



STATE OF THE ENVIRONMENT REPORT

Contents

| | |
|---|----|
| Summary..... | 1 |
| Background | 2 |
| A Brief Profile of the Shire of Broome | 2 |
| Future prospects for Broome..... | 8 |
| Current and future challenges | 12 |
| Ecologically Sustainable Development & SOE Reporting..... | 16 |
| The Pressure - State - Response (PSR) Model | 16 |
| Challenges for the PSR model | 17 |
| Shire of Broome SOE Approach..... | 20 |
| Layout of SOE Themes and Topics..... | 22 |
| Managing the Environment..... | 24 |
| Pressures on the Broome Environment | 27 |
| Demographic and settlement patterns | 27 |
| Tourist Industry..... | 28 |
| Patterns of Recreation | 29 |
| Weather, climate and climate change..... | 29 |
| Pastoral activities | 30 |
| Resources sector | 31 |
| Fire management..... | 33 |
| Feral animals and invasive organisms | 33 |
| SOE Theme: Land Management..... | 34 |
| Topic 1: Maintaining Landscapes..... | 36 |
| Topic 2: Fire Control..... | 38 |
| SOE Theme: Biodiversity | 39 |
| Topic 1: Maintaining Biodiversity | 44 |
| Topic 2: Improving Urban Biodiversity | 48 |
| Topic 3: Managing Invasive Species | 49 |
| SOE Theme: Water | 53 |
| Topic 1: Conserving Water | 58 |
| Topic 2: Managing Stormwater | 60 |
| Topic 3: Managing Groundwater | 61 |
| Topic 4: Managing wastewater | 63 |
| SOE Theme: Coasts..... | 64 |
| Topic 1: Foreshore Management | 66 |

| | |
|---|-----|
| Topic 2: Coastal Vulnerability and Access | 68 |
| SOE Theme: Energy..... | 69 |
| Topic 1: Built Form Energy Use..... | 71 |
| Topic 2: Transport Energy Use..... | 75 |
| SOE Theme: Waste Management..... | 77 |
| Topic 1: Household Waste | 80 |
| Topic 2: Litter and Illegal Dumping..... | 81 |
| | |
| Shire of Broome Environmental Management Plan | 85 |
| | |
| References | 101 |

Figures

| | |
|---|----|
| 1 Statistics for the Shire of Broome | 4 |
| 2 Summary of agricultural activity in the Shire of Broome and beyond..... | 11 |
| 3 Aspects of Broome that appeal to the community..... | 13 |
| 4 Conceptual structure of the Australian National SOE (2011)..... | 19 |
| 5 Layout of indicators, performance ratings and data confidence used throughout this report | 24 |
| 6 Factors that interact to determine the success of environmental management..... | 25 |
| 7 Mining tenements and resources developments for the north west of WA..... | 32 |
| 8 Environmental areas | 41 |
| 9 Areas of Threatened Ecological Communities - Monsoon Vine Thickets | 47 |
| 10 Weeds of national significance in the Shire of Broome | 51 |
| 11 Integration of stormwater into local public open space | 60 |
| 12 Type and location of illegal dumping incidents around Broome | 82 |

Tables

| | |
|--|----|
| 1 Aboriginal environmental concerns | 14 |
| 2 Roles and responsibilities for land management within the Shire of Broome..... | 35 |
| 3 Roles and responsibilities for biodiversity | 43 |
| 4 The impact pest animals have on the different regions of the Northern WA..... | 50 |
| 5 Potable water demand and consumption for Broome in 2012/13..... | 54 |
| 6 Roles and responsibilities for Water..... | 57 |
| 7 Roles and responsibilities for Coasts..... | 66 |
| 8 Roles and responsibilities for Energy | 71 |
| 9 Options for the Shire's waste management..... | 77 |
| 10 Roles and responsibilities for Waste | 79 |

Appendices

| | |
|---|-----|
| 1 Agency stakeholders and responsibilities for aspects of natural resources management..... | 104 |
| 2 Relevant legislation..... | 109 |

Summary

According to an assessment of various reports by Department of Parks and Wildlife (DPAW), the Kimberley Land Council (KLC) Aboriginal Ranger Services and other sources, natural areas across the Dampier Peninsula and the Shire of Broome remain in a near-pristine condition²¹. While this is good news for the Shire, it does not mean that there are not significant vulnerabilities or risks, or areas requiring additional protection and rehabilitation. Increasing numbers of tourist visitors, invasions of feral animals and weeds and uncontrolled wild fires all threaten the Shire's considerable environmental and cultural values.

It is important that the Shire continues its strong strategic and operational response to environmental matters, as well as furthering partnership agreements with various stakeholder agencies, Aboriginal interests and community groups who have statutory responsibilities and/or interests in protecting the Broome environment and its cultural values.

This State of the Environment (SOE) process used the Pressure-State-Response (PSR) framework, which was also used by Federal and Western Australian governments to quantify and manage the impacts of human activities on the environment. Under the PSR framework, Pressures are categorised as the impacts on the environment arising from human activities. State is defined as the dynamic condition of the Shire's abiotic (non-living) and biotic (living) components and Response is the Actions undertaken by groups, individuals or governments to prevent, compensate, ameliorate or adapt to changes in the state of the environment. The PSR framework utilises agreed Indicators to report on progress.

Six environmental themes were developed for the Shire by EMRC consulting in 2010, through a comprehensive four-stage process including community consultation and detailed research on key environmental issues. Environmental themes identified for the Shire's SOE included: Land management, Biodiversity, Water, Coasts, Energy and Waste management. This SOE summarises expert and community views of environmental quality, status and risks and management responses that may be undertaken collectively by the mix of stakeholder agencies to prevent and ameliorate environmental damage.

Clearly there is a range of agency (legislative) responsibilities and not all required environmental actions are the responsibility of the Shire of Broome. This report characterises the responses to environmental issues on the basis of whether the Shire has direct or indirect responsibility or no involvement.

Policy and management actions determined in the SOE to be the responsibility of the Shire that are currently or may in the future be addressed strategically or operationally through existing programs, form the Shire's Environment Management Plan (EMP) presented as the final sections of this SOE report. The EMP uses the headings: Governance and Communication, Actions and Performance Enhancement. While many environmental issues that are the Shire's responsibility are currently being addressed, some Shire responses that fall outside current strategic, policy or operational activities will require future strategic assessment, prioritisation, budget procurement and implementation. Identified new Shire responses requiring future action will be brought before Council on a case by case basis as appropriate, as resources become available.

Background

Acacia Springs Environmental was engaged by the Shire of Broome to review an earlier State of Environment (SOE) report prepared for the Broome townsite in 2000. The process included preparing an issues paper based on desktop research, which was provided to targeted stakeholders for review. The Shire's Community Engagement Framework was used as a basis for selecting and engaging with those representative agencies and individuals who were perceived to be responsible for, or have expert knowledge of particular environmental issues. Consultations were undertaken at the level of CONSULT as specified in the Shire's community engagement framework because of the level of complexity of multiple environmental issues and the degree of community impact of findings and their political sensitivity. Community engagement specifically sought comments from remote Aboriginal communities through face-to-face meetings with representatives of the 5 main communities in the Shire. Following its review, the issues paper was further developed into a draft SOE report by Acacia Springs Environmental. The draft SOE Report prepared by Acacia Springs Environmental was condensed and used by Shire officers to prepare this report. The Shire acknowledges the work undertaken by Acacia Springs Environmental in developing the draft SOE Report, the contents of which have been used in this report.

This SOE report covers the Shire of Broome geographical area of 56,000km² and its focus is on those issues that are the responsibility of the Shire of Broome. Many elements of the local environment are managed or regulated by State, Federal and other stakeholder agencies with limited involvement by the Shire. For issues where there are shared responsibilities, the Shire has established a number of partnerships with other agencies to value-add to finite resources and to assist the Shire in achieving its environmental outcomes.

A Brief Profile of the Shire of Broome

Broome Shire is located at the southern gateway to the Kimberley region (Figure 1), and has extraordinary beauty, spectacular natural attractions and a unique cultural history. In the dry season, Broome remains a favourite holiday destination for national and international travellers.

Broome is surrounded by spectacular red Pindan soils, azure seas, white sandy beaches and an equitable climate in the dry season. This beautiful environment is what has been drawing around 180,500 visitors a year to its residential base of 17,251 people. The maintenance and protection of Broome's natural and cultural heritage is commonly viewed by the community as the key to maintaining the quality of life and feel of Broome, commonly called by locals "Broome Time". This is reflected as a relaxed gentler pace to life than is experienced in the bigger cities of the world.

Broome's history is as a pearling town, with pearlers coming from Japan, Malaysia, Thailand, the Philippines and China bringing with them their unique cultures which have blended with the local Indigenous and non Indigenous population, making Broome a cultural melting pot with a strong local identity. Many locals view Broome as an effective working model of multi-culturalism.

Tourism, both domestic and international, generates significant income for the Kimberley region. In Broome, visitors can enjoy everything from five star accommodation and fine dining, to fishing from the foreshore and escaping to deserted and remote beaches, boating and other nature based tours such as camel rides along Cable Beach, bird watching and hovercraft tours.

In addition to tourism which employs many people, Broome's major industries include fishing, aquaculture, agriculture, horticulture, mining and exploration. Broome provides all the modern facilities of restaurants, shopping centres, medical centres, a hospital and tertiary education and training together with the opportunity to relax, camp and fish locally and in the Kimberley. Broome's lifestyle is a drawcard for travellers who settle in increasing numbers permanently in the town.

If projected development opportunities relating to tourism, resources, agriculture, and aquaculture are fully realised, it is expected that many more employment and business opportunities will become available¹. The growth forecasts, while pleasing for some, may however result in unintended negative consequences for the environment unless growth is planned and managed well. In addition to new developments and land uses, increasing numbers of people seeking recreational access to the best parts of the local environment will inevitably place pressure on these often fragile places. Maintaining the quality of the Broome environment while managing the impacts of growth will be a key to Broome remaining the premier eco-cultural-tourist mecca it currently is.

Additionally, the climate, geomorphology, and vegetation of the north-west varies considerably from much of Western Australia and this creates unique logistical and management challenges for environmental protection, particularly as accepted engineering and management practices cannot always be easily applied under north-west conditions. The challenge will be to balance growth with environmental protection while developing and operationalising practices and processes to safeguard the unique Broome environment and lifestyle.

Socio-economic factors

Broome was founded as a pearling town over 100 years ago and the local economy has subsequently developed and diversified. Broome now serves as a focal point and service hub for the wider Kimberley region. The resources, agriculture, aquaculture, and tourism industries are central components of the Broome economy and will continue to play a significant role in Broome's future.

The population of the Kimberley has grown more rapidly than the rest of the State of WA (an average of 2.9% per annum over the past 6 years) but has now settled at just below the state average at 2%. The projected base population within the Shire of Broome independent of any major industrial development, is projected to increase by 90% from 16,524 people in 2012 to 31,400 in 2041²

Aboriginal people of Broome Shire now hold Native Title³ over extensive areas of land in and surrounding Broome. Indigenous knowledge, values, principles and protocols are able to inform how environmental issues may be managed in many areas. There are now a number of Aboriginal Ranger groups caring for country throughout the Kimberley⁴. Specifically, within the Shire of Broome, there are at least 6 Indigenous ranger groups; Bardi Jawi, Bardi Jawi Oorany, Nyul Nyul, Yawuru Country Managers, Yawuru/DPaW rangers and Karajarri Rangers actively managing country inclusive of, fire, weed and feral animal management, cultural heritage management and biodiversity conservation.

¹ Broome Economic Profile – Connectivity & Liveability (2014) Geographia

² Shire of Broome Strategic Community Plan 2013 - 2023.

³ Bardi Jawi, Rubibi (Yawuru), Ngurrara, Karajarri A, Karajarri B, Nyangumarta & Nyangumarta-Karajarri Overlap (Yawinya). Still to be determined include Nyul Nyul, Djabera Djabera, Jabirr Jabirr, Goolarabooloo, Nyikina & Mangalaand Yi-Martuwarra Ngurrara claims.

⁴ Mangalagun - Crab Creek Management Plan. Roebuck Bay Working Group 2010. Pp69.

| Geographic Statistics | Broome |
|---|-----------------------|
| Distance from Perth by Road (RAC 2013) | 2,224km |
| Distance from Perth by Air (Google Earth 2013) | 1,678km |
| Area (km ² , Shire website) | 55,796km ² |
| Population Statistics | Broome |
| Population (Census 2011) | 14,997 |
| Estimated Indigenous Population (ABS 2011) | 29.1% |
| Number of Electors (Shire website 2013) | 7,294 |
| Number of Dwellings (Shire website 2013) | 7,020 |
| Economic Statistics | Broome |
| Median Family Income - without Children (Census 2011) | \$2,378 |
| Median Family Income – With Children (Census 2011) | \$2,402 |
| Median household income – Indigenous (Census 2011) | \$970 |
| Median Weekly Rent (REIWA Jan - Mar 2013) | \$700 - \$800 |
| Taxable Individuals (ABS.STAT 2011) | 6,019 |
| Average Taxable Income (All) (ABS.STAT 2011) | \$49,304 |



Figure 1 Statistics for the Shire of Broome¹

A vision for Broome as a City in the North has recently been promoted where Broome's geographical location close to Asia is promoted as a boon for big business and major resources infrastructure projects servicing the fossil fuel industry. A recent submission by the Paxon Group described Broome's economy as:

Broome, unlike many other regional areas in northern Australia, is not a 'mining town' that operates as a one-industry economy. The foundations of Broome stem from its pearling industry and since this time, has developed to support strong and diversified economy including agriculture, aquaculture, mining and tourism industries. Broome's proximity to the large oil and gas deposits in the Browse Basin and Canning Basin as well as other potential mineral deposits has seen increased activity in support services for these industries. Due to the location of Broome on the coast with the only deep water Port in the region, Broome is the regional centre that businesses use to support their operations and transport their goods and products throughout Australia and overseas⁵.

Along with these visions, there is an emerging recognition that environmental issues have social and economic linkages and vice versa and actions and consequences that cannot be viewed in isolation. Wise stewardship of government policy development will be required if Broome's development future is not to compromise the cultural and natural assets for which it is famous.

Environmental factors

Broome is situated in a sub-tropical environment and is characterised by distinct wet and dry seasons, with monsoonal tropical rains and flooding, and hot and dry conditions in each season respectively. The average temperature during the dry period between April and September is 24°C, contrasting with the monsoonal wet season with an average temperature of 29°C, and much higher levels of humidity.

⁵ Paxon Group 2014. Submission in response to the Green Paper on Developing Northern Australia August 2014

The Shire's landscapes include marine waters, wetlands, undulating plains, vast pastoral areas, part of the Great Sandy Desert and extensive coastlines of sand beaches, dunal systems and coastal mudflats. Sections of the Shire of Broome are contained within the West Kimberley National Heritage area, which is recognised for its inspirational landscapes; ancient geology; biological richness; a rich and dynamic Aboriginal culture; early European exploration; a rich pastoral history; and pearling.

The geomorphology of the area is characterised by Quaternary sand plains of red sands and alluvial plains of grey-brown clays. Low uplands of sandstone and limestone have shallow stony soils. The most common soil type within the Shire is Pindan, a red silty sand with a high clay content and low nutrient content. When dry, Pindan becomes very hard and when wet it can become waterlogged and untrafficable. Pindan soils are susceptible to erosion and sediment loss following land clearing.

The Shire's coastline in and around the Broome townsite, including areas of Roebuck Bay to the south is a combination of Unallocated Crown Land and Crown Reserve widely known as the 'Coastal Park' and/or 'Minyirr Park'. The Coastal Park contains important vegetation assemblages including mangroves near Roebuck Bay; Federally Endangered Monsoon Vine Thickets in the leeward side of the dunes along Cable, Reddell and Simpsons Beach; State-listed Priority one ecosystems endemic to the Broome Peninsula (Cable Beach Ghost Gum, Minyjuru on relict dunes); as well as the relatively un-documented Priority 1 ecosystem Dwarf Pindan Heath and the Critically Endangered plant - *Keraudrenia exastia*. These vegetation assemblages have significant ecological values and also function as environmental corridors for mobile frugivores critical to the health and viability of Monsoon Vine Thicket at its southern most extent, and other species, and for erosion control.

Most of the Coastal Park is jointly vested with the Shire and the Yawuru Registered Native Title Body Corporate (RNTBC) responsible for the areas within the Broome townsite and the Department of Parks and Wildlife and Yawuru responsible for areas outside of the townsite. There is also an area to the north of the Townsite vested with all three parties for joint management. Management plans for these areas are currently being prepared. The draft management plan for the out-of-town areas (which will be known as the Yawuru Birragun Conservation Park) was advertised for public comment in 2015.

The proposed Yawuru Nagulagun / Roebuck Bay Marine Park will be jointly managed by the Yawuru RNTBC and the Department of Parks and Wildlife (Parks and Wildlife). The indicative joint management plan was released in 2015 for a three month comment period which has now closed. The comments are being collated and it is expected that the joint management agreement will be finalised following this process.

Two IPA's (Indigenous Protected Areas) are actively managed by Aboriginal ranger groups outside of the townsite; Bardi Jawi IPA and Karajarri – Stage 1 IPA. Additionally, two more IPA's are in the consultation phase; Karajarri Stage 2 IPA and Yawuru IPA. Boundaries and status of these reserves are available online⁶. IPA's form part of Australia's network of protected areas and, in addition to integrating Aboriginal ecological and cultural knowledge, they are managed in line with international guidelines.

A number of Threatened and Priority ecosystems and Threatened species occur throughout the IPAs, including the Endangered Monsoon Vine Thicket, Endangered Gouldian Finch, Vulnerable Greater Bilby, Vulnerable Red Goshawk and others as well as endemic species such as the Dampierland

⁶ <http://environment.gov.au/indigenous/ipa/images/ipa-map.jpg>

burrowing snake and limbless slider. Additionally, the Coulomb Point Nature Reserve occurs within the Shire area and covers 28,300ha. It is the management responsibility of the State Department of Parks and Wildlife.

A number of other areas throughout the Dampier Peninsula have previously been earmarked as potential conservation areas due to their high environmental cultural values.

Broome experiences a semi-diurnal tidal regime, with a lowest to highest astronomical tidal range of 10.5m. Exposed parts of the Shire's coastline are vulnerable to storm surge. The coastline orientation makes the town centre of Broome less susceptible to storm surge than other parts of the northwest coast, although anecdotal evidence suggests that areas of the Broome townsite, predominantly in Chinatown, become flooded in high spring tides. Other areas in-town have been protected by the series of coastal dunes. Since 1910 there have been 22 cyclones that have produced gale-force winds at Broome and caused damage through coastal erosion and storm surge associated with the cyclonic activity.

Processes associated with extreme weather events and human activities may lead to adverse impacts such as coastal dune erosion, damage to vegetation or coastal formations and disruption of breeding sites and fauna habitat.

Water Resources

The key water resource assets within the Shire of Broome are generally associated with groundwater or the seasonal flow of watercourses (surface water) during the wet season. There are very few examples of perennially flowing rivers within the Shire, most drying to a series of pools (some fed by groundwater) during the dry season.

The majority of the groundwater resources in the Shire are contained within the sedimentary rock aquifers which are found in the Fitzroy sub-region around Broome and the Fitzroy River Basin. These aquifers vary considerably in quality and quantity. The Shire is covered by the Canning-Kimberley Groundwater Area and the Broome Groundwater Area, which are divided into a number of groundwater subareas. Although no allocation plan exists for the Broome Groundwater area, an allocation plan has been released for the La Grange North and South subareas to provide protection for the area's groundwater-dependent environmental and cultural values including the Mandora Marsh, while providing users with secure access to water.

Vegetation

Most of the Shire's vegetation (commonly known as Pindan vegetation) is characterised by low and open woodlands with scattered trees, acacia thickets and an understorey of grasses and herbs, transitioning to areas of grasslands and savannahs. Towards the north end of the Dampier Peninsula it becomes more heavily vegetated with larger trees.

Within the Shire there are 1,663 species of flora of which 151 are endemic and there are 539 species of fauna of which 17 are endemic. In addition the Shire contains two flora species that are rare or likely to become extinct and 14 species of fauna that are rare or likely to become extinct.

Two significant areas for biodiversity are the extensive coastal mudflats which support numerous migratory birds at Roebuck Bay and Eighty Mile Beach. These sites are considered of international significance given the numbers and diversity of birds that feed in these areas seasonally, and are listed as RAMSAR sites under the International RAMSAR Wetlands Convention. These sites are also

subject to two other international agreements, the Japanese-Australia Migratory Birds Agreement (JAMBA) and the Chinese-Australia Migratory Birds Agreement (CAMBA).

Roebuck Bay is internationally important for at least 20 species of migratory shorebirds with total numbers of waders using the site each year estimated at over 300,000. All of the migratory shorebirds are listed under JAMBA and CAMBA and are specially protected as matters of national environmental significance under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). More than 472,000 migratory waders have been counted on the mudflats of Eighty Mile Beach during the September to November period. 65 bird species have been recorded; 33 are listed JAMBA and CAMBA and are specially protected by the EPBC Act (Department of Conservation and Land Management, 2003).

There are also a number of Declared Important Wetland Areas (DIWA) of National significance in the Shire of Broome including:

- Willie Creek Wetlands (salt flats, mangroves, waterbodies and inundation areas);
- Bunda Bunda Mound Springs (mangroves);
- Dragon Tree Soak (lake);
- Mandora Salt Marsh (lake);
- Roebuck Plans system (lake);
- Roebuck Bay (slat flats,mangroves, waterbodies); and,
- Portion of Eighty Mile Beach system (salt marshes, inundation areas).

The Shire further contains one Federally Endangered Ecosystem and a number of Threatened (TEC) and Priority (PEC) ecological communities. Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat. An ecological community is found to be threatened if it is defined as either; presumed totally destroyed, critically endangered, endangered or vulnerable.

Monsoon Vine Thickets were listed as Endangered under the EPBC Act 1999 in 2013. In the Broome Peninsula they occur at their southern-most extent. The state still lists them as Vulnerable despite federal recognition as Endangered.

State TECs located within the Shire include:

- Roebuck Bay Mudflats (vulnerable) - Species-rich faunal community of the intertidal mudflats of Roebuck Bay;
- Moonsoon Thickets (vulnerable) - Monsoon (vine) thickets on coastal sand dunes of Dampier Peninsula;
- Bunda Bunda (endangered) – Assemblages of Bunda Bunda organic mound spring;
- Big springs (vulnerable) - Assemblages of Big Springs organic mound springs; and
- Mandora Mounds (endangered) - Assemblages of the organic springs and mound springs of Mandora Marsh area.

There are a number of Priority Ecological Communities (PECs) in the Shire, which are possible threatened ecological communities that do not meet the DPaWs survey criteria, or are not adequately defined.

Locations and particular PECs within the Shire can be identified by accessing DPaW Threatened and Priority Community database. State-listed PEC's located within the Shire include:

- Inland Mangrove (*Avicennia marina*) community of Salt Creek (Priority 1)
- Dwarf pindan heath community of Broome coast (Priority 1)
- *Corymbia paractia* dominated community on dunes (Priority 1)
- Relict dune system dominated by extensive stands of *Mangarr sersalisia*, formerly known as *Pouteria sericea* (Priority 1)
- Nimalaica clay pan community (Priority 4 (ii))
- A number of Priority 1 Vegetation Associations as defined by John Beard's Vegetation mapping for the Kimberley.

Future prospects for Broome

With Broome's population set to increase over the coming years, with a predicted population of 31,400 by 2041, Broome is set for considerable growth across all industries. Specifically, if development opportunities relating to tourism, resources, agriculture, and aquaculture are fully realised, it is expected that employment and business opportunities will come available.

Population growth in resident, visitor and service sectors is creating pressure for residential, commercial and industrial development. The Shire's continued growth and expansion and its relatively complex land tenure and management arrangements, means that effective land use planning and management is critical. Wise land use planning will ensure that development meets the needs of the community and causes minimal environmental impact.

To ensure sustainable environmental development is optimised, it is imperative that planning and management processes utilise up to date and comprehensive mapping processes that accurately and geographically define environmental and cultural values. For example, the TEC and PEC lists for the state, as well as maps specific to Broome PEC's were updated as recently as 2015 and these should be incorporated into the planning system to allow for incompatibilities to be identified.

It should be recognised, however, that the Shire does not always have the authority to determine approvals for certain land uses and decision-making authority often resides with State or Federal government agencies who may not share the Shire's development vision.

With appropriate support, Broome has the potential to become a labour supplier through further growth in training and education on both a local and international scale. The Kimberley Training Institute is the fastest growing higher education technical training facility in Australia well positioned to meet the emerging needs for higher and technical education regionally⁵.

Broome is now recognised through the WA State Planning Strategy as a 'Regional Centre' and a Growth Plan will be soon be prepared to guide its socio-economic development. Broome's status as the primary settlement of the Kimberley is reiterated in the Kimberley Regional Planning and Infrastructure framework⁷ as it is identified as the 'Regional City' within the settlement hierarchy for the region. This means government offices based in Broome will provide a wide range of government services for the wider region. Aspirational population projections under the KRPIF / Regional

⁷ WAPC (2014) Kimberley Regional Planning and Infrastructure Framework. Available from: http://www.planning.wa.gov.au/dop_pub_pdf/Kimberley_RPIF_draft.pdf

Economic Blueprint would see a 5% average annual growth rate, and this level of population growth may place additional strain on the existing settlement pattern.

Tourism

Broome continues to be the gateway to the Kimberley and one of the top two destinations in Western Australia. Due to the sub-tropical climate of the area, the region is inundated with visitors in the dry months from April to October each year. During this period, the population of the region increases substantially.

Emerging cultural tourism enterprise throughout the Dampier Peninsula and within some of the Indigenous communities, has the potential to draw visitors whilst enabling local employment and protecting and conserving the natural and cultural heritage values of the area.

Through extensive branding, marketing and enhanced tourism product offerings, opportunities for future development are highly prospective. These strategies are already in place through the Shire of Broome's partnership with the Chamber of Commerce, Australia's North West, Broome Visitor Centre, Broome International Airport and Tourism WA and the development of their marketing strategy. Broome serves as the gateway to the Kimberley and one of the top two tourist destinations in Western Australia⁵.

Agriculture

Along with a well established pastoral industry (Figure 2), there is currently a significant and expanding horticulture industry operating within the Shire of Broome. Producers in the Shire grow high quality 'out of season' goods including watermelons, sweet corn, beans, mangoes, vegetables and fodder. The value of Agricultural produce in 2014 in the Shire was \$32.9M over a total area of 1,873 ha (1,340 ha irrigated).

The Department of Agriculture and Food is investigating the La Grange water allocation area, south of Broome. It extends south from the town of Broome to slightly south of Sandfire Roadhouse, 360 km from Broome towards Port Hedland. The project is conducting a prefeasibility study of the area including soils, groundwater modelling, approval pathways, and conducting innovative market, economic and investment research with local landholders. This information will provide a solid foundation to support future agricultural developments and foster local and third party opportunities.

Agricultural expansion will also be encouraged through the Water for Food program, a \$40 million dollar State funded project to realise additional agricultural and horticultural opportunities across WA. One new project in Broome is the potential expansion of the area known as Skuthorpe, located 30 km from the Broome townsite.

It is anticipated that if water supplies are sufficient and other factors such as land tenure, soil type and financial viability are supportive, there may be an opportunity to develop a significant food bowl for the nation, as well as the development of new export markets for fresh and manufactured food. Given much of the land is under native title, this may present enterprise opportunities for Traditional owners⁵.

Less intensive agricultural pursuits, such as the wild and enrichment harvesting of bush fruits such as gubinge are already emerging as an economically viable and environmentally and culturally compatible enterprise. Gubinge is a superfood, already being harvested and sold locally within the Shire and elsewhere, by companies who are also using it to manufacture secondary products including chocolate. Cosmetic companies are also purchasing and using gubinge for high-end

products. Further refinement and development of this industry is being led by the Kimberley Training Institute at their rural education and training facility at 12 Mile called Balu Buru. Various species are being grown at Balu Buru as part of a living seed bank and alternative production processes for Gubinge are being investigated including "enrichment" planting. Enrichment planting is alternative to intensive horticultural production and minimises the impact to the surrounding environment by increasing the number of gubinge plants and selectively watering through drip-irrigation.

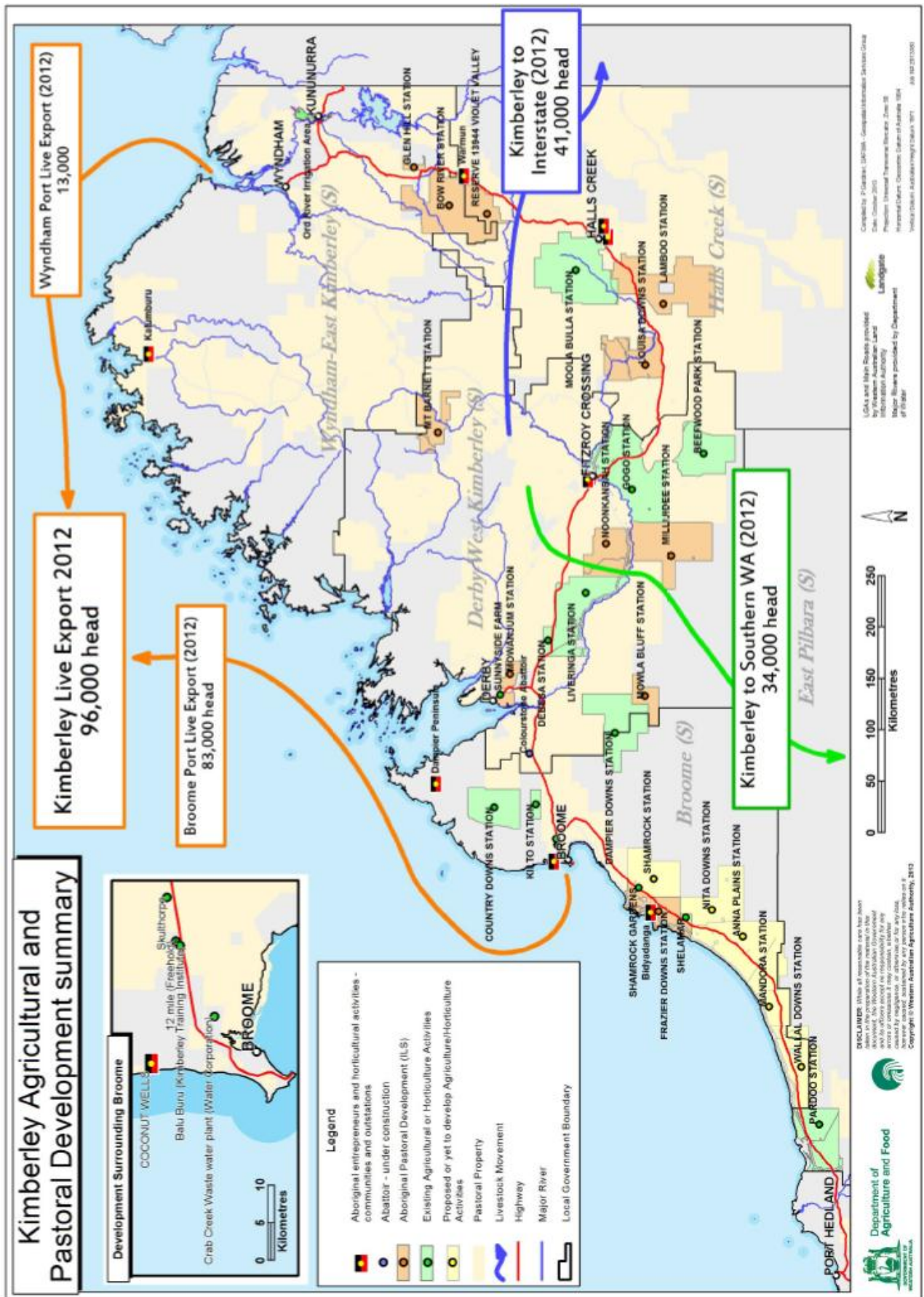


Figure 2 Summary of agricultural activity in the Shire of Broome and beyond.

Conservation and Land Management

Conservation and cultural land management is also proving to be an increasing employment opportunity, particularly for Indigenous people who have been developing and professionalising their Natural, Cultural Resource Management (NCRM) skills within Indigenous Ranger Groups. In addition to undertaking fully-funded and important NCRM roles within IPA's, Conservation parks, Marine Parks and across other Aboriginal Lands Trust and Unallocated Crown lands, these groups are actively undertaking and seeking NCRM contracts and consultancies in the areas of natural and cultural heritage management, including fire management.

Aquaculture

Broome's aquaculture industry consists of three categories being, pearl farming, fishing, and the recently established fish farming industry. Global and domestic trends created an array of opportunities for local producers in Broome who are known for the freshness and quality of their produce. The recently established fish farming industry of Broome farms salt water barramundi at Cone Bay in the Buccaneer Archipelago (located 54 kilometres offshore north of Broome). In 2009/10, the regional fishing industry generated \$9.8 million, with anticipated growth over the coming years. As the port in Broome serves the wider Kimberley region, it provides a focal point for these industries. It is anticipated that over the medium to long term, there will be additional export opportunities in emerging markets such as Indonesia, Vietnam and China⁵.

These opportunities will be supported through the creation of the Kimberley Aquaculture Development Zone where finfish aquaculture production will be undertaken.

Current and future challenges

The Shire experiences many challenges that are different to other local governments in Western Australia and which impact on the Shire's ability to manage the environment and control environmental impacts. These include:

- Isolation from the State's capital (2,200km away) and other major regional centres (619km from Port Hedland);
- The rate of population growth and development, including increased numbers of residents and tourists as well as possible incompatibility between some land uses such as nature-based tourism and mining;
- A large population increase in peak tourism season which may impact adversely on the natural environment through illegal camping, effluent problems, vehicle and human traffic, spread of invasive species, and dumping of litter and waste in reserves;
- Complex tenure and management arrangements including pastoral leases, unallocated crown land, Aboriginal reserves and private property. The Shire may have no direct management responsibility or powers in some of these areas;
- A lack of resources and staffing, particularly as the Shire's remoteness increases the cost of providing products and services;
- The challenge of delivering services outside Broome townsite across the vast non-urban areas of the Shire;
- Potential changes in responsibility for service provision to remote Aboriginal communities;

- Community expectations that the Shire play a bigger role in environmental management;
- Climatic conditions of the north-west, regular cyclones and intense rainfall events which create challenges for managing storm water quality;
- Lengthy coastlines which are vulnerable to impacts arising from human recreational use;
- Government policies based on south-west situations which may not translate easily for north-west conditions.

People’s expectations of the environment

The Broome 2040 community survey asked Broome residents what they valued most about living in the Shire of Broome (Figure 3) and found that the highest response was the relaxed lifestyle, laid-back attitude and atmosphere. Outdoor living was a significant component with the close proximity of beautiful and untouched and often deserted natural environments. Fishing and camping were all part of the preferred lifestyle. A clean environment with unpolluted water, air and climate were also a highly valued part of Broome’s attractiveness.

The beaches and the coastline were the second-most valued thing about living in the Shire of Broome, and this of course related to being surrounded by pristine, beautiful beaches, a stunning coastline, and diverse flora and fauna. Easy access to beaches was also highly valued, including being able to drive along them on occasions to access isolated places.

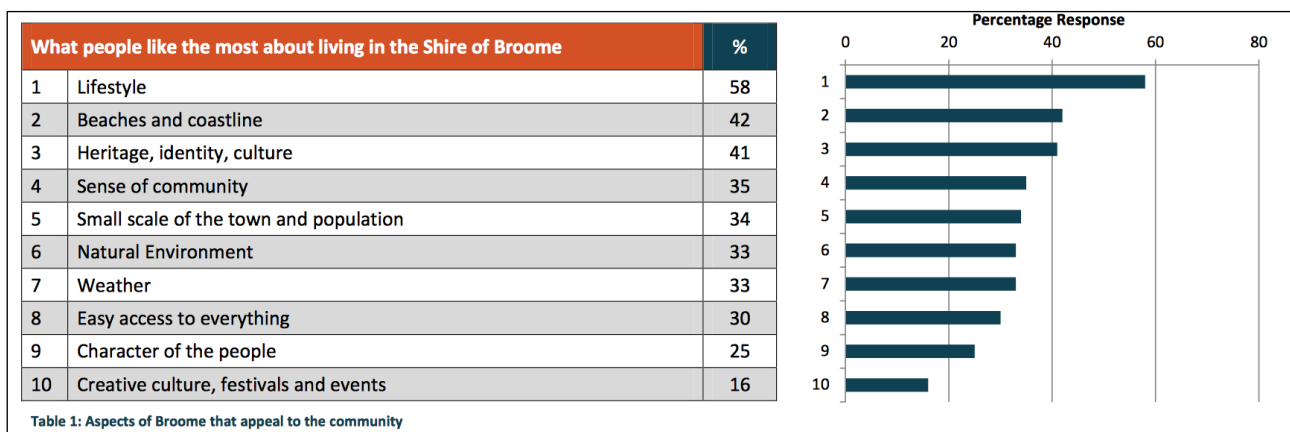


Figure 3 Aspects of Broome that appeal to the community².

Local heritage, identity and culture and a sense of community, are historically tied to the local natural environment and inseparable from it. The following are past indications by local people⁴ on what they expect of the Broome environment:

- the full range of outdoor recreational activities;
- best practice in eco-cultural tourism;
- practical education and awareness raising of environmental issues;
- opportunities for food harvesting and gathering (bush tucker);
- promotion of climate-responsive development styles for Broome;
- native plant propagation and planting;
- sponsorships and support for environmental initiatives; and,

- fostering and promoting skills development.

Aboriginal people are an important part of Broome's multicultural community and as the original custodial owners, have a unique connectedness, a valuable long-term perspective and a keenly felt sense of responsibility for the care of the local environment. Some of their concerns are expressed in Table 1, and although these issues may affect community and culture specifically, these concerns are generally applicable to environmental threats impacting everyone in the region. Fish stocks depleting, off-road vehicles destroying sensitive bushland and breeding grounds, impacts of tourists, climate change and invasive species are all issues of considerable concern to locals. Often it is the areas that are popular for recreation today that are also the places that have been traditionally highly valued for fishing, gathering cockles and practicing law and culture.

| Theme | Potential impact |
|--------------------------|---|
| Population Growth | Greater use and competition for resources & space for lands and coastal & marine areas. eg. Increasing numbers of vehicles on beaches and a rise in recreational boating and fishing. |
| Urban Development | Urban infrastructure encroaching on Aboriginal lands, alienating culturally significant areas. Environmental impacts of drainage and leaching. Incremental not holistic development approvals (death of a thousand cuts). |
| Growth in tourism | Greater visitor impacts in culturally and environmentally sensitive areas. |
| Increased fishing effort | More people fishing and newer technologies create greater pressure on fish stocks, threatening opportunities for traditional uses. |
| Resource exploration | Interference with culturally significant land and resources. Pollution risks from oil spills or other industrial accidents. |
| Cultural awareness | Lack of understanding about Aboriginal culture and rights leads to misunderstanding and a lack of respect for traditions and environmental knowledge. |
| Tenure | Uncertainty over agency jurisdiction for managing terrestrial, intertidal and sub-tidal areas. |
| Invasive Species | Unmanaged weeds and feral animals pose a threat to the natural and cultural values of country. |
| Climate Change | Impacts on biodiversity, rainfall and frequency of severe weather events, vulnerability to rising sea levels because of the low elevation, and seawater encroachment on groundwater reserves. |
| Fire Management | Current burning regimes, combined with lack of understanding of Aboriginal values and rights, can cause damage to culturally sensitive areas. Unmanaged wild fires also pose a continual threat to country. |

Table 1 Aboriginal environmental concerns⁸.

Members of the community vary in how they perceive the success of managing Broome's environment. There is general agreement however, that there are some environmental issues that need to be better managed. Members of the community have concluded that the main impediments to effective management of the environment in Broome include:

- a lack of time;
- a lack of money;
- a lack of expertise; and,
- not enough support from government authorities.

Many members of the community believe there is not enough money spent on environmental management across Broome shire, which has resulted in less than optimal outcomes in some situations¹². A number of other concerns were raised regarding the management of Broome's environment which included:

- a perceived lack of communication from authorities regarding development in the town;
- a perceived need to change priorities;
- individuals feeling powerless or unheard in the current system;
- a need for better management of conflict; and,
- a perception that expertise is sometimes available but not always used effectively in decision-making.

In a similar vein, some members of the community believe that there is not enough support from State and Federal authorities and that regional areas are often left to deal with issues that are of little interest to people living in larger population centres. This perception is supported by the absence of some government agencies in Broome and increasing responsibilities being devolved to cash-strapped local governments in general.

Community members associated with the tourism industry are of the view that the community generally and tourists especially should be better educated about the vulnerabilities and potential adverse impacts of their actions on the environment. Many community members feel that they are unable to become involved in environmental issues as fully as they would like to due to other time commitments.

On the question of there being conflict between different interest groups, which may be impeding environmental protection and management, residents from all sectors of the community generally believe this is not the case. A mature attitude prevails in the community that recognises the role of negotiation and lobbying as part of the process of arriving at an agreed position.

⁸ Source: Broome Coastal Reserves Master Plan workshop hosted by CCS strategic & ASE - Feb 2013.

Ecologically Sustainable Development & SOE Reporting

Broome Shire has a unique, varied and mostly pristine environment with an abundance of natural assets. It is the Broome environment, particularly its coastal landscapes, that attracts both residents and tourists alike. Sustaining these attributes into the future can be achieved through Ecologically Sustainable Development (ESD).

The Australian National Strategy for defined ESD as:

'Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.'

Under Section 516A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act - Appendix 2), Commonwealth organisations have a statutory obligation to report on their environmental performance and how it has advanced the principles of ecologically sustainable development. This requirement has often cascaded down in non-binding form to State and Local Government agencies. Although not a legislative requirement, this SOE report for the Shire of Broome is therefore an important part of the Shire's demonstration of its progress toward ESD⁹.

When undertaken well, ESD protects the environment and provides a boost to economic opportunities while maintaining quality of life and sense of place. Maintaining the Broome environment while managing competing land uses is the key to Broome is to remaining the premier tourist destination.

The Pressure - State - Response (PSR) Model

The PSR scheme is a flexible framework used to guide environmental policy development and decision-making. It was initially developed by the Organisation for Economic Co-Operation and Development (OECD) in 1994 and has been used to relate human activities to the state of the receiving environment since that time.

Pressures are intentional or unintentional impacts on the environment arising from human activities including: land use changes, resource consumption, release of substances and physical damage through direct contact uses. Pressures depend on the kind and level of technology involved in source activities, and can vary across geographic regions and spatial scales. Pressures may include substances emitted into environments from industrial or agricultural developments or physical damage or habitat loss from clearing for urban development.

The State of ecosystems is defined as the dynamic condition of its abiotic (non-living) and biotic (living) components. Changes in state are a reaction to the extent, duration and nature of pressures. Multiple pressures acting together may cause even greater impacts than single impacts operating in isolation. An ecosystem's resilience governs how its state changes under the influence of the various pressures. Changes in state may be measured by physical, chemical or biological variables including:

⁹ World Commission on Environment and Development (1987) Our Common Future. Report of the World Commission on Environment and Development, United Nations.

habitat structure and diversity, species richness, functioning of communities, or individual or community genetic makeup or fitness. Environmental indicators are used to monitor and report on changes to the system's environmental condition or state and these where possible should be policy-relevant.

A Response is the action taken by groups, individuals or governments to prevent, compensate, ameliorate or adapt to changes in the state of the environment by seeking to:

- control drivers or pressures through regulation, prevention, or mitigation;
- directly maintain or restore the state of the environment; or,
- deliberately 'do nothing'.

Decision-making processes may occur at a variety of scales, from local managers addressing site-specific and local issues to state and federal governments wrestling with matters of national significance.

Challenges for the PSR model

Ecosystems by their very nature are dynamic systems and their health has been defined as their ability to maintain homeostasis and to adapt and evolve. This approach values ecosystems in their own right and is called an ecocentric approach. Ecosystem values may also be defined in human terms as those things that humans can extract or use from an ecosystem without compromising its ability to continue to provide such goods or services. This approach is termed anthropocentric.

Exploiting ecosystem services even in an apparently sustainable way, can eventually alter ecosystem structure and compromise certain delicate dynamic balances and species composition. In an anthropocentric management paradigm, if human extraction of goods and services was not compromised by these changes, the ecosystem would be said to have remained in a healthy state.

Determining ecosystem health from the lens of human resource utilisation may be seen to be fundamentally flawed in that it defines health as the value (usually financial) of goods and services available to humans rather than the intrinsic value of the natural system itself. This has led to an understanding that impact assessment becomes a process of negotiating trade-offs. Subtle ecosystem changes are traded off against the public good. The challenge for SOE reporting is in defining when the environmental impacts are not a reasonable compromise for the value of the goods and services being extracted.

Clearly, negotiating these trade-offs between human value and acceptable change is different for ecosystems adjacent to population centres or for those where there are significant cultural values that need to be maintained in perpetuity. Aboriginal Native Title holders could express a view that any loss or damage to the culturally-significant Monsoon Vine Thickets of Broome is an example of an entirely unacceptable ecosystem change.

The selection of environmental indicators for SOE reporting is problematic as it must reflect dynamic ecosystem process, human value systems, human decision making scales and processes and provide timely feedback for systems that are inherently complex and 'unknowable' in the available time frames. Environmental indicators must also be policy-relevant if they are to adequately inform the management effort.

The opportunity for landscape ecologists during SOE reporting is to provide quality information describing options, actions and consequences that best support decision-makers in their often difficult decision-making processes. The best SOE reports are those that take the community on a journey of appreciating the consequences of compromise and tradeoffs and in understanding the relationships between human use and ecosystem resilience. Another challenge for landscape ecologists is to render this process in a way that speaks to the whole community.

National SOE framework

The framework for the Australian National SOE (Figure 4) included in 2011¹⁰: Drivers, State, Trends and Pressures. An assessment of Management effectiveness included: Understanding of context, Planning, Management capacity, Inputs, Process, Outputs, Outcomes, Resilience, Risk (including frequency and consequence) and Outlook.

The national SOE also included 9 themes: Atmosphere, Inland water, Land, Marine environment, Antarctic environment, Biodiversity, Heritage, Built environment and Coasts.

¹⁰ SOE reporting [Internet]. [cited 2015 Apr 25]. Available from: <http://www.environment.gov.au/topics/science-and-research/state-environment-reporting>

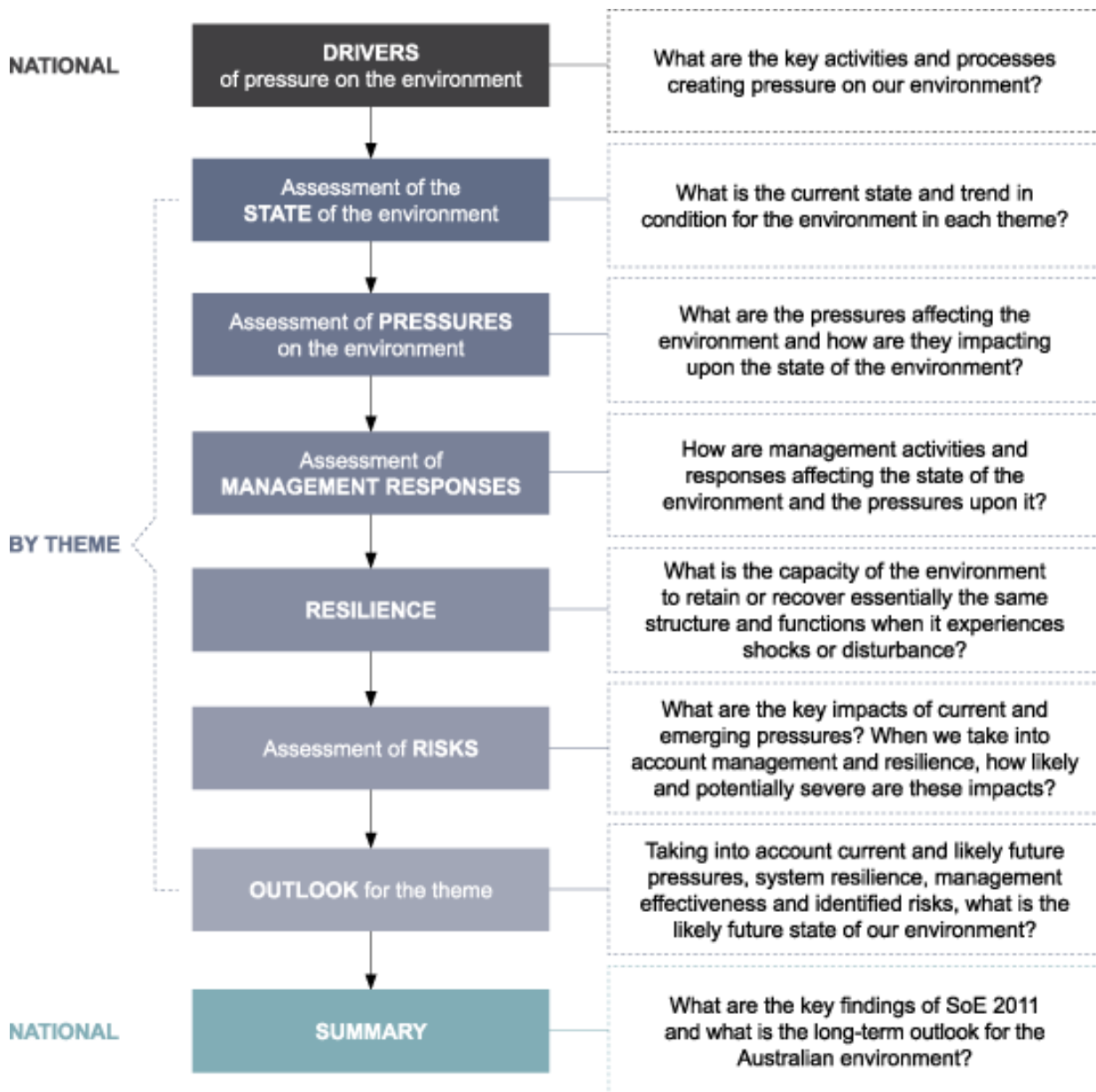


Figure 4 Conceptual structure of the Australian National SOE (2011).

WA State SOE framework

The SOE framework for WA¹¹ modified the original OECD 'Pressure, State Response' model and used: Condition, Pressure, Response, Implication for each of the various themes, issues and indicators. There were 8 themes which referred to major groupings of the environment, including: Atmosphere, Land, Inland Waters, Biodiversity, Marine, Human Settlements, Heritage and Towards Sustainability.

The WA SOE report (2007) used the following format for each theme (where appropriate):

- Introduction: Described natural resources and information related to this theme and explains the significance or importance of these resources to the environment, society and the economy.
- Objectives: Outlined broad environmental goals relevant to the theme and the environmental values for the natural resource.

¹¹ State of Environment WA [Internet]. [cited 2015 Apr 26]. Available from: <http://www.epa.wa.gov.au/AbouttheEPA/SOE/2007/Pages/default.aspx>

- **Headline indicators:** High-level indicators that provided a summary measure of the progress towards meeting the objectives.
- **Overall condition:** Summarised the general condition of the environment relevant to the theme.
- **Effectiveness:** A summary of the progress and effectiveness of government actions that arose from State of the Environment Report: Western Australia 1998.
- **Suggested responses:** Recommended various policy, on-ground action and strategies to address environmental conditions.
- **Emerging or outgoing issues:** An emerging issue is a minor issue with potential to be a problem in the future, or it has little current information available about it. An outgoing issue is an issue that previously appeared in the State of the Environment Report: Western Australia 1998 but is no longer considered a major environmental problem.

The format for each environmental issue was as follows:

- **Indicative extent:** A map representing areas of WA that were affected by the issue.
- **Priority rating:** A five-level score assigned by the EPA to represent the priority of the environmental issue to WA. A priority rating of "1" indicated a top priority environmental issue.
- **Key findings:** Summary dot points which highlighted the major findings.
- **Description:** Described various aspects of the issues.
- **Objectives:** Outlined the specific objectives for addressing the environmental issue. These statements were often based on existing policy documents.
- **Condition:** Summarised what was known about the then status and trend of the issue's impact on the environment. This section may have included environmental indicators.
- **Pressures:** Identified the key processes that caused the issue. This section may have included environmental indicators.
- **Current responses:** Summarised the current major community and government strategies, policies and on-ground actions that had been implemented to address the issue. This section may have included environmental indicators.
- **Implications:** Identified the social, environmental and economic consequences of the issue.
- **Suggested responses:** Recommended responses included strategies, policies and on-ground actions that should be implemented to address the issue.

Shire of Broome SOE Approach

The Shire of Broome has a mission statement: *'to deliver affordable and quality local government services'*. The *Local Government Act (1995)* provides a simple definition of the overarching outcomes for Local government services as follows:

'In carrying out its functions, a local government is to use its best endeavours to meet the needs of current and future generations through integration of environmental protection, social advancement and economic prosperity.'

This 'triple bottom line' approach recognises the interconnected nature of social, economic and environmental issues, and requires a holistic approach to decision-making. In terms of environmental management, the Shire of Broome's primary role is the protection, rehabilitation and enhancement of

the natural environment and the sustainable use of resources for land or activities directly under its control. This includes both strategic and operational activities that address planning and management responsibilities.

Information gleaned during preparatory consultation for this SOE, concluded that the Broome community preferred that:

- The significance and value of Broome's environment be recognised, valued and protected;
- The sense of place and unique lifestyle that is valued by the Broome community be protected;
- For areas directly under its control, Shire operations maintain or enhance all aspects of the Broome environment including local natural areas, local flora and fauna, and management of weeds, drainage, erosion and sediment, and address climate change, and water and energy conservation;
- The Shire demonstrates environmental leadership by improving the sustainability of its own buildings, operations and activities;
- Environmental management becomes incorporated into the Shire's operations and processes as part of normal business and the Shire's plans, strategies and actions continually enhance the Shire's environmental position;
- The important relationship between the natural environment and cultural heritage is recognised, valued and protected;
- Effective communication and consultation that ensures the community has a sound understanding of the Shire's environmental roles and responsibilities, together with its partners;
- The Shire advocates for the Broome environment and community in State and Federal government issues; and,
- Relationships with relevant stakeholders are built and maintained, to achieve effective environmental management and strategic outcomes, consistent on-ground works programs and information sharing.

Environmental themes and topics

Previous consultation and engagement with Shire staff and the community¹² identified six SOE themes for issues that require management by the range of stakeholders in the Shire. The SOE themes were developed through a comprehensive four-stage process including research on key environmental issues. A number of topics were developed within each theme. Policies, strategies or actions that are the Shire's responsibility were developed into an Environment Management Plan presented as the final section of this report.

¹² EMRC (2010) Shire of Broome Environmental Management Strategy 2010-2015. Stage 2 Report: Community and Staff Consultation. Eastern Metropolitan Regional Council, August 2010.

Layout of SOE Themes and Topics

SOE Theme: Land management



Topic 1: Maintaining landscapes



Topic 2: Fire control

SOE Theme: Coasts



Topic 1: Foreshore management



Topic 2: Coastal vulnerability and access

SOE Theme: Biodiversity



Topic 1: Maintaining biodiversity



Topic 2: Improving urban biodiversity



Topic 3: Managing invasive species

SOE Theme: Energy



Topic 1: Built form energy use



Topic 2: Transport energy use

SOE Theme: Water



Topic 1: Conserving water



Topic 2: Managing stormwater



Topic 3: Managing groundwater



Topic 4: Managing wastewater

SOE Theme: Waste management



Topic 1: Household waste



Topic 2: Litter and illegal dumping

Indicators of performance

The purpose of developing and using indicators for State of the Environment reporting is to be able to track changes in the pressures acting on the environment and the condition of the environment. Indicators need to provide information on how aspects of the environment have changed both over time and spatially. Response indicators are particularly relevant for assessing the performance of a policy, programme or initiative, where large-scale changes in the condition of the environment resulting from the response action may be slow to reveal themselves.

There is a so-called ‘SMART’ concept of indicators which can be summarised as:

- Simple (easily interpreted and monitored);
- Measurable (statistically verifiable, reproducible and show trends);
- Accessible (able to be regularly monitored, cost effective and consistent);
- Relevant (directly address issues or agreed objectives); and,
- Timely (provide early evidence of success or early warning of potential problems).

Other important characteristics of indicators are that they should be administratively practical and cost-effective to determine. An indicator graphic (Figure 5) has been developed for this Shire of Broome SOE to help community members interpret the performance information.

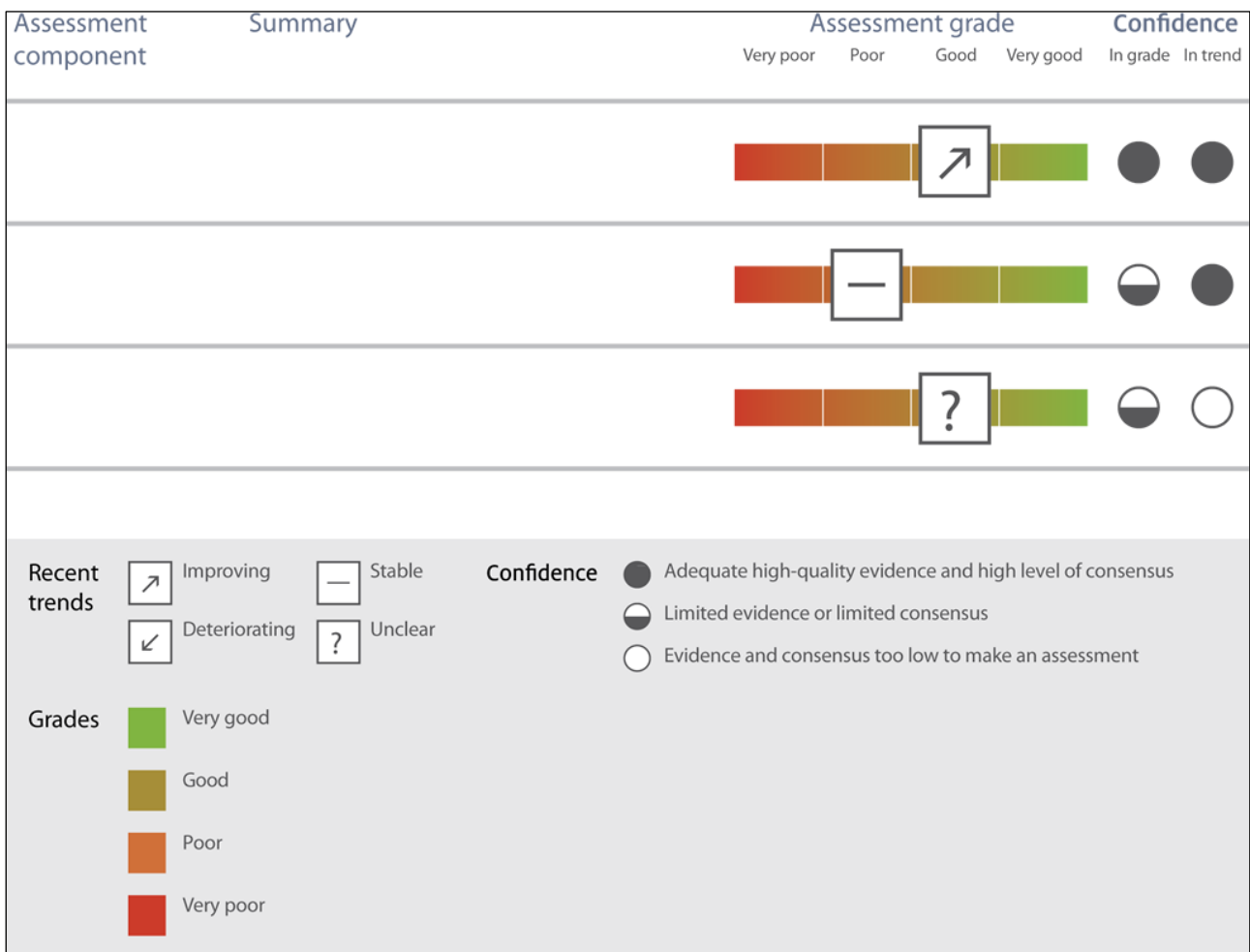


Figure 5 Layout of indicators, performance ratings and data confidence used throughout this report.

Managing the Environment

Environmental management in the broadest sense is multi-dimensional with interacting structural, procedural, logistical and tactical factors determining management success (Figure 6). Measures of management success may need to include references to integration, partnership, innovation, activity and cost effectiveness because the performance of human-natural systems with their inherent complexity and variability, is often difficult or impossible to determine until irreparable damage has occurred¹³.

Management partnerships are important. There are usually finite resources available for environmental management and competition for them has been keen historically, and increasing. Combined efforts arising from effective partnerships and strategic alliances are important in value-adding to the resource 'spend', particularly where resources are scarce and mutually-beneficial outcomes for all parties are possible. They can also serve to close skills and resource gaps within individual partner agencies.

Management capacity

While most environmental management efforts are served by personnel with relevant skills and experience in their specific scientific disciplines in remote areas, there is often a lack of effective policies and strategies within which to frame management actions. Environmental managers may also lack relevant skills and experience in dealing with the complex array of issues requiring management.

The capacity of local government to manage aspects of environment is contingent on:

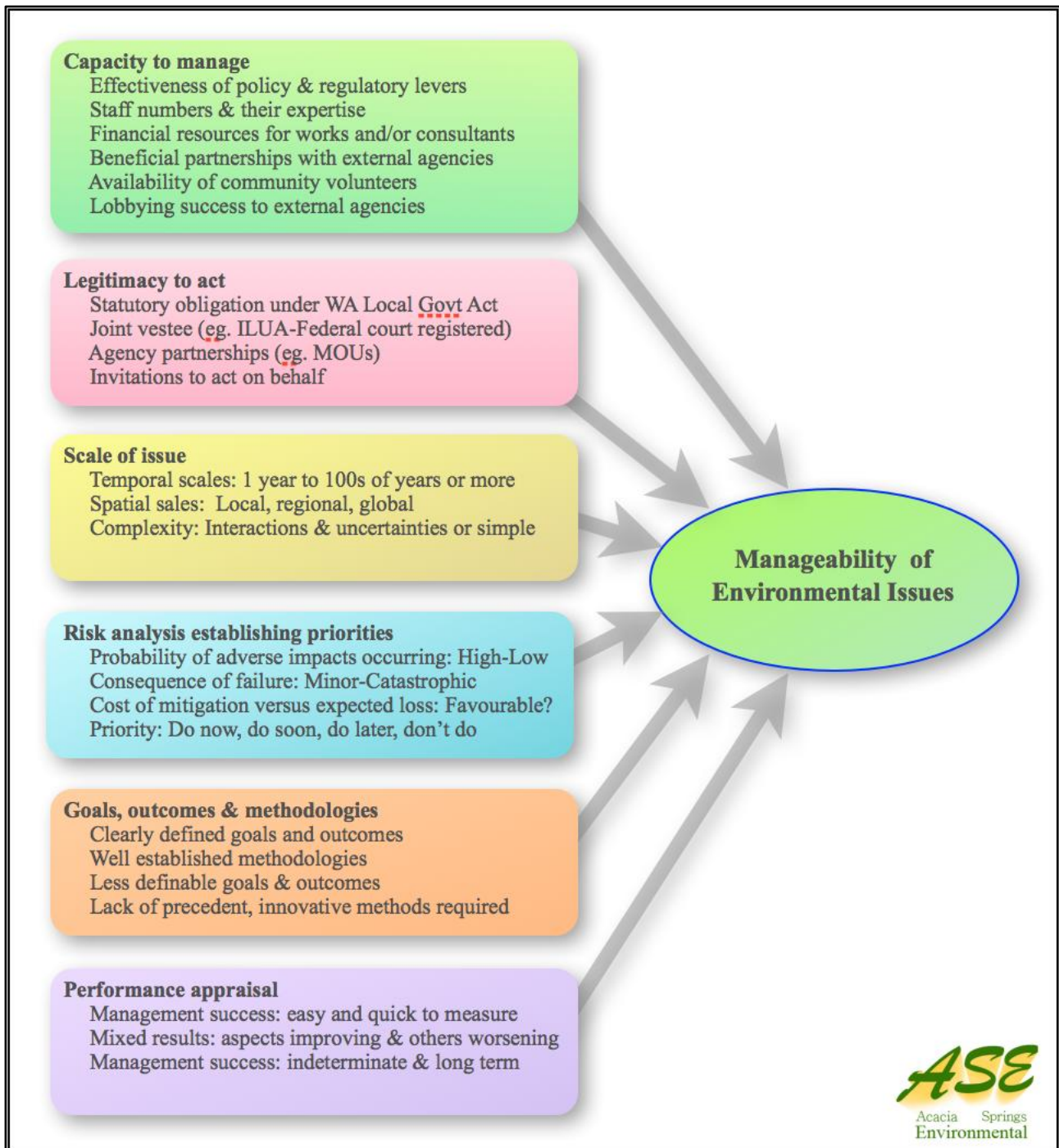
- availability of suitable policy & regulatory levers and how effectively they are applied;
- available staff resources and their capacity, expertise and experience;
- financial resources available to plan and undertake works and programs and/or for consultants and contractors to if required, act on Council's behalf;
- formal or informal partnerships with external agencies that provide for Council's needs and which value-add to Council's capacity to act;
- the success of lobbying external agents to gain financial or other support or practical actions which meet Council's needs; and,
- availability and capacity of community volunteers who can provide assistance with planning and implementation.

It has been found elsewhere that as issues requiring management increase in complexity, community involvement in planning and implementation can greatly lessen the burden currently carried by local governments and serve to improve outcomes flowing from often limited resources available for natural resource management.

¹³ Deeley, D.M. and Paling, E.I.(1999) Assessing the ecological health of Estuaries in Australia. Land and Water Resources Research and Development Corporation Occasional Paper 17/99, Urban sub-program report No 10.

Jurisdiction and legitimacy to act

There is a complex raft of legislation and regulation that requires amongst other things, the management of certain aspects of the environment, but these are often the responsibility of State and Federal agencies who may have different priorities and agenda. This means that local government is often somewhat constrained in its attempts to manage the local environment because of jurisdictional



issues.

Figure 6 Factors that interact to determine the success of environmental management.

Factors governing the Shire's motivation to act in a particular management role may include:

- whether there is a statutory obligation under the *WA Local Government Act (1995)* or other Act;
- if it is designated as the responsible management authority over particular land parcels;
- whether it is a member of particular formal agency partnerships through MOU or other management agreements; and,
- if there have been compelling requests to act on behalf of another land owner.

Examples of formal and informal agreements between agencies, such as Indigenous Land Use Agreements that have ironed-out jurisdictional gaps for environmental management are becoming increasingly common in the north of Australia.

Scale of issues

Some environmental matters are restricted to a relatively small geographic location such as the Vine Thickets and local management efforts can succeed here. Other environmental issues may be more widely dispersed such as the increased wildfire risk associated with introduced grasses across the Kimberley, which will require a more coordinated regional response with multiple agencies involved. Some environmental issues may be encapsulated within a short time frame such as the one-off replacement of poorly-designed storm water management infrastructure causing soil erosion. Other issues may be getting worse and growing in scale, such as visitor pressures on sensitive environments. Some environmental issues may be relative simple to understand while others may be plagued by significant gaps in understanding and uncertainties.

Clarity of goals, outcomes and methods

Establishing the scope of environmental management actions is sometimes difficult where issues are complex and where there are no clearly defined goals and outcomes or well established methodologies. In situations where there are less definable goals & outcomes or there is a lack of precedent, innovative and pioneering methodologies would be required. These would need a greater level of piloting and evaluation as they are implemented.

An additional challenge in establishing the scope of management is in reconciling the myriad of community expectations. Achieving the best balance of these sometimes conflicting expectations may provide a challenge for managers.

Performance appraisal

Performance appraisal is sometimes mandated within certain statutory instruments and is an important component of management capacity because of its role in fostering continuous improvement and accountability.

Despite its usefulness, it may not be possible in all situations to determine management success, particularly where issues are complex, lengthy time frames are involved and where there are divergent expectations of stakeholders over what constitutes success.

Pressures on the Broome Environment

In the PSR conceptual framework, Pressures are categorised as the social, demographic and economic developments in societies that directly and indirectly trigger pressures on the state of environmental elements. Pressures are generally considered to arise from meeting human needs for food, water, shelter, health, security, well-being and culture.

Factors considered to be pressures on the Shire of Broome's environment include:

- demographic and settlement patterns;
- the tourist industry;
- patterns of recreation;
- pastoral and agricultural activities;
- resource sector;
- fire management;
- invasive organisms; and,
- government policy and management.

Demographic and settlement patterns

The direct and indirect impacts of population growth on the built and natural environment and concerns about clearing of local vegetation, urban encroachment, high rise buildings and the loss of the town's unique character have been considered by sections of the community to be significant issues for Broome. Other issues of concern have included impacts of urban growth and development on amenity and habitat including:

- Loss of environmental and cultural corridors;
- Loss of large flowering trees which encourage birds into the town-site; and
- Noise pollution/loss of amenity caused by increased traffic from the airport.

Retaining Broome's character, identity and lifestyle during population increases, industrial development and urbanisation will remain a challenge for the Shire into the future.

It has been established elsewhere that protection of biodiversity and other environmental assets has the potential to add significantly to local economies and to improve the quality of life of local residents. Cultural and eco-tourism experiences are highly sought after by visitors to Broome and there is currently a global undersupply of these sorts of experiences, especially those providing a diversity of immersive opportunities for tourists¹⁴, such as is on offer within the Broome Shire and beyond.

Tourism has played a major role in the growth of the local Broome economy and much of the attraction has been based upon tourist's experiences of a high quality natural environment. Fostering an ethic of stewardship amongst local tourist operators and visitors utilising natural environments has proven a most cost effective method of environmental protection.

While a quality environmental experience is the major drawcard for many tourist visitors, there are concerns that population increases and the influx of tourists means increasing numbers of people

¹⁴ Dr. Paul F. J. Eagles is a Professor at the University of Waterloo in Canada.. PLA Annual conference, Melbourne, 2008.

using 4WD and off-road vehicles to gain access to environmentally and culturally sensitive areas. This has the potential to cause considerable damage and destruction of plant communities, increased amounts of litter and illegal rubbish dumping, greater risk of wild fires and the spread of weeds, pests and feral animals. Greater numbers of fishing craft with ever more sophisticated technologies means fishing pressures on vulnerable fish stocks have been increasing.

Visitors not understanding fragile environments and local Indigenous cultural sensitivity may cause unintended adverse impacts on the very things they love to visit because seemingly insignificant actions, through cumulative impacts, may lead to more serious consequences over time.

Another often forgotten aspect of human settlement is the increase in imperviousness of stormwater catchments as part of the built form, and this can lead to higher peak stormwater velocities which may exacerbate erosion and sedimentation problems associated with unmanaged or poorly managed stormwater systems, especially during high ARI events¹⁵. Because of the occurrence of regular peak storm events associated with cyclonic influences, the Shire of Broome faces some unique challenges in managing its stormwater and avoiding flooding damage to the built form and associated infrastructures.

Uncertainty & Limits:

How Broome's population will grow into the future is uncertain, as is the impact of future mining activities on the environment. The impacts of climate change are also difficult to predict with any certainty.

Manageability:

Existing legislative instruments and regulations can be used to stop overfishing and to control access to delicate and sensitive environments, such as limiting vehicle access to areas at certain times of the year when breeding seasons of species are occurring¹⁶. Examples of these include the recent suspension of commercial gill netting in Roebuck Bay and the closure of Cable Beach to vehicle access in the peak turtle breeding season.

Sound environmental planning is also an important mechanism that the Shire can use to avoid the loss of significant ecological and cultural areas. A lack of biological documentation is a common occurrence in remote regions and by actively staying abreast of new information and supporting the survey and documentation of the local ecology, the Shire can implement best practice development planning and avoid, minimise and offset important ecological loss. The Broome peninsula is a wealth of rarity, endemism, ecological and cultural values and is important that a balance be struck between the conservation of important areas and sustainable development.

Tourist Industry

Sections of local communities are often well-informed about their local environment having been educated about its value and fragility over a longer period of time. Because they live there, local residents are often motivated to care for their local environment.

It is more of a challenge to educate short-term visitors about the fragility of local ecological balances and culturally-sensitive areas. Much of the nature-based tourism in the region is self managed, and so

¹⁵ Source: Planning for the future: Yawuru Cultural Management Plan 2011 & other discussions.

¹⁶ Roebuck Bay Working Group Newsletter, Dec 2013.

the level of understanding of the tour guides of the environmental issues impacts directly on how well the areas are managed.

Manageability:

The success of managing tourist impacts on local environments is directly related to resources available to those agencies responsible for management. There are greater risks of adverse impacts when less-informed tourists or locals venture into fragile environments or culturally-sensitive areas. Community-based social marketing has proven effective in establishing a stewardship ethic for tourist operators and visitors.

Patterns of Recreation

Outdoor living is a major part of Broome's idyllic lifestyle and culture. Outdoor nature-based recreation in Broome Shire is to a large extent, based around fishing, boating, camping and access to beaches.

There is clearly considerable economic benefit in maintaining healthy environments for the Shire of Broome and the Kimberley. Currently only 5% of the Kimberley has protection, whilst the state average is 15% of areas. While outdoor recreation in wilderness and coastal areas is beneficial to people, as numbers of people visiting natural places increases, so too does the potential for adverse impacts.

There is very little published information available about the patterns of recreational activities in the Kimberley or Broome regions, and therefore any impact they may be having. There is very little monitoring of susceptible species, therefore it is not known how they might be being impacted. While concerns have been expressed by Aboriginal interests and others, there is little documented information on what the tipping points for excess visitor numbers might be for various landscapes with differing capacities to support visitors.

Manageability:

Management arrangements have been established in some locations by DPAW, the Fisheries Dept and the Shire to control access by people to sensitive areas, and to limit environmental degradation, overfishing, erosion, destruction of bushland, and general overuse of isolated and pristine areas.

More research needs to be undertaken to determine what species need to be protected and what needs to be done to protect them. It is however apparent that the Endangered Monsoon Vine Thicket community clearly needs protection and there are a number of documents and on-ground projects already in action throughout the wider Dampier Peninsula that clearly demonstrate valuable activities that can be undertaken and supported by the Shire in high impact areas close to the Broome townsite.

Weather, climate and climate change

Broome's weather is defined by a Dry season, from April to September and a Wet season from October to March. The dry season has clear sunny days and a maximum average daily temperature of 30°C, and in the Wet season the temperatures are hotter at around 35°C maximum. Between January and March 75% of the 615mm of annual rainfall occurs and there are regular heavy downpours associated with thunder storms and high humidity. The climate is classified as being

semi-arid climate despite being in the tropical zone because most of the year there is little rainfall¹⁷. While the southern part of Australia continues to dry, predicted increases in annual rainfall associated with climate change mean that northern Australia may indeed increase in overall productivity. This raises the prospect of it increasing its potential as a food bowl for the rest of Australia.

The natural environment is well adapted and resilient to the seasonal climatic variations found in Broome, but the impacts of human settlements, agriculture, introduced species, land clearing and mining can serve to upset this delicate balance. The long dry season contributes to drying vegetation and there is significant risk of wild fires throughout the dry season. Heavy rainfall may contribute to erosion, sediment runoff and flooding and this combined with the pattern of cyclones with their associated storm-surge, gale-force winds and extreme downpours of rain poses considerable risks to human settlements and infrastructure.

Weather patterns show natural patterns of variability, but there is expected to be an increase in climatic variability and unpredictability associated with climate change. Climate change forecasts are becoming increasingly consistent and what they are telling us is that the Kimberley can expect higher rainfall, higher temperatures, warming ocean temperatures and higher sea levels. Extreme weather patterns are expected to become less predictable and although it is likely that there will be fewer tropical cyclones, the proportion of intense cyclones is set to increase in line with ocean temperature increases²⁶. Rainfall appears to be increasing during the wet season with temperatures increasing overall in line with predictions.

The consequences of climate change may vary considerably from region to region, depending on the extent of human adaptation including technological innovation, preparedness to change and the extent and timing of ameliorative actions undertaken. Risk management techniques and the latest flood modelling will support flood response planning, flood hazard analysis, flood mitigation options and development assessments²⁶.

Pastoral activities

There is a relatively small but productive horticultural industry operating around Broome at 12 Mile, Skuthorpe and Shamrock Gardens, that is currently producing mangos, melons, bananas and irrigated pasture seeds. Whilst commercially viable this does put some pressure on Roebuck Bay. The La Grange ground water resource to the south of Broome may provide significant agricultural opportunities in the future.

Over-grazing and overuse of groundwater in agricultural activities can lead to serious environmental issues such as soil compaction, erosion, degradation of soils, increased nutrient loads, altered fire regimes, introduced plant species and feral animals gaining a foothold, loss of high quality agricultural land, and loss of natural biodiversity.

There were no comprehensive studies of the pre-grazing plant community structure and pastoral grazing has been so widespread throughout the Kimberley that there are few areas to act as representative baselines against which to undertake comparisons and industry-based impact assessments. It appears that there has been a decline in plant cover in many areas and soil erosion has increased significantly in many areas.

¹⁷ http://en.wikipedia.org/wiki/Broome,_Western_Australia

Manageability:

It is possible to manage land use and use good management practices to ensure minimal environmental damage to soils, vegetation, biodiversity and water supplies from pastoral or other agricultural practices.

Resources sector

The north-west shelf of Western Australia is the site of major existing and proposed oil and gas ventures. Figure 9 shows proposed or potential resources developments for the Shire of Broome and offshore developments of greater than \$20 million in capital expenditure are shown in red in Figure 9a. These developments as they come on stream are going to add significantly to the local economy.

Onshore resources developments and unconventional (shale and tight gas in the Canning Basin) gas recovery are being promoted for the region (Figures 9b and 9c). The Canning Basin is 530,000 km² in extent and is estimated to contain more gas than the whole east coast of Australia.

The state government has adopted a risk-based approach when assessing and providing advice on the potential impacts of onshore petroleum activities. The advice will focus on water protection and management, and includes appropriate mitigation and remediation measures to ensure sustainability of water resources and the environment, community and industry they support. Information is provided on DoW and DMP websites.

The true social, environmental and economic impacts of major resources developments are difficult to quantify.

Manageability

There is a raft of existing legislation and regulations that can assess and manage the direct impacts of proposed resources developments.

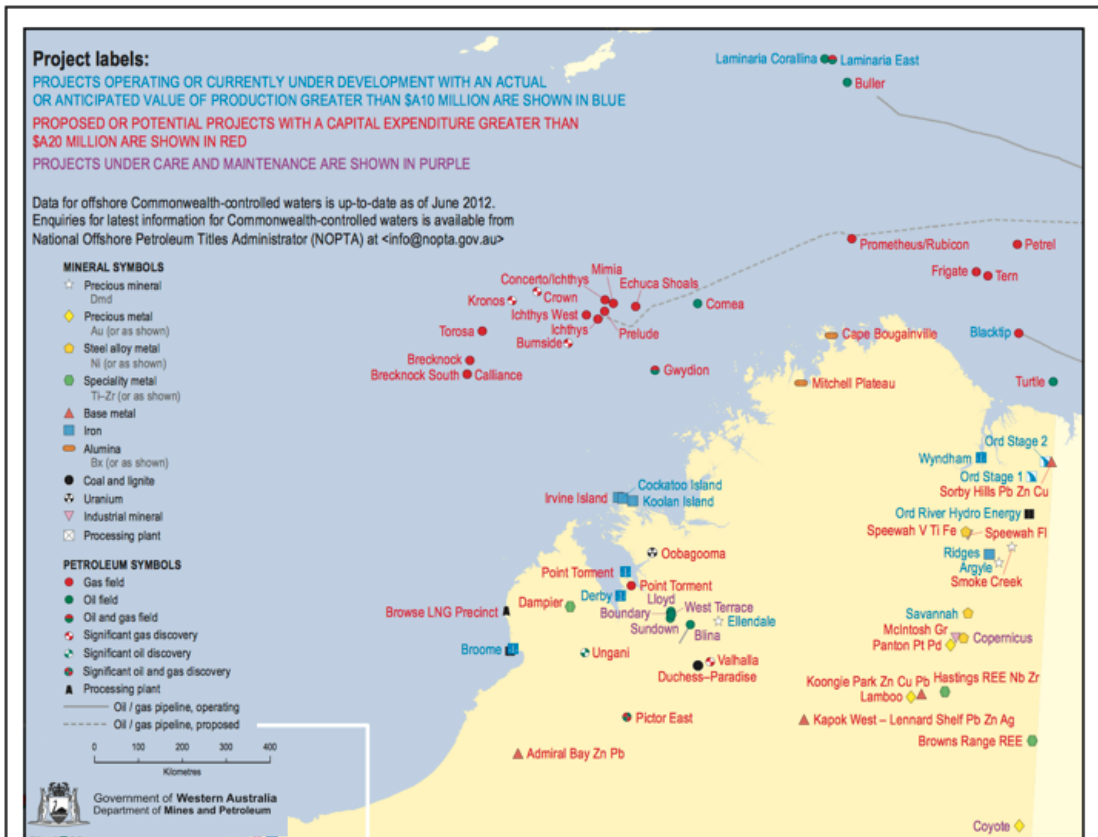


Figure 9a Existing resources projects within the Shire of Broome.

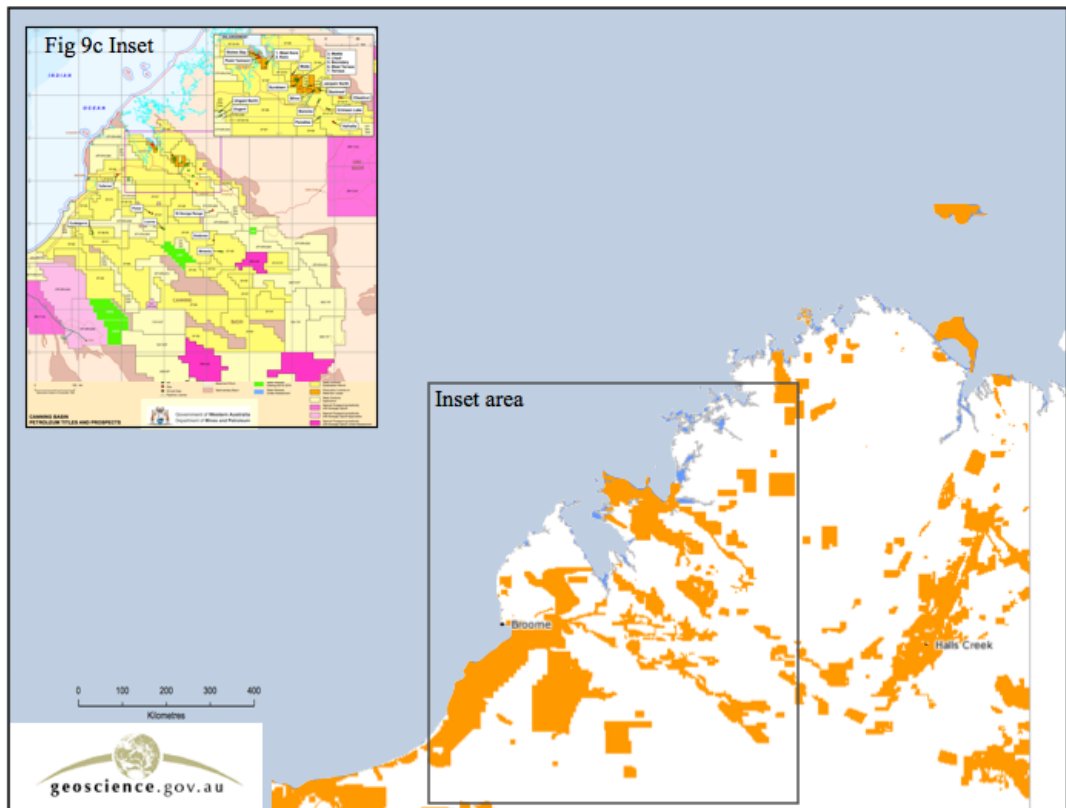


Figure 9b Existing resources tenements within the Shire of Broome.

Figure 9c (Inset) Existing petroleum titles and prospects within the Shire of Broome.

Figure 7 Mining tenements and resources developments for the north west of WA. (After, WA Dept Mines and Petroleum and Geoscience.gov.au 2012-2014).

Fire management

Wild fires are a part of the Australian landscape. Controlled burning regimes aim to reduce the fuel load and reduce the risks to life and property.

Every year, millions of hectares of northern Australian vegetation are destroyed by wildfires causing adverse impacts on animal and plant communities and exacerbating erosion problems. Threats combine to intensify the impact upon important ecosystems like the vine thickets.

Little is known about the cumulative effects of continuing wildfires, but it has been speculated that it is contributing to the loss of biodiversity across the rangelands.

Manageability:

Aboriginal traditional burning practices adapted to incorporate changed fuel loads from introduced weeds together with controlled burns have the potential to reduce the risks of wildfires. The massive areas needing to be managed and the scarce resources means that management of this issue is difficult.

Feral animals and invasive organisms

Impacts of feral animal pests on native ecosystems and humans include:

- destruction of native plants and their seed crop, preventing natural regeneration and altering ecosystem function;
- soil disturbance at a landscape scale, loss of ground cover resulting in less soil infiltration, higher peak stream flows which promotes erosion and sedimentation of waterways and wetlands;
- contamination of surface waters due to water borne diseases transmittable to domestic animals and humans;
- spread of plant diseases and pathogens;
- facilitation of invasive species into native forests, shrublands, and bogs through browsing and trampling of native species, dispersal of alien plant seeds, and soil disturbance favouring weeds; and,
- destruction of native animals, nesting sites including eggs and chicks, and food sources for native wildlife.

The main threats are inappropriate fire regimes, feral cats, feral and domestic introduced herbivores (cattle, horses, donkeys), feral pigs, cane toads and weeds. Mining, tourism and agricultural expansion may exacerbate the damage¹⁸.

Little is currently understood about the processes leading to the decline and loss of animal and plant species, and invasive organisms and diseases have the capacity to interact in unpredictable ways, making it a challenge to plan effectively how to manage them.

Manageability:

Keeping all species across the Kimberley region (with a probably of at least 90% survival) has been estimated to cost about \$40 million a year with \$95 million set-up costs. An investment of only \$27

¹⁸ <http://invasives.org.au/feral-animal-control/the-cost-of-saving-the-kimberleys-wildlife/>

million a year would achieve a 50% chance of avoiding imminent species losses but risking threatening declines¹⁹.

SOE Theme: Land Management

Background:

The Kimberley region is of global importance and is one of the least impacted and largest naturally functioning ecosystems left on the planet. The Shire of Broome sits within the Dampierland bioregion which is home to spectacular landscapes and natural heritage²⁰.

The Shire of Broome's successful tourism industry is built on this unique and near pristine natural environment. It is this natural environment that has attracted many of the Shire's residents and plays an important part in the culture, lifestyle and recreation activities of the community. Thus preservation of the Shire's natural landscapes is critically important to sustain the communities across the Shire into the future.

The Shire is responsible for managing a number of open space reserves including active playing fields, bushland and also drainage reserves within the Broome townsite. The Shire has joint management responsibilities for the management of substantial areas of coastal parkland jointly vested with the Shire and Yawuru under the direction of the Yawuru Park Council.

Outside the Broome townsite, land and environmental management is generally the responsibility of private landowners, pastoral managers, State agencies and Traditional Owners (depending on the details of existing and possible future tenure and management arrangements).

Issues:

Landscape function across the Shire is affected by changed fire regimes and grazing pressure operating at the landscape scale. Threatening processes for most vertebrate species in the Shire are poorly understood or unknown. It has one critically endangered (*Keraudrenia exastia*) and one endangered (*Pandanus spiralis* var. *flammeus*) plant listed. The condition of both is unknown but their trend appears to be static or improving. Threatening processes at the landscape scale include: urbanisation, altered fire regimes, over-grazing and weed invasion²¹.

Successes:

- International RAMSAR recognition for 80 Mile Beach and Roebuck Bay and proposed marine parks for both,
- Indigenous Ranger programs in a number of locations undertaking monitoring and management of various landscape-scale issues.

¹⁹ <http://www.perthnow.com.au/news/western-australia/cane-toad-invasion-a-kimberley-tragedy-colin-barnett/story-fnhocx03-1226643117765>

²⁰ Environment NGOs Response to the WA Government's Kimberley SCIENCE SYNTHESIS /SCIENCE AND CONSERVATION STRATEGY JUNE 2009 [Internet]. [cited 2015 Apr 25]. <http://oldsite.wilderness.org.au/files/kimberley-june-09.pdf>

²¹ CALM (2003) Bioregional Summary of the 2002 Biodiversity Audit for Western Australia [Internet]. [cited 2015 Apr 25].

Available from: http://www.dpaw.wa.gov.au/images/documents/about/science/projects/waaudit/2002_bio_summary.pdf

Gaps:

- There are currently major knowledge gaps in the scientific understanding of the region and how threatening processes operating at the landscape scale are impacting²².

Roles and responsibilities:

There is an array of agencies involved in land management across the Shire of Broome (Table 2).

| Issue | Responsible Agency | Role of the Shire of Broome |
|---|---|--|
| Management of Unallocated Crown Lands (UCL) | Department of Lands (State Land Services Unit), Department of Parks and Wildlife – fire and declared plants and animals on UCL and unmanaged reserves outside the metropolitan area, regional centres and townsites. | Only responsible for UCL with a Management Order in favour of the Shire for the purpose set out in the Management Order. |
| Management of Pastoral Leases | Lease holders and Department of Lands (Pastoral Lands Board) | None |
| Management of Aboriginal Reserves | Aboriginal Lands Trust (Western Australian Government), Indigenous Lands Corporation (Commonwealth Government) or an Aboriginal organisation | None |
| Management of Conservation Estate | Vested in the Conservation Commission or Marine Parks and Reserves Authority The Department of Parks and Wildlife undertakes all management activities associated with the land. | None |

²² WA Gov (2011) Kimberley Science and Conservation Strategy Government of Western Australia [Internet]. [cited 2015 Apr 25]. Available from: http://www.dpaw.wa.gov.au/images/documents/conservation-management/kimberley/kimberley_science_conservation_strategy.pdf

| Issue | Responsible Agency | Role of the Shire of Broome |
|------------------|---|--|
| In-town reserves | Yawuru Park Council comprising Yawuru RNTBC, Department of Parks and Wildlife and Shire of Broome | Jointly administer the management of the Yawuru Conservation Estate as joint vestees with RNTBC. |

Table 2 Roles and responsibilities for land management within the Shire of Broome.

Shire of Broome Strategic Direction:

Land resources are collaboratively managed to sustain their cultural, social, environmental and economic values.

- To incorporate natural resource management and environmental considerations into the Shire's planning processes;
- To achieve improvements in locations where Shire-managed land has been degraded; and,
- To build and maintain relationships and partnerships with traditional owners and other land managers to deliver improved environmental outcomes.

Topics:

The following topics are discussed in more detail:

Topic 1: Maintaining landscapes; and,

Topic 2: Fire control.



Topic 1: Maintaining Landscapes

Pressure:

The management of the Kimberley's landscapes needs to be a 'big picture' approach taking into account the interactions between species, habitat, climate and people.

State:

Because the Shire's natural areas have remained largely intact and undeveloped, the condition and health of Broome's landscapes is generally very good. The Shire contains a number of bushland reserves as part of the 'Environmental Cultural Corridor Reserve', however no management plans currently exist for these. A landscape-scale conservation plan is needed because the Kimberley is facing profound, pervasive and cumulative threats, due to the combination of climate change, uncontrolled wildfires, invasive weeds, feral animals, unmanaged tourism, overgrazing, illegal fishing and overfishing, poor water/river management and pressure for ad hoc industrialisation and development²¹.

There are currently significant data gaps and agreed research priorities that are not able to attract sufficient resources to be progressed. Management planning requires regional vegetation, soil and

environmental geology maps at better than 1:250,000 scale. Protection, rehabilitation, and management of the Shire's reserves is important, particularly because of predicted increases in population growth and increasing tourist numbers during peak season.

Indicators:

i) Percentage of important landscapes covered by current management plans.

Data source: CALM 2002 Bioregional summary²¹

Reporting responsibility: DPAW

ii) Percentage of landscape-scale threatening processes understood at a basic level required for management.

Data source: Calm 2002 Bioregional summary²¹

Reporting responsibility: DPAW



Assessment ratings, trends and data confidence for Maintaining Landscapes.

Response:

Nongovernment Environmental Organisations²¹ have requested that the State Government develop and implement a comprehensive conservation and compatible development plan for the Kimberley, based on broad-scale regional planning process which integrate conservation, environmental protection and management, Indigenous rights and interests and long term economic development that is compatible with stated environmental outcomes.

Ideally, the plan should be based on whole-of-land/seascape principles using the best available scientific, traditional and local knowledge and should identify and protect the natural and cultural values of the region. Environmental assessment of all future proposals for coastal developments may need to consider the cumulative impacts of such developments on key species and ecosystems and the Kimberley coast.

There are responses that should be undertaken by appropriate stakeholder agencies, as part of NRM for the Shire including²³:

- To develop collaboratively with all stakeholders, coordinated environmental management systems to control weeds, fire and feral animals across the range of land tenures; and,

²³ Ibid.

- To halt the decline and to achieve improvements in areas where land has become degraded by threatening processes.

Perspectives for Remote area Aboriginal communities

It has been determined that the State Government should develop and implement in partnership with Traditional Owners as a matter of urgency, a policy and legislative framework for Indigenous ownership, leaseback, management and co-management of conservation areas across the Kimberley. Statutory instruments such as Indigenous Land Use Arrangements (ILUAs), voluntary agreements such as Indigenous Protected Areas (IPAs), and management bodies such as the Aboriginal Lands Trust have achieved significant wins for the protection of Aboriginal cultural and nature-based values.

There are currently 30 Indigenous tourism ventures operating in the Kimberley, employing 520 local Indigenous workers (WA Legislative Council Hansard, 2009) and this number is set to increase in the future.

Shire of Broome Response:

Strategic response

- To facilitate and participate in collaborative, multi-stakeholder landscape-scale conservation measures for land that the Shire has a management obligation for.

Operational response

- To use fencing and signage to deter people from accessing sensitive and hazardous areas.



Topic 2: Fire Control

Pressure:

Fire has an important role to play in maintaining many terrestrial ecosystems in the Kimberley, but inappropriate fire regimes are stripping organic matter from soil profiles and simplifying plant composition and diversity. The traditional mosaic of small, patch fires lit by Aboriginal people for hunting and other purposes has been replaced by very large wild fires, many of them occurring late in the dry season when they cause most damage.

The adverse impacts of wild fires and over-grazing are major issues for tropical savannah ecosystems generally. Climate change is set to increase the risk and severity of wild fires.

State:

The Fire and Emergency Services Authority has reported²⁴ that of the Kimberley's 43 million hectares, between 10 and 13 million are burned annually through lightning strikes, arson or carelessness, with two - three million burnt through prescribed burns. Prescribed burns occur at the end of the wet season and are cooler, protecting animals, plants, seeds and sensitive cultural sites. The intensity and frequency of wild fires has caused loss of vegetation structure and composition, soil erosion and decline in the diversity of vegetation and faunal assemblages. Wild fires also result in losses to

²⁴ <http://www.abc.net.au/local/stories/2010/02/22/2826830.htm>

industry, especially pastoralism, and can have negative impacts on cultural values of Indigenous communities²².

Indicators:

i) Number of significant unmanaged wild fires per year.

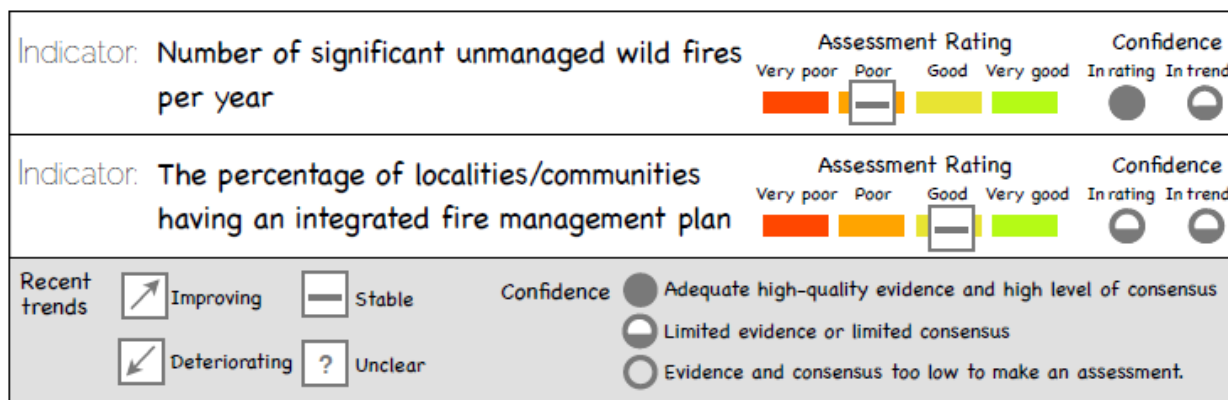
Data source: DFES

Reporting responsibility: DFES

ii) The number of localities/communities having an integrated bushfire response plan.

Data source: Discussions with Aboriginal ranger services, Shire staff.

Reporting responsibility: DFES, KLC, Shire.



Assessment ratings, trends and data confidence for Fire Control.

Response:

- To continue detailed vegetation mapping of the Shire as a basis for management of fire and other issues; and
- To develop a template for an integrated fire management response outlining education messages and emergency response provisions.

Perspectives for Remote area Aboriginal communities

Resource constraints and varying perspectives around preferred burning regimes make a unified approach to fire management somewhat difficult.

Shire of Broome Response:

Strategic response

- To lobby for and support data acquisition and mapping to support bushfire prevention and management; and
- To support and encourage Ranger services on Aboriginal lands in their management of traditional burning methods.

Operational response

- To develop bushfire management plans for Shire managed reserves in accordance with State Planning Policy 3.7.

SOE Theme: Biodiversity

Background:

The Pindanland and coastal areas of the Broome Shire support a unique and biodiverse natural heritage that is a significant tourist drawcard²², for example, the Shire contains two of only a dozen areas in the world with huge intertidal flats rich in shorebirds. The recently declared Eighty Mile Beach Marine Park and proposed Roebuck Bay Marine Park are summer refuges for hundreds of thousands of internationally protected migratory waders that fly to and from as far afield as Siberia. Roebuck Bay and Eighty Mile Beach are integral to the planet's most species-rich shorebird flyways. Roebuck Bay also lays claim to having the largest known population of snubfin dolphins, a recently discovered species found only in Australia²¹.

As the Shire's natural areas have remained largely intact and undeveloped, the condition and health of Broome's biodiversity is generally very good. The Shire contains a number of bushland reserves as part of the 'Environmental Cultural Corridor Reserve.' These areas have more recently been largely unmanaged and therefore human impacts and invasive weeds have had detrimental effects on them. These reserves are subject to joint management arrangements, however no management plans currently exist. Protection, rehabilitation, and management of these reserves is important, particularly in light of predicted increases in population growth and increasing tourist numbers during the peak season.

There are currently four Nature Reserves in the Shire – Coloumb Point, Dragon Tree, Swan Island and the Lacepede Islands which are managed by the Department of Wildlife. A number of areas are also under consideration to be formalised as Nature Reserves. These are depicted in the Shire's Local Planning Strategy (Refer Figure 10) and include the Leveque, Cygnet Bay, Borda, Lake Louisa, Nimalarragun and Edgar Range Conservation Investigation Areas.

Issues:

- Clearing and loss of native vegetation through residential, industrial and commercial development;
- Lack of detailed knowledge of flora and fauna particularly outside of the townsite and how natural areas are responding to threats such as weed invasions, wildfires and climate change;
- Establishing functional joint management arrangements across a range of locations, tenures and indigenous and stakeholder aspirations;
- Invasive species such as weeds, feral animals and the soon-to-arrive, cane toads;
- Human impacts particularly during peak tourist seasons;
- A lack of resources and instruments for effective weed management on private property; and
- Complex land tenure arrangements with multiple stakeholders having responsibility for various areas of bushland.

Successes:

- A reasonable understanding of the nature and location of many biodiversity hot spots such as the Monsoon Vine Thickets;
- A willingness amongst stakeholders to develop effective management strategies and plans;

- International recognition for Roebuck Bay and Eighty Mile Beach;
- Establishment of Environmental Cultural Corridors in the Broome townsite; and
- Native landscaping programs and policies.

Gaps:

- Lack of management plans for many coastal areas and bushland across the Shire;
- Lack of a Shire-wide, multi-stakeholder biodiversity strategy to guide rehabilitation activities and provide mapping of biodiversity corridors;
- Lack of a comprehensive Broome-wide Public Open Space (POS) asset management plan;
- Lack of a comprehensive weed management plan for the Shire including for private land; and
- Lack of resources for bushland rehabilitation and management activities.

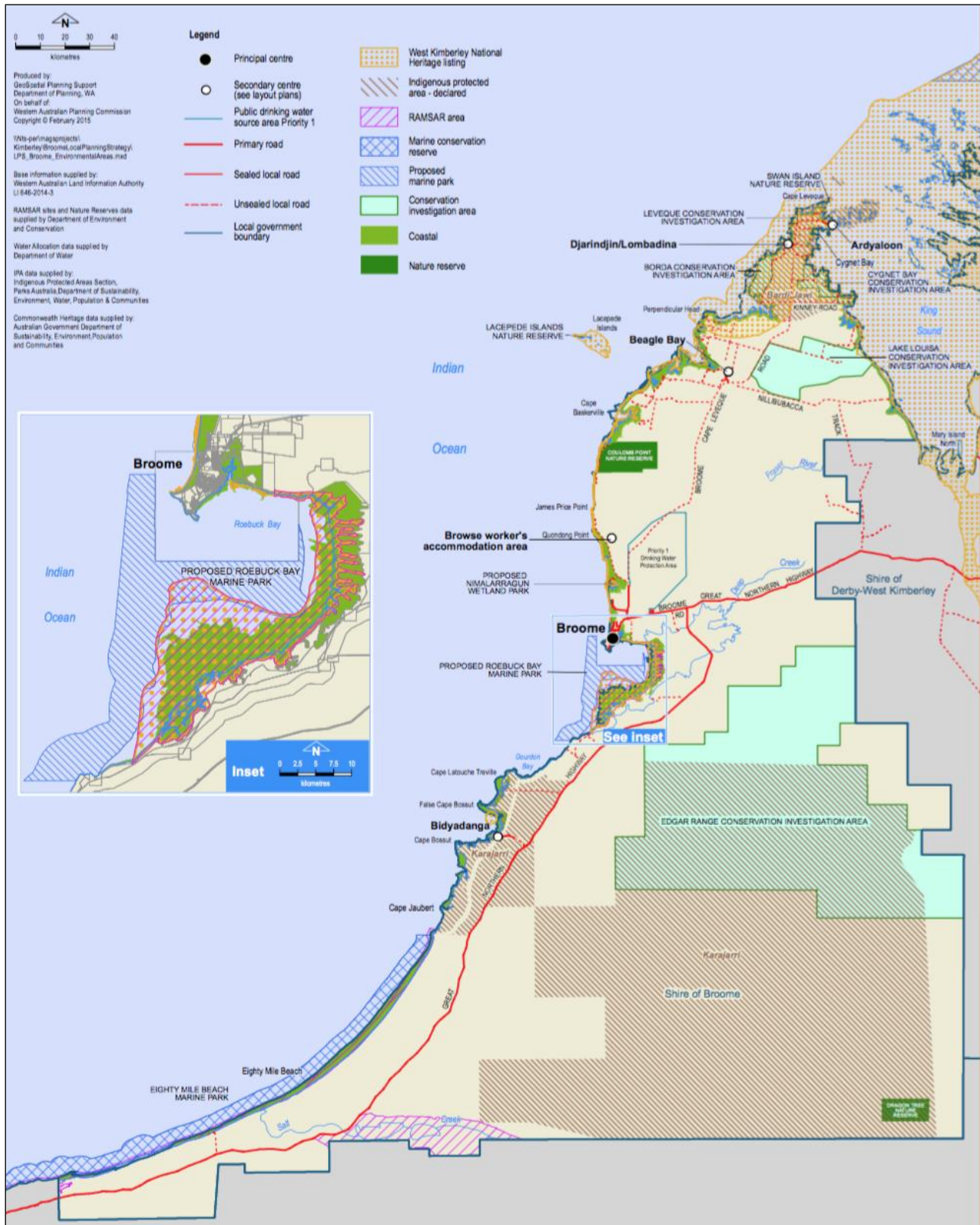


Figure 8 Environmental Areas

Roles and responsibilities for Biodiversity:

In addition to important areas of biodiversity on private and leasehold land, there is a complex array of tenures and stakeholders for biodiversity management across the Shire of Broome (Refer Table 3).

| Issue | Responsible agencies | Role of the Shire |
|--|---|---|
| Maintaining biodiversity | | |
| Broome peninsula coastal reserves | In Town – jointly vested with Yawuru RNTBC and Shire of Broome, DPAW responsible for management planning and operations. Out-of-Town – jointly vested with Yawuru RNTBC and DPAW | Participation in Yawuru Park Council, Yawuru Park Council Working Group, jointly responsible for the in-town area subject to management arrangements being formalised |
| Conservation reserves throughout the Shire | DPAW, with potential for future joint vesting with various Native Title Bodies Corporate. | Information and education. |
| Research and data collection | DPAW Federal Department of the Environment | Advocate for State and Federal Governments to undertake research and identification of flora and fauna in the region including threatened ecological communities, to better define under-represented flora and fauna for the Kimberley. |
| Assessment of native vegetation clearing proposals | DPAW | Referral of clearing applications and provision of advice to DPAW |
| Improving urban biodiversity | | |
| Public open space (POS) | Shire of Broome | Planning, design, establishment and management of POS |
| Domestic gardens | Private land owners | Providing information and education, subsidised plants |
| Managing invasive species | | |
| Private land | Private land owners | Information and education |

| Issue | Responsible agencies | Role of the Shire |
|---|--|--|
| Shire owned land | Shire of Broome | Weed management for public open space, road verges, medians, stormwater management corridors |
| Unallocated Crown land | DPAW | None |
| Research and maintaining registers of declared weeds (weeds of national significance) | Department of Agriculture Federal Department of the Environment | None |

Table 3 Roles and responsibilities for Biodiversity

Shire of Broome Strategic Direction:

Bushland, open spaces and biodiversity are protected and enhanced for future generations.

- Protect, maintain and/or enhance the quality of vegetation and habitat on Shire owned or managed land;
- Minimise threats to biodiversity from pests, weeds and feral animals on Shire owned or managed land; and,
- Encourage residents, developers and other land managers to protect and maintain biodiversity.

Topics:

Topic 1: Maintaining biodiversity;

Topic 2: Improving urban biodiversity; and

Topic 3: Managing invasive species.



Topic 1: Maintaining Biodiversity

Pressure:

Pindanland was rated as having a stress class of six (near pristine), but this may need to be reviewed because despite being in relatively good condition, vegetation cover throughout the region has declined through altered fire regimes, invasive species and over-grazing that have all contributed to a degradation of the subregion²².

State:

More than 10 per cent of Dampierland's original mammal fauna has become extinct regionally. One bird and two reptiles (both turtles) are listed as endangered, and one mammal, two birds, and four reptiles (also all turtles) are declared as vulnerable under State legislation²¹.

Currently, listed conservation reserves comprise one per cent of the bioregion and include examples of only 17 of the region's 86 significant vegetation associations. Fifty-two of the unreserved vegetation associations and 12 partially-reserved associations have a high priority for acquisition or further reservation²¹.

Six Threatened Ecological Communities (TECs) have been declared vulnerable under State legislation in the region, and an additional 13 communities are thought to be at risk. The declared TECs include²¹:

- Monsoon (vine) thickets on the Dampier Peninsula (Figure 11 shows currently mapped occurrences);
- An intertidal faunal community on Roebuck Bay mudflats;
- Organic mound spring communities at Bunda Bunda;
- Organic mound spring communities at Mandora Marsh;
- Assemblages of permanent/ephemeral wetlands, damplands, and riparian habitat of the Dampierland region; and,
- Vegetation assemblages of Taylor's Lagoon, Lake Champion, and Lake Eda.

Threats to these communities are primarily from grazing (usually cattle) and the associated changes to soil structure, and weed invasion. Intertidal mudflats are threatened by human impacts. Areas associated with water (wetlands, mound spring communities, clay pans, lakes and creeks), also feature heavily in the ecosystems at risk. These continue to be threatened by:

- Grazing and altered fire regimes;
- Urbanisation and ground water extraction; and
- Invasive animal species.

Indicators:

i) Number of animal species lost regionally or declared vulnerable or endangered.

Data source: CALM 2002 Bioregional summary²¹

Reporting responsibility: DPAW

ii) Percentage of significant vegetation assemblages adequately represented in reserves.

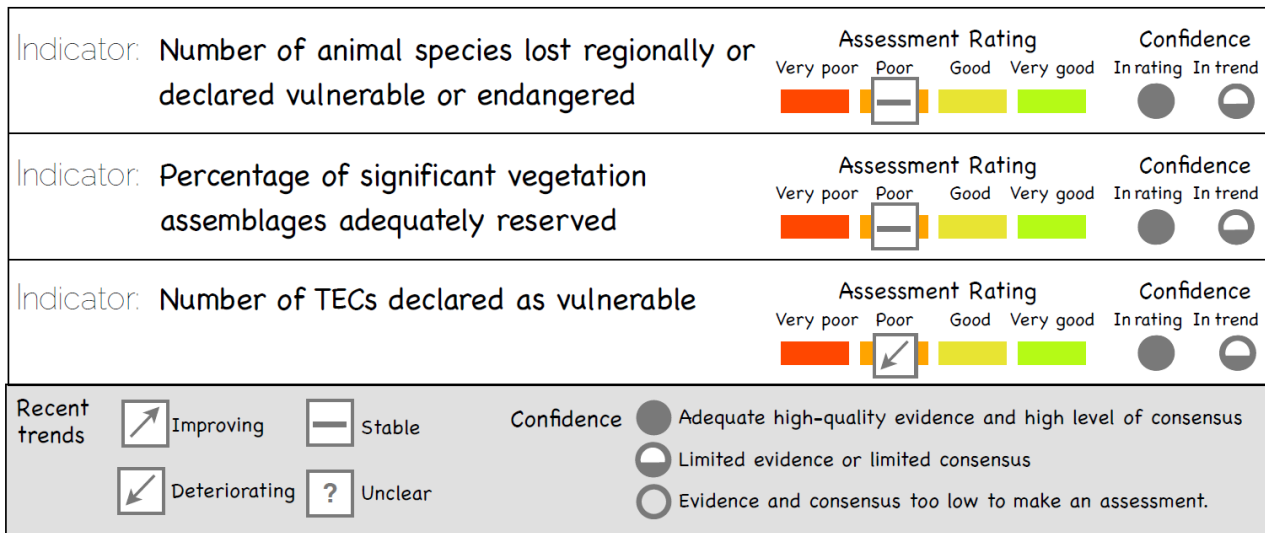
Data source: CALM 2002 Bioregional summary²¹

Reporting responsibility: DPAW

iii) Number of TECs declared as vulnerable.

Data source: CALM 2002 Bioregional summary²¹

Reporting responsibility: DPAW



Assessment ratings, trends and confidence for Maintaining Biodiversity

Response:

To establish a system of conservation reserves that adequately represents and protects the full spectrum of ecosystems, ecological processes and species in well-resourced and well-managed Indigenous Protected Areas, private conservation reserves, National Parks and other conservation reserves²⁰.

Perspectives for Remote area Aboriginal communities

To lobby for and support targeted benchmark fauna and flora surveys and ongoing monitoring which will assess and document change in species distributions, especially for those species known to be at risk and declining. Surveys and monitoring should be undertaken in collaboration with Traditional Owners and Indigenous Rangers.

Shire of Broome Response:

Strategic response

- To incorporate biodiversity objectives into Shire planning and acknowledge the worth of the natural environment to tourism balanced against the cost of managing biodiversity and making conservation areas accessible;
- In conjunction with other relevant stakeholders, to develop a comprehensive Shire-wide, multi-stakeholder Biodiversity Management Plan to guide bushland management and rehabilitation activities and provide mapping of biodiversity areas and corridors;

- Advocate for State and Federal Governments to undertake research and identification of flora and fauna in the region including threatened ecological communities; and
- Develop Management Plans for reserves controlled by the Shire which provide for management and restoration of conservation areas, and support the preparation of multi-stakeholder management plans for all reserves throughout the Shire which provide for management and restoration of conservation areas.

Operational response

- Continue to provide recommendations and advice to DPAW on native vegetation clearing applications; and
- Continue to close Cable Beach during the wet season at night and high tide to protect turtle breeding sites.

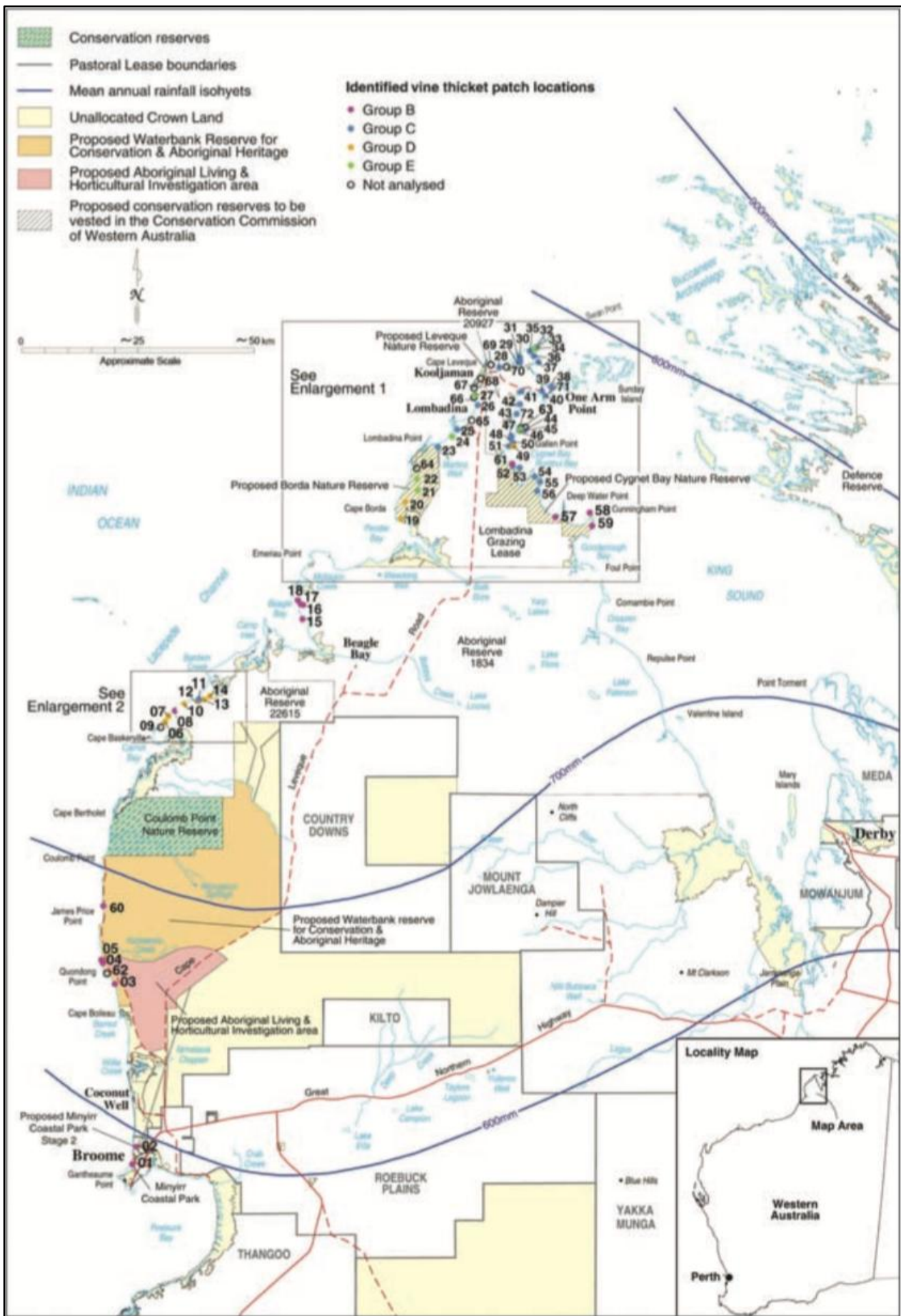


Figure 9 Areas of Threatened Ecological Communities - Monsoon Vine Thickets (After Environs Kimberley N.D.).



Topic 2: Improving Urban Biodiversity

Pressure:

Outside of natural areas, landscaping with endemic plants is an increasingly important function to improve the amenity value of both public and private spaces. However there is a lack of climate-sensitive landscapes in certain elements of the Broome built form including:

- a lack of shaded paths and breezeways;
- more lawns and exotic vegetation in domestic landscapes requiring irrigation; and
- weed infestations and habitat loss in residential areas.

State:

Broome has a unique 'sense of place' because of its natural heritage and landscapes. Despite unique vegetation assemblages and landscapes being a major reason people are attracted to Broome, the built form is at risk of losing its own unique character, because of a proliferation of exotic vegetation often requiring irrigation.

Indicators:

i) Irrigation requirements of created landscapes in Shire-managed POS.

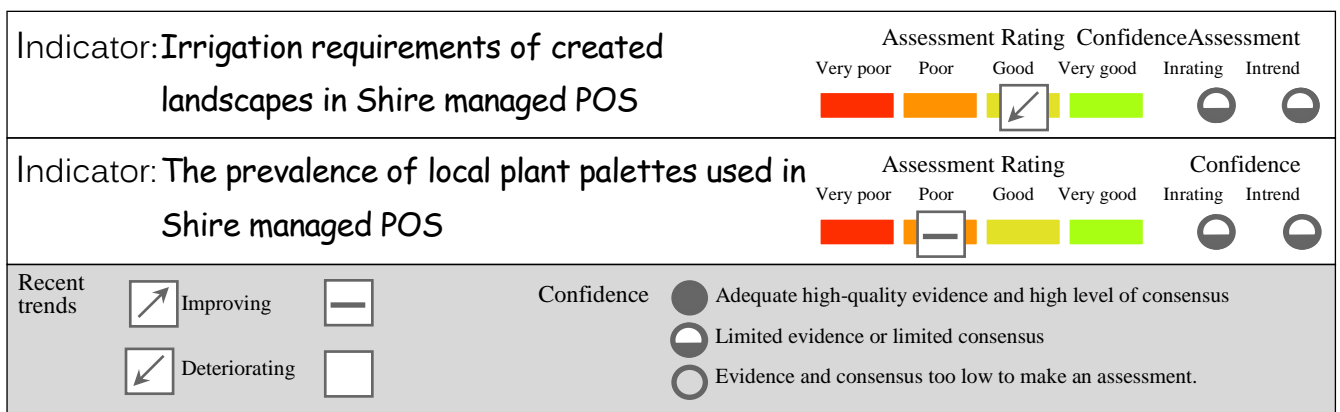
Data source: DoW currently requires this statistic as part of LGA groundwater license conditions.

Reporting responsibility: Shire of Broome.

ii) The prevalence of local plant palettes being used in Shire-managed POS.

Data source: New data to be generated.

Reporting responsibility: Shire of Broome



Assessment ratings, trends and confidence for Improving Urban Biodiversity.

Perspectives for Remote area Aboriginal communities

The Bardi Jawi Oorany (Women) Rangers understand the benefits and cultural significance of local plant species and have recently gained funding to establish a small propagation nursery to make local plants available for landscapes around their communities.

Shire of Broome Response:

The Shire maintains a native landscaping program throughout the Broome townsite which has been widely recognised by the community. Other Shire initiatives to improve biodiversity protection and management include the free native plants program for residents, the Shire's verge policy, and encouraging private landowners and developers to establish native gardens.

Strategic response

- To develop a Biodiversity Management Plan which includes enhancing biodiversity outcomes in urban areas; and
- To progress the draft Public Open Space Asset Management Plan.

Operational response

- Continue and expand the propagation and use of native plants in the Shire's landscaping activities; and
- Continue to encourage residents to establish native gardens, including offering free native plants to residents at community events.



Topic 3: Managing Invasive Species

Pressure:

Unmanaged cattle, feral pigs, horses, donkeys and camels damage vegetation, spread weeds and can exacerbate soil erosion. Feral cats prey on native fauna. Cane toads have crossed into Western Australia from the Northern Territory and will continue to spread south, despite the efforts of both community groups and Government to contain their expansion²¹. Particular problems for the Shire are feral horses, donkeys, cattle destroying wetland habitat on the Dampier Peninsula, wild camels on Anna Plains station and feral pigs around Barred Creek and elsewhere.

Weeds have been introduced to natural ecosystems and out-compete native plants and once established, they can be extremely difficult to manage. Weeds occur in natural areas, open drains, public open space, verges and medians, as well as on private property. Weeds threaten the viability of native vegetation and can be spread easily through the drainage network or can be transported by wind, vehicles or animals.

Ongoing and proactive action is needed to manage the threats from weeds within the Shire. Of particular importance for the Shire are three Weeds of National Significance (WONS) that occur within the Broome townsite - Mesquite, (*Prosopis species*), Parkinsonia (*Parkinsonia aculeate*) and Rubber Vine (*Cryptostegia grandiflora*). The Department of Agriculture and Food maintains a list of declared pests for the State and identifies a level of control to manage them. Management measures are needed to address weeds on both public and private lands.

State:

- Invasive species pose a biosecurity risk for WA and are a significant problem in the North-West (Table 5, Figure 12).

- There has been no quadrant-based fauna and flora survey of the region to assess species and ecosystem status, condition, trend and the effects of threatening processes such as cats, cattle, donkeys, pigs, fire and weeds.

| District | Pest | Impact | | | N/A |
|------------------------|---------------------|--------|--------|-----|-----|
| | | High | Medium | Low | |
| East Kimberley | Dogs | 3 | 7 | 7 | 1 |
| | Donkeys | 6 | 0 | 0 | 12 |
| | Camels | 5 | 2 | 0 | 11 |
| | Horses | 5 | 0 | 0 | 13 |
| | Kangaroos/Wallabies | 5 | 4 | 6 | 3 |
| | Pigs | 2 | 2 | 1 | 13 |
| | Other | 1 | 0 | 0 | 2 |
| North Kimberley | Dogs | 1 | 0 | 4 | 0 |
| | Donkeys | 3 | 1 | 0 | 1 |
| | Camels | 0 | 0 | 0 | 5 |
| | Horses | 1 | 3 | 0 | 1 |
| | Kangaroos/Wallabies | 4 | 1 | 0 | 0 |
| | Pigs | 1 | 1 | 2 | 1 |
| | Other | 0 | 0 | 1 | 0 |
| West Kimberley | Dogs | 5 | 10 | 10 | 0 |
| | Donkeys | 9 | 0 | 0 | 15 |
| | Camels | 7 | 2 | 2 | 14 |
| | Horses | 10 | 2 | 0 | 13 |
| | Kangaroos/Wallabies | 12 | 5 | 5 | 3 |
| | Pigs | 3 | 8 | 1 | 13 |
| | Other | 2 | 1 | 0 | 1 |
| East Pilbara | Dogs | 1 | 4 | 6 | 0 |
| | Donkeys | 4 | 3 | 1 | 3 |
| | Camels | 2 | 6 | 2 | 0 |
| | Horses | 5 | 3 | 1 | 2 |
| | Kangaroos/Wallabies | 3 | 4 | 4 | 0 |
| | Pigs | 2 | 0 | 0 | 9 |
| | Other | 0 | 0 | 0 | 0 |
| West Pilbara | Dogs | 3 | 1 | 13 | 0 |
| | Donkeys | 8 | 1 | 2 | 6 |
| | Camels | 3 | 0 | 0 | 14 |
| | Horses | 7 | 0 | 1 | 9 |
| | Kangaroos/Wallabies | 5 | 6 | 5 | 1 |
| | Pigs | 0 | 0 | 0 | 17 |
| | Other | 0 | 1 | 0 | 0 |

Table 4 The impact pest animals have on the different regions of the North of Western Australia²⁵.

²⁵ The impact pest animals have on the different regions of the Northern Western Australia (Western Australia Department of Agriculture and Food & Meat and Livestock Australia (2011).

| | | | |
|---|---|---|--|
| <p><i>Acacia farnesiana</i> Mimosa bush</p> <p><i>Acacia karroo</i> Karoo Thorn</p> <p><i>Acanthospermum hispidum</i> Star burr</p> <p><i>Azadirachta indica</i> Neem</p> <p><i>Aerva javanica</i> Kapok Bush</p> <p><i>Alternanthera philoxeroides</i> Alligator Weed</p> <p><i>Alternanthera pungens</i> Khaki weed</p> <p><i>Andropogon gayanus</i> Gamba Grass</p> <p><i>Ardisia elliptica</i> Ardisia</p> <p><i>Argemone ochroleuca</i> Mexican poppy</p> <p><i>Asystasia gangetica gangetica</i> Chinese Violet</p> <p><i>Asystasia gangetica micrantha</i> Chinese Violet (a form of)</p> <p><i>Barleria prionitis</i> Barleria</p> <p><i>Bryophyllum delagoense</i> Mother-of-Millions</p> <p><i>Cabomba caroliniana</i> Cabomba</p> <p><i>Calotropis procera</i> Calotrope</p> <p><i>Caulerpa taxifolia</i> Caulerpa</p> <p><i>Cenchrus biforus</i> Gallon's curse</p> <p><i>Cenchrus ciliaris</i> Buffel Grass</p> <p><i>Cenchrus echinatus</i> Mossman River Grass</p> | <p><i>Chromolaena odorata</i> Siam Weed</p> <p><i>Conyza bonariensis</i> Flaxleaf Fleabane</p> <p><i>Cryptostegia grandiflora</i> Rubber Vine</p> <p><i>Cryptostegia madagascariensis</i> Rubber vine (2)</p> <p><i>Cuscuta campestris</i> Golden dodder</p> <p><i>Datura ferox</i> Fierce Thornapple</p> <p><i>Datura innoxia</i> Downy Thornapple</p> <p><i>Datura stramonium</i> Common Thornapple</p> <p><i>Echium plantagineum</i> Paterson's Curse</p> <p><i>Eichhornia crassipes</i> Water Hyacinth</p> <p><i>Heteranthera reniformis</i> Kidneyleaf Mudplantain</p> <p><i>Hydrocotyle ranunculoides</i> Hydrocotyle</p> <p><i>Hymenachne amplexicaulis</i> Olive Hymenachne</p> <p><i>Hyparrhenia hirta</i> Coolatai Grass</p> <p><i>Hypytis suaveolens</i> Mint bush</p> <p><i>Ipomoea cairica</i> Coastal Morning Glory</p> <p><i>Jatropha gossypifolia</i> Bellyache Bush</p> <p><i>Lantana camara</i> Lantana</p> <p><i>Leonotis nepetifolia</i> Lion's Tail</p> <p><i>Leucaena leucocephala</i> Leucaena</p> | <p><i>Limnorchis flava</i> Limnorchis</p> <p><i>Macropitium atropurpureum</i> Siratro</p> <p><i>Megathyrus maximus</i> Guinea Grass</p> <p><i>Merremia aegyptia</i> Merremia dissecta</p> <p><i>Mimosa diplotricha</i> Giant Sensitive Plant</p> <p><i>Mimosa pigra</i> Mimosa</p> <p><i>Mucuna pruriens</i> Cow Itch</p> <p><i>Myriophyllum aquaticum</i> Parrot's Feather</p> <p><i>Nymphaea mexicana</i> Yellow Waterlily</p> <p><i>Opuntia tomentosa</i> Velvet tree pear</p> <p><i>Parkinsonia aculeata</i> Parkinsonia</p> <p><i>Parthenium hysterophorus</i> Parthenium Weed</p> <p><i>Passiflora foetida</i> Stinking Passionflower</p> <p><i>Passiflora suberosa</i> Corky Passionfruit</p> <p><i>Pennisetum polystachion</i> Mission Grass</p> <p><i>Phoenix dactylifera</i> Date Palm</p> <p><i>Pithecolobium dulce</i> Madras Thorn</p> <p><i>Prosopis pallida</i> Algaroba</p> <p><i>Prosopis pallida</i> Mesquite</p> <p><i>Prosopis velutina</i> Velvet Mesquite</p> | <p><i>Salvinia molesta</i> Salvinia</p> <p><i>Senna obtusifolia</i> Sicklepod</p> <p><i>Senna occidentalis</i> Coffee senna</p> <p><i>Sida acuta</i> Spinyhead Sida</p> <p><i>Sida rhombifolia</i> Paddy's lucerne</p> <p><i>Solanum nigrum</i> Blackberry nightshade</p> <p><i>Sonchus oleraceus</i> Common sowthistle</p> <p><i>Sphagneticola trilobata</i> Singapore Daisy</p> <p><i>Sporobolus africanus</i> Parramatta Grass</p> <p><i>Striga asiatica</i> Witchweed</p> <p><i>Stylosanthes hamata</i> Caribbean Stylo</p> <p><i>Themeda quadrivalvis</i> Grader grass</p> <p><i>Trapa natans</i> Water Caltrop</p> <p><i>Tribulus terrestris</i> Caltrop</p> <p><i>Urochloa mutica</i> Para Grass</p> <p><i>Xanthium occidentale</i> Noogoora Burr</p> <p><i>Xanthium spinosum</i> Bathurst Burr</p> <p><i>Ziziphus mauritiana</i> Chinee Apple*</p> |
|---|---|---|--|

Weeds Of National Significance - Dampierland
Weeds of Broome town
Source: <http://www.weeds.org.au>

TREES AND SHRUBS

Coffee Bush (*Leucaena leucocephala*)

A native of Central America "coffee bush" grows into a 6 metre high tree with feathery dark green leaves and creamy-yellow "pom-pom" flowers. It is a common garden plant. The flowers produce seedpods that are long and fat and full of dark seeds when ripe. A prolific seed producer where seeds germinate readily it can grow into dense thickets and is spread by birds, wind and water movement.

Neem (*Azadirachta indica*)

A native of India "neem" grows into a 6 metre high tree. Originally introduced as a fast growing shade tree it has become a weed of undisturbed bushland. The clusters of yellow berries are eaten and spread by birds.

Bellyache Bush (*Jatropha gossypifolia*)

A native of the Caribbean it was introduced as an ornamental garden plant in the late 1900s. An erect perennial shrub to 4 metres high, the young leaves are purple and sticky. The small red flowers develop in capsules full of seeds. The seeds are toxic and grow to form dense thickets in disturbed areas.

VINES AND CREEPERS

Siratro (*Macropitium atropurpureum*)

A native of tropical America this rampant perennial vine has purple-black flowers on rising stalks that produce long skinny bean-shaped seedpods. Parrots eat the seedpods and the resulting plants cover native plants and fence lines, completely disintegrating the natural environment.

Merremia aegyptia & Merremia dissecta

A native of South America these fast growing twining vines with hairy leaves have escaped from gardens and taken over large areas of disturbed land. The leaves have finger like projections and the white flowers produce a round seedpod. Spreading rapidly these vines cover native plants, trees and fence lines.

Wild Passionfruit (*Passiflora foetida*)

A native to South America this perennial vine has soft hairy leaves, distinct passionflower and characteristic yellow orange fruit capsule. Eaten by birds the seeds are widely spread in undisturbed bushland producing vines that cover emerging plants, shrubs and trees.

GRASSES, PRICKLES & BURRS

Khaki Weed (*Alternanthera pungens*)

A native of South America Khaki Weed is a prostrate perennial with broad elliptical leaves and a carrot like root system. Masses of sharp, spiny burrs are produced over the plant commonly found in lawns and pedestrian traffic areas. When manually controlling Khaki Weed the tuberos root system must be removed altogether, otherwise reshooting will occur with more vigour.

Gallon's Curse (*Cenchrus biforus*)

A native of Northern hemisphere tropical areas this erect grass grows up to 1 metre tall producing numerous seed heads. The seed heads form a spike with many clusters of spiny burrs that stick to clothing, skin and passing animals.

Caltrop (*Tribulus terrestris*)

A native of Europe Caltrop is now found in all mainland states of Australia. A spreading prostrate annual it is characterised by yellow flowers that produce an aggressive woody prickly that punctures bare feet and bicycle tyres. It is a problem on verges and all pedestrian traffic areas.

Figure 10 Weeds of National Significance in the Shire of Broome (Shire of Broome Weeds Brochure)

Indicators:

i) Extent of invasive weed species.

Data source: A number of reports mention the presence of invasive weed species in various locations throughout the Shire but most state there is a significant lack of accurate quantitative data with significant gaps for many locations.

Reporting responsibility: DAFWA

ii) Percentage of WONS invasions with effective management control.

Data source: Several reports indicate that there are significant gaps in the management effort.

Reporting responsibility: Federal Department of Environment

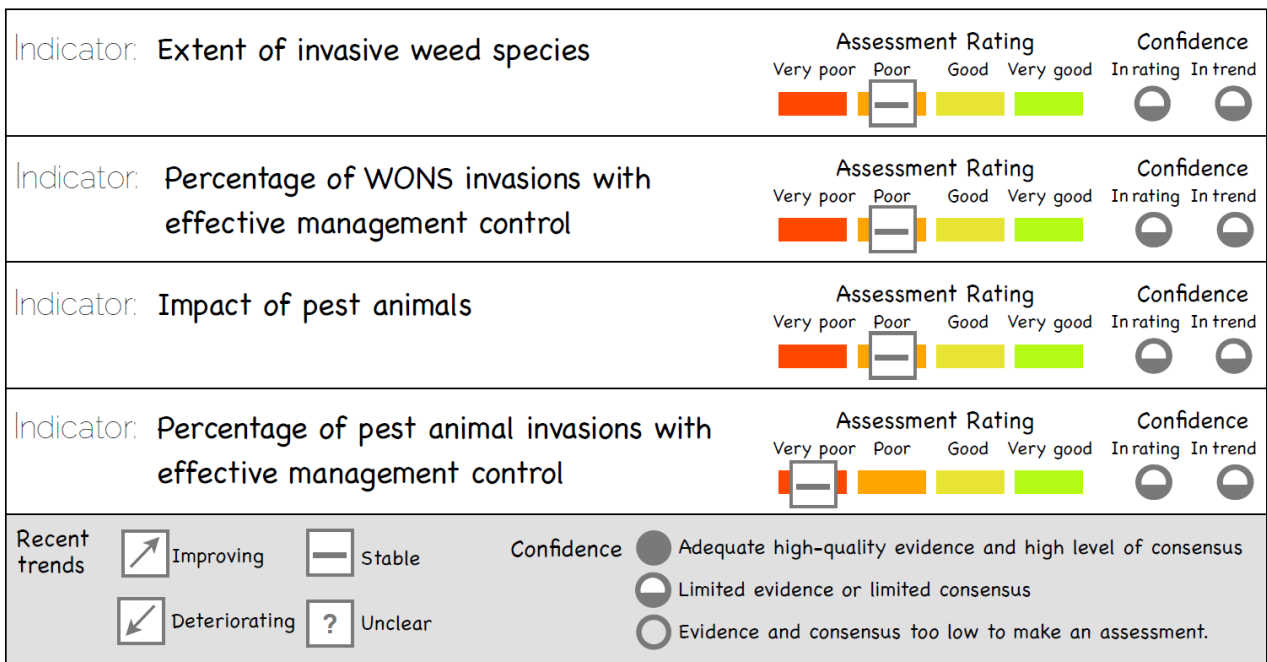
iii) Impact of pest animals.

Data source: DAFWA 2011²⁵ Table 5.

Reporting responsibility: DAFWA

iv) Percentage of pest animal invasions with effective management control.

Reporting responsibility: DPAW



Assessment ratings, trends and confidence for Managing Invasive Species

Response:

The State Government develops and funds programs to eradicate unmanaged wild cattle, donkey, horses, pigs and camels from outside pastoral leases and provide additional support for campaigns to hold back the cane toad western front line through manual removal methods and fencing. Contingency strategies need to be developed for protection of high biodiversity hotspots and endangered species from the impacts of cane toads²¹.

A large off-reserve effort is required over much of the Dampierland bioregion, yet resources and community capacity are limited. State and regional weed strategies need definite priorities in both an agricultural sense and an environmental context. Resources are required for priorities that have already been identified²².

A noxious weed plan (including a rapid response network via Indigenous Rangers and community groups) should be developed for the Kimberley and the Broome Shire, based on strong region-wide approaches to rapidly detect and eradicate WONS which may be transported into the region²¹.

Perspectives for remote area Aboriginal communities

Karajarri Rangers at Bidyadanga and Nyul Nyul Rangers at Beagle Bay have signalled a willingness and capacity and suggested methods to halt the invasion of the cane toad, but additional resourcing needs to be provided to make this happen.

Aboriginal Rangers currently undertake mapping and assessment of invasive weeds and animals using Cybertrackers and engage in control and management activities as resources permit. Current efforts are at best a holding pattern, and additional resources are required.

Shire of Broome Response:

Strategic response

- To develop a comprehensive Weed Management Strategy to guide the Shire's weed management activities on land under its care and control.

Operational response

- To review the Shire's project management plan template for engineering works to include consideration of weed management when undertaking specific projects; and
- Ensure that areas cleared of native vegetation are managed and mulched to prevent soil erosion and the establishment of weeds.

SOE Theme: Water

Background:

Broome's environment, economic productivity and the community's lifestyle and health all depend upon the availability of good quality fresh water. Careful management and use of water resources is necessary to ensure that ecosystems are sustained while delivering economic and social benefits.

For Broome, the median annual rainfall is 532 mm with over 75% of the average annual rainfall falling between January and March. Rainfall is usually associated with thunderstorms and tropical lows or cyclones which may produce very heavy rain for short periods, making it probable that much of the yearly total can fall over several days. Except for these very extreme events, the landscape in its natural undisturbed state, can absorb much of the rainfall, which infiltrates into the local Pindan soils recharging superficial groundwater aquifers.

Broome's potable water supply is currently based entirely on groundwater sourced from bore fields 12km to the northeast of Broome townsite. Investigation²⁶ and recent upgrades²⁷ have confirmed that supplies are currently adequate for domestic, commercial and agricultural uses. It should be

²⁶ DOW (2012) Drinking water source protection plan. Broome town water supply. Water resource protection series. Department of Water. Report WRP 100 December 2012. [Internet]. [cited 2015 Apr 25]. Available from: <http://www.water.wa.gov.au/PublicationStore/first/104287.pdf>

²⁷ Water Corporation (2015) [Internet]. [cited 2015 May 26]. <http://www.watercorporation.com.au/about-us/media/media-releases/media-release/water-supply-upgrades-continue-in-broome>

recognised however that there is a degree of uncertainty about how the changing climate may influence rainfall and groundwater recharge. Water is a real cost to consumers and water conservation under these circumstances is prudent.

Vegetation clearing and urbanisation leads to major changes in the natural water balance. Impervious surfaces such as roofs and roads yield high volumes of runoff that can exceed the infiltration capacity of the local soils. During heavy rainfall events, stormwater peak velocities generated from impervious surfaces may lead to soil erosion and unacceptable loads of sediment and other pollutants being delivered to receiving waterways. Water sensitive urban design (WSUD) is WA's approach to integrating stormwater management into the built form through the use of multiple use corridors that blend the recreation function of linear public open spaces (POS) and reserves with stormwater management.

The State Government's Water for Food (WFF) initiative is a suite of water investigation projects designed to increase economic growth and employment in regional communities by defining water source availability for the establishment of new irrigation areas and increasing the size and water efficiency of existing irrigation districts.

The WFF aims to position regional communities to take advantage of emerging food export opportunities by accelerating water and land capability investigations across the state to open up new irrigation precincts and expand the productivity in existing districts.

Issues:

- A community mindset of water abundance and a lack of appreciation of the longer term benefits of conserving water;
- Stormwater management systems of different design, age and effectiveness;
- Standard WSUD practices generated for catchments in Perth may not apply for the NW climate and measures need to be sensitive to local climatic and soil conditions;
- Changes in climate leading to more frequent and severe droughts and storms;
- Contamination of drinking water supplies in remote communities; and
- Management of sediment from development sites.

Successes:

Broome's potable water demand (Table 6), was at 5.2GL/pa in for 2012/13. There appears to have been a significant reduction in consumption for all land uses of 16% (down by 0.74 GL/pa) for 2012/13 compared to 2009/10. This is ahead of the Water Corporation's target of a 15% reduction in consumption for regional areas to 2030.

| | |
|-------------------|------------|
| Demand | 5.2GL/pa |
| Total Residential | 2 GL/pa |
| Commercial | 1 GL/pa |
| Industrial/Other | 0.83 GL/pa |

Table 5 Potable water demand and consumption for Broome in 2012/13.²⁸

²⁸ Shire of Broome Local Planning Strategy. Pt 2, Section 7.12.5

Recent programs that contributed to the success of Broome's potable water supply reductions have included²⁹:

- 2010 to 12 Free Home Smart residential & non residential retrofits (toilets, shower heads and tap aerators);
- 2012 'Reset your Retic' – free irrigation specialists visit residential property to reset or replace the controllers;
- 2012/13 and ongoing – Outpost data logger installation on 50 highest consuming Broome connections;
- 2013 – Leak Search 4 Broome sites which had significant base flows of between 20L-60L/min and including Roebuck Bay Caravan Park; and
- Promoting Waterwise Councils, Waterwise gardens, verges including the Anne Street renewal project.

Other successes include:

- Improved drainage design more reflective of local conditions in recent developments;
- Reuse of waste water for irrigation; and
- A telemetry system for POS which optimises irrigation rates incorporating weather conditions.

Gaps:

- New development and associated population growth within the Shire of Broome will put significant pressure on existing utilities;
- Lack of water quality data for stormwater and groundwater and potential saline intrusion; and,
- Presence of some less water efficient appliances, fixtures and fittings in some Council buildings and operations.

Roles and responsibilities:

| Issue | Responsible agencies | Role of the Shire |
|--|---|---------------------------|
| Conserving water | | |
| Water efficient appliances, water-wise behaviours, water-wise domestic gardens | Private citizens are responsible for their water conserving choices. State government 'water' agencies provide information and education | Information and education |

²⁹ Ibid

| Issue | Responsible agencies | Role of the Shire |
|--|--|---|
| Water-wise Shire buildings and public landscapes | Shire of Broome | Ensuring water efficient appliances and fittings in all Shire buildings, educating staff for improved water conservation awareness, ensuring water-wise plantings in POS and landscapes. |
| Managing stormwater | | |
| Design and construction of multiple-use stormwater management corridors in new residential and commercial developments | WA Department of Planning for structure planning and determining the nature of stormwater management corridors in development areas. Developers and their consultants | Can influence and improve outcomes of development plans during the design phase. Providing information and education to the community on their role in runoff quality from verges and roads. |
| Remediation of older drains | Shire of Broome | Responsible for maintenance and redesign of older drains. |
| Managing groundwater | | |
| Groundwater allocation planning and licensing and surface water assessment | Department of Water | Minimise water use through increasing efficiencies Compliance with groundwater licensing allocation (i.e. bores). |
| Managing wastewater | | |

| Issue | Responsible agencies | Role of the Shire |
|---|--|--|
| Wastewater management | Water Corporation – manages the wastewater treatment plant Shire of Broome – approves onsite wastewater systems including greywater reuse systems | Uses treated greywater from waste water treatment plant for watering local ovals. Undertakes regular testing of the greywater being used for watering to ensure it meets health standards. Refers illegal practices in waste water management by industry to DER and to DoH as required under the <i>Health Act (1911)</i> & <i>Environmental Protection Act (1986)</i> . |
| Management of waste water in industrial areas | Department of Environment Regulation – Industry Regulation Branch (Kununurra) | Shire can refer suspected license breaches to the DER. |

Table 6 Roles and responsibilities for Water

Shire of Broome Strategic Direction:

Water resources are sustainably managed so that their values are protected into the future.

- Effectively manage the Shire's drainage assets to minimise adverse impacts on natural areas like Roebuck Bay;
- Improve the Shire community's understanding of water resources including water quality issues and their impact on natural areas; and
- Ensure the Council minimises its water use through efficiency and conservation measures and the use of alternative water sources where possible.

Topics:

The following topics are explored in more detail:

Topic 1: Conserving water;

Topic 2: Managing stormwater;

Topic 3: Managing groundwater; and

Topic 4: Managing wastewater.



Topic 1: Conserving Water

Pressure:

Finite groundwater supplies for potable supplies, a rapidly expanding population and created landscapes that are increasingly requiring irrigation.

State:

The WA State of Environment report found in 2007¹¹, that:

- Sixty-four percent of the State's 116 water supply schemes met the State Water Strategy water use target of less than 155 kL a person per year in 2005– 06.
- Although this target level was developed for Perth households, the target can be applied across the State as an interim measure.

The WA State Water Plan³⁰ provides a vision of 'Our precious water resources are managed and developed in a sustainable manner to maintain and enhance our natural environment, cultural and spiritual values, our quality of life and the economic development of the State, and is supported by objectives that include to:

- use and recycle water wisely;
- plan and manage water resources sustainably;
- protect ecosystems, water quality and resources; and
- enhance the security of water for the environment and use.

Indicators:

i) Per capita water consumption for Broome residents.

Data source: Water Corporation⁵¹.

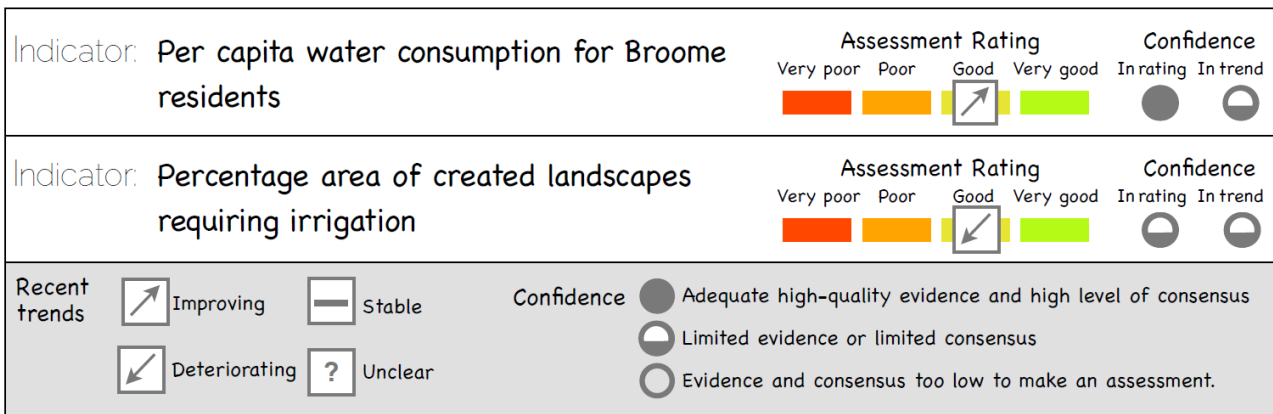
Reporting responsibility: Water Corporation

ii) Area of Broome's created landscapes requiring irrigation.

Data source: Water Corporation and/or the Shire of Broome may be able to determine this statistic for the whole of Broome by using GIS data, ground-truthed as necessary.

Reporting responsibility: Water Corporation/Shire of Broome.

³⁰ Government of WA 2007, State water plan, Department of Premier and Cabinet.



Assessment ratings, trends and confidence for Conserving Water

Perspectives for Remote area Aboriginal communities

There is limited information available on the per capita use and availability of potable water supplies for remote area Aboriginal communities. Water supply to remote Aboriginal communities is currently a significant issue. Given most of these are self-supplied and unlicensed, there are potential issues of:

- security of supply because of sometimes ad hoc community planning and development; and
- quality of supply because of limited treatment, poor location of source areas with respect to waste water or rubbish disposal areas and lack of ongoing maintenance and effective monitoring.

The Remote Area Service Provision (RAESP) program, run through the DoH, provides some level of service and monitoring to remote communities of a certain size. This service has been limited however, and does not apply to very small communities. A more robust framework for security and protection of these supplies needs to be established.

Shire of Broome Response:

Strategic response

- To review irrigation requirements for Broome's active sports grounds and recreational parks and consider the increased use of hydrozoning and ecozoning (ie. removing irrigated landscapes and replacing them with local plants);
- To better balance irrigation demand with sports ground usage and surface wear;
- Advocate to State government to improve drinking water quality and water source protection in Aboriginal communities; and
- To undertake a fit-for-purpose water supply study to identify alternative water sources for irrigation of Public Open Space.

Operational response

- Review water consumption for Shire buildings and assets and determine where possible, leakage or opportunities for improved water use efficiencies;
- Replace or retro-fit appliances and fixtures in Shire facilities with water efficient options as part of asset replacement schedules; and
- Implement and retrofit low water use and low maintenance landscape designs as part of landscape renewal schemes.



Topic 2: Managing Stormwater

Pressure:

The rapidly expanding population of Broome is accompanied by an expansion of impervious surfaces (roads and roofs) which generate additional amounts of stormwater runoff and significantly increase peak discharge velocities, especially during extreme rainfall events. Detention and retention in correctly-sized structures reduces overland flow, erosion and the subsequent sedimentation of streams and watercourses which are recognised as contributing to the degradation of waterways and water quality (Figure 13).

Roebuck Bay is one of the most significant discharge points for the Shire's drainage network and best possible stormwater management is required to protect the RAMSAR site's fragile ecosystems from adverse impacts of stormwater drainage. Cable Beach is another stormwater discharge point that requires best practice management.



Figure 11: Integration of stormwater into local public open space (left), compared to traditional trapezoidal drains which may lead to erosion, channelling and health and safety issues (right).

State:

A recent study on the nutrient export of Broome's stormwater³¹ concluded that Broome's annual nutrient export was relatively low. Despite Broome having relatively low nutrient export rates, the international significance of receiving waterways like the RAMSAR-listed Roebuck Bay requires best practice in stormwater management. The emerging use of WSUD in the new Broome North sub-catchments appeared to be effective when compared to conventional 'conveyance' stormwater management in older areas of Broome.

The Shire has adopted a Structure Plan and Subdivision Standards Local Planning Policy (LPP) which adopts North-West variations to the POS standards in the Western Australian Planning Commission's *Liveable Neighbourhoods* to achieve WSUD outcomes. The LPP also contains updates to the Shire's Guidelines for the Design of Stormwater Drainage Systems.

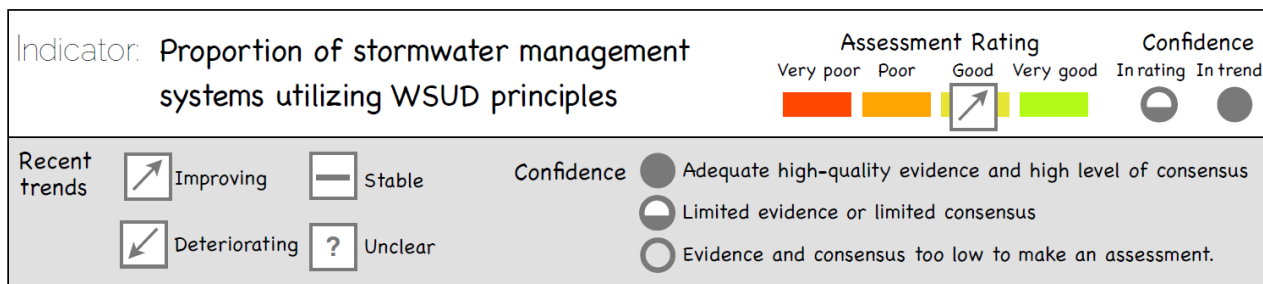
Indicator:

i) Proportion of Broome's stormwater management systems utilising WSUD principles.

³¹ Gunaratne, G., Vogwill, R. and Hipsey, M. (2015) Effect of seasonal flushing on nutrient export characteristics of an urbanising, remote, ungauged coastal catchment. in prep, submitted to: Hydrological Sciences Journal.

Data source: Information is available to derive this statistic combined with strategic ground-truthing of stormwater management systems of differing ages.

Reporting responsibility: Shire of Broome, Infrastructure



Assessment ratings, trends and confidence for Managing Stormwater

Shire of Broome Response:

Strategic response

- To require that all future development and subdivisions incorporate best practice WSUD;
- To lobby state water agencies for additional practical guidance around design and sizing of stormwater detention and retention systems better suited for North-West rainfall conditions;
- To undertake a District Drainage Strategy to assess impacts from localised flooding and areas of high nutrient loading, and identify and cost capital works and improvements that can be undertaken to alleviate drainage quantity and quality issues; and
- To recommend to the WAPC that developers prepare a mosquito management plan as a condition of subdivision in areas of known mosquito breeding.

Operational response

- To require better management of runoff from building and construction sites via conditions of development approval with adequate buffers and silt retention systems; and
- To explore opportunities for retro-fit of WSUD features into older stormwater management systems as part of maintenance and renewal schedules.



Topic 3: Managing Groundwater

Pressure:

Broome's projected population increase and increasing agricultural development through the 'Water for Food' program will require increased water supplies. The Broome well field currently comprises 18 production bores drawing water from the highly transmissive Broome Sandstone Aquifer. As demand has increased, the well field has been extended north of Crown reserve 25716 on the former Waterbank Station, an area now managed by the Department of Planning²⁶. Current risks to the groundwater supply include development pressure, population increase, salt water intrusion, contamination from waste, nutrient enrichment, reduced groundwater recharge, clearing of remnant vegetation, size of management area, as well as limited information on quality, capacity and recharge rates of the main water supply aquifer.

State:

Because the Broome Sandstone Aquifer is unconfined, it is vulnerable to contamination from inappropriate surface-based land uses and activities. The by-laws of the *Country Areas Water Supply Act* (1947) apply within the Broome Water Reserve to control activities with the potential to contaminate this public drinking water supply³⁰.

Indicators:

i) Percentage allocation of groundwater schemes.

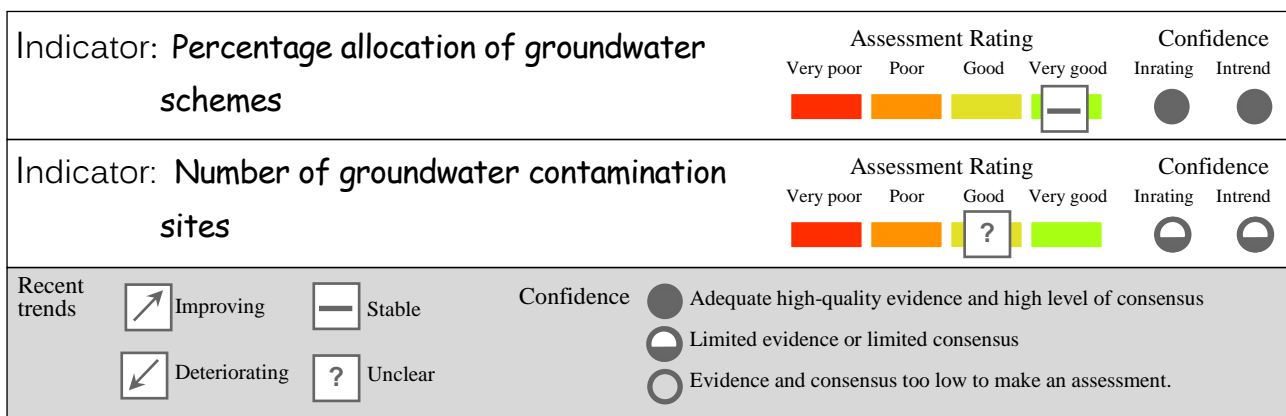
Data source: DOW 2015³²

Reporting responsibility: DOW

ii) Number of groundwater contamination sites.

Data source: Information has not been obtained but may be available in the future from DER.

Reporting responsibility: DER



Assessment ratings, trends and confidence for Managing Groundwater.

Response:

The Department of Water has developed drinking water source protection plans (DWSPPs) for Broome²⁶. The following activities have been undertaken:

- Amendment of the Broome Water Reserve boundary to reflect current data and groundwater modelling;
- The water reserve will be managed as a Priority 1 area; and
- To require activities that occur in the water reserve to adopt best practice management to protect water quality of this drinking water source.

Perspectives for remote area Aboriginal communities

Reported contamination of groundwater and drinking water supplies within the Shire's Aboriginal communities is of considerable concern to them.

State and Federal Governments are currently responsible for the management of water supplies and wastewater for Aboriginal communities. The Department of Water has recently drafted Water Source Protection Plans for some Aboriginal communities, however these Plans are not supported by

³² DoW 2015, pers. comm.

legislation and will therefore be difficult to enforce. In the future, management responsibility may be handed over to Local Government, in which case the Shire would need to take an active role in addressing these problems if they remain unsolved.

Shire of Broome Response:

Strategic response

- To continue to advise State agencies on policy and management responses to prevent groundwater contamination; and
- To update the extents of the 'Aquifer Recharge' Special Control Area in Local Planning Scheme No. 6 based on the outcomes of the Coastal Vulnerability Study.

Operational response

- To continue to implement best practice wastewater management and groundwater protection.



Topic 4: Managing wastewater

Pressure:

Broome's groundwater and surface water receiving environments are vulnerable to contamination from poorly managed industrial activities that generate wastewater.

State:

Broome's wastewater is currently managed through the Water Corporation's treatment plants. In Broome, the community's wastewater is collected and treated at the Broome South Wastewater Treatment Plant on Clementson Street and more recently at the new facility along Crab Creek Road. The treated wastewater from Broome South WWTP is recycled for irrigation at Haynes Oval, Broome Golf Course, Broome Recreation Aquatic Centre and St Mary's College. Concerns have recently been raised over possible nutrient contamination of groundwater around Broome South WWTP and the Golf Course and other areas having received treated waste water in the past.

The Shire and the Department of Health are responsible for approving the design and installation of onsite wastewater systems that are not connected to reticulated sewerage infrastructure.

Indicators:

i) Volume percentage of treated wastewater being reused.

Data source: Water Corporation³³.

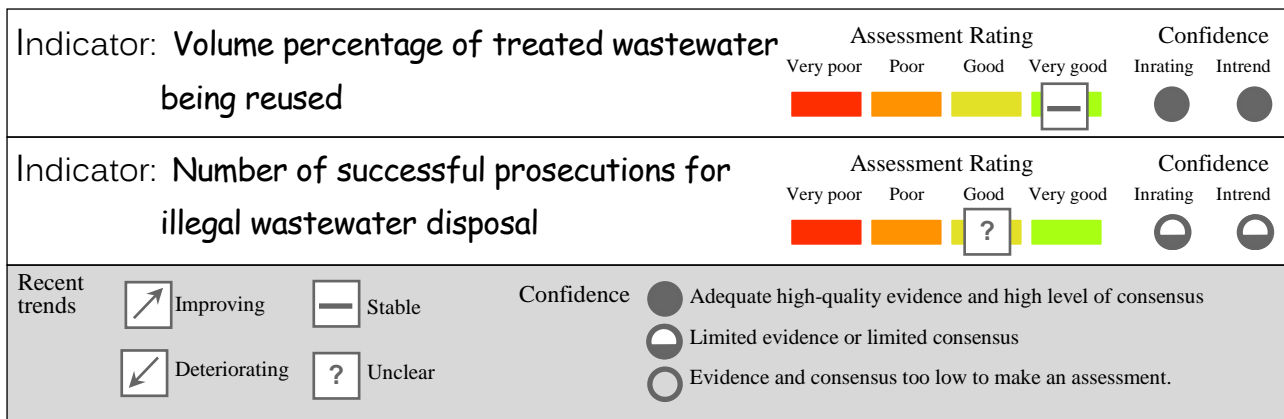
Reporting responsibility: Water Corporation

ii) Number of successful prosecutions for illegal wastewater disposal.

Data source: DER.

Reporting responsibility: DER

³³ <http://www.watercorporation.com.au/water-supply-and-services/solutions-to-regional-water-supply/regional-water-and-wastewater-schemes/broome-wastewater-scheme-summary>



Assessment ratings, trends and confidence for Managing Wastewater.

Perspectives for Remote area Aboriginal communities

Anecdotal evidence from the Ardyaloon community and Bardi Jawi Rangers indicated that there have been occurrences of overtopping of the wastewater treatment ponds in heavy rainfall, resulting in untreated wastewater entering the marine environment. Wastewater treatment needs to be upgraded commensurate with population increases in communities.

Shire of Broome Response:

Strategic response

- Advocate to State government to improve wastewater treatment in Aboriginal communities; and
- Advocate for the connection of sewerage to old and proposed industrial areas.

Operational response

- To continue to use and explore opportunities for using recycled wastewater on POS and other irrigated landscapes.

SOE Theme: Coasts

Background:

The Shire of Broome's coastline is a major tourist attraction and also supports a wide range of recreational and commercial activities. The Shire's coastal systems are in good condition but it will be become increasingly important to maintain this situation in the face of development pressures.

The Broome coastline is also highly valued for cultural activities and has a number of sites of historical significance. Access to the coast outside the townsite away from Aboriginal communities is largely uncontrolled at this point, and this may lead to adverse impacts on coastal resources such as loss or damage to fragile vegetation assemblages, wild fires, litter and rubbish dumping.

Issues:

- Illegal camping and access by vehicles and boats, to culturally and environmentally sensitive coastal areas;
- Uncertainty about specific impacts of climate change including inundation and sea level rise, particularly outside the Broome townsite;
- Pressure on marine species from recreational and commercial fishing; and

- Water quality issues related to the release of ballast water, agricultural runoff and industry discharges.

Successes:

- A Coastal Vulnerability Assessment has been completed for the Broome townsite and a similar assessment for the major Aboriginal communities is being prepared by the Department of Planning;
- The Yawuru Park Council has been established and continues to effectively progress management issues with the assistance of the Yawuru Park Council Working Group; and
- Draft Management Plans have been prepared for the In-Town and Out-of-Town Yawuru Conservation Reserves.

Gaps:

- Information on the vulnerability of the Shire's coastlines to coastal hazards outside the Broome Peninsula; and
- The lack of a marine protected areas (MPA) network for the Kimberley, although this will change as the recommendations of the Kimberley Science and Conservation Strategy are implemented.

Roles and responsibilities:

| Issue | Responsible agencies | Role of the Shire |
|----------------------------------|---|---|
| Foreshore management | | |
| Management of coastal foreshores | Shire of Broome/Yawuru Native Title Body Corporate - jointly vested coastal reserves Native title bodies corporate together with DPAW where native title has been determined Department of Lands and DPAW - unallocated Crown land Pastoral lease owners – foreshores on pastoral lands | Management of reserves vested in the Shire including facilities planning, provision, promotion and managing uncontrolled access (including camping) Litter management Determination of planning applications in areas of coastal hazard risk, provides advice to the WA Planning Commission on structure plan and subdivision applications. |
| Coastal vulnerability and access | | |

| Issue | Responsible agencies | Role of the Shire |
|-----------------------|--|---|
| Coastal vulnerability | <p>Department of Transport – ports</p> <p>Department of Planning – sets state level policy, determines structure plans and subdivision applications</p> <p>Shire of Broome – manages foreshore reserves and infrastructure, makes decisions on development applications and provides advice to the Department of Planning.</p> | Management of Shire assets in areas of coastal hazard risk and determination of planning proposals in vulnerable areas. |

Table 7 Roles and responsibilities for Coasts

Shire of Broome Strategic Direction:

The values of the coastal region including its associated ecosystems, human uses and ecological processes are understood, appropriately managed and protected.

- Maintain and enhance the coastal environment in order to retain important social, heritage, environmental and economic values; and
- Understand and address coastal hazard processes and risks.

Topics:

Topic 1: Foreshore management

Topic 2: Coastal vulnerability and access



Topic 1: Foreshore Management

Pressure:

Foreshores are often vulnerable to inappropriate actions and people-pressures. Rapidly increasing populations of tourists and local visitors have the potential to overwhelm current management efforts, particularly in more remote locations.

State:

The Broome environment and its foreshores are generally in very good condition with highly successful recreational planning and management efforts. The planning and management effort must be balanced against predicted increases in people-pressures.

Indicators:

i) Utilisation rates and provision of foreshore facilities.

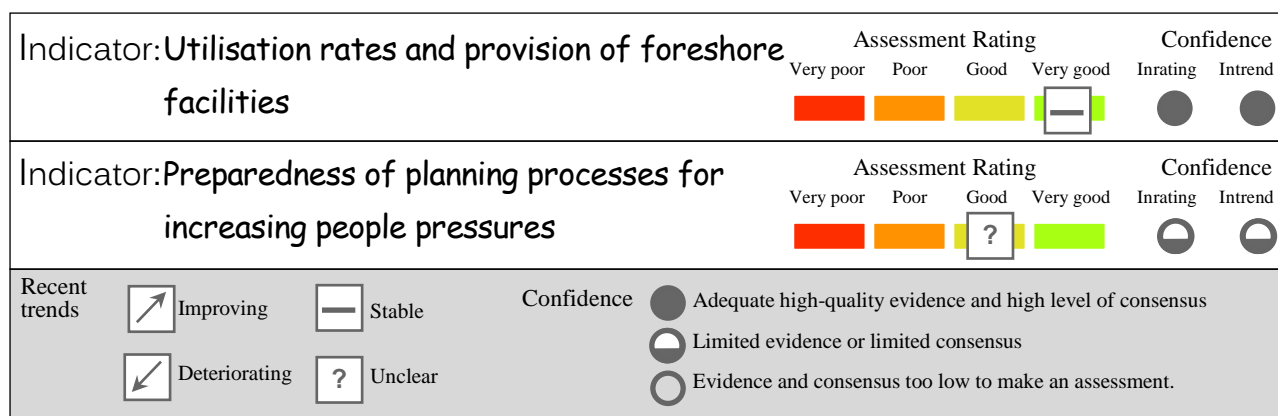
Data source: Simple measure like counting visitor cars in the car park on particular key index times/days such as public holidays, or using directional traffic counters can both be used as surrogates for visitor utilisation of public facilities provided at particular locations.

Reporting responsibility: New data - Shire of Broome.

ii) Preparedness of planning processes for increasing people pressures.

Data source: This can be measured through community satisfaction surveys with the Shire's provision of public facilities.

Reporting responsibility: New data - Shire of Broome.



Assessment ratings, trends and confidence for Foreshore Management

Perspectives for remote area Aboriginal communities

Aboriginal people are concerned that increasing numbers of visitors to their traditional lands will result in a significant increase in inadvertent damaging actions, both culturally and environmentally. Aboriginal Rangers have consistently signalled that most people will do the right thing if they are well informed. Good information and proactive management responses are the key. Suggestions have included:

- signage and information in the Broome airport baggage collection area;
- Aboriginal Rangers being supported to come to Broome to present directly to locals and visitors at important cultural events highlighting areas and situations where visitations are supported and welcomed, together with information on cultural and environmental sensitivities and exclusions; and
- Additional resources being provided to undertake forward planning, to ensure management efforts remain ahead of increasing tourist numbers.

Shire of Broome Response:

Strategic response

- To continue to support the multiple stakeholders and Aboriginal interests in determining which coastal locations are acceptable for tourist visitations, the nature of required facilities and programs to enhance tourist experiences and to manage visitor impacts at these locations;

- To advise on methods to control access to culturally or environmentally significant areas that are not suitable for tourist access; and,
- To continue to support the multiple stakeholders and Aboriginal interests in understanding coastal processes and the consequences and impacts of tourist visitations, wild fires and invasive species and the requirements for management.

Operational response

- To continue operational management of foreshores that are the Shire's responsibility.



Topic 2: Coastal Vulnerability and Access

Pressure:

Coastal vulnerability is affected by a number of complex factors including the interplay between extreme weather and tidal processes and the geologic structure of the region's sandy beaches, rocky cliffs and mangrove mudflats. The identification of areas which are vulnerable to changing coastal processes requires consideration of the variability of the primary processes driving change along the coast, together with the probability of that change, within the context of the geology of the area. Consideration must also be given to the likely outcomes of climate variability which include sea level rise and a predicted increase in extreme weather events.

State:

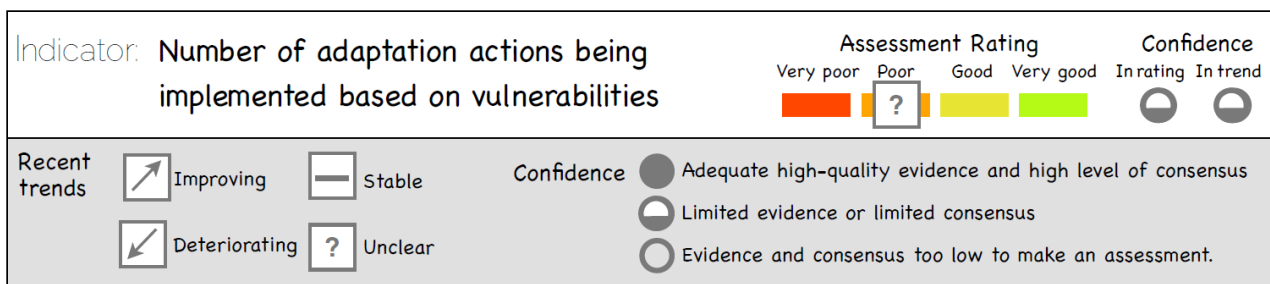
The most likely climate change impacts to be felt in the coastal areas are through changes in tidal extent and more extreme weather events, particularly tropical cyclones. Although the system of tidal creeks along the coast are generally well equipped to absorb the effect of storm surges, modifications made to accommodate growing settlements, roads, railways and ports are not always able to cope with the strain of rising tides and often result in low-lying areas being affected. It is noted that very low-lying areas of the Broome townsite currently remain inundated for a time after cyclonic events.

Indicator:

i) **Number of adaptation actions being implemented based upon Coastal Hazard Risk Management and Adaptation Planning (CHRMAP).**

Data source: WAPC 2014 and a CHRMAP for the Broome townsite.

Reporting responsibility: Shire of Broome



Assessment ratings, trends and confidence for Coastal Vulnerability and Access.

Shire of Broome Response:

Strategic response

- Amend the extents of the 'Flood Prone Land' Control Areas in Local Planning Scheme No. 6 and introduce a Special Control Area for erosion risk based on the outcomes of the Coastal Vulnerability Study to provide guidance for how development in these areas is to be assessed;
- In accordance with State Planning Policy 2.6, undertake a Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) for the Broome townsite;
- To continue to support the multiple stakeholders and Aboriginal interests in understanding coastal processes and vulnerabilities across the Shire's coastlines and the requirements for policy development and management actions; and
- To continue to monitor and update coastal vulnerability assessments in line with the best available data on climate change impacts, sea level rise and coastal hazards.

Operational response

- To utilise the outcomes of the Coastal Vulnerability Study to determine the appropriate location and lifespan of new coastal assets;
- Once the CHRMAP has been completed, undertake staged implementation of the adaptation and mitigation strategies to reduce the risk of coastal hazards in vulnerable areas of the Broome townsite;
- To continue to monitor and update management planning and operational activities for the in-town reserves in partnership with RNTBC and DPAW as the implications of vulnerability assessments become better understood; and
- To continue to support the Broome Port Authority in its emergency response planning for the Port boundaries extending from Cable Beach to Crab Creek (Mangalagun).

SOE Theme: Energy

Background:

Horizon Power, a state government-owned corporation currently provides and maintains electricity grids for the Broome townsite and the Shire. Trucked-in compressed natural gas is the main fuel source for power generation for the Broome townsite, supplemented by small amounts of diesel generation at the Old Broome power station. Horizon Power also provides electricity for remote area Aboriginal communities using modular diesel-powered generators. Broome's energy requirements are increasing rapidly inline with increases in permanent resident and visiting tourist populations.

Broome's very hot, humid climate provides challenges for energy efficient urban design, construction, and occupier behaviour. Occupier behaviour and the design and construction of urban built form can have a significant bearing on energy requirements.

The WA State Government maintains a uniform tariff policy so that WA domestic and many commercial consumers pay the same price for energy, regardless of location in WA. The power costs for Broome and remote areas across the Shire, are significantly below the costs of provision because of these Government subsidies.

Issues:

- Broome's high per capita rates of built form and transport energy consumption because of remoteness; and
- Broome's climate which confounds the adoption of cost-effective building methods that have proven to be successful elsewhere, and the need to develop and promote climate responsive design appropriate for north-west conditions.

Successes:

- Use of solar-powered lighting for many parks and footpaths around Broome;
- The state-of-the-art renewable power supply installed on the Broome Community Centre; and
- Solar power systems installed in some remote Aboriginal communities.

Gaps:

- Limited use of energy efficient appliances, fixtures or fittings in Council buildings;
- Limited use of alternative energy sources for Shire's built assets; and
- Little monitoring of energy use in Shire buildings.

Roles and responsibilities:

| Issue | Responsible agencies | Role of the Shire |
|--|--|---|
| Built form energy use | | |
| Energy supply | Horizon Power – Retail Energy Developments Limited – Infrastructure & network | To conserve its own energy use. Lobby for renewables |
| Subdivision design and planning | Developers | Provide input and approval Provide policy and best management guidelines. |
| Building construction and design – energy efficiency | Australian Building Codes Board – maintains and updates the Building Codes of Australia. | Approval of building applications and ensure the requirements of the Building Codes of Australia are met. Unable to make amendments to the Building Codes to suit local climate. |
| Public lighting | Horizon Power – street lighting Shire of Broome – some public open space areas | Shire provides some public lighting on Shire owned land i.e. parks, ovals etc. Lobby Horizon Power to use energy efficient street lighting |

| Issue | Responsible agencies | Role of the Shire |
|---------------------------|---|---|
| Transport energy use | | |
| Public Transport | Public Transport Authority | No official role as is the responsibility of State Government. Lobby State Government for improved public transport in Broome. |
| Fuel efficient vehicles | Shire of Broome | Purchasing and acquisition policies that emphasize fuel efficiency |
| Cycle paths and footpaths | Shire of Broome Land developers – construction in new subdivisions | Shire responsible for planning, maintaining and upgrading existing cycle paths and footpaths. |

Table 8 Roles and responsibilities for Energy

Shire of Broome Strategic Direction:

Energy use is optimised through design, conservation, efficiency and using renewable energy sources:

- Improve the energy-use efficiency and sustainable design for assets and programs during planning and procurement of new assets and as part of replacement/maintenance schedules.

Topics:

Topic 1: Built form energy use; and,

Topic 2: Transport energy use.



Topic 1: Built Form Energy Use

Pressure:

According to the WA State of Environment report¹¹, Western Australia may well have among the world's highest per capita levels of energy consumption and CO₂ emissions. Combined with rapid population increases across Australia, there is a trend of increasing per capita energy consumption. This means exponential growth in energy demand.

State:

The WA State of Environment report found, in 2007,¹¹ that:

- Over the previous 15 years, residential energy use per capita had increased by 15%;
- Households in the North West consumed more than twice the energy of South West households, largely due to use of air conditioners;
- There was little information describing the efficiency of gas usage; and
- Only 0.5% of WA households participated in the State's Green Power program (electricity purchased from renewable energy sources), the lowest participation rate in Australia.

Indicators:

i) Per capita energy consumption for Broome residents.

Data source: Horizon Power

Reporting responsibility: Horizon Power

ii) Per capita energy consumption for Broome residents including tourists.

Data source: Horizon Power

Reporting responsibility: Horizon Power

iii) Per capita energy consumption for remote Aboriginal communities.

Data source: Horizon Power

Reporting responsibility: Horizon Power

iv) Percentage of the Shire's energy sourced from renewables.

Data source: Horizon Power

Reporting responsibility: Horizon Power, Shire of Broome

| | | |
|--|---|--|
| Indicator: Per capita energy consumption - Broome residents | Assessment Rating Very poor Poor Good Very good | Confidence In rating In trend |
| Indicator: Per capita energy consumption - Broome Residents including Tourists | Assessment Rating Very poor Poor Good Very good | Confidence In rating In trend |
| Indicator: Per capita energy consumption - Remote area Aboriginal communities | Assessment Rating Very poor Poor Good Very good | Confidence In rating In trend |
| Indicator: Percentage of the Shires energy sourced from renewable sources | Assessment Rating Very poor Poor Good Very good | Confidence In rating In trend |
| Recent trends | Improving Stable Deteriorating Unclear | Confidence Adequate high-quality evidence and high level of consensus Limited evidence or limited consensus Evidence and consensus too low to make an assessment. |

Assessment ratings, trends and confidence for Built Form Energy Use.

Response:

Western Australian agencies and the Shire of Broome have taken steps to improve our current disproportionately high energy consumption and greenhouse emissions through a number of

improved procedures, regulations and standards. Possible responses for Energy, fall into four categories including:

- i. Subdivision layout and orientation of lots;
- ii. Energy-efficient, climate-sensitive design and construction;
- iii. Energy efficient fittings and appliances and effective occupier behaviour; and
- iv. Responses for remote area Aboriginal communities.

Subdivision layout and orientation of lots

A wide range of statutory planning policies and procedures have been amended to include components of sustainability, including, but not limited to³⁴:

- State Planning Framework (Statement of Planning Policy 1);
- Residential Design Codes (Statement of Planning Policy 3.1);
- Urban Growth and Settlement (Statement of Planning Policy 3);
- Shire of Broome Structure Plan and Subdivision Standards (Local Planning Policy 8.32); and
- Liveable Neighbourhoods (WAPC Operational Policy).

Lot size, orientation and lot placement, all impact on sustainability and the energy consumption of urban built form. A WA Ministry for Planning inquiry found that a traditional grid network of streets when aligned within good parameters for solar orientation (ie. north-south or east-west), provides significantly more potential for energy efficiencies associated with passive solar design than layouts that are handicapped by curvilinear street networks³⁵.

The Shire of Broome operationally supports and gives effect to the range of WAPC energy-efficiency planning provisions at the sub-divisional level. The Broome North Housing Guide³⁶ and Kimberley Vernacular Handbook provide more information.

Energy efficient fittings and appliances and occupier behaviour

From 1 May 2012, increased energy efficiency provisions of the National Construction Code became mandatory for all new houses in Western Australia³⁷. This means all new dwellings must be equal to or exceed a BCA 6 star energy rating. When applying for a building permit, documented evidence of compliance with energy efficiency provisions is required to demonstrate that compliance can be achieved³⁸.

The BCA 6-star code includes the following provisions for dwellings:

- heating and cooling loads;
- building fabric thermal insulation;
- thermal breaks: building sealing and floor edge insulation;
- compensation for loss of ceiling insulation through fittings, flues and voids; and
- services and hot water routing.

³⁴ Statutory Planning in WA [Internet]. [cited 2015 Apr 25]. Available from: <http://www.piacongress.com.au/documents/item/111>

³⁵ Mackay M. Which suburbs work? In: Malcolm, editor. 2001. Available from: http://www.planning.wa.gov.au/dop_pub_pdf/Whichsubshow.pdf

³⁶ coda-studio.com/research/broome-housing-guide/

³⁷ BCA 6 star mandated [Internet]. [cited 2015 Apr 25]. Available from: <https://www.commerce.wa.gov.au/building-commission/energy-efficiency-residential-building>.

³⁸ BCA 6 star verification [Internet]. [cited 2015 Apr 25]. Available from: <https://www.commerce.wa.gov.au/sites/default/files/atoms/files/option1bcacheck-sheet.pdf>

The BCA 6-star rating promotes the use of solar-passive design and fixtures.

Horizon Power advocates for efficient use of energy.. It provides guidance for energy-efficient occupier behaviour and appliances including³⁹:

- Set your air-conditioner to 24°;
- Switch lights off if you are the last to leave a room;
- Use the clothesline instead of the dryer;
- Turn off unused appliances;
- Turn appliances off at the wall;
- Close doors to the rooms you are not using;
- Take shorter showers;
- Open the curtains during the day before turning on lights; and
- Replace old incandescent light globes with new energy efficient globes.

An Energy Assistance Program (previously known as the Cost of Living Assistance [CoLA] scheme) is a means tested program to help low income and disadvantaged families with energy bills.

On 1 October 2012, the Greenhouse and Energy Minimum Standards (GEMS) legislation came into effect, creating a national framework for appliances and equipment energy efficiency in Australia. Specific requirements for regulated products include, Minimum Energy Performance Standards (MEPS) and energy rating labelling requirements⁴⁰. These regulated uniform labelling provisions facilitate consumer choice of energy efficient appliances.

Perspectives for remote area Aboriginal communities

Consultation with remote area Aboriginal community leaders reveal an understanding of their relatively high per capita use of heavily subsidised energy supplies based mostly upon fossil fuel power generation. They consistently signalled a desire to move beyond external subsidies for this type of energy and a strong desire for energy self-sufficiency as soon as possible. Community leaders were strongly in support of renewable energy self-supply and some communities have already begun to move in that direction. For example, Ardyaloon Inc (One Arm Point) are in the process of commissioning a solar photovoltaic array on the community store and have been in consultation with a range of national and international companies regarding wind and tidal power opportunities.

Shire of Broome Response:

Strategic response

- Support subdivision layouts that facilitate energy efficiency and best solar orientation for passive solar outcomes and where necessary, amend or supplement WAPC policy to achieve outcomes suitable for the north west climate conditions;
- Require BCA 6 star compliance for all Shire building approvals ensuring a continuing progression toward energy efficient built form for greenfield and brownfield developments; and,
- Providing 'in principle' support for remote area Aboriginal communities in their progress toward energy efficiency and self supply; and

³⁹ Energy Efficiency Guidelines [Internet]. [cited 2015 Apr 25]. Available from: [http:// www.horizonpower.com.au/2174.html](http://www.horizonpower.com.au/2174.html)

⁴⁰ Energy labeling [Internet]. [cited 2015 Apr 25]. Available from: [http:// www.energyrating.gov.au/about/legislation/](http://www.energyrating.gov.au/about/legislation/)

- Demonstrate leadership in the area of energy efficient built form.

Operational response

- Prepare and promote energy efficiency through the local planning framework through best practice design of parks and streetscapes, covered or shaded footpaths, dual use paths and car parks and energy efficient outdoor lighting;
- Adopt a Local Planning Policy for regional variations to the Residential Design Codes to incorporate energy efficiency and solar passive design provisions appropriate for the north-west climate, such as shaded outdoor living areas and breezeways;
- Support Horizon Power's philosophy of energy efficiency by linking to and promoting their web-based promotional material;
- Direct home owners and occupiers to energy rating and efficiency websites through promotional material, facilitating consumer choice of energy efficient domestic appliances; and
- Continue to explore ways of improving energy-use efficiencies as part of asset replacement/ refurbishment schedules.



Topic 2: Transport Energy Use

Transport along with stationary energy use are among the largest producers of carbon dioxide emissions globally. Transport is a fundamental component of human settlements that allows movement of people and goods from one place to another. Modern transport systems depend on a network of infrastructure including footpaths, cycleways, roads, rail lines, ports and airports.

Western Australia is heavily reliant on trucks for much of its intrastate freight movement, air transport for interstate passenger travel and motor vehicles for personal use. It has been shown that despite significant improvements in the fuel efficiency of motor vehicles since the early 1960s, the increase in the power and size (weight) of motor vehicles and higher speeds travelled means that fuel consumption per kilometre travelled in Australian motor vehicles has not improved and remains the same as it was in the early 1960s⁴¹.

Pressure:

Transport systems may adversely impact the environment in a number of ways including, land clearing for the development of roads and associated infrastructure, atmospheric pollution from vehicle emissions, noise pollution and pollutants in road runoff. It can also contribute to landscape fragmentation particularly when large transport corridors are built through urban communities. Motor vehicles are responsible for a large number of deaths and injuries to wildlife each year and can promote the greater spread of feral animals and weeds.

Broome Shire is very remote and there is currently no practical alternative to road, ship and air transport of people and goods in to and out of Broome Shire. In order to minimise transport emissions, there is an opportunity to move toward more fuel efficient vehicles.

⁴¹ Cities, transport and greenhouse gas emissions: What does the evidence tell us? Dr Paul Mees Senior Lecturer, Transport and Planning University of Melbourne, 2008

State:

The WA SOE report found in 2007¹¹ that:

- WA has the highest rate of vehicle ownership in Australia – nearly 75 vehicles per 100 people in 2004;
- Energy consumed for transport (mostly oil and petrol) represents about 20% of all energy consumed in WA; and
- Motor vehicles contribute significantly to several of Perth's air quality issues and to WA's greenhouse gas emissions.

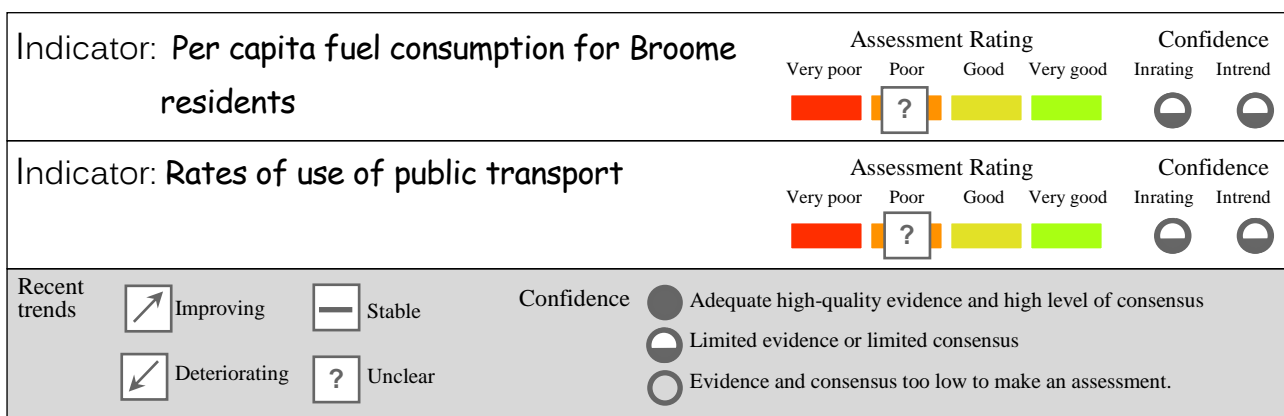
Indicators:

i) Per capita fuel consumption for Broome residents.

Data source: Information could be sourced from the Department of Transport's database of vehicle licensing in Broome.

ii) Rate of use of public transport.

Data source: Data may be sourced from Broome Bus Service.



Assessment ratings, trends and confidence for Transport Energy Use

Perspectives for remote area Aboriginal communities

Consultation with remote area Aboriginal community leaders reveal a consistent understanding of their relatively high per capita use of fuel. Given the constraints of their remote locations, community leaders focus on cost minimisation in their selection of appropriate motor vehicles. This means optimising fuel efficiencies.

Shire of Broome Response:

Strategic response

- To continue to include fuel efficiency as an important consideration in the Shire's vehicle and plant procurement policies; and
- To ensure good connectivity and accessibility for walking and cycling in new developments.

Operational response

- To continue to improve the Shire's shared path network where possible;

- To continue to provide information on the multiple benefits of reducing car dependency where possible; and
- Whilst public transport is minimal in Broome at present, require developers to consider future public transport routes as part of the design process for structure plans and subdivisions.

SOE Theme: Waste Management

Background:

Small-scale recycling efforts have been in place for several decades in Broome. Until recently, most waste streams have generally not been considered useful and little effort has been made in recovering resources for future use. 'Resource recovery' involves retrieving resources (materials, products or waste) from waste streams that have potential value and which can be used to make new products (Table 11).

| Topic | Description | Method |
|----------|--|---|
| Reduce | Minimising the volume of waste generated | Publicising alternative products and/or containers and packaging |
| Reuse | Creating new products | Researching reuse opportunities, eg. building rubble into road base or footpath foundations |
| Recycle | Using materials repeatedly | Selling sorted waste streams to recyclers eg. plastic, metals |
| Landfill | Least desirable option | Best practice requirements now include leachate and gas interception and monitoring |

Table 9 Options for the Shire's waste management

Issues:

- Limited lifespan of existing landfill facility and difficulties in developing a replacement Resource Recovery facility;
- Low levels of community awareness and participation in recycling and waste minimisation schemes;
- Broome's transient population and diverse cultural mix presents challenges for waste management education programs;
- Seasonal population fluctuations impact on the amount and type of waste;
- Numerous smaller landfill disposal sites at Aboriginal communities, some of which are poorly sited in relation to groundwater abstraction bores;

- The Shire's relatively small population and large distances between settlements and to potential markets compromises the economies-of-scale required to maintain viable recycling programs;
- Littering and illegal dumping of waste is common throughout the Shire and difficult to manage; and
- A history of poor record keeping about the nature of contaminated sites in the Shire.

Successes:

- In recent times, two waste audits have been undertaken so there is some understanding of the Broome waste stream;
- In 2013 the Shires of Broome, Derby / West Kimberley, Halls Creek and Wyndham / East Kimberley collaborated to develop a Regional Waste Management Plan in alignment with the Waste Authority's Zero Waste Plan⁴²;
- The Shire currently collects and recycles green waste, which is mulched and used by the Shire and wider community;
- The Shire delivers kerb-side comingled recycling within the town site and recycles glass, paper, cardboard, plastic, steel and aluminium packaging;
- The Shire currently collects and recycles car bodies and scrap metal, which is stockpiled and collected by a metal management Contractor; and
- The Shire currently collects and stockpiles waste concrete, which will be crushed and reused by the Shire in road and drainage works.

Gaps:

- The lack of an integrated waste management scheme for Broome Shire particularly one that may in the future include the needs of the Shire's Aboriginal communities.

Roles and responsibilities:

| Issue | Responsible agencies | Role of the Shire |
|--|----------------------|---|
| Household waste | | |
| Household waste collection (Broome townsite) | Shire of Broome | Contractors operate kerb-side rubbish and recycling collection. The Shire operates the town's landfill site. |

⁴² Zero waste institute [Internet]. [cited 2015 May 26] Available from: <http://zerowasteinstitute.org>

| Issue | Responsible agencies | Role of the Shire |
|---|---|--|
| Aboriginal communities | Aboriginal Lands Trust, Departments of Families, Housing, Community Services and Indigenous Affairs Nirrambuk Aboriginal Corporation | No current role The Shire may in the future partner with Native Title Bodies Corporate once Native Title has been determined and a Shire-wide waste management strategy has been implemented. |
| Reuse and recycling | | |
| Household waste reuse and recycling | Shire of Broome | Currently reuses green waste as compost and mulch Currently recycles car bodies, light and heavy gauge metals Currently stockpiles waste concrete for crushing and reuse on future Shire projects Undertakes some sorting, transport and sale of recycled materials |
| Litter and illegal dumping | | |
| Litter | Shire of Broome | Responsible for management and cleanup of litter and has ability to fine offenders |
| Illegal dumping of industrial/ hazardous waste | Department of Environment Regulation | Refer incidences of illegal dumping of waste to DER for action |
| Commercial and industrial waste | | |
| Commercial and industrial waste collection | Responsibility of private business | None |

Table 10 Roles and responsibilities for Waste

Strategic Direction:

Waste is managed sustainably to ensure the highest level of economic return from resource recovery.

- Improve the Shire's waste management facilities and practices including community participation in waste collection and recycling activities.

Topics:

Topic 1: Household waste; and

Topic 2: Litter and illegal dumping.



Topic 1: Household Waste

Pressure:

The current Broome landfill site is now close to capacity and an effective new waste management facility is required for the Shire. It is proposed that the new landfill site be established as a Resource Recovery Facility so as to convert waste into usable and marketable products such as compost, recyclables and/or energy and to reduce the amount of material going into landfill.

Broome's projected increase in population will serve to increase the demand for effective waste management while at the same time acting to improve economies of scale that are critical in the financial operations of resource recovery schemes.

State:

The WA State of Environment report found in 2007¹¹ that:

- Western Australians generate about 5 million tonnes of solid waste per year. About 20% is recycled or composted;
- Construction and demolition waste makes up over half of waste going to landfill in Perth; and
- Recycling in Perth is slowly increasing, but significant improvements are needed to address rising waste generation.

Household recycling services generally include collection of dry recyclables such as newspaper, cardboard, glass containers, aluminium and steel cans, plastic dairy and soft drink bottles, and liquid paperboard dairy cartons. During 2013/14 it is estimated that the Shire of Broome sent approximately 753 tonnes of kerbside collected materials for recycling, which increased to 780 tonnes in 2014/15. This equates to approximately 45kg per person per year, or 15% of the total waste stream. Typical yields for recyclable materials from rural or remote areas are 50-60kg per person per year.

Indicators:

i) Per capita waste generation.

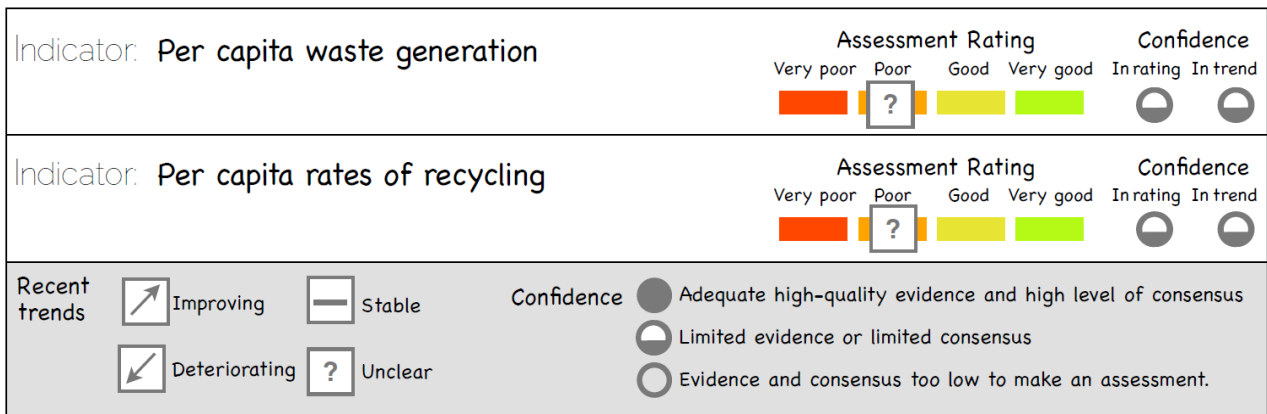
Data source: Information from the Shire's waste audits could be used to provide these statistics.

Reporting responsibility: Shire of Broome.

ii) Per capita rates of recycling.

Data source: Information from the Shire's waste audits could be used to provide these statistics.

Reporting responsibility: Shire of Broome.



Assessment ratings, trends and confidence for Household Waste

Perspectives for remote area Aboriginal communities

Reported contamination of groundwater and drinking water supplies within the Shire's Aboriginal communities is of considerable concern to them. These communities obtain drinking water from bores which are often located in proximity to unregulated and poorly maintained wastewater or solid waste disposal sites and it is possible that leaching from the waste sites is contaminating drinking water supply (anecdotal evidence from Bidyadanga and Ardyaloon communities).

Shire of Broome Response:

Strategic response:

- To continue the process of design and location for a suitable Resource Recovery Facility to meet Broome's household and other solid waste needs into the future.

Operational response

- To review and implement closure plans for the existing land fill site which is nearing its effective working life;
- To continue the annual pre-cyclone season clean-up to prevent rubbish and debris ending up in natural areas and waterways; and
- Improve the effectiveness of the kerb-side co-mingled recycling service.



Topic 2: Litter and Illegal Dumping

Pressure:

Illegal dumping degrades the environment and risks public health. The local community pays a high cost to clean it up. It can lead to chemical and physical pollution in our neighbourhood and waterways. Dumped green-waste can also spread pests, weeds and add to fire risks, while hazardous materials can pollute waterways.

State:

Anecdotal evidence suggests that illegal dumping probably has been a problem for some time, but it appears to have increased in recent times. Illegally-dumped waste has included: concrete, green waste, brick paving, rubble, tin sheets and white goods. Figure 14 shows the breakdown of waste types dumped within the Broome townsite and the most common dumping locations.

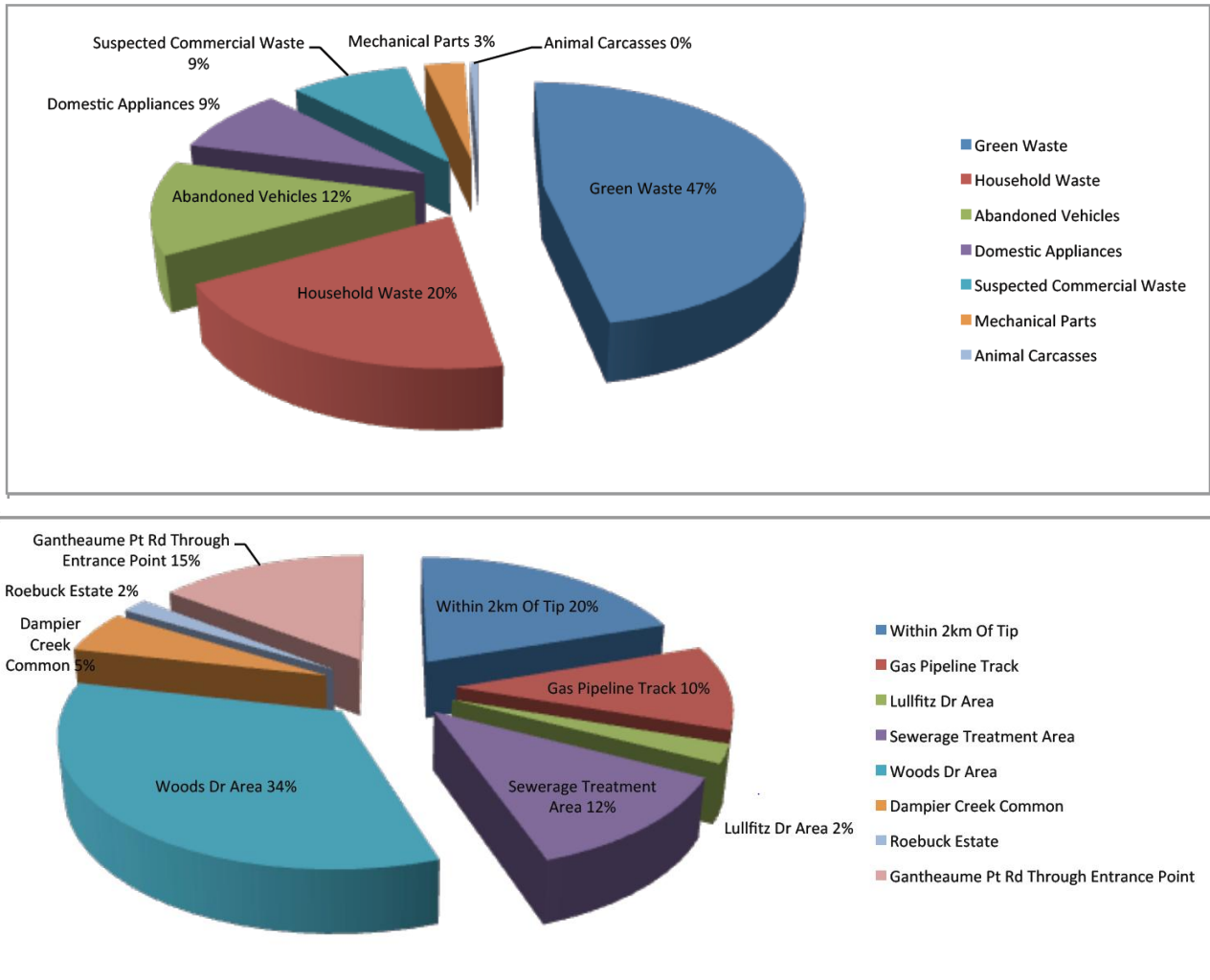


Figure 12 Type and location of illegal dumping incidents around Broome (Source Shire of Broome Rangers).

Indicators:

i) Rate of illegal dumping.

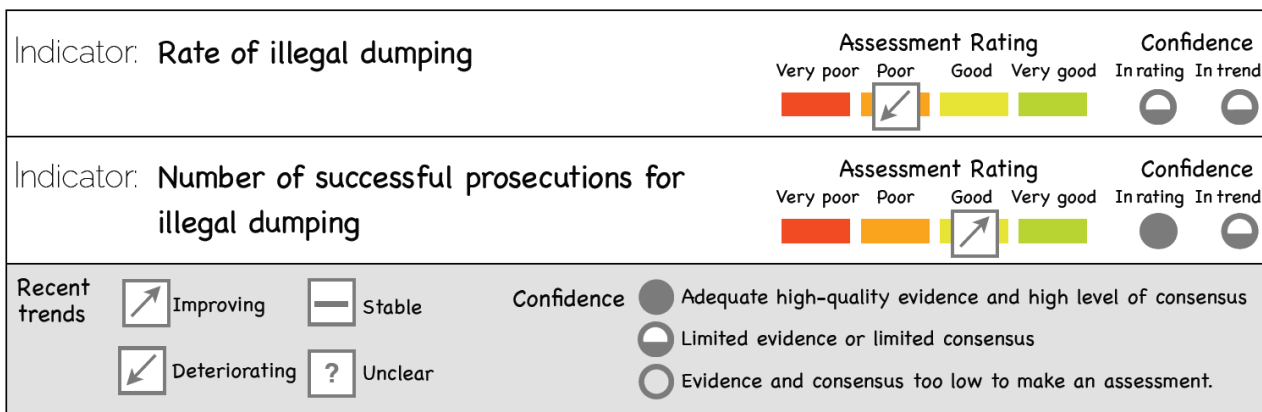
ii) Data source: Shire of Broome (Figure 14).

Reporting responsibility: DER

iii) Number of successful prosecutions for illegal dumping.

Data source: DER.

Reporting responsibility: DER



Assessment ratings, trends and confidence for Litter and Illegal Dumping

Shire of Broome Response:

- To maintain the current high levels of surveillance and forensic assessment of dumped rubbish;
- To pursue enforcement action as appropriate if people dump rubbish illegally; and
- To continue to provide information and promote the 'Keep Broome Clean Team' on Facebook and other media.

Operational response

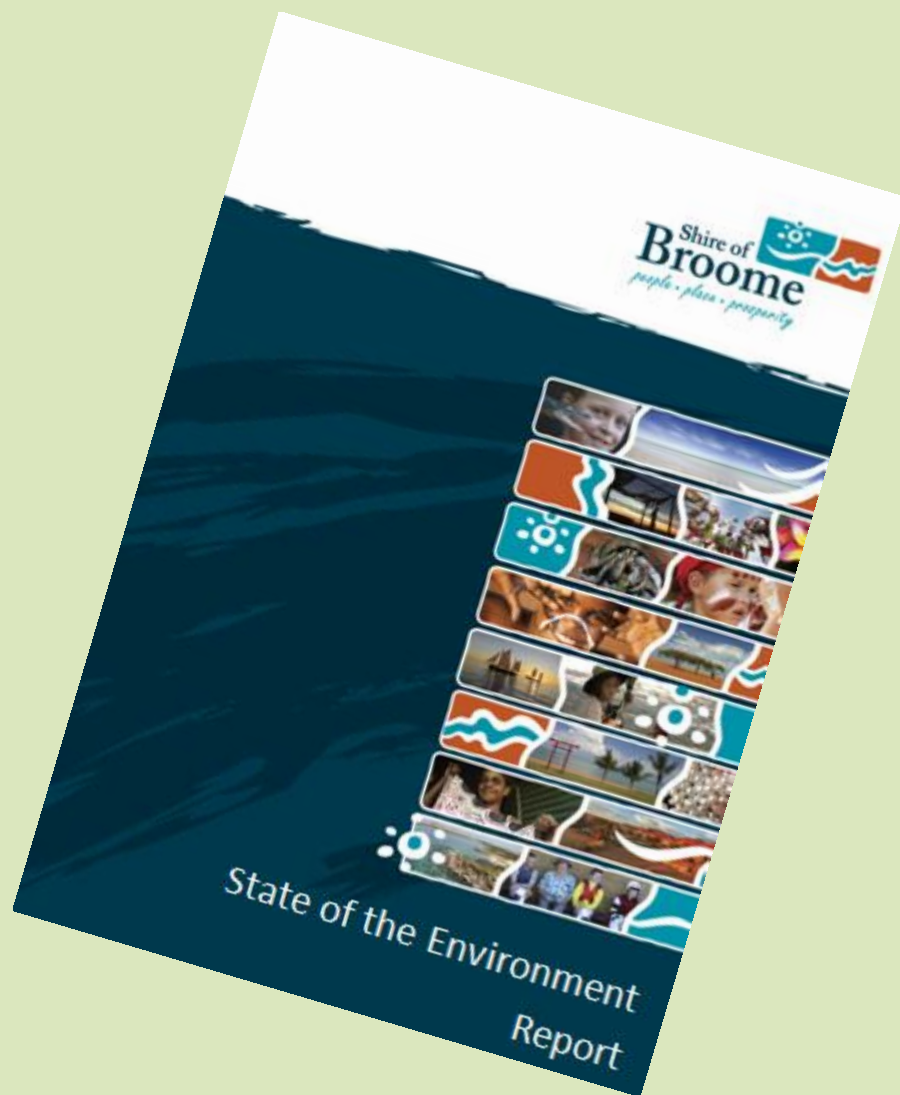
- Continue to employ the full-time community clean-up crew to maintain and remove litter from parks, gardens, beaches and verges;
- Continue to operate the orange bag rubbish collection system where individuals who can register with the Council and be paid for rubbish they collect; and
- Continue to support community groups such as the Keep Broome Clean Team.



Shire of Broome

Environmental Management Plan

Response to the SOE



Contents of the EMP

| | |
|--|-----|
| Introduction..... | 88 |
| EMP Policy setting | 88 |
| Local Government Act..... | 88 |
| Integrated Planning and Reporting Framework..... | 89 |
| Shire of Broome Environmental Policies | 90 |
| Relationship to SOE reporting..... | 90 |
| EMP Objectives, Strategies and Responses | 92 |
| Land | 92 |
| Biodiversity..... | 93 |
| Water..... | 94 |
| Coasts..... | 95 |
| Energy..... | 96 |
| Waste..... | 97 |
| EMP Governance and Implementation | 98 |
| Confirming responsibilities..... | 99 |
| Creating partnerships | 100 |
| Exerting influence and communication | 100 |
| Improving performance..... | 101 |

Figures

| | | |
|------|---|----|
| EMP1 | Relationships between strategic community and corporate business planning.... | 89 |
| EMP2 | Relationship between SOE and EMP..... | 91 |

Introduction

There is a complex structure of stakeholder agencies (Appendix 1) and legislation (Appendix 2) that applies to environmental management. It is not the responsibility of the Shire of Broome to manage all aspects of the local environment.

The following sections of this report constitute the Shire's Environment Management Plan (EMP) which, building on the preceding SOE chapters, summarises those functions that have been, and continue to be the direct responsibility of the Shire of Broome to undertake and outlines how the Shire of Broome has been and intends to continue responding to its legislative obligations in maintaining the quality of the local environment. The first section briefly summarises the policy setting for the Shire's environmental matters. The second section sets out the relationship between the EMP and the SOE reporting. The EMP then outlines the EMP objectives, strategies and responses.

EMP Policy Setting

There are a number of Federal, State and Local Government legislative instruments that guide environmental management for the Shire of Broome. Appendix 2 describes the range of Acts. This section briefly describes those instruments of direct relevance to the activities of the Shire of Broome.

Local Government Act

Section 3.18 of the *Local Government Act 1995* provides for the overarching executive functions of local government in relation to environmental management as follows:

SECT 3.18 PERFORMING EXECUTIVE FUNCTIONS

- (1) A local government is to administer its local laws and may do all other things that are necessary or convenient to be done for, or in connection with, performing its functions under this Act.
- (2) In performing its executive functions, a local government may provide services and facilities.
- (3) A local government is to satisfy itself that services and facilities that it provides:
 - (a) integrate and coordinate, so far as practicable, with any provided by the Commonwealth, the State or any public body; and
 - (b) do not duplicate, to an extent that the local government considers inappropriate, services or facilities provided by the Commonwealth, the State or any other body or person, whether public or private; and
 - (c) are managed efficiently and effectively.

Integrated Planning and Reporting Framework

All Local Governments in Western Australia are required to develop a Plan for the Future as prescribed under Section 5.56(1) of the *Local Government Act 1995*. In 2011, amendments were made to the *Local Government (Administration) Regulations 1996*, which introduced the Integrated Planning and Reporting Framework. This Framework states that a Plan for the Future is to incorporate a Strategic Community Plan and a Corporate Business Plan.

A Strategic Community Plan (SCP) is a strategy and planning document that reflects the longer term (10+ year) community and local government aspirations and priorities. A Corporate Business Plan (CBP) activates the Strategic Community Plan by setting out the short to medium term priorities to achieve the objectives and aspirations of the community. Through prioritisation of aspirations and consideration of external factors impacting on resources, the Corporate Business Plan governs internal business planning.

The Shire of Broome first adopted a SCP in June 2013, and was reviewed and updated in tandem with the CBP in February 2015. The SCP and CBP are informed by several other key 'Informing Strategies,' as shown in the diagram below.

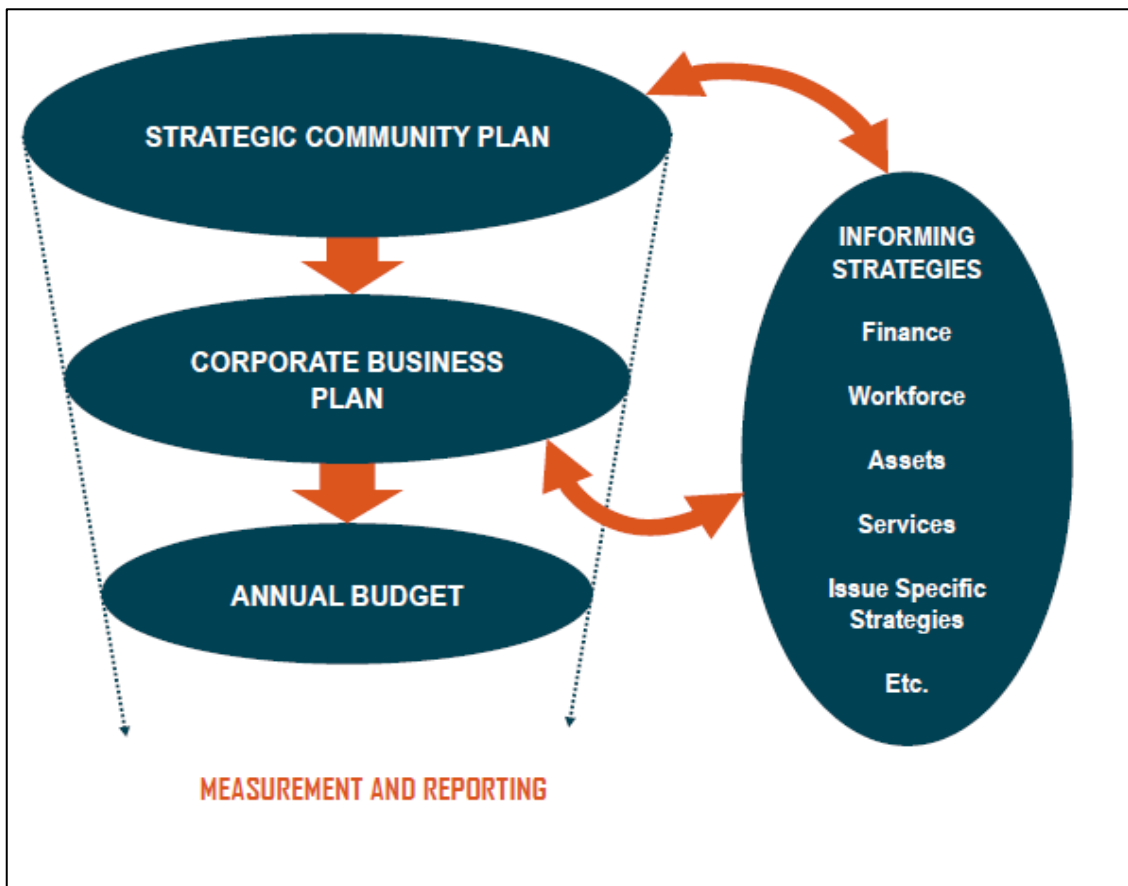


Figure EMP1 Relationships between strategic community and corporate business planning and informing strategies.

It is intended that the SOE Report and this EMP will become an 'Informing Strategy' under the Integrated Planning and Reporting Framework. This means that they will become reference documents and used in subsequent revisions of the SCP and CBP to establish organisational priorities. They will also inform the allocation of resources through the Annual Budget. In this way the Shire's environmental management commitments will become part of the organisation's forward planning.

Shire of Broome Environmental Policies

The Shire has adopted a suite of policies addressing environmental matters, including:

- 4.4.1 Principal Environmental Policy;
- 4.4.3 Environmentally Preferred Products Policy;
- 4.4.7 Energy Conservation; and
- 4.4.9 Significant Tree Register

In addition there are State policy documents that address environmental matters and that are applied in the Shire, primarily through the planning approvals process.

The relevant portions of Policies 4.4.1 and 4.4.7 have been incorporated into the EMP, and it is recommended that these policies be revoked.

EMP Relationship to SOE Reporting

The relationship between the process of SOE reporting and the Shire's statutory environmental obligations are presented in Figure EMP2. The green boxes on the left of the diagram represent the history of the public process of documenting expert knowledge and community views on broader aspects of the Broome environment, which informed the development of the SOE.

The responses contained in the SOE have been reframed as the Shire's Environment Management Plan (EMP). The Shire of Broome gives effect to its environmental responsibilities through its EMP. The EMP categorises which SOE Responses form part of on-going operations or alternatively whether they become part of strategic planning. Responses deemed to fall into the Operational category are addressed by the responsible Shire Directorates within existing budget and project scheduling provisions. New strategic initiatives need to go through a strategic assessment process (represented on the larger yellow box on the right hand side of the diagram). Other responses which have been included in the SOE that are considered outside the Shire of Broome's control have not been included in the EMP.

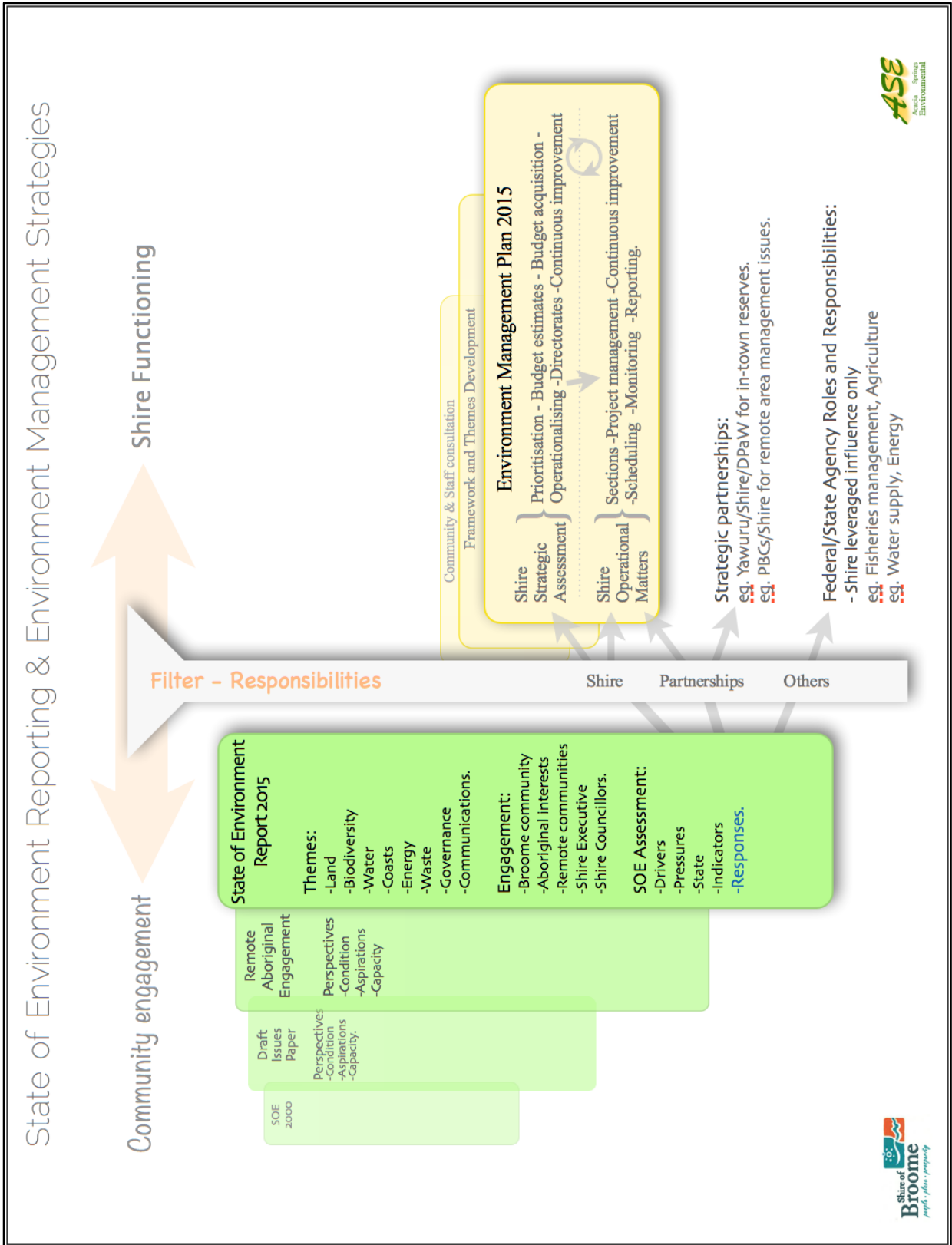


Figure EMP2 Relationship between SOE and EMP

EMP Objectives, Strategies and Responses

The strategic directions set out below are based on the broader SOE themes for issues that require management within the Shire of Broome. These directions are considered to be within the power of the Shire to implement. Strategies that are principally the responsibility of other stakeholders, whilst captured in the SOE, have not been included in these sections.

1. Land

| |
|---|
| OBJECTIVE |
| <i>Land resources are collaboratively managed to sustain their cultural, social, environmental and economic values.</i> |
| STRATEGIES |
| a) Incorporate natural resource management and environmental considerations into the Shire's planning processes. |
| b) Achieve improvements in locations where Shire-managed land has been degraded. |
| c) Build and maintain relationships and partnerships with traditional owners and other land managers to deliver improved environmental outcomes. |
| STRATEGIC RESPONSES |
| <ul style="list-style-type: none"> Facilitate and participate in collaborative, multi-stakeholder landscape-scale conservation measures for land that the Shire has a management obligation for. Lobby for and support data acquisition and mapping to support bushfire prevention and management. Support and encourage Ranger services on Aboriginal lands in their management of traditional burning methods. |
| OPERATIONAL RESPONSES |
| <ul style="list-style-type: none"> Use fencing and signage to deter people from accessing sensitive and hazardous areas. Develop bushfire management plans for Shire managed reserves in accordance with State Planning Policy 3.7. |

2. Biodiversity

| | |
|---|--|
| OBJECTIVE | |
| <i>Bushland, open spaces and biodiversity are protected and enhanced for future generations.</i> | |
| STRATEGIES | |
| a) | Protect, maintain and/or enhance the quality of vegetation and habitat on Shire owned or managed land. |
| b) | Minimise threats to biodiversity from pests, weeds and feral animals on Shire owned or managed land. |
| c) | Encourage residents, developers and other land managers to protect and maintain biodiversity. |
| STRATEGIC RESPONSES | |
| <ul style="list-style-type: none"> • Incorporate biodiversity objectives into Shire planning, and acknowledge the worth of the natural environment to tourism is balanced against the cost of managing biodiversity and making conservation areas accessible. | |
| <ul style="list-style-type: none"> • In conjunction with other relevant stakeholders, develop a comprehensive Shire-wide, multi-stakeholder Biodiversity Management Plan to guide bushland management and rehabilitation activities, provide mapping of biodiversity areas and corridors, and enhance biodiversity outcomes in urban areas. | |
| <ul style="list-style-type: none"> • Advocate for State and Federal Governments to undertake research and identification of flora and fauna in the region including Threatened Ecological Communities. | |
| <ul style="list-style-type: none"> • Develop Management Plans for reserves controlled by the Shire which provide for management and restoration of conservation areas, and support the preparation of multi-stakeholder management plans for all reserves throughout the Shire which provide for management and restoration of conservation areas. | |
| <ul style="list-style-type: none"> • Develop a comprehensive and multi-stakeholder Weed Management Strategy to guide the Shire's weed management activities on land under its care and control. | |
| <ul style="list-style-type: none"> • Progress the draft Public Open Space Asset Management Plan. | |
| OPERATIONAL RESPONSES | |
| <ul style="list-style-type: none"> • Continue to provide recommendations and advice to DPAW on native vegetation clearing applications. | |
| <ul style="list-style-type: none"> • Continue to close Cable Beach during the wet season at night and high tide to protect turtle breeding sites. | |
| <ul style="list-style-type: none"> • Continue and expand the propagation and use of native plants in the Shire's landscaping activities. | |
| <ul style="list-style-type: none"> • Continue to encourage residents to establish native gardens, including offering free native plants to residents at community events. | |
| <ul style="list-style-type: none"> • Review the Shire's project management plan template for engineering works to include consideration of weed management when undertaking specific projects. | |

- Ensure that areas cleared of native vegetation are managed and mulched to prevent soil erosion and the establishment of weeds.

3. Water

| | |
|--|---|
| OBJECTIVE | |
| <i>Water resources are sustainably managed so that their values are protected into the future.</i> | |
| STRATEGIES | |
| a) | Effectively manage drainage assets to minimise impacts on natural areas, like Roebuck Bay. |
| b) | Improve the Shire's understanding of water resources including water quality issues and their impact on natural areas. |
| c) | Ensure the Shire minimises its water use through efficiency and conservation measures and the use of alternative water sources where possible. |
| STRATEGIC RESPONSES | |
| • | Review irrigation requirements for Broome's active sports grounds and recreational parks and consider the increased use of hydrozoning and ecozoning (ie. removing surplus irrigated areas and replacing them with local plants). |
| • | Balance irrigation demand with sports ground usage and surface wear. |
| • | Advocate to State government to improve drinking water quality and water source protection in Aboriginal communities. |
| • | Undertake a fit-for-purpose water supply study to identify alternative water sources for irrigation of Public Open Space. |
| • | Require that all future development and subdivisions incorporate best practice Water Sensitive Urban Design (WSUD). |
| • | Lobby state water agencies for additional practical guidance around design and sizing of stormwater detention and retention systems better suited for North-West rainfall conditions |
| • | Undertake a District Drainage Strategy to assess impacts from localised flooding and areas of high nutrient loading, and identify and cost capital works and improvements that can be undertaken to alleviate drainage quantity and quality issues. |
| • | Recommend to the WAPC that developers prepare a mosquito management plan as a condition of subdivision in areas of known mosquito breeding. |
| • | Continue to advise State agencies on policy and management responses to prevent groundwater contamination. |
| • | Update the extents of the 'Aquifer Recharge' Special Control Area in Local Planning Scheme No. 6 based on the outcomes of the Coastal Vulnerability Study. |
| • | Advocate to State government to improve wastewater treatment plants in Aboriginal communities. |
| • | Advocate for the connection of old and proposed industrial areas to reticulated sewerage infrastructure. |

| OPERATIONAL RESPONSES |
|--|
| <ul style="list-style-type: none"> Review water consumption for Shire buildings and assets and determine, where possible, leakage and opportunities for improved water use efficiencies. |
| <ul style="list-style-type: none"> Replace or retro-fit appliances and fixtures in Shire facilities with water efficient options as part of asset replacement schedules. |
| <ul style="list-style-type: none"> Implement and retrofit low water use and low maintenance landscape designs as part of landscape renewal schemes. |
| <ul style="list-style-type: none"> Require better management of runoff from building and construction sites via conditions of development approval, with adequate buffers and silt retention systems. |
| <ul style="list-style-type: none"> Explore opportunities for retro-fit of WSUD features into older stormwater management systems as part of maintenance and renewal schedules. |
| <ul style="list-style-type: none"> Continue to implement best practice wastewater management and groundwater protection. |
| <ul style="list-style-type: none"> Continue to use and explore opportunities for using recycled wastewater on POS and other irrigated landscapes. |

4. Coasts

| OBJECTIVE |
|--|
| <p><i>The values of the coastal region including its associated ecosystems, human uses and ecological processes are understood, appropriately managed and protected.</i></p> |
| STRATEGIES |
| <p>a) Maintain and enhance the coastal environment on Shire owned or managed land in order to retain important social, heritage, environmental and economic values.</p> |
| <p>b) Understand and address coastal hazard processes and risks.</p> |
| STRATEGIC RESPONSES |
| <ul style="list-style-type: none"> Continue to support the multiple stakeholders and Aboriginal interests through the land use planning framework in determining which coastal locations are acceptable for tourist visitation, the nature of required facilities and programs to enhance tourist experiences and to manage visitor impacts at these locations. |
| <ul style="list-style-type: none"> Provide input on the control of access to culturally or environmentally significant areas that are not suitable for tourist access. |
| <ul style="list-style-type: none"> Continue to support the multiple stakeholders and Aboriginal interests in understanding coastal processes and vulnerabilities across the Shire's coastlines and the requirements for policy development and management actions. |
| <ul style="list-style-type: none"> Amend the extents of the 'Flood Prone Land' Control Areas in Local Planning Scheme No. 6 and introduce a Special Control Area for erosion risk based on the outcomes of the Coastal Vulnerability Study to provide guidance for how development in these areas is to be assessed. |
| <ul style="list-style-type: none"> Continue to monitor and update Coastal Vulnerability Assessments in line with the best available data on climate change impacts, sea level rise and coastal hazards. |

- In accordance with State Planning Policy 2.6, undertake a Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) for the Broome townsite.

OPERATIONAL RESPONSES

- Continue operational management of foreshores that are the Shire's responsibility.
- Utilise the outcomes of the Coastal Vulnerability Study to determine the appropriate location and lifespan of new coastal assets.
- Once the CHRMAP has been completed, undertake staged implementation of the adaptation and mitigation strategies to reduce the risk of coastal hazards in vulnerable areas of the Broome townsite.
- Continue to monitor and update management planning and operational activities for the in-town reserves in partnership with RNTBC and DPAW as the implications of vulnerability assessments become better understood.
- Continue to support the Broome Port Authority in its emergency response planning for the Port boundaries extending from Cable Beach to Crab Creek (Mangalagun).

5. Energy

OBJECTIVE

Energy use is optimised through design, conservation, efficiency and the use of renewable energy sources.

STRATEGIES

- a) Improve the energy-use efficiency and sustainable design for all Council assets and programs during planning and procurement of new assets and as part of replacement/maintenance schedules for existing assets.

STRATEGIC RESPONSES

- Support subdivision layouts that facilitate energy efficiency and best solar orientation for passive solar outcomes and where necessary, amend or supplement WAPC policy to achieve outcomes suitable for the north west climate conditions.
- Ensure good connectivity and accessibility for walking and cycling in new developments.
- Require BCA 6 star compliance for all Shire building approvals, ensuring a continuing progression toward energy efficient built form for greenfield and brownfield developments
- Provide 'in principle' support for remote area Aboriginal communities in their progress toward energy efficiency and self supply.
- Demonstrate leadership in the area of energy efficient built form.
- Continue to include fuel efficiency as an important consideration in the Shire's vehicle and plant procurement policies.
- Whilst public transport is minimal in Broome at present, require developers to consider future public transport routes as part of the design process for structure plans and subdivisions.

| OPERATIONAL RESPONSES |
|--|
| <ul style="list-style-type: none"> • Prepare and promote energy efficiency through the local planning framework through best practice design of parks and streetscapes, covered or shaded footpaths, dual use paths and car parks and energy efficient outdoor lighting. |
| <ul style="list-style-type: none"> • Prepare and adopt a Local Planning Policy for regional variations to the Residential Design Codes to incorporate energy efficiency and solar passive design provisions appropriate for the North-West climate, such as shaded outdoor living areas and breezeways. |
| <ul style="list-style-type: none"> • Support Horizon Power's philosophy of energy efficiency by linking to and promoting their web-based promotional material. |
| <ul style="list-style-type: none"> • Direct home owners and occupiers to energy rating and efficiency websites through promotional material, facilitating consumer choice of energy efficient domestic appliances. |
| <ul style="list-style-type: none"> • Continue to explore ways of improving energy-use efficiencies as part of asset replacement/ refurbishment schedules. |
| <ul style="list-style-type: none"> • Continue to improve the Shire's shared path network where possible. |
| <ul style="list-style-type: none"> • To continue to provide information on the multiple benefits of reducing car dependency where possible. |

6. Waste

| OBJECTIVE |
|---|
| <i>Waste is managed sustainably to ensure the highest level of economic return from resource recovery.</i> |
| STRATEGIES |
| <p>a) Improve the Shire's waste management facilities and practices including community participation in waste collection and recycling activities.</p> |
| STRATEGIC RESPONSES |
| <ul style="list-style-type: none"> • Continue the process of design and location for a suitable Resource Recovery Facility to meet Broome's household and other solid waste needs into the future. |
| <ul style="list-style-type: none"> • Maintain the current high levels of surveillance and forensic assessment of dumped rubbish. |
| <ul style="list-style-type: none"> • Pursue enforcement action as appropriate if people dump rubbish illegally. |
| <ul style="list-style-type: none"> • Continue to explore strategic opportunities for community engagement through initiatives such as: the 'Keep Broome Clean Team' on Facebook and other media. |
| OPERATIONAL RESPONSES |
| <ul style="list-style-type: none"> • Review and implement closure plans for the existing landfill site which is nearing its effective working life. |
| <ul style="list-style-type: none"> • Continue the annual pre-cyclone season clean-up to prevent rubbish and debris ending up in |

| |
|--|
| natural areas and waterways. |
| <ul style="list-style-type: none"> • Improve the effectiveness of the kerb-side co-mingled recycling service. |
| <ul style="list-style-type: none"> • Continue to employ the full-time community clean-up crew to maintain and remove litter from parks, gardens, beaches and verges. |
| <ul style="list-style-type: none"> • Continue to operate the orange bag rubbish collection system where individuals can register with the Shire and be paid for rubbish they collect. |
| <ul style="list-style-type: none"> • Continue to support community groups such as the Keep Broome Clean Team. |

EMP Governance and Implementation

Within the complex regulatory framework that applies to environmental management, it is recognised that the Shire does not always have the authority to determine approvals for certain environmental matters. Often this authority resides with State or Federal government agencies. This means that good ongoing working relationships between Shire staff and these agencies are required to ensure that the Shire's interests are being adequately addressed during environmental or planning assessments.

In some cases, public education is also required as community members look to the Shire to take a lead role in matters that are the responsibility of other state/federal agencies or stakeholder groups. Ensuring the accurate mapping of vegetation types, rare and threatened flora and fauna is one common example, as this responsibility rests with the Department of Parks and Wildlife and not the Shire.

For these reasons, the Strategies and Actions in the above sections deal only with matters the Shire is able to implement. However, it is also necessary to consider how the Shire can more effectively build partnerships with other organisations to achieve broader outcomes. This section contains strategies and actions for how this can be accomplished.

Issues:

- Implementation of environmental policies and prioritisation of operational matters concerning the environment, may at times appear ad hoc because of gaps in community understanding of the full range of the Shire's often competing roles and responsibilities at a Local level;
- Difficulty in establishing shared policy objectives and operational priorities with State agency colleagues;
- Difficulties in extending environmental management activities to non-urban areas as the Shire has no jurisdiction to manage much of the land in these areas; and
- Uncertainty about future governance and service arrangements to Aboriginal communities.

Strategic Direction:

The Shire's programs and partnerships are integrated to better achieve sustainable environmental outcomes:

- Continue to improve the integration of best practice environmental management into the Shire's policies, procedures and processes;
- To work with State and Federal agencies to actively promote the Kimberley's emerging 'culture and conservation' economy; and

- Collaborate with other land managers operating in the Shire to share learning and experience and implement management strategies across a range of land tenures.

Topics:

Topic 1: Confirming responsibilities;

Topic 2: Creating partnerships;

Topic 3: Exerting influence and communication; and

Topic 4: Improving performance.

Topic 1: Confirming Responsibilities

Land tenure is an important consideration for environmental planning and management of the region. The main land tenures across the Shire include Unallocated Crown Land, pastoral leases, and Aboriginal Lands Trust reserve with a small area of conservation estate. The Shire does not have direct responsibility for some of these land tenures. In addition, native title is held or pending over much of the Shire's Unallocated Crown Land affecting the type of management and development activities that can occur on these lands.

The Yawuru ILUA provides an example of how a Native Title agreement can lead to joint management of land, as is occurring between the Shire, Yawuru RNTBC and Department of Parks and Wildlife in the Yawuru Conservation Estate. Joint management brings with it an opportunity to jointly prepare Management Plans recognising the aspirations of both parties with the common goal of heritage, conservation and sustainability.

A key governance question for the Shire over the coming years will be the potential reallocation of service provision to remote Aboriginal communities from State and Federal government to local government. The Shire has 84 Aboriginal communities of which 78 are classified as very remote (Local Government Advisory Board, 2008). As discussed in the SOE Report, remote Aboriginal communities are likely to have a number of significant environmental management issues relating to waste management, potable drinking water, pollution, contamination of groundwater etc. If the responsibility of servicing remote Aboriginal communities is transferred to local government this would create a number of significant challenges for the Shire.

Strategic response

- Continue negotiating with State government on the handover of municipal services for Aboriginal communities. If the Shire is given responsibility for Aboriginal communities ensure environmental outcomes are considered including waste management, groundwater contamination and drinking water quality;
- Advocate to State and Federal governments on environmental issues within Aboriginal communities that are not adequately being addressed in State and Federal documents, programs, management plans and policies.
- Advocate for and support Indigenous land management outside Indigenous Protected Areas; and
- Participate in the development and implementation of management plans for areas where the Shire has joint management responsibility, such as within the Yawuru Conservation Estate.

Operational response

- Negotiate joint management arrangements for some operational matters on Aboriginal lands; and
- Where possible within existing resource capacity, support training needs of Aboriginal environmental managers (ie. Rangers) active on Aboriginal lands.

Topic 2: Creating Partnerships

The Shire recognises that it cannot deliver this EMP in isolation and will need to work with the residents, businesses, industry, community interest groups, stakeholders and all levels of government to achieve the objectives. Education and the sharing of information across the community about the EMP is an important tool in promoting a shared sense of responsibility for the management of the natural environment.

Strategic response

- Further explore opportunities for partnerships with stakeholder agencies and groups for improved policy development and to achieve more integrated environmental outcomes; and,
- Nurture partnerships with Indigenous groups and organisations for a richer understanding of country and two-way capacity building.

Operational response

- Ensure environmental management projects are shared with and discussed by the Shire's internal Strategic Initiatives Coordination Group, to improve awareness across the organisation;
- Participate in relevant stakeholder and community groups to ensure good environmental outcomes; and
- Advise environmental community groups of community sponsorship program as necessary.

Topic 3: Exerting Influence and communication

The Shire currently provides a considerable amount of information on its environmental activities through a wide range of media. Despite this freely available information, a community survey undertaken as part of this EMP's development¹², found that sections of the community wanted more information on what the Shire was doing to protect the environment, how the Shire was liaising with State and Federal governments on environmental issues and sustainable living in general. This provides an opportunity for the Shire to review its communication strategies in order to better meet the community's expectations.

Strategic response

- Undertake a strategic review of the Shire's current environmental promotional material and explore additional opportunities to better promote the Shire's environmental policy development management partnerships and activities to the community through a variety of media.

Operational response

- Continue to support established forms of communication for the community including the Shire bulletin, the Shire's website and the Shire directory;
- Improve and expand the environmental information provided on the Shire's website and directory, including sustainable living information and Local, State and Federal environmental roles and responsibilities;
- Promote and educate residents on the Shire's environmental policies including the verge policy and weed brochure; and
- Fill gaps in environmental information on the Shire's website and directory for some topics.

Topic 4: Improving performance

Effective implementation of environmental programs requires regular monitoring and review to ensure actions are being completed in a timely fashion and that program aims and objectives are being met. This SOE report is the Shire's second such report over the past 15 years. Because of the rapidly changing nature of the Broome resident and visitor population base and the very considerable threats facing the Kimberley environments, it is considered appropriate for a comprehensive environmental report of this type to be considered within each decade as a minimum.

Strategic response

- Continue to assess and report to the community on the performance of the Shire's environmental policy development and operational activities using appropriate environmental indicators and report to the community using the SOE template at intervals of 5-10 years.

Operational response

- Provide ongoing staff training on environmental matters relevant to the various operational directorates.

References:

- 1 Broome Economic Profile – Connectivity & Liveability (2014) Geographia
- 2 Shire of Broome Strategic Community Plan 2013 - 2023.
- 3 Bardi Jawi, Rubibi (Yawuru), Ngurrara, Karajarri A, Karajarri B, Nyangumarta & Nyangumarta-Karajarri Overlap (Yawinya). Still to be determined include Nyul Nyul, Djabera Djabera, Jabirr Jabirr, Goolarabooloo, Nyikina & Mangalaand Yi-Martuwarra Ngurrara claims.
- 4 Mangalagun - Crab Creek Management Plan. Roebuck Bay Working Group 2010. Pp69.
- 5 Paxon Group 2014 Submission in response to the Green Paper on Developing Northern Australia August 2014
- 6 <http://environment.gov.au/indigenous/ipa/images/ipa-map.jpg>
- 7 WAPC (2014) Kimberley Regional Planning and Infrastructure Framework. Available from: http://www.planning.wa.gov.au/dop_pub_pdf/Kimberley_RPIF_draft.pdf
- 8 Source: Broome Coastal Reserves Master Plan workshop hosted by CCS strategic & ASE - Feb 2013.
- 9 World Commission on Environment and Development (1987) Our Common Future. Report of the World Commission on Environment and Development, United Nations.
- 10 SOE reporting [Internet]. [cited 2015 Apr 25]. Available from: <http://www.environment.gov.au/topics/science-and-research/state-environment-reporting>
- 11 State of Environment WA [Internet]. [cited 2015 Apr 26]. Available from: <http://www.epa.wa.gov.au/AbouttheEPA/SOE/2007/Pages/default.aspx>
- 12 EMRC (2010) Shire of Broome Environmental Management Strategy 2010-2015. Stage 2 Report: Community and Staff Consultation. Eastern Metropolitan Regional Council, August 2010.
- 13 Deeley, D.M. and Paling, E.I.(1999) Assessing the ecological health of Estuaries in Australia. Land and Water Resources Research and Development Corporation Occasional Paper 17/99, Urban sub-program report No 10.
- 14 Dr. Paul F. J. Eagles is a Professor at the University of Waterloo in Canada.. Keynote presentation PLA Annual conference, Melbourne, 2008.
- 15 Planning for the future: Yawuru Cultural Management Plan 2011 & other discussions.
- 16 Roebuck Bay Working Group Newsletter, Dec 2013.
- 17 http://en.wikipedia.org/wiki/Broome,_Western_Australia
- 18 <http://invasives.org.au/feral-animal-control/the-cost-of-saving-the-kimberleys-wildlife/>
- 19 <http://www.perthnow.com.au/news/western-australia/cane-toad-invasion-a-kimberley-tragedy-colin-barnett/story-fnhocxo3-1226643117765>
- 20 Environment NGOs Response to the WA Government's Kimberley SCIENCE SYNTHESIS /SCIENCE AND CONSERVATION STRATEGY JUNE 2009 [Internet]. [cited 2015 Apr 25]. <http://oldsite.wilderness.org.au/files/kimberley-june-09.pdf>
- 21 CALM (2003) Bioregional Summary of the 2002 Biodiversity Audit for Western Australia [Internet]. [cited 2015 Apr 25]. Available from: http://www.dpaw.wa.gov.au/images/documents/about/science/projects/waaudit/2002_bio_summary.pdf
- 22 WA Gov (2011) Kimberley Science and Conservation Strategy Government of Western Australia [Internet]. [cited 2015 Apr 25]. Available from: http://www.dpaw.wa.gov.au/images/documents/conservation-management/kimberley/kimberley_science_conservation_strategy.pdf
- 23 Ibid.
- 24 <http://www.abc.net.au/local/stories/2010/02/22/2826830.htm>
- 25 The impact pest animals have on the different regions of the Northern Western Australia (Western Australia Department of Agriculture and Food & Meat and Livestock Australia (2011)

- 26 DOW (2012) Drinking water source protection plan. Broome town water supply. Water resource protection series. Department of Water. Report WRP 100 December 2012. [Internet]. [cited 2015 Apr 25]. Available from: <http://www.water.wa.gov.au/PublicationStore/first/104287.pdf>
- 27 Water Corporation (2015) [Internet]. [cited 2015 May 26]. <http://www.watercorporation.com.au/about-us/media/media-releases/media-release/water-supply-upgrades-continue-in-broome>
- 28 LPS6, Pt 2, Section 7.12.5
- 29 Ibid.
- 30 Government of WA 2007, State water plan, Department of Premier and Cabinet.
- 31 Gunaratne, G., Vogwill, R. and Hipsey, M. (2015) Effect of seasonal flushing on nutrient export characteristics of an urbanising, remote, ungauged coastal catchment. in prep, submitted to: Hydrological Sciences Journal.
- 32 Department of Water 2015. Personal Communication.
- 33 <http://www.watercorporation.com.au/water-supply-and-services/solutions-to-regional-water-supply/regional-water-and-wastewater-schemes/broome-wastewater-scheme-summary>
- 34 Statutory Planning in WA [Internet]. [cited 2015 Apr 25]. Available from: <http://www.piacongress.com.au/documents/item/111>
- 35 Mackay M. Which suburbs work? In: Malcolm, editor. 2001. Available from: http://www.planning.wa.gov.au/dop_pub_pdf/Whichsubshow.pdf
- 36 coda-studio.com/research/broome-housing-guide/
- 37 BCA 6 star mandated [Internet]. [cited 2015 Apr 25]. Available from: <https://www.commerce.wa.gov.au/building-commission/energy-efficiency-residential-building>.
- 38 BCA 6 star verification [Internet]. [cited 2015 Apr 25]. Available from: <https://www.commerce.wa.gov.au/sites/default/files/atoms/files/option1bcacheck-sheet.pdf>
- 39 Energy Efficiency Guidelines [Internet]. [cited 2015 Apr 25]. Available from: <http://www.horizonpower.com.au/2174.html>
- 40 Energy labelling [Internet]. [cited 2015 Apr 25]. Available from: <http://www.energyrating.gov.au/about/legislation/>
- 41 Cities, transport and greenhouse gas emissions: What does the evidence tell us? Dr Paul Mees Senior Lecturer, Transport and Planning University of Melbourne, 2008
- 42 Zero waste institute [Internet]. [cited 2015 May 26] Available from: <http://zerowasteinstitute.org>

Appendix 1 Agency stakeholders and responsibilities for aspects of natural resources management.

| Department | Summary of Environmental Role |
|--------------------------------------|--|
| State Government Agencies | |
| Department of Parks and Wildlife | <p>The Department is the lead agency for protecting and conserving the State's environment. This includes:</p> <ul style="list-style-type: none"> • managing the State's national parks, marine parks, conservation parks, State forests, timber reserves, nature reserves, marine nature reserves and marine management areas; • conserving biodiversity and protecting, managing, regulating and assessing many aspects of the use of the State's natural resources, development of environmental protection policies, managing the environmental impact assessment process and carrying out regulatory functions to achieve improved environmental outcomes; • responsibility for fire preparedness and pest animal and weed control on 89 million hectares of unallocated Crown land and unmanaged reserves; • undertaking science and research on the States flora and fauna; and • has a role in climate change policy and waste management policy. |
| Department of Environment Regulation | <p>The Department is responsible for:</p> <ul style="list-style-type: none"> • management of contaminated sites and responding to pollution incidents; and • provision of licenses for prescribed premises. |
| Department of Water | <p>The Department looks after the State's water resources. It makes decisions on the adequate and equitable provision of water throughout the State and takes into consideration all the relevant factors in achieving this balance.</p> <p>The Department is involved in measurement and allocation of the State's water resources. It sets the rules and allocation plans for the extraction of water, management of waterways and for water service providers.</p> <p>The Department is responsible for approving land use planning decisions through District, Local and Urban Water Management Strategies.</p> |

| Department | Summary of Environmental Role |
|-------------------------------------|--|
| Water Corporation | The Water Corporation is the principal supplier of water, wastewater and drainage services in Western Australia to hundreds of thousands of homes, businesses and farms, as well as providing bulk water to farms for irrigation. |
| Department of Local Government | Is responsible for promoting and fostering strong, sustainable local government. It provides leadership and advice to local governments throughout Western Australia. It also has a key role in promoting and supporting good governance in the sector, through its administration of the <i>Local Government Act 1995</i> . |
| Department of Lands | Manages the State's Crown Land and pastoral estate, and is involved in the development and revitalization of towns and communities in regional Western Australia. |
| Department of Regional Development | Is responsible for overseeing the State Government's Royalties for Regions initiative, managing key projects such as the Ord expansion and East Kimberley infrastructure project, and is responsible for regional development matters, including the State and pastoral lands functions. |
| Department of State Development | Provides leadership to drive responsible development for Western Australia's future. Works with industry, communities and government agencies to deliver significant State initiatives and facilitate major resource, industrial and infrastructure projects. It also works to attract strategic investment to Western Australia, assist the development of export markets, and enable the development of strategic industrial land and infrastructure. |
| West Australian Planning Commission | <p>The WAPC is the statutory authority with state-wide responsibilities for urban, rural and regional land use planning and land development matters.</p> <p>The WAPC operates with the support of the Department of Planning (DoP), which provides professional and technical expertise, administrative services, and resources to advise the WAPC and implement its decisions. The WAPC delegates some of its functions to officers of the department. This delegated authority includes decisions on subdivision and development applications, when they comply with the WAPC policies and practices.</p> |

| Department | Summary of Environmental Role |
|----------------------------------|---|
| Department of Health | <p>Manages the public health system to ensure healthier, longer and better lives for all Western Australians by providing the health care services that people need and delivering a safe, high quality, accountable and sustainable health system.</p> <p>Their services include:</p> <ul style="list-style-type: none"> • public hospitals and community health services; • health protection through public health services and disaster preparedness management; • mental health services including in-patient services, crisis management and community treatment and support services; • drug and alcohol information, prevention and treatment services; • dental health services including school dental health and public community dental services; and • Aboriginal health services. |
| Department of Aboriginal Affairs | <p>The Department is responsible for advising Government on the adequacy, implementation and coordination of services to Indigenous people in Western Australia. It leads policy development on key issues affecting the lives of Indigenous Western Australians and across-Government strategies to improve program planning and coordination.</p> |
| Office of Energy | <p>Provides a range of services on energy matters to the Minister for Energy, Government, the energy sector and the Western Australian community. It:</p> <ul style="list-style-type: none"> • plans, develops and implements energy policies and strategies for Western Australia; • develops and administers subsidies, rebates and grants for the Western Australian community and energy industry; • researches, analyses and advises on energy sector developments, trends and issues; • provides information and educational materials for industry and consumers; • consults and communicates with industry, consumers and other stakeholders; • monitors the performance of the Government-owned Electricity Corporations; and • contributes to the achievement of government's wider policy outcomes. |

| Department | Summary of Environmental Role |
|--------------------------------|--|
| Federal Government Agencies | |
| Department of Environment | The department is responsible for implementing the Australian Government's policies to protect our environment and heritage, and to promote a sustainable way of life. |
| National Native Title Tribunal | <p>The National Native Title Tribunal assists people to facilitate timely and effective native title outcomes.</p> <p>Set up under the <i>Native Title Act (1993)</i>, the Tribunal is a federal government agency and is part of the Attorney-General's portfolio.</p> <p>On request, the Tribunal can provide assistance and information to all people involved in the native title process. This is supported by the Tribunal's Legal, Research, Geospatial, Library and Operations Policy services.</p> |
| Other Stakeholder Agencies | |
| Yawuru Park Council | The Yawuru Park Council is responsible for the Yawuru agreements that provide for the establishment and joint management of the Yawuru Conservation Estate. The Yawuru Park Council comprises representative members from Yawuru RNTBC, Department of Parks and Wildlife and Shire of Broome. |
| Kimberley Land Council | The Kimberley Land Council Aboriginal Corporation (KLC), an association of Aboriginal people in the Kimberley region, is the Federal Government native title representative body for the Kimberley region and has statutory functions under the <i>Native Title Act (1993)</i> . In accordance with these functions, it assists Aboriginal people to obtain recognition of, and fully enjoy, their native title rights and interests. Native Title Operations of the KLC are funded primarily, but not exclusively, by the Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA). |
| Roebuck Bay Working Group | The RBWG is a not-for-profit community based group. The RBWG works with landholders, community groups, non-government organisations, scientists, conservation groups, industry and the Federal and State government to help affect change 'on-ground' to protect, restore and maintain Roebuck Bay. |

| Department | Summary of Environmental Role |
|--------------------|---|
| Environs Kimberley | <p>Environs Kimberley (EK) is an independent and local community environmental organisation in Broome dedicated to protecting the nature and culture of the Kimberley Region. EK work both as advocates on a wide range of significant issues as well as programs focused on natural resource management and community education.</p> |

Appendix 2 Relevant legislation

| Legislation | Summary |
|---|--|
| State Government Legislation | |
| Environmental Protection Act 1986 | <p>This Act is the key legislation for environmental management in the State and is the main method of considering the environmental impacts of major developments. The Act:</p> <ul style="list-style-type: none"> • establishes the Environmental Protection Authority and its governance arrangements; • allows for the development of environmental protection policies; • outlines the environmental impact assessment process including referral and assessment of proposals; • establishes the State's environmental regulations including pollution and environmental harm offences, clearing of native vegetation, and prescribed premises, works approvals and licences; and • provides for enforcement of regulations including legal proceedings. |
| Wildlife Conservation Act 1950 | <p>Provides for the conservation and protection of all native flora and fauna. Under the Act, individual species of plants and animals are protected, with the level of protection varying depending on whether the species is rare or endangered. Flora and fauna that needs special protection because they are under identifiable threat of extinction, are rare, or otherwise in need of special protection are placed on the threatened species list.</p> |
| Conservation and Land Management Act 1984 | <p>The Act establishes a comprehensive set of legislative provisions dealing with state conservation and land management matters. It also provides for the vesting or reservation of land, particularly State forest or timber reserve, and the ability to enter into agreements with private landholders.</p> |
| Contaminated Sites Act 2003 | <p>Imposes significant responsibilities on parties causing contamination and on owners of contaminated land. Land owners, occupiers and polluters are required to report known or suspected contaminated sites to the Department of Environment Regulation (DER). Reported sites are then classified, in consultation with the Department of Health, based on the risks posed to the community and the environment and responsibility for clean-up is allocated.</p> |

| Legislation | Summary |
|---|--|
| Health Act 1911 | <p>This is the primary Act dealing with all matters relating to public health, including waste management, sanitary provisions, pest controls and environmental health and defines local government responsibilities.</p> <p>Note: a new Public Health Act is being developed for Western Australia to better protect and promote public health as well as prevent illness and injury.</p> |
| Biosecurity and Agriculture Management Act 2007 | <p>Under the BAM Act, organisms are grouped into four main classifications - Declared pests; Permitted; Prohibited; and Permitted Requiring a permit. All declared pests are placed in one of three categories, namely C1 namely C1 (exclusion), C2 (eradication) or C3 (management).</p> <p>The Western Australian Organism List (WAOL) has been created to easily find out the declared status of Organisms that have now been classified as part of the enactment of the BAM Act.</p> |
| Waste Avoidance and Resource Recovery Act 2007 | <p>The Act established the Waste Authority and required it to develop a long term Waste Strategy for Western Australia. The primary objective of the Act is to contribute to sustainability, and to protect human health and the environment. It is also designed to help Western Australia to move towards a waste-free society by:</p> <ul style="list-style-type: none"> • Promoting the most efficient use of resources, including resource recovery and waste avoidance; • Reducing environmental harm, including pollution through waste; • Considering resource management through avoidance of unnecessary resource consumption and disposal; and • Resource recovery which includes reuse, reprocessing, recycling and energy recovery. |
| Planning and Development Act 2005 | <p>This Act provides the basis for local governments to develop and amend their local planning frameworks through the adoption of local planning strategies and local planning schemes. It enables the State to adopt State Planning Policies which have effect across Western Australia and guide decision making on planning matters, including those relating to the environment. It also sets out the process for subdividing land, appealing planning decisions and undertaking enforcement action.</p> |
| Litter Act 1979 | <p>This Act establishes the Keep Australia Beautiful Council (WA) and makes provision for the abatement of litter. It establishes penalties for various forms of littering and set out the process for authorisation of officers to undertake enforcement action.</p> |

| Legislation | Summary |
|---|---|
| Federal Government Legislation | |
| Environment Protection and Biodiversity Conservation Act 1999 | <p>Provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places. The Australian Government Department of the Environment, Water, Heritage and the Arts administers the Act. The objectives of the Act are to:</p> <ul style="list-style-type: none"> • provide for the protection of the environment, especially matters of national environmental significance • conserve Australian biodiversity; • provide a streamlined national environmental assessment and approvals process; • enhance the protection and management of important natural and cultural places; • control the international movement of plants and animals (wildlife), wildlife specimens and products made or derived from wildlife; and • promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources. |
| Native Title Act 1993 | <p>The Act was enacted as a result of the decision made by the High Court of Australia in <i>Mabo v Queensland (No.2)</i> 1992. It:</p> <ul style="list-style-type: none"> • recognises and protects native title; • provides that native title cannot be extinguished contrary to the Act; • provides for the making of Indigenous Land Use Agreements (ILUAs); • validates any past grants of freehold or leasehold interests that were thrown into doubt by the Mabo decision; and • creates a National Native Title Tribunal to administer claims to land by Aboriginal people. |



Shire of Broome

Phone: (08) 9191 3456

Email: shire@broome.wa.gov.au

Web: www.broome.wa.gov.au