Potable Water
- Raw Water
- Municipal Waste (includes sewerage, garbage and recycling)
- Trade Waste
- Telecommunications, Landline and Mobile
- Electricity
- Gas Supply
- Airport – does need for more flights trigger any requirements?
- Rail / Ship Intermodal
- Potential of existing developments to supply needs;

This report:

- Performs high-level assessment (not detailed) of potential demand side management options.
- Assesses potential augmentation requirements and costs for augmentation + / - 35% (does not need concept design).
- Has regard for the age of assets, ambient population / demand growth and deterioration trajectory.
- Has regard for the cumulative impact of other major industrial projects and aim to isolate the impact of the QCLNG project.

This report has been prepared as an initial advice document for the impacts of the workforce of the infrastructure of Gladstone. As the project is in its early stages of development, the basis for making estimates of capacity and impacts may change, and thus the document must be updated by GHD should the information be used for later documents.

A significant amount of information has been obtained from infrastructure providers. GHD has no control over this data and limited opportunities to verify the content. Verbal advice can be subject to individual interpretation and as such should not be relied upon in total.

2. The LNG Project

The key elements of the QCLNG proposal are:

» The expansion of QGC's coal seam gas operations in the Surat Basin;

» A 380 km gas pipeline connecting the QGC gas fields to Gladstone; and

» An LNG processing plant and export terminal at Curtis Island with initial production capacity of 7.5 million tonnes a year from two processing units, or "trains".

The LNG plant cools the gas to minus 162 degrees Celsius reducing the volume to 1/600th of the original. This allows it to be transported safely and economically by specially designed ships to where it is required. Once unloaded the LNG is 'regasified' and becomes natural gas ready to be distributed to the point of use.

It is anticipated that construction of the plant will commence in 2010 with completion in 2013. It is envisaged that a construction workforce will be accommodated mainly in a workers' camp on Curtis Island but with the balance of 100 to 200 persons being distributed around the region. However, a mainland workers camp option is still being assessed,

The proposed LNG plant is located within the boundaries of the Gladstone Regional Council, which has been formed by the recent amalgamation of Gladstone City Council, Calliope Shire Council and the Miriam Vale Shire Council.

QGC believes that companies that operate responsibly and safely also prosper economically. The investment criteria take account of economic returns as well as the environmental and social impact. A guiding principle of the QCLNG Project is to ensure that communities benefit from their presence on an enduring basis.

In order to assess the impacts of the location of the LNG plant in the Gladstone Region, the underlying population growth must be examined in the context of its surroundings including the impacts of industrial expansion. The underlying housing activity in Gladstone also has to be gauged in order to assess the effect of the additional persons associated with the LNG plant arriving in Gladstone.

2.1 Expected Workforce and Accommodation

The total number of workers expected for the project has been initially estimated at 2,000, with a break down of the general source of workers for the construction of the plant as indicated in Table 1.

Table 1 Workforce Numbers and Source

Total Workforce	**2,000**
Local Gladstone	1,100
Imported	900

The project reference case is that accommodation for the workforce may be sourced as follows:

» 1,100 persons in private dwellings

» 900 person camp on Curtis Island.

The above estimates are used as a basis to the assessment of the impacts on infrastructure by the construction and operation of the LNG plant.

Four possible accommodation scenarios were considered for the work force as outlined in Table 2.

Table 2 Four Possible Accommodation Scenarios

Scenario	**A**	**B**	**C**	**D**
Total Workforce	2,000	2,000	2,000	2,000
Local Gladstone	1,100	1,100	1,100	1,100
Imported	900	900	900	900
Accommodation	100% Mainland 1,100 in private dwellings 900 in Mainland Camp - Aldoga	100% Mainland 1,100 in private dwellings 900 in Mainland Camp - Calliope	100% Island	55% Mainland 45% Island 1,100 in private dwellings 900 in Camp on Island

Only the mainland workers camps are considered to have caused an impact on services as the island camp would be self sufficient for most public infrastructure.

2.2 Workforce and Accommodation Update

The workforce and accommodation options outlined in Section 2.1 of the report have changed since the initial assessment of the impacts on Gladstone Infrastructure. The workforce and accommodation options have been assessed at a high level on the basis of a number of factors, including:

» Expansion of the project footprint;

» Social impacts labour availability implications and impacts on housing availability within the Gladstone region;

» Traffic impacts;

» Greenhouse impacts arising from transport of construction personnel; and

» Implications for project cost and schedule.

In assessing these options, it was assumed that the potential bridge across The Narrows would not be available for the construction phase of LNG Process Trains 1 and 2, with the majority of personnel transit to and from the LNG Facility construction site being via ferry staging out of Auckland Point.

Based on this assessment a revised workforce and accommodation option was framed that involved a reduced total workforce number, an alternative accommodation approach and a different transport arrangement. A 9/90 workforce shift arrangement (9 days worked each fortnight on a 5 days on, 2 days off, four days on 3 days off rotation) is proposed. The result is that the total number of workers has been revised down from 2,000 to 1,500 in a revised resources analysis. The revised number and source of workers for the construction of the plant is shown in Table 3.

Table 3 Workforce Numbers and Source

Total Workforce	**1,500**
Local Gladstone	1,050
Imported	450

THESE WORKFORCE NUMBERS AND SOURCE HAVE NOT BEEN REFLECTED THROUGH THE ASSESSMENTS IN THIS REMAINDER OF THIS DOCUMENT, THEREBY ENSURING THAT A MAXIMUM IMPACT SCENARIO HAS BEEN ADDRESSED

Under the revised option now adopted as the project base case, the non-local personnel would firstly be accommodated in mainland hotels and rental accommodation up to a level that did not place stress on the local short term accommodation supply (ie 100- 200 persons), but this is subject to further analysis. These persons would commute to and from the project site daily with local Gladstone personnel. However, further employment of non-local personnel above this level, would trigger the accommodation of all non-local personnel, in an island camp. Non-locals accommodated in the island camp would remain on the island each day until shift rotation.

3. Population and Housing

The Planning Information and Forecasting Unit (PIFU) of the Department of Infrastructure and Planning of the Queensland Government have supplied population statistics used in this report. Population data in their reports are based on the 5-year census data provided through the Australian Bureau of Statistics (ABS) operated by the Federal Government. Housing and residential land activity data are collected by PIFU from each local government area throughout the state.

The intention of this section of the report is to set the background trends for population and housing growth in the Gladstone Region putting it in context with state and regional trends. The report will then compare the impacts of the number of additional workers as provided by the proponent with the availability of housing.

3.1 State Wide Trends

There is a general positive population trend in Queensland with in the vicinity of 95,000 people moving to Queensland every year, making Queensland Australia's fastest growing State. The graph below from PIFU (2008) provides a comparison with the other states of Australia.

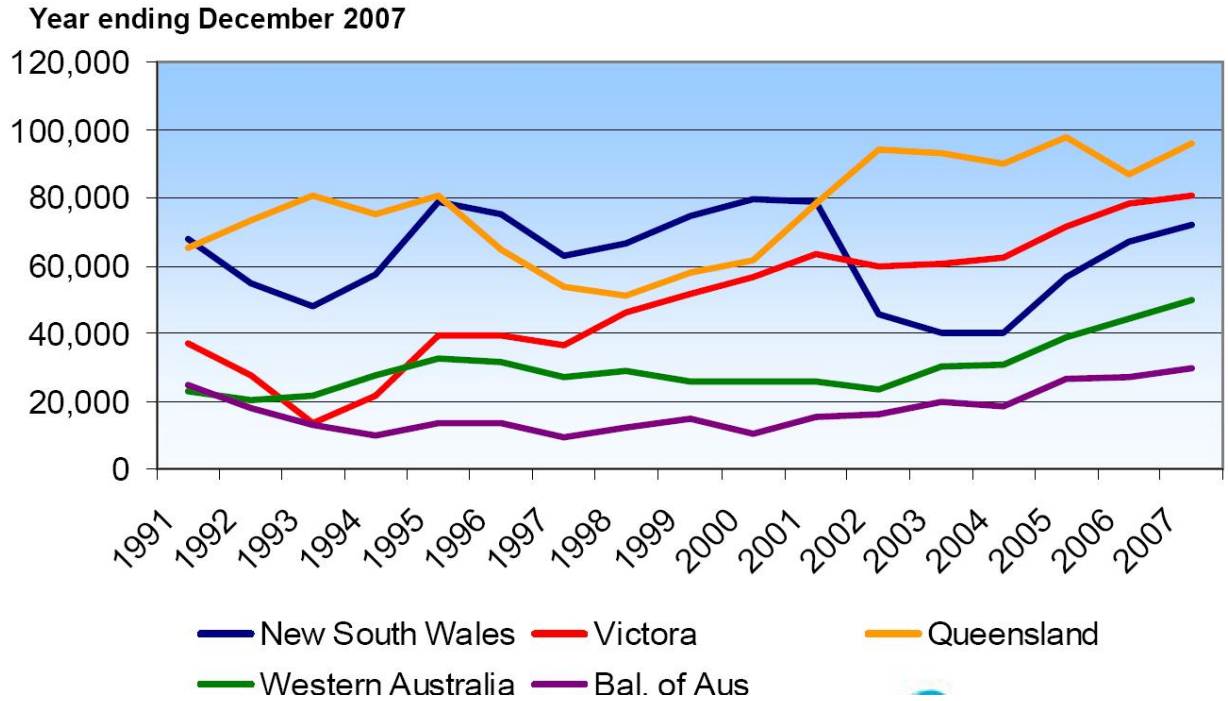

Figure 1 - Comparison of Population Growth of Australian States

It is anticipated that the underlying growth in Queensland is expected to be between 2% and 3% per annum over the next five years.

3.2 Gladstone Regional Council Area

The population within the Gladstone Regional Council as at 2007 is approximately 55,550 persons. Table 4 gives a comparison of the Gladstone Regional Council with its neighbouring local governments.

Table 4 Comparison of Neighbouring Local Governments

Local Government	Population
Rockhampton Regional Council	109,850
Gladstone Regional Council	***55,550***
Central Highlands Regional Council	28,700
Banana Shire Council	15,400

3.3 Growth in the Gladstone Region

On a percentage basis, the Gladstone Regional Council is one of the 10 fastest growing local government areas with population growth over the period between 2001 and 2007 being in the order 3% per year, ranking 7th in the State on a percentage basis. Table 5 compares Gladstone's growth with the 10 fastest growing Local Government Areas in Queensland.

Table 5 10 Fastest Growing LGAs in Queensland

Rank	Local Government	2001-2006		2006-2007	
		Average No.	Av. %	No.	%
1	Weipa (T)	171	6.9	192	6.4
2	Gold Coast (C)	15,910	3.8	16562	3.5
3	Ipswich (C)	3,376	2.6	5,026	3.5
4	Fraser Coast (R)	3,010	3.8	2,978	3.3
5	Moreton Bay (R)	9,241	3.0	10816	3.3
6	Cairns (R)	3,882	2.9	4,598	3.1
7	**Gladstone (R)**	**1,521**	**3.1**	**1,582**	**2.9**
8	Townsville (C)	4,033	2.6	4,529	2.7
9	Sunshine Coast (R)	9,592	3.6	7,952	2.7
10	Lockyer Valley (R)	656	2.2	828	2.6

R= Regional Council C= City Council T = Town Council

Table 6 below outlines the population change for the major centres within the new Gladstone Regional Council local government area. Noticeable are the trends that the Gladstone, Calliope, Boyne Island and Tannum Sands townships have grown significantly over the years with the number of industries locating in the Gladstone area.

Table 6 Population Change in Urban Centres and Localities, Gladstone Regional Council

Town	1971	1981	1991	2001	2006	Change 25 yrs
Agnes Water	N/a	N/a	N/a	1,262	1,836	N/a
Benaraby	N/a	N/a	N/a	N/a	693	N/a
Boyne Island	N/a	N/a	2,547	3,539	3,720	N/a
Calliope	451	728	962	1,182	1,503	775
Gladstone	15,574	22,083	23,462	26,625	29,211	7,128
Miriam Vale	381	431	447	391	394	-37
Mount Larcom	285	308	235	214	256	-52
Seventeen Seventy	N/a	N/a	N/a	228	257	N/a
Tannum Sands	457	1,217	2,460	3,663	4,309	3,092

3.4 Household Size

Household sizes in Gladstone are declining slightly on average from 2.8 persons per household in 1996 to 2.6 persons per household in the 2005 census. A comparison of the Gladstone Regional Area with the adjoining Council areas in the Fitzroy Statistical Division is indicated in Figure 2.

Household size provides an approximate correlation between the demand placed on housing and the number of persons arriving in the Gladstone area. This reflects the migration of younger workers into the area working with the major industries in the area.

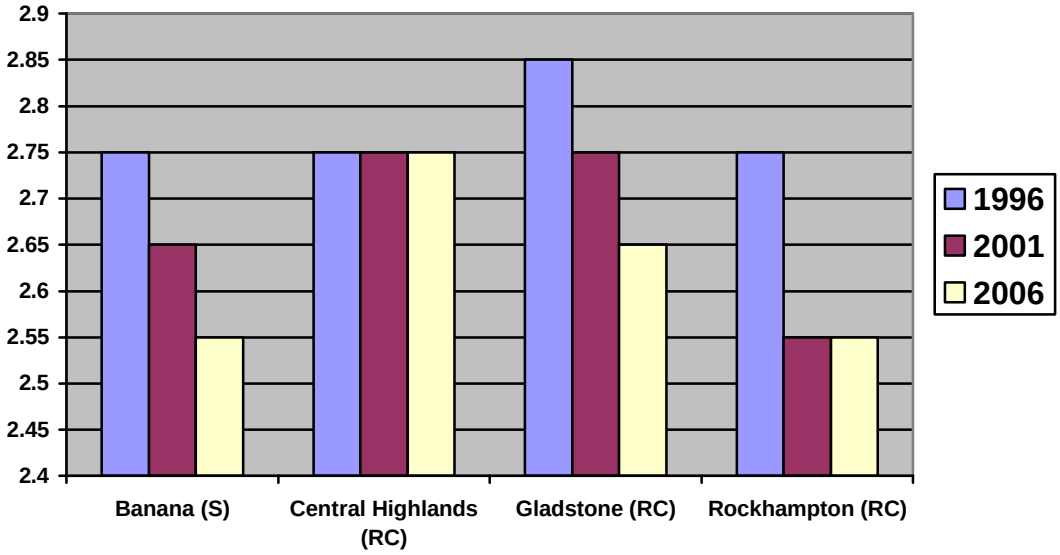

Figure 2 - Household Size for Fitzroy Statistical Division

Source: PIFU (2008) (data source ABS Census 2006)

3.5 Migration Patterns

Net migration of persons moving to Gladstone have been generally within the age group of 21-54 years which indicates that people are moving to Gladstone for the opportunities that present themselves with working for a major industry such as job security and higher earnings. Figure 3 indicates the trends in population migration based on age group.

The negative migration of persons between the ages of 55 and 75 years of age from the Gladstone area is an indication that the area is not attractive to this age group which represents predominantly people retired from the work. It is speculated that the factors that make Gladstone unattractive to this age group are a high cost of living due to the higher average income and the lack of quality aged care facilities and hospitals for persons with a higher demand for specialist health services due to their age. Figure 3 indicates most of the negative migration is intrastate for which the main areas that are attracting this age group are likely to be Bundaberg, the Sunshine Coast and the southeast corner of the State.

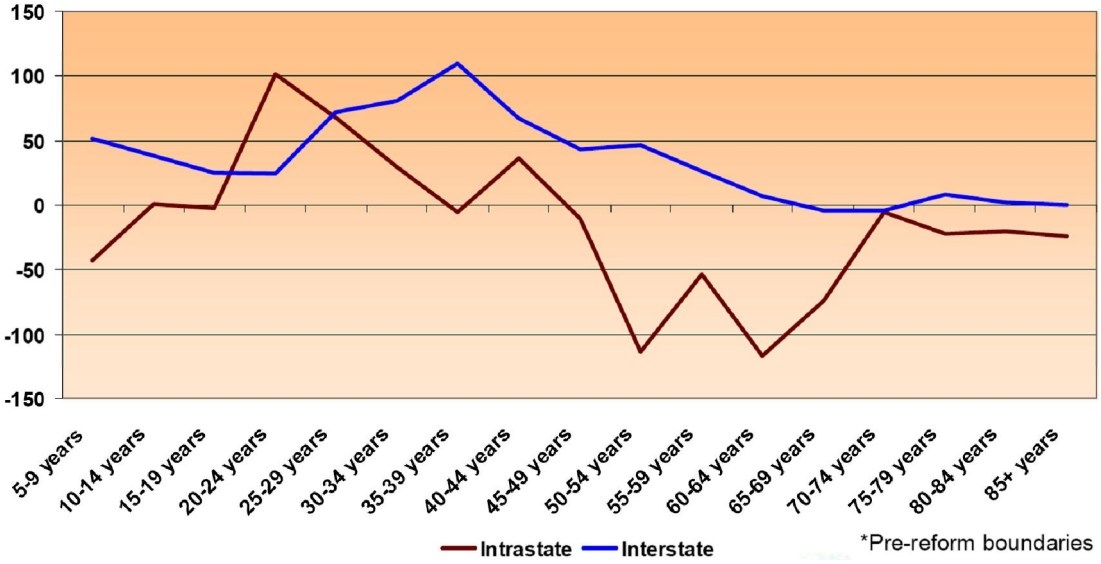

Figure 3 - Net Migration for Gladstone City Council Area

Source: PIFU (2008)

3.6 Population Forecasts

As mentioned earlier, Queensland's population outlook for the next 50 years is for positive growth as indicated on Figure 4 below.

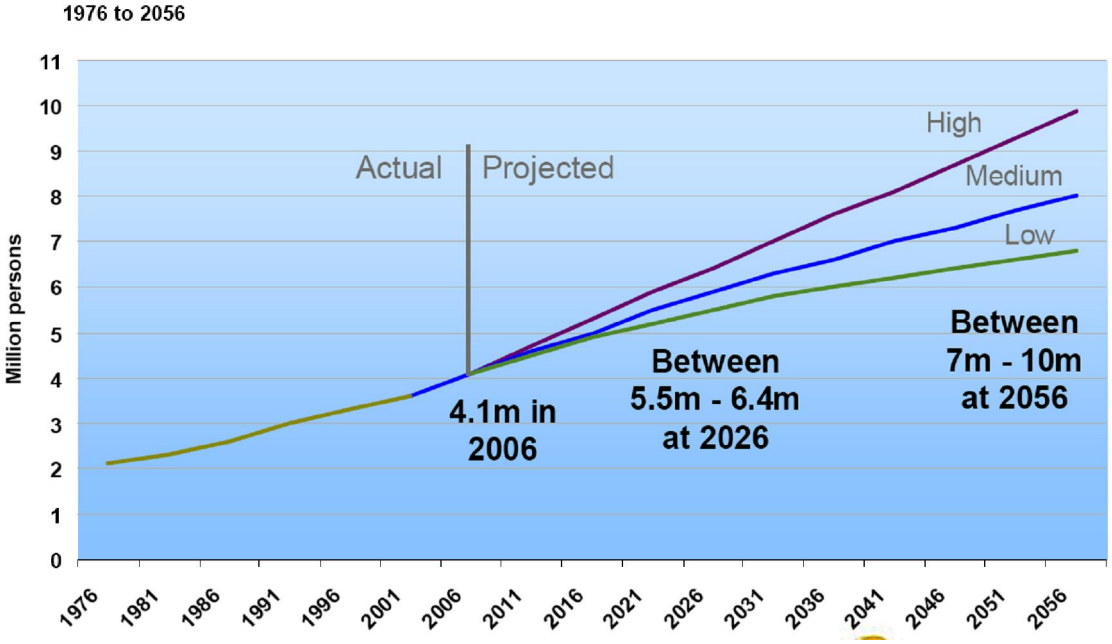

Figure 4 - Actual & Projected Population for Queensland

This positive growth is also reflected across the Fitzroy Statistical Division with Gladstone's population predicted to almost double in 25 years, as indicated on Figure 5 below.

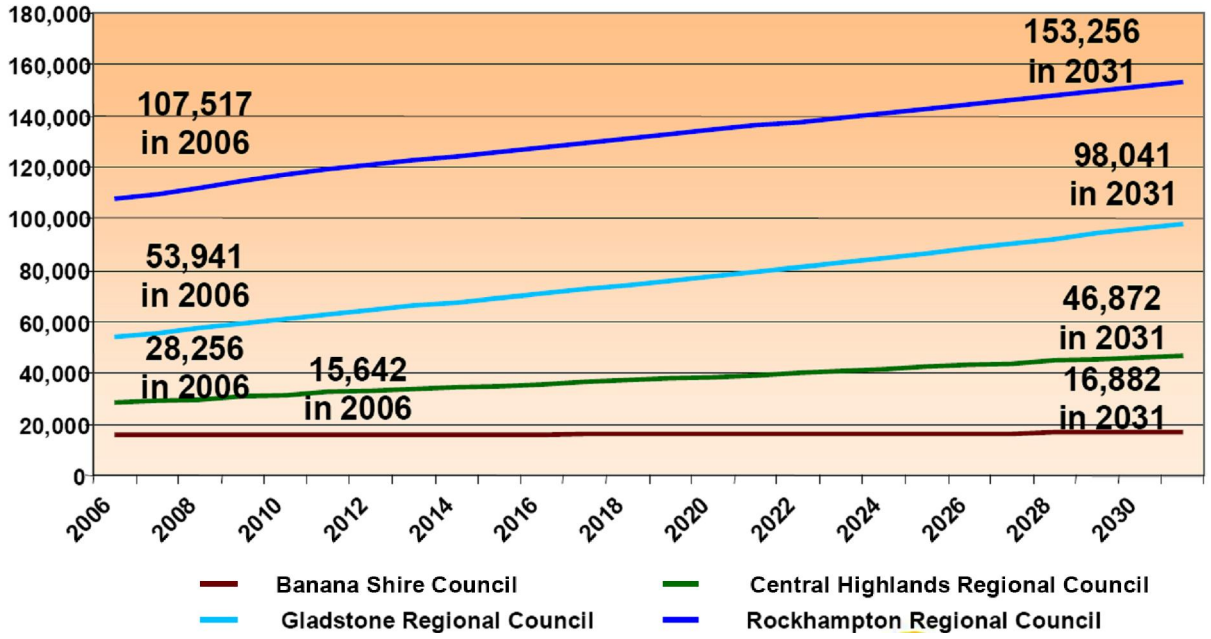

Figure 5 - Projected Population Growth for the Fitzroy Statistical District

(Source: PIFU 2008).

Table 7 outlines the projected population increases for the local government areas in the Fitzroy Statistical Division. On average, PIFU forecasts that there will be an inflow of people of approximately 1,700 persons per year into the Gladstone Regional Council area. This reflects the strong growth created by the resources industries. These figures could soften given the global financial crisis that commenced in December 2008.

Table 7 Actual and Projected Growth for Fitzroy Statistical District

Local Government	**Actual**		**Projected**	
	1986-1996	1996-2006	2006-2016	2016-2026
Banana (S)	-3,401	211	345	508
Central Highlands (RC)	1,670	2,249	7,509	7,288
Gladstone (RC)	***8,954***	***9,817***	***16,986***	***17,338***
Rockhampton (RC)	12.761	11,720	20,254	16,913
Total - Fitzroy SD	**19,804**	**23,761**	**41,936**	**42,280**

3.7 Residential Land Supply and Building Trends

The Planning Information and Forecasting Unit of the Department of Infrastructure and Planning also provides significant information on the supply of land and housing statistics based on information supplied by the local governments in the State.

3.7.1 Housing Delivery Figures

Figure 6 indicates the trends for residential land production at the different stages of production as at June 2008. Current figures may vary significantly from those shown as the global financial crisis has had a considerable affect on the production and sales in the residential land market.

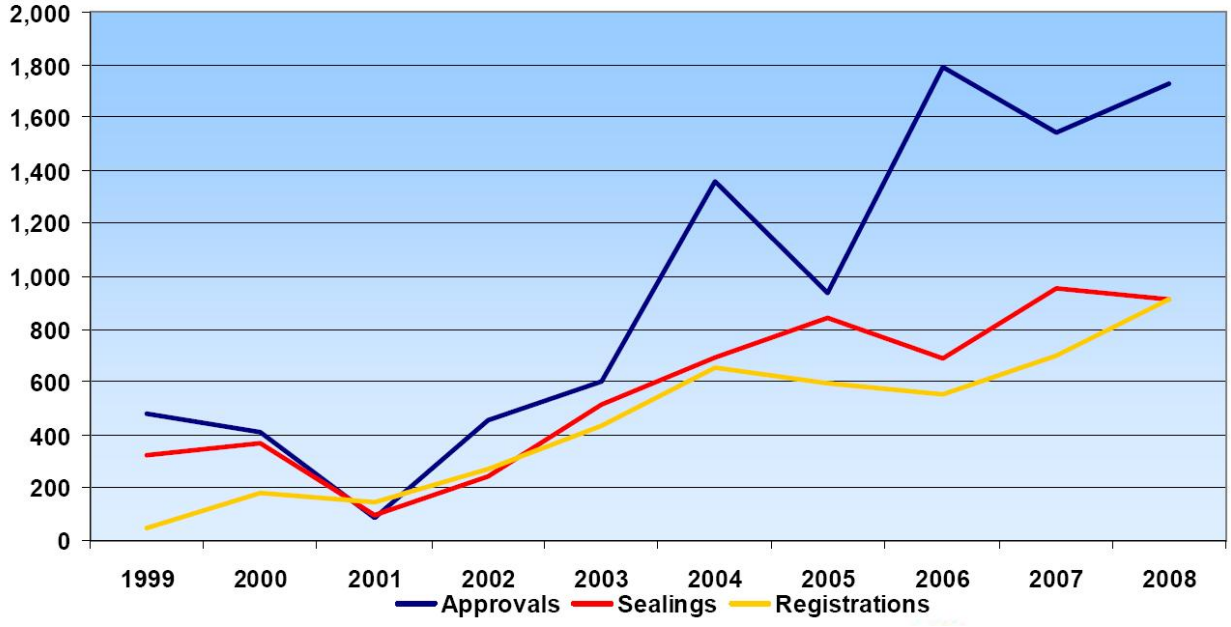

Figure 6 - Residential Land Production Trends to June 2008

Table 8 indicates the actual numbers of residential allotments at the different stages of approval, with further extrapolation based on the average household size as to the number of persons accommodated as the process continues.

Table 8 Residential Housing Production for the Gladstone Regional Council Area - June 2008

Development Stage	Number of lots	Approved Accommodation	Minimum Delivery Time
Approval to create allotments	1,407	3,728 persons	13 months
Approval of Construction Documentation	704	1,865 persons	11 months
Housing Approvals	627	1,660 persons	6 months

3.8 Properties Already in Market

A quick and simple estimate of the immediate availability of housing and land in the area is to enquire on the “realestate.com” and find the number of listings. This website is used by most of the larger real estate agents and thus provides a good indication of available properties.

The 4680 postcode covers Boyne Island, Tannum Sands, Calliope, Gladstone, and Benaraby areas. The number of listings found for this postcode as at 26 January 2009 are as per Table 9.

Table 9 Numbers of Listings on “Realestate.com.au” for Postcode 4680.

Real Estate Type	Number of Listings
Vacant land	200 listings
Rental housing	192 listings
House for sale	200 listings.

In some instances there will be duplicate listings, but to balance that some agents do not utilise the services of the website. On face value, a conclusion could be drawn that for the 4680 post code area there are in the order of 400 houses currently available and another 200 possibly available within 6-12 months.

3.9 Trends in the Housing Market

With the property boom over the last number of years, the price of residential housing the Central Queensland area has increased markedly over time. A comparison of median sales prices for vacant allotments in the various pre-amalgamation local government areas is indicated in Figure 7.

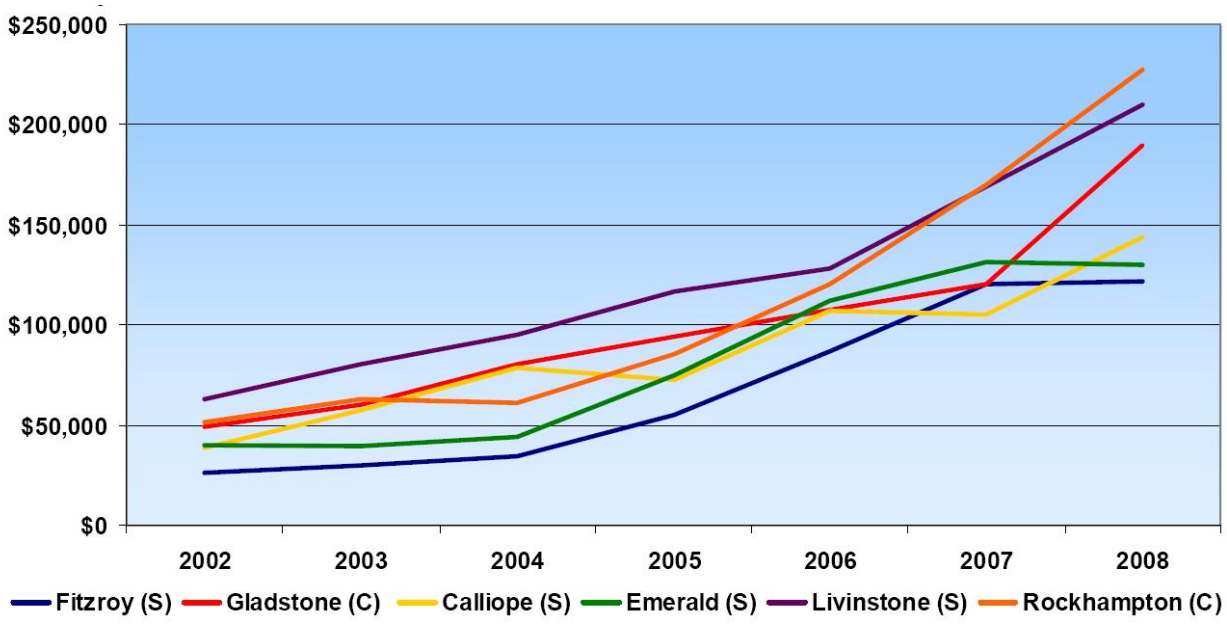

Figure 7 - Median Sale Price of Vacant Lots to June 2008

A graph of land sale volumes and pricing for Gladstone, shown in Figure 8, illustrates how the volume of land sales have declined as the price reached around $150,000. This is speculated to be caused by the affordability of the house and land package and the ability of people to service loans on properties over the $450,000 mark.

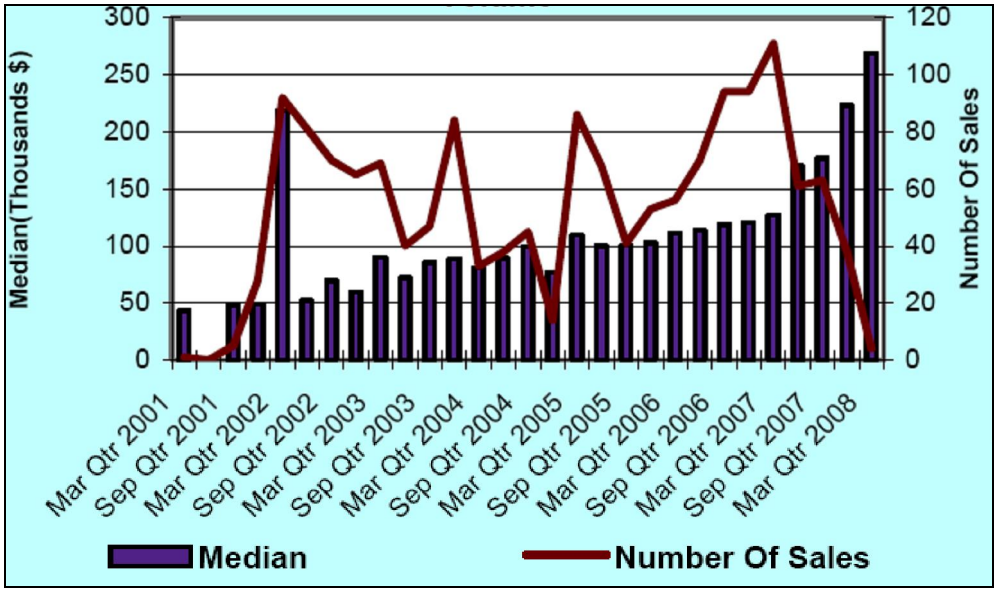

Figure 8 - Land Sales Volume and Price, Gladstone City Council Area

To further exacerbate matters, the global financial crisis and "credit crunch" has seen the value of real estate in Central Queensland decline up to 25% changing the market from a seller's market to a buyer's market. The unfortunate result of this downturn is that real estate sales have dropped significantly as buyers avoid losses of tens of thousands of dollars on a newly acquired piece of real estate. Further, speculation in the production of housing has virtually stopped with very limited proposals for broad hectare housing developments being received by Council.

The length of the boom of the real estate market caused broad hectare land parcels to change hands at record high prices which in a declining market makes some parcels unviable for development. Lending institutions have also had difficulty in sourcing credit for housing projects than in the recent past.

It appears though that some order is returning to financial circles and that housing is again moving in the marketplace. Interest rates have fallen both reducing the number of loan foreclosures and making housing more affordable. Investors are unlikely to enter the market again on the basis of increases in the capital value of the property and rental returns will now dominate investment decisions over the next couple of years. This is evidenced by the increase in rental charges across the state.

3.10 Provision of Mainland Worker Accommodation

It is likely that a small percentage of construction workers will not wish to be accommodated in construction camps, probably due to their desire to remain with their family over the extended construction period or other reasons.

General practice from previous industrial construction projects has been that a number of houses have been leased for the construction period providing a guaranteed return for the owner for a two to three year period. This resulted in empty houses under lease in a tight housing market, which was unpopular with the community. Current return rates on money are around the 4% for a 12-month term deposit, while the share market is not in a position to offer any guaranteed gains over the next year or so. Therefore guaranteeing a net return of 5-6% on a new rental property could stimulate additional housing in the area.

The strategy taken with the construction of later industrial projects is to secure only a small buffer of housing in front of demand that has resulted in a significantly lower demand. Another factor with reduced demand with the supply of accommodation with RTAY Stage 2 has been a large number of local construction workers returning to Gladstone from other construction projects outside of the Gladstone area.

A second avenue of accommodation utilised by construction workers has been to utilise motel, apartment or caravan park accommodation in the area. The result of this is that contractors or visitors to the town cannot secure accommodation and hence other industries suffer such as tourism.

A number of speculators have gained material change of use approvals for worker's camps on the mainland for the locations as shown in Table 10:

Table 10 Mainland Construction Camps

Location	Number of Workers
Stowe Road Calliope	300 persons
Calliope River Road	240 person (2000 ultimate)

3.10.1 Calliope Worker's Camp

The primary location for a workers camp is on the Curtis Island plant site; however consideration is also being given to a workers camp on Calliope River Road near the Bruce Highway. Of the 2000 construction workers, 900 workers could be accommodated in a worker's camp on Calliope River Road near the Bruce Highway and the Calliope River.

3.11 Other Projects Influencing Accommodation Availability

From the above statistics, the Gladstone region experiences significant growth as a background to any additional growth factors. Population growth in Gladstone has traditionally increased significantly during the construction of major industrial projects; however there have also been significant maintenance and process improvement projects undertaken by existing industries already located in Gladstone that have increased the baseline growth figures.

A number of other projects have announced their intentions to be located in Gladstone. Their program and commitment to commencing can change with the economic climate markets and obtaining approvals.

Table 11 lists the construction projects that appear to be approaching the construction phase in Gladstone, their timelines and workforce.

Table 11 Proposed Industry Construction Timelines and Workforces

Industry Location	Work	Period of construction	Value of Project	Workforce in EIS
Rio Tinto-Alcan, Yarwun 2	Alumina Refinery	October 2007-September 2010	$1.8 Billion	2200 Construction?? 270 Permanent
Wiggins Island Coal Terminal (Proposed)	Coal Terminal 3 Stage Plan	1st Stage: Expected 2009-2012	Stage 1: $1.3 Billion Future: $2.2 Billion Extra	650 Construction 130 Permanent
Gladstone Pacific Nickel (Proposed)	Refinery	Yet to be announced	$3.65 Billion	Stage 1 – 2600 Stage 2 – 1750
Santos Gladstone LNG (Proposed)	LNG production	2010-2014	A$7.7 Billion	3000 Construction 200 Operational

3.11.1 Comalco Rio Tinto Alumina Refinery Yarwun Stage 2

This is a $1.8 billion project the will more than double the alumina output from the Yarwun refinery, work began in September 2007 and is due for completion in September 2010. The timeframe for the construction workforce is shown below[1]:

	Sep-07	Dec-07	Mar-08	Jun-08	Sep-08	Dec-08	Mar-09	Jun-09	Sep-09	Dec-09	Mar-10	Jun-10	Sep-10
YAR2	80	240	390	760	1,000	1,700	2,200	2,800	2,300	1,250	340	100	-

It is evident from the table that work at the refinery is due to wind down around the proposed start time for the QCLNG project; however these timelines may further change due to Rio Tinto experiencing financial difficulties during the World Financial Crisis.

3.11.2 Santos LNG (GLNG)

According to Santos, a final investment decision should be made by Santos by the end of 2009 to enable first cargoes to be exported in early 2014. Santos has also secured a site to construct a LNG export facility on Curtis Island.[2]

It is anticipated that GLNG will create 3,000 jobs during construction and sustain more than 200 jobs during operation. This should stimulate further business development and employment opportunities in the Gladstone and Roma regions through increased demand for goods and services.

[1] Personal correspondence with Kylie Breadsell

[2] http://www.glng.com.au/

3.11.3 Wiggins Island

Work on Stage 1 of the Wiggins Island Coal Terminal has been scheduled to begin in 2009 however timing on this decision would appear to be in question with the economic downturn.

3.12 Accommodation Summary

The numbers of construction staff re-locating to Gladstone over the next three years associated with a number of proposed industrial plants could vary from 2000 persons to 9000 persons, depending on which major industrial projects proceed.

Without allowing for underlying growth in the Gladstone area, in the order of 400 dwellings are 'readily' available through houses for purchase or rent and with an optimistic forecast of 700 dwellings available in the next twelve months as additional houses are constructed. With the current conditions, it would be unlikely that this would satisfy the accommodation requirements for the QGC workforce let alone other projects, and thus temporary worker's accommodation will be needed to accommodate the workforce. It is also likely that housing demand would cause an unacceptable impact on housing prices through demand-pull inflation, and displacement of low income families from rental housing.

Two worker's camps are currently being considered, located at the project site on Curtis Island and a private camp at Calliope River Road.

If the average population growth of Gladstone (1,700 persons per year) is to continue, the Gladstone Regional Council has approximately two years stock of approved allotments and less than one year of stock of approved housing. The difficult part of the analysis is to separate general growth to that associated with new industries arriving in town.

When assessing the construction workforce of 2000 persons, the 9 days on 5 days off roster results in 36% of the workers not staying in the worker's camp the island at any one time, 30% of which are expected to leave the area during their time off. The impact of these estimates is that approximately 504 construction workers will be in Gladstone at any one time. This is comparable to the 530 persons that will settle in Gladstone with the permanent operational workforce. It would appear that housing these staff would be difficult if the QCLNG was to proceed on its own, but very difficult if other projects proceed at the same time.

4. Water

The key components to be assessed for a water supply network are the water source/storage and treatment plants that have a lead-time of 5-10 years to bring on line. Trunk infrastructure within the town can generally be augmented in reasonably short time frame, however without a location specified for the demand to impact the network it is not possible to determine upgrading requirements.

The Gladstone Area Water Board (GAWB) and the Gladstone Regional Council (GRC) operate the majority of water infrastructure in the Gladstone area. The GAWB operate the water storage and bulk water infrastructure in the Gladstone area including raw water and treated water supplies. The GAWB also operate the potable water treatment plant and service the state industrial areas north of the city with treated and raw water. Between 2000 and 2002, the nearby Awoonga Dam on the Boyne River, a major water source in the region, was raised from 30 m to 40 m Australian Height Datum (AHD) to increase its storage capacity to 777,000 ML.

The Gladstone Regional Council formally went through the amalgamation process in March 2008 and is currently consolidating the organisation and revising planning documents. The Gladstone Regional Council manages the water reticulation networks downstream of the treatment plants, and sewerage collection and treatment systems within the study area.

4.1 Bulk Water

The GAWB is a Category 1 commercialised water authority operating under the *Water Act 2000.* The Board is owned by the Queensland Government and is responsible to the Minister for Natural Resources and Water. The Board is made up of State and Local Government members.

GAWB's main role is to supply water in bulk to Gladstone Regional Council, industries in the Gladstone region and to Callide power stations near Biloela.

Approximately 80% of the water supplied by GAWB is for industrial consumers. The balance is supplied to Gladstone Regional Council for commercial and domestic use. Around 20% of the bulk water supplied is treated water (treated to drinking water standard).

The GAWB owns and operates the following infrastructure in the Gladstone region including:

- Awoonga Dam on the Boyne River south of Gladstone;
- 147 km of delivery pipelines for delivery of untreated water to treatment plants and industrial customers;
- Water treatment plants in Gladstone and Yarwun;
- 58 km of delivery pipelines of treated water to the Gladstone Regional Council water reticulation systems and to other industrial consumers;
- Untreated water pumping station at Awoonga;
- Treated water pumping stations at Benaraby, Calliope, Glen Eden, Boat Creek, Gladstone Water Treatment Plant and Yarwun Water Treatment Plant; and
- Untreated water reservoirs at Gladstone (Fitzsimmons Street) and Toolooa, and treated water reservoirs at Boyne Island, East End, Golegumma, South Gladstone and Yarwun.

The GAWB water network is outlined in Figure 9.

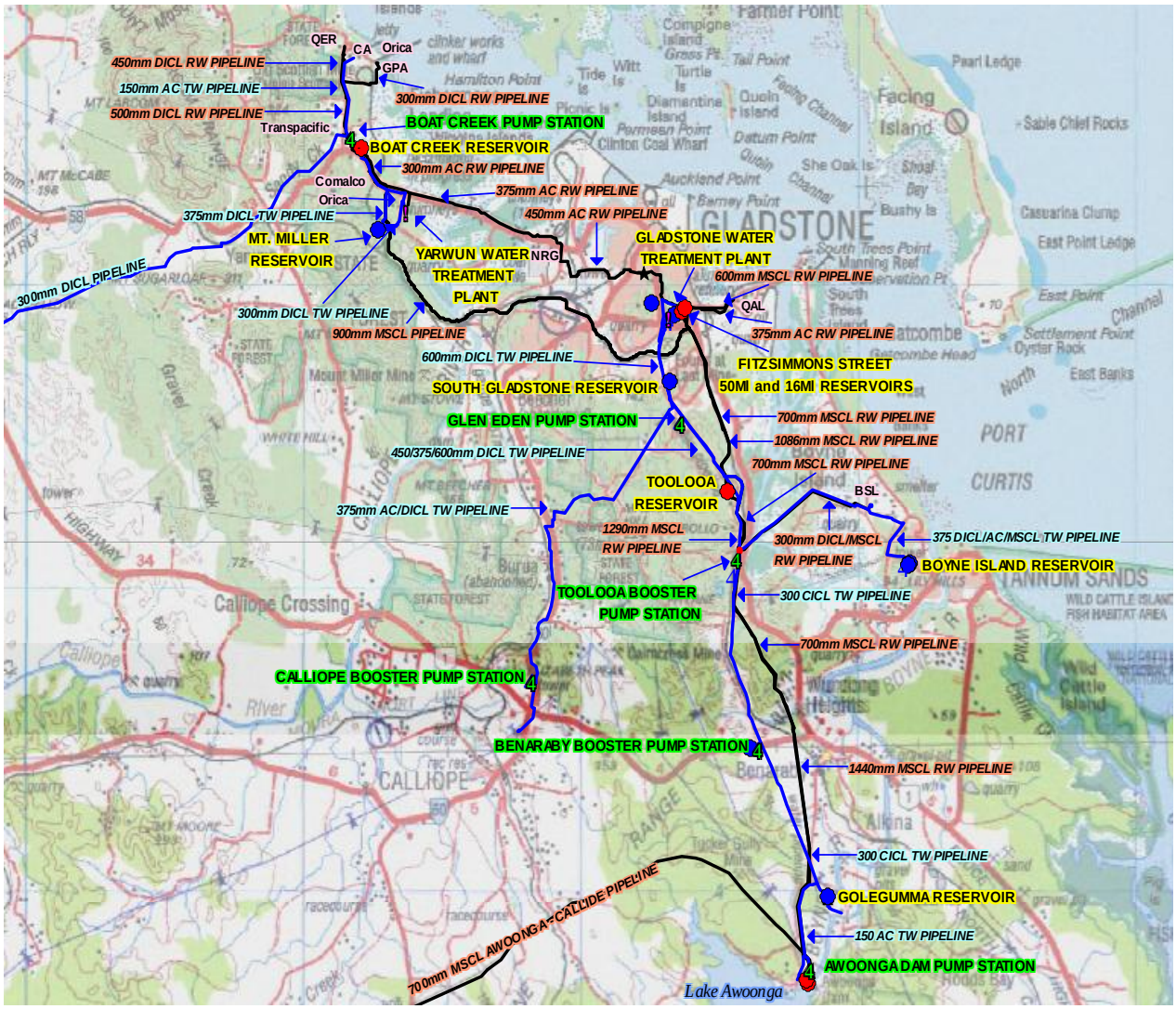

Figure 9 - GAWB Water Network Map (Source: GAWB)

Lake Awoonga is the primary water collection and storage facility for the Gladstone Region. The height of the dam wall and spillway were raised to 40 m AHD in 2002 creating a storage capacity of 770,000ML (when full). The storage capacity can be further increased in future by constructing gates on the spillway with a number of staging levels considered up to 62 m AHD. Further government approvals are required for this stage of the storage.

Under the *Resource Operations Plan: Boyne River Basin,* GAWB currently has a water allocation of 70,000 ML per year, which will increase to 78,000ML per year when the dam first overtops. Current industrial and urban water consumption from Awoonga Dam is approximately 53,000 ML per year.

The pump station at Awoonga Dam has adequate capacity, being able to ramp up the volume of water by 2.5 times the current average volume. The pump station currently only pumps at night through the off peak electricity supply tariffs, but can be brought on line through peak supply periods, but at higher cost due to increased power tariffs.

The impact of the construction work force on the bulk water network of Gladstone is reasonably small, given that less than 20% of the water supply is used for domestic purposes and the impact of the 2,000 workers on a population base of 45,000 is only 3%. However, the ability of the bulk water system to cope with additional demand depends on the considerable demands placed on the system by other new industries such as Stage 2 of the Alumina refinery at Yarwun and the Gladstone Pacific Nickel plant.

4.1.1 Contingent Supply Strategies

As part of its drought mitigation strategy and planning for long-term water supply for the Gladstone Region, the GAWB has secured an allocation of a further 30,000ML of water per year from Fitzroy River near Rockhampton. The GAWB is currently undertaking preparatory works to obtain and retain capability to construct a pipeline between Fitzroy River and Gladstone State Development Area within a two year period, if and when required due to drought or demand. The Board has a fail trigger in their water plan such that when water supply drops below the 48 months at 90% supply, alternative supplies are triggered for construction.

GAWB is also continuing investigations into options for a desalination plant as an additional source of water supply. Reverse osmosis plants also provide an opportunity to provide low quality process water to industry at a reasonable cost.

4.1.2 Potable Water

The GAWB is responsible for the Gladstone Water Treatment Plant that currently produces approximately 35 ML of treated water per day. The Gladstone water treatment plant has a capacity to produce to 61 ML per day, which is 1.7 times current production.

It is estimated that 188 ML/y of potable water will be required on the island during construction and 77 ML/y on the mainland, based on a maximum of 1700 personnel on the island and 700 personnel on the mainland all consuming 300 L/day. During the operation of the plant, the requirement will be 17 ML/y on the island and 49 ML/y on the mainland based on a workforce of 200 personnel (150 on and 50 off the island) with a multiplier of three for families.

4.1.3 Bulk Water Requirements from Other Projects

Due to confidentiality agreements with their customers, the GAWB is unable to provide the bulk potable and raw water figures of their customers. Table 12 provides an indication of the water demands proposed by industries relocating to the area through released EIS documents. Current industrial and urban water consumption from Awoonga Dam is approximately 53,000 ML per year with a water allocation of 70 -78,000 ML per year.

Table 12 Known Industry Demands

Industry	Stage	Potable	Raw
Gladstone Pacific Nickel	1	32ML/y	5,400ML/y
Gladstone Pacific Nickel	2	64ML/y	10,500ML/y

4.1.4 Cost Recovery Mechanisms

The GAWB has one contract for reservation and storage of water, as well as one contract for delivery (and treatment if required). The cost of augmentation and operation of the bulk water network is recovered through access and volumetric charges depending on the infrastructure utilised to deliver the water.

Prices charged by GAWB incorporate operating, maintenance, drought mitigation and administration costs and a return on capital (including working capital) value of the infrastructure used in the delivery of the water.

GAWB's water delivery and water treatment systems are separated into clearly defined network segments and customers are charged for the segments used to deliver water to their premises.

4.2 Treated Water Reticulation

The Gladstone Regional Council is generally responsible for the reticulation of water from the treatment plant, but there are some exceptions.

Local reticulation to new residential housing developments is provided by the developer as a condition of the approval for the development. This enables water to be reticulated to each allotment provided as a part of the development.

The local reticulation network is connected to the trunk water network which is generally provided by the Council and costs recovered through a headworks charge on the developer for each allotment within the development. In some cases the development will not be in close proximity to the trunk mains or reservoirs, in which case the developer may be required to construct (or pay for) part of the trunk network, with possible part reimbursement by the Council, which is recovered by headworks mechanisms.

As the water reticulation network is spread over three towns and no particular site within the developed areas of the Gladstone Region has been identified to house the additional workers, it is difficult to assess the upgrades required to house these workers. However, given the small proportion increase in the additional workers over the total population, the costs of the additional infrastructure capacity consumed should be easily recovered through development conditions and or headworks charges.

4.3 Water Demand - Construction and Operation of the QCLNG plant

The majority of water for the construction and operation of the QCLNG plant will be sourced on site independently of the infrastructure on the mainland.

4.3.1 Construction Demand

Early in the construction schedule (for no longer than the first 12 months), there will be relatively few personnel on the Curtis Island site. During this early period, fresh water will be brought to the site on barges or ferries, contained in road tankers and iso-containers.

The water will have been treated at source and suitable for use as clean construction water, primarily for dust control and water make-up for concrete activities involved with the construction of the Materials Offloading Facility (MOF) and other minor temporary facilities. While the volume required will vary due to weather conditions and the consequent variation in water required for dust control, this would be in the order of 20 to 40 m^3 per day (one to two tanker trucks per day). At this stage of the project, potable water for drinking will be purchased and bottled and supplied to the site as necessary.

While a source for construction water has not been finalised, preliminary assessment of bulk water availability in the Gladstone region that this volume of bulk water should be available within the Gladstone area through the Gladstone Area Water Board.

Testing of excavated materials that have been encountered during initial site investigations indicate that the materials that are most suitable for re-use as fills will require approximately 50 to 60 litres of water for moisture conditioning per cubic metre of fill. Current benching evaluation and calculation of earthworks quantities indicate that backfill will be approximately 1,800,000 m^3, layered and compacted over a duration of approximately 6 months during Stage 1 of construction activities. It is therefore anticipated that, at peak, approximately 900 m^3 to 1,000 m^3 of water will be required per day for moisture conditioning. With the exception of water required for conditioning of backfill materials, the single largest volume of water required during construction will be for hydrotesting on LNG tanks and LPG tanks prior to commissioning. This will require a volume of approximately 100,000 m^3, sourced from retention ponds on site with make-up from RO as required. LNG tanks will be hydrotested sequentially, with re-use of some or all water (water will be drained back into retention ponds at completion of hydrotesting of each tank).

The estimated potable and service water demand during the construction phase of the project is estimated as follows (excluding water required for conditioning of backfill):

Table 13 Indicative Water Utilisation During Construction

Water Demand	Total/Peak Rate
Hydrotest Water (Note 1)	100,000 m^3
LNG Plant Concrete Work (Note 2)	40,000 m^3
Site preparation/dust control	6,000 m^3
Potable water (Note 3)	40,000 m^3
Water used for “flushing”	4,000 m^3
Feed water (seawater) (Note 3)	1 - 60 m^3/hr
Potable water demand rate (Note 3)	1 - 30 m^3/hr

Note 1: Based on largest tank and re-using water to test other tanks and piping.

Note 2: Based on 0.214 m^3 water per m^3 of concrete

Note 3: Based on peak manpower loading of 1,500 people over a construction duration of 55 months with potable water demand of 300 litres/person/day. Does not include hydrotest water, which is anticipated to be produced from impounded storm water runoff and made-up with desalinated seawater.

Water supply for moisture conditioning is planned to be through desalination of seawater using reverse osmosis (RO). This would utilise a floating barge moored near the shoreline of the LNG facility, with a minimum of 2 or 3 days storage requirement on board and with a reverse osmosis unit rated between 60 m^3 and 90 m^3 per hour, running on a 10-hour basis. The barge and the discharge would be located close to the inlet and discharge for the construction RO units that will be required upon completion of site development activities.

4.3.2 Water Supply and Management - Operations

All water for facility operations will be sourced through use of reverse osmosis (RO) desalination system to treat seawater to an appropriate quality. The desalinated water would be further treated to meet specific needs (e.g., process water, potable water). Uptake of seawater for the RO system, and discharge of RO brine streams, will be located at the end of the MOF.

4.3.3 General Water Supply and Management

Retention ponds will be constructed on site during Stage 1 of construction, and integrated into the temporary site drainage system. Rainfall runoff into these retention ponds will be the primary source of water once the retention ponds are completed.

A storm water filtration plant, combined with dosing, natural flocculation, pressure filters and sedimentation through the retention pond, will be provided to treat the impounded storm water that will be recycled for use. It is proposed to provide constant monitoring of the water entering the water distribution network.

Desalination of seawater using RO will be used as a second source of water, with RO plants moved from barge mounted operation to on-shore operation when bulk earthworks on site are complete. RO will form a source of make-up water for periods where rainfall does not provide sufficient water supply. The RO process utilises permeable membranes to separate the dissolved salts in the water. Two streams will result from the RO plant, one to the water treatment facility to supply the construction camp with fresh drinking water (where the permeate from the RO plant, also termed as product water, will be disinfected using ultra violet tubes prior to pumping it to the users) and the second being the make-up to the impounding basin. The arrangement will be valved in such a way that the make-up to the impounding basin can be isolated when rainfall and surface water run off are already supplying sufficient feed water.

The RO brine stream is proposed to discharge at the end of the MOF by means of a polyethylene pipe line with diffuser at the discharge point

4.3.4 Workers Camp

The primary location for a worker's camp is on the Curtis Island plant site; however consideration is also being given to a workers camp on Calliope River Road near the Bruce Highway. The third possible location at Aldoga will not be pursued. Of the 2000 construction workers, 900 workers are expected to be housed in the camp.

It is assumed that the water demand for a person in workers camp would be in the order of 150 - 300 litres per person per day. The expected daily requirement for the camp would be the order of 270 kL per day.[3]

Two sources of potable water are in the area being the 300mm diameter ductile iron cement lined pipeline along Gladstone Mt Larcom Road and the reservoir site at Mt Elizabeth north of the Calliope Township.

Of the two water source options, the Gladstone Regional Council is likely to be in favour of the Calliope option as a number of schemes have already been suggested for the area and the final infrastructure may be able to be re-used at a later date by the public.

In order to provide a guide to the likely costs for water supply with a tolerance of around 35%, the following estimate of main sizes and costs has been provided.

Peak flows for the camp would be similar to high density unit living which in accordance with the WSAA Water Code of Australia has a peak flow in the order of 6-8 L/s per 100 units making a peak flow of around 30 and 40L/s. A fire fighting flow of 15L/s per second should also be considered in the peak flow with a minimum of 20 m of head pressure. The TWL of the Mt Elizabeth reservoir is RL 100m AHD while the land at the site is in the order of RL 15 m AHD, leaving a head difference of 65 m. For a design flow of 55 L/s, it is estimated that a 200 mm diameter uPVC class 12 pipe would provide the bare minimum water reticulation from the Mt Elizabeth Reservoir, but a 250 mm diameter pipeline is likely to be the preferred option.

The estimated cost of constructing the pipeline would be in the order of $2 million to $3 million. In addition to the pipeline cost, the Regional Council may charge a headworks connection fee for the development of around $1.5 million to $2 million.

Indicative advice from the Gladstone Regional Council is that an additional reservoir would be required as well as augmentation of a pump station – both of which are in the Calliope Water Plan for 2014. The Gladstone Regional Council is likely to also impose bring-forward costs on the construction of a new reservoir and upgrading of the pump station which is estimated to be in the order of $500,000.

In summary, the cost of water supply to the Calliope River workers camp could be between $4 million to $5 million with annual water charges in the order of $150,000 per annum.

For some time, the Gladstone Regional Council has been considering the construction of a water main to connect from Mt Elizabeth to the Calliope Historical Village to service the Village and allotments along the route. It is therefore suggested that there is likely to be some scope to look at the costs involved with the water scheme with Council to achieve common goals.

4.4 Water Supply Summary

The loading from the construction of the plant and a construction camp on the island will be minimal as the majority of water will be sourced from retention ponds and RO plants.

[3] Bechtel

It is generally concluded that the impact on the potable water supply system of 2000 workers dispersed across Gladstone would be minimal as the water treatment plant has 50% spare capacity and the bulk water system has been operating at 20% of full capacity.

This does not take into account the bulk demands of the other industries proposing to locate in Gladstone. The additional load of Gladstone Pacific Nickel alone would take up the spare capacity of the GAWB's water allocation. A large customer is likely to be treated on the individual merit of the project and a contract put in place to ensure existing customers are not disadvantaged. The GAWB has a drought management plan in place to bring online an additional 20ML per year via the proposed Fitzroy pipeline should the appropriate triggers occur.

GAWB recovers costs through charges for services. At this stage it is impossible to forecast a cost for the infrastructure needed to supply the proposed LNG facility with water, as it is likely to be sourced on-site at the plant.

For the case of a worker's camp on Calliope River Road, a total capital investment of $4 million to $5 million and an annual water consumption charge of the order of $150,000 would be required. It must be stressed that these figures are based on an approximate model for a workers' camp and are likely to change significantly as plans are finalised.

From this study it appears that Gladstone is well placed generally to provide the water required for the project.

5. Waste Water

The sewage output on the island during construction has been modelled at 188 ML/y and 77 ML/y on the mainland. These figures could accommodate up to 1700 personnel on, and 700 personnel off the island all producing 300L of sewage per day. During the operational stage of the plant, the output will be 17 ML/y on the island 49 ML/y on the mainland based on a workforce of 200 personnel (150 on and 50 off the island) with an allowance for an average of three persons per family on the mainland (including family remaining on the mainland).

The key component to be assessed for a sewerage network is a community sewage treatment plant which has a lead time of 5-10 years to bring on line. As trunk infrastructure can be augmented in a considerably shorter time frame and no specific location for the impact of the demand to be assessed it is not possible to determine upgrading requirements.

Gladstone Regional Council operates a number of sewage treatment plants in the study area as follows:

» Calliope River

» South Trees

» Boyne Island

» Tannum Sands

» Calliope

The capacity and current loading of each treatment plant as well as the Yarwun and Yaroa treatment plants specific to those industries is as per Table 14.

Table 14 Sewerage Treatment Plant Capacities

Treatment Plant	Current Loading (EP)	Current Capacity (EP)	Planned Upgrade (EP)	Ultimate Capacity (EP)
Calliope River	43,000	57,000	87,000	*
South Trees	2,500	5,000	10,000	*
Yarwun (industrial)	1900	2,000	2,000	*
Yaroa (Aldoga)	0	2,000	2,000	2,000
Boyne Island	4,500	12,000	12,000	12,000
Tannum Sands	4,000	7,500	15,000	30,000
Calliope Town	1,900	2,500	# 6,000	6,000
Total	**57,800**	**88,000**		

* = Data unavailable

= Currently under construction.

5.1 Sewerage Reticulation

The Gladstone Regional Council is responsible for the local sewerage reticulation of water from the residential areas to the treatment plant. Local sewerage reticulation for new residential housing developments is provided by the developer as a condition of the approval for the development. This enables sewage to be collected from each allotment to be provided as a part of the development.

The local reticulation network is connected to the trunk sewerage network, which is generally provided by the Council and includes major rising mains, pump stations and sewage treatment plants. These costs are recovered through a headworks charge on the developer for each new allotment or change of use of the land. In some cases the development will be not in close proximity to the truck mains or reservoirs, in which case the developer may be required to construct part of the trunk network, with possible part reimbursement by the Council that is recovered by a headworks mechanism.

5.2 Construction and Operation Demands of the QCLNG Plant

The wastewater from the operation of the plant on Curtis Island will be treated on site with waste sludge disposed of on the mainland, with no impact on the local government sewerage system. There will be a dispersed loading on the system from residents taking up residential accommodation across the Gladstone area, however, the local government sewerage system has mechanisms to cope with this type of growth. Concentrated point source loads as produced by workers camp would provide the only loading that may create stresses on local government infrastructure and hence incur charges for QGC.

5.2.1 Workers Camp

It would appear that both the Curtis Island and Calliope River Road worker's camps will be serviced by on-site sewerage treatment plants provided by the operator of the camp. If town sewerage was to be considered for the Calliope River Road Camp, two options would be considered: Euroa at Mylrea Road some 14 km from the site and the Calliope Township plant 7 km away. The Calliope Township would appear to be the most viable. Without any development of any methodology, the estimated costs of connecting to Council's sewerage plant would be similar to the water reticulation and may be in the order of $3 million to $4 Million. This estimate should be developed further before being relied upon for any costing exercise.

5.3 Waste Water Summary

The majority of Gladstone City utilises the Calliope River sewage treatment plant that has spare capacity of 14,000 people, whilst the majority of other residential treatment plants operating at approximately 50% capacity. There appears to be adequate capacity in the existing treatments plants to absorb the loadings associated with a general spread of workers for the Wiggins Island and both the QCLNG and Gladstone LNG plants.

The increase in loadings on the network due to workers taking up normal residential accommodation in the Gladstone area is handled through the development assessment process that recovers costs for trunk infrastructure through headworks charges. The delivery of residential accommodation is generally governed (both regulation and timing) by the land development process which takes account of any major demands outside of the headworks policies.

As both of the proposed workers camps are to have their own sewage treatment plant, the worker's camps do not have an effect on current capacity of the existing treatment plants.

6. Electricity

The key components to be assessed for the electricity network are the bulk transmission and substations that have a lead-time of 5-10 years to bring on line and have significant capital costs. Trunk infrastructure within the town can generally be augmented in a considerably shorter time frame. Without a specific location for the increase in demand to be assessed it is not possible to determine upgrading requirements for the trunk infrastructure.

The Gladstone area accounts for over 15% of Queensland's peak summer electricity demand, with load dominated by large industrial users. Queensland currently has a generation capacity of more than 10,000 megawatts (MW). Since 1998, $4.7 billion or 75 percent of new generation investment in the National Electricity Market has occurred in Queensland. Additionally, by 2015 approximately $12 billion more will be invested in more than 10,000 MW of new generation capacity across the National Electricity Market. Given the high quality and low cost of Queensland fuel sources, and their proximity to load growth, a significant proportion of this investment is expected to occur in this state.'[4]

Gladstone Power Station is Queensland's largest, with a generating capacity of 1,680 megawatts. The Station was sited near Auckland Inlet to take advantage of seawater for cooling and to be near Central Queensland's vast coal reserves.'[5]

6.1 The Electricity Supply System

Generally the transmission of high voltage power is the responsibility of Powerlink in Queensland who feed power from 275 kV lines ranging to 110 kV while local transmission of electricity around the town is the responsibility of Ergon Energy.

The supply of electricity to the network is open to competition and can be supplied from any number of companies located across the east coast of Australia. The trading of power across the grid occurs through the National Electricity Marketing Management Company (NEMMCO). The cost of power supplied through the networks depends on the demand at the time and the amount of transmission infrastructure the electricity has to pass through. Therefore, the supply of power in the Gladstone grid is flexible. At the end of the process, the energy retailers are able to contest the market and supply power to the major customers in an environment of competition, sharpening customer service.

6.2 Powerlink Queensland

Powerlink's Queensland transmission network consists of 1,700 km of transmission lines comprising of 275 kV transmission from Cairns in the north to Mudgeeraba in the south, with 110 kV and 132 kV systems providing transmission in local zones and providing some backup to the 275 kV network. Also, 330 kV lines link Braemar, Middle Ridge, Millmerran and Bulli Creek to the New South Wales network. Powerlink is a registered 'Transmission Network Service Provider' under the National Electricity Rules. The Powerlink network servicing Gladstone is represented in the diagram in Figure 10.

[4] http://www.energy.qld.gov.au/generation.cfm

[5] http://www.nrggos.com.au/page/About_Us/The_Process

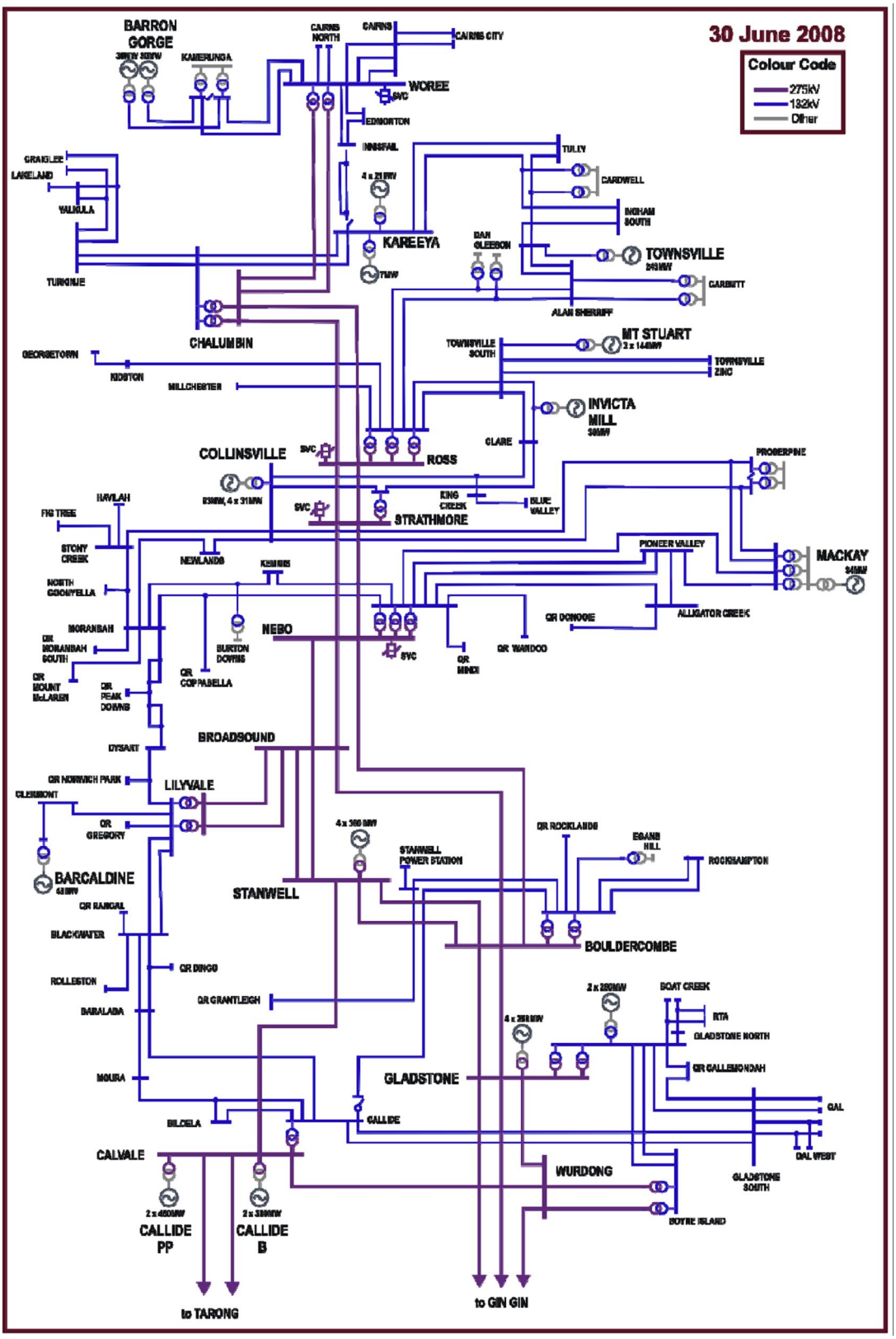

Figure 10 - Existing 330/275/132kV Network June 2008 – North and Central Queensland

An additional 275kV line has been constructed into Boat Creek from the north west of the Gladstone to service the expansion of the Comalco Alumina Refinery. This additional feed provides additional significant capacity into the Gladstone reticulation and a second feed to provide some reliability of supply should the feed into South Gladstone fail.

This additional capacity though will be taken up in large portions as other industries move into the Yarwun and Aldoga state industrial areas.

6.3 Planned Augmentations

Powerlink has commenced the process of acquiring easements to allow for the future reinforcement of the transmission network supplying the Gladstone area to help meet the anticipated increase in electricity demand in the Gladstone area due to proposed industrial developments.

The first stage of this development involves the future construction of a 275kV line from the Calvale substation near the Callide Power Station, to a new substation at Larcom Creek in the Gladstone State Development Area. The longer-term second stage involves the construction of a new 275kV line from Gladstone Power Station to Larcom Creek Substation. The schematic shown in Figure 11 below illustrates the proposed route.

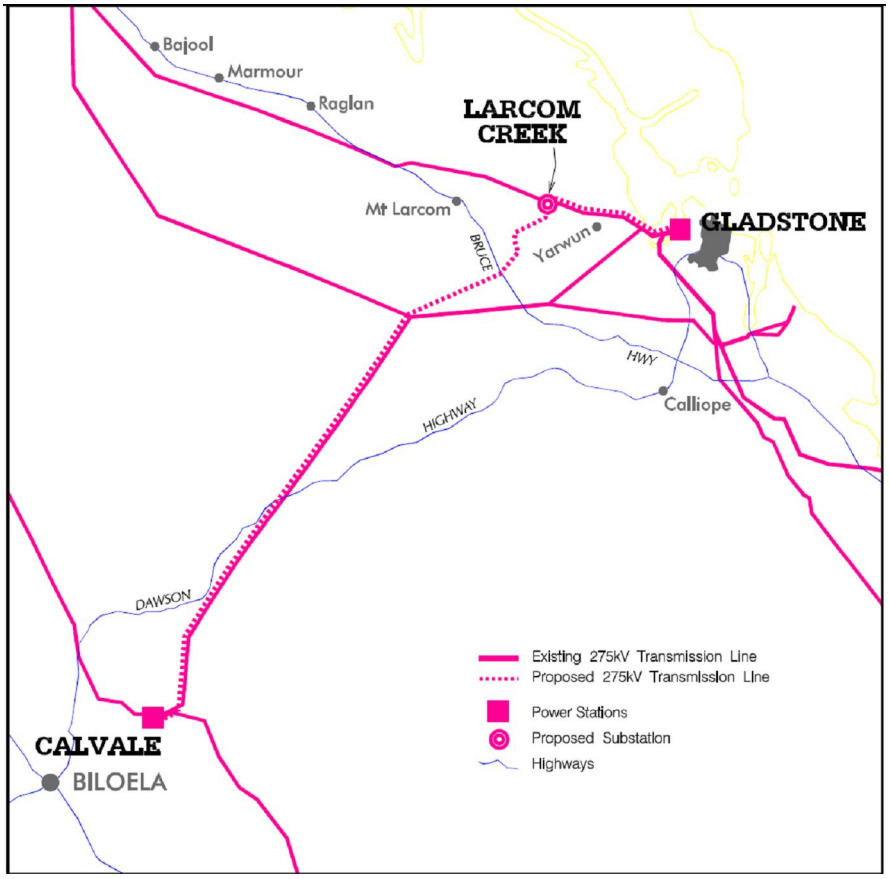

Figure 11 - Larcom Creek Augmentation (Source: Powerlink)

The appropriate use of capital funds dictates that the timing of these projects depends on the growth in electricity usage in this area and the development of the proposed Aldoga Aluminium Smelter or other major industrial development in the Gladstone area proceeding.

Powerlink Queensland has identified the need to build a new 132/33kV substation within QAL's alumina refinery site at South Gladstone.

6.4 Ergon Energy

A meeting was attended by GHD and Ergon network planning representatives on the 8 January 2009. Blake Harvey of Ergon stated that Gladstone in a good position to supply electricity to additional workforce settling in Gladstone with adequate capacity to supply a population expected to grow in the next couple of years.

Ergon stated that the additional Powerlink connection in the local reticulation at the substation adjacent to the Gladstone Power Station has significantly lifted the capacity of the network in Gladstone as electricity is fed from both Callemondah and South Gladstone. Ergon Energy's trunk electricity network is indicated as per Figure 12.

Figure 12 – Ergon Energy's Trunk Network (Source: Ergon Energy)

6.5 Description of Relevant Substations

The following is a description of the Gladstone area substations operated by Ergon Energy and Powerlink. This information has been included in the report as provided by Ergon. The material provided by Ergon is for general information purposes only. It is subject to change, and whilst Ergon Energy attempts to ensure the material is current, the user of this information should be aware that the information may be out of date, incomplete or inaccurate. No guarantee is made as to the currency or accuracy of the material. Ergon Energy is not liable to you for any loss suffered arising out of or in connection with the use of this document or access to any information or material contained in it.

GLADSTONE NORTH BSP

Gladstone North is a 2×80 MVA 132/66 kV substation, connecting into the Gladstone 66 kV ring at Clinton Industrial Zone substation and providing 66 kV supply to the new Port Curtis Zone substation. The 2×40 MVA transformers are used to supply the Barney Point coal loading facility. Gladstone North was commissioned in early 2007, and will be used to support the Gladstone 66 kV network.

GLADSTONE SOUTH BSP

Gladstone South is the bulk supply point that until recently supplied all the Gladstone City substations and tied into the 66 kV ring from Egans Hill. The recent establishment of Gladstone North is resulting in a re-arrangement of the 66 kV network around Gladstone and movement of some substations off Gladstone South. Those substations currently fed from Gladstone South are Gladstone South Zone substation, Gladstone Friend Street, Clinton Industrial, Calliope, Littlemore, Miriam Vale, Awoonga and Boyne Residential, as well as the customer substations of Wooderson, Bocoolima and East End Quarry.

BOAT CREEK BSP

T130 Boat Creek is the bulk supply point feeding into the industrial area of Gladstone. Those substations normally fed from Boat Creek are ICI, Comalco, Fishermans Landing, Minproc and Stuart Shale Oil. Load on T130 Boat Creek is predominantly industrial.

GLADSTONE SOUTH ZS

Gladstone South substation supplies the South Gladstone, Racecourse, and Gladstone CBD areas. Growth on the substation is due to residential and CBD increases in the area. A new distribution feeder is planned from Gladstone South to the Kirkwood Rd industrial area to support residential load growth.

CLINTON ZS

Clinton supplies the areas to the West of Gladstone, including Clinton Park, and Kin Kora. With the establishment of the Port Curtis substation, distribution capacity will be freed from the Clinton Coal feeders, which will be redirected to service load in the area.

GLADSTONE FRIEND ST ZS

The Gladstone Friend Street substation supplies the West Gladstone, Gladstone CBD, Auckland Point Wharf and Barney Point areas. Growth on the substation is strong due to redevelopment and growth in the CBD and West Gladstone areas.

BRIFFNEY ZS

The future Briffney substation will split load to the south west of Gladstone off the Clinton Industrial and Gladstone South substations, and provide for new residential growth in the Kirkwood Road area.

6.6 Current and Forecast Substation Loadings

Table 15 Current Bulk Supply Substation Loadings in the Gladstone Area 2008

SUB-STATION	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Boat Creek 2x80MVA										
Demand	55.3	61.4	69.7	73.8	75	76	78	79.5	83.1	84.3
Rated Capacity	151.6	151.6	151.6	151.6	151.6	151.6	151.6	151.6	151.6	151.6
N-1 Capacity	91.1	91.1	91.1	91.1	91.1	91.1	91.1	91.1	91.1	91.1
Normal Utilisation	36%	41%	46%	49%	49%	50%	51%	52%	55%	56%
N-1 Utilisation	61%	67%	77%	81%	82%	83%	86%	87%	91%	93%
Gladstone North 2x80MVA										
Demand	16.8	17	19.3	19.5	27.5	27.6	27.8	37.8	38	38.2
Rated Capacity	176	176	176	176	176	176	176	176	176	176
N-1 Capacity	104	104	104	104	104	104	104	104	104	104
Normal Utilisation	10%	10%	11%	11%	16%	16%	16%	21%	22%	22%
N-1 Utilisation	16%	16%	19%	19%	26%	27%	27%	36%	37%	37%
Gladstone South (Powerlink) 2x100MVA										
Demand	88.7	95.4	97	99.8	102.4	105	107.6	110.1	112.5	114.7
Normal Rating	220	220	220	220	220	220	220	220	220	220
N-1 Capacity	130	130	130	130	130	130	130	130	130	130
Normal Utilisation	40%	43%	44%	45%	47%	48%	49%	50%	51%	52%
N-1 Utilisation	68%	73%	75%	77%	79%	81%	83%	85%	87%	88%
Clinton Industrial 2x20MVA										
Demand	17.8		19.5	20.4	21.4	22.4	23.4	24.5	25.6	26.8
Rated Capacity	35.4	55	55	55	55	55	55	55	55	55
N-1 Capacity	17.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8
Normal Utilisation	50%	0%	35%	37%	39%	41%	43%	45%	47%	49%
N-1 Utilisation	101%	0%	82%	86%	90%	94%	98%	103%	108%	113%

SUB-STATION	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Gladstone Friend Street 20+32MVA										
Demand	23.4	24.4	25.4	26.4	27.4	28.5	29.5	30.5	31.5	32.5
Rated Capacity	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2
N-1 Capacity	22	22	22	22	22	22	22	22	22	22
Normal Utilisation	41%	43%	44%	46%	48%	50%	52%	53%	55%	57%
N-1 Utilisation	106%	111%	115%	120%	125%	130%	134%	139%	143%	148%
N-1 Util. best case	73%	76%	79%	83%	86%	89%	92%	95%	98%	102%
Gladstone South (Ergon) 2x10MVA										
Demand	16.2	17	17.8	18.6	19.4	20.2	21	21.8	22.6	23.4
Rated Capacity	20	20	20	20	20	20	20	20	20	20
N-1 Capacity	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9
Normal Utilisation	81%	85%	89%	93%	97%	101%	105%	109%	113%	117%
N-1 Utilisation	149%	156%	163%	171%	178%	185%	193%	200%	207%	215%
Boyne Residential 2x10MVA										
Demand	12.2	13	13.8	14.8	15.5	16.5	17.5	18.5	19.7	20.9
Rated Capacity	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6
N-1 Capacity	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
Normal Utilisation	69%	74%	78%	84%	88%	94%	99%	105%	112%	119%
N-1 Utilisation	139%	148%	157%	168%	176%	188%	199%	210%	224%	238%
Calliope Town 2x10MVA										
Demand	4.4	4.7	5.1	5.5	5.9	6.4	6.9	7.4	8	8.7
Rated Capacity	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8
N-1 Capacity	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1
Normal Utilisation	19%	21%	22%	24%	26%	28%	30%	32%	35%	38%
N-1 Utilisation	34%	36%	39%	42%	45%	49%	53%	56%	61%	66%

Notes to Table 15

1. All figures are in MVA unless noted otherwise.

2. Figures adapted from Ergon supplied information

3. Demand is based on measured figures extrapolated over time.

4. Rated Capacity – is the full capacity of the substation.

5. N-1 Capacity – is the rated capacity of the substation with one sector debilitated.

The capacity of the Gladstone Boyne Island and Calliope electricity grid is summarised in Table 16:

Table 16 Summary of Grid Capacity

Total Current Demand	234.8 MVA
Total Rated Capacity	700.6 MVA
N-1 Capacity	397.6 MVA
Utilisation	34%
N-1 Utilisation	59%

6.7 Capital Works Program

From the summary of the network in Table 16, the overall network has significant reserve capacity, although some individual components are approaching their capacity. Ergon has a capital work program in place for which particular items are triggered by demand as it occurs in specific locations in the network, and not necessarily in the timing outlined in the program.

Table 17 Ergon Capital Works Program

Substation	Capital Works
Clinton	2009: Transformer being replaced with 25MVA higher impedance transformer to control fault levels.
Briffney Substation	Constructed as demand from development along Kirkwood Road comes on line, taking load off of Clinton.
Gladstone Friend Street	2010: Cables and switchboard limit capacity. Replace 11kV switchboard and augment transformer cables.
GLSO South Gladstone	2009: 20MVA 66/11kV transformer added.
Boyne Island Residential	2012: Additional 66kV feeder, additional, 66V capacitor banks and transformer upgrade.

The majority of growth expected in Gladstone is along the Kirkwood Road corridor as outlined in the well-planned Kirkwood Road Structure Plan and in Unit Development in the CBD area.

In order to cope with the demands from residential development in the Kirkwood Road area, Ergon have plans in place to construct the new Briffney substation in the vicinity of the Powerlink transmission lines in the western end of the corridor. Plans are in place also for the trunk transmission system along the Kirkwood Road corridor to service the development.

The expansion of the number of unit developments in the CBD area is also a source of additional demand on the system. Ergon though have plans for augmentations to occur from their Friend Street to service the additional demand created by these Unit developments.

The costs of the local reticulation provided in residential subdivisions is borne predominantly by the developer with augmentations to the trunk network provided by Ergon and costs recovered through the transmission charges in the electricity tariff. Unit developments pay for the upgrade of the reticulation in the street such as additional transformers and the common feeder mains into the unit development.

Ergon has a capital work program designed to cope with increased demand from new development. Each line item has an approximate implementation date, however these are usually shuffled in order to provide the most effective upgrades to the network. Each area has a certain annual budget allocation which could provide the limitation in the augmentation process should a surge of development occur with a number of industry workforces being attracted to Gladstone.

6.8 Electrical Loads from the QCLNG Plant

6.8.1 Plant Construction

Power requirements on the Curtis Islands site during LNG facility construction will be met through use of diesel powered generators. While power requirements (and consequently diesel consumption) will vary subject to the construction phase, it is estimated that peak construction power requirements will be in the order of 15MVA for approximately 18 months. No use of mains power is currently proposed for the works on Curtis Island, and no transmission / distribution lines are proposed outside the site boundary.

6.8.2 Plant Operations

Once operating, electric power for the LNG Plant will be generated by two LM2500+G4 gas turbine generators be equipped with dry low NOx emission systems. These will be sufficient for two and three trains. Generation requirements are approximately 28 MW for Train 1, plus an additional 20 MW for each of Train 2 and 3. No interconnection with existing of future power generation sources outside the LNG facility is anticipated.

These gas turbine generators will be augmented with a “black-start” diesel generator at the generator area, and with standby diesel generators at the Administration building and at the Marine Terminal Building. The gas turbine generators will be fired from pipeline gas upon plant start-up; but are fuelled from the plant fuel gas system after the plant is in operation. A standby LM2500+G4 gas turbine generator will also be in place to allow for continued power supply while maintenance on one of the generators is being undertaken.

Dual redundant UPS systems featuring redundant 4-hour VLRA batteries and redundant battery chargers will provide power to DCS equipment installations and to control room equipment, telecommunications equipment, security equipment, and strain-gage marine monitoring equipment.

6.8.3 Plant Workforce

As mentioned earlier, Ergon provide the reticulation for electricity in the local Gladstone network. Provided that the additional staff relocating to Gladstone are dispersed across the town of Gladstone and other centres such as Boyne Island, Tannum Sands and Calliope, the mechanism used to provide power to new land subdivision and unit development should be adequate to cope with the expected growth.

Of the 2000 construction workers, 900 are expected to be housed in camps. The primary location for a workers camp is on the Curtis Island plant site, which is going to be self-sufficient for electricity supply.

Consideration is also being given to a workers camp on Calliope River Road near the Bruce Highway. It is assumed that the major loading from the camp will be from room air conditioning. Recognisant of the impact of the start up loads of air-conditioners, soft start inverter type air-conditioners will be used in the camp accommodation.

For a 16 m^2 room with insulation, a 3.5 kW unit would be sufficient. This unit would have an average operating load of 1.2 kW but with peak loads of 4 kW. For 900 units the peak load may be 3.6 MW but this would be unlikely, with the demand with load factoring would come down significantly. This energy demand would be easily accommodated by the Calliope substation, however significant local reticulation upgrades would likely be required. Overall this amounts to 1.4% of Gladstone's domestic load.

Ergon are reluctant to supply any information with respect to the required augmentations unless an application is made accompanied with the appropriate fees. This process would take 28 days to receive a preliminary design and an offer to carry out the work.

6.9 Electricity Retailers

As part of the Queensland Government's regulatory framework, small business and residential customers are able to choose their electricity retailer. To protect customers, only companies that are appropriately licensed can retail electricity to Queensland businesses and residents.

Ten companies currently hold a Queensland electricity retail authority and have indicated they may offer market contracts to residential customers. It would appear that Ergon is the only retailer in Gladstone.

6.10 Other Industry Loads

Significant loads are expected with major industries locating to the Yarwun and Aldoga Industrial Estates. These loads are generally beyond the scale of Ergon's network and are handled by Powerlink. GLNG has not released their EIS and thus water consumption figures were not readily available. Electricity loads that have been made available in the EIS process are generally as per Table 18:

Table 18 Industry Electricity Loading

Industry	Estimated load
Gladstone Pacific Nickel	Stage 1 - 61 MW Stage 2 - 122 MW
Rio Tinto Yarwun Alumina Refinery	120 MW

6.11 Electricity Summary

Data from both Ergon Energy and Powerlink suggests that electricity network in Gladstone is well prepared to handle a large influx of people, as the substations are on average operating at 34% to 59% capacity. Provided the workforce was distributed across the Gladstone region, it is expected that the trunk network would cope with additional construction staff from the QCLNG, GLNG and GPN projects.

Substations adjacent to existing developments are either expected to be able to cope with the demand or have planned augmentations which will occur on an as needs basis to cope with demand.

Significant local upgrades are expected to supply a Calliope worker's camp with the required power. Ergon are reluctant to supply any information with respect to the required augmentations unless an application is made accompanied with the appropriate fees.

Major industries will require significant electrical loads in the order of 60 MW to 120 MW that are 25% to 50% of the current electricity load in Gladstone. Such loadings will need to be addressed by Powerlink on a case-by-case basis with augmentations specifically designed to accommodate the demands. In comparison, the peak demand from the workers camp at Calliope River Road is 3.6 MW that represents 1.4% of the current domestic load.

7. Waste

For the purposes of this report, waste does not include residential type sewage effluent, but may include trade waste, domestic waste (garbage & recycling), and commercial waste.

7.1 Trade Waste

Trade waste from the domestic and small industry sector of the market makes up only a small proportion of the waste stream. Gladstone Regional Council has no particular Trade Waste Policy, except that the majority of the inflows are controlled through material change of use applications made when the particular activity commences. This enables the Council to control the inflows and set charges.

Generally trade waste from smaller industries tends to be placed through a separate treatment process before being discharged into the Council sewerage system. Waste sludges chemicals and by products from the pre-treatment is managed according to its chemical characteristics.

7.2 Municipal Waste (Includes garbage & recycling)

Most garbage and refuse is taken to the landfill site operated by the Gladstone Regional Council at Benaraby. The landfill site at Benaraby has adequate capacity at current predicted levels to accept material up to the year 2050. On average 150 tonnes of waste per day was accepted in 2008, with the current cell having a remaining life of 4 years. Approvals through the Environmental Protection Agency are required for the next cell to be created on the northern side of the site, and it is expected that the landfill will continue to satisfy the EPA regulations.

The current charge for waste deposited at the Benaraby Landfill is $57/tonne; but may vary according to the composition of the load.

7.2.1 Domestic Waste Services

The current domestic waste collection service is a kerb side service that is currently contracted to JJ Richards. The service consists of two 140 litre wheelie bins, one for general waste and the other for recyclable material. The general waste stream is collected once a week while the recyclable material is collected once a fortnight.

JJ Richards' kerb side collection service is currently operating at approximately 90% capacity. Collection routes have not changed for a number of years and new residential growth has created an imbalance in the daily collection loading. A re-distribution of collection areas to balance the load will allow kerb side collections to operate at approximately 80% capacity. The current refuse collection fleet has some redundancy built in to allow for breakdowns etc. The recyclable waste stream is currently delivered to a Visy recycling facility in Brisbane by JR Stephens Pty Ltd where it is processed.

The Gladstone Regional Council has joined a Regional Association of Landfills through the Local Government Association which includes Councils surrounding Rockhampton. A regional Material Recovery Facility (MRF) will be established for the Councils within 12 months to accept and process recyclable materials. The bailed recyclable material will then be shipped to Brisbane.

JJ Richards & Sons Pty Ltd is the largest privately owned waste management company in Australia employing over 1100 people, with a fleet of over 800 vehicles, and performing over 1,500,000 household collections per week and solid hazardous and liquid waste services for over 50,000 commercial customers.

Any significant and sudden increase in kerbside collection numbers could be accommodated by JJ Richards by drawing on the resources of the national pool of collection vehicles while additional vehicles are placed on order. JJ Richards also maintains a reserve capacity of operators to accommodate fluctuations in demand holiday periods and employee movements.

The impacts of additional 200 additional refuse services on the mainland due to the operational moving to Gladstone would easily be accommodated by the company.

7.3 Commercial Waste

Contractors handle commercial waste streams as arranged by the commercial premises. Contractors must be appropriately licensed to carry waste, which is generally disposed of at the Benaraby landfill. Three contractors are located in Gladstone being:

- JJ Richards (current GRC contract);
- Transpacific; and
- Veolia Environmental Services.

7.3.1 Transpacific

Transpacific is a large multinational organisation that provides, amongst other services waste collection and disposal to business and industry. Their collection business in Australia is operated primarily through subsidiary companies such as Gladstone Mini Bins, Northern Bin Hire/North West Waste and Remove All. Gladstone Mini Bins has been providing services to commercial customers since 1994. The Melbourne based business Northern Bin Hire is in the skip and roll-on/roll-off sector and North West Waste provides front lift services. Remove All is Adelaide based and provides solid waste collections utilising a fleet of both owner-driver and company vehicles. Due to the size of their operations Transpacific can quite easily accommodate large contracts by relocating resources from other parts of the state and country.

7.3.2 Veolia Environmental Services

Veolia (formerly known as Collex) is a national leader in resource recovery and waste management. They have a large national network of resources to call on to deliver solutions to clients. They have made it clear that if required they can call on a wide range of resources from other parts of the state or country to deal with waste collection and disposal. It is not envisaged that there will be any problems with engaging contractors to carry out this work.

7.4 Construction and Operation Volumes from the LNG Plant

7.4.1 Indicative Construction Waste Amount - Construction

The following waste streams will be generated predominantly from the camp and camp operations (total over all Stages of construction).

Table 19 Indicative Total Volumes of Construction Camp Wastes

Waste Stream	Indicative Amount	
Sewage	240,000	m^3
Sewage Treatment Plant Solids	650	m^3
Food Waste	350	tonnes
Domestic Waste	520	tonnes
Paper	180	tonnes
Plastics	60	tonnes
Glass	30	tonnes
Metals	40	tonnes
Other	205	tonnes

Apart from construction camp waste, other expected constructions wastes to be exported off-site from the plant site are summarized in Table 20:

Table 20 Anticipated Construction Waste Exported Off-Site

Waste	Anticipated Quantity	
General construction waste:	1500	tonnes/month
Used Batteries:	1,150	Units
Used Oil Filters:	220	Drums
Solvent Wastes:	57,400	Litres

Solid and solvent wastes will be managed and temporarily stored on site, with removal from site by an appropriately licensed waste management contractor for disposal on the mainland. No final disposal of solid or solvent wastes is anticipated on the LNG Facility site. The general construction waste stream will accelerate the encapsulation rate for waste at the landfill but there is more than sufficient capacity in the life of the Benaraby Landfill to contain the waste.

7.4.2 Solid and Semi-Solid Waste Management - Operations

Digested sewage sludge will be periodically trucked offsite for disposal at an appropriate licensed facility.

Operational wastes for the plant have been indicated in Table 21. Waste will be barged to the mainland and generally disposed of in consultation with the Gladstone Regional Council through either the Benaraby Landfill or a licensed carried to be treated by a licensed waste treater.

Table 21 Waste Product Quantity

Type of Waste	Waste (kg per year)		
	1-Train	2-Trains	3-Trains
Waste Lubricating Oils	8,000	14,000	20,000
Spent Oils	1,000	1,700	2,500
Cellulose	1,000	1,500	2,500
Biological Sludge	4,000	5,000	6,000
Oily Sludge/Float	7,000	14,000	20,000
Spent Solvents	100	200	250
Ceramic Balls*	12,000	24,000	36,000
Molecular Sieve Waste*	116,400	232,800	349,200
Activated Carbon (Amine filter)	33,000**	66,000	99,000*
Trash	50,000	80,000	120,000
Waste Oil from Slop Oil Tank	20 m^3/year	35 m^3/year	50 m^3/year

7.5 GRC Advice for Construction and Camp Waste

Generally the construction and workers campsite would be classified as a commercial operation and hence arrangements would need to be made with a commercial entity to remove refuse from the island. The use of alternative waste disposal methods have been suggested and some of them raised by the Gladstone Regional Council.

7.5.1 Gladstone Regional Council Requirements

The preferred option for management and disposal of waste on the island for the construction phase and the operational phase is to utilise best practice for waste management on the site. Best practice currently in Gladstone is to adopt a Site Based Waste Management Plan for the site that includes:

» Employing a site waste officer and paid for by recyclables and reduced waste charges, and

» Create waste sorting facility.

A number of similar facilities have been set up in other major industry around Gladstone. The Gladstone Regional Council indicated one of the more recently set up facilities is located at QAL.

7.5.2 Incineration

Incineration of waste is a waste management option that was initially considered for the project. To set up and operate an incinerator on site will require a material change of use approval by the Environmental Protection Agency for ERA 76.

Incineration was raised with officers from the Gladstone Regional Council and it was established that Council would not support it. With recent scrutiny of the emissions of industry prompting measures such as the "Clean and Healthy Air for Gladstone" initiative by the Environmental Protection Agency, it is viewed to be in industry's interest to minimise unnecessary emissions from the site.

Emissions from an incinerator depend upon the content of the waste being reduced, with experience from the Council indicating that putrescibles in waste streams make it particularly difficult to control emission quality.

Furthermore, this disposal option does not reflect BG Group's waste management philosophy and prevents opportunities for reuse to be determined. In view of the above, QGC has decided that incineration will not be pursued.

7.5.3 Workers Camp

The accommodation quarters in the camp maybe serviced by a domestic kerb side type refuse via collection trucks lifting both general waste and recyclable wheelie bins placed beside the road. The volume of waste associated with the camp would appear to make a weekly service viable. This type of service must be arranged directly with the contractor, and cost would be directly attributable to the proponent. Charges would include

» Normal waste $57/t;

» Recyclables $112 /t;

It is estimated that approximately 4kg[6] of waste would be generated per person per week which amounts to an estimated load of 10 tonnes per truck;

7.5.4 Construction Waste

It has been suggested that as a part of the Site Based Waste Management Plan that a waste sorting facility be established early in the project. This waste sorting facility would consist of:

» A shed with fenced yard to stop blown refuse;

» An excavator with grab bucket to sort waste quickly and safely;

» Stationery compactors to bail cardboard, PE, aluminium cans; and

» Timber – stockpile – tub grinder to make mulch; (use as Erosion control)

Inert material such as concrete and gravel, ceramics etc can be crushed onsite and used as road base or fill. The Gladstone Regional Council uses the crusher of a local earthworks contractor to process material at the Benaraby landfill, hence the same plant maybe available for use at the construction site on Curtis Island.

[6] from correspondence with GRC

Process inert material may be delivered to the Benaraby landfill at a fee of $30/tonne, with processed concrete only waste being charged at $20/tonne.

7.5.5 Cleared Vegetation

The Gladstone Regional Council was adamant that it would not support cleared timber being burnt on site suggesting that:

» Cleared timber should be mulched;

» Clean waste timber from packaging and off cuts should also be mulched;

» Burning not supported by Council

Mulched material can be used to prevent erosion, stabilise batters, help establish re-vegetated plant stock, and as a soil conditioner.

QGC proposes that Vegetation cleared from across the site will be managed as follows:

» Leaves, branches and small timber will be mulched / chipped on site, with some use of mulch for site stabilisation / erosion control and landscaping / re-planting (where appropriate). Excess mulch will be placed in the spoil disposal areas;

» Millable timber (estimated at 35,000 tonnes, although detailed survey has yet to be undertaken to assess quantities) will be made available to the local Gladstone community, with timber loaded on to trucks and shipped across from Curtis Island to the mainland on ferries via Auckland Point on an as needs / demand basis. Minimal stockpiling will occur at Auckland Point in order to avoid double handling; and

» Timber which is unsuitable for milling or which exceeds the local capacity for timber use will be disposed of at the municipal waste disposal facility as green waste for mulching, subject to agreement on volumes to be accepted and cost.

7.5.6 Sludge waste from Sewage Treatment Plant

Sludge waste from the on-site sewage treatment plant may be accepted at the Benaraby landfill by prior arrangement. Sludge must have particular qualities and meet particular standards to be accepted. Depending on the source and composition of the sludge accepted at the landfill, it maybe used in green waste mulching or encapsulated in landfill if unsuitable for mulch.

7.6 Factors Affecting Waste Data

The information provided by the Gladstone Regional Council should be tempered with some caution as the current situation of pricing and policy may change quite quickly.

The Queensland Government is considering the introduction of a landfill levy on all local governments across Queensland on top of the current licensing fess paid by Council. The intention of this levy is to make recycling and reuse more attractive. The cost of the levy on the users of the facility is unknown at this time.

It would also appear that landfills will be a part of emissions trading legislation potentially increasing the cost of accepting waste into landfill. In particular, the emission of methane from the landfill appears to be attracting the most attention.

The Gladstone Regional Council has become a member of the Regional Association of Landfills that includes the Gladstone Regional, Rockhampton Regional, Central Highlands and Isaac Regional Councils. Waste could go to regional landfill at Rockhampton incurring additional costs for transport and acceptance of the waste.

Gladstone Regional Council's current fees for dumping material are low now, $57/tonne, in comparison with other councils along the Queensland coast. Current tipping fees along the coast range from $80 to $120 per tonne at other local government tips up the coast. This may be to reflecting landfill capping and completion works.

7.7 Waste Summary

The region is well placed to accommodate the waste generated from an influx of people. At the current loading of 150 tonne per day, the Benaraby landfill is expected to be in service until 2050. The current cell has an expected remaining life of 4 years. Funding for creation of new cells is collected through a charge per tonne and hence no additional capital charges are likely to apply to increased domestic loads within the collection area. An increased requirement for waste collection may be met by the waste contractors bringing in extra vehicles from elsewhere in the country.

A site based management plan will be required for the construction camp involving the appointment of site waste officer; as incineration is unlikely to be approved by Council a waste sorting facility may be required. It is important to note that the figures obtained from Council and presented in this section are subject to change with short notice.

Kerb side collection of domestic waste is carried out under contract to JJ Richards, which will be running at 80% capacity. Additional capacity can be sourced through the organisation at short notice, and hence there are no foreseen capacity issues with kerb side waste collection.

8. Telecommunications

As with electricity the supply of communications is open to free market and there are numerous suppliers that connect the Gladstone region with telephone, mobile and data networks.

A communications network consists of core and access parts, the core is the network that interconnects transmission hubs, exchanges and data nodes and the access part connects to the customers (including mobile).

8.1 Landline

Telstra has provided information about their network in the Gladstone region.

Gladstone is connected to the intrastate network by very high capacity DWDM (dense wave division multiplexer) optical fibre transmission systems. Telstra states that 'Core network capacity in the Gladstone area would be increased (if necessary) based on demand and it is relatively easy to do so based on the extensive fibre infrastructure that already exists.'[7]

Fixed access network is provided to new developments or to redevelopments as required – this infrastructure is characterised by an individual feed to each customer from some point in the network eg. direct from the exchange, from a roadside cabinet, from an optical fibre distribution point in the case of fibre to the premises, from a radio terminal site.[1] Appendix B shows the boundaries of the telephone exchanges in the region.

8.2 Mobile Phone Coverage

Mobile phone access is determined by the presence of bases and their configuration, Telstra monitors the capacity of existing bases and increases resources as required. In order to provide new coverage an adequate economic driver must be present in terms of return on investment. Appendix A contains coverage maps for the area for the three major mobile phone networks. The area surrounding Gladstone has good mobile phone and mobile data coverage, and so a mainland worker's camp would likely be covered by existing infrastructure.

8.3 QCLNG Construction and Operational Requirements

At the early stage of the project planning, during the Construction Phase of the Project, mobile phone connection may be the primary telecommunications method. The existing telecommunications infrastructure in the area (mobile tower at Targinie) has a peak capacity of 3 mbits/sec download, but consultation with the local telecommunications provider indicates that this is planned to be expanded to 21 mbit/sec which would be sufficient to allow for the LNG Facility requirements as well as growth in demand in Gladstone.

[7] Personal Correspondence with Noel Sandstrom

For the Operational Phase of the plant, the primary needs may be able to be served by a proposed 30 strand fibre optic cable that may be co-located with the pipeline from the mainland to the island, with indicative bandwidth of 100Mb/sec. Backup supply may be via the existing mobile phone network. Telecommunication providers are also investigating high capacity digital radio from Gladstone due to the uncertainties about whether there will be a bridge constructed at the appropriate time or not. QGC is also considering a microwave system that may completely obviate the need for fibre optic connection.

8.4 Additional Infrastructure

Additional infrastructure that would attract a contribution from QGC would include infrastructure of a temporary nature e.g. services to camps or construction contractors and permanent infrastructure to the camp.

Telstra are unable to provide cost estimates at this stage due to there being too many variables and uncertainties, continued consultation throughout the project planning will allow them to continue to provide a high quality communications service in the region.

8.5 Telecommunications Summary

As with other utilities expansion of telecommunications networks are market driven. Therefore if the demand is in place then the infrastructure will be improved at the cost of the service provider. Where special loadings have to be accommodated in areas of limited service the persons requiring the service would have to pay, usually on a case-by-case basis.

Gladstone is connected to the intrastate network by very high capacity dense wave division multiplexer optical fibre transmission systems with sufficient capacity to accommodate the communication and data transmission demands posed by the workforces of all projects proposing to locate in the Gladstone area.

Residential networks in town expand organically and the large-scale transmission equipment is in place to accommodate further growth in the region. If temporary augmentation were required for a workers camp, there may be an investment required by the project. Telecommunications connections to the facility on the island would almost certainly require a contribution. At this stage there is insufficient information to provide a cost estimate, however as decisions are made and the information becomes available consultation with the major telecommunications companies is vital to ensure the continuation of a quality service.

9. Gas Supply

A natural gas network exists in Gladstone with a Liquid Petroleum Gas (LPG) supplied in and around the central business district and Tempered Liquid Petroleum Gas (TLP) supplied in some of the suburbs (see Figure 13). There is no current plan to augment the existing network however it may be extended to supply any new developments. There is no requirement for a high pressure gas supply to the facility and any gas required in the worker's camp for cooking, heating etc. will have to be brought in.

As the LNG plant is set up to cool gas for distribution elsewhere, locating the plant in Gladstone will have no effect on the local gas distribution network. This means that the QCLNG project will not trigger any changes to the network.

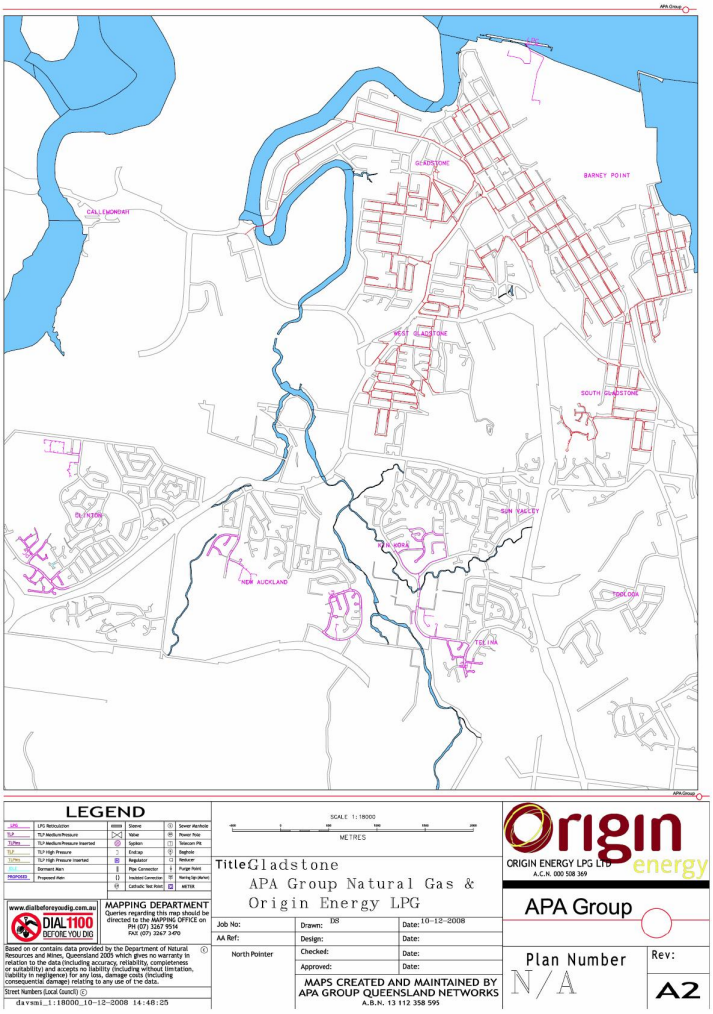

Figure 13 - Current LPG network Gladstone

10. Airport

Estimates provided by QGC's EPC contractor, Bechtel Oil and Gas, for the LNG plant suggest a bi-weekly loading on the airport of 376 persons during construction, over a period of 50 weeks this amounts to 18,800 persons per annum.

Accurate prediction of passenger numbers is often a tricky business due to the numerous, often independent factors involved.

The Gladstone Airport Development plan (April 2008) stipulates a prediction for passenger numbers of 310,000 in 2009/10 and 496,000 in 2015/16. The Rio Tinto Alumina Refinery expansion (due for completion in 2011) has a requirement for 800 persons to travel by air every fortnight, this gives a total loading of 41,600 passenger movements a year. Other major projects such as the Wiggins Island Coal Terminal and the GPN plant will also considerably increase the number of flights required in and out of Gladstone Airport.

10.1 Current Airport Redevelopment

The current proposed upgrade of the Gladstone airport will include a strengthening and extension of the runway so that a 170 seat Boeing 737-300 Embraer 170/170 or Airbus A320 will be able to land without causing damage. In addition improvements to the terminal and access routes will significantly increase the capacity of the airport. The one factor that cannot be planned for is whether or not airlines will choose to route extra flights to Gladstone. It can be assumed however that given the airport upgrade and the other projects happening concurrently as well as the wider range of aircraft able to land that the airlines will provide flights to meet the new demands.

Once jet aircraft with a capacity of 170 seats are using the Gladstone Airport, security screening of passengers and luggage will need to be installed. This somewhat reduces the floor area available to accommodate passengers and upgrading would be considered.

Terminal upgrades proposed with the current upgrade would suffice for passenger movements associated with the operation of 100-seat aircraft, but there is no further room on the current site to expand the terminal capacity to cater comfortably for the increased passenger and visitor numbers associated with larger aircraft.

Infrequent operations by 170-seat B737-800 or A320 aircraft may be accommodated, provided no other passenger movements are being processed at the same time. Forecast passenger growth suggests that a new terminal facility will need to be considered in 5-7 years.

10.1.1 Car parking

As a part of the current expansion an additional 450 car parking spaces are required to be constructed in close proximity to the terminal for both passengers and rental vehicle storage.

10.1.2 Airport Rescue And Fire Fighting Service (ARFFS)

When passenger numbers reach 350,000 the Civil Aviation Safety Authority (CASA) requires an ARFF service to be provided. Where operations are conducted with aircraft of 30 passenger seats or greater, a minimum Category 4 Aviation Rescue and Fire Fighting Service (ARFFS) must be provided. Based on the mid-range forecasts an ARFFS is likely to be required by 2010. It is estimated that two fire tenders will be required to be provided by the Airport.

A fire station will also need to be provided to house the service on the site including a fire station observation tower where take offs and landings can be observed from.

10.1.3 Control Tower

Given the predicted volume, type and mix of traffic (the numbers of light and heavy aircraft for example), or the proportions operating under visual flight rules (VFR) or instrument flight rules (IFR) it is unlikely a control tower is required within 20 years.

10.1.4 Fuel Facilities

The Airport has a current fuel facility with a capacity of 50,000 litres of JetA1 in tank storage. This is augmented by 40,000 litres of truck storage. This will need expansion to 250,000 litres within 10 years to cater for forecast growth in aircraft numbers and size. A new site for an expanded fuel storage facility also needs to be provided.

10.2 Cost Recovery for Expansion

Although the Gladstone Regional Council is requesting State and Federal government assistance for funding of the redevelopment of the Gladstone Airport, it is unlikely that funding of the magnitude requested will be forthcoming given the possibility of the airport being sold to private interests in the future.

The cost of the upgrade is expected to be recovered through increasing the passenger service charges (landing tax) to $20 per passenger and utilising loans to finance the expansion.

10.3 Airport Summary

Construction works on the runway re-development for the Gladstone Airport commenced in May 2009. These works will allow the airport to accommodate aircraft as large as Airbus A320 and Boeing 737s.

The provision of flights will be driven by market forces and if the demand is there it will be met, either by the use of larger planes or more frequent flights.

Landing taxes will fund the re-development of the Airport and it is not expected that the QCLNG project would be asked to contribute towards the proposed airport expansion.

Should there be any problems with providing the required flights from the Gladstone Airport, alternate strategies may need to be developed such as using the larger Rockhampton Airport situated approximately 115 km to the north.

11. Rail/Ship Intermodal

QGC is investigating the possibility of importing gas pipeline lengths and components through Auckland Point and using rail services to transport the lengths and components. Port and rail infrastructure is presently installed at Auckland Point and QGC is negotiating with Gladstone Ports Corporation and Queensland Rail on the potential capacity and role of this infrastructure. Further analysis will be needed to assess this concept.

12. Conclusion

An assessment of the current and projected infrastructure capacities in the Gladstone region has been undertaken. The quality and type of available data varies widely between sectors, companies and even between departments within companies and thus collation and analysis of data has been complex to provide a detailed and integrated assessment of supply and demand within the region.

This report has brought together information and data from a wide range of sources to present a general picture of the current and projected infrastructure capacity and loading within the region. Where relevant, an attempt has been made to provide an approximate early indication of augmentation costs. In many circumstances companies were unable or unwilling to provide a figure for augmentation contributions without a formal request or significantly more project particulars than available at present. A dialogue has been started as early as possible with respect to project initiated systems upgrades in order that the providers may continue to provide a high quality service to the people of Gladstone.

Dependant on the actual total number of construction workers coming to Gladstone within the project timeframe, it is envisaged that the number of domestic dwellings available will not be sufficient to meet demand, and as a result, temporary worker's accommodation will be required.

Demand for water and electricity can be broken down into two broad categories being the macro demand from industry and the "domestic" demand to service people and supporting industries. The demands from large industrial processes has largely been ignored as the scale of the demand is so great that the companies involved will have to negotiate directly with the utility provider to augment their system in order to maintain supply to existing and "domestic" customers with an allowance for some growth.

The main consideration of this report is the reticulation of services to the point of use; for domestic dwelling this cost is accumulated into the cost of providing the infrastructure to the development; however for a worker's camp a significant contribution may be expected as the demand is outside of planned service areas and cost recovery systems of the service provider.

The Gladstone Region is in a strong position with regards to waste collection and disposal; the current Benaraby landfill site is not expected to reach capacity until 2050 and there are a number of companies with established collection infrastructure in the region who are well placed to take on large waste contracts.

Sewage treatment in Gladstone will be running at approximately 50% capacity once the immediate augmentation projects are completed, and as such, domestic accommodation within the Gladstone Region is well catered for even with a number of construction work forces in Gladstone.

Gladstone is connected to the interstate communications network with high capacity optical fibre systems, the capacity of which is expected to significantly exceed the requirement of all the proposed projects. The supply of telecommunications services to the public is predominantly market driven and as such the major communications companies will provide additional capacity according to market demand. If there is a large project specific or temporary requirement such as providing mobile services to a temporary worker's camp then a financial contribution may be expected.

The Gladstone airport re-development commenced in May 2009 and will significantly increase the passenger capacity of the airport by allowing for larger aircraft to land. Extra flights or larger aircraft may have to be provided by the carriers servicing the region to cope with the increase in demand from the planned projects however as this is due to market forces it is difficult to accurately forecast. Costs for the airport are recovered through landing taxes and hence no contribution is expected from industry.

This assessment clearly shows that the Gladstone region is in a position of strength when it comes to infrastructure and services. As the project planning progresses and changes are made or more information becomes available it is of the utmost importance to keep the local service providers updated in order to minimise the impact of this large project.

Currently there are two sites for the proposed workers' camp: one being on Curtis island and the second at Calliope River Road. QGC strongly prefers the Curtis Island site for a plant construction workforce but is continuing to assess Calliope River Road as a possible location. Potable water from the Council supply is expected to come from Mt Elizabeth at Calliope, and cost in the order of $4 million to $5 million to provide. Both camps are expected to utilise on-site sewerage treatment plants therefore the reticulation and treatment of sewerage in the domestic system for Gladstone is not expected to be adversely affected by the LNG plant's proposed construction workforce. Should a Council treatment plant be considered for the Calliope River Road camp, the closest plant would be at Stowe Road Calliope with the cost transmission infrastructure be similar to the water reticulation. Electricity supply to the Calliope River Road camp would likely need to be fed from the substation in Morcom Street Calliope. Costs were not available from Ergon for the transmission lines to the site.

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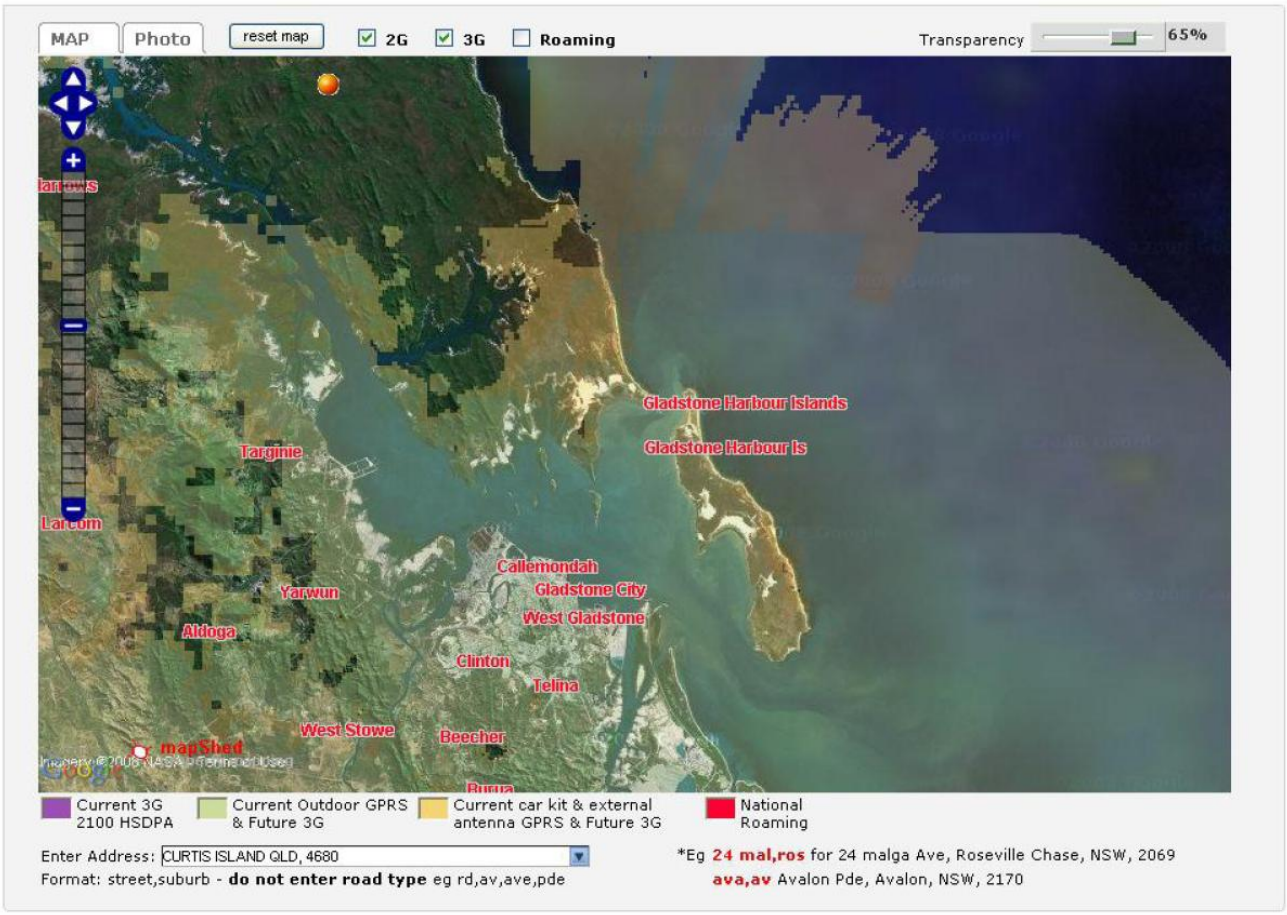
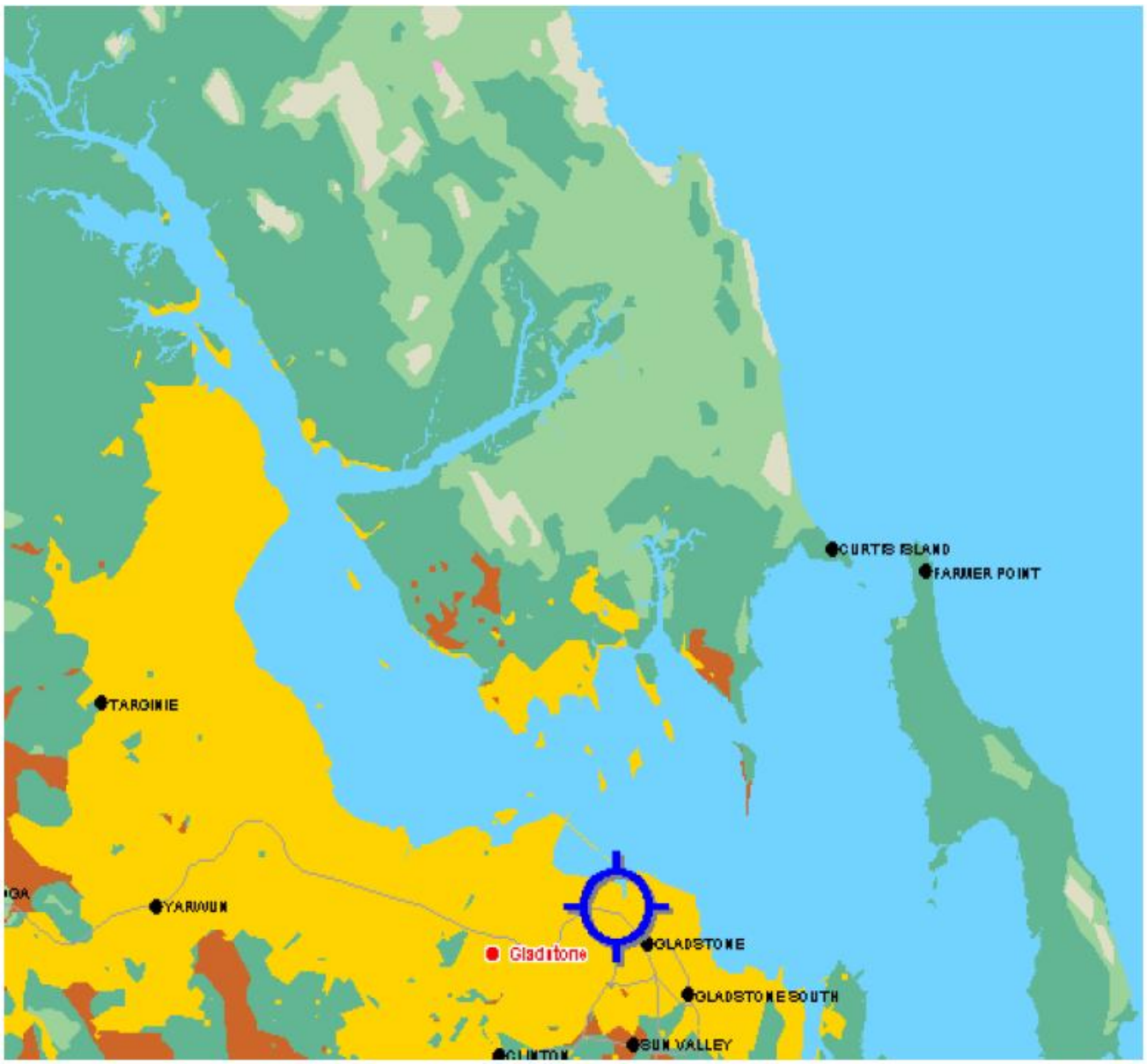
Appendix A

Mobile Phone Coverage



Vodafone Coverage Map



LEGEND

- 3G/HSPA 2100MHz
- 3G/HSPA 900MHz
- GSM/GPRS On Street
- GSM/GPRS Car Kit
- Future GSM/GPRS Coverage
- Wifi Hotspot

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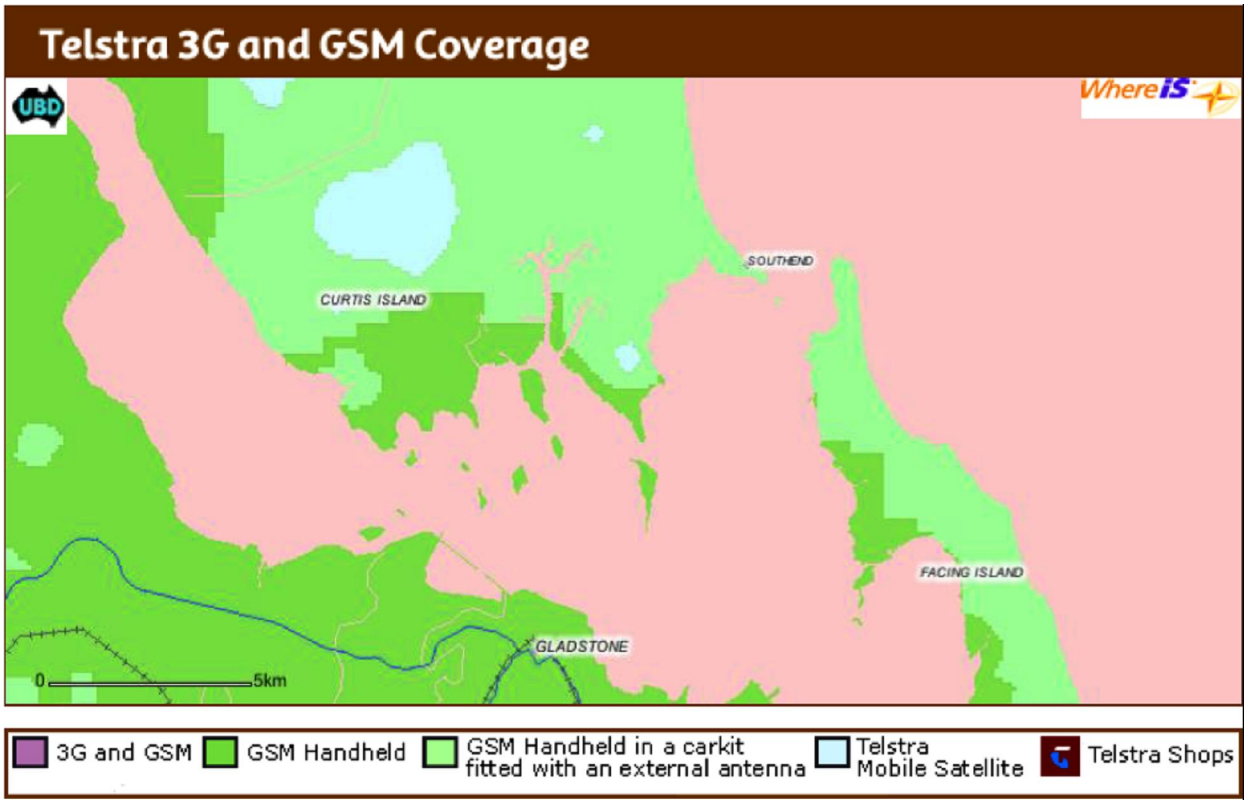
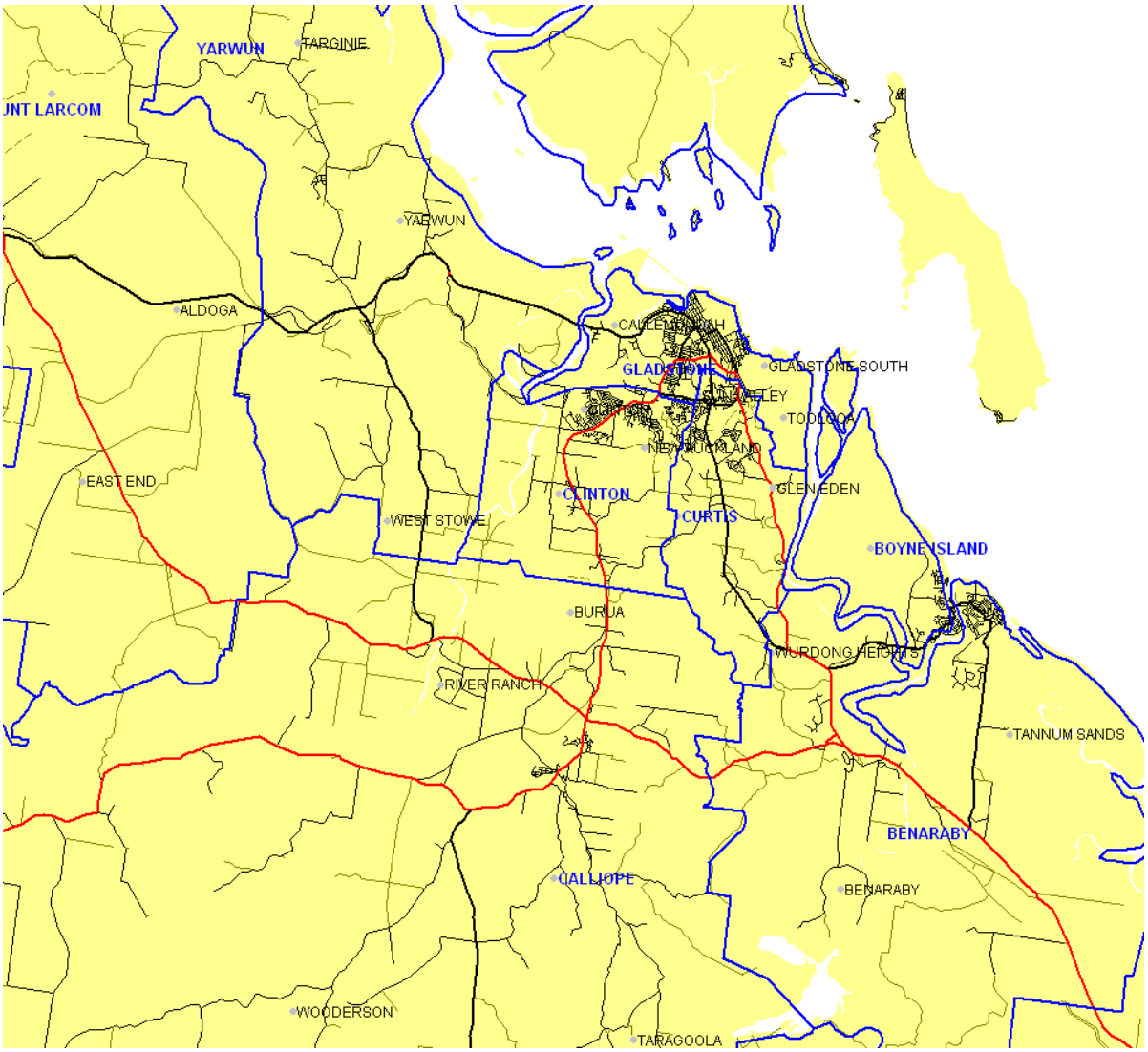
Optus Coverage Map



Telstra Coverage Map

Appendix B

Telstra Phone Exchange Boundaries



Telstra Phone Exchange Boundaries (Blue)

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