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Profile of Leonora:
A sustainability case study

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Abstract

This paper presents the profile of Leonora town, located in Western Australia. It discusses Leonora's population, including main demographic characteristics, and economy. It draws on a range of secondary sources, particularly data available from Australian Bureau of Statistics, and it supplements this with insights from several visits to Leonora and its environs over the past two years. The paper also discusses some issues in regards to the sustainability of the town and concludes with some comments in regards to implications for adaptability and sustainable futures

Profile of Leonora: A sustainability case study

General characteristics

Leonora is a township located in the Goldfields-Esperance region of Western Australia. It sits within the Western Desert, a large area of desert in the west of Australia, comprising the Gibson Desert, Great Sandy Desert and Little Sandy Desert. It is situated 832 km north-east of Perth and 230 km north of the city of Kalgoorlie-Boulder. Together with the town of Leinster, the town of Leonora forms part of the Shire of Leonora which covers a land area of 31 743 sq km (Shire of Leonora 2008). The town itself consists of around 350 houses, 100 industrial sites, three mining accommodation camps and a caravan park (Shire of Leonora 2008). Other general characteristics of the area are shown in Table 1.

Table 1: General characteristics, Leonora

Established	1898
Postcode	6438
Distance to Perth	832 km
Total population 2006	2326
Aboriginal population 2006	155
% Aboriginal population 2006	6.7%
Industry	Mining, exploration, pastoral, services and tourism
Average weekly individual income 2006	\$1291
Average weekly household income 2006	\$1378
Average weekly family income 2006	\$1795
Unemployment rate 2006	1.9%

Source: Compiled from Shire of Leonora 2008

Leonora lies on the joint boundary of the Murchison and Great Victorian Desert IBRA (Interim Biogeographic Regionalisation for Australia) zones (DEWHA 2007) with latitude of 28.88 °S and longitude of 121.33 °E (Bureau of Meteorology 2008). It has an elevation of 376 metres above sea level. The international Koppen climate classification system classifies the climate in Leonora as BWh – Hot Desert. It shares similar climatic patterns with the central desert town of Alice Springs. Its monthly temperature ranges from 6.1°C to 37.0°C with an average annual maximum temperature of 27.9°C and average annual minimum temperature of 13.9°C (Figure 1). Being extremely arid, its monthly rainfall ranges from 9 mm to 30 mm (Figure 2), with an average annual rainfall of 234.3 mm (Bureau of Meteorology 2008).

The foundation of the township was first initiated by John Forrest and his explorer group during the search of the lost Leichardt Expedition. In 1869 they camped on a hillside which they named Mount Leonora (see Figure 3) and this consequently became the name of the town. The discovery of gold in late eighteenth century lead to the establishment of the twin towns of Leonora and Gwalia (today part of Leonora) as a large mining service centre in the North Eastern Goldfields (Shire of Leonora 2007). Leonora was declared a town site on April 15, 1898 and was eventually gazetted as a municipality on August 21, 1900 (Shire of Leonora 2008).

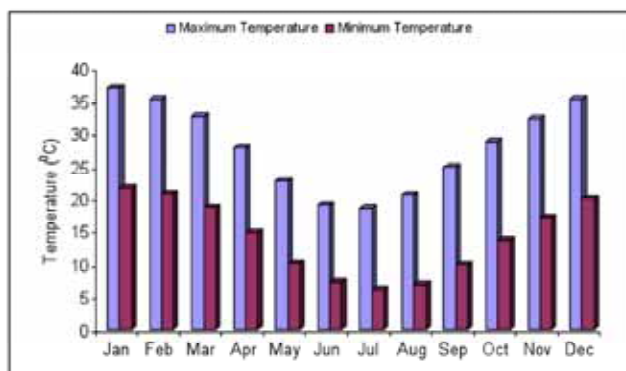


Figure 1: Mean monthly temperature Leonora

Source: Bureau of Meteorology 2008

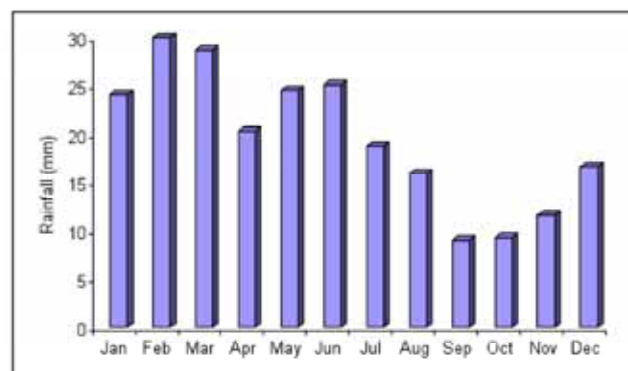


Figure 2: Mean monthly rainfall Leonora

Source: Bureau of Meteorology 2008



Figure 3: Mount Leonora

Photo: Dora Marinova 2008



Figure 4: Leonora town site

Photo: Guy Singleton 2007

Gold prospectors were in the area as early as 1893, and from 1895 Leonora developed rapidly into a mining centre due to the dozens of gold mines operating in the region (see Figure 4). Of these mines, the Sons of Gwalia mine was the most productive, generating significant international attention (Strickland 2003). The town's first mayor William Snell (1900–1905) was successful in establishing public service facilities for Leonora residents, providing full street lighting, water supply, public health and educational services and much more (Strickland 2003). A railway from Kalgoorlie (236 km) opened in 1902. The town was not only an important service centre in the region, it has also pioneered Aboriginal employment in the region by appointing the first Aboriginal Matron in its hospital in 1958 (Strickland 2003).

The town's population declined markedly in 1966 (to 338 people, down from 970 in 1961) due to the closure of the Sons of Gwalia mine three years prior. While the closure effectively shut the town of Gwalia (today classified as part of Leonora), Leonora has survived as a result of the alternative economy based on district administration, the railhead and the town's function as a supply centre (Shire of Leonora 2007). In 1976 the neighbouring town of Leinster was established originally as a company town supporting the nickel mine of the Agnew Gold Mining Company. Commercial production from nickel deposits commenced in 1979 and the mineral discovery of lead, zinc and silver deposits at Teutonic Bore (Jaques et al. 2005) lead to production operations in 1981. The rise of prices for gold in 1980 saw a resurgence of interest in gold mining in the Leonora area (including the re-assessments of gold in the old Harbour Lights mine, the re-opening of the Sons of Gwalia mine and re-development of the Tower Hill mine). Gold and nickel continue to be the main resources in the area.

Leonora and Leinster are now two separate townships within the Leonora shire. The length of the shire's sealed roads (363 km) is less than a third the length of its unsealed roads (which is 1212 km). In 2006 it had just above \$2 million total rates levied and around \$4.5 million of total revenue. There are 19 employers and the main industries in the town are mining, exploration and pastoralism. Leonora Shire is a participant in local government initiatives, such as Roadwise, Tidy Towns and Linking Councils and Communities (LCC), and is an Esperance–Eastern Goldfields zone member.



Figure 5: Main street, Leonora

Photo: Guy Singleton 2007

The significant fluctuations in world mineral markets continue to influence Leonora's population and economy. The shire's population fluctuates in numbers as mining operations close or re-open but since 1996 has been declining (see Table 2).

Table 2: Population of Leonora Shire, Western Australia

Year	Leonora (Shire)	Gwalia
1901	314	884
1911	1154	114
1921	539	562
1933	456	784
1947	452	692
1961	970*	
1966	338*	
1971	594*	
1981	1900*	
1985	2400*	
1987	2259*	
1996	3511*	
2001	2950*	
2006	2341*	

Source: Compiled from Shire of Leonora 2008 and ABS 2006a

* = Combined Leonora, Gwalia and Leinster residents.

In 2005 the Sons of Gwalia mine was purchased by St Barbara Ltd which re-opened the mine as an underground operation (see Figure 6). This saw an increase in economic and social activity within the town, as several of the town's mine camps re-opened and an increase in service demand was experienced (St Barbara Ltd 2007). Numerous mining explorations around the Leonora town site over recent years indicate further mining expansion locally for some time to come (see Figure 7).



Figure 6: St Barbara gold mine

Photo: Dora Marinova 2009



Figure 7: Active drilling in Leonora

Photo: Dora Marinova 2008

Despite this, population numbers remain low due to the predominant fly-in/fly-out operations by the mining industry. In fact, during the population census night in August 2006, only 38% of the people present and counted in Leonora were usual residents in the town (see Table 3); the majority of the remainder were fly-in/fly-out workers.

Table 3: Leonora population: Present and at usual residence, August 2006

	Present	Usual residence	Usual as % of present
Total	1412	532	37.7
Aboriginal	155	123	79.4

Source: ABS 2006a

Leonora's 2006 population (at the time of the last Australian Census) was 1412 persons, 60% of whom were males and 40% females (see Table 4). The dependency ratio was 38 per 100 working age persons; however, it differed greatly between Aboriginal and non-Aboriginal people. The non-Aboriginal dependency ratio was 34, and was significantly lower than the national average of 48 (AIHW 2009) due to the higher number of working age people represented in the labour force for the area. The Aboriginal dependency ratio on the other hand was 85, significantly higher than the national average of 68 (AIHW 2009). The dependency ratio for young Aboriginal people was 77, compared with the national figure of 67 for young Aboriginal people (AIHW 2009). These figures indicate that there are relatively less working-age Aboriginal people in Leonora, and significantly more older and relatively more younger Aboriginal people in the town. There are two contributing trends for this acting in the same direction. The first relates to employment opportunities outside Leonora and the attractiveness of other locations, such as Kalgoorlie-Boulder and Perth. The second is the higher share of older people within Leonora's Aboriginal population. This dependency ratio for older Aboriginal people of 8 per 100 working-age people is a positive sign compared with the national average of only 1 and shows a relatively healthier Aboriginal population.

Table 4: Leonora population, 2006

People	1412
Male	831
Female	581
Aboriginal persons	155
Indigenous status not stated	80
0–4 years	135
5–14 years	206
15–24 years	159
25–54 years	743
55–64 years	121
65 years and over	48

Source: ABS 2006b

The median age of the township population is 32, with the Aboriginal population being much younger with a median age of 17. The average household size for Aboriginal households is 3.4, while that for non-Aboriginal households is 2.6, and the total number of families in Leonora is 390 (279 family households and 111 non-family households).

The population pyramids for 2006 for Aboriginal and Torres Strait Islander and non-Aboriginal and non-Torres Strait Islander populations (see Figures 8, 9, 10 and 11) indicate some significant differences. Fertility levels for Aboriginal people are higher than those of the total population with the age group of under 10 being the most numerous in Leonora. Mortality levels appear to be much higher among Aboriginal people overall and particularly for men, with no males older than 55. Also

because of the small size of Leonora’s Aboriginal population (155 in total), some age groups, such as 25–29 and 40–44 for males and 30–34 and 55–59 for females, are not represented at all. Despite the small numbers, Leonora’s Aboriginal pyramid shows young people and people of working age being absent from the town, most likely in search of educational and employment opportunities elsewhere. By comparison, while still displaying high fertility rates, the 2006 WA Aboriginal and Torres Strait Islander population pyramid is more balanced and symmetrical.

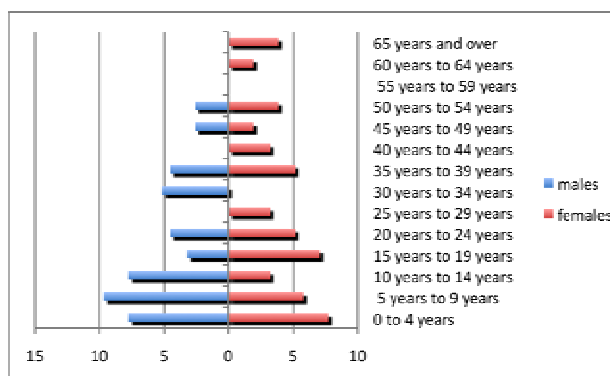


Figure 8: Aboriginal population pyramid, Leonora 2006

Source: ABS 2006b

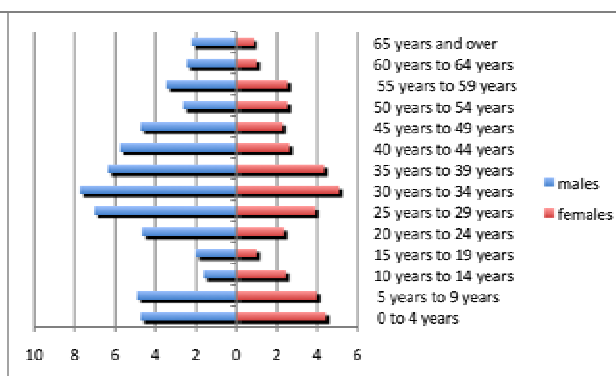


Figure 9: Non-Aboriginal population pyramid, Leonora 2006

Source: ABS 2006b

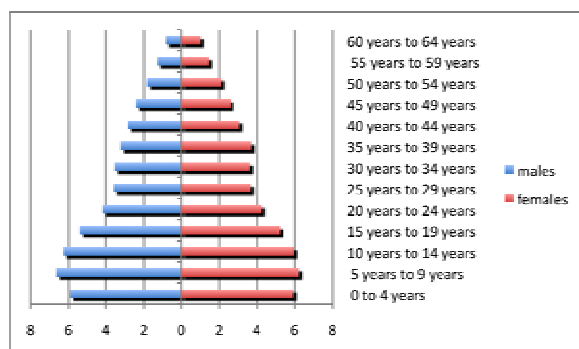


Figure 10: Aboriginal population pyramid, WA 2006

Source: ABS 2006b

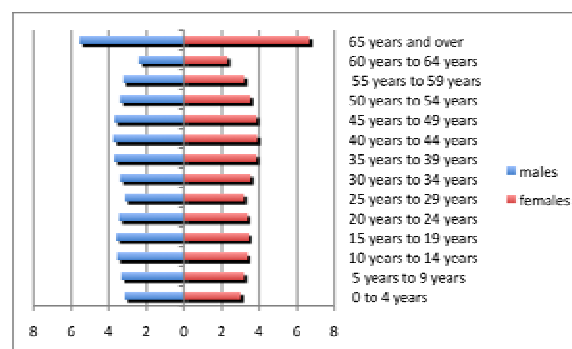


Figure 11: Non-Aboriginal and non-Torres Strait Islander population pyramid, WA 2006

Source: ABS 2006b

Leonora’s non-Aboriginal population pyramid is drastically different from both the Aboriginal pyramid and that of the State. It is highly skewed towards males, who represent more than 60% of Leonora’s population and particularly there are more than 1.5 times working-age males than females. The explanation for this situation is the dominance of men employed in the mining and exploration sector, including fly-in/fly-out workers. Another prominent feature of Leonora’s non-Aboriginal population is the small presence of young adults, namely between 10 and 19 years. This is largely due to the expanding fly-in/fly-out practices, which are not attractive to families with teenage children. Compared with WA State, there are less older (above 65) people in Leonora, making the town a place for work but not for retirement.

Separate population projections for the town of Leonora are not available; however, the population numbers in the Leonora shire are projected to grow slightly (see Table 5) at the average rate of 1% per

year (WAPC 2005). The population structure, however, is expected to age, with the 45–55 age bracket becoming the largest by 2021 (these are the same people who were 30–40 in 2006, and they were the largest age bracket then). As these people continue to age, Leonora’s population will start to decline after 2021.

Table 5: Historical estimated resident and forecast population

	1991	1996	2001	2006	2011	2016	2021
Leonora Shire	2500	2800	2000	2000	2100	2200	2300
% change	100	112	71	100	105	105	105

Source: WAPC 2005

Selected demographic characteristics

Education

A district high school which starts from kindergarten and pre-primary level is located in Leonora. It has approximately 160 students. The enrolment numbers in 2008 were between 9 and 18 in each class, there being 18 students enrolled in Year 5, and 9 students in each of the Years 3, 9 and 10. The number of students who continue to the senior years is very low, with only 4 students attending Year 11 and 4 in Year 12. A lot of other students have either left school or left with their families in search of better opportunities to study in the bigger metropolitan areas.

The school’s facilities are excellent and include a playground and specialised equipment, such as telescopes, environmental centre and regular science workshops. Regular football competitions and other events are being held on its grounds. Leonora District High School served as a case study for teaching and learning at the Department for Educational and Training (Venville et al. 1999). Its curriculum adopts an integrated approach aimed at promoting cultural, social and environmental sustainability by introducing a theme plan which discussed differences, relationships, resources, environment, citizenship, earth, media, communication and popular culture. Due to the partnerships developed on promoting health and the employment of an Aboriginal health worker, an improvement in ear health has been observed among Leonora’s school children¹ (Department of Indigenous Affairs 2007).

A small step towards improvement of collaboration between the mining industry and the school was the BHP Billiton West Pilot Program aimed at students gaining experience at ground level of jobs associated with the mining industry. Despite this positive attempt at collaboration, the interaction between the school and the mining industry remains limited and fragmented. The training facilities which could provide good training grounds for students are located over 60 kilometres away and access to them is normally strictly prohibited. There is a need for extension of similar collaboration projects which would assist students in their transition from the school to the workplace.

Almost all residents 15 years and over had some form of schooling, albeit at varying levels. In 2006, the highest level of education achieved (by 37% of those who were 15 years and over) was Year 12 (see Figure 12). The educational level achieved varied by Aboriginal status (see Figure 13) with less Aboriginal residents completing Year 11 and 12.

¹ The Leonora School Aboriginal health worker was a finalist in the WA inaugural 2007 Health Awards: Aboriginal health work.

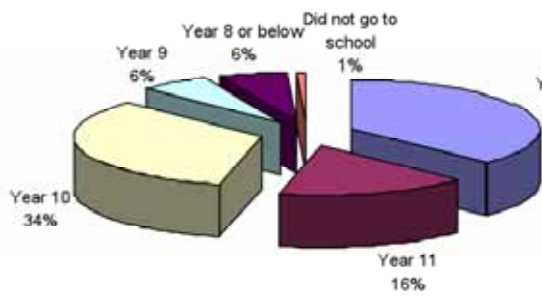


Figure 12: Highest year of school completed in Leonora, 2006

Source: ABS 2006b

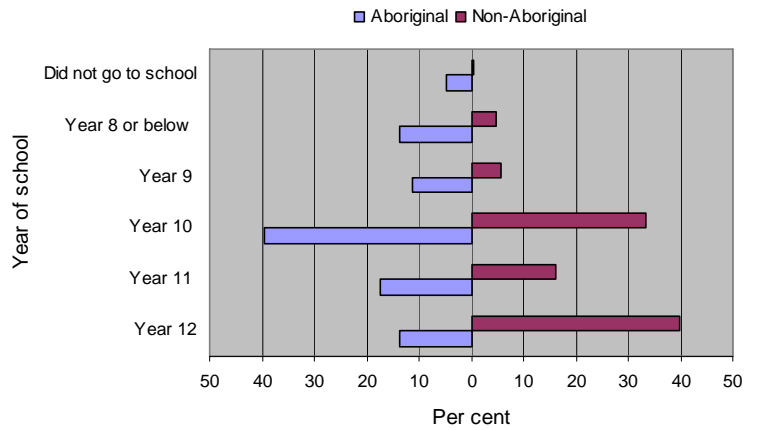


Figure 13: Highest year of school completed by Aboriginal status in Leonora, 2006

Source: ABS 2006b

Religion

In 2006, more than half of the residents (53%) were Christians, and almost a third (30%) had no religion (Figure 14). Others were affiliated with Islam, Buddhism and other religious groups.

There were slightly more non-Aboriginal Christians (56%) than Aboriginal Christians (53%). More than a third of the Aboriginal people (35%) had no religion compared with 30% of the non-Aboriginal people (Figure 15).

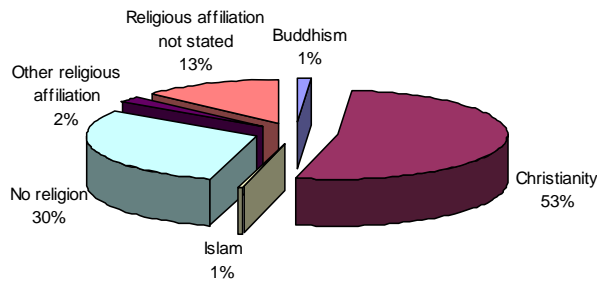


Figure 14: Religious affiliations in Leonora, 2006

Source: ABS 2006b

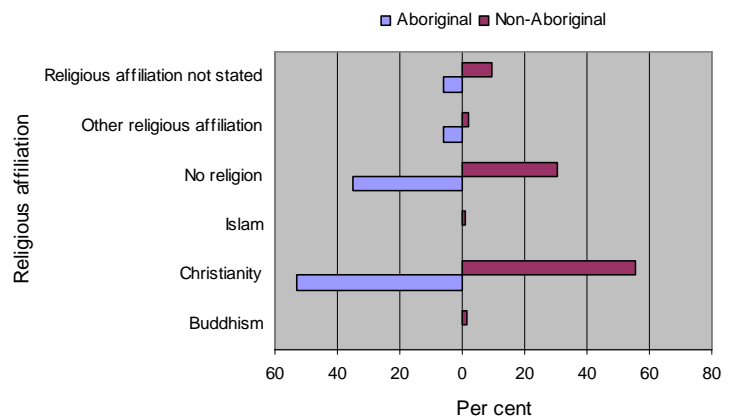


Figure 15: Religious affiliation by Aboriginal status in Leonora, 2006

Source: ABS 2006b

The denominations of the Christian religion represented in Leonora include Catholic (38% of residents), Anglican (35%) and the smaller numbers of Baptist, Uniting Church, Lutheran, Churches of Christ, Presbyterian and Reformed groups.

The data on religious affiliation for Aboriginal people are only indicative. Firstly, answering the question about religion was optional in the 2006 Census and Australia-wide there was a high percentage of Aboriginal and Torres Strait Islander people who did not provide an answer (ABS 2006b). Secondly, Australian Aboriginal Traditional Religion was given close to the bottom of the list of options, which affected how people responded to it. Thirdly, multiple answers were not accepted. In talking with some Aboriginal people in Leonora it became clear that they have opted for a Christian denomination when answering the census question, which affected the way traditional beliefs are being accounted for in the Census.

Housing

In 2006, almost three-fourths (74%) of the total housing in Leonora was rented (the list of lending bodies includes caravan parks, employers and government, among others) and only 12% of the houses were fully owned by their residents (Figure 16). The majority of both Aboriginal people (73%) and non-Aboriginal people (75%) did not own their dwelling structures (Figure 17). While 14% of the non-Aboriginal residents owned the houses they lived in, none of the Aboriginal residents did. A positive sign, however, was that there were more Aboriginal (16%) than non-Aboriginal (6%) residents who were in the process of purchasing their houses.

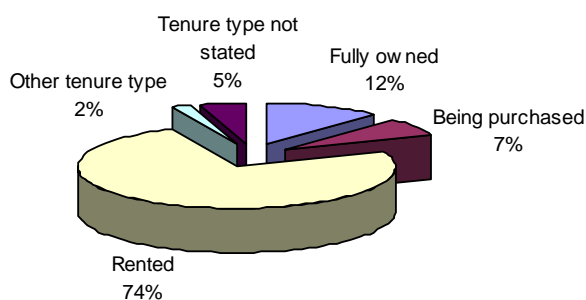


Figure 16: Tenure of dwelling structure in Leonora, 2006

Source: ABS 2006b

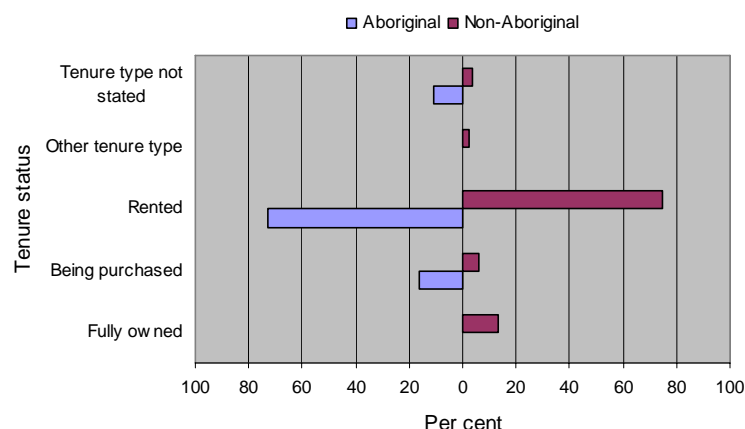


Figure 17: Tenure of dwelling structure by Aboriginal status in Leonora, 2006

Source: ABS 2006b

The majority of accommodation in Leonora is provided by the mining companies in caravan parks. The shire owns only 3 houses, 2 duplexes and a single person’s quarters, but the private housing market is quite active (with around 15 houses for sale at any one time). There is a big range in house prices in Leonora (from \$50 000 to above \$310 000); however, the median house price in Leonora was below \$100 000 in 2008 (compared with the region’s average of around \$319 000 and Perth’s average of \$474 000 in December 2008) (see Figure 18).

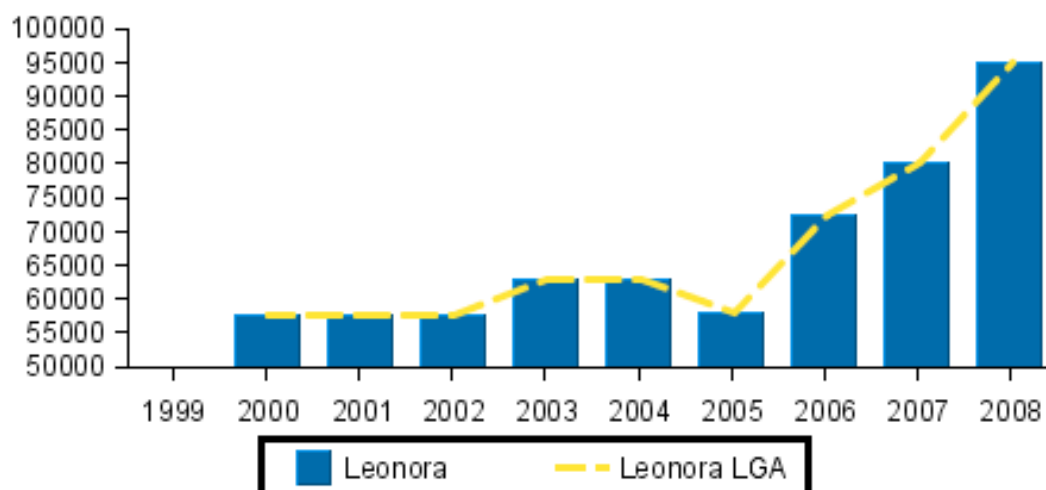


Figure 18: Median price, Leonora

Source: RP Data 2008

The Nambi Road Village (Katumpul), located five minutes' walk from Leonora's centre, provides accommodation for a large part of the Aboriginal community. It was rebuilt by the Shire in 1998 and a new community layout plan was commenced in 2001, but did not proceed to completion.

Facilities and services

The township of Leonora offers public services that include emergency, main services, recreation, education, religion, library, accommodation as well as land and air transportation. Emergency services include ambulance, medical surgery, fire brigade, hospital, police and Royal Flying Doctor Service. Establishments providing main services include post office, shire office, tourist bureau, Water Corporation, Western Power, community health, family and children's services, funeral services, hospital/home care, Department of Industry and Resources, court house, and Goldfields-Esperance Development Commission Officer (Shire of Leonora 2008).

Leonora is also hosts the Ngalia Heritage Research Council (Aboriginal Corporation) which is a non-profit community-run organisation (see Figure 19). It was established in the 1980s by the Ngalia (Leonora's Aboriginal tribe) elders with the objective of retaining and maintaining the traditions, laws, customs and language of the Aboriginal people who live in the area. It also encourages Aboriginal enterprise.



Figure 19: Leonora Aboriginal Corporation

Photo: Dora Marinova 2008

Leonora has modern recreation and aquatic centres that provide access for health and fitness as well as sports activities. The recreation centre houses two air-conditioned squash courts, a gymnasium and an indoor basketball court that can also be used for other sports such as indoor cricket, volleyball and badminton. It has outdoor tennis and netball courts and a grassed oval and change-room facility. The aquatic centre has a 25-metre lap pool and other ‘fun’ pools. In addition, the following social clubs are active in the town: Race Club, Gun Club, Golf Club, Rifle Club and the Leonora-Gwalia Go-Kart Club. There is a small library open to the public within the shire building (Shire of Leonora 2008). Leonora residents have access to one medium-sized supermarket, which provides all of the town’s regular food and household items. There is a separate butcher located on the main street that also serves as the booking agent for Skippers Aviation and Thrifty car rentals. There are two roadhouses on the main street that offer basic consumable items as well as fuel.

Educational facilities in Leonora support kindergarten, pre-primary, primary and high school students. The Rural Transaction Centre serves as a public library and provides access to tourist information. Two tourist attractions are the Gwalia Museum and the Gwalia Ghost Town, which are open daily. A number of churches provide religious services in the area. These include the Catholic Church, Christian Fellowship and Yiwarra Palya Ministries (Shire of Leonora 2008).

There is a regular bus service from Perth in the Perth/Goldfields Express. There is a functional airport largely used to service the mining industry. The airport is located two kilometres away from the town and it boasts a two-directional runway system; the main one has a length of 2018 meters, and the secondary runway is 1000 meters long. The airport allows medium-size aircrafts, such as Bombardier ‘Dash 8-100’ and Fairchild Metro 23, to service the town. Skippers Aviation has a regular service to Perth (four days a week), Laverton and Leinster.

Expansive accommodation exists in Leonora, largely due to the transient nature of the mining industry. There are two hotels, one motel, a lodge, a caravan park, bed and breakfast, and a rural station stay. The two mining camps located within the town offer public accommodation pending availability.

Overall, Leonora offers a full range of facilities and services (see Table 6).

Table 6: Facilities and services in Leonora

Aboriginal corporation	Yes	Funeral services	Yes	Public telephone	Yes
Accommodation	Yes	Golf	Yes	Race track	Yes
Airport	Yes	Hospital	Yes	Restaurant	Yes
Ambulance	Yes	Library	Yes	Sporting facilities	Yes
Bakery	Yes	Mechanical Services	Yes	Shire Office	Yes
Banking facilities	Yes	Medical Facilities	Yes	Store	Yes
Bottled Gas	Yes	Museum	Yes	Swimming pool	Yes
Coach stop	Yes	Newsagent	Yes	Tourist bureau	Yes
Court house	Yes	Picnic Area	Yes	Takeaway food	Yes
Community Hall	Yes	Police	Yes	Visitor Centre	Yes
EFT at point of sale	Yes	Post Office	Yes	Wildlife rescue	Yes
Fuel	Yes	Public Bar	Yes	Worship place	Yes

Compiled by authors

Health facilities

Leonora Hospital is located 20 minutes' walk from the town's centre and is open 24 hours a day. It has an emergency department and also provides a wide range of services (dietetics, gynaecology, home and community care, general medical, nursing, obstetrics, outpatients, palliative care, physiotherapy, podiatry, radiology, speech therapy and X-Ray services) that are used equally by locals, industry employees and tourists. Unlike the other services accessible in Leonora, the hospital attracts more visitors from mining due to the nature of the work in the industry. The medical equipment has been upgraded with the help of mining companies, such as St. Barbara Ltd and Jubilee Mines, as well as with the sponsorship of the Shire of Leonora and the Australian Government under its Regional Partnerships Program.

The state of the hospital is of vital importance, not only for the local communities, but also for the number of businesses operating in the vicinity of Leonora, and most importantly for the mining sector.

An interesting fact about the Leonora Hospital is that it was the first in Western Australia to appoint an Aboriginal matron. Sadie Canning commenced her duties in 1958 and set about fully integrating Aboriginal patients. Many nurses and staff regard Sadie as a fine and brilliant colleague, the finest they have worked under. It is not surprising that the Shire of Leonora has honoured her efforts by naming the road to Leonora Hospital after her: Sadie Canning Drive (Strickland 2003).

Economy

Today, the town of Leonora has about 100 industrial sites, two mining accommodation camps, two hotels and a motel, a shady caravan park, shopping facilities, a sporting recreational centre, tennis courts and about 350 houses (see Figure 20). It has a medical centre where a resident doctor provides medical services, and other specialists (such as a physiotherapist) work on a roster. A district junior high school starts from pre-primary level (see Figure 21). The railway to Kalgoorlie, built after the discovery of gold, is still operational today (Shire of Leonora 2007). The town has a Rural Transaction Centre, incorporating a Telecentre, Tourist and Information Centre and a Public Library. The shire is actively involved in organising a range of activities, including the annual Golden Gift Carnival (dirt track horse racing, BMX demonstrations, fireworks, market stalls, bands and street

entertainment), the annual Golden Nugget clay pigeon shoot and the Sport of Kings horse races three times per year, which culminate in the Leonora Cup.



Figure 20: Houses in Leonora

Photo: Dora Marinova 2008



Figure 21: Leonora District High School

Photo: Dora Marinova 2008

From the local government and regional development perspective Leonora is included in the Goldfields-Esperance region, where the average taxable income of the population is the second highest in WA (\$44 206 in 2003 compared with the state average of \$39 254). Mineral resources, gold and nickel mining form the main economic sector in the Goldfields sub-region, in which Leonora is located (GEDC & DLGRD 2006).

In 2006, the unemployment rate in the Goldfields sub-region was 2.6% (1.6% for Leonora) (ABS 2006a). This figure is low compared with the national average of 5.2%. The mining industry is the main employer in the region (DEWR 2006).

The region is experiencing shortages of skilled employees. A phone survey conducted by DEWR (2006) among 191 employers in the region revealed that two-thirds of the employers were struggling to recruit staff for specialised positions such as retail trade, health, education and community services, property and business services, accommodation and catering. Nine percent out of 1275 vacancies in a 12-month period remained unfilled, according to the survey results (DEWR 2006).

An indication for the low level of competition in the labour market is the number of applicants for a vacant position, which averages only 1.5. Half of the surveyed businesses expressed lack of competitiveness of the applicants. However, employers are willing to provide on-the-job training or working experience to the unemployed people (DEWR 2006).

According to DEWR, about 3200 working-age people receive Centrelink support in the region and 39% of them are Aboriginal (1290 people). The 2006 ABS Census reports 9.8 % unemployment rate for Aboriginal people in Leonora; this is much higher than for the rest of the town's population (over four times) but only two-thirds the average Australian Aboriginal and Torres Strait Islander unemployment rate of 16% in 2006 (ABS 2006c).

The Gwalia Historical Precinct and the prospects of finding gold attract a stable and continuous number of tourists who use the services of the caravan parks, Leonora Rural Transaction Centre, the local hotels and other services offered by the town. The advertisements developed by the Western Australia Tourist Commission that featured Elle McPherson (see Figure 22) helped build the town's reputation around the theme of 'Holidays of an entirely different nature'.



Figure 22: Australia's top model Elle McPherson and Leonora's resident and prospector Bill Johnson on holiday advertisement by the Western Australian Tourism Commission

Photo: Dora Marinova 2008

Stocks and flows – an overview

Water

Water is of primary importance for both residents and industries operating in Leonora. Being a desert town with an average annual rainfall of 234.3 mm, it experiences water shortages. In order to satisfy the constantly increasing water demand through the mains (see Figure 23), a \$4 million desalination plant was made operational in October 2005.

Industry water consumption, however, is not easily accounted for because it is largely sourced directly from the underground aquifers through extensive bore fields, as well as harvested from open pits and tailing dams. According to Habermehl (2008), large parts of the palaeo-channels and tributaries in the Northern Goldfields around Leonora 'contain limited storage of non-renewable groundwater with qualities' [suitable for human use] and 'groundwater extraction in most areas exceeds recharge'.

For the long-term future of the town, there is a need to plan for the sustainable use of its limited water resources.

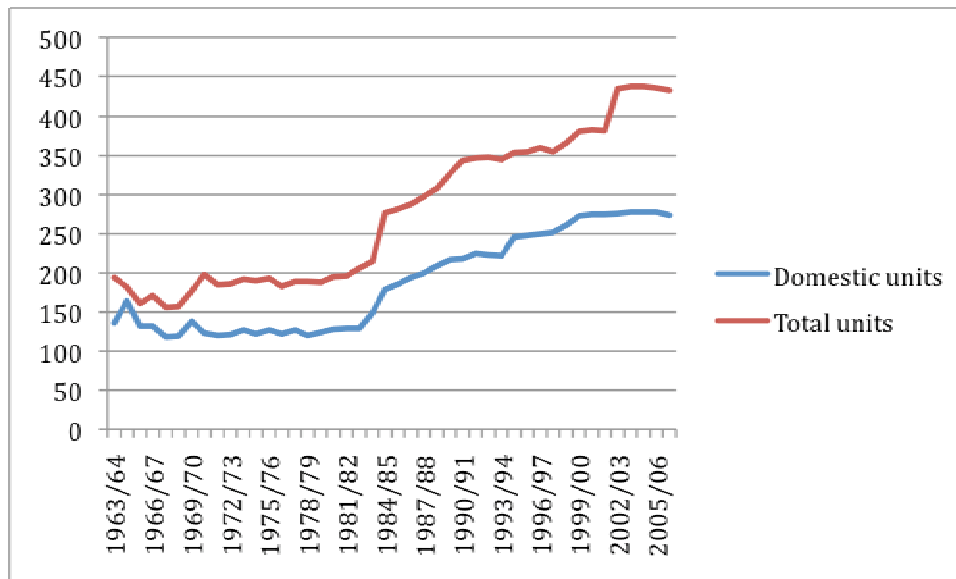


Figure 23: Water consumption, Leonora (1 unit = 1000 L)

Source: Compiled from data provided by Water Corporation

Metals and minerals

Leonora and its environs hold an enormous wealth of minerals, including metals and petroleum. In this small desert settlement, the total value of minerals and petroleum for 2007 is estimated at \$2.7 billion (Department of Industry and Resources 2007).

Food

Leonora's pastoral history stretches back to 1896 when James Willis drove the first consignment of cattle to the area. Nowadays there is food grown for local consumption and commercially. There are currently around 20 pastoral leases in Leonora's environs but only a couple of them are part of the Aboriginal Land Trustee Estate. The majority of stations in the area mostly carry sheep or goats for the meat and wool markets. Many, however, are looking for a more diversified approach to their operations. Between 1999 and 2007 local government pastoral property rentals on average have increased by about 120%.

Most people shop for food locally and only top up their supplies from Kalgoorlie-Boulder. Since September 2007, Indigenous Business Australia owns the supermarket in Leonora and the recent refurbishment of the store increased the range of goods available for sale as well as its overall appearance.

Power

Electricity services are available throughout the town of Leonora, including for street lights, and can be extended for any new developments. The main provider is Horizon Power, a Western Australian State-owned company, which is the regional business responsible for the generation, transport and sale of electricity in areas outside of the WA's South West Interconnected System as part of a Regional Non-Interconnected System. Horizon Power opened a state-of-the-art gas facility to supply Leonora with its electricity needs in January 2000.

Industry provides its own power supply for the operation of its various facilities. For example, St Barbara, which operates the Gwalia gold underground mine (estimated to have in excess of nine years of mine life), runs a gas-fired power station as well as a paste-fill plant and a refrigeration plant to cool the underground working environment. Recently it has started to look for energy efficient and more environmentally friendly ways of providing electricity to its accommodation camp.

Communications

The full range of communications is available in Leonora. In particular, access to information technology and the Internet is available to 63% of its households. However, access to the Internet differed by Aboriginal status, with it being available to only 40% of Aboriginal households.

Leonora and the region

In addition to Kalgoorlie-Boulder, the main mining centre of the region, Leonora is in close proximity to several other desert settlements with relatively similar characteristics (see Table 7, namely: Laverton, Menzies, Mount Magnet and Leinster [the towns of Leonora and Leinster form the shire of Leonora]).

The reason for referring to this group of settlements in relation to Leonora is that their future is in many ways similar. Each one of them is very small in comparison to the regional centre of Kalgoorlie-Boulder, which has a population of 28 422, including 2133 (or 7 %) Aboriginal people. In fact, their combined populations (3547) are only an eighth that of Kalgoorlie-Boulder. Their combined Aboriginal populations are 696, and some local Aboriginal leaders have expressed desire for these settlements to be seen as an interrelated network. Aboriginal people argue that there are many linkages and interconnections between the five smaller settlements and that their long-term sustainability can be improved if thought of and understood as a vibrant network, rather than as isolated settlements. How this concept could work requires further investigation and negotiation between the communities, government and industry.

Factors likely to influence sustainability of Leonora

Employment and the resource sector influence

Due to the town's high reliance on the immediate mining industry operations, maintaining long-term social and economic prosperity without dependence on the current resource boom heads the list of Leonora's sustainability issues.

The dramatic ebbs and flows of Leonora's population are closely linked to localised mining operations, and the majority of the town's employment is provided through the resource sector. Further to this, the demographics of residents attracted to the town are also related to the demand in the resources sector: largely non-Aboriginal males in the 25–44 age group category. There are flow-on social implications from this demographic trend. As many of the workers are fly-in/fly-out residents, there are a lack of families taking residence within the town, leading to a limited number of stable, resident families attending local schools, and a human capital deficit in public committees. The local school has not had any additional enrolments following the recent mining boom. On the other hand, there are expectations that services such as the ones provided by the hospital or the recreation centre should be available to everybody.

In recent years limited success has been experienced by small businesses seeking to create non-mining related business niches within the town. Essentially all of the main street businesses operating in Leonora have direct or indirect service connections to the localised mining operations. It is therefore likely that once these operations are reduced or cease to exist, so will the service requirements and business operations for many of the town's small businesses.

Table 7: Leonora and the region

	Laverton	Menzies	Mount Magnet	Leinster	Leonora	National
Established	1900	1895	1891	1976	1898	-
Distance to Leonora	120 km	94 km	433 km	124 km	-	-
Distance to Perth	956 km	735 km	562 km	368 km	832 km	-
Shire size	18 000 sq km	13 000 sq km	14 000 sq km	31 743 sq km		-
Total population 2006	730	216	458	731	2326	21 017 200
Aboriginal population 2006	287	135	91	28	155	517 174
% Aboriginal population 2006	39.3%	62.0%	20.0%	3.8%	6.7%	2.5%
Industry	Mining: gold, nickel, cobalt	Pastoral, mining and tourism	Agriculture and mining	Mining	Mining, pastoral, services and tourism	-
Average individual income 2006	\$810	\$245	\$502	\$1153	\$1291	\$466
Average household income 2006	\$846	\$480	\$1031	\$2054	\$1378	\$1027
Average family income 2006	\$875	\$512	\$1225	\$1939	\$1795	\$1171
Unemployment rate 2006	2.8%	4.2%	6.4%	5.8%	1.9%	5.2%
Shire revenues 2006	\$4M	\$1.7M	\$2.5M	\$2.1M		-

Source: ABS 2007

In a recent survey of Aboriginal residents, individuals voiced concern that the change within the industry from a residential to a fly-in/fly-out workforce had reduced prosperity within the town. A high proportion of retail shops within the town closed (see Figure 24), allegedly allowing the few remaining to increase prices. The range of goods offered was also reduced, particularly fresh fruits and vegetables. House prices within the town also dropped after mine employees were given on-site accommodation close to town. It was also harder to sell and find tenants for houses in Leonora. The relatively recently rebuilt Shire housing stock for the Katampul Community is poorly used and maintained.

Compared with the state and national average house prices, Leonora house prices are viewed as affordable and well below the 2006 national average of \$396 400 (Kryger 2006).



Figure 24: Recently closed supermarket in Leonora

Photo: Dora Marinova 2008

Aboriginal employment options

There are many socio-cultural issues that limit employment opportunities within the resource sector for the region's Aboriginal residents (Martu, Wangai, Tjupan and Ngalia). Many Aboriginal people are reluctant to travel outside the region to seek work, due to their significant attachment and connection to place. Although there are large numbers of jobs in Leonora, they are usually not filled by local residents. The fly-in/fly-out practices adopted by the mining companies mean that local Aboriginal people are rarely employed. This is the heart of the problem for Leonora residents.

Another issue is that access to culturally appropriate work opportunities within Leonora is limited. Meaningful jobs for local residents is a key sustainability issue that needs to be considered.

Alternative opportunities

Outside the resource sector, tourism has been identified as a future diversification possibility for economic and social focus within the town. The Australian Government's (AusIndustry) marketing of the 'Golden Quest Discovery Trail' (<http://www.goldenquesttrail.com/>) is significant for the region and seeks to link the town with other northern goldfields towns such as Laverton and Kalgoorlie-Boulder as an international destination for tourists seeking an authentic Australian experience. This initiative stands alone as the only publicly noticeable push to market Leonora as a global tourist destination. A push to 'place-brand' Leonora in this fashion (see Singleton & McKenzie 2008) may provide the competitive identity required to generate sufficient alternative economic and social activity in order to reduce the region's reliance on and vulnerability to the resource sectors.

There are, however, significant gaps in the required infrastructure that would need to be filled to support such an initiative before the town could adequately service larger numbers of tourists (particularly, targeted higher-paying international tourists) than at present. Specific tourism-related infrastructure and services include higher standard accommodation, restaurants, a range of tours/tour guides and general access to services and amenities.

As has been observed in other mining towns, such as Karratha in the Pilbara region, the significant mining activities in the town also serve as a threat to the tourism shift. Many of the town's services

and amenities are absorbed through its operations, including accommodation and vehicle hire. In the case of Karratha, many tourists seeking to use the town to observe the nearby Aboriginal rock art of the Burrup Peninsular are unable to source accommodation due to the demands and expansions of the resource sector (Singleton & McKenzie 2008).

Social issues

Literature about social issues in Leonora is not abundant. Leonora currently seems to demonstrate the characteristics of a working town. In essence, the greater proportion of residents (particularly those of non-Aboriginal descent) is located in the town for employment reasons alone. This could be reducing the social growth and development within the town due to the short-term and transient nature of the resource sector employment and other industry associative trends (Newman & Gossel 2003). Furthermore, the increasing fly-in/fly-out practice of the resource sector encourages little local social, cultural or economic returns from company employees.

In 2005, the Shire of Leonora published the results of a survey of 91 people – on community safety and crime prevention – with recommendations and a proposed plan. Vandalism; alcohol, drug and substance abuse; and boredom among the youth were named as some of the issues of concern in Leonora. Around 40% of the respondents were concerned that the level of crime and anti-social behaviour is high in Leonora. Lack of youth-related activities was named as a significant factor for such behaviour.

The development of a youth culture of resentment towards Leonora businesses may be negatively influencing further business development, particularly within the business areas involving close contact with youth clients. This can be seen as an area of interest for sustainable development initiatives within the town, as resolving youth social issues and encouraging new business development are both key priorities.

Another relatively recent, quite unexpected issue for Western Australia in the fly-in/fly-out operations of the mining industry is the sharp increase in the rate of infection with the human immunodeficiency virus (HIV) which causes AIDS, in 2007. According to the Australian Federation of AIDS organisation, Western Australia has witnessed a '68 percent increase in HIV infection among heterosexual males over the past three years' (MedIndia 2008). The infection is most commonly acquired on the overseas holidays in countries such as Papua New Guinea, Cambodia or Thailand that are taken by men working in the mining industry on high wages. Although this is not yet directly affecting Leonora, it is another example of the social unsustainability of the business model adopted by the mining industry.

Despite these social issues, Leonora presents itself as a safe and proud regional town. The main street is lined with recently planted olive trees, and the road is divided by well-kept flower beds. Regular council services ensure rubbish in public places is kept to a minimum.

Climate change and fossil fuels energy influence

Due to its location, Leonora's economy is highly dependent on fossil fuel-based energy use. Consequently any government measures or schemes to reduce greenhouse gases (GHG), such as emissions trading schemes or ecological taxes, will impact on the profitability of the mining sector. Decarbonising Leonora's economy will be a major challenge; however, there is significant potential for GHG reduction in fuel substitution, including conversion of the large number of vehicles and road trains to natural gas. Solar and wind energy are other sources that should be encouraged, particularly

within the building/residential, water (e.g. desalination) and service sectors. A good attempt at this has been made in St Barbara's residential camps, but much more can be achieved. Many organisations and businesses, including Indigenous Business Australia (IBA) and the local shire, are committed to a wider use of renewable energy sources. Leonora is also part of Australia's Regional Energy Efficiency Program, which is supported by the Federal Government through the Renewable Remote Power Generation Program.

A significant debate surrounds uranium mining, particularly the proposed Yeelirrie Uranium Mine, the outcome of which will affect Leonora's future. The issue of whether nuclear power is a reliable technology to reduce CO₂ emissions and combat climate change globally is highly contested, and any future policy decisions about this will have important implications for Leonora.

The geographical location of Leonora and its relatively hot climate make it vulnerable to any further temperature changes. The 2007 Intergovernmental Panel on Climate Change (IPCC) report forecast is for around 1°C temperature increase by 2030 under most scenarios, with further reductions of around 2% in rainfall (see various scenarios and information available at <http://www.climatechangeinaustralia.gov.au/watemp1.php>). This means that all aspects of decarbonising Leonora's economy, including emission reduction from fly-in/fly-out operations, are equally important for the town's future as well as the health of the planet.

Conclusion

The significant local mining activities offer prospects for employment as well as business opportunities in the short term. However, the economic reliance from the surrounding resource industry should be seen as a key sustainability issue. The ability for Leonora to maintain its current economic and social operations without the support of the resource industry are viewed as negligible. Further, the development and expansion of Leonora under the premise of ongoing resource sector support is short-sighted.

The town's current level of economic activity should be seen as an opportunity to lay down the foundations for a future, alternative economy. Investing in identifying the region's assets, creating the required infrastructure, and increasing the state, national and international awareness of the region through a well-thought through branding of Leonora can be a transformative initiative, in terms of actions for sustainable futures.

There are some indications signalling forthcoming changes related to sustainability within some of the mining companies operating in Leonora. An example of this is St Barbara, whose mine site accommodation has been re-developed using an environmentally sustainable design. St Barbara received a Golden Gecko award in 2009 for this work (DMP 2009).

Planning, stakeholder consultation and foundation development over the next five years will be critical if a successful alternative economy for Leonora is to be unearthed and successfully implemented, as will the attraction and utilisation of available resources and funding support. If it succeeds, this process will provide invaluable documentation of alternative economy creation, place branding and social rejuvenation within an isolated desert town.

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