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**Wellington Shire Council**  
Implementation of Coastal Strategy  
Land Capability Assessment

March 2008





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# 1. Background

## 1.1 Recent Strategy and Policy Decisions

The Wellington Shire Council adopted the Wellington Coast Subdivision Strategy Option 4 – Nodal Urban settlement pattern at its meeting of 20<sup>th</sup> September, 2005 and the preparation of the Wellington Coast Subdivision Strategy: The Honeysuckles to Paradise Beach was finalised in February 2007. The Strategy was developed in accordance with the relevant coastal planning and management principles of the Victorian Coastal Strategy, 2002 prepared by the Victorian Coastal Council, and the Gippsland Coastal Board's Coastal Action Plans. This strategy provides a preferred settlement structure for the Wellington Coast between Paradise Beach and The Honeysuckles, as a way to encourage development that responds appropriately to environmental values and community needs, and is consistent with established policy in the Victorian Coastal Strategy.

## 1.2 Current Implementation Process

In February 2007 the Victorian Government convened two committees to provide recommendations to government relating to the preferred approach to dealing with the long-term issues surrounding old and inappropriate subdivisions along the Ninety Mile Beach in Gippsland. These include the Project Control Group (PCG) and the Interdepartmental Working Group (IWG). The PCG is due to deliver its recommendations to Government at the end of 2007.

In May 2007, GHD was requested to undertake a land capability and suitability assessment to provide additional supporting information for the deliberations of the PCG and IWG in relation to the Strategy.

The objective of the assessment is to provide a rational and structured basis for measuring the capability and suitability of land to accommodate residential development. This aims to test the variations in physical conditions that determine capability and the supplementary socio-economic conditions that determine suitability. This may result in some areas presenting as incapable or unsuitable to accommodate residential development, and for the remaining areas may suggest a spectrum of capability and suitability according to dwelling density thresholds.



## 2. Methodology

### 2.1 Initial Methodology

The initial methodology proposed for the land capability and suitability assessment was discussed in a Methodology Workshop held on 23<sup>rd</sup> May, 2007 with the IWG.

The suggested process was to involve an integrated approach to measuring capability for dwelling densities. This is based on a series of land qualities, evaluated for established land resource units, to measure how they may limit certain dwelling density opportunities by resulting in greater land degradation risk and more costly management inputs. Rating tables would then be prepared for each dwelling density. The table describes the variations in land qualities that contribute to a land resource mapping unit having a capability ranking I – V. Each land resource mapping unit would have a pre-assessed series of land qualities and could be interpreted to have a level of capability for the relevant dwelling densities.

A multi-criteria assessment based on multiple and separate spatial datasets would be integrated by attributing multiple data items using a common weighting scale. Weightings would be assigned based on separate objectives, rationale, criteria and measurements for each data item. Finally, weighted spatial polygons would be merged by intersection and amalgamation using GIS queries.

It was acknowledged at the workshop that no land resource unit mapping is available for the project area. Indeed, various members of the IWG agreed that the land resources of the project are relatively homogeneous.

The IWG also resolved that there is insufficient spatial variation in the socio-economic considerations, which may inform dwelling density alternatives within the project area, to render continuing with the land suitability elements (or human values) of the assessment process.

Finally the IWG agreed to proceed with acquiring the remaining relevant data required for the land capability assessment; interrogate the data obtained for quality, accuracy and applicability, and verify any data gaps.

### 2.2 Data Availability

The workshop held on the 23<sup>rd</sup> May, 2007 included discussions on each possible dataset available for use in the project. For each dataset the likely agency or data custodian was identified, as well as a list of possible contacts to assist in obtaining the data for the project.

Following the workshop, the relevant contacts and agencies were contacted and a number of important spatial datasets were obtained. These investigations also confirmed that other seemingly useful datasets would or could not be obtained due to their limited applicability or coverage. Various key datasets, however, were successfully acquired and these will be discussed in greater detail in Section 3.2 of this report.

The datasets successfully obtained were discussed and reviewed for relevance to the project in a second workshop held on 2<sup>nd</sup> August, 2007 with the Interdepartmental Working



Group (IWG). At this workshop the IWG confirmed that the land capability assessment should be finalised.

Discussions at the workshop emphasised the need for an updated methodology for the land capability assessment to accommodate a two-stage approach as outlined below.

### **2.3 Revised Methodology**

The need for a two-stage process resulted from the IWG review of available datasets and the understanding that some datasets indicate that land is completely inappropriate for dwellings, and other datasets suggest possible variations in capability for different dwelling densities.

The revised two-stage process was agreed to include:

Stage 1: Determine appropriate and inappropriate (Go – No Go) areas for dwellings.

Stage 2: Determine dwelling density capabilities for the remaining areas.

The IWG also suggested that additional key datasets should be integrated into the land capability assessment, including:

- » Mapping which reflects the observations from the Landscape Values Assessment regarding the variations in landscape qualities in the project area;
- » The mapped outcomes from an on-site assessment of flora and fauna characteristics to be undertaken as soon as possible; and
- » The mapped outcomes from an assessment of climate change and sea level rise implications for the project area to be undertaken by Ethos NRM, and that in this regard a meaningful assessment may be reliant on more detailed topographic data for the coast, from the Victorian Government purchase of new LIDAR contour information.



## 3. Data

### 3.1 Data Sorting

The GIS datasets acquired for the assessment were sorted and stored electronically, and various elements of the data were recorded in a comprehensive spreadsheet.

### 3.2 Critical Data Sets

#### 3.2.1 Flood Data

It was agreed by the IWG that areas within the 1 in 100 year flood extent be considered inappropriate for development and excluded from the Land Capability Assessment. The Gippsland Lakes Flood Level Modelling Project of 2004 developed new estimates for the 1 in 100 year flood levels for the Gippsland Lakes. The results are based on methods that use available meteorological and river flow records to account for physical influences such as streamflows, wind and ocean levels. Recommended 1% (1:100yr) annual exceedence levels are summarised in the report for various locations around the Gippsland Lakes area, although a value was not recommended for Lake Reeve.

A recommended 1 in 100 year flood AHD level for the project area, however, was discussed by GHD with Professor Rodger Grayson of the Science Team that undertook the flood modelling for the project, who advised that the flood level value recommended for Loch Sport should be adopted for the project area. This coincides with 1.9 m AHD. Grayson stated that observations made from the more recent floods that occurred in the Gippsland Lakes area confirms the appropriateness of the adoption of this value for the land surrounding Lake Reeve.

These 1 in 100 year flood levels do not include consideration of additional increases in flood levels that may result from climate change induced sea level rise. It was agreed at the IWG workshop that the extent of this increase, generally being discussed as relevant to Victoria is 0.7 m. Since this workshop the Victorian Coastal Council has adopted a precautionary policy position that the increase may range between 0.4m and 0.8m. The upper extent of this range has been added to the 1 in 100 year AHD flood level, on the basis that Lake Reeve, due to its connectivity to the Gippsland Lakes system, has a consequent susceptibility to sea level rise.

#### 3.2.2 Depth to Groundwater

The IWG agreed that it is necessary to consider the requirement for dwellings not connected to reticulated sewerage to have on-site effluent disposal. It is preferable for disposal systems to be constructed with a 2 metre clearance above the natural groundwater level to avoid possible contamination of groundwater. Although groundwater levels are unknown for the project area; it is assumed that they are hydraulically linked to Lake Reeve. To maintain adequate clearance, the areas available for the development of dwellings, which are capable of avoiding potential contamination of groundwater by on-site effluent disposal, have been assumed to be 2 metres above the water level of Lake Reeve assuming a 0.8



metre sea level rise, which results in capable areas for on-site effluent disposal being greater than 2.8 AHD. The remaining areas are considered to be inappropriate for dwellings in the absence of reticulated sewerage.

### 3.2.3 Ground Slope

The EPA Victoria publication *Land Capability Assessment for Onsite Domestic Wastewater Management* outlines a procedure that should be used to ensure that unsewered residential development only proceeds on land that has an acceptable capability for sustainable on-site wastewater management. This document considers the topography of a site and indicates that land with a slope greater than 20% has a very poor land capability class rating.

A preliminary assessment of the topography of the study area suggests that the land is relatively flat. Greater slopes exist along the edges of the primary dunes. However, these slopes are unlikely to restrict the land capability for accommodating onsite effluent disposal as the greater slopes are localised and do not appear to cover entire sites. Therefore, ground slope is not regarded as an important consideration in this land capability assessment.

### 3.2.4 Flora & Fauna

The potential for future dwellings within the study area to impact on native flora and fauna have been included in this land capability assessment. To assist in understanding this consideration, GHD was instructed by the IWG to prepare a flora and fauna assessment of the study area including a field survey. Refer to Appendix A for the outcomes of the Flora and Fauna Assessment.

The purpose of the assessment was to:

- » Summarise any ecological issues and impacts associated with the development of dwellings in the location;
- » Highlight those areas considered inappropriate for future development of dwellings on the basis of unacceptable impact on existing flora and fauna;
- » Determine dwelling density thresholds for the remaining areas on the basis of an assessment of potential ecological impacts; and
- » Outline mitigation measures to avoid and/or minimise potential impacts.

The flora and fauna assessment determined that any future development of the study area is likely to have some impact on ecological values. Potential impacts and mitigation measures are outlined in the relevant sections of the flora and fauna assessment report. The report suggests that if these are implemented appropriately, the potential risk of those impacts is minimised. However, general ecological concerns associated with development at the study site can be classified into five categories:

- » Potential impacts to threatened flora;
- » Potential impacts to threatened fauna;
- » Removal of native vegetation and fauna habitat;
- » Weed management; and



- » Restoration or revegetation strategy.

In addition, the flora and fauna assessment report outlines an *Ecologically Favourable Strategy for Future Development of the Study Area*, which highlights that there are several important strategic considerations for sustainable development within the study area. In order to achieve ecological objectives for sustainable development, the report recommends that Wellington Shire Council should consider the following items.

1. Ideally, the low density living in the existing discrete communities at The Honeysuckles, Glomar Beach, and the Golden Beach/Paradise Beach areas should not be subjected to any increases in dwelling density.
2. If further development is considered necessary, it would be preferable to add to existing settlements rather than create new settlements. For example, any new dwellings should be placed on land within existing settlements (e.g., The Honeysuckles, Glomar Beach, Golden Beach, Paradise Beach) rather than expanding into large areas of uncleared land.
3. All uncleared land between settlements currently offers very high quality habitat for a range of fauna, and provides a natural corridor between the ocean and Lake Reeve and this should be retained in a natural condition where possible.
4. If new settlements are planned, these should be located and planned to avoid disruption to the ecological function of the coastal vegetation corridor.
5. As visitation to the area increases, there is likely to be a greater potential for 'dune blow-out' through access tracks and loss of dune vegetation. It is recommended, therefore, to limit the number of access points to 90-Mile Beach.
6. It is likely that the state-listed Hooded Plover uses/breeds along this stretch of the 90 Mile Beach coast. This species is well known to be easily disturbed by humans. Further survey for Hooded Plovers would be required to determine the presence of this species.
7. If native vegetation is required to be removed for development a Net Gain Assessment, Habitat Hectare Assessment, and detailed report would be required to satisfy requirements of the Department of Sustainability and Environment under Victoria's Native Vegetation Management – A Framework for Action.

The flora and fauna assessment included a search of all relevant databases to identify flora and fauna that could potentially occur within the study area, including the presence of threatened species and communities. These included the FIS (Flora Information System, 2005), AVW (Atlas of Victorian Wildlife, 2005) and the EPBC Protected Matters Search Tool (PMST).

The Department of Sustainability and Environment Interactive Maps website and BioSites 1: 25 000 database was reviewed for the presence of EVCs (Ecological Vegetation Classes) and BioSites (sites of biodiversity significance) within the study area. Other relevant databases and literature were also accessed where these were considered necessary.

The BioSites map layer, EVCs map layer and map layers with recorded threatened flora and fauna sites with point locations are critical data sets for the land capability assessment.



These mapping layers have been used to define the areas considered by the flora and fauna assessment to contain variations in ecological values and, therefore, variations in capability for different dwelling densities.

### 3.2.5 Climate Change & Sea level Rise Impacts

The IWG agreed that the potential implications of climate change and sea level rise are a critical consideration for the land capability assessment. To provide an initial indication of these implications, Ethos NRM, in conjunction with Water Technology, have provided an overview of the relevant considerations.

The assessment includes consideration of beach erosion and sediment transport on Ninety Mile Beach, in the context of climate change events, including sea level rise. Ocean Storm Surge Inundation lines have been identified, assuming 0.48m and 0.8 m sea level rise. Locations in the study area where a breach in the coastal foredune is most likely in extreme climate events have been identified. These are where the 0.8 m sea level rise intersects the revised 1 in 100 year flood level. A 500 m buffer around these locations has been used to define areas that may be directly impacted by such breaches, and these are considered inappropriate for further dwelling development.

### 3.2.6 Landscape Values

The significance of landscape values throughout the project area, and potential impacts on these values from future development, was confirmed by the IWG as another key consideration in this land capability assessment.

GHD was engaged to undertake a landscape assessment to ascertain the landscape significance and values within the study area. The assessment of the landscape involved a site visit. During this site visit the extent of the area was explored via road. The landscape was then divided into areas where it was felt differences may occur based on a number of factors. These differences began to define the criteria for the landscape qualities.

The criteria for assessing the landscape values included: visual qualities, landscape character, key landscape features, and legislative significance.

The following conclusions were made in the report regarding the observed landscape differences in the study area:

**Group 1 Paradise Beach and Golden Beach** has low to moderate landscape value. Current patterns and location of dwellings create a significant modified natural setting. The area has the capacity to accommodate additional dwellings with no significant impacts on the character of the landscape between Shoreline Drive and Lake Reeve.

**Group 2 (Delray-Flamingo Beach) and Group 4 (Glomar Beach south)** have the most significant landscape value. Any further development of dwellings would potentially have a detrimental impact on the landscape character and values in these locations.

**Group 3 Glomar Beach** has moderate landscape value, with some natural features compromised by the current location and density of development. Regeneration areas remain in some locations and these form part of the current landscape character of the location, which could be impacted by further dwelling development.



**Group 5 The Honeysuckles** has moderate to high landscape value, defined predominantly by the surrounding scenic qualities of Lake Reeve and coastal dunes. Canopy trees dispersed through the built environment are also a key aspect of the current landscape character. Further dwelling construction should respect this pattern of development to be consistent with current landscape values.

Refer to Appendix B for the landscape assessment report.

These observations have been integrated into the land capability assessment.

### **3.2.7 Aboriginal Cultural Heritage Significance**

The recognition, protection and conservation of Aboriginal cultural heritage is an important consideration in managing future development of the Ninety Mile Beach region.

GHD contacted Aboriginal Affairs Victoria (AAV) and obtained a dataset showing areas of cultural heritage sensitivity for the project area. Areas of cultural heritage sensitivity are also specified in the Aboriginal Heritage Regulations 2007 (Part 2, Division 3), and include registered cultural heritage places, waterways, ancient lakes, declared Ramsar wetlands, coastal land, coastal Crown land, parks, dunes and sand sheets, amongst other areas, and includes land within specified distances of these cultural heritage sensitive areas.

These areas have been defined by AAV as a result of:

- » Analysis of the Aboriginal Heritage Register;
- » Knowledge of where Aboriginal cultural heritage occurs in the landscape; and
- » Research and analysis of where cultural heritage has been threatened.

In accordance with the Aboriginal Heritage Act 2006 and the Aboriginal Heritage Regulations 2007, if a high impact activity is proposed in an area of cultural heritage sensitivity then a Cultural Heritage Management Plan (CHMP) may be required for a proposed development. A CHMP is a written report setting out the results of an assessment to determine the nature of any Aboriginal cultural heritage present in an area and recommendations to mitigate harm to that heritage. Activities proposed in areas of cultural heritage sensitivity are not necessarily prevented from taking place; rather the completion of a CHMP provides proponents and planners with the maximum design flexibility to respond to and manage Aboriginal cultural heritage values.

Therefore, for the purpose of this land capability assessment this dataset cannot assist in determining areas inappropriate for development. However, this dataset assists in determining dwelling density thresholds within the project area, as discussed in greater detail in the Analysis section of this report.

### **3.2.8 Bushfire**

The determination of areas prone to bushfire and areas where the intensity of wildfire is significant and likely to pose a threat to life and property (i.e. areas covered by a Wildfire Management Overlay) is a significant consideration when determining areas appropriate for dwelling development and dwelling density thresholds. Key issues/factors relate to the likelihood of bushfire occurring on the basis of impact from human activity and from the



amount of vegetative fuel at the site, access to and egress from the project area in the event of bushfire, and native vegetation impacts from clearing to mitigate bushfire risk.

The bushfire related data obtained for the project is bushfire prone area mapping. The mapping indicates that the entire project area is prone to bushfire.

Discussions held with the Country Fire Authority (CFA) indicated that more detailed mapping is currently being produced, but is not yet available. This mapping will form a Wildfire Management Overlay (WMO) for later incorporation to the Wellington Planning Scheme.

The CFA has indicated that areas considered prone to bush fires are not necessarily inappropriate for the development of dwellings. Even those areas covered by the WMO do not prevent development. Rather, the objective of wildfire protection and the application of the WMO, is to assist the minimisation of risk to life, property, the natural environment and community infrastructure from wildfire. The bushfire prone area mapping cannot be used to determine areas inappropriate for dwellings, but have some applicability in determining the level of capability of the area for different dwelling densities.

### **3.2.9 Waterbodies/Wetlands**

The IWG confirmed that the potential impact of dwellings, and associated population increases, on the ecology of waterbodies and wetlands should be a consideration for the land capability analysis. The data search indicated that the most appropriate data set is the “Lakes & Waterbodies” element of the VicMap 1:25,000 topographic data, which identifies boundaries of these features. It should be acknowledged that waterbodies and wetlands do not have a fixed edge, and that there is a riparian zone adjacent to the waters edge, that forms a part of the ecology of these features. This has been factored into the analysis.

### **3.2.10 Parks and Reserves**

The Gippsland Lakes Coastal Park is a narrow coastal reserve covering 17,600 hectares along a portion of the Ninety Mile Beach, including part of the study area that extends from The Honeysuckles to Paradise Beach. This unique and picturesque park consists of lakes, wetlands, marine and terrestrial environments. Preservation of the natural and heritage values of this park is an important consideration in this land capability assessment.

A dataset outlining the locations of national and state significant parks and reserves has been obtained for use in this project. Development located in the vicinity of parks and reserves increases the likelihood of human interaction impacting on the natural environment of these areas and damaging flora and fauna habitat through informal access to the parks and reserves. Another consideration for the land capability assessment is that further development within the project area may remove important linkages between existing reserves.

The seasonal impacts of camping in the park and reserve areas may have a greater affect than permanent dwellings in the vicinity. These include impacts on flora and fauna habitat, and in addition, impacts from the lack of established infrastructure such as toilet and ablution facilities. It is also important to note that impacts from permanent dwellings are more manageable than impacts from camping, which are more sporadic. However, impacts



from temporary/ impermanent occupation, such as camping, are beyond the scope of this assessment as the focus here is on managing the location of future dwelling development.

### **3.2.11 Acid Sulfate Soils**

Coastal Acid Sulfate Soils pose a major risk to Victoria's coastal regions. If these soils are disturbed there is considerable risk of degradation of the local environment and physical infrastructure. Whilst these soils are relatively harmless undisturbed, when disturbed and exposed to oxygen through drainage or excavation, these soils produce sulfuric acid in large quantities. This sulfuric acid and other toxins released from the soil eventually flow into surrounding waterways, having potentially devastating effects on sensitive ecosystems. Acid discharges also damage town services and structures like pipes, foundations, drains, bridges and flood controls. Therefore, the existence of acid sulfate soils is an important consideration in determining the appropriate location of future dwelling development.

Acid sulfate soil mapping has been compiled for Victoria's coastal areas and has been viewed on the Department of Primary Industries (DPI) website. The mapping shows the estimated extent of probable acid sulfate soils. It is a calculated approximation and due to the scale of the mapping there may be areas outside the estimated regions that also have acid sulfate soils. The mapping indicates that within the project area there is only a minimal area that potentially has acid sulfate soils. In light of this, and due to the considerably large scale of the mapping, the meaningfulness of the existing data is questionable. Therefore, the applicability of the available data for the purposes of this project is limited, and consequently the GIS data has not been sought for the project.

### **3.2.12 Salinity**

The IWG indicated that salinity may be a relevant land capability consideration for dwelling densities.

In 2005 an investigation into urban salinity in the West Gippsland region was carried out for the West Gippsland Catchment Management Authority as part of their implementation of the West Gippsland Salinity Management Plan (report entitled West Gippsland Urban Salinity Risk Assessment). As the first study on urban salinity in West Gippsland it forms a preliminary investigation into the urban assets currently being affected by salinity, and makes an assessment of the risk of urban salinity in the area based on water table depths. The risk of urban salinity in West Gippsland is increasing as a result of increasing urban development combined with the effects of land clearing and irrigation leading to a rising water table. Therefore, salinity risk is a key consideration for this land capability assessment, with salinity impacts likely to increase as a result of any future development.

Project methodology included using the existing West Gippsland depth to watertable map developed for the West Gippsland Salinity Management Plan, to make an initial assessment of 'at risk' townships. This data was supplemented with additional groundwater levels gathered from new bores drilled in the township localities for the purposes of the project for the compilation of enhanced groundwater maps for the region. However, the risk assessment report concludes that there were insufficient monitoring records in the Seaspray, Golden Beach and Paradise Beach townships and surrounds for an assessment of groundwater trends.



The following was observed from site inspections at those towns that fall within the project area for the land capability assessment:

- » Salinity was observed throughout the eastern and north-eastern parts of the township of Seaspray, which is located outside of, but adjacent to, the project area for this land capability assessment. The salinity is considered likely to be predominantly primary due to the proximity to the coast, and it is reported that infrastructure at Seaspray has been developed to cope with the issue of salinity.
- » Golden Beach and Paradise Beach were both identified as being townships with possible minor salinity or potential future salinity, but salinity is stated as not generally being an issue. In reference to Golden Beach it was stated that the margins of Lake Reeve are very saline.

The risk assessment states that inland residential development and new subdivisions should be discouraged in areas of high water table where there is a higher risk of salinity.

Despite the identification of Golden Beach and Paradise Beach as potentially being subject to salinity, the available data is limited and inconclusive due to the lack of detailed groundwater level data within the project area. In the absence of this data salinity will not be considered in this land capability analysis.



## 4. Analysis

### 4.1 Stage 1: Areas Inappropriate for Additional Dwellings

The following datasets have been used to determine the areas inappropriate (or No-Go) for dwelling development:

- » Areas below 2.7 AHD, which represent areas within the 1 in 100 year flood extent (1.9 AHD), taking into account 0.8m sea level rise;
- » Areas below 2.8 AHD, which do not have sufficient clearance between assumed groundwater levels, taking into account 0.8m sea level rise, and on-site effluent disposal;
- » Areas with both a vulnerable EVC classification and endangered flora and fauna;
- » Buy back lots areas identified in the 'Wellington Coast Subdivision Strategy: The Honeysuckles to Paradise Beach, Hollands Landing and Seacombe, October 2003'. These areas are located in narrow sections, mostly between Glomar Beach and The Honeysuckles, are located on primary coastal dunes, and are part of a currently inactive buy-back scheme to transfer the land to the Crown. Several smaller areas also occur north of Glomar Beach.

### 4.2 Stage 2: Capability Assessment for Dwelling Densities

The remaining areas considered 'Go', or appropriate for dwellings development, have been subject to analysis which assigns a range of capability scores to the relevant data elements and the related impact criteria, according to 5 potential levels of dwelling density.

The following dwelling densities have been considered in this analysis:

1. Residential (10 – 20 dwellings per Ha, most dense);
2. Low Density Residential (1 – 10 dwellings per Ha);
3. Rural Living (1 dwelling per 1 – 10 Ha);
4. Small Rural Holdings (1 dwelling per 10 – 40 Ha); and
5. Rural (1 dwelling per 40 ha+, least dense).

Separate maps have been generated for each dwelling density, which aggregates the scores for each density category. The basis for the scores assigned to each criteria is discussed in detail in this section.

In some cases, there is no spatial variation in the datasets or the associated impact criteria relating to these. For example, when considering impacts from public access to parks and reserves, future dwelling development in one particular part of the project area would likely result in similar impacts as compared to development in another area, as the parks and reserves are just as accessible from one area to the next. Impacts may however, differ depending on the dwelling density proposed for development, and this is considered accordingly in the capability scoring.

In other instances, datasets may have a spatial variation, which suggests capability criteria scoring would also be variable within each dwelling density category. For example, the project area has particular locations with flora and fauna values identified as being greater than in other locations, and these locations have varying levels of capability to accommodate dwelling different densities.

For each of the impact criteria discussed in further detail below, scores have been assigned to represent the level of associated land capability to accommodate different dwelling density levels. A low score has been assigned where the land is considered to be most capable of accommodating that level of dwelling density under consideration. Similarly, a high score has been assigned where the land is considered to be least capable of accommodating that level of dwelling density under consideration.

The scores are aggregated for each dwelling density category, with different aggregations applying to different locations within the project area, based on the boundaries of spatially variable impact criteria. Appendix C contains a table of capability scores assigned to the various dwelling density scenarios.

The results of GIS queries which apply the capability scores for each separate dwelling density scenario are displayed in figures contained in Appendix D.

### **4.3 Assigning Capability Scores for Dwelling Densities**

#### **4.3.1 Flora and Fauna**

The GHD Flora and Fauna assessment indicates that there are five different categories of flora and fauna variability in the project area, where dwellings may not necessarily be inappropriate, but which may have varying capabilities to accommodate different dwelling densities. These are:

- » Vulnerable EVCs (Coast Banksia Woodland);
- » Remaining EVCs (other vegetation corridors);
- » Vegetation in existing low density areas;
- » Vegetation in partly developed low density areas; and
- » Not classified (no EVC coverage or significant vegetation).

The vulnerable EVCs are considered to be the least capable areas for dwelling development, and this capability may vary marginally according to the density of dwelling development proposed.

All remaining areas covered by EVCs may be considered to have a wider range of capability, depending on dwelling density, as these EVCs reflect corridors of vegetation that may offer opportunities for selective locations of dwellings. In any event, the more dense the dwelling development, the greater the impact, and the less capable these areas are considered.

The Flora and Fauna Report states that *ideally, the low density living in the existing discrete communities at The Honeysuckles, Glomar Beach and the Golden Beach/ Paradise Beach areas should not be subjected to any increases in dwelling density. Additionally, if further*



*development is considered necessary, it would be preferable to add to existing settlements rather than create new settlements.* This is reflected in the analysis by designating the land in the urban nodes as having *Extremely High Capability* for accommodating dwelling densities up to the existing dwelling density levels. For higher dwelling density levels the land capability is reduced.

#### **4.3.2 Climate Change & Sea Level Rise Impact Areas**

The Ethos NRM report (March 2008) on this item highlights the areas that are considered most vulnerable to a coastal dune breach in the event of severe weather events associated with climate change and sea level rise. These are the intersection of the Loch Sport 1% AEP flood level and the 0.8m sea level rise.

It is considered that these vulnerable areas should be protected from potential impacts from dwelling development, and that dwellings developed in the surrounding locations could be impacted in the event of a coastal dune breach. A buffer of 500m surrounding these potential breach locations is considered appropriate and this area should be assigned as having extremely low capability for additional dwelling development.

#### **4.3.3 Landscape Values**

The GHD Landscape Assessment Report concludes that different locations in the project area have existing landscape characteristics and values, that would be altered in the event of further dwelling development. These locations have been mapped as follows:

- » Areas with significant vegetation coverage;
- » Lake edge vegetation areas (with Canopy);
- » Lake edge vegetation areas (with salt marsh);
- » Urban nodes, low density & partial low density areas;
- » Restructure lots with scattered dwellings;
- » Restructure lots with few dwellings; and
- » Areas not assessed.

Areas defined as *good vegetation coverage and lake edge vegetation* are considered to contain high landscape values. These areas are most likely to be impacted from future development. The capability of the land in these areas to accommodate any dwelling density is considered extremely low.

Urban nodes and existing low density areas have moderate landscape values as natural landscape features have been compromised due to settlement. Further development in these areas at the existing density levels will have an extremely low impact on existing landscape values. Development at lower densities would be reversing the current level of dwelling development and would, therefore, have no impact. This assumption also applies to those areas with scattered dwellings, where small rural holdings and rural dwelling densities would reverse the current level of dwelling development, although the impact of dwelling development at higher dwelling densities would have a high impact on the landscape values in these locations.

The areas with few dwellings would be impacted by further dwelling development in uniformly variable way, depending on the density of dwelling development.

#### **4.3.4 Sites of Cultural Heritage Sensitivity**

The likelihood of impacting on Aboriginal cultural heritage values is considered greater within the identified sites of cultural heritage sensitivity. Outside these site boundaries Aboriginal cultural heritage items may exist but may not have yet been uncovered. Therefore, impacts on sensitive sites may also occur outside the mapped sensitivity boundaries, although the likelihood of this occurring may be considered marginally lower.

In addition, it is considered that impacts on Aboriginal cultural heritage values may be greater for higher dwelling densities and lower for lower densities.

#### **4.3.5 Bushfire Prone Areas**

##### **Impacts from increased likelihood of wildfire**

Impacts in this instance can be measured two ways:

1. Impacts from increased likelihood of wildfire from human activity – where higher dwelling density is associated with greater impacts from increased likelihood of wildfire due to increased human activity. Therefore, the land may be considered less capable of accommodating higher densities. Lower densities are associated with fewer impacts and therefore more capable of being accommodated.
2. Impacts from increased likelihood of wildfire from amount of vegetative fuel – where higher dwelling density is associated with less impacts from decreased likelihood of wildfire due to smaller amounts of vegetative fuel and/or increased vegetation clearance. Lower densities are associated with greater impacts.

In this case spatial variations in impacts from likelihood of wildfire across the project area are difficult to assess and have not been considered.

These two factors level each other as capability scores, but will nonetheless be included in the GIS mapping spatial analysis of dwelling densities.

##### **Impacts of native vegetation from management requirements**

In making a property safe from bushfire it is important to keep vegetative fuel to a minimum. Whilst the CFA recommends a risk management approach to wildfire that avoids unwarranted removal of native vegetation in the name of wildfire protection, there are planning permit exemptions for more flexible vegetation management for wildfire protection, which allows the removal of some native vegetation.

Higher density dwelling development is associated with more vegetation removal and therefore greater impact on native vegetation. Therefore, higher densities are less capable of being accommodated when considering native vegetation impacts in this regard. Lower density dwelling development is associated with less vegetation removal and therefore more capable of being accommodated.



### **Access in case of fire**

The ability for residents to escape the project area in the event of fire is considered. The project area access/egress points are located at each end of Shoreline Drive, and therefore residents located in the middle of the project area and furthest from these points, are at greater risk of being trapped and unable to escape a fire event. Land in the centre of the project area is, therefore, considered less capable of accommodating future dwelling development when compared to development at either end of the project area, closer to the egress points.

In addition to this spatial variation in land capability, impacts may differ depending on the dwelling density proposed for development. Evidently the more dense the development, the more people need to safely escape the project area in the event of a fire. Therefore, in considering the safety of residents higher densities are less capable of being accommodated. Lower densities would similarly be more capable of being accommodated.

#### **4.3.6 Waterbodies & Wetlands**

##### **Stormwater runoff**

Stormwater runoff has potential impacts on the riparian zone in and around waterways, waterbodies and wetlands. Impacts may consist of contamination of these environmental assets and their associated flora and fauna habitat.

An initial approach to assessing land capability for accommodating varying density levels was to protect the riparian zones from contamination from adjacent retarding basins using a larger buffer for higher densities where larger retarding basins area required, and a smaller buffer for lower densities, where smaller retarding basins are required. Land within the buffer could be considered to have low capability of accommodate dwelling development, whilst areas outside the buffer could be highly capable. However, defining the extent of the riparian zone is not possible without further detailed on-site investigations.

Instead, spatial variations in land capability have not been considered, and more broad assumptions into the likely impact from varying dwelling densities on the contamination of the waterways / waterbodies / wetlands from stormwater runoff has been made.

The residential density of dwelling development is considered to be most easily accommodated, notwithstanding that it would result in the greatest volumes of stormwater runoff. Impacts from stormwater runoff can be most easily managed at this density.

Similarly, the rural density of dwelling development is also considered to be the most easily accommodated due to small volumes of stormwater runoff being manageable, with lowest impact.

By contrast, the rural living density, which is likely to result in moderate stormwater runoff, but less managed stormwater arrangements and, therefore, this density is the least capable of being accommodated.

## Public Access

There is no apparent spatial variation in the capability of the land to accommodate different levels of dwelling density in the consideration of likely impacts from public access to waterways / waterbodies / wetlands. Impacts include possible contamination from human interaction and the need to control human accessibility to waterways/ waterbodies/ wetlands for safety reasons. These impacts are considered to apply equally across the project area due to the accessibility of both the ocean and Lake Reeve from any potential future development location.

The residential density of dwelling development is considered to be most easily accommodated, notwithstanding that it would result in the largest populations, as impacts from human interaction can be more easily managed at this density.

Similarly, the rural density of dwelling development is considered to be most easily accommodated due to smaller populations having lowest impact.

By contrast, the rural living density, which is likely to result in a moderate population, would be most difficult to manage, and therefore this density is the least capable of being accommodated.

### 4.3.7 Parks and Reserves

The impacts of dwelling development on parks and reserves include damage to flora and fauna habitat, and impacts from human interaction causing physical damage to the natural environment. Spatial differences in these impacts are difficult to assess to due to accessibility of the parks and reserves from all locations within the project area. Hence, a similar approach to that discussed above for assessing land capability for public access to waterways/ waterbodies/ wetlands has been adopted for parks and reserves.

The residential density of dwelling development is considered to be most easily accommodated, notwithstanding that it would result in the largest populations, as impacts from human interaction can be more easily managed at this density.

Similarly, the rural density of dwelling development is considered to be most easily accommodated due to smaller populations having lowest impact.

By contrast, the rural living density, which is likely to result in a moderate population, would be most difficult to manage, and therefore this density is the least capable of being accommodated.



## 5. Findings

### 5.1 Key Constraints to Development of Dwellings

#### 5.1.1 Areas Inappropriate for Additional Dwellings

The first stage of the capability analysis determined the areas considered inappropriate for dwelling development.

Figure 1 of Appendix D shows the extent of these areas, where they are located within the restructure area, being the extent of the subdivided lots under consideration.

Approximately 50% of the total restructure area is now considered inappropriate for development.. In some cases, this confirms assumptions that informed the existing Strategy, and in other cases new considerations, and more detailed topographic data, have now been applied to the subdivisions. This new information results in the following areas being considered inappropriate for any dwelling development:

- » The majority of The Honeysuckles, considered inappropriate as a large extent of its area falls into the 1 in 100 year flood extent with consideration of sea level rise, and much of the area does not have sufficient clearance for on-site effluent disposal;
- » The majority of the lots that lie between The Honeysuckles and Glomar Beach, as they have previously been identified by Government as lots to be acquired as part of a buy-back scheme, due to their location on the primary dunes. Some buy-back lots have also been identified adjacent to Flamingo and Letts Beaches;
- » The Lake Reeve islands that lie north-west of The Wreck Beach, as almost the entire area is subject to the 1 in 100 year flood extent, with remaining small parcels of land not meeting on-site effluent disposal clearance requirements; and
- » A significant stretch of the restructure area on the lake side is deemed inappropriate due to its susceptibility to flooding and the fact that it does not meet on-site effluent disposal clearance requirements.

#### 5.1.2 Capability Assessment for Dwelling Densities

The remaining areas, considered potentially capable for dwellings, have been assessed for capability to be developed at a range of densities. The outcomes of this capability assessment are shown in Figures 2.1-6.2 of Appendix D, and outlined below.

Each figure indicates the assigned capability ratings for each assessed dwelling density category.

#### Capability Differences Within Each Dwelling Density Category

*Land Capability for (Standard) Residential Dwelling Density (10 – 20 dwellings per Ha)  
(Refer to Figures 2.1 – 2.2)*

- » The study area generally has low-moderate capability of accommodating residential dwelling densities.

- » More specifically, the existing developed areas (currently with a low density residential level of development) including Paradise Beach, Golden Beach and parts of Delray Beach are considered to have moderate capability for standard density residential development. These areas have natural and landscape characteristics which have already been somewhat modified and would, therefore, be less impacted on by standard density residential development.
- » Much of the land to the west of the existing developed areas is considered to have low capability. The existing natural and landscape characteristics in this area have greater value and are more likely to be impacted on by standard density residential development.
- » Although much of The Honeysuckles is considered inappropriate for dwellings, the remaining areas in The Honeysuckles have a low capability for standard density residential development due to the potential impacts of a coastal dune breach in a combined 1 in 100 year (climate change scenario) storm surge and flooding event.

*Land Capability for Low Density Residential (1 – 10 dwellings per Ha)*

(Refer to Figures 3.1 – 3.2)

- » The study area generally has very low-moderate capability of accommodating low density residential dwelling development.
- » More specifically, the existing developed areas (currently with a low density residential level of development) including Paradise Beach and Golden Beach, and some areas in the vicinity of The Wreck Beach, are considered to have moderate capability. As the level of development in these areas is currently low density, the density category under consideration represents little change and, therefore, the natural and landscape characteristics, would not be greatly altered by development of a low density nature.
- » Much of the land to the west of the existing developed areas is considered to have low capability. The existing natural and landscape characteristics in this area have greater value and are more likely to be impacted on by low density residential development.
- » Some land at, and to the west of Glomar Beach, is considered to have very low capability of accommodating low density residential development. This results from these areas containing identified sites of cultural heritage sensitivity.

*Land Capability for Rural Living Dwelling Density (1 dwelling per 1 – 10 Ha)*

(Refer to Figures 4.1 – 4.2)

- » The study area generally has very low-moderate capability of accommodating rural living density development.
- » More specifically, the existing developed areas (currently with a low density residential level of development) including Paradise Beach and Golden Beach, and some areas in the vicinity of The Wreck Beach, are considered to have moderate capability. As the level of development in these areas is currently low density, the density category under consideration represents less development than the existing situation and, therefore, the natural and landscape characteristics, would not be greatly altered.



- » Much of the land to the west of the existing developed areas is considered to have low capability. The existing natural and landscape characteristics in this area have greater value and more likely to be impacted on by rural living development.
- » Land at, and extending east and west from, Glomar Beach is considered to have very low capability. This is predominantly due to Glomar Beach being the most isolated from egress points on the coast and, therefore, at greater fire risk.
- » Some areas in the vicinity of Letts Beach are considered to have very low capability. These areas contain Coast Banksia Woodland; a vulnerable EVC, and identified sites of cultural heritage sensitivity..

*Land Capability for Small Rural Holdings Dwelling Density (1 dwelling per 10 – 40 Ha)  
(Refer to Figures 5.1 – 5.2)*

- » The study area has generally moderate-high capability of accommodating small rural holdings dwelling development.
- » More specifically, the existing developed areas (currently with a low density residential level of development) including Paradise Beach, Golden Beach and parts of Delray Beach are considered to have high capability. As the level of development in these areas is currently low density, the density category under consideration represents less development than the existing situation and, therefore, the natural and landscape characteristics, would not be greatly altered.
- » Much of the land to the west of the existing developed areas is considered to have moderate capability. Although the existing natural and landscape characteristics in this area have value, this would not be greatly impacted by rural living development.

*Land Capability for Rural Dwelling Density (1 dwelling per 40 Ha)+ (Refer to Figures 6.1 – 6.2)*

- » The study area generally has high-very high capability of accommodating rural dwelling density development. This density of development under consideration has very little potential impact on the current natural and landscape values in any location.

### **Comparison of Capability Differences Between Dwelling Density Categories**

When comparing all maps for the varying levels of dwelling density the following points become evident:

- » The subject land is most capable of accommodating the lowest dwelling density; the rural dwelling density.
- » The subject land is least capable of accommodating the middle dwelling density level; the rural living dwelling density.
- » This outcome results from the consideration of managing impacts associated with public access to waterbodies, wetlands, and public parks and reserves. The rural density of dwelling development is considered to be most easily accommodated due to smaller populations having lowest impact. Similarly, standard density residential development, notwithstanding higher population, can also accommodate higher resourced, more

formalised management arrangements. By contrast, the rural living density, which is likely to result in a moderate population but with less capacity to formally manage impacts, would be most difficult to manage, and therefore this density is the least capable of being accommodated.

- » In all dwelling density scenarios, except the rural density, the majority of the subject land has a very low to low capability for dwellings.
- » The existing developed areas of Golden Beach, Paradise Beach and parts of Delray Beach and the Wreck Beach, have a moderate to very high capability to accommodate all dwelling scenarios.
- » The combined effects of wildfire management and risk of impact from wildfire on the capability assessment suggest that the greater the density, the greater the fire management issues associated with development.

## 5.2 Implications for Current Adopted Settlement Structure

### 5.2.1 Current Adopted Settlement Structure

The preferred settlement structure adopted by Wellington Shire Council is outlined in The Wellington Coast Subdivision Strategy: The Honeysuckles to Paradise Beach, February 2007, prepared by GHD for Wellington Shire Council.

The key elements of the preferred settlement structure include:

- » A preference for urban standard development in well defined settlement nodes at Golden Beach/Paradise Beach/Delray Beach, and at The Honeysuckles, with design guidelines to ensure development is in harmony with the coastal character of the area.
- » Eliminating the need to restructure lots within these nodes, creating more development opportunities, and removing the administrative burden associated with the consolidation process.
- » Acknowledging the Golden Beach/Paradise Beach/Delray Beach node as the focus for settlement on the coast between Seaspray and Loch Sport.
- » Acknowledging The Honeysuckles as a development node connected to Seaspray and its services.
- » Removing the oversupply of land, to create a buoyant and focussed land market, with related economic spin-offs for land owners and local businesses.
- » Concentrating development in defined locations to increase the cost efficiencies in providing new or improved roads, utility and community services, particularly the provision of reticulated water and sewerage.
- » Reducing the potential for direct population and development impacts on the coastal and lakes environment.
- » Transferring areas that are subject to inundation, have significant coastal values or have not been substantially modified to environmental management, either publicly owned as



part of an expanding Coastal Lakes Park, or in large privately owned and managed rural conservation lots.

- » Providing for new nodes of recreation, tourism and related commercial activities in strategic locations along the coast, to supplement Councils tourism strategy initiatives. These nodes are proposed for low key development with minimal services, predominantly day activities, with some camping and overnight cabin style accommodation.

### **5.2.2 Land Capability Comparison**

The more recent investigations undertaken for the land capability assessment included a Flora and Fauna Assessment, a Landscape Values Assessment, and a Climate Change and Sea Level Rise Implications Assessment. These assessments supplement the preliminary considerations made for native vegetation and habitat protection, landscape character, and climate change, which informed the decision for the preferred settlement structure as outlined above.

The following comparisons can be drawn from the results of the land capability assessment:

- » The Honeysuckles, which was previously acknowledged as a development node with preference for urban standard development, is now considered by the land capability assessment as inappropriate for dwelling development due to the climate change / sea level rise risks.
- » The land between The Honeysuckles and Glomar Beach was identified as requiring management of conservation and recreation values and designated as buy back lots, which is consistent with the land capability outcomes where this land is considered as inappropriate for dwelling development.
- » The current strategy recommends that the lots at Glomar Beach be restructured to create large rural conservation holdings accommodating existing dwellings, although some of this land is now considered by the land capability assessment as inappropriate for dwelling development. Some of the land comprising Glomar Beach, has high capability of accommodating rural dwelling densities and moderate capability for small rural holdings dwelling density, which is generally in line with the existing strategy.
- » The land between Glomar Beach and The Wreck Beach is identified in the strategy as being appropriate for rural conservation, excluding the lots proposed for the buy back scheme. Some of this land is now considered by the land capability assessment as inappropriate for dwelling development, and the remainder has high capability of accommodating rural dwelling density development.
- » The Lake Reeve islands, and land on the lake side of Paradise Beach were identified as land subject to inundation to be transferred to environmental management. These areas are now identified as being inappropriate for dwelling development, consistent with the view put forward in the strategy.
- » The land between The Wreck Beach and Delray Beach was identified as an urban node in the strategy, however, the recent land capability assessment suggests that this land is only moderately capable of accommodating residential dwelling densities. By

contrast, the recent assessment regards this land as having high capability of accommodating small rural holdings density development, and having very high capability of accommodating rural dwelling density development.

- » The strategy designates the lots at Delray Beach as low density residential development, however, the land capability assessment suggests that this land is only moderately capable of accommodating this dwelling density. Instead, the land is considered highly capable of accommodating small rural holdings, and having very high capability of accommodating rural dwelling density development.
- » Golden Beach and Paradise Beach are identified in the strategy as urban nodes where urban standard development is preferred. The land capability assessment, however, outlines that the land is only moderately capable of accommodating this dwelling density. Instead, small rural holdings or rural dwelling densities are deemed more appropriate.

### **5.3 Implications of Land Capability Assessment**

This land capability assessment has been undertaken to provide information to assist in comparing three options for addressing the Ninety Mile Beach subdivisions issue. These options are:

- » No change (do nothing).
- » Council adopted Strategy.
- » Council adopted Strategy, taking into account land capability, including climate change factors.

The assessment suggests that there are absolute capability constraints to the development of dwellings at any density in many parts of the subdivision area. This suggests that The Honeysuckles and Glomar Beach, previously considered appropriate for some level of development, have significant capability constraints. In particular, these and other areas of the subdivisions are at risk from coastal dune breach, in assumed climate change conditions and during extreme weather events, and/or do not have the required clearance to groundwater from on-site effluent disposal units. The physical characteristics of the remaining areas, outside the existing developed locations of Golden Beach, Paradise Beach and Delray Beach, suggest that there is a low to very low capability to accommodate densities greater than 1 dwelling per 10 ha, particularly in areas. The existing developed locations have a moderate capability to accommodate densities greater than 1 dwelling per 10 ha.

In comparing the three above options, there are costs and benefits of implementing each option. These include costs associated with managing impacts and risks identified by the capability criteria, in addition to other implementation costs relating to land acquisition, infrastructure provision, governance and administration, and parks management.

### **5.4 Utilising the Outcomes of the Land Capability Assessment**

Amalgamating the findings of land capability assessment with non-physical economic and social criteria, is often referred to as land suitability assessment. It is suggested that such



an assessment may be a useful tool for integrating the land capability findings with the additional considerations that State Government and the Wellington Shire Council may need to consider to conclude on the preferred course of action. The following is a suggested list of criteria that may be useful in further comparing the options:

#### **Government Policy**

- » Planning
- » Coastal
- » Environmental
- » Infrastructure

#### **Community Implications**

- » Economic costs and benefits
- » Social costs and benefits
- » Environmental costs and benefits

#### **Parks Management**

- » Impacts on existing Parks
- » Costs and benefits of amalgamation with existing Parks

#### **Financial Management**

- » Administrative, governance and legal costs
- » Land transfer costs – voluntary acquisition / compulsory acquisition / new regulatory arrangements / shared private management
- » Infrastructure costs

The consideration of these suitability criteria may require comparison of the alternatives using a full cost/benefit analysis, planning balance sheet or similar comparison tool.

Additionally, some of these criteria may be appropriately examined following selection of the preferred course of action, as part of considering implementation options. In particular there may be complex governance, land transfer, parks management, legal and liability issues to consider, which extend beyond a cost/benefit comparison.



Appendix A

## Flora and Fauna Report

GHD Pty Ltd





CLIENTS | PEOPLE | PERFORMANCE

**Wellington Shire Council**  
Flora and Fauna Assessment  
Stage 2  
The Honeysuckles to Paradise Beach

November 2007





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## Abbreviations

AVW	Atlas of Victorian Wildlife
CAMBA	China-Australia Migratory Bird Agreement
DSE	Department of Sustainability and Environment
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FFG Act	Flora and fauna Guarantee Act 1988
FIS	Flora Information System
GP	Gippsland Plain
JAMBA	Japan-Australia Migratory Bird Agreement
PMST	Protected Matters Search Tool
VROTS	Victorian Rare or Threatened Species





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The following individuals or groups have assisted in the preparation of this report. However, it is acknowledged that the contents and views expressed within this report are those of GHD Pty Ltd and do not necessarily reflect the views of the parties acknowledged below.

- » The Department of Sustainability and Environment for allowing access to records in the Flora Information System, records in the Atlas of Victorian Wildlife database, and threatened species Action Statements.





# Executive Summary

## Introduction

GHD was commissioned by the Wellington Shire Council to provide a flora and fauna assessment as part of a land capability assessment for an area between The Honeysuckles and Paradise Beach. The study area is located approximately 30 km south east of Sale and approximately 220 km east of the Melbourne CBD. The assessment is required because there is potential for native flora and fauna to be impacted during future development within the study area.

## Biodiversity Assessment

All relevant databases were initially searched to identify flora and fauna that could potentially occur within the study area, including the presence of threatened species and communities. These included the FIS (Flora Information System, 2005), AVW (Atlas of Victorian Wildlife, 2005) and the EPBC Protected Matters Search Tool (PMST).

The Department of Sustainability and Environment Interactive Maps website and BioSites 1: 25 000 database was reviewed for the presence of EVCs (Ecological Vegetation Classes) and BioSites within the study area. Other relevant databases and literature were also accessed where these were considered necessary.

### Flora

The study area contains both native and exotic flora species. However, exotic species are mostly confined to recently disturbed areas along roadsides, development sites, and designated camping sites. Overall, the vegetation is in good to excellent condition throughout most of the study area. There is some localised evidence of dune blowouts adjacent to some camping areas. This has resulted in some degradation to native vegetation.

A total of 88 flora species (67 native, 19 exotic) were recorded from the study area during the current survey. The FIS database includes observations of 679 flora species (529 native, 150 introduced) from documented sites (i.e. quadrats, defined area species lists, herbarium and incidental records) within a 10 km radius of the study area. There were no flora species of national or state significance recorded during the current assessment. It is possible that listed threatened flora species currently occur within the study area. Some listed species have been previously recorded and suitable habitat exists for some listed species.

### Fauna

The study area contains a diversity of fauna habitat. These include marine areas, coastal dunes and coastal scrub, and estuarine wetlands. The study area is in a relatively undisturbed condition and consists of a narrow strip of high quality coastal vegetation. It is likely that the area also supports a wide range of fauna species.

The study area is bordered on the eastern side by the sea and on the western side by an extensive freshwater/brackish wetland system. Some available habitat appears to have been disturbed and modified in the past, but some of those areas have regenerated naturally and now



provide fauna habitat of good condition. Most habitats available to fauna in the area are generally considered to be of moderate to very high quality.

## **Conservation Significance**

### **Study Area**

A total of 12 EVCs occur within 10 km of the study area according to DSE mapping of EVCs (1:50 000 scale). There are only four EVCs, however, occurring within the actual study area. One of the recognised EVCs is considered to be vulnerable within the Gippsland Plain bioregion. Others are of least concern.

### **Flora**

There is potential for nationally listed threatened flora species to occur within the study area. Previous records of those species are from within the study area and good quality habitat exists to support their presence. The vegetation communities are in good condition and appear to be relatively undisturbed and weed free. As a result, they can be considered to have high conservation significance.

### **Fauna**

The entire study area is located immediately adjacent to 90-Mile Beach and the Southern Ocean. The ocean offers a unique opportunity for many fauna species, particularly some birds, mammals, and all fish. Most of the habitat is relatively undisturbed and therefore provides good quality habitat for native fauna species. For that reason, the area is considered to have high conservation significance.

## **Impacts and Mitigation Measures**

While no specific works have been proposed for this project, some of the more general potential impacts of future development of the study area are identified below. In each case, impacts are provided based upon a scenario where no mitigation measures are undertaken at all.

A number of potential impacts could potentially occur to flora and fauna values both within and adjacent to the study area. A range of possible impacts and appropriate mitigation measures are suggested.

## **Relevant Government Legislation and Policy**

### **Commonwealth**

#### ***Environment Protection and Biodiversity Conservation Act 1999***

The Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) promotes the conservation of biodiversity within Australia by providing protection for threatened species, threatened ecological communities, migratory and marine species, and other protected matters. Certain actions – in particular, actions that are likely to have a significant impact on any *Matter of National Environmental Significance* (MNES) – are subject to a rigorous assessment and approval process (DEH, 2006). There are seven MNES identified in



the EPBC Act that may act as triggers for the Commonwealth assessment and approval regime, which are relevant to this project.

### **State (Victoria)**

#### ***The Flora and Fauna Guarantee Act 1988***

The *Flora and Fauna Guarantee Act 1988* (FFG Act) is the key piece of Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes.

The FFG Act seeks to put in place preventative management mechanisms to ensure no biota or ecological communities become extinct within Victoria, and to ensure that the processes that threaten biodiversity are identified and addressed. The Act is more broad than 'endangered species' legislation, covering ecological communities; potentially threatening processes; community involvement in conservation; and a strategic approach to biodiversity conservation and sustainable use. Under the Act, a permit is required from the Department of Sustainability and Environment to 'take', kill, injure, disturb or collect listed protected flora and fish species, or flora species that form part of listed or protected communities.

#### ***Environment Effects Act 1978***

The ministerial guidelines for assessment of environmental effects under the *Environment Effects Act 1978* provide a range of criteria that can be used to determine whether an Environmental Effects Statement (EES) may be required (page 7; DSE 2006). Many of the listed potential effects that may warrant a referral of a project are related to flora and fauna issues.

#### ***Victoria's Native Vegetation Management – A Framework for Action***

The main goal of *Victoria's Native Vegetation Management – A Framework for Action* is to achieve a reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation, leading to a Net Gain. In applying the Net Gain approach to protection and clearance decisions, an established 3-step approach must be applied.

### **Local**

The study area is subject to the Wellington Planning Scheme.

Planning provisions for this area (particularly any relevant environmental zones or overlays) are likely to contain important information relevant to this project and thus should be consulted. Actions or permits pertaining to flora and fauna considerations under local legislation may be required for this project. Other aspects of the study area (e.g. heritage sites) may need consideration with respect to local legislation.

### **Conclusions**

Any future development of the study area is likely to have some impact on ecological values. Potential impacts and mitigation measures are outlined in the relevant sections below. If these are implemented appropriately, the potential risk of those impacts may be minimised. Details of mitigation measures are outlined in the relevant sections of the report.





## Limitations of the Study

This flora and fauna assessment generally covers vascular plants (ferns, conifers and flowering plants) and vertebrate fauna (mammals, birds, reptiles and frogs), as information on these groups is readily available. Non-vascular flora (e.g. mosses, liverworts, lichens), fungi, aquatic fauna and terrestrial invertebrates have been considered as part of this assessment where possible, although there is relatively little information available for these groups.

The results of the desktop investigation are limited to the accuracy of information available in the databases searched.

The flora of the study area was assessed in late winter/early spring. This may be considered to be generally a sub-optimal time for conducting flora surveys in east Gippsland. Some species may be difficult to locate or identify at this time of year due to a lack of reproductive material and the seasonal nature of some species. It is expected that further flora species are likely to have been recorded if the area was searched during a different time of year. These limitations are likely to have minimal effect on the recommendations made in this report.

The fauna assessment was also conducted during late winter/early spring, which is generally considered a suitable time of the year to record many fauna species in the east Gippsland area. Additional fauna species may be recorded if surveys were also undertaken at different times of the year (in spring, for example, when many animals become more active as they are dispersing, calling or breeding), over a longer time-period, and by using more intensive fauna survey techniques (e.g. trapping). September is also a time of year when many reptiles and amphibians are becoming active and migratory species may be moving to other areas. These limitations are partially offset by the information available from the AVW database and other sources. It should be acknowledged that this assessment of flora and fauna values was a preliminary assessment.





# 1. Introduction

## 1.1 Background

GHD was commissioned by Wellington Shire Council to undertake a flora and fauna assessment of an area between The Honeysuckles and Paradise Beach adjacent to 90 Mile Beach. The assessment was undertaken in two stages. Stage 1 comprised a desktop assessment of all relevant databases to determine species that could potentially occur in the area, including threatened species. Stage 2 involved undertaking a two-day site visit to record observations regarding flora and fauna which could assist in interpreting the database search results.

## 1.2 Purpose of the Study

The purpose of this study is to: a) summarise any ecological issues pertaining to the proposed development; and b) identify potential ecological impacts associated with the project and c) outline mitigation measures to avoid and/or minimise potential impacts. The aims of this study are to:

- » Describe the flora species and vegetation communities of the study area;
- » Describe fauna habitats within the study area and immediate vicinity;
- » Identify any additional potential species or ecological communities that may occur within the study area, particularly those which may be of conservation significance;
- » Evaluate the ecological significance of the study area;
- » Identify and describe any potential impacts on flora and fauna resulting from the development of dwellings;
- » Outline potential responses, which may inform the land capability assessment for alternative dwelling densities; and
- » Outline the government legislation and policy relevant to the protection of flora and fauna.

## 1.3 Study Area

The study area is located within the boundaries of the Wellington Shire Council between The Honeysuckles and Paradise Beach and approximately 200 km east of the Melbourne CBD.

Coastal vegetation communities dominate most of the area. The majority of the area is also located adjacent to Lake Reeve, which is a Ramsar listed wetland.

### 1.3.1 Bioregion

Bioregions are geographical areas with distinctive ecological and environmental characteristics. The study area occurs entirely within the Gippsland Plain bioregion (GP).





## 2. Methods

### 2.1 Assessment of Existing Information

To identify flora and fauna that could potentially occur within the study area, including the presence of threatened species and communities, the following primary data sources were searched as part of Stage 1 of this assessment:

- » **Flora Information System (FIS).** The FIS is a geographically registered, relational database of the distribution of Victorian plants, managed and maintained by the Victorian Department of Sustainability and Environment (DSE). Data within the FIS were reviewed for a 10 km radius around the study area;
- » **Atlas of Victorian Wildlife (AVW).** Data within the Atlas of Victorian Wildlife was reviewed for a 10 km radius around the study area. This database is managed and maintained by the Victorian Department of Sustainability and Environment (DSE). The Atlas of Victorian Wildlife (AVW) documents records of vertebrate fauna recorded from throughout the state of Victoria. Using this database, surveys from within a defined geographical area can be searched to produce lists of known fauna species. This list of fauna species is only as accurate as the quality and quantity of data that has been recorded and documented from this area. Surveys include lists of fauna, incidental observations of unusual species and museum specimens. The information from the AVW was accessed on the 27 February 2007;
- » **The Environment Protection and Biodiversity Act 1999 (EPBC) ‘Protected Matters Search Tool’.** The Commonwealth Department of Environment and Water Resources (DEW) website has a search program (the Protected Matters Search Tool - PMST), which can be used to identify potential *matters of national environmental significance*<sup>1</sup> for any specified area within Australian territorial boundaries. The PMST differs from the FIS and AVW databases in that it: a) only considers flora and fauna listed in one or more provisions of the EPBC Act; and b) is based on the predicted distributions of flora and fauna and/or their habitat, rather than on known observations. That is, the PMST predicts the potential occurrence of a species or its habitat within an area, whether or not documented observations occur for that area. This includes species or habitat listed as threatened, migratory and/or marine under the *Environment Protection and Biodiversity Conservation Act 1999*. The search of the PMST included an area covered by a 10 km radius around the study area;
- » **DSE Biodiversity Interactive Maps website**<sup>2</sup> was reviewed for the presence of Ecological Vegetation Classes (EVCs) within the vicinity of the study area; and
- » **BioSites EVC 1:25 000** data base and other relevant literature sources were accessed during this study.

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<sup>1</sup> as defined under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*

<sup>2</sup> nremap.vic.gov.au



## **2.2 Field Assessment**

### **2.2.1 Flora**

The study area (Figure 1) was assessed by a botanist on 4 and 5 September 2007 and the following tasks undertaken:

- » Identification of all native and exotic flora species;
- » Recording the location of rare or threatened flora species;
- » Identification and mapping of all Ecological Vegetation Classes present; and
- » Assessment of vegetation condition.

### **2.2.2 Fauna**

A zoologist visited the study area on 4 and 5 September 2007. The following tasks were undertaken during the fauna assessment of the study area:

- » Identification of fauna habitats occurring within the study area and their condition; and
- » Recording of an opportunistic list of fauna species present from within the study area, including both direct observations and indirect evidence (e.g. hearing calls, scats, tracks).

## **2.3 Nomenclature**

### **Flora Species**

Common and scientific names for all plants follow the FIS (2005 version) of the Department of Sustainability and Environment (DSE).

### **Ecological Vegetation Classes**

Native vegetation in Victoria is classified into units known as Ecological Vegetation Classes (EVCs). Ecological Vegetation Classes are described according to a combination of floristic, life form and ecological characteristics, and through an inferred fidelity to particular environmental attributes. Each EVC occurs under a common regime of ecological processes within a given biogeographic range, and may contain multiple floristic communities (DSE 2003).

### **Fauna**

Common and scientific names for terrestrial vertebrate fauna (mammals, birds, reptiles, and amphibians) follow the Atlas of Victorian Wildlife (AVW) database, maintained by DSE.

## **2.4 Definition of Significant Species, Communities, and Sites**

The conservation significance of flora, fauna, ecological communities, and sites supporting flora and fauna, is based on a number of formally applied categories and criteria outlined in Appendix A.



DATA SOURCE: Google Earth Pro. Image © 2007 Digital Globe. © 2007 Europa Technologies.



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Project: **Wellington Coast Subdivision Strategy**

Title: **Locality Map**

Project No: **31/ 20287** Date: **04/10/2007** **A4** Scale: **1:200 000** Sh **1** of **1** Rev. **0**

Prepared.	KEL	Date: 04/10/07	Workspace	flora_and_fauna_locality_map
Checked.	xxx	Date	Location	G:31/20287/CADD/GIS/Projects
Approved.	xxx	Date	Map Grid	GDA 94 (MGA Zone 55)





## 3. Flora Results

### 3.1 Overview of Floristic Values

The study area contains both native and exotic flora species. Exotic species are mostly confined to areas where there has been recent disturbance such as along roadsides, development sites, and recognised camping sites. Overall, the vegetation throughout the entire length of the study area is in good to excellent condition because of low weed cover. However, there is some evidence of dune blowouts adjacent to some camping areas, which has resulted in some localised degradation of native vegetation.

### 3.2 Flora Species

During the current survey, a total of 88 (67 native, 19 exotic) species were recorded from the study area (Table 1). The FIS database includes observations of 679 species (529 native, 150 introduced) from documented sites (i.e. quadrats, defined area species lists, herbarium and incidental records) within a 10 km radius of the study area.

**Table 1 List of flora species recorded from the current survey**

Scientific Name	Common Name
<b>Indigenous Species</b>	
<i>Acacia dealbata</i>	Silver Wattle
<i>Acacia genistifolia</i>	Spreading Wattle
<i>Acacia longifolia</i> subsp. <i>sophorae</i>	Coast Wattle
<i>Acacia melanoxylon</i>	Blackwood
<i>Acacia stricta</i>	Hop Wattle
<i>Acaena echinata</i>	Sheep's Burr
<i>Acrotriche serrulata</i>	Honey-pots
<i>Allocasuarina littoralis</i>	Black Sheoak
<i>Allocasuarina verticillata</i>	Drooping Sheoak
<i>Apium prostratum</i> subsp. <i>prostratum</i>	Sea Celery
<i>Atriplex paludosa</i> subsp. <i>paludosa</i>	Marsh Saltbush
<i>Austrostipa</i> spp.	Spear Grass
<i>Banksia integrifolia</i> subsp. <i>integrifolia</i>	Coast Banksia
<i>Banksia marginata</i>	Silver Banksia
<i>Banksia serrata</i>	Saw Banksia
<i>Billardiera scandens</i>	Common Apple-berry
<i>Bossiaea prostrata</i>	Creeping Bossiaea
<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Sweet Bursaria
<i>Calocephalus lacteus</i>	Milky Beauty-heads



Scientific Name	Common Name
<i>Cassinia aculeata</i>	Common Cassinia
<i>Clematis microphylla</i>	Small-leaved Clematis
<i>Comesperma volubile</i>	Love Creeper
<i>Correa reflexa</i>	Common Correa
<i>Dianella revoluta s.l.</i>	Black-anther Flax-lily
<i>Dichondra repens</i>	Kidney-weed
<i>Disphyma crassifolium</i> subsp. <i>clavellatum</i>	Rounded Noon-flower
<i>Distichlis distichophylla</i>	Australian Salt-grass
<i>Einadia nutans</i> subsp. <i>nutans</i>	Nodding Saltbush
<i>Eucalyptus globoidea</i>	White Stringybark
<i>Eucalyptus tereticornis</i> subsp. <i>mediana</i>	Gippsland Red-gum
<i>Eucalyptus viminalis</i>	Manna Gum
<i>Gahnia sieberiana</i>	Red-fruit Saw-sedge
<i>Geranium</i> sp. 2	Variable Cranesbill
<i>Gonocarpus tetragynus</i>	Common Raspwort
<i>Halosarcia pergranulata</i> subsp. <i>pergranulata</i>	Blackseed Glasswort
<i>Helichrysum</i> spp.	Everlasting
<i>Hibbertia virgata</i>	Twiggy Guinea-flower
<i>Indigofera australis</i>	Austral Indigo
<i>Isolepis inundata</i>	Swamp Club-sedge
<i>Juncus pallidus</i>	Pale Rush
<i>Juncus procerus</i>	Tall Rush
<i>Kennedia prostrata</i>	Running Postman
<i>Kunzea ericoides</i> spp. agg.	Burgan
<i>Lepidium foliosum</i>	Leafy Peppercress
<i>Leptospermum laevigatum</i>	Coast Tea-tree
<i>Leucopogon parviflorus</i>	Coast Beard-heath
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
<i>Malva</i> spp.	Mallow
<i>Monotoca scoparia</i>	Prickly Broom-heath
<i>Oxalis</i> spp.	Wood Sorrel
<i>Ozothamnus turbinatus</i>	Coast Everlasting
<i>Pimelea humilis</i>	Common Rice-flower
<i>Platysace lanceolata</i>	Shrubby Platysace
<i>Poa</i> spp.	Tussock Grass
<i>Pomaderris paniculosa</i> subsp. <i>paralia</i>	Coast Pomaderris



Scientific Name	Common Name
<i>Portulacaceae</i> spp.	Portulaca
<i>Pteridium esculentum</i>	Austral Bracken
<i>Ranunculus</i> spp.	Buttercup
<i>Rhagodia candolleana</i> subsp. <i>candolleana</i>	Seaberry Saltbush
<i>Samolus repens</i>	Creeping Brookweed
<i>Sarcocornia quinqueflora</i>	Beaded Glasswort
<i>Senecio spathulatus</i> s.l.	Dune Groundsel
<i>Senecio</i> spp.	Groundsel
<i>Solanum</i> spp.	Nightshade
<i>Tetragonia tetragonoides</i>	New Zealand Spinach
<i>Tetratheca pilosa</i>	Hairy Pink-bells
<b>Exotic Species</b>	
<i>Acetosella vulgaris</i>	Sheep Sorrel
<i>Centaurium erythraea</i>	Common Centaury
<i>Cirsium vulgare</i>	Spear Thistle
<i>Cortaderia selloana</i>	Pampas Grass
<i>Cotula coronopifolia</i>	Water Buttons
<i>Fumaria bastardii</i>	Bastards Fumitory
<i>Holcus lanatus</i>	Yorkshire Fog
<i>Juncus acutus</i> subsp. <i>acutus</i>	Sharp Rush
<i>Lagurus ovatus</i>	Hare's-tail Grass
<i>Lolium perenne</i>	Perennial Rye-grass
<i>Lycium ferocissimum</i>	African Box-thorn
<i>Malva parviflora</i>	Small-flower Mallow
<i>Pinus radiata</i>	Radiata Pine
<i>Romulea rosea</i>	Onion Grass
<i>Sonchus asper</i> s.s.	Rough Sow-thistle
<i>Sonchus oleraceus</i>	Common Sow-thistle
<i>Sporobolus africanus</i>	Rat-tail Grass
<i>Taraxacum officinale</i> spp. agg.	Garden Dandelion
<i>Trifolium</i> spp.	Clover



### 3.3 Significant Flora Species

#### 3.3.1 National Significance

##### Current Assessment

There were no flora species of national significance recorded during the current assessment.

##### EPBC Act Protected Matters Search Tool

The Environment Protection and Biodiversity Conservation Act (EPBC) Protected Matters Search Tool predicted the existence of suitable habitat for three threatened flora species within the study area, as outlined in Table 2. None of these species were recorded during the current assessment.

**Table 2 Vascular flora species of national or state significance recorded (*Flora and Fauna Guarantee Act 1988*, Flora Information System), or predicted to occur (EPBC Act Protected Matters Search Tool) within the study area**

##### Status:

- E Endangered in Australia (EPBC Act 1999)
- V Vulnerable in Australia (EPBC Act 1999)
- F Listed under the *Flora and Fauna Guarantee Act 1988*
- e endangered in Victoria (VROTS)
- v vulnerable in Victoria (VROTS)
- r rare in Victoria (VROTS)

##### Information source:

PMST EPBC Act Protected Matters Search Tool

VROTS Victorian Rare or Threatened Species Advisory List

##### National and State Significant Threatened Flora Species – Likelihood of Occurrence<sup>3</sup>

Scientific name	Common name	Status	Source	Likelihood of occurrence
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V, e, F	PMST	<b>Unlikely.</b> No suitable habitat
<i>Prasophyllum frenchii</i>	French's Leek-orchid	E, e, F	PMST	<b>Possible.</b> Has been recorded in the Golden Beach locality
<i>Thelymitra epipactoides</i>	Metallic Sun-orchid	E, e, F	PMST	<b>Possible.</b> Has been recorded in the Golden Beach locality

<sup>3</sup> Likelihood of occurrence habitat information derived from Walsh and Entwistle (1994, 1996, 1999).



### 3.3.2 State Significance

#### Current Assessment

No flora species of state significance were recorded during the current assessment.

#### Flora Information System

The FIS database contains records of 20 rare or threatened species within 10 km of the study area. However, none were recorded during the current assessment. These species, along with their conservation status and likelihood of occurrence, are described in Table 3.

**Table 3 National and State significant Flora Species – Likelihood of Occurrence**

#### Legend

Code	Status	Source
C	Critically Endangered	EPBC Act 1999
E	Endangered in Australia	EPBC Act 1999
e	Endangered in Victoria	EPBC Act 1999
f	Threatened in Victoria	FFG Act 1988
k	Poorly known	VROTS
r	Rare in Victoria	VROTS
V	Vulnerable in Australia	VROTS
v	Vulnerable in Victoria	VROTS

Status	Scientific Name	Common Name	Likelihood of Occurrence
r	<i>Austrostipa littoralis</i>	Coast Fescue	<b>Possible.</b> Previously recorded from the Seaspray region
r	<i>Bossiaea heterophylla</i>	Variable Bossiaea	<b>Possible.</b> Numerous records from within the region
k	<i>Caladenia alata</i>	Fairy Orchid	<b>Possible.</b> Previously recorded from near Paradise Beach
r	<i>Calochilus imberbis</i>	Naked Beard-orchid	<b>Possible.</b> Previously recorded from the Golden Beach region
v	<i>Diuris punctata</i> var. <i>punctata</i>	Purple Diuris	<b>Unlikely.</b> No suitable habitat
r	<i>Eucalyptus</i> aff. <i>willisii</i> (Gippsland Lakes)	Gippsland Lakes Peppermint	<b>Possible.</b> Numerous records within the region
r	<i>Lachnagrostis punicea</i> subsp. <i>filifolia</i>	Purple Blown-grass	<b>Possible.</b> Previously recorded from the Seaspray region
r	<i>Lachnagrostis robusta</i>	Salt Blown-grass	<b>Possible.</b> Previously recorded from the Seaspray region
r	<i>Lawrennia spicata</i>	Salt Lawrennia	<b>Possible.</b> Previously recorded from the Golden Beach region
k	<i>Lomandra glauca</i> s.s.	Blue Mat-rush	<b>Possible.</b> Previously recorded from the Golden Beach region
k	<i>Lotus australis</i>	Austral Trefoil	<b>Possible.</b> Previously recorded from the Golden Beach region



Status	Scientific Name	Common Name	Likelihood of Occurrence
r	<i>Muellerina celastroides</i>	Coast Mistletoe	<b>Possible.</b> Previously recorded from near Paradise Beach
r	<i>Platysace ericoides</i>	Heath Platysace	<b>Possible.</b> Numerous records within the region
E e f	<i>Prasophyllum frenchii</i>	Maroon Leek-orchid	<b>Possible.</b> Has been recorded in the Golden Beach locality
k	<i>Stackhousia spathulata</i>	Coast Stackhousia	<b>Unlikely.</b> No suitable habitat
E e f	<i>Thelymitra epipactoides</i>	Metallic Sun-orchid	<b>Possible.</b> Has been recorded in the Golden Beach locality
k	<i>Thelymitra planicola</i>	Shy Sun-orchid	<b>Unlikely.</b> No suitable habitat
r	<i>Thryptomene micrantha</i>	Ribbed Thryptomene	<b>Possible.</b> Numerous records from within the region
r	<i>Triglochin mucronata</i>	Prickly Arrowgrass	<b>Possible.</b> Previously recorded from near Paradise Beach
r	<i>Zieria veronicea</i> subsp. <i>veronicea</i>	Pink Zieria	<b>Possible.</b> Numerous records from within the region

#### Likelihood of Occurrence

Present      Individuals recorded within the study area during the current or any previous assessment

Possible      Suitable habitat occurs within the study area

Unlikely      Suitable habitat unlikely to occur within the study area, or suitable habitat present but species not recorded for over 30 years within 5 km of the site

Not present    No suitable habitat present within the study area

### 3.4 Vegetation Condition

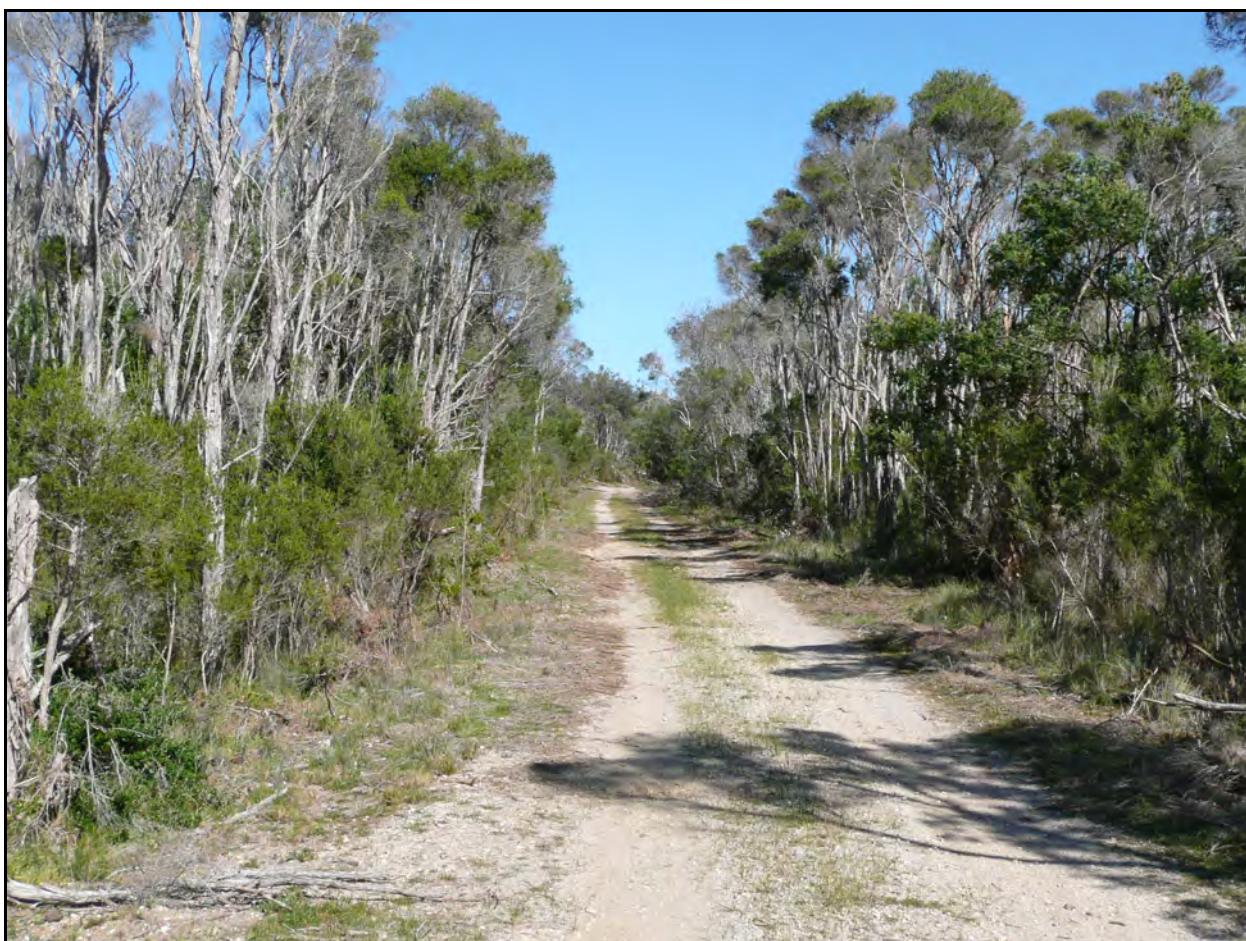
Overall, the vegetation condition within the study site has low weed cover and is, therefore, considered to be in good condition. Although some areas have been previously disturbed, they have regenerated naturally following cessation of the disturbance. There are some scattered and hardened tracks/roads throughout most of the area and there is little regeneration on these (Figure 2)

Some areas are degraded as a result of human settlement and activity. Some of these are being colonised by exotic species such as *Acetosella vulgaris* (Sheep Sorrel), *Centaurium erythrea* (Common Centaury), *Cirsium vulgare* (spear Thistle), *Fumaria bastardii* (Bastards Fumitory), and *Romulea rosea* (Onion Grass), see also Table 1, but these are mainly confined to areas that remain disturbed. It is unlikely that any of the weed species recorded during the current assessment will have potential to colonise adjacent to undisturbed areas.



Vegetation condition within some of the EVCs, occurring within the study area, could be considered to be in a modified condition based on species present. This is, presumably, the result of previous land clearance and land use activities. There is evidence of less formed roads and tracks throughout the area. While this may have had some initial impact on ecological values, the majority of these have regenerated naturally and now appear to be in a relatively good condition. Several exotic species such as *Holcus lanatus* (Yorkshire Fog) and *Sonchus oleraceus* (Common Sow-thistle) are present, although they are concentrated along the edges of formed roads and tracks and also within currently cleared areas.

**Figure 2 Typical view of hardened road within the study area**



### **3.5 Ecological Vegetation Classes**

A total of 12 EVCs are recognised by the DSE 1:50 000 mapping within close proximity to the study area. These include: EVC 1, Coastal Dune Scrub/Coastal Dune Grassland Mosaic; EVC 2, Coast Banksia Woodland; EVC 3, Damp Sands Herb-rich Woodland; EVC 6, Sand Heathland; EVC 9, Coastal Saltmarsh; EVC 10, Estuarine Woodland; EVC 16, Lowland Forest; EVC 48, Heathy Woodland; EVC 53, Swamp Scrub; EVC 134, Sand Forest; EVC 136, Sedge Wetland; and EVC 191, Riparian Scrub.



The majority of the study area consists of EVC 1, Coastal Dune Scrub/Coastal Dune Grassland Mosaic; EVC 2, Coast Banksia Woodland; EVC 9, Coastal Saltmarsh; and EVC 10, Estuarine Woodland.

### **3.5.1 Coastal Dune Scrub/Coastal Dune Grassland Mosaic**

This particular EVC is common throughout the study area and also within the Gippsland Plain bioregion and is of least concern in the GP bioregion. It extends, within the study area, almost continuously from The Honeysuckles to Paradise Beach.

Coastal Dune Scrub/Coastal Dune Grassland Mosaic has been described by DSE (2004) as a closed scrub or grassland on siliceous and calcareous sands that are subject to high levels of salt spray and continuous disturbance from onshore winds.

Coastal Dune Scrub/Coastal Dune Grassland Mosaic (Figure 3) is dominated by several medium tree species including *Acacia longifolia* (Coast Wattle), *Leptospermum laevigatum* (Coast Tea-tree), and *Leucopogon parviflorus* (Coast Beard-heath) up to 5 m tall.

The understorey contains small to medium shrub species such as *Atriplex cinerea* (Coast Saltbush), *Suaeda australis* (Austral Seablite), and *Lagenophora stipitata* (Common Bottle-daisy) up to 1.5 m tall with a ground cover consisting of species such as *Dichondra repens* (Kidney-weed), *Oxalis corniculata* (Yellow Wood-sorrel), and *Crassula sieberiana* (Sieber Crassula).

**Figure 3** View of campsite within the Coastal Dune Scrub/Coastal Dune Grassland Mosaic EVC. Most of the understorey vegetation has been removed as a result of campsite development. The small trees shown are *Leptospermum laevigatum* (Coast Tea-tree)



The majority of Coastal Dune Scrub/Coastal Dune Grassland Mosaic within the study area is in relatively good condition and would provide good quality habitat for native fauna species. There is some scattered development within some areas of this EVC and also many developed camping sites are also present. There is however, minimal weed colonisation within the developed campsites.

### **3.5.2 Coast Banksia Woodland**

Coast Banksia Woodland (Figure 4) is a naturally restricted EVC within the Gippsland Plain bioregion. It is generally restricted to coastal areas on secondary or tertiary dunes behind Coastal Dune Scrub and is dominated by *Banksia integrifolia* (Coast Banksia) up to 15 m high over a medium shrub layer (DSE, 2004). The total area occupied by this EVC within the Gippsland Plain bioregion is approximately 41.55 ha. As a result of this relatively small area, the conservation status of Coast Banksia Woodland is considered to be vulnerable within the GP bioregion.

Most of the Coast Banksia Woodland areas identified within the study area are in relatively good condition. It appears that some areas have been subjected to previous land clearance and other disturbance, yet in most cases those areas have regenerated naturally. There is minimal colonisation by weed species within undisturbed areas of this particular EVC. Weed colonisation is generally restricted to the edges of remnant patches e.g. along previously formed roads and tracks.

**Figure 4 Typical view of Coast Banksia Woodland within the study area**



Some development has already occurred within areas that could have previously been considered as Coast Banksia Woodland particularly around the Glomar Beach area. Other areas of Coast Banksia Woodland occur approximately 1 km northeast of the Glomar Beach region and approximately 2.5 km to the northeast of The Honeysuckles area.

This particular EVC has high conservation value (vulnerable) within the Gippsland Plain bioregion and therefore, any further development that would require the removal of native vegetation from this EVC should be avoided where possible.

### **3.5.3 Coastal Saltmarsh**

Coastal Saltmarsh is a naturally restricted EVC within the Gippsland Plain bioregion. According to DSE (2004), 'it occurs on and immediately above marine and estuarine tidal flats and contains



distinct floristic communities as bands or zones in the same location, depending on the position of the various floristic communities in relation to the saline environment'. Coastal Saltmarsh vegetation typically consists of a wide range of life forms including *Sclerostegia arbuscula* (Shrubby Glasswort), *Suaeda australis* (Austral Seablite), *Sarcocornia quinqueflora* (Beaded Glasswort), *Disphyma crassifolium* ssp. *clavellatum* (Rounded Noon-flower, and *Distichlis distichophylla* (Australian Salt-grass).

**Figure 5 Typical view of Coastal Saltmarsh vegetation within the study area**



The majority of the Coastal Saltmarsh vegetation is relatively undisturbed and there is minimal colonisation by weed species. A small area of Coastal Saltmarsh vegetation occurs approximately 2 km northeast of The Honeysuckles with a larger area located approximately 4 km northeast of the Glomar Beach region. Most of the Coastal Saltmarsh vegetation identified in the current study is most likely subjected to periodic inundation.

#### **3.5.4 Estuarine Wetland**

Vegetation communities identified as Estuarine Wetland (Figure 6) within the study area are generally restricted to lower lying areas adjacent to Lake Reeve. Estuarine Wetland communities are naturally restricted in the Gippsland Plain bioregion but are of least concern within the GP bioregion. According to DSE (2004), Estuarine Wetland communities grow on anaerobic peat-

rich muds on the edges of estuarine waterbodies, creeks, rivers, and lagoons with intermediate salinity conditions.

The type of vegetation supported in Estuarine Wetland communities is determined by fluctuations in salinity levels according to river flow and marine tide events (DSE, 2004). Estuarine Wetland vegetation is dominated by the medium sized shrub *Melaleuca ericifolia* (Swamp Paperbark) and graminoids or halophytic herb species including *Samolus repens* (Creeping Brookweed), *Hydrocotyle hirta* (Hairy Pennywort), and *Distichlis distichophylla* (Australian Salt-grass).

If construction activities are considered, it is likely that significant fill would be required. This could potentially have impacts to water flow patterns, which could reduce the quality of the vegetation communities and therefore, fauna habitat. In addition, there could also be some impacts to the adjacent Ramsar listed wetland, Lake Reeve. As a result, any construction in Estuarine Wetland areas should be avoided where possible.

**Figure 6    Typical view of Estuarine Wetland vegetation within the study area**





### 3.6 DSE BioSites

Three BioSites have been recognised within the study area (Figure 7). Two are located near Golden Beach (BioSite ID = 1816 and 1820) one at Letts Beach (BioSite ID = 1815).

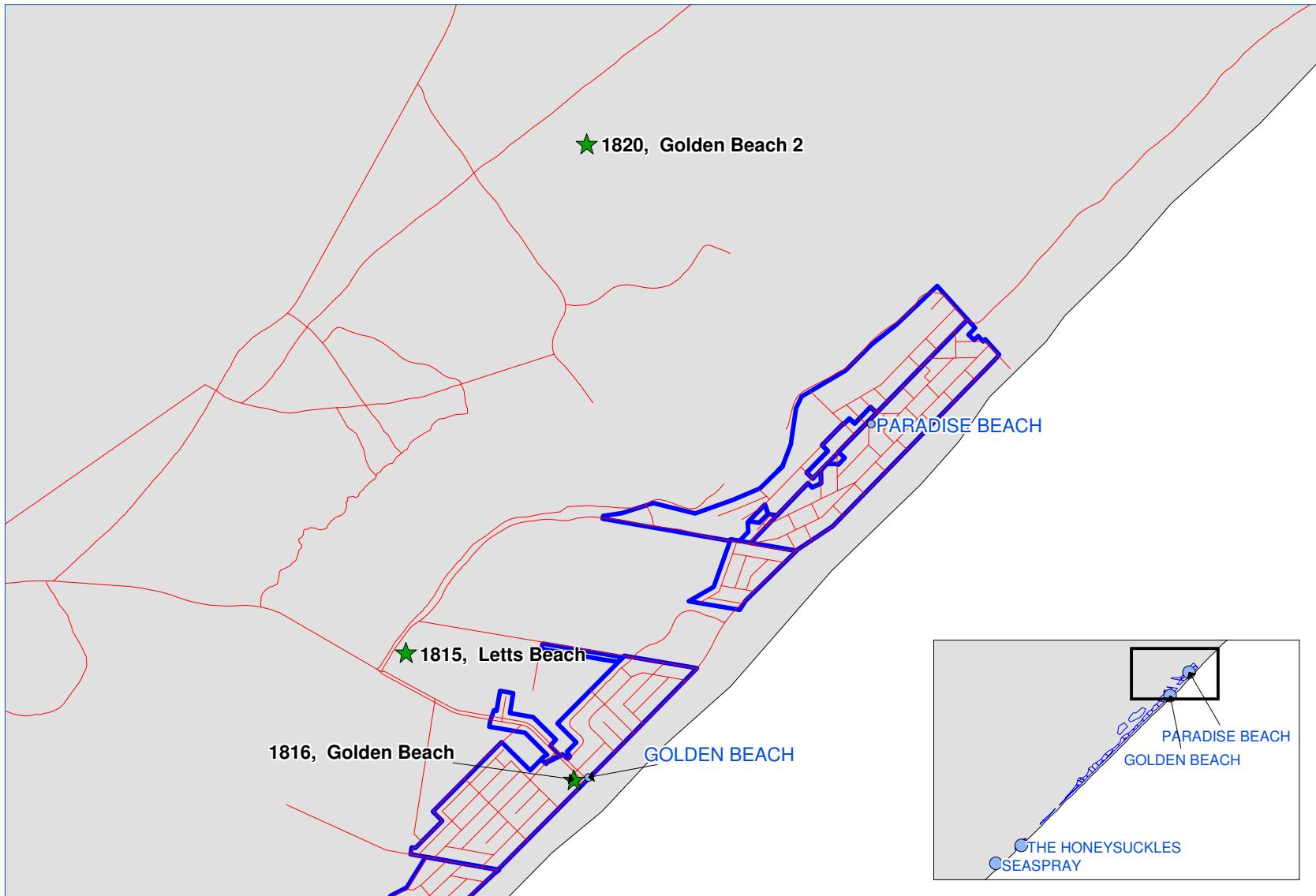
BioSite 1816 is nationally recognised for containing suitable habitat for the FFG listed *Pseudomys novaehollandiae* (New Holland Mouse), which has also been documented from within the area.

BioSite 1820 is recognised for the presence of the *Thryptomene micrantha* (Ribbed Thryptomene) which is listed as rare under the Victorian Advisory List of Rare or Threatened Species (VROTS).

The BioSite at Letts Beach, (1815) is nationally recognised for the presence of *Thelymitra epipactoides* (Metallic Sun-orchid). This species is listed as nationally endangered under the EPBC Act, 1999 and endangered in Victoria under the FFG Act, 1988.

Both *Thelymitra epipactoides* (Metallic Sun-orchid) and *Thryptomene micrantha* (Ribbed Thryptomene) have been previously recorded from the Golden Beach area (FIS, 2005).





DATA SOURCE				 180 Lonsdale Street Melbourne Vic 3000 Tel: 61 3 8687 8000 Fax: 61 3 8687 8111	Project: Wellington Land Capability Assessment			
Prepared.	WF	29/10/2007	Workspace 23_Biosite_Location_A4.wor		Title: Biosite Locations			
Checked.	KL	29/10/2007	Location G:\31\20287\CADD\GIS\Projects					
Approved.	KL	29/10/2007	Map Grid GDA 94 (MGA Zone 55)		Project No:	31 / 20287	Date:	29/10/2007
					A4			Sh 1 of 1 Rev. 0





## 4. Fauna Results

### 4.1 Overview

The study area provides a diverse range of fauna habitat from marine areas to coastal dunes and coastal scrub to wetlands. The entire study area is relatively undisturbed and consists of a narrow strip of high quality coastal vegetation. It is likely that the area would also support a wide range of fauna species.

### 4.2 Fauna Habitats and Habitat Condition

With respect to fauna habitats, this stretch of Victorian coastline consists of a narrow strip of high-quality coastal vegetation, bordered on one side by the sea and on the other by an extensive freshwater/brackish wetland system. Some of the habitat available to fauna may have been extensively disturbed and modified in the past, but some disturbed areas have been left to restore naturally and are now approaching their natural state. Many areas appear to be relatively undisturbed, at least in recent decades. Thus, in their current condition, habitats available to fauna in the area are generally considered to be of moderate to very high quality. Fauna habitats can be classified into six categories, as discussed below.

#### 4.2.1 Beaches, Marine Areas, and Coastal Dunes

The entire study area lies immediately adjacent to 90-Mile Beach and the Southern Ocean. The ocean offers a unique opportunity for many fauna species, particularly some birds, mammals, and all fish (NB: fish are not considered as part of this report). However, given the exclusively terrestrial location of the study area and the sheer size of the adjacent ocean habitat for fauna, fauna that depend on the ocean environment are considered unlikely to be impacted by any development activity that may occur within the study area. Marine fauna that show no direct association with the land (i.e., those that do not nest or roost within the study area, e.g., cetaceans, albatrosses) are considered unlikely to be impacted at all. However, marine species which show at least some association with the land (e.g., gulls, terns) stand more chance of being disturbed.

The beach along the border of the entire study area is a very good example of little-disturbed beach habitat. While this beach may get frequent visitation by humans in warmer months, it appeared to be relatively undisturbed at the time of the site visit. Because it is relatively undisturbed, it provides very good quality beach habitat for a range of fauna, including birds (gulls, terns, ravens, shorebirds) and possibly rarely some mammals such as seals and sea-lions.

The area of 90-Mile Beach appears to be ecologically and geographically suitable for the state-listed, beach-dependent Hooded Plover (*Thinornis rubricollis*). At the time of the site visit, recent storm damage had misshapen the beach and dune profile, making it impossible to assess the beach conclusively for the suitability of the Hooded Plover. While only a few AVW records of the species exist for the area, the Hooded Plover is known to use 90-Mile Beach, but the degree to which it occurs there remains uncertain.

At the top of the beach is a relatively intact primary dune system, complete with dense, low coastal vegetation (Figure 8). While much of the vegetation is the introduced Marram Grass, this vegetation offers dense and very high quality habitat to a range of native coastal fauna, particularly

reptiles (snakes, skinks, dragons), small mammals (native rodents and possibly dunnarts) and small birds (fairy-wrens, scrub-wrens, honeyeaters).

**Figure 8 View of beaches and coastal dunes within the study area**



#### **4.2.2 Tall Coastal Scrub**

The majority of the study area comprises tall, dense coastal scrub, with good quality overstorey and midstorey layers (Coastal Banksia, Coastal Tea-tree, Bearded Heath), and dense, predominantly native understorey vegetation (Figure 9). The structural complexity (i.e., vegetation at all levels) of this habitat, and its generally good condition in many areas, makes it of very high value to native fauna, particularly small and medium-sized mammals (macropods, possums, bandicoots, echidnas, native rodents), birds (honeyeaters, robins, whistlers, emus), and reptiles (snakes, skinks, dragons). Its value is lowest in areas disturbed by humans, and highest in areas between human settlements.

The narrow linear strip of tall coastal vegetation provides an important ecological corridor for some habitat-dependent species that do not venture into more open areas (e.g., beach or wetland areas). To maximise its usefulness to fauna and to retain its integrity as a natural corridor, the width of this habitat should be retained or expanded, rather than reduced.



**Figure 9 Typical view of tall coastal scrub within the study area**



Along the entire north-western border of the study area, the tall coastal vegetation meets Ramsar-listed Lake Reeve. At that interface, there is a high quality strip (narrow in parts, wider elsewhere) of grassland and marshy habitat (Figure 10). Given its proximity to Lake Reeve, this area is likely to be subjected to seasonal flooding, and is likely to support a range of fauna that favour such habitat (e.g., shorebirds, waterfowl).

**Figure 10 Grasslands and marshy habitat along the northwestern border of the study area**



#### **4.2.3 Wetlands**

The study area is bordered along one entire side by Lake Reeve, which forms part of the Gippsland Lakes (Figure 11). This lake system is of very high conservation significance and is recognised internationally (i.e., listed under the Ramsar Convention) for the abundance and diversity of marine birds, shorebirds and waterfowl (ducks, swans, gallinules) that it supports. Lake Reeve is situated at the upstream end of the lake system, and is likely to be inundated seasonally rather than permanently. Its level of salinity is also likely to vary as rains and tides fill the lake to varying degrees.

This wetland environment is likely to support a wide range of fauna, including migratory and non-migratory shorebirds, waterfowl, reptiles, small mammals, and possibly frogs in the less brackish parts of the wetlands.

In addition to Lake Reeve, the study area also contains some scattered ponds and inundated areas on the northwest side of the tall coastal vegetation community (Figure 11). At the time of the site visit, some of these wetlands hosted small populations of common species of frogs (Common Froglet *Crinia signifera*, Southern Brown Treefrog *Litoria ewingi*). It is possible that some of these ponds are used under favourable conditions by threatened frog species, although the proximity of these ponds to high-salinity conditions of the coast lessens the likelihood of this. The AVW shows

a handful of relatively old records (most recently 1978) in the area of both the Growling Grass Frog (*Litoria raniformis*) and the Green and Golden Bell Frog (*Litoria aurea*).

Wetland environments in the study area are also breeding grounds for insects such as sandflies and mosquitoes (R. Retallick and K. Leeson, pers.obs).

**Figure 11 Examples of wetlands in the study area. Note the Red-necked Avocet in the wetlands of Lake Reeve (left). One of the small scattered ponds is shown on the right**



#### 4.2.4 Disturbed Areas of Native and Non-native Vegetation

Existing human settlements (e.g., Seaspray, Glomar Beach, Golden Beach, Paradise Beach) are dominated by relatively disturbed areas of native and non-native vegetation. The two isolated sections of the study area across one arm of Lake Reeve (south west of Golden Beach) are also dominated by cleared land where native and non-native species have returned in varying stages of succession (Figure 12).

Cleared land generally offers poor sheltering opportunities for fauna, and is therefore of relatively low value to fauna, regardless of whether its composition is predominantly native or non-native flora. Common species of native and non-native fauna (e.g., Australian Magpie, Masked Lapwing, Common Starling, and European Rabbit) are likely to thrive in such modified landscapes.

Disturbed areas that have been allowed to regenerate, at least partially, offer better opportunities for fauna. Dense regrowth of shrubs that is evident in a number of areas allows mammals, small birds and reptiles to persist. The full complement of fauna species would be unlikely to return to regenerating areas until overstorey trees become established.

**Figure 12 View of one of the disturbed areas showing native and non-native vegetation near Lake Reeve and south west of Golden Beach**



#### **4.2.5 Infrastructure**

Infrastructure, when defined as a habitat for fauna, incorporates any feature in the landscape that has been constructed by humans (Figure 13). Within this study area, infrastructure includes sealed and unsealed roads, paths, fences, powerlines and buildings. Infrastructure is generally considered to be of little value for most native fauna species, even though some features may be used regularly by some species for perching or foraging. Most of the fauna species expected to use infrastructure within the study area are common, adaptable species of native or non-native fauna (e.g. Australian Magpie, Spotted Turtle-dove).



**Figure 13 Examples of current infrastructure within the study area**



### **4.3 Fauna Species**

This assessment covers terrestrial vertebrate fauna (mammals, birds, reptiles and frogs) only, as most information is available on these groups. Aquatic vertebrate fauna (fish) and all invertebrates have not been considered as part of this assessment.

#### **4.3.1 Overview of Species in the Study Area**

A total of 177 indigenous fauna species (134 birds, 25 mammals, nine reptiles and nine frogs) and 13 introduced fauna species (seven birds and six mammals) have been recorded historically from 234 surveys within 5 km of the study area (AVW results).

An additional six species of birds have been recorded historically on the Birds Australia database, but are not included in the AVW results, and an additional 19 EPBC-listed threatened species (13 birds and six mammals) have not been recorded historically but are predicted to occur within 5 km of the study area (PMST results).

During the two-day site visit on 4-5 September 2007, 68 fauna species were recorded (60 birds, five mammals, one reptile and two frogs; 62 native, six introduced), eight of which had not been



previously documented in the AVW or Birds Australia database results from the local area. This suggests the historical survey effort for fauna in the local area has been relatively poor.

A full list of all 224 species known or predicted to occur within 5 km of the study area and species recorded during the current assessment is provided in Appendix D.

## 4.4 Significant Fauna Species

### 4.4.1 Threatened Species

A total of 40 species of fauna (29 birds, nine mammals and two frogs) considered to be threatened at the national or state level (i.e. listed under any of the EPBC Act, FFG Act, or DSE's advisory list) are known or predicted to occur within 5 km of the study area. These species are listed in Table 4, along with their conservation status under each of the legislative lists. Many of these are marine species and are not expected to depend on the study area at all. Others may be occasional visitors to the study area or to habitats near the study area. Ecological groups of threatened species are addressed in more detail below, with emphasis given to species that are considered most relevant to the study area.

Given the coastal location of the study area, it is not surprising that many of the threatened species identified for the site are marine or wetland-dependent birds. Twelve species of **marine birds** (nine albatrosses, two giant-petrels and one tern) are known or predicted to occur within 5 km of the study area. Of these, only the Caspian Tern would be likely to have any association with the terrestrial environment of the study area. The Caspian Tern may set down or roost within the wetland area of Lake Reeve and/or along any part of 90-Mile Beach.



Two threatened species of **shorebirds** (Hooded Plover and Great Knot) are known to occur near the study area. While Lake Reeve is likely to provide suitable habitat for the Great Knot, 90-Mile Beach appears to be ecologically and geographically suitable for the state-listed, beach-dependent Hooded Plover. At the time of the site visit, recent storm damage had misshapen the beach and dune profile, making it impossible to assess the beach conclusively for the suitability of the Hooded Plover. While only a few AVW records of the species exist for the area, the Hooded Plover is known to use 90-Mile Beach, but the degree to which it occurs there remains uncertain. Targeted surveys for this species would be required before an assessment could be made of the potential impact that development of the study area could have on this species.

Nine threatened species of **other wetland birds** (one snipe, one spoonbill, two egrets and five ducks) are predicted or known to occur near the study area. These species are likely to frequent wetland habitats within and surrounding Lake Reeve. Urban development of the study area could impact on any these species if the development were to result in increased disturbance to birds by humans or degradation of wetland habitats.

Four species of state-significant **birds of prey** may hunt within or fly over the study area. All of these species are relatively uncommon or rare in south-eastern Victoria, but any of them could turn up in the study area at any time. The White-Bellied Sea-Eagle was seen during our two-day site visit. In general, these species could be impacted by development of the study area if such development reduced the quality of critical nesting or foraging habitat. For these species, nesting habitat within the study area is most likely to be among the tall coastal vegetation, where taller trees provide cover and vantage points, while foraging habitat is likely to encompass all habitats, including the densely vegetated areas and the more open wetland areas.

Two **other threatened bird species** are known or predicted to occur in the area (Regent Honeyeater and Orange-bellied Parrot). Given the types of habitat within the study area, and their apparent unsuitability for Regent Honeyeaters, the presence of Regent Honeyeaters is considered highly unlikely. No records of the Orange-bellied Parrot exist from within 5 km of the study area, although a small number of records occur in nearby wetland areas to the south-east. Given the type of wetland/marshy habitat that surrounds Lake Reeve, and the fact that the fauna survey effort for this area has been relatively small, the presence of the Orange-bellied Parrot within the wetland/marshy areas of the study area is at least possible. Targeted surveys for this species would be required before an assessment could be made of the potential impact that development of the study area could have on this species. In general, the Orange-bellied Parrot could be impacted by development of the study area if such development reduced the quality of foraging habitat, primarily in the more open wetland areas.

Four species of **marine mammals** (three whales and a seal) are unlikely to occur regularly within the study area, but may occur occasionally offshore. Only the Southern Elephant Seal has any association at all with the terrestrial environment, and this species may rest occasionally on 90-Mile Beach. None of these species is considered likely to be impacted by development of the study area.



Five **terrestrial mammals** (Spot-tailed Quoll, Long-nosed Potoroo, Smoky Mouse, New Holland Mouse and Grey-headed Flying-fox) are predicted or known to occur within 5 km of the study area. The Grey-headed Flying-fox may fly over or forage within the study area occasionally, but this species is unlikely to depend on any part of the study area and is unlikely to be impacted by development of the site. The Spot-tailed Quoll is a forest-dependent mammal, and there is no suitable forest habitat within or near to the study area. The Long-nosed Potoroo, Smoky Mouse and the New Holland Mouse are ground-dwelling mammals that depend on thick understorey for their protection against predators. There are no records of the Smoky Mouse or Potoroo from near the study area, but there are records of the New Holland Mouse. Given that all species favour dense undergrowth, their presence in the study area is considered possible. Given the historically small fauna survey effort in this area, targeted surveys for these species is advisable.

The Southern Brown Bandicoot (*Isoodon obesulus obesulus*), which is listed as Endangered under the EPBC Act, is another ground-dwelling mammal that depends on thick understorey for its protection. This species is not known to occur within 5 km of the study area, nor was it predicted by the PMST to occur there. The species is known to occur, however, further along the coast to both the east and west of the study area. Given the historically small fauna survey effort in this area, presence of the Southern Brown Bandicoot should be considered possible, and a targeted survey for the species is recommended.

Two species of **frog** are known to occur within or near to the study area. Given the proximity of the area's wetlands to the salty environment of the coast, these species are considered unlikely to occur within the study area. Given that two species of frogs, however, were detected in a number of locations during the two-day site visit, the presence of other species, including threatened species, is at least possible. Targeted surveys for these species would be advisable to determine the potential impact that development of the study area could have on these frog species.

**Table 4 Threatened fauna species known or predicted to occur within 5 km of the study area**

**Key to Table:**

PMST	Information sourced from the EPBC Protected Matters Search Tool
AVW	Information sourced from the Atlas of Victorian Wildlife database
EPBC	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
FFG	Victorian <i>Flora and Fauna Guarantee Act 1988</i>
DSE	DSE List of threatened fauna in Victoria (DSE 2003)
CR	critically endangered
EN	endangered
VU	vulnerable
NT	near threatened (Note: this is not considered by DSE to be a category of threat. It is included here to show the full range of species that may occur within the study area and that are included on authoritative lists).
L	listed
nom	Currently nominated for listing, but yet to be accepted.

Species Group	Common name	Scientific Name	Source	EPBC	FFG	DSE	This study
<b>National significance</b>							
birds	Southern Giant-Petrel	<i>Macronectes giganteus</i>	PMST	EN	L	VU	
	Northern Giant-Petrel	<i>Macronectes halli</i>	PMST	VU	L	NT	
	Shy Albatross	<i>Diomedea cauta</i>	PMST	VU	L	VU	Seen



Species Group	Common name	Scientific Name	Source	EPBC	FFG	DSE	This study
	Salvin's Albatross	<i>Thalassarche salvini</i>	PMST	VU			
	Light-mantled Sooty Albatross	<i>Phoebetria palpebrata</i>	AVW	L	VU		
	Southern Royal Albatross	<i>Diomedea epomophora</i>	PMST	VU	L	VU	
	Northern Royal Albatross	<i>Diomedea sanfordi</i>	PMST	EN	L	VU	
	Campbell Albatross	<i>Thalassarche impavida</i>	PMST	EN			
	Buller's Albatross	<i>Diomedea bulleri</i>	PMST	VU	L		
	Gibson's Albatross	<i>Diomedea gibsoni</i>	PMST		L		
	Antipodean Albatross	<i>Diomedea antipodensis</i>	PMST	VU	?	?	
	Hooded Plover	<i>Thinornis rubricollis</i>	AVW	L	VU		
	Australian Painted Snipe	<i>Rostratula australis</i>	PMST	VU	L	CR	
	Orange-bellied Parrot	<i>Neophema chrysogaster</i>	PMST	EN	L	CR	
	Regent Honeyeater	<i>Xanthomyza phrygia</i>	PMST	EN	L	CR	
mammals	Spot-tailed Quoll	<i>Dasyurus maculatus</i>	PMST	EN	L	EN	
	Long-nosed Potoroo	<i>Potorous tridactylus</i>	PMST	VU	L	EN	
	Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	PMST	VU	L	VU	
	Smoky Mouse	<i>Pseudomys fumeus</i>	PMST	EN	L	EN	
	Southern Elephant Seal	<i>Mirounga leonina</i>	AVW	VU			
	Southern Right Whale	<i>Eubalaena australis</i>	AVW, PMST	EN	L	CR	
	Blue Whale	<i>Balaenoptera musculus</i>	PMST	EN	L	CR	
	Humpback Whale	<i>Megaptera novaeangliae</i>	PMST	VU	L	VU	
frogs	Green and Golden Bell Frog	<i>Litoria aurea</i>	AVW, PMST	VU		NT	
	Growling Grass Frog	<i>Litoria raniformis</i>	AVW, PMST	VU	L	EN	
	<b>State significance</b>						
birds	Caspian Tern	<i>Sterna caspia</i>	AVW	L	NT		
	Great Knot	<i>Calidris tenuirostris</i>	AVW	L	EN		
	Royal Spoonbill	<i>Platalea regia</i>	AVW, BA		VU		
	Little Egret	<i>Egretta garzetta</i>	AVW	L	EN		
	Great Egret	<i>Ardea alba</i>	AVW	L	VU		
	Australasian Shoveler	<i>Anas rhynchos</i>	AVW		VU		
	Freckled Duck	<i>Stictonetta naevosa</i>	AVW	L	EN		
	Hardhead	<i>Aythya australis</i>	AVW		VU		
	Blue-billed Duck	<i>Oxyura australis</i>	AVW	L	EN		
	Musk Duck	<i>Biziura lobata</i>	AVW, BA		VU		
	Grey Goshawk	<i>Accipiter novaehollandiae</i>	AVW, BA	L	VU		
	White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	AVW, BA	L	VU	Seen	
	Black Falcon	<i>Falco subniger</i>	AVW, BA		VU		

Species Group	Common name	Scientific Name	Source	EPBC	FFG	DSE	This study
	Masked Owl	<i>Tyto novaehollandiae</i>	AVW, BA	L	EN		
mammals	New Holland Mouse	<i>Pseudomys novaehollandiae</i>	AVW	L	EN		

#### 4.4.2 Migratory and Marine Species

The Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* contains a list of species that are considered in Australia to be Migratory or Marine. The migratory list includes all native fauna listed on international migratory fauna agreements to which Australia is a signatory. This includes the China-Australia Migratory Bird Agreement (CAMBA), the Japan-Australia Migratory Bird Agreement (JAMBA) and the Bonn Convention.

Large numbers of 'migratory' and/or 'marine' species are known or predicted to occur within 5 km of the study area. In total, there are 45 migratory species identified for the study area and 89 marine species. All but one of the species categorised as migratory under the EPBC Act are categorised as marine also (not Regent Honeyeater). This is primarily because these species use or cross the marine environment during their migrations.

These species are listed in the table below, and include 14 marine birds, eight gulls and terns, 18 migratory or non-migratory shorebirds, eight other predominantly wetland birds, six birds of prey, three parrots, and 15 other bird species that are not dependent on wetland environments for their survival. Eighteen marine mammals are also identified. Potential use of the study area by these species is discussed below.

Twenty-two species of **marine birds, gulls and terns** (one penguin, seven albatrosses, five petrels and shearwaters, five terns, three gulls, one gannet) are known or predicted to occur within 5 km of the study area. While any of these species may visit marine areas near the study area, not all of them are considered likely to reside near the study area or visit the study area frequently. Only the penguin, gulls and terns would be likely to have any association with the terrestrial environment of the study area. Any of those species may come ashore, set down or roost anywhere along 90-Mile Beach, or set down or roost within the wetland area of Lake Reeve. The degree of impact to these species would depend on the extent to which development encroached on the wetland or beach environment.

Eighteen species of **shorebirds** (plovers, sandpipers, etc...) and eight species of **other wetland birds** (pelican, two ibis, four egrets/herons, one duck) are predicted or known to occur near the study area. Ramsar-listed Lake Reeve provides ideal habitat for most of these species, particularly the egrets/herons and migratory and non-migratory shorebirds. The Hooded Plover differs from many other shorebirds in that it is likely to nest at top of beach rather than in more protected wetland environments. For all of these species, the degree of impact would depend on the extent to which development of the area encroached on the wetland or beach environment.

Six **birds of prey** (including one species of owl) are likely to use the study area to varying degrees. The Swamp Harrier in particular is likely to depend on marshy habitat associated with Lake Reeve. The White-bellied Sea-eagle is likely to utilise the marine and wetland environments in the area for its hunting, while the Whistling Kite may also hunt within the wetland area. Other raptor species are more dependent on trees, and species such as the Brown Goshawk hunts almost exclusively in treed habitats.



Eighteen **other migratory or marine bird species** are known or predicted to occur in the area (three parrots, three cuckoos, seven bush birds, five others). No records of the Orange-bellied Parrot exist from within 5 km of the study area, although a small number of records occur in nearby wetland areas to the south-east. Given the type of wetland/marshy habitat that surrounds Lake Reeve, and the fact that the historical fauna survey effort for this area has been relatively small, the presence of the Orange-bellied Parrot within the wetland/marshy areas of the study area is at least possible. Targeted surveys for this species would be required before an assessment could be made of the potential impact that development of the study area could have on this species. In general, the Orange-bellied Parrot could be impacted by development of the study area if such development reduced the quality of foraging habitat, primarily in the more open wetland areas.

All bush birds, and parrots other than the Orange-bellied Parrot, would most likely be associated with settlement areas and/or tall coastal scrub. The presence of Regent Honeyeaters in the area is considered highly unlikely, given the types of habitat within the study area and their apparent unsuitability. Other species such as ravens, swifts and needletails could occur overhead at any time, but would not be expected to be impacted by development of the study area.

Eighteen species of **marine mammals** (four seals, ten whales, four dolphins) may occasionally occur offshore from the study area, but would be most unlikely to be impacted by development of the study area.

**Table 5 Species listed under the EPBC Act as Migratory or Marine and known or predicted to occur within 5 km of the study area**

Common name	Scientific Name	Migratory	Marine
Little Penguin	<i>Eudyptula minor</i>		Ma
Fluttering Shearwater	<i>Puffinus gavia</i>		Ma
Sooty Shearwater	<i>Puffinus griseus</i>	Mi	Ma
Short-tailed Shearwater	<i>Puffinus tenuirostris</i>	Mi	Ma
Southern Giant-Petrel	<i>Macronectes giganteus</i>	Mi	Ma
Northern Giant-Petrel	<i>Macronectes halli</i>	Mi	Ma
Shy Albatross	<i>Diomedea cauta</i>	Mi	Ma
Salvin's Albatross	<i>Thalassarche salvini</i>	Mi	Ma
Light-mantled Sooty Albatross	<i>Phoebetria palpebrata</i>	Mi	Ma
Southern Royal Albatross	<i>Diomedea epomophora</i>	Mi	Ma
Northern Royal Albatross	<i>Diomedea sanfordi</i>	Mi	Ma
Campbell Albatross	<i>Thalassarche impavida</i>	Mi	Ma
Buller's Albatross	<i>Diomedea bulleri</i>	Mi	Ma
Australasian Gannet	<i>Morus serrator</i>		Ma
Australian Pelican	<i>Pelecanus conspicillatus</i>		Ma
Whiskered Tern	<i>Chlidonias hybridus</i>		Ma
Caspian Tern	<i>Sterna caspia</i>	Mi	Ma
Crested Tern	<i>Sterna bergii</i>		Ma



Common name	Scientific Name	Migratory	Marine
Little Tern	<i>Sterna albifrons</i>	Mi	Ma
Common Tern	<i>Sterna hirundo</i>	Mi	Ma
Silver Gull	<i>Larus novaehollandiae</i>		Ma
Pacific Gull	<i>Larus pacificus</i>		Ma
Kelp Gull	<i>Larus dominicanus</i>		Ma
Ruddy Turnstone	<i>Arenaria interpres</i>	Mi	Ma
Hooded Plover	<i>Thinornis rubricollis</i>		Ma
Double-banded Plover	<i>Charadrius bicinctus</i>	Mi	Ma
Red-capped Plover	<i>Charadrius ruficapillus</i>		Ma
Black-winged Stilt	<i>Himantopus himantopus</i>		Ma
Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>		Ma
Eastern Curlew	<i>Numenius madagascariensis</i>	Mi	Ma
Bar-tailed Godwit	<i>Limosa lapponica</i>	Mi	Ma
Common Greenshank	<i>Tringa nebularia</i>	Mi	Ma
Curlew Sandpiper	<i>Calidris ferruginea</i>	Mi	Ma
Red-necked Stint	<i>Calidris ruficollis</i>	Mi	Ma
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	Mi	Ma
Red Knot	<i>Calidris canutus</i>	Mi	Ma
Great Knot	<i>Calidris tenuirostris</i>	Mi	Ma
Broad-billed Sandpiper	<i>Limicola falcinellus</i>	Mi	Ma
Pectoral Sandpiper	<i>Calidris melanotos</i>	Mi	Ma
Latham's Snipe	<i>Gallinago hardwickii</i>	Mi	Ma
Australian Painted Snipe	<i>Rostratula australis</i>		Ma
Australian White Ibis	<i>Threskiornis molucca</i>		Ma
Straw-necked Ibis	<i>Threskiornis spinicollis</i>		Ma
Little Egret	<i>Egretta garzetta</i>		Ma
Great Egret	<i>Ardea alba</i>	Mi	Ma
Cattle Egret	<i>Ardea ibis</i>	Mi	Ma
Nankeen Night Heron	<i>Nycticorax caledonicus</i>		Ma
Musk Duck	<i>Biziura lobata</i>		Ma
Swamp Harrier	<i>Circus approximans</i>		Ma
Brown Goshawk	<i>Accipiter fasciatus</i>		Ma
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	Mi	Ma
Whistling Kite	<i>Haliastur sphenurus</i>		Ma
Nankeen Kestrel	<i>Falco cenchroides</i>		Ma
Southern Boobook	<i>Ninox novaeseelandiae</i>		Ma



Common name	Scientific Name	Migratory	Marine
Orange-bellied Parrot	<i>Neophema chrysogaster</i>	Mi	Ma
Blue-winged Parrot	<i>Neophema chrysostoma</i>		Ma
Swift Parrot	<i>Lathamus discolor</i>		Ma
Rainbow Bee-eater	<i>Merops ornatus</i>	Mi	Ma
White-throated Needletail	<i>Hirundapus caudacutus</i>	Mi	Ma
Fork-tailed Swift	<i>Apus pacificus</i>	Mi	Ma
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>		Ma
Horsfield's Bronze-cuckoo	<i>Chrysococcyx basalis</i>		Ma
Shining Bronze-cuckoo	<i>Chrysococcyx lucidus</i>		Ma
Rufous Fantail	<i>Rhipidura rufifrons</i>	Mi	Ma
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	Mi	Ma
Black-faced Monarch	<i>Monarcha melanopsis</i>	Mi	Ma
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>		Ma
Silvereye	<i>Zosterops lateralis</i>		Ma
Regent Honeyeater	<i>Xanthomyza phrygia</i>	Mi	
Richard's Pipit	<i>Anthus novaeseelandiae</i>		Ma
Little Raven	<i>Corvus mellori</i>		Ma
Forest Raven	<i>Corvus tasmanicus</i>		Ma
Australian Fur Seal	<i>Arctocephalus pusillus</i>		Ma
New Zealand Fur Seal	<i>Arctocephalus forsteri</i>		Ma
Southern Elephant Seal	<i>Mirounga leonina</i>		Ma
Leopard Seal	<i>Hydrurga leptonyx</i>		Ma
Southern Right Whale	<i>Eubalaena australis</i>	Mi	Ma
Pygmy Right Whale	<i>Caperea marginata</i>	Mi	Ma
Blue Whale	<i>Balaenoptera musculus</i>	Mi	Ma
Minke Whale	<i>Balaenoptera acutorostrata</i>		Ma
Bryde's Whale	<i>Balaenoptera edeni</i>	Mi	Ma
Humpback Whale	<i>Megaptera novaeangliae</i>	Mi	Ma
Pygmy Sperm Whale	<i>Kogia breviceps</i>		Ma
Strap-toothed Whale	<i>Mesoplodon layardi</i>		Ma
Killer Whale	<i>Orcinus orca</i>	Mi	Ma
Long-finned Pilot Whale	<i>Globicephala melas</i>		Ma
Risso's Dolphin	<i>Grampus griseus</i>		Ma
Common Dolphin	<i>Delphinus delphis</i>		Ma
Dusky Dolphin	<i>Lagenorhynchus obscurus</i>	Mi	Ma
Bottlenose Dolphin (Port Phillip)	<i>Tursiops sp. (cf aduncus)</i>		Ma



#### 4.4.3 Other Species

Due to the widespread loss and degradation of native fauna habitat in southern Victoria and in the local coastal areas, any species of indigenous fauna that occurs within or near to the study area is considered to be of at least local conservation significance. Many fauna species that are not listed under special categories of legislation (i.e., threatened, marine, migratory) are likely to visit or use the study area occasionally (see list in Appendix D).

All species of exotic (non-native) fauna that occur within the study area are considered to be of negligible conservation significance. Exotic fauna includes species that have been introduced to Australia since European settlement (e.g. Common Starling, European Rabbit), and species that are native to Australia but that have been introduced to the local area only since European settlement [e.g. aviary escapees, such as the Scaly-breasted Lorikeet (*Trichoglossus chlorolepidotus*) in the Melbourne area]. The full list of fauna species known or predicted to occur within 5 km of the study area is provided in Appendix D.

### 4.5 Areas of Significance to Fauna

- » Wetland environment associated with Ramsar-listed **Lake Reeve** along the entire length of the study area;
- » **Beaches and primary dunes** along the entire length of the study area;
- » Coastal **vegetation patches** that offer a buffer zone between habitats, particularly between human settlements and Lake Reeve (e.g., at Paradise Beach), and between human settlements and the ocean;
- » **Coastal vegetation corridor**, particularly very narrow sections of the corridor where the chances of disrupting the corridor's functionality are relatively high; and
- » **The widest, uncleared sections of tall coastal vegetation**, for example near Flamingo Beach north-east of Glomar Beach. These areas provide habitat nodes along the length of the corridor for species that favour denser, larger patches of habitat (e.g., Eastern Yellow Robin, Emu, Southern Brown Bandicoot).



## 5. Ecologically Favourable Strategy for Future Development of the Study Area

There are several important strategic considerations for the potential development of different densities of dwellings within the study area. In order to achieve ecological objectives for this development, it is recommended that Wellington Shire Council should consider the following items.

1. Ideally, the low density living in the existing discrete communities at The Honeysuckles, Glomar Beach, and the Golden Beach/Paradise Beach areas should not be subjected to any increases in dwelling density.
2. If further development is considered necessary, it would be preferable to add to existing settlements rather than create new settlements. For example, any new dwellings should be placed on land within existing settlements (e.g., The Honeysuckles, Glomar Beach, Golden Beach, Paradise Beach) rather than expanding into large areas of uncleared land.
3. All uncleared land between settlements currently offers very high quality habitat for a range of fauna, and provides a natural corridor between the ocean and Lake Reeve and this should be retained in a natural condition where possible.
4. If new settlements are planned, these should be located and planned to avoid disruption to the ecological function of the coastal vegetation corridor.
5. As visitation to the area increases, there is likely to be a greater potential for 'dune blow-out' through access tracks and loss of dune vegetation. It is recommended, therefore, to limit the number of access points to 90-Mile Beach.
6. It is likely that the state-listed Hooded Plover uses/breeds along this stretch of the 90 Mile Beach coast. This species is well known to be easily-disturbed by humans. Further survey for Hooded Plovers would be required to determine the presence of this species.
7. If native vegetation is required to be removed for development a Net Gain Assessment, Habitat Hectare Assessment, and detailed report would be required to satisfy requirements of the Department of Sustainability and Environment under Victoria's Native Vegetation Management – A Framework for Action.





## 6. Potential Impacts and Mitigation Measures

While no specific works have been proposed for this project, some of the more general potential impacts that development of the study area would be likely to encounter are identified below. In each case, impacts are provided based upon a scenario where no mitigation measures are undertaken at all.

### 6.1 Potential Impacts

Assuming no mitigation measures are implemented, potential impacts of developing additional dwellings in the largely regenerated parts of the study area could result in any of the following:

- » Introduction and spread of new weed species and pathogens to native flora communities during construction activities. Although a number of introduced flora species are already present in the study area, there is a possibility that more invasive or otherwise damaging environmental weeds and/or other detrimental pests such as *Phytophthora cinnamomi* could be introduced;
- » Further spread of existing weed species into new areas, both within and beyond the study area. For example, construction vehicles working at the site may inadvertently spread weed seeds to other sites during the construction process;
- » Direct mortality or injury to flora and/or ground-dwelling fauna (e.g. wetland birds, reptiles, mammals) and loss of important vegetation and fauna habitat by machinery or vehicles during construction period;
- » Visual and/or acoustic disturbance to fauna during construction processes, particularly near wetlands (waterbirds, migratory shorebirds);
- » Input of hazardous or toxic substances (e.g. oils, chemicals) into wetlands and/or estuarine or marine environments during construction activities; and
- » Ongoing disturbance to fauna (possibly including roadkill) as a result of increased vehicular traffic along new roads.

### 6.2 Mitigation Measures

Without knowledge of specific localised impacts, the following general mitigation measures would be likely to reduce any ecological impact of additional dwelling development in the study area. These measures would most likely need to be developed into an Environmental Management Plan for the project (incorporating other environmental protection measures not directly related to ecology) and be implemented before, during and after the construction phase.

#### 6.2.1 Pre-development Phase

- » Develop an appropriate weed management strategy for construction processes;
- » Develop appropriate measures to minimise any potential impact to native fauna species;
- » Identify the location of any significant flora and fauna species and communities; and
- » Identify any risk of sedimentation and oil or chemical spills into adjacent wetlands.



### **6.2.2 Construction Phase**

- » Implement a weed management strategy for construction;
- » Limit all construction activity to as small a footprint as possible;
- » Avoid/minimise the removal of native vegetation as every native species has conservation value;
- » Install sediment traps and/or fences where there is a risk of sedimentation and/or oil or chemical spills into wetlands, waterways or adjacent coastal habitat (particularly Lake Reeve, which is a Ramsar site); and
- » Consider undertaking construction activities in autumn and winter, which is generally not the peak activity or breeding period for fauna (including migratory shorebirds) in Victoria.

### **6.2.3 Post-construction Phase**

- » Restore native vegetation in areas that are disturbed/destroyed as part of any construction process. Replacement species should include local indigenous species and those that are able to act as colonising species within disturbed areas;
- » Monitor weed colonisation and implement weed control strategies where required;
- » Implement slow traffic speed zones along new roads to minimise ongoing fauna disturbance and roadkill;
- » Increase more active management of human access to habitat adjacent to development areas; and
- » Protect known populations of rare or threatened species within close proximity to any construction zones.



## 7. Relevant Legislation and Policy

This section of the report provides information regarding specific biodiversity legislation and policy. This information is not intended to provide an exhaustive list of legislative requirements but rather a summary of the key requirements. The information below is based upon GHD's understanding of the legislation and policy, and the GHD consultants' experience with its implementation. There is a possibility that regulatory authorities may interpret and/or implement the legislation and policy differently.

### 7.1 Commonwealth

#### 7.1.1 Environment Protection and Biodiversity Conservation Act, 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) promotes the conservation of biodiversity within Australia by providing protection for threatened species, threatened ecological communities, migratory and marine species, and other protected matters. Certain actions – in particular, actions that are likely to have a significant impact on any *matter of national environmental significance* (MNES) – are subject to a rigorous assessment and approval process (DEH, 2006). There are seven MNES identified in the EPBC Act that may act as triggers for the Commonwealth assessment and approval regime, as addressed below:

1. **World Heritage Properties.** The PMST identifies no World Heritage Properties within the study area.
2. **National Heritage Places.** The PMST identifies no National Heritage Places within the study area. Assessment of sites of cultural significance is beyond the scope of this ecological assessment and should be considered separately.
3. **Ramsar Wetlands of International Significance.** The PMST search tool identifies three wetlands of international significance within or near to the study area. The study area itself is within the *Gippsland Lakes Ramsar* site, and lies within the catchment area for two other Ramsar sites: *Corner Inlet* and *Western Port*. Because of the study area's proximity to multiple ecologically valuable wetland areas, extreme care would be needed for the development of the study area to ensure that Ramsar-listed sites are not impacted directly or indirectly.
4. **Threatened Species and Communities.** Numerous EPBC-listed flora and fauna species are predicted by the PMST to potentially occur within the study area. No threatened ecological communities are predicted to occur there, however. An Environment Management Plan and comprehensive mitigation measures would be required for any development, to minimise the potential for any significant impact to those species. GHD recommends targeted surveys for threatened species to determine the likelihood of threat to any local populations that may occur there.
5. **Migratory species.** A total of 45 EPBC-listed migratory species are predicted or known to occur within 5 km of the study area. Habitats within the study area are likely to be used to some extent by many of those listed migratory species.



6. **Commonwealth Marine Areas.** Given the coastal location of the study area, development of the study area would need to be designed and managed carefully so that it does not cause a significant impact to commonwealth marine areas offshore.
7. **Nuclear Actions (including uranium mining).** Development of the study area would not constitute a nuclear action.

## 7.2 State

### 7.2.1 Flora and Fauna Guarantee Act, 1988

The *Flora and Fauna Guarantee Act 1988* (FFG Act) is the key piece of Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes. The Act seeks to put in place preventative management mechanisms to ensure no biota or ecological communities become extinct within Victoria, and to ensure that the processes that threaten biodiversity are identified and addressed. The Act is far more broad than 'endangered species' legislation, covering ecological communities; potentially threatening processes; community involvement in conservation; and a strategic approach to biodiversity conservation and sustainable use. Under the Act, a permit is required from the Department of Sustainability and Environment to 'take', kill, injure, disturb or collect listed protected flora and fish species, or flora species that form part of listed or protected communities.

The FFG Act applies primarily to public land, but also applies to private land if projects are to be undertaken by state government authorities. The FFG Act will apply only to minimal parts of this project, where development would occur on public land. As a minimum, development of the study area should aim to meet the stated objectives of the FFG Act. This would involve demonstrating to DSE that measures have been taken to avoid impacts upon FFG-listed threatened species and communities, and that potentially threatening processes have been avoided or minimised. For FFG species for which Action Statements have been prepared, the project should be undertaken in accordance with those Action Statements.

### 7.2.2 Listed Threatened Flora and Communities

There are no FFG listed communities within the study area. A total of four FFG listed species are recorded on the FIS database within 5 km of the study area. However, none were recorded during the current assessment.

### 7.2.3 Threatened Flora

This report identified that a total of four FFG-listed flora species are likely to occur within the study area. Although suitable habitat exists for those species and they have been previously recorded from the study area, none were recorded during the current assessment. See also Table 3.

### 7.2.4 Protected Flora Species

There were no listed protected flora species recorded from within the study area during the current assessment. Therefore, a FFG permit is likely/unlikely to be required for any proposed construction activities. However, if protected flora species are identified during any subsequent construction activities, and they need to be removed, a permit would be required under the FFG Act.



### 7.2.5 Threatened Fauna

This report identified 30 FFG-listed fauna species that could potentially occur within the study area. While most of these are unlikely to be impacted by any associated development or construction activities, they will need consideration before the commencement of any development. Implementation of appropriate mitigation measures will help to minimise/avoid any potential impact.

### 7.2.6 Potentially Threatening Processes

A number of potentially threatening processes (PTP) listed under the FFG Act may be relevant to any development within the study area. These are listed below and are provided based upon the assumption that no mitigation measures are undertaken during any construction and post-construction phases. Their impacts will be reduced and/or avoided if mitigation measures are fully implemented.

- » Collection of native orchids;
- » Habitat fragmentation as a threatening process for fauna in Victoria;
- » High frequency fire resulting in disruption of life cycle processes in plants and animals and loss of vegetation structure and composition;
- » Inappropriate fire regimes causing disruption to sustainable ecosystem processes and resultant loss of biodiversity;
- » Infection of amphibians with Chytrid Fungus, resulting in chytridiomycosis;
- » Input of petroleum and related products into Victorian marine and estuarine environments;
- » Introduction and spread of Spartina to Victorian estuarine environments;
- » Invasion of native vegetation by Blackberry *Rubus fruticosus* L. agg.;
- » Invasion of native vegetation by environmental weeds;
- » Loss of hollow-bearing trees from Victorian native forests;
- » Predation of native wildlife by the cat, *Felis catus*;
- » Predation of native wildlife by the introduced Red Fox *Vulpes vulpes*;
- » The spread of *Phytophthora cinnamomi* from infected sites into parks and reserves, including roadsides, under the control of a state or local government authority;
- » Use of *Phytophthora*-infected gravel in construction of roads, bridges and reservoirs; and
- » Wetland loss and degradation as a result of change in water regime, dredging, draining, filling and grazing.

#### **Conclusion**

The project is proposed to occur at least partly on public land, and the Wellington Shire Council will need to adhere to the general objectives of the FFG Act and undertake actions in accordance with any Action Statements prepared for listed items occurring within the study area.

There are FFG-listed potentially threatening processes relevant to the project, and threatened FFG-listed flora and fauna species are likely to occur in or near the study area.



Implementation of appropriate mitigation measures where required for any development should meet the requirements under the FFG Act. A permit would be required under the FFG Act if any protected flora is to be removed.

#### **7.2.7 Planning and Environment Act, 1987**

A planning permit is required under the Victoria Planning Provisions (made pursuant to the *Planning and Environment Act 1987*) to remove, destroy or lop native vegetation on land, which, together with all contiguous land, in one ownership, has an area greater than 0.4 hectares (4000 m<sup>2</sup>), unless particular exemptions apply. The Department of Sustainability and Environment (DSE) is a referral authority for applications where native vegetation is planned to be removed on public land.

##### **Conclusion**

A permit would be required under this Act for the removal of any native vegetation associated with further development within the study site if the dwelling or site development density was greater than 4000 m<sup>2</sup> per dwelling.

#### **7.2.8 Environment Effects Act, 1978**

The ministerial guidelines for assessment of environmental effects under the *Environment Effects Act 1978* provide a range of criteria that can be used to determine whether an Environmental Effects Statement (EES) may be required (page 7; DSE 2006). Many of the listed potential effects that may warrant a referral of a project are related to flora and fauna issues.

The criteria for assessing the need for a referral under the *Environment Effects Act 1978* that may be relevant to any development within the study site related to flora and fauna issues are described below.

There are two types of referral criteria: 1) individual potential environmental effects; and 2) a combination of potential environmental effects. It should be noted that not all of the criteria are listed here. There are also other triggers not related to flora and fauna such as social, economic and environmental triggers that may need consideration during future construction activities.

Environmental impact assessment may also be required under the *Commonwealth's Environment Protection and Biodiversity Conservation Act 1999*, where a significant impact on a specified matter of national environmental significance could occur.

##### **Referral criteria: Individual potential environmental effects**

According to DSE (2006), a referral under the *Environment Effects Act 1978* would be warranted if any activities were to result in any individual potential environmental effects that may be of regional or state significance (see p.7, DSE 2006). The following individual potential effects relating to flora and fauna are likely to be relevant to this project<sup>4</sup>:

- » Potential long-term change to the ecological character of a wetland listed under the Ramsar Convention or in 'A Directory of Important Wetlands in Australia'; and

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<sup>4</sup> Note that there are other potential referral criteria that are not related to flora and fauna.



- » Potential extensive or major effects on the health or biodiversity of aquatic, estuarine or marine ecosystems, over the long term.

Any development within the study areas has the potential to impact on a wetland listed under the Ramsar Convention. If mitigation measures are not implemented there may be a potential for a long-term change to the wetland's ecological character.

#### **Referral criteria: A combination of potential environmental effects**

A referral under the *Environment Effects Act 1978* would be warranted if this project were to result in the combination of two or more listed types of potential effects on the environment that might be of regional or state significance (see p.7, DSE 2006). The following potential effects relating to flora and fauna are likely to be relevant to this project:

Matters listed under the *FFG Act 1988*: Potential significant effects on habitat values of a wetland supporting migratory bird species.

#### **Conclusion**

A referral under the *Environment Effects Act 1978* may be required for any future development within the study area.

#### **7.2.9 Victoria's Native Vegetation Management – A Framework for Action**

The main goal of *Victoria's Native Vegetation Management – A Framework for Action* is to achieve a reversal, across the entire landscape of the long-term decline in the extent and quality of native vegetation, leading to a Net Gain. In applying the Net Gain approach to protection and clearance decisions, a 3-step approach must be adhered to. The three stages are described in order of priority below:

- » **Avoid** adverse impacts, particularly through vegetation clearance;
- » If impacts cannot be avoided, **minimise** impacts through appropriate consideration in planning processes and expert input to project design and management; and
- » a) Identify and b) undertake appropriate **offsets**. In other words, any permitted clearing of native vegetation must be offset in a manner that adequately addresses the impacts of the proposed clearing.

Refer to Appendix B for an outline of the current policy.

### **7.3 Local**

The Wellington Planning Scheme includes overlays which, in part, acknowledge the ecological and flora and fauna values of the area. These overlays also include planning permit requirements and decision guidelines that partly relate to the protection of ecological values in implementing land use, development and subdivision. These are ESO1: Coastal and Gippsland Lakes Environs and ESO2: Wetlands. The ESO1 is particularly relevant to most of the project area..





## 8. Conclusions and Recommendations

Any future development of the study area is likely to have some impact on ecological values. Potential impacts and mitigation measures are outlined in the relevant sections above. If these are implemented appropriately, the potential risk of those impacts may be minimised. General ecological concerns associated with development at the project area, however, can be classified into five categories:

- » Potential impacts to threatened flora;
- » Potential impacts to threatened fauna;
- » Removal of native vegetation and fauna habitat;
- » Weed management; and
- » Restoration or revegetation strategy.

### 8.1 Threatened Flora

It is likely that any development or construction activities within the study area will have some impact on native flora species. If native vegetation is to be removed during any future construction, there will be requirements to undertake Net Gain Assessment under state legislation to avoid and minimise the removal of native vegetation.

Potentially, there may be loss of threatened species as a result of native vegetation removal, particularly within those areas that have been recognised as potential habitat for those species. It is, therefore, recommended that targeted surveys should be undertaken before the commencement of any construction activities.

### 8.2 Threatened Fauna

Further development of the study area is likely to result in some habitat loss. Potentially, there may be some habitat loss for listed species of fauna. In view of this, we recommend the following before the commencement of any construction activity:

- » Conduct targeted surveys for the presence of listed fauna likely to occur in the study area.

### 8.3 Removal of Vegetation/Fauna Habitat

As any development within the study area is likely to result in the removal of native vegetation, we recommend the following:

- » Undertake a Net Gain Assessment of native vegetation to be removed;
- » Minimise the area of any construction zone so that minimal vegetation removal is required; and
- » Avoid impacts to the grassland/marshy habitat adjacent to Lake Reeve. This habitat most likely supports the EPBC-listed Orange-bellied Parrot (*Neophema chrysogaster*), and the adjacent Lake Reeve is part of a Ramsar listed wetland site.



#### **8.4 Restoration/Revegetation Strategy**

Removal of native vegetation has the potential to result in the spread or introduction of weeds to and from the study area. Disturbed areas will also require rehabilitation/restoration following completion of any associated construction activities. It is, therefore, recommended that disturbed areas should be revegetated, post-construction, with appropriate and locally available indigenous flora species.

A vegetation management plan may need to be developed and implemented as a component of any restoration or revegetation strategies within the study area.

#### **8.5 Weed Management**

Any future development is likely to result in disturbance to the existing soil profile and landscape features. Disturbance will result in the provision of suitable conditions for weed establishment. It will, therefore, be necessary to design and implement an appropriate weed management strategy before, during, and following any proposed construction activities to prevent the introduction, spread, or establishment of weed species.

#### **8.6 Other Considerations**

The current dwelling density within the study area is likely to be having some ongoing impact on native flora and fauna. The relatively low density of current development in most areas, is likely to have minimal impacts on ecological values. Any increase in dwelling density is likely to have a greater impact on those ecological values in terms of flora and fauna habitat. In particular the ecological values of the largely regenerated areas, outside existing developed precincts, would be significantly impacted by any density of dwellings that removed the predominant vegetation cover, introduced exotic species or encouraged greater access to adjacent areas by humans. This would include the effects associated with an increase of effluent disposal and nutrient input into the adjacent Ramsar listed Lake Reeve wetland. Therefore, consideration should be given to these factors in view of assessing an appropriate future dwelling density within the study area.



## 9. References

*Advisory List of Threatened Plants in Victoria* (2003). Victorian Department of Sustainability and Environment, Victoria, East Melbourne, Victoria.

*Advisory List of Threatened Vertebrate Fauna in Victoria* (2003). Victorian Department of Sustainability and Environment, Victoria, East Melbourne, Victoria.

Briggs JD and Leigh JH (1996). Rare or threatened Australian plants. CSIRO, Canberra.

Ecological Vegetation Class (EVC) Benchmarks for each Bioregion (2004). Department of Sustainability and Environment (unpubl. data).

Flora Information System (2005).

*Victoria's Native Vegetation Management – A Framework for Action NRE* (2002).



**Appendix A**

**Significance Assessment**



## Definition of Significance

Significance is defined as “noteworthy, of considerable importance” by the Oxford Dictionary. However, when defining the conservation significance value of ecological communities, species and sites, a more detailed scientific definition is required.

### Species

The conservation significance of an individual species is defined according to two main criteria: the level of threat (conservation status) ascribed to the species, and the scale/context in which it occurs.

Conservation status of individual species falls into one of the following categories: not rare, poorly known, rare, vulnerable, endangered or extinct, with ‘threatened’ species being those that are classified as either vulnerable or endangered. Scale is defined at four levels: national (Australia), state (Victoria), regional (Gippsland Plain bioregion) and local (90 Mile Beach region, within a 5 kilometre radius of the study area).

Therefore, in accordance with these criteria, a species is considered significant at the largest scale at which it is at least rare.

### National Significance

Species of national significance are either:

- » Flora or fauna listed as extinct, extinct in the wild, critically endangered, endangered, and vulnerable or conservation dependent in Australia under the *Environment Protection and Biodiversity Conservation Act 1999*.
- » Flora listed as rare in Australia in *Rare or Threatened Australian Plants* (Briggs and Leigh 1996).
- » Fauna listed as extinct, extinct in the wild, critically endangered, endangered or vulnerable in Australia in an Action Plan published by the Department of the Environment and Water Resources.

### State Significance

Species of state significance are either:

- » Flora or fauna listed as threatened in Victoria under Schedule 2 of the *Flora and Fauna Guarantee Act 1988*.
- » Flora listed as presumed extinct, endangered, vulnerable or rare in Victoria in the *Advisory List of Threatened Plants in Victoria – 2003* (DSE 2003b).
- » Flora listed as poorly known in Australia in *Rare or Threatened Australian Plants* (Briggs and Leigh 1996).
- » Fauna listed as extinct, regionally extinct, extinct in the wild, critically endangered, endangered or vulnerable in the *Advisory List of Threatened Vertebrate Fauna in Victoria, 2003* (DSE 2003c).
- » Fauna listed as lower risk (near threatened) in Australia in an Action Plan published by the Department of the Environment and Water Resources

## **Regional**

Species of regional significance are either:

- » Flora recorded from less than 1% of documented sites (quadrats, defined area lists) within the Highlands Southern Fall bioregion on the DSE Flora Information System, unless there is a valid reason to believe that the species has been under sampled (e.g. some native species that readily colonise farm dams may be recorded in less than 1% of sites on the FIS, simply owing to the dearth of vegetation surveys on farm dams, and not inherent rarity).
- » Fauna listed as near threatened in the *Advisory List of Threatened Vertebrate Fauna in Victoria, 2003* (DSE 2003c).

## **Local**

All species of indigenous flora and fauna are considered to have at least local significance, owing to the degree of habitat modification across much of the state.

## **Communities**

Similarly to species, the conservation significance of ecological communities is defined according to two main criteria: the level of threat (conservation status) ascribed to the community, and the scale/context in which it occurs.

Conservation status of ecological communities in Australia falls into one of the following categories: critically endangered, endangered or vulnerable. In Victoria, vegetation communities are classified according to Ecological Vegetation Classes (EVCs), which are categorised, as either presumed extinct, endangered, vulnerable, rare, depleted or of least concern.

Scale is defined at four levels: national, state, regional and local.

Therefore, in accordance with these criteria, an ecological community is considered significant at the largest scale at which it is at least rare or threatened.

Ecological communities may include both flora and/or fauna communities.

## **National Significance**

Ecological communities of national significance are:

- » Listed as critically endangered, endangered or vulnerable in Australia under the *Environment Protection and Biodiversity Conservation Act 1999*.

## **State Significance**

Ecological communities of state significance are either:

- » Listed as threatened in Victoria under Schedule 2 of the *Flora and Fauna Guarantee Act 1988*.
- » Listed as an EVC that is presumed extinct, endangered, vulnerable or rare across most bioregions in which it occurs in Victoria (DSE 2002 unpubl. data).

## **Regional Significance**

Ecological communities of regional significance are:

- » Listed as an EVC that is presumed extinct, endangered, vulnerable, rare or depleted within a specific Victorian bioregion in a Draft Native Vegetation Plan.

## **Local Significance**

All ecological communities are considered to have at least local significance, owing to the degree of habitat modification across much of the state.

## **Sites**

A site is considered significant at a specific geographic scale (national, state, regional, local) when it is deemed to make a considerable contribution to biodiversity at that level.

The major factors affecting site significance are:

- » Presence or likely presence of significant flora and fauna species;
- » Presence of threatened ecological communities;
- » Ecological condition (e.g. level of intactness, human disturbance, weed invasion, etc); and
- » Size of the site.

The combination of the highest level of community and/or species significance at which at least 1% of the remaining extent occurs is considered to be the threshold for a ‘considerable contribution’ (e.g. if one plant of a nationally significant species was recorded in a small, high quality remnant of a state significant community, the site would most likely be regarded as being of regional significance, as both the species and the community are unlikely to comprise 1% of the total population/extents at either the state or national level).

Other factors likely to influence site significance include the following:

- » Species, community and habitat diversity;
- » Connectivity to other sites / wildlife corridor value; and
- » Species or community ‘edge of range’ values.

If a site forms part of a broader area of significance, then the significance of the broader area also applies to the site, unless there is a valid ecological reason to separate the site from the broader area.

Sites that have an especially high level of regional or local significance are designated as ‘high regional’ or ‘high local’ significance respectively.



Appendix B

## **Victoria's Native Vegetation Management: A Framework for Action**



## **Introduction**

*Victoria's Native Vegetation Management – A Framework for Action* establishes the strategic direction for the protection, enhancement and revegetation of native vegetation across the State (NRE 2002).

The Framework identifies the following principles to guide native vegetation management in Victoria:

- » Retention and management of remnant native vegetation is the primary way to conserve natural biodiversity across the landscape;
- » The conservation of native vegetation and habitat in a landscape is dependent on the maintenance of catchment processes;
- » The cost of vegetation management should be equitably shared according to benefits accrued by the landholder, community and region; and
- » A landscape approach to planning native vegetation management is required. Goals for native vegetation management will be based on bioregions, or sub-units, within the Catchment Management Authority region. Priorities for vegetation management should be specific for each bioregion and catchment.

The goals and principles presented in the Framework apply across the State to both private and public land. However, the ways in which the goals are achieved will vary depending on the management objectives of the land and the conservation value of the native vegetation.

The Framework sets out a broad approach to native vegetation management in Victoria and specifies minimum standards, recognising that as native vegetation values and issues vary across the State, so too will the regional priorities and responses identified by this broad approach. Draft Regional Native Vegetation Plans outline these priorities and responses in detail, setting targets and extending the minimum standards as required.

## **Net Gain**

The principal goal for native vegetation management in Victoria is to achieve:

*a reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation, leading to a Net Gain*

Net Gain is the outcome for native vegetation and habitat where overall gains are greater than overall losses and where individual losses are avoided where possible. The losses and gains are determined by a combined quality-quantity measure over a specified area and period of time. This accounting system is based on the 'habitat hectares' approach, a site-based measure of quality and quantity of native vegetation that is assessed in the context of the relevant native vegetation type (DSE 2004).

## **3-step Process**

In applying the Net Gain approach to protection and clearance decisions, a 3-step approach should be adhered to. The three stages are described in order of priority below:

1. **Avoid** adverse impacts, particularly through vegetation clearance.
2. If impacts cannot be avoided, **minimise** impacts through appropriate consideration in planning processes and expert input to project design and management.

### 3. Identify appropriate **offset** options.

It should be noted that offsets (actions undertaken to achieve commensurate gains) should only be considered after Steps 1 and 2 have been fully investigated and documented. Calculation of the amount of gain associated with the offset actions will be based on an estimate of the improvements that are likely to be realised over a ten-year period from commencement of the action.

#### **Habitat Hectares**

As mentioned earlier, losses and gains can be assessed by a combined quality-quantity measure known as habitat hectares. The Department of Sustainability and Environment has developed a standard state-wide approach for estimating general vegetation/habitat quality using the following criteria: retention of large old trees, retention of tree canopy cover, retention of the cover and diversity of understorey life forms, presence of appropriate recruitment, absence of weeds, litter cover, log abundance, size of remnant vegetation patch, and links to, and amount of, neighbouring patches. Each of these components has been weighted according to its perceived ecological importance (DSE 2004).

Under the habitat hectares approach, native vegetation at a site is assessed by comparing it to a benchmark that represents the average characteristics of a mature and apparently long-undisturbed stand of the same type of vegetation. Vegetation is assessed according to habitat zones, with each zone composed of a single EVC, condition state and preferably land tenure. The decision point for assessing a different habitat zone is generally *one category difference in the majority of the condition components, or two categories difference in any of these components* (DSE 2004).

General vegetation/habitat quality is scored from one (complete retention of natural quality as described by benchmark characteristics) to zero (complete loss) (DSE 2004). If it is assumed that an unaltered area of natural habitat is at 100% of its 'natural' quality, then one hectare of such habitat will be equivalent to one habitat hectare. That is the quality multiplied by the quantity. Ten hectares of this high quality habitat would be equivalent to ten habitat hectares, and so on. If an area of habitat had lost 50% of its quality (e.g. through weed invasion and subsequent loss of understorey species), then one hectare would be equivalent to 0.5 habitat hectares, ten hectares would be equivalent to five habitat hectares, and so on.

#### **Formal Agreement to Achieve and Secure Offsets**

To ensure that the management actions required to achieve offsets are undertaken, and that permanent losses from clearing are mitigated by gains of an ongoing and secure nature, offset arrangements should be formally established through the routine and streamlined use of management agreements or permit conditions.

#### **Current Status**

The goal of Net Gain expressed in *Victoria's Native Vegetation Management – A Framework for Action* is given effect in the State Planning Policy Framework by Clause 15.09 and in the Victoria Planning Provisions by Particular Provisions Clause 52.17 (Native Vegetation), which state:

Planning and responsible authorities must consider *Victoria's Native Vegetation Management – A Framework for Action* (NRE 2002). If native vegetation is proposed to be removed as part of a land use or development proposal, among other things, the responsible authority must also consider:

- » Whether the proposed development can be located and designed to **avoid** the removal of native vegetation;
- » Whether the proposed development is located and designed to **minimise** the removal of native vegetation; and
- » The need to **offset** the loss of native vegetation having regard to the conservation significance of the vegetation.

In relation to offsets, the responsible authority must consider the following:

- » The conservation significance of the native vegetation;
- » The offset criteria in *Victoria's Native Vegetation Management – A Framework for Action* (NRE 2002);
- » Offset requirements in an approved Regional Vegetation Plan; and
- » The long-term security of the offset.



**Appendix C**

**Species Recorded on the FIS  
Database Within 10 km of the Study  
Area**



Scientific Name	Common Name
<b>Indigenous species</b>	
<i>Acacia genistifolia</i>	Spreading Wattle
<i>Acacia implexa</i>	Lightwood
<i>Acacia mearnsii</i>	Black Wattle
<i>Acacia longifolia</i> subsp. <i>longifolia</i>	Sallow Wattle
<i>Acacia longifolia</i> subsp. <i>sophorae</i>	Coast Wattle
<i>Acacia melanoxylon</i>	Blackwood
<i>Acacia oxycedrus</i>	Spike Wattle
<i>Acacia spp.</i>	Wattle
<i>Acacia stricta</i>	Hop Wattle
<i>Acacia suaveolens</i>	Sweet Wattle
<i>Acacia ulicifolia</i>	Juniper Wattle
<i>Acaena echinata</i>	Sheep's Burr
<i>Acaena novae-zelandiae</i>	Bidgee-widgee
<i>Acaena ovina</i>	Australian Sheep's Burr
<i>Acianthus caudatus</i>	Mayfly Orchid
<i>Acianthus exsertus s.l.</i>	Gnat Orchid
<i>Acianthus spp.</i>	Mosquito Orchid
<i>Acrotriche serrulata</i>	Honey-pots
<i>Acrotriche spp.</i>	Ground Berry
<i>Actites megalocarpa</i>	Dune Thistle
<i>Agrostis s.l. spp.</i>	Bent/Blown Grass
<i>Allocasuarina littoralis</i>	Black Sheoak
<i>Allocasuarina misera</i>	Slender Sheoak
<i>Allocasuarina misera/paradoxa</i>	Slender/Green Sheoak
<i>Allocasuarina paludosa</i>	Scrub Sheoak
<i>Allocasuarina paradoxa</i>	Green Sheoak
<i>Allocasuarina spp.</i>	Sheoak
<i>Allocasuarina verticillata</i>	Drooping Sheoak
<i>Almaleea subumbellata</i>	Wiry Bush-pea

Scientific Name	Common Name
<i>Amperea xiphoclada</i> var. <i>xiphoclada</i>	Broom Spurge
<i>Amphibromus fluitans</i>	River Swamp Wallaby-grass
<i>Amphibromus nervosus</i>	Common Swamp Wallaby-grass
<i>Amyema pendula</i>	Drooping Mistletoe
<i>Amyema pendula</i> subsp. <i>pendula</i> (s.s.)	Drooping Mistletoe
<i>Anisopogon avenaceus</i>	Oat Spear-grass
<i>Aotus ericoides</i>	Common Aotus
<i>Aphelia pumilio</i>	Dwarf Aphelia
<i>Apium prostratum</i> subsp. <i>prostratum</i>	Sea Celery
<i>Apodasmia brownii</i>	Coarse Twine-rush
<i>Asperula subsimplex</i>	Water Woodruff
<i>Asplenium flabellifolium</i>	Necklace Fern
<i>Astroloma humifusum</i>	Cranberry Heath
<i>Astroloma pinifolium</i>	Pine Heath
<i>Atriplex cinerea</i>	Coast Saltbush
<i>Atriplex paludosa</i> subsp. <i>paludosa</i>	Marsh Saltbush
<i>Austrodanthonia caespitosa</i>	Common Wallaby-grass
<i>Austrodanthonia geniculata</i>	Kneed Wallaby-grass
<i>Austrodanthonia laevis</i>	Smooth Wallaby-grass
<i>Austrodanthonia pilosa</i>	Velvet Wallaby-grass
<i>Austrodanthonia racemosa</i> var. <i>racemosa</i>	Stiped Wallaby-grass
<i>Austrodanthonia setacea</i>	Bristly Wallaby-grass
<i>Austrodanthonia setacea</i> var. <i>setacea</i>	Bristly Wallaby-grass
<i>Austrodanthonia</i> spp.	Wallaby Grass
<i>Austrostipa littoralis</i>	Coast Fescue
<i>Austrostipa flavescens</i>	Coast Spear-grass
<i>Austrostipa mollis</i>	Supple Spear-grass
<i>Austrostipa pubinodis</i>	Tall Spear-grass
<i>Austrostipa semibarbata</i>	Fibrous Spear-grass
<i>Austrostipa</i> spp.	Spear Grass
<i>Azolla filiculoides</i>	Pacific Azolla

Scientific Name	Common Name
<i>Banksia integrifolia</i> subsp. <i>integrifolia</i>	Coast Banksia
<i>Banksia marginata</i>	Silver Banksia
<i>Banksia serrata</i>	Saw Banksia
<i>Baumea acuta</i>	Pale Twig-sedge
<i>Baumea juncea</i>	Bare Twig-sedge
<i>Billardiera scandens</i>	Common Apple-berry
<i>Boronia anemonifolia</i>	Sticky Boronia
<i>Boronia anemonifolia</i> subsp. <i>anemonifolia</i>	Sticky Boronia
<i>Boronia</i> spp.	Boronia
<i>Bossiaea cinerea</i>	Showy Bossiaeae
<i>Bossiaea heterophylla</i>	Variable Bossiaeae
<i>Bossiaea obcordata</i>	Spiny Bossiaeae
<i>Bossiaea prostrata</i>	Creeping Bossiaeae
<i>Bossiaea</i> spp.	Bossiaeae
<i>Brachyloma daphnoides</i>	Daphne Heath
<i>Brachyscome cardiocarpa</i>	Swamp Daisy
<i>Brachyscome graminea</i>	Grass Daisy
<i>Brachyscome parvula</i>	Coast Daisy
<i>Brachythecium rutabulum</i>	Rough-stalked Feather-moss
<i>Burchardia umbellata</i>	Milkmaids
<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Sweet Bursaria
<i>Caesia parviflora</i>	Pale Grass-lily
<i>Caladenia alata</i>	Fairy Orchid
<i>Caladenia carneae</i> s.s.	Pink Fingers
<i>Caladenia carneae</i> sensu Willis (1970)	Pink Fingers
<i>Caladenia dilatata</i> s.l.	Green-comb Spider-orchid
<i>Caladenia latifolia</i>	Pink Fairies
<i>Caladenia</i> spp.	Caladenia
<i>Caladenia tentaculata</i>	Mantis Orchid
<i>Caladenia tessellata</i>	Thick-lip Spider-orchid
<i>Caleana major</i>	Large Duck-orchid

Scientific Name	Common Name
<i>Callistemon citrinus</i>	Crimson Bottlebrush
<i>Callistemon pityoides</i>	Alpine Bottlebrush
<i>Calocephalus lacteus</i>	Milky Beauty-heads
<i>Calochilus imberbis</i>	Naked Beard-orchid
<i>Calochilus robertsonii</i>	Purple Beard-orchid
<i>Calochilus spp.</i>	Beard Orchid
<i>Calystegia sepium</i> subsp. <i>roseata</i>	Large Bindweed
<i>Calytrix</i> spp.	Fringe Myrtle
<i>Calytrix tetragona</i>	Common Fringe-myrtle
<i>Campylopus introflexus</i>	Heath Star Moss
<i>Cardamine gunnii</i> s.l.	Common Bitter-cress
<i>Carex appressa</i>	Tall Sedge
<i>Carex breviculmis</i>	Common Grass-sedge
<i>Carex inversa</i>	Knob Sedge
<i>Carpobrotus rossii</i>	Karkalla
<i>Cassinia aculeata</i>	Common Cassinia
<i>Cassytha glabella</i>	Slender Dodder-laurel
<i>Cassytha melantha</i>	Coarse Dodder-laurel
<i>Cassytha phaeolasia</i>	Rusty Dodder-laurel
<i>Cassytha pubescens</i> s.s.	Downy Dodder-laurel
<i>Caustis flexuosa</i>	Curly Wig
<i>Caustis pentandra</i>	Thick Twist-rush
<i>Caustis</i> spp.	Twist Rush
<i>Centaurium spicatum</i>	Spiked Centaury
<i>Centella cordifolia</i>	Centella
<i>Centrolepis aristata</i>	Pointed Centrolepis
<i>Centrolepis strigosa</i> subsp. <i>strigosa</i>	Hairy Centrolepis
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	Blue Stars
<i>Cheilanthes austrotenuifolia</i>	Green Rock-fern
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	Narrow Rock-fern
<i>Chenopodium glaucum</i>	Glaucous Goosefoot

Scientific Name	Common Name
<i>Cladia aggregata</i>	Common Coral-lichen
<i>Cladium procerum</i>	Leafy Twig-sedge
<i>Clematis microphylla</i>	Small-leaved Clematis
<i>Comesperma calymega</i>	Blue-spike Milkwort
<i>Comesperma volubile</i>	Love Creeper
<i>Convolvulus erubescens</i> spp. agg.	Pink Bindweed
<i>Correa reflexa</i>	Common Correa
<i>Correa reflexa</i> var. <i>speciosa</i>	Eastern Correa
<i>Corunastylis despectans</i>	Sharp Midge-orchid
<i>Corybas</i> spp.	Helmet Orchid
<i>Cotula australis</i>	Common Cotula
<i>Cotula</i> spp.	Cotula
<i>Cotula vulgaris</i> var. <i>australisica</i>	Slender Cotula
<i>Craspedia glauca</i> spp. agg.	Common Billy-buttons
<i>Crassula decumbens</i> var. <i>decumbens</i>	Spreading Crassula
<i>Crassula helmsii</i>	Swamp Crassula
<i>Crassula sieberiana</i> s.l.	Sieber Crassula
<i>Cryptandra amara</i> s.s.	Bitter Cryptandra
<i>Cynodon dactylon</i>	Couch
<i>Cynoglossum australe</i>	Australian Hound's-tongue
<i>Cytostylis reniformis</i>	Small Gnat-orchid
<i>Damasonium minus</i>	Star Fruit
<i>Dampiera</i> spp.	Dampiera
<i>Dampiera stricta</i>	Blue Dampiera
<i>Danthonia</i> s.l. spp.	Wallaby Grass
<i>Daucus glochidiatus</i>	Australian Carrot
<i>Daviesia latifolia</i>	Hop Bitter-pea
<i>Daviesia ulicifolia</i>	Gorse Bitter-pea
<i>Desmodium gunnii</i>	Southern Tick-trefoil
<i>Desmodium</i> spp.	Tick Trefoil
<i>Deyeuxia quadrisetoides</i>	Reed Bent-grass

Scientific Name	Common Name
<i>Dianella revoluta</i> s.l.	Black-anther Flax-lily
<i>Dianella revoluta</i> var. <i>revoluta</i> s.l.	Black-anther Flax-lily
<i>Dichelachne crinita</i>	Long-hair Plume-grass
<i>Dichelachne</i> spp.	Plume Grass
<i>Dichondra repens</i>	Kidney-weed
<i>Dillwynia cinerascens</i> s.l.	Grey Parrot-pea
<i>Dillwynia glaberrima</i>	Smooth Parrot-pea
<i>Dillwynia sericea</i>	Showy Parrot-pea
<i>Dillwynia</i> spp.	Parrot Pea
<i>Disphyma crassifolium</i> subsp. <i>clavellatum</i>	Rounded Noon-flower
<i>Distichlis distichophylla</i>	Australian Salt-grass
<i>Diuris pardina</i>	Leopard Orchid
<i>Diuris sulphurea</i>	Tiger Orchid
<i>Drosera macrantha</i>	Climbing Sundew
<i>Drosera peltata</i>	Pale Sundew
<i>Drosera peltata</i> subsp. <i>auriculata</i>	Tall Sundew
<i>Drosera peltata</i> subsp. <i>peltata</i>	Pale Sundew
<i>Drosera pygmaea</i>	Tiny Sundew
<i>Drosera</i> spp.	Sundew
<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	Bushy Hedgehog-grass
<i>Echinopogon</i> spp.	Hedgehog Grass
<i>Einadia hastata</i>	Saloop
<i>Einadia nutans</i> subsp. <i>nutans</i>	Nodding Saltbush
<i>Eleocharis acuta</i>	Common Spike-sedge
<i>Eleocharis sphacelata</i>	Tall Spike-sedge
<i>Elymus scaber</i> var. <i>scaber</i>	Common Wheat-grass
<i>Empodium minus</i>	Spreading Rope-rush
<i>Epacris impressa</i>	Common Heath
<i>Epilobium billardierianum</i>	Variable Willow-herb
<i>Epilobium billardierianum</i> subsp. <i>billardierianum</i>	Smooth Willow-herb
<i>Eragrostis brownii</i>	Common Love-grass

Scientific Name	Common Name
<i>Eragrostis</i> spp.	Love Grass
<i>Eriochloa pseudoacrotricha</i>	Early Spring-grass
<i>Erodium</i> spp.	Heron's Bill
<i>Eucalyptus</i> aff. <i>willisii</i> (Gippsland Lakes)	Gippsland Lakes Peppermint
<i>Eucalyptus baxteri</i> s.l.	Brown Stringybark
<i>Eucalyptus bridgesiana</i> s.l.	But But
<i>Eucalyptus bridgesiana</i> s.s.	But But
<i>Eucalyptus cephalocarpa</i> s.l.	Silver-leaf Stringybark
<i>Eucalyptus cephalocarpa</i> s.s.	Mealy Stringybark
<i>Eucalyptus consideniana</i>	Yertchuk
<i>Eucalyptus conspicua</i>	Silver Swamp Stringybark
<i>Eucalyptus globoidea</i>	White Stringybark
<i>Eucalyptus goniocalyx</i> s.l.	Bundy
<i>Eucalyptus melliodora</i>	Yellow Box
<i>Eucalyptus ovata</i>	Swamp Gum
<i>Eucalyptus polyanthemos</i>	Red Box
<i>Eucalyptus radiata</i> s.l.	Narrow-leaf Peppermint
<i>Eucalyptus</i> spp.	Eucalypt
<i>Eucalyptus tereticornis</i> subsp. <i>mediana</i>	Gippsland Red-gum
<i>Eucalyptus viminalis</i>	Manna Gum
<i>Eucalyptus viminalis</i> subsp. <i>pryoriana</i>	Coast Manna-gum
<i>Eucalyptus willisii</i>	Shining Peppermint
<i>Euchiton collinus</i> s.l.	Clustered/Creeping Cudweed
<i>Euchiton collinus</i> s.s.	Creeping Cudweed
<i>Euchiton involucratus</i> s.l.	Common Cudweed
<i>Euchiton sphaericus</i>	Annual Cudweed
<i>Euchiton</i> spp.	Cudweed
<i>Euphrasia collina</i> subsp. <i>collina</i>	Purple Eyebright
<i>Euryomyrtus ramosissima</i>	Rosy Baeckea
<i>Euryomyrtus ramosissima</i> subsp. <i>prostrata</i>	Rosy Baeckea
<i>Exocarpos cupressiformis</i>	Cherry Ballart

Scientific Name	Common Name
<i>Ficinia nodosa</i>	Knobby Club-sedge
<i>Gahnia clarkei</i>	Tall Saw-sedge
<i>Gahnia filum</i>	Chaffy Saw-sedge
<i>Gahnia radula</i>	Thatch Saw-sedge
<i>Gahnia sieberiana</i>	Red-fruit Saw-sedge
<i>Gahnia trifida</i>	Coast Saw-sedge
<i>Galium gaudichaudii</i>	Rough Bedstraw
<i>Galium propinquum</i>	Maori Bedstraw
<i>Geranium potentilloides</i>	Cinquefoil Cranesbill
<i>Geranium retrorsum s.l.</i>	Grassland Cranesbill
<i>Geranium solanderi s.l.</i>	Austral Cranesbill
<i>Geranium spp.</i>	Crane's Bill
<i>Glossodia major</i>	Wax-lip Orchid
<i>Glycine clandestina</i>	Twining Glycine
<i>Gnaphalium indutum</i>	Tiny Cudweed
<i>Gnaphalium spp.</i>	Cudweed
<i>Gompholobium huegelii</i>	Common Wedge-pea
<i>Gonocarpus humilis</i>	Shade Raspwort
<i>Gonocarpus micranthus</i>	Creeping Raspwort
<i>Gonocarpus micranthus</i> subsp. <i>micranthus</i>	Creeping Raspwort
<i>Gonocarpus spp.</i>	Raspwort
<i>Gonocarpus tetragynus</i>	Common Raspwort
<i>Gonocarpus teucrioides s.l.</i>	Germander Raspwort
<i>Goodenia humilis</i>	Swamp Goodenia
<i>Goodenia paniculata</i>	Branched Goodenia
<i>Gratiola peruviana</i>	Austral Brooklime
<i>Grevillea chrysophaea</i>	Golden Grevillea
<i>Grevillea lanigera</i>	Woolly Grevillea
<i>Hakea ulicina</i>	Furze Hakea
<i>Halosarcia pergranulata</i> subsp. <i>pergranulata</i>	Blackseed Glasswort
<i>Helichrysum scorpioides</i>	Button Everlasting

Scientific Name	Common Name
<i>Helichrysum</i> spp.	Everlasting
<i>Hemichroa pentandra</i>	Trailing Hemichroa
<i>Hibbertia acicularis</i>	Prickly Guinea-flower
<i>Hibbertia fasciculata</i> var. <i>prostrata</i>	Bundled Guinea-flower
<i>Hibbertia riparia</i>	Erect Guinea-flower
<i>Hibbertia sericea</i> s.l.	Silky Guinea-flower
<i>Hibbertia</i> spp.	Guinea Flower
<i>Hibbertia virgata</i>	Twiggy Guinea-flower
<i>Hydrocotyle foveolata</i>	Yellow Pennywort
<i>Hydrocotyle hirta</i>	Hairy Pennywort
<i>Hydrocotyle laxiflora</i>	Stinking Pennywort
<i>Hydrocotyle sibthorpioides</i>	Shining Pennywort
<i>Hydrocotyle</i> spp.	Pennywort
<i>Hypericum gramineum</i>	Small St John's Wort
<i>Hypolaena fastigiata</i>	Tassel Rope-rush
<i>Hypoxis hygrometrica</i> var. <i>hygrometrica</i>	Golden Weather-glass
<i>Imperata cylindrica</i>	Blady Grass
<i>Indigofera australis</i>	Austral Indigo
<i>Isachne globosa</i>	Swamp Millet
<i>Isolepis cernua</i> var. <i>cernua</i>	Nodding Club-sedge
<i>Isolepis cernua</i> var. <i>platycarpa</i>	Broad-fruit Club-sedge
<i>Isolepis fluitans</i> var. <i>fluitans</i>	Floating Club-sedge
<i>Isolepis fluitans</i> var. <i>lenticularis</i>	Floating Club-sedge
<i>Isolepis hookeriana</i>	Grassy Club-sedge
<i>Isolepis inundata</i>	Swamp Club-sedge
<i>Isolepis marginata</i>	Little Club-sedge
<i>Isotoma fluviatilis</i> subsp. <i>australis</i>	Swamp Isotome
<i>Juncus australis</i>	Austral Rush
<i>Juncus bufonius</i>	Toad Rush
<i>Juncus caespiticus</i>	Grassy Rush
<i>Juncus holoschoenus</i>	Joint-leaf Rush

Scientific Name	Common Name
<i>Juncus kraussii</i> subsp. <i>australiensis</i>	Sea Rush
<i>Juncus pallidus</i>	Pale Rush
<i>Juncus planifolius</i>	Broad-leaf Rush
<i>Juncus procerus</i>	Tall Rush
<i>Juncus spp.</i>	Rush
<i>Juncus subsecundus</i>	Finger Rush
<i>Kennedia prostrata</i>	Running Postman
<i>Kennedia spp.</i>	Coral Pea
<i>Kunzea ericoides</i> spp. agg.	Burgan
<i>Lachnagrostis billardierei</i> s.l.	Coast Blown-grass
<i>Lachnagrostis billardierei</i> subsp. <i>billardierei</i>	Coast Blown-grass
<i>Lachnagrostis filiformis</i>	Common Blown-grass
<i>Lachnagrostis filiformis</i> var. 1	Common Blown-grass
<i>Lachnagrostis punicea</i> subsp. <i>filifolia</i>	Purple Blown-grass
<i>Lachnagrostis robusta</i>	Salt Blown-grass
<i>Lagenophora stipitata</i>	Common Bottle-daisy
<i>Lawrenzia spicata</i>	Salt Lawrenzia
<i>Laxmannia orientalis</i>	Dwarf Wire-lily
<i>Lemna disperma</i>	Common Duckweed
<i>Lepidium foliosum</i>	Leafy Peppercress
<i>Lepidosperma concavum</i>	Sandhill Sword-sedge
<i>Lepidosperma gladiatum</i>	Coast Sword-sedge
<i>Lepidosperma laterale</i>	Variable Sword-sedge
<i>Lepidosperma longitudinale</i>	Pithy Sword-sedge
<i>Lepidosperma spp.</i>	Sword Sedge
<i>Lepilaena cylindrocarpa</i>	Long-fruit Water-mat
<i>Lepilaena spp.</i>	Water Mat
<i>Leptinella longipes</i>	Coast Cotula
<i>Leptinella reptans</i> s.l.	Creeping Cotula
<i>Leptocarpus tenax</i>	Slender Twine-rush
<i>Leptoceras menziesii</i>	Hare Orchid

Scientific Name	Common Name
<i>Leptorhynchus nitidulus</i>	Shiny Buttons
<i>Leptospermum continentale</i>	Prickly Tea-tree
<i>Leptospermum laevigatum</i>	Coast Tea-tree
<i>Leptospermum myrsinoides</i>	Heath Tea-tree
<i>Leptospermum</i> spp.	Tea Tree
<i>Lepyrodia muelleri</i>	Common Scale-rush
<i>Leucophyta brownii</i>	Cushion Bush
<i>Leucopogon ericoides</i>	Pink Beard-heath
<i>Leucopogon parviflorus</i>	Coast Beard-heath
<i>Leucopogon virgatus</i>	Common Beard-heath
<i>Leucopogon virgatus</i> var. <i>virgatus</i>	Common Beard-heath
<i>Lilaeopsis polyantha</i>	Australian Lilaeopsis
<i>Lindsaea linearis</i>	Screw Fern
<i>Lobelia anceps</i>	Angled Lobelia
<i>Lobelia pratioides</i>	Poison Lobelia
<i>Lomandra filiformis</i>	Wattle Mat-rush
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	Wattle Mat-rush
<i>Lomandra glauca</i> s.s.	Blue Mat-rush
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
<i>Lomandra longifolia</i> subsp. <i>longifolia</i>	Spiny-headed Mat-rush
<i>Lomandra</i> spp.	Mat-rush
<i>Lotus australis</i>	Austral Trefoil
<i>Luzula campestris</i> spp. agg.	Field Woodrush
<i>Luzula meridionalis</i> var. <i>densiflora</i>	Common Woodrush
<i>Luzula meridionalis</i> var. <i>flaccida</i>	Common Woodrush
<i>Luzula meridionalis</i> var. <i>meridionalis</i>	Common Woodrush
<i>Lyperanthus suaveolens</i>	Brown-beaks
<i>Lythrum hyssopifolia</i>	Small Loosestrife
<i>Malva</i> spp.	Mallow
<i>Marsilea hirsuta</i>	Short-fruit Nardoo
<i>Melaleuca ericifolia</i>	Swamp Paperbark

Scientific Name	Common Name
<i>Melaleuca gibbosa</i>	Slender Honey-myrtle
<i>Melicytus dentatus s.l.</i>	Tree Violet
<i>Melicytus dentatus s.s.</i>	Tree Violet
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
<i>Microseris scapigera</i> spp. agg.	Yam Daisy
<i>Microtis parviflora</i>	Slender Onion-orchid
<i>Microtis unifolia</i>	Common Onion-orchid
<i>Mimulus repens</i>	Creeping Monkey-flower
<i>Monotoca elliptica</i> s.l.	Tree Broom-heath
<i>Monotoca scoparia</i>	Prickly Broom-heath
<i>Muehlenbeckia adpressa</i>	Climbing Lignum
<i>Muellerina celastroides</i>	Coast Mistletoe
<i>Myoporum insulare</i>	Common Boobialla
<i>Myosotis australis</i>	Austral Forget-me-not
<i>Myriocephalus</i> spp.	Woolly-heads
<i>Myriophyllum crispatum</i>	Upright Water-milfoil
<i>Myriophyllum verrucosum</i>	Red Water-milfoil
<i>Neopaxia australasica</i>	White Purslane
<i>Notodanthonia longifolia</i>	Long-leaf Wallaby-grass
<i>Notodanthonia semiannularis</i>	Wetland Wallaby-grass
<i>Olearia axillaris</i>	Coast Daisy-Bush
<i>Olearia glutinosa</i>	Sticky Daisy-bush
<i>Olearia lirata</i>	Snowy Daisy-bush
<i>Olearia phlogopappa</i>	Dusty Daisy-bush
<i>Olearia ramulosa</i>	Twiggy Daisy-bush
<i>Opercularia ovata</i>	Broad-leaf Stinkweed
<i>Opercularia varia</i>	Variable Stinkweed
<i>Ophioglossum lusitanicum</i>	Austral Adder's-tongue
<i>Orthoceras strictum</i>	Horned Orchid
<i>Oxalis corniculata</i> s.l.	Yellow Wood-sorrel
<i>Oxalis exilis</i>	Shady Wood-sorrel

Scientific Name	Common Name
<i>Oxalis</i> spp.	Wood Sorrel
<i>Ozothamnus turbinatus</i>	Coast Everlasting
<i>Paracaleana minor</i>	Small Duck-orchid
<i>Parietaria debilis</i> s.l.	Shade Pellitory
<i>Parietaria debilis</i> s.s.	Shade Pellitory
<i>Pelargonium australe</i>	Austral Stork's-bill
<i>Pellaea falcata</i> s.l.	Sickle Fern
<i>Pellaea falcata</i> s.s.	Sickle Fern
<i>Pentapogon quadrifidus</i> var. <i>quadrifidus</i>	Five-awned Spear-grass
<i>Persoonia juniperina</i>	Prickly Gebung
<i>Phragmites australis</i>	Common Reed
<i>Phyllanthus hirtellus</i>	Thyme Spurge
<i>Pimelea curviflora</i> s.s.	Curved Rice-flower
<i>Pimelea humilis</i>	Common Rice-flower
<i>Pimelea linifolia</i>	Slender Rice-flower
<i>Pimelea linifolia</i> subsp. <i>linifolia</i>	Slender Rice-flower
<i>Pimelea serpyllifolia</i> subsp. <i>serpyllifolia</i>	Thyme Rice-flower
<i>Pimelea</i> spp.	Rice Flower
<i>Plantago varia</i>	Variable Plantain
<i>Platysace ericoides</i>	Heath Platysace
<i>Platysace lanceolata</i>	Shrubby Platysace
<i>Poa australis</i> spp. agg.	Tussock Grass
<i>Poa fordeana</i>	Forde Poa
<i>Poa labillardierei</i>	Common Tussock-grass
<i>Poa labillardierei</i> var. <i>labillardierei</i>	Common Tussock-grass
<i>Poa poiformis</i>	Coast Tussock-grass
<i>Poa poiformis</i> var. <i>poiformis</i>	Coast Tussock-grass
<i>Poa sieberiana</i> var. <i>sieberiana</i>	Grey Tussock-grass
<i>Poa</i> spp.	Tussock Grass
<i>Pomaderris paniculosa</i> subsp. <i>paralia</i>	Coast Pomaderris
<i>Pomaderris</i> spp.	Pomaderris

Scientific Name	Common Name
<i>Poranthera microphylla</i>	Small Poranthera
<i>Potamogeton tricarinatus s.l.</i>	Floating Pondweed
<i>Prasophyllum elatum</i>	Tall Leek-orchid
<i>Prasophyllum frenchii</i>	Maroon Leek-orchid
<i>Prasophyllum spp.</i>	Leek Orchid
<i>Pseudanthus ovalifolius</i>	Oval-leaf Pseudanthus
<i>Pseudognaphalium luteoalbum</i>	Jersey Cudweed
<i>Pteridium esculentum</i>	Austral Bracken
<i>Pterostylis concinna</i>	Trim Greenhood
<i>Pterostylis curta</i>	Blunt Greenhood
<i>Pterostylis nana</i>	Dwarf Greenhood
<i>Pterostylis nutans</i>	Nodding Greenhood
<i>Pterostylis parviflora s.l.</i>	Tiny Greenhood
<i>Pterostylis pedunculata</i>	Maroonhood
<i>Pterostylis robusta s.l.</i>	Large Striped Greenhood
<i>Pterostylis spp.</i>	Greenhood
<i>Puccinellia stricta</i> var. <i>stricta</i>	Australian Saltmarsh-grass
<i>Pultenaea dentata</i>	Clustered Bush-pea
<i>Pyrorchis nigricans</i>	Red-beaks
<i>Ranunculus inundatus</i>	River Buttercup
<i>Ranunculus sessiliflorus</i>	Annual Buttercup
<i>Ranunculus sessiliflorus</i> var. <i>sessiliflorus</i>	Annual Buttercup
<i>Ranunculus spp.</i>	Buttercup
<i>Rhagodia candolleana</i> subsp. <i>candolleana</i>	Seaberry Saltbush
<i>Rhytidosporum procumbens</i>	White Marianth
<i>Ricinocarpus pinifolius</i>	Wedding Bush
<i>Rulingia prostrata</i>	Dwarf Kerrawang
<i>Rumex brownii</i>	Slender Dock
<i>Ruppia megacarpa</i>	Large-fruit Tassel
<i>Samolus repens</i>	Creeping Brookweed
<i>Sarcocornia blackiana</i>	Thick-head Glasswort

Scientific Name	Common Name
<i>Sarcocornia quinqueflora</i>	Beaded Glasswort
<i>Schoenoplectus pungens</i>	Sharp Club-sedge
<i>Schoenus apogon</i>	Common Bog-sedge
<i>Schoenus brevifolius</i>	Zig-zag Bog-sedge
<i>Schoenus imberbis</i>	Beardless Bog-sedge
<i>Schoenus maschalinus</i>	Leafy Bog-sedge
<i>Schoenus nitens</i>	Shiny Bog-sedge
<i>Sebaea ovata</i>	Yellow Sebaea
<i>Selaginella gracillima</i>	Tiny Selaginella
<i>Selaginella uliginosa</i>	Swamp Selaginella
<i>Selliera radicans</i>	Shiny Swamp-mat
<i>Sematophyllum homomallum</i>	Bronze Signal-moss
<i>Senecio biserratus</i>	Jagged Fireweed
<i>Senecio glomeratus</i>	Annual Fireweed
<i>Senecio linearifolius</i>	Fireweed Groundsel
<i>Senecio minimus</i>	Shrubby Fireweed
<i>Senecio odoratus</i> var. <i>odoratus</i>	Scented Groundsel
<i>Senecio pinnatifolius</i>	Variable Groundsel
<i>Senecio quadridentatus</i>	Cotton Fireweed
<i>Senecio spathulatus</i> s.l.	Dune Groundsel
<i>Senecio</i> spp.	Groundsel
<i>Solanum aviculare</i>	Kangaroo Apple
<i>Solanum prinophyllum</i>	Forest Nightshade
<i>Solanum</i> spp.	Nightshade
<i>Solenogyne gunnii</i>	Hairy Solenogyne
<i>Spergularia marina</i> s.l.	Salt Sand-spurrey
<i>Spergularia media</i> s.l.	Coast Sand-spurrey
<i>Sphaerolobium vimineum</i> s.l.	Leafless Globe-pea
<i>Sphaerolobium vimineum</i> s.s.	Leafless Globe-pea
<i>Spinifex sericeus</i>	Hairy Spinifex
<i>Sporobolus virginicus</i>	Salt Couch

Scientific Name	Common Name
<i>Stackhousia monogyna</i>	Creamy Stackhousia
<i>Stackhousia spathulata</i>	Coast Stackhousia
<i>Stackhousia</i> spp.	Stackhousia
<i>Stellaria multiflora</i>	Rayless Starwort
<i>Stellaria pungens</i>	Prickly Starwort
<i>Stellaria</i> spp.	Starwort
<i>Stuartina muelleri</i>	Spoon Cudweed
<i>Stylium armeria</i>	Common Triggerplant
<i>Stylium graminifolium</i> s.l.	Grass Triggerplant
<i>Stylium graminifolium</i> s.s.	Grass Triggerplant
<i>Stylium inundatum</i>	Hundreds and Thousands
<i>Suaeda australis</i>	Austral Seablite
<i>Suaeda</i> spp.	Seablite
<i>Tetragonia implexicoma</i>	Bower Spinach
<i>Tetragonia</i> spp.	Native Spinach
<i>Tetragonia tetragonoides</i>	New Zealand Spinach
<i>Tetratheca ciliata</i>	Pink-bells
<i>Tetratheca pilosa</i>	Hairy Pink-bells
<i>Tetratheca pilosa</i> subsp. <i>latifolia</i>	Hairy Pink-bells
<i>Thelionema</i> spp.	Tufted Lily
<i>Thelemitra arenaria</i>	Forest Sun-orchid
<i>Thelemitra aristata</i>	Great Sun-orchid
<i>Thelemitra epipactoides</i>	Metallic Sun-orchid
<i>Thelemitra ixioides</i> s.s.	Spotted Sun-orchid
<i>Thelemitra pauciflora</i> s.s.	Slender Sun-orchid
<i>Thelemitra planicola</i>	Shy Sun-orchid
<i>Thelemitra rubra</i>	Salmon Sun-orchid
<i>Thelemitra</i> spp.	Sun Orchid
<i>Themeda triandra</i>	Kangaroo Grass
<i>Thryptomene micrantha</i>	Ribbed Thryptomene
<i>Thysanotus patersonii</i>	Twining Fringe-lily

Scientific Name	Common Name
<i>Tricoryne elatior</i>	Yellow Rush-lily
<i>Triglochin mucronata</i>	Prickly Arrowgrass
<i>Triglochin procera s.l.</i>	Water Ribbons
<i>Triglochin striata</i>	Streaked Arrowgrass
<i>Triquetrella papillata</i>	Common Twine-moss
<i>Veronica calycina</i>	Hairy Speedwell
<i>Veronica gracilis</i>	Slender Speedwell
<i>Veronica plebeia</i>	Trailing Speedwell
<i>Veronica spp.</i>	Speedwell
<i>Villarsia exaltata</i>	Erect Marsh-flower
<i>Viminaria juncea</i>	Golden Spray
<i>Viola fuscoviolacea</i>	Dusky Violet
<i>Viola hederacea sensu Entwistle (1996)</i>	Ivy-leaf Violet
<i>Viola hederacea sensu Willis (1972)</i>	Ivy-leaf Violet
<i>Viola sieberiana</i> spp. agg.	Tiny Violet
<i>Wahlenbergia gracilenta s.l.</i>	Annual Bluebell
<i>Wahlenbergia gracilenta s.s.</i>	Hairy Annual-bluebell
<i>Wahlenbergia gracilis</i>	Sprawling Bluebell
<i>Wahlenbergia graniticola s.l.</i>	Granite Bluebell
<i>Wahlenbergia gymnoclada</i>	Naked Bluebell
<i>Wahlenbergia multicaulis</i>	Branching Bluebell
<i>Wahlenbergia spp.</i>	Bluebell
<i>Wahlenbergia stricta</i> subsp. <i>stricta</i>	Tall Bluebell
<i>Wilsonia backhousei</i>	Narrow-leaf Wilsonia
<i>Wilsonia rotundifolia</i>	Round-leaf Wilsonia
<i>Wurmbea dioica</i>	Common Early Nancy
<i>Xanthorrhoea australis</i>	Austral Grass-tree
<i>Xanthorrhoea minor</i> subsp. <i>lutea</i>	Small Grass-tree
<i>Xanthorrhoea resinosa</i>	Spear Grass-tree
<i>Xanthorrhoea spp.</i>	Grass Tree
<i>Xanthosia pilosa</i>	Woolly Xanthosia

Scientific Name	Common Name
<i>Xanthosia spp.</i>	Xanthosia
<i>Zieria veronicea</i> subsp. <i>veronicea</i>	Pink Zieria
<i>Zoysia macrantha</i> subsp. <i>macrantha</i>	Prickly Couch
<i>Zoysia macrantha</i> subsp. <i>walshii</i>	Walsh's Couch
<b>Exotic species</b>	
<i>Acetosella vulgaris</i>	Sheep Sorrel
<i>Aira caryophyllea</i>	Silvery Hair-grass
<i>Aira cupaniana</i>	Quicksilver Grass
<i>Aira elegantissima</i>	Delicate Hair-grass
<i>Aira praecox</i>	Early Hair-grass
<i>Aira spp.</i>	Hair Grass
<i>Alopecurus pratensis</i>	Meadow Fox-tail
<i>Ammophila arenaria</i>	Marram Grass
<i>Anagallis arvensis</i>	Pimpernel
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
<i>Arctotheca calendula</i>	Cape Weed
<i>Asparagus asparagoides</i>	Bridal Creeper
<i>Aster subulatus</i>	Aster-weed
<i>Atriplex prostrata</i>	Hastate Orache
<i>Avellinia michelii</i>	Avellinia
<i>Avena barbata</i>	Bearded Oat
<i>Briza maxima</i>	Large Quaking-grass
<i>Briza minor</i>	Lesser Quaking-grass
<i>Bromus catharticus</i> var. <i>catharticus</i>	Prairie Grass
<i>Bromus diandrus</i>	Great Brome
<i>Bromus hordeaceus</i> subsp. <i>hordeaceus</i>	Soft Brome
<i>Cakile maritima</i> ssp. <i>maritima</i>	Sea Rocket
<i>Callitricha stagnalis</i>	Common Starwort
<i>Carduus tenuiflorus</i>	Winged Thistle
<i>Carpobrotus aequilaterus</i>	Angled Pigface
<i>Catapodium rigidum</i>	Fern Grass

Scientific Name	Common Name
<i>Centaurium erythraea</i>	Common Centaury
<i>Centaurium tenuiflorum</i>	Slender Centaury
<i>Cerastium glomeratum s.l.</i>	Common Mouse-ear Chickweed
<i>Cerastium glomeratum s.s.</i>	Sticky Mouse-ear Chickweed
<i>Cerastium pumilum</i>	Curtis's Mouse-ear Chickweed
<i>Chenopodium album</i>	Fat Hen
<i>Cicendia filiformis</i>	Slender Cicendia
<i>Ciclospermum leptophyllum</i>	Slender Celery
<i>Cirsium vulgare</i>	Spear Thistle
<i>Conyza bonariensis</i>	Flaxleaf Fleabane
<i>Conyza spp.</i>	Fleabane
<i>Conyza sumatrensis</i>	Tall Fleabane
<i>Coprosma repens</i>	Mirror Bush
<i>Cotula coronopifolia</i>	Water Buttons
<i>Cupressus macrocarpa</i>	Monterey Cypress
<i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch
<i>Cyperus congestus</i>	Dense Flat-sedge
<i>Cyperus eragrostis</i>	Drain Flat-sedge
<i>Cyperus tenellus</i>	Tiny Flat-sedge
<i>Dactylis glomerata</i>	Cocksfoot
<i>Delairea odorata</i>	Cape Ivy
<i>Digitaria sanguinalis</i>	Summer Grass
<i>Echinochloa crus-galli</i>	Barnyard Grass
<i>Echium plantagineum</i>	Paterson's Curse
<i>Ehrharta calycina</i>	Perennial Veldt-grass
<i>Ehrharta erecta</i> var. <i>erecta</i>	Panic Veldt-grass
<i>Ehrharta longiflora</i>	Annual Veldt-grass
<i>Eragrostis curvula</i>	African Love-grass
<i>Erodium cicutarium</i>	Common Heron's-bill
<i>Festuca arundinacea</i>	Tall Fescue
<i>Galium murale</i>	Small Goosegrass

Scientific Name	Common Name
<i>Gamochaeta americana</i>	Spiked Cudweed
<i>Gamochaeta purpurea</i> s.s.	Spiked Cudweed
<i>Gazania linearis</i>	Gazania
<i>Hedera helix</i>	English Ivy
<i>Holcus lanatus</i>	Yorkshire Fog
<i>Hordeum hystrich</i>	Mediterranean Barley-grass
<i>Hordeum leporinum</i>	Barley-grass
<i>Hordeum marinum</i>	Sea Barley-grass
<i>Hypericum perforatum</i> subsp. <i>veronense</i>	St John's Wort
<i>Hypochoeris glabra</i>	Smooth Cat's-ear
<i>Hypochoeris radicata</i>	Cat's Ear
<i>Hypochoeris</i> spp.	Cat's Ear
<i>Isolepis hystrix</i>	Awned Club-sedge
<i>Juncus acutus</i> subsp. <i>acutus</i>	Sharp Rush
<i>Juncus articulatus</i>	Jointed Rush
<i>Juncus capitatus</i>	Capitate Rush
<i>Lagurus ovatus</i>	Hare's-tail Grass
<i>Leontodon taraxacoides</i> subsp. <i>taraxacoides</i>	Hairy Hawkbit
<i>Lepidium africanum</i>	Common Peppercress
<i>Lolium perenne</i>	Perennial Rye-grass
<i>Lycium ferocissimum</i>	African Box-thorn
<i>Malva parviflora</i>	Small-flower Mallow
<i>Medicago polymorpha</i>	Burr Medic
<i>Melilotus indicus</i>	Sweet Melilot
<i>Modiola caroliniana</i>	Red-flower Mallow
<i>Nassella trichotoma</i>	Serrated Tussock
<i>Oenothera stricta</i> subsp. <i>stricta</i>	Common Evening-primrose
<i>Onopordum acanthium</i> subsp. <i>acanthium</i>	Scotch Thistle
<i>Parentucellia latifolia</i>	Red Bartsia
<i>Parentucellia viscosa</i>	Yellow Bartsia
<i>Paronychia brasiliiana</i>	Whitlow Wort

Scientific Name	Common Name
<i>Paspalum distichum</i>	Water Couch
<i>Pennisetum clandestinum</i>	Kikuyu
<i>Petrorhagia dubia</i>	Velvety Pink
<i>Phalaris aquatica</i>	Toowoomba Canary-grass
<i>Phalaris minor</i>	Lesser Canary-grass
<i>Phytolacca octandra</i>	Red-ink Weed
<i>Pinus radiata</i>	Radiata Pine
<i>Plantago coronopus</i>	Buck's-horn Plantain
<i>Plantago coronopus</i> subsp. <i>coronopus</i>	Buck's-horn Plantain
<i>Plantago lanceolata</i>	Ribwort
<i>Poa annua</i>	Annual Meadow-grass
<i>Poa bulbosa</i>	Bulbous Meadow-grass
<i>Polycarpon tetraphyllum</i>	Four-leaved Allseed
<i>Polygonum aviculare</i> s.l.	Prostrate Knotweed
<i>Polygonum aviculare</i> s.s.	Hogweed
<i>Polypogon monspeliensis</i>	Annual Beard-grass
<i>Romulea rosea</i>	Onion Grass
<i>Rostraria cristata</i>	Annual Cat's-tail
<i>Rubus fruticosus</i> spp. agg.	Blackberry
<i>Rumex conglomeratus</i>	Clustered Dock
<i>Rumex crispus</i>	Curled Dock
<i>Rumex obtusifolius</i> subsp. <i>obtusifolius</i>	Broad-leaf Dock
<i>Rumex</i> spp. (naturalised)	Dock (naturalised)
<i>Sagina apetala</i>	Common Pearlwort
<i>Senecio elegans</i>	Purple Groundsel
<i>Senecio jacobaea</i>	Ragwort
<i>Setaria pumila</i> subsp. <i>pumila</i>	Pale Pigeon-grass
<i>Silene gallica</i> var. <i>quinquevulnera</i>	Spotted Catchfly
<i>Silene</i> spp.	Catchfly
<i>Solanum linnaeanum</i>	Apple of Sodom
<i>Solanum nigrum</i> s.s.	Black Nightshade

Scientific Name	Common Name
<i>Solanum nigrum</i> sensu Willis (1972)	Black Nightshade
<i>Soliva sessilis</i>	Jo Jo
<i>Sonchus asper</i> s.l.	Rough Sow-thistle
<i>Sonchus asper</i> s.s.	Rough Sow-thistle
<i>Sonchus asper</i> subsp. <i>asper</i>	Rough Sow-thistle
<i>Sonchus oleraceus</i>	Common Sow-thistle
<i>Spergularia media</i> s.s.	Greater Sea-spurrey
<i>Sporobolus africanus</i>	Rat-tail Grass
<i>Stellaria media</i>	Chickweed
<i>Stenotaphrum secundatum</i>	Buffalo Grass
<i>Taraxacum officinale</i> spp. agg.	Garden Dandelion
<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover
<i>Trifolium campestre</i> var. <i>campestre</i>	Hop Clover
<i>Trifolium cernuum</i>	Drooping-flower Clover
<i>Trifolium dubium</i>	Suckling Clover
<i>Trifolium fragiferum</i> var. <i>fragiferum</i>	Strawberry Clover
<i>Trifolium repens</i> var. <i>repens</i>	White Clover
<i>Trifolium</i> spp.	Clover
<i>Trifolium subterraneum</i>	Subterranean Clover
<i>Ulex europaeus</i>	Gorse
<i>Urtica urens</i>	Small Nettle
<i>Vellereophyton dealbatum</i>	White Cudweed
<i>Verbascum virgatum</i>	Twiggy Mullein
<i>Vicia hirsuta</i>	Tiny Vetch
<i>Vicia sativa</i>	Common Vetch
<i>Vicia sativa</i> subsp. <i>nigra</i>	Narrow-leaf Vetch
<i>Vulpia bromoides</i>	Squirrel-tail Fescue
<i>Vulpia muralis</i>	Wall Fescue
<i>Vulpia myuros</i>	Rat's-tail Fescue
<i>Vulpia myuros</i> f. <i>myuros</i>	Rat's-tail Fescue
<i>Vulpia</i> spp.	Fescue

**Appendix D**

**Fauna Species Known or Predicted to  
Occur Within 5 km of the Study Area  
(All Results)**



**Key to Table:**

AVW	Information sourced from the Atlas of Victorian Wildlife database
PMST	Information sourced from the EPBC Protected Matters Search Tool
EPBC	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
FFG	Victorian <i>Flora and Fauna Guarantee Act 1988</i>
DSE	DSE List of threatened fauna in Victoria (DSE 2003)
CR	critically endangered
EN	endangered
VU	vulnerable
NT	near threatened (Note: this is not considered by DSE to be a category of threat. It is included here to show the full range of species that may occur within the study area and that are included on authoritative lists).
L	listed
nom	Currently nominated for listing.
*	Introduced, non-indigenous species

Species Group	Common name	Scientific Name	Source	EPBC	FFG	DSE	This study	Significance
birds	Little Penguin	<i>Eudyptula minor</i>	AVW, BA					L
	Emu	<i>Dromaius novaehollandiae</i>	AVW, BA				Seen	L
	Brown Quail	<i>Coturnix ypsilophora</i>	AVW			NT		R
	Peaceful Dove	<i>Geopelia striata</i>	AVW					L
	Common Bronzewing	<i>Phaps chalcoptera</i>	AVW, BA					L
	Purple Swamphen	<i>Porphyrio porphyrio</i>	AVW, BA					L
	Eurasian Coot	<i>Fulica atra</i>	AVW, BA					L
	Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	AVW					L
	Hoary-headed Grebe	<i>Poliocephalus poliocephalus</i>	AVW, BA					L
	Fluttering Shearwater	<i>Puffinus gavia</i>	AVW, BA					L
	Sooty Shearwater	<i>Puffinus griseus</i>	AVW					L
	Short-tailed Shearwater	<i>Puffinus tenuirostris</i>	AVW, BA					L
	Southern Giant-Petrel	<i>Macronectes giganteus</i>	PMST	EN	L	VU		N
	Northern Giant-Petrel	<i>Macronectes halli</i>	PMST	VU	L	NT		N
	Shy Albatross	<i>Diomedea cauta</i>	PMST	VU	L	VU	Seen	N
	Salvin's Albatross	<i>Thalassarche salvini</i>	PMST	VU				N
	Light-mantled Sooty Albatross	<i>Phoebetria palpebrata</i>	AVW		L	VU		N
	Southern Royal Albatross	<i>Diomedea epomophora</i>	PMST	VU	L	VU		N
	Northern Royal Albatross	<i>Diomedea sanfordi</i>	PMST	EN	L	VU		N
	Campbell Albatross	<i>Thalassarche impavida</i>	PMST	EN				N

Species Group	Common name	Scientific Name	Source	EPBC	FFG	DSE	This study	Significance
	Buller's Albatross	<i>Diomedea bulleri</i>	PMST	VU	L			N
	Gibson's Albatross	<i>Diomedea gibsoni</i>	PMST		L			N
	Antipodean Albatross	<i>Diomedea antipodensis</i>	PMST	VU	?	?		N
	Great Cormorant	<i>Phalacrocorax carbo</i>	AVW				Seen	L
	Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	AVW					L
	Pied Cormorant	<i>Phalacrocorax varius</i>	AVW, BA			NT		R
	Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>	AVW					L
	Darter	<i>Anhinga melanogaster</i>	AVW, BA					L
	Australasian Gannet	<i>Morus serrator</i>	AVW, BA				Seen	L
	Australian Pelican	<i>Pelecanus conspicillatus</i>	AVW, BA					L
	Whiskered Tern	<i>Chlidonias hybridus</i>	AVW		NT			R
	Caspian Tern	<i>Sterna caspia</i>	AVW	L	NT			S
	Crested Tern	<i>Sterna bergii</i>	AVW, BA				Seen	L
	Common Tern	<i>Sterna hirundo</i>	AVW, BA					L
	Silver Gull	<i>Larus novaehollandiae</i>	AVW, BA				Seen	L
	Pacific Gull	<i>Larus pacificus</i>	AVW, BA		NT	Seen		R
	Kelp Gull	<i>Larus dominicanus</i>	AVW, BA					L
	Ruddy Turnstone	<i>Arenaria interpres</i>	AVW					L
	Pied Oystercatcher	<i>Haematopus longirostris</i>	AVW, BA					L
	Masked Lapwing	<i>Vanellus miles</i>	AVW, BA				Seen	L
	Hooded Plover	<i>Thinornis rubricollis</i>	AVW	L	VU			N
	Double-banded Plover	<i>Charadrius bicinctus</i>	AVW					L
	Red-capped Plover	<i>Charadrius ruficapillus</i>	AVW, BA				Seen	L
	Black-winged Stilt	<i>Himantopus himantopus</i>	AVW, BA					L
	Banded Stilt	<i>Cladorhynchus leucocephalus</i>	AVW					L
	Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>					Seen	L
	Eastern Curlew	<i>Numenius madagascariensis</i>	AVW		NT			R
	Bar-tailed Godwit	<i>Limosa lapponica</i>	AVW					L
	Common Greenshank	<i>Tringa nebularia</i>	AVW					L
	Curlew Sandpiper	<i>Calidris ferruginea</i>	AVW					L

Species Group	Common name	Scientific Name	Source	EPBC	FFG	DSE	This study	Significance
	Red-necked Stint	<i>Calidris ruficollis</i>	AVW				Seen	L
	Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	AVW					L
	Red Knot	<i>Calidris canutus</i>	AVW			NT		R
	Great Knot	<i>Calidris tenuirostris</i>	AVW	L	EN			S
	Broad-billed Sandpiper	<i>Limicola falcinellus</i>	AVW					L
	Pectoral Sandpiper	<i>Calidris melanotos</i>	AVW			NT		R
	Latham's Snipe	<i>Gallinago hardwickii</i>	BA			NT		R
	Australian Painted Snipe	<i>Rostratula australis</i>	PMST	VU	L	CR		N
	Australian White Ibis	<i>Threskiornis molucca</i>	AVW, BA					L
	Straw-necked Ibis	<i>Threskiornis spinicollis</i>	AVW, BA					L
	Royal Spoonbill	<i>Platalea regia</i>	AVW, BA			VU		S
	Yellow-billed Spoonbill	<i>Platalea flavipes</i>	AVW					L
	Little Egret	<i>Egretta garzetta</i>	AVW	L	EN			S
	Great Egret	<i>Ardea alba</i>	AVW	L	VU			S
	Cattle Egret	<i>Ardea ibis</i>	AVW, BA					L
	White-faced Heron	<i>Egretta novaehollandiae</i>	AVW, BA				Seen	L
	Nankeen Night Heron	<i>Nycticorax caledonicus</i>	BA			NT		R
	Australian Wood Duck	<i>Chenonetta jubata</i>	AVW					L
	Black Swan	<i>Cygnus atratus</i>	AVW, BA				Seen	L
	Australian Shelduck	<i>Tadorna tadornoides</i>	AVW, BA					L
	Pacific Black Duck	<i>Anas superciliosa</i>	AVW, BA				Seen	L
	Chestnut Teal	<i>Anas castanea</i>	AVW, BA				Seen	L
	Grey Teal	<i>Anas gracilis</i>	AVW, BA					L
	Australasian Shoveler	<i>Anas rhynchos</i>	AVW			VU		S
	Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	AVW					L
	Freckled Duck	<i>Stictonetta naevosa</i>	AVW	L	EN			S
	Hardhead	<i>Aythya australis</i>	AVW			VU		S
	Blue-billed Duck	<i>Oxyura australis</i>	AVW	L	EN			S
	Musk Duck	<i>Biziura lobata</i>	AVW, BA			VU		S
	Swamp Harrier	<i>Circus approximans</i>	AVW, BA					L
	Grey Goshawk	<i>Accipiter novaehollandiae</i>	AVW, BA	L	VU			S

Species Group	Common name	Scientific Name	Source	EPBC	FFG	DSE	This study	Significance
	Brown Goshawk	<i>Accipiter fasciatus</i>	AVW, BA				L	
	Wedge-tailed Eagle	<i>Aquila audax</i>	AVW, BA				L	
	Little Eagle	<i>Hieraetus morphnoides</i>	BA				L	
	White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	AVW, BA	L	VU	Seen	S	
	Whistling Kite	<i>Haliastur sphenurus</i>	AVW				L	
	Australian Hobby	<i>Falco longipennis</i>	AVW, BA				L	
	Peregrine Falcon	<i>Falco peregrinus</i>	AVW, BA				L	
	Black Falcon	<i>Falco subniger</i>	AVW, BA		VU		S	
	Brown Falcon	<i>Falco berigora</i>	AVW, BA				L	
	Nankeen Kestrel	<i>Falco cenchroides</i>	AVW, BA			Seen	L	
	Southern Boobook	<i>Ninox novaeseelandiae</i>	AVW, BA				L	
	Barn Owl	<i>Tyto alba</i>	AVW, BA				L	
	Masked Owl	<i>Tyto novaehollandiae</i>	AVW, BA	L	EN		S	
	Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	AVW, BA			Seen	L	
	Musk Lorikeet	<i>Glossopsitta concinna</i>	AVW, BA				L	
	Yellow-tailed Black-Cockatoo	<i>Calyptorhynchus funereus</i>	AVW, BA				L	
	Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	AVW, BA			Seen	L	
	Galah	<i>Cacatua roseicapilla</i>	AVW, BA			Seen	L	
	Crimson Rosella	<i>Platycercus elegans</i>	AVW, BA			Seen	L	
	Eastern Rosella	<i>Platycercus eximius</i>	AVW, BA			Seen	L	
	Orange-bellied Parrot	<i>Neophema chrysogaster</i>	PMST	EN	L	CR	N	
	Blue-winged Parrot	<i>Neophema chrysostoma</i>	AVW			Seen	L	
	Australian Owlet-nightjar	<i>Aegotheles cristatus</i>	AVW, BA				L	
	Laughing Kookaburra	<i>Dacelo novaeguineae</i>	AVW, BA			Seen	L	
	White-throated Needletail	<i>Hirundapus caudacutus</i>	AVW				L	
	Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>				Heard	L	
	Horsfield's Bronze-cuckoo	<i>Chrysococcyx basalis</i>				Heard	L	
	Shining Bronze-cuckoo	<i>Chrysococcyx lucidus</i>				Heard	L	
	Welcome Swallow	<i>Hirundo neoxena</i>	AVW, BA			Seen	L	
	Fairy Martin	<i>Hirundo ariel</i>	AVW, BA				L	

Species Group	Common name	Scientific Name	Source	EPBC	FFG	DSE	This study	Significance
	Grey Fantail	<i>Rhipidura fuliginosa</i>	AVW, BA				Seen	L
	Willie Wagtail	<i>Rhipidura leucophrys</i>	AVW, BA				Seen	L
	Restless Flycatcher	<i>Myiagra inquieta</i>	AVW, BA					L
	Eastern Yellow Robin	<i>Eopsaltria australis</i>	AVW, BA				Heard	L
	Golden Whistler	<i>Pachycephala pectoralis</i>	AVW, BA				Heard	L
	Rufous Whistler	<i>Pachycephala rufiventris</i>	AVW, BA					L
	Grey Shrike-thrush	<i>Colluricincla harmonica</i>	AVW, BA				Heard	L
	Magpie-lark	<i>Grallina cyanoleuca</i>	AVW, BA				Seen	L
	Eastern Whipbird	<i>Psophodes olivaceus</i>	AVW, BA				Heard	L
	Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	AVW, BA				Seen	L
	White-fronted Chat	<i>Epthianura albifrons</i>	AVW				Seen	L
	Weebill	<i>Smicromis brevirostris</i>	AVW, BA					L
	Striated Thornbill	<i>Acanthiza lineata</i>	AVW, BA					L
	Yellow Thornbill	<i>Acanthiza nana</i>	AVW, BA					L
	Brown Thornbill	<i>Acanthiza pusilla</i>	AVW, BA				Seen	L
	Buff-rumped Thornbill	<i>Acanthiza reguloides</i>	AVW, BA					L
	Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	BA					L
	White-browed Scrubwren	<i>Sericornis frontalis</i>	AVW, BA				Seen	L
	Striated Fieldwren	<i>Calamanthus fuliginosus</i>					Seen	L
	Superb Fairy-wren	<i>Malurus cyaneus</i>	AVW, BA				Seen	L
	White-throated Treecreeper	<i>Cormobates leucophaeus</i>	AVW, BA					L
	Spotted Pardalote	<i>Pardalotus punctatus</i>	AVW				Heard	L
	Striated Pardalote	<i>Pardalotus striatus</i>					Heard	L
	Silveryeye	<i>Zosterops lateralis</i>	AVW, BA					L
	White-naped Honeyeater	<i>Melithreptus lunatus</i>	AVW, BA				Heard	L
	Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	BA					L
	Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	AVW, BA				Heard	L
	Regent Honeyeater	<i>Xanthomyza phrygia</i>	PMST	EN	L	CR		N
	Lewin's Honeyeater	<i>Meliphaga lewinii</i>	AVW, BA					L
	Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	AVW, BA				Heard	L
	White-eared Honeyeater	<i>Lichenostomus leucotis</i>	AVW, BA					L

Species Group	Common name	Scientific Name	Source	EPBC	FFG	DSE	This study	Significance
	Crescent Honeyeater	<i>Phylidonyris pyrrhoptera</i>	AVW, BA				L	
	New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>	AVW, BA			Seen	L	
	Noisy Miner	<i>Manorina melanocephala</i>	AVW, BA			Seen	L	
	Little Wattlebird	<i>Anthochaera chrysoptera</i>	AVW, BA			Seen	L	
	Red Wattlebird	<i>Anthochaera carunculata</i>	AVW, BA			Heard	L	
	Richard's Pipit	<i>Anthus novaeseelandiae</i>	AVW, BA			Seen	L	
	Red-browed Finch	<i>Neochmia temporalis</i>	AVW, BA				L	
	Olive-backed Oriole	<i>Oriolus sagittatus</i>	AVW, BA				L	
	Australian Raven	<i>Corvus coronoides</i>	AVW, BA				L	
	Little Raven	<i>Corvus mellori</i>	AVW, BA			Heard	L	
	Forest Raven	<i>Corvus tasmanicus</i>	AVW, BA			Heard	L	
	White-winged Chough	<i>Corcorax melanorhamphos</i>	AVW, BA				L	
	Pied Currawong	<i>Strepera graculina</i>	AVW, BA				L	
	Grey Currawong	<i>Strepera versicolor</i>	AVW, BA			Heard	L	
	Grey Butcherbird	<i>Cracticus torquatus</i>	AVW, BA			Heard	L	
	Australian Magpie	<i>Gymnorhina tibicen</i>	AVW, BA			Seen	L	
	Skylark	<i>Alauda arvensis</i>		*		Heard		None
	Spotted Turtle-Dove	<i>Streptopelia chinensis</i>	AVW, BA		*	Seen		None
	European Greenfinch	<i>Carduelis chloris</i>	AVW, BA		*			None
	Common Blackbird	<i>Turdus merula</i>	AVW, BA		*	Seen		None
	Eurasian Tree Sparrow	<i>Passer montanus</i>	AVW, BA		*			None
	House Sparrow	<i>Passer domesticus</i>	AVW, BA		*	Seen		None
	Common Pheasant	<i>Phasianus colchicus</i>	BA					None
	Common Myna	<i>Acridotheres tristis</i>	AVW, BA		*			None
	Common Starling	<i>Sturnus vulgaris</i>	AVW, BA		*			None
mammals	Short-beaked Echidna	<i>Tachyglossus aculeatus</i>	AVW			Seen	L	
	Spot-tailed Quoll	<i>Dasyurus maculatus</i>	PMST	EN	L	EN		N
	Agile Antechinus	<i>Antechinus agilis</i>	AVW					L
	Long-nosed Bandicoot	<i>Perameles nasuta</i>	AVW					L
	Common Brushtail Possum	<i>Trichosurus vulpecula</i>	AVW					L

Species Group	Common name	Scientific Name	Source	EPBC	FFG	DSE	This study	Significance
	Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	AVW				L	
	Sugar Glider	<i>Petaurus breviceps</i>	AVW				L	
	Eastern Pygmy-possum	<i>Cercartetus nanus</i>	AVW				L	
	Koala	<i>Phascolarctos cinereus</i>	AVW				R	
	Common Wombat	<i>Vombatus ursinus</i>	AVW				L	
	Long-nosed Potoroo	<i>Potorous tridactylus</i>	PMST	VU	L	EN	N	
	Black Wallaby	<i>Wallabia bicolor</i>	AVW				Seen	L
	Eastern Grey Kangaroo	<i>Macropus giganteus</i>	AVW				Seen	L
	Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	PMST	VU	L	VU	N	
	Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>	AVW				L	
	Chocolate Wattled Bat	<i>Chalinolobus morio</i>	AVW				L	
	Southern Forest Bat	<i>Vespadelus regulus</i>	AVW				L	
	Little Forest Bat	<i>Vespadelus vulturnus</i>	AVW				L	
	Swamp Rat	<i>Rattus lutreolus</i>	AVW				L	
	New Holland Mouse	<i>Pseudomys novaehollandiae</i>	AVW		L	EN	S	
	Smoky Mouse	<i>Pseudomys fumeus</i>	PMST	EN	L	EN	N	
	Dingo/Dog (feral)	<i>Canis familiaris</i>	AVW				L	
	Black Rat	<i>Rattus rattus</i>	AVW		*		None	
	Brown Rat	<i>Rattus norvegicus</i>	AVW		*		None	
	House Mouse	<i>Mus musculus</i>	AVW		*		None	
	European Rabbit	<i>Oryctolagus cuniculus</i>	AVW		*	Seen	None	
	Hog Deer	<i>Cervus porcinus</i>	AVW		*		None	
	Red Fox	<i>Canis vulpes</i>	AVW		*		None	
	Cat (feral)	<i>Felis catus</i>			*	Seen	None	
	unidentified brushtail possum		AVW					
	unidentified Rattus		AVW					
	Southern Elephant Seal	<i>Mirounga leonina</i>	AVW	VU			N	
	Leopard Seal	<i>Hydrurga leptonyx</i>	AVW				L	
	Southern Right Whale	<i>Eubalaena australis</i>	AVW, PMST	EN	L	CR	N	
	Blue Whale	<i>Balaenoptera musculus</i>	PMST	EN	L	CR	N	
	Humpback Whale	<i>Megaptera novaeangliae</i>	PMST	VU	L	VU	N	

Species Group	Common name	Scientific Name	Source	EPBC	FFG	DSE	This study	Significance
	Pygmy Sperm Whale	<i>Kogia breviceps</i>	AVW				L	
	Strap-toothed Whale	<i>Mesoplodon layardi</i>	AVW				L	
	Long-finned Pilot Whale	<i>Globicephala melas</i>	AVW				L	
	Common Dolphin	<i>Delphinus delphis</i>	AVW				L	
reptiles	Common Long-necked Tortoise	<i>Chelodina longicollis</i>	AVW				L	
	White's Skink	<i>Egernia whitii</i>	AVW				L	
	Garden Skink	<i>Lampropholis guichenoti</i>	AVW				L	
	Blotched Blue-tongued Lizard	<i>Tiliqua nigrolutea</i>	AVW				L	
	Common Blue-tongued Lizard	<i>Tiliqua scincoides</i>	AVW				L	
	Lowland Copperhead	<i>Austrelaps superbus</i>	AVW				L	
	White-lipped Snake	<i>Drysdalia coronoides</i>	AVW				L	
	Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>	AVW				L	
	unidentified copperhead	<i>Austrelaps sp.</i>	AVW					
	unidentified skink						Seen	
frogs	Southern Bullfrog	<i>Limnodynastes dumerilii</i>	AVW				L	
	Striped Marsh Frog	<i>Limnodynastes peronii</i>	AVW				L	
	Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>	AVW				L	
	Haswell's Froglet	<i>Paracrinia haswelli</i>	AVW				L	
	Common Froglet	<i>Crinia signifera</i>	AVW				Heard	L
	Green and Golden Bell Frog	<i>Litoria aurea</i>	AVW, PMST	VU		NT		N
	Southern Brown Tree Frog	<i>Litoria ewingii</i>	AVW				Heard	L
	Growling Grass Frog	<i>Litoria raniformis</i>	AVW, PMST	VU	L	EN		N
	Verreaux's Tree Frog	<i>Litoria verreauxii</i>	AVW					L

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**Appendix B**

**Landscape Assessment Report**

**GHD Pty Ltd**





CLIENTS | PEOPLE | PERFORMANCE

## **Wellington Shire Council**

Landscape Values Assessment

The Honeysuckles to Paradise Beach

November 2007







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# 1. Introduction

## 1.1 Background

GHD was commissioned by the Wellington Coast Shire Council to provide an assessment of landscape values as part of a land capability assessment for an area between The Honeysuckles and Paradise Beach. The study area is located approximately 30 km south east of Sale and approximately 220 km east of the Melbourne CBD.

## 1.2 Purpose

The purpose of the report is to ascertain the landscape significance and values within the study area. The assessment is required because there is potential for landscape values to be impacted by future development within the study area.

## 1.3 Landscape Context

This coastal area is located on 90-Mile Beach dune system located between the Bass Straight and Lake Reeve. Lake Reeve forms part of the Gippsland Lakes Coastal Park. Adjacent areas inland from lake Reeve are largely rural in character, used predominantly for agriculture and livestock.



## 2. Assessment Area

The area for this landscape values assessment extends from Paradise Beach & Golden Beach in the north east to The Honeysuckles in the south west. Golden Beach and Paradise Beach have the highest concentration of residential development with some local commercial and community facilities. The Honeysuckles also contains residential development. Areas between these two locations are predominantly undeveloped, with the exception of Glomar Beach, which contains scattered dwellings.

Shoreline Drive is a sealed single lane road extending the entire length of the coastline adjacent to the coastal foredune. The dunes contain “understorey cleared” camping grounds within Melaleuca vegetation communities, and these are managed by Parks Victoria.

The Wellington Planning Scheme includes overlays which, in part, acknowledge the landscape values of the area. These overlays also include planning permit requirements and decision guidelines that partly relate to the protection of landscape values in implementing land use, development and subdivision. These are ESO1: Coastal and Gippsland Lakes Environs and ESO2: Wetlands. The ESO1 is particularly relevant to the landscape character of the area.

### **Environmental Significance Overlay 1: Coastal and Gippsland Lakes Environs**

*Coverage:* The entire area subject to this landscape assessment.

*Items of Significance:* The Ninety Mile Beach and Gippsland Lakes and their environs are some of the most significant environmental, landscape, and recreational areas within the State of Victoria. The coast and lakes systems comprise easily disturbed ecosystems susceptible to soil erosion, ground and surface water pollution, and habitat disturbance. In particular, areas which have been developed as coastal settlements and towns along the Ninety Mile Beach are beginning to cause significant environmental management problems, including loss of water and soil quality, as well as loss of native vegetation.

*Relevant Objectives:* To protect and enhance the visual amenity and landscape of the coastal area.

*Decision Guidelines:* Before deciding on an application, the responsible authority must consider, *inter alia*, whether the proposal:

- » Minimises the impact of construction (including construction of roads) within prominent areas such as hillsides, promontories, ridge-lines and headlands;
- » Ensures that the scale, height and materials of buildings complements the coastal environment and local township character.



### 3. Landscape Values Assessment Methodology

The assessment of landscape values involved a site visit. During this site visit the extent of the area was explored by road. The site was categorised into broad landscape character groupings where similarities and differences in landscape features were observed. These assisted in defining the criteria for landscape qualities. The assessment is a preliminary study only.

The criteria for assessing the landscape values includes the following:

#### 3.1 Visual Qualities.

Visual qualities refer to the scenic value of the landscape:

- » High scenic value: The landscape has strong contrast between the foreground, middle and background through topography and vegetation cover;
- » Moderate scenic value: The landscape has less variation but retains some change between foreground- background with respect to topography and vegetation; and
- » Low scenic value: The landscape has a low contrast topographically between foreground- background. Predominately low scenic value landscapes are flat or have minimal vegetation.

#### 3.2 Landscape Character

Landscape character is the sum of various landscape features in a defined location, the nature of which may be the result of the action and interaction of natural and/or human factors.

#### 3.3 Key Landscape Features

The elements that contribute to landscape character include vegetation, topography and landform, waterways, geology, soils, and human interaction, land use and development.



## 4. Specific Landscape Assessment Areas

As a result of the site analysis, the landscape has been divided into landscape character groups, where the observed landscape demonstrates groupings of characteristics that have relatively homogeneous characteristics.

- » Group 1: Paradise Beach & Golden Beach;
- » Group 2: Delray Beach- Flamingo Beach;
- » Group 3: Glomar Beach;
- » Group 4: Glomar Beach South; and
- » Group 5: The Honeysuckles.



## 5. Paradise Beach & Golden Beach

### 5.1 Visual Qualities

The primary coastal dunes in this location have high visual qualities relating to topographical variations and vegetation. Adjacent urban areas have low to moderate visual qualities relating to the low density residential nature of the landscape.

### 5.2 Landscape Features

#### 5.2.1 Topography and landform

The primary dunes are reasonably pronounced in this area with a number of higher vantage points through Paradise Beach. The topography undulates through the residential areas, with some views west towards Lake Reeve from the most eastern point of Paradise Beach.

#### 5.2.2 Vegetation

The primary dunes are characteristic of an established residential coastal area with a consistent alteration to the coastal landscape through land use, vegetation types and access points to the beach. Vegetation on the edge of the dunes, adjacent to Shoreline Drive, is largely canopy trees with some naturally occurring low lying species. Human activity has reduced the number of naturally occurring low - mid height shrub species; particularly at beach access points. Native vegetation in residential areas has been significantly cleared, and exotic species introduced to create a modified urban landscape consistent with the typical settlement character of the Gippsland region. Coastal salt marsh and estuarine woodland stands occur adjacent to Lake Reeve.

#### 5.2.3 Waterbodies

The coastline is the dominant feature in the area. Lake Reeve to the west forms part of the Gippsland Lakes Coastal Park. Landforms in the area adjacent to the lake are low-lying and subject to flooding and inundation.

### 5.3 Landscape Character

The overall landscape character of the area, therefore, is defined by significant residential development at Golden Beach and Paradise Beach. Golden Beach contains a small commercial area with a service station and general store. Housing in this area is a combination of permanent and holiday housing with gardens that reflect the typical character of coastal settlements in the region.

Roads are largely sealed and constructed without kerb and channel drainage in Golden Beach and mostly unsealed through Paradise Beach.

Golden Beach has the most significant public facilities, including public toilets, community centre, CFA, a coastal reserve providing car parking and access to the beach, and commercial facilities in the main street.

These two established residential areas have the most accessibility to the beach and dunes. A reduction of vegetation diversity and the introduction of more domestic vegetation such as exotic lawn species is characteristic of the subdivided parts of this area.



**Photo 1** Paradise Beach



**Photo 2** Paradise Beach



**Photo 3** Golden Beach



**Photo 4** Paradise Beach

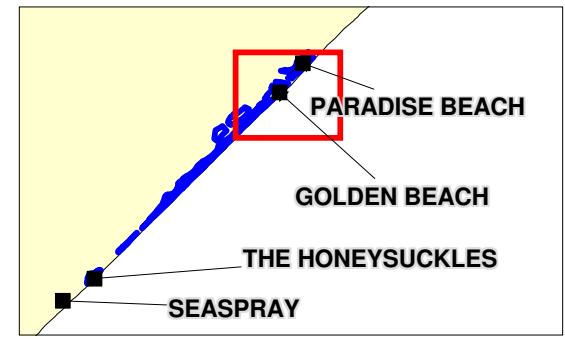
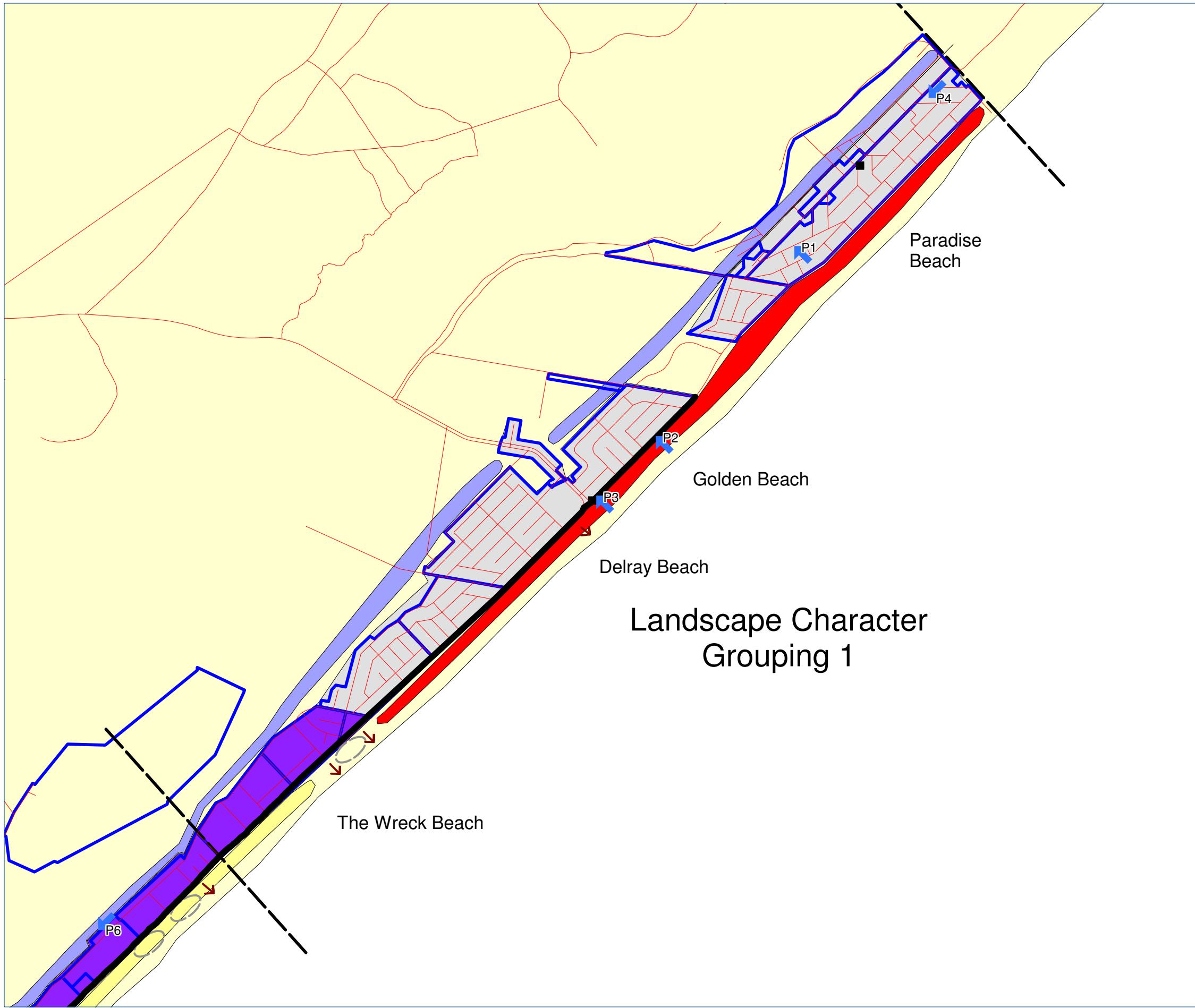
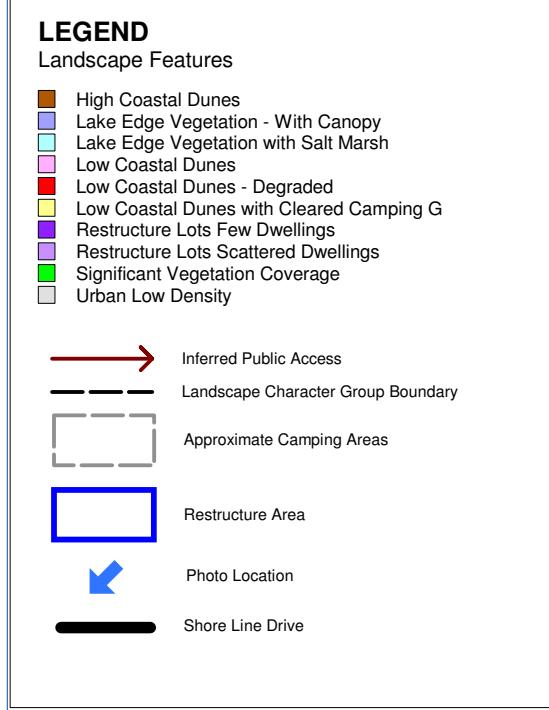
## 5.4 Landscape Values: Opportunities and Constraints

Paradise Beach and Golden Beach have the most significant urban landscape character in the assessment area, and consequently the natural landscape characteristics have less value compared to other areas. In this regard there are few natural landscape elements that are considered worthy of protection from further development in this location. The dune system on



the shoreline side of Shoreline Drive provides a natural landscape backdrop to the residential areas, and this should be managed to retain and protect these values.





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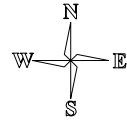


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Title: Area 1 Paradise Beach & Golden Beach

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## 6. Delray Beach - Flamingo Beach

### 6.1 Visual Qualities

The primary coastal dunes of this area have a high visual quality. The secondary dunes, and the area between Shoreline Drive and Lake Reeve, have moderate to low visual qualities. These areas behind the primary dunes are sheltered from the coastline. Although there are occasional views to Lake Reeve; coastal woodland vegetation hinders significant views across the landscape.

### 6.2 Landscape Features

#### 6.2.1 Topography

The area is largely sheltered from the coast by the primary dunes. The landform has little variation in height, generally sloping towards Lake Reeve.

#### 6.2.2 Vegetation

The vegetation in this area is largely coastal woodland. There is evidence of earlier disturbance from clearing when the original subdivision was undertaken. These areas, however, are reasonably regenerated with indigenous species. The earlier disturbance indicates that exotic species may be present in the regenerated vegetation communities, particularly where some clearing remains. In locations less accessible by road, vegetation regeneration has been more prolific.

#### 6.2.3 Waterbodies

The entire area is defined at its inland boundary by Lake Reeve. This accentuates the linear nature of this area.

### 6.3 Landscape Character

The overall landscape character of the area, therefore, is characterised by predominantly regenerated native vegetation in areas previously subdivided for residential development and not yet developed. Some unsealed limebase roads remain passable, however many have also regenerated. Most accessible roads are situated perpendicular to Shoreline Drive and terminate at the edge of the salt marsh area at Lake Reeve. There are few dwellings in the entire area, and only occasional properties have been partly cleared to accommodate private camping or caravans.

The coastal dune system between Shoreline Drive and Bass Straight contains various areas partially cleared for camping grounds. In this area the vegetation is less diverse and mainly consists of canopy species. Where the understorey has been disturbed, exotic grasses dominate. These campsite locations also have access points to the beach. Flamingo Beach has the most public access for this area with a large turning circle car park and access path to the beach.





**Photo 5** View along Shoreline Drive



**Photo 6** Vegetation cleared on track near Lake Reeve



**Photo 7** View along Shoreline Drive



**Photo 8** Flamingo Beach



**Photo 17** View along Shoreline Drive



**Photo 18** View of Lake Reeve

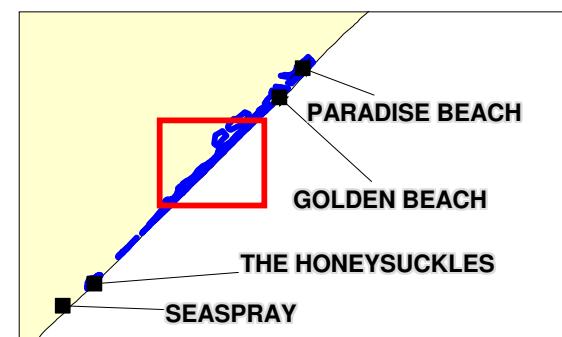
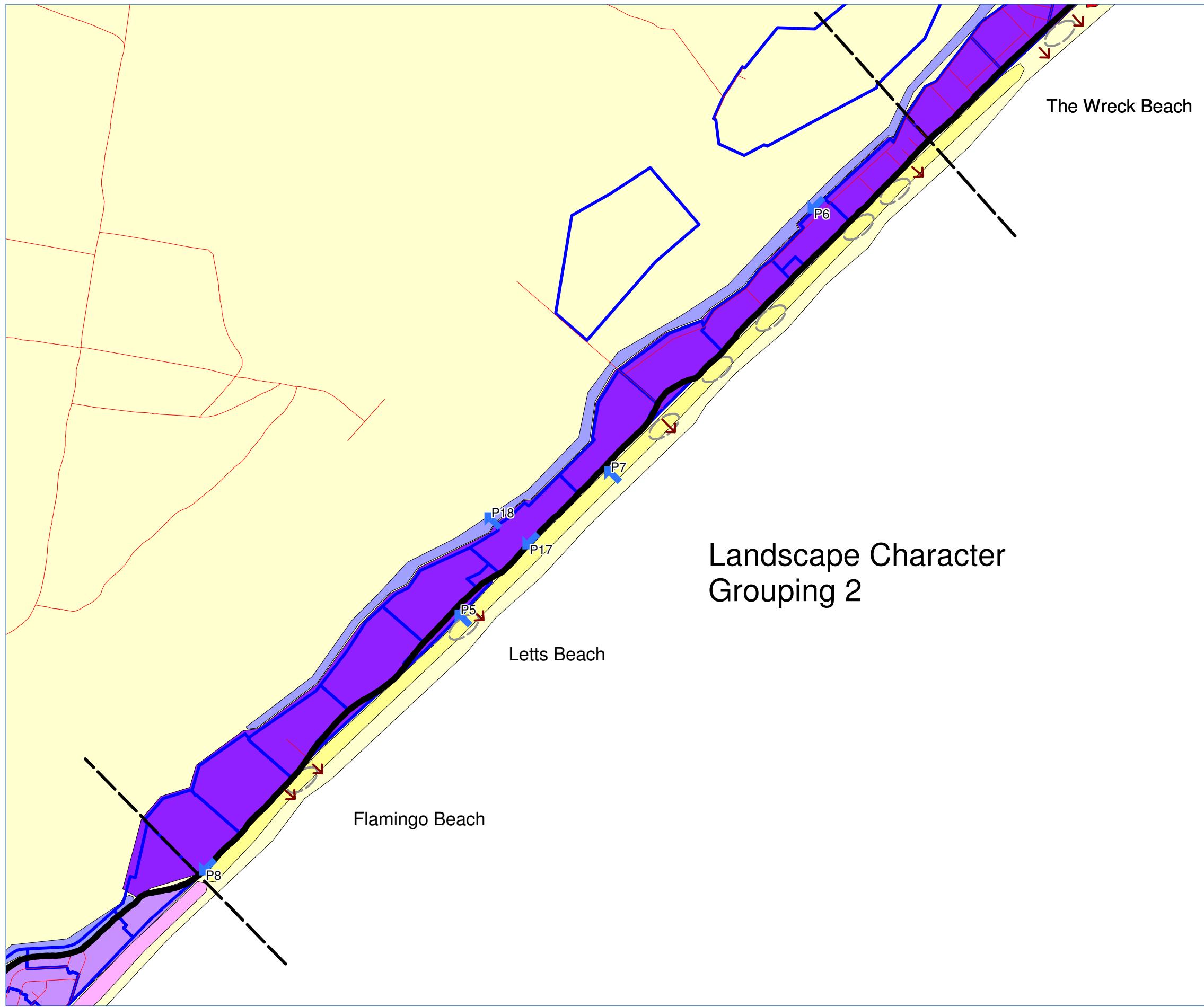


## 6.4 Landscape Values: Opportunities and Constraints

This is a linear section of coastline containing both disturbed and regenerated vegetation between the primary dune area and Lake Reeve.

The primary dunes have a high scenic value and the remaining areas between Shoreline Drive and Lake Reeve have a low to moderate scenic value, resulting from a combination of lack of topographical variation and few external views. The regenerated nature of the vegetation in the landscape, the current low intensity of land use, its contribution to the sense of vegetated coastal gaps between settlements in this location, however, suggests that the overall landscape quality of the area is moderate to high.

These landscape characteristics should be considered for protection from more intense land uses, which could impact on the extent of vegetation coverage in this location.

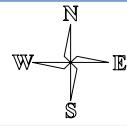


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Title: Area 2 The Wreck Beach - Flamingo Beach			
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## 7. Glomar Beach

### 7.1 Visual Qualities

Glomar Beach contains a scattering of dwellings and cleared roads, with variations in the extent of clearing, influenced by the location of dwellings and intensity of land use on particular properties.

The alignment of Shoreline Drive in this location shifts inland, creating a sense of enclosure to the scattered dwellings and road layout in the area.

There are very few viewlines out and across this landscape and as a result the area has low to moderate visual quality.

### 7.2 Landscape Features

#### 7.2.1 Topography

The landform slopes downwards from the primary dunes to Lake Reeve. The primary dunes are comparatively high.

#### 7.2.2 Vegetation

The vegetation, due to the sheltered nature of the environment, is more varied. Banksia woodland can be observed in proximity to Shoreline Drive. The areas adjacent to the coastal dunes are predominately coastal woodland with lower lying canopy trees of Leptospermum.

Various locations have areas of disturbed vegetation where more recent human activity is associated with dwellings. In other locations, regeneration exists, and some roads that were originally cleared are now broken tracks and largely inaccessible.

### 7.3 Landscape Character

The overall landscape character of the area, therefore, is defined by variations in vegetation and a distinct presence of scattered dwellings nestled behind primary coastal dunes.

The Shoreline Drive alignment also changes to accommodate the subdivision pattern of Glomar behind the primary dunes.





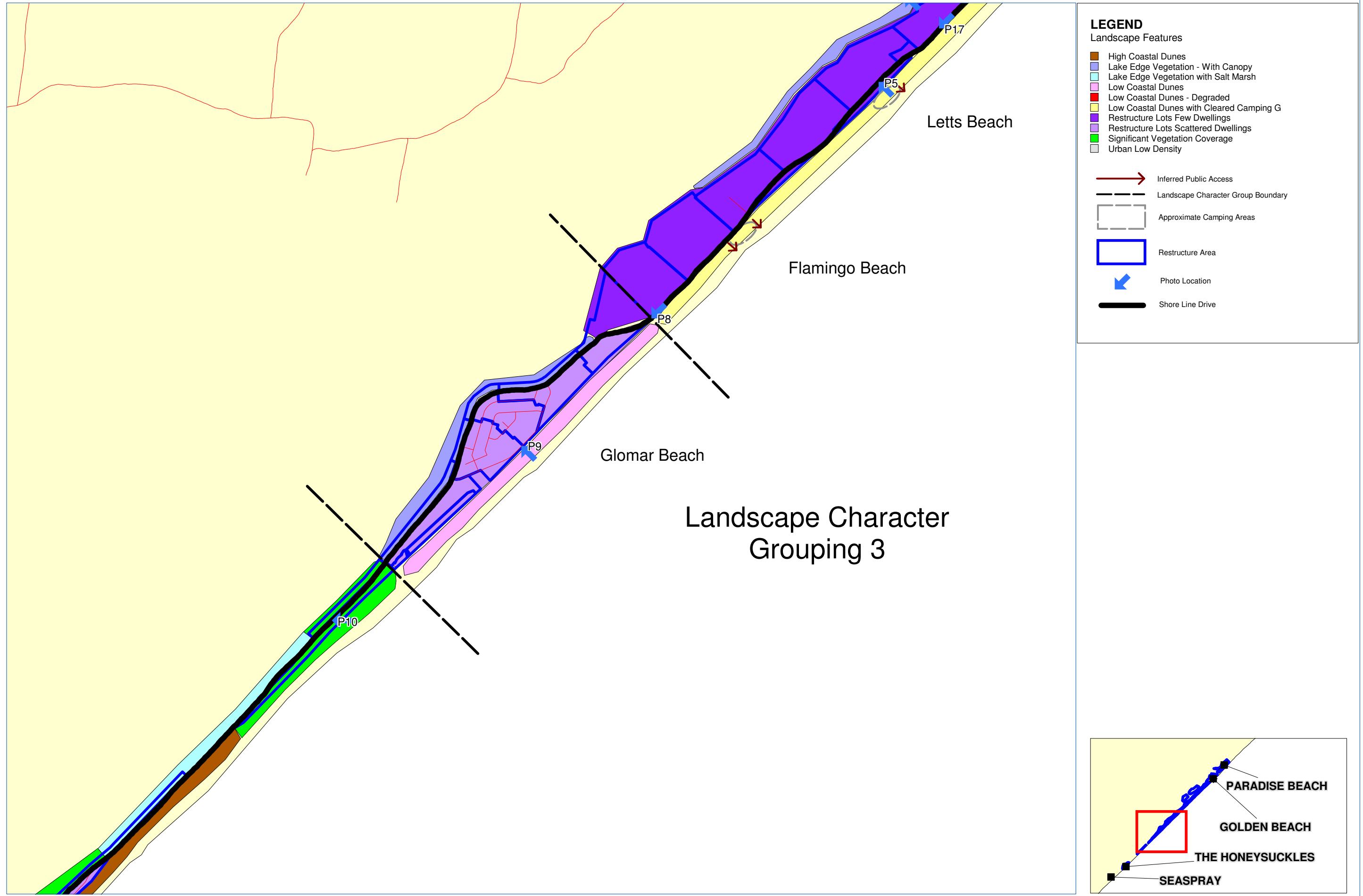
**Photo 9** Scattered dwelling development at Glomar Beach



Photo example of coastal scrub on previously cleared land

## 7.4 Landscape Values: Opportunities and Constraints

Although the area has a low to moderate scenic value, the current landscape character of scattered dwellings in a partly cleared environment may be highly susceptible to change in the event more intense development was to occur.



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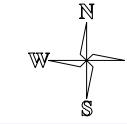


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## 8. Glomar Beach South

### 8.1 Visual Qualities

There is strong variation between middle ground and background landscape elements in this location; creating significant high value landscapes with scenic quality. The extent of land between the primary dunes and Lake Reeve is at its most narrow at this point, creating a more dramatic platform from which to observe the lake.

The landscape is also more open in this area, allowing highly scenic panoramic views north and northwest across Lake Reeve, which is otherwise inaccessible.

### 8.2 Landscape Features

#### 8.2.1 Topography

The primary coastal dunes are also more prominent in this area, as they are comparatively high and immediately adjacent to Shoreline Drive. The difference between the level of the lake & adjacent salt marsh and the height of the dunes is accentuated by the narrow width of the land area containing Shoreline Drive.

#### 8.2.2 Vegetation

Vegetation in this area is more open coastal woodland and low level coastal dune vegetation between Shoreline Drive and Bass Straight. Open salt marsh vegetation and lower lying woodland occurs adjacent to Lake Reeve.

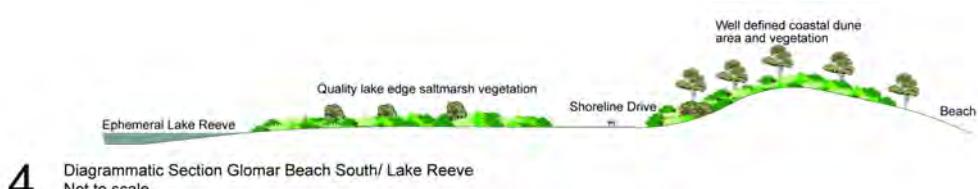
Vegetation on the dune area contains a variety of canopy species, including Banksia, Acacia and Leptospermum species.

#### 8.2.3 Waterbodies

Lake Reeve has a dominant presence in this area. The significant size of the lake system is apparent from the open views available from Shoreline Drive.

### 8.3 Landscape Character

The landscape character of the area, therefore, is typically more open and the natural elements of the landscape are more evident and spectacular, with significant views across Lake Reeve. This area is not disturbed by development.





**Photo 10** Banksias at Glomar Beach



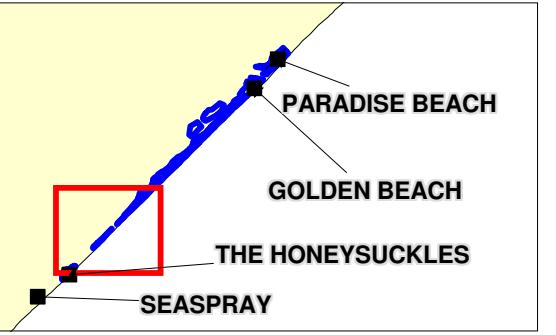
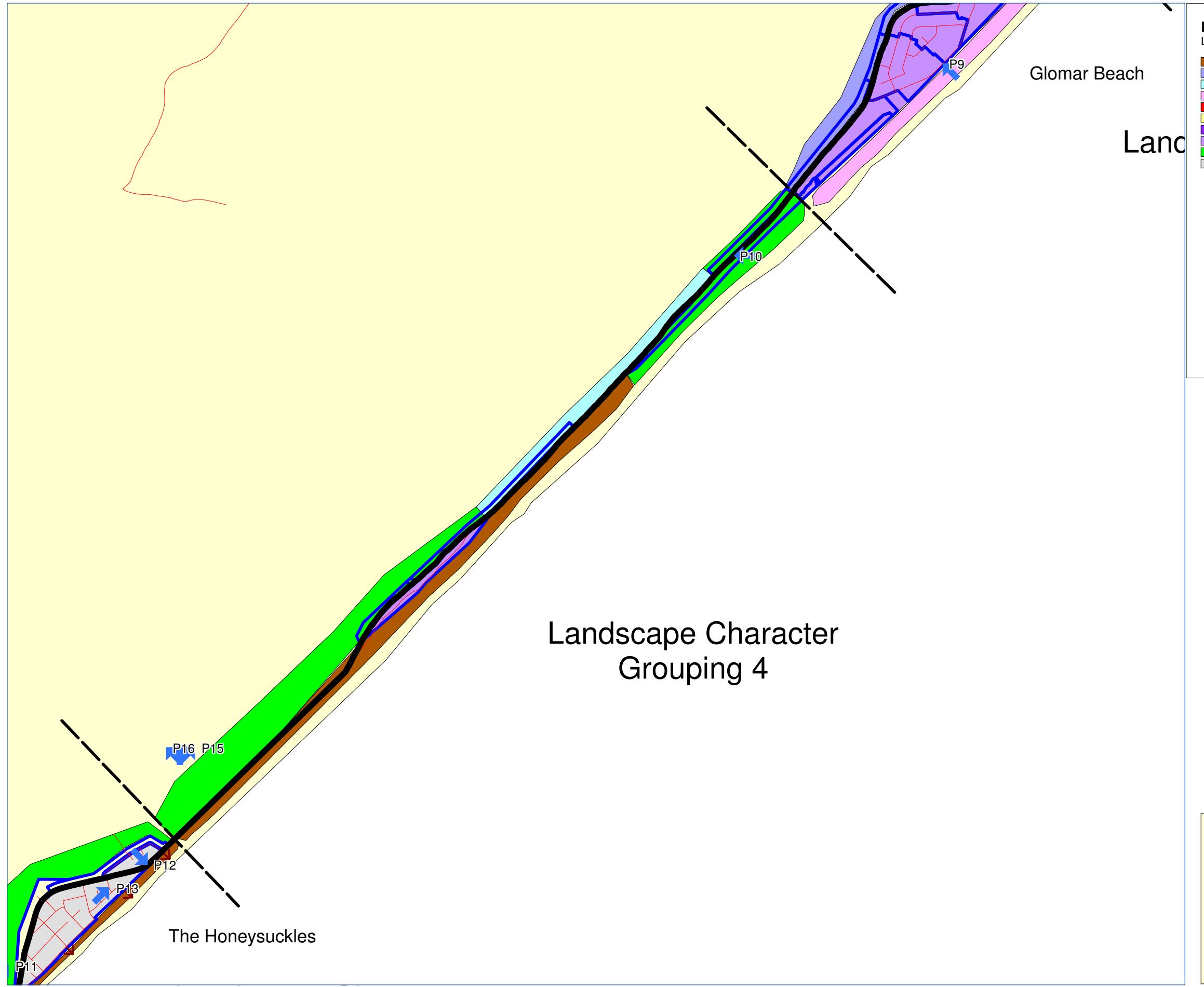
**Photo 15** View to Lake Reeve from Shoreline Drive



**Photo 16** View to Lake Reeve from Shoreline Drive

## 8.4 Landscape Values: Opportunities and Constraints

This is the most significant landscape of the 5 areas, due to its lack of disturbance and scenic qualities. Development should be discouraged in this area to ensure these values are protected.

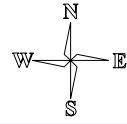


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A3		Scale:	1:30,000
Sh 1 of 1		Rev. 0	







## 9. The Honeysuckles

### 9.1 Visual Qualities

The Honeysuckles has scenic views across Lake Reeve and to the adjacent coastal dunes. The area has a consistent low density of dwellings throughout, nestled within stands of native canopy vegetation. These dwellings are located on a flat plain that contrasts with the adjacent dunes and lake, further emphasising the height of the dunes and the size of the lake. The area has moderate to high scenic values.

### 9.2 Landscape Features

#### 9.2.1 Topography

The primary coastal dunes are comparatively high, and are an extension of the coastal landforms of the adjacent Glomar Beach South area. The flat landscape between the coastal dunes and Lake Reeve widens in this location and this accommodates The Honeysuckles settlement. The alignment of Shoreline Drive in this location shifts inland, creating a sense of enclosure to the dwellings and road layout in the area.

#### 9.2.2 Vegetation

Vegetation in this area consists of open coastal woodland, with understory cleared to accommodate dwellings, with retained canopy trees creating a significant defining contribution to the landscape character of the area. Open salt marsh vegetation occurs adjacently to the lake. Vegetation on the dunes includes coastal dune scrub with comparatively less canopy trees.

#### 9.2.3 Waterbodies

Lake Reeve is relatively close to the edge of development in this area. The lower height salt marsh vegetation enables views across the lake.

### 9.3 Landscape Character

The distinctive character of this area is the heightened coastal dune area and the remnant native canopy vegetation that surrounds dwellings.

The Honeysuckles is also distinguished by its highly scenic interface with Lake Reeve and the primary coastal dunes.

The housing density is greater to that of Glomar Beach and similar to that at Paradise & Golden Beaches. Dwellings are set within the natural landscape features with greater sensitivity, compared to dwellings at Paradise and Golden Beaches.

The public access to the beach area is ill-defined and characterised by informal tracks through primary coastal dunes.



**Photo 11** View of Shoreline Drive towards The Honeysuckles



**Photo 12** Access to beach from The Honeysuckles

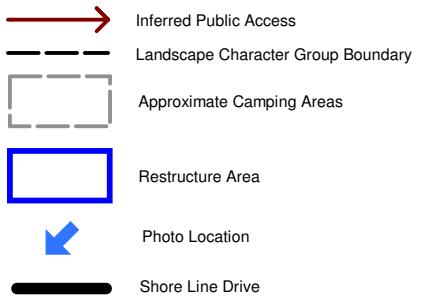


**Photo 13** View to primary dunes from Shoreline Drive

#### 9.4 Landscape Values: Opportunities and Constraints

This area is discreetly set into the surrounding landscape setting and responds to the surrounding scenic values of the coastal dunes and Lake Reeve. The landscape character includes built form that integrates with surrounding retained native canopy vegetation. The current average spacing of development reflects the existing landscape character of the settlement. The landscape may have capacity to accommodate additional dwellings, but this should occur in a manner that is consistent with the existing spacing between dwellings and maximises the sensitive location of dwellings in relation to canopy vegetation.

LEGEND	
Landscape Features	
High Coastal Dunes	
Lake Edge Vegetation - With Canopy	
Lake Edge Vegetation with Salt Marsh	
Low Coastal Dunes	
Low Coastal Dunes - Degraded	
Low Coastal Dunes with Cleared Camping G	
Restructure Lots Few Dwellings	
Restructure Lots Scattered Dwellings	
Significant Vegetation Coverage	
Urban Low Density	



## Landscape Character Grouping 4

P16 P15

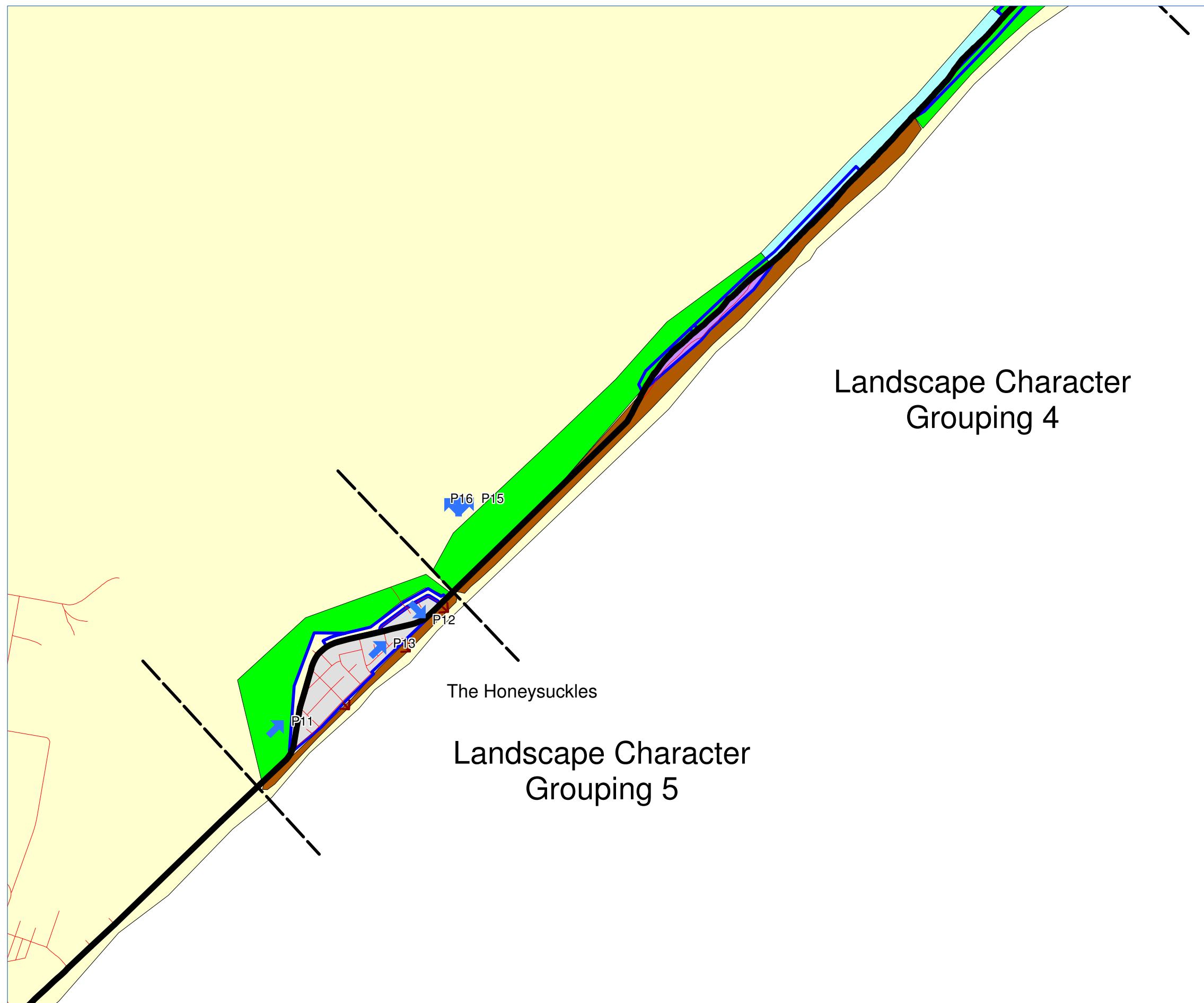
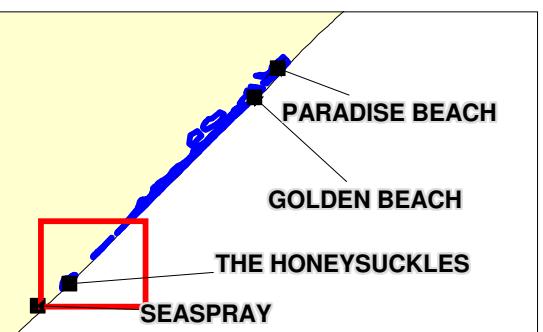
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P13

The Honeysuckles

## Landscape Character Grouping 5

P11



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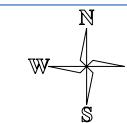


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## 10. Conclusion

**Group 1 Paradise Beach and Golden Beach settlements** have low to moderate landscape value. Current patterns and location of dwellings create a significant modified natural setting. The area has the capacity to accommodate additional dwellings with no significant impacts on the character of the landscape between Shoreline Drive and Lake Reeve.

**Group 2 (Delray-Flamingo Beach) and Group 4 (Glomar Beach south)** have the most significant landscape value. Any further development of dwellings would potentially have a detrimental impact on the landscape character and values in these locations.

**Group 3 Glomar Beach** has moderate landscape value, with some natural features compromised by the current location and density of development. Regeneration areas remain in some locations and these form part of the current landscape character of the location, which could be impacted by further dwelling development.

**Group 5 The Honeysuckles settlement** has moderate to high landscape value, defined predominantly by the surrounding scenic qualities of Lake Reeve and coastal dunes. Canopy trees dispersed through the built environment are also a key aspect of the current landscape character. The current average spacing of dwellings also reflects the existing landscape and built form character of the settlement. Further dwelling construction should respect this pattern of development to be consistent with current landscape values.





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\* Denotes signature on original



Appendix C

**Table of Capability Scores for Dwelling  
Density Scenarios**



**Table 1 Capability Scores for Dwelling Density Scenarios**

Criteria  (NB. capability criteria marked Green have spatial variations, capability criteria marked Blue apply consistently to all areas)	Highest Density Residential  10 – 20 dwellings per Ha	→ Low Density Residential  1 – 10 dwellings per Ha	→ Rural Living  1 dwelling per 1 – 10 Ha	→ Small Rural Holdings  1 dwelling per 10 - 40 Ha	Lowest Density Rural  1 dwelling per 40 Ha
<b>Flora &amp; Fauna</b>					
Vulnerable EVC (Coast Banksia Woodland)	5	4.5	4	3.5	3
Vegetation Corridor (Remaining EVCs)	5	4	3	2	1
Urban node (low density development)	2	1	1	1	1
Urban node (partial low density development)	3	2	1	1	1
Not classified (not covered by an EVC)	0	0	0	0	0
<b>Climate Change &amp; Sea Level Rise Impact Areas</b>					
Areas at risk of coastal dune breach (+ 500m buffer)	5	5	5	5	0

0	No Impact/Not Applicable
1	Extremely High Capability
2	High Capability
3	Moderate Capability
4	Low Capability
5	Extremely Low Capability

Criteria	Residential 10 – 20 dwellings per Ha	Low Density Residential 1 – 10 dwellings per Ha	Rural Living 1 dwelling per 1 – 10 Ha	Small Rural Holdings 1 dwelling per 10 - 40 Ha	Rural 1 dwelling per 40 Ha
<b>Landscape Values</b>					
Areas with significant vegetation coverage	5	5	5	5	5
Lake edge vegetation areas (with canopy)	5	5	5	5	5
Lake edge vegetation areas (with salt marsh)	5	5	5	5	5
Urban node, low density & partial low density areas	1	1	0	0	0
Restructure lots with scattered dwellings (Glomar)	4	4	4	0	0
Restructure lots with few dwellings	5	4	3	2	1
Not assessed	0	0	0	0	0
<b>Sites of Cultural Heritage Sensitivity</b>					
Potential impact on areas within site boundaries	5	4.5	4	3.5	3
Potential impact on areas outside site boundaries	5	4.3	3.5	2.8	2
<b>Bushfire Prone Areas</b>					
Likelihood of wildfire from human activity	5	4	3	2	1

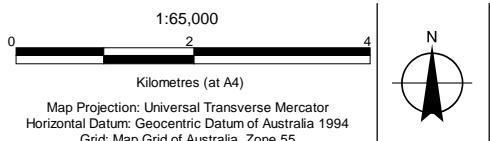
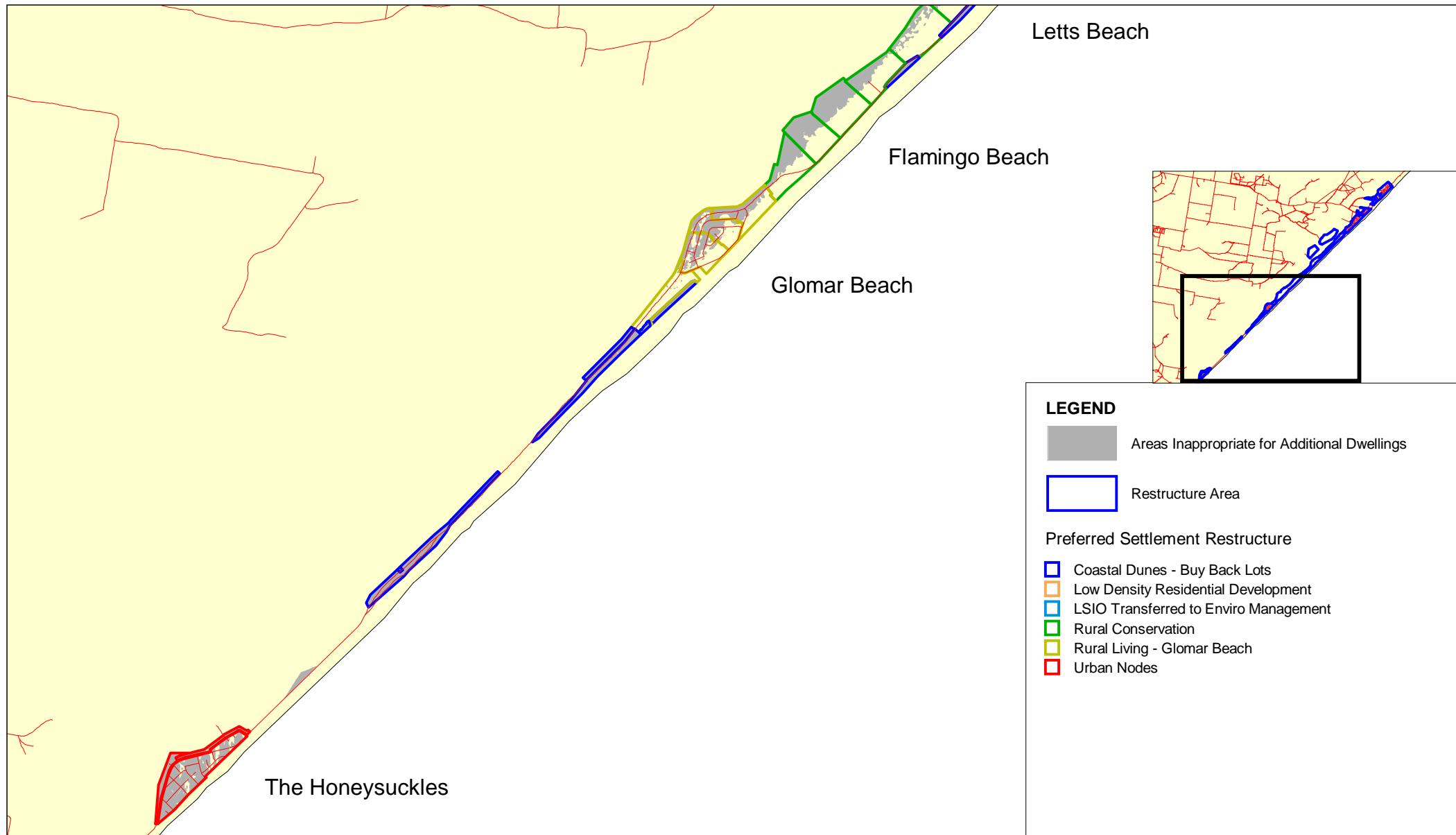
Criteria	Residential 10 – 20 dwellings per Ha	Low Density Residential 1 – 10 dwellings per Ha	Rural Living 1 dwelling per 1 – 10 Ha	Small Rural Holdings 1 dwelling per 10 - 40 Ha	Rural 1 dwelling per 40 Ha
Likelihood of wildfire from amount of vegetative fuel	1	2	3	4	5
Impacts on native veg from wildfire management	5	4	3	2	1
<b>Bushfire Prone Areas Cont.</b>					
Access in the event of fire from areas within 5km of access points	1	1	1	1	1
Access in the event of fire from areas between 5 – 10km of access points	2	2	2	2	2
Access in the event of fire from areas between 10 – 15km of access points	3	3	3	3	3
<b>Waterbodies &amp; Wetlands</b>					
Impacts from public access	1	3	5	3	1
<b>Parks &amp; Reserves</b>					
Impacts from public access	1	3	5	3	1



Appendix D

## Land Capability Mapping



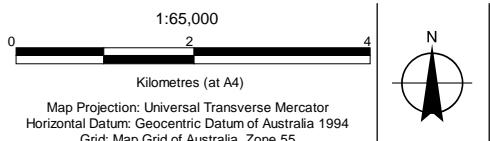
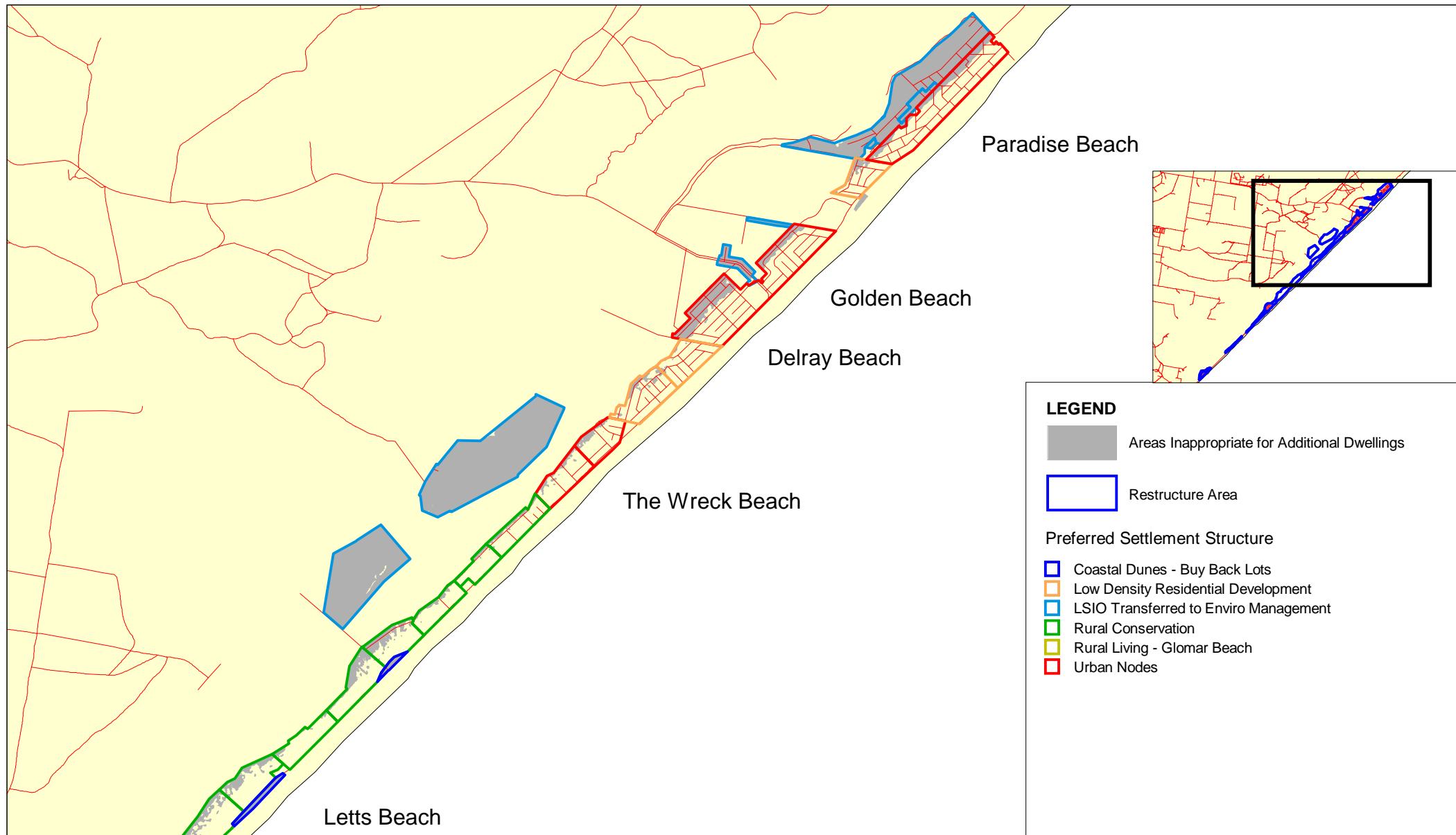


Wellington Shire Council  
Wellington Coast Subdivision Strategy  
Land Capability Assessment

Areas Inappropriate for Additional Dwellings

Job Number | 31-20287  
Revision | A  
Date | 28 Jan 2008

Figure 1.1

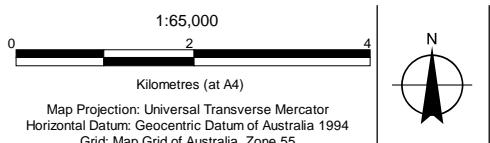
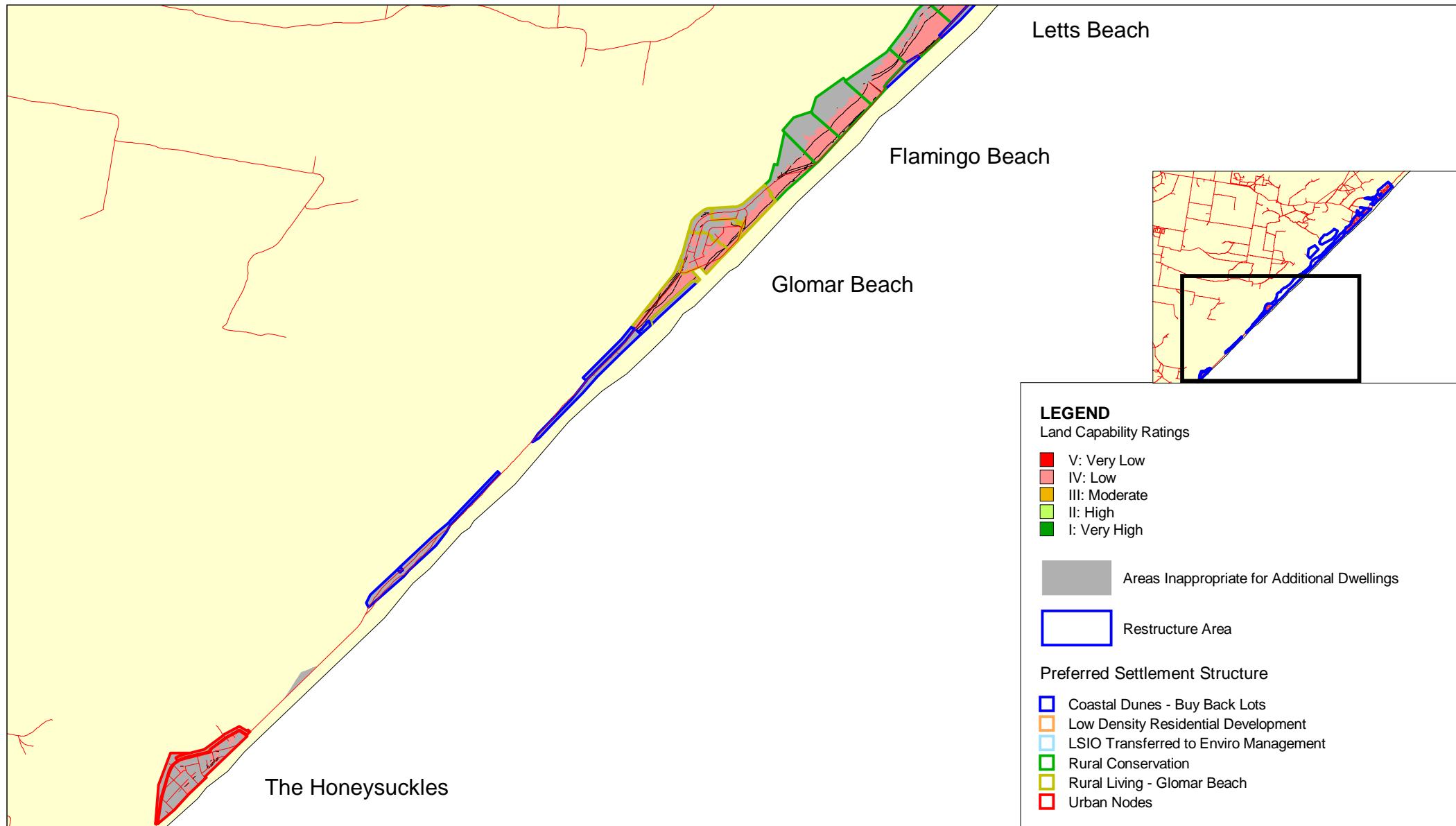


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Wellington Coast Subdivision Strategy  
Land Capability Assessment

Areas Inappropriate for Additional Dwellings

Job Number | 31-20287  
Revision | A  
Date | 28 Jan 2008

Figure 1.2

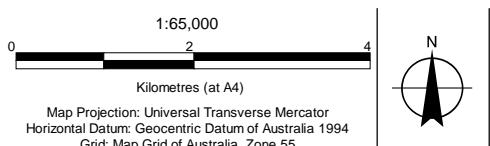
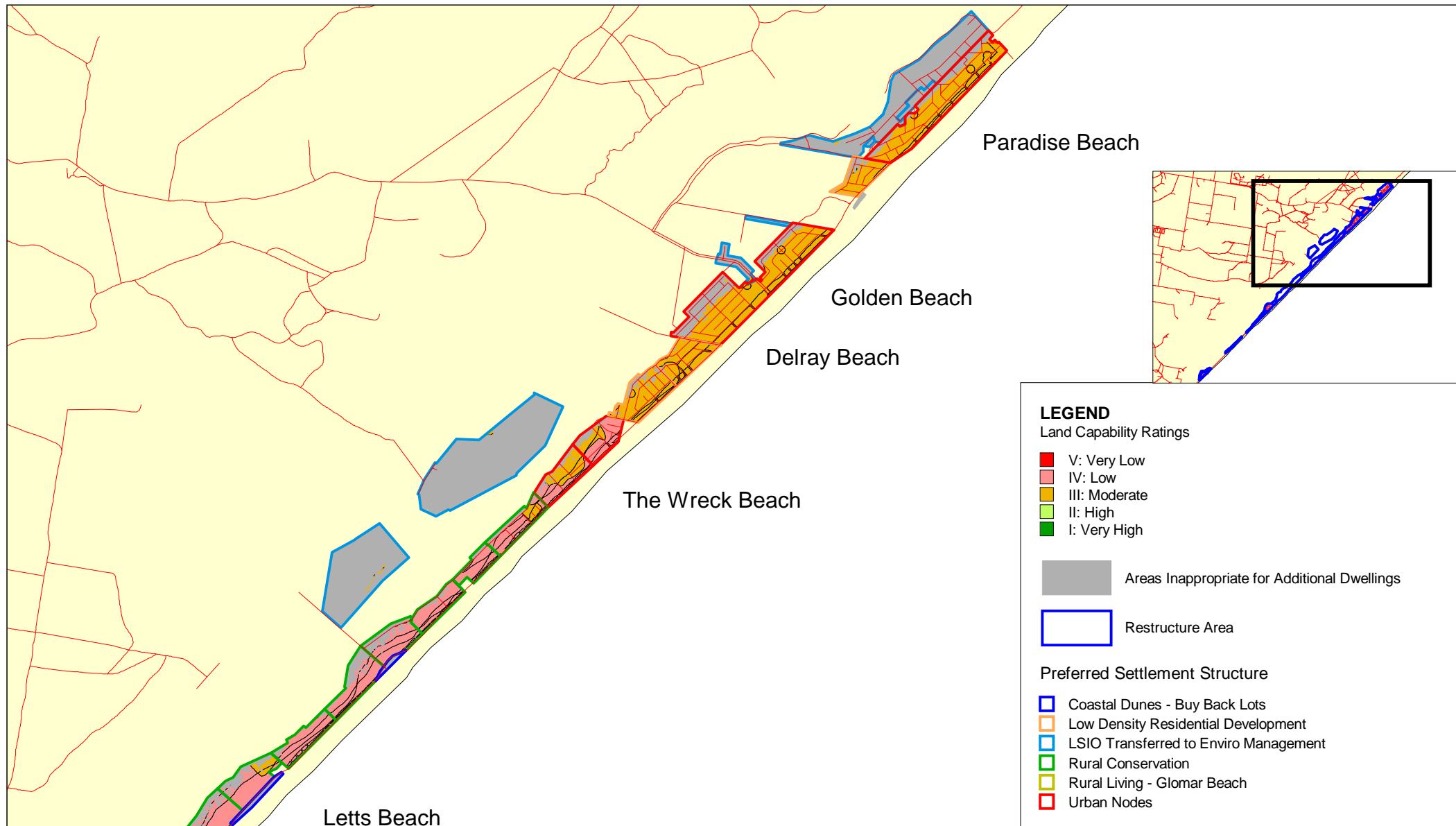


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Land Capability Assessment

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Revision | A  
Date | 28 Jan 2008

Land Capability for Residential Dwelling  
Density: 10 - 20 dwellings per Ha

Figure 2.1

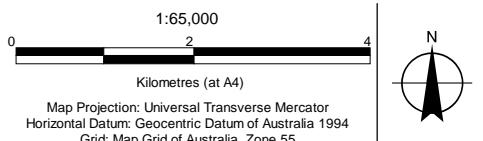
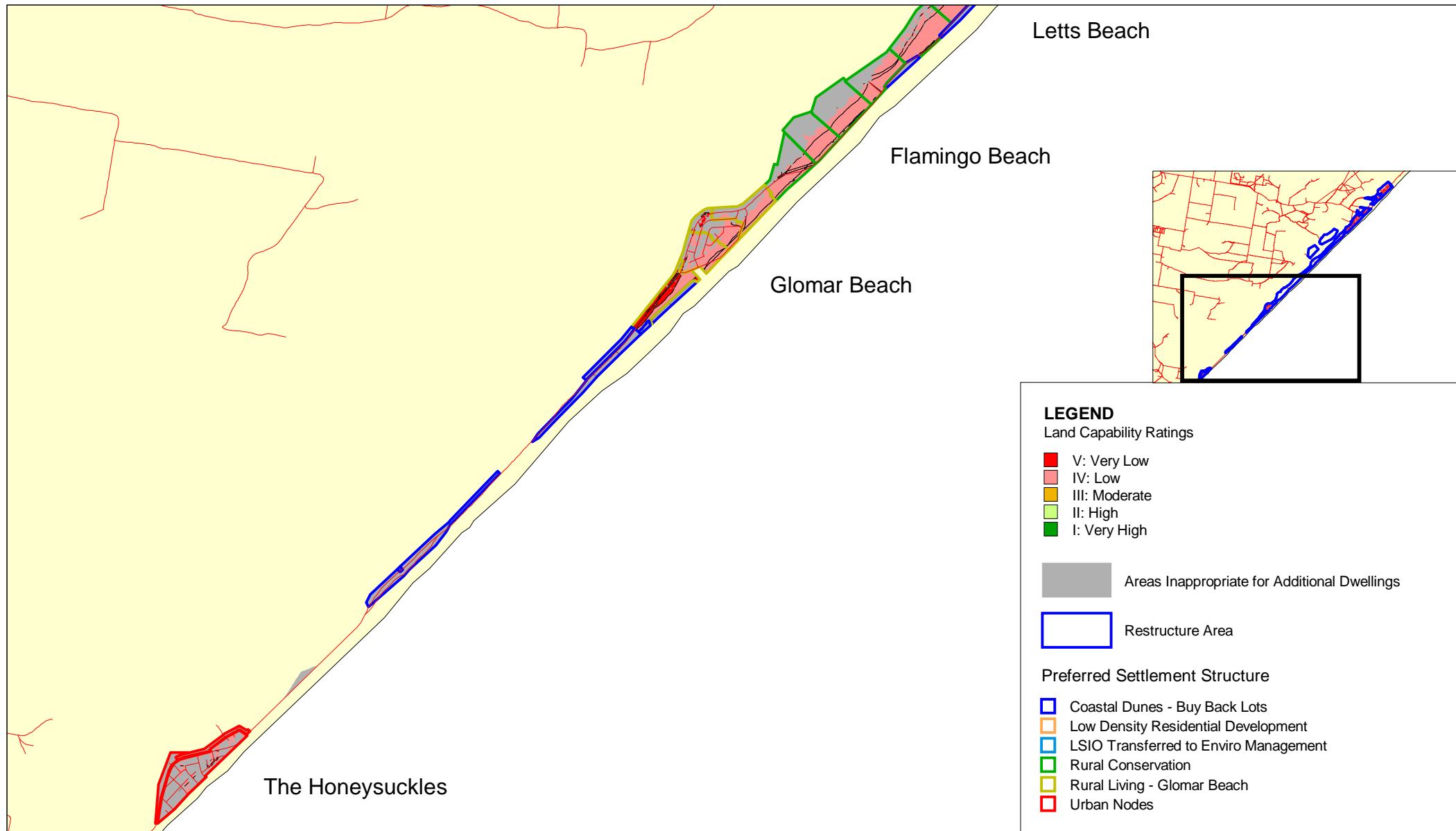


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Land Capability Assessment

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Revision | A  
Date | 28 Jan 2008

Land Capability for Residential Dwelling  
Density: 10 - 20 dwellings per Ha

Figure 2.2

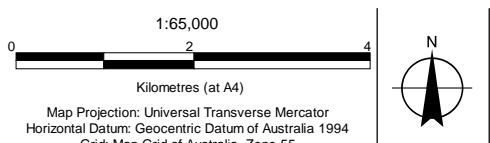
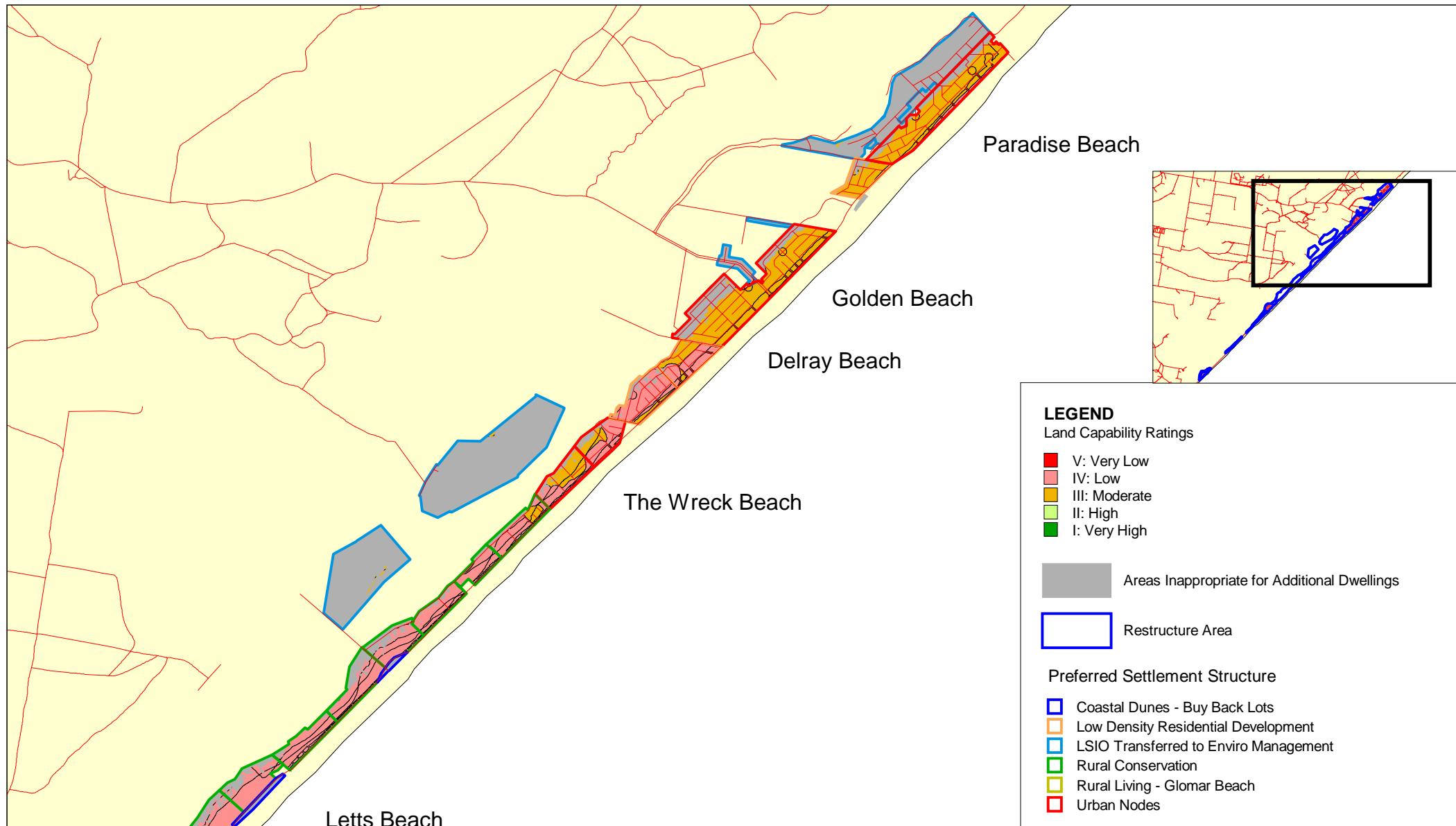


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Land Capability Assessment

Land Capability for Low Density  
Residential: 1 - 10 dwellings per Ha

Job Number | 31-20287  
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Date | 28 Jan 2008

Figure 3.1

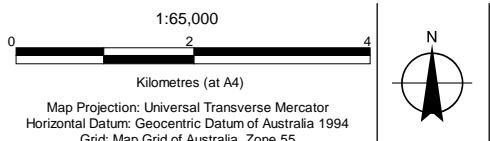
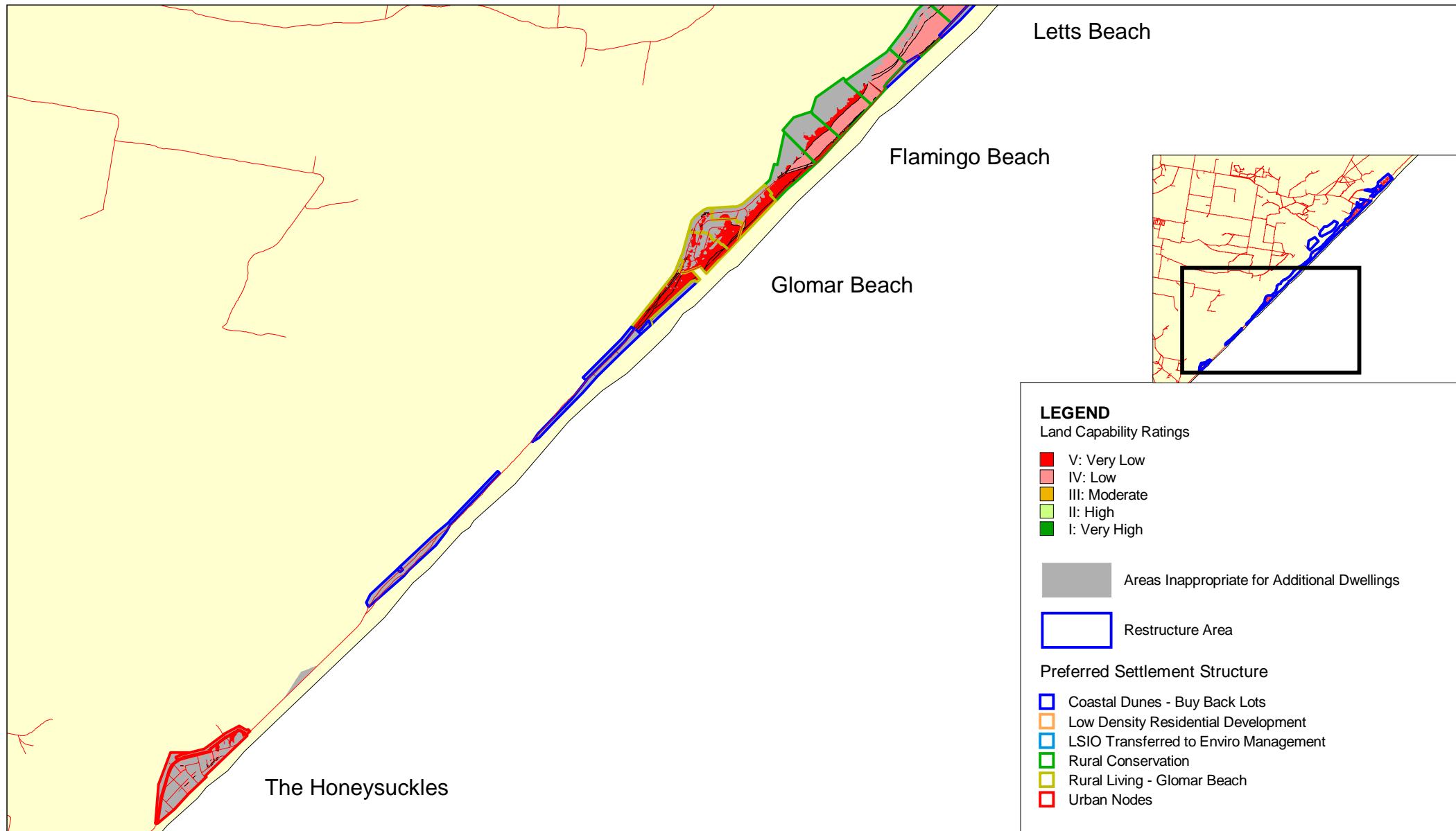


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Land Capability Assessment

Job Number | 31-20287  
Revision | A  
Date | 28 Jan 2008

Land Capability for Low Density  
Residential: 1 - 10 dwellings per Ha

Figure 3.2

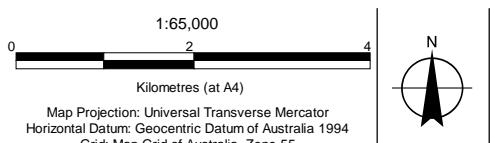
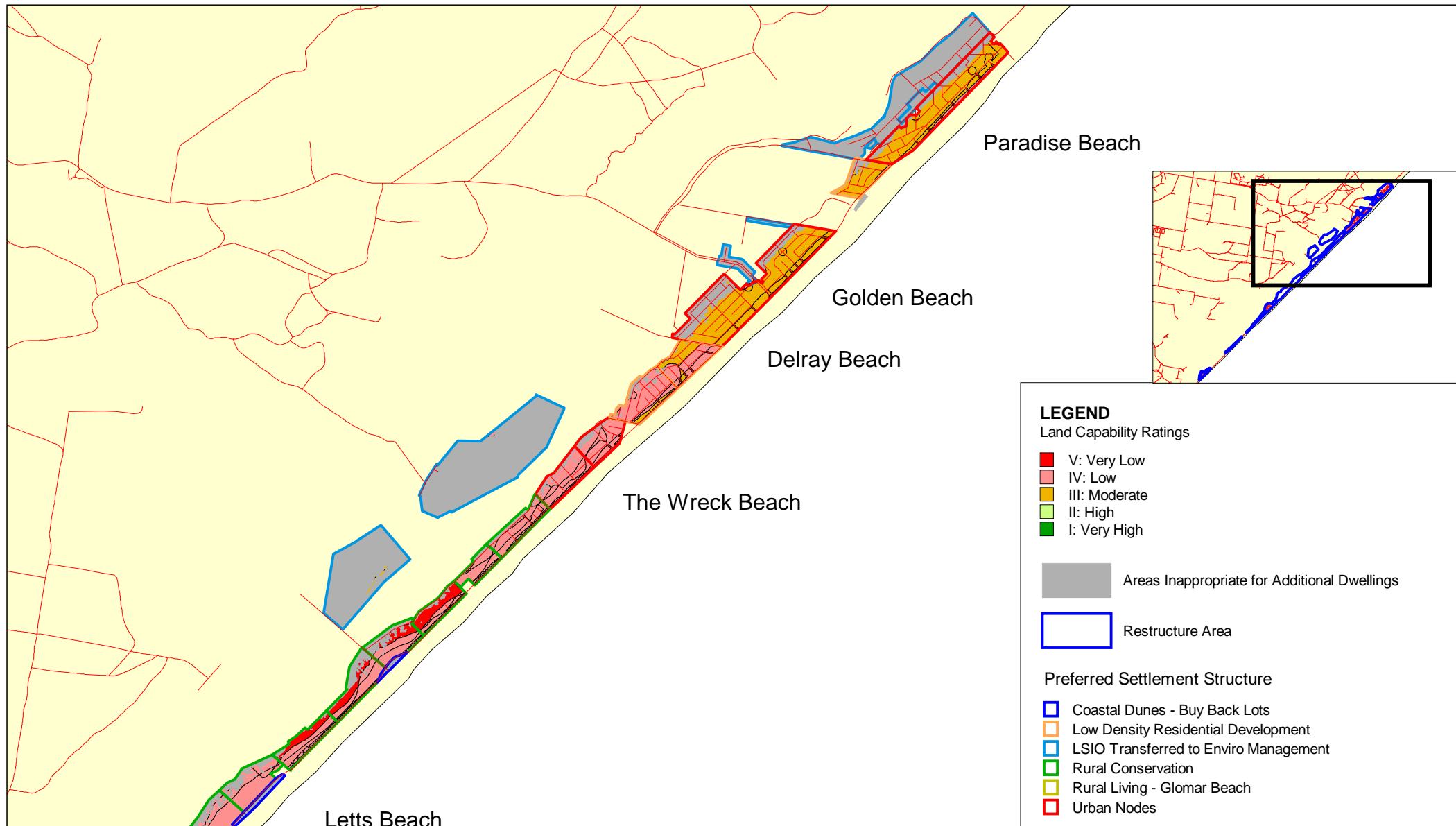


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Land Capability for Rural Living Dwelling  
Density: 1 dwelling per 1 - 10 Ha

Figure 4.1

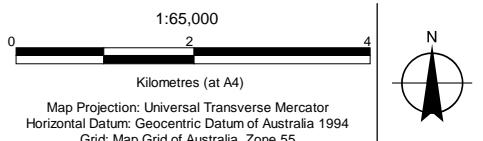
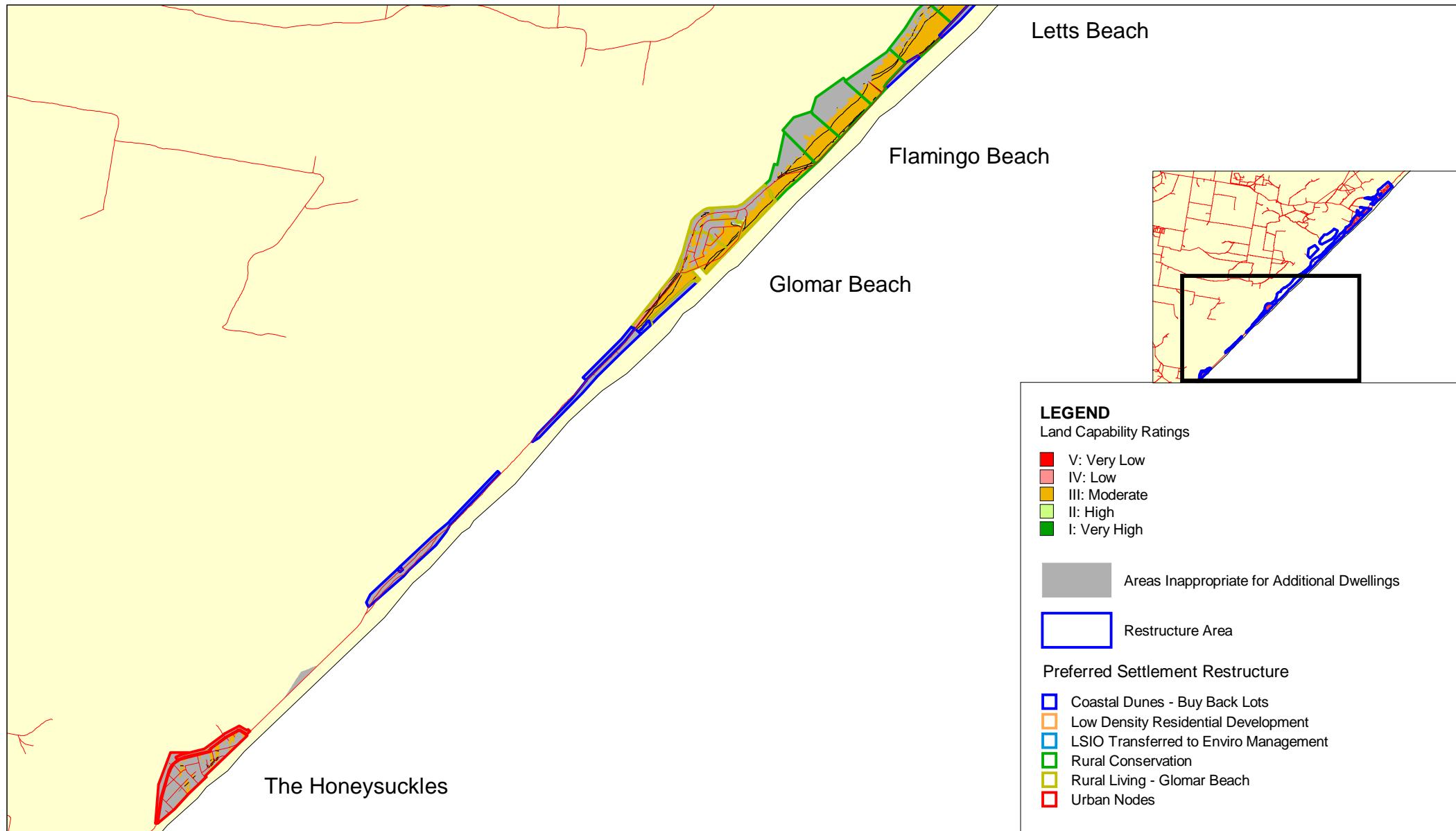


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Land Capability Assessment

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Land Capability for Rural Living Dwelling  
Density: 1 dwelling per 1 - 10 Ha

Figure 4.2

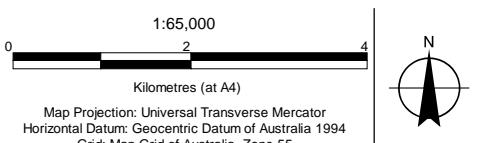
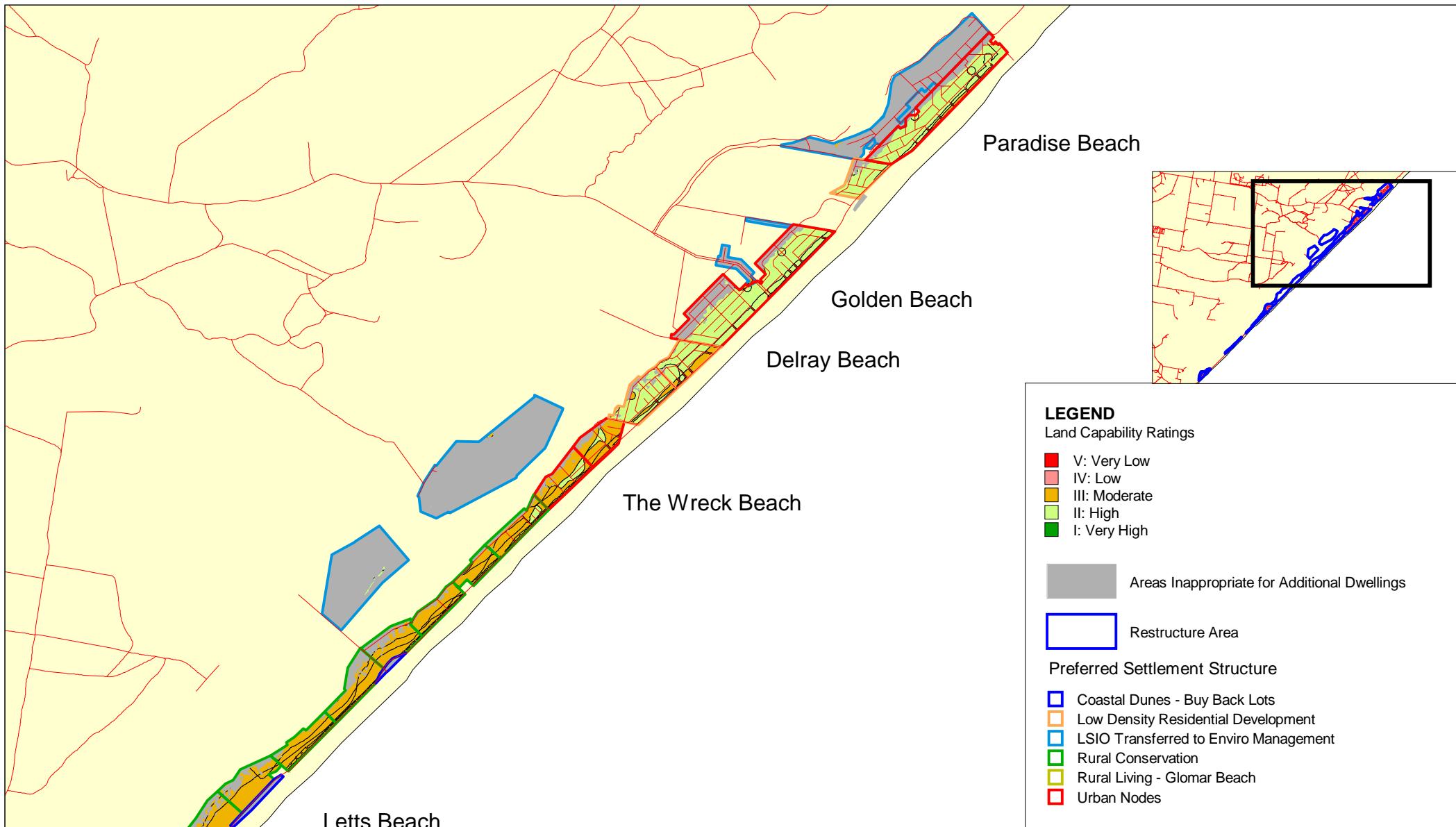


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Land Capability Assessment

Land Capability for Small Rural Holdings: 1 dwelling per 10 - 40 Ha

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Figure 5.1

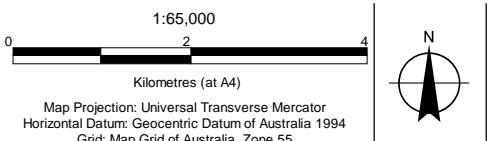
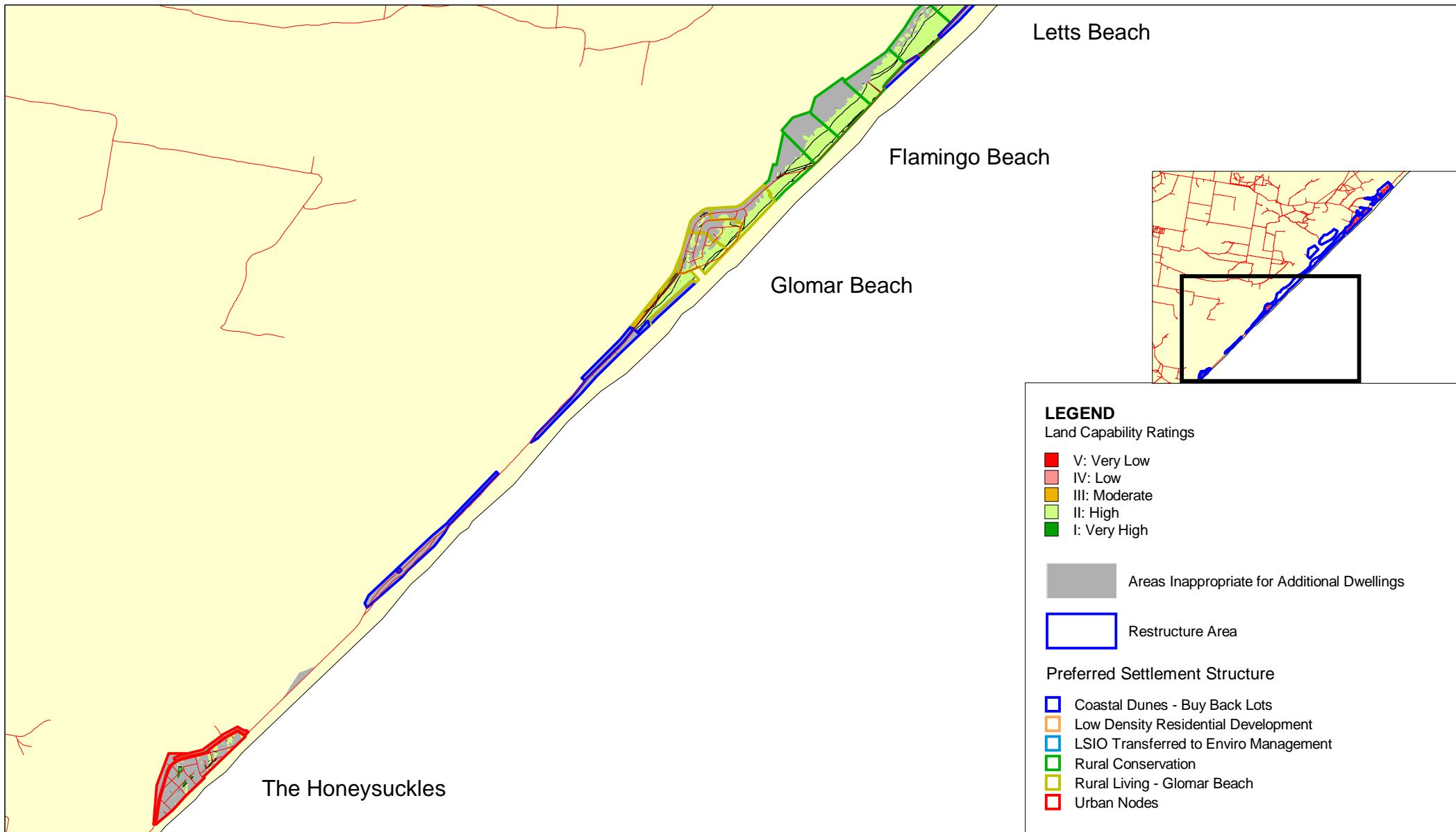


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Land Capability Assessment

Land Capability for Small Rural  
Holdings: 1 dwelling per 10 - 40 Ha

Job Number | 31-20287  
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Date | 28 Jan 2008

Figure 5.2

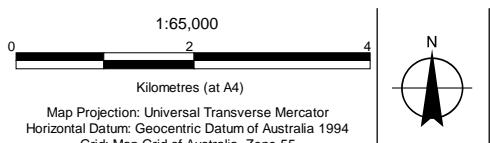
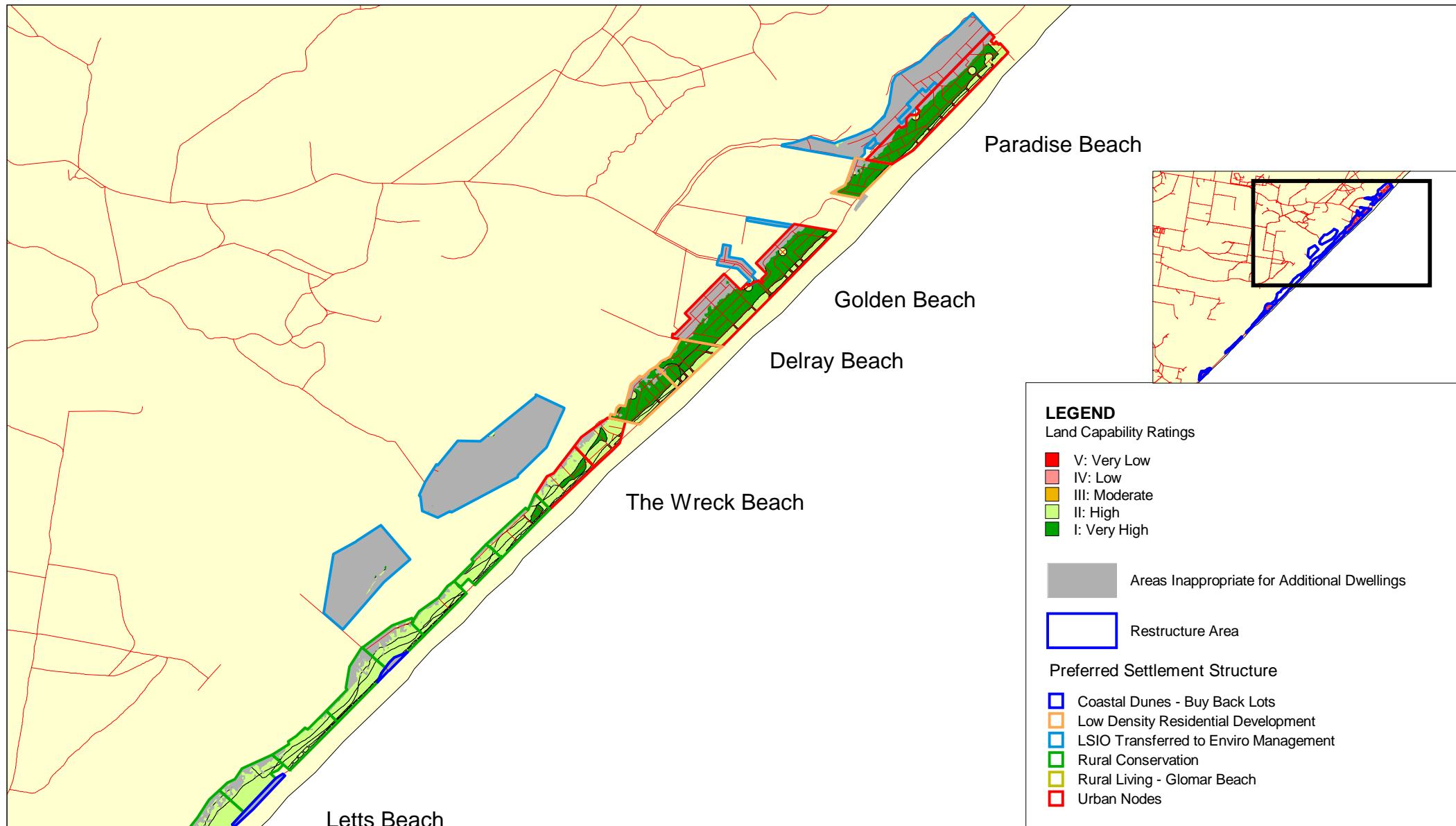


Wellington Shire Council  
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Land Capability Assessment

Land Capability for Rural Dwelling  
Density: 1 dwelling per 40+Ha

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Revision | A  
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Figure 6.1



Wellington Shire Council  
Wellington Coast Subdivision Strategy  
Land Capability Assessment

Land Capability for Rural Dwelling  
Density: 1 dwelling per 40+Ha

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Figure 6.2

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**Document Status**

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		Name	Signature	Name	Signature	Date
0	N. Hirsh	C. Watts	<i>C. J. Watts</i>	C. Watts	<i>C. J. Watts</i>	13/11/07
1	N. Hirsh	C. Watts	<i>C. J. Watts</i>	C. Watts	<i>C. J. Watts</i>	13/12/07
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3	N. Hirsh	C. Watts	<i>C. J. Watts</i>	C. Watts	<i>C. J. Watts</i>	08/02/08
4	N. Hirsh	C. Watts	<i>C. J. Watts</i>	C. Watts	<i>C. J. Watts</i>	28/03/08