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Gascoyne Coast

Sub-regional Strategy

PART B: Sub-regional profile





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Gordon Stephenson House
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Locked Bag 2506
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website: www.dplh.wa.gov.au
email: corporate@dplh.wa.gov.au

tel: 08 655 19000
fax: 08 655 19001
National Relay Service: 13 36 77
infoline: 1800 626 477

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1 Introduction

The Gascoyne Coast sub-region extends over an area of considerable size, which includes the Shire of Exmouth and coastal portions of the shires of Carnarvon and Shark Bay (Figure 1). It is characterised by its remoteness and unique environmental attributes that include two World Heritage properties; and is widely renowned for its numerous natural attractions and horticultural produce.

The *Gascoyne Coast Sub-regional Strategy Part B: Sub-regional profile* contains an overview of the sub-region's economy, infrastructure and environment. Significantly, this provides a general context for the strategic planning direction that is outlined in Part A of the Strategy.

As part of providing a context for strategic planning in the Gascoyne Coast, this document may refer to a number of projects and initiatives that have been proposed through previous processes. Their inclusion in this document should not be taken as a commitment by Government to fund these projects in each and every case. Public funding of projects beyond the current financial year is generally not confirmed; and annual budget papers indicate projects that have been funded by the Government.

Contextual mapping

Mapping has been prepared that gives a spatial context to several of the considerations outlined in this section. This includes:

- a sub-regional scale map featuring relevant information pertaining to land tenure, infrastructure and natural resources (Figure 2); and
- settlement-scale maps for Carnarvon (Figure 3), Exmouth (Figure 4) and Denham (Figure 5) that consolidate relevant contextual information as it relates to each settlement.

Importantly, this material is intended to be read in conjunction with Part A of this Strategy where relevant, including that document's sub-regional and settlement land-use plans.



Figure 1: Study area

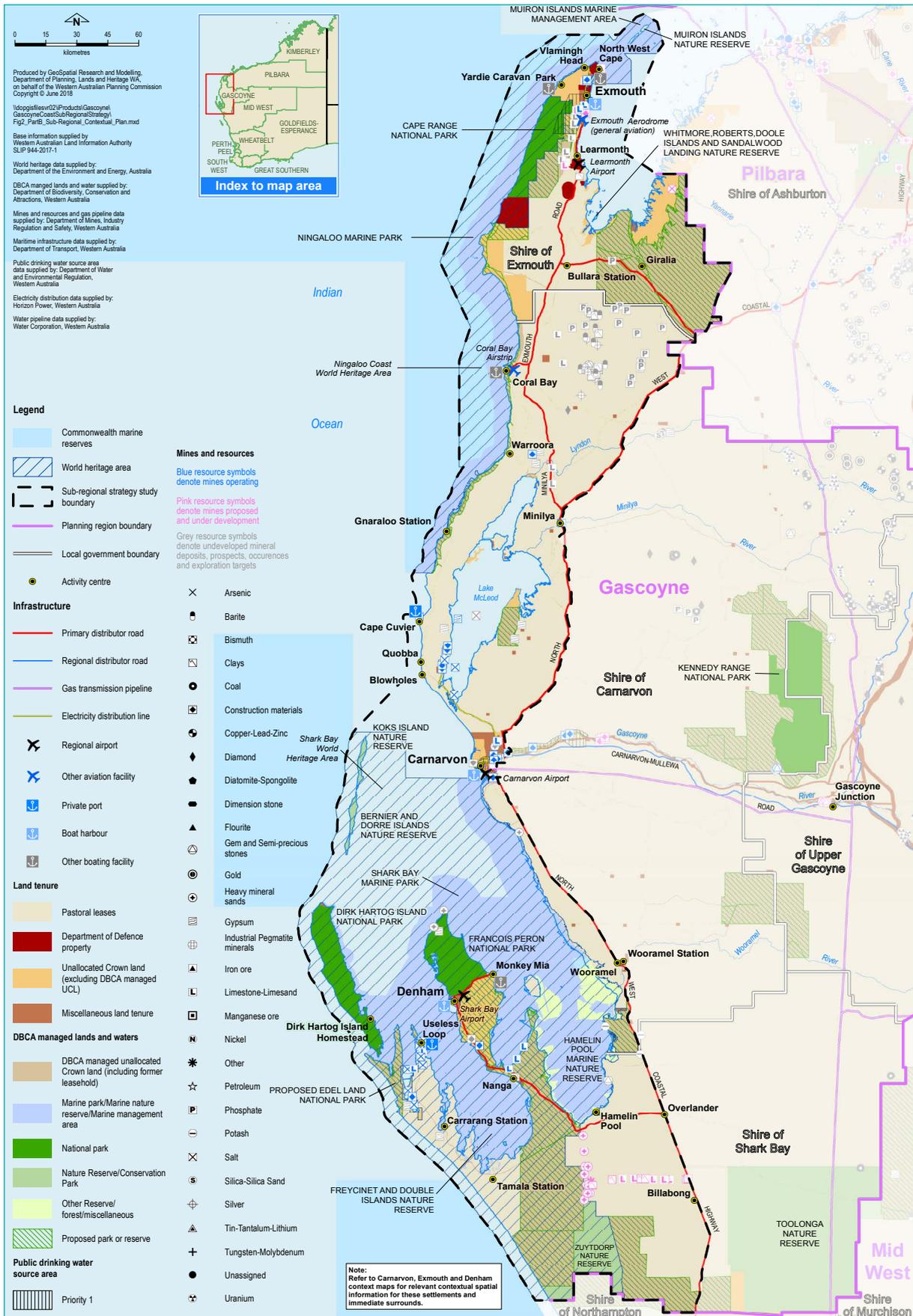


Figure 2: Gascoyne Coast sub-region context map

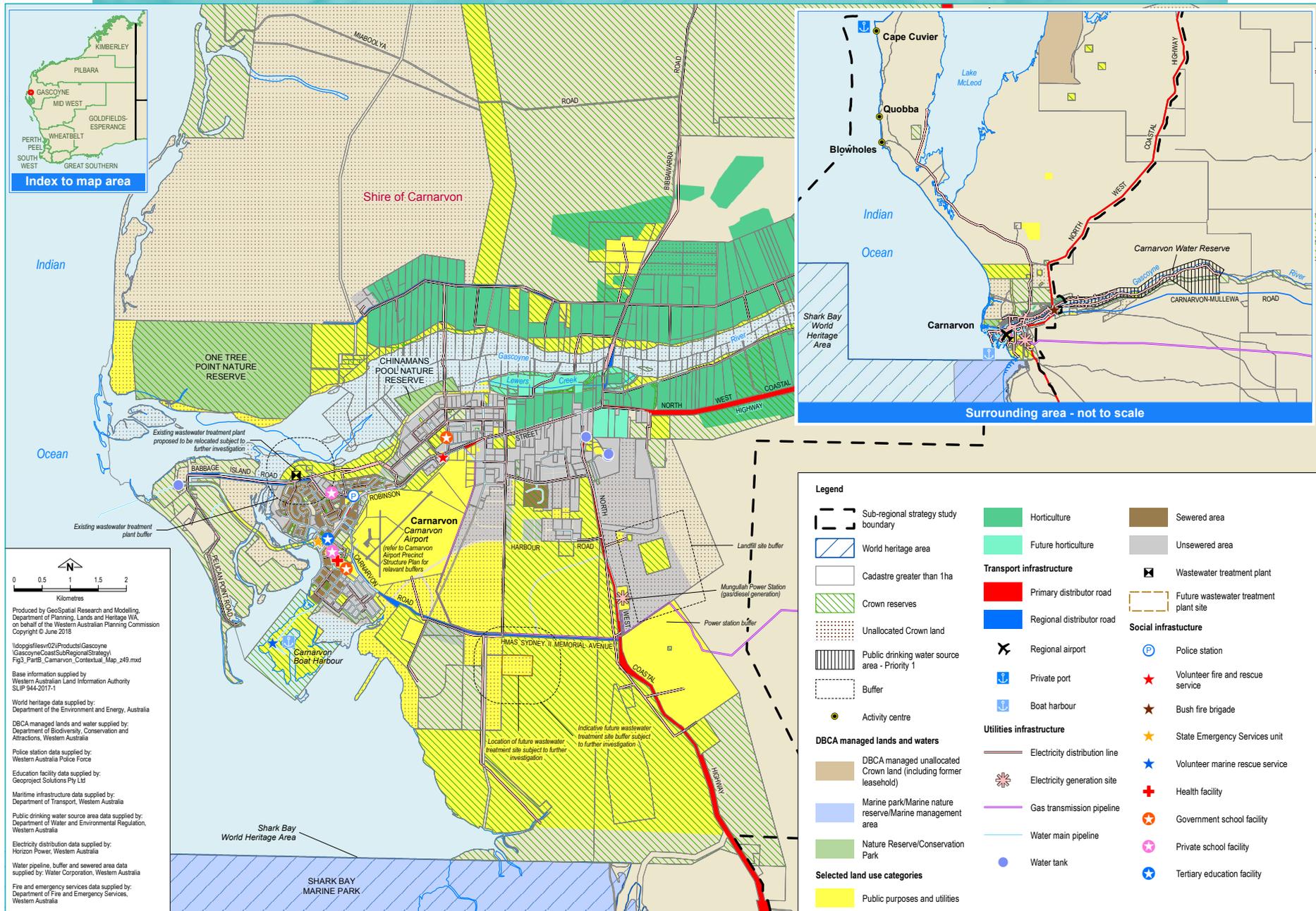


Figure 3: Carnarvon contextual map



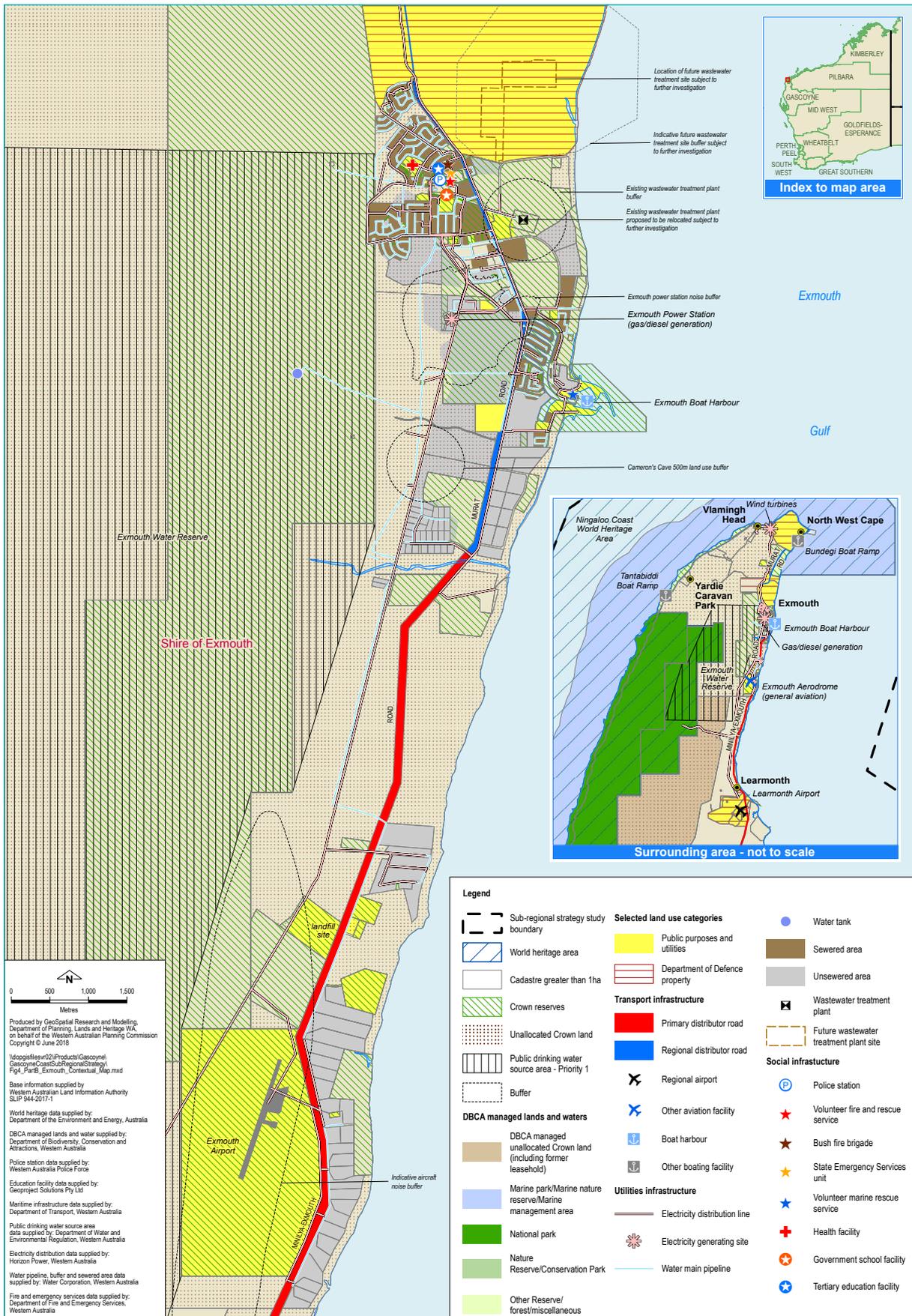


Figure 4: Exmouth context map

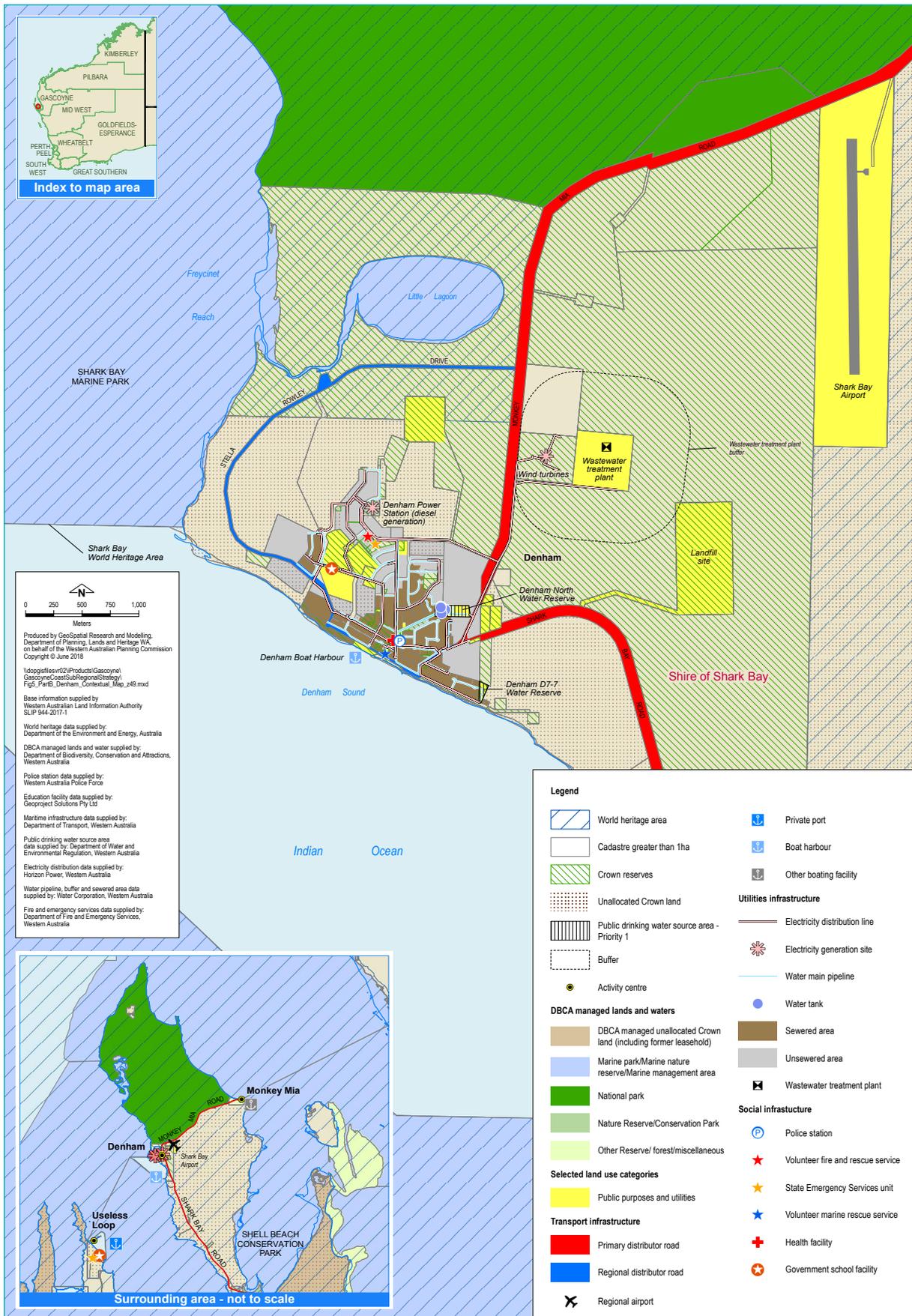


Figure 5: Denham context map

2 Economy

Note: Unless otherwise noted, the majority of the statistical data in this chapter is by the Department of Primary Industries and Regional Development (DPIRD); and relates to the whole of the Gascoyne region, which includes the Shire of Upper Gascoyne in addition to the three Gascoyne Coast local governments (Carnarvon, Exmouth and Shark Bay). For further information with respect to the figures and/or the latest available figures, please refer to DPIRD's Regional Snapshot series at www.drd.wa.gov.au/publications/Pages/default.aspx.

Where regional data is reported, it is considered relevant on the general assumption that it can be largely attributed to the Gascoyne Coast sub-region. For the purpose of this document, this is considered reasonable as the sub-region typically generates about 95 per cent of the Gascoyne's gross regional product and contains over 97 per cent of its population.

Tourism, mining, agriculture and fisheries are prominent and valuable sectors in the diverse economy of the Gascoyne Coast sub-region. In the financial year 2012/13 the value of the gross regional product of the Gascoyne region was estimated to be \$870 million (Figure 6) (Department of Regional Development, 2014).

For the 2017 March quarter, the labour force of the Gascoyne Coast sub-region was 5,758 persons, of which 355 (6.2 per cent) were unemployed (Department of Employment, 2017). Mining is the Gascoyne Coast's most labour intensive employment sector according to Australian Bureau of Statistics 2016 Census data, employing approximately 20 per cent of the sub-region's workforce. A further 20 per cent of Gascoyne workers are employed in social services including health, education and public administration.

Future growth in the Gascoyne Coast sub-region and the rate at which it occurs will invariably be influenced by the strength of its economy. It is therefore critical to plan for land assembly and infrastructure to meet the needs of the economic drivers; and it is important that this is done in such a way so that land is available and affordable.



(source: Department of Regional Development, 2014)

¹ latest data available from DRD

Figure 6: Value of Gascoyne industry activities

2.1 Tourism

Contributing an average of \$234.5 million annually from the years 2010-12, tourism is the Gascoyne region's most valuable industry sector (Department of Regional Development, 2014). According to Department of Jobs, Tourism, Science and Innovation, an average of 261,900 people visited the region annually in the years 2014-15, with 16 per cent being international visitors (Tourism WA, 2016). With the Gascoyne Coast sub-region containing the most accessible areas of the region, it receives the most of this visitation and generates the bulk of the sector's value to the regional economy.

The Gascoyne Coast offers a unique tourism product with people being attracted by its distinctive and unspoilt tranquillity, and warm winters. The area is renowned for its marine and terrestrial attractions including the Ningaloo Coast World Heritage Area, Shark Bay World Heritage Area, Ningaloo and Shark Bay marine parks; and Cape Range and Francois Peron and Kennedy Range national parks.

With tourism being such a valuable sector for the region and local communities alike it is imperative that existing and potential tourism opportunities are developed in a strategic and sustainable manner. Notably, the predicted increase in cruise shipping activity in Western Australia over the coming decade may present opportunities to further diversify the tourism sector, particularly at Exmouth (Tourism WA, 2012). There is also an increasing interest worldwide in nature-based tourism and the Gascoyne Coast contains a number of attractions that lend themselves well to this concept.

Given current economic indicators and recent trends, it is likely that growth in tourism over the longer term will be sustained. In the Gascoyne Coast sub-region, this may require additional accommodation in existing settlements to be developed to cater for demand. The identification or development of additional tourism accommodation sites will be subject to relevant local planning processes.

At present, tourism in the Gascoyne Coast sub-region is highly seasonal in nature, with many destinations experiencing huge influxes of tourists and visitors at peak times. This can exert considerable pressure on the environment, host populations and service infrastructure.

The Commonwealth Government's Australia's National Landscape Program identifies the sub-region as being within the Ningaloo-Shark Bay National Landscape. The

program is a long-term strategic approach to regional tourism development and conservation that aims to highlight the value of Australia's most remarkable tourism assets, and in turn, increase support for their conservation. As Ningaloo-Shark Bay is one of only 16 National Landscapes, its identification is significant and will promote further tourism opportunities in the Gascoyne Coast sub-region. As part of the program's implementation, a strategic framework for regional tourism development, planning and marketing has been developed for the Ningaloo-Shark Bay National Landscape. For further information, refer to www.tourism.australia.com/programs/national-landscapes.aspx.

2.2 Agriculture

Agriculture – and particularly horticulture – is a valuable industry for the Gascoyne Coast sub-region. The agricultural sector contributed \$91.4 million to the Gascoyne region's gross domestic product in 2011/12 (Department of Regional Development, 2014), much of which can be attributed to value of production from the Carnarvon horticultural precinct. With the inclusion of the commercial fisheries sector, agriculture employs approximately 8 per cent of the Gascoyne region's workforce (Australian Bureau of Statistics, 2016).

2.2.1 Horticulture

The Gascoyne Coast sub-region has a well-established, diverse and thriving horticulture industry. Produce is predominantly grown in the Carnarvon Horticultural District located on fertile soils of the Gascoyne River delta; however, horticulture is also being developed as an alternative industry for pastoral properties in the region. Horticultural production at Carnarvon was estimated to be worth \$98 million in 2016; with tomatoes, vegetables and melons being the most valuable crops (Department of Agriculture and Food, 2017). Other valuable crops include bananas, table grapes and tree fruits. The industry has proven to be resilient, despite being vulnerable to adverse climatic events, and is increasingly being recognised from a State perspective as an important area for food production. Most of the production is consumed by domestic markets at present; however, given the sub-region's proximity to neighbouring Asian countries it is well positioned to develop existing and emerging export markets.

Horticulture at Carnarvon occurs along the banks of Gascoyne River, and covers an area of about 1,200 hectares. There are currently 170 plantations, with plantation sized ranging between two and 40 hectares.

It is thought that the horticulture industry in the Gascoyne is capable of expanding significantly, potentially up to 3,600 hectares. The State Government's Gascoyne Food Bowl initiative proposes to expand the Carnarvon horticultural precinct by about 400 hectares. (Department of Water, 2016).

2.2.2 Pastoralism

Pastoralism is a major land use in the Gascoyne Coast in terms of area, with a number of pastoral properties in the sub-region. All pastoral properties are located on leasehold land tenure. Several former pastoral leases in the Gascoyne Coast have been proposed to be incorporated into the conservation estate and are currently being managed by the Department of Biodiversity, Conservation and Attractions.

Livestock production for export or slaughter is the main focus for Gascoyne pastoralists, including those in the Gascoyne Coast sub-region. The value of Gascoyne wool production has been in decline over recent years.

Livestock is generally raised on natural pasture and watered through a variety of local sources. Consequently, the carrying capacity of the sub-region's pastoral areas varies from season to season as this practice is dependent on sporadic rain over the vast tenure areas. As a result this can influence the pastoral production in the region from year to year. A number of enterprising stations have made a move toward diversification from pastoral pursuits to take advantage of tourism opportunities including horticulture and inland aquaculture.

An increase in productivity within the Gascoyne's pastoral sector will require improved land management practices. This may include restoring native vegetation in degraded areas, particularly to improve the condition of land surfaces in river catchments.

2.3 Mineral and resource production

The Gascoyne Coast sub-region is strategically placed to provide value to the State's major resource projects, including offshore oil and gas developments in the Carnarvon Basin and major mining projects in the Pilbara. Exmouth and Carnarvon already play a significant role in the resource sector supply chain and there may be additional opportunities in the future for the region to play an expanded role in this regard. Economic development opportunities associated with resource sector investment and expansion are explored in the Gascoyne Development Commission's Gascoyne Pilbara Project, particularly in regard to leveraging opportunities from the region's proximity to the Pilbara region (SGS Economics and Planning, 2012)..

2.3.1 Mining

Mining is a valuable industry sector for the Gascoyne Coast sub-region. The sector was worth \$113 million in 2012/13 to the entire Gascoyne region (Department of Regional Development, 2014), much of which can be attributed to the Gascoyne Coast sub-region given the high value of salt operations at Shark Bay and Lake MacLeod. Other commodities that are currently mined in the sub-region include gypsum, limestone and other construction materials such as sand. In addition, the sub-region also has deposits of other minerals including mineral sands, potash, and barite. Notably, the State's largest gypsum deposits are located in the Lake MacLeod area.

The distribution of the sub-region's mines and resources is indicated on Figure 2. Additionally, the economic importance of mines is acknowledged through the sub-region's activity centres framework outlined in Part A of this Strategy.

Currently, the main mining activity is salt production at Useless Loop in the Shire of Shark Bay and at Lake Macleod near Cape Cuvier, north of Carnarvon. Both major salt operations maintain private port facilities for direct transport of product. When operating at their present combined capacity of 4.2 million tonnes per annum, these two operations have historically accounted for as much as one third of the State's annual salt production.

The future development of mineral deposits in the sub-region may provide further opportunities to expand and diversify its mining sector.

2.3.2 Basic raw materials

Basic raw materials include surface sand, clay, hard rock, limestone on the coastal plain and sand and gravel along the major rivers other construction and road building materials are also sourced in the region. The extraction of basic raw materials on Crown Land is governed by the Department of Mines, Industry Regulation and Safety under the *Mining Act 1978* whereas local governments are responsible for the administration of quarrying for basic raw materials on private land under the Local Planning Scheme and relevant local laws.

Potential sources of basic raw materials include surface sand, gravel and limesand deposits on the coastal plain; and sand and gravel along the major rivers. A ready supply of basic raw materials is important for future urban and industrial development. In areas of rapid growth, land use conflicts can arise around basic raw material extraction sites; and in these circumstances planning protection may be required to ensure a cost-effective supply of these strategic materials.

The Department of Mines, Industry Regulation and Safety has identified and mapped regionally significant basic raw materials around the Carnarvon and Exmouth settlements. For further information, please refer online at www.dmp.wa.gov.au/Geological-Survey/Basic-Raw-Materials-1411.aspx.

2.3.3 Oil and gas

Offshore from North West Cape there is substantial oil and gas production in the Exmouth sub-basin; however, as this is carried out in Commonwealth waters, the production value is not considered to be a part of the Gascoyne economy. Despite this, it still provides industry opportunities to investors interested in servicing the offshore petroleum industry. In physical terms, the Carnarvon Basin is largely underexplored for onshore petroleum. The existing gas pipeline infrastructure in the Gascoyne may enable petroleum resource development activities within the region. The Gascoyne region more generally also has prospective geothermal energy resources which could potentially provide energy requirements to nearby industrial, commercial and residential areas.

2.4 Fishing and aquaculture

2.4.1 Fishing

The Gascoyne Coast sub-region is where the entirety of the Gascoyne region's commercial fishing industry is based, which in 2011/12 caught over 3,600 tonnes and was worth \$38.4 million. This represented nearly 21 per cent of the State's total catch by weight and over 14 per cent by value (Department of Regional Development, 2014). The sub-region is home to the State's largest prawn industry and other significant products include scallops, crabs and fish (mostly snapper and whiting). (Gascoyne Development Commission, 2010).

As the fishing industry depends on healthy functional ecosystems, sustainable development and environmental management is imperative. Management of the area's fisheries assets falls under the Department of Primary Industries and Regional Development (DPIRD), for which DPIRD's predecessor, the Department of Fisheries, had prepared a draft Fisheries Environmental Management Plan for the Gascoyne Region (Fisheries Management Paper No. 142) (Department of Fisheries, 2002). DPIRD is currently developing an ecosystem-based fisheries management plan for the Gascoyne Coast Bioregion, which will update and supersede the draft Fisheries Environmental Management Plan. Other management plans have also been developed for a number of specific fisheries in the sub-region.

2.4.2 Aquaculture

The aquaculture industry in the Gascoyne region was worth \$9.4 million in 2011/12. The Gascoyne region's aquaculture industry is predominantly located within the Gascoyne Coast sub-region. There are several opportunities for commercial development in this industry. Existing aquaculture predominantly focuses on the production of pearl oysters; however, pilot projects involving giant clams, freshwater aquarium fish, edible oysters and beta carotene production have also been trialled. (Department of Regional Development, 2014)

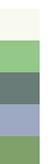


2.5 Retail and manufacturing

For the financial year 2011/12 the Gascoyne region's retail turnover was \$104 million, having grown over the previous decade at an average annual rate of 3.6 per cent (Department of Regional Development, 2014).

Manufacturing in the Gascoyne region reported a turnover of \$27 million in 2006/07, with the majority of the 28 business establishments being located in the Shire of Carnarvon. Prominent manufacturing establishments in the region include food processing (including fruit, vegetables and seafood) and metal product manufacturing. (Department of Regional Development, 2011)

As more than 97 per cent of the Gascoyne's population resides in the Gascoyne Coast sub-region, it is reasonable to assume that these values can be largely attributed to the sub-region.



3 Infrastructure

Infrastructure is essential in supporting all economic sectors of the Gascoyne Coast sub-region, in addition to its general population. From an economic perspective, inter-regional links are vital to ensure strong connectivity between the area and other markets; and to allow for the efficient movement of goods and people into and out of the sub-region. The sub-region's strategic regional and inter-regional connections have been considered in the *Western Australian Regional Freight Transport Network Plan* (Department of Transport, 2013).

Coordinated infrastructure corridors, which can potentially accommodate multiple types of transport and utility services infrastructure, are considered to be an efficient means of delivering the land requirements for future regional and inter-regional infrastructure, particularly in areas where land is highly constrained. As such, infrastructure corridors should ideally be identified, planned for and secured well in advance of the additional regional infrastructure being required.

3.1 Utility infrastructure

3.1.1 Energy

Each settlement in the Gascoyne Coast sub-region has its own remote electricity system; including generation predominantly through diesel, gas, wind, or a combination of multiple sources; and a transmission and distribution network, which services that settlement itself and its immediate hinterland. As there are considerable distances between settlements, which themselves are limited markets, there is no impetus for a regional transmission network.

Horizon Power is the supply authority for electricity services in Carnarvon, Exmouth including Learmonth, Coral Bay and Denham.

The main generator on the Carnarvon system is the 18MW diesel and gas Mungullah Power Station. This site became operational in 2014, at which point the former Carnarvon Power Station was decommissioned. The Mungullah facility has been developed on a new site that contains room for future expansion, including capability for future renewable energy generation. A private solar power generator, capable of producing 290kW, also feeds into the Carnarvon grid.

The Exmouth Gas Fired Power Station has a capacity of 5.9MW and consists of eight gas engines and one diesel engine. Compressed natural gas for the facility is transported by road to Exmouth from the Dampier-Bunbury natural gas pipeline. A small wind farm also supplements the base-load generation of the power station. A number of 11kV distribution feeders distribute power to the town of Exmouth and surrounding areas. Exmouth is expected to experience ongoing growth in demand for electricity, and in this regard options for increasing generation capacity will be considered by Horizon Power.

The Denham power system consists of both wind and diesel generation with a total system capacity of 1.4MW. Several 11kV feeders distribute power to the town of Denham and surrounding areas. It has been identified that there is potential to increase the capacity of wind generation in Denham.

The Coral Bay power system has a capacity of 1.5MW and consists of wind and diesel generation. Three wind turbines at the Coral Bay power station supplies up to 40 per cent of the output. A number of 22kV distribution feeders distribute power to Coral Bay and surrounding areas.

Horizon Power is considering energy storage technology options to address the high photovoltaic penetration in Carnarvon, Exmouth and Denham. Additionally, it has been proposed through the Gascoyne Development Commission that replacing existing overhead power lines in Carnarvon, Exmouth and Denham with underground lines would have a number of benefits to the community and service provider.

(Gascoyne Development Commission, 2013)

The only gas transmission infrastructure within the sub-region is a lateral pipeline from the Dampier Bunbury Natural Gas Pipeline (DBNGP), which services the Mungullah Power Station at Carnarvon. There are no reticulated gas networks in Gascoyne Coast settlements.

3.1.2 Water

Urban water supplies in the Gascoyne Coast sub-region are predominantly drawn from alluvial aquifers and delivered via regional water supply schemes operated and maintained by the Water Corporation. The Water Corporation operates and maintains schemes at Carnarvon, Exmouth, Denham and Coral Bay. Public drinking water source areas are indicated on the contextual maps in this document. In addition, drinking

water source protection reports are available for each of these potable sources from the Department of Water and Environmental Regulation at www.water.wa.gov.au.

Carnarvon's main borefield is along the lower Gascoyne River; and Exmouth's is within the Cape Range Limestone Aquifer. Groundwater sources supplying Denham and Coral Bay are affected by salinity and require desalination. The Water Corporation also operates a separate scheme at Denham providing a supply of non-potable artesian water for uses such as toilets and outdoor use.

The sub-region's horticulture industry (refer section 2.2.1 Horticulture) is reliant on the availability of groundwater. The Gascoyne Water Cooperative maintains an irrigation distribution system that delivers water to growers at Carnarvon. This is a critical piece of infrastructure, which has recently undergone a complete refurbishment. A number of growers located on the banks of the Gascoyne River also source water from private bores on the river.

Pastoral and other remote operations in the sub-region are generally reliant on artesian water.

The *Carnarvon Artesian Basin Water Management Plan* (Department of Water, 2007), provides information to organisations, industry and individuals about the way that groundwater in the basin will be managed. It focuses on managing the impacts of groundwater abstraction to maintain any associated environmental and economic values. Additionally, the former Department of Water released a water allocation plan for the Lower Gascoyne in 2011 to guide the management of ground and surface water resources that support the Carnarvon horticultural area.

Growth in demand for water in the Gascoyne region is likely to be due to increased usage for irrigation within agricultural activities and the increase in tourism populations, specifically during peak periods. However, according to *Water for Growth: Urban – Western Australia's water supply and demand outlook to 2050*, future water demand for urban areas within the Gascoyne region (mostly Carnarvon and Exmouth) is expected to remain relatively stable, with slight growth in demand anticipated by 2050. (Department of Water, 2016)

Upgrades to borefield infrastructure at Carnarvon are currently underway, which should support the expansion of the horticulture industry in particular. Additionally, investigations have been occurring to better understand the potential groundwater resources of the area.

3.1.3 Wastewater

Carnarvon, Exmouth, Denham and Coral Bay each have a wastewater scheme operated by the Water Corporation.

The Carnarvon and Exmouth wastewater treatment plants are both proposed to be relocated. It is recognised that their current locations are sub-optimal, with their operations impacting on sensitive land uses that surround them. Sites proposed for the relocated facilities have adequate buffers separating them from urban land uses, and potential to accommodate increased capacities compared to the existing facilities.

Significant areas of the Carnarvon settlement are currently unsewered, including parts of South Carnarvon, East Carnarvon and Kingsford; which ultimately limits their development potential.

The reticulated sewerage system in Denham was completed to mitigate against impacts from septic systems on the surrounding Shark Bay World Heritage Area. The Coral Bay system, which was also built to minimise environmental impacts, was designed with the capacity to accommodate its significant peak tourist populations. (Gascoyne Development Commission, 2013)

Additionally, wastewater reuse strategies are in place in Carnarvon and Exmouth, where treated waste water is used for greening open spaces and sporting fields.

3.1.4 Waste management

The Carnarvon, Exmouth, Denham and Coral Bay settlements each have an associated landfill site that services their respective local areas.

A strategic waste management plan for the Gascoyne (which includes the Shire of Upper Gascoyne in addition to the shires of Carnarvon, Exmouth and Denham) has been prepared for the Gascoyne Development Commission on behalf of the region's four local governments. The management plan primarily facilitates waste infrastructure planning; and seeks to ensure provision for solid waste management infrastructure at strategic regional locations. Such infrastructure could include transfer stations, resource recovery facilities, recycling process facilities, landfills and requirements associated with waste related to industrial expansion.

From a statewide perspective, the *Western Australian Waste Strategy* (Western Australian Waste Authority, 2012) provides strategic guidance on waste management issues.

It is recognised that a significant amount of the waste generated in the Gascoyne Coast sub-region is due to visitors to the region. This is a pertinent consideration when planning for future waste management requirements, given the importance of tourism to the sub-region's economy and in particular the high number of visitors to the region relative to its permanent population base.

3.1.5 Telecommunications

Telecommunications infrastructure performs a vital role in keeping the Gascoyne Coast sub-region well connected due to its vast and isolated location. A range of telecommunications services exist within the sub-region, depending on location and accessibility to settlements. As large parts of the sub-region are remote, telecommunications services in these areas can be limited or otherwise reliant on delivery through satellite networks.

Within the Gascoyne Coast sub-region, mobile services are generally available in the settlements surrounding areas of Carnarvon, Exmouth, Denham and Coral Bay; and along North West Coastal Highway. The State Government has recently completed the delivery of the Regional Mobile Communications Project, which has resulted in improved mobile telecommunications services through new and upgraded infrastructure in the Gascoyne Coast sub-region, particularly along the North West Coastal Highway.

Currently, the main populated areas of the Gascoyne Coast generally have access to ADSL and/or wireless broadband services. In the more isolated parts of the sub-region where these services are currently not available, broadband services are generally available via satellite.

The proposed rollout of the National Broadband Network will see optical fibre and next generation wireless coverage offering significantly higher speed broadband than those available on current services to the main populated areas of Carnarvon, Exmouth and Denham.

New and emerging technologies may create further opportunities for regional economic investment as well as innovation in service delivery. In addition emerging technologies may create opportunities to increase

and improve service delivery to remote locations for services such as health and education, while also providing various economic and social benefits to the regional settlements.

3.2 Transport infrastructure

3.2.1 Roads

The sub-regional road network is comprised of 'primary distributor roads' and 'regional distributor roads'. These are indicated on the relevant contextual maps in this document.

'Primary distributor roads' fundamentally provide efficient mobility of people and goods. They predominantly link significant towns and destinations, carry relatively high traffic volumes and constitute the main inter-regional road linkages. Roads classified as 'primary distributor roads' are comprised of State roads (declared highways and main roads) and are managed by Main Roads Western Australia. Primary distributor roads provide inter-regional linkages, with the key route through the sub-region – North West Coastal Highway – facilitating important connections to the Mid West, Pilbara and beyond. Other primary routes include Shark Bay, Monkey Mia, Minilya–Exmouth, Coral Bay and Burkett roads; and Robinson Street in Carnarvon. The primary network in the Gascoyne Coast can carry a significant amount of inter-regional freight traffic and seasonal tourist traffic, in addition to servicing the needs of the local economy and population. In particular, North West Coastal Highway is included as a Strategic State Freight Road in the Department of Transport's *Western Australian Regional Freight Transport Network Plan* (Department of Transport, 2013).

'Regional distributor roads' also provide a high level of connectivity allowing efficient movement of people and goods and can also link significant towns and destinations. 'Regional distributor roads', and all other public roads, are the responsibility of local government authorities. In particular, Carnarvon-Mullewa Road is as an important route for tourism and freight; and provides connectivity with the Upper Gascoyne and Murchison local governments.

Other significant routes in the sub-region include Useless Loop Road, the coastal route north of Carnarvon and Yardie Creek Road, which provide important access routes for regional industries such as tourism and mining. In addition, the Department of Biodiversity, Conservation and Attractions manage a

considerable network of roads within the sub-region's conservation reserves, which performs a vital role in supporting regional tourism.

3.2.2 Ports and boating facilities

There are two port installations along the Gascoyne coast, being at Useless Loop and Cape Cuvier. Collectively these installations comprise the proclaimed port of Carnarvon. Both ports are bulk export facilities that exclusively serve nearby salt mining operations; and are privately operated by the relevant resource company associated with each operation. Under the State Government's port reforms initiative, Useless Loop and Cape Cuvier ports are proposed to be eventually overseen by the Mid-West Ports Authority.

Bejaling, about 30 kilometres north of Carnarvon, is understood to have bathometric characteristics that may make it a viable site for a deepwater port. If the need for such a facility within proximity to Carnarvon be needed in the future, it could be a site of interest.

The sub-region's major boat harbour facilities are located at Exmouth and Carnarvon. As well as servicing recreational users, this infrastructure is critical in servicing commercial fishing and tourism industries. The Carnarvon Boat Harbour also serves as the home port for tugs required for the private port operations at Cape Cuvier; whereas the Exmouth facility supports the offshore oil and gas exploration and production service industry.

The Exmouth Boat Harbour is currently subject to a substantial upgrade and expansion to cater for future demand, which will invariably support local economic development. Future upgrades could potentially service increased demand generated through the anticipated growth in cruise shipping, particularly as Exmouth is identified as a key cruise destination in the *Western Australian Cruise Shipping Strategic Plan 2012-2020* (Tourism WA, 2012).

A smaller boat harbour facility exists at Denham, which caters mainly for recreational and tourist users as well as harbouring the local fishing fleet. This facility is also currently being upgraded, and is being delivered with a revitalisation of Denham's foreshore. Other boat launching facilities considered significant from a sub-regional perspective are located at Monkey Mia, Coral Bay, Tantabiddi and Bundegi; which cater for tourism and recreational users in the Shark Bay and Ningaloo marine parks.

3.2.3 Aviation

The major airports in the Gascoyne Coast sub-region are located at Learmonth and Carnarvon. These, along with Shark Bay Airport, service regular passenger flights. Given that the Gascoyne Coast is geographically remote, aviation plays a key role in the sub-region's transport network. Aviation is fundamental in supporting economic activity in the Gascoyne Coast, particularly tourism. However, at present most regular passenger flights in the Gascoyne Coast fly directly to Perth; and there are no regular passenger flights between Learmonth and Carnarvon airports.

Learmonth Airport, operated by the Shire of Exmouth, is the largest and busiest airport in the sub-region. It is located approximately 35 kilometres south of Exmouth and services approximately 90,000 passengers annually. Generally, multiple regular passenger flights to Perth depart daily. The airport is located within the Learmonth RAAF base and is leased by the Shire under a Deed of Operation with the Department of Defence. The facility has the capacity to accommodate larger aircraft used for international flights.

Carnarvon Airport, which is operated by the Shire of Carnarvon, caters for about 20,000–25,000 passengers annually and runs at least one passenger flight per day. Regular passenger flights operate to and from Perth, with some flights routed via Shark Bay Airport. The Shire of Carnarvon has investigated the future role of Carnarvon Airport through recent structure planning. This also considers the potential for the development of areas adjacent to airport infrastructure for urban uses, such as business and housing.

Shark Bay Airport accommodates regular passenger flights that link Denham/Monkey Mia to Perth and Carnarvon. Total passenger numbers are around 5,000 annually.

Additional important aviation infrastructure in the sub-region includes Exmouth Airport, which is a general aviation facility operated by the Shire of Exmouth; and a light aircraft strip at Coral Bay. In particular, Exmouth Airport has an important role in regional aviation as it complements the Learmonth Airport, which is subject to restricted operating arrangements. Other private airstrips service specific locations and purposes, such as those situated at minesites and pastoral stations.

3.3 Social infrastructure and services

It is important that all communities have access to social infrastructure and services, including essential services such as educational and medical facilities. The provision of social infrastructure and services makes a significant contribution to the liveability and attractiveness of a local community, which can play an important role in attracting and retaining staff. The types of social infrastructure services vary from regional to local; and it is important that future requirements are identified through appropriate mechanisms. For example, the Gascoyne Development Commission, with local governments and other key stakeholders, has identified a number of local and regional social infrastructure priorities through their Gascoyne Revitalisation Plan.

3.3.1 Health

The Carnarvon Health Campus is the sub-region's most substantial piece of health infrastructure; providing regional hospital facilities. It currently provides a range of higher services including inpatient and outpatient services, emergency care, residential aged care, community child health, allied health, mental health and drug and alcohol services. The Exmouth Health Campus contains a district hospital facility that services the Exmouth community. It offers a range of inpatient and outpatient services including emergency care, general practitioner appointments, allied health, community child health, mental health, residential aged care and home and community care. Both the Carnarvon and Exmouth health campuses have recently undergone substantial redevelopment, providing the sub-region with expanded and modern health-care facilities.

The Silver Chain Nursing Association operates a nursing post at Denham. The WA Country Health Service (WACHS) provides visiting medical and allied health services from Carnarvon to Denham as well as Useless Loop. The WACHS also maintains a remote area nursing post at Coral Bay.

A purpose-built residential aged care facility is proposed adjacent to the Carnarvon Health Campus, which will increase the number of residential aged beds available within the sub-region.

The Royal Flying Doctor Service (RFDS) is of great importance to the Gascoyne due to the vast distances between facilities. However, the RFDS does not

permanently base aircraft, medical infrastructure or flight crew in the region; with the nearest base being located at Meekatharra. The predicted increase in numbers of tourists travelling in isolated parts of the region is expected to further escalate the importance of this service.

In addition to the availability of mainstream health services, the Carnarvon Medical Service Aboriginal Corporation offers primary, secondary and tertiary health and medical services to the Aboriginal people of Carnarvon and surrounding areas.

Service providers in the region have indicated that health services are under increasing pressure to meet additional demand during the peak tourist seasons.

3.3.2 Education

Within the Gascoyne Coast sub-region, government school facilities are currently located at Carnarvon, Exmouth, Denham and Useless Loop. Additionally, private schooling is available in Carnarvon from Kindergarten to Year 10. With the exception of the Useless Loop Primary School, the sub-region's government schools provide schooling up to Year 12, although in some schools, secondary schooling is delivered through the School of Isolated and Distance Education. Department of Education figures indicate that there is sufficient physical capacity at all schools in the sub-region to accommodate anticipated growth in student numbers in the immediate term.

The structure of government schooling in Carnarvon has recently been reorganised, with the town's two primary schools and senior high school having been amalgamated to form a new Carnarvon Community College. This institution currently operates over multiple campuses; however it is proposed to consolidate the college on a single site, which will involve the construction of new facilities.

Education services to more remote parts of the sub-region are delivered via radio by the Carnarvon School of the Air.

Additionally, Central Region TAFE has campuses located in Carnarvon and Exmouth, and offers a variety of academic and community courses.

3.3.3 Emergency and corrective services

There are police stations currently located at Carnarvon, Denham and Exmouth. The sub-region is predominantly within the Mid-West–Gascoyne police district with the exception of the Shire of Exmouth, located within the Pilbara police district. The recently completed Carnarvon Police and Justice Complex contains the only court facilities in the sub-region.

The Department of Fire and Emergency Services (DFES) oversees a range of emergency service providers in the Gascoyne, including:

- Volunteer Fire and Rescue Services based at Carnarvon, Exmouth and Denham;
- Volunteer Bush Fire Service Brigades at Gascoyne River (Carnarvon) and Shark Bay (Denham);
- State Emergency Service units based at Carnarvon, Exmouth, Shark Bay (Denham) and Useless Loop;
- A Volunteer Emergency Service unit at Coral Bay; and
- Volunteer Marine Rescue Services at Carnarvon, Exmouth, Shark Bay (Denham) and Coral Bay.

These are under the jurisdiction of the Midwest–Gascoyne DFES region.

Ambulance services are delivered by St John Ambulance WA, with sub-centres within the Gascoyne located at Carnarvon, Coral Bay, Exmouth and Shark Bay (Denham).

3.3.4 Recreation

Sport and recreation is often considered to be the lifeblood for many regional communities, promoting social and community cohesion, healthier lifestyles and providing economic advantages. There is a number of quality sporting and recreational facilities within the Gascoyne Coast sub-region. At Carnarvon, the Police and Community Youth Centre (PCYC) provides a dedicated recreational centre with both indoor and outdoor recreational areas available for younger people and the wider community. There is also a recreation centre at the Carnarvon Community College, which is available for community hire after school hours. Carnarvon also contains various sporting clubs, a skate park and a 50 metre swimming pool.

The Shire of Exmouth has recently completed the Exmouth Recreation Precinct Plan which provides a master plan for the existing recreation centre but with the inclusion of ovals, tennis courts and skate park on

one site. There are also various sporting and recreation clubs in Exmouth, with some having their own club houses. Exmouth also has a 50 metre swimming pool.

The Shark Bay Community Sport and Recreation Centre has recently been completed at Denham, which provides a significant community and recreational facility.

Maintenance and upgrading of sporting facilities are often considered to be essential for many regional communities, helping to ensure that adequate opportunities are provided for both individuals and sporting organisations.

There is a range of resourcing and training initiatives provided by the Department of Local Government, Sport and Cultural Industries, State sporting associations and other organisations to support the upgrading or maintenance of regional sporting facilities. The Royalties for Regions Grants Scheme can also provide funding for upgrading or new facilities.

3.3.5 Cultural facilities

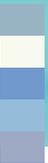
The Gascoyne Coast sub-region's key settlements contain a variety of civic and cultural facilities. The nature and scale of these facilities are generally commensurate with the local population they service, however certain facilities, such as visitor information centres, also cater for tourists.

Libraries in the sub-region include a regional library in Carnarvon, and other library facilities in Exmouth and Denham. The Carnarvon facility is modern, having recently been upgraded; and also incorporates an art gallery.

Other significant and proposed facilities in the sub-region include the:

- Shark Bay Discovery Centre at Denham;
- Ningaloo Centre at Exmouth – which includes community facilities;
- Carnarvon Civic Centre – a multi-purpose entertainment venue that caters for purposes including performances, functions and exhibitions; and
- Space and Technology Museum at Carnarvon.

Additionally, recreational facilities (section 3.3.4) can also provide important hubs for community and cultural activities. Multipurpose community facilities are often be incorporated as part of recreation centres, for example the Shark Bay Community Sport and Recreation Centre at Denham.



4 Natural resources, environment and heritage

The Gascoyne Coast sub-region has a diverse and highly valued range of natural resource assets. These contribute to the area's economy through tourism, research, fisheries and agriculture. A unique wilderness experience is provided on both land and sea; and as a point of significance, the region contains numerous and sizable National and World Heritage listed areas. Surface and groundwater resources are highly valued throughout the sub-region and careful management is required to ensure quality and quantity is provided sustainably. Sound management is imperative as, if realised, forecast long-term weather trends may have adverse effects on the region. The Gascoyne Coast also has significant cultural heritage with many sites of both Aboriginal and European significance having been identified.

4.1 Biodiversity

Terrestrial

The Interim Biogeographic Regionalisation of Australia (IBRA) classifies major divisions of land defined by distinct assemblages of climate, geology, landform, fauna and vegetation. According to IBRA, most of the Gascoyne Coast is within the Carnarvon Bioregion, with only the far southern extents of the sub-region occurring in the Yalgoo and Geraldton Sandplains bioregions. IBRA bioregions and sub-bioregions are the reporting unit for assessing the status of natural ecosystems and their protection in the National Reserve System. Although not ideal, bioregions are often used as a proxy for terrestrial biodiversity. Generally there is a greater diversity of vegetation communities along the coast when compared to the inland areas.

The Gascoyne Coast sub-region contains two national biodiversity hotspots listed under Australia's 15 national biodiversity hotspots — the Carnarvon Basin and the Geraldton to Shark Bay sand plains.

As minimal wholesale clearing has occurred in the region, the Gascoyne region is relatively well covered in native vegetation. However, in some areas pastoral activities have impacted on native vegetation and ecosystem processes.

The Gascoyne contains significant threatened fauna, as well as several species of flora that are declared rare or priority.

The Department of Biodiversity, Conservation and Attractions lists Cameron's Cave and the Cape Range Remipede Community (Bundera sinkhole) as threatened ecological communities (TECs). Both TECs have interim recovery plans which detail the conservation value of and potential threats to these communities (*Cameron's Cave Troglotic Community, Cameron's Cave Millipede and Cameron's Cave Pseudoscorpion Interim Recovery Plan 2012-2017* and *Cape Range Remipede Community (Bundera Sinkhole) and Cape Range Remipede Interim Recovery Plan 2000-2003* respectively).

A number of programs aim to restore biodiversity in parts of the sub-region through environmental and ecological rehabilitation. One notable example is an ecological restoration project on Dirk Hartog Island, which aims to eliminate introduced species and pests; and reintroduce locally extinct mammal species to the island.

Marine

The Gascoyne Coast sub-region contains marine areas of international significance and great scientific interest, in particular as it occurs in the transition zone between tropical and temperate biogeographical areas.

A variety of coastal landforms occur, including high cliffs, islands and shallow bays, as well as an area where the edge of the continental shelf is closer to the shoreline than any other place in the State. The associated habitats support diverse marine ecosystems, containing temperate south-western Australian species mixed with tropical and temperate Indo-Pacific species. Many of the marine habitats have yet to be described in detail, but more is known about the coastal habitats because they are relatively accessible to human observers. (Department of Fisheries, 2000)

There are numerous unique marine environments that fringe the Gascoyne coast. For example, Shark Bay has several isolated basins that support unique populations of marine life. Between Carnarvon and Exmouth is the Ningaloo Reef, which at more than 300 kilometres in length is the largest fringing coral reef in Australia.

Substantial areas of the Shark Bay and Ningaloo Coast areas are protected and managed through marine reserves and marine parks. The significance of the Gascoyne's marine environment is further reinforced



through identification on National and World Heritage Lists. Much of the Gascoyne's coastal areas are protected and managed under multiple pieces of legislation, including the *Conservation and Land Management Act 1984*, *Fish Resources Management Act 1994* and the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*. Significant marine biodiversity may exist beyond areas that are currently protected; for example, the area of coast between Red Bluff to Point Quobba and in Exmouth Gulf (Department of Conservation and Land Management, 1994). According to the Department of Biodiversity, Conservation and Attractions, Exmouth Gulf in particular has significant conservation values; including the marine environment, island nature reserves and fringing coastal areas such as mangroves; and it contains significant environmental values including habitat for threatened and priority flora and fauna, including breeding and feeding habitat for migratory birds.

4.2 Landscape and geology

The Gascoyne Coast sub-region is characterised by low relief, open drainage and large gently undulating sand plains. Varied landforms occur within the basin, including Tamala limestone formations such as the Zuytdorp Cliffs; and the Peron, Nanga and Edel Land Peninsulas in the Gascoyne Platform around Shark Bay. (Department of Mines, 1987)

Cape Range on the North West Cape is another significant landform. It comprises a heavily dissected plateau, gorges and extensive cave systems; and has marine deposit characteristics inherently linking it to the marine environment (WAPC, 2004).

The soils in the sub-region are predominantly coastal soils that are sandy, calcareous, and made up of littoral shell fragments that are prone to oxide leaching and contain areas of mangroves, coastal cliffs and floodplains. Tourism and recreation are the major use on these soils. Alluvial soils of the river systems comprise loamy fine sands that support horticulture at Carnarvon and pastoral pursuits including grazing.

Most of the Gascoyne Coast sub-region lies within the Southern Carnarvon Basin, a Phanerozoic sedimentary basin which has a long history spanning from 542 million years to present. Sedimentary rocks within the Southern Carnarvon Basin include shale, mudstone, sandstone, limestone, marl and radiolarite. In the southern part of the sub-region, a portion of the Perth Basin overlies the Southern Carnarvon Basin.

This portion comprises the Coolcalalaya Terrace which contains up to 8,500 metres of sedimentary rocks aged between 488 and 251 million years.

Cape Range and Shark Bay are two sites recorded in the Gascoyne Coast sub-region on the State's register of Geoheritage sites. Geoheritage sites should be protected from incompatible activities by relevant government agencies including local government planning and approval processes. For further information, refer to <http://www.dmp.wa.gov.au/Geological-Survey/Geoheritage-1413.aspx>.

The sub-region's mineral resources are described in section 2.3 of this document; and their distribution is indicated on Figure 2.

4.3 Water resources

Groundwater

The Gascoyne Coast sub-region is nearly entirely in the Gascoyne groundwater management area as proclaimed under the *Rights in Water and Irrigation Act 1914*. Part of the Shire of Exmouth, which includes the former Giralia pastoral station, is within the Pilbara groundwater management area.

All settlements in the sub-region are reliant on groundwater for domestic, commercial and horticultural purposes. While the groundwater resources are significant, quality and supply can vary, and recharge of these areas can be limited. As a result careful management of these sources are required to ensure the quality of, and accessibility to, ground water is not compromised and is safeguarded for future generations (refer section 3.1.2 Water).

The Carnarvon Artesian Basin is a major subsurface storage comprising Exmouth Gulf, Lyndon–Minilya Catchments, Gascoyne and Wooramel systems and Shark Bay. The basin contains the Birdrong Aquifer, which is Western Australia's most geographically extensive artesian aquifer, covering approximately 50,000 square kilometres. Artesian groundwater from the Birdrong has historically been used by the pastoral industry, but is under increasing demand from new development proposals. The shallow alluvial aquifer along the Gascoyne River at Carnarvon and the upstream part of the alluvial aquifer within the Gascoyne Groundwater Area are not considered to be part of the Carnarvon Artesian Basin. Neither are other shallow aquifers, such as the Wooramel River alluvium and the limestone aquifer at Cape Range. (Department of Water, 2007)

Surface Water

The main hydrographic catchments in the Gascoyne Coast sub-region are the Gascoyne–Murchison, Wooramel and Lyndon–Minilya catchments. These support the Gascoyne, Wooramel, and Lyndon–Minilya Rivers which are largely ephemeral waterways that dry up for part of the year. Heavy rainfall events over catchment areas, which are often associated with tropical cyclones, can result in widespread flooding; severely impacting settlements, infrastructure and rural lands, particularly those on or adjacent to river floodplains.

The Lyndon and Minilya Rivers are two relatively small rivers which originate from rangelands approximately 200 kilometres inland and both discharge in Lake MacLeod. The Gascoyne River and tributaries are surface water proclamation areas. The Gascoyne River basin has an area of 77,600 square kilometres, originating more than 780 kilometres inland. The river passes through pastoral land for most of its length before discharging into the ocean at Carnarvon.

The Wooramel River is ephemeral and the main tributary of the Wooramel catchment, originating in the Mid West region some 250 kilometres inland from the Shark Bay coast. The river has a small delta and discharges into Shark Bay.

The *Directory of Important Wetlands in Australia* (Department of the Environment, 2016) identifies nationally important wetlands including several in the sub-region, such as Cape Range subterranean waterways, wetlands in the Exmouth Gulf, Hamelin Pool, Lake MacLeod, McNeill Claypan System and wetlands in the Shark Bay East vicinity.

Estuaries are located at the mouth of the Gascoyne River and Yardie Creek. The estuaries are greatly impacted upon by tidal influences and nutrient levels are likely to increase with increasing development along the coast. The estuaries and the large coastal lake, Lake MacLeod, are home to mangroves, salt marshes and numerous species of bird life. These systems are largely unmodified; particularly the near-pristine Lake MacLeod and Yardie Creek estuary.

Periodic high volume discharge of river water and associated sediment to the sea is an important influence on coastal and marine ecosystems.

4.4 World Heritage Areas

The Commonwealth of Australia is a signatory to the international treaty *Convention concerning the Protection of the World Cultural and Natural Heritage*, which was adopted by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1972. UNESCO seeks to encourage the identification, protection and preservation of cultural and natural heritage places, and maintains a World Heritage List. For properties to be inscribed on the World Heritage List they must be of outstanding universal value and meet at least one of 10 selection criteria set by UNESCO. On account of their World Heritage significance, sites inscribed on the World Heritage List are categorised as natural sites; cultural sites; or mixed sites, in instances where sites are of both natural and cultural significance.

The Gascoyne Coast sub-region is significant in that it contains two of Western Australia's three natural sites inscribed on the World Heritage List; being Shark Bay (inscribed in 1991) and the Ningaloo Coast (2011). Given this status in particular, the Strategy acknowledges these areas as being strategic assets to the sub-region, from both environmental and economic perspectives. Shark Bay and Ningaloo also both feature on the National Heritage List.

The protection of World Heritage values in declared World Heritage properties is regulated through the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999*. The Australian Government's Department of the Environment and Energy has primary responsibility for the development and implementation of national policy on World Heritage matters. The Department of Biodiversity, Conservation and Attractions is the lead State Government agency for World Heritage matters relating to natural heritage sites, including the two properties in the Gascoyne Coast sub-region. World Heritage advisory committees for each of the World Heritage properties also play an important role in their administration.

For further information on the Ningaloo Coast and Shark Bay World Heritage sites – including specific information relating to criteria for their listings and the World Heritage values for each area – refer to the Australian Government's Department of the Environment and Energy website at www.environment.gov.au/heritage/places.

4.5 Conservation estate

Through managed parks and reserves, the conservation estate primarily protects and conserves significant landscape and biodiversity assets. From an economic perspective, national parks and nature reserves are an important attractor for tourism in the Gascoyne Coast sub-region. Much of the conservation estate also falls within the Shark Bay and Ningaloo Coast World Heritage Areas. Conservation estate reserves in Gascoyne Coast sub-region are listed in Table 1.

The conservation estate is administered through management plans prepared by the Department of Biodiversity, Conservation and Attractions. For more information on management planning refer to section 1.3.3 of Part A.

In addition to the State-managed conservation estate, the Australian Government manages a network of marine reserves in Commonwealth waters. Of these, the portion of the Ningaloo Commonwealth Marine Reserve in the Ningaloo Coast World Heritage Area is within the study area of this Strategy.

A number of proposed additions to the conservation estate include the:

- establishment of new reserves including the proposed Edel Land National Park; Giralia, South Peron and Petit Point conservation parks; Nanga Nature Reserve; and a proposed reserve along the Ningaloo coast adjacent to Ningaloo Marine Park between Winderabandi and Red Bluff;
- proposed extensions to the Cape Range National Park, Zuytdorp Nature Reserve and Shark Bay Marine Park; and
- other former pastoral leasehold properties managed by the Department of Biodiversity, Conservation and Attractions.

Current and future conservation estate areas are reflected in relevant land-use categories on this Strategy’s sub-regional land-use plan (refer section 4.1 of Part A). Additionally, given their economic importance to the sub-region, conservation estate reserves are also acknowledged as a component of the Gascoyne Coast’s Activity Centres Framework, which is outlined in section 2 of Part A.

Table 1: Conservation estate – Gascoyne Coast sub-region

	Type of reserve	Park or reserve
Terrestrial reserves	National park	Cape Range National Park
		Francois Peron National Park
		Dirk Hartog Island National Park
	Coastal park	Jurabi Coastal Park
		Bundegi Coastal Park
	Conservation park	Shell Beach Conservation Park
	Nature reserve	Zuytdorp Nature Reserve
		Freycinet, Double Islands Nature Reserve
		Bernier and Doore Islands Nature Reserve
		Koks Island Nature Reserve
One Tree Point Nature Reserve		
Chinamans Pool Nature Reserve		
Muiron Islands Nature Reserve		
Whitmore, Roberts, Doole Islands and Sandalwood Landing Nature Reserve		
Marine reserves	Marine park	Ningaloo Marine Park
		Shark Bay Marine Park
	Marine nature reserve	Hamelin Pool Marine Nature Reserve
Marine management area	Muiron Islands Marine Management Area	

4.6 Cultural heritage

4.6.1 Aboriginal heritage

The Gascoyne Coast sub-region has been inhabited by Aboriginal people for many thousands of years. The premise for much of their traditional culture is a strong connection to their country and in particular the landscape; which is a strong influence in traditional Aboriginal spirituality, customs, beliefs and social systems. Aboriginal cultural heritage in the Gascoyne Coast includes archaeological, historical, ceremonial and mythological sites in addition to cultural living practices.

A range of groups whose traditional country is within the Gascoyne Coast sub-region include the Baiyungu, Inggarda, Malagna and Nanda peoples. A considerable portion of the sub-region is within what is collectively known as Yamatji country. The living culture of Aboriginal people in the Gascoyne region is on display at Gwoonwardu Mia Gascoyne Aboriginal Heritage and Cultural Centre in Carnarvon.

The *Aboriginal Heritage Act 1972* provides automatic protection to all Aboriginal sites in Western Australia. The presence of an Aboriginal site may restrict the purposes for which the subject land can be used.

The Department of Planning, Lands and Heritage maintains a Register of Aboriginal Sites as a record of places and objects of significance to which the Act applies. There are numerous sites in the Gascoyne Coast sub-region that are listed on the Register. It should be noted that a search of the Register does not constitute a full assessment under the *Aboriginal Heritage Act 1972*. Further information on the location of sites on the Register is available from the Department's online Aboriginal Heritage Inquiry System at <http://www.daa.wa.gov.au/heritage/place-search/>.

4.6.2 Historic heritage

Prior to European settlement, the sub-region was visited many times by Dutch, French and English explorers – the first of whom was Dirk Hartog, who in 1616 landed on the island that now bears his name. Australia's pearling industry was established at Shark

Table 2: Historic heritage places – Gascoyne Coast sub-region

Local government area	Suburb/locality	Heritage-listed place
Shire of Carnarvon	Babbage Island	Carnarvon Lighthouse Keeper's Cottage (former)
		One Mile Jetty and Tramway
	Brown Range	OTC Satellite Earth Station (former) (Overseas Telecommunications Station)
	Carnarvon	St George's Anglican Church
		ANZ Bank Building (Union Bank of Australia Ltd Building)
		Homeswest Building (Bank of New South Wales (NSW), Main Roads Office)
		Church of St Mary Star of the Sea Group
	South Carnarvon	Carnarvon Pioneer Cemetery (Carnarvon Cemetery)
North and South Plantations	Gascoyne River Bridge (MRWA 838)	
	Gascoyne Research Station (Carnarvon Research Station)	
Shire of Exmouth	Ningaloo	Point Cloates Lighthouse and Quarters (ruins)
		Norwegian Bay Whaling Station
	North West Cape	Vlamingh Head Lighthouse Group
Shire of Shark Bay	Dirk Hartog Island	Cape Inscription Lighthouse and Quarters (including Landing site, Dirk Hartog Island)

source: Department of Planning, Lands and Heritage, 2018

Bay in the 1850s, however the townsite of Denham was not officially settled until 1898. Pastoralists were induced to take up leases in the Gascoyne from the 1860s, marking the beginning of active European settlement in the area.

The settlement of the Gascoyne delta began in the late 1870s, with the town of Carnarvon being developed as a port for shipping livestock and wool. In the early 1920s the banana plantations along the Gascoyne River were established. The importance of coastal shipping in the early development of the sub-region for passengers, supplies and exports is evident by the Mile Long Jetty and Lighthouse Keepers Cottage on Babbage Island, the lighthouse and keepers quarters at Cape Inscription on Dirk Hartog Island and the Vlamingh Head lighthouse at Exmouth.

North West Cape has a significant military and aviation history, with an airbase and naval refuelling point for allied forces in World War II, and the town of Exmouth which was opened in the 1960s to service the Naval Communications Centre. Operating from 1966-1975 the Overseas Telecommunications Centre near Carnarvon was Australia's first earth station for satellite communication. (GDC, 2009)

The State Register of Heritage Places, which is managed by the Heritage Council of Western Australia with assistance from the Department of Planning, Lands and Heritage, was established by the *Heritage of Western Australia Act 1990* to protect places that are recognised for their value and importance to the State.

The State Register of Heritage Places lists 14 places within the Gascoyne Coast sub-region, with the majority of these being located in and around the Carnarvon settlement. Listings include a range of places located across townsites, rural and remote locations. Given that listed places encompass a diverse range of heritage significance, value comparisons between them are difficult to make.

In addition to the State Heritage listings, the Cape Inscription area on Dirk Hartog Island also features on the National Heritage List. There are also around 200 historic heritage places of local heritage significance in the shires of Carnarvon, Exmouth and Shark Bay, of which 160 are currently listed in the municipal heritage inventories maintained by the respective local governments.

Local planning schemes are one planning mechanism that allows local governments to provide statutory protection to heritage places. Scheme provisions can stipulate special planning approval requirements for identified heritage places, including those recognised on a local government's Heritage List.

4.7 Native title

The unique ties that some Aboriginal groups have to land are recognised through native title, a form of land title; which may be applicable where Aboriginal people have maintained a traditional connection to land. Several native title applications that affect land within the Gascoyne Coast sub-region have been registered by the relevant groups with the National Native Title Tribunal; however native title has not yet been determined on any of these claims.

4.8 Coastal management

The coastline of the Gascoyne Coast sub-region is a valuable community, environmental and economic resource. It provides a focus for recreation and tourism, with its unique landforms having particular environmental significance.

Careful consideration should be undertaken in regard to coastal management, coastal processes/vulnerability and the potential impacts on existing and future development. A number of broad issues include:

- ensuring proposed development is consistent with current, strategic, statutory and policy documents, such as State Planning Policy 2.6;
- protection and enhancement of recreational activities;
- provision of appropriate access to the coast;
- consideration of heritage assets and values within the area;
- the need to identify coastal recreational nodes and provision of facilities with appropriate controls to sustainably provide for tourist and recreational demands;
- appropriate management of negative externalities associated with camping in the study area;
- appropriate sustainable management of off-road vehicles within the area; and
- addressing climate variability and the potential for impacts resulting from climate change.

Coastal management in the Gascoyne Coast sub-region occurs through various processes depending on the responsible authority, for example through management planning.

The vulnerability of the coastal areas of the sub-region to changing environmental conditions has been qualitatively assessed using analysis of coastal geology and landforms (Damara WA, 2012). The approach combined measures of susceptibility (potential for change) and sensitivity (observed coastal dynamics) to determine an overall index of coastal vulnerability. Determination of susceptibility and sensitivity was undertaken at the scale of individual coastal cells within the sub-region. The assessment and its associated methodology is contained in a technical report, available from the Department of Transport website: <http://www.transport.wa.gov.au/imarine/coastal-erosion-and-stability.asp>.

4.9 Climate change

The climate of the study area is characterised by hot, dry summers and mild-to-warm winters. Average annual rainfall is low, with much of the sub-region averaging around 200 to 250 millimetres annually. In southern parts of the sub-region, most of the annual rainfall generally occurs from May to August. Areas around Exmouth average 300 millimetres annually, mostly falling between January and July. Tropical cyclones, which usually occur in summer or early autumn, affect rainfall patterns, particularly in the north of the sub-region. Consequently, rainfall totals can vary markedly from year to year.

According to the Bureau of Meteorology, the observed mean annual temperature from 1970-2016 is higher than historical records. This is generally consistent with the observed trend in global annual temperature over the same time period.

The implication of future temperature increases, both locally and globally, needs to be considered as part of future planning. This includes consideration of the long-term effects on the environmental systems and biodiversity. Further, it is anticipated that in the future there will be an increased likelihood of extreme events such as bushfire, storm events and coastal impacts within the study area. Proactive planning within this context can address otherwise irreversible impacts on the environment and both public and private infrastructure. Guidance for addressing several of these issues is provided through State Planning Policies (SPP), such as SPP 2, SPP 2.5, SPP 2.6 and SPP 3.7.

4.10 Bushfire risk

Areas within Western Australia are designated as bushfire prone by the Fire and Emergency Services Commissioner. Most of the Gascoyne Coast sub-region is designated as bushfire prone, including rural and remote areas as well as areas within settlements. Such areas are mapped and reviewed regularly; with applicable extents available from the Department of Fire and Emergency Services website, <http://www.dfes.wa.gov.au/regulationandcompliance/bushfireproneareas/Pages/default.aspx>.

Bushfire protection is a land-use and development issue in much of the Gascoyne Coast sub-region, particularly where an interface with settlements and development activities occurs. From a planning and development perspective, *State Planning Policy 3.7: Planning in Bushfire Prone Areas* (SPP 3.7) outlines implications for bushfire prone areas. In this regard there can be certain implications for local planning schemes, assessment processes and development requirements.

It is intended that bushfire planning and management measures be addressed as early as possible in the planning process. Notwithstanding, SPP 3.7 and the accompanying Guidelines for Planning in Bushfire Prone Areas are applicable to every stage of the planning process.

Bushfire protection measures can include construction of fire breaks and removal of vegetation from around dwellings. In instances where biodiversity management conflicts with bushfire risk management measures and significant clearing of native vegetation is the only means of managing bushfire risk, the policy position is that the proposal should generally not be supported (WAPC, 2017).

References

- A Prince Consulting (2009) *Strategic Waste Management Plan*. Accessed online at: http://www.gdc.wa.gov.au/uploads/files/09_06_04%20Gascoyne%20Regional%20SWMP%20FINAL.pdf [accessed 21 January 2013]
- Australian Bureau of Statistics (2016) *Census of Population and Housing*. Canberra, ACT. Accessed online at: <http://www.abs.gov.au/>.
- Damara WA (2012) *The Coast of the Shires of Shark Bay to Exmouth, Gascoyne, Western Australia – Geology, Geomorphology and Vulnerability, Western Australia*. Prepared by Damara WA Pty Ltd and Geological Survey of Western Australia for the Department of Planning and the Department of Transport. Perth WA. Accessed online at: <http://www.transport.wa.gov.au/imarine/coastal-erosion-and-stability.asp>
- Department of Agriculture and Food (2017) *Carnarvon plantation industry production statistics*. Perth, WA. Accessed online at: <https://www.agric.wa.gov.au/bananas/carnarvon-plantation-industry-production-statistics?page=0%2C0> [accessed 2 October 2017]
- Department of Commerce (2016) *Regional Mobile Communications Project completed sites*. Perth, WA. Accessed from: <https://www.commerce.wa.gov.au/industry-and-innovation/regional-mobile-communications-project-completed-sites> [accessed 5 July 2016]
- Department of Conservation and Land Management (1994) *A representative marine reserve system for Western Australia*. Perth, WA.
- Department of Conservation and Land Management (2001) *Cape Range Remipede Community (Bundera Sinkhole) and Cape Range Remipede Interim Recovery Plan 2000-2003*. Perth, WA.
- Department of Employment (2017) *Small Area Labour Markets: March Quarter 2017*. Canberra, ACT. Access online at: <https://www.employment.gov.au/small-area-labour-markets-publication> [accessed 2 October 2017]
- Department of Environment and Conservation (2012) *Cameron's Cave Troglotic Community, Cameron's Cave Millipede and Cameron's Cave Pseudoscorpion Interim Recovery Plan 2012-2017*. Perth, WA.
- Department of Fisheries (2000) *Fisheries Environmental Management Review – Gascoyne Region*. Perth, WA.
- Department of Fisheries (2002) *Fisheries Environmental Management Plan for the Gascoyne Region – Draft Report*. Fisheries Management Paper No. 142. Perth, WA.
- Department of Mines (1987) *Geological Survey of Western Australia Bulletin 133: Geology of the Carnarvon Basin, Western Australia*. Perth, WA.
- Department of Mines and Petroleum (2016) *Basic Raw Materials (BRM)*. Perth, WA. Accessed at: www.dmp.wa.gov.au/Geological-Survey/Basic-Raw-Materials-1411.aspx [accessed 5 July 2016]
- Department of Mines and Petroleum (2016) *Geoheritage*. Perth, WA. Accessed at: <http://www.dmp.wa.gov.au/Geological-Survey/Geoheritage-1413.aspx> [accessed 5 July 2016]
- Department of Planning, Lands and Heritage (2018) *inHerit online heritage places database*. Accessed online at: <http://inherit.stateheritage.wa.gov.au/> [accessed 23 March 2018]
- Department of Regional Development (2014) *Regional Snapshot Part 5 – Regional Economies*. Perth, WA. Accessed online at: <http://www.drd.wa.gov.au/publications/Pages/default.aspx> [accessed 4 July 2016]
- Department of Regional Development (2014) *Gascoyne: A region in profile 2014*. Perth, WA. Accessed online at: http://www.drd.wa.gov.au/Publications/Documents/A_region_in_Profile_2014_Gascoyne.pdf [accessed 5 July 2016]
- Department of the Environment (2016) *Directory of Important Wetlands in Australia*. Canberra, ACT. Accessed online at: <https://www.environment.gov.au/water/wetlands/australian-wetlands-database/directory-important-wetlands> [accessed 5 July 2016]
- Department of the Environment (2016) *Interim Biogeographic Regionalisation of Australia*. Accessed online at: <https://www.environment.gov.au/land/nrs/science/ibra> [accessed 5 July 2016]

- Department of Transport (2013) *Western Australian Regional Freight Transport Network Plan*. Perth, WA.
- Department of Transport (2015) *Ports Handbook Western Australia 2015*. Perth, WA.
- Department of Water (2007) *Carnarvon Artesian Basin: Water Management Plan*. Perth, WA.
- Department of Water (2016) *Water for Growth: Urban – Western Australia's water supply and demand outlook to 2050*. Perth, WA.
- Department of Water (2016) *Water for Food Projects Summary*. Perth WA. Accessed online at: <http://www.waterforfood.wa.gov.au/pdf/wff-projects-summary-april-16.pdf> [accessed 4 July 2016]
- Gascoyne Development Commission (2010) *Gascoyne Fishing and Aquaculture Investment Profile*. Carnarvon, WA.
- Gascoyne Development Commission (2013) *Gascoyne Regional Infrastructure Review*. Carnarvon, WA.
- Gascoyne Development Commission (2015) *Gascoyne Regional Investment Blueprint*. Carnarvon, WA.
- SGS Economics and Planning (2012) *Gascoyne Pilbara Project: Economic development opportunities for the Gascoyne region associated with resource sector investment and expansion*. Prepared by SGS Economics and Planning Pty Ltd for the Gascoyne Development Commission. Accessed online at: <http://www.gdc.wa.gov.au/publications-statistics/gascoyne-pilbara-report/> [accessed 5 July 2016]
- Tourism Western Australia (2012) *Western Australian Cruise Shipping Strategic Plan 2012-2020*. Perth, WA.
- Tourism Western Australia (2014) *Ningaloo–Shark Bay National Landscape Experience Development Strategy*. Perth, WA.
- Tourism WA (2016) *Gascoyne Development Commission Area Overnight Visitor Fact Sheet 2014/15*. Perth, WA.
- WAPC (2004) *Ningaloo Coast Regional Strategy Carnarvon to Exmouth*. Perth, WA.
- WAPC (2015) *Gascoyne Regional Planning and Infrastructure Framework*. Perth, WA.
- WAPC (2017) *Guidelines for Planning in Bushfire Prone Areas*. Perth, WA.
- Western Australian Waste Authority (2012) *Western Australian Waste Strategy*. Perth, WA.