

Department of Natural Resources and Environment

**ENVIRONMENTAL ASSESSMENT  
PROPOSED OCEAN ACCESS**



**AIRPORT COVE - MALLACOOTA**



FEBRUARY 1999

**Department of Natural Resources and Environment**

**ENVIRONMENTAL ASSESSMENT  
PROPOSED OCEAN ACCESS**



**AIRPORT COVE - MALLACOOTA**

by

**Shearwater Environmental Management**

in association with

**Mr Gerry Byrne, Vantree Pty.Ltd.**

**Mr Ken Norris**

**Mr Keith Seddon, MPA Williams And Associates Pty.Ltd.**

**Dr Linda Wilkinson, Kaleidoscope Consultancy Services**

**FEBRUARY 1999**

---

## SUMMARY

---

Airport Cove lies a little less than four kilometres south west of Bastion Point, Mallacoota and is opposite the northern end of the airfield. The cove is about 150 metres long and is backed by steep vegetated cliffs for its entire length. This section of coast has been rated as largely "an unspoilt wilderness coastline of considerable beauty".

The study was found to have four main vegetation associations. The heathland in the study area is particularly species rich and contains a number of species listed as 'rare', 'vulnerable' or 'insufficiently known'. The study area is used by two species of bat listed on Schedule 2 of the *Flora and Fauna Guarantee Act 1988* and may also provide habitat for other 'listed', 'threatened' or 'rare' species of fauna covered by that Act.

The geology of the site comprises Tertiary alluvium comprising sand, gravel and clay overlying Ordovician marine sediments. The topsoil is relatively thin grey silty sand up to about half a metre thick. Locally, the rocks are tightly folded and significant variations from the regional orientations occur.

The beach is formed of fine to medium grained quartz sand. The beach has a low angle of repose above low water mark and varies from 30 metres wide at low tide to very little at high tide.

The escarpment behind the beach has a height of about 18 to 20 metres and has an angle of about 36° to 38° although significant irregularities occur. The slope is mainly vegetated and comprises talus fragments of bedrock and slump debris from the Tertiary sands. Bedrock outcrops occur as minor bluffs in many places.

The coast in this locality is exposed to severe wave action from storms in Bass Strait as well as from swells from further south. There appears to be a plentiful supply of sand along the coast and it is likely that there will be a strong movement of sand along the coast.

Shell midden sites are found along this section of coast and survey and consultation would be required if a development were to proceed.

The minimum facilities required for an ocean access facility at the Cove are a car park on the flat land above the Cove, an access road in a deep cutting through the cliff line, a turning area and launching ramp on the beach and a rock breakwater and jetty.

The study found that the proposal would result in loss of about 12,000 square metres of native vegetation, including some rare flora species, and some disturbance to rare species of fauna. Due to the exposed nature of the coast and sand movement along the coast it is probable that the area inside the breakwater would fill with sand.

The conclusion of the study is that the impacts on flora, fauna, landscape and cultural values would not be sufficient, individually, to prevent the project from going ahead, but that the impacts taken together are substantial and would make it difficult to justify a project of this type. This, combined with the likelihood that the harbour would silt up, leads us to the conclusion that we cannot recommend Airport Cove as a suitable location for an ocean access facility.

---

## ACKNOWLEDGEMENTS

---

This report was prepared in association with the following people. I would like to thank them for their substantial contributions to the content of this report.

Mr Gerry Byrne, Vantree Pty.Ltd. who advised on coastal processes.

Mr Ken Norris who advised on flora and fauna.

Mr Keith Seddon, MPA Williams And Associates Pty.Ltd. who advised on geology.

Dr Linda Wilkinson, Kaleidoscope Consultancy Services who advised on cultural heritage.

Our thanks also to the following individual individuals for their advice and assistance:

Dr Stephen Henry, Department of Natural Resources and Environment

Mr Bob Fisher, Ranger in Charge, Croajingolong National Park

Mr Jamin Moon, Aboriginal Affairs, Victoria.

**Brian Martin**

*Shearwater Environmental Management*

February 1999

---

## CONTENTS

---

SUMMARY	ii
ACKNOWLEDGEMENTS	iii
1 INTRODUCTION	1
1.1 Background	1
1.2 Terms of reference	1
1.3 Methodology	3
1.4 Site description	3
1.5 Proposed ocean access	3
1.6 Legislation, LCC recommendations and guidelines	6
2 FLORA AND FAUNA	7
2.1 Biological attributes and significance	7
2.2 Significance	9
2.3 Potential impacts	11
3 GEOLOGY, LANDFORMS AND SLOPE STABILITY	12
3.1 Physical description	12
3.2 Physical description	12
3.3 Stratigraphy	12
3.4 Landforms	13
3.5 Slope Stability	13
3.6 Access Road	16
3.7 Conclusions	16
4 COASTAL PROCESSES	18
4.1 Attributes and significance	18
4.2 Potential impacts	18
5 CULTURAL HERITAGE	20
5.1 Attributes and significance	20

5.2	Potential impacts	20
6	LANDSCAPE AND LANDFORM MODIFICATION	22
6.1	Attributes and significance	22
6.2	Potential visual impacts	22
6.2	Landform modification	23
7	CONCLUSIONS	24
	BIBLIOGRAPHY	26
	APPENDICES	
Appendix 1	Flora	28
Appendix 2	Mammals	31
Appendix 3	Birds	32
Appendix 4	Reptiles and Amphibians	34
	FIGURES	
Figure 1	Location map	2
Figure 2	Photomap of site	4
Figure 3	Proposed ocean access	5
Figure 4	Vegetation associations	8
Figure 5	View from the northern end of the Cove	14
Figure 6	Rock strata at the northern end of the Cove	14
Figure 7	Topsoil slip at northern end of Cove	17
Figure 8	Sandringham Harbour	19
Figure 9	Recorded midden sites	21

---

## 1 INTRODUCTION

---

### 1.1 Background

In 1989 the Shire of Orbost sought planning approval from the Ministry for Planning and Environment for a new breakwater, boat ramp and car park at Bastion Point, Mallacoota. The existing ramp is not an all-weather facility and suffers from siltation, and is mainly used by the abalone fishing industry. A new ocean access was thought to have the potential to encourage wider use by the fishing industry and to increase tourism opportunities, especially sport fishing.

The Shire engaged Tract Consultants Australia Pty.Ltd. in 1990 to examine the options for the project. The Tract report found that there was a demonstrated demand for such a facility and presented options for a new ocean access. Nevertheless, there were various unresolved issues and no further action was taken until 1995 when the Mallacoota Inlet Business and Tourism Association again raised the issue. A submission to the Minister for Natural Resources from East Gippsland Shire Council followed.

In 1996, the Shire and the Department of Natural Resources and Environment (NRE) commissioned Coastal Engineering Solutions Pty.Ltd. to undertake an economic study of the proposal. Their 1998 report identified two possible sites at Bastion Point and predicted that a new ocean access would have significant economic benefits.

The 1997 draft report from Coastal Engineering Solutions Pty.Ltd. also identified Airport Cove, Mallacoota (Figure 1) as a possible site for an ocean access but the scope of the study did not allow detailed examination of this alternative. The environmental attributes and potential impacts on Airport Cove are the subject of this study.

### 1.2 Terms of Reference

The brief for the study calls for an examination of the environmental attributes of Airport Cove and comment on the significance of these values including:

- flora
- fauna
- geomorphology
- archaeology
- landscape
- nearshore marine
- other attributes identified in the study

An assessment is required of the potential impacts of car and trailer parking, an access road, revetment section, ramp, jetty and breakwater and increased use by visitors.

Finally, the brief requires a recommendation on the appropriateness of the location and a recommendation on its suitability, from an environmental viewpoint, taking into account Victorian government policy, in particular the *Victorian Coastal Strategy 1995*, and other strategic documents.

FIGURE 1 LOCATION MAP



### 1.3 Methodology

Due to the range of issues to be investigated, the study team included expertise in flora, fauna, geotechnical engineering, coastal engineering, aboriginal and european cultural heritage and coastal planning.

Analysis of the issues was based on available published technical information, aerial photography and other departmental records. This work was supplemented by discussions with staff of NRE, Parks Victoria and Aboriginal Affairs Victoria and a field inspection on 13-14 February 1999. Within the time and resources available, it was not possible to comment on the marine biology of the area or on potential impacts on marine flora and fauna. Otherwise, all aspects of the brief were covered to a sufficient extent to come to a conclusion on the values of the area and the potential impacts.

Details of individual aspects of the investigation are given in Sections 2 to 6.

### 1.4 Site description

Airport Cove lies a little less than four kilometres south west of Bastion Point, Mallacoota and is opposite the northern end of the airfield (Figure 2). As there is sometimes confusion with place names that are not marked on topographic maps, the grid reference on the 1:50,000 map sheet is [8822-N, 8823-S (Part), MALLACOOTA, 410354].

The cove is reached by the road that runs from Mallacoota, past the Betka River beach to the airfield and thence to the Shipwreck Creek camping area in Croajingolong National Park. It is about five kilometres by road from Mallacoota. The sealed road finishes at the turnout to the airport.

The cove is about 150 metres long and has a sandy beach with a gentle gradient. A small subsidiary cove immediately to the north is accessible from the main beach at low tide and contains a cave used as a roosting site by bats. There are large rocks in the intertidal and nearshore zone at the southern end of the beach and other rocks in other parts of the beach and nearshore zone.

The cove faces east and is directly exposed to the prevailing south-easterly swell and from gales from the south to the north-east.

The beach is backed by steep vegetated cliffs about 18 to 20 metres high for its entire length with bare rock faces in some places. There has been some rock fall and soil slumping on the steep sections at either end of the beach.

On the flat land at the top of the cliff there is a dense band of Melaleuca scrub about 30 to 40 metres wide for the full length of the cove. Between the Melaleuca and the road there is a band of heathland about 50 metres wide. The edge of the cliff is about 70 metres from the road at its closest point. A powerline runs along the eastern side of the road through the area where a car park would be located.

There is no walking access to the cove except for a rough track which goes through dense vegetation and is a steep scramble. Similarly, access around the coastline from either direction at low tide would be difficult. For these reasons it seems likely that the cove receives very few visitors.

### 1.5 Proposed ocean access

The layout for an ocean access at Airport Cove has been adapted from the 1997 draft report from Coastal Engineering Solutions Pty.Ltd. (Figure 3). It is assumed that the schematic

FIGURE 2 PHOTOMAP OF SITE



FIGURE 3 PROPOSED OCEAN ACCESS



Note that the yellow/brown areas on either side of the access road indicate the approximate location of the sides of the cutting.

drawings in that report are conceptual only and not the result of detailed investigations. Nevertheless, they give a good basis for the investigation of potential impacts. Any proposal for access to this cove would involve a car park, access road, cutting through the cliff, turning bay at the bottom, boat ramp, jetty and breakwater and we believe that small variations in design would not affect our overall assessment of impact.

For the purposes of this report, it is assumed that construction of an ocean access at Airport Cove will require a car park with a minimum capacity for 30 boat trailers and 20 cars. This would have dimensions of 180 metres by 40 metres. Provision would also have to be made for future expansion to accommodate an additional 30 boat trailers. A dual lane access road approximately eight metres wide would connect the carpark on the plateau, at a height of about 20 metres above sea level, to the boat ramp and would pass through the cliff line in the middle of the cove.

The gradient of this road would need to be no steeper than 1 in 10 to allow use by large and heavy boats. This means that the road needs to be about 200 metres long and that the downward grade would commence at the exit to the car park. The cutting would be approximately 10 metres deep and 30 metres wide before it reached the cliff line. As the cutting passes through the cliff line, the angle of the cliff and the angle of the walls of the cutting would mean that most of the vegetation above the cutting would be removed to the cliff edge and the area below the road would also need to be stabilised. These issues are discussed in Sections 2, 3 & 5.

#### 1.5 Legislation, LCC recommendations and guidelines

Airport Cove and the land between the top of the cliff and the road is declared under the *Crown Lands (Reserves) Act 1978* and is classified as 'Natural Features Reserve'. The land is managed by Parks Victoria. The provisions of the *Flora and Fauna Guarantee Act 1988* will apply to species listed under that Act.

Land Conservation Council investigations and recommendations relevant to the area are:

- Land Conservation Council 1974, *Report on the East Gippsland Study Area*.
- Land Conservation Council 1977, *Final Recommendations: East Gippsland Study Area*.
- Land Conservation Council 1985, *Report on the East Gippsland Area: Review*.
- Land Conservation Council 1986, *East Gippsland Area Review: Final Recommendations*.
- Land Conservation Council 1996, *Marine & Coastal Special Investigation: Draft Final Recommendations*.

Strategic policy documents and guidelines which apply to the site are:

- Victorian Coastal Council 1997, *Victorian Coastal Strategy*.
- Victorian Coastal Council 1998, *Siting and Design Guidelines for Structures on the Victorian Coast*, by Tract Consultants Pty.Ltd. and Chris Dance Land Design Pty.Ltd.
- Victorian Coastal Council 1998, *Landscape Setting Types for the Victorian Coast*, by Tract Consultants Pty.Ltd. and Chris Dance Land Design Pty.Ltd.

Other relevant published documents are listed in the Bibliography.

FIGURE 4 VEGETATION ASSOCIATIONS



---

## 2 FLORA AND FAUNA

---

### 2.1 Biological attributes and significance

#### 2.1.1 Description

##### Flora

The vegetation between the beach of Airport Cove and the Betka Rd consists of four, visually distinct associations, of varied width, parallel to the coast (Figure 4). An incomplete list of species observed in the associations is shown in Appendix 1. The classification of the four associations follows the description of Ecological Vegetation Classes (EVCs) for East Gippsland (Woodgate *et al.* 1994).

- The vegetation of sand dunes and rock outcrops falls within the description of EVC 1, Coastal Dune Scrub Complex: *Spinifex sericeus* and *Cakile maritima* dominate the sand dunes; rocky outcrops support *Stipa stipoides*, *Agrostis billardieri* and *Samolus repens*; the rocky cliffs with some soil the shrub *Alyxia buxifolia*. As soil depth and quality increases up the cliff, the vegetation grades into the next vegetation association.
- The vegetation of slopes of the cove falls within the description of EVC 2, Coast Banksia Woodland. The association at Airport Cove varies considerably with environmental factors like substrate, slope and proximity of drainage lines. On deeper soils, the small trees *Myoporum insulare*, *Banksia integrifolia*, *Leptospermum laevigatum* and *Monotoca elliptica* dominate above *Olearia axillaris*, *Einadia* sp., *Muehlenbeckia adpressa* and *Poa labillardieri*.
- For about 30 metres from the edge of the cliff towards the Betka Rd, the vegetation is a dense, tall thicket (about 6 metres) of tall shrubs dominated, almost to the exclusion of other species, by *Melaleuca armillaris*. To which EVC this association belongs is unclear; the thicket might represent a long unburnt or otherwise undisturbed development of one of the heath EVCs (Peel *pers. comm.*).
- Between the edge of the *Melaleuca* thicket and the Betka road, the vegetation is a complex heath that has closest affinities with the 'Seacliff Clay Heathland' form of EVC 7, Clay Heathland. The area of heath at Airport Cove has had the soil disturbed by machinery and possibly slashed in the last 20 years and has several excavated drains cut to take water from the road to the cliff. The heath contains a large number of species; the list in Appendix 1 is indicative only despite containing about 70 species; heath of the type at Airport Cove might include up to 170 species (Cameron *pers. comm.*). The taller shrubs (to 1 metre) include *Allocasuarina paludosa*, *Kunzea ericoides* and *Banksia marginata*. The ground layer contains a diverse mix of species from several families, the dominant of which were Cyperaceae, Dilleniaceae, Epacridaceae, Fabaceae, Lauraceae, Liliaceae, Poaceae, Rhamnaceae and Xanthorrhoeaceae.

##### Fauna

The area of Airport Cove has not been subject to a formal trapping and observation program. Airport Cove probably contains fauna typical of similar areas along this part of the Victorian coast, subject to two limitations: the area is a relatively narrow band, not contiguous with a forest environment inland (the Airport environment beyond the road and a stock fence is mown grassland); and the area of heath has probably been grossly disturbed in the last 20 years. Appendix 2 lists the species of vertebrate, taken mainly from the Victorian Wildlife Atlas,

which might occur in the area and lists species recorded at or near the site during this assessment.

Importantly, the small indent of the headland at the northern end of Airport Cove contains a sea cave that is used, at least seasonally, as a roosting site for Common Bent-wing Bat *Miniopterus schreibersii* and occasionally by Eastern Horseshoe Bat *Rhinolophus megaphyllus*.

## 2.2 Significance

### 2.2.1 Floral communities

'Seacliff Clay Heathland' is one of the richest heaths on Earth (Parsons and Cameron 1974). In Victoria, Seacliff Clay Heathland occurs only from Sandpatch Point to Mallacoota within 500 metres of the cliff.

### 2.2.2 Floral species

#### FFG Listing

None of the species of plant recorded at Airport Cove is 'Listed' under Schedule 2 of the *Flora and Fauna Guarantee Act 1988*.

#### Victorian Rare or Threatened Species

Of the species recorded at Airport Cove: Tiny Spyridium *Spyridium cinereum*, which is common at Airport Cove, is 'Rare' nationally (Briggs and Leigh 1988) and 'vulnerable' in Victoria (Gullan *et al.* 1990); and Sheath Sedge *Cyathochaeta diandra*, which is also common at Airport Cove, is 'rare' in Victoria (Gullan *et al.* 1990).

Eight other rare, vulnerable or insufficiently known species occur in heath environment between Mallacoota and Sandpatch Point (FIS):

- Sword Bossiaca *Bossiaca ensata*
- Tiny Logania *Logania pusilla*
- Hairy Beard-heath *Leucopogon microphyllus* var. *pilibundus*
- Wiry Stackhousia *Stackhousia nuda*
- Southern Spider-orchid *Caladenia australis*
- Green Leek-orchid *Prasophyllum lindleyanum*
- Broad-lip Leek-orchid *Prasophyllum patens*
- Slender Leek-orchid *Prasophyllum parviflorum*

One rare species recorded from foreshore environment near Mallacoota (FIS):

- Glistening Saltbush *Atriplex billardieri*

### 2.2.3 Fauna

#### FFG Listing

Airport Cove is used by two 'Listed' taxa on Schedule 2 of the *Flora and Fauna Guarantee Act 1988* and might also provide habitat for other 'Listed', 'Threatened' or 'Rare' taxa.

Two cave bats, Common Bent-wing Bat and Eastern Horseshoe Bat, use the sea cave at Airport cove (NRE, Orbst). Common Bent-wing Bat was in the sea cave during this assessment and is known regularly to roost in the cave (Henry *pers. comm.*). Eastern Horseshoe Bat apparently does not use the site regularly.

Common Bent-wing Bat and Eastern Horseshoe Bat rely on caves for roosting and breeding. The statement provided by the SAC (1992) to justify the listing of Common Bent-wing Bat included:

'Criterion 1.1 *The taxon is in a state of demonstrable decline which is likely to result in extinction*

'Evidence:

'The Common Bent-wing Bat depends on very few locations for maternity and roosting sites in Victoria. Early records indicate that colonies occurred in laval caves of the stony rises in the Western District and limestone caves in East Gippsland, but have since been vacated as a result of human disturbance (DCE Colac and Bairnsdale Regions). The loss of previously known breeding and roosting caves has caused a significant decline in population numbers.'

'Criterion 1.2 *The taxon is significantly prone to future threats which are likely to result in extinction*

'Evidence:

'The major threats to the species result from its dependency on very few known maternity sites. It requires precise microclimate conditions for maternity sites and has specific requirements for roosting sites in caves, disused mineshafts, stormwater and aqueduct channels. Such sites are particularly vulnerable to human disturbance which can lead to mortalities, especially during the winter hibernation period and during summer when females are breeding.'

In Victoria, there are only four 'natural' roosting sites known for Common Bent-wing Bat east of Victoria's main maternity cave near Nowa Nowa. The cave at Airport Cove might be an important staging site or migratory waypoint for bats moving down the East Coast en route to Nowa Nowa.

The Wildlife Atlas records for the area (Appendices 3 & 4) include four other 'Listed' taxa that occupy the coastal and heath environment in this part of Victoria: Ground Parrot, *Pezoporus wallicus*; Turquoise Parrot, *Neophema pulchella*; Hooded Plover, *Thinornis rubricollis*; and Diamond Python, *Morelia spilota*. A third Listed species, Eastern She oak Skink, *Cyclodomorphus michaeli*, is known to inhabit coastal heath both north and south of Airport Cove but the Wildlife Atlas has no records from the immediate vicinity.

The Wildlife Atlas records five other 'Listed' taxa for the area: Southern Right Whale *Eubalaena australis*; Great Egret *Ardea alba*; Glossy Black-Cockatoo *Calyptorhynchus lathami*; Spot-tailed Quoll *Dasyurus maculatus*; and White-bellied Sea-Eagle, *Haliaeetus leucogaster*. Records of Southern Right Whale do not indicate that the species uses the inlets near Airport Cove for breeding. The other four species might utilise Airport Cove but a coastal woodland and heath environment is not an important part of their range.

#### Victorian Rare or Threatened Species

The Wildlife Atlas records one rare and restricted species, Swamp Skink *Egernia coventryi*, in the area; Swamp Skink inhabits wet coastal heath. Common Scaly Foot *Pygopus lepidopus*, a species for which there are only two records in Victoria east of Melbourne (*Coventry pers. comm.*), occurs in coastal heath in Nadgee (NSW) and was recently (1998) observed in coastal heath at Shipwreck Creek.

The rare or threatened species of bird that recorded for the area are water birds for which the coastal environment of Airport Cove is probably not important.

### 2.3 Potential impacts

Although, in itself, the proposed development will not have a large, overall impact on the conservation of flora and fauna in the State or Region, incremental development from and near coastal towns and villages diminishes Coastal EVCs and associated communities of fauna throughout Victoria. The coastal vegetation of the Airport Cove area is rich on a global scale, is restricted in distribution and contains several Listed, rare, threatened or vulnerable species of flora and fauna, some of which would be adversely affected by the development.

#### Flora

Development of the type mooted at Airport Cove would: remove about 5,000 square metres for the road and associated drains; remove about 7,200 square metres for the car park, if constructed on the east of the existing Betka Rd; increase the edges of the heath, thus increasing the likelihood of invasion by exotic species of plant; and probably disrupt the existing drainage patterns, on which the heathland relies, over a greater area around the development. The development will remove at least two rare or vulnerable species, *Spyridium cinereum* and *Cyathochaeta diandra* from the affected area. Also, the site probably supports several other rare, threatened or vulnerable species recorded from coastal environments nearby, all of which would be adversely affected by development.

#### Fauna

The general effect of development is to: increase the use, hence potential disturbance of the site by humans; remove an area of heath that supports a faunal community of, probably, restricted extent; and fragment the remaining heath with an environment (asphalt or gravel) inimical to the free flow of some fauna. The impact on the bat cave is the most significant potential implication of development; increased disturbance of the bats by people associated with the boat-ramp would probably lead to the cave's abandonment. The effects on other species of fauna would probably be small in the context of their overall distribution, but significant on site.

#### Threatening processes

The Flora and Fauna Guarantee Act lists 'Input of petroleum and related products into Victorian marine and estuarine environments.' as a threatening process for flora and fauna.

---

### 3 GEOLOGY, LANDFORMS AND SLOPE STABILITY

---

#### 3.1 Physical description

Airport Cove is approximately 150 metres in length. The beach is approximately 25-30 metres wide at low tide, and much less (0-10 metres wide) at high tide. The escarpment behind the beach is understood to be some 18 to 20 metres in height.

The beach is aligned almost N-S, and is enclosed by nearly vertical cliffs forming the headlands at both ends. The existing land surface above the cliffs is flat.

#### 3.2 Physical description

The 1:250,000 "Mallacoota" geology sheet indicates that the subsurface conditions at the site consists of late Tertiary (Pliocene) alluvium comprising sand, gravel and ferruginous sand clay, overlying Ordovician marine sediments including phyllite, slate, shale, siltstone, sandstone etc.

#### 3.3 Stratigraphy

On the basis of exposures of soil and rock visible on the site, the typical subsurface profile comprises:-

- Topsoil
- Tertiary sediments
- Ordovician Bedrock

##### 3.3.1 Topsoil

"Topsoil" is relatively thin, and typically comprises 0.3 to 0.5 metres of grey silty sand, principally derived from the underlying sediments.

##### 3.3.2 Tertiary Sediments

These sediments typically consist of clayey sand with gravel, red-brown with some grey, very dense/slightly cemented by ironstone, sand typically fine to medium grained, gravel fine angular quartz, the whole mass containing a degree of ironstone bands and modules. This unit is unconformable over the underlying bedrock. The undisturbed thickness is typically 3-6 metres, but may be greater locally depending on bedrock configuration.

##### 3.3.3 Bedrock

Bedrock consists of sedimentary rock of Ordovician Age, comprising principally interbedded sandstone and siltstone, with minor mudstone and chert/quartzite. The sandstones appear to be quartz -lithic in type, and fine to medium grained. The rock is highly to moderately weathered (brown and yellow-brown in outcrop in the bluffs) but trends to slightly weathered (grey) in some outcrops at the back of the beach. Typical strengths are medium strong to very strong. Strong quartz veining is apparent, and a degree of iron cementation has occurred on joints and bedding planes, particularly in the more highly weathered zones.

The general strike of the bedding is around 010° Magnetic (about parallel to the alignment of the beach), with a subvertical dip to the west. Locally, the rocks are tightly folded, and significant variations from the regional orientations occur.

There appears to be a very tightly folded/shear zone immediately behind the bluffs at both ends of the beach, and minor rock falls have occurred due to slabbing off of some of the rock associated with it.

### **3.4 Landforms**

#### **3.4.1 Beach**

The beach appears to be formed predominantly of fine to medium grained, quartz sand. Beach slopes are visually relatively uniform along the length of the cove. In the centre of the cove, the slope from high to low tide level was measured to be approximately 3.5° (Figure 5).

In places at the back of the beach, steeper sections of rounded cobbles up to 200-300 mm diameter, formed from the Ordovician bedrock, occur. The presence of these cobbles suggests that the sand on the beach is transitory, and on some occasions in the past it has been largely absent from the beach.

It is noted that the small cove immediately south of Airport Cove contains no sand at all, but has a steep beach formed by similar shingle/cobbles.

#### **3.4.2 Escarpment**

A total of five traverse sections were undertaken across the escarpment. Slope angles were measured using an inclinometer.

The majority of the slope is at an overall angle of about 36° to 38°, although significant local irregularities occur.

The lower part of the slope consists of talus type fragments of the Ordovician rock, plus slump debris derived from the Tertiary clayey sands. At some locations slumped Tertiary material was clearly evident at beach level.

The maximum thickness of these talus/slump deposits is unknown, however, Ordovician rock outcrops at about half to 2/3 height up the slope in many places, forming local minor bluffs to 1 to 2 m in height.

The slopes above the Ordovician outcrops appear to be comprised of relatively undisturbed Tertiary sediments.

### **3.5 Slope Stability**

#### **3.5.1 Rock**

As noted above, there is a tightly folded, sheared zone in the Ordovician rock, immediately behind the headland bluffs at each end of the beach (Figure 6). These have produced zones of rock with a higher degree of fracturing, and higher weathering than the more intact rock to either side.

At the northern end of the beach, a rockfall comprising several cubic metres of material is apparent. The debris from this fall has landed directly on the sandy beach.

At the south end, a similar weakened zone occurs immediately above the proposed turning loop. In this area there is a small irregular slip, primarily caused by continued slumping of weathered Ordovician rock from near the top of the cliff. The mechanism at this point appears to comprise continual minor fretting of the face, and there is less apparent accumulated debris on the beach.

In both cases, the nature of the rock suggests that continuing instability can be expected.

FIGURE 5 VIEW FROM THE NORTHERN END OF THE COVE



FIGURE 6 ROCK STRATA AT THE NORTHERN END OF THE COVE



### Remedial measures

Given the nature of the proposed facility at this site, and the configuration of the areas of instability, physical remediation of the slip areas is unlikely to be practicable.

Typical measures which could be adopted would include:

- Incorporation of adequate clearance of the turning loop from the base of the cliffs (say 10 to 20 metres minimum)
- Placement of a "rock fence" at the base of the southern slope area to prevent boulder type debris rolling onto the ramp.
- Erection of safety/warning signs.

### 3.5.2 Tertiary Sediments

At a number of places along the beach slides have occurred in the Tertiary sediments overlying the bedrock.

The most recent of these is clearly evident as an exposed scarp area about 8 to 10 metres wide by 5 metres high, near the northern end of the beach (Figure 7). There is a natural drainage depression about 4 metres back from the crest at this location, which channels natural runoff plus runoff from turnout drains along the side of the road. It is possible that the recent instability has been influenced by increased ponding of water at this location. However, similar sumps, now overgrown by trees and shrubs, are visible at other locations along the crest (the most obvious being near the south end of the beach), indicating that this type of failure is an ongoing process.

These slips in the Tertiary sediments do not appear to extend into the generally more competent bedrock.

### 3.6 Access Road

It is expected that cut slopes for the access road may require cuttings at an angle of around 1.5:1 (H:V) in the upper Tertiary soils (about 34°). Steeper slopes of 0.66:1 (H:V) should be generally possible in the more competent Ordovician rock (about 56°). The actual extent of a cutting to these dimensions is difficult to evaluate because of imprecise knowledge of the thickness of Tertiary soils; consequently for initial evaluation we have used an overall cut slope angle of about 1:1 (45°).

This results in a cut volume of about 1500 cubic metres in Tertiary, and about 1500 cubic metres in Ordovician or talus/debris material. These overall quantities are in agreement with the volumes suggested by C.E.S (1998).

### 3.7 Conclusions

- The subsurface conditions at the site comprise up to about 5 metres of Tertiary alluvial soils overlying folded Ordovician sedimentary rocks.
- The escarpment slopes behind the beach are at a typical overall angle of 36° to 38°, and are comprised principally of talus and slide debris, indicating a relatively active continuing erosion process.
- In places behind the headland bluffs the Ordovician rocks are tightly folded, sheared and weathered to create relatively weaker zones. Areas of slope instability are associated with these zones at both ends of the beach.

Geology, landforms and slope stability

- Effective stabilization of these zones is not considered to be practical in the context of the proposed development. Remedial measures would be expected to take the form of offsets of constructed works, protective fences, and warning signs.
- Separate areas of slope instability are evident in the overlying Tertiary soils.
- An access cut to the beach is likely to require excavation of about 3000 cubic metres of material. An indication of the likely extent of earthworks is shown on the previously supplied sketch.

FIGURE 7 TOPSOIL SLIP AT NORTHERN END OF COVE



---

## 4 COASTAL PROCESSES

---

### 4.1 Attributes and significance

The coast to the west of Mallacoota is of relatively uniform origin and consists of exposed cliffs of strongly folded Ordovician rock comprising shales and slates with harder bands of sandstones and quartzites. This Ordovician rock is capped by looser tertiary sediments. Near Airport Cove these tertiary sediments are made up of coarsely graded, friable gravels and sands. Differential weathering of the Ordovician rocks has created numerous small coves. Some of these are filled with sand and some of the smaller ones are covered with coarse rounded boulders and gravels.

The section of the Victorian coast between the 90 Mile Beach and the NSW border is exposed to severe wave action from storms generated in Bass Strait and to the south east of Australia as well as from long period waves generated in the Roaring Forties and diffracted around the south of Tasmania. It is known that the amount of sand moved in the vicinity of Lakes Entrance is at least 1,000,000 cubic metres per year. The waves striking the coast near Mallacoota would have at least the same capacity to move sand as the waves near Lakes Entrance. Therefore if there is mobile sand near the airport beach site it will be very mobile.

It is clear from observing the sand in suspension in the waves and from observation of the available vertical aerial photography, that there is sand available to be moved. Samples of sand were taken from the beach and from the tertiary sediments in the cliff. There is some slight amount of sand entering the local beach from slumping of the cliffs and the slow erosion of the exposed rocks, but the majority of the sand on the beach is not derived directly from the local rocks. The sand on the beach is uniform fine grained sand of about 0.25-0.3 mm diameter. It is virtually all quartz. This indicates that it is being moving from west to east from further along the coast, and is probably of the same origin as the sand passing Lakes Entrance.

### 4.2 Potential impacts

The significance of the above is that sand that is moving past the breakwater from further westward along the coast, will be caught behind the breakwater and will be realigned to the shape of the diffracted waves behind the breakwater. Once the sand is caught there is no mechanism for its removal and so the beach will build out. One of the best examples of this mechanism is the breakwater built after the second world war to create Sandringham harbour in Port Phillip Bay. Figure 8 shows the build up of sand in that harbour.

It could be expected that a breakwater at the Airport Cove site would act in the same way as the Sandringham breakwater. It is not possible to say with the available information how much sand would accumulate in the harbour but it is likely to be sufficient to interfere with the operation of the boat ramp. For this coastal process reason the site is not considered suitable for a sheltered boat ramp.

Field observations at low tide also indicated breaking waves with sand in suspension at the approximate position of the end of the proposed breakwater. This suggests that a breakwater would have to be longer to give adequate depth of water, but this would have to be confirmed by detailed soundings.

FIGURE 8 SANDRINGHAM HARBOUR



---

## 5 CULTURAL HERITAGE

---

### 5.1 Attributes and significance

During 1979 and 1981 a complete coastal archaeological survey was conducted between Cape Howe and Wingan Inlet. A total of 37 sites between Bastion Point and Wingan Inlet were recorded. All were shell middens that contained mostly rock platform shell fish species. (Fullagar, 1984, p. 246)

Three sites are located near Airport Cove - two along Quarry Beach and the third on the headland to the south of Airport Cove. (Coultts et al, 1984, p. 3)(Figure 9). Site 88224/143 is described as a midden in very poor condition due to erosion, but with potential sub-surface deposits. The site was extensive, measuring 28 x 3 metres.(VAS Site Record 88224/143; Aboriginal Affairs Victoria, Heritage Services; Fullagar, 1984, p. 256) The site was located during a field visit on 14 February 1999 and it was found that deterioration due to erosion and foot traffic has been extensive.

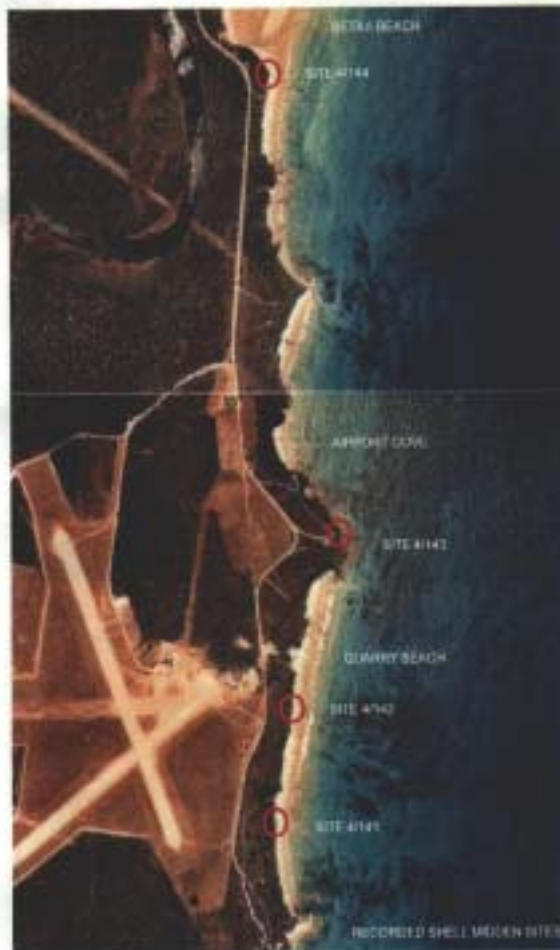
### 5.2 Potential impacts

Whilst the middens in the locality are in poor condition, the coastal sites provide considerable evidence of Aboriginal occupation, diet, and usage of the land and resources. No sites have been recorded at the site of the proposed works but, due to the thick scrub, it is possible that other remains exist in the area. Should the proposed project at Airport Cove proceed it would be imperative to conduct a full archeological survey of the area. The site registrar of Heritage Services at Aboriginal Affairs Victoria also recommends that Site 88224/143 be fully excavated prior to any works in the area. (Moon, pers. comm)

We recommend that:

- prior to any works being conducted at Airport Cove a full archeological survey of the area be conducted
- consultation occur with the Cultural officers and relevant community members of the local Koorie communities
- consultation occur with the Heritage Services, AAV with regard to an excavation being conducted on site 88224/143.

FIGURE 8 RECORDED MIDDEN SITES



---

## 6 LANDSCAPE AND LANDFORM MODIFICATION

---

### 6.1 Attributes and significance

The coast between Sydenham Inlet and the New South Wales border is one of extreme contrasts of rocky headlands, large mobile dune systems and dense coastal vegetation. Between Little Rame Head and Mallacoota the south-east facing coast has cliffs cut in strongly folded Ordovician sandstones, shales, slates and cherts at the seaward edge of a terrace 20 to 30 metres above sea level, backed by a rising hinterland. Beneath the cliffs the foreshore is rugged with shore platforms cut in shales and slates separated by ribs and ridges. The rocks show honeycombing and irregular weathering and ironstone joint fillings in some places. There are boulder and cobble beaches and abrasion potholes scoured in the shore platforms (Bird 1993). This spectacular cliffed coast also has small sandy beaches between rocky points, one of which is Airport Cove.

Development along this coast is limited to lighthouses and inlet settlements such as Mallacoota. The Victorian Coastal Council's *Landscape Setting Types for the Victorian Coast 1998* describes the coast between Sydenham Inlet and the NSW border as "wild and windswept" and that it is "largely an unspoilt wilderness coastline of considerable beauty". The wilderness coast near Mallacoota Inlet is characterised as "particularly unique" and "particularly vulnerable to change in which values could suffer if subjected to intensive or inappropriate development".

It is noted that the final recommendations for both the *East Gippsland Study Area* (LCC 1977) and *East Gippsland Area Review* (LCC 1986) mark this coast as 'Scenic Coast'.

The draft final recommendations for the *Marine & Coastal Special Investigation* (LCC 1996) (currently under review) also propose that the section of coast near the Betka River, including Airport Cove, be managed as a Coastal Protection Zone with objectives including "...protect and conserve coastal landscapes...".

Far East Gippsland has also been marketed by the tourism industry as the "Wilderness Coast" which reflects the considerable attraction of this coastline. The *Far East Gippsland Ecotourism Strategy 1997* states that the attraction is based on its natural features as well as the opportunities for traditional beach activities. A Wilderness Coast Walk being developed through Croajingolong National Park to the New South Wales border will pass through this section of coast.

Clearly then, the section of coast in which Airport Cove is found has outstanding scenic qualities and deserves the utmost care in siting facilities so that these qualities will not be impaired.

### 6.2 Potential visual impacts

As noted earlier, although Airport Cove itself and its cliff-top vegetation are in a natural condition, the airport across the road presents a modified environment. The most notable intrusions are the radio aerials, powerline and house. The airfield itself is a large slashed area but has no other facilities to stand out and is not heavily used by aircraft. This is the only development south of Mallacoota township and is low key in nature.

From the sea, the current view of the coast is intact, other than for the radio aerials (Figure 5 and cover). From the road, the view towards the sea is intact but the view on the landward side is of a modified, but not built, environment.

Development of an ocean access at this location will have two major effects on the quality of the landscape. The view from the sea and the view from the road towards the sea will both be impaired.

The large cutting required for the road from the carpark to the boat ramp will expose an area of bare rock on the side of the cliff face about 60 metres long for the full 20 metre height of the cliff. This represents a severe visual impact on an otherwise vegetated escarpment. The turning area and breakwater will also be visible from the sea but, being close to sea level and if constructed of sympathetic materials, will be less visible.

The carpark and cutting for the access road on the top of the escarpment will be a significant visual impact looking from the road. The coastal vegetation here forms an important natural barrier between road and cliff edge. In these circumstances, the Victorian Coastal Council's *Siting & Design Guidelines* recommends:

*If development occurs on major landscape features, such as ridges, cliffs and headlands, it should be visually screened.*

Loss of this vegetation, together with a view of a large number of parked cars and trailers, will result in a degraded landscape. Due to the cleared area on the other side of the road, this effect would be regarded as moderate.

Airport Cove can also be seen from Bastion Point. However, because of the distances involved, the visual impact would be rated as minor.

In summary, the proposed ocean access would significantly degrade the landscape on a coastline noted for its scenic quality. The effect would be severe looking from seaward and moderate looking from the land.

## **6.2 Landform modification**

The long cutting required for the access road poses problems for drainage. Thunderstorms are common in this area and the arrangements for discharging large volumes of water at the lower end of the cutting would have to be carefully engineered to avoid damage to the beach.

It is also noted that construction of an ocean access at this site would also attract the interest of the non boating public who would be very likely to wish to visit the beach. Sharing a narrow cutting between boating traffic and pedestrians poses safety problems. If these problems were considered unacceptable, the alternatives would be to widen the cutting to provide for a footpath or to construct a set of stairs down the cliff face. Both options would be expensive.

The Victorian Coastal Council's *Siting & Design Guidelines* recommend that:

*Siting, design and construction of any structure should result in minimal change to the natural drainage patterns of the area.*

*Natural vegetation should be disturbed as little as possible.*

*Siting, design and construction of any structure should result in minimal disturbance to soils.*

In summary, the degree of modification to landforms with this proposal is extensive and would need careful engineering design to avoid instability in the cutting faces, instability in the adjacent soils and drainage problems.

---

## 7 CONCLUSIONS

---

Our comments on the environmental attributes of the study area are:

- The coastal vegetation is rich on a global scale, is restricted in distribution and contains several Listed, rare, threatened or vulnerable species of flora and fauna. Many questions remain about the presence of rare and endangered species at the site and a full field survey would be strongly recommended if the project receives further consideration.
- 11 plant species classified as rare, vulnerable or insufficiently known occur in heath and foreshore environment between Mallacoota and Sandpatch Point, two of which are known to exist in the study area.
- A sea cave at the end of the beach is used by two species of bat 'listed' on Schedule 2 of the *Flora and Fauna Guarantee Act*. Four other 'listed' taxa occupy the coastal and heath environment in this region.
- One rare and restricted species of Skink is known in the area.
- This section of the coast have been assessed as having high landscape values and being particularly vulnerable to intensive or inappropriate development.
- Shell midden sites have been recorded in the general vicinity.
- This section of coast is exposed to severe wave action and it is likely that there is considerable movement of sand along the coast.

The potential impacts from an ocean access facility would be:

- About 7,200 square metres of heathland and 5,000 square metres of other coastal vegetation would be lost. Although this is small in comparison to the area of similar native vegetation in the area, it represents incremental development from coastal towns and diminishes Coastal EVCs and associated communities of fauna.
- There would be an increased likelihood of invasion by exotic species of plant and possible disruption of drainage patterns on which heathlands rely.
- At least two rare or vulnerable plant species would be removed from the site.
- Several other rare, threatened or vulnerable plant species likely to be present would be adversely affected.
- Increased human activity on the beach is likely to affect use of the cave by two species of bats listed in the *Flora and Fauna Guarantee Act*.
- Removal of heath would have a local effect on fauna using it as habitat.
- Spill of petroleum products would affect flora and fauna.
- The sections of cliff at either end of the beach have areas of instability and stabilisation is not considered practical. Measures would have to be taken to protect the public from rock fall.
- The road cutting would need careful engineering design to avoid instability in the cutting faces, instability in the adjacent soils and drainage problems.

## Conclusions

- The access cut to the beach is likely to require excavation of about 3,000 cubic metres of material.
- The proposed breakwater is likely to interact with sand movement along the coast, resulting in the harbour accumulating sand and interfering with the operation of the boat ramp.
- Construction of a carpark and deep road cutting will significantly degrade the landscape, particularly when viewed from the sea.

Other general comments are:

- The road from Betka Beach to the aerodrome is relatively narrow and would have to be widened to accommodate additional traffic. Parking arrangements would also need to be improved for safety reasons.
- Provision would have to be made for safe pedestrian access to the beach.
- Toilet facilities would be required at the car park.
- The power lines on the eastern side of the road at the site of the proposed car park are low and would have to be relocated.
- The proposed breakwater may need to be longer to provide sufficient depth of water at all tides.
- Prior to any works being undertaken at Airport Cove a full archaeological survey of the area should be conducted and appropriate consultation occur with Cultural officers, the Koorie community and Aboriginal Affairs Victoria.

Our assessment of the appropriateness of the location and the suitability of Airport Cove, from an environmental viewpoint, was guided by, amongst other things, the Victorian Coastal Strategy, the guidelines set down by the Victorian Coastal Council for siting & design and landscape settings, the *Flora and Fauna Guarantee Act* and other relevant legislation.

Our overall conclusion is that, while the impacts on flora, fauna, landscape and cultural values would not be sufficient, individually, to prevent the project from going ahead, the impacts taken together are substantial and would make it difficult to justify a project of this type. This, combined with the likelihood that the harbour would silt up, leads us to the conclusion that we cannot recommend Airport Cove as a suitable location for an ocean access facility.

## 8 BIBLIOGRAPHY

- Atlas of Victorian Wildlife. Department of Natural Resources and Environment, Victoria.
- Bird E.C.F. 1993, *The Coast Of Victoria*.
- Briggs, J.D. and Leigh, J.H. (1988) *Rare or Threatened Australian Plants*. Australian National Parks and Wildlife Service, Canberra.
- CAMBA. China-Australia Migratory Bird Agreement. Agreement between the Government of Australia and the Government of the People's Republic of China for the protection of migratory birds and their environment.
- Coutts, P.J.F. et al (1984) 'Archaeological investigations at Captains Point, Mallacoota' *Coastal Archaeology in South-Eastern Victoria*, ed. P. J. F. Coutts. (Records of the Victorian Archaeological Survey No. 14).
- East Gippsland Shire Council & Department of Natural Resources and Environment 1997, *Mallacoota Ocean Access: Economic Benefit and Demand Analysis (Draft)*, by Coastal Engineering Solutions Pty.Ltd.
- East Gippsland Shire Council & Department of Natural Resources and Environment 1998, *Mallacoota Ocean Access: Economic Benefit and Demand Analysis*, by Coastal Engineering Solutions Pty.Ltd.
- FIS. Flora Information System. Department of Natural Resources and Environment, Melbourne.
- Fullagar, R. (1984) 'An archaeological survey of the coast from Cape Howe to Wingan Point including Gabo Island', *Coastal Archaeology in South-Eastern Victoria*, ed. P.J.F. Coutts (Records of the Victorian Archaeological Survey No. 14)
- Geological Surveys of Victoria and NSW, *Mallacoota and Part of Bega*, 1:250,000 Sheet SJ 55-8, First edition, 1976
- Gullan, P.K., Cheal, D.C. and Walsh, N.G. (1990) *Rare or Threatened Plants in Victoria*. Department of Conservation and Environment, Victoria.
- JAMBA. Japan-Australia Migratory Bird Agreement. Agreement between the Government of Australia and the Government of Japan for the protection of migratory birds and birds in danger of extinction and their environment.
- Land Conservation Council 1974, *Report on the East Gippsland Study Area*.
- Land Conservation Council 1977, *Final Recommendations: East Gippsland Study Area*.
- Land Conservation Council 1985, *Report on the East Gippsland Area: Review*.
- Land Conservatoin Council 1986, *East Gippsland Area Review: Final Recommendations*.
- Land Conservation Council 1996, *Marine & Coastal Special Investigation: Draft Final Recommendations*.
- Parks Victoria & Department of Natural Resources and Environment 1997, *Far East Gippsland Ecotourism Strategy*.
- Parsons and Cameron 1974. *Biotropica*. Cited on page 132. Woodgate, P.W., W.D. Peel, K.T. Ritman, J.E. Coram, A. Brady, A.J. Rule and J.C.G. Banks, 1994. *A Study of the Old Growth Forests of East Gippsland*. Department of Conservation and Natural Resources, Victoria.

## Bibliography

SAC (1992) Final recommendation on a nomination for listing. *Miniopterus schreibersii* (Kuhl, 1819) – Common Bent-wing Bat. Nomination 233. Flora and Fauna Guarantee - Scientific Advisory Committee, Victoria.

Shire of Orbost 1990, *Bastion Point, Mallacoota: Ocean Access Boat Launching Ramp Proposal: Summary Report*, by Tract Consultants Aust. Pty.Ltd.

Survey & Mapping Victoria 1994, *8822-N, 8823-S (Part): Mallacoota*, 1:50,000 map sheet.

Thompson, K. (1985) *A History of the Aboriginal People of East Gippsland*. A report prepared for the Land Conservation Council of Victoria.

Victorian Archaeological Survey Site Register. Site no. 88224/143. Aboriginal Affairs Victoria, Heritage Services.

VIC DPS 1986, *Aerial Photography, N'ty Mile Bch C.Howe Proj 1717, 4050-21, 22 & 23*.

Victorian Coastal Council 1997, *Victorian Coastal Strategy*.

Victorian Coastal Council 1998, *Siting and Design Guidelines for Structures on the Victorian Coast*, by Tract Consultants Pty.Ltd. and Chris Dance Land Design Pty.Ltd.

Victorian Coastal Council 1998, *Landscape Setting Types for the Victorian Coast*, by Tract Consultants Pty.Ltd. and Chris Dance Land Design Pty.Ltd.

Woodgate, P.W., W.D. Peel, K.T. Ritman, J.E. Coram, A. Brady, A.J. Rule and J.C.G. Banks, 1994. *A Study of the Old Growth Forests of East Gippsland*. Department of Conservation and Natural Resources, Victoria.

### Personal communications

Cameron, D., Botanist, Department of Natural Resources and Environment, Heidelberg

Coventry, A.J., Curator of Herpetology, Museum of Victoria

Moon, J, Aboriginal Affairs Victoria, Melbourne.

Peel, W., Botanist, Department of Natural Resources and Environment, Melbourne

Henry, Dr S., Senior Wildlife Planner, Department of Natural Resources and Environment, Orbost

## APPENDIX 1 FLORA

Species	Common name	Vegetation Association			
		1	2	3	4
<i>Acacia longifolia</i>	Sallow Wattle		1	1	
<i>Acacia myrtifolia</i>	Myrtle Wattle				1
<i>Acacia suaveolens</i>	Sweet Wattle				1
<i>Acaena novae-zelandiae</i>	Bidgee-widgee		1		
<i>Acrotriche serrulata</i>	Honey-pots				+
<i>Agrostis billardieri</i> var. <i>billardieri</i>	Coast Blown Grass	+	+		
<i>Allocasuarina paludosa</i>	Scrub Sheoke				1
<i>Alyxia buxifolia</i>	Sea Box		2		
<i>Anisopogon avenaceus</i>	Oat Spear-grass				1
<i>Astroloma humifusum</i>	Cranberry Heath				1
<i>Austrodanthonia penicillatum</i>	Slender Wallaby-grass				+
<i>Banksia integrifolia</i>	Coast Banksia		1		
<i>Banksia marginata</i>	Silver Banksia				1
<i>Billardiera scandens</i>	Common Apple-berry	+	+		+
<i>Bossiaea prostrata</i>	Creeping Bossiaea				1
<i>Brachyscome aculeata</i>	Branching Daisy	+			
<i>Briza minor</i>	Lesser Quaking-grass				+
<i>Bulbine bulbosa</i>	Yellow Bulbine-lily				+
<i>Burchardia umbellata</i>	Milkmaids				+
<i>Cakile maritima</i>	Beach Rocket	1			
<i>Carpobrotus rossii</i>	Karkalla	1			
<i>Cassinia longifolia</i>	Shiny Cassinia		+		
<i>Cassytha glabella</i>	Slender Dodder-laurel				1
<i>Cassytha phaeolasia</i>	Rusty Dodder-laurel				+
<i>Centaurium erythraea</i>	Common Centaury	+	+		
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	Blue Squill				+
<i>Clematis glycinoides</i>	Forest Clematis	+			
<i>Comesperma defoliatum</i>	Leafless Milkwort				+
<i>Correa alba</i>	White Correa	1			
<i>Correa reflexa</i>	Common Correa				1
<i>Cryptostylis subulata</i>	Large Tongue-orchid				+
<i>Cyathochaeta diandra</i>	Sheath Sedge				2
<i>Dampiera stricta</i>	Blue Dampiera				1
<i>Deyeuxia quadriseta</i>	Reed Bent-grass				1
<i>Dianella caerulea</i> var. <i>caerulea</i>	Paroo Lily				+
<i>Dianella tasmanica</i>	Tasman Flax-lily			+	
<i>Dichondra repens</i>	Kidney-weed	+			
<i>Dillwynia sericea</i>	Showy Parrot-pea				1
<i>Entolasia marginata</i>	Bordered Panic				2
<i>Epacris impressa</i>	Common Heath				1
<i>Eriochilus cucullatus</i>	Parson's Bands				+
<i>Eucalyptus botryoides</i>	Bangalay				+
<i>Euphorbia paralias</i>	Sea Spurge	1			
<i>Gahnia radula</i>	Thatch Saw-sedge				1
<i>Gahnia sieberiana</i>	Red-fruit Saw-sedge				+

Species	Common name	1	2	3	4
<i>Glycine clandestina</i>	Twining Glycine				+
<i>Gompholobium huegelii</i>	Common Wedge-pea				1
<i>Gonocarpus teucroides</i>	Germander Raspwort				1
<i>Goodenia ovata</i>	Hop Goodenia		+	+	1
<i>Hakea teretifolia</i> ssp. <i>hirsuta</i>	Dagger Hakea				1
<i>Hardenbergia violacea</i>	Purple Coral-pea				+
<i>Hibbertia acicularis</i>	Prickly Guinea-flower				+
<i>Hibbertia empetrifolia</i>	Tangled Guinea-flower				1
<i>Hovea linearis</i>	Common Hovea				+
<i>Hypericum gramineum</i>	Small St John's Wort				+
<i>Hypochoeris radicata</i>	Cat's Ear				+
<i>Isolepis nodosa</i>	Knobby Club-sedge	1			
<i>Kunzea ericoides</i>	Burgan				1
<i>Lasiopetalum macrophyllum</i>	Shrubby Velvet-bush			1	
<i>Lepidosperma filiforme</i>	Common Rapier-sedge				1
<i>Lepidosperma laterale</i>	Variable Sword-sedge			+	
<i>Leptospermum continentale</i>	Prickly Tea-tree				1
<i>Leptospermum laevigatum</i>	Coast Tea-tree		1	+	+
<i>Leucopogon parviflorus</i>	Coast Beard-heath		1		
<i>Lindsaea linearis</i>	Screw Fern				1
<i>Lobelia alata</i>	Angled Lobelia			+	
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush				1
<i>Lomatia ilicifolia</i>	Holly Lomatia				+
<i>Melaleuca armillaris</i>	Bracelet Honey-myrtle		+	5	1
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass				+
<i>Monotoca elliptica</i>	Tree Broom-heath		+	+	
<i>Monotoca scoparia</i>	Prickly Broom-heath				+
<i>Muehlenbeckia adpressa</i>	Climbing Lignum	1	1		
<i>Myoporum insulare</i>	Common Boobialla	1	1		
<i>Olearia axillaris</i>	Coast Daisy-Bush		+		
<i>Opercularia ovata</i>	Broad-leaf Stinkweed		+	+	
<i>Orthoceras strictum</i>	Horned Orchid				+
<i>Oxalis</i> sp.					+
<i>Ozothamnus turbinatus</i>	Coast Everlasting		+		
<i>Patersonia glabrata</i>	Leafy Purple-flag				1
<i>Phyllanthus hirtellus</i>	Thyme Spurge				+
<i>Plantago debilis</i>	Shade Plantain		+		
<i>Poa clelandii</i>	Matted Tussock-grass				+
<i>Poa labillardieri</i> var. <i>labillardieri</i>	Common Tussock-grass		+		
<i>Pteridium esculentum</i>	Austral Bracken				+
<i>Pultenaea daphnoides</i>	Large-leaf Bush-pea		+		
<i>Rhagodia candolleana</i>	Scaberry Saltbush	1	1		
<i>Samolus repens</i>	Creeping Brookweed				+
<i>Schoenus apogon</i>	Common Bog-sedge				+
<i>Schoenus brevifolius</i>	Zig-zag Bog-sedge				+
<i>Senecio spathulatus</i>	Coast Groundsel	1	+		
<i>Sonchus asper</i> s.l.	Rough Sow-thistle		+		
<i>Spinifex sericeus</i>	Hairy Spinifex	1			
<i>Spyridium cinereum</i>	Tiny Spyridium				1
<i>Stipa semibarbata</i>	Fibrous Spear-grass				1
<i>Stipa stipoides</i>	Prickly Spear-grass		+		
<i>Stylidium graminifolium</i>	Grass Trigger-plant				1

Appendix 1 - Flora

Species	Common name	1	2	3	4
<i>Suaeda australis</i>	Austral Seablite	+			
<i>Tetragia capillaris</i>	Hair-sedge				1
<i>Tetrateca pilosa</i>	Hairy Pink-bells				+
<i>Themeda triandra</i>	Kangaroo Grass				1
<i>Tylophora barbata</i>	Bearded Tylophora			+	
<i>Veronica calycina</i>	Hairy Speedwell		+		
<i>Viola hederacea</i>	Ivy-leaf Violet			+	

The numbers +, 1, 2, 3, 4 & 5 within the table refer to the 'cover-abundance' for each species in that veg. type

## APPENDIX 2 MAMMALS

Species	Common Name	Status	Notes
<i>Eubalaena australis</i>	Southern Right Whale	L, End	Atlas
<i>Hydrurga leptonyx</i>	Leopard Seal		Atlas
<i>Mirounga leonina</i>	Southern Elephant Seal		Atlas
<i>Antechinus stuartii</i>	Brown Antechinus		Atlas
<i>Antechinus swainsonii</i>	Dusky Antechinus		Atlas
<i>Dasyurus maculatus</i>	Spot-tailed Quoll	L, Vul	Atlas
<i>Felis catus</i>	Cat (feral)		Atlas
<i>Oryctolagus cuniculus</i>	Rabbit		AC
<i>Macropus giganteus</i>	Eastern Grey Kangaroo		Atlas, AC
<i>Macropus rufogriseus</i>	Red-necked Wallaby		Observed about 500m. North
<i>Wallabia bicolor</i>	Swamp Wallaby		Signs recorded on site
<i>Rattus fuscipes</i>	Bush Rat		Atlas
<i>Miniopterus schreibersii</i>	Common Bent-wing Bat	L	AC
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat	L	Recorded in Sea-cave (NRE Orbost)
<i>Perameles nasuta</i>	Long-nosed Bandicoot		Signs of this or <i>Potorous</i> on site
<i>Vombatus ursinus</i>	Common Wombat		AC
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum		Atlas, AC
<i>Petaurus australis</i>	Yellow-bellied Glider		Atlas
<i>Potorous tridactylus</i>	Long-nosed Potoroo		Signs of this or <i>Perameles</i> on site. Observed about 1 km south in 1997
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna		Atlas
<i>Ornithorhynchus anatinus</i>	Platypus		Atlas
<i>Vulpes vulpes</i>	Fox		AC

AC - Observed at Airport Cove

Atlas - Recorded in the Atlas of Victorian Wildlife for the Block that includes Airport Cove

L - Listed on Schedule 2 of the Flora and Fauna Guarantee Act 1988

End - Endangered

R/R - Rare and restricted in Victoria (Atlas of Victorian Wildlife)

Vul - Vulnerable in Victoria (Atlas of Victorian Wildlife)

APPENDIX 3 BIRDS

Species	Common name	Status	Treaties	Notes
<i>Acanthagenys rufogularis</i>	Spiny-checked Honeyeater			Atlas
<i>Acanthiza lineata</i>	Striated Thornbill			Atlas
<i>Acanthiza pusilla</i>	Brown Thornbill			Atlas, AC
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill			Atlas
<i>Accipiter fasciatus</i>	Brown Goshawk			AC
<i>Alcedo azurea</i>	Azure Kingfisher			Atlas
<i>Anas castanea</i>	Chestnut Teal			Atlas
<i>Anas superciliosa</i>	Pacific Black Duck			Atlas
<i>Anthochaera chrysoptera</i>	Little Wattlebird			Atlas, AC
<i>Anthus novaeseelandiae</i>	Richard's Pipit			Atlas
<i>Aquila audax</i>	Wedge-tailed Eagle			Atlas
<i>Ardea alba</i>	Great Egret	L, R/C	C, J	Atlas
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo			Atlas
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	L, Vul		Atlas
<i>Chenonetta jubata</i>	Australian Wood Duck			Atlas
<i>Circus approximans</i>	Swamp Harrier			Atlas
<i>Colluricincla harmonica</i>	Grey Shrike-thrush			Atlas
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike			Atlas
<i>Corcorax melanorhamphos</i>	White-winged Chough			Atlas
<i>Cormobates leucophaeus</i>	White-throated Treecreeper			Atlas, AC
<i>Corvus coronoides</i>	Australian Raven			Atlas, AC
<i>Cracticus nigrogularis</i>	Pied Butcherbird			Atlas
<i>Cygnus atratus</i>	Black Swan			Atlas
<i>Dacelo novaeguineae</i>	Laughing Kookaburra			Atlas
<i>Egretta novaehollandiae</i>	White-faced Heron			Atlas, AC
<i>Elanus axillaris</i>	Black-shouldered Kite			Atlas
<i>Eopsaltria australis</i>	Eastern Yellow Robin			Atlas
<i>Erythronyx cinctus</i>	Red-kneed Dotterel			Atlas
<i>Esacus neglectus</i>	Beach Stone-curlew			Atlas
<i>Gymnorhina tibicen</i>	Australian Magpie			Atlas
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher			Atlas, AC
<i>Haematopus longirostris</i>	Pied Oystercatcher			Atlas
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	L, R/R	C	Atlas
<i>Hirundapus caudacutus</i>	White-throated Needletail		C, J	Atlas, AC
<i>Hirundo neoxena</i>	Welcome Swallow			Atlas, AC
<i>Hylacola pyrrhopygia</i>	Chestnut-rumped Heathwren			Atlas
<i>Larus novaehollandiae</i>	Silver Gull			Atlas
<i>Leucosarcia melanoleuca</i>	Wonga Pigeon			Atlas
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater			Atlas
<i>Lopholaimus antarcticus</i>	Topknot Pigeon			Atlas
<i>Malurus cyaneus</i>	Superb Fairy-wren			Atlas, AC
<i>Melithreptus lunatus</i>	White-naped Honeyeater			Atlas
<i>Menura novaehollandiae</i>	Superb Lyrebird			Atlas
<i>Monarcha melanopsis</i>	Black-faced Monarch			Atlas
<i>Morus serrator</i>	Australasian Gannet	R/C		Atlas
<i>Myiagra cyanoleuca</i>	Satin Flycatcher			Atlas
<i>Neochmia temporalis</i>	Red-browed Finch			Atlas, AC

Species	Common name	Status	Treaties	Notes
<i>Neophema pulchella</i>	Turquoise Parrot	L, R/R		Atlas
<i>Numenius madagascariensis</i>	Eastern Curlew	R/R	C, J	Atlas
<i>Oceanites oceanicus</i>	Wilson's Storm-Petrel		J	Atlas
<i>Pachycephala pectoralis</i>	Golden Whistler			Atlas
<i>Pachycephala rufiventris</i>	Rufous Whistler			Atlas
<i>Pardalotus punctatus</i>	Spotted Pardalote			Atlas
<i>Pezoporus wallicus</i>	Ground Parrot	L, R/R		Atlas
<i>Phalacrocorax carbo</i>	Great Cormorant			Atlas
<i>Phalacrocorax fuscescens</i>	Black-faced Cormorant	R/C		Atlas
<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant			Atlas
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant			Atlas
<i>Phalacrocorax varius</i>	Pied Cormorant	R/C		Atlas
<i>Phaps chalcoptera</i>	Common Bronzewing			AC
<i>Phylidonyris melanops</i>	Tawny-crowned Honeyeater			Atlas
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater			Atlas, AC
<i>Platycercus elegans</i>	Crimson Rosella			Atlas
<i>Psophodes olivaceus</i>	Eastern Whipbird			Atlas
<i>Puffinus tenuirostris</i>	Short-tailed Shearwater		J	Atlas
<i>Pycnoptilus floccosus</i>	Pilotbird			Atlas
<i>Rhipidura fuliginosa</i>	Grey Fantail			Atlas
<i>Sericornis frontalis</i>	White-browed Scrubwren			Atlas, AC
<i>Stagonopleura bella</i>	Beautiful Firetail			Atlas
<i>Sterna bergii</i>	Crested Tern	R/C		Atlas
<i>Sterna caspia</i>	Caspian Tern	R/C	C, J	Atlas
<i>Stipiturus malachurus</i>	Southern Emu-wren			Atlas
<i>Strepera versicolor</i>	Grey Currawong			Atlas
<i>Thinornis rubricollis</i>	Hooded Plover	L, Vul		Atlas
<i>Threskiornis molucca</i>	Australian White Ibis			Atlas
<i>Todiramphus sanctus</i>	Sacred Kingfisher			Atlas
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet			Atlas
<i>Zosterops lateralis</i>	Silvereve			Atlas, AC

AC - Observed at Airport Cove during this assessment

Atlas - Recorded in the Atlas of Victorian Wildlife for the Block that includes Airport Cove

L - Listed on Schedule 2 of the Flora and Fauna Guarantee Act 1988

R/R - Rare and restricted in Victoria (Atlas of Victorian Wildlife)

R/C - Rare and a colonial breeder

Vul - Vulnerable in Victoria (Atlas of Victorian Wildlife)

C - Species subject to the CAMBA treaty (CAMBA)

J - Species subject to the JAMBA treaty (JAMBA)

## APPENDIX 4 REPTILES AND AMPHIBIANS

Species	Common name	Status	Notes
<i>Amphibohurus muricatus</i>	Jacky Lizard		Atlas, AC
<i>Drysdalia coronoides</i>	White-Lipped Snake		Atlas
<i>Morelia spilota</i>	Diamond Python	L, Vul	Atlas
<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake		Atlas, AC
<i>Pygopus lepidopodus</i>	Common Scaly Foot		*
<i>Cyclodomorphus michaeli</i>	Eastern She-oak Skink	L	*
<i>Egernia coventryi</i>	Swamp Skink	R/R	Atlas
<i>Egernia saxatilis</i>	Black Rock Skink		AC
<i>Egernia whitii</i>	White's Skink		Atlas
<i>Eulamprus heatwolei</i>	Yellow-bellied Water-skink		Atlas, AC
<i>Lampropholis delicata</i>	Delicate Skink		Atlas
<i>Varamus varius</i>	Lace Monitor		*
<i>Chelodina longicollis</i>	Eastern Snake-Headed Tortoise		Atlas
<i>Caretta caretta</i>	Loggerhead Turtle		Atlas
<i>Litoria ewingii</i>	Bwn Tree-frog		AC

\* Specimens have been observed or taken from coastal heath both north and south of Airport Cove

AC - Observed at Airport Cove during this assessment

Atlas - Recorded in the Atlas of Victorian Wildlife for the Block that includes Airport Cove

L - Listed on Schedule 2 of the Flora and Fauna Guarantee Act 1988

R/R - Rare and restricted in Victoria (Atlas of Victorian Wildlife)

Vul - Vulnerable in Victoria (Atlas of Victorian Wildlife)