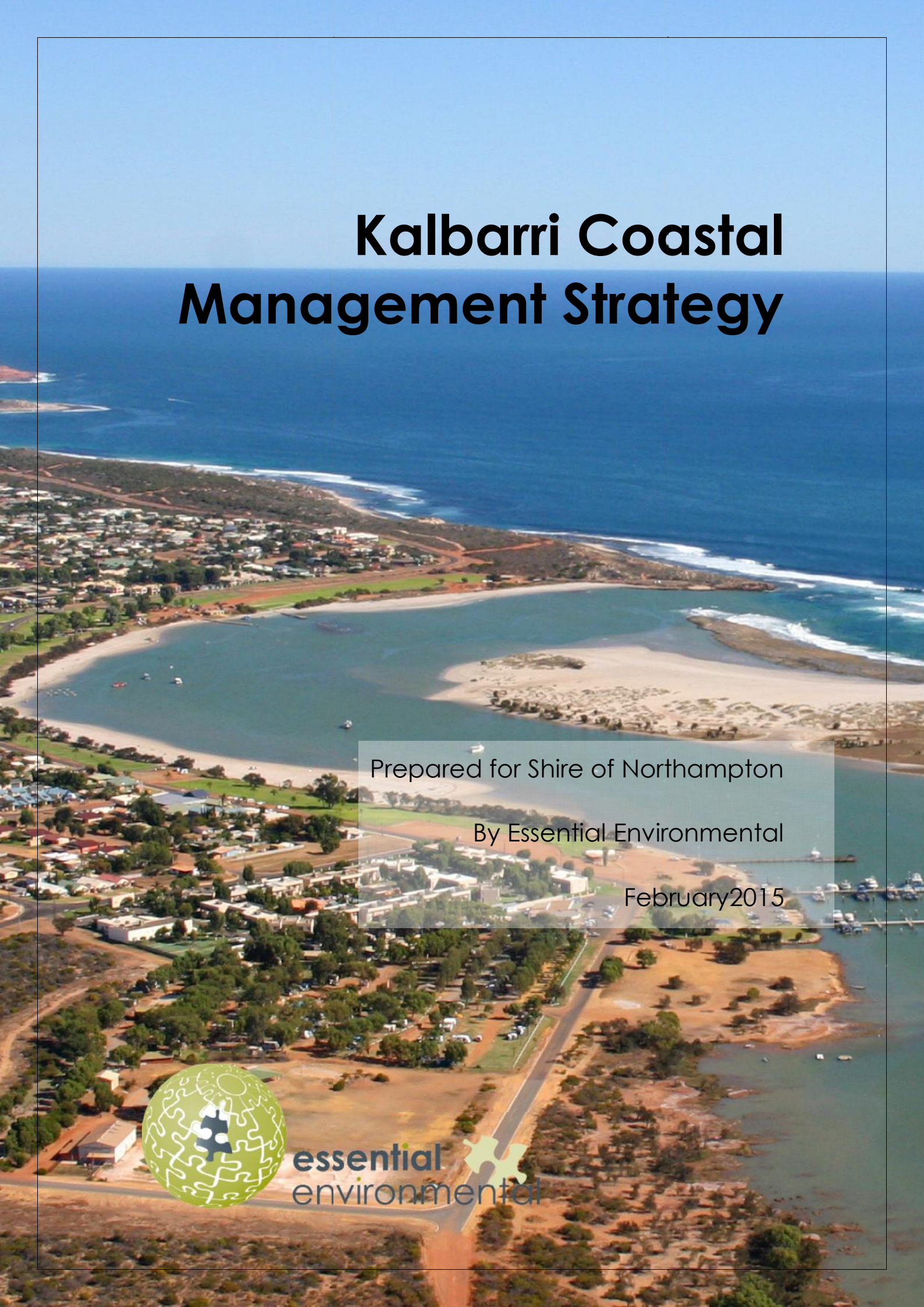
Kalbarri Coastal Management Strategy



Prepared for Shire of Northampton

By Essential Environmental

February2015

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Acknowledgement

This report incorporates the recommendations of the *Kalbarri Foreshore Parkland Redevelopment Plan – draft 3 (2013)* prepared for the Shire of Northampton by Ecoscape and the Kalbarri Development Association.

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1 INTRODUCTION

The Kalbarri coastal management strategy has been prepared to provide guidance for the management of coastal and human use impacts on the Kalbarri foreshore reserve in the Shire of Northampton (Figure 1).

The Kalbarri coastal management strategy describes the environmental, cultural, and recreational values associated with the study area, many of which are under threat from coastal processes and/or human activities on the coast. The Strategy makes recommendations regarding the future management of impacts in order to maintain or enhance the identified values for the long term.

This document has been prepared to enable input on its recommendations by the community during a period of public comment. It will be revised in response to comments received and presented to Council for endorsement.

1.1 Study Area

Kalbarri, or Wutumalu, as it is known to the Nanda people, is located in the Mid-West Region of Western Australia approximately 600 km north of Perth and 150km north of Geraldton, at the northern extent of the Shire of Northampton (27° 43' S and 114° 09 W). The townsite is situated on the southern banks of the Murchison River and is bordered by the coastline to the west, and is surrounded by the Kalbarri National Park to the east and south (Figure 1). Kalbarri is serviced by two entrance roads and an airport situated within the National Park.

The study area for the Kalbarri coastal management strategy covers approximately 1,800 ha along 22 km of coastline, and 17 km of Murchison River estuarine and river foreshore. It is around 1.9 km wide at its widest point, decreasing to 70 m at its narrowest point along the southern coast. The area that is the subject of this management strategy is that which is currently reserved for Conservation, Recreation and Natural Landscapes, and Parks, Recreation and Drainage in the Shire of Northampton Town Planning Scheme No 9 (Figure 2).

The study area contains a large stretch of coast from Red Bluff to Chinaman's Point; the river foreshore within the Kalbarri townsite and the largely unmanaged Murchison River Reserve to Murchison House homestead. These three sectors have rather different characteristics of use and so have been addressed separately in the strategy.

The majority of the coastal strategy area is owned by the State(Table 1), with some lots owned privately. Management responsibility for the reserves within the coastal strategy area rests mostly with the Shire of Northampton, as well as the Department of Lands, Water Corporation and the Department of Parks and Wildlife.

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 1: Kalbarri Site Location and Study Area

Datasource: Shire of Northampton, Landgate Created by: A. Kaye

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0 2 km

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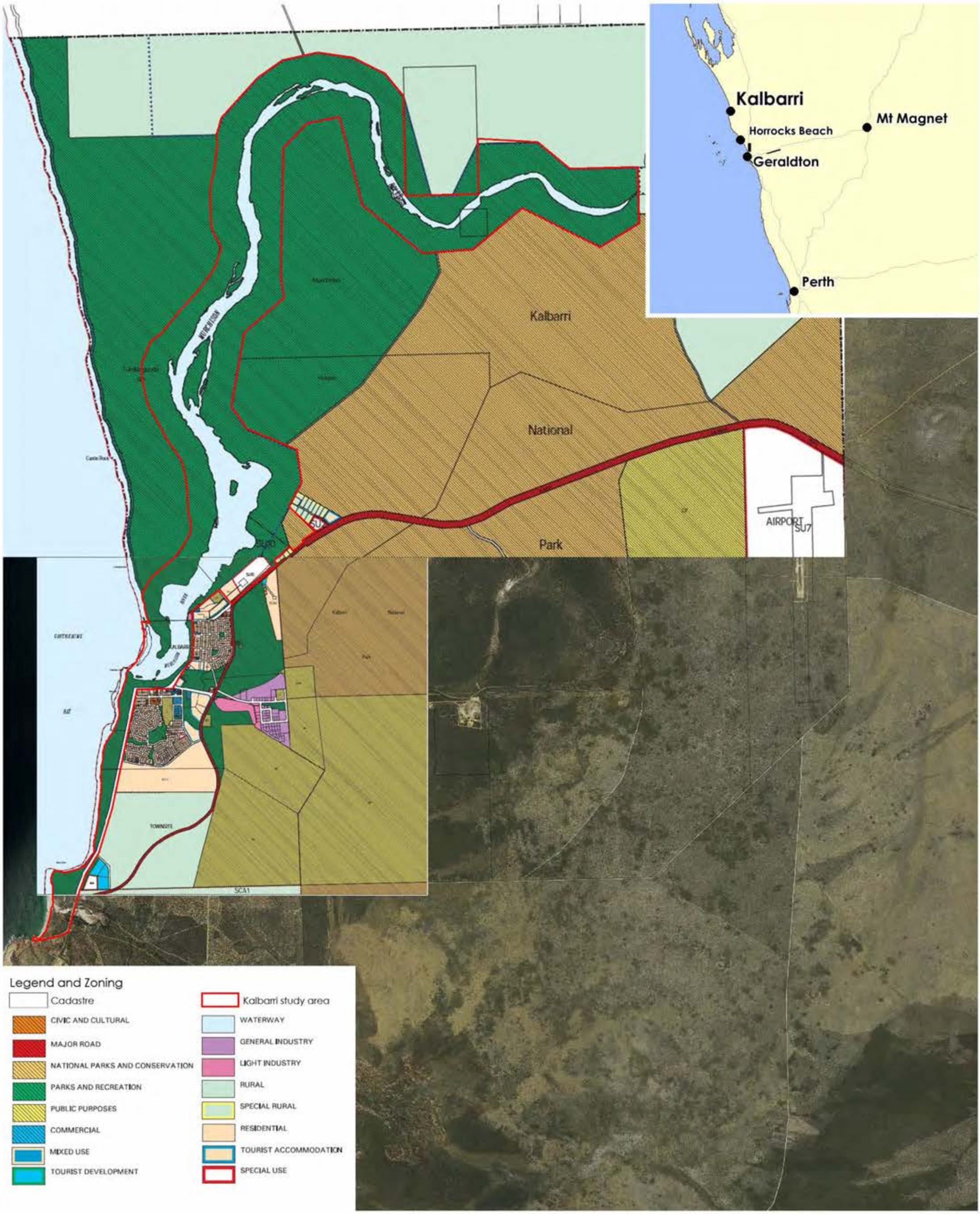
Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 2: Town Planning Sceme No.9 - Kalbarri Townsite



Datasource: Shire of Northampton, Landgate Created by: A. Kaye

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Table 1: Reserves comprising the Kalbarri coastal management strategy area

Reserve no	Purpose	Management responsibility
R12996	Parkland and recreation	Shire of Northampton
R25307	Recreation and Parklands Act76 -1961	Shire of Northampton
R26591	Parklands	Shire of Northampton
R27004	National Park	Department of Parks and Wildlife
R30502	Slipway	Shire of Northampton
R31390	Change rooms and parking area	Shire of Northampton
R31883	Fishing and tourist industries	Shire of Northampton
R34550	Recreation and parklands	Shire of Northampton
R38262	Sewerage pumping station site	Water Corporation

1.2 Management Objectives

Objectives for this Strategy relate to environmental protection, protection of assets and facilitating ongoing human uses of the coast. The objectives of this Strategy are to:

- **Protect and maintain the environmental and cultural values of the Kalbarri coast.** To ensure significant landscape, environmental features and conservation values are preserved and/or enhanced. This includes maintaining the coastal environment and the social, environmental and economic services which they currently provide.
- **Protect and maintain the environmental and cultural values of the Murchison River.** To conserve areas of geological, environmental and cultural significance, minimise the impact of human activities on the values and preserve the important cultural and recreational values of the River Reserve.
- **Protect and enhance the attraction of Kalbarri as a tourist destination.** To ensure that Kalbarri can continue to support a local tourist economy and to enhance Kalbarri's position as a premier holiday destination within Western Australia.
- **Protect and maintain facilities and access for commercial and recreational use**. To facilitate ongoing, sustainable public access and recreational use of the area for current and future generations. Ensure the facilities are adequate to meet the current needs of the community, visitors and local industry.
- **Manage public safety and protect infrastructure.** To ensure public safety and the protection of infrastructure from damage by coastal and fluvial forces.

1.3 Preparation of the Strategy

This Strategy has been prepared on the basis of a review of a number of existing relevant documents including:

- *Kalbarri Foreshore and Coastal Management Plan* (Landvision, 2003)
- *Kalbarri Foreshore Parkland Redevelopment Plan* – draft 3 (Ecoscape, 2013)
- *State Planning Policy 2.6: State Coastal Planning Policy* (2013)
- *Kalbarri Townsite Strategy* (Larry Smith Planning, 2011)
- *Kalbarri National Park draft management plan* (DPaW, 2014)

- *The Coast of the Shires of Coorow to Northampton, Mid West, Western Australia: Geology, Geomorphology and Vulnerability* (Prepared by Damara WA Pty Ltd and Geological Survey of Western Australia for the Department of Planning and Department of Transport).

A summary of these documents is provided in Appendix 1.

A series of community forums were held throughout May, June and July 2014 at the Allen Community Centre in Kalbarri. The forums aimed to identify community values, issues and objectives associated with the use of the coast which were then used as a basis for preparation of options for future management. The options were workshopped and refined into the concept that is presented in this draft strategy for public comment. The forums were attended by a number of community members representing a range of stakeholders on the basis of open invitations issued via the Shire website and local newspaper.

In addition, a number of interviews were undertaken with members of the Kalbarri and Nanda communities to assist in the identification of values and discern support for the recommendations proposed.

The desk top review and community input was supported by a number of site visits to ground truth the findings and recommendations.

The strategy was publically advertised from Friday 7th November 2014, for a period of 42 days, closing on Friday 19th December at 4.30pm. Thirty seven submissions were received. A summary of the issues raised and responses made is contained in Appendix 2.

1.4 Implementation of the strategy

Specific recommendations for implementation are contained in section 4. It is recognised that further detailed work will be required, including detailed design and costing of infrastructure, to facilitate implementation in some instances.

No commitments have yet been made regarding the implementation of this coastal management strategy. Its delivery will depend on the availability of resources and priorities identified by the Shire.

It is anticipated that implementation of the adopted coastal management strategy will require the formulation of partnerships and the identification of a variety of sources of funding. The lead agency for implementing this Strategy will be the Shire of Northampton.

2 KALBARRI FORESHORE – CHARACTERISTICS

2.1 Existing facilities and Infrastructure

The Kalbarri foreshore contains a variety of facilities and infrastructure to support the cultural, recreational and commercial activities undertaken at various nodes. Recreation nodes are mostly located on the south western coastal foreshore between Red Bluff and Chinaman's Point (Figure 3 and Figure 4), and throughout the townsite to Anchorage Lane (Figure 5). Murchison House Station is not part of the study area.

Facilities by sector include:

Kalbarri Coast

- Gravel car parks at all the coastal recreational nodes;
- Signed, fenced pedestrian access to the beach from the coastal car parks;
- Public toilets at Red Bluff;
- Litter bins at all coastal car parks and cigarette bins at Jakes Point;
- Disabled beach access at Jakes Point;
- Emergency vehicle access at Jakes Point;
- Vehicle access to the beach at Wittecarra Creek;
- A dual use path along the Red Bluff Road from the townsite to Red Bluff access road;
- Information on natural and cultural heritage at Blueholes and Back Beach.

Kalbarri Townsite

- Jetty and Marina facilities;
- Toilet, changing facilities, showers, shelters, BBQ, pelican feeding, playground, rubbish bins;
- Sealed parking for vehicles and boat trailers;
- Lookouts at Chinaman's Point;
- Public open space.

Murchison River

There are no formal recreational facilities provided by the Shire in the Murchison River Reserve but there are facilities to support the camping that is permitted on the Murchison House Station just outside the study area. There is an informal BBQ and picnic table at Nanny Goat Well currently utilised by commercial tour operators in the River Reserve (Figure 6).

An off road vehicle is required to access recreational areas of the Murchison River reserve. Access to the northern foreshore is via the Murchison House Station lease with permission or via pontoon from the townsite (Plate 1). There are a number of access routes available to the southern foreshore; the major routes are via Grey Street and through the Murchison House Station access road and Gregory's rocks.

There are a number of recreation nodes within the River Reserve that are known to the local community although there are no designated routes for their access. As a result much of the river foreshore in the study area is subject to indiscriminate vehicular access (Plate 2).


Plate 1: Pontoon and Grey Street access to the Murchison River Reserve


Plate 2: Access Tracks in the Murchison River Reserve Sector

2.1.1 Commercial Activities

The town is supported by tourism, some commercial fishing and the provision of goods and services to surrounding pastoral and agricultural activities. The largest industry of employment is tourism (DPaW, 2014).

The principal commercial fishery in the area is the western rock lobster fishery but there is also significant commercial scalefish catches. In 2010, there were a total of 15 registered commercial fishing vessels in Kalbarri (Department of Fisheries, 2011) and in 2012 there were a total of seventeen vessels (Department of Fisheries, 2013).

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 3: Coastal Characteristics - Red Bluff to Ocean View

Symbols
- Shelter
- Existing Toilet
- Recreational Node
- Walking
- Surfing
- Fishing
- Swimming/Snorkelling
- 4WD Beach Access

Data source: Shire of Northampton Created by: A. Kaye

Scale 1: 25,000 @ A3
0 1000 m

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Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 4: Coastal Characteristics Ocean View - Chinamans Point

Symbols
- Shelter
- Public Toilet
- Recreational Node
- Walking
- Surfing
- Fishing
- Swimming/Snorkelling
- Blueholes Marine Reserve

Data source: Shire of Northampton Created by: A. Kaye

Scale 1: 25,000 @ A3
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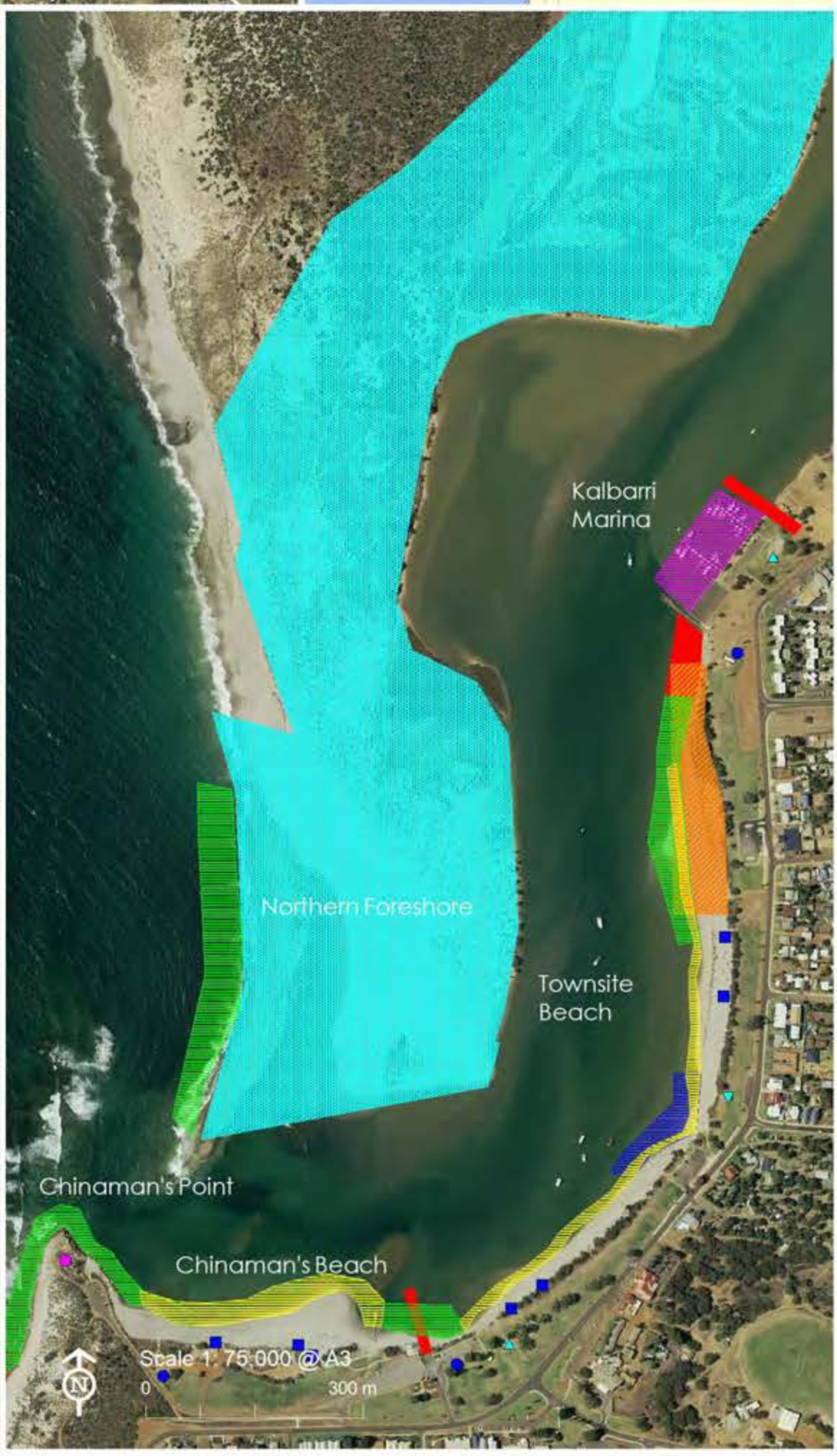
Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 5: Coastal Characteristics - Kalbarri Townsite Foreshore



Symbols

- Recreational Node
- Public Toilet
- Shelter
- Playgorund
- Pelican Feeding
- Walking/Cycling
- Boat Launching
- Commerical Marina
- Recreational Boating
- Swimming/Snorkelling
- 4WD Beach Access
- Fishing
- Disperesed commerical and rereational activity inc. Quad Biking, Horse Riding, Boat Tours

Data source: Shire of Northampton Created by: A. Kaye

Scale 1: 25,000 @ A3
0 1000 m

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Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 6: Coastal Characteristics - Murchison River Reserve

Tutula
Go Bang
Pastoral View
Paddock View
Gregory Rocks River Bend
Cement Springs
Gregory's Rocks
First Mill
Nanny Goat Well
Paradise Spring
Goat Island
Tidal Flats
North Forehsore View

Symbols

- Key Recreational Node
- Race Track - Area of signficiant environmental value
- Area of signficiant environmental value
- Tidal Flats - Area of signficiant environmental value
- Northern Forehsore - Area of signficiant environmental value
- Area of significant cultural value
- Study Area

Data source: Shire of Northampton Created by: A. Kaye

Scale 1: 25,000 @ A3

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2.2 Climate

Climatic conditions influencing the Kalbarri coastal environment are representative of a sub-tropical climate, with distinctly dry summers and a winter dominant rainfall pattern. Average annual rainfall is approximately 348 mm (BoM, 2014), the majority of which results from rainfall during the winter period between May and August, whilst maximum temperatures range from 35 degrees in summer to 21 degrees in winter (Figure 7).

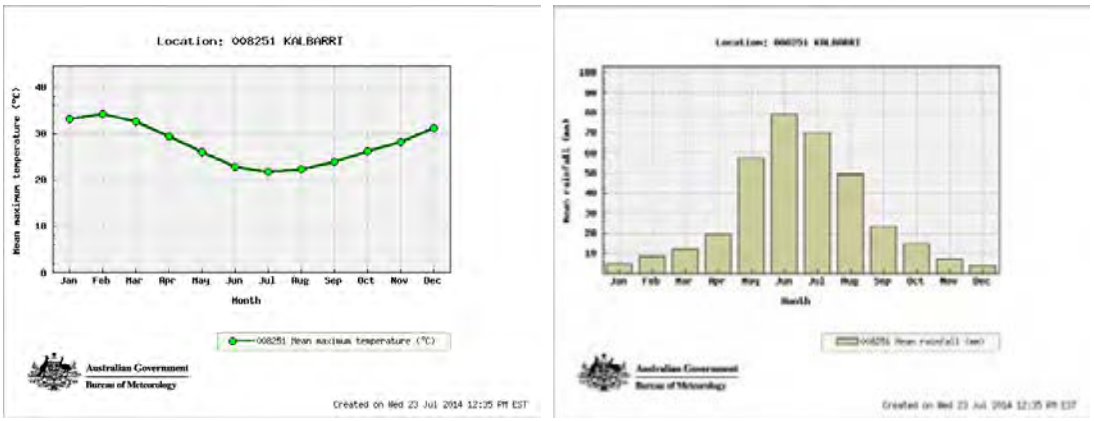


Figure 7: Climate statistics for Kalbarri weather station no. 008251 (Bureau of Meteorology, 2014)

While Kalbarri does not experience regular cyclonic activity, a number of tropical cyclones have caused severe damage to the coastline resulting in flooding and buildings. Most recent notable destructive tropical cyclones were Herbie (1988), and Hazel (1979).

Winds in Kalbarri are characterised by dominant south westerly winds occurring throughout summer and prevailing north easterly winds in the winter.

Recent work by the CSIRO and the Climate Commission (Steffen, 2011) suggests that temperature, rainfall and storm event patterns have significantly changed in Western Australia in recent decades. The coastal area around Kalbarri has seen an increase in average temperatures, and rainfall patterns have decreased and become more variable, with more frequent and intense storm events. These changes are likely to result in significant impacts on biodiversity, water resources and coastal infrastructure.

2.3 Geology and Coastal Geomorphology

The northern foreshore is composed of alluvial flats adjacent to the river, some Tumblagooda sandstone cliffs and on the western coast active parabolic dunes (Quindalup). There is a foredune and a beach extending north of the study area.

The Murchison River Reserve is dominated by hills and slopes composed from Tumblagooda sandstone and extensive areas of alluvial deposits (sand, silt and clay) at Paradise Flats formed by the Murchison River (Department of Transport, 2012)(Plate 3) (Figure 8).

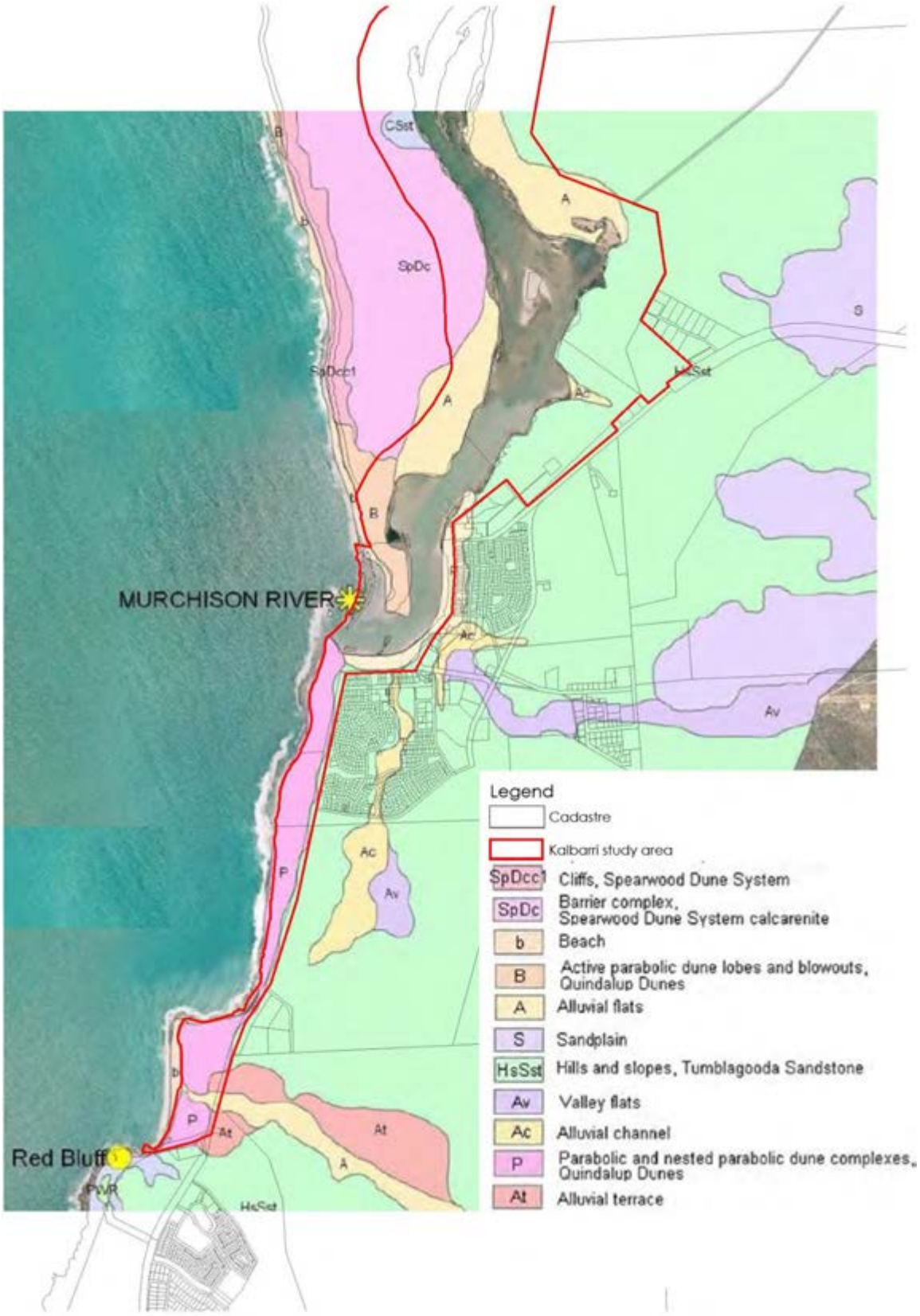


Figure 8: Landform (Source: Eliot *et al*, 2012)

Plate 3: Murchison River Reserve alluvial deposits

The Kalbarri townsite is situated on foredunes and there is a flat, gently sloping shoreline to the Murchison River. The Murchison Estuary is a complex, dynamic environment and various processes influence the landforms and coastal morphology at this location. Key estuarine landforms including the spit, river bed, bar and dune blowouts fluctuate and mobilise under the influence of sediment supply, wave action, cyclones, flood discharge and tidal inundation (O'Connell, 2011). These landforms including the townsite beach change as a result of the processes. The townsite beach is actively maintained with dredge spoil (Plate 4).

Plate 4: Murchison Estuary with associated landforms (T Nash) and Kalbarri Townsite Foreshore

South of the Murchison River the Kalbarri coast consists of soft sedimentary rock with Tumblagooda sandstone cliffs at Red Bluff and a beach fronted parabolic and nested parabolic dune complex northwards to Chinamans point. The area between Red Bluff and Murchison River consist of west facing beaches with wave dominated morphology (Plate 5). The beach is bounded by a frontal dune ridge but no foredune (Department of Transport, 2012).

Eliot *et al.* (2012) indicated that the landforms in the area between Red Bluff and Murchison River are highly susceptibility to environmental change and are of moderate instability. This level of vulnerability requires consideration as part of the coastal risk assessment and when developing appropriate management responses.


Plate 5: Sandstone Cliffs at Red Bluff (T Nash) and rock platform and dune ridge at Back Beach

2.4 Coastal processes

Coastal vulnerability is a product of interrelationships between extreme weather, oceanic forces, coastal geology and topographic features. The identification of areas which are vulnerable to changes through coastal processes requires consideration of the primary processes driving change along the coast, together with the probability of that change, within the context of the geology and topography of the area.

Wind and Waves

The offshore and near shore wave climate of Kalbarri has never been directly measured. Measurements for nearby regions have limited correlation to that at Kalbarri, as the wave sheltering effects of the Houtman-Abrolhos Islands experienced by this area of coast limits the accuracy of any extrapolation of such measurements (O'Connell, 2011).

The prevailing wind and wave processes go northwards generating longshore currents as waves break on an angle with the shore (Department of Transport, 2012).

Tides

Limited tidal predictions for Kalbarri are available from a number of sources, including the Bureau of Meteorology. Tides in Kalbarri are predominantly diurnal in nature (one tidal cycle per day) and limited in range, falling into the micro tidal classification. Typical daily tidal ranges for Kalbarri are around 0.7m during spring tides, and 0.3m or less during neap tides. The highest astronomical tide for Kalbarri is 0.6m above mean sea level (Department of Defence, 2012).

Tidal impacts extend along 18km of the Murchison River (O'Connell, 2011).

Storm Surge

During storm events barometric and wind effects can cause significant storm surges. The importance of storm surge on beach processes and morphology is most significant when surge levels exceed the tidal range. In extreme storms the surge in Geraldton (150km south of Kalbarri) can exceed 1m above the astronomical tide level (O'Connell, 2011). Extreme storm surges in Kalbarri are likely to be similar to this level, which is significantly larger than the tidal range.

As described in section 2.2, the area is subject to the effect of tropical cyclones and mid latitude depressions which can both create storm surge.

Sea Level Rise

Projections of sea level rise resulting from climate change are predicted to result in some significant changes to the balance between chronic erosion and accretion in the near shore environment.

The Intergovernmental Panel on Climate Change (IPCC) has presented various scenarios of possible climate change and the resultant sea level rise in the coming century (IPCC 2001, 2007). There is still some uncertainty as to which of these scenarios will occur.

A worst case scenario is considered by SPP2.6 and Department of Transport (2010)(Figure 9). This requires that coastal development allow for a 0.9 m sea level rise over a 100 year planning horizon and has been adopted for coastal planning throughout Western Australia. (Note: Red line SRES scenario A1F1 95th percentile, blue line continuation of scenario to 2110)

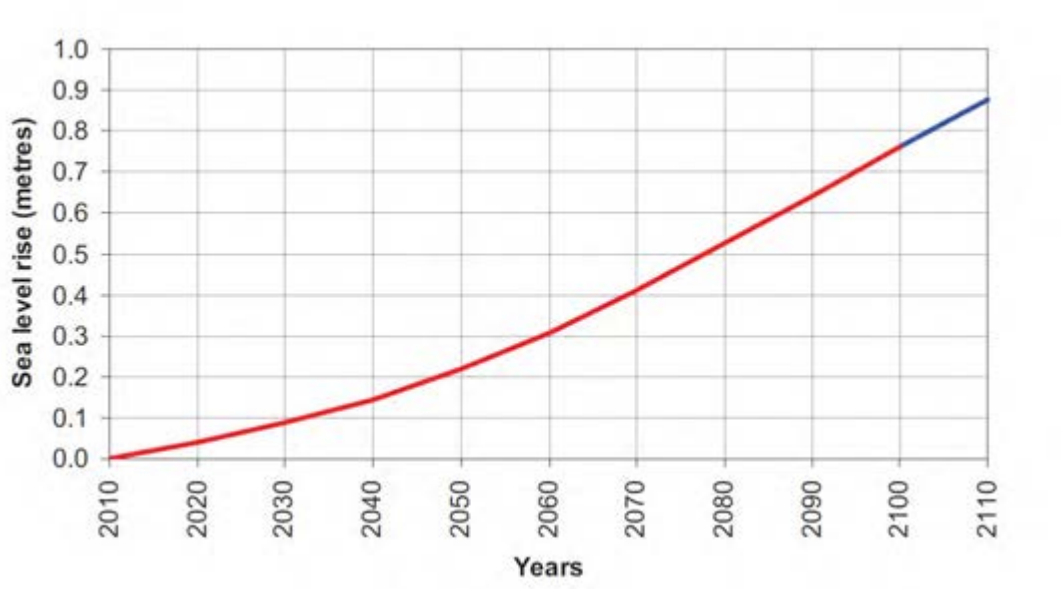


Figure 9: Department of Transport (2010) recommended allowance for sea level rise in coastal planning for WA

Future sea level rise may increase the frequency, and potentially severity, of existing storm inundation events and these impacts will need to be considered in this risk assessment and coastal management strategy.

2.5 Riverine processes

The Murchison River is the second longest in Western Australia at around 800km in length and extending about 550km inland from Kalbarri (Landagte, 2014). The Murchison River Catchment covers an area of about 82,000 square km. Flow rate is highly variable and dependant on rainfall over the catchment.

Flooding of the Murchison River

The Murchison River catchment receives erratic rainfall and the river flow is highly variable which strongly influences dynamics of the Estuary and river foreshore. A peak river flow of over 1770 m^3/L was recorded during Tropical Cyclone Emma in 2006 (O'Connell, 2011).

A survey of peak flood levels following the 2006 1:50 year Average Recurrence Interval event was undertaken by the Department of Water and levels of 2.41m above AHD in the townsite were observed. Anecdotal evidence of a depth of 1.45m was recorded at the Murchison Homestead during the 2006 event (Rodgers, 2014)(Plate 6).

Plate 6: Flooding of the Murchison River (David Pratt)

Sediment Transport (waterborne and wind-blown)

Sediment transport in the Murchison River is complex and the subject of a number of studies (O'Connell, 2011; Bailey, 2005). There is a large riverine input of material as well as longshore transport of sediment along the Kalbarri coast in a northerly direction. Nett littoral drift estimates are approximately 27,000-33,000 m^3/yr (Bailey, 2005).

The large input of material results in the Department of Transport undertaking annual dredging of approximately 43,000 m^3/year of sediment between the river mouth and the Kalbarri Maritime facility to maintain passage to the Indian Ocean for larger vessels. The spoil has previously been used to maintain Chinaman's Beach and any excess is disposed of 1200 m north of Oyster Reef (Department of Transport, 2014).

2.6 Environmental Values

2.6.1 Landscape

The study area contains a variety of landscapes including creeks, sandy beaches, rocky headlands, dune systems, tidal flats and an estuary.

Erosion of the Tumblagooda Sandstone by the Murchison River and coastal action has generated sites of geological significance. Rock strata exposed through erosion are of regional and state significance in the understanding of stratigraphy and ancient faunas of the area from the Silurian to the Pleistocene epochs (Department of the Environment, 2014).

The Paradise flats area is composed of aeolian and alluvial units which are dynamic and sensitive therefore prone to destabilisation through natural and human activity (Taylor, 1993). The town foreshore has little remnant fringing vegetation, introduced species and the

landscape has been significantly modified from its natural state as a result of development, the desire to create a habitable urban environment, and the practical aspect of using the river.

2.6.2 Flora and Fauna

Kalbarri is significant for rare species due to widespread clearing in the surrounding landscape, and to the high diversity and level of local endemism. Kalbarri is located the Geraldton Sandplains IBRA, one of the most botanically rich provinces in Australia and supports a high diversity of species, particularly for reptiles, with 64 species and birds, with 178 species. It also supports a high diversity of flora with almost 800 species (Department of Conservation and Land Management, 2002).

The area contains 53 of the flora species that are endemic to the south and western parts of Western Australia including 20 endemic eucalypts, and 15 endemic acacias. In addition, a total of 21 plant species are endemic to Kalbarri itself including the Kalbarri Catspaw (*Angozanthos Kalbarriensis*), and the Kalbarri Lechenaultia (*Lechenaultia Chlorantha*). Of the 178 recorded fauna species, 44 are endemic, including 4 frogs, 25 reptiles, and 13 bird species (Department of Conservation and Land Management, 2002).

Kalbarri National Park is located just west and south of the study area and has an array of natural and recreational values that attract around 300,000 visitors a year (DPaW, 2014). The area is widely known for the geological significance of the Murchison River gorge and the important biological and environmental diversity.

The Kalbarri National Park is the translocation site for locally extinct fauna and there is significant potential for further reintroductions (DPaW, 2014). The Murchison River is the only river in the south west land division with no known introduced species (DPaW, 2014).

A search of the Department of Environment and Conservation Nature Map search tool identified a number of endangered, nationally vulnerable and priority species. Two species, Beard's Mallee (*Eucalyptus Beardiana*), and the Long-leaved Hypocalymma (*Hypocalymma Longifolium*), are recorded as nationally endangered; the Malleefowl, the Black-flanked Rock-wallaby (*Petrogale Lateralis lateralis*), and five plant species, including the Kalbarri Lechenaultia, an eremophila (*Eremophila Microtheca*) and two species of orchid Caladenia Wanosa and the Hammer Orchid (*Drakaea Concolor*), are nationally vulnerable. The Barking Owl (*Ninox Connivens*), and the Red-tailed Black-cockatoo (*Calyptorhynchus Banksii*) are listed as priority species.

The history of pastoral use, and the patterns of human activity associated with proximity to Kalbarri, has contributed to changes in the natural habitat and wildlife diversity of the Murchison River which includes the Paradise Flats area (Figure 6)(Taylor, 1993). Paradise Flats are an area of discrete natural value, ecological and environmental sensitivity and are identified as an important wetland in the *Directory of Important Wetlands in Australia* (2014) along with the whole of the northern and southern foreshore of the Murchison River in the Strategy study area.

The riparian zone of the Murchison River, particularly upstream of the Kalbarri Townsite, has an important function as a wildlife corridor (Plate 7). The diversity, abundance and behaviour of terrestrial fauna that utilise the foreshore reserve should be a consideration when making management decisions. This includes ensuring adequate habitat is provided during weed removal and management of pests and feral animals.

Plate 7: Riparian habitats of the Paradise Flats area

Control of feral animals is also an integral part of managing the reserve. Although the feral goat and pig population is actively managed by Murchison House Station (Plate 8) and the Rangers in the Kalbarri National Park, community members have reported increased numbers of feral goats in recent years.

Plate 8: Murchison House Station

The waters of the Kalbarri coast are known for their rich diversity in marine life. This also provides a significant recreational and professional fishing resource. The marine environment is predominantly a temperate oceanic zone heavily influenced by the Leeuwin Current which transports warm tropical water southwards along the continental shelf (Department of Fisheries, 2011).

The Blues Holes form part of an inshore coastal limestone reef system to the south west of Kalbarri (Figure 4). The reef is home to a rich abundance of aquatic animals and fish and is a popular attraction for local people and visitors to the area due to the ease of access and the safe environment for recreational activities. The Blue Holes is a recognised Fish Habitat Protection Area (FHPA) and has held the status since 2007. As a FHPA, the Blue Holes has been identified as "*having special ecological and community significance and thus deserving special management to ensure its long-term sustainability*" (Department of Fisheries, 2009).

2.7 Cultural Values

2.7.1 European Heritage

Kalbarri has a rich European history that spans nearly 400 years. There are strong communal and cultural links to the Dutch sailors of the 17th century who encountered this part of the coast throughout the 1600s.

Survivors of the Batavia shipwreck in 1629 are thought to have been marooned in the area which would make them the earliest Europeans to live in Western Australia. The shipwrecking of the Zuytdorp north of the Murchison River possibly resulted in more survivors living and encountering the traditional aboriginal inhabitants of the area.

Later exploration was undertaken by George Grey, who made an expedition to the area in the 1830's to investigate the area's mineral and pastoral potential. Grey's expedition were wrecked near the mouth of the Murchison and made detailed records of the area on an arduous journey back to Perth. Significantly, Grey made detailed recordings of the Nanda people and their way of life (Grey, 1841).

Mining and the establishment of the Murchison House Station in 1848 brought permanent settlement to the area. It wasn't until the 1900's that fishermen recognised the potential of the mouth of the Murchison River and began to visit. They set up permanent camps by the mid 1940's and further development of the local fishing industry led to it becoming the largest economic contributor to the town. Around this time the town's tourist industry also started as it became a holiday destination for families from the Galena mines. In 1951 the town was officially gazetted. The European heritage is acknowledged throughout the study area (Plate 9).

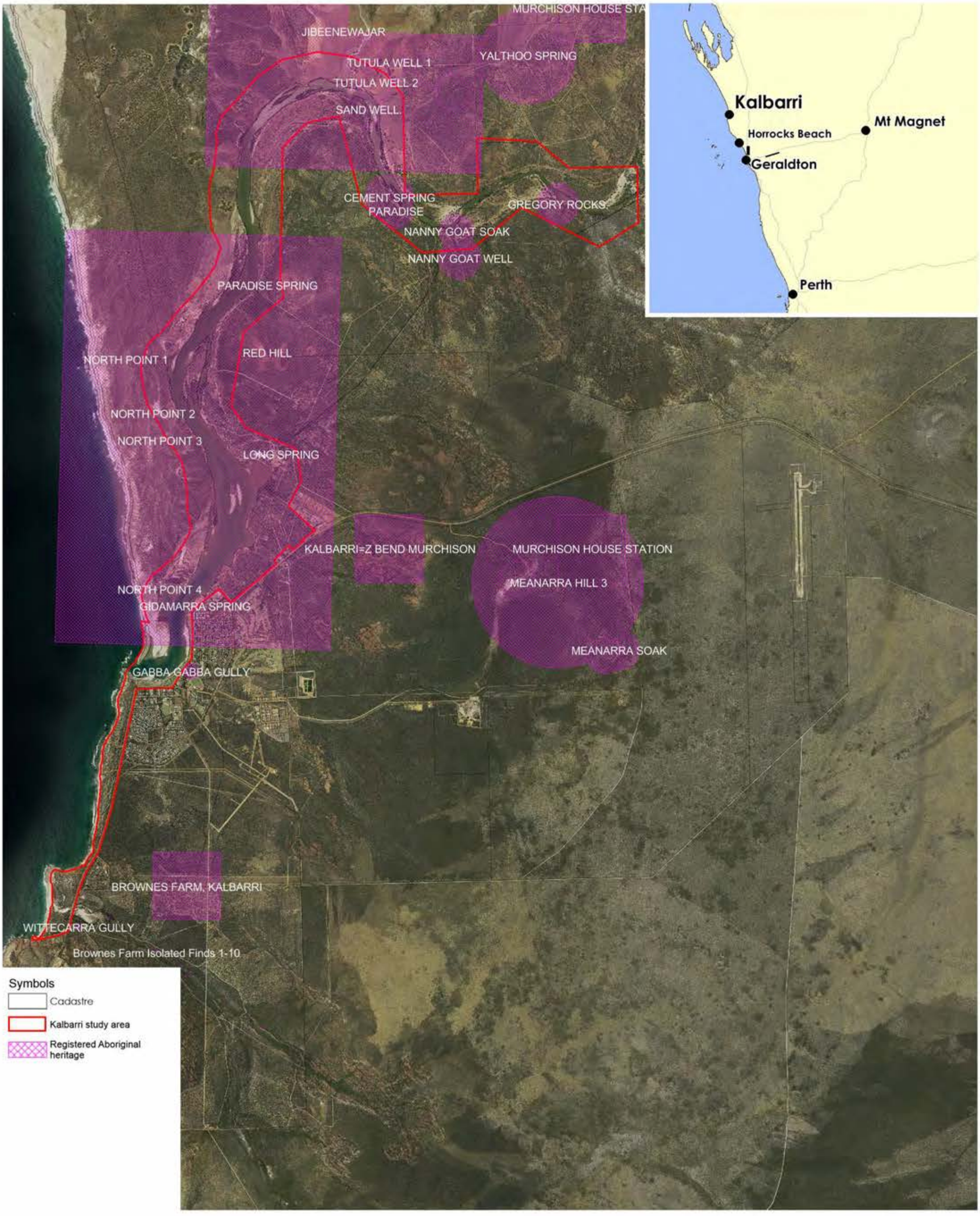
Plate 9: European heritage information on the Batavia and settlement at Wittecarra Creek

2.7.2 Aboriginal Heritage

The area is an important and sacred area for the local Nanda people with many Dreaming stories associated with the natural features such as the rocks, hills, Murchison River, streams and springs. The Nanda believe that the landscape and features in the area were formed by the activities of their ancestors and the Beemarra river serpent during the Dreamtime. The Nanda hold long standing, traditional knowledge of the landscape and natural resources in the study area.

The study area contains a number of cultural sites that are important to the Nanda people (Plate 10), some of which are registered with the Department of Aboriginal Affairs (Figure 10).

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 10: Aboriginal Heritage



Symbols

- Cadastre
- Kalbarri study area
- Registered Aboriginal heritage

Data source: Shire of Northampton, DIA Created by: A.Kaye

Scale 1: 50,000 @ A3

0 2 km

essential environmental


Plate 10: Registered Aboriginal sites: Paradise Spring and Gregory's Rocks

The area covered by this Strategy has previously been the focus of a number of dedicated ethnographic and archaeological studies into the extensive Aboriginal heritage and sites of importance to the Nanda people (Taylor & Burrell, 1993, Morley, 1979; Jackson, 1996). There is a concentration of heritage throughout the study area and Murchison River Reserve, particularly in Paradise flats (Reserve 12996) which includes numerous camping grounds, freshwater springs, engravings, artefacts and mythological sites (Table 2). The campsites have been previously associated with specific families and in the past were largely respected and reserved by the local community for Aboriginal use (Taylor, 1993).

Table 2: Location and significance of the aboriginal heritage in Kalbarri

Site	Location	Significance
Giddamarra Spring	Kalbarri Townsite R26591	Mythological
Gabba Gabba Gully	Kalbarri Townsite R25307	Artefacts
Long Spring	Murchison River Reserve R12996	Mythological, Artefacts
Paradise Spring	Murchison River Reserve R12996	Mythological, Campsite, Artefacts
Jibeenewajar	Murchison River Reserve R12996	Mythological
Mullaw	Murchison River Reserve R12996	Campsite
Sand Well	Murchison River Reserve R12996	Campsite
Cement Spring	Murchison River Reserve R12996	Campsite
Nanny Goat Soak	Murchison River Reserve R12996	Campsite
Nanny Goat Well	Murchison River Reserve R12996	Campsite, Artefacts
Gregory's Rocks	Murchison River Reserve R12996	Campsite, Engravings, Artefacts
Tutula/The Dancefloor	Murchison River Reserve R12996	Campsite, Artefacts

Giddamarra Spring in the townsite foreshore is a recognised heritage site and the only site in the study area with protected status. It was reported that some heritage has been lost to land practices and purposeful action.

It is important to note that the cultural values associated with the foreshore environment are not represented only by the registered aboriginal heritage sites. The land and water environment of coastal areas contains many sustaining values associated with the use and enjoyment of the land that are important to the region's Aboriginal community.

2.8 Recreational values

The Kalbarri community and its visitors highly value their outdoor recreational activities and the Kalbarri lifestyle. Activities undertaken in the study area include:

- fishing
- camping
- boating
- swimming
- surfing
- walking, jogging, cycling
- off road vehicles and horses
- skydiving

2.8.1 Fishing

Fishing and crabbing are highly popular activities that occur throughout the foreshore area particularly in the Murchison River Reserve Paradise flats area and in the townsite foreshore from Chinaman's point. Fishing tours are also run from the town. Commercial and recreational fishing vessels use the harbour facilities at the townsite (Plate 11) in order to fish in the Indian Ocean although commercial fishing in the area is declining.

Plate 11: Fish cleaning table and commercial fishing in Kalbarri (David Pratt)

2.8.2 Camping

Camping for the Kalbarri area is provided for at 3 formal campsites in the Kalbarri townsite and camping supported on the Murchison House Station. Informal camping throughout the study area is not permitted and the Shire employs a ranger to enforce this.

Camping does occur in the Murchison River Reserve but is not formally permitted although there is a permanent record of aboriginal family camping in the Murchison River Reserve and different campsite locations throughout the reserve are associated with different Nanda families.

There is no informal camping or designated vehicle based camping sites within the Kalbarri national park which may place pressure on the camping resources in Kalbarri and also result in illegal camping throughout the area.

2.8.3 Boating

Commercial river canoeing and boat hire occurs on the Murchison River from the townsite foreshore and the river reserve (Figure 6). Access for the canoe tours in the river reserve is by 4WD from Nanny Goat Well (Plate12).

Plate12: Canoe Hire and Nanny Goat Well area

Marine facilities at Kalbarri consist of a boat harbour and boat ramp at the northern end of the townsite foreshore and another recreational boat ramp and jetty near the river mouth by the Kalbarri Sea Search and Rescue (Plate13)(Figure 5). The harbour is operated by the Department of Transport and consists of 32 commercial boat pens, two jetties, maintenance and fuelling facilities. The car parking facilities and boat ramps adjacent to the marina and sea search and rescue are operated by the Shire.

Plate13: Kalbarri Marina and Jetty Facilities

2.8.4 Swimming

Swimming occurs throughout the study area and particularly at Chinaman's beach, Jakes Point and Blueholes where the water environment is more sheltered. The Blueholes marine reserve with its abundant biodiversity is a popular location for snorkelling (Plate14).


Plate14: Swimming at Blueholes and the townsite beach (Photos supplied by David Pratt)

2.8.5 Surfing

The Kalbarri Boardriders worked to establish the Kalbarri National surf reserve at Jake's Point (Figure 3) (Plate 15). The Kalbarri coast is one of three National Surfing Reserves in Western Australia. National Surfing Reserves are recognised, 'iconic' places of environmental, heritage, sporting and cultural value. The aim of the National Surfing Reserves is to help people and the surfing community understand, enjoy and protect special coastal environments of national and international value.


Plate 15: Kalbarri NSR ceremony (Photos supplied by David Pratt)

2.8.6 Walking/Jogging/Cycling

The whole study area is considered to be important for walking, jogging and cycling. This includes use of the Murchison River Reserve by the community and visitors for bushwalking and jogging along informal pathways.

Within the townsite foreshore, there are two lookout areas at Chinaman's Point that can be accessed by foot from the Back Beach car park and Chinaman's Beach. Access is via signed and defined paths but there is also indiscriminate access over fences and dunes in this area. There is a path in the foreshore reserve along Grey Street, set back from the beach. Access to the beach is primarily gained through vehicle access points associated with car parks.

A dual use path connects Chinaman's Point with Red Bluff along the Port Gregory-Kalbarri Road (Plate16). The dual use path does not link directly with the recreation nodes; however,

and users must leave the path and walk along the access track travelled by vehicles to get to the coast. This is a significant safety issue for pedestrians and cyclists.


Plate16: Dual use path in the Kalbarri coastal sector

2.8.7 Off road vehicles and horses

Off road vehicle use is a significant activity within the study area. Vehicles can access the beach directly at Wittecarra Creek, in the townsite and along parts of the Murchison River Reserve. Emergency beach access is also available at Jakes Point. Access to Wittecarra and the townsite beach is permitted and accepted by the community with access to the townsite beach restricted to one location opposite Auger Street (Plate 17). Movement of vehicles is restricted on the townsite beach via bollards and signage indicates the permissible/restricted areas.


Plate 17: 4WD Beach area in Kalbarri and bollards to identify the 4WD area

Vehicle access to the beach at Wittecarra Creek is via a number of routes from the established car park that facilitate access depending on levels of water in the creek itself (Plate 18). Pedestrian access from the car park is via the same routes as the 4WD but no conflicts were perceived due to the number of route options providing an informal segregation of users.


Plate 18: 4WD beach access at Wittecarra Creek

Commercial recreational tourism is permitted in the Murchison River Reserve. This includes Quadbike Tours and horse riding. The Shire's *Commercial Recreational Tourism Activity on Crown Reserves* Local Planning Policy (2012) permits a maximum of six 4 wheel bike tours in Reserves 12996 and 26591.

In addition to organised tours, off road vehicles including quad bikes and dirt bikes often access the Murchison River Reserve on both the northern and southern shores. The level of access is felt by the community to be increasing and is likely to lead to further impacts on the values of the Reserve such as loss of vegetation, noise and degradation of coastal dune landforms.

3 RISK ASSESSMENT

State Planning Policy 2.6 recommends coastal hazard risk management and adaptation planning to ensure that risk assessment and ongoing management are incorporated into the decisions that are made in protecting, conserving and enhancing the cultural, environmental and recreational values of the coast.

A risk management approach is particularly relevant given the uncertainty surrounding the local effects of climate change and lack of data for erosion rates, historical shoreline change and sediment transport. A risk assessment framework can help to define overall levels of risk, as outcomes may be assessed and compared even when there is little available data. This process involves the identification, analysis and evaluation of risks leading to recommendations for adaptation and management.

A coastal risk assessment of the study area has been undertaken using the framework established within AS/NZS ISO 31000 (Standards Australia, 2009). The risk assessment has been used to inform the Strategy by identifying risks which guide the identification of short and long term actions required to reduce risk to a tolerable / acceptable level.

3.1 Context and Objectives

The first step in understanding risks to be managed is to establish the objectives of the assessment. Objectives for this risk assessment relate to environmental protection, protection of assets and facilitating ongoing human uses of the coast. Section 1 outlined the objectives for the coastal management strategy which can be summarised as follows:

- Protect and maintain the environmental and cultural values of the Murchison River;
- Protect and maintain the environmental and cultural values of the Kalbarri coast;
- Protect and enhance the attraction of Kalbarri as a tourist destination;
- Protect and maintain facilities and access for commercial and recreational use; and
- Manage public safety and protect infrastructure.

Each of these objectives is affected by risks which may require planning controls and/or active management actions.

3.2 Risk Identification

Coastal processes, environmental factors and recreational activities identified in Section 2 present risks to the achievement of the objectives identified above. Specific risks associated with each of the objectives have been identified as follows:

Objective 1: Protect and maintain the environmental and cultural values of the Murchison River

1. Recession of River foreshore leading to loss and/or degradation of recreational and environmentally sensitive areas. There is the risk of shoreline recession and an increase in river levels that may impact on environmentally sensitive areas and recreational, cultural and commercial activities.
2. Significant Indigenous heritage damaged by coastal erosion and fluvial processes. There is a concentration of cultural heritage along the river foreshore that is at risk from degradation and/or loss through coastal erosion and fluvial processes.

3. Degradation of the foreshore environment from human activities and weed proliferation. Human activities including off-road vehicle use can degrade sensitive dune areas and associated vegetation causing proliferation of weeds, reduction in visual amenity and damage dunal ecosystems.
4. Perceived loss of amenity and potential conflict due to toilet litter at recreational nodes and culturally sensitive sites. There is the risk of potential conflict due to lack of awareness of the location of culturally sensitive sites and a lack of toilet facilities in the River Reserve, particularly in areas of high use.
5. Sea level rise alters estuary dynamics causing increased tidal range and foreshore inundation. There is the risk that estuarine dynamics could be altered through sea level rise which could impact on the estuarine landforms and the foreshore reserve.

Objective 2: Protect and maintain the environmental and cultural values of the Kalbarri coast

6. Loss of dunes, dune vegetation and ecosystems due to coastal recession. There is a risk to recreational and environmental amenity due to coastline recession. Valuable ecosystems could be lost.
7. Degradation and/or loss of ecosystems and species due to changes in landform. There is a risk degradation of the coastal dune environment due to the significant uncertainty in local ecosystem responses to climate change.
8. Accelerated rates of erosion and or degradation from human activities. There is the risk of human activities such as unrestricted pedestrian and off-road vehicle access degrading the natural environment.

Objective 3: Protect and enhance the attraction of Kalbarri as a tourist destination

9. Beach, dunes and foreshore inundated or subject to erosion damage during storm event. There is the risk of beaches, dunes and areas such as Wittecarra Creek and the Blueholes being damaged and vulnerable ecosystems lost.
10. Landscaped and vegetated areas not viable within the foreshore reserve as a result of coastal erosion and fluvial processes. It is predicted that coastal forces could result in recession of the coastline during the 100 year planning timeframe. Adapting to natural recession may not be possible if there is not enough space in the foreshore reserve area.
11. Perceived loss of amenity due to toilet litter at recreational nodes. There are areas of the foreshore with toilet litter impacting on the amenity at those locations.

Objective 4: Protect and maintain facilities and access for commercial and recreational use

12. Estuary landforms (Spit, bar, dune blowouts and Beach) inundated or subject to erosion or accretion though sea level rise, storm surge or river floods. Potential inundation, erosion or accretion could result in damage to facilities or the need for additional adaptation measures.
13. Commercial activities not viable within the foreshore and river reserve due to coastal erosion and/or stormwater/ fluvial processes. There is the risk that capability to operate commercial activities within the foreshore or river reserve is diminished as a result of coastal and fluvial processes such as storm surge, flooding or rainfall runoff.
14. Recreational facilities not viable within the foreshore reserve as a result of coastal erosion and/or stormwater/ fluvial processes. There is the risk of impact on facilities that provide service to local and tourist populations.

Objective 5: Manage public safety and protect infrastructure

15. Inundation of infrastructure or property during storm surge event. Potential inundation from storm surge could result in damage to property or the need for additional adaptation measures.
16. Inundation or flooding of property or infrastructure from rainfall runoff. Potential flooding during extreme rainfall events could impact property, damage infrastructure and result in injury to public.
17. Inundation or flooding of property or infrastructure due to river flood events. Potential inundation due to flooding of the Murchison River could impact property, damage infrastructure and result in injury to public.
18. Injury to users of recreational facilities due to structural failure as a result of damage from erosion during storm surge/rainfall runoff and/or coastal recession. There is a risk that damage to recreational facilities in the foreshore area may result in injury to one/more people.
19. Human activities undermining stability of foredunes such that they are no longer able to provide protection to inland areas. There is a risk that uncontrolled or poorly designed access through the foredune could result in blowouts that undermine the existing coastal dunes and reduce the protection and amenity that is currently provided by them.

3.3 Risk Analysis

Qualitative assessments of the likelihood and consequences for each of the identified risks needs to be undertaken in order to consider the need for management actions.

In order to undertake this assessment it is necessary to describe the uncertainty in risk through definitions of likelihood and consequence of occurrence for the defined risk event. Table 3 and
Table 4 outline the definitions of risk likelihood and consequence that were used for the assessment.

Table 3: Qualitative measures of Likelihood

Level	Descriptor	Example description
A	Rare	Highly unlikely that the event will occur. Not recorded historically and not expected to occur. 0 – 20% probability of occurring over the timeframe.
B	Unlikely	Low possibility that the event will occur. Infrequent and isolated occurrence. 20 – 40% probability of occurring over the timeframe.
C	Possible	Might occur or should be expected to occur. 40 – 60% probability of occurring over the timeframe.
D	Likely	Likely the event will occur. History or probability of casual occurrence. 60 – 80% probability of occurring over the timeframe.
E	Almost certain	High possibility the event will occur. History or probability of periodic occurrence. 80 – 100% probability of occurring over the timeframe.

Table 4: Qualitative Measures of Consequence

Level	Descriptor	Community / Infrastructure	Health / Environment
1	Insignificant	Little or no impact on communities and services. Minor temporary impact to private property or infrastructure. Temporary treatments required to maintain amenity.	No health impacts. Minor naturally assimilated environmental damage. No treatments / interventions required.
2	Minor	Minor or temporary impact on services for small population. Minor impact to private properties or infrastructure. Temporary, isolated treatments are required to maintain services or protect property and infrastructure. Permanent treatments required to maintain amenity.	Minor injury to individual. Potential harmful impact to local ecosystem with impacts contained to a specific site. First aid or medical treatment. Site specific intervention to assist in ecosystem recovery.
3	Moderate	Minor impact on services large population. Moderate impact to private properties or infrastructure. Temporary treatments are required to maintain services or protect property and infrastructure. Relocation of temporary infrastructure.	Minor injury to more than one person. Potential harmful impact to local ecosystem with impacts contained but occurring at multiple sites. First aid or medical treatment. Site specific interventions and monitoring to assist in ecosystem recovery.
4	Major	Major impact on services for small population. Major impact to private properties or infrastructure. Permanent treatments are required to maintain services or protect property and infrastructure. Relocation of permanent infrastructure.	Significant injury to small number of people causing lost time or restricted capacity. Long term, potentially irreversible damage to local ecosystem with impacts primarily contained, but potential for regional impacts. Medical treatment or hospitalisation required with expected full recovery. Widespread interventions and monitoring to assist in ecosystem recovery.
5	Catastrophic	Major impact on services for large population. Irreversible impact to large number of private properties or infrastructure. Permanent treatments are required to maintain services or protect property and infrastructure. Viability of land uses compromised, relocation of permanent infrastructure.	Fatality or permanent injury to an individual. Temporary injury to large number of people causing lost time or restricted capacity. Long term damage to regional ecosystem or loss of threatened species. Ongoing medical treatment for permanent injury. Isolated medical treatment or hospitalisation required for large number of people. Widespread interventions and monitoring to assist in ecosystem recovery.

3.4 Risk evaluation and controls

In order to evaluate risks and consider the need for risk management actions or controls it is necessary to define the level of acceptable risk. In order to do this the following definitions are considered.

- **Low risk** is tolerable and no further action is required.
- **Moderate risk** is tolerable but should be further reduced where possible and requires ongoing monitoring and communication to affected people.
- **High risk** is unacceptable and further action is required to reduce risk where possible.
- **Very high risk** is unacceptable and further actions are required before activities should be allowed to continue.

The definitions of risk, likelihood and consequence are considered to derive the qualitative levels of risk as presented in Table 5.

Table 5 Qualitative risk evaluation table

Likelihood	Consequence				
	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
A Rare	Low	Low	Moderate	Moderate	High
B Unlikely	Low	Moderate	Moderate	High	Very High
C Possible	Low	Moderate	High	High	Very High
D Likely	Moderate	Moderate	High	Very High	Very High
E Almost Certain	Moderate	High	Very High	Very High	Very High

The risk evaluation presented in Table 6 provides an assessment of inherent risk in the absence of coastal management planning or other controls. The residual risk is then estimated on the basis of implementation of the proposed controls.

In order to reduce the risks to tolerable levels, the following management response is proposed. These actions have been incorporated into the proposed management strategy which follows.

- Set back any new facilities and amenities to allow erosion and coastal processes to occur up to/over a 100 year timeframe.
- Educate and communicate the risks to environmental, cultural and heritage values to public accessing the Northern Foreshore, Murchison River Reserve and Coastal area.
- Identify long term options for provision of a foreshore reserve, facilities and recreational activities with allowance for erosion from sea level rise over 100 years and allowance for major fluvial flood events.
- Maintain beach and dune system to protect infrastructure from storm surge and set new permanent infrastructure at a suitable level to avoid storm surge.
- Management of river flood events should be covered by an emergency response plan and identification of appropriate temporary treatments.
- Management of extreme rainfall events should be considered through preparation of a stormwater management strategy for the site.
- Ongoing treatments to estuarine landforms through dredging and beach nourishment to continue
- Site specific interventions such as revegetation/brushing, rationalisation and management of off road access are required to assist in ecosystem recovery.

- Undertake consultation with indigenous communities to identify specific management options in the Murchison River reserve.

Table 7 presents more detailed assessment of the likelihood and consequence of each of the identified risks.

Table 6: Risk assessment for Kalbarri Coast, Townsite and Murchison River Reserve

Objective	Risk ID	Description of Safety Hazard or Environmental Impact	Likelihood	Consequence	Risk	Proposed Action/Control	Likelihood	Consequence	Residual Risk Rating
Protect and manage the conservation, environmental and heritage values of the Murchison River	1	Recession of River foreshore leading to loss and/or degradation of recreational and environmentally sensitive areas	D	1	MODERATE	Site specific interventions such as revegetation/brushing and rationalisation of off road access required to assist in ecosystem protection. Communicate the interventions to advertise the risk.	D	1	MODERATE
	2	Significant Indigenous heritage damaged by coastal erosion and fluvial processes	C	4	HIGH	Consultation with indigenous communities to identify sites of significance and determine appropriate management options including recognition of values. As majority of sites are in River Reserve, the sites have a degree of resilience.	C	2	MODERATE
	3	Degradation of the coastal environment from human activities and weed proliferation.	D	3	HIGH	Manage human activities in the foreshore reserve and limit access or activities in areas most at risk from degradation or where treatment for weeds is required/has been implemented. Use appropriate weed control techniques and undertake ongoing monitoring of weeds throughout the coastal environment through appropriate documentation.	B	2	MODERATE
	4	Perceived loss of amenity and potential conflict due to toilet litter at recreational nodes and culturally sensitive sites	D	2	MODERATE	Provide adequate toilet facilities near to problem sites. Provide signage to identify culturally sensitive sites.	C	1	LOW
	5	Sea level rise alters estuary dynamics causing increased tidal range increasing foreshore inundation.	C	4	HIGH	Monitor tidal ranges at Kalbarri. Identify long term options for provision of facilities and recreational activities with allowance for erosion from sea level rise over 100 years.	C	2	MODERATE
Protect and maintain the environmental and visual importance of the Kalbarri coast	6	Loss of dunes, dune vegetation and ecosystems due to coastal recession.	C	4	HIGH	Undertake ongoing monitoring and environmental works to assist in dune, beach and ecosystem recovery. Shoreline recession and shoreline movement are natural processes and maintenance following erosive events should be employed.	C	2	MODERATE
	7	Degradation and/or loss of ecosystems and species due to changes in landform. There is a risk degradation of the coastal dune environment due to the significant uncertainty in local ecosystem responses to climate change	C	2	MODERATE	Protect areas of coastal vegetation and dune habitat as part of any future development including of transport corridors to allow migration where necessary.	B	2	MODERATE
	8	Accelerated rates of erosion and or degradation from human activities	D	3	HIGH	Site specific interventions such as revegetation/brushing and rationalisation of off road access required to assist in ecosystem recovery. Communicate the interventions to advertise the risk.	C	2	MODERATE
Protect and enhance the attraction and importance of Kalbarri as a traditional tourist destination	9	Beach, dunes and foreshore inundated or subject to erosion damage during storm event.	D	2	MODERATE	Undertake ongoing monitoring and environmental works to assist in dune, beach and ecosystem recovery.	D	1	MODERATE
	10	Landscaped and vegetated areas not viable within the foreshore reserve as a result of coastal erosion and fluvial processes	C	2	MODERATE	Identify long term options for provision of a foreshore reserve, facilities and recreational activities with allowance for erosion from sea level rise over 100 years and allowance for major fluvial flood events.	A	1	LOW
	11	Perceived loss of amenity due to toilet litter at recreational nodes	D	1	MODERATE	Undertake ongoing monitoring of toilet litter and provide adequate toilet facilities	C	1	LOW
Protect and maintain facilities and access for commercial and recreational use	12	Estuary landforms (Spit, bar, dune blowouts and Beach) inundated or subject to erosion or accretion through sea level rise, storm surge or river floods	D	3	HIGH	Ongoing treatments through dredging and beach nourishment to be maintained.	D	2	MODERATE
	13	Commercial activities not viable within the foreshore and river reserve due to coastal erosion and/or stormwater/ fluvial processes	C	1	LOW	Identify long term options for provision of facilities and recreational activities. It is assumed that they can be located elsewhere in the townsite foreshore.	B	1	LOW

Objective	Risk ID	Description of Safety Hazard or Environmental Impact	Likelihood	Consequence	Risk	Proposed Action/Control	Likelihood	Consequence	Residual Risk Rating
	14	Recreational facilities not viable within the foreshore reserve as a result of coastal erosion and/or stormwater/ fluvial processes	C	4	VERY HIGH	Identify long term options for provision of facilities and recreational activities.	B	1	LOW
Manage public safety and protect infrastructure.	15	Inundation of infrastructure or property during storm surge event	B	3	MODERATE	Maintain beach and dune system to protect infrastructure from storm surge and set new permanent infrastructure at a suitable level to avoid storm surge. Identify long term options for provision of facilities and recreational activities with allowance for erosion from sea level rise over 100 years.	B	2	MODERATE
	16	Inundation or flooding of property or infrastructure from rainfall runoff.	D	3	HIGH	Management of extreme rainfall events should be considered through preparation of a stormwater management strategy. Temporary treatments may be required in only extreme events.	C	2	MODERATE
	17	Inundation or flooding of property or infrastructure due to River flood Events	D	3	HIGH	Management of river flood events should be covered by an emergency response plan and temporary protection/treatment.	D	2	MODERATE
	18	Injury to users of recreational facilities due to structural failure as a result of damage from erosion during storm surge/rainfall runoff and/or coastal recession	C	4	HIGH	Assess asset condition following storm surge and rainfall events. Undertake maintenance following erosive event or close the facility if deemed unsafe for use and when maintenance cannot be carried out.	A	4	MODERATE
	19	Human activities undermining stability of foredunes such that they are no longer able to provide protection to inland areas	C	2	MODERATE	Rehabilitate damaged areas of dune and closed access tracks through revegetation. Educate and communicate the risks.	A	1	LOW

Table 7: Assessments of Likelihood and Consequence for Kalbarri Coast, Townsite and Murchison River Reserve

Risk ID	Prior to Implementation of control / action		After implementation of control / action	
	Initial Likelihood	Initial Consequence	Final Likelihood	Final Consequence
1	Shoreline recession within this area is considered possible and may impact on existing areas of foreshore.	Potential harmful impact to local ecosystem with impacts contained but occurring at multiple sites. There may be moderate impact on the use of the sector for recreational cultural and commercial activities.	The proposed management actions do not affect likelihood.	Consequence remains the same. There is evidence that river floods deposit alluvial sediments throughout the foreshore facilitating natural recovery of the ecosystem.
2	The foreshore could be at risk of coastal processes over a 100yr timeframe and significant river flood events. Shoreline recession and fluvial inundation within this area is considered possible.	The Indigenous community would experience a major impact due to loss of the heritage value.	The proposed management actions do not affect likelihood.	Consequence remains the same until likelihood reduced.
3	There is a history and high probability of future occurrence.	Potential impacts to the coastal environment and ecosystems from human activities with impacts occurring at multiple sites.	Likelihood reduced by controlling access, restricting human activity in sensitive areas and through ongoing monitoring of intervention and ecosystem recovery.	Consequences are diminished by reducing likely impacts.
4	Likely - there is a history of casual occurrence	Impact on culturally significant sites, loss of visual and environmental amenity in areas used for toilets.	With adequate consideration the likelihood of impacts is reduced.	Consequences are mitigated by reducing likely impacts
5	Might be expected to occur over a 100yr timeframe	Major impact on services, foreshore and infrastructure.	No reduction in likelihood.	Consequence remains the same
6	Degradation of the dune environment and ecosystems is considered possible due to the significant uncertainty in local ecosystem responses to climate change. Shoreline recession has a high probability of occurrence	The dunes and coastal ecosystem provide the foundation for the tourism industry in Kalbarri. Degradation would have a major impact on the community, tourist industry and local economy.	The proposed management actions do not affect likelihood.	Consequences are diminished by reducing likely impacts.

Risk ID	Prior to Implementation of control / action		After implementation of control / action	
	Initial Likelihood	Initial Consequence	Final Likelihood	Final Consequence
7	Degradation of the dune environment is considered possible due to the significant uncertainty in local ecosystem responses to climate change. Dune and sandsheet migration have a probability of occurring under changing wind forcing and sediment supply.	Although environments would naturally be subjected to these events they are highly likely to naturally assimilate any damage but some MINOR site specific interventions could be required to assist in ecosystem recovery.	Likelihood reduced by interventions and education.	Consequence reduced because potential impacts will be restricted to specific sites.
8	Likely - There is a history of casual occurrence.	Minor Site specific interventions such as revegetation/brushing and rationalisation of off road access may be required to assist in ecosystem recovery. There is evidence that river floods deposit alluvial sediments throughout the foreshore facilitating natural recovery of the ecosystem.	Likelihood reduced by interventions and education.	Consequence reduced because potential impacts will be restricted to specific sites. There is evidence that river floods deposit alluvial sediments throughout the foreshore facilitating natural recovery of the ecosystem.
9	Beaches, foredunes and natural coastal features are likely to be inundated. The natural landscape, beaches and dunes at Kalbarri are of high value to the community.	Minor consequence. Although environments would naturally be subjected to these events and are likely to naturally assimilate any damage, loss of natural assets could occur. Site specific interventions would be required to assist in their recovery. The Blueholes is a designated Fish Habitat Protection Area with special ecological and community significance.	Maintenance of natural environment provides protection from predicted storm surge.	Consequences are mitigated by reducing likely impacts.
10	Natural adaptation through replacement cycles may not be possible if there is limited space within the foreshore reserve. Shoreline recession and impacts from fluvial processes within this area is considered possible	Some minor impacts on the local community as the landscaped areas are used for local recreation including markets and festivals.	With adequate consideration the likelihood of impacts is reduced.	Consequences are mitigated by reducing likely impacts
11	Likely - there is a history of casual occurrence	Impact on nationally significant site (National surfing reserve), loss of visual and environmental amenity in dune areas used for toilets, damage to dunes and dune vegetation due to human activity.	With adequate consideration the likelihood of impacts is reduced.	Consequences are mitigated by reducing likely impacts
12	The foreshore is likely be at risk of coastal processes over a 100yr timeframe and at risk from significant river flood events. Estuary landforms are subject to marine and fluvial processes.	Environments would naturally be subjected to these events and are likely to naturally assimilate any damage and the impact is minor. Evidence indicates that the features are transient and the community has adaptive capacity to the change in landforms as a result of the natural processes. An annual dredging programme is in place to maintain boat passage through the Murchison River Mouth. This actively maintains the passage to the Indian Ocean for large commercial fishing vessels. The consequence would be major should the dredging programme be halted.	The proposed management actions do not affect likelihood. Estuary landforms are affected by marine and fluvial processes.	Consequence remains the same
13	Commercial activities and assets are at possible risk of fluvial and marine processes.	Insignificant consequence. Although the River Reserve would be naturally subject to these events, it is possible to adapt the location and scope of commercial activities within the River Reserve	With adequate consideration the likelihood of impacts can be reduced.	Consequence remains the same
14	Adapting to natural recession may not be possible if there is not enough space in the foreshore reserve area. Shoreline recession is considered possible.	The facilities are intended to provide services to local and tourist populations. Loss of the facilities could have a major impact on the recreational values.	With adequate consideration the likelihood of impacts is reduced.	Consequences are mitigated by reducing likely impacts
15	Some high value assets will possibly be at risk of 100yr coastal processes and river flood events. Shoreline recession and fluvial inundation within this area is considered possible.	Temporary or permanent treatments would be required to protect property and infrastructure. Potential significant injury to small number of people due to infrastructure failure. In the absence of a stormwater management plan there may be minor injury to one or more individuals.	Maintenance of natural environment (Beach and dunes) provides protection from predicted storm surge.	Consequences are mitigated by reducing likely impacts

Risk ID	Prior to Implementation of control / action		After implementation of control / action	
	Initial Likelihood	Initial Consequence	Final Likelihood	Final Consequence
16	Extreme rain events are likely to occur	Temporary or permanent treatments would be required to protect property and infrastructure. Potential significant injury to small number of people due to infrastructure failure. In the absence of a stormwater management plan there may be minor injury to one or more individuals.	Extreme rainfall events are likely to occur. Likelihood of flooding reduced with implementation of stormwater management.	Impacts of an extreme rainfall event will be minor. Possible temporary treatments required to protect property.
17	Extreme rain events are likely to occur	Temporary or permanent treatments would be required to protect property and infrastructure. Potential significant injury to small number of people due to infrastructure failure.	River flood events occur and extreme events are likely. No reduction in likelihood.	Impacts of a river flood event can be reduced through adequate emergency response, education, communication and temporary treatments.
18	There is a possibility of an injury occurring with current management practices. The facility will be will be affected by coastal processes and extreme rain events over a 100 year timeframe and the facility is the main point for launching of boats in Horrocks Beach. Other facilities are available but the risk is also present at these sites. Shoreline recession within this area is considered possible. Natural adaptation through replacement or relocation may not be possible if there is limited space within the foreshore reserve.	Temporary treatments including temporary closure, relocation of boat launching and maintenance would most likely be required following an erosive storm event. Permanent treatments including permanent closure and relocation of facilities may also be required.	Likelihood reduced by controlling the use through closure and/or maintenance following an erosive/damaging event. An event may still occur even after treatments due to the location of the boat ramp, the hazardous coastal environment and ongoing coastal processes.	Consequence remains the same
19	LIKELY - There is a history of casual occurrence.	Minor- implementation of coastal management strategy and ongoing monitoring by future community is likely to address any issues as they arise.	Likelihood reduced by interventions and education.	Consequence reduced because potential impacts will be restricted to specific sites.

3.5 Risk adaption planning, monitoring and review

The definitions of likelihood and consequence and the proposed evaluation of risk described in Table 3,
Table 4 and Table 5 provide a subjective assessment of the level of risk which might be considered tolerable in the current social and administrative context.

Further, the identification of key risks (Section 3.2), assessment of likelihood and consequence and evaluation of risks presented in Table 6 and

Table 7 considers the current understanding and information about local coastal processes and likely impacts. This is particularly relevant given the rate at which new knowledge regarding climate change and potential impacts on coastal forces has been developed over the past few years, and the potential impacts that this will have on community expectations.

These observations highlight the need for ongoing monitoring and review to continuously refine the assessment of risks, consider new information and observations, and to reflect changing needs and aspirations of society. It is therefore necessary that the risk assessment and outcomes reflected in this coastal management strategy are reviewed every 5 years.

4 COASTAL MANAGEMENT STRATEGY

The purpose of this strategy is to provide guidance for the future management of the Kalbarri coastal area in order to address identified issues and achieve objectives to protect and maintain environmental, cultural, social and economic objectives. The issues and management recommendations were identified through consultation with the community and stakeholders, supported by desk top and field assessment. Key issues and recommendations for the Murchison River Reserve, Kalbarri Townsite foreshore and Kalbarri coast from Red Bluff to Chinaman's Point are outlined below.

An overarching recommendation of this strategy is to undertake implementation of the recommendations and ongoing management of the area in conjunction with other land managers and owners who manage land adjacent to the Study area including the area's Traditional Owners. Some of the identified issues are not isolated to the foreshore reserves and are shared at a landscape, catchment, regional and state-wide level. There is demonstrable success from undertaking a multi-agency or joint management approach and addressing regional issues with joint funding.

4.1 Murchison River Reserve

Limited active management has occurred within the Murchison River Reserve to date. This, coupled with increasing numbers of visitors and feral animals requires immediate consideration and action in order to reduce degradation and enhance recognised values.

4.1.1 Key Issues

Key issues affecting the Murchison River Reserve are:

- Off-road vehicle use and uncontrolled access;
- Weeds and feral animals;
- Illegal camping; and
- Lack of awareness regarding cultural values.

Off road vehicle use and uncontrolled access

Bush bashing, or the creation of new, indiscriminate tracks, is not legal in any public land with the exception of designated off road vehicle areas. Bush bashing occurs in the reserve due to a lack of guidance, directional signage, individual driver behaviour and the lack of clear tracks and routes.

There are various access routes into the reserve through both public and private land although the majority of access is via two locations: the Murchison House Station and Grey Street.

Vehicle use and recreational activities are concentrated in the floodplain throughout the reserve. In these locations vegetation systems are complex, diverse and interrelate directly with the estuarine system. Much of the riparian vegetation on the south side of the river has been degraded by access tracks (Plate 19).

Plate 19: Degradation of the Race track and Paradise Springs area

There are multiple tracks to each location creating confusion for users unfamiliar with the area. This creates the potential for additional tracks to be made to get to intended locations. New tracks are made for a number of purposes including to bypass an obstacle, create a route for a specific purpose, travel cross country or to avoid barriers specifically put in place to deter off road vehicle use.

The issues caused by off road vehicle use in the Reserve have been identified in previous studies and the Shire and community has taken a number of steps to limit the impact on the Murchison River Reserve. One such intervention included the installation of barriers and fencing to prevent vehicle access to sensitive parts of the Paradise flats area. The fence lines in the tidal flats area followed the line of the main access track. They were not designed to block all access but were intended to divert vehicles around degraded areas and permit traffic at designated entrance points to limit the creation of new tracks. The post and wire fence has aided the regeneration of the tidal mud flat area but the fence has been cut at numerous places to gain access and in some cases, this has occurred adjacent to a designated entrance point (Plate 20 and Plate 21). Anecdotal evidence has suggested that the wire fence acts as a barrier to large fauna movement. It is recommended that the pieces of damaged fence (including wire on the ground) are removed.

Plate 20: Cut fence lines to gain access for 4WD


Plate 21: 4WD Track and removal of bollards in River Reserve

Problems associated with the use of off road vehicles are still being experienced throughout the Murchison River Reserve and it is necessary to control vehicle use to limit environmental damage, protect heritage and culturally significant sites. The significant area of the reserve and the lack of active management to date means enforcement of access and monitoring of use of routes throughout the area is difficult.

Weeds and feral animals

Environmental degradation of the reserve is evident and has been highlighted in previous management strategies. Although this is largely attributed to off road vehicles, other causes include proliferation of weeds, grazing by feral goats and campfires. This issue is recognised by the Nanda community who report that the impact of human activities and unmanaged access to the reserve is a threat to bush tucker.

Feral goats and pigs are considered by the community to pose a significant threat to the values of the River Reserve. Annual culling operations targeting goats and pigs have been carried out in the Kalbarri National Park since 2006 and a steady decline in goat numbers has been recorded during this time (Department of Parks and Wildlife correspondence, 2014). The animals are also controlled within the Murchison House Station, demonstrating that multi-agency management of the issue across the region is required.

Vehicles in the reserve help to spread weeds. They permit incursions into sensitive habitat areas, and can stress and kill wildlife. Previous works have been undertaken in the Paradise Flats area to conserve habitats and native vegetation through fencing to facilitate regeneration. The fences; however, have sometimes posed a barrier to native animals (as well as people) and so are not supported by the community.

The coastal dunes of the northern foreshore have poor stability due to the nature of the vegetation and topography of the area. This is exacerbated by degradation through human activities and grazing by feral animals. There is a need to protect the stability of dunes on the northern foreshore as they respond to changes in coastal and fluvial processes.

Illegal camping

Camping is not formally permitted in the Murchison River Reserve but due to the seclusion and natural beauty of the area it does occur and is largely unregulated.

Camping occurs at a number of sites that are popular for recreational activities and are also Registered Sites of Aboriginal Heritage. The local Nanda community have a historic association

of camping in the reserve and this is still a popular activity amongst their community with numerous family campsites being recognised in previous studies.

The River Reserve suffers from littering, particularly during peak tourist season. Following the season the local community enter the reserve and clean up after the influx of people. Currently, there are no facilities in the area to dispose of rubbish or toilet waste. There is widespread toilet litter throughout the reserve with concentrations at the key recreational and culturally significant sites. This is a sensitive issue requiring active management and the provision of facilities for visitors.

Lack of awareness regarding cultural values

The traditional Nanda inhabitants of the Kalbarri area have a long history of use and strong cultural association with the River Reserve and in particular Gregory's Rocks and the Paradise Flats area (Figure 6). The Murchison House Station was historically a big employer of aboriginal people in the area and there is a permanent use of the station and paradise flats area for recreational and cultural activities.

There are numerous sites of cultural and mythological significance that experience the highest incidence of recreational use by members of the Kalbarri community and visitors to the area. These areas are registered with the Department of Aboriginal Affairs and known to the local community but there is no other recognition of the significance of the locations and heritage.

There is a need to formally recognise the heritage sites in the River Reserve to protect and enhance the cultural values of the area. This will require a detailed assessment of the cultural heritage in the area in order to update Shire and Department of Aboriginal Affairs records.

4.1.2 Recommendations for the Murchison River Reserve

Key recommendations for management of the Murchison River Reserve are to:

- Identify preferred access to recreation nodes;
- Close and rehabilitate unnecessary tracks and sensitive areas;
- Install interpretive signage and other markers;
- Improve facilities;
- Develop a walk trail; and
- Increase education, community participation and enforcement.

It is recognised that a number of these recommendations will need to be implemented in parallel in order to achieve successful outcomes. The initiatives need to be led at the community level and involve direct contact with users of the reserve.

Identify preferred access to recreation nodes

Managing access and use in the reserve is a priority action. It is recommended that the key recreation nodes and preferred access tracks are identified, mapped and signed appropriately. The suggested nodes and route is depicted in Figure 11.

A number of heavy use areas are located on alluvial sands and it is recognised that during river flood events these areas are subject to deposition of sediments that effectively remove all tracks and regenerate the areas. These areas are recognised as recreation areas where off road vehicle access is permitted to direct use away from more fragile areas (Figure 11).

Heavy rainfall has the potential to degrade the quality of the access tracks, particularly in areas of clay soils and heavy use. It is noted that these conditions are identified by the Shire as part of ongoing management and it is recommended that appropriate information (signage) is incorporated into the entry statement at the beginning of the reserve to notify visitors of track closures and deter the removal of such signs.

No recommendations are made for additional fencing at this stage.

Close and rehabilitate unnecessary tracks and sensitive areas

There is a need to close unnecessary tracks within the reserve to minimise further environmental degradation and manage the cultural value of the area. This will require the installation of effective physical barriers to prevent access and immediate camouflaging (brushing) with vegetation.

Areas proposed to be closed to vehicles include Paradise Flats and Tidal Flats (Figure 11). There are a number of significant cultural values associated with Paradise Flats and it is proposed that this area is closed to vehicles to protect these important sites. Due to the establishment of a walk trail around Tidal Flats (Figure 14) it is also necessary to close this area to vehicles to protect pedestrian safety as it is not viable to establish 2 sets of trails that are used by different modes of transit. It is also proposed that the northern foreshore is closed to licenced vehicles (cars) to reduce degradation of the fragile dune environments. The area will remain open to eco-tourism opportunities such as quad bikes tours on the condition that all access is constrained to existing pathways. Additional signage is to be erected to support this outcome.

Revegetation, associated with track closure and rationalisation, should be undertaken as part of an ongoing and prioritised approach to rehabilitating the reserve. It is recognised that track rationalisation is unlikely to be successful in the long term unless supplemented with a standardised and recognisable signage program; and sustained education and communication. A committed presence in the Murchison River Reserve is required to communicate as well as enforce the track closures.

Install interpretive signage and other markers

Signage is an important management, educational and informative tool. Consistent with the Mid West Tourism Development Strategy (Evolve Solutions, 2014), it is recommended that opportunities are sought to share Aboriginal heritage and cultural experiences and values, together with environmental values and other visitor information through actions such as appropriate signage.

Access tracks are to be marked with directional signs and track markers. Tracks to be closed should be identified with instructive signs (see Figure 12 to Figure 14).

Recreational sites should be marked with signs at the location that display their locally recognised names (Plate 22).

Plate 22: Example Interpretive and Informative signage

All signs need to be clear and consistent across the area. Large signs at the major access points to the reserve should be installed which display the following information and highlight the environmental and cultural values of the area (Plate 23):

- What to expect in the reserve e.g. route types, difficulty, presence of other users;
- Notification of any temporary and permanent closures;
- Location of important heritage and sensitive cultural sites within the reserve;
- Highlight environmental aspects including the location of sensitive areas;
- Tenure information;
- Permitted tracks and access points;
- Suggested do's & don'ts such as tyre pressure, take litter with you etc.;
- Accepted driving and social behaviours;
- Where to go for more specific info and useful contact details.

Plate 23: Example Interpretive and Informative signage for entry (welcome) statement

This signage should be supplemented with printed maps at the Tourist information office and online information on the Shire website to ensure that users know where they can and can't travel, why these measures are in place and the enforcement in place.

In addition to signs throughout the southern foreshore, it is recommended that informative signs at the tip of the Murchison Peninsula are installed which explain the sensitive nature of the area and guidelines for its use including the need to keep to the existing tracks (Figure 15).

Improve facilities

It is recommended that priority should be given to provision of the following facilities:

- Create car park at the entrance to the River reserve on Grey Street with a toilet, rubbish bins and informative signage (Figure 11);
- Install a dry composting toilet (Plate 24) near to Gregory's Rocks. This needs to be located out of floodplain and away from indigenous cultural site (Figure 12); and
- Establishment of a looped walk trail from the Grey Street car park to Goat Island with and interpretive signage on the environmental and cultural values of the area (Figure 14).

It was felt by the community that upgrading or increasing access as well as permitting camping in the reserve was unacceptable and would threaten the cultural, recreational and environmental values.

Plate 24: Composting toilets designs sympathetic to the local environment

Increase education and community participation

Education is a key component of a successful strategy. It is recommended that the Shire uses media campaigns, social media and the Shire website to educate and cultivate support amongst the community and visitors for the proposed management recommendations.

Implementation of this Strategy will require significant community support and involvement. An increased ranger presence is also required to communicate as well as enforce and issue infringements. There is an opportunity to enhance and protect the reserve further through formal arrangements with Aboriginal involvement in the ongoing management. The Shire could recruit or partner with a Nanda ranger to improve cultural and recreational management .and also seek partnership with other agencies such as Bush Heritage Australia or Department of Parks and Wildlife to implement and fund the ranger program.

Further consultation with Aboriginal Stakeholders will be necessary as part of the implementation of this Strategy. This should include a full assessment and recording of the cultural sites in the study area in conjunction with Aboriginal stakeholders.

4.2 Kalbarri Townsite Foreshore

The Shire of Northampton have previously commissioned Ecospace to develop a *Kalbarri Foreshore Parkland Redevelopment Plan* (2013) that details a Strategy to enhance the townsite foreshore, manage stormwater, reduce water consumption and increase functionality for all user groups. Issues and recommendations from the Plan have been incorporated into this Strategy and these authors would like to acknowledge the significant work that was undertaken.

The *Kalbarri Foreshore Parkland Redevelopment Plan* (2013) goals are to:

- Maintain the natural look of the river foreshore and endemic vegetation;
- Create more shaded areas;
- Manage or prevent further erosion;
- Enhance beauty;
- Increase or improve functionality for different users groups; and
- Reduce water consumption.

4.2.1 Key issues

This Strategy identified a number of issues to be addressed in order to meet the objectives of the strategy and the goals of the *Kalbarri Foreshore Parkland Redevelopment Plan.* These are associated with:

- Existing facilities;
- Stormwater management; and
- Water use.

Existing facilities

The Kalbarri townsite foreshore contains a number of facilities such as toilets, shade shelters, playgrounds, rubbish bins, BBQs and jetties. It also contains large expanses of grass. Consultation with the community has identified the need to refurbish some of these facilities including the toilets and create additional shade to combat the high temperatures and ultra-violet rays that occur during summer.

There is the opportunity to improve pedestrian access throughout the foreshore reserve. Currently, there is a dual use path running along Grey Street that is set back a considerable distance from the beach. Access to the beach is gained indiscriminately via the turf, car parks and beach access tracks. Unsegregated vehicle and pedestrian access points could create conflict and should be addressed.

Vehicles are permitted to access the beach from the gravel car park opposite Auger Street. There is a designated section of the beach for vehicle use and the area is signed and marked with bollards. Although it has been suggested that vehicle access to the beach is no longer required or is not appropriate, members of the community value this facility and want it to remain.

Stormwater and erosion

The townsite beaches are part of an estuarine habitat subject to estuarine processes including accretion and erosion. These processes are exacerbated by river floods. A brief survey of the foreshore identified the potential to better integrate the management of stormwater with future landscaping and revegetation of the parkland.

At present the majority of stormwater is directed to and infiltrates into the parkland area. The existing grass swales will provide some nutrient uptake and allow infiltration but it is recommended that this function is improved through the addition of a biofilter which will also be more complimentary to the aesthetics of the parkland.

Water Use

Groundwater is used extensively throughout the town foreshore reserve to irrigate the extensive lawn areas. Whilst the lawn is visually appealing, there is the opportunity to reduce the area of turf to reduce watering requirements, provide more shade and reintroduce a more natural look to the foreshore through establishment of locally native vegetation.

4.2.2 Recommendations for the Kalbarri townsite foreshore

Key recommendations for management of the Kalbarri townsite foreshore are to:

- Improve access throughout the foreshore;
- Improve facilities and Infrastructure;
- Install interpretive signage and other markers;
- Revegetate the foreshore; and
- Improve stormwater management.

Improve access throughout the foreshore

This Strategy supports the Foreshore and Parkland Redevelopment Plan's recommendation to improve access throughout the foreshore and increase the functionality for different users groups. In particular, the key recommendation is to improve the accessibility to the beach and segregate vehicle and pedestrian access points. This can be achieved through the provision of a meandering pathway connecting car parks and sited adjacent to the beach with access points to the beach at points along its length (Figure 16).

An additional path set back from the foreshore should be provided for dual use purposes to permit efficient access throughout the foreshore. This should have some connectivity to the lower, meandering path. All pathways should be lit to extend their use, increase safety and enhance the function of the foreshore reserve and parkland.

It is recommended that 4WD access to the foreshore is maintained in the current designated area. The remaining unsealed car park should be sealed and marked with parking bays. The practice of renourishing the beaches with dredged spoil should be maintained.

Signage

It is recommended that additional signage is provided throughout the townsite foreshore reserve in order to instruct, inform and educate users. Signs to provide direction to the facilities and amenities in the foreshore reserve should be installed at key points throughout the foreshore (Figure 16).

Educational and interpretive signage should be installed that explains the historical and cultural significance of Kalbarri and the surrounding area. It is recommended that the signage is styled in line with the Kalbarri National Park signage.

Improve facilities and infrastructure

It is recommended that the following improvements are made to facilities and infrastructure as depicted in Figure 16.

- Additional shelters provided on the beach and in the foreshore parkland. Where shelters cannot be sited outside of the flood zone, they should be constructed so as to withstand a significant flood event. It is recommended that shelters near BBQ facilities have lighting to permit extended use;
- Provide a new playground near Chinaman's near current toilet facilities and update the existing playground to provide more natural themed play environments;
- Provide seating throughout the foreshore and parkland;
- Refurbish the existing foreshore toilet facilities to improve their appearance;
- Relocate the Search and Rescue building inland from its current position; and
- Provide a river based floating swimming pool – this will require consultation with Department of Transport.

These recommendations are consistent with the *Mid West Tourism Development Strategy* (Evolve Solutions, 2014)

Revegetate the foreshore

Revegetating the foreshore will help to improve the visual amenity, reduce water consumption, improve the natural look and feel of the area and provide shaded areas to encourage more dispersed recreation throughout the foreshore area.

The parkland is currently heavily landscaped with grass and introducing more natural habitats into the area could enhance biodiversity and potentially provide an opportunity to showcase endemic flora and fauna. This could be highlighted through informative and interpretive signage throughout the foreshore. Waterwise planting will also reduce water use and planting endemic tree species will provide additional shade as depicted in Figure 16.

Improve stormwater management

Consideration should be given to the design and construction of swale biofilters in the foreshore in areas where stormwater is discharging either directly into the River or into grassed parkland. This will result in an attractive, safe and functional feature of the parkland through increased planting with native vegetation which will also improve the quality of any stormwater entering the River. The use of biofilters to improve water quality is consistent with the recommendations of the Department of Water's *Stormwater Management Manual for WA* (DoW, 2004 – 2007).

4.3 Kalbarri Coast

The Kalbarri coast is a unique location of national significance and the coastal recreational nodes are heavily used by the community and visitors to Kalbarri. There has been a significant community effort to improve the coastal area in the past, resulting in Kalbarri's recognition as a major tourist destination and National Surf Reserve. A renewed strategy is required; however, to maintain and enhance this coastal sector.

4.3.1 Key issues

Key issues affecting the Kalbarri coast relate to:

- Existing facilities;
- Car parking; and
- Stormwater management.

Existing facilities

Toilet facilities are available at Red Bluff and in the townsite (Plate 25). These facilities are heavily utilised and in need of regular maintenance.

Plate 25: Red Bluff and townsite foreshore toilet facilities

There is also evidence of toilet litter in the dunes at Jakes Point and this is most likely due to the heavy use of the location and lack of facilities on site. This problem has been noted in previous strategies and has not abated as a result of other management activities. It is considered that the facilities at Jake's Point should be reflective of the status of the national surfing reserve which attracts national and international visitors, and accordingly it is recommended that a dry composting toilet(s) is installed. A solution that is sensitive to the environmental values and visual amenity of Jakes Point is required to manage the issue, similarly to toilets located in other surfing locations (Plate 26).

Plate 26: Toilet facilities at surf locations in the Shire of Augusta-Margaret River

Beach access tracks and pathways throughout the sector require rationalisation. There are numerous paths to single locations through sensitive dunes and loss of vegetation at the locations where the beach access paths are not formalised, fenced and signed (Plate 27). At Chinaman's Point, an informal path has been created between the lookouts and visitors commonly access the lookouts via the dune system from the pull-in rather than using the well-made existing paths from back beach or Chinaman's. This degrades dune vegetation and causes erosion.


Plate 27: Informal pedestrian access over dune systems

The existing dual use path network along the Red Bluff Road is used extensively but does not currently connect directly to the recreational nodes. It is recommended that the connectivity is improved by extending the network to the coastal node car parks.

Car Parking

The coastal nodes are subject to heavy use in peak tourist season (Plate 28) and are often overflowing at these peak times. This results in parking on vegetation and the use of informal parking such as the pull in at the entrance to the Kalbarri townsite. During winter, the car parks are often flooded due to a lack of stormwater management and significant erosion in some areas is impacting on vegetation, pedestrian access ways and the beach. There is some evidence that dust from the gravel car parks is also degrading the vegetation as a result of smothering.

To meet the objectives of enhancing the attraction of the Kalbarri as a tourist destination and maintaining the existing facilities for recreational use, it is recommended that the car parking facilities are improved throughout the coastal area.


Plate 28: Car parking facilities in peak season

Stormwater management

There is substantial flooding of car parks in the coastal reserve after heavy rainfall that limits the effective parking area and any runoff scours paths through the dunes to the beach resulting in dune degradation and a safety risk (Plate 29). A lack of stormwater management also damages the dual use path network and interface between bitumen access roads and gravel car parks throughout the sector. Maintenance of paths and any stormwater drainage is required.


Plate 29: Car park flooding and stormwater damage

4.3.2 Recommendations for the Kalbarri coast

Based on identified patterns of use, coastal processes and community values, the following actions are recommended to be undertaken in the coastal area as depicted in Figure 17 to Figure 22.

- Seal car parks in order of priority (Jakes Point, Blueholes, Siphons, Back Beach and Ocean View).
- Improve stormwater management practices at all car parks including installation of soakwells;
- Extend the car parks at Blueholes (Figure 21) and Jakes Point (Figure 19) to increase capacity. Retain and protect the car park vegetation at Jakes Point with rocks as this provides landform protection (Figure 19);
- Provide a public toilet at Jakes Point at either of the locations identified in Figure 19 as determined through the public consultation phase. The toilet is to be sympathetically designed and located so as not to impact on the visual amenity of Jake's Point and be well maintained. Provide signage to ask people not to use the dunes;
- Provide new dual use paths to link the existing dual use path network to the recreational nodes (Figure 21 and Figure 22). Set the paths back from the main access roads to segregate pedestrians and vehicles;
- Reduce the number of beach access paths at Siphons, Ocean View and Red Bluff and brush the closed tracks immediately following closure (Figure 20 and Figure 21);
- Extend the revegetation area south of Jakes Point car park (Figure 19) and close/brush the pedestrian access to Wittecarra (Figure 18);
- Repair fencing along beach access paths throughout the coastal area.

5 IMPLEMENTATION

The recommendations of the Kalbarri Coastal Management Strategy are to be undertaken by the Shire of Northampton in partnership with the community and other stakeholders. Key recommendations together with priorities for implementation are provided in Table 8.

These recommendations should be implemented in line with the Shire's annual Operational Plan and incorporated into the Shire's Community Strategic Plan and Corporate Business Plan where required.

It is recognised that the implementation of this Strategy will require additional resources to be identified and allocated by the Shire of Northampton. This strategy recommends that members of the Kalbarri community, inclusive of the local aboriginal community, are engaged and recruited to implement the recommendations of this strategy. Some actions may be accomplished through community actions and grant funding will also be sought wherever possible.

As noted in section 4.1, the success of some of the actions is dependent on the coordinated implementation of interrelated actions. These high priority actions include recommendations 1, 2, 3, 8 and 12.

Table 8: Recommended actions for implementation

	Recommendation	Location	Priority
1	Develop trail maps and media that highlight off road vehicle routes, permitted tracks, access points, sensitive areas, cultural sites and location of facilities	Murchison River Reserve	High
2	Close 4WD tracks, immediately brush with vegetation and sign closures	Murchison River Reserve	High
3	Shire to increase enforcement of reserve rules and issue infringements	Murchison River Reserve	High
4	Fence off walk trails and construct Chinaman's Point car park area as per Grey Street Road Improvement Plan previously adopted by Council	Chinaman's point	High
5	Work in consultation with the Nanda community to identify a location for dry composting toilet	Gregory's Rocks area	High
6	Seal car parks and provide drainage	(1)Jakes, (2) Blueholes,	High
7	Construct public toilet at Jakes Point	Jakes Point	High
8	Provide signs to identify recreation nodes using locally recognised names	Murchison River Reserve	High
9	Construct a gravel car park at the entrance to the River Reserve on Grey Street with appropriate stormwater management, as an entry point to the Reserve with significant signage and information.	Murchison River Reserve	High
10	Provide interpretive media to highlight the natural, cultural and aboriginal heritage of the river reserve and significant sites	All Murchison River Reserve recreation nodes	High

	Recommendation	Location	Priority
11	Install soakwells in gravel car parks and address stormwater management from pathways	Red Bluff	High
12	Provide directional trail markers for 4WD tracks	Murchison River Reserve	High
13	Provide dual use path with lighting through foreshore reserve	Townsite Foreshore	High
14	Undertake maintenance/refurb of toilet facilities	Townsite Foreshore	High
15	Provide dedicated pedestrian beach access points from the proposed Dual Use Path	Townsite Foreshore	High
16	Undertake a full cultural assessment of the area in conjunction with Nanda representatives to identify cultural sites, update Shire and DAA records and identify risks to the sites from land use and human activities	Throughout strategy area	High
17	Provide printed maps at the Tourist information office and online information on the Shire website that details the access tracks, sensitive areas and do's and dont's of the Murchison River Reserve	Murchison River Reserve	High
18	Install signs on the Northern foreshore peninsula to inform of the sensitive nature of the area; that everyone must keep to the tracks; and that the area is closed to licenced vehicles.	Northern Foreshore	High
19	Increase car park capacity	Blueholes, Jakes	Medium
20	Construct walk trail (cycling and walking)	Murchison River Reserve	Medium
21	Provide new dual use path connection to recreational nodes from existing dual use path	Ocean View, Syphons, Blueholes, Back Beach	Medium
22	Liaise with the Kalbarri National Park to refurbish bitumen/rock interface at Red Bluff Car Park	Red Bluff	Medium
23	Protect and rehabilitate dune vegetation – sign rehabilitated areas	All coastal recreation nodes	Medium
24	Seal car parks and provide drainage	(3) Syphons, (4) Back Beach	Medium
25	Seek multi-agency support to implement a volunteer management and youth ranger programme for cultural and park management	Murchison River Reserve	Medium
26	Closure of beach access tracks, revegetation/brushing and associated signage as per community recommendations	Throughout strategy area	Medium
27	Provide appropriate signage to control access and activities	Throughout strategy area	Medium
28	Design and construct Swale Biofilters with native, endemic vegetation in the foreshore parkland	Townsite Foreshore	Medium
29	Plant endemic vegetation and reduce the turf in the foreshore reserve	Townsite Foreshore	Medium
30	Plant native species of trees to provide shade	Townsite foreshore	Medium

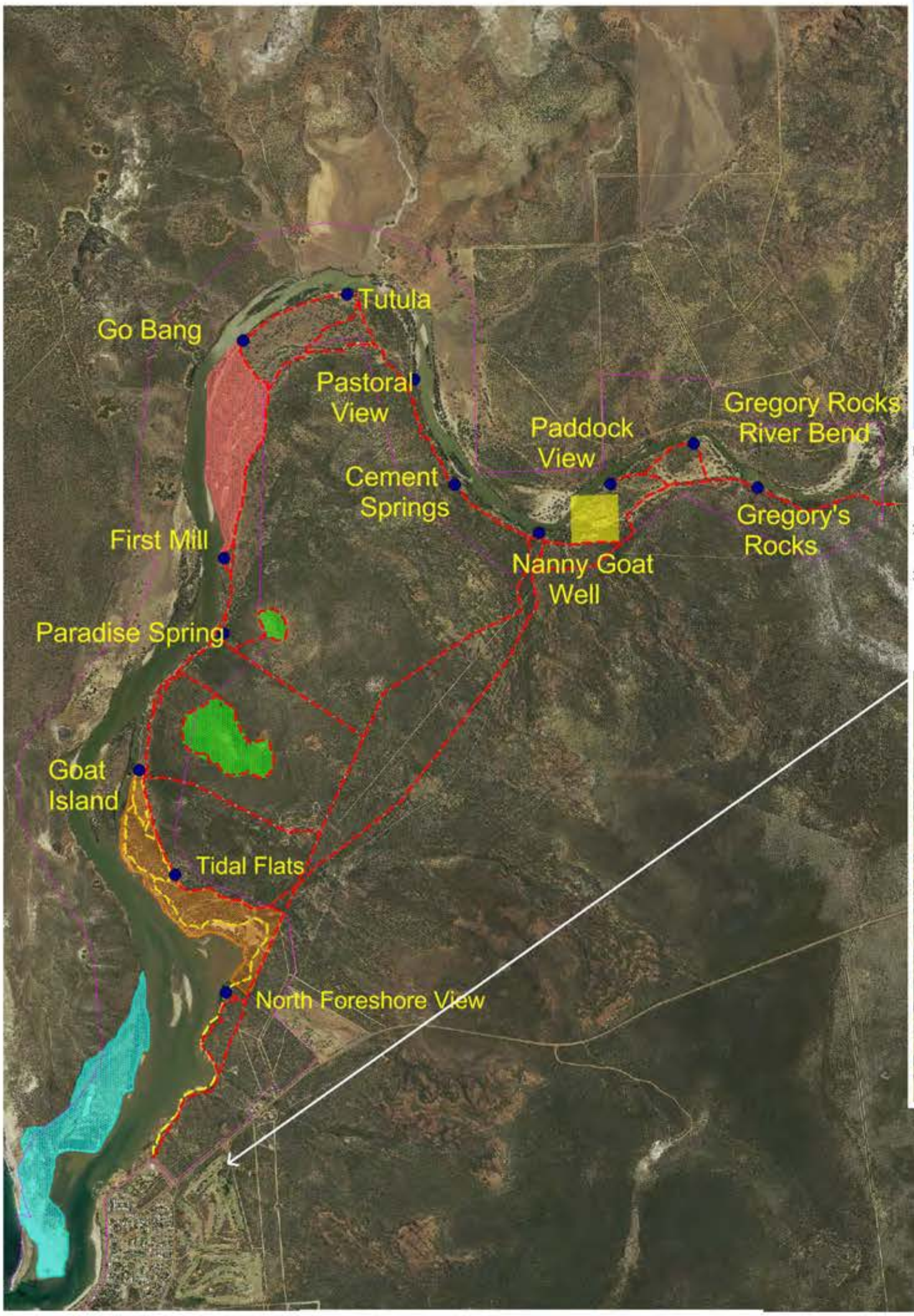
	Recommendation	Location	Priority
31	Provide new playground near existing toilet facilities	Chinamans	Low
32	Update existing playground to more natural theme	Townsite foreshore	Low
33	Provide new pedestrian footpath between lookouts	Chinaman's Point	Low
34	Maintain sand in front of beach shelter against erosion	Blueholes	Low
35	Seal car parks and provide drainage	(5) Ocean view, (6) Pull-In	Low
36	Provide new shelters	Townsite Foreshore	Low
37	Rehabilitate and revegetate dune systems	Throughout strategy area	Low
38	Seal townsite car parks	Townsite Foreshore	Low
39	Relocate the search and rescue building out of the river flood zone	Townsite Foreshore	Low
40	Enhance social media activity to communicate action and encourage participation within the local and regional community	Throughout strategy area	Ongoing

6 MONITORING AND REVIEW

It is recommended that the implementation of this coastal management strategy is audited annually and outstanding actions incorporated into the Shire's Operational Business Plan.

The effectiveness of the Strategy should be reviewed in 5 years and updated as required.

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 11: Murchison River Reserve - Overview



NOTES:

1. Directional Signage is proposed to assist with vehicular movement through the river reserve.
2. Recreation nodes to be signed and identified with locally used names and references. See Inset A.
3. Major information and education point at the entrance to the River Reserve at Grey Street car park. See Inset B.

Symbols

- Bin
- Dry Composting Toilet
- Parking
- Information point
- Recreation Node
- ORV Track
- Walk Trail
- Gravel Car Park
- Study Area
- Paradise Flats - Vehicle Exclusion Area
- Sensitive Area - Vehicle Exclusion Area
- Tidal Flats - Vehicle Exclusion Area
- Northern Foreshore - Licensed Vehicle Exclusion Area
- Pastoral Station Freehold

A

B

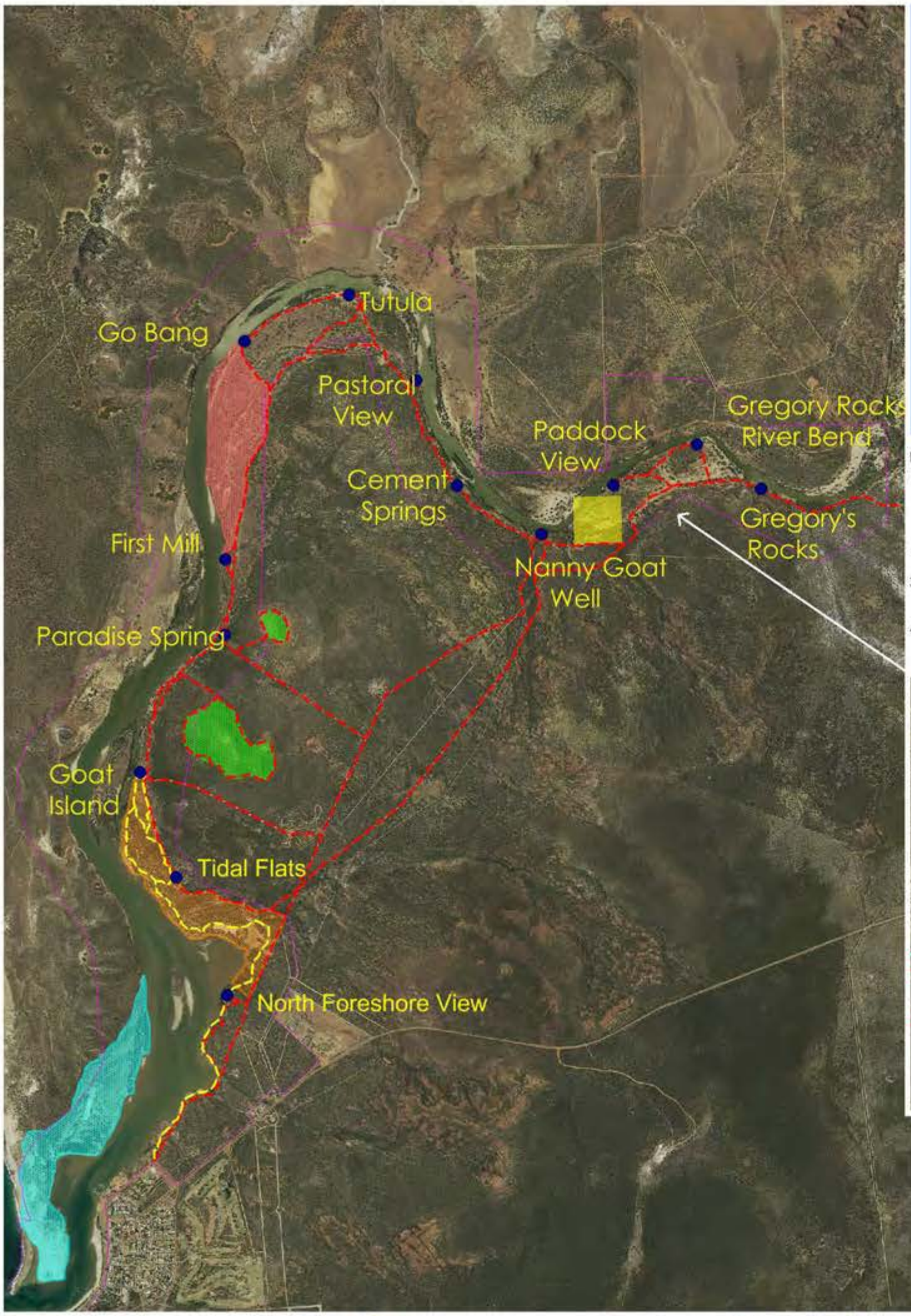
Data source: Shire of Northampton, Landgate Created by: A Kaye. Updated R.Mackintosh

Scale 1: 40,000 @ A3

0 1600 m

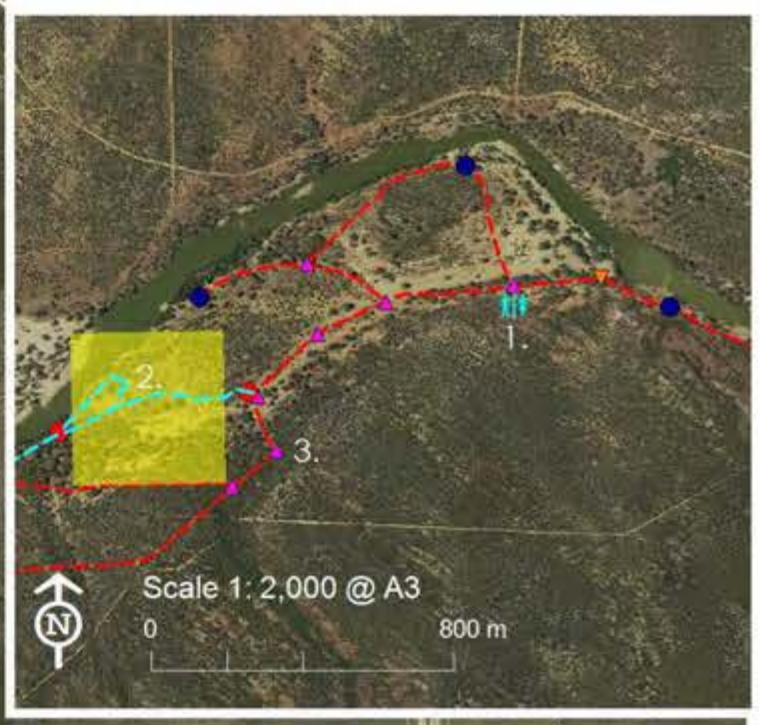
essential environmental

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 12: Murchison River Reserve - Gregory's Rocks



NOTES:

1. Toilet design should be sympathetic to cultural and environment values, be functional, low maintenance and durable. Toilet should be located above flood levels or be of a flood proof design. See Inset A.
2. Tracks through private land closed with brushing and signage.
3. Provide track markers to direct vehicle movement through the River Reserve.
4. Sign to highlight cultrual significance of the area. See Inset B.



Symbols

- Trail Marker
- Dry Composting Toilet
- Heritage sign
- Track closure and Sign
- Key Recreation Node and Sign
- ORV Track
- Closed track

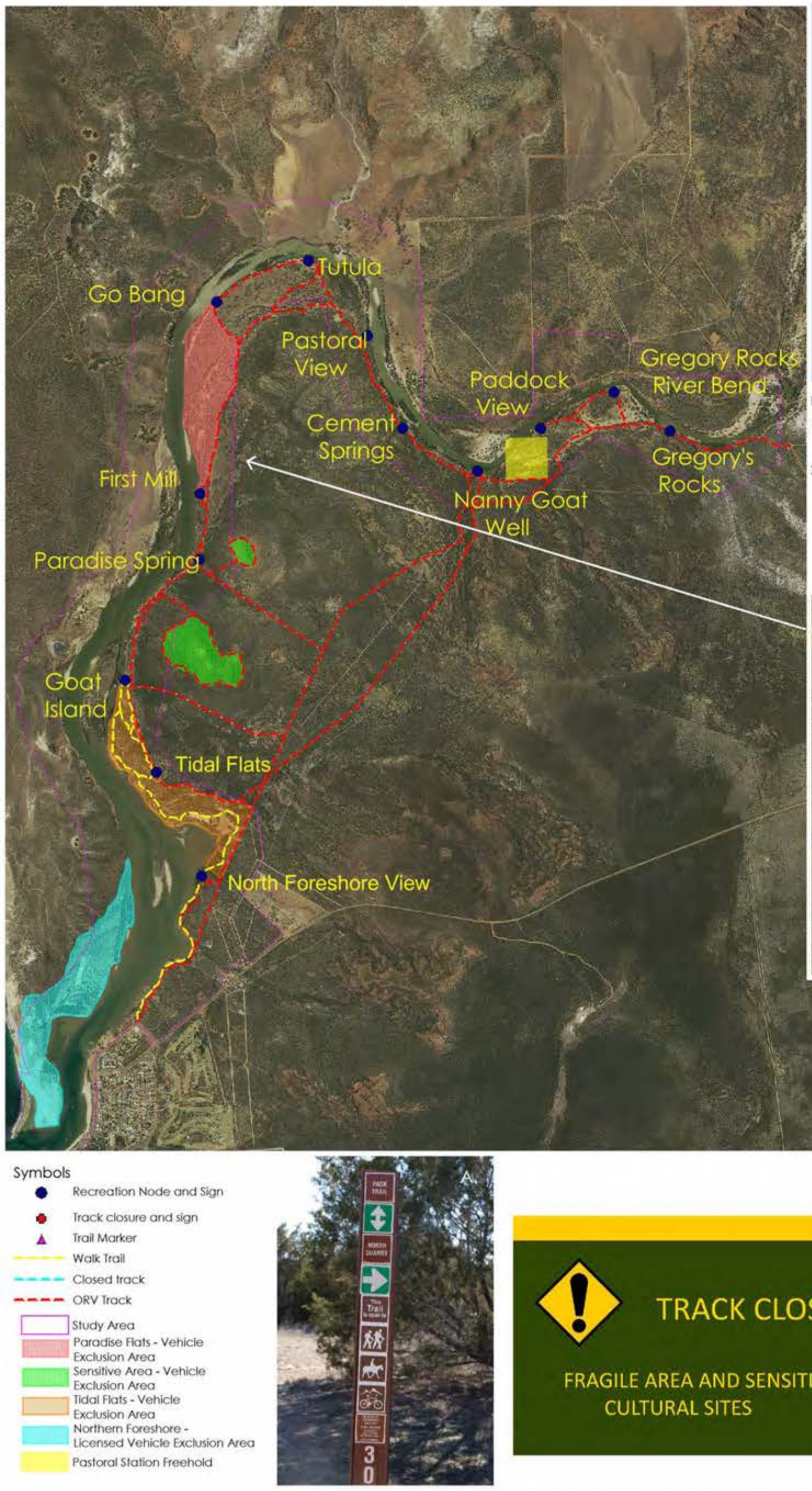
- Study Area
- Paradise Flats - Vehicle Exclusion Area
- Sensitive Area - Vehicle Exclusion Area
- Tidal Flats - Vehicle Exclusion Area
- Northern Foreshore- Licensed Vehicle Exclusion Area
- Pastoral Station Freehold

Data source: Shire of Northampton Created by: A. Kaye. Updated R.MacIntosh

Scale 1: 40,000 @ A3
0
1600 m

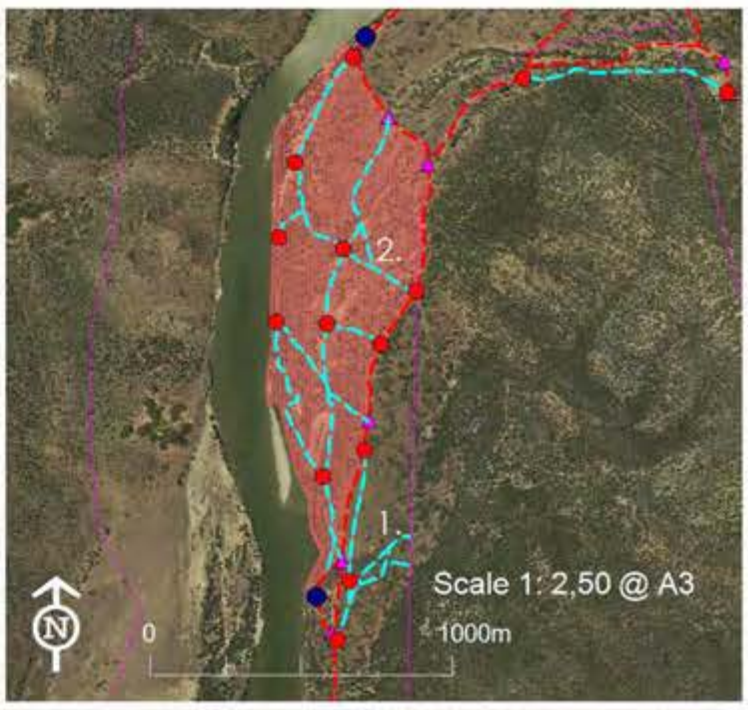
essential environmental

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 13: Murchison River Reserve - Race Track



NOTES:

1. Provide track markers to direct vehicle movement through the River Reserve. See Inset A.
2. Tracks closed with brushing and signage to indicate cultural and ecological sensitivity. See Inset B.



Symbols

- Recreation Node and Sign
- Track closure and sign
- Trail Marker
- Walk Trail
- Closed track
- ORV Track
- Study Area
- Paradise Flats - Vehicle Exclusion Area
- Sensitive Area - Vehicle Exclusion Area
- Tidal Flats - Vehicle Exclusion Area
- Northern Foreshore - Licensed Vehicle Exclusion Area
- Pastoral Station Freehold

A.

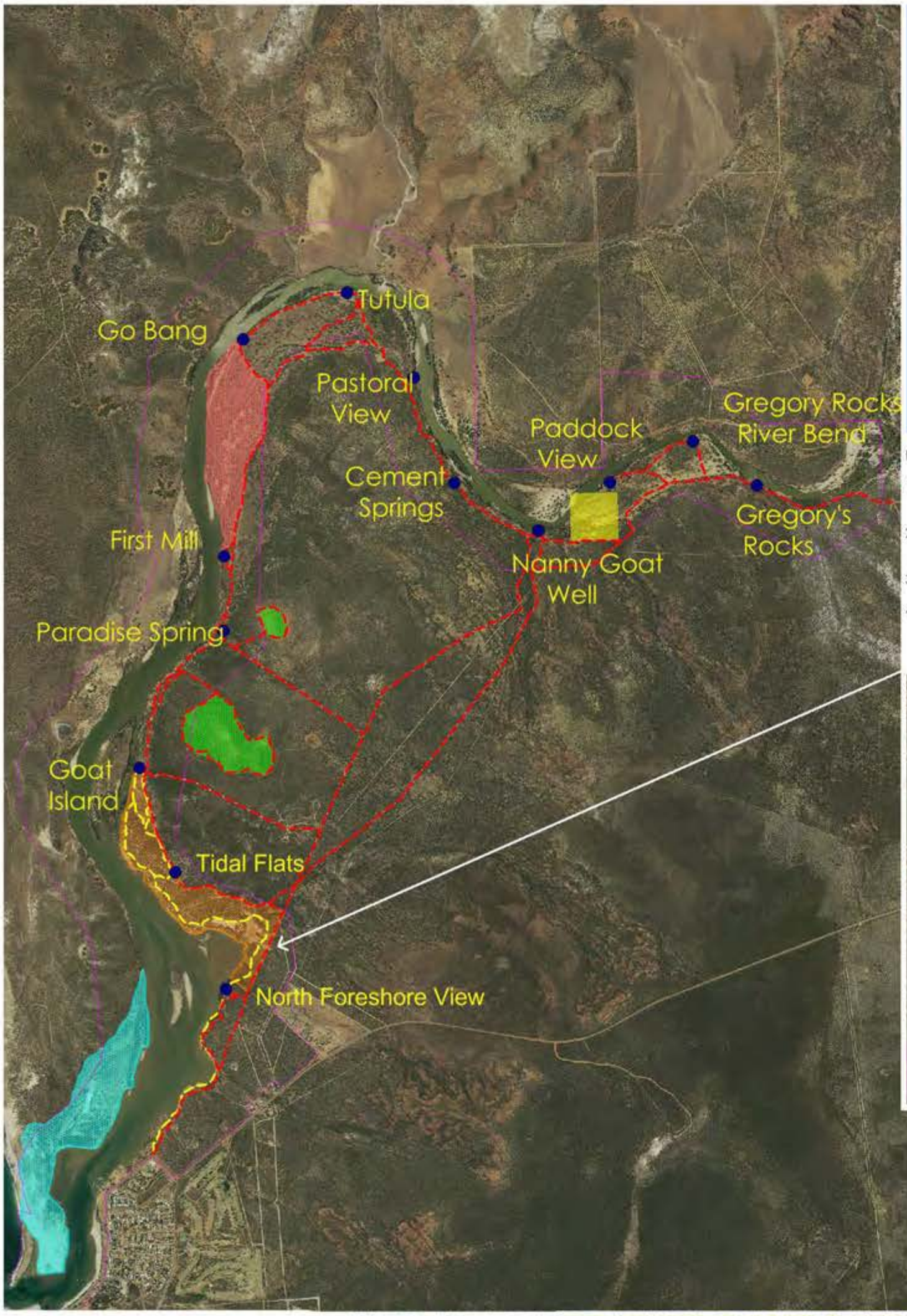
B.

Data source: Shire of Northampton, Landgate Created by: A. Kaye. Updated R.Mackintosh

Scale 1: 40,000 @ A3
0 1600 m

essential environmental

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 14: Murchison River Reserve -Tidal Flats



NOTES:

1. Provide track markers to direct vehicle movement through the River Reserve. See Inset A.
2. Walk trail with interpretive signs on cultral and environmental values. See Inset B.
3. Area is subject to inundation from river flooding.
4. Tracks closed with brushing and signage to indicate cultural and ecological sensitivity. See Inset C.

Symbols

- Track Marker
- Key Recreation Node and Sign
- Track closure and sign
- Walk trail
- Closed track
- ORV Track
- Study Area
- Paradise Flats - Vehicle Exclusion Area
- Sensitive Area - Vehicle Exclusion Area
- Tidal Flats - Vehicle Exclusion Area
- Northern Foreshore - Licensed Vehicle Exclusion Area
- Pastoral Station Freehold

A.

B.

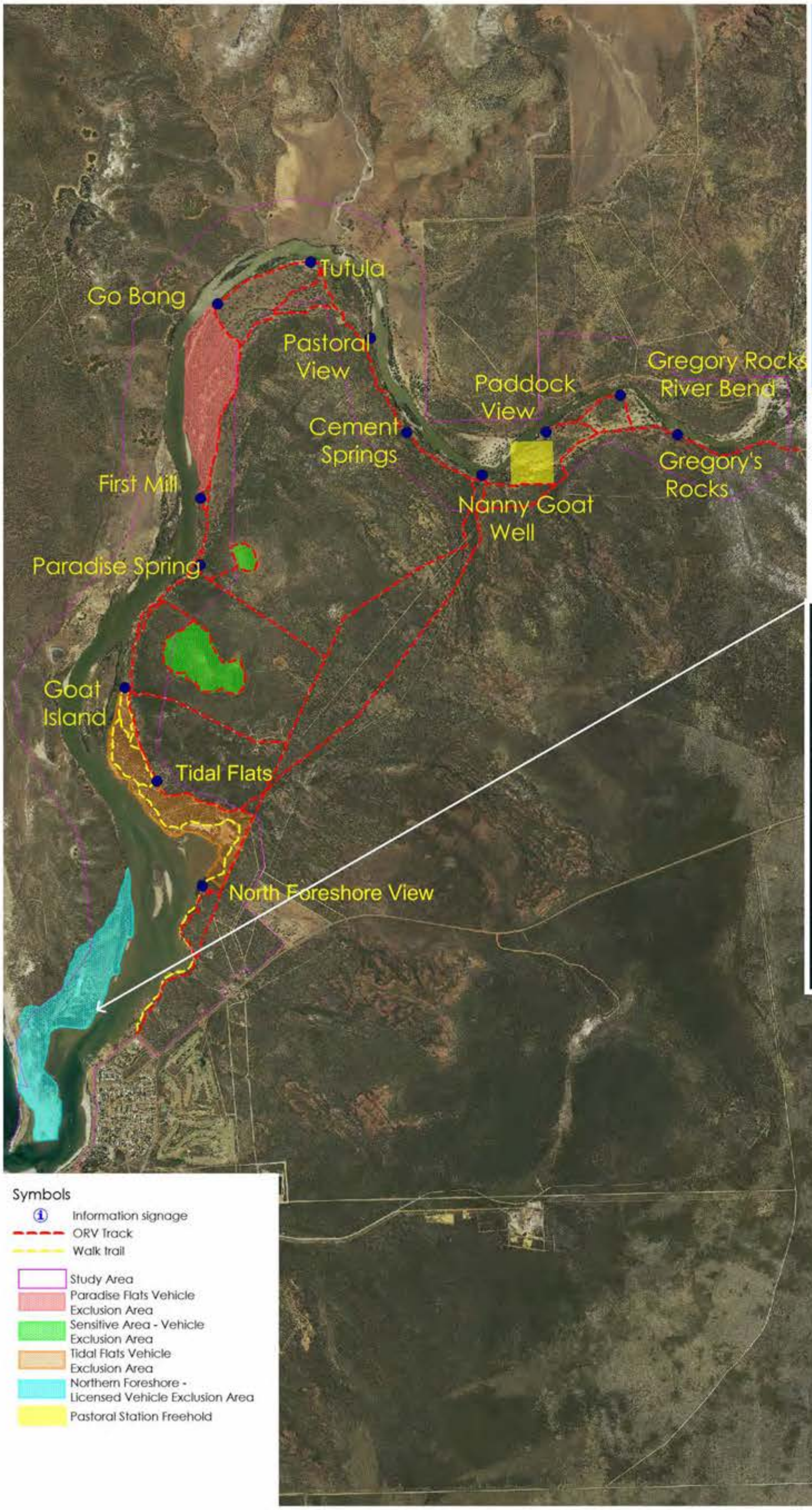
C.

Data source: Shire of Northampton, Landgate. Created by: A. Kaye. Updated R.Macklntosh

Scale 1: 40,000 @ A3
0 1600 m

essential environmental

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 15: Murchison River Reserve - Northern Foreshore



NOTES:

1. Close Northern Foreshore to licensed vehicles.
2. At key foreshore access points install information points to highlight sensitivity of area and guidelines for use of vehicles. Add signage restricting all access to existing tracks.
3. Continue to monitor degradataion of dunes and dune vegetation.

Symbols

- Information signage
- ORV Track
- Walk trail
- Study Area
- Paradise Flats Vehicle Exclusion Area
- Sensitive Area - Vehicle Exclusion Area
- Tidal Flats Vehicle Exclusion Area
- Northern Foreshore - Licensed Vehicle Exclusion Area
- Pastoral Station Freehold

Data source: Shire of Northampton Created by: A. Kaye. Updated R.MacIntosh

Scale 1: 40,000 @ A3
0 1600 m

essential environmental

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 16: Kalbarri Townsite - Townsite Foreshore

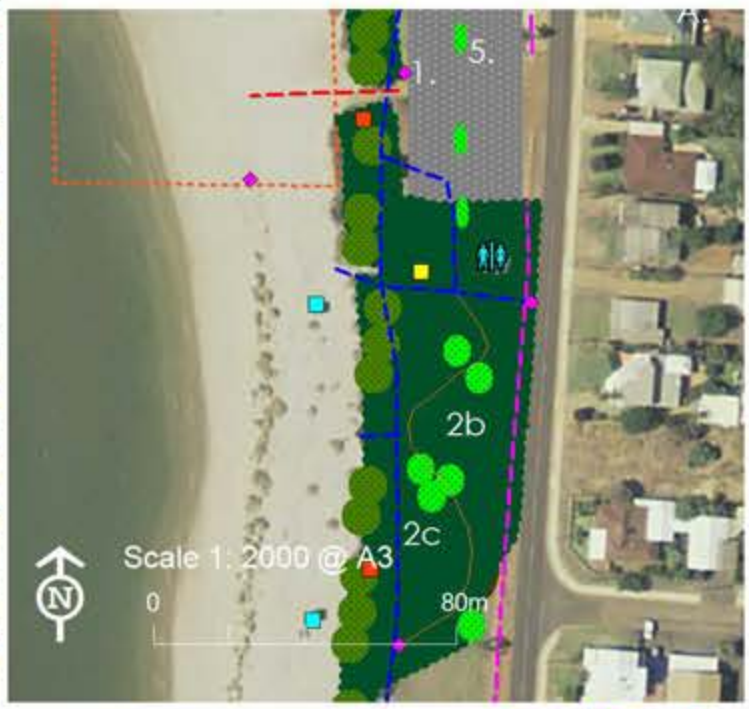
NOTES:
1. Retain 4WD beach access area

2. Foreshore amenities and landscaping as per Kalbarri Foreshore Parkland Redevelopment Plan:
   a.) Maintain natural look and provice endemic vegetation
   b.) Create more shaded areas - provide trees. See Inset A&B
   c.) Increase usability for different groups - new pathways
   d.) Provide swale Biolfilter to manage stormwater. See Inset B.

3. Provide a leisure and sport area

4. Provide a River swimming pool

5. Seal car parks



Symbols

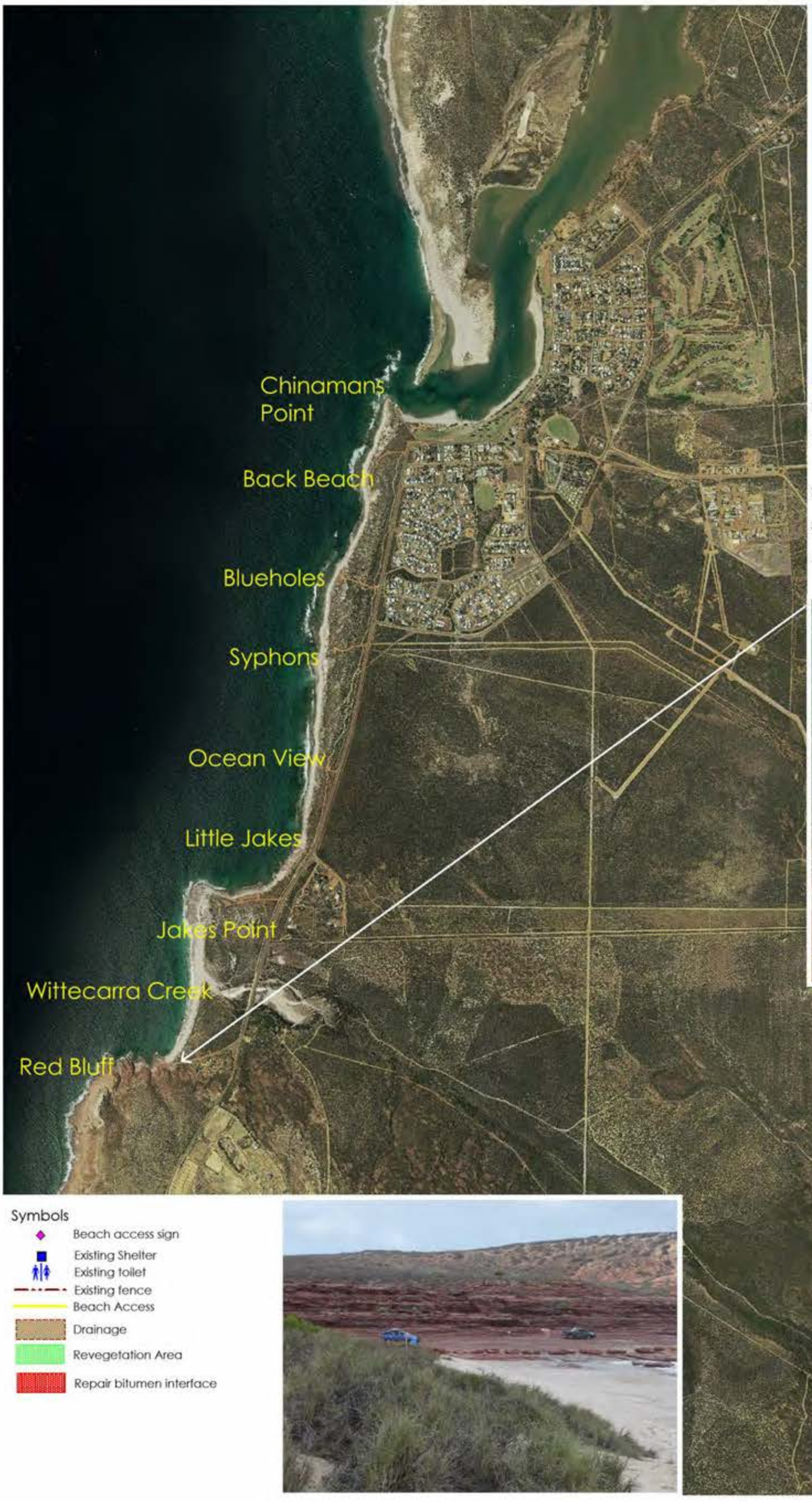
- Footpath
- Upper DUP
- Boardwalk
- 4WD Access
- Picnic Area
- Playground
- Fish Cleaning
- Seating
- Toilet
- Existing Shelter
- New shelter
- Shelter with lighting
- Sealed Car Park
- Native planting
- 4WD Area
- Signage
- Pelican Feeding
- Picnic Area
- Playground
- BBQ Kitchen
- Toilet
- Bioretention Swale
- River Pool
- Search and Rescue
- Turf
- Recreational Area
- Amphitheatre
- Existing Tree
- New Tree
- Foreshore Vegetation
- Northern Foreshore - Sensitive Area

Data source: Shire of Northampton, LMP1c Kalbarri Foreshore Landscape Masterplan Created by: A. Kaye

Scale 1: 5000 @ A3
0 200 m

essential environmental

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 17: Kalbarri Coast - Red Bluff



NOTES:

1. Install soakwell in car parks to improve storm-water management.
2. Protect and rehabilitate dune vegetation.
3. Undertake regular maintenance of existing toilets
4. Repair rock car park/bitumen transition

Symbols

- Beach access sign
- Existing Shelter
- Existing toilet
- Existing fence
- Beach Access
- Drainage
- Revegetation Area
- Repair bitumen interface

Data source: Shire of Northampton Created by: A. Kaye

Scale 1: 25,000 @ A3
0 1000 m

essential environmental

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 18: Kalbarri Coast - Wittecarra

NOTES:

1. Protect and rehabilitate dune vegetation.

2. Maintain 4WD access to Wittecarra Beach

Symbols

- Beach access sign
- Existing fence
- 4WD beach access
- Revegetation areas

Data source: Shire of Northampton Created by: A. Kaye

N

Scale 1: 25,000 @ A3

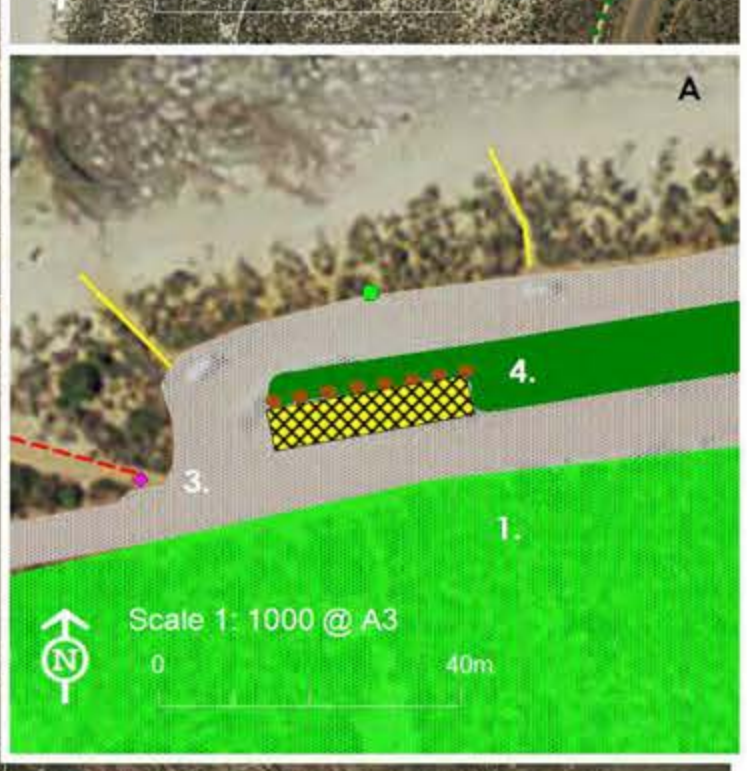
0 1000 m

essential environmental

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 19: Kalbarri Coast - Jakes Point

NOTES:

1. Protect and rehabilitate dune vegetation.
2. Provide a dry composting toilet. Toilet should be in keeping with the ethos of the National Surfing Reserve. 2 options for location shown.
3. Seal car park & provide drainage.
4. Increase car park and protect vegetation. See Inset A.



Symbols

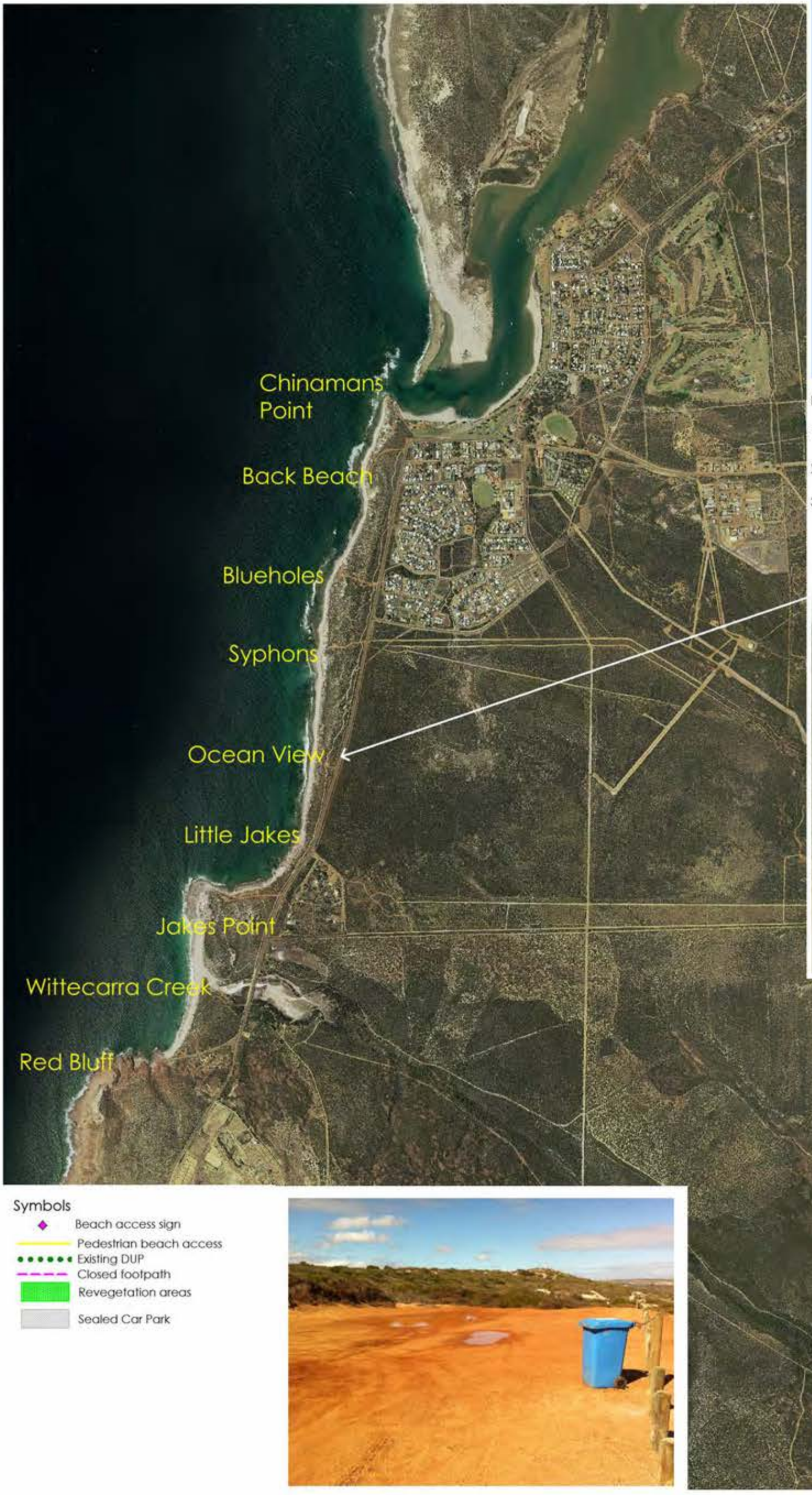
- Signage
- Existing Shelter
- New Dry Composting Toilet
- Existing Bin
- Pedestrian Beach Access
- Existing DUP
- Emergency Vehicle Access
- Revegetation Area
- Sealed Car Park
- Car Park Vegetation
- Car Park Extension
- Rocks

Data source: Shire of Northampton Created by: A. Kaye. Updated R.Mackintosh

Scale 1: 25,000 @ A3
0 1000 m

essential environmental

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 20: Kalbarri Coast - Ocean View



NOTES:

1. Protect and rehabilitate dune vegetation.
2. Seal car park and provide drainage.
3. Close footpath and brush immediately to allow revegetation to occur.

Symbols

- Beach access sign
- Pedestrian beach access
- Existing DUP
- Closed footpath
- Revegetation areas
- Sealed Car Park

Data source: Shire of Northampton Created by: A. Kaye

Scale 1: 25,000 @ A3
0 1000 m

essential environmental

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 21: Kalbarri Coast - Syphons and Blueholes

NOTES:
1. Provide new dual use path connection from existing dual use path. Provide stormwater managment.
2. Seal car park and improve drainage.
3. Increase Blueholes car park capacity by extending eastwards.

Symbols
- Beach access sign
- Existing Shelter
- Existing fence
- Beach Access
- Existing DUP
- New DUP
- Blueholes Marine Reserve
- Sealed Car Park
- Blueholes Car Park Extension
- Revegetation Area

Data source: Shire of Northampton Created by: A. Kaye

Scale 1: 25,000 @ A3
0 1000 m

essential environmental

Shire of Northampton - Kalbarri Coastal Management Strategy
Figure 22: Kalbarri Coast - Back Beach & Chinamans Point

NOTES:
1. Provide new dual use path (DUP) connection from existing DUP. Improve stormwater managment.
2. Seal car park and improve drainage.
3. Provide a new footpath between Chinamans lookouts. Improve stormwater managment.
4. Fence the pull-in car park to prevent pedestrian access to lookout via dune system. Provide directional signs to formal access routes.
5. Revegetate dune areas and consider use of jute matting

Symbols
- Beach access sign
- Lookout
- Pedestrian and Vehicle Barrier
- Existing beach access
- Existing DUP
- Existing Footpath
- New DUP
- New footpath
- Upgraded footpath
- Revegetation Areas
- Sealed car park

Data source: Shire of Northampton Created by: A. Kaye

Scale 1: 25,000 @ A3
0 1000 m

essential environmental

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APPENDIX 1: PLANNING AND POLICY CONTEXT

Key planning and policy context for Kalbarri is provided by the following documents. Key outcomes and implications are summarised where possible.

State Planning Policy 2.6: State Coastal Planning Policy (2013)

The purpose of the Policy is to provide guidance for decision-making within the coastal zone including managing development and land use change; establishment of foreshore reserves; and to protect, conserve and enhance coastal values. This policy recognises and responds to regional diversity in coastal types; requires that coastal hazard risk management and adaptation is appropriately planned for; and encourages innovative approaches to managing coastal hazard risk, and provides public ownership of coastal foreshore reserves.

The policy provides high order guidance for decision making on coastal planning matters and applies state wide. The objectives of this policy are to:

- Ensure that the location of coastal facilities takes into account coastal processes, landform stability, coastal hazards, climate change and biophysical criteria;
- Ensure the identification of appropriate areas for the sustainable use of the coast for housing, tourism, recreation, ocean access, maritime industry, commercial and other activities;
- Provide for public coastal foreshore reserves and access to them on the coast; and
- Protect, conserve and enhance coastal zone values, particularly in areas of landscape, biodiversity and ecosystem integrity, indigenous and cultural significance.

Policy measures include clauses relating to:

- Coastal hazard risk management and adaptation planning;
- Coastal protection works;
- Protection of public interests;
- Identification of coastal foreshore reserves;
- Preparation of coastal strategies and management plans, and the precautionary principle.

In regards to management of coastal hazards, SPP 2.6 requires that development proposals are considered in the context of coastal hazard risk management and adaption planning undertaken by the responsible authority or proponent of the development. SPP 2.6, Clause 5.5(i) notes the following.

"Adequate coastal hazard risk management and adaptation planning should be undertaken by the responsible management authority and/or proponent where existing or proposed development or landholders are in an area at risk of being affected by coastal hazards over the planning timeframe."

This coastal management strategy aims to address key aspects of the policy as they relate to the study area.

Draft Mid-West Regional Planning and Infrastructure Framework (WAPC, 2011)

The framework defines a direction for future development of the Mid West region, which includes the Shire of Northampton. It seeks to ensure that development in the region is achieved in a strategic way that supports vibrant communities and enhances the liveability, economic opportunities and environmental attributes of the region. The objectives of the framework are to:

- provide the regional context for land-use planning in the Mid-West;
- provide an overview of the major regional economic, social, cultural and environmental issues;
- identify the priority actions required to enable comprehensive regional and sub-regional planning; and
- identify the priority regional infrastructure projects to facilitate economic and population growth in the Mid-West.

In particular, the framework identifies fishing and tourism along the coast as making important contributions to the local economy. Some of the key challenges addressed in the framework include:

- the strategic and sustainable development of tourism and recreation infrastructure and services;
- determining the need for additional tourism and recreation sites to cater for an expected increase in demand; and
- shift of inland populations to coastal areas.

Batavia Coast Strategy (Batavia Coast Coastal Planning Group, Land Vision; 2001)

The Batavia Coast Strategy provides a framework for coastal management and land use at a regional and local level. It is intended to compliment other regional initiatives and guide local decision-making and actions undertaken within local planning and management frameworks. Kalbarri is identified as a district centre in this strategy. The primary objective of the Batavia Coast Strategy is:

> "to ensure that all reasonable demands along the coast for housing, tourism, recreation, commercial, industrial and other activities are provided for, while sustaining or enhancing existing coastal resources and environmental quality at an acceptable community cost."

The strategy also recommends further policy development through review of the Shire of Northampton's Coastal Management Strategy and the preparation of a Kalbarri Foreshore Management Plan (the completed Kalbarri Foreshore and Coastal Management Plan, 2003).

Shire of Northampton Coastal Strategy (Landvision & Shire of Northampton, 2006)

The Strategy has been prepared to guide decision making in relation to the management, protection and planning of foreshore and coastal areas in the Shire of Northampton from its boundary with the Shire of Chapman Valley to the southern boundary of Kalbarri National Park. It does not include Kalbarri townsite within its study area, however, the strategy refers to a number of issues relevant to the townsite and surrounding area. The Strategy also refers to the Kalbarri Foreshore and Coastal Management Plan (2003) as the relevant document addressing issues in the Kalbarri area of the Northampton coastline.

Kalbarri Foreshore and Coastal Management Plan (Landvision, 2003)

This Management Plan was prepared for the Kalbarri Townscape Committee and Shire of Northampton in recognition of the need for adequate planning and management of Kalbarri's river and coastal foreshores. Specifically, the plan was prepared to ensure that the important natural features of Kalbarri are available for future generations of residents and visitors.

The plan includes criteria for considering future development proposals, rehabilitation, management and development priorities for particular precincts, concept plans for priority

areas, recommendations for future involvement of Aboriginal people in management programs, and recommendations for funding and resource allocation.

Kalbarri Foreshore Parkland Redevelopment Plan - draft 3 (Ecoscape and Kalbarri Community Committee, 2013)

This plan was developed for the Shire of Northampton to guide redevelopment of the Kalbarri River foreshore. After the initial preparation of a draft plan by Ecoscape, a Community Committee was established to further develop the plan. The draft plan acknowledges the need to take existing strategies into account to and to undertake extensive consultation with stakeholder groups and the community to achieve its goals. It provides location specific recommendations with the purposes of:

- maintaining the natural look of the river foreshore and endemic vegetation;
- creating more shaded areas;
- managing or preventing further erosion
- enhancing beauty
- increasing or improving functionality of different user groups; and
- reducing water consumption.

Status of Coastal Planning in Western Australia (WAPC, 2012)

This report presents the latest results of a biennial audit of the status of coastal planning in WA. Audits are undertaken through the Coastal Planning Program, a key tool used to update the WAPC on land use and management of the State's coastal resources. Status reports are used to monitor changes in planning activities across the state and thus allow the Department of Planning to ensure that prioritised work reflects outstanding needs. Coastal considerations for the Mid West planning region were defined as:

- Protection of the coast and the cost of protection works;
- Control of off-road vehicles;
- Balancing recreational demands for coastal access and Oakajee Port requirements;
- Preservation of areas with high biodiversity conflicting with land use required for residential or commercial development; and
- Planning for climate change.

No outstanding planning tasks were referred to for Kalbarri in this 2012 status report.

Kalbarri Townsite Strategy (larry smith planning, 2011)

This Townsite Strategy was prepared to guide the Shire of Northampton with respect to the future planning, development and management of the Kalbarri Townsite. It was prepared in response to the identification of development pressures associated with the expansion of tourism and planned major resource projects in the town and region, an increasing population associated with this development and those seeking a coastal lifestyle, and to review and update the previous Kalbarri Plan 1992.

The vision of the Kalbarri Townsite Strategy is:

> "To develop a long term Strategy for the future development and enhancement of Kalbarri that recognises, builds upon and promotes the tourism and residential values of the location in an environmentally and economically sustainable manner."

The objectives of the Kalbarri Townsite Strategy are:

- "To enhance Kalbarri's position as a premier family holiday destination within Western Australia while recognising the continuing value and importance of non-family Intrastate, Interstate and International visitors."
- "To broaden Kalbarri's economic and employment base by furthering Kalbarri's position as a desirable alternative residential and employment location within the Mid-West."
- "To protect and enhance Kalbarri's unique urban values and particularly its connectivity to the surrounding natural environment together with its compactness and high level of walkability."

Shire of Northampton – Local Planning Policy - Commercial Recreational Tourism Activity on Crown Reserves (2012)

This Local Planning Policy provides guidance and criteria for assessment and the determination of permissible commercial activities on all recreational crown reserves, immediate ocean/river foreshores and beach areas within the Shire, including UCL. The policy recognises:

- the increase in public demand for beaches/rives and reserves and the need to ensure ecologically sustainable use;
- that certain activities should not be supported in certain areas and places restrictions on activities in specific locations, including complete restrictions on all commercial recreational tourism activity in some reserves; and
- those reserves have the capacity to satisfy an important portion of the public demand for outdoor recreation and tourism.

Kalbarri National Park – Draft Management Plan (Department of Parks and Wildlife, 2014)

The draft Kalbarri National Park Management Plan was prepared to address present management issues and to plan for future needs to ensure that values are conserved in the long term. The plan provides a summary of policies, guidelines and operations proposed to be undertaken in the park over a ten year period. It also provides guidance for more specific operational documents describing management direction for issues including recreation site development, introduced animals, fire, and control of environmental weeds.

Management priorities are emphasised in the plan through defined outcomes, management actions and key performance indicators, with a focus on:

- managing cultural heritage;
- managing visitor use;
- involving the community;
- managing the natural environment;
- managing resource use; and
- research and monitoring.

While the Kalbarri National Park is not included in the study area, the users of the study are typically the same as those of the National Park, and similar issues have been considered and addressed.

APPENDIX 2: KALBARRI COASTAL MANAGEMENT STRATEGY- SUMMARY OF SUBMISSIONS

The Kalbarri Coastal Management Strategy has been prepared to provide guidance for the management of the coastal foreshore reserves in Kalbarri from Red Bluff to Murchison House Station. The strategy was developed by the Shire of Northampton with assistance from the local community and makes recommendations regarding the future management of impacts in order to maintain or enhance the identified values for the long term.

The Shire of Northampton endorsed the draft Kalbarri Coastal Management Strategy for public comment. The strategy was advertised from Friday 7th November to Friday 19th December 2014. A total of 37 submissions were received on the draft Strategy.

Of the 37 submissions that were received, most provided a comment on only one or two issues. Six submissions noted their overall support for the Strategy and its recommendations including a submission from the Nhunda community. Two submissions did not support the Strategy - one with no reasons provided and the other due to a perceived lack of consultation. Four submissions provided comment on each of the Strategy recommendations.

The key issues raised and the changes made to the Strategy in response to the submissions are outlined below.

- Toilet at Gregory Rocks – Six submissions objected to the toilet at Gregory Rocks and so it is proposed to change the recommendation to a lower priority that is more about working with the Nhunda people and increasing Ranger presence;
- Toilet at Jakes – Although there was some very strong opposition to the toilet at Jakes Point (10 of the submissions), there was much stronger community support for it which included a petition with 85 signatures as well as 6 other submissions. The recommendation will be retained.
- Sealing of car parks – Seven submissions felt that it was too costly and unnecessary to seal the carparks. Although only 4 submissions supported the recommendation, it is proposed that it is retained with some added justification as follows. The significant erosion of the current car parks is resulting in impacts on the vegetation and beach. The dust coasting of vegetation in the summer also impacts on the growth and survival rates of the vegetation. Bitumenising the car parks will reduce this impact and also allow improvements to be made to drainage so that the car parks can be used at all times.
- Closure of northern foreshore to vehicles was recommended to reduce degradation of the dunes. Five submissions objected to this recommendation as the area is currently used for quad bike tours and has been used in the past for emergency rescues. It is proposed that the area is closed to licenced vehicles so that the quad bikes are still able to use the paths. Signage about keeping to the tracks will then be very important.
- Four of the submissions also objected to the closure of Paradise Flats and the Tidal Flats to vehicles ; however, it is recommended that these recommendations are retained. The Paradise Flats vehicle exclusion area is proposed to protect the heritage values of this area rather than ecological values (as suggested by the submission) and the Tidal Flats vehicle exclusion area is needed to protect pedestrians on the walk track as it is not possible to have two separate tracks.
- Five submissions objected to the new shelter at Jakes Point so this recommendation will be removed. It should be noted that three submissions supported this shelter.

- Four submitters objected to the proposed biofilter swale, the nature playground and the reduction in grass through establishing native plantings in the townsite, with 2 submitters providing support. It is proposed that the recommendations are retained with additional detail included in the report to provide better support. The biofilters will assist in the treatment of stormwater prior to it flowing into the River which is the preference of the Department of Water. The playground requires refurbishment and nature play has recognised benefits and Government support. The reduction in turf is to reduce the area that requires irrigation. Although there is currently no pressure on groundwater resources, it is a more sustainable response.
- The reference to commercial activities/recreation in townsite foreshore was not supported by four submitters and so will be deleted.

Other comments which did not specifically relate to the recommendations were noted, including:

- The need to remove the wire and broken fencing where this has been vandalised;
- The need to address the permanent camps; and
- A preference that the Shire object to any fracking in the area.

Appropriate changes were made to the draft strategy in response to the above comments.

Client: Shire of Northampton

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Draft report	V1	SSh/AK	SSh	Electronic	30 July 2014
Draft for advertising	V2	Ak	SSh	Electronic	18 August 2014
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