Tooway Lake – Caloundra Bar Coastal Management Plan

CALOUNDRA CITY

June. 2000

CALOUNDRA COASTAL MANGEMENT PLAN

TOOWAY LAKE TO CALOUNDRA BAR

(final draft)

June 2000

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> "
>
> The coastal zone has a special place in the lives of Australians. Most Australians want to live or take their holidays there.
>
> It is a priceless national asset.
>
> There *is* a risk of the coast being loved to death. Conservation of the coastal environment, including its biodiversity, is a central purpose of this Policy.
>
> "

Extracts from Living on the Coast
The Commonwealth Coastal Policy 1995.

EXECUTIVE SUMMARY

Caloundra City Council has initiated a series of management plans for its coastal areas. This study covers the area from Tooway Lake to Caloundra Bar.

This Plan is meant to

- Assess the environmental values of this part of the coast;
- Provide a strategic framework for present and future planning and management decisions;
- Recommend specific actions and priorities.

The study area is very diverse, consisting of partially sheltered bays, headlands and associated rocky shores and platforms, wide surf beaches and stretches of calmer water. The headlands, bays and sandy surf beaches provide strong landscape contrasts within a confined area, and establish a setting of coastal diversity not replicated anywhere else in the City.

The study area offers :

- A close location to the City commercial centre;
- Diversity in landscape formations;
- A range of recreation settings – from high use and developed to quieter, more 'natural' areas;
- Strong linear linkages which connect the series of beaches and headlands, and
- Natural values and ecosystems rare in south east Queensland which are in good condition.

Consultation

A number of residents with an ongoing involvement and interest in the coastal strip were contacted for their input representing groups such as the Wildlife Preservation Society of Queensland (Jill Chamberlin), and the Queensland Wader Study Group (Barbara Dixon, Jill Dening). This is an important information source regarding coastal wildlife and community efforts in the area.

A newsletter was also developed with an attached comment sheet and distributed among nearby residents. The results from the 86 responses are as follows:

Issue	Times mentioned
Appreciation of natural values, natural beauty and ambience of the area	49
Coastal paths favourable = 24 not favourable = 10	34
No high rise or excessive development	32
George Watson Park favourable = 6 not favourable = 11	17
Facilities (taps, bins, shade, lighting, tables)	14
Views, view enhancement	13
Weeds, rehabilitation, rubbish dumping	13
Tooway Lake – clean up	12
Kings Beach improvements	8
Dogs (mostly anti dog)	9
Safety (lights, rail on headland)	7
Coastal erosion	7
Public access (stairs to beach, Moffat headland)	5
Consultation (appreciative of this effort)	5
More interpretative information	3

There is a clear preference from these responses for a relatively 'natural' coastline with an absence of excessive or high rise development.

Environmental Values

An important finding of the study centred on the significant natural values of the Shelly Beach and Caloundra Headland area. I summary, this area supports features significant at the national, State and regional scale due to :

- Habitat for migratory shorebirds protected under international treaties along the rocky shore at Caloundra headland, and also on the sandbars in Pumicestone Passage near Caloundra Bar (just outside study area boundary). Species include the Sooty Oystercatcher, Wandering Tattler, Crested Tern, Ruddy Turnstone. Many of these species are uncommon in south east Queensland, with the Sooty Oystercatcher listed as Rare under the Nature Conservation Act 1992.
- Nesting areas for marine turtles which are also protected by international treaties. Both Loggerhead turtles (listed as Endangered under State and Federal legislation) and Green turtles nest along Shelly Beach during the summer months.
- One of the most diverse and distinctive marine ecosystems along the rocky shoreline edging Caloundra headland. The richness and diversity of species in the intertidal and subtidal zone along the platform fringes suggest a regional significance
- Three unusual and rare species located on the rocky shoreline. They include the Caloundra Abalone not known outside this site *(Haliotis melculus)*; a limpet restricted to south-east Queensland *(Cellana turbator)*, and a species of clam listed as Endangered in the International Union for the Conservation of Nature Red Book *(Tridacna sp.)*.
- Unusual headland vegetation which has some historic significance, being the site for early collections of plant species by botanists. This vegetation community is naturally very restricted in south-east Queensland.
- The dynamic nature of the shoreline along this area combined with uncertainties created by climatic change mean decisions should be cautious and conservative along the coastline.

The above suggests a cluster of significant environmental values along Shelly Beach and the base of the Caloundra Headland areas. This, together with sites of cultural significance and the high visual amenity which characterises the coastline provides the basis for the management plan.

Management Units

Six management units were identified along the coast, corresponding to distinctive changes in the physical landscape. They are:

Happy Valley
Kings Beach
Caloundra Headland
Shelly Beach
Moffat Headland
Moffat Beach.

Management objectives and issues were identified for each management unit, with a series of recommended actions also included. The management objectives provide the overall framework for future management, whilst the actions address existing issues and needs.

A collated set of prioritised actions forms the action and implementation plan. A number of key strategies which have wider implications for Council coastal programs can be identified from this more detailed action plan. They include :

a) **Weed Management Rehabilitation**

Weed invasion along the coastal strip is a major management issue for Council. It can consume considerable resources. Weed management has been targeted toward the following areas;

- those where weed invasion is restricted to confined areas of a manageable size (eg the coastal strip from Margaret St to the pool);
- areas where native canopy or understorey exists, and so have the basic elements to assist rehabilitation (eg near the boat ramp at the base of Caloundra headland);
- sites which have a strong visual profile, and where there is community return for the investment in rehabilitation (eg headland walk bridge near Russell St), and
- areas of some environmental sensitivity (eg Caloundra headland).

Some of the weed management is best undertaken by contractors, particularly where there are safety or liability issues, the handling of chemicals or need for specialised equipment.

Weed management is best seen as a three year program, tackled as a 'mosaic' of weed management sites along the coast so that efforts are visible along a broad area. Small, manageable areas are best tackled to give realistic results.

b) **Interpretation and Education**

This is a fundamental action area which has both strategic and site based elements. Interpretation has a role in education, encouraging appropriate behaviour and appreciation of the site and its values.

Interpretation needs to avoid the 'do and don't' approach in favour of well designed, interesting and varied presentation which readily involves the visitor and attracts their interest.

Well designed interpretation is not inexpensive, but it is a long term investment in the area's use and value, and also has direct links to the quality of the tourist experience.

State agencies offer expertise and assistance with developing these products, in particular the Queensland Museum, and QP&WS (Cleveland office – Shorebirds Education Strategy).

c) **Headland Walk**

The headland walk is essentially a path through a series of different coastal landscapes and settings – many of which are not headlands. It is most likely to be experienced in stages.

The walk would benefit from unifying themes, furnishings, symbols, icons and interpretation. Co-ordinated signage and 'icons' would assist the walk profile and presentation.

d) **Water Quality**

Water quality monitoring results for Tooway Lake indicate variable results, with key indicators for primary and secondary contact often being exceeded. Clearly these are related to rainfall events.

Water quality monitoring for the Kings Beach stormwater outlet undertaken by the EPA also shows primary contact being exceeded on some occasions (though not regularly).

This raises issues of :

- Council's legal liability with people swimming in water which would not meet primary contact standards on many occasions during the peak swimming season,
- Unsightly stormwater drains discharging onto beaches, which pose a health and safety risk, which do not reflect recommended best practice to finding alternatives to the release of stormwater across beaches or foreshores (DNR 1998).

The issue of stormwater and water quality is a major strategic program for Council. The directions outlined in the draft Urban Stormwater Management Strategy reflect this. It is suggested that given the profile and recreational use of coastal areas, these sites should be given priority in this Strategy.

e) Resident / environment Interface

Many of the coastal sites are linear and surrounded by development. Successful management of these sites must manage people, their access and use of the area. Evidence across a number of sites indicates problems with access, weed escapees from gardens, vegetation clearing, lopping and rubbish dumping.

Education material and information is needed to address a number of issues to encourage greater stewardship by residents for their local environment. Suggestions could include:

- a series of newspaper articles on local coastal environments, highlighting their various values;
- posters or information sheets (with sketches) on weed species, suitable plants;
- co-ordinated information pamphlets on the values of coastal sites (perhaps as part of a Caloundra natural heritage series) and distributed to local residents.

f) Community Involvement

There are relatively few community groups involved with the coastal environment. Specific projects arising from this study could include:

- catchment planning for Tooway Creek catchment;
- turtle action group (monitoring nests, removing eggs from unsuitable nesting sites);
- dune and remnant management (Shelly Beach, George Watson Park);
- maintenance of Caloundra headland;
- public dissemination of results (eg local papers)from current monitoring and counting of shorebirds;
- community art/sculpture display at Moffat Beach.

All community groups need encouragement and tangible assistance, with Council's community grant program playing an important role. Co-ordination and assistance to community groups is often an important program for Councils.

g) Responsibility within Council

Coastal zones are multi-purpose, and involve engineering, ecological, community, planning and recreation issues. Such diversity can result in issues such as community involvement, interpretation, education and weed management not having clear ownership by a particular section within Council. This can result in inaction and promotes a reactive, rather than proactive program.

All actions and action areas identified in this plan need to have clear and

agreed areas of responsibility.

Ownership vested in one area of Council, or the absence of clear, over-arching responsibility is a structure often leading to piecemeal solutions.

An outcome of internal ownership should be the integration of the three coastal management plans as well as supporting plans into a holistic and unified strategic direction for coastal management in Caloundra.

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FIGURES

1.0 INTRODUCING THE COASTLINE

The Queensland coastline has been formed over the past 6000 years, during a period of constant sea level, although dune and sand deposits have been formed over a much longer period.

The forces and processes acting to form the coastline include winds, currents, tidal flows, waves and freshwater flows.

Of the types of coastline in Queensland, 296 km consists of rocky shores, 2664 km of sand, 74 km of mud and 1406 km of mud/mangrove. Clearly rocky shores constitute a minor and specialised element of our coastline.

The study area is very diverse, consisting of partially sheltered bays, headlands and associated rocky shores and platforms, wide surf beaches and stretches of calmer water.

The headlands, bays and sandy surf beaches provide strong landscape contrasts within a confined area, and establish a setting of coastal diversity not replicated anywhere else in the City.

The study area offers :

- A close location to the City commercial centre;
- Diversity in landscape formations;
- A range of recreation settings – from high use and developed to quieter, more 'natural' areas;
- Strong linear linkages which connect the series of beaches and headlands, and
- Natural values and ecosystems rare in south east Queensland which are in good condition.

This combination of features coupled with increasing recreation demand from local and regional visitors suggests the area requires both careful management and strategic planning decisions to protect existing values and amenity, and to ensure a sustainable balance between the natural values and recreation access, use and impacts into the future.

2.0 PROJECT BACKGROUND

2.1 Why This Study ?

The Queensland coastline supports around 85% of its population. Coastal areas are a complexity of values and resources, which in turn support a diversity of uses. The Sunshine Coast experienced the most rapid population growth of all coastal areas in Queensland during the period 1991-6 (SoE p.5.12). This rapid growth and the consequential change to a more developed landscape produces substantial and widespread pressures upon the coastal environment.

Caloundra reflects the more general development pattern of the Sunshine Coast, with increasing residential development and recreational pressure on its coast originating from both local and sub-regional catchments. The pace and extent of such development strongly suggests that if coastal areas are not being actively managed, they are being mismanaged.

Caloundra Council has developed a number of plans which impact upon this coastline. Some are site specific, some have a single issue focus, and others are at a scale unsuitable for effective planning of the study area. The completion of the Caloundra Coastline – the Northern Coastal Management and Protection Plan, and the formation of the Deception Bay/Caloundra Bar Coastal Management Plan meant that the study area previously formed a gap in coastal planning for the Caloundra coast.

Given the increasing pressure on coastal areas, the expectation to manage these areas sustainably, and the diversity of existing plans and information, the aim of this study was to provide:

1. An assessment of the environmental assets and values of the area;

2. An integrated and holistic view for managing this part of the coastline by analysing a range of environmental issues, and

3. Strategic management directions and recommended actions.

It is therefore not a detailed operational program, but rather sets a management direction and a strategic overview from which more detailed operational plans and decisions can be made. It will establish an overall rationale for the area's management, so that future management and operational decisions will be consistent and reflect the objectives and framework.

It is important to establish the area's ecological and environmental values to provide a fundamental information layer which will lay the framework for subsequent decisions and management.

Consequently, the physical structure and character of the area and the habitat it supports are critical elements of the study. However, in an area which is currently experiencing intensive and increasing use from recreation and residential growth, assessing the physical environmental in isolation would be inappropriate. Clearly, accommodating human appreciation and use needs to be recognised and included in a sustainable management strategy for the future.

2.2 Study Area

The study is limited to the foreshore and associated parkland areas within the coastal strip from Tooway Lake in the north to Caloundra Bar in the south. The coastal strip includes the inter-tidal zone, although it focuses upon areas above Highest Astronomic Tide (HAT). The study area is illustrated in Figure 1.

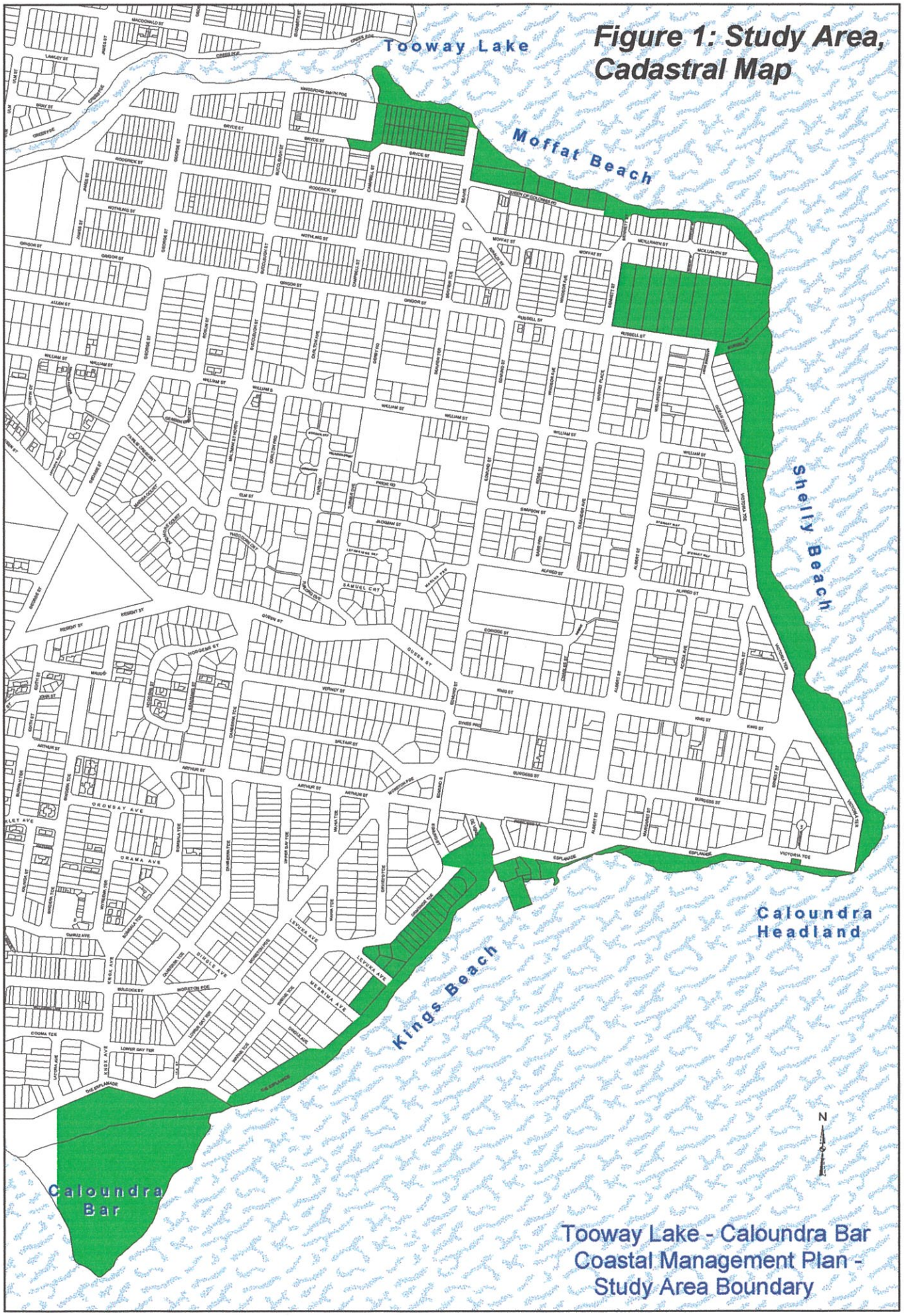
Figure 1: Study Area, Cadastral Map
Tooway Lake
Moffat Beach
Shelly Beach
Caloundra Headland
Kings Beach
Caloundra Bar
N
Tooway Lake - Caloundra Bar
Coastal Management Plan -
Study Area Boundary

It should be noted that although Council's jurisdiction ends at the inter-tidal zone, this area has been included in the study for its importance in the overall management of coastal areas.

2.3 Methodology

Heavy reliance was placed upon collating existing technical and environmental studies which provide a solid information basis for evaluating the area's values and issues. A number of specialists (refer to table in 2.4) were also contacted to provide additional information, or to clarify more general recommendations in reports.

Previous studies were supplemented with detailed site inspections, which were conducted on a number of occasions for environmental assessments, identification and prioritisation of management issues as well as a weeds and rehabilitation assessment.

The study developed in a series of stages:

Stage 1	• Information collection, collation, review • Follow up contact with specialists
Stage 2	• Initial workshop with Council officers from a range of sections for views, input and comment
Stage 3	• Contact with community groups with an interest in the area • Community newsletter and feedback sheet to local residents
Stage 4	• Fieldwork
Stage 5	• Report development • Council workshop and comments on draft report
Stage 6	• Final draft report produced.

2.4 Consultation

Consultation for the project occurred through two avenues:

(a) a newsletter (refer Appendix C) outlining the project and seeking comments from nearby residents on coastal management issues and their views on the future management direction for the coastal strip; and

(b) a selection of local residents as well as experts from further afield were contacted and interviewed for information regarding the coastline and its management. A list is provided below, with thanks to all participants for their input and interest.

Name	Organisation, or Group
Community	
Jill Chamberlain	Wildlife Preservation Society of Queensland
Jill Dening	Queensland Wader Study Group
Barbara Dickson	Queensland Wader Study Group
Erica Riis	Wildlife Preservation Society of Queensland
Government Agency	
Mark Allen	Coastal Management Branch, EPA
Ian Smith	Policy Officer, Environmental Protection Agency
Stephen Storer	Coastal Management Branch, EPA
Council	
Kathy Burnett	Project Manager
Michael McNamara	River Watch (Maroochy Council)
Specialist Expertise	
Dr Mike Olsen	Botanist
George Batianoff	Botanist, Queensland Herbarium
Dr Darren Richardson	Ecologist WBM Oceanics
Peter Driscoll	Queensland Wader Study Group
Dr Greg Skilleter	Zoologist, University of Queensland
Dr Colin Limpus	Environmental Protection Agency
Peter Davie	Queensland Museum

(c) A community consultation program was undertaken with a display of the Draft Coastal Management Plan in Council's Customer Service Counter for a period of 3 weeks.

Comments were invited from the community and were forwarded to the consultant for consideration into the management plan. Community members specifically involved in the provision of comments and data (i.e. those listed in section 2.4) were provided with a copy of the draft plan for review purposes. Community members who had responded to the previous letterbox drop were specifically invited (via written correspondence) to review the document and forward any comments. Comments received from these individuals were forwarded to the consultant for consideration into the final plan.

2.4.1 Community Consultation Responses and Implications

Of the 1200 newsletters sent, 86 responses were received; around a 7% response rate.
The responses from the 86 local residents contained some striking features:

i) A wide diversity of issues were mentioned, ranging from paths, weeds and views to picnic facilities, erosion and dogs.

ii) The most frequent and consistent response was the strong appreciation of the coast's natural beauty, natural or unspoilt features and the 'natural' ambience of the beaches, parks and headlands.

iii) The second most frequent issue mentioned was objections to high rise development encroaching on the beach and coastal values, and degrading the current natural, open space feel of these areas. A parallel issue was the negative response to intensive development, resulting in overcrowding and increased congestion along the coastal strip.

iv) Paths, and more specifically the recently constructed headland path were frequently mentioned, with the overall response being favourable (24 out of 34 path responses).

v) Those with negative comments about the path usually referred to its placement across the dunes on Shelly Beach (damage to the dunal system and lack of consultation), or the concern over a concrete path encouraging the noise and activity from skateboards, rollerblades in essentially residential areas.

vi) George Watson Park also attracted many comments (16 out of 175 specific comments). It was the fourth most frequently mentioned issue. Most responses (11 out of 16) were negative, with many seeing it as an untidy and unwanted piece of scrubby bush with no value and an eyesore. Some respondents preferred to see unit development in its place (good commercial land going to waste), although many wanted a planted and maintained 'park' which would encourage picnicking and children playing.

Positive responses about the park included the value to bird life, and the appreciation of an area of natural vegetation.

vii) Views, especially the enhancement of current views by providing more seating at popular viewing spots, and lopping vegetation which screened views was also a frequent response. Clearly residents value the ocean and coastal landscape, and seek additional opportunities to appreciate them.

viii) The sixth most frequent response concerned 'facilities' including the provision of taps and showers, additional rubbish bins, shade, lighting, tables and BBQ's. Generally the residents use and appreciate existing facilities.

ix) Weeds, rehabilitation and dumping of rubbish was the 7th most frequently mentioned issue. Many felt strongly about the need for rehabilitation of many areas along the coast (dunes, headlands) and were dismayed by the dumping of garden and other rubbish as well as general weed invasion along the coast.

x) The 8th most frequently mentioned issue was the water quality of Tooway Lake, and the need to ensure it is clear and safe for swimming.

A summary table of all issues mentioned follows.

Table 1 Community Responses Summary

Issue	Times mentioned
Appreciation of natural values, natural beauty and ambience of the area	49
Coastal paths favourable = 24 not favourable = 10	34
No high rise or excessive development	32
George Watson Park favourable = 6 not favourable = 11	17
Facilities (taps, bins, shade, lighting, tables)	14
Views, view enhancement	13
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Tooway Lake – clean up	12
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Dogs (mostly anti dog)	9
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Consultation (appreciative of this effort)	5
More interpretative information	3

2.4.2 Consultation Implications

- The two key themes which emerge strongly and consistently are preservation of the natural beauty and values of the area (expressed in views, clean beaches, attractive parks, vegetated dune areas, pleasant and peaceful ambience) and the absence of 'excessive' development. This was usually mentioned by reference to 'no high rise, development located back at some distance from the coastal strip, no intensive development, not another Gold Coast". Assuming these sentiments are also widely held in the community, it suggests a clear direction for future planning of the coast for the preservation and management of its environmental, visual and landscape values.

- Facilities such as the headland path are generally welcomed, although its location in sensitive areas (eg dunes, Moffat headland) needs consultation and additional attention to design.

- The community feel of Moffat and Shelly beaches were contrasted by a number of respondents to the high–rise, tourist and commercial character of many other beaches. These comments wished to retain this community scale and ambience.

- George Watson Park evoked a strong negative response, possibly due to a lack of awareness of its values. This suggests people are more tuned to appreciate managed and cultivated parklands in this coastal setting rather than remnant vegetation. Aims for the Park would be to increase interpretation both internally and externally from viewspots (eg Moffat headland) as well as creating a more 'cared for' feel of the Park. Entry statements, signage, attention to rubbish would assist in improving the visual impact of this park.

- Although only 5 out of 86 respondents specifically congratulated Council on this consultation effort, the fact they did so suggests further initiatives like this are appreciated by the local community. Many responses were detailed and reflect a community that strongly identifies with, and wishes to protect their local coastal area.

3. THE EXISTING MANAGEMENT CONTEXT

This management plan sits within a hierarchy of other plans, policies and legislation at all levels of government which may directly affect its management priorities and implementation.

This chapter provides a brief summary of these, as well as indicating their implications for the plan.

3.1 Queensland and SEQ Coastal Management Plans

Their preparation under the Coastal Protection and Management Act (1997) will provide specific implementation tools for the coastal areas across the State and within South east Queensland.

The State coastal plan is expected to be released around April 2000, although a position paper is currently available. This document sets out 27 principles for the protection and management of Queensland's coastline. Although the current study is not for statutory purposes under the Act and it is confined to a relatively small area, key principles of coastal management still apply, and are relevant to this report. As these principles will also form the basis for the State and regional plans, it is appropriate that they are included here for consistency.

They are listed below, with their significance for this study indicated by the relevant symbols.

Table 2 Relevance of State Coastal Principles

Coastal Management Principal	Relevance to this study
Conserving Nature	
1. Biological diversity of marine, freshwater and terrestrial ecosystems and the ecological processes essential for their continued existence should be protected.	●
2. Further loss or degradation of native vegetation on the coast should be avoided	●
3. Further loss or degradation of coastal wetlands should be avoided	○
4. Further loss of coastal habitats, particularly habitats of protected wildlife and migratory species should be avoided.	●
5. Rehabilitation opportunities should be taken when evaluating management options	●
Physical Coastal Processes	
6. Coastal buffer zone protected from development	◎
7. Physical coastal processes should be allowed to occur naturally	●
8. Risks from storm and extreme events minimised.	◎
Water Quality	
9. Release of pollutants and contaminants reduced to levels that can be assimilated without degradation	●
10. Coastal catchments managed so changes in runoff does not impact on water quality	●
11. Disturbance of acid sulphate soils to avoid adverse impacts on water quality	○
Cultural Heritage	
12. Significant cultural heritage values and features to be conserved and/or rehabilitated	●
13. Significant indigenous values and resources be conserved.	◎
Coastal Landscapes	
14. Protect and manage coastal cultural and scenic values, and rehabilitate degraded landscapes	●
Human Use	
15. Finite and often scarce coastal resources managed for the welfare of current and future generations	◎
16. Interdependence of coastal resources recognised in decisions	●
17. The precautionary principle should apply to coastal resource decisions	●
18. Cumulative impacts taken into account in coastal resource planning	●
19. Human use to maintain biodiversity	●
Public Access	
20. Public common right of access retained & enhanced	●
21. Access managed to protect coastal values and public safety	●
22. Vehicular access provided to, not along the coast	◎
23. Impacts from access infrastructure minimised.	◎
Management and Administration	
24. Planning decisions by government agencies reflect the goals & principles of the State plan	○
25. All levels of government and community participate in coastal planning	◎
26. State coastal land managed in an ecologically sustainable manner	●
Research and Information	
27. Relevant research and information should enhance coastal management	●
28. Systematic and co-ordinated monitoring.	◎

● highly relevant and significant to this study
◎ somewhat relevant to this study ○ not relevant to this study

Implications for the Caloundra coast

The conservation and sustainable use of features and values such as the rocky headland, the presence of migratory species, coastal remnant vegetation and coastal processes are all tangible examples of State-wide principles for Caloundra.

Continuing public access and use of coastal areas is also highly relevant.

3.2 Environment Protection and Biodiversity Conservation Act (1999)

This recent Federal legislation defines the interest of the Federal government in environmental matters, as well as seeking to protect significant biodiversity. It potentially broadens the reach of Commonwealth responsibility for environmental protection and biological conservation, based on translating Commonwealth international commitments and obligations to all development activities. It defines matters of 'national environmental significance' which would trigger the application of the Act, particularly for assessing and managing the impacts of development.

Relevant criteria for this management plan for identifying 'national environmental significance' are

- a migratory species protected under an international agreement, and
- listed threatened species or communities.

Implications for Caloundra coast

1. *Some of the migratory shorebirds which use the rocky headland for roosting and foraging and the adjacent coastline as general wader habitat are protected by international agreements JAMBA and CAMBA (section 4.1). However, the sites are not extensive, and are not one of the more significant roost sites in Moreton Bay. It is therefore unlikely that this Act would be triggered for the study area, although the highlighting the conservation of these species at the federal level should stimulate awareness and conservation effort locally.*

2. *Marine turtles are listed under the Threatened Species Management Act, and so are likely to be a 'listed threatened species' under this new legislation. Loggerhead turtles are listed as 'Endangered'. Therefore, there is a federal interest in conservation of these species and their habitat, and controls on actions which are likely to have a 'significant impact' on this species. Shelly Beach (refer Section 4.2) as a nesting ground for this species is likely to be relevant to this criteria. However, Shelly Beach is not recognised as a critical nesting site for turtles compared with other sites in Queensland.*

3.3 Moreton Bay Marine Park

The Marine Park was declared in 1993 under the Marine Parks Act (1982) with a zoning plan identifying areas for specific protection and management legislated in 1997.

Part of the study area lies within the Marine Park, including the area of Happy Valley and Kings Beach to the Caloundra headland. This area is designated a 'Habitat Zone' which permits most recreation and fishing activities, including trawling and motorised watercraft.

Implications for Caloundra Coast

1. *People, pets, vehicles or watercraft must not cause undue disturbance to shorebirds in any part of the Marine Park.*

2. *Collection of bait is restricted to bag limits for worms, pipis or yabbies. Otherwise, few restrictions apply.*

3. *Kings Beach and Happy Valley are located immediately north of a more restrictive area – the Conservation Park zone along Pumicestone Passage. There is the potential for activities originating around the Kings Beach area to impact on this sensitive area, which also includes shorebird roost sites of major significance (around Caloundra Bar).*

3.4 International Agreements

Australia is signatory to a number of agreements aimed at migratory species which need suitable habitat across a range of countries. Thus, the continued existence of these species needs international co-operation and agreements.

Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA)

- Under these agreements, the governments of Australia, Japan and China have agreed to preserve and enhance the habitats used by migratory birds listed in the agreements, engage in joint research programs and share information.

Convention of the Conservation of Migratory Species of Wild Animals (the Bonn Convention)

- Migratory shorebirds and marine turtles are listed as species subject to the agreement.

Asia-Pacific Migratory Waterbird Conservation Strategy 1996-2000

- This Agreement encourages greater multilateral co-operation to promote the conservation of migratory waterbirds in the Asia-Pacific region. A number of strategy objectives relate to habitat management, training, information exchange, establishment of networks of significant wetland sites and development of action plans for priority species.

Implications for the Caloundra Coast

Refer to Section 3.2.

3.5 Council Plans

The Caloundra coast has been the subject of numerous Council plans and strategies over the past few years. They are listed below, with a comment as to the relevance or implications for this study.

Overview of Key Plans, Legislation

FEDERAL →

- Environmental Protection and Biodiversity Conservation Act
- Oceans Policy
- National Strategy for the Conservation of Biological Diversity
- National Strategy for Ecological Sustainable Development

STATE →

- Integrated Planning Act
- Coastal Protection and Management Act
  - State Coastal Plan
  - SEQ Coastal Plan

LOCAL →

- Planning Scheme
  - Strategic Plan
  - DCP's, LAP's for Kings Beach
- Urban Stormwater Management Strategy

SPECIFIC LOCAL PLANS →

- Urban Stormwater Management Strategy
- Moffat Beach Master Plan
- Kings Beach DCP Draft
- Tooway Lake Water Quality Management Plan
- Kings Beach Master Plan
- Northern Caloundra Coastal Management Plan
- Urban Stormwater Management Strategy
- Deception Bay-Caloundra Bar Management Plan
- Cultural Landscape Study
- Coastal Management Plan – Commercial Opportunities
- Open Space Plan

Table 3 Relevant Council Plans and Strategies

Plan, Strategy	Comment
Kings Beach Master Plan 1998	Draft only at present. Presents detailed plans for redevelopment and landscaping of the Kings Beach precinct. Will alter access, landscaping, park facilities. As this plan represents detailed planning for this site, this study recognises that some issues (visual amenity, recreation use, access) will be defined by this study.
Cultural Landscape Study 1995	Identifies sites of cultural significance (both European and Indigenous) which have been included in the present study.
Kings Beach Development Control Plan 1999 Draft	Identifies and maps the future direction and vision for Kings Beach precinct. • States that "areas important for nature conservation, wildlife habitat or coastal processes are to be protected." • Retains the foreshore as 'environment, open space & community facilities' precinct • Headland areas re-inforce current land use of low density residential and tourist accommodation, indicating a continuing and increasing recreational demand within coastal areas.
Caloundra Open Space Plan 1998	A City-wide assessment of existing open space, predicted future demand, and likely open space requirements. The importance of foreshores noted in the plan.
Caloundra Coastal Management Plan – Commercial Opportunities	Assesses existing commercial operations along the coastline and recommends future directions. • Recommends café/kiosk at Shelly Beach • Headland walk to offer small commercial nodes along the route • Kings Beach a major commercial node.
Draft Urban Stormwater Management Strategy	Seeks to include social and ecological issues into drainage. This includes pollution and nutrient control, and protection of biodiversity processes
Northern Caloundra Coastal Protection and Management Plan 1998	A plan for managing the coastal dune complexes between Tooway Lake north to Port Cartwright.
Southern Coastal Management Plan (Deception Bay to Caloundra Bar)	In preparation. • Addresses in more detail issues connected with the Caloundra Bar and Pumicestone Passage.
Moffat Beach Master Plan	A detailed plan for operational works on this beach area.
Headland Walkway Plan	In preparation. Maps the route of the coastal walkway from Kings Beach to Moffat Beach.
Watson Park Management Plan 1995	A detailed management plan for this coastal bushland remnant. An assessment of focus on vegetation values, weed management and rehabilitation.

Clearly the above list indicates intensive and detailed work on the management of recreation and open space in general, and the coastal strip in particular.

There is a need to co-ordinate the findings of these reports to achieve a consistent and integrated approach to coastline management. Some of the recommendations from these reports could be influenced by the findings of this study, and include input for:

- More detailed guidelines for code assessment of applications in the Kings Beach Open Space strip;
- A review of commercial activities operations in certain locations (eg Shelly Beach);
- Priorities and strategic directions for the Southern Coastal Management Plan.

The potential issue with the presence of numerous plans and the incremental, piecemeal approach to coastal planning and management is that a coherent vision and management direction for the coast is frequently absent.

Each area develops it own priorities and actions in isolation from the 'big picture'. The intense interest and pressure on the Caloundra coastline is such that a more holistic and integrated plan is needed, so that the role of the various coastal areas and their diverse character (headlands, beaches, parks, open space) fit into the Caloundra coastal framework.

Therefore, although this plan attempts to develop an integrated management vision and direction, it only does so for values, features and issues within its boundaries.

It is recommended that once this study and southern coastal plans are completed, all findings and information should be integrated into a consistent coastal management plan for the whole Caloundra coast to include environmental, social and economic values.

4.0 ECOLOGICAL VALUES

4.1 Fauna

4.1.1 Migratory Shorebirds

Sightings
A number of shorebirds that migrate annually between the northern hemisphere and Australia are found on the rocky platforms at the base of Caloundra headland – particularly the area between Shelly Beach and the ANZAC memorial.

These birds are protected by Australian legislation (Environmental Protection and Biodiversity Conservation Act), international treaties (refer section 3.4) and some species by Queensland legislation (Moreton Bay Marine Park and the Nature Conservation (Wildlife) Regulation.

Shorebird species that have been sighted in the study area include:

Species	Comment
Wandering Tattler	Only odd ones sighted, and infrequently.
Ruddy Turnstone	As above
Sooty Oystercatchers	Seven birds sighted most days since September 1999
Crested Terns	Large numbers roost
Little Terns	Large numbers roost in sandbanks adjacent to Caloundra Bar and are vulnerable to disturbance.
Eastern Curlew	Feed on the Caloundra Bar. The feeding areas are part of the Ramsar listed wetlands of Pumicestone Passage.

* the above observations made by Mrs Barbara Dickson during bird counts conducted for the Queensland Wader Study Group since September 1999. Information for the last two species supplied by Jill Chamberlain.

Other notable bird species include a pair of Ospreys, Brahminy Kite and Pied Cormorants.

Appendix D contains a summary of data on sightings, species and numbers.

Although this area is not noted as a significant roost site in Moreton Bay for migratory shorebirds, it is used as both a roost and foraging site for the above species. The Crested Terns in particular have been observed in considerable numbers.

Descriptions

The ***Sooty Oystercatcher*** is confined to coastal areas, but is rarely sighted in south-east Queensland. This species is listed as Rare under *the Nature Conservation (Wildlife) Regulation 1994*. It favours inter-tidal rocky ledges and reefs, and in contrast to many shorebirds is rarely sighted on inter-tidal mudflats. It breeds on off-shore islands and rocky stacks, often close to the coast, and feeds on a wide range of prey, including molluscs, crustacean, polychaetes and small fish.

The small colony on the Caloundra Headland has been present since the 1980's.

The ***Wandering Tattler*** migrates from the northern hemisphere around September and resides along Australia's eastern coast until May. Its favoured habitats are wave-washed rocky shores and reefs, either on islands or the mainland. Many are likely to frequent off-shore islands, and so the actual population may be larger than the estimate of 500 for Australia.

It ahs very specific habitat requirements, with the Caloundra headland long being known as a summer habitat. It is possible (though unknown at present) they alternate between the Caloundra headland rocks and those at Point Cartwright. Although few birds are sighted, this reflects their small worldwide population, as well as difficulty in sighting.

It feeds on a diverse range of prey found along rocky shores, including molluscs, polychaete worms and crustaceans. (from WBM 1999 p. 42)

Crested Tern
Occurs along Australian beaches, bays inlets, tidal rivers, salt swamps and off-shore islands, with large numbers in Moreton Bay. Not to be confused with the Lesser Crested Tern which occurs only rarely and as a vagrant in this area.

Ruddy Turnstone
This distinctive wader has a habitat of tidal reefs and pools, weed covered rocks mudflats and Shelly beaches. It only occurs in the northern Australia coast, where it migrates from the northern hemisphere during our warmer months.

Eastern Curlew
Numbers worldwide are relatively small (approx. only 2000 worldwide). This species is Australia's largest migratory wader, easily distinguished by its size and the long, down-curved bill approximately half the size of its body. They are vulnerable to disturbance and are classified as Rare under the Nature Conservation Act.

Little Tern
This small wader is characterised grey and white plumage. It is classified as Vulnerable under the Nature Conservation Act. It inhabits coastal coastal waters, bays and shallow inlets as well as salt or brackish lakes.

Information on shorebirds is very recent. The collection of longer term data should be encouraged by Council, and is important for appropriate management.

4.1.2 Local Shorebird Counts

A local resident, Barbara Dickson has been undertaking shorebird counts for the Queensland Wader Study Group for the past six months. The full results of daily observations are included as Appendix D, and a summary given below.

i)	*Most days shorebird numbers were above 100, with counts of over 300 birds recorded on many days*
ii)	*Large numbers of Crested Terns of 400+ were frequently seen, with flocks of up to 1660 birds*
iii)	*Shorebirds regularly observed include Sooty Oystercatcher, Crested Terns, Ruddy Turnstone, Pied Cormorant, Little Black Cormorant, White Fronted Heron, Eastern Reef Egret, Wandering Tattler.*
iv)	*A recent observation of a group of White-fronted Terns at the sandbanks off Bulcock beach is the first recorded summer sighting in this area. They are occasionally sighted during winter (Jill Dening, pers. comm.).*

About Shorebirds....

Description

"Shorebirds" are birds which use a variety of habitats in Moreton Bay. Resident species breed in Moreton Bay; the migratory species breed in China, Siberia and Alaska during their summer and fly to Moreton Bay and other sites in Australia to escape the harsh northern winters. They arrive here around August and stay until the following April.

Shorebirds feed along intertidal sand, mud and coral flats, and also along the fringes of inland wetlands. Unlike most other birds, they are not diurnal or nocturnal. Their behaviour and activities are influenced by tides, as they feed at lower tides and rest or roost at high tides. They have two rest periods and two feeding periods in each 24 hours; all four periods are important to their well-being.

Shorebirds require specific habitat conditions. They must have space, food, roosts above high tide and protection from predators or disturbances to recuperate from long flights and build up their energy reserves for their next journey.

Shorebirds constitute almost 10% of Australia's bird species; about 3.1 million birds. At least 43 species use the inter-tidal habitat in Moreton Bay.

Species

Shorebirds include the following groups:

- sandpipers, snipes, godwits, curlews
- snipe
- stone-curlews
- oystercatchers
- stilts and avocet
- plovers and lapwings
- pratincoles.

Moreton Bay is *internationally* important for seven shorebird species: Bar-tailed Godwit, Curlew Sandpiper, Eastern Curlew, Grey-tailed Tattler, Lesser Sand Plover, Pacific Golden Plover (the most important site in Australia), Pied Oystercatcher.

It is *nationally* important for another three species of shorebird: Ruddy Turnstone, Terek Sandpiper and Whimbrel.

Flyways and Migration

Flyways are the routes they travel along on their biannual migration. One of three around the world, the East Asian - Australasian Flyway (EA / AF) extends from within the Arctic Circle through South-east Asia to Australia and New Zealand. Flyways contain a chain of important wetlands that shorebirds visit to rest and feed. Moreton Bay is an important habitat in the EA / AF.

Each year, more than a million Australian migratory shorebirds, and many more millions worldwide, travel great distances. Some shorebirds weighing as little as 30 grams may migrate 25,000 kilometres annually and some species may fly more than 6,000 kilometres non-stop. In doing this, they use favourable weather patterns when possible, but even so will commonly lose 40% of their bodyweight (the equivalent of an 80kg person losing 32 kg) flying at over 60 km per hour non-stop for three days and nights

When they stop, they desperately need to "refuel"; to feed and rest to build up reserves of fat for the next marathon stage of their journey. Minor disturbances which put them to flight can use up precious energy reserves which may mean they do not successfully complete their next migration.

4.1.3 Marine Turtles

Marine turtles are protected under various pieces of Federal and State legislation and international agreements to which Australia is a signatory:

- The Endangered Species Act (soon replaced with the Environment Protection and Biodiversity Conservation Act)
- Nature Conservation Act
- Convention for the Protection of Migratory Species
- Convention of International Trade in Endangered Species (CITES)
- International Union for the Conservation of Nature (IUCN) (listed as endangered)

A draft National Recovery Plan for the long-term conservation of marine turtles has been developed. The Loggerhead turtle is listed as Endangered under Federal legislation.

Small numbers of Loggerhead turtles (*Caretta caretta)* nest along Shelly Beach from late November with eggs hatching up till March. Occasional Green turtles may also occur, with the current year (2000-2001) likely to see an increase in their numbers. Current figures record between 1-10 nests each year. On average, a turtle lays three clutches of eggs, with 125 eggs in each which approximates to 375 eggs per turtle. Around 85% of eggs produce a live hatchling. This suggests that around 1,275 turtle hatchlings occur at Shelly Beach each year.

Shelly Beach is particularly suited to marine turtles as it:

- Has coarser, darker sand rather than a fine, white sand. This facilitates incubation of the eggs and allows the eggs to be laid at a shallower depth.
- The beach is on the northern side of a rocky headland, which is ideal for northern flowing currents.

It is likely that turtles have historically nested in this area, and are not a recent occurrence. It is the most southern nesting area on the Queensland mainland; turtle nests also occur on Bribie and Moreton Islands. Nests also occur at Buddina.

About Marine and Loggerhead Turtles....

There are less than 500 loggerhead turtles currently nesting along the Queensland coast, which represents a dramatic population decline from numbers in the 1960's. Although Shelly Beach is not a highly significant nesting site, the Endangered status of the species and global population decline makes it important to conserve and manage viable nesting sites.

Marine turtles are imprinted to the place where they are born through the earth's magnetic field. This is not precise enough to enable turtles to locate the exact beach where they were hatched, but rather to the general vicinity. Therefore turtles hatched at Shelly and Buddina Beaches will return to the general Caloundra coast to nest, but will not be able to differentiate between beaches located close together.

More precise imprinting occurs when mature turtles select a beach to lay eggs. They will then return to that same beach through their reproductive life.

It is possible, and preferable that when turtles lay eggs on an unsuitable beach which has been developed (eg with bright lights), the eggs are removed to a more suitable (and dark) beach where the hatchlings have a better chance of survival. The mature turtle will continue to return to the beach that they originally selected to lay eggs.

4.2 Vegetation

Much of the remnant vegetation has been cleared, with small areas remaining along less accessible and more constrained locations such as the rocky headlands and dunal areas.

The parklands have generally been developed to accommodate a high level of access and recreation activity, and planted with a mix of native and exotic tree species. This section focuses upon three communities of remnant vegetation:

- The rocky headlands
- The dunal areas and foreshore
- George Watson Park, the largest remaining remnant within this coastal strip, and representative of a more diverse mix of coastal communities.

4.2.1 Rocky Headland

(based on Batianoff 1989, and Batianoff pers.comm. 2000)

The Caloundra headland is a naturally confined area with a highly diverse and complex vegetation. Species are estimated to be between 50-70 along the headland, with 20-30 of these introduced.

It supports species that are confined to headland areas, including a headland form of *Themeda trianda,* which could be useful in future rehabilitation of areas with similar physical character.

Although the area has been disturbed through trampling and numerous informal access tracks, it still represents an important site supporting a vegetation type restricted in south-east Queensland.

The area also has historic significance, as early collections of plants species by Brisbane botanists occurred here and now housed in the Queensland herbarium. It is therefore an important collecting site as it offers an objective comparison between current and historic flora which may be useful in tracing the differences in species composition over time. (Batianoff, pers. comm.)

Vegetation has been identified by Batianoff et al (1989) as Headland grassland and low shrubland, typical of the windswept and exposed rocky headlands. This occurs on both Caloundra and Moffat headlands. The community is dominated by closed grassland, with scattered low shrubs and emergent trees.

Typical species are *Themeda trianda, Pimelea linifolia, Lomandra longifolia, Banksia integrifolia, Casuarina spp., Acacia spp.* and *Myoporum acuminatum.*

On Moffat headland, a small pocket of headland heath and scrub remains, which has many species common to the previous vegetation type.

4.2.2 Frontal Dune Communities

(based on Batianoff 1989)

This vegetation type occurs along parts of Shelly Beach and toward the Caloundra Bar. Unlike the headland vegetation, it us extensively represented in Caloundra and elsewhere along sandy dunal stretches. Typically, the vegetation communities are arranged in parallel bands to the shore. Three sub-units were identified, and are listed in order of appearance from seaward to landward:

Spinifex Open Grassland
Dominated by *Spinifex sericeus* (Beach spinifex) and usually restricted to recently formed low mobile foredunes and exposed slopes of frontal dunes.

Foredune Herbland is landward of the previous community, and has a more diverse plant composition. Typical species include *Ipomoea pes-caprae* subsp. b*rasiliensis.(*Goats foot) This community can be invaded by garden plants.

***Casuarina equisetifolia* low woodland and low open forest.** This is confined to a small patch near Caloundra Bar on the landward slopes of the frontal dune system. Other species include *Pandanus tectoris*,(Pandanus), *Banksia integrifolia* (Coast banksia) and *Acacia leiocalyx*. A shrub layer is usually absent, although ground covers can be dense, including previously mentioned species in addition to *Hibbertia scandens*, (Climbing guinea flower) *Dianella congesta* (Flax lily) *and Eragrostis interrupta*.

4.2.3 George Watson Park

This small but significant site with a colourful and chequered history has an existing management plan developed in 1995. This plan was adopted by Council in 1995. The detailed vegetation survey completed for the report is a useful resource in compiling a more detailed assessment of remnant vegetation along the coastline, and is the basis for much of the following discussion.

Of particular interest are the small areas of Littoral Rainforest in a gully toward the south-eastern margin, the unusual stunted form of *Eucalyptus intermedia* (Pink Bloodwood) which is exposed to salt-laden winds and a *Melaleuca quinquenervia* (Broad-leafed Paperbark) community which dominates the site. The varying height and structural form of this community suggests a response to varying drainage patterns, with the likelihood that it has expanded following increased stormwater runoff into the Park from surrounding areas.

Although small, the rainforest community should form the basis of species selection for replanting and rehabilitation in adjacent areas.

Although a number of degrading influences have been documented including a plethora of tracks, erosion, some serious weed infestations, nutrient enrichment through stormwater run-off and frequent fires, the area has the diversity and quality of vegetation to provide a refuge for numerous birds and other native fauna. Bird sightings include Brahminy Kites, Black Faced Cuckoo-shrike and White-faced Heron. A thorough fauna survey of the site has not been undertaken, and it may well support a wider diversity of species than is currently listed.

The park has a strategic location, in that its linkage to the coast provides the only opportunity in the study area to walk through native vegetation in a natural setting through to the coast. In addition, it is connected to Moffat headland, and establishes opportunities for a walkway in a natural setting to occur from the headland to Shelly beach. Clearly its recreation and landscape value are substantial and add to its ecological value of supporting small tracts of vegetation types which have been largely cleared elsewhere along this coastline.

4.3 Rocky Shores

Caloundra headland is a special place. Its distinctiveness derives from an unusual species richness and diversity – probably the most diverse of all rocky shorelines in south east Queensland (P. Davie pers. comm).

Its rocky shoreline is broken up with wide, flat rocks with many cavities and rock pools which provide diverse habitat niches. This mix of habitats and therefore species diversity is strongest toward the sub-tidal zone, where habitats are protected from human disturbance in all but the most favourable conditions (ie very low tide coinciding with calm conditions).

The report on inter-tidal Rocky Shores of south east Queensland (WBM 1999) further identifies the Caloundra headland as having particular significance.

Both Caloundra and Moffat rocky shorelines have been characterised as 'high cliff with reef platform' and supporting a mix of tropical, sub-tropical, temperate and cosmopolitan benthic species. They were formed from the Landsborough sandstone and formed during the Triassic period.

The most distinctive elements of the Caloundra headland are the presence of species which have their northern geographic limit at Caloundra coupled with endemic species; naturally rare and currently only known from the Caloundra Headland.

The species and their features are :

- The limpet *Cellana turbator* which is restricted to south-east Queensland;
- The Caloundra abalone *(Haliotis melculus)* which is currently thought to be endemic to Caloundra in southern Queensland;
- A species of tridacnid clam *Tridacna sp.)* which is listed as Endangered in the International Union for the Conservation of Nature Red Book. Although reasonably widespread in the tropical Indo-Pacific, it is vulnerable to over-collecting.

Very little is known of the ecology of the first two species beyond their habitat as algae feeders on intertidal rocky shores. Given their highly restricted geographic range, it is reasonable to assume they risk extinction over the longer term.

The WBM report (WBM 1999) suggests the Caloundra headland has National significance due to it being suitable habitat for two highly restricted species.

The key management issues for these species are

i) collecting and harvesting,
ii) water quality degradation and
iii) general disturbance by humans and recreation activities.

The high visitation rates by fishermen and tourists is a factor of its easy accessibility and range of interesting formations (rockpools, stones), and fauna. Consideration could be given to creating a series of 'sacrificial rock pools' where people can observe fauna and marine habitats at close range without exploring every part of the rocky shelf.

4.4 Coastal Systems

4.4.1 Coast and Shoreline Dynamics

The coast is an area recognised for its dynamic nature, and as a transitional zone between terrestrial and marine environments. As such, cyclical changes coupled with sporadic extreme and sometimes dramatic events are the norm in this environment. Stability and constant, incremental change is less evident in the south east Queensland coast than a more dynamic regime characterised by cycles of coastal erosion and accretion.

Beaches and the dunal system are critical elements in this process, as they absorb much of the energy from wave action and act as a natural buffer between wave action in storm periods and foreshore areas. They naturally fluctuate in size and width. Studies done for beaches in Caloundra and Maroochydore following cyclone activity in 1976 suggest there is no 'rule' applying to all beaches – their individual features and geography will vary the extent and rate of erosion and accretion. The study also found marked changes in erosion and sand accretion over a two and a half year period (Batianoff et al, 1989).

Currently, anecdotal evidence strongly suggests that an erosional cycle is currently underway along the coastline, with impacts upon coastal infrastructure, development, parkland, beaches and associated vegetation. A noted rise in sea-level of several centimetres has occurred over the last few decades, suggesting that the current erosive cycle has some link to natural causes. (Flood, quoted in Batianoff and Elsol 1989 p. 33.)

The natural storage system of sand reserves being stored in the dunal system and available for beach replenishment has been diminished over past decades with development encroaching into these

areas. Normally, beach erosion is a naturally occurring process which is balanced by a period of beach accretion. Problems arise when development occurs in the zone of natural beach fluctuations (including the dunal system) which threatens infrastructure and interferes with the natural sand storages.

The northern tip of Bribie Island is a local example in the dynamic nature of the coastal zone, and the predicted breakthrough by waves of this tip will have implications for the Caloundra Bar and property in the vicinity.

Studies indicate a rapid erosion of the seaward side of the island (almost 2 metres per year) and an average volumetric loss of sand since 1962 of 6.5 m^3 per metre per year (SoE 1999 p. 5.35). The probability of a breakthrough on the northern tip is very high, and is likely to occur within 15 years, or sooner as an immediate result of a major event such as a severe storm or cyclone.

Given the :

- inherent dynamic nature of the coastal zone;
- the erosional cycle currently being experienced in coastal areas;
- the additional uncertainties created by climatic change and a possible rise in sea-levels, as well as
- the predicted breakthrough of the Bribie Island tip;

the application of the 'precautionary principle' is both appropriate and timely in Council decisions regarding coastal management.

Future costs of repairing the impacts from decisions which accelerate or exacerbate coastal erosion are likely to far outweigh those arising from a cautious approach when assessing development and infrastructure plans.

4.4.2 The Beach Environment

The beach environment is a unique one characterised by salt laden winds, moisture stress, shifting sand, high temperature and infertile soils. The resulting vegetation has adapted to this mix of factors, and successful management of coastal vegetation must recognise these physical constraints.

The natural marine debris which lines most seashores contains large volumes of microscopic plants and animals which are flushed, filtered and trapped through the pore spaces in beach sand through constant wave action. This organic matter is then decomposed and returned to the sea. Beaches have been described as a 'great digestive and incubating system by removing the organic remains and returning breakdown products such as phosphates, nitrogen and other nutrients to the sea.' Some of the nutrients may be deposited along foredunes, increasing the nutrient content and causing a rapid growth of spinifex grasses.

Nutrient analysis for beach debris collected along northern Bribie Island suggest nutrient content is higher than debris collected from forest floor litter on Stradbroke Island (Batianoff 1989 p40).

Clearly the beach plays a role in general nutrient treatment and recycling. This could have implications for the practice of beach cleaning which occurs on busy recreation beaches, where sand is mechanically sifted and 'cleaned' from debris for aesthetic and safety reasons.

However, on a sandy beach which is heavily used for recreation, most fauna would feed on small particles between sand grains, rather than on large pieces of detritus. It could be stated that recreation activities (compaction, digging, general disturbance) would cause greater impact than sand sieving, particularly as this activity is irregular and seasonal.

4.4 Summary of Ecological Values

The previous discussion has highlighted a number of significant environmental values associated with this coastal strip. The following summary provides an integrated overview of these, and links them to a spatial context.

Table 4 Values Summary by Location

	Environmental Value (see below)					
	1	2	3	4	5	6
Moffat Beach	-	-	-	○	○	-
Moffat Headland	-	-		○	-	-
George Watson Park	-	-	-	○	-	-
Shelly Beach	-	●	-	-	○	◎
Caloundra Headland	●	-	●	◎	-	-
Kings Beach	-	-	-	-	◎	-
Happy Valley	-	-	-	-	○	-
Caloundra Bar	●	-	-	-	○	○

Values

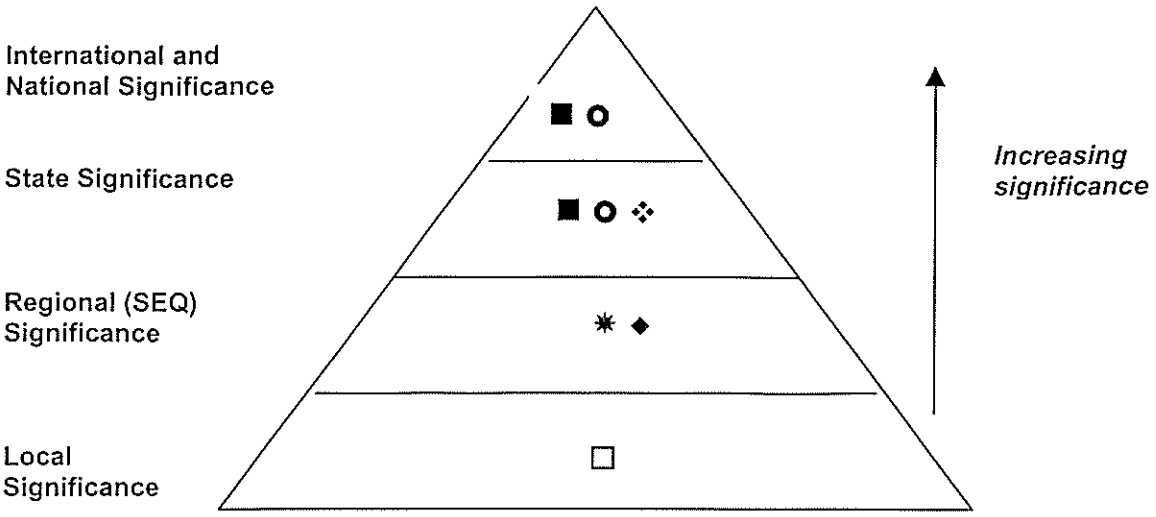
1. Migratory shorebirds and waders
2. Nesting marine turtles
3. Rare and geographically restricted crustacea
4. Naturally restricted coastal vegetation
5. Undeveloped dunal buffer and sand reserve
6. Presence of stabilising dunal vegetation

Key

● = National or State significance
◎ = Regional significance
○ = Local significance
- = Absent/not known at this location

Although the above represents a 'snapshot' in time, clearly Shelly Beach and Caloundra Headland emerge as supporting a cluster of significant environmental values at the national and regional scales.

Levels of Significance



■ = shorebirds
O = marine turtles
❖ = rare and geographically restricted marine species
◆ = diverse ands species rich marine ecosystems
✱ = vegetation - headland
□ = vegetation - coastal dunes, George Watson Park

5.0 OTHER ENVIRONMENTAL VALUES

Although the project has a focus on determining ecological values, the study area also clearly supports cultural, recreation, open space and landscape amenity values.

This chapter is a summary of these values, their features and significance.

5.1 Recreation and Open Space

Recreational activity in the study area is focused on the ocean and beaches. Activities in the study area include both water based and land based activities, however, most land based activities are focused on viewing opportunities and the ocean setting.

The range of activities which occur in the study area include:

- beach swimming and body surfing;
- pool swimming;
- Surf Life Saving Club training, carnivals and social activities;
- motorised water sports;
- sky diving;
- picnics and BBQs;
- walking, jogging and cycling;
- viewing and landscape interpretation;
- memorial services;
- environmental study and research;
- dog exercise;
- nature appreciation activities such as bird watching;
- children's play and informal sporting activity such as cricket and ball games; boating activity;
- scuba diving and snorkelling;
- tandem sky diving landing and hang gliding
- rock scrambling and exploring;
- fishing, worming and pippies;
- sailing and wind surfing;
- painting and photography;
- festivals and carnivals; and
- surf board riding.

With such a diverse range of activities, there is the potential for conflict, especially during peak use times. Management of recreational activity is therefore important.

Recreational experience in the study area ranges from developed recreation in the Kings Beach and Happy Valley precinct through to semi-natural at Shelly Beach. This diversity should be reinforced and strengthened.

5.2 Landscape and Scenic Amenity

The study area enjoys a high visual scenic amenity along its length due to the variety of visual experiences it offers as the beach evolves from dunes to sandy shores, bays to punctuated by headlands, and lakes and creeks flow into the sea. The site alternates from wide sweeping beaches to enclosed bays with the ocean unifying the study area and the foreshore always the focus of activity and viewing.

Norfolk Pines in both avenues and clumps are a feature at a number of points along the ocean side parkland.

5.3 Cultural

Sites of both Indigenous and European cultural significance were identified from the Cultural Landscapes study, commissioned by Caloundra City Council in 1995.

The following sites located within the study area were identified:

Within Study Area	
Caloundra Headland	Headland vista across the ocean.
Norfolk Island Pines	Along the esplanade at Kings Beach, planted in 1930's. Provide shade and are an icon feature along this high profile road.
Kings Beach Bathing Pavilion	Listed by the National Trust. Erected in 1937 in a Mediterean style.
Caloundra Head Art Site	Pecked rock engravings around the base of the Caloundra headland. They include emu, dingo, kangaroo and human footprints. They are now thought to be destroyed by wave action.
Queen of the Colonies Monument, Moffat Head	Historical monument erected in 1933 commemorating the survival of 13 sailors on Moffat Beach from a shipwreck off-shore
Outside Study Area	
Numerous houses and precincts in the Moffat Beach vicinity	Lack of high rise and streetscapes typical of holiday housing styles in past decades. Adds to the distinctiveness of the general Moffat Beach area.
SS Dicky Wreck and Caloundra Lighthouse	

In addition to the sites mentioned above, the ANZAC and centaur memorials and the memorial walkway is also significant, being a focus for local RSL activities and commemorative services.

These sites are indicated on Figure 6.

Cultural significance of the area is expressed as tangible, constructed elements, with visible or physical evidence of indigenous significance now removed or destroyed. The Pavilion at Kings Beach is assessed is having the highest level of significance.

Although a detailed archaeological assessment has not been undertaken in the coastal area, almost every area of land, beach and water was named, had an indigenous history and belonged by law to a family group who could identify exactly the boundaries of their land. The diversity of the coastal landscape and its wealth of resources strongly suggests this area would have been highly significant for indigenous groups (anthropologist Peter Sutton contained in the Cultural Landscape Study) .

5.4 Overall Values Summary

Physical features of the two headlands with associated rocky shorelines in combination with three different beaches and foreshore areas dominate the study area, and establish the settings for intensive recreation and leisure use.

Although ecological values do not have the same visibility and instant community profile that are associated with distinctive topographic and landscape features, they are none-the-less a fundamental element of this coastal environment.

The rocky headland and adjacent Shelly Beach clearly provide suitable habitat for an unusual suite of flora and fauna species. The ecosystems inhabiting the inter-tidal rocky platforms are perhaps the most diverse in South-east Queensland. The beach, foredune and rocky shoreline in combination represent an unusual cluster of significant, rare or endangered species which should serve as a fundamental issue for the management plan.

Endangered marine turtles, rare and protected migratory shorebirds, unusual and significant coastal vegetation and geographically restricted crustacea are all concentrated on or immediately adjacent to the rocky Caloundra headland.

This strongly suggests that management of Shelly Beach and Caloundra headland should be responsive to these ecological values, and that they should direct management direction and decisions.

An overall summary of the study area's values is presented in the following table.

Table 5 Overall Values Summary

	Marine ecosystem	Fauna	Significant coastal vegetation	Dune sand reserves	Landscape amenity	Cultural	Recreation	Tourism/ ecotourism	Linkage to adjacent areas
									
Happy Valley	O	O	O	O	●	O	●	●	O
Kings Beach	O	O	O	●	●	O	●	●	O
Caloundra Headland	●	●	●	O	●	●	O	●	O
Shelly Beach	O	●	●	●	●	O	O	O	O
Moffat Headland	O	O	O	O	●	O	O	O	O
Moffat Beach	O	O	O	O	●	O	●	O	O

● = High
O = Medium
O = Low

A number of patterns emerge from this summary.

1. **Landscape and recreation values are moderate to high throughout all units.**
2. **The values of Happy Valley, Moffat Kings Beaches are largely confined to recreation, tourism and visual facilities.**
3. **In contrast, Caloundra headland and Shelly Beach score highly on natural values.**
4. **No one precinct scored moderate - high on all attributes, although Caloundra headland emerges as supporting diverse values.**

5.5 Sustainability

Sustainability for Caloundra Headland, Shelly Beach

'Sustainable use' for these two areas means assisting the continuation of these species and conserving the habitat that supports them. This includes:

Marine Turtles	• Appropriate lighting and generally dark surrounds • Dog, fox control • Overall low level of noise and disturbance • Access to suitable foredune areas for nesting • Good water quality
Shorebirds	• Relatively low levels of disturbance, especially for roosting sites • Food source (crustacea) among the rocky platform • Avoidance of large amounts of debris from fishing and other debris
Rocky Shore Ecosystems and Species	• Secure habitat niches and reduced vulnerability to exposure to the atmosphere and predators through overturned rocks • Good water quality
Headland vegetation	• Weed invasions removed • Rehabilitation of exposed areas • Reduce trampling, erosion
Other coastal vegetation (George Watson Park)	• Rehabilitation • Appropriate (ie not excessive) fire regime

Clearly the main challenge is to manage human access and the volume and intensification of recreational activity.

Sustainability for Kings Moffat Beaches, Happy Valley.

The other sections of the study area – the top of Caloundra headland, Kings Beach, Moffat Headland, Moffat Beach and Happy Valley - do not support the same concentration of significant flora and fauna, and therefore have greater flexibility and more options for the level and intensity of access and recreational activities.

Sustainability for these locations is determined more by the site's ***carrying capacity*** for the desired level of recreational use and activity in terms of :

- Matching the site's facilities and ambience with expectations and general recreational experience of visitors;
- Facilities to adequately cater for the peaks of recreational use;
- Site 'hardening' through access routes, signage, fencing, paving, to avoid degradation of heavily used areas (eg through erosion, trampling);
- Maintenance of the ambience and quality of the site in terms of scenic outlook, quality of the surrounding environment and safety; and
- Maintenance of essential coastal physical features, processes and values. This includes stable foredunes, dunal buffer areas, adequate water quality for primary contact and aquatic ecosystems.

6.0 MANAGEMENT UNITS

Six management units were identified along this coastline on the basis of:

- distinctive physical, topographic and ecological features;
- similar recreational settings and activities, intensity of use;
- perceived by the community as an area distinct from adjoining locations.

They provide the geographic basis for a more detailed description and assessment of the coastline following a logical structure which reflects the diversity of the physical and social environment.

The units are, in order from south to north:

- Happy Valley
- Kings Beach
- Caloundra Headland
- Shelly Beach
- Moffat Headland
- Moffat Beach.

Their location and a summary of values per management unit are illustrated on Figures 2 and 3.

Figure 2: Management Unit Location Plan

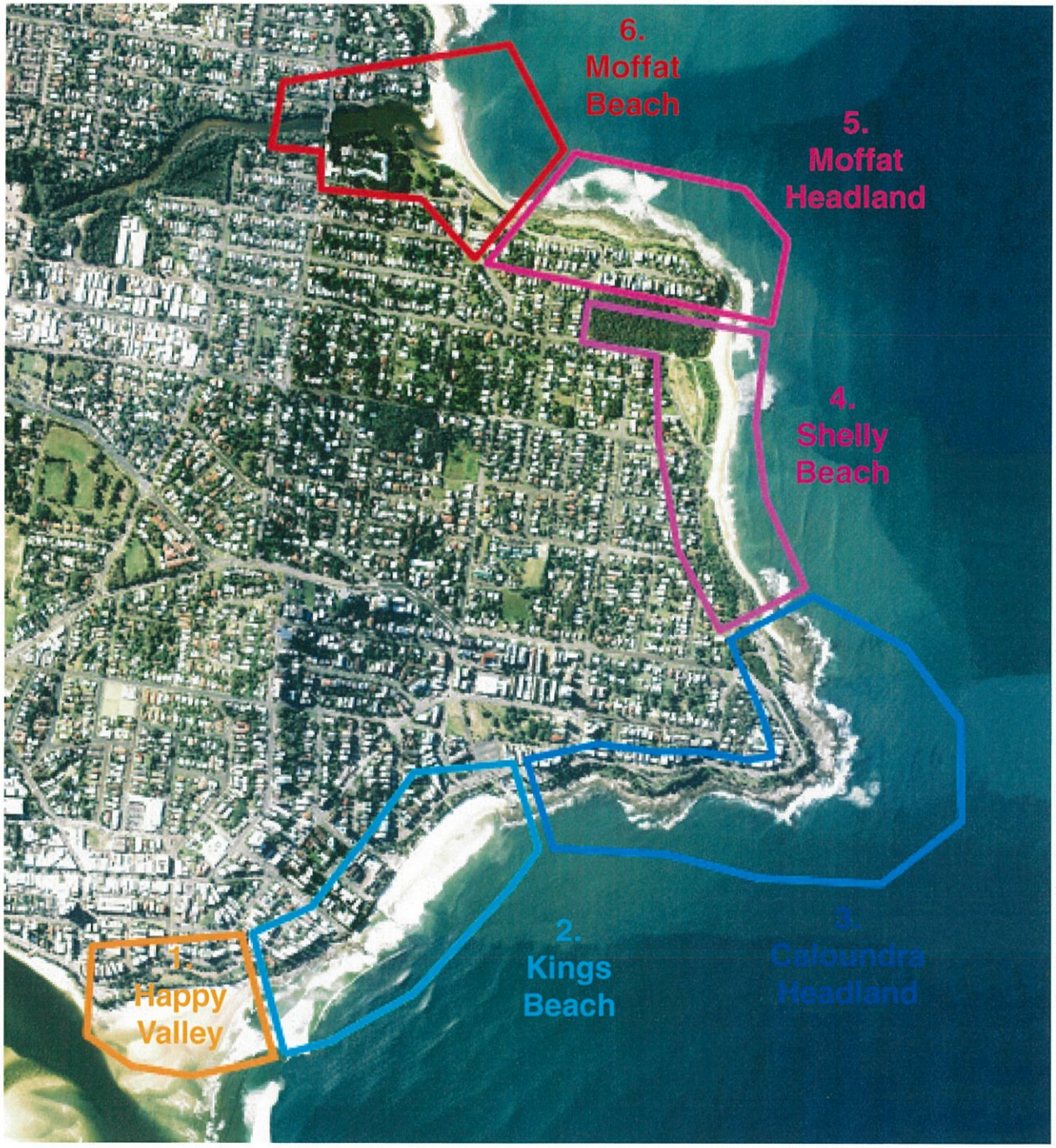
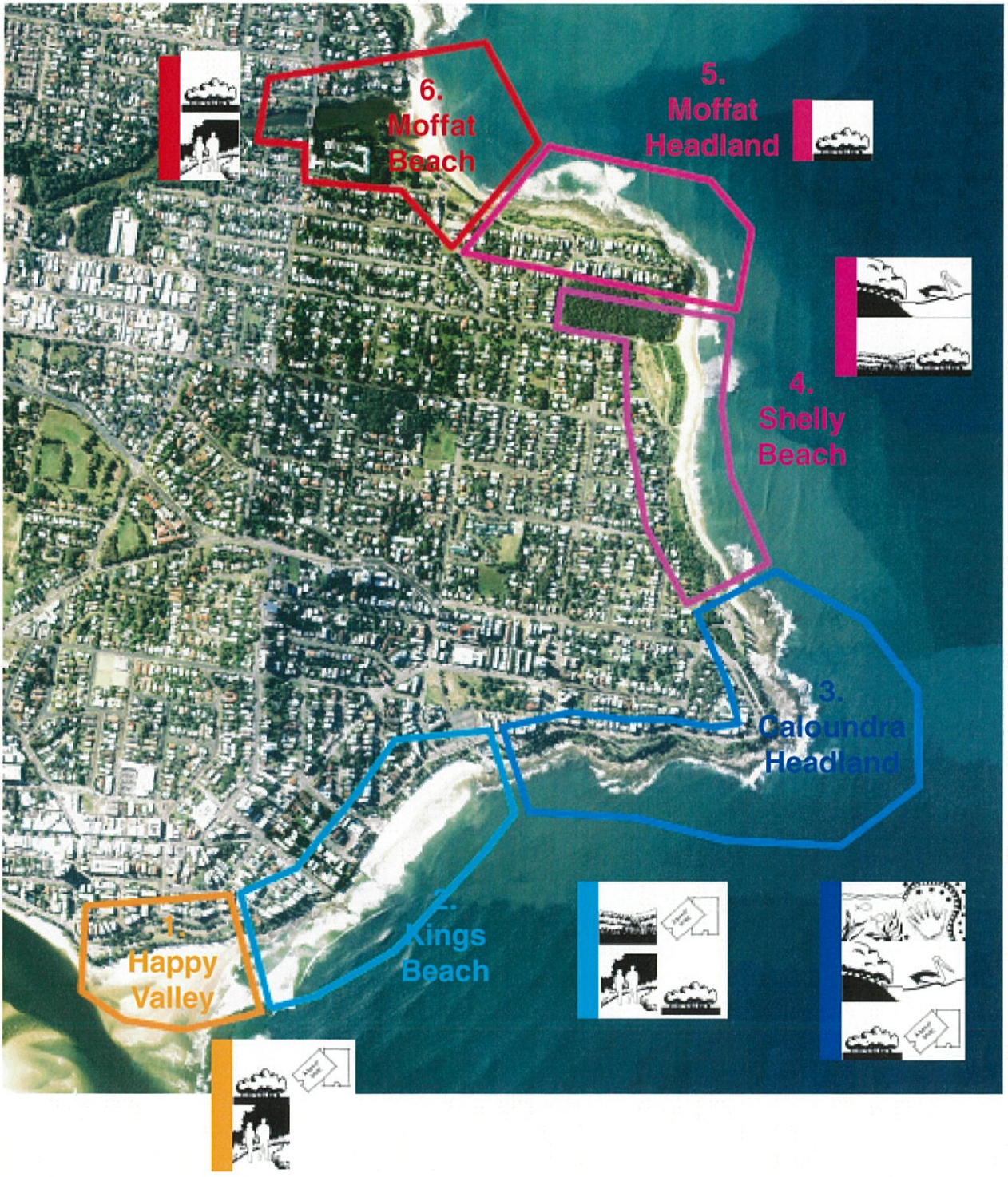


Figure 3: Summary Values by Management Unit



KEY

LANDSCAPE VALUES

Marine ecosystem

Fauna

Significant coastal vegetation

Dune sand reserves

Landscape amenity

Cultural

Recreation

Tourism/ ecotourism

Linkage to adjacent areas

Weeds / Rehabilitation

Historic

6.1 Happy Valley

HAPPY VALLEY

Description

This unit commences at the Caloundra Bar and extends north through to the 'little headland' which separates this area from Kings Beach. It is characterised by a calm stretch of beach, wide and sandy foreshore and an intensively used park aligning the foreshore. Recreation – particularly for family groups – is a key feature of this area which offers shade, a high standard of facilities and playgrounds with easy access and parking.

It is a popular and intensively used area, with the park strip often attracting a higher use than the adjacent beach. The area has been largely designed and maintained to cater for this heavy and constant use.

The beach area is clearly dynamic and unstable, with large movements of sand evident over the past 50 years. Any 'breakthrough' of the sea through the tip of Bribie Island may well considerably alter wave and sand patterns along the beachfront.

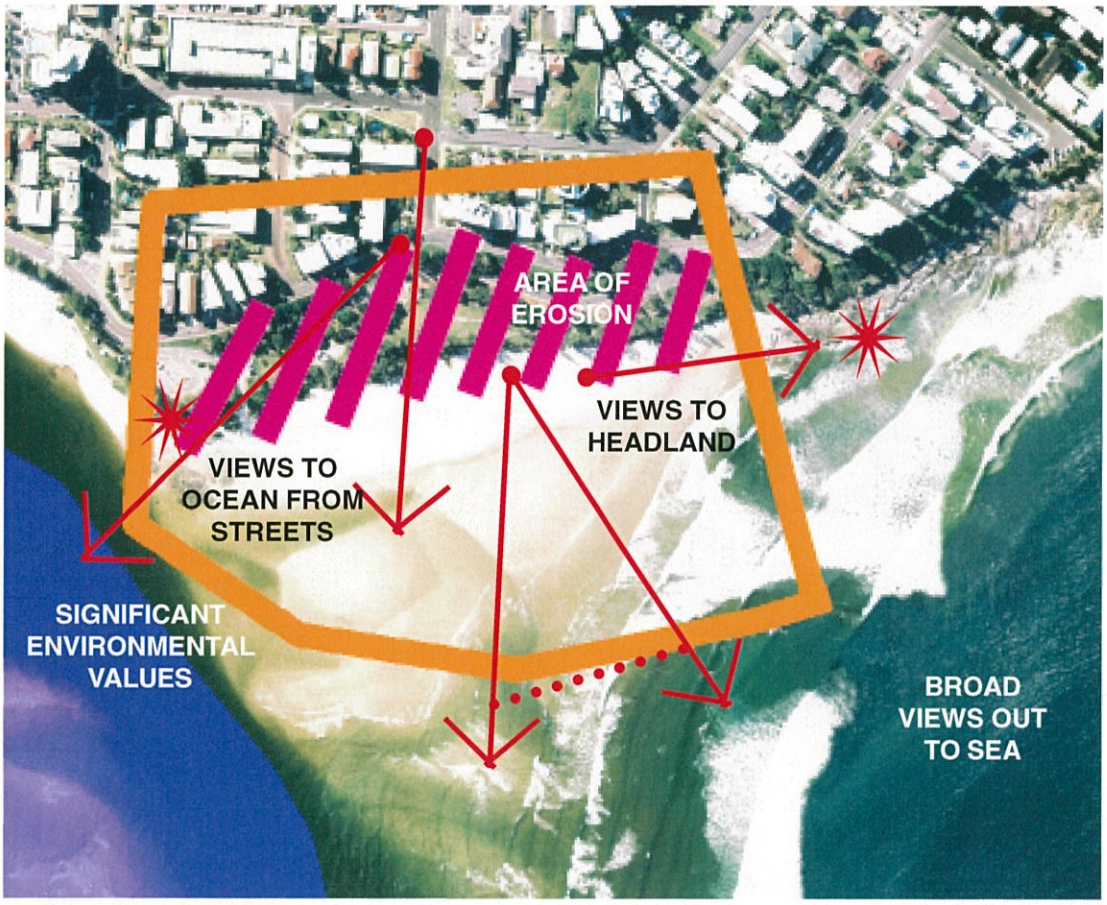
Management Objectives and Principles

1. The area is continued to be managed primarily as a high use, formalised foreshore recreation area.
2. Quality landscaping and visual amenity are achieved through careful planning and maintenance of this high profile precinct.
3. Recreational or commercial activities originating in this area which may impact on the values of the Caloundra Bar and Pumicestone Passage should be avoided.
4. Management should recognise and accommodate the dynamic nature of the Bar and shoreline in this area and attempt to stabilise the foreshore area.

A sustainable Happy Valley should include:

- Managing the area primarily for high and intensive recreation use focused on the beach and parkland areas.
- Maintaining a high level of landscaping and visual amenity through careful planning of this high profile precinct.
- Recognising the physical and geomorphic context of the area as part of a dynamic coastal zone in planning decisions for this area.
- A sensitive response to the adjacent environmentally significant areas of Caloundra Bar and Pumicestone Passage.

Figure 4: Happy Valley, Management Unit Analysis



Significant Landscape Values

HIGH

MODERATE

KEY
LANDSCAPE VALUES

Marine ecosystem
Fauna
Significant coastal vegetation
Dune sand reserves
Landscape amenity
Cultural
Recreation
Tourism/ ecotourism
Linkage to adjacent areas
Weeds / Rehabilitation
Historic

KEY

VISUAL FEATURE

BROAD VIEWS

DIRECT VIEWS

Values and Features

Ecological

- Located adjacent to the Caloundra Bar and beginning of Pumicestone Passage, which have recognised ecological values and are protected under the Moreton Bay Strategic Plan.
- Small areas of coastal vegetation (currently undergoing rehabilitation) on the 'little headland' area.

Scenic & Landscape

- Norfolk Island pines an iconic visual element along the foreshore
- Strong views to Bribie Is and Caloundra Bar
- A 'developed' recreation setting

Cultural

- Presence of mature Norfolk Pines planted in the 1930's and which are now a recognised landmark.

Management Issues & Actions

Management Issue	Discussion and Recommended Actions *Actions in italics*
Beach Erosion	Erosion and the changing nature of the foreshore and Bar has clearly been a recurring issue along much of Happy Valley, indicating the dynamic nature of the shoreline. Aerial photography between 1940 and 1992 shows the dramatically changed shoreline in this area. • *Avoid encroaching on the foredune areas, and encourage stabilisation by vegetation rehabilitation.*
Fencing and Access	Current fencing separating the park and foredune presents a barrier between the park and the beach, limiting visual or aesthetic contact. This fencing is now an outmoded form of dune stabilisation. Beach access is also restricted to the northern and southern ends of the beach, with no middle access point. The northern stairs are presently unsafe. Fencing dividing the park from the Esplanade is unsightly (star pickets and wire). • *Liaise with the Beach Protection Authority (Brisbane) for input as to more appropriate dune stabilisation treatment. Upgrade northern stairs to the beach* • *Consider another access point to the beach mid-way through the park* • *Remove the star picket fencing along the road. Replace with more appropriate fencing if required.*
Facilities	Tables currently are located close to the carpark and road, reducing amenity. • *Additional tables be provided away from the road and traffic.*
Weeds and Rehabilitation	Rehabilitation of vegetation aligning the foreshore should be undertaken as part of broader erosion control. • *Liaise with the BPA to develop an action plan for the park and foreshore.*
Environmental Appreciation	The large numbers of shorebirds in the Pumicestone Passage could be observed by a high quality telescope with interpretative material located at Bulcock Beach. • *Investigate the feasibility and location of these educational facilities.*

6.2 Kings Beach

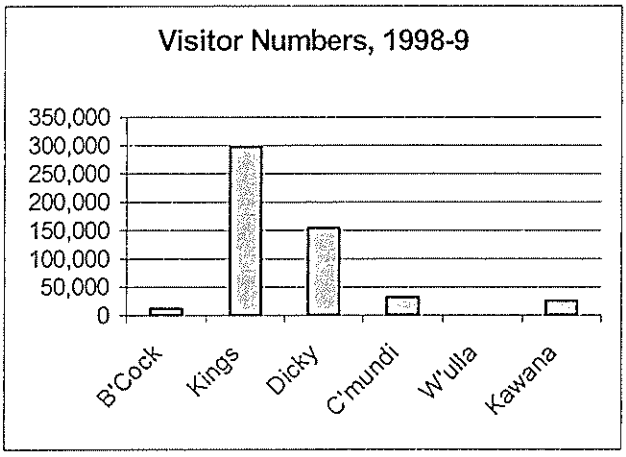
KINGS BEACH

Description

This area represents one of the most intensively used coastal sites for recreation and tourism in Caloundra, although the area is in need of upgrading and rehabilitation. The easy accessibility and car-parking, presence of associated amenities and facilities and a safe surfing and swimming beach with a wide, sandy foreshore clearly distinguish it from other coastal areas in the City.

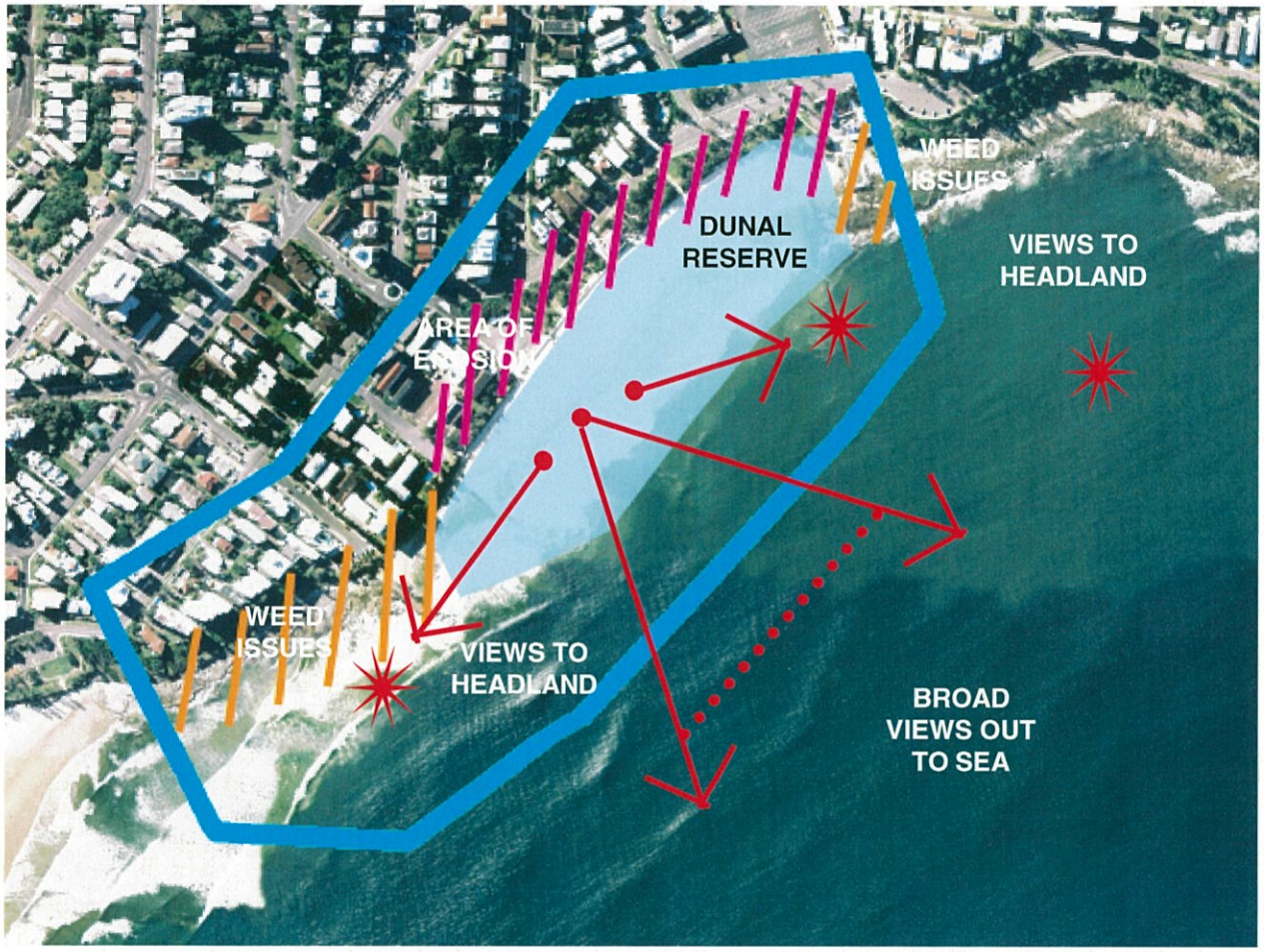
The area has a high tourist and recreational profile, and is one of Caloundra's recognised and promoted natural icon sites. The graph below indicates the dominance of Kings Beach for people visits relative to other Caloundra beaches. This management unit also includes the 'little headland'; a small rocky outcrop which forms the southern boundary of Kings Beach.

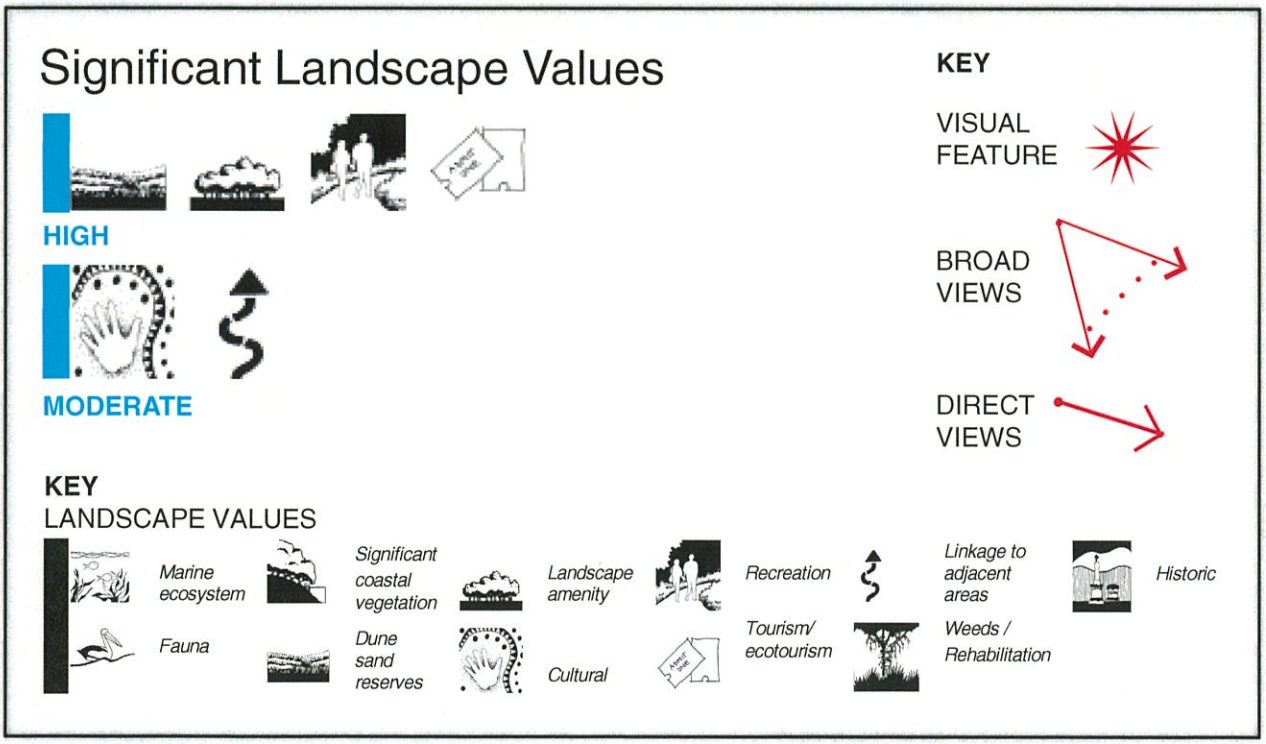
The surf life saving club reflects an important community presence on the beach, and has an important role in the ongoing planning and management of this area.



Source: Caloundra Surf Life Saving Club, Kings Beach

Figure 5: Kings Beach, Management Unit Analysis





Management Objectives and Principles

1. The area is managed primarily for high and intensive recreation use focused on the beach and parkland areas, with the capacity to cater for peak use times.
2. Management is geared toward a formalised, and surf related activity area, with ongoing input from the surf life saving club in future planning and management decisions.
3. The precinct is recognised and developed as a primary focus point for coastal recreation in Caloundra.
4. Landscaping, visual amenity and a precinct unity are achieved through careful planning of this high profile precinct.

A sustainable Kings Beach should include:

- Water quality consistently meeting Australian Water Quality Guidelines for primary contact and aquatic ecosystems
- High and intensive recreational use maintained without resulting in erosion or degradation to foredune or parkland areas
- Achieving a consistently pleasing level of landscape and visual appeal with a safe environment for day and night use which is accessible by all.

Values and Features

Ecological	• Sand reserves and buffer contained in foreshore and foredunes
Scenic & Landscape	• Formalised and 'developed recreation' setting • A moderate sense of nature with some dune vegetation and views to the headlands
Cultural	• 'The Pavilion', which is listed by the National Trust.

Management Issues, Actions and Priorities

Management Issue	Discussion and Recommended Action *Actions in italics*
Foredune Erosion	The foredunes are unstable, with sand blows evident and erosion noticeable along the dune edge. The current erosion treatment (fencing) is outmoded. Appropriate treatment to stabilise the dunes may require some additional area. These factors should be included in any design developed as part of the Kings Beach Master Plan. • *Establish a stable foredune area by maintaining controlled access, increasing vegetation cover along the dunal edge in denuded or degraded areas and encouraging colonisation of stabilising foredune vegetation (eg spinifex) where possible. This will require no or heavily reduced access to such areas. This should be undertaken after liaison with and input from the Beach Protection Authority, Brisbane.* • *Further encroachment of development (including parkland) onto the dunal system should be avoided.*
Fencing	The current fencing which assists controlling access and preventing erosion establishes a barrier between the park and beach area, preventing any visual link between the two areas. The fencing is unsightly and detracts from the area's amenity.

	• *Re-establish a visual and aesthetic link between the parkland and the beach area by replacing current fencing with a design controlling access, but permitting visual and aesthetic contact.*
Stormwater Drain	The stormwater drain at Kings Beach near the Surf Lifesaving Club is an eyesore, safety and occasional health hazard. It is located in a high risk area due to the level and type of recreational use. It could also impact upon aquatic ecosystems off the adjacent Caloundra headland. • *Determine as a priority the community and ecological water quality values for the receiving waters of the drains, and to implement BMP's to achieve them. This is in line with the goals of the (draft) Urban Stormwater Management Strategy under the Water EPP.* • *Assess options for the long-term removal of the stormwater drain as inappropriate drainage infrastructure for this setting.*
Fragmented Parkland	The current road alignment fragments existing parkland and so diminishes its value. The Lions Park is a small, isolated pocket of parkland separated from the main beachside park by the busy Esplanade. • *Consideration be given in the Kings Beach Master Plan to re-routing the road to achieve the consolidation of the parkland.*
Facilities	Existing public amenities (particularly the toilet amenities) are somewhat rundown and not in keeping with such a high profile and intensively used beach. • *Address the design of existing public facilities, incorporating disabled access as part of the Kings Beach Master Plan.* • *Development of plans for spectator facilities for coastal sports and recreation eg surfing and SLSC competition*
Weeds and Rehabilitation	A serious weed problem exists along the 'little headland'. Invasive exotic species used to landscape gardens (especially Singapore Daisy) now dominate adjacent coastal areas. From Margaret St to the pool a patch of pandanus and other canopy trees in good condition provides a basis for rehabilitation. The Norfolk Pines at the southern end of the car park are in poor condition and need attention. • *Weed education and educative materials are urgently needed, as part of a broader weed management strategy (refer 7.4.1). Liaison with landholders is critical to longer term solutions. The Landscape Policy which prohibits invasive weeds should be strictly enforced to prevent future management problems and costs to Council.* • *Control weedy understorey from Margaret St to the pool and replant as an open, 'parkland' area. Work to be done in accordance with Council's Weed Management Strategy* • *Use an arborist to assess treatment for the stressed Norfolk Pines*
Access	• *Ensure access for mobility impaired users to beach and along tracks*
Surf Life Saving	• *Consult with the Surf Life Saving Club for all planning and management decisions.*

6.3 Caloundra Headland

CALOUNDRA HEADLAND

Description

This area is a major geological and landscape feature along the Caloundra coast with multiple values - scenic, vegetation, marine ecosystems and fauna. Its distinctiveness in the landscape is coupled with supporting a cluster of unusual, rare and threatened species.

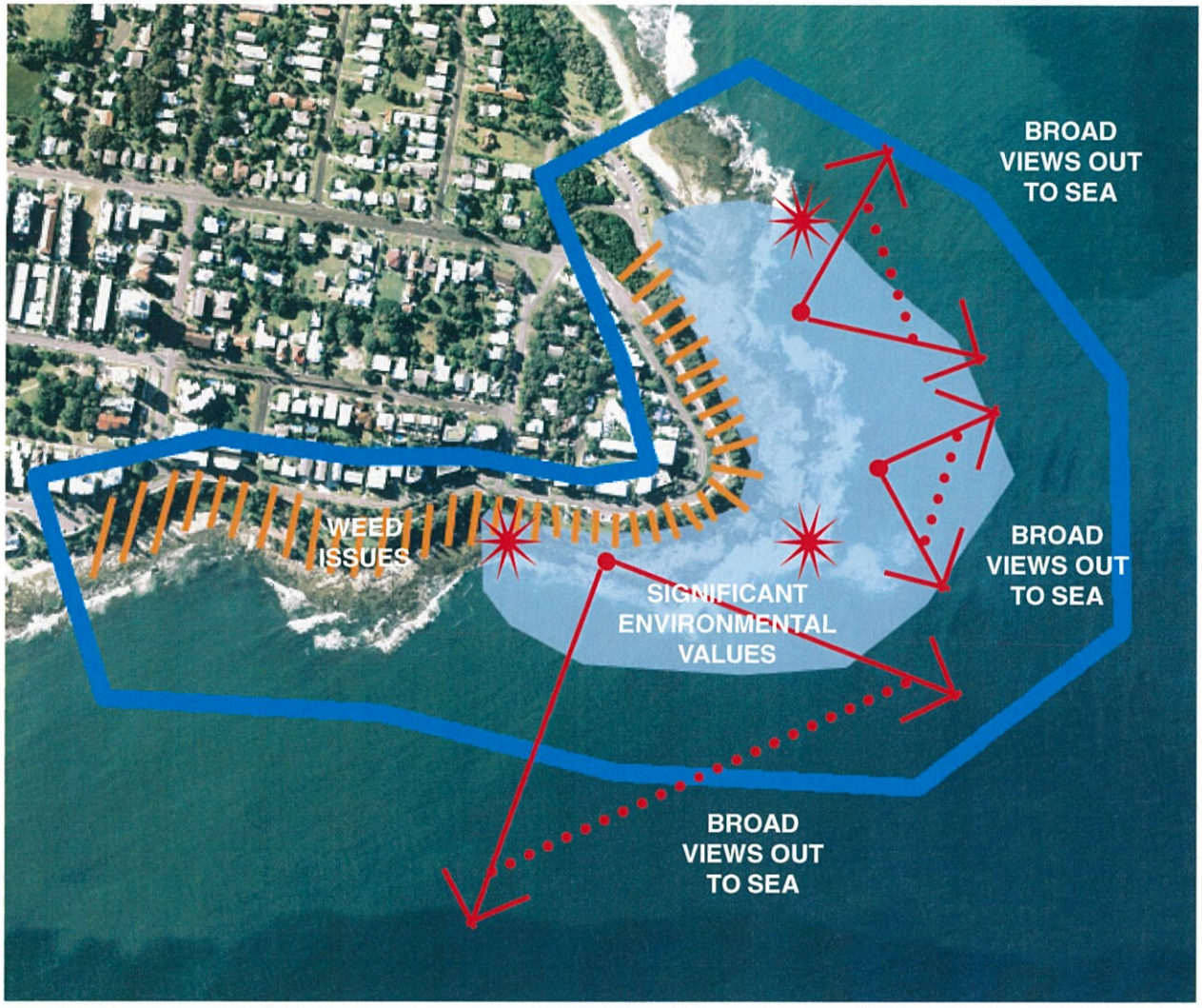
The unit has two distinctive elements:

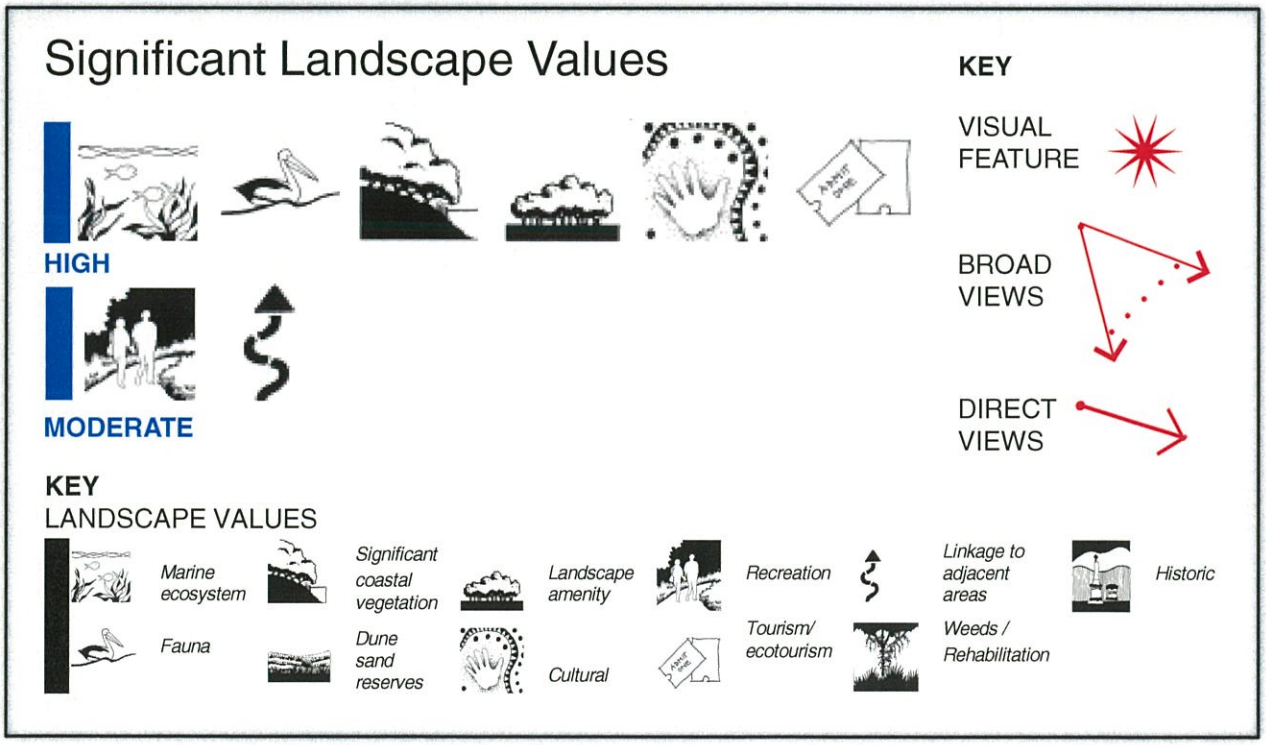
i) The top of the headland which is extensively visited and landscaped, offers excellent scenic vistas within a formalised and 'developed' recreation setting;

ii) Headland vegetation combined with the inter-tidal and sub-tidal rocky shoreline which is largely undeveloped and forms a natural experience as immediate interface between the sea and land.

Access to the rocky shoreline is mostly from Shelly and Kings Beach, although numerous informal tracks provide many access points. Flocks of shorebirds can be seen at low tide, with bird counts (refer Appendix D) indicating a range of shorebirds use the rocky platforms.

Figure 6: Caloundra Headland, Management Unit Analysis





Management Objectives and Principles

1. The top of the headland should be managed as a semi-formalised area to provide impressive scenic vistas, quality interpretation and facilities for a high level of visitation.
2. Interpretation should include cultural as well as physical and ecological features – their distinctive characteristics, management or habitat needs and appropriate behaviour.
3. The rocky shoreline will continue to be accessed and appreciated by people interested in recreational fishing, and closer exploration of a rocky platform in a low impact way.
4. Increased knowledge and awareness of this marine environment and significant species will assist the appreciation and sustainable use of this area.

A sustainable Caloundra headland should include:

- Increased knowledge and appreciation of this environment by occasional visitors and regular users
- Rehabilitation of degraded native headland vegetation
- Conservation of the habitat for significant species.
- Planned use and access to achieve a balance between recreation and appreciation of the unit combined with preserving natural values.
- An environment along the headland top which is a safe setting for day and night use.

Values and Features

Ecological

- presence of migratory shorebirds including the rare Sooty Oyster catcher and other marine birds (Osprey, Crested Tern, Cormorant) which roost or forage along the rocky shoreline, particularly at low tide.
- Naturally restricted coastal headland vegetation
- The presence of three species of mollusc the first two of which are species endemic to this coastline and possibly Caloundra headland
  - the limpet (*Callana turbator)*
  - the Caloundra abalone (*Haliotis melculus,)*
  - a Tridacnid clam (*Tridacna sp.)* listed as Endangered in the IUCN Red Book.

  Their presence suggests the area has State and possibly National significance.
- Historic botanic collections made from the headland.
- Species rich and diverse aquatic ecosystems

Scenic & Landscape

- Viewing opportunity from cars
- Spectacular views to ocean, coastal beaches of Happy Valley, Kings and Golden Beach, as well as the Glasshouse Mountains

Cultural

- The war memorial, memorial plaques and memorial to the Centaur wreck. These were constructed in 1948 and 21969 respectively , and are used today for war memorial services.
- The Norfolk Pines aligning the road which were planted in the 1930's.
- The area has significance for indigenous groups, although tangible evidence in pecked rock engravings in the cliffs have been eroded and are no longer visible.

Management Issues & Actions

Management Issue	Discussion and Recommended Actions *Actions in italics*
Access	Informal paths from the headland top to the rocky shoreline are frequent, and are the cause of erosion and trampling of vegetation. In addition, there are a number of sandy tracks along the base of the headland. Increased use will make such unformed and unmaintained paths increasingly problematic. • *Construct a signed, formalised access from the headland to the rocky platform.* • *Consider installing low impact paths (eg stepping stone effect or track markers) along the cliff base to provide for more sustainable access.* • *Create opportunities for return trips rather than doubling back by road by using top and bottom of headland ('headland exploration walk').* • *Ensure access for mobility impaired users to viewing nodes and general viewing areas.*
Signage & Interpretation	The area is very suitable for integrated, high quality and detailed education and landscape interpretation on the themes of: - The Glasshouse Mountains – geological history, indigenous significance, European discovery and naming - Migratory shorebirds – their migratory feats, flyways, habitat - Significant marine ecosystems - Headland vegetation (history of early botanists). A number of panels, displays, signs could add value to a headland visit, and include a behavioural message which encourages sustainable use of the area. Use should be made of agency expertise, who can assist with the development of such materials. • *Develop and implement a high quality interpretation plan for this area, with the emphasis on information and education.* • *Unify the precinct experience by a consistent treatment and suite of materials, design and furnishings* • *Consolidate and enhance the memorial setting into a high quality facility* • *Liaise with Queensland Museum, local naturalists and QP&WS re information and interpretation products suitable for the rocky shores.* • *Consider the possibility of establishing some 'sacrificial' rock pools to attract a large proportion of visitors to the rocky shore. Input from the Queensland Museum should be sought.*
Viewing Nodes	Views across the headland and to the rocky shores below are often obscured by tall, exotic vegetation. There is scope for maximising view opportunities from the headland. • *Assess the area for suitable locations for viewing nodes and/or platforms which may involve construction of a small platform, or clearing some vegetation, with the aim of developing one or more consolidated lookout point(s)* • *Such sites should be designed as high profile viewing sites, with suitable interpretative material. Low profile, bird lookout sites could also be considered* • *Promote viewing eg directional totems / telescope*

Weeds and Rehabilitation	There are two areas for weed control and rehabilitation. One is close to the boat ramp, where approx a 100 metre stretch of lantana, singapore daisy is mixed through a overstorey of pandanus and banksia. The area is of a scale to be very treatable, is close to mangroves and a popular fishing spot. Secondly is the headland itself, where because of botanical significance together with high visitor profile, rehabilitation is very worthwhile. • *At boat ramp area – control lantana, singapore daisy, brushcutt then replant. This leads up to the memorial – RSL, Rotary or similar may be willing to become involved with rehabilitation.* • *At Caloundra headland – spearfell Umbrella trees and other exotics* • *Control Singapore daisy, morning glory, lantana, ochna, mother-of-millions* • *Replant with endemic species which will not obliterate view* • *Assess establishing a community group to assist with ongoing maintenance and stewardship of this important site.*

6.4 Shelly Beach

SHELLY BEACH

Description

Nestled between Caloundra and Moffat headlands, Shelly Beach offers an undeveloped setting and a quiet ambience unique along the Caloundra coast. From the carpark and adjacent picnic areas, traffic noise is largely inaudible, and built features unobtrusive.

Features of easy access to the rocky platforms of the Caloundra headland as well as a degree of seclusion suggest a distinctive landscape.

The presence of nesting marine turtles, (an Endangered species) and nearby roosting and foraging areas for migratory shorebirds (on the Shelly Beach side of the Caloundra headland) further reflect the natural setting. Whip birds still remain in the small, isolated fragment of coastal vegetation adjoining the carpark (E. Riis, pers.comm.).

Facilities are few but sufficient to meet basic recreational needs and require maintenance. The newly constructed Headland Walk which traverses the area along the dune edge is likely to result in some increase in pedestrian traffic to the area.

Coastal dunal vegetation is most developed along this area of all beaches in the study area, with diverse species of dune ground covers, as well as mature and regenerating *Banksia integrifolia*, (Coastal banksia), *Casuarina equistifolia*, (Horsetail she-oak) *Pandanus*, (Pandanus), *Cupaniopsis anacardioides* (Tuckeroo).

The northern section of Shelly Beach includes the George Watson Park; a small and isolated remnant of coastal vegetation which supports a mix of vegetation communities in good condition and enjoys ongoing community management and use. The sand dunes are well developed and stable.

The steeply shelving shoreline combined with rocky outcrops make the beach unsafe for swimming.

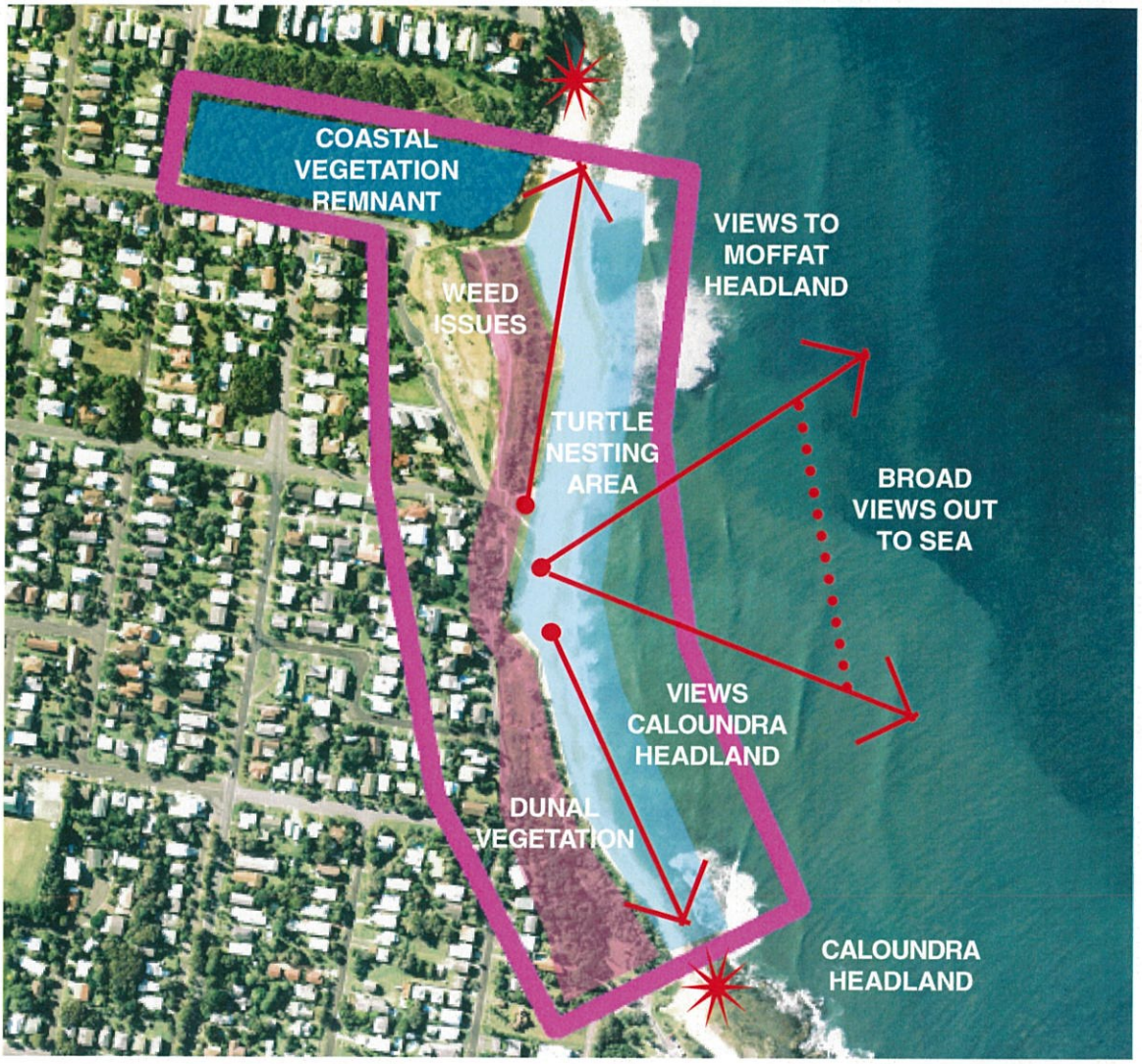
Management Objectives and Principles

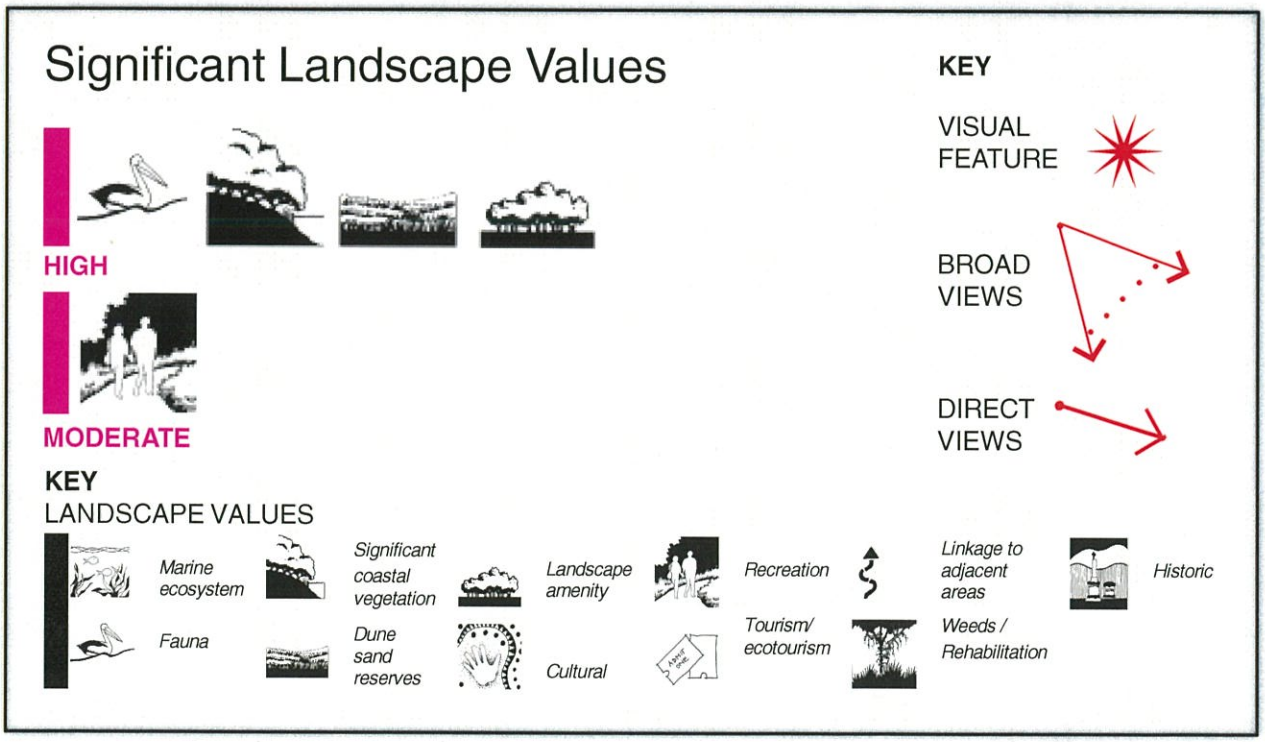
1. The vegetation and fauna of Shelly Beach described above coupled with its distinctive, natural setting strongly suggests that ecological values should direct planning and management decisions in this unit.
2. The natural, small scale and informal ambience of the unit should be retained to provide a diverse spectrum of coastal settings within close proximity. Retention of such relatively undeveloped areas is important to achieve a mix and range of coastal landscapes and settings. Construction of commercial facilities (eg kiosk) is not compatible with these objectives.
3. Maximise opportunities for interpretation and education materials for vegetation, marine life and shorebirds.

A sustainable Shelly Beach should include:

- Maintaining a suitable environment for nesting marine turtles
- Establishing an awareness of the area's values with both regular and occasional visitors, so that people use the beach sustainably,
- Conserving a diverse, largely weed-free and continuous cover of coast dunal vegetation which covers a stable foredune system
- Maintaining a quiet setting and ambience which contrasts with the more developed adjacent sites of Kings and Moffat Beaches.

Figure 7: Shelly Beach, Management Unit Analysis





Values and Features

Ecological	• Presence of nesting Loggerhead and Green turtles over December – early February. Although not a highly significant nesting site, it represents the most southern site for nesting turtles on the Queensland mainland. • Vegetated remnant of mixed coastal communities, including unusual stunted form of *Eucalyptus intermedia* (Pink Bloodwood) and mature *Corymbia racemosa* (Scribbly Gum) • Intact coastal dunal vegetation in good condition • Extensive reserves of sand in the stable foredunes
Scenic & Landscape	• Norfolk Pines along the picnic site as well as foredune vegetation • A semi-natural setting with views to headlands framed by the bay
Cultural	• Mature Norfolk Pines which align the park edge.

Management Issues & Actions

Management Issue	Discussion and Recommended Actions *(actions in italics)*
Signage & Interpretation	Existing signage and interpretation is minimal, old and outdated. For an area with such significant environmental values, there is considerable potential and need for innovative and educative interpretation. • *Initiate the development of good quality, innovative interpretative material. This could include signage, panels, pamphlets, pictures, footprints of shorebirds, shorebird silhouettes for easy ID, the shorebird story, marine turtles. The emphasis should be on information and appropriate behaviour. It should address the issues of bait collection, fishing behaviour, dog control, rock pool fossicking. Quality interpretation could become a feature of the picnic and car park area.*
Dogs	Dogs off- leash are a recognised pest to nesting marine turtles and frequently disturb roosting or feeding shorebirds (located on headland). • *Reassess current off-leash arrangements for dogs. Dogs should at a minimum be controlled or excluded during the turtle nesting season, November -March. Dog access to the rocky headland should also be prevented.*
George Watson Park	The George Watson Park is a focus for community and Council management of scarce coastal remnant vegetation. Entry points from the street are poorly signed (or not signed) with the only 'entry statement' located in a site with poor visibility. Interpretation requires upgrading, with a broader focus than species names. Community efforts need ongoing support to maintain the remnant's value. Management focus needs to be on interpretation, track rationalisation, ongoing weed management and establishing suitable entrance spots. • *Establish entry point along Russell Street and the foredune area with signage and perhaps an appropriate entry structure.* • *Introduce interpretation on vegetation communities, not just species at different points along the tracks. Signs could indicate vegetation community, typical species and associated fauna.* • *Interpretation information is also needed along the headland walk path.*

	• *Track rationalisation needs attention, with further track closures recommended. A main track (loop) should be identified and re-furbished.* • *The fire break adjacent to high rise residential areas is excessive. Part could be rehabilitated.* • *Dumping of garden waste and planting of invasive species in adjacent gardens is an on-going problem Refer the weed management strategy (section 7.4.1)* • *Continue to assist and tangibly support the Wildlife Preservation Society in their management efforts.* • *Formalise an entry on to the headland walk from the Park and onto Shelly beach*
Marine Turtles	Turtle nesting needs a relatively quiet area, few predators (dogs, foxes) and a dark beach. • *Lighting on the toilet block and car park/picnic area changed to low pressure sodium lights, and follow general lighting guidelines in section 4.1. Any new lighting should also follow these guidelines.* • *Encourage the fox control program currently operating in the northern Sunshine Coast to be implemented along the Caloundra coast.* • *Dog control be reviewed from the current off-leash arrangements particularly for the nesting season.* • *Intensive activities and night-time activities should be avoided.*
Weeds and Rehabilitation	Dune areas are in good condition, although occasional bare patches could be replanted. Two areas suggest good returns from weed control: a) Canna lilies and umbrella trees are growing in parkland with casuarinas, banksias etc. A manageable task and easy to rehabilitate with coastal dune species. b) Area around Russell St bridge back to drain, which is high profile from the headland walk. This site could become an attractive 'wetland' area. • *Retain stabilising paragrass around the Russell St bridge. Treat area (spray) around bridge back to the drain. Replant for a wetland effect. Some follow-up weed control required.* • *Add to scattered casuarinas along Victoria Terrace. A line of vegetation to reduce light onto the beach would be beneficial to turtles.*
Access and Tracks	There is currently a number of unformed sand tracks through the dunes to the beach. The new headland walk may well encourage further tracks to be developed. This may present problems for dune erosion, weed invasion and removal of dune vegetation. • *Monitor access tracks for signs of increased use. Some fencing along the dunes may be necessary to formalise access in the longer term, dependant on monitoring results.* • *Consider the development of a loop/return track using the George Watson Park*
Facilities	Current facilities are adequate for the relatively low level of use, although additional tables could be accommodated. Current eating areas are becoming degraded, with erosion evident and an eating shelter which would benefit from a facelift. Any additional features should retain a low impact design. Given the unsafe nature of the swimming beach, any provision of play facilities for children should remain a minor focus of this area. • *Maintain and upgrade existing facilities whilst retaining a sensitive and low impact design and ambience of the picnic area. Avoid developing a high profile of the area as a children's playground.*

6.5 Moffat Headland

MOFFAT HEADLAND

Description

Moffat Headland is smaller than the nearby Caloundra headland, and is very difficult to traverse around the base due to strong wave action along the cliff base. However, it still offers excellent views and is a generally less developed and a lower profile site than Caloundra headland.

The headland is steep, making informal access from top to bottom virtually impossible. Rocky cliff walls are more pronounced than in Caloundra headland, with headland vegetation correspondingly less extensive. Extensive weed invasions occur toward the Queen of Colonies end.

The area offers opportunities for walking links between Shelly and Moffat beaches, as well as nature-based recreation which could add interest and diversification to the headland walk.

Management Objectives and Principles

1. Reinforce the semi-developed setting to ensure a diversity of experience throughout the Caloundra coast
2. Managed and safe public access so the site can be appreciated by all
3. Maximise opportunities for viewing nodes and landscape interpretation
4. Encourage sustainable adventure and nature-based recreation.

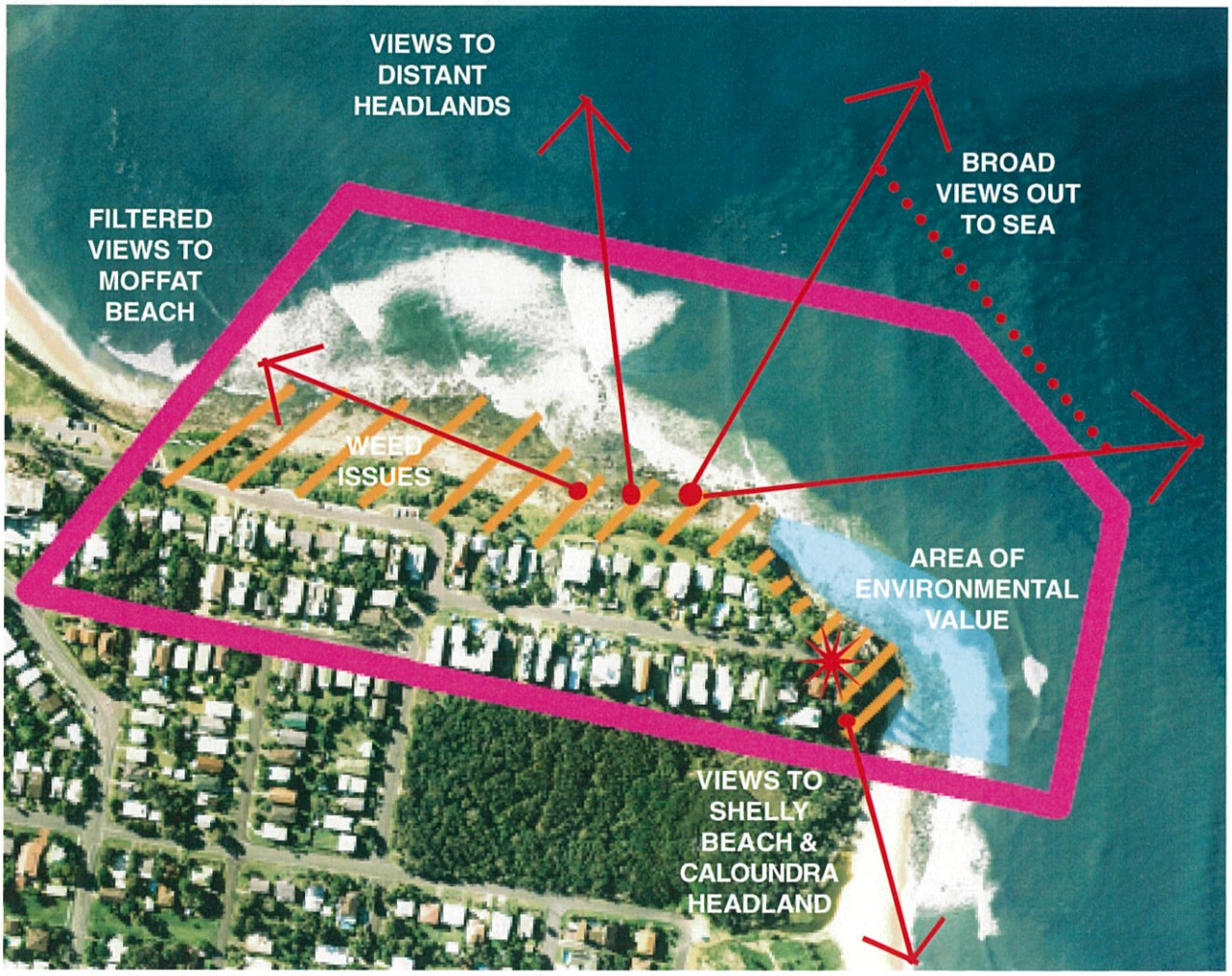
Sustainability for Moffat Headland should include:

- Establishing a safe and inviting area for enjoying the site's views
- Developing agreed principles and workable arrangements between private and public access and enjoyment of the area

Values and Features

Ecological	• Limited areas of native coastal headland vegetation
Scenic & Landscape	• Spectacular ocean vista • Feel of a rugged, wild landscape, with focus on cliff base • Rugged cliffs suitable for some adventure activities
Cultural	• Queen of Colonies monument

Figure 8: Moffat Headland, Management Unit Analysis



Significant Landscape Values

HIGH

MODERATE

KEY

VISUAL FEATURE

BROAD VIEWS

DIRECT VIEWS

KEY
LANDSCAPE VALUES

Marine ecosystem
Fauna
Significant coastal vegetation
Dune sand reserves
Landscape amenity
Cultural
Recreation
Tourism/ ecotourism
Linkage to adjacent areas
Weeds / Rehabilitation
Historic

Management Issues & Actions

Management Issue	Discussion and Recommended Actions *Actions in italics*
Rehabilitation	Eroded areas caused by numerous tracks and trampling make the top of the headland area near McIllraith St. a safety issue. The headland is extensively weed infested, with steeper areas highly problematic and expensive for weed control. • *Establish viewing platform to control access* • *Investigate contract work for headland weed infestation*
Viewing Opportunities	The views from this area offer opportunities. The area, although small, is suitable for a viewing platform (planned as part of the headland walk) which can be an added feature. • *Construct a viewing platform or lookout point with landscape interpretation to maximise the vistas from this site. Signage, display panels, telescope, public art could all be considered.*
Resident/ Environment Interface	The narrow walkway along the headland top provides problems for public access. However, alienation of this area from the public may preclude a number of opportunities for the headland's use and appreciation. Sensitive treatments can balance private and public access and foster harmony, rather than segregation. • *Formal liaison with residents to identify key concerns and address where possible through sensitive design and management* • *Consider the use of a subtle footpath through this area – perhaps a 'stepping stone' effect or markers – to establish a more formal walking path.* • *Signage or other means to convey the area has public access*
Nature-based active recreation	The headland has been identified as a possible location for active nature based recreation (eg abseiling). The following issues would need to be addressed: - access at the base (difficult at or near high tide) - access issues at the top (liaison with residents) - safety - level of infrastructure or permanent fixtures needed - management of people numbers – casual, clubs, special events. - More detailed knowledge of the ecological values of this site. • *Proposals for these types of activity would be assessed on their merits, with the above issues resolved. Liaison with a relevant Council (eg Brisbane City Council for abseiling at Kangaroo Point) recommended to ensure all relevant issues are addressed.* • *If the selected site and proposed activity will destroy native headland vegetation, a competent botanist should survey the site to ensure significant species or communities are protected.*

6.6 Moffat Beach

MOFFAT BEACH

Description

Moffat Beach is a secondary recreation node along the Caloundra coast, with less intensive activity than Kings Beach. However, it still experiences steady use coupled with peak periods especially during surfing carnivals.

Although the beach is not particularly safe for swimming (currents and a steeply shelving foreshore), its surf breaks make it attractive for both casual and organised surfing activities.

The parkland associated with the beach is a major point of attraction particularly for families with its shaded, well-maintained facilities, quiet ambience and easy access. The view across Tooway Lake is an added attraction, with many visitors, (especially children), taking advantage of its calm water for swimming. The area has more of a residential neighbourhood than a commercial, tourist character. There is a low to moderate sense of nature in this unit.

Anecdotal evidence states that Tooway Lake flows through to the sea a few times per year, although its usual condition is for flow to be blocked by a sandbar. Its catchment is relatively small, and is suitable for active catchment management to improve water quality.

This precinct has the most clearly developed 'local' character' feel, with a greater sense of community permanency, smaller scale development and parkland designed to accommodate a large number of small groups of people.

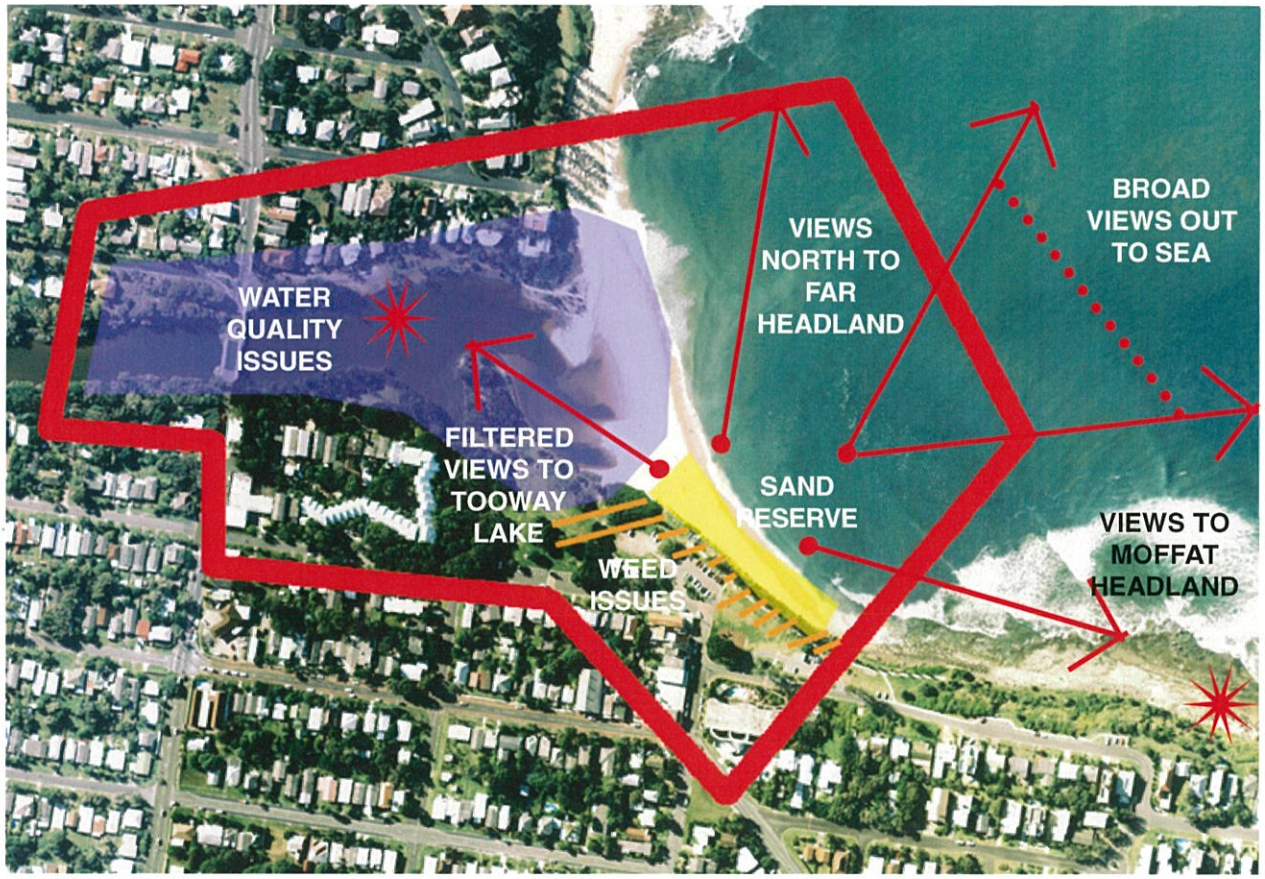
Management Objectives and Principles

1. Management of the area should be for beach and parkland based recreation, with an appropriate standard of facilities to accommodate these uses.
2. The water quality of Tooway Lake should be suitable for primary contact.

Sustainability for Moffat Beach should be toward:

- Water quality of a standard suitable for primary contact
- Planning and facilities which can cater for high volume use at peak times
- Planning a solution for traffic and parking which avoids encroaching onto parkland or open space.

Figure 9: Moffat Beach, Management Unit Analysis



Significant Landscape Values

HIGH

MODERATE

KEY

VISUAL FEATURE

BROAD VIEWS

DIRECT VIEWS

KEY
LANDSCAPE VALUES

Marine ecosystem
Fauna
Significant coastal vegetation
Dune sand reserves
Landscape amenity
Cultural
Recreation
Tourism/ ecotourism
Linkage to adjacent areas
Weeds / Rehabilitation
Historic

Values and Features

Ecological	• A sand buffer and reserve along the beach
Scenic & Landscape	• views to headland and off-shore reefs dominate, and are reflected in the orientation of facilities • lake feature to add interest to scenic outlook • informal recreation activity setting, with a 'semi developed' recreation setting. • Large fig tree in smaller park dominates this setting.
Cultural	• Mature Norfolk Pines along the park edge.

Management Issues & Actions

Management Issue	Discussion and Recommended Actions *Actions in italics*
Parking	There are currently nearly 90 car parking spaces adjacent to Moffat Beach/Eleanor Shipley Park, excluding shops and side street parking. This gives considerable capacity, suggesting any parking problems need to be solved by a range of solutions other than continual increases in parking spaces. • *Resurface the car park surface near the toilet and mark parking bays.* • *Consider a turnaround and drop-off area in this car park, so people can park further afield but still drop gear and luggage off close to the beach or park.*
Water Quality	There are no signs indicating water quality in the lake may not be suitable for swimming. Council is potentially legally liable in this situation. • *Erect signs concerning water quality along the lake shore.*
Catchment Planning	The lake has a relatively small catchment. Any improvements in water quality require a catchment based approach, which should seek co-operation from a major landuse – the golf course. • *Initiate a catchment management plan for the Tooway Lake catchment*
Facilities	Indications are that demand for tables and BBQ's is high. • *Some additional tables could be added under shady trees at the car park end of Eleanor Shipley Park.* • *Increase the useable park area by creating shade and facilities in the adjoining park area and in the relatively bare area behind the line of Norfolk Pines.*
Parkland Links	There is opportunity for creative linking and maximising the park areas stretching up to Moffat headland. • *Develop the parkland leading up to the headland as an informal amphitheatre to facilitate spectators of surfboard riding carnivals.*
Erosion	Some grassy slopes along the beach side of the park and along the Lake are experiencing slumping and erosion through informal access to the beach. • *Stabilisation of this area may be required and some formalised access to the beach. Monitoring is recommended in the short term to assess urgency for action.*

Community Input	The bare area behind the Norfolk Pines and walkway could become a focus for community art or other permanent displays or sculptures. This would add a rich dimension to the area. • *Assess the merits of themes art/sculpture displays, with involvement from local community and art groups*
Weeds and Rehabilitation	Area off eastern end of car park has a severe infestation of singapore daisy. Patch of lantana and broad-leafed pepper tree has high community visibility, and is a size suitable for easy treatment. The bank of vegetation running along the beach has a mix of weeds interspersed with coastal canopy vegetation (casuarina, pandanus, banksia) with some kangaroo grass understorey. • *Spray, cut and replant the above areas* • *Constitutes a manageable area for weed control.* • *Reduce spraying area under Norfolk Pines in the park. Leads to excessive area of bare soil.* • *Remove emergent umbrella trees.*

HAPPY VALLEY

The attractive and heavily maintained parkland area adjacent to the beach is the primary focus for most of Happy Valley's recreation.

Dunal rehabilitation currently underway at the 'little headland'. There is now a good coverage of native vegetation over this area.

KINGS BEACH

The sand and surf which make Kings Beach a preferred location for coastal recreation

Strip parkland adjoining the beach is designed and managed for heavy use

CALOUNDRA HEADLAND

The heavily landscaped and visited area along the Headland top, with impressive vistas. Large areas have been given over to car parking.

Photo courtesy of B. Dickson

Shorebirds: Six rare Sooty Oystercatchers regularly seen perched on rocks at Caloundra headland.

CALOUNDRA HEADLAND

Photo courtesy of B. Dickson

Shorebirds: Numerous Crested Terns at the Shelly Beach end of Caloundra headland.

SHELLY BEACH

Coastal vegetation provides a good cover over dunal areas, with colonising spinifex evident (foreground). Moffat headland provides a clearly defined northern boundary to this unit.

The southern edge of Shelly Beach, with its easy access to the rocky platforms of Caloundra headland.

Mature and striking example of Scribbly Gum (Corymbia racemosa) in George Watson Park.

Steep access to the beach from the carpark and picnic grounds. Minimal and outdated signage.

MOFFAT HEADLAND

The headland, showing the steep drop to its base and eroded areas near the edge.

The steep nature of the headland, and difficulty of accessing along its base near high tide.

Magnificent views from the headland, which are opportunities as yet undeveloped.

The narrow path along the top does not give the impression of public access. Managing the interface between residents and the environment is important here.

MOFFAT BEACH

View across Tooway Lake showing the pleasant ambience and maintained parkland.

Moffat Beach illustrating the eroded coastline, line of mature Norfolk Pines (far right), Moffat Headland in the distance, and the somewhat rough sea conditions.

7.0 THE ACTION PLAN

7.1 The Overall Plan

The coastal management plan is based around the principle that a diverse range of settings - from developed to natural - be retained and managed to conserve their key features.

Overall Setting Characterisation

Precinct	Developed	Semi-developed	Semi-natural	Natural
1: Caloundra Bar / Happy Valley	☐			
2: Kings Beach	☐			
3: Caloundra Headland (top) (rocky shore base)		☐		☐
4: Shelly Beach			☐	
5: Moffat Headland			☐	
6: Moffat Beach to Tooway Lake		☐		

☐ Existing setting
Desired setting

A summary of each of the settings appears below. A more complete description of their distinguishing characteristics is contained in Appendix B.

Developed	Semi developed	Semi-natural	Natural
Highly developed, formal areas, managed primarily to maximise formal recreational values	Partially developed areas managed primarily to maximise outdoor recreation values	Semi-natural areas managed primarily to enhance nature based ecotourism and recreation values	Predominantly natural areas managed primarily for the protection of natural heritage values

Currently the range of settings extends from developed to natural, including two very developed areas, two semi-developed settings, two semi natural settings one natural setting. The recommendations of this study essentially reinforce the current variety. However, to balance ecological significance and accommodate an increasing development pressure on the study area, the above distribution of setting is desired.

This distribution will maintain the semi-natural setting of Shelly Beach and Caloundra headland balanced with an increased use of Moffat headland. Happy Valley and Kings Beach will be reinforced as developed settings.

7.2 Key Action Strategies

The action plan consists of two categories of actions:

i) those that are small, specific to a site and clearly limited to a well defined issue, and
ii) those that occur across many sites, may involve input from number of sections within Council and require a strategy for their successful implementation. They will not be adequately addressed by an ad-hoc response on an issue-by-issue basis.

Although all actions are contained in the summary action plan, the second action category is outlined further below.

(a) Weed Management & Rehabilitation

Weed invasion along the coastal strip is a major management issue for Council. It can consume considerable resources. Weed management has been targeted toward the following areas;

- those where weed invasion is restricted to confined areas of a manageable size (eg the coastal strip from Margaret St to the pool);
- areas where native canopy or understorey exists, and so have the basic elements to assist rehabilitation (eg near the boat ramp at the base of Caloundra headland);
- sites which have a strong visual profile, and where there is community return for the investment in rehabilitation (eg headland walk bridge near Russell St), and
- areas of some environmental sensitivity (eg Caloundra headland).

In response to these criteria, two heavily weed infested sites have not been identified for priority treatment:
a) the 'little headland', and
b) Moffat headland.

These areas are largely inaccessible by the public or have severe physical constraints. It is considered at this point that the return from weed management is less than for other sites.

Some of the weed management is best undertaken by contractors, particularly where there are safety or liability issues, the handling of chemicals or need for specialised equipment.

Weed management is best seen as a three year program, tackled as a 'mosaic' of weed management sites along the coast so that efforts are visible along a broad area. Small, manageable areas are best tackled to give realistic results.

(b) Interpretation and Education

This is a fundamental action area which has both strategic and site based elements. Interpretation has a role in education, encouraging appropriate behaviour and appreciation of the site and its values.

Interpretation needs to avoid the 'do and don't' approach in favour of well designed, interesting and varied presentation which readily involves the visitor and attracts their interest.

Well designed interpretation is not inexpensive, but it is a long term investment in the area's use and value, and also has direct links to the quality of the tourist experience.

State agencies offer expertise and assistance with developing these products, in particular the Queensland Museum, and QP&WS (Cleveland office – Shorebirds Education Strategy).

(c) Headland Walk

The headland walk is essentially a path through a series of different coastal landscapes and settings – many of which are not headlands. It is most likely to be experienced in stages.

The walk would benefit from unifying themes, furnishings, symbols, icons and interpretation, A series of names could be considered – the coastal walk, coastal edges, coastal landscapes walk (the headland section, the environmental section, the bushland section, the surfing beach section etc)

Co-ordinated signage and 'icons' would assist the walk profile and presentation.

(d) Water Quality

Water quality monitoring results for Tooway Lake indicate variable results, with key indicators for primary and secondary contact often being exceeded. Clearly these are related to rainfall events.

Water quality monitoring for the Kings Beach stormwater outlet undertaken by the EPA also shows primary contact being exceeded on some occasions (though not regularly).

This raises issues of :

- Council's legal liability with people swimming in water which would not meet primary contact standards on many occasions during the peak swimming season;
- Unsightly stormwater drains discharging onto beaches, which pose a health and safety risk, which do not reflect recommended best practice to finding alternatives to the release of stormwater across beaches or foreshores (DNR 1998).

The issue of stormwater and water quality is a major strategic program for Council. The directions outlined in the draft Urban Stormwater Management Strategy reflect this. It is suggested that given the profile and recreational use of coastal areas, these sites should be given priority in this Strategy.

(e) Resident / environment Interface

Many of the coastal sites are linear and surrounded by development. Successful management of these sites must manage people, their access and use of the area. Evidence across a number of sites indicates problems with access, weed escapees from gardens, vegetation clearing, lopping and rubbish dumping.

Education material and information is needed to address a number of issues to encourage greater stewardship by residents for their local environment. Suggestions could include:

- A series of newspaper articles on local coastal environments, highlighting their various values;
- Posters or information sheets (with sketches) on weed species, suitable plants;
- Co-ordinated information pamphlets on the values of coastal sites (perhaps as part of a Caloundra natural heritage series) and distributed to local residents.

(f) Community Involvement

There are relatively few community groups involved with the coastal environment. Specific projects arising from this study could include:

- Catchment planning for Tooway Creek catchment;
- Turtle action group (monitoring nests, removing eggs from unsuitable nesting sites);
- Dune and remnant management (Shelly Beach, George Watson Park);
- Maintenance of Caloundra headland;
- Public dissemination of results (eg local papers)from current monitoring and counting of shorebirds;
- Community art/sculpture display at Moffat Beach.

All community groups need encouragement and tangible assistance, with Council's community grant program playing an important role. Co-ordination and assistance to community groups is often an important program for Councils.

g) Responsibility within Council

Coastal zones are multi-purpose, and involve engineering, ecological, community, planning and recreation issues. Such diversity can result in issues such as community involvement, interpretation, education and weed management not having clear ownership by a particular section within Council. This can result in inaction and promotes a reactive, rather than proactive program.

All actions and action areas identified in this plan need to have clear and agreed areas of responsibility.

Ownership vested in one area of Council, or the absence of clear, over-arching responsibility is a structure often leading to piecemeal solutions.

An outcome of internal ownership should be the integration of the three coastal management plans as well as supporting plans into a holistic and unified strategic direction for coastal management in Caloundra.

7.3 Summary Action Plan

The following action plan includes all actions identified in each of the Management Units. It identifies the department or section chiefly responsible for the action, together with its priority.

Table 6 Summary Action Plan

Actions	H Vlly	K Bch	Cal Hld	Sh Bch	M Hld	M Bch
Weeds & Rehabilitation						
Attention to stressed and inappropriately sprayed Norfolk Pines		●				○
Russell St bridge rehabilitation (wetland approach)				●		
Headland weed control and rehabilitation				●		
Weed control along beach in high profile areas until steep headland areas occur						●
Interpretation & Signage						
An integrated, landscape interpretation facility should be developed to inform the users of environmental, historic and cultural significance of the site and encourage appropriate behaviour throughout the site. This interpretative facility would encourage interpretation through visual, verbal and written means.			●	●	○	
Provide a regular indicator of the direction of the headland walk, especially when it diverts away from the foreshore	○	●	●	●	○	○
Liaise with other expertise for assistance & input (eg QP&WS, Q. Museum, local naturalists)			●	●		
A unified suite of directional and location signage, design and furnishing is required to ensure legibility of the study area	●	●	●	●	●	●
Additional interpretation for G. W. Park, avoiding an exclusive emphasis on species				○		
Develop visible entry statement for G. W. Park				○		
Quality interpretation and signage needed to inform, add interest and encourage appropriate behaviour.			●	●	○	
Viewing Nodes & Sites						
Establish or construct viewing nodes or platforms with appropriate interpretive material			●		●	
Water Quality and Stormwater						
Initiate a Catchment Management Plan for Tooway Lake						○
Assess Council's responsibilities for public health and swimming in Tooway Lake						●
Assess options for long term removal of stormwater drain at Kings Beach		●				
Agree on coastal stormwater outlets as a high priority for attention/retrofitting under the Urban Stormwater Management Strategy	●	●		●		
Parking						
Review current arrangements and establish a 'drop-off' turnaround area and mark parking bays						○
Dogs & Feral Species						
Review dog control arrangements			●	●		
Encourage the fox control program to be implemented along the Caloundra coast				●		
Access and Tracks						
Track rationalisation (G.W.Park) and construction of main track and track loop				○		
Connect track in G.W. Park to headland walk and entry to Shelly Beach				○		
Formalise access to headland and rocky platform			○			
Informal track monitoring				●		
Review safety of northern beach access (steps)	○					
Review location of beach access	○					
Appropriate signage, tracks re public access					●	
Formalise access to top of headland					○	
Constructed but 'soft treatment' track around headland base			○			

add det.

Actions	H Vlly	K Bch	Cal Hld	Sh Bch	M Hld	M Bch
Fencing						
Review fencing as part of reassessment of erosion control methods and with respect to visual & aesthetic links and turtle nesting requirements	●	●		●		
Erosion – coastal & site						
Review beach erosion treatment with controlled access, planting and appropriate planning along dunes following liaison with BPA	●	●				○
Avoid encroachment (including parkland) on the dunal system.	●	●				
Treatment of slumping and erosion treatment along beachside of grassed park edges				○		○
Outdoor recreation						
The introduction of new activities to be assessed with reference to safety, environmental and social issues.					○	
Resident/Environment Interface						
Education and information material prepared and promoted			●	●	●	
Further consultation with residents re public use and access; design and planning					●	
Parkland Planning & Management						
Design parkland from Moffat Beach for amphitheatre effect						○
Consider the amalgamation of fragmented parkland along Kings Beach in master planning exercise		○				
Community Input						
Support new and existing community rehabilitation and management efforts			●	●	●	
Initiate discussions with EPA to establish a turtle watch group				○		
Scope the nature and possibility of a community art feature with art groups						○
Amenities and Facilities						
Major upgrade of existing facilities		●				
Develop plans for the development of spectator facilities for coastal sports and recreation eg surfing and SLSC competition		●	○		○	●
Maintenance and minor upgrade of facilities				○		○
Lighting						
Address lighting issues for marine turtles including source, type, location and vegetation buffers.				●		
Coastal Policy						
Develop an integrated coastal plan and policy for the whole Caloundra coast.	●	●	●	●	●	●

Key

Management Units

HVlly Happy Valley
KBch Kings Beach
CHlnd Caloundra Headland
SBch Shelly Beach (includes George Watson Park)
MHlnd Moffat Headland
MBch Moffat Beach

Priority

● high
○ moderate

7.4 Implementation Plan

The following table is based on the summary action plan, adding timetable and costing to provide the basis for implementing the coastal management plan.

A more detailed breakdown of weed and rehabilitation treatment is also provided separately.

Table 7 Summary Implementation Plan

Actions	Action Plan Priority VH=very high H = high, M = mod	Preferred Commencement Immediate	1-2yrs	*$ (est)
Weeds and Rehabilitation				
Attention to stressed and inappropriately sprayed Norfolk Pines	H	✓		1
Russell St bridge rehabilitation	H	✓		2
Headland weed control and rehabilitation	H		✓	2
Weed control along beach in high profile areas until steep headland areas occur	H	✓		1
Interpretation & Signage				
An integrated, quality landscape interpretation facility	VH	✓		2**
Identify headland walk	VH	✓		1**
A unified suite of directional and location signage	VH	✓		2**
Liaise with State agencies for assistance & input	H	✓		**
Unify precinct experience by consistent treatment of design and furnishings	M		✓	3
Additional interpretation for G. W. Park, avoiding an over emphasis on species	M		✓	1
Develop visible entry statement for G. W. Park	M		✓	1
Viewing Nodes & Sites				
Establish / construct viewing nodes or platforms	H	✓		3-4
Promote viewing eg directional totems/telescope	M		✓	2
Water Quality and Stormwater				
Catchment Management Plan for Tooway Lake	M		✓	2
Coastal treatment for stormwater outlets and stormwater quality as a priority of the Urban Stormwater Management Strategy	VH	✓		4
Assess Council's responsibilities for public health and swimming in Tooway Lake	VH	✓		**
Parking				
Parking in significant visual areas to be softened with tree and shrub planting	M		✓	4
Parking to be reorganised to allow a buffer between visually significant areas and the parking provided	M		✓	4
Review parking arrangements at Moffat Beach and develop 'turnaround' area	H		✓	4
Dogs and Feral Species Control				
Review dog control arrangements	H	✓		**
Encourage implementation of fox control program	M	✓		**
Access and Tracks				
Track rationalisation (G.W.Park) and construction of main track and track loop	M		✓	1
Connect track in G.W. Park to headland walk and entry to Shelly Beach	M		✓	1
Formalise access to beach	H		✓	3
Informal track monitoring	M	✓		**
Introduce a 'marker' system to identify preferred trails along rocky foreshores and informal movement corridors eg Caloundra headland base	M	✓		2
Ensure access for mobility impaired users to beach and along tracks	H	✓		2
Review safety, location of beach access	H	✓		1
Appropriate signage, tracks re public access	M	✓		1
Formal headland access	H	✓		3

Fencing				
Appropriate fencing along beach to allow a visual link	H	✓		
Erosion – coastal and site				
Stabilising efforts to continue with controlled access, planting	H	✓		1
Treatment of slumping and erosion along grassed park edges	M		✓	2
Nature-based Recreation				
Introduction of new activities assessed with reference to safety, environmental and social issues	M	✓		**
Resident/Environment Interface				
Education and Information	H	✓		3
Further consultation re design and planning of public use and access	H	✓		**
Parkland Planing & Management				
Consider amalgamation of fragmented parkland	M		✓	**
Design parkland leading from Moffat Beach to headland to provide a natural amphitheatre	M		✓	2-3
Community Input				
Support new and existing community rehabilitation and management efforts	VH	✓		2
Initiate discussions with EPA re a turtle watch group	M	✓		**
Scope the nature and possibility of a community art feature	M	✓		**
Amenities and Facilities				
Develop plans for spectator facilities for coastal sports and recreation eg surfing and SCSC competition	M	✓		3-4
Major upgrade of existing facilities	H	✓		3
Maintenance and minor upgrade	M	✓		2
Lighting				
Address lighting issues for marine turtles	VH	✓		1
Ensure lighting in high use areas provides a safe environment for night use	H	✓		2

***Costing key**
1 = under $10,000 and a minor initiative
2 = between $10,000 – $50,000
3 = between $50,000 and 150,000
4 = over $150 000
** = cost involves mainly Council staff time

Priority – The 5 year Implementation Timetable
VH = Very High (between 1-2 years)
H = High (between 3-4 years)
M = Moderate (5 years)

7.4.1 Estimated Costing, Weed and Rehabilitation Treatment

General points:

- Rehabilitation costing varies widely depending on the density of replanting.
- 2-3 years follow up maintenance is preferred; consisting mainly of weed control
- Recommended 12 weeks initial maintenance – weeds and water.
- 'Brushoff' weed treatment is effective against most weeds (including singapore daisy) and does not affect native plants.

Table 8 Weed and Rehabilitation Costing

Site	Treatment	$ (est)
Kings Beach : Margaret St to the pool	Spraying Weed control Replanting	$8 000
Caloundra headland (boat ramp)	Weed spray (=1 day) Brushcut (= 1 day) Replant	$10 000
Caloundra headland	Weed spray Tree removal (1-2 days) Rehabilitation	$20 000
Shelly Beach (general)	Patch planting Refurbishment of fencing, signs, board & chain access	$5-10 000
Shelly Beach (northern end, old caravan park vicinity)	Weed control Replanting, dependant on planting density	$1 000 $2 – 8000
Shelly Beach (Russell St bridge, northern end)	Weed spray Replanting (= 2 days work)	$4 000
Shelly Beach (George Watson Park)	Refurbish tracks (regrade, resurface) & establish proper connection to Shelly Beach and headland walk	$10 000
Moffat headland (trial sites)	Initial preparation work Revegetation	$10 000 $20 000
Moffat Beach (200 metre stretch along beach toward headland area)	Preparation, replanting	$8 000
Moffat Beach (20mx30m patch near carpark)		$ 500
Moffat Beach (edge of carpark, near boatramp)	Spray, cut, revegetate	$8 000

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APPENDIX A. VEGETATION SPECIES LIST AND WEED SPECIES

Vegetation present (note that this is by no means a complete list)*20 March-2000*

Weeds are in **Bold**

T=Tree S=Shrub H=Herb V=Vine F=Fern O=Orchid P=Parasite G=Grass Se=Sedge C=Creeper A=Aquatic
Bold=Weed #=Planted Priority: L=low, M=medium, H=high

BOTANICAL NAME	FORM	COMMON NAME	PRIORITY
Adiantum aethiopicum	F	Common Maidenhair	
Adiantum hispidulum	F	Rough Maidenhair	
Agave americana	H	**Agave**	L/M
Ageratum houstonianum	H	**Billygoat Weed**	L
Alternanthera denticulata	H	Lesser Joyweed	
Anredera cordifolia	V	**Madeira Vine**	H
Araucaria cunninghamii	T	Hoop Pine	E
Asplenium attenuatum	F	Simple Spleenwort	
Aster subulatus	H	**Bushy Starwort**	L
Austrosteenisia blackii	V	Blood Vine	
Avicennia marina	T	Grey Mangrove	
Baccharis halimifolia	S	**Groundsel Bush**	H
Breynia oblongifolia	S	Coffee bush	
Bryophyllum daigremontianum	H	**Hybrid Mother-of-millions**	M
Bryophyllum tubiflorum	H	**Mother -of- millions**	M/H
Callistemon salignus	T	Pink Tips or Willow Bottlebrush	
Canna indica	H	**Canna Lily**	M
Carpobrotus glaucescens	C	Coastal Pigface	
Casuarina equisetifolia	T/S	Horsetail She-oak	
Casuarina glauca	T	Swamp She Oak	
Celtis sinensis	T	**Chinese Elm**	H
Chloris gayana	G	**Rhodes Grass**	M
Cinnamomum camphora	T	**Camphor Laurel**	M/H
Cissus antarctica	V	Native Grape	
Chryanthemoides monilifera	S	**Bitou Bush**	H
Citriobatus linearis	S	Black-fruited Thornbush	

Commelina cyanea	**V**	**Wandering Jew or Scurvy Weed**	**L**
Commersonia bartramia	T	Brown Kurrajong	
Dianella longifolia	H	Pale Flax Lily	
Dichondra repens	H	Kidney Weed	
Doodia caudata	F	Small Rasp Fern	
Eclipta prostrata	H	White Twin Heads	
Eragrostis tenuifolia	**G**	**Elastic Grass**	**Nil**
Eucalyptus intermedia	T	Pink Bloodwood	
Eucalyptus racemosa	T	Scribbly Gum	
Eucalyptus siderophloia	T	Grey Ironbark	
Eucalyptus tereticornis	T	Forest Red Gum	
Eucalyptus tessellaris	T	Moreton Bay Ash	
Euphorbia cyathophora	H	Painted Spurge	M
Eustrephus latifolius	V	Wombat Berry	
Ficus elastica	T	Rubber Tree	M
Ficus platypoda	T	Rock Fig	
Flindersia australis	T	Crow's Ash	
Gazania rigens	**H**	**Gazania**	**L**
Geitonoplesium cymosum	V	Scrambling Lily	
Glycine clandestina	V	Lover's Twine	
Gomphocarpus fruticosus	**S**	**Balloon Weed**	**M**
Gomphrena celosioides	**H**	**Soft Khaki Weed**	**L**
Grevillea robusta	T	Silky Oak	
Hibbertia scandens	C	Guinea Flower	
Hardenbergia violacea	C	False Sarsparilla	
Hibiscus tiliaceus	T	Cotton Tree	
Ipomoea indica	**V**	**Blue Morning Glory**	**H**
Ipomoea cairica	**V**	**Mile a Minute**	**H**
Jagera pseudorhus	T	Foam Bark	
Lantana camara	**S**	**Lantana**	**H**
Ligustrum lucidum	**T**	**Privet**	**H**
Lobelia purpurascens	C	White Root	
Lomandra longifolia	H	Spiny-Headed Mat Rush	
Macadamia integrifolia	T	Qld Nut	
Maclura cochinchinensis	V	Cockspur	L (native can invade)
Macroptilium atropurpureum	**V**	**Siratro**	**M**

Mallotus philippensis	T	Red Kamala	
Melaleuca quinquenervia	T	Broad Leaved Paperbark	
Myoporum acuminatum	C	Boobialla	
Myoporum boninense	H	Boobialla	
Myoporum debile	S	Winter Apple	
Notelaea longifolia	T	Mock Olive	
Ochna serrulata	**S**	**Mickey Mouse Plant**	**M**
Opuntia sp	**S**	**Prickly Pear**	**N**
Pandanus pedunculatus	T	Screw Pine	
Pandorea jasminoides	V	Bower of Beauty	
Panicum maximum v maximum		**G**	
Guinea Grass	**M**		
Parsonsia straminea	V	Monkey Rope	
Passiflora suberosa	**V**	**Corky Passion Flower**	**M**
Pennisetum alopecuroides	G	Swamp Foxtail Grass	
Peperomia leptostachya	H	Rock Peperomia	
Poa labillardieri	G	Tussock Grass	
Protasparagus densiflorus	**H**	**Now P aethiopicus Asparagus Fern**	**H**
Protasparagus plumosa	**V**	**Climbing Ferny Asparagus**	**L**
Pteridium esculentum	F	Bracken	
Schefflera actinophylla	T	Umbrella Tree	H
Schinus terebinthifolia	**T**	**Pepperina**	**H**
Senna pendula v glabrata	**S**	**Easter Cassia**	**H**
Solanum americanum	**S**	**Glossy Nightshade**	**M**
Solanum mauritianum	**S**	**Wild Tobacco**	**L**
Sonchus oleraceus	**H**	**Common Sowthistle**	**L**
Spinifex sericeus	G	Beach Spinifex	
Sporobolus virginicus	G	Marine Couch	
Streblus brunonianus	T	Whalebone Tree	
Tetragonia tetragonioides	C	New Zealand Spinach	
Themeda australis	G	Kangaroo Grass	
Trema tomentosa	S	Poison Peach	
Verbena bonariensis	**S**	**Purple Top**	**L**
Wedelia trilobata	**C**	**Singapore Daisy**	**H**
Wikstroemia indica	S	Tie Bush	

**Note: the above has included information from fieldwork conducted by Ann Moran.*

APPENDIX B. OPEN SPACE ASSESSMENT AND VALUES FOR COASTAL SETTINGS

(from EDAW (Aust))

Coastal Open Space Values

A **Coastal Open Space Value** is a measure of quality, importance or significance which people place on some aspect or characteristic of a park. For many people, values are the foundation on which they begin assembling a vision for a park. In a management plan, values represent those things that are to be conserved or in some instances, enhanced.
The relative importance of a park value can be rated subjectively according to commonly accepted benchmarks, such as recognition by relevant authorities. The importance rating is not intended as an absolute measure, but rather as an indicator of the need for further consideration or investigation before significant change is contemplated. If values are thought to be more significant than indicated, an asterisk (∴) can be used to flag that further verification is required.
The importance rating of particular values can be assessed as:
High: when *supported by documentation* produced by a recognised authority.
Moderate: when *generally recognised* by relevant stakeholders as being important.
Low: when *disturbed and* containing little or no known value.
Not known: where there is *uncertainty* as to whether a value may be present or not.

Coastal Open Space Setting

A Coastal Open Space Setting can be described by considering those physical, biological and social characteristics that combine to make a particular area distinctive and therefore attractive to particular types of users. For this exercise, typical settings are described along a spectrum ranging from developed (most developed) through to scientific reference (most natural). Smaller coastal open spaces typically comprise one coastal open space setting, while larger coastal open spaces may contain two or more coastal open space settings, which can provide totally different experiences.

The assessment of setting has been undertaken by applying a two step process. Firstly, each coastal open space (or significant sub-components of it) should be evaluated individually and rated according to the typical descriptions outlined below. This enables an assessment of the **existing coastal open space setting** to be made.

If the pattern that emerges is consistent, (ie. the open space characteristics all fall within a narrow band or one coastal open space setting type), it suggests that the coastal open space has been consciously planned and managed in a consistent way. If the pattern that emerges is inconsistent, (ie. the coastal open space characteristics fall within a broad band or spans several coastal open space setting types), this usually indicates that the coastal open space has been incrementally without the guidance of an overall plan.

Desired Coastal Open Space Setting

The question to be answered is *"what is the desired setting to be aimed for in this particular area and how does this compare with what currently exists?"* This question has been answered by a second step involving consideration of the area's values, management objectives and its role in the foreshore open space system as a whole. A decision has therefore been made regarding the **desired setting** for the area, keeping in mind that a balanced range of quality settings (within the wider open space system at the local, district and/or regional level) is being aimed for.

By comparing the current and desired settings, a decision can be made as to what actions are required to achieve the desired setting from the current situation.

Suggested Setting Characterisation for Coastal Open Space

Setting / Characteristic	DEVELOPED Recreation	SEMI-DEVELOPED	SEMI-NATURAL	NATURAL	SCIENTIFIC REFERENCE
	Highly developed, formal areas, managed primarily to maximise formal recreational values	*Partially developed areas managed primarily to maximise outdoor recreation values*	*Semi-natural areas managed primarily to enhance nature based ecotourism and recreation values*	*Predominantly natural areas managed primarily for the protection of natural heritage values*	Natural area managed primarily to maintain natural ecological processes and values.
Experience	Mainly social and activity focussed.	Activity focussed with low level of outdoor skills required	Moderate sense of nature. Low to moderate level of outdoor skills required.	Strong sense of nature. Moderate level of outdoor skills required.	Very strong sense of nature and isolation from human activity.
Access	Public transport, car, coach, cycle, and pedestrian access of a high standard. Good access provision to facilities and features for people with impaired mobility.	Vehicle access to within 100m of most areas. Formed walking tracks with some provision to selected facilities and features for people with impaired mobility.		Walking and boat access only. No motorised access, except for management and emergency purposes.	Access by permit only.
Activities	Activities that require safety and convenience including picnicking, playground play, beach swimming and body surfing, commercial activities and large group gatherings etc.	High impact, outdoor activities including, boating, fishing, cycling etc.	Outdoor activities that require a natural setting including rock scrambling, snorkeling, bird watching etc.	Low impact, nature based activities, including walking, nature study, photography, boating.	Scientific study.
Facilities	May include a range of quality visitor facilities including: SLSC buildings, picnic facilities, public art, amenities, play equipment etc.	Facilities located in "nodes" to support appropriate activities and may include picnic shelters, toilets, a multi-purpose pathway system, boat launching facilities etc.		Basic facilities, mainly at carparks and trailheads and at strategic including pathways systems, toilets, BBQ facilities, shelters etc.	None.
On Site Management	Very frequent supervision and intensive site maintenance required.	Supervision is moderate to high, concentrated on the main visitor nodes and access routes. Moderate to high site maintenance required.		Infrequent supervision with maintenance focused on controlling impacts and threats	No supervision, with minimal maintenance focused on pest and fire control.
Usage & User Density	Designed to withstand high levels of usage. User density is very high at peak times with some areas designed for large groups. Likelihood of interaction between groups is very high.	Usage and user density can be moderate. Likelihood of interaction between groups is moderate to high.		Usage and user density is moderate to low (>20 people at one time), Likelihood of contact between groups is moderate to low.	Nil

APPENDIX C. COMMUNITY INFORMATION SHEET

Coastal Management Plan - Tooway Lake to Caloundra Bar

Introducing the Project

Caloundra City Council has commissioned consultants to develop a management plan for the coastal strip from Tooway Lake to the Caloundra Bar. Council recognises this area has significant recreation, economic, landscape and environmental values. Increased use and a growing population mean that it needs careful planning and management if it is to keep the range and quality of its values.

The management plan will

- assess the environmental values and assets of this area,
- identify management issues and
- recommend actions.

The Project location

The coastal strip (including the foreshore and inter-tidal areas) and associated parks are the focus for this study. It includes Caloundra headland, as well as Moffat, Shelley and Kings beaches. Neighbouring residential and commercial areas are outside the study boundary.

Having your say

As a resident who lives close to this area, you are likely to frequently use, appreciate or pass by this coastal strip.

Council encourages you to make your views known, so they can be taken into account when the Management Plan is being developed.

Please note any comments in the space below, and return the pre-paid envelope to Council. You may insert additional sheets if needed.
They will be treated confidentially.

This letterbox drop has been restricted to residential areas in close proximity to the study area. Others interested in providing their views can contact the project coordinator directly or access survey forms from Council's Customer Service Center, (1 Omrah Ave, Caloundra) or contact 1300 650 112 (local calls) or 5420 8200 (for STD and mobile calls)

What features of this coastal area do you value or appreciate, and would like to see conserved or retained (within the study area)?

Are there any management issues or impacts which concern you along the coastal strip (within the study area)?

(more space at bottom of next page, or attach an extra sheet if desired.)

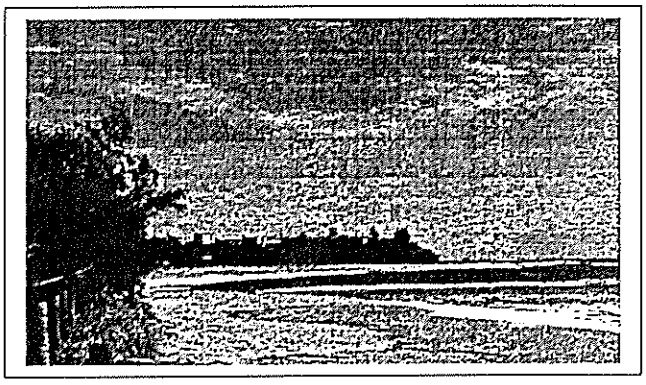
No postage stamp required
if posted in Australia

Coastal Management Plan
(Tooway Lake to the Caloundra Bar)

REPLY PAID 117
Caloundra City Council
PO Box 117
Caloundra Qld 4551

FOLD HERE

No envelope or stamp is required. Just fold and then staple or sticky tape the questionnaire to form an envelope. Then post or bring the envelope to Council before the 17TH March.



For further information.....

please contact:- The Project Coordinator

Kathy Burnett

Policy Officer (Environment),

Ph: 5491 0866;

Environmental Policy Unit;
Governance and Strategy Division;
Caloundra City Council.

THANK YOU FOR YOUR PARTICIPATION

FOLD HERE

Do you have any comments about present or future management for particular areas along the coast? eg. Moffat Beach, Moffat Headland, Shelly Beach, Caloundra Headland, Kings Beach, Happy Valley

Your details (optional) Name: Phone:
Address

APPENDIX D. SHOREBIRD BIRD COUNTS, CALOUNDRA HEADLAND

Information obtained from Barbara Dixon, as part of the Queensland Wader Study Group shorebirds monitoring program.

Page No.	Abbreviation	*Species*	*Notes*
90	BUTK	Bush Stone Curlew (Thick-knee)	
90	BETK	Beach Stone Curlew (Thick-knee)	
90	PASN	Painted Snipe	
90	PIOY	Pied Oystercatcher	
90	SOOY	Sooty Oystercatcher	
92	MALW	Masked Lapwing	
92	BALW	Banded Lapwing	
92	GRPL	Grey Plover	
92	LGPL	Lesser Golden Plover	
92	RKDO	Red-kneed Dotterel	
92		Hooded plover	
94	MOPL	Mongolian Plover	
94	DBPL	Double-banded Plover	
94	LSPL	Large Sand Plover	
94		Oriental Plover	
96	RCPL	Red-capped Plover	
96	BFPL	Black-fronted Plover	
96	WSTL	Black-winged Stilt	
96	BSTL	Banded Stilt	
96	RNAV	Red-necked Avocet	
78	RUTU	Ruddy Turnstone	
78	EACU	Eastern Curlew	
78	WHIM	Whimbrel	
78	LICU	Little Curlew	
78	WQSP	Wood Sandpiper	
80	GTAT	Grey-tailed Tattler	
80	WTAT	Wandering Tattler	
		Tattler sp.	
80	COSP	Common Sandpiper	
80	GREE	Greenshank	
80	MRSP	Marsh Sandpiper	
80	TESP	Terek Sandpiper	
82	LASN	Latham's Snipe	
		Snipe sp.	
82	BLGO	Black-tailed Godwit	
82	BAGO	Bar-tailed Godwit	
82	REKN	Red Knot	
82	GRKN	Great Knot	
84	STSP	Sharp-tailed Sandpiper	
84	PESP	Pectoral Sandpiper	
84	RNST	Red-necked Stint	
84		Long-toed Stint	
86	CUSP	Curlew Sandpiper	
86	SAND	Sanderling	
86	RUFF	Ruff or Reeve	
86	BRSP	Broad-billed Sandpiper	
88		Oriental Pratincole	
		Other waders	

Page No.	Abbreviation	*Species*	*Notes*
42	PELI	Australian Pelican	
42	AUGA	Australasian Gannet	
48	DART	Darter	
48	PICO	Pied Cormorant	
48	LBCO	Little Black Cormorant	
48	LPCO	Little Pied Cormorant	
68	WFHR	White-faced Heron	
70	GREG	Great Egret	
70	LIEG	Little Egret	
70	INEG	Intermediate Egret	
72	STHR	Striated Heron	
72	RNHR	Rufous Night-Heron	
74	BNST	Black-necked Stork	
74	SAIB	Sacred Ibis	
74	SNIB	Straw-necked Ibis	
74	RSPO	Royal Spoonbill	
52	BSWN	Black Swan	
56	PBDU	Pacific Black Duck	
56	CHTL	Chestnut Teal	
58	MADU	Maned (Wood) Duck	
110	OSPR	Osprey	
110	BSKI	Black-shouldered Kite	
112	BRKI	Brahminy Kite	
112	WHKI	Whistling Kite	
114	WTSE	White-bellied Sea Eagle	
120	AUKE	Australian Kestrel	
100	SIGU	Silver Gull	
102	WWTE	White-winged (Black) Tern	
102	GBTE	Gull-billed Tern	
102	CATE	Caspian Tern	
104	COTE	Common Tern	
104	WFTE	White-fronted Tern	
106	LITE	Little Tern	
108	CRTE	Crested Tern	
108	LCTE	Lesser Crested Tern	
70	EREG	Eastern Reef Egret	

WICKHAM ROCKS WADER COUNTS FOR 1999 - START DATE: 13.09.99

Site: WICK Coastal, Tidal, Ocean, Marine, Rock

Barbara Dickson, 34 Victoria Terrace, Caloundra, 4551

TOMR Lat: 26 48 04 Long: 153 09 01

Date:	13.9	14.9	15.9	17.9	19.9	20.9	21.9	22.9	23.9	24.9	25.9	26.9	27.9	28.9	29.9	30.9
Time S:	7.10	7.25	7.00	7.30	7.15	7.10	6.45	6.55	7.00	8.00	7.30	7.30	7.00	7.10	7.00	7.30
Time F:	7.25	7.40	7.15	7.50	7.30	7.20	7.05	7.10	7.15	8.10	7.50	7.45	7.10	7.20	7.10	7.45
Tide	4	4	3	3	4	2	1	1	1	1	1	4	4	4	3	3
Wind Dir:	SE	SE		NE	0	SE	SE	SE	SE	SE			E	E	SE	SE
Wind Str:	0	1		1	0	1	1	1	1	1			3	3	2	2
Cloud cover	1	1		0	0	0	5	0	0	0			0	4	2	2
Rain	0	0		0	0	0	1	0	0	0			0	0	0	0
People	2	3		0	6	1	0	2	1	3				1	1	0
Dogs	0	1		0	3	0	0	0	0	0				0	0	0
Tot spp	6	6	3	4	4	4	9	4	4	3	6	4	2	3	5	3
Tot birds	300	446	403	561	182	417	307	320	22	7	222	12	22	44	51	67
PIOY		1														
SOOY		1			1	2	4	3								
RUTU	1	1					1									
WHIM																
GTAT																
WTAT																
BAGO											1			1		
PICO	1			1			3				2				1	
LBCO		2		2					1					1		1
LPCO																
WFHR	1						1			1	1					
OSPR	1		1		2	2	2	1	1	1	2					
BRKI							1								1	
SIGU	4	11	2	8	4	3	6	5	5	5	13	2	1		3	3
WWTE																
GBTE																
CATE																
COTE																
WFTE																
LITE																
CRTE	292	430	400	550	175	410	287	311	15		203	10	21	42	45	63
LCTE																
EREG							2								1	

WICKHAM ROCKS WADER COUNTS FOR 1999 - OCTOBER 1999

Site: WICK Coastal, Tidal, Ocean, Marine, Rock

Barbara Dickson, 34 Victoria Terrace, Caloundra, 4551

TOKR Lat: 26 48 04 Long: 153 09 01

Date:	1.10	2.10	3.10	4.10	5.10	6.10	7.10	8.10	9.10	11.10	12.10	13.10	15.10	16.10	17.10	18.10	19.10	20.10	21.10	22.10	23.10	24.10	25.10	26.10	27.10	28.10	29.10	30.10	31.10
Time S:	7.05	7.00	7.00	6.55	7.00	7.00	7.00	17.40	7.40	6.10	6.50	7.10	6.45	7.00	7.30	6.45	7.00	6.30	7.00	7.00	8.00	9.00	6.30	7.00	6.20	6.40	6.20	6.40	8.20
Time F.	7.20	7.20	7.15	7.10	7.15	7.15	7.15	18.00	7.55	6.25	7.05	7.20	7.00	7.15	7.45	7.00	7.15	6.45	7.15	7.15	8.05	9.10	6.40	7.15	6.35	6.55	6.35	6.50	8.35
Tide	3	3	2	2	1	1	1	4	4	4	4	4	3	3	3	2	2	1	1	1	1	1	4	4	4	3	3	3	3
Wind Dir:	E	E	ENE	SE	SE	SW	SE	SE	SE	N	SE	NE	SE	SE	SE	NE	NE	0	E	N				0	N	S	0	0	N
Wind Str.	3	1	3	1	1	1	1	2	1	2	1	1	1	1	1	1	1	0	1	1				0	2	1	0	0	2
Cloud cover	0	5	4	5	1	0	0	0	1	0	0	5	4	3	2	4	2	5	5	2				1	2	5	0	0	2
Rain	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0	0	0	0	0	0
People	0	0	1	0	1	1	1	3	3	1	0	0	1	1	1	0	0	2	1	0	-			7	2	1	0	2	9
Dogs	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0				1	0	0	0	0	2
Tot spp	6	4	3	4	3	4	6	4	6	4	5	3	7	9	6	3	3	3	6	4	2	2	3	4	4	2	4	2	5
Tot birds	256	494	375	299	65	260	232	427	8	414	394	279	57	92	165	229	301	20	582	7	3	5	5	7	47	136*	8	12	186
PIOY																													
SOOY		1				3	3	5		1	3		1	2	2			1	2	2					1				
RUTU														1											2				
WHIM																													
GTAT																												.	
WTAT	1							1	1		1			1	1											1			
BAGO																													1
PICO	1			1			2		1				2	4	3	3			4	2	1	1	2	1			2		5
LBCO	3								1					2															
LPCO																													
WFHR													1																
OSPR	1	1	2	2			2		1	1	1	2	1	2	1		1		2	1				1			1		2
BRKI					1								1																
SIGU	2	7	3	3	1	8	4	1	2	12	17	7	4	2	6	12	2	2	2	2	2	4	2	2	2		3	3	4
WWTE																													
GBTE																													
CATE																													
COTE																													
WFTE																													
LITE																													
CRTE	248	485	370	293	63	248	220	420	2	400	372	270	47	77	152	214	298	17	571					3	42	135	2	9	174
LCTE																													
EREG						1	1							1									1						

*overflying CRTE

WICKHAM ROCKS WADER COUNTS FOR 1999 - NOVEMBER 1999

Barbara Dickson, 34 Victoria Terrace, Caloundra, 4551

Site WICK Coastal, Tidal, Ocean, Marine, Rock

TOSR Lat: 26 48 04 Long: 153 09 01

Date	1.11	2.11	3.11	4.11	5.11	6.11	7.11	8.11	9.11	10.11	11.11	12.11	13.11	14.11	15.11	16.11	17.11	18.11	19.11	20.11	21.11	22.11	23.11	23.11	24.11	25.11	26.11	27.11	29.11	30.11
Time S:	7.00	7.00	7.00	7.00	7.10	7.00	8.30	7.10	7.00	6.50	6.45	6.20	7.10	7.30	7.00	6.20	7.35	6.50	6.50	7.30	7.45	7.30	7.25	18.00	7.25	6.40	7.15	7.30	7.00	6.45
Time F:	7.15	7.15	7.15	7.15	7.20	7.10	8.55	7.25	7.15	7.05	7.00	6.35	7.25	7.45	7.15	6.35	7.50	7.05	7.05	7.45	8.00	7.45	7.40	18.10	7.40	6.55	7.30	7.45	7.15	7.00
Tide	2	2	1	1	1	1	1	4	4	4	4	3	3	3	3	2	2	2	1	1	1	1	4	4	4	4	4	4	3	2
Wind Dir:	N	SE	SE	SE	0		NE	S	W	SW	SE	SE	0	SE	N	N	S	SE	ESE	S	S	N	0	N	S	SE	E	E	S	SE
Wind Str:	1	4	3	1	0		1	1	3	1	1	2	0	1	1	2	4	2	1	1	1	1	0	1	1	3	1	1	4	1
Cloud cover	5	1	4	0	5		0	0	0	0	3	1	0	0	0	4	4	5	5	5	5	5	5	2	4	5	5	5	5	5
Rain	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	Q	0	0	0	0	0	2	0	0
People	0	0	0	0	1		4	0	0	0	1	1	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dogs	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tot spp	4	3	3	6	3	3	4	4	5	3	6	6	5	3	4	4	3	3	4	5	6	4	1	3	4	5	3	5	4	3
Tot birds	44	5	4	9	7	57	272	11	31	82	100	73	33	67	136	1667	683	788	427	117	239	34	5	12	39	13	26	54	5	3
PIOY																														
SOOT					2	2	3	4	1		4				4	2					6	6		7		2		5	1	
RUTU										2																				
WHIM																														
GTAT																														
WTAT				1								1	1																	
BAGO																														
PICO	2			1	3		9	4	3		2		1	2	1		1		1	1	2	2	5		6			2	1	1
LBCO		1																												
LPCO																														
WFHR																														
OSPR	1	2	2	2	2				2		1	2	2			1	2	2	2	2	2				2	2	2	2	2	1
BRKI												1								1										
SIGU	1	2		2		2	3	2	3	4	1	2	1	3	2	4		6	4	4	2	3		4		1	1	2	1	1
WWTE																					1									
GBTE																														
CATE																														
COTE																														
WFTE																														
LITE																														
CRTE	40		1	2		53	257		22	76	91	66	28	62	129	1660	680	780	420	109	226	23			30	7	23	43		
LCTE																														
EREG			1	1				1			1	1												1	1	1				

WICKHAM ROCKS WADER COUNTS FOR 1999 - DECEMBER 1999

Barbara Dickson, 34 Victoria Terrace, Caloundra, 4551

Site: WICK Coastal, Tidal, Ocean, Marine, Rock TOCR

Date:	1.12	2.12	3.12	4.12	6.12	7.12	8.12	9.12	10.12	11.12	12.12	14.12	15.12	16.12	17.12	18.12	19.12	20.12	22.12
Time S:	6.10	6.00	6.10	8.05	6.50	7.00	6.40	6.40	6.45	6.20	7.40	5.30	7.10	7.40	6.40	6.40	7.00	6.10	3.40
Time F:	6.30	6.20	6.30	8.25	7.15	7.20	7.00	7.00	7.10	6.45	8.00	5.50	7.30	8.00	7.00	7.00	7.20	6.30	4.00
Tide	2	1	1	1	1	1	4	4	4	4	4	3	3	3	2	2	2	1	3
Wind Dir:	Nil	2	4	4	4	4	3	1	1	4	1	5	5	4	2	5	5	4	4
Wind Str:	0	1	2	1	1	1	1	1	2	1	1	3	2	1	1	1	2	1	2
Cloud cover	5	0	2	1	1	1	0	0	2	5	5	3	1	1	5	5	0	3	3
Rain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0
People	0	0	0	2	4	1	0	0	6	4	0	0	0	0	0	0	2	1	13
Dogs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2
Tot spp	4	4	4	7	8	5	3	6	3	3	6	5	7	3	3	2	7	2	3
Tot birds	9	8	27	47	15	5	10	8	8	3	33	11	36	7	4	5	32	4	28
PIOY																			
SOOY	5	5	6		2		7			1	5	4	4			4	6		7
RUTU	2				1														
WHIM													1	1					
GTAT																			
WTAT		1		2	1	1				1			2				2		
BAGO																			
PICO				6		1		1							1		4		
LBCO					1		1	2			6	3	1						
LPCO																			
WFHR											1								
OSPR	1	1	1	2	1	1		1	2		2	1	2		1		2	2	
BRKI				1	1	1		1				1					1		
SIGU		1	1	2	2	1	2	2		1	2	2	1	2	2		4	2	2
WWTE																			
GBTE																			
CATE																			
COTE				1															
WFTE																			
LITE																			
CRTE	1		19	33	6				5		17		25	4			13		19
LCTE																			
EREG								1	1							1			

Notes:

Dead wedge-tailed shearwaters found on Shelly Beach on the following days:

Date	Number
3.12.99	3
6.12.99	6
7.12.99	17
9.12.99	11

PIOY	PIED OYSTERCATCHER
SOOY	SOOTY OYSTERCATCHER
RUTU	RUDDY TURNSTONE
WHIM	WHIMBREL
GTAT	GREY-TAILED TATTLER
WTAT	WANDERING TATTLER
BAGO	BAR TAILED GODWIT
PICO	PIED CORMORANT
LBCO	LITTLE BLACK CORMORANT
LPCO	LITTLE PIED CORMORANT
WFHR	WHITE-FACED HERON
OSPR	OSPREY
BRKI	BRAHMINY KITE
SIGU	SILVER GULL
WWTE	WHITE-WINGED TERN
GBTE	GULL-BILLED TERN
CATE	CASPIAN TERN
COTE	COMMON TERN
WFTE	WHITE-FRONTED TERN
LITE	LITTLE TERN
CRTE	CRESTED TERN
LCTE	LESSER CRESTED TERN
EREG	EASTERN REEF EGRET

Tide: 1 = High tide (incl 1.5 hrs before/after)
2 = Going Out
3 = Low tide (incl 1.5 hrs before/after)
4 = Coming In

Wind:	N	NE	E	SE	S	SW	W	NW	Nil
	1	2	3	4	5	6	7	8	0
Strength:	Gentle		Moderate		Strong		Gale		Calm
	1		2		3		4		0

WICKHAM ROCKS WADER COUNTS FOR 2000 - JANUARY 2000

Site: WICK Coastal, Tidal, Ocean, Marine, Rock

Barbara Dickson, 34 Victoria Terrace, Caloundra, 4551

TOCR Lat: 26 48 04 Long: 153 09 01

Date:	7.01	8.01	9.01	10.01	11.01	12.01	13.01	14.01	15.01	16.01	17.01	18.01	19.01	20.01	21.01	21.01	22.01	23.01	24.01	25.01	26.01	27.01	28.01	29.01	30.01	31.01
Time S:	7.55	7.00	7.50	6.45	7.00	7.10	7.20	6.45	6.20	7.35	7.50	6.05	6.05	6.35	6.45	18.05	7.15	7.30	6.45	6.50	9.10	6.45	6.45	6.35	8.00	7.00
Time F:	8.15	7.15	8.05	7.00	7.15	7.25	7.40	6.55	6.35	7.50	8.00	6.20	6.20	7.25	7.00	18.15	7.30	7.45	7.00	7.05	9.35	7.00	7.00	6.50	8.25	7.15
Tide	1	4	4	4	4	4	3	3	2	2	2	1	1	1	4	4	4	4	4	3	4	3	2	2	2	2
Wind Dir:	4	4	4	4	5	5	5	4	5	5	4	4	3	1	2	2	3	3	5	4	4	0	1	5	5	4
Wind Str:	1	2	3	1	3	3	3	2	2	1	1	1	1	1	1	2	1	1	3	1	1	0	1	1	1	1
Cloud cover	5	4	3	5	1	4	4	4	1	1	0	1	0	0	0	3	5	0	5	4	4	0	5	5	3	3
Rain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
People	1	1	0	1	5	3	1	2	1	5	0	0	0	3	0	0	4	2	0	0	11	0	2	8	3	0
Dogs	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Tot spp	4	6	7	5	4	6	6	3	3	5	3	3	3	5	3	1	7	7	4	2	7	2	3	4	5	5
Tot birds	10	12	38	11	27	21	10	7	9	11	7	9	10	82	33	7	20	26	10	3	17	4	11	11	20	13
PIOY																										
SOOY	6	6	6	6	6	2	2		4	5	5	6	6	6	6	7	7	7			7			7	5	7
RUTU																	1	1								
WHIM																										
GTAT																										
WTAT		1	2			1	1	2					2	1			2				2				1	1
BAGO																										
PICO	1	1	2			1															1					
LBCO			1	1													2							1		1
LPCO																										
WFHR																										
OSPR	1	1	2	2	1	2	2	2	2	2	1	1		1			1	1	1	1	1	2	1		1	1
BRKI				1															1							
SIGU	2	2	4	1	2	2	2	3	3	2		2	2	14	12		5	10	2	2	2	2	4	1	2	3
WWTE																										
GBTE																										
CATE																										
COTE																										
WFTE																										
LITE																										
CRTE		1	21		18	13	2			1				60	15		2	6	6		3		6	2	11	
LCTE																										
EREG							1			1	1							1			1					

WICKHAM ROCKS WADER COUNTS FOR 2000 - FEBRUARY 2000 Barbara Dickson, 34 Victoria Terrace, Caloundra, 4551

Site: WICK Coastal, Tidal, Ocean, Marine, Rock TOCR Lat: 26 48 04 Long: 153 09 01

Date:	1.02	2.02	3.02	4.02	5.02	6.02	7.02	8.02	9.02	10.02	11.02	12.02	13.02	14.02	15.02	16.02	17.02	18.02	19.02	20.02	21.02	22.02	23.02	24.02	25.02	26.02	27.02	28.02	29.02
Time S:	6.20	7.00	7.30	7.40	8.30	7.20	7.20	7.15	6.50	6.40	6.15	7.20	8.00	6.25	7.10	7.10	7.20	7.00	7.20	8.30	6.50	7.30	6.20	7.35	6.55	6.50	12.50	6.50	7.10
Time F:	6.40	7.25	7.50	8.00	8.50	7.40	7.40	7.40	7.15	7.00	6.35	7.45	8.30	6.45	7.35	7.25	7.55	7.20	7.40	8.50	7.15	7.50	6.40	7.50	7.05	7.35	13.30	7.30	7.35
Tide	1	1	1	1	1	4	4	4	4	4	3	3	3	2	2	2	1	1	1	1	4	4	4	4	3	3	1	2	2
Wind Dir:	3	5	4	5	3	3	3	5	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	4	4	4	4	5	5
Wind Str:	2	3	3	1	2	1	1	3	2	2	2	1	2	3	3	3	3	3	2	1	1	1	1	1	1	3	3	3	3
Cloud cover	4	4	0	3	3	1	3	4	4	1	2	1	5	5	5	5	5	2	4	2	5	5	4	4	5	2	2	5	4
Rain	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	5	0	0	0	0	0	0	0	3	0	0	2	0
People	0	0	0	0	0	6	2	0	1	2	0	3	8	0	0	0	0	0	4	3	2	0	0	1	0	0	0	0	0
Dogs	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tot spp	1	4	4	3	3	4	5	5	6	2	5	6	9	2	5	4	4	3	2	3	3	4	1	2	2	3	5	2	3
Tot birds	7	13	12	11	9	5	12	14	7	2	10	23	12	2	8	10	12	11	2	8	2	9	3	2	3	6	25	4	24
PIOY					1			5																					
SOOY	7	7	7	7	5		6		2		5	5	4			6	7	7		6	2	5			1		7		6
RUTU																													
WHIM																													
GTAT																													
WTAT				2	3		2	1	1		1	2	1				3	3											
BAGO																													
PICO			1			1							1		1												1		
LBCO								1					1																
LPCO																													
WFHR													1																
STHR													1																
OSPR		1	2			1	1			1	1	1			1	2	1	1	1	1		1		1	2	1	2		
BRKI						1			1							1													
SIGU		2	2	2		2	1	1	1	1	1	1	1	1	2		1		1	1		1	3			1		1	2
WWTE																													
GBTE																													
CATE																													
COTE																													
WFTE																													
LITE																													
CRTE		3					2	6	1		2	13	1	1	3											4	15	3	16
LCTE																													
EREG									1			1	1		1	1						2		1					

WICKHAM ROCKS WADER COUNTS FOR 2000 - MARCH 2000

Site: WICK Coastal, Tidal, Ocean, Marine, Rock

Barbara Dickson, 34 Victoria Terrace, Caloundra, 4551

TOCR Lat: 26 48 04 Long: 153 09 01

Date:	1.03	2.03	3.03	4.03	5.03	6.03	7.03	8.03	9.03	10.03	11.03	12.03	13.03	14.03	15.03	16.03	17.03	18.03	19.03	20.03	21.03	22.03	23.03	24.03	25.03	26.03	27.03	28.03	29.03	30.3	31.3
Time S:	7.00	7.00	7.00	6.45	7.35	7.30	7.15	6.15	7.20	7.20	7.15	7.10	6.45	7.35	6.50	7.20	7.50	6.50	7.20	7.10	7.00	6.30	6.40	6.30	7.45	8.00	6.45	7.05	7.05	6.45	7.15
Time F:	7.20	7.20	7.20	7.00	7.50	7.50	7.35	6.40	7.45	7.50	7.45	7.30	7.00	7.55	7.15	7.40	8.10	7.05	7.40	7.30	7.20	7.00	7.00	7.00	8.10	8.25	7.10	7.35	7.35	7.10	7.45
Tide	2	1	1	1	1	4	4	4	4	4	3	3	2	2	2	2	1	1	1	1	4	4	4	3	2	3	3	3	2	2	2
Wind Dir:	5	4	4	4	4	4	4	4	2	2	4	4	4	4	4	3	2	0	3	4	4	4	5	4	4	4	5	5	5	4	1
Wind Str:	3	3	3	1	2	1	1	1	2	3	2	2	1	1	1	1	1	0	1	1	1	1	1	1	2	3	2	2	1	3	1
Cloud	3	3	2	5	4	1	2	3	5	5	5	3	1	4	1	3	4	4	2	5	3	5	2	2	5	3	4	2	3	5	1
Rain	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0
People	0	0	0	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	2	0	0	0	1	2	0	2	2	0	0	0	5
Dogs	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
Tot spp	3	4	5	3	4	5	5	6	4	1	6	6	4	4	4	5	6	3	4	4	4	4	6	7	6	7	5	6	3	5	6
Tot birds	9	12	15	11	6	11	13	13	9	1	13	10	10	17	12	10	30	10	12	11	13	21	13	18	60	22	43	43	112	13	41
PIOY																															
SOOY	6	5	7	7		4	4	4	5		4	2	3		5	4	7	7	7	7	9	10	4	5	2	4		1		4	1
RUTU																															
WHIM																															
GTAT																															
WTAT		3	2			3		2				1			1		1		2		1	2	3	1		1	1			1	1
BAGO																															
PICO					1		2		1		2			1			1		1	1				3	3	3					
LBCO									2		2																				
LPCO																															
WFHR																															
STHR																												1			
OSPR	2	2	2	2	2	2	2	2				2	2	2	2	2	1	2		2	2	1	2	2	2	1	2	2	2		2
BRKI	1		1		1	1		1					1														1	1			
SIGU		2	3	2	2	1	4	1	1	1	5	3	4	13	4	2	9	1	2	1			1	2	9	3	2	5	3	3	1
WWTE											1																				
GBTE																															
CATE																															
COTE																															
WFTE																															
LITE																															
CRTE												1				1	11				1	8	2	4	43	9	37	33	107	4	35
LCTE																															
EREG							1	3			1	1		1		1							1	1	1	1				1	1