CHAPTER 3: THE ELEMENTS AT RISK AND THEIR VULNERABILITY

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In the first chapter we introduced the 'five esses' (shelter, sustenance, security, society and setting) into which we have organised our consideration of the elements at risk in the community and their vulnerability. The broader 'setting' elements were outlined in the previous chapter. In this chapter we describe the key aspects of the remaining four groups. At the outset, however, it is important to understand the limitations and uncertainties imposed on this study by a range of issues.

Given the broad regional nature of the South-East Queensland study, it has not been possible, with the resources and time available, to undertake the extensive and detailed field work that would provide data at a resolution similar to that compiled for earlier *Cities Project* studies (Cairns, Mackay and Gladstone). We have, therefore, been heavily reliant on data made available to us by the eight local government councils involved. This council data has been developed for a range of local government purposes such as rates administration, urban planning and assets management; it has not been developed to support community risk assessment studies. As a result, many of the descriptive attributes available, such as the classification of land use, has been far from ideal for our purposes. We have had to interpret and otherwise massage that source data, as best we could, with the use of documentary sources such as the *Yellow Pages* and the UBD Street Directory, personal knowledge of the region and limited field verification. Any error or uncertainty introduced by the land use data will be consistent across the study area so the relative levels of vulnerability reflected by the various indexes used will also be consistent across the study area.

Geocoding of property data has been based on the digital cadastral database (DCDB) maintained by the Department of Natural Resources, with the point location of properties ('buildings') established as the land parcel centroid. Whilst this may not be absolutely accurate for many of the non-residential properties, parcel centroid is felt to be quite adequate for residential properties, which make up the bulk of the developed land in the study area. Whilst this practice will undoubtedly introduce some spatial inaccuracies at the individual property level, at the broader 'neighbourhood-level' of assessment employed here, we feel that it is more than adequate, i.e. whilst the absolute accuracy may be questioned, the relative accuracy is more than adequate.

The second major source of data used to develop an understanding of the elements at risk and their vulnerability has been the statistical summaries of the results of the 1996 national census. Those data are now five years old and in areas of rapid urban growth, as found in parts of South-East Queensland, they will now be quite inaccurate. The 1996 data, however, is the most comprehensive and best available at a reasonably high level of spatial resolution. We believe that overall, the values used (mostly ratios rather than absolute values) will still be valid for the vast majority of the area.

Shelter

Buildings: The buildings that provide shelter to the community at home, at work and at play vary considerably in their vulnerability to different hazards, and hence the degree of protection they provide the community. A series of eight databases containing details of the use and other characteristics of a total of approximately 685 090 developed properties in the study area was developed. For convenience, this mass of detail has been summarised down to the local government area (LGA) level in Table 3.1.

Table 3. 1 South-East Queensland developed property use by local government area

Locality	Properties	Houses	Flats	Motels, etc	Business	Logistic	Safety	Community	Utility	Telecoms
Caboolture	37 473	34 269	1862	32	727	77	37	223	18	12
Pine Rivers	38 384	34 935	1780	12	1267	46	21	232	91	12
Redcliffe	20 013	16 935	1949	17	721	62	33	133	6	3
Brisbane	321 700	278 153	24 910	427	10 026	4745	404	1827	799	56
Ipswich	45 654	41 430	1383	47	1857	86	35	349	67	14
Redland	42 919	40 390	375	40	853	62	48	435	46	8
Logan	59 001	49 772	6148	21	2208	241	27	234	20	8
Gold Coast	119 946	86 950	25 982	672	4750	375	155	664	118	34
Region	**685 090**	**582 834**	**64 389**	**1268**	**22 409**	**5694**	**760**	**4097**	**1165**	**147**

Notes:
1. The numbers will not necessarily tally across the table because some minor usages, such as open land, have not been included.
2. Flats include all domestic multi-resident properties regardless of the number of dwelling units involved.
3. Motels etc. includes all commercial accommodation such as caravan parks, hostels, etc.
4. Businesses include all shops, offices and industries other than those which have a logistic function.
5. Logistic includes all facilities that process, wholesale or retail food and fuel as well as associated properties involved in transport and storage.
6. Safety includes all police, fire, ambulance, SES, marine rescue, life saving, hospitals and other medical facilities.
7. Community includes schools, recreational and sporting clubs, churches, theatres, libraries and properties with a government function.
8. Utility includes power and water supply and sewerage facilities.
9. Telecoms includes telephone exchanges and other telecommunications facilities such as broadcast radio and TV transmitters.

This table provides the council-by-council tally of the uses to which the developed land in the study area is put. It should be noted that the numbers relate to individual properties rather than buildings. For example, in the 1996 census there were 132 931 individual flats and units recorded in the region, compared with the 64 389 properties used for multi-occupant dwellings identified in Table 3.1. Around 94% of all developed properties in South-East Queensland, however, are residential (houses, or blocks of flats) and have a single building. We did not attempted to tally buildings in institutional properties (e.g. schools) or industrial and commercial properties that typically have more than one building.

Distribution of residential development is uneven across the study area. There are 15 neighbourhoods (i.e. CCD) in which less than 10% of all properties are used for residential purposes. These are in unpopulated areas such as Moreton Island; in the industrial and commercial precincts that follow along the Brisbane River from Carole Park to Eagle Farm and Lytton; or in the commercial hub of Surfers Paradise. The vast majority of CCD are more than 90% residential, with 458 of them (14% of the total) having a 100% residential function. This distribution is shown in Figure 3.1.

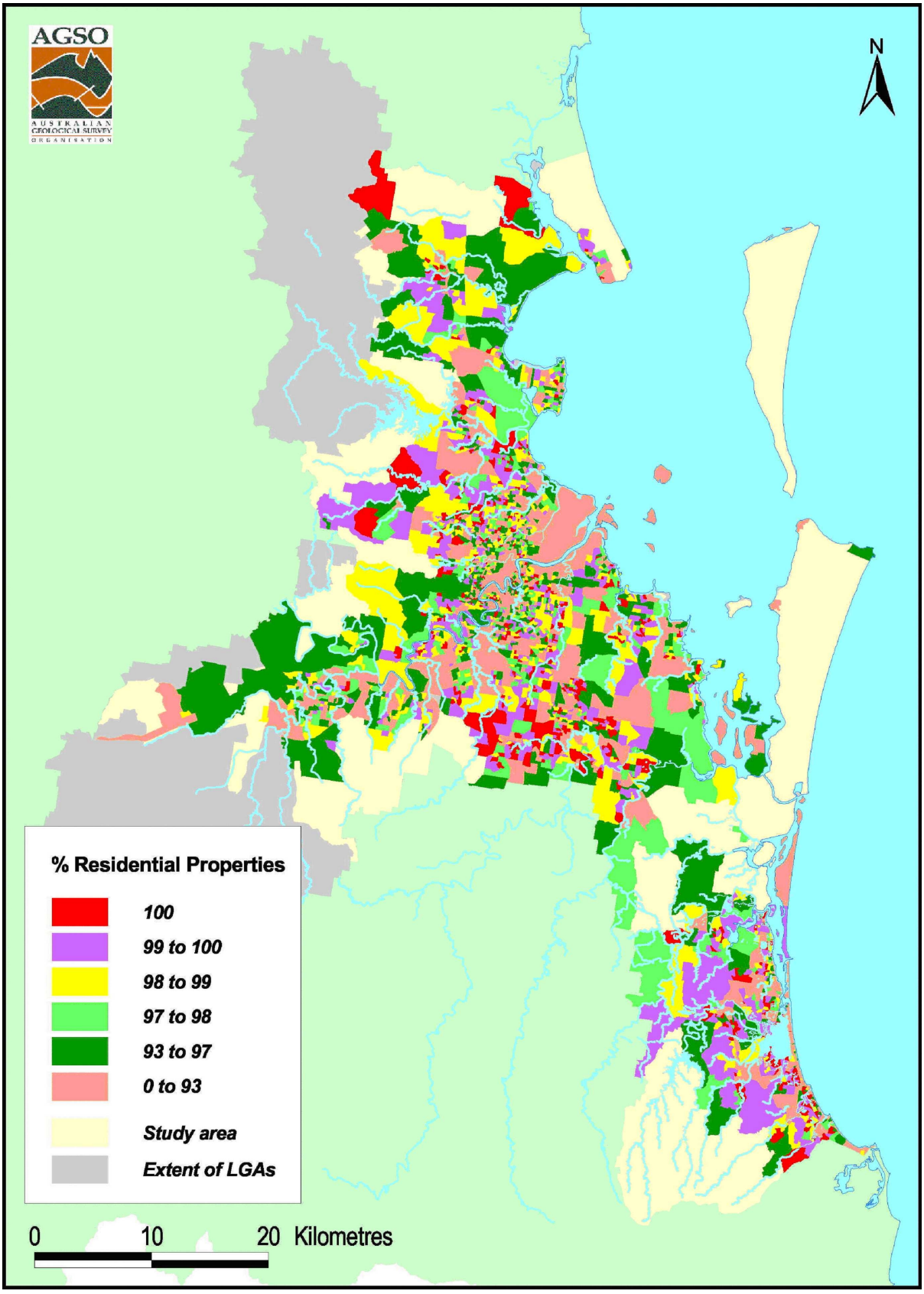

Figure 3.1 Distribution of residential property.

The period of development of each suburb is strongly reflected by the general style of housing each contains. In the older suburbs throughout the region, the most common houses are elevated on stumps and have timber or fibro-clad walls. They also (typically) have high pitched, hip ended roof shapes and small windows. In these older suburbs, however, there has been some degree of re-development with some of the original houses giving way to blocks of flats and other higher density developments.

This is in strong contrast to houses in the more recent suburbs which are almost universally built on a slab, have walls of brick, tiled roofs and large areas of glass. Roof forms are predominantly gable ended, but typically have a much lower pitch than those in the older suburbs. Brick walls are most common in suburbs that developed since the 1960's. Given their general vintage, the majority are likely to be of brick veneer construction, rather than 'solid' or cavity construction, given that brick veneer became an accepted construction method in Queensland in the late 1950s and has been the predominant 'brick' form since then.

Many of the multi-level blocks of flats, town houses and units, especially the common 'six pack' types, have a reinforced concrete frame and are brick veneer clad.

A similar age-dependency is also found with non-residential buildings. Older buildings, including schools and commercial properties are typically of solid brick, timber or fibro construction with metal roofs, whilst industrial buildings have predominantly steel frames and are metal-clad. Larger buildings constructed since the mid-1970s are typically of concrete frame construction, whilst in the period since about 1990 pre-cast tilt-up construction has become common.

The pattern of urban growth in the region over the past 40 years, can be seen in Figures 3.2 to 3.6. These maps have been compiled from a range of sources including historic aerial photography, satellite imagery and council records.

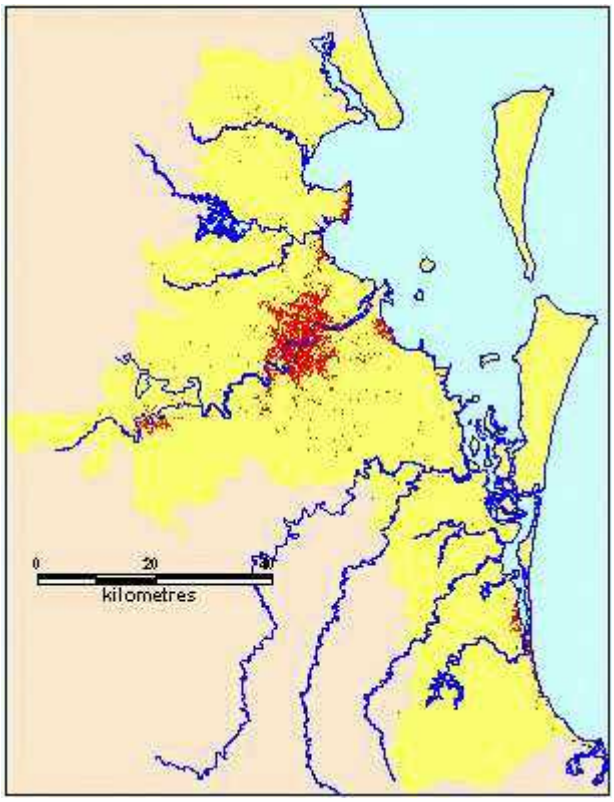

Figure 3. 2 Urban development in 1960

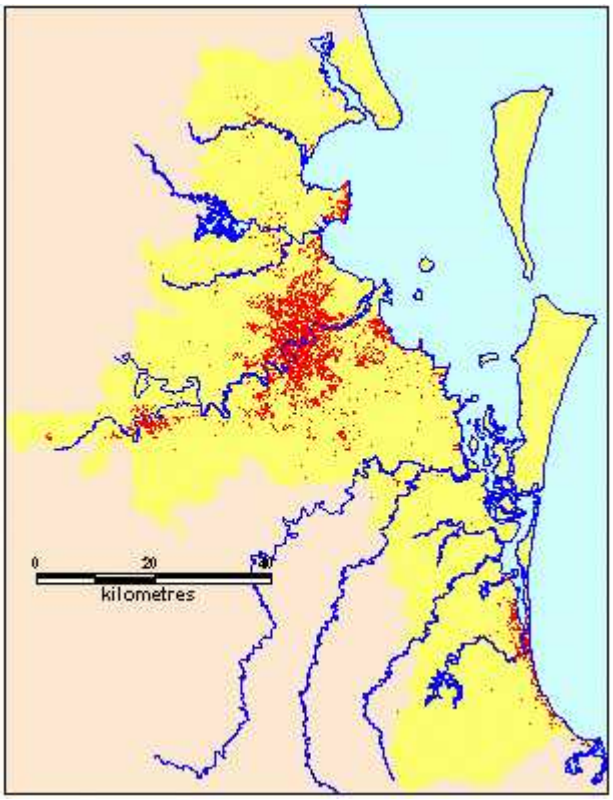

Figure 3. 3 Urban development in 1970

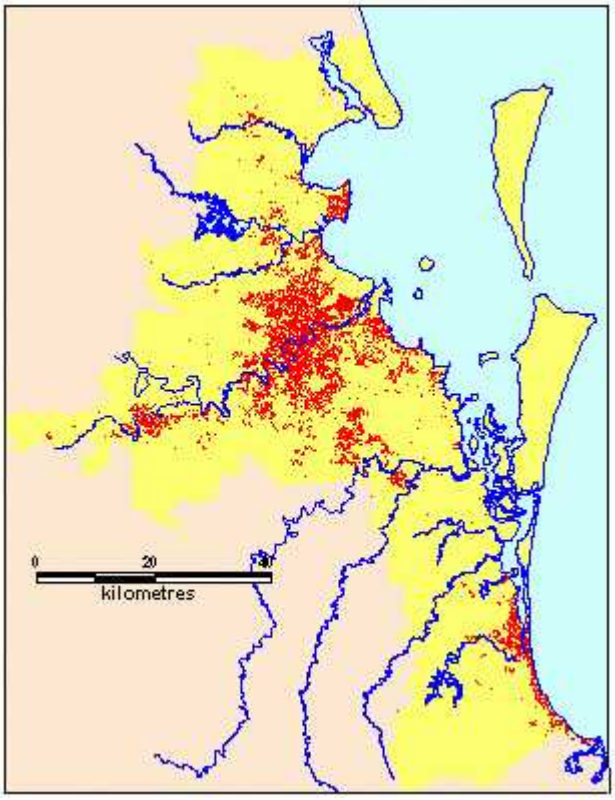

Figure 3. 4 Urban development in 1980

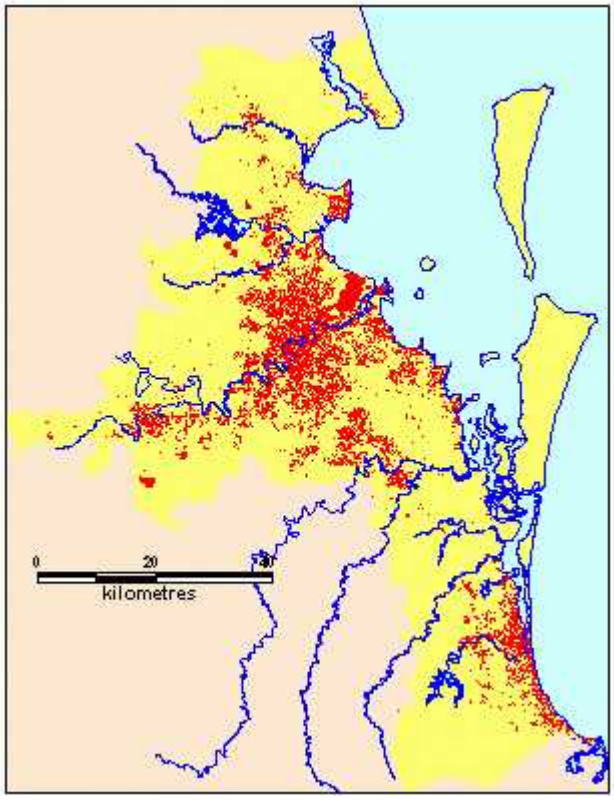

Figure 3. 5 Urban development in 1990

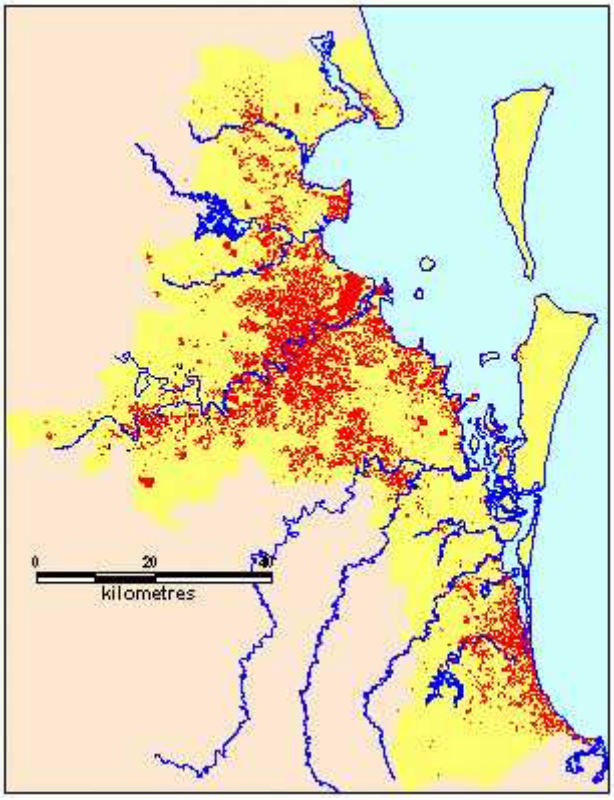

Figure 3. 6 Urban development in 2000

Engineered buildings constructed since 1975 have been subject to the Wind Loading provisions of the Australian Building Code, whilst domestic buildings have been covered since 1983. Earthquake Loading provisions were introduced in 1979 and upgraded (and extended to domestic construction) in

1993. The approximate numbers and percentages of properties in each LGA, by age class, are shown in Table 3.2. No allowance is made for re-development of properties – if a property had a house on it in 1960, but was subsequently redeveloped with units in 1999, it will still be shown as pre-1960.

LGA	Pre1960	1961-1970	1971-1980	1981-1990	1991-2000
Caboolture	934 (2.4%)	2410 (6.4%)	8752 (23.4%)	10 939 (29.2%)	14 438 (38.5%)
Pine Rivers	437 (1.1%)	6823 (17.8%)	11 401 (29.7%)	9695 (25.3%)	10 202 (26.6%)
Redcliffe	8271 (41.3%	4803 (24.0%)	5308 (26.5%)	904 (4.5%)	727 (3.6%)
Brisbane	162 669 (50.6%)	57 235 (17.8%)	49 803 (15.5%)	26 520 (8.2%)	25 464 (7.9%)
Ipswich	8942 (19.6%)	8861 (19.4%)	7226 (15.8%)	7410 (16.2%)	13 215 (28.9%)
Redland	1424 (3.3%)	2808 (6.5%)	12 131 (28.3%)	15 815 (36.8%)	10 720 (25.0%)
Logan	337 (0.6%)	3382 (5.7%)	30 381 (51.5%)	15 554 (26.4%)	9347 (15.8%)
Gold Coast	10 678 (8.9%)	14 704 (12.3%)	20 218 (16.7%)	47 751 (39.8%)	26 591 (22.2%)
Region	193 052 (28.2%)	101 683 (14.8%)	146 686 (21.4%)	134 588 (19.6%)	110 704 (16.2%)

Mobility: The ability of people to get to and from shelter is almost as significant as the shelter itself. The region has a well developed urban road network. The 15 400 km of roads that make up the network is almost entirely bitumen sealed and, apart from the occasional flooding of low-lying bridges and culverts, is an all-weather network. In the study area there are 629 km of freeways and highway (Beaudesert Road, Bradfield Highway, Bruce Highway, Centenary Highway, Cunningham Highway, D'Aguilar Highway, Gateway Motorway, Gold Coast Highway, Ipswich Motorway, Logan Motorway, Mount Lindsay Highway, Pacific Highway and Motorway, Southeast Freeway, Warrego Highway, Western Freeway); 1411 km of urban main roads; 964 km of suburban access roads, and 11 586 km of suburban roads. Maintenance of these roads is largely the responsibility of the individual LGA in which the are located. Only the designated highways and urban main roads are maintained by the Department of Main Roads.

Passenger transport in the region is based ver heavily on use of the family car. Mobility is, consequentially, very heavily dependant on household access to private cars, of which there are an estimated 926 200 in the region. Households without access to a car are consequently considered to be more vulnerable than those with access. Figure 3.7 shows the distribution of households with no access to a car.

The highest proportion of car-less households is 21 out of the 24 households (87.5%) in an inner Spring Hill neighbourhood, whilst thirteen other neighbourhoods have more than 50% of households without access to cars. These are either inner city neighbourhoods in suburbs such as Brisbane City, Broadbeach, Fortitude Valley, Redcliffe, South Brisbane, Surfers Paradise, or West End; Bay Island communities such as Eden Island; or areas where the inhabitants are not permitted to travel, such as the CCD containing the Wacol prisons. By contrast, there are 204 rural and rural fringe CCDs where no households are without access to a car. The mean value across the region is 12.2%.

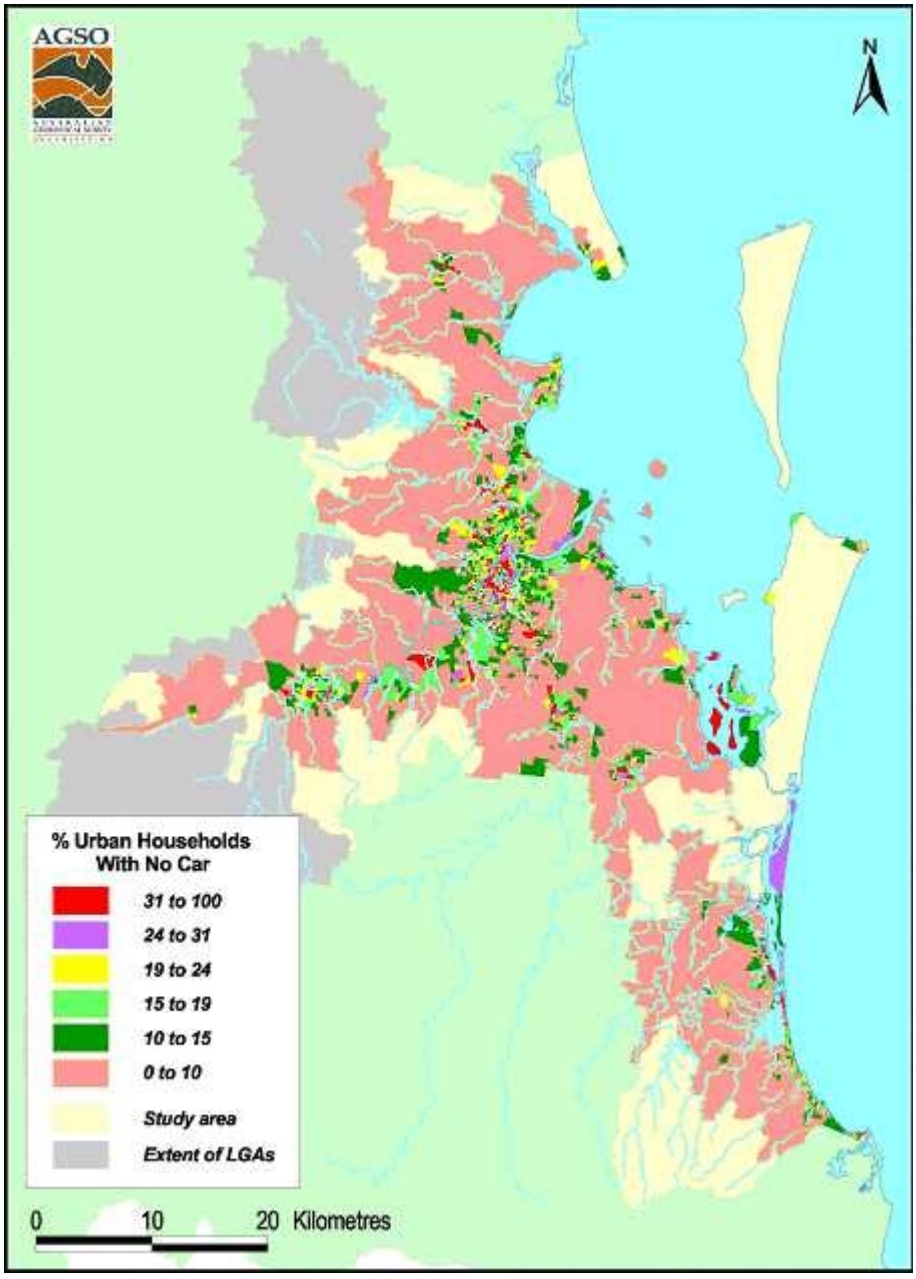

Figure 3. 7 Percentage of urban households with no car (ABS, 1998a data)

This dependence on the private car is quantified in Table 3. 2 which shows the proportions of travel mode used to get to work in South-East Queensland on the day of the 1996 census. It clearly shows the dominance of the car, especially the use of the car by a single occupant. Most of the 'multiple mode' travellers are likely to have either driven or caught a bus to the nearest railway station before completing their journey by train.

Table 3. 2 Mode of travel to work in South-East Queensland (Source: ABS, 1998a)

MODE	NUMBER	PERCENT
Train	26 657	3.5
Bus	27 701	3.6
Ferry	864	0.1
Taxi	3205	0.4

Car driver	463 005	60.7
Car passenger	57 301	7.5
Motor bike	6884	0.9
Bicycle	7660	1.0
Walk	21 157	2.8
Worked at home	34 478	4.5
Did not go to work	92 015	12.1
Multiple modes	21 858	2.8

The region has good numbers of coaches, taxis, hire cars and other passenger vehicles available, especially in Brisbane and Gold Coast Cities where the tourist industry is strongest. Brisbane City Council operates by far the largest and most comprehensive bus service throughout its area (and to some areas in neighbouring LGA). Throughout the rest of the region, bus services are operated by private providers. These include:

- in Caboolture - Caboolture Bus Line, Kangaroo Bus Lines and Bribie Island Coaches;
- in Pine Rivers - Thompsons – Strathpine and Hornibrook Bus Lines;
- in Redcliffe - Hornibrook Bus Lines;
- in Brisbane – Brisbane Bus Lines, Griffith University Shuttle, Mt Gravatt Bus Service, Rochedale Bus Service, St Andrews Hospital and Westside Bus Service;
- in Ipswich – Heritage City Sunbus;
- in Redland - National Bus Company and North Stradbroke Island Bus Service;
- in Logan - Clarks Logan City buses and Park Ridge Transit; and
- in Gold Coast - Surfside Buslines and Time Out Coaches.

The routes and schedules for all of these services are provided on the *Transinfo* web site (*www.transinfo.qld.gov.au*).

Sustenance

South-East Queensland communities are sustained by a well developed infrastructure of utility lifelines (power, water, sewerage, telecommunications, etc) and logistic resources for the supply and distribution of food, clothing, fuel and other personal requisites. Each of these is important in its own right. There is, however, a very significant degree of interdependence as illustrated in Table 3. 3. In this table, the loss of the lifeline in the left-hand column will have an impact on the lifelines across the row to a significant (**S**) or moderate (**M**) degree.

Table 3. 3 Interdependence of lifeline assets

	POWER	WATER	SEWER	COMMS	ROAD	RAIL	BRIDGE	AFLD	PORT
POWER		**S**	**S**	**S**	**M**	**S**		**S**	**S**
WATER	**M**		**S**					**M**	**M**
SEWER		**S**						**M**	**M**
COMMS	**S**	**S**	**S**		**M**	**S**		**S**	**S**
ROAD	**M**	**M**	**M**	**M**		**M**	**M**	**M**	**M**
RAIL					**M**		**M**		**M**
BRIDGE	**S**	**S**	**S**	**S**	**S**	**S**			
AFLD									
PORT									

(developed from Granger, 1997, Table 2)

It is clear from this analysis that power supply and telecommunications ('comms') are overwhelmingly the most important of all lifeline assets in terms of what is dependant on them, followed closely by bridges, roads and water supply. Their significance to community sustainability, however, may be somewhat different - e.g. people can not survive for long without a safe water supply, but they can survive (albeit with some inconvenience) without the telephone, light and even power for some time.

Power supply: As described in Chapter 2, the main source of the region's power supply is from the base-load power stations on the Queensland grid, notably Swanbank, Tarong, Callide, Stanwell and Gladstone. Transmission lines operated by Powerlink bring that supply to the Blackwall switching station (Ipswich) and the South Pine (Pine Rivers) and Belmont substations from whence it is reticulated by Energex.

Energex manages reticulation throughout the region. There are 163 high voltage sub-stations operated by Energex throughout the area. Energex also operates 638 km of 110 kV line and 1410 km of 33 kV line in the area as well as an unknown length of 240 V reticulation. Whilst some high voltage mains have recently been established underground and the reticulation in newer residential subdivisions is now largely established underground, observation indicates that this infrastructure is overwhelmingly above ground. This makes it particularly susceptible to damage by tree fall or airborne debris carried by the high winds associated with severe thunder storms or cyclones.

Water supply and sewer: The major water supply infrastructure for the region was described in Chapter 2. The entire developed urban area of South-East Queensland and some rural residential areas have access to a reticulated and treated water supply. This is achieved through an extensive network of reservoirs, pumping stations, supply mains and smaller distribution pipelines. Throughout much of the older parts of the area the pipe network consists of quite brittle material such as asbestos cement (AC) and cast iron. These pipes are quite susceptible to failure under pressure surges, soil subsidence or the ground shaking experienced in earthquakes. Most newer urban areas, however, are serviced by more resilient pipelines of PVC or concrete-lined steel.

There is some degree of interconnection between the supply system operated by Brisbane Water and those operated by the other LGA so that failure of supply from storages in areas such as Caboolture, Pine Rivers, Redland and Gold Coast Rural can in part be supplemented from Brisbane. A major failure in the Brisbane Water system, however, could not be made up from external supply.

Rural properties depend on roof catchment and tank storage. Some LGA, such as Caboolture Shire, are also encouraging urban dwellers to install roof catchment tanks to supplement the mains supply. Other councils, including Brisbane City, prohibit domestic roof catchment and storage.

Most of the residential parts of the region are connected to a reticulated sewerage network. Like the water reticulation network, the much of the sewer network consists largely of jointed and brittle pipes using material such as earthenware and concrete. Each LGA operates its own network and treatment systems and all depend on numerous electric pumps to keep things moving.

There are at least 28 sewerage treatment plants in the region operated by the respective LGA. These range from small-scale secondary treatment plants which discharge effluent directly back into the drainage system, to modern tertiary treatment plants. Amongst the more significant are the Luggage Point plant at the mouth of the Brisbane River and the Elanora Water Quality Control Centre on the Gold Coast.

In the rural or rural residential areas not serviced by reticulated sewer systems, sewage treatment is by on-site septic or domestic treatment plants.

Telecommunications: Much of the telecommunications network infrastructure operated by Telstra in the study area (both copper wire and optical fibre) is underground, though network details were not available for this study. The key to telecommunications - regardless of whether it is by conventional telephone, mobile phone, fax or Internet - and regardless of the service provider - is the network of telephone exchanges. There are approximately 140 telephone exchanges throughout the region which service both urban and rural communities. These range from simple metal cabins, such as the Highvale exchange near Samford to the major South-East Queensland zone exchange at Woolloongabba.

Details of the infrastructure operated by Optus and other providers were unavailable.

Both ABC and commercial broadcast radio and TV services covering the region area are broadcast from transmitters within the study area, the main concentration being on Mount Coot-tha. There are also local studios for the ABC, Channel Nine, Channel Ten as well as Prime (Channel 7) bureau, on the Gold Coast. The ABC radio studios are located in Toowong, whilst the transmitters are at Bald Hills. Several commercial radio stations also cover the region, ranging from nationally syndicated stations to local community stations. All of these broadcast facilities have a role to play in keeping the community aware of any impending threat from hazards such as severe storms, floods or cyclones.

Dedicated telecommunications networks serving both public (e.g. police, emergency services, councils, etc) and private users (e.g. taxis, couriers, fishing fleet, etc) also cover the study area. Details of their transmitter locations were not available to this study.

Logistic support: The supply and distribution of goods such as fuel, food, and clothing are essential to the sustenance of the community. Of particular significance are those facilities that provide bulk or large scale storage and distribution services.

Fuel supply: The fuel distribution regime in South-East Queensland is characterised by the concentration of physical infrastructure within a 7 km-wide area at the mouth of the Brisbane River, and the high degree of integration of the operations of the individual fuel companies. The risks posed by the spatial and economic centralisation of this critical logistic industry have local, regional, national and international significance.

There are four major international conglomerates – Mobil, Shell, Caltex and British Petroleum (BP) and two 'independent' suppliers, Fletcher Challenge and South-East Queensland Fuels. All six of these companies operate in an environment of limited, if not restricted, competition as a result of fuel pricing policies, government excises and economies of scale, especially in terms of production. On a national level it is not economical for each of the major companies to refine their own product at each major urban location. In most cases, fuel is exchanged, on shared infrastructure, rather than being sold between companies. The fuel exchanged between companies in Perth for instance is balanced somewhere else in the country. This system determines the product levels to be exchanged in Brisbane. This leads to a very dynamic situation which makes it difficult to be definitive about the is amount of fuel traded, or available, at any one time.

At the very centre of the distribution network is the BP refinery on Bulwer Island, Pinkenba, on the north side of the river, and the Caltex refinery on Whyte Island, Lytton, on the south side of the river. They are connected by an underwater pipe and a shared 'network' pipe that runs both over and underground to the major terminals where product is stored and distributed. There are four major product terminals, three (Shell, Fletcher Challenge and the jointly operated BP-Mobil site) are in the Whinstanes area of Eagle Farm and one (Caltex) in Lytton. Mobil also operates a smaller lubricants terminal in Morningside. These terminals receive stocks from:

- either or both of the local refineries, and/or
- by sea or road from other Australian refineries, and/or
- by sea directly from overseas (notably Asian) refineries.

These terminals typically hold between 5 and 10 days of supply.

Apart from the supply of aviation fuels to the Brisbane International Airport, which is by underground pipelines, distribution of products to down-stream suppliers and users within South-East Queensland from these bulk terminals is exclusively by road tanker. Distribution to more distant consumers to the west (say beyond Miles) is by rail, and to northern ports is by sea. The major companies no longer operate their own dedicated 'company' trucks; distribution is contracted out to transport companies such as Lynfox and Finemores. This is effectively a round-the-clock operation, given that most service stations and other retail outlets rarely carry more than two or three days of stock, with some smaller outlets even requiring daily resupply because of limited on-site storage.

Disruption of fuel supplies for more that a few days would have a profound impact on the South-East Queensland community, given their heavy dependence on road transport. Such disruption could be caused by any one or more of:

- the isolation of these major facilities due to flood or storm damage to the access routes;
- production problems brought about by plant failures or industrial action (as witnessed by the Longford gas plant accident in Victoria in 1999);
- excessive demand situations (such as those caused by a major military exercise held in Queensland in mid-2001);
- product contamination (such as that experienced in 2000 with some Mobil avgas supplies); or
- disruption to shipping services bringing both crude and refined product to Brisbane.

The general spatial layout of the key fuel facilities is shown in Figure 3.8. The locations of the pipelines are only indicative.

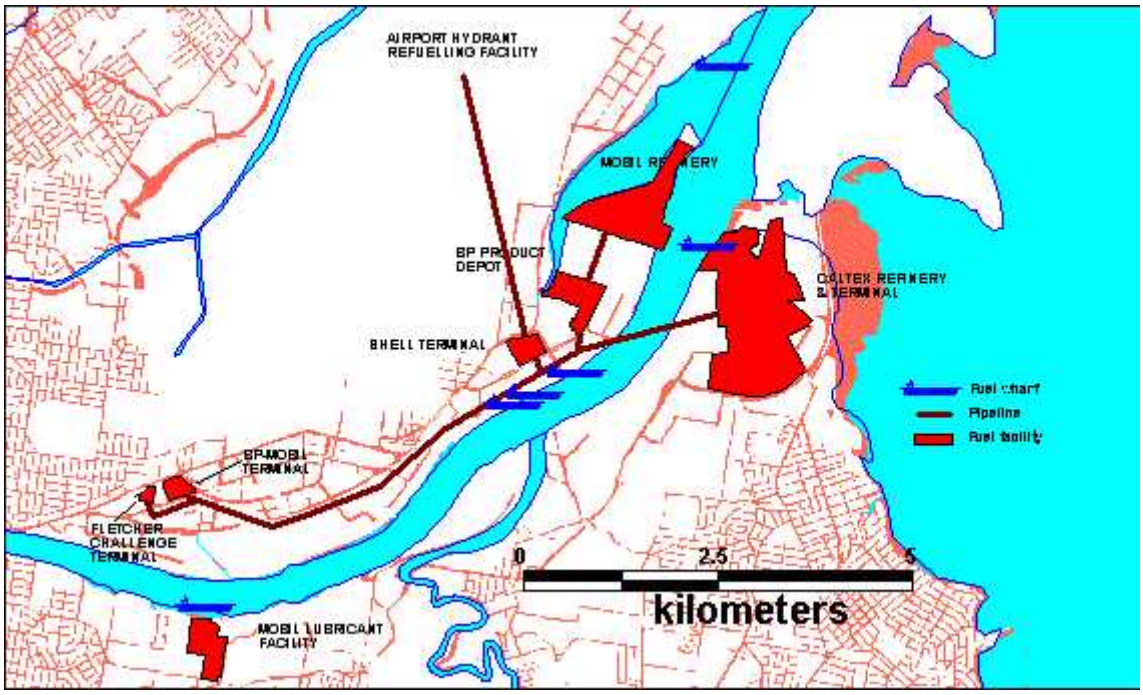

Figure 3. 8 Queensland's major fuel supply infrastructure

Food supplies: Brisbane is the centre for the distribution of most foods throughout the South-East Queensland region and beyond. As with fuel supply and distribution, there are very few truly independent distributors. Many of the supposedly 'independent' retailers are, in fact, either subsidiaries of the larger players, such as Woolworths, or are supplied by them. Economies of scale dictate that large holdings of supplies are stored in one location and that there is a significant degree of integration of the supply infrastructure. The food distribution system, however, is significantly more widely disbursed spatially, though most of the major facilities are located within the Brisbane City suburbs of Acacia Ridge, Archerfield and Rocklea.

Food supplies seem to come from two sources. Dry goods are trucked in from the major depots in Sydney and Melbourne to the State distribution centres in the Rocklea/Archerfield area. Fresh fruit and vegetables are distributed from a centre close by in Richlands. Woolworth's Richlands centre itself is supplied by local growers, either through the Lockyer Valley and Toowoomba, or further north for trans-seasonal produce. The Brisbane Markets at Rocklea are not so much a distribution point for growers but a market distribution point for known customers. Coles-Myer, for example, operate from Rocklea, as well as distributing produce from their own farms. Franklins, by contrast, buy from the Rocklea markets and operate a warehouse for distribution at that locality.

South-East Queensland has a reliable and varied supply of fresh meat. The government Q Meat abattoirs in Townsville, Bundaberg, Ipswich and Brisbane ensure that the sources of supply are widely dispersed. Australian Country Choice, which operates in partnership with Q Meats at the Cannon Hill abattoirs, supplies boneless product and carcasses to both Coles and Woolworths. Most of the supply for Cannon Hill is trucked in from feedlots in the west or north. Seasonal interstate supply is common, for instance, chilled lamb carcass is trucked in directly from Victoria in one day. Local butchers predominantly buy cartons of processed (i.e. boneless) meats. It is unlikely that there would be a shortage of supply of fresh meat. According to industry sources, in the event of no refrigeration due to power cuts, sufficient supply could be maintained as long as the roads were open for chiller trucks.

Dairy produce is increasingly being trucked in as processed milk product from interstate. National Foods Ltd, (Pura-brand milk products) for instance, operates chiller trucks directly from factories at Morwell in Victoria to the shelves of the major retailers such as Woolworths and Coles. Milk is tankered in to the Pauls facility at Crestmead for processing before distribution. Dairy Farmers process and package the bulk of their milk at their factory at Booval. Their factories in Caboolture and Toowoomba now serve mainly as points of accumulation for producers in the Caboolture-Sunshine Coast and Darling Downs areas respectively.

Bread supply throughout South-East Queensland is dominated by two major players, Goodman Fielder (Buttercup breads, Allied Flour and Alliance Flour) and George Weston Foods (Tip Top breads). Buttercup have three bakeries within the South-East Queensland study area - at Carina, Darra and Andrews. There are two Tip Top two bakeries – at Nundah and Slacks Creek. These major bakeries truck directly to the larger distributors such as Woolworths, Franklins and Coles. Flour and pre-mix baking products are produced by both Allied and Alliance mills. The Allied mill is in Tennyson, whilst Alliance operates mills at Archerfield and Albion. Apart from these major bakeries there is a growing range of small-scale franchised suburban bakeries such as Bakers Delight and Brumby's. These bakers utilise pre-prepared bread mixes to bake a range of 'specialty' breads on-site.

Brisbane is also home to several national food manufacturing or processing facilities. Most notable of these are the Arnott's Biscuit factory at Virginia; the Golden Circle cannery at Northgate and the Sanitarium Health Foods factory at Moorooka.

The centralized nature of the food supply and distribution process can best be illustrated by looking at the Woolworths (the largest retailer in the region) distribution arrangements.

Woolworths receives most of their dry goods by rail and road from Sydney and Melbourne, however, transport is the responsibility of the suppliers and details of routes and volumes were unavailable. Woolworths maintain three distribution locations, which are, in the order of importance:

- their Acacia Ridge depot holds dry goods and groceries and supplies approximately 90% to Woolworths stores throughout Queensland and Northern NSW as far south as Grafton. On average, stocks held at this location should last around 2.5 weeks of normal consumption. This centre is supplemented by the smaller grocery distribution centre at Oxley. Supplies are delivered 6 days per week.
- their Eagle Farm cold store holds chilled and frozen goods and has the same distribution area as that of the Acacia Ridge depot. Supplies are brought in each day apart from Sunday.
- their Richlands fresh fruit and vegetable facility holds, on average, 1 to 2 days of stock at normal levels of consumption.

Woolworths retail stores not only receive goods from these depots but also from the suppliers directly. Dairy product, usually from southern states, comes in by truck to the individual stores. Meat is delivered from the Brismeat processing factory at Churchill and Woolmeat, at Underwood. Their smallgoods processing centre (Chisholm Manufacturing) at Wacol produces predominantly pork smallgoods.

There are 41 Woolworths stores throughout South-East Queensland providing dry, dairy and fresh foods. These stores tend to hold the same level of stocks as the distribution centres, however, fast moving stocks would run out at 1-2 days, without resupply, at the store level.

The other major distributors, including Coles, Bi-Lo (a Coles subsidiary), Australian Independent Wholesalers, Davids and Franklins each operate comparable, if smaller, networks of supply and distribution, mainly from facilities in Acacia Ridge, Loganlea, Morningside, Richlands and Rocklea. Their sources of supply and the levels of stock held are also similar to that described for Woolworths.

Perhaps the most notable feature about the food distribution system in South-East Queensland is the very heavy reliance on frequent and regular re-supply by road and rail from distant suppliers. It is evident that all distributors, both large and small, carry the minimum amount of stock on hand to satisfy normal levels of consumption because of the economies involved and the efficiency of the system under normal conditions. This economic regime is also evident in the vast majority of households where only basic stocks of food are typically held. This is quite reasonable under normal conditions, however, it would represent a significant contribution to vulnerability when disaster strikes. What could be termed ‘convenience store complacency’ represents a significant, if hidden threat.

The region is serviced by a very large number of outlets for key commodities such as food, clothing and other personal requisites. The largest complexes include:

- in Caboolture – Morayfield Plaza, the Caboolture Park Shopping Centre, Bribie Shopping Village (Bongaree), Burpengary Plaza and Deception Bay Plaza;
- in Pine Rivers – Westfield Plaza at Strathpine, however, smaller suburban centres are established in Arana Hills, Everton Hills, Kallangur, Lawnton, Petrie and Samford Village;
- in Redcliffe – Peninsula Fair (Kippa-Ring) and the Margate Shopping Centre

- in Brisbane - Carindale Shopping Centre, Garden City (Upper Mount Gravatt), Pick N Pay Hypermarket (Carseldine), the Queen Street Mall precinct (Brisbane City), Sunnybank Hills Shoppingtown, Toowong Village and the Westfield Shoppingtowns at Chermside, Indooroopilly and Toombul
- in Ipswich – Booval Fair, Brassall Shopping Village, Centrepoint Boulevard (Ipswich), Ipswich City Heart, St Ives Shopping Centre and Redbank Plaza;
- in Redland – Capalaba Central, Cleveland Town Centre, Capalaba Park, Koala Park (Victoria Point) and Birkdale;
- in Logan - Logan Hyperdome (Shailer Park), Marsden Park, Springwood Mall, Waterford Plaza, Woodridge Park and Woodridge Plaza;
- in Gold Coast - Eagleby Shopping Plaza, Harbourtown Shopping Centre (Biggera Waters), Helensvale Plaza, Runaway Bay Shopping Village, Australia Fair (Southport), Southport Park, Nerang River Plaza, Robina Town Centre, Pacific Fair (Broadbeach Waters), Burleigh Shopping Town (Burleigh Heads), The Pines Shopping Centre (Elanora) and Showcase on the Beach (Coolangatta).

A hierarchy of stores, ranging from extremely large regional complexes down to the traditional 'corner store' is evident. Virtually every suburb has its own retail outlets, be they in smaller integrated drive-in complexes, in strip developments, or as free standing establishments.

Security

In the context of our risk assessment methodology, 'security' relates to aspects of community health, wealth and the services and structures that provide for public safety. In addition to identifying the physical elements at risk that relate to these aspects, we have identified a range of factors (health, wealth, socio-economic disadvantage and protection) that will provide relative measures of community vulnerability and their distribution across Brisbane.

Health: South-East Queensland is very well served by its hospitals and other medical services. There are 14 major public hospitals in the region, four of which have multiple facilities. They are, from north to south:

- Caboolture Hospital
- Redcliffe Hospital
- The Prince Charles (Prince Charles and Bald Hills Acute) Hospital (Chermside)
- Royal Brisbane (Keperra, Queensland Radium Institute and Royal Brisbane) Hospital (Herston)
- Royal Children's (Royal Children's and Riverton Centre) Hospital (Herston)
- Royal Women's Hospital (Herston)
- Mater Misericordiae (Adult Public, Children's Public and Mother's Public) Hospital (South Brisbane)
- Princess Alexandra (Woolloongabba)
- The QE II Jubilee Hospital (Coopers Plains)
- Ipswich Hospital
- Redland Hospital (Cleveland)
- Logan Hospital (Meadowbrook)
- Gold Coast Hospital (Southport)
- St Vincents Hospital (Robina)

In addition to these public hospital facilities, there are 19 major licensed private hospitals. They are:

- Caboolture Private Hospital
- Riverview Private Hospital (Strathpine)
- Peninsula Private Hospital (Redcliffe)
- North West Private Hospital (Everton Park)
- Holy Spirit Hospital (Brisbane)
- St Andrew's War Memorial Hospital (Brisbane)
- Mater Misericordiae Children's Private Hospital (South Brisbane)
- Mater Misericordiae Mother's Private Hospital (South Brisbane)
- Mater Misericordiae Private Hospital (South Brisbane)
- Greenslopes Private Hospital (Greenslopes)
- The Sunnybank Private Hospital (Sunnybank)
- The Wesley Turrawan Hospital (Clayfield)
- The Wesley Hospital (Auchenflower)
- Saint Andrews Private Hospital (Ipswich)
- Mater Private Hospital (Cleveland)
- Logan Private Hospital (Meadowbrook)
- Allamanda Private Hospital (Southport)
- John Flynn Hospital (Tugun)
- Pindara Private (Benowa)

There is also a military hospital located within the Gallipoli Barracks at Enoggera. The distribution of hospitals across the region is shown in Figure 3.9.

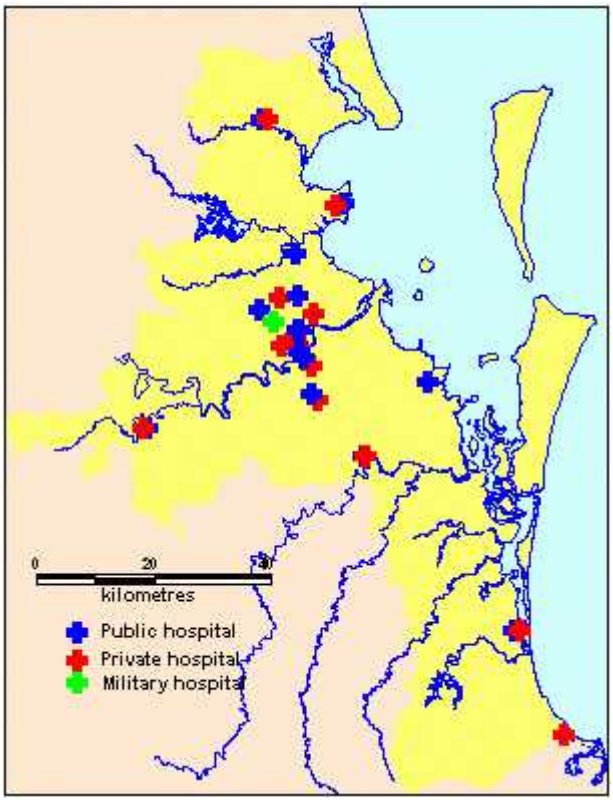

Figure 3.9 South-East Queensland hospitals

There are several hundred smaller private hospitals, day surgeries, medical centres, clinics, aged care hostels, nursing homes and hospices are established throughout region. In addition, there is a

comprehensive range of specialist medical services, such as medical imaging and pathology, as well as physiotherapy, dental, podiatry, chiropractic, optometry and pharmacist services available. Many of these specialist services are concentrated at or close to the major hospitals, or in enclaves such as Wickham Terrace in Brisbane. A wide range of community health or support services, such as Blue Nurses and Meals on Wheels, are also available in most areas.

The age make-up of the population is a reasonable indicator of the health vulnerability of the community, with the very young (under 5 years) and the elderly (over 65) considered to be the most vulnerable groups. The relative distribution of these age groups is shown in Figure 3.10 and Figure 3.11 respectively.

The average percentage of the population per CCD that is under 5 years across the region is 6.4%. The highest percentages are in neighbourhoods of Oppossum Creek (50.0%), Banyo (23.1%) and Lytton (22.0%) each of which have populations of less than 50, so their under 5 years statistics are somewhat exaggerated. The higher values for 'normal' sized neighbourhoods (more than 15% of the total population under 5 years) are located in the outer suburbs – the so-called 'nappy valleys', especially in Logan City, Caboolture Shire, Pine Rivers Shire and Ipswich City.

The average percentage of people per CCD who are over 65 across the region is 13.0%. The spatial distribution is like a mirror image of the under 5 years distribution, i.e. 'God's waiting rooms' rather than 'nappy valleys'. The highest values coincide with CCD that contain the larger retirement villages and aged care institutions such as nursing homes. There are 20 CCDs in which more than 50% of the population is over 65, with the greatest percentage being 93.8% in an Ashmore neighbourhood. They are very much concentrated in Gold Coast (9 of the 20), Brisbane (8/20) and Caboolture (2/20).

We have no specific information on the numbers or distribution of the particularly vulnerable segments of the population with specific physical or mental disabilities, or of their carers.

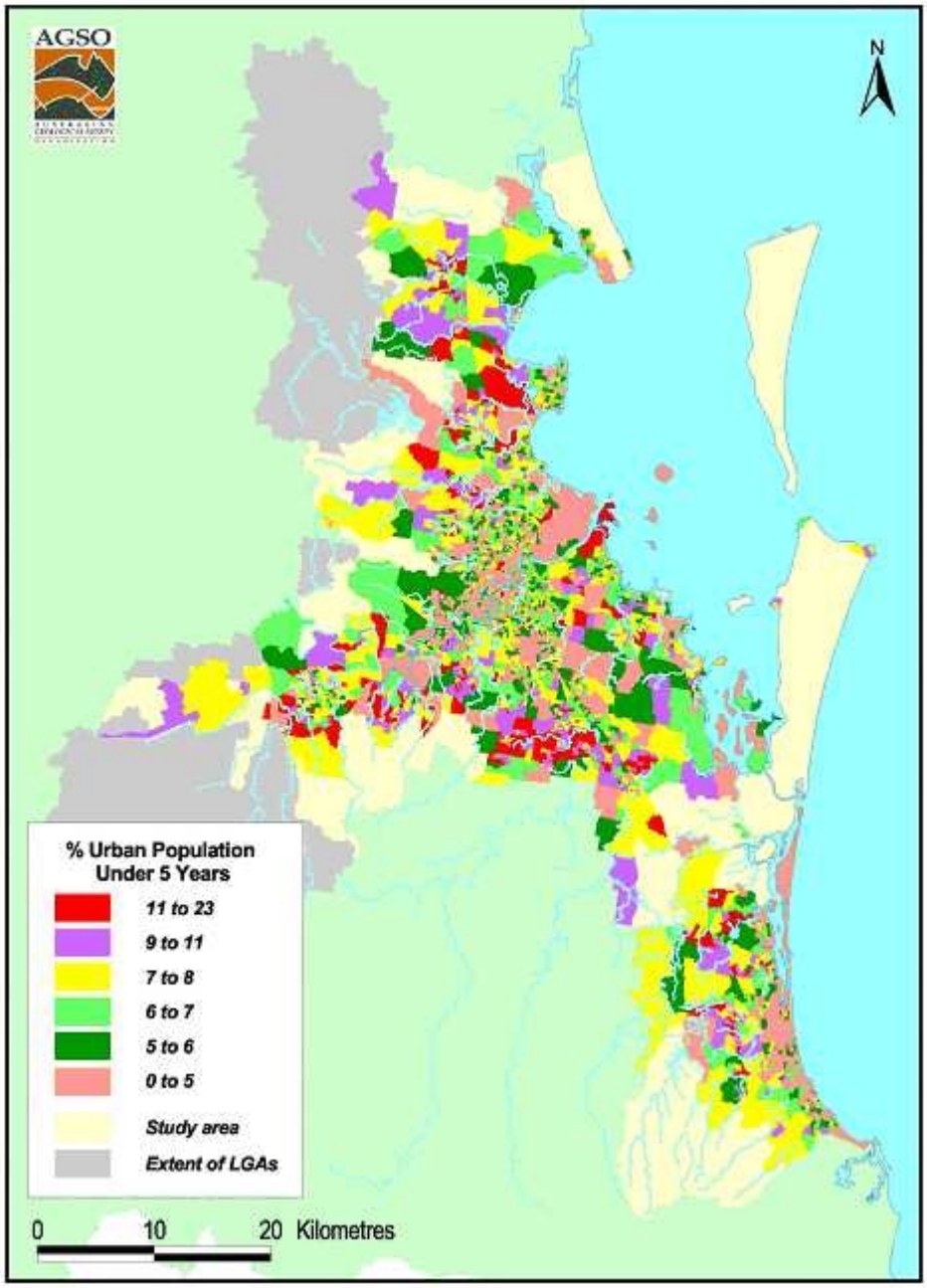

Figure 3. 10 South-East Queensland urban population under 5 years of age (ABS, 1998a data)

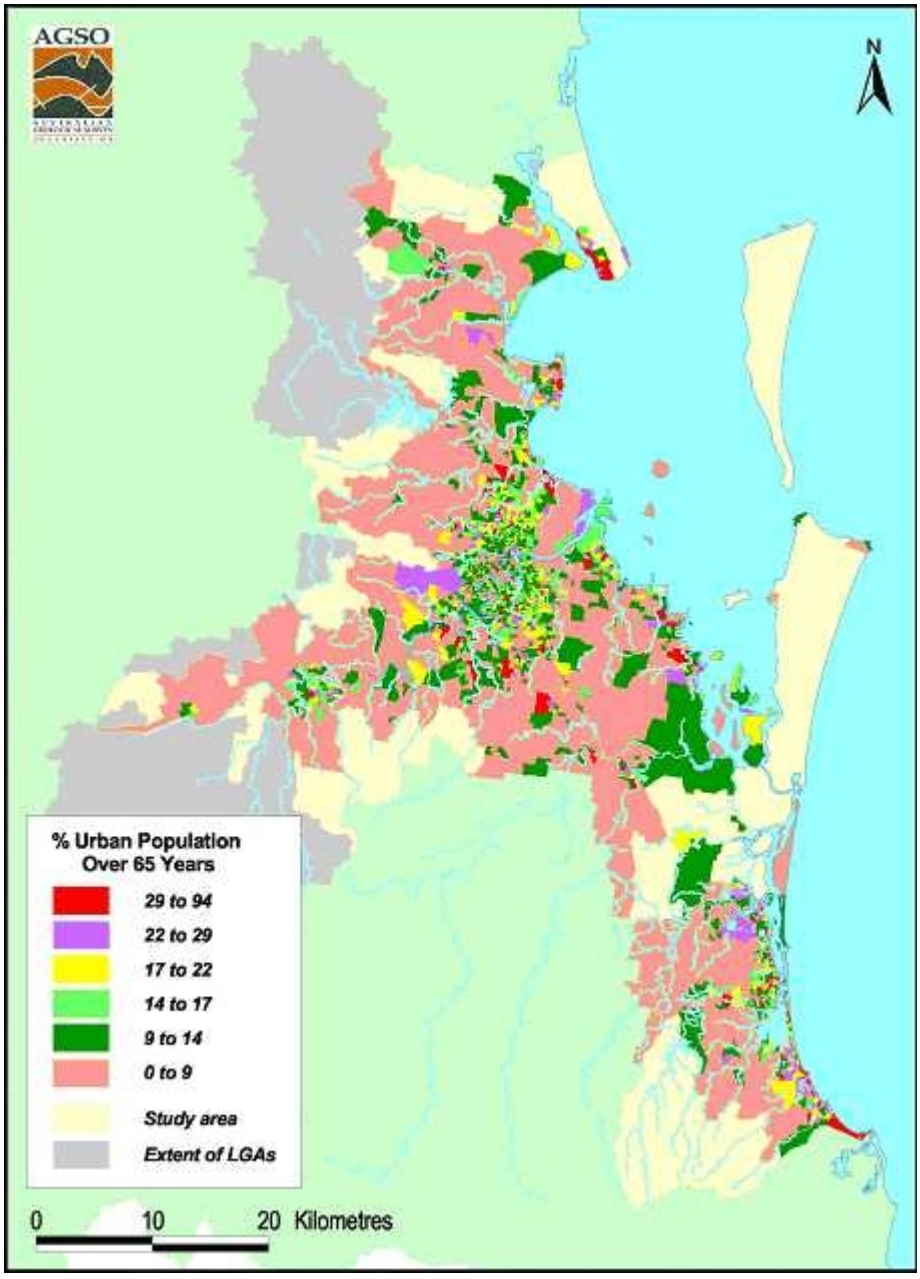

Figure 3. 11 South-East Queensland urban population over 65 years of age (ABS, 1998a data)

Wealth: The economy of South-East Queensland is extremely diverse, with strong input from retail, industry, services, manufacturing, property and the public sectors. The 1996 makeup for the study area are provided in Table 3.4.

Table 3. 4 South-East Queensland employment by industry (Source: ABS, 1998a)

INDUSTRY GROUP	PERSONS EMPLOYED	INDUSTRY PERCENT
Agriculture, forestry and fishing	7445	0.9
Mining	3418	0.4
Manufacturing	90 477	11.5
Electricity, gas and water supply	4212	0.5
Construction	56 096	7.1

INDUSTRY GROUP	PERSONS EMPLOYED	INDUSTRY PERCENT
Wholesale trade	49 203	6.3
Retail trade	113 836	14.4
Accommodation, cafes and restaurants	40 081	5.1
Transport and storage	37 622	4.8
Communication services	15 780	2.0
Finance and insurance	29 338	3.7
Property and business services	89 904	11.4
Government administration and defence	38 559	4.9
Education	56 246	7.2
Health and community services	76 810	9.8
Cultural and recreational services	21 608	2.7
Personal and other services	31 049	3.9
Non-classifiable economic units	11 361	1.4
Not stated	13 417	1.7
Total persons employed	786 462	

The distribution of the commercial activity in South-East Queensland is concentrated strongly in a band that more-or-less straddles the Brisbane River, and in the commercial/industrial enclaves of Caboolture, Brendale, Surfers Paradise, Broadbeach, Andrews and Coolangatta. There are 24 CCD across the region in which all of the properties have a commercial purpose, all of them in the Surfers Paradise-Broadbeach area. The distribution is shown in Figure 3.12.

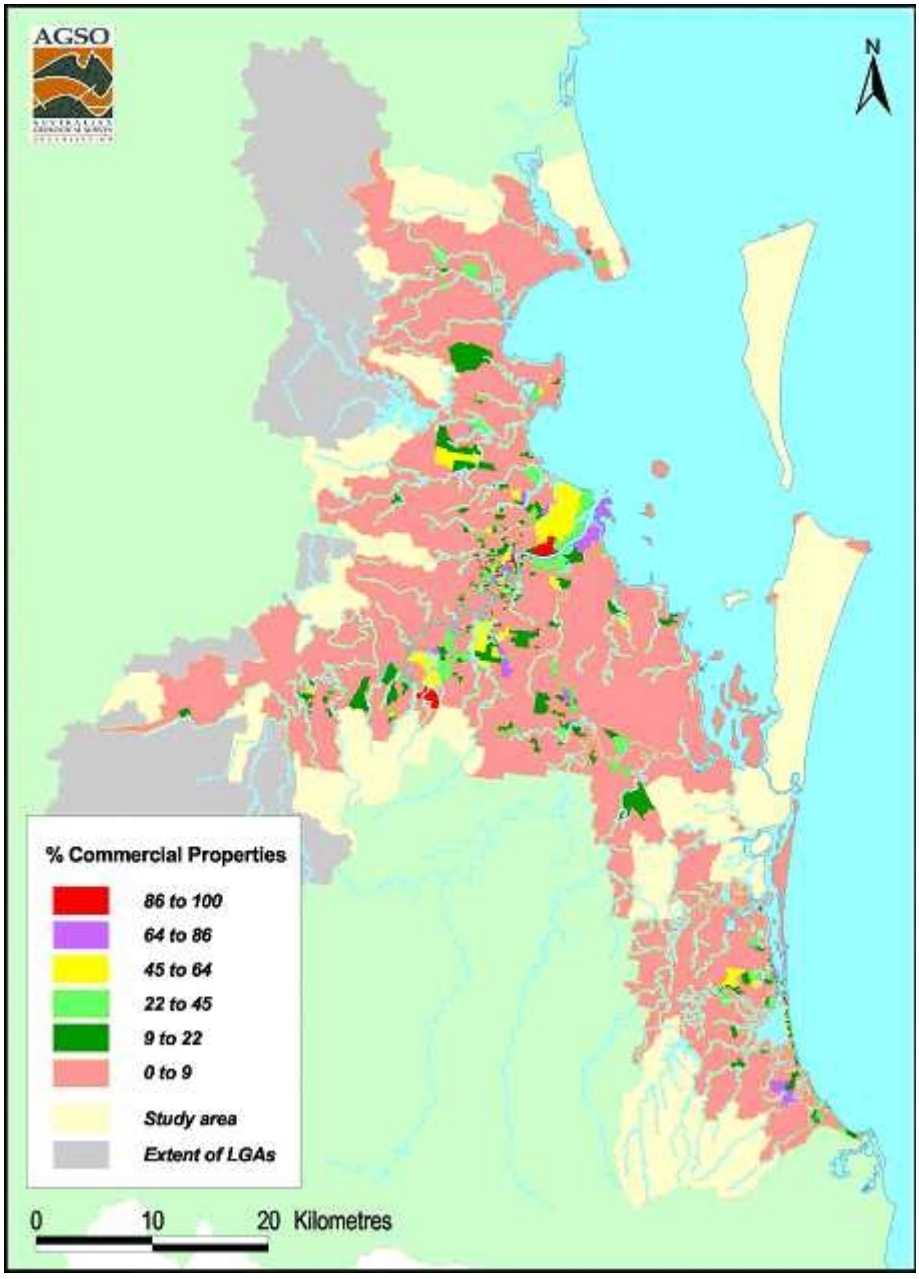

Figure 3. 12 South-East Queensland commercial and industrial facility concentrations

The Brisbane CBD is a particularly significant commercial enclave given that it has a substantial concentration of key commercial operations including the Brisbane Stock Exchange, the headquarters of the major insurance companies and banks and the registered offices of many thousands of companies (with the accounting firms that inhabit the many high rise towers in the city). It also houses major administrative functions including the State Parliament, the headquarters of many State Government departments and agencies and the regional offices of several Commonwealth Government departments. These enterprises exercise a level of control that extends well beyond the boundaries of Brisbane City.

The spatial distribution of 'wealth' within the region can also be gauged from indicators such as unemployment and rental accommodation. Such indicators are relevant to risk calculations because the less wealthy will have greater difficulty recovering from a disaster impact and are more likely to have no, or inadequate, insurance protection, thus exacerbating their losses.

At the 1996 census the unemployment rate across the study area averaged 10.14%, however, there are some 16 CCD in which the 1996 unemployment levels was in excess of 33%. The highest levels of unemployment in 1996 were in South Brisbane, Leichhardt and Goodna where the rates were over 40%. By contrast, the areas generally north of the Brisbane River and the rural areas to the west, had relatively low levels of unemployment. There were 24 CCD in which there was zero unemployment. Amongst the more significant of these were the Gallipoli Barracks at Enoggera and the Amberley RAAF Base, though neighbourhoods in inner Brisbane suburbs such as Fortitude Valley also feature. The distribution is shown in Figure 3.13.

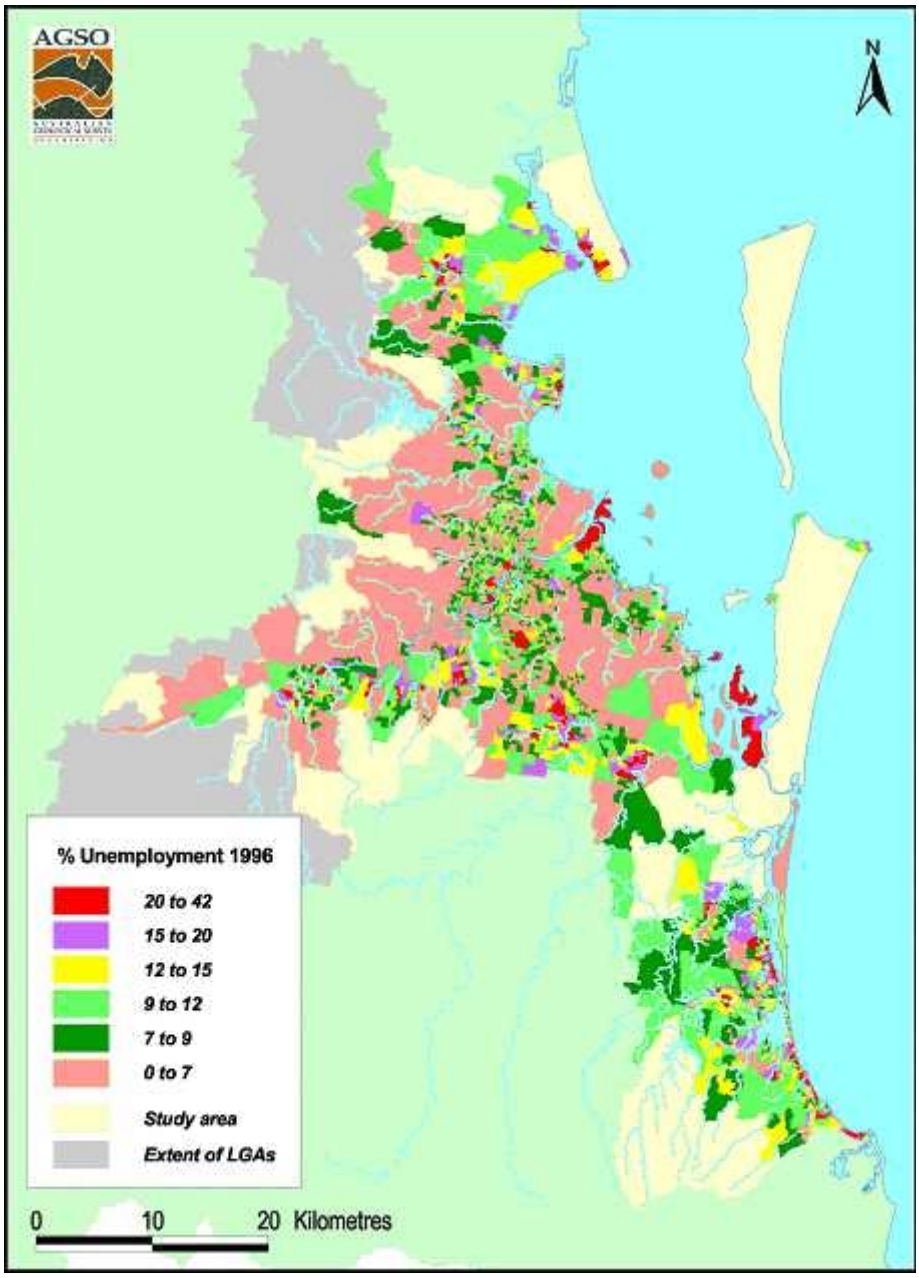

Figure 3. 13 South-East Queensland 1996 urban unemployment rate (ABS, 1998a data)

Across the region, the spatial distribution of the unemployment rate only correlates closely with the proportion of households that are in rented accommodation in the east-west Ipswich-Brisbane-Logan corridor. In other areas, most notably in the Toorbul-Donnybrook-Bribie Island area flanking Pumicestone Passage, where low-cost accommodation such as long-stay caravan parks are available, and on the Bay Islands such as Russell Island, the correlation is somewhat negative. There are 24 neighbourhoods where more than 70% of households are in rental accommodation, three of which