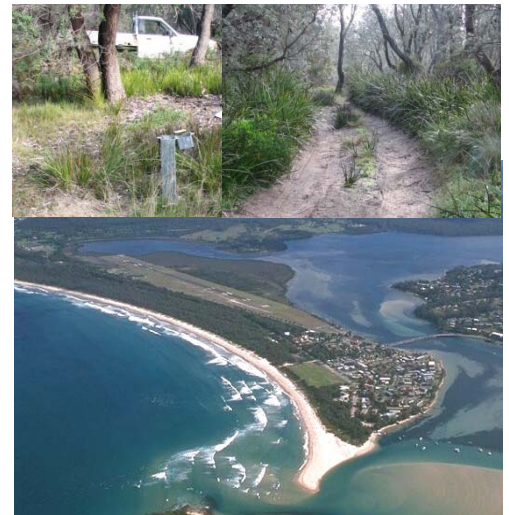




# Review of Environmental Factors

PROPOSED DUNAL EXFILTRATION INVESTIGATIONS  
MERIMBULA STP



OCTOBER 2009



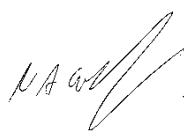

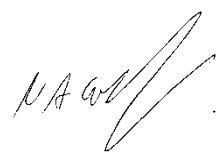



## Document Verification



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# 1 INTRODUCTION

This Review of Environmental Factors (REF) has been prepared for the Bega Valley Shire Council (BVSC) to assess the potential environmental impacts associated with a proposed research activity. The proposal involves installing test bores to investigate the potential to use an exfiltration system for the disposal of treated effluent from the Merimbula Sewage Treatment Plant (STP). The proposal would occur in a coastal foredune area between the Merimbula Airport and Merimbula Main Beach (refer to **Figure 2-1**).

The Review of Environmental Factors:

- Describes the proposed activity
- Identifies statutory assessment and approval requirements in relation to the proposal
- Identifies the major environmental, cultural and social values of the proposal area
- Identifies and assesses the significance of the potential impacts and risks associated with the proposed works
- Identifies measures to manage risks, and avoid or mitigate potential impacts

The REF focuses on the impacts relating to the test bore investigation activity only ('the proposal'). Impacts associated with installation and operation of exfiltration infrastructure in the Merimbula dune area are beyond the scope of this impact assessment. The investigations are being carried out as part of general research into options for the future management of treated effluent from the Merimbula STP.

The proposal has a limited scope of works, described in detail in Section 2. The REF has been adapted to the nature of the activity, the proposal site and relevant environmental and planning issues. Key issues were identified prior to the assessment in a scoping exercise and effort has been concentrated on these factors. The precautionary principle has been applied where uncertainty exists. The assessment draws on past research and studies, as well as dedicated fieldwork and technical assessments undertaken for the project.

The REF is intended to meet the assessment requirements of planning and environmental protection legislation, particularly the *Environmental Planning and Assessment Act 1979* (NSW) and the *Environmental Planning and Assessment Regulation 2000* (NSW).

## 2 THE PROPOSAL

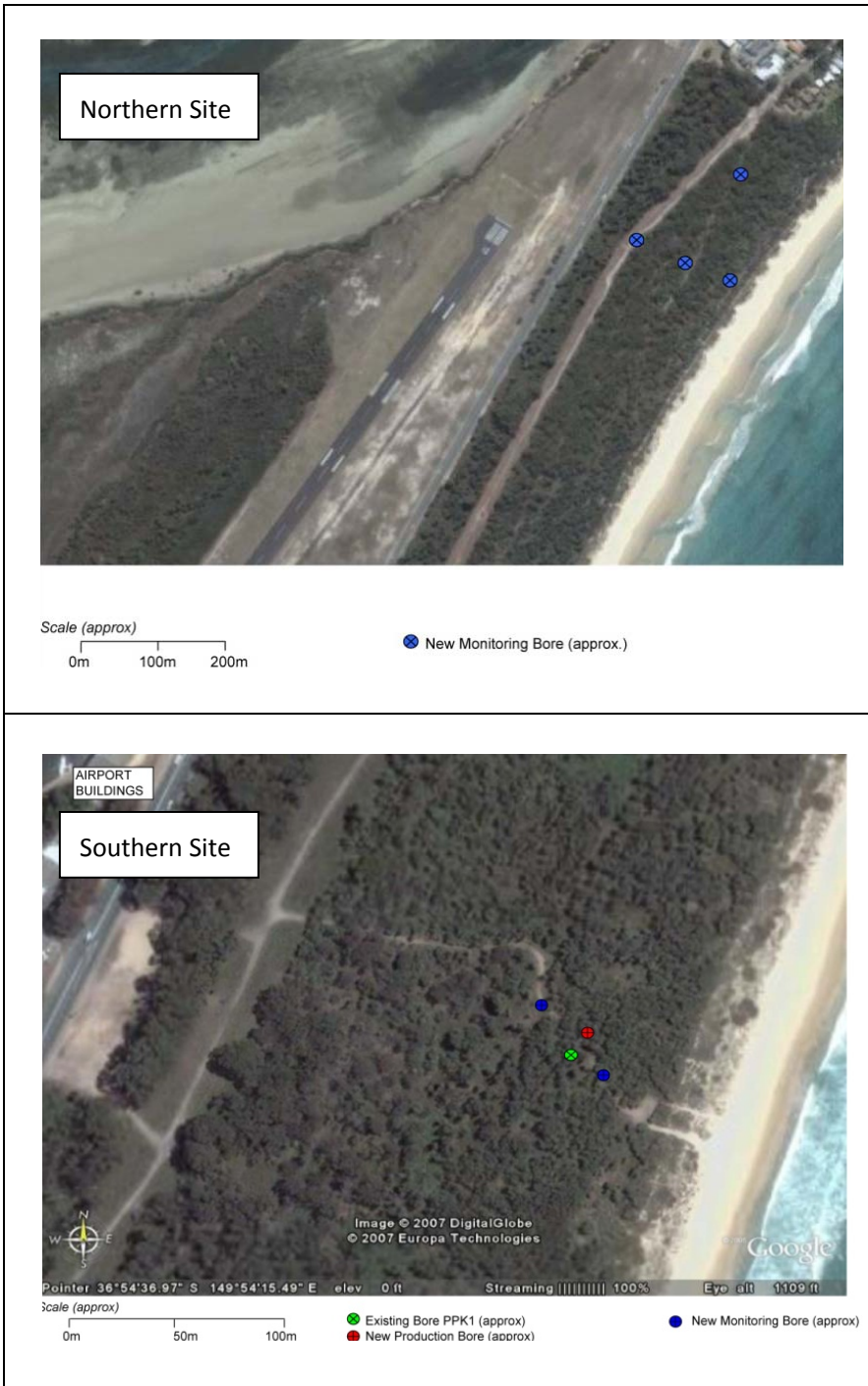
### 2.1 GENERAL DESCRIPTION AND OBJECTIVES OF THE PROPOSAL

Ian Grey Groundwater Consulting (IGGC) has been contracted by BVSC to carry out investigations into the potential to use exfiltration trenches associated with the Merimbula Sewage Treatment Plant (STP). The proposed investigations would involve the installation of groundwater monitoring bores at two sites that have been investigated in this report (referred to as the 'northern' and 'southern' sites).

The southern location is directly opposite Merimbula airport, while the northern alternative site includes one borehole within 50 metres of the southern edge of the Fishpen residential area and a loose cluster of three boreholes 200-250m south of this, on the eastern side of the utilities easement which runs parallel to Arthur Kaine Drive. The proposed sites are shown in **Figure 2-1** and their location detailed in **Table 1** and **Figure 2-2**. The general aim of activities at each site is described below.



Figure 2-1: Approximate locations of the Northern and Southern Sites



**Figure 2-2: Approximate locations of new monitoring bores, production bores and existing bore**  
(NOTE: images provided by BVSC)

**Table 1: Site locations**

Site	Easting (GDA96)	Northing (GDA96)
Existing bore (Southern Site)	758787	5911134
Northern Site, E edge of easement	759184	5912130
Northern Site, track end E of easement	759255	5912069
Northern Site, just behind frontal dunes	759300	5912052
Northern Site, near southern edge of Fishpen houses	759376	5912293

## Southern Site

The aim of works at the Southern Site is to construct a simulation model, identifying likely flow patterns in ground water and/or effluent. Infrastructure required to enable monitoring includes installation of a test production bore and three monitoring bores. These would be close to the location of existing bore PPK. The monitoring bores would be located approximately 20 metres from the production bore.

## Northern Site

The aim of work at the Northern Site is to provide information about substrate within the dune complex area, and carry out groundwater monitoring through the installation of four monitoring wells.

At least one bore at each of the northern and Southern Sites will be drilled to the base of the upper sand unit (or to maximum 20m) and a detailed profile will be logged.

### 2.1.1 Construction process

Details of the construction process and monitoring activities are provided in the following section.

#### Pre-construction

1. **Proposed work locations:** Proposed locations have been identified as part of the REF preparation, based on a preliminary site inspection involving the Botanist (Jackie Miles), Archaeologist (Julie Dibden), two representatives of the Eden Local Aboriginal Land Council (Lawrence Bramblett and Terry Scott), **ngh**environmental (Nick Graham-Higgs), BVSC (Ken McLeod) and IGGC (Ian Grey). Locations have been selected where potential impacts are likely to be low.
2. **Site walk-over/survey:** A detailed walkover inspection of the study area would be undertaken by IGGC, to note any surface features that may indicate groundwater discharge. This would include the lake shoreline around Merimbula Airport (subject to access permission). A surface water level monitoring point will be established in the water feature/wetland located in the southern area. Surveying of all monitoring points will be completed.

#### Construction phase

3. **Access:** Site access would be required for a tracked drill rig, support vehicle and 4WD 2000L water cart. The support vehicle and water cart are each approximately the size of a large ute. An additional 4WD ute may also be used for personnel access. Access would be via existing tracks.
4. **Working area:** A working area of up to 3m by 5m (15m<sup>2</sup>) will be needed at each new bore site. It is anticipated that all locations will be close to the existing tracks, and site investigations have determined that it should be possible for the working area to include the track at most sites to minimise disturbance. Clearing of vegetation is not expected to be required, however some grasses or shrubs may be temporarily flattened when equipment rests on it.
5. **Archaeology investigations:** Prior to construction of bores, it is proposed that the upper 1.2 metres would be excavated in order to safeguard against archaeological impacts (refer to Archaeology Assessment, Appendix F, and Section 5.7). As the soil is sandy, the excavations are likely to be about one square metre in size, at each bore site. Spoil from the excavations would be stockpiled and returned to the excavation site once investigations have been completed. Any grasses or tussocks removed from the excavation sites would also be reserved in a shady area and kept moist. They would then be replanted



without delay on completion (i.e. within one to two days). Sites where woody vegetation/shrubs are dominant would be avoided.

## 6. Bore construction:

### Southern Site (production bore)

The production bore, which is used for pumping from, would be constructed at the Southern Site. It would have a 100mm nominal diameter.

The production bore would be drilled using a mud rotary drilling technique to allow installation of screen and casing of 100mm nominal diameter. The bore would be drilled through the entire thickness of the upper aquifer, or a maximum of 20m. This would enable the bore to be screened throughout the entire saturated thickness of the aquifer.

### Northern and Southern Sites (monitoring bores)

- Two monitoring bores (50mm diameter) would be constructed at the Southern Site (the existing Bore PPK1 would also be used as an additional monitoring bore).
- Four 50mm diameter monitoring bores would be constructed at the Northern Site.

Monitoring bores would be drilled using a hollow flight auger technique through the entire saturated thickness of the aquifer if the drilling technique allows (or maximum 20m depth), and completed with 50mm diameter screen and casing.

All boreholes would be developed by airlifting, pumping and/or surging to remove drilling mud and fines and ensure a good connection with the aquifer. A mud slurry technique would be used for the production bore, with a biodegradable polymer added to the mud to prevent the bore sides collapsing. A few square metres of spoil is likely to be generated at each bore site. The spoil would be captured on site and disposed of either by distribution on tracks, or, in the case of the production bore, by transfer to a suitable recipient.

To finish, PVC piping would be inserted into the bores. The production bore has a slotted section at the base that is packed with 2mm graded sand that provides a gravel screen. All bores are then completed with gravel packs, bentonite seals and lockable steel surface monuments that are cemented into place. The surface manifestation of a typical finished bore is shown in **Figure 2-3**.

7. **Surface monitoring point:** A surface monitoring point would be identified within the wetland south of the investigation areas. Apart from access (using existing tracks and on foot) and hand removal of approximately three litres of water, there would be no impact at this area.



**Figure 2-3: Existing bore PPK1 showing typical bore capping**

## Operational/monitoring phase

8. **Site base and water quality sampling:** A conventional four to six person tent would be erected temporarily for use as a site base during the 72 hour pump test period. The tent would be located in a disturbed, relatively flat area where impact on vegetation would be avoided or restricted primarily to grasses (eg, site similar to that shown in **Figure 2-3**). Water quality sampling for PH, conductivity, redox potential etc. would be conducted on site. Further sampling would be carried out at a laboratory.

9. **Monitoring activities:**

Southern Site – production bore only

A 72 hour test pump would be undertaken using the production bore. This would provide accurate data on shallow aquifer parameters in the area of the proposed exfiltration trench.

The bore would be pumped at a rate sufficient to stress the surrounding aquifer, with a target rate similar to that required for injection (nominally 5 L/s or greater), with water levels monitored in the test production bore and in nearby monitoring wells during pumping and recovery.

A preliminary step test may be carried out prior to the main test to determine an appropriate pump rate.

Water from the production bore would be discharged to the beach (high tide mark) via a lay-flat hose. The discharged water would be unaltered aquifer water (no additives). The discharge point would be monitored for erosion, so that it could be moved if erosion becomes notable.

Northern and Southern Sites – monitoring bores

Recovered groundwater levels would be measured in all bores after development. Short-term pump tests and/or slug tests will be carried out in all wells and the data analysed to provide estimates of the hydraulic conductivity of the surrounding strata. Continuous groundwater level data will be collected from at least one bore in each area for a period of at least 24 hours to allow preliminary assessment of tidal influences.

Surface water monitoring site

A water sample (approximately 3 litres) from the surface monitoring point would also be taken for laboratory analysis.

## Decommissioning

It is proposed that test bores would remain *in situ* beyond the immediate activity period so that they can be used in further work, if required. Decommissioning is therefore, beyond the scope of this assessment.

### 2.1.2 Summary of impact areas

A summary of the impact area of the works is provided in Box 1, below.

**Box 1: Summary of impact areas**

**Total impact area**

The total impact area of the working spaces at each site (excluding access and site tent) would be approximately 3m by 5m (15m<sup>2</sup>), making a total impact area of 105 m<sup>2</sup> for the seven sites. This comprises equipment platforms (where vegetation would be crushed) and excavation areas (where vegetation would be removed). The actual excavation areas would be approximately 1 square metre in size, therefore a total of 7 m<sup>2</sup> would be excavated.

*Note: part of this area would be within existing disturbed areas including tracks, therefore the impact on undisturbed areas would be significantly less.*

**Impact of tent**

The tent would occupy approximately 5m<sup>2</sup>, however the majority of this area would be within existing disturbed areas.

**Finished (permanent) impact area**

The final finished surface area of each site (including steel monument and concrete footing) would be approximately 300 mm by 300 mm (90cm<sup>2</sup>).

The total finished impact area for the 7 bores would, therefore, be approximately 4.5 m<sup>2</sup>.

### **2.1.3 Environmental risk management and mitigation**

This REF identifies environmental risks associated with the proposed investigations, and details a range of safeguards and environmental risk mitigation strategies that would be used to avoid and reduce environmental impacts during the construction, operation and decommissioning of the activity. These measures are consolidated and summarised in Table 2. Further detail and explanation is contained in Section 5.

The summary of environmental management strategies in Table 2 has been designed so that it can be used by the contractor and/or project auditor to ensure that the project complies with these strategies, and assess whether key performance indicators (KPIs) have been achieved.

### **2.1.4 Timing**

Site works will require two mobilisations (one for drilling and one for pump testing/sampling) with a total duration of around six weeks. Installation of the bores would take about 3 weeks initially (for the two sites) followed by the pump testing and water sampling shortly afterwards.

It is anticipated that drilling would commence in October.

**Table 2: Environmental safeguards and impact mitigation measures for the proposal**

Objective & Safeguards	Responsibility	Key Performance Indicators (KPI)
<b>Objective A: Protect items of Aboriginal cultural significance</b>		
<ul style="list-style-type: none"> <li>A subsurface test excavation program will occur prior to the works commencement, in accordance with the conditions recommended by DECCW in the letter included in Appendix G. This program will ensure that if present, human skeletal material will be identified without causing significant damage to either the bone material (skeleton) or burial context (burial pit).</li> <li>In the event of no Aboriginal objects or evidence being encountered, the test bore sites would require no further assessment and the test bores can be completed. If Aboriginal evidence is encountered during the subsurface test excavation program, an Aboriginal Heritage Impact Permit would need to be sought in order to permit impacts relating to the proposed test bore works.</li> <li>All spoil from the excavations are to be placed on top of tarpaulins and then returned to the original subsurface position.</li> </ul>	<p><b>Archaeologist</b> (in collaboration with Contractor)</p>	<p>Subsurface testing completed in accordance with AHIP.</p>
<b>Objective B: Prevent impact on threatened species or ecological communities</b>		
<ul style="list-style-type: none"> <li>The contractor would be aware of the appearance of the three threatened species potentially occurring on the site, and the need to avoid impact. This would facilitate identification at the work stage and enable appropriate safeguards to be developed.</li> <li>The area of native vegetation impacted by the works should be minimised by using disturbed areas for bore location, vehicle access, machinery parking, materials laydown and tent location wherever practicable.</li> <li>Excavations and vehicle/machinery movements would occur outside the drip-line of trees wherever practicable.</li> <li>Any cleared vegetation should be chopped up and placed on access to protect soil and allow for natural decomposition. It should not be burned, left in heaps or lines or pushed up around trees or other plants.</li> <li>Place materials/equipment on open areas or bare ground where possible, and thoroughly search any location for the presence of fauna such as White-footed Dunnarts/Eastern Pygmy-possums before undertaking the activity.</li> <li>Avoid driving over logs and rocks that could provide fauna habitat – utilise existing tracks where possible.</li> <li>Do not otherwise disturb habitat features such as rocks and logs.</li> <li>Minimise night work including driving on the site after dark.</li> <li>Minimise noise where possible (refer below).</li> <li>Do not leave pits/bores open/uncovered overnight.</li> </ul>	<p><b>Contractor &amp; BVSC</b> <b>(refer to Sections 5.4, 5.5 and 5.6)</b></p>	<p>No impact on threatened species or communities</p>

- Check tent for the presence of fauna before packing.
- Contractor will be informed of the nature of environmental risks, including key threatening processes, and how the proposed activity could contribute to impacts.
- Assess risk of introduction of *Phytophthora* (considering previous work locations and presence of *Phytophthora*) and thoroughly clean, and if risk of *Phytophthora* has been identified or risk assessment shows uncertainty, sterilize all equipment that will come in contact with ground, groundwater or vegetation.
- Soil protection and fire prevention safeguards would be employed as detailed below.

#### Objective C: Prevent the introduction and spread of weeds

- |  |  |                                  |
|--|--|----------------------------------|
| <ul style="list-style-type: none"> <li>• Existing weeds at the site, such as African Lovegrass present along track verges, should be managed prior to site activity to reduce potential for them to be spread by the vehicles and machinery to be used in the proposal.</li> <li>• Machinery, vehicles and equipment used in the works must be washed and disinfected before and after onsite access to reduce the introduction and spread of weeds and pathogens such as <i>Phytophthora</i> (Cinnamon Fungus).</li> <li>• Weed monitoring would be carried out at all sites after the completion of construction works and ongoing weed control would occur where noxious or invasive species are recorded. In particular, monitoring would be undertaken during the following late spring/early summer, and remedial action taken as required.</li> </ul> | <p><b>Contractor</b><br/>(monitoring by<br/><b>auditor</b> at audit<br/>stage)</p> | <p>Weeds effectively managed</p> |
|--|--|----------------------------------|

#### Objective D: Protect soils

- |  |                          |  |
|--|--------------------------|--|
| <ul style="list-style-type: none"> <li>• Investigative activities (including access, tent situation, bore establishment, pumping and water testing) would not be carried out when heavy rain is forecast.</li> <li>• The extent and duration of the works would be minimised.</li> <li>• Site access and egress would be via existing tracks.</li> <li>• The tent would be situated in an existing disturbed area.</li> <li>• Spoil would be captured in tubs on site and disposed of either on access tracks or a suitable off-site location.</li> <li>• Washing and refuelling of machinery would, where possible, take place at an appropriately bunded location offsite. Where refuelling is required on site (for the generator), this would occur within a bund. A spill kit would be available in case of fuel spill.</li> <li>• Concreting would occur only during stable weather conditions, or when there is a low risk of rainfall, to ensure that concrete wash or dust does not impact on the surrounding environment. Concrete wash-up would occur off site or over a suitable container so that all washup water is captured and disposed of at a suitable location off site.</li> <li>• Waste would be managed as detailed under 'Objective G', to ensure soils are protected from contamination.</li> </ul> | <p><b>Contractor</b></p> | <p>Minor disturbance limited to bore locations and tracks.<br/>No evidence of erosion. Disturbed soils replaced or placed in appropriate locations, not on vegetation.<br/>No evidence of contamination.</p> |
|--|--------------------------|--|

- Water from the production bore would be released via lay flat hose to the beach, below the high tide mark. The discharge point would be monitored for erosion, so that it could be moved if erosion becomes notable.

#### Objective E: Prevent pollution

- If dust becomes a nuisance, the contractor would be required to suppress emissions.
- The contractor would be required to ensure that all plant and equipment are in optimal working condition to ensure that exhaust emissions are minimal.
- (See waste disposal and spill risk measures under objectives D and G).

**Contractor**

No complaints about dust.  
No significant evidence of dust coating vegetation.

#### Objective F: Safeguard against fire

- The job safety assessment completed under OH&S requirements would address fire risk mitigation.
- Equipment would be maintained in good condition to minimise risk of sparking.
- Water would be available on site for fire fighting and fire extinguishers are carried on all vehicles.
- The activity is expected to take place during early spring, when fire danger is likely to be low. If the activity occurs during high fire danger weather, additional controls would be developed and applied to minimise risk.

**Contractor**

#### Objective G: Resource efficiency

- In order to minimise resource use and wastage, the works would be carefully planned to ensure efficiency in all aspects of resource use.
- All machinery and equipment would be of high quality and maintained in optimal operating condition so that fuel is used as efficiently and clean as possible.
- All employees would be informed of the need to maintain a clean and secure site.
- All recyclable or reusable waste would be managed appropriately. Waste that is unsuitable for re-use or recycling would be disposed of at a licensed landfill site.
- Littering or dumping of waste, disposal of surplus construction materials, or permitting such activities on any land on or around the site would not be permitted. Rubbish will not be burnt or buried at the site. Concrete wash would not be disposed of on site.
- Construction litter would be contained within nominated sites. Secure rubbish bins would be provided at the site and emptied as required. Smaller objects that can be windblown would be disposed of in hoppers.
- All loads of rubbish or any other material transported would be securely covered to ensure no spillage.

**Contractor**

No waste on site  
Evidence of appropriate disposal of waste  
(**Contractor records**)

#### Objective H: Safeguard amenity

- Minimise the duration of the activity - construction activities would not occur prior to 7 am or after 6 pm. Noisy activities would be completed in the shortest practicable time.
- The concurrent use of multiple items of noisy equipment would be avoided where practicable.
- Unnecessary noise emissions would be avoided by turning equipment off when it is unused for an extended period.
- Plant and equipment would be maintained in optimal working condition.
- The contractor should minimise vehicle movement and exercise due caution when accessing and leaving the site.
- If in any doubt, the contractor would contact phone and power companies to ensure there would be no impact on these services.
- The contractor would ensure that the works are completed under adequate occupational health and safety standards and insurance. These would include completion of job safety assessments specific to the activity and sites, to identify and manage risks prior to completion of the work.
- All staff would be inducted so that they understand risks and appropriate management strategies.
- Equipment would not be left unattended or in a state that would pose a risk to the public.
- Staff training, equipment and practices would conform to occupational health and safety protocols.
- Close by residents would be informed of the reason for the activity and who to contact if they have cause for complaint.
- Any complaints would be dealt with quickly and effectively.
- A complaints register detailing complaints and remedial actions would be retained by the contractor.

**Contractor**

No complaints.  
Adequate **Contractor records**.

## 2.2 JUSTIFICATION OF THE PROPOSAL

Currently, approximately 700 megalitres of advanced secondary treated effluent are discharged from the Merimbula STP annually. The total volume disposed is approximately:

- Ocean outfall: 400 ML/annum
  - Exfiltration ponds: 150 ML/annum
- and the volume beneficially reused is approximately:
- Golf course: 150 ML/annum

Currently, the use of the ocean outfall is the major disposal method however, this method is unsightly and receives significant negative comment from the community.

The objective of the dune exfiltration project is to investigate whether some of the effluent currently being discharged from the ocean outfall could be disposed of through dunal exfiltration. This would allow additional filtering of effluent as it passes through the sand, improving the quality of water eventually released from the system however, it is important that the effluent flows towards the sea, not Merimbula Lake.

The investigations would assess groundwater movement patterns to determine whether this is likely to occur, allowing a more complete assessment of the likely impact of dunal exfiltration to be conducted if this option is to be pursued further in the future.

### 2.2.1 Alternatives to the proposal

#### Do nothing

The do nothing approach would result in continuing demand for effluent discharge via the ocean outfall. Other existing methods of disposal on the Golf Course and via exfiltration ponds are at current capacity. Continuing ocean outfall disposal would create further community dissatisfaction and may contribute to marine pollution.

#### Alternative solutions

The dune exfiltration method of effluent disposal would provide an improved method of disposal compared to the current ocean outfall, however further work is needed to determine the volume able to be disposed of in the dunes and the volume able to be beneficially reused. Beneficial reuse options under investigation concurrently with the dune investigations for disposal include farmland irrigation and irrigation of playing fields.

## 2.3 REVERSIBILITY

The proposed activity would affect a very small area (temporary impact: 105 m<sup>2</sup>, mostly non-vegetated sand; permanent impact 4.5m<sup>2</sup>; refer to **Box 1**). It has been designed with regard to potential impacts, with activities sited in disturbed and/or low impact locations. These measures minimise potential impacts. The overall impact has been assessed as low (refer to Section 5).

Considering that, unless skeletal remains were found on test bore sites and damaged as a result of the activity, the impact of the activity is likely to be small scale and minor in nature. Apart from the steel monuments capping bores, almost all traces of the proposed bores and water testing activities would be indistinguishable within a very short period of time. If the bores were later removed, the remaining impact area would be very small and unlikely to be noticeable. The impact of the proposal is therefore considered to be reversible, unless skeletal remains were found. If this occurs, the impact of the proposal would be reassessed separately through the process of applying for an Aboriginal Heritage Impact Permit.



## 2.4 ASSOCIATED DEVELOPMENT AND FUTURE IMPLICATIONS

The proposed activity would be carried out to investigate potential for disposal of effluent from the Merimbula STP by sub-surface exfiltration into the study area. The future implications of the proposal may therefore include disposal of treated effluent via exfiltration into the study area, pending the findings of the investigation. If the study outcomes indicate that the target area is suitable for exfiltration, further planning may be completed to develop a dunal exfiltration system associated with the Merimbula STP. The potential impacts of operational dune exfiltration of effluent would be fully investigated at that stage.

The investigations would enable completion of a robust assessment of the potential environmental impacts of dunal exfiltration, including the capacity of the target area to dispose of treated effluent. It would also provide data on the movement of groundwater within the target area and into surrounding areas. The proposed activity would therefore, be a valuable prelude to further planning and environmental impact assessment, and facilitate BVSC's understanding of the options available to them to improve Merimbula STP effluent disposal methods.

## 3 CONSULTATION

### 3.1.1 Government

The environmental assessment requirements for the proposal were scoped based on consultation between Bega Valley Shire Council and the NSW Department of Environment, Climate Change and Water (DECCW). The REF focuses on matters of significance to DECCW, discussed further below.

#### Department of Environment, Climate Change and Water

Consultation with DECCW focussed on the following:

- **Threatened species conservation:** DECCW advised that a Section 91 license under the Threatened Species Conservation Act may be required if impact on threatened species or ecological communities is likely. Accordingly, the relevant application process should be followed, including submission of a flora and fauna report with the application. This REF provides the required flora and fauna assessment.
- **Aboriginal heritage:** DECCW advised that an Aboriginal archaeological assessment should be prepared with the involvement of the Eden Local Aboriginal Land Council (ELALC). DECCW advised that a Section 87 permit may be required.

In light of the small scale of the proposal and tight timeframes, an alternative to Section 87 requirements was investigated. Further consultation was carried out between the Archaeologist (Julie Dibden, NSW Archaeology), BVSC and Jackie Taylor (DECCW Archaeologist) to determine an appropriate methodology for managing potential for impact during the activity. This methodology is detailed in Section 5.7 and the outcomes of consultation with DECCW are detailed in Appendix G.

### 3.1.2 Aboriginal community

Consultation with the local Aboriginal community was carried out by the project archaeologist, Julie Dibden (NSW Archaeology). The study area falls within the ELALC boundaries and two representatives of the ELALC, Lawrence Bramblett and Terry Scott assisted in the field survey and formulation of management and mitigation strategies. A draft copy of the archaeology assessment has been provided to ELALC for review and comment.

### **3.1.3**     *Affected landholders*

The subject land has two land tenures, public land managed by the BVSC and Crown Land, managed by the Department of Lands. Consultation with the Department of Lands is detailed in Sections 4.3 and 4.4.

## **3.2**        **SPECIALIST STUDIES**

An Aboriginal Archaeological Assessment has been carried out by NSW Archaeology. This is included as **Appendix F** and the findings have been considered within this REF.

## 4 STATUTORY REQUIREMENTS

### 4.1 PLANNING LEGISLATION AND POLICY

OBJECTIVE	RELEVANT PARTS	PROJECT COMPLIANCE
<b>Environmental Planning and Assessment Act 1979</b>		
<ul style="list-style-type: none"> <li>Controls environmental planning and development in NSW.</li> <li>Provides framework for statutory planning instruments including State Environmental Planning Policies, Policies (SEPP), Regional Environmental Plans (REP) and Local Environmental Plans (LEP).</li> <li>Establishes assessment and approval processes that apply to public authorities as well as individuals.</li> </ul>	<ul style="list-style-type: none"> <li>Clause 111: determining authorities must consider 'to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity'. The Act specifies certain matters to be considered.</li> <li>Proposals which do not require development consent under a planning instrument may be approved by relevant government agencies under Part 5 of the Act. A Review of Environmental Factors (REF) is required if significant impacts are unlikely. If significant impacts are likely, (for 'designated development', refer to EP&amp;A Regulation, below) an Environmental Impact Statement (EIS) would be required.</li> <li>The Director-General of Planning can issue guidelines for particular kinds of activities; if no guidelines are in force, factors listed in the Act and Regulation are used to guide decisions regarding whether an activity is likely to significantly effect the environment.</li> </ul>	<p>Although the proposal appears to be exempt development under clause 107(b) of the SEPP Infrastructure 2007 (refer below), consent from DECCW is required for activities with potential to impact on aboriginal heritage or threatened species, populations or ecological communities. An REF has been prepared to fulfil this requirement.</p> <p>The REF focuses on matters of concern to DECCW, including threatened species, populations and ecological communities and matters of aboriginal heritage significance.</p> <p>The proposal has been assessed as not likely to have a significant environmental impact, therefore an EIS is not required.</p>
<b>Environmental Planning and Assessment Regulation 2000</b>		
<p>Details assessment processes and information that must accompany development applications.</p>	<p>Schedule 3 of the Regulation lists 'designated developments' which have special notification and assessment requirements.</p> <p>Part 5, Clause 228 of the Regulation provides a list of general factors which are to be taken into account in the assessment</p>	<p>The proposal is not designated development therefore an EIS is not required.</p> <p>This REF considers the factors listed under Part 5, Clause 228 of the Regulation. A checklist against these matters is</p>

OBJECTIVE	RELEVANT PARTS	PROJECT COMPLIANCE
	of impacts.	included in Appendix A).
<b>NSW Coastal Policy 1997</b>		
<p>Provides a strategic policy framework for the balanced and coordinated management of coastal resources and values through the policies, plans and activities of government and community agencies in NSW and a comprehensive system of coastal protected areas and reserves.</p> <p>Objectives include environmental protection and rehabilitation, accommodating natural processes, cultural heritage protection, ecologically sustainable settlement, integrated planning and management and adoption of the precautionary principle.</p>	<p>Councils are to take account of the Policy when development applications.</p> <p>The Policy applies to both littoral and estuarine zones in urban and rural areas outside the Sydney metropolitan region, including one kilometre landward of the open coastline and one kilometre around estuaries and coastal lakes. The proposed works would occur within the coastal zone as defined under the Policy.</p>	<p>The proposed activity, with application of the recommended safeguards, would have a very low impact on the coastal environment, and therefore complies with the objectives of the Coastal Policy.</p> <p>There are no other specific requirements under the Coastal Policy.</p>
<b>State Environmental Planning Policies</b>		
<b>SEPP (Infrastructure) 2007</b>		
<p>SEPP (Infrastructure) consolidates and updates 20 previous NSW State planning instruments and has the objective of simplifying the process for NSW Government and local councils to provide infrastructure services.</p>	<p>Section 107 of the SEPP (Infrastructure) details exempt development, including 'development in connection with a sewage system'.</p> <p>Division 4, Section 20 of the SEPP (Infrastructure) states however, that exempt development 'cannot be carried out in critical habitat of an endangered species, population or ecological community'.</p>	<p>The proposal would take place within an area that has been identified as an endangered ecological community, therefore consent from DECCW is required. This REF fulfils assessment requirements (refer to Environmental Planning and Assessments Act, above).</p>
<b>SEPP No. 14 Coastal Wetlands</b>		
<p>SEPP 14 directs Councils in the procedures for assessing development applications in coastal wetlands as shown on a set of maps maintained under the SEPP. It ensures coastal wetlands are preserved and protected for environmental and</p>	<p>SEPP 14 identifies over 1,300 wetlands of high natural value from Tweed Heads to Broken Bay and from Wollongong to Cape Howe. Land clearing, levee construction, drainage work or filling may only be carried out within these wetlands with the consent of the local council and the agreement the</p>	<p>There are six SEPP 14 Wetlands (43-48) located around the margins of Merimbula Lake. The proposal is not likely to impact on these wetland areas, therefore there are no specific compliance requirements for this project.</p>

OBJECTIVE	RELEVANT PARTS	PROJECT COMPLIANCE
economic reasons.	Department of Planning. Such development also requires an environmental impact statement to be lodged with a development application.	
<b>SEPP No. 71 Coastal Protection</b>		
<p>The objectives of this SEPP are:</p> <ul style="list-style-type: none"> <li>To ensure that development in the NSW coastal zone is appropriate and suitably located</li> <li>To ensure a consistent and strategic approach to coastal planning and management</li> <li>To ensure there is a clear development assessment framework for the coastal zone</li> </ul>	<p>Defines the coastal zone as the one kilometre landward strip from the low water mark, extending to three nautical miles out to sea.</p> <p>Section 8 lists matters for consideration by the consent authority in determining proposals affecting the coastal zone.</p> <p>The policy regulates 'significant coastal development' and affects development control in the areas of effluent disposal.</p>	<p>The proposal would occur within the coastal zone, therefore the matters listed under clause 8 of SEPP 71 must be considered in determining the application. These are listed and discussed in Appendix B.</p> <p>The proposal is not 'significant coastal development' under SEPP 71.</p>
<b>Lower South Coast Regional Environmental Plan (REP No.2 1992)</b>		
The LEP encompasses a range of policies aimed at protecting the environment and coordinating growth in the Bega Valley and Eurobodalla Shires.	Clause 43 addresses the need to 'facilitate the economic and orderly provision of utility services'. The proposal would meet these policy objectives by addressing some of the limitations of the existing sewerage system.	A range of other policy goals contained in the REP are relevant to the proposal, covering environmental protection, protection of agricultural land and the planning and provision of infrastructure. Section 5 of the REF details environmental impacts and specific mitigation measures associated with the proposal. The proposal is consistent with the aims and requirements of the Lower South Coast REP.
<b>Bega Valley Shire Local Environmental Plan (LEP)</b>		
<p>The Local Environmental Plan (LEP) establishes the framework for future development within the local government area. The plan aims to:</p> <p>a) Ensure a balanced approach to development which is sensitive to both the economic and social needs of the</p>	To obtain planning approval, the proposal must be consistent with the objectives and restrictions applicable to planning scheme land use zones detailed in the LEP, unless adequate justification for exemption can be demonstrated.	<p><b>Environmental Planning and Assessment - Model Provisions (1980)</b></p> <p>The Bega Valley LEP adopts the Model Provisions for LEPs which, among other things, does not allow Council to restrict or prohibit "the carrying out of development of any</p>

OBJECTIVE	RELEVANT PARTS	PROJECT COMPLIANCE
<p>community,</p> <p>b) Protect and improve the economic, natural, social and cultural resources within the Council’s area,</p> <p>c) Encourage the efficient and effective delivery of services,</p> <p>d) Recognise, protect and improve the inherent natural and built character of the Council’s area, and</p> <p>e) Ensure that development has regard to the principles of ecologically sustainable development.</p>		<p>description specified in Schedule 1". Schedule 1 includes the following:</p> <p><i>“(2) The carrying out by persons carrying on public utility undertakings, being water, sewerage (and other) undertakings, of any of the following development...:</i></p> <p><i>“(a) development of any description at or below the surface of the ground”</i></p> <p>The proposed activity is, therefore, permitted under the LEP.</p>

## 4.2 CONSERVATION LEGISLATION

OBJECTIVE	RELEVANT PARTS	PROJECT COMPLIANCE
<b>National Parks and Wildlife Act 1974</b>		
<p>This act:</p> <ul style="list-style-type: none"> <li>Establishes the National Parks and Wildlife Service (now the Parks and Wildlife Division of the Department of Environment, Climate Change and Water [DECCW])</li> <li>Provides for the protection, regulation and management of native wildlife (excluding fish).</li> </ul>	<p><b>Protection of Items of Aboriginal Cultural Significance</b></p> <p>Under the Act, DECCW is required to maintain a register of sites of archaeological and Aboriginal cultural significance (Schedule 14). Section 90 prohibits a person from knowingly destroying or damaging an Aboriginal place or object, without written permission from the Director-General of the DECCW.</p> <p>Where works would impact on archaeological or heritage site, licensing would be required. The relevant licenses include:</p> <ul style="list-style-type: none"> <li>Section 87 – consent to conduct sub-surface test excavation, and</li> <li>Section 90 – consent to destroy an aboriginal site or</li> </ul>	<p>In order to determine whether the works are likely to impact on sites of Aboriginal cultural or archaeological significance, an archaeological assessment has been carried out for this proposal. The archaeological assessment report has been included as Appendix F.</p> <p>The works may involve an application for a license to conduct subsurface test excavations under Section 87 if Aboriginal artefacts are identified during the monitoring, as detailed in Section 5.7 of the REF.</p> <p>Historic heritage values have not been identified in association with the proposal location.</p> <p>The safeguards developed for the proposal would ensure that native wildlife is protected. Further detail on flora and</p>

OBJECTIVE	RELEVANT PARTS	PROJECT COMPLIANCE
	<p>object.</p> <p><b>Protection of Wildlife</b></p> <p>All fauna are deemed to be 'protected' under the Act unless included on Schedule 11 (which lists introduced species).</p>	<p>fauna protection is in relation to the Threatened Species Conservation Act.</p>
<p><b>Threatened Species Conservation Act 1995</b></p>		
<p>This act:</p> <ul style="list-style-type: none"> <li>Provides for the identification and protection of threatened species, populations, ecological communities and their habitat.</li> <li>Provides for the preparation of recovery plans for threatened species, populations and ecological communities.</li> <li>Provides for the preparation and implementation of Threat Abatement Plans to manage Key Threatening Processes.</li> </ul>	<p><b>Protection of endangered species and communities</b></p> <p>Consent authorities have a statutory obligation, under the EP&amp;A Act, to consider whether a proposal is likely to significantly affect threatened species, populations or ecological communities, or their habitats by applying the Seven Part Test. If the determination is made that there is likely to be a significant impact then:</p> <ul style="list-style-type: none"> <li>A Species Impact Statement (SIS) must be prepared and the concurrence of the Director-General of the National Parks and Wildlife Service obtained prior to the consent authority making a determination; or</li> <li>The proposal may be modified such that a significant effect on threatened species, populations or ecological communities, or their habitats is unlikely. This may require the original application to be withdrawn and the modified proposal to be submitted for re-assessment.</li> </ul> <p>The <i>Threatened Species Conservation Act 1995</i> (TSC Act) specifies seven factors which must be considered by decision-makers regarding the effect of a proposed development or activity on threatened species, populations or ecological communities, or their habitats. These factors form part of the threatened species assessment process under the EP&amp;A Act and are collectively referred to as the</p>	<p>A 'Seven-part Test' has been completed for species determined as likely to be affected by the proposal. This is included in Appendix E. The seven part test has found that the proposal is not likely to have a significant impact on threatened species, populations, endangered ecological communities, or their habitat, therefore an SIS is not required.</p> <p>A range of safeguards have been developed to ensure that the impact of the proposal on threatened species, populations, communities or EECs is minimised.</p> <p>There are no Recovery Plans or Threat Abatement Plans relevant to the proposal.</p> <p>Three Threatening Processes are relevant to the proposal. These are discussed in Section 5.6.</p>

OBJECTIVE	RELEVANT PARTS	PROJECT COMPLIANCE
	<p>'Seven-part Test'.</p> <p><b>Recovery Plans &amp; Threat Abatement Plans</b></p> <p>Under the EP&amp;A Act, recovery plans and Threat Abatement Plans are to be taken into account by determining authorities when they are considering development or activity approvals under Part 4 or Part 5 of that Act.</p>	
<p><b>Commonwealth Environment Protection and Biodiversity Conservation Act 1999</b></p>		
<p>This Act provides for a Commonwealth assessment and approvals system for:</p> <ul style="list-style-type: none"> <li>a) Actions that have a significant impact on 'matters of national environmental significance';</li> <li>b) Actions that (indirectly or directly) have a significant environmental impact on Commonwealth land; and</li> <li>c) Actions carried out by the Commonwealth Government.</li> </ul>	<p>A proposal requires the approval of the Environment Minister if an action is likely to have a significant impact on a matter of national environmental significance or listed as a matter of national significance which includes:</p> <ul style="list-style-type: none"> <li>i) World Heritage Properties,</li> <li>ii) Wetlands of International Importance (Ramsar wetlands),</li> <li>iii) Commonwealth Listed Threatened Species and Ecological Communities,</li> <li>iv) Commonwealth Listed Migratory Species,</li> <li>v) Nuclear action,</li> <li>vi) Commonwealth marine areas, or</li> <li>vii) Commonwealth land.</li> </ul> <p>The Act aims to ensure the conservation and recovery of flora and fauna species and communities at a state and national level. Schedules 1 and 2 list species and communities that are endangered, vulnerable or presumed extinct. Schedule 3 outlines key threatening processes.</p>	<p>The potential for the proposed activity to impact on matters of Commonwealth significance has been assessed and it has been found that the proposal is not likely to impact on any matter of Commonwealth significance, therefore consent from the Federal Environment Minister is not required.</p>



## 4.3 OTHER LEGAL REQUIREMENTS

OBJECTIVE	RELEVANT PARTS	PROJECT COMPLIANCE
<b>Local Government Act 1993</b>		
Sets out the functions and operating rules of Councils, provides for public works such as water supply, drainage and sewerage services, the regulation of building and other activities and the classification and management of community lands.	Under Section 60 of the Act, the approval of the Minister for Land and Water Conservation is required if the works involve constructing or extending water supplies or water treatment works, constructing or extending flood retarding basins or providing for 'sewage from its area to be discharged, treated or supplied to any person'.	The current work does not involve works such as those listed under Section 60, therefore approval under the Local Government Act is not required. Approval may be required at a later stage if changes to sewage discharge methods are pursued further.
<b>Crown Lands Act 1989</b>		
Ensures that Crown land is managed for the people of NSW through proper development and conservation.	Section 29 of the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> , states that approval is required by the Department of Lands for acquisition of land, however acquisition would not be required for the proposed activity.	Council has sought advice from the Department of Lands and been informed that should advise the Department of the proposed activity for approval (pers. comm. between Ken McLeod, BVSC and Christ Irwin, Department of Lands, 27/8/09). This advice will be complied with by provision of this REF to the Department by BVSC.
<b>Ecologically Sustainable Development</b>		
Ecologically sustainable development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes.	In 1992, the Commonwealth and all state and territory governments endorsed the <i>National Strategy for Ecologically Sustainable Development</i> . In NSW, the concept has been incorporated in legislation such as the EP&A Act and Regulation.	The aims, structure and content of this REF have their foundations in the principals of ESD. The principles of ESD and compliance of the proposal to these has been assessed in Section 5.10 of this report.

## 4.4 SUMMARY OF APPROVALS REQUIRED

The proposal would require the following government approvals:

- Approval from the Department of Lands (obtained through the Land & Property Management Authority, Nowra) to undertake investigative works on Crown Land.
- Consent from DECCW under Section 87 or Section 90 of the *National Parks and Wildlife Act 1974* may be required if Aboriginal artefacts are identified during the test excavations.

## 5 ENVIRONMENTAL ASSESSMENT

### 5.1 CLIMATE AND AIR QUALITY

#### Values at proposal site

Mean temperatures recorded at Merimbula Airport, which is directly adjacent to the proposal site, are summarized in Table 3.

**Table 3: Mean temperatures, Merimbula Airport**

Season	Minimum temperature	Maximum temperature	Prevailing winds
Summer (February)	15.3°C	24.5°C	north easterly
Winter (June)	4.3°C	15.9°C	south westerly

The Merimbula area has an annual mean rainfall of 879 mm, with a peak in spring and lower rainfall in winter. The area can experience intense rainfall events. The highest daily rainfall event recorded at Merimbula Airport was 252 mm in December. The highest monthly rainfall recorded was 447.2 mm, recorded over April.

Being predominantly within a natural setting and distant from major industries, background air quality at the proposal site is likely to be generally high. Air quality is occasionally reduced during hazard reduction burning activities, commonly undertaken during autumn.

#### Nature, scale and significance of potential impacts

The construction phase of the project would result in a very localised and very low reduction in air quality due to vehicle and machinery emissions and possibly dust. This impact would be temporary, and is not expected to be significant. There are no residential receivers within 100 metres of the northern site and these are protected from the site by bushland, therefore it is unlikely that they would be impacted by dust or emissions.

In view of the limited scale and temporary nature of the construction operation, the contribution of carbon dioxide emissions to global warming would be low. Greenhouse gas emissions are discussed further under *Cumulative Impacts*, Section 5.9.

#### Risk and uncertainty

Low

#### Further assessment requirements

None

#### Impact mitigation

- If dust becomes a nuisance, the contractor would be required to suppress emissions.
- The contractor would be required to ensure that all plant and equipment are in optimal working condition to ensure that exhaust emissions are minimal.

## 5.2 HYDROLOGY AND CATCHMENT VALUES

### Values at proposal site

No surface hydrological features are present near any of the bore locations. It is likely that some sub-surface water occurs within the dune environment. The extent, flow and quality of this water would be investigated as part of the activity.

### Nature, scale and significance of potential impacts

The surface impacts of the proposed activity would be very limited in extent and are likely to have a negligible impact on stormwater flow or potential for erosion.

- Pitching of the site office - tent may cause some concentration of stormwater flow, however the tent would be left on site for no more than three to four days and adverse conditions would be avoided.
- Bores would be capped and water would not be left to flow freely.
- During the pump test, water would be extracted from the test bore at an expected rate of 5 liters per second. Over 72 hours, this would amount to a total extraction of approximately 1.3 megalitres of water released to the beach (approximately half an Olympic sized swimming pool). Pumped water would be released to the beach (high tide mark) to minimise potential for any impact on soil. To protect beach sand, the outlet would be monitored and moved regularly if necessary.
- The water that would be released would be unaltered aquifer water with no additives.

In addition to pumping of groundwater, water samples would be taken from the production bore and surface water monitoring location. Approximately 3 litres would be taken from each source. Onsite testing would utilise a small quantity of this for testing of conductivity, pH etc using an electronic metre. This water would be returned to the site on completion of testing (it would be essentially unaltered by the electronic testing). The sum of each sample would be sent to a laboratory for analysis.

### Risk and uncertainty

Low-moderate

### Further assessment requirements

None

### Impact mitigation

Consolidated under Section 5.3 *Geomorphology, geology and soils*.

## 5.3 GEOMORPHOLOGY, GEOLOGY AND SOILS

### Values at proposal site

The proposed activity would take place on a low-relief dune complex between Merimbula Beach and Merimbula Airport. The surface gradient throughout the subject areas is low (<5°) and elevation is around 10 metres ASL.

The proposal site is located within the Wallagoot Foredune (wf) soil landscape, defined by Tulau (1998) (refer Figure 5-1). Soil landscapes are areas of land that have recognisable, describable and mappable topography and soils.

The Wallagoot Foredune soil landscape is a wind blown depositional landscape featuring undulating rises formed of well sorted, deep sands. This landscape is considered active and vulnerable to blow-outs if vegetation is removed. Vulnerability to wind erosion and erosion by concentrated surface flows is high to very high.

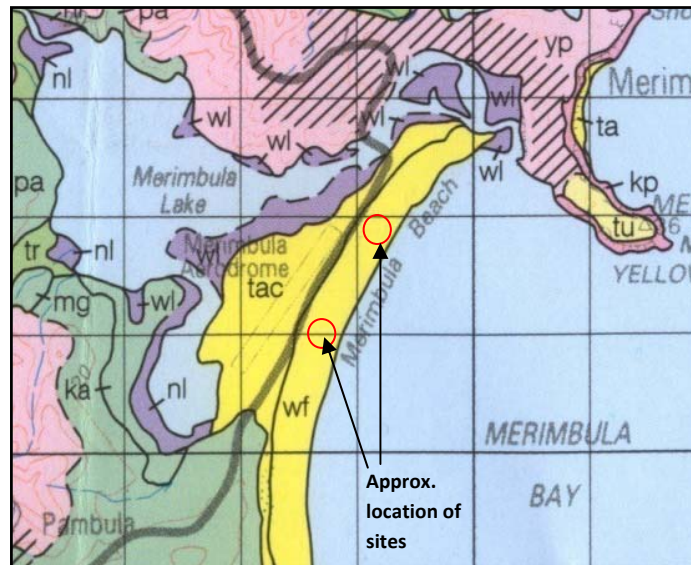


Figure 5.1 Soil landscape of the study area (Tulau 1998)

### Nature, scale and significance of potential impacts

The proposed test boring activities would have a small range of low level impacts including:

- Compaction and disturbance of soil during site access (access would be via existing tracks).
- Very localized displacement of soil in the seven bore locations (7 monitoring bores with 50 mm diameter plus one 100 mm diameter production bore at the Southern Site) – this would create approximately 4.5 m<sup>2</sup> of surface disturbance in total, plus the removal of spoil from each bore.
- A few cubic metres of spoil is expected to be extracted from each bore. This would be in the form of a slurry of soil/sand and water. The production bore would have an additional non-toxic, biodegradable polymer included in the slurry (used to stabilise the sides of the bore).
- Small scale potential to disturb soil by concentration of stormwater if rainfall occurs while the site tent is set up or when vehicles are on site.
- Potential to pollute soil if a fuel or concrete spill occurs on site or if waste is left on site.

### Risk and uncertainty

Low

### Further assessment requirements

None

### Impact mitigation

- Investigative activities (including access, tent situation, bore establishment, pumping and water testing) would not be carried out when heavy rain is forecast.
- The extent and duration of the works would be minimised.
- Site access and egress would be via existing tracks.
- The tent would be situated in an existing disturbed area.
- Spoil would be captured in tubs on site and disposed of either on access tracks or a suitable off-site location.

- Washing and refuelling of machinery would where possible, take place at an appropriately bunded location offsite. Where refuelling is required on site (for the generator), this would occur within a bund. A spill kit would be available in case of fuel spill.
- Concreting would occur only during stable weather conditions, or when there is a low risk of rainfall, to ensure that concrete wash or dust does not impact on the surrounding environment. Concrete wash-up would occur off site or over a suitable container so that all washup water is captured and disposed of at a suitable location off site.
- Waste would be contained safely on site and removed in a timely manner, and would not be allowed to contaminate local surroundings.
- Water from the production bore would be released via lay flat hose to the beach, below the high tide mark. The discharge point would be monitored for erosion, so that it could be moved if erosion becomes notable.

## 5.4 FLORA VALUES

### 5.4.1 Assessment method and limitations

The Northern and Southern Bore Sites were surveyed on 4 June 2009, using the random meander method around each potential borehole area on each site. At the Southern Site, where the boreholes will be closer together, the entire area around all four was searched. At the Northern Site an area of about 20 metres radius around each borehole location and the edges of the access tracks were searched. The survey took about two hours to complete.

A full list of species recorded for each site is presented in Appendix C. The scientific names of introduced species are preceded by an asterisk in the text and appendices.

The survey timing in early winter was not optimal for species identification, so some species may have been overlooked, particularly grasses on which no seed heads were present. The Northern Site had been burnt within the previous 6-8 months, which has also probably affected what species are present and what could be detected. Some shrubs had been killed by the fire, but were still recorded as present since the burnt remains were still identifiable, and it is likely that they will be replaced by seedlings once there has been adequate rainfall to stimulate germination. It is considered unlikely that any significant flora species have been overlooked despite the survey timing, based on local knowledge of the habitat type and the species which can be expected in it.

### 5.4.2 Flora values at the proposal sites

#### Vegetation communities present

Both sites are situated within the extensive sand spit south of the mouth of Merimbula Lake, at an elevation of around ten metres above sea level, on a substrate of Quaternary sand deposits. Although the northern and Southern Sites are roughly equally distant from the ocean, the Southern Site is in Dune Scrub vegetation dominated by Coast Banksia (*Banksia integrifolia*), while the northern bore hole sites are all within eucalypt forest dominated by Bangalay (*Eucalyptus botryoides*). Dune Scrub is generally located closer to the ocean and forms a buffer behind which the less salt and wind tolerant eucalypt forest can develop.

Under the SCIVI vegetation classification of Tozer *et al.* (2006) Dune Scrub is referred to as DSF e61 (Coastal Fore-dune Scrub). It is found between Beach Strand Grassland (Map Unit Grl e62) which occurs on the most exposed dunes of the beach, and DSF p64 (Coastal Sand Forest), which is located slightly further inland on stabilised dunes, and occasionally on aeolian sand deposits on headlands or further inland.

#### Northern Site

COASTAL SAND FOREST is dominated by Bangalay (*Eucalyptus botryoides*) with smaller trees Saw Banksia (*Banksia serrata*), Coast Banksia, Native Cherry (*Exocarpos cupressiformis*), Hickory Wattle and Black Wattle (*Acacia mearnsii*), the latter killed by the recent fire, but still recognisable. Shrubs include *Pittosporum undulatum*, *Monotoca elliptica*, *Breynia oblongifolia* and, on the nearby unburnt easement, *Hibbertia linearis*, *H. acicularis*, *Aotus ericoides*, *Acacia suaveolens* and *Correa reflexa*. The understorey is dominated by the low sedge *Lepidosperma concavum*, with *Lomandra longifolia* and bracken (*Pteridium esculentum*) being locally abundant.

This community is listed as the Endangered Ecological Community Bangalay Sand Forest of the NSW Sydney Basin and South East Corner Bioregions, under the *Threatened Species Conservation Act 1995*. Threats to the community include the high degree of clearing for residential development and, in remaining areas, weed invasion, track proliferation, rubbish dumping and similar threats associated with close proximity to towns. Coastal Foredune Scrub is not listed, as its position closer to the sea on less stable dunes has saved it from being cleared to the same extent. Tozer *et al.* (2006) estimate that up to half of it has been cleared, but most of that remaining is within conservation reserves, where it may still be subject to threats from vehicle tracks, dumping and weeds.

### Southern Site

COASTAL FOREDUNE SCRUB consists of a low (3-8m) canopy of Coast Banksia (*Banksia integrifolia*), with scattered thickets of sapling Hickory Wattle (*Acacia implexa*), shrubs *Monotoca scoparia* and *Hibbertia* spp., and a dense groundcover of the scrambling succulent shrub *Rhagodia candolleana*, sedges *Lepidosperma concavum* and *L. gladiatum*, Spiny Mat-rush (*Lomandra longifolia*) and various grasses, including *Microlaena stipoides* and *Poa poiformis*. Weed invasion along tracks has resulted in locally high density of the exotic grasses African Lovegrass (*\*Eragrostis curvula*), Parramatta Grass (*\*Sporobolus africanus*) and Panic Veldtgrass (*\*Ehrharta erecta*), and the forb Cat's Ear (*\*Hypochaeris radicata*). Away from tracks weeds are less common, although Panic Veldtgrass has spread quite widely.

Coastal foredune scrub is relatively common and not regarded as threatened in NSW, however it's presence is restricted to suitable coastal sites, which, in general, should be considered to be under pressure due to coastal development patterns in NSW.

### 5.4.3 Significant species

No plant species which are listed on Schedules 1 or 2 of the *Threatened Species Conservation Act 1995* or listed as nationally threatened under the *Environment Protection and Biodiversity Conservation Act 1999* were found on either site.

DECCW Wildlife Atlas records were consulted for records of threatened plant species from the South East Coastal Plains subregion of Southern Rivers Catchment Management Area to help determine which threatened species have the potential to occur in the area. These species, their habitat requirements and the likelihood of them occurring on the site are discussed in Appendix D.

The habitat assessment found that only three of the threatened flora species recorded from the region, the shrub *Pseudanthus ovalifolius*, forb *Galium australe* and the orchid *Caladenia tessellata*, have any potential to occur on the site. The probability of any of them actually occurring there is extremely low. *Pseudanthus ovalifolius* is known in the region from only a single old record, although this is located quite close to the site, in North Ben Boyd National Park. The sites were searched sufficiently thoroughly to detect this species if present, and it was not seen. *Galium australe* is a very inconspicuous plant, but as the sites are relatively small, it is considered that they were searched sufficiently thoroughly that this species too, would have been detected if present. Orchids are generally only visible or identifiable during their flowering period, which in the case of *Caladenia tessellata* is spring. The survey timing was therefore not suitable for its detection. However, as it has only been included in the list of potentially occurring species on the grounds of its occurrence to the north (in Shoalhaven LGA) and south (in East Gippsland) of the region, there is no strong reason to suppose it might occur

on the sites. The probability of occurrence of any of these three species on the sites is so low that Seven-part Tests are not considered warranted for them.

#### **Nature, scale and significance of potential impacts – significant species**

Three threatened flora species are considered to have potential to occur on the site (*Pseudanthus ovalifolius*, *Galium australe* and *Caladenia tessellate*), however the probability of any of these species actually occurring on the site there is considered to be extremely low. It is very unlikely that the proposal would impact on significant species if the safeguards detailed below are applied.

#### **Significance of impacts**

Low

#### **Risk and uncertainty**

Low – moderate

#### **Further assessment requirements**

None if recommended safeguards are applied during works

#### **Impact mitigation**

- The contractor would be made aware of the appearance of the three threatened species potentially occurring on the sites, and the need to avoid impact if they are observed (refer to Appendix H). This would facilitate identification at the work stage and enable appropriate safeguards to be developed.

### **5.4.4 Endangered Ecological Communities**

Bangalay Sand Forest is an EEC listed under the *Threatened Species Conservation Act 1995*. It is not listed as nationally threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. The Northern Site is wholly within this community, while the Southern Site is not within it.

#### **Nature, scale and significance of potential impacts - EECs**

The proposed installation of bores has potential to result in the removal of vegetation at the seven bore locations resulting from the subsurface test excavations (Archaeological assessment prior to works). Each bore will be assessed resulting in the excavation of 1 metre diameter pits. This would create approximately **7 square metres** of disturbance in total, however this has the potential to enlarge because the substrate is loose sand and is prone to collapse. Nevertheless actual removal of vegetation would be avoided altogether in most cases by installing the bores in existing areas of bare ground.

Minor trimming or compression of some vegetation may occur where drilling equipment is situated. A work area of approximately 3 metres by 5 metres would be required at each bore area, making a total impact area of approximately 60 square metres at the Northern Site (excluding access, by existing tracks). Impact on vegetation at each site would be minimised, however, by using existing tracks and open/bare areas where possible. Avoiding the removal of vegetation and following weed hygiene protocols (refer below) would minimise potential for impact associated with weed incursion. Generally, activity at the Northern Site would have a small scale and reversible impact on Bangalay Sand Forest.

#### **Significance of impacts**

Low

#### **Risk and uncertainty**

Low

#### **Further assessment requirements**

None

#### **Impact mitigation**

- The area of native vegetation impacted by the works should be minimised by using disturbed areas for bore location, vehicle access, machinery parking, materials laydown and tent location wherever practicable.
- Excavations and vehicle/machinery movements would occur outside the dripline of trees
- Works would be avoided during, and immediately following heavy rainfall events to protect soils and vegetation at the site.
- Any cleared vegetation should be chopped up and placed on access to protect soil and allow for natural decomposition. Do not burn, leave in heaps or lines or push up around trees or other plants.
- Appropriate fire fighting equipment would be held on site when the fire danger is very high to extreme, with the operator on site trained in its use.

#### 5.4.5 Disturbance and weeds

The Northern Site appeared at the time of the survey to be less disturbed and weedy than the Southern Site, despite its closer proximity to a residential area, though the recent fire may have temporarily removed some weeds. Although it has tracks through it, they do not go all the way to the beach, and are therefore probably less used than the track running through the Southern Site, which does provide informal, but obviously well used, access for vehicles to the beach. The presence of a network of such tracks through this dune complex and a cleared utilities corridor with a maintenance track running north-south through the entire area has encouraged vehicle use in the dunes, with consequent invasion of three weedy grass species, African Lovegrass (*\*Eragrostis curvula*), Parramatta Grass (*\*Sporobolus africanus*) and Panic Veldtgrass (*\*Ehrharta erecta*). As discussed above, these are more prominent at the Southern Site, though present at both. African Lovegrass is widely established along the easement west of both sites, and continues to spread along tracks into less disturbed parts of the dune system. Panic Veldtgrass seems capable of spreading through the dunes in the absence of disturbance, but is more common in the Coastal Fore-dune Scrub than in the Bangalay Sand Forest. Other weedy grasses detected on the site were Buffalo Grass (*\*Stenotaphrum secundatum*), locally common at the eastern-most of the northern cluster of sites, and Kikuyu (*\*Pennisetum clandestinum*), recorded on a mound of dumped soil adjacent to one of the tracks at the Northern Site. Both these infestations are relatively small at the moment but have the capacity to spread.

Two weeds listed as noxious in Bega Valley Local Government Area occur on the sites, African Lovegrass, and Bridal Creeper (*\*Asparagus asparagoides*). The latter is scattered at the Northern Site, but was not recorded at the Southern Site, though it is quite likely to be present in this area too. Several other environmental weeds are present at one or other site in low numbers, including Formosan Lily (*\*Lilium formosana*) at both sites and a few small plants of Dolichos Pea (*\*Dipogon lignosus*) at the Southern Site.

Disturbance associated with the proposal has the potential to exacerbate weed problems on the sites. At the moment weeds are a surprisingly minor component of the flora away from track edges, given the proximity to town, but it is very likely that this area of native vegetation will continue to deteriorate over time, without some intervention. Currently it appears that no weed control work is undertaken in the area. While some evidence of dumping was seen at a single location, and this had clearly introduced several minor weeds as well as Kikuyu, it appears that dumping is not a major contributor to weed infestations at the moment, but that most weed spread is via seed carried on passing vehicles, people and animals.

#### **Nature, scale and significance of potential impacts – weeds and disturbance**

The proposed activity would not require clearing of canopy vegetation, but would involve minor disturbance of the shrub layer and some compression of the groundcover layer, as well as the general movement of vehicles and equipment to and from the site. This disturbance has potential to promote further weed invasion through exposure and disturbance of soil, however the extent and duration of disturbance is low therefore potential for



the spread of weeds would be relatively low provided the recommended safeguards are applied. The Northern Site is the least weedy of the two sites.

### Significance of impacts

Low-moderate

### Risk and uncertainty

Low. No threatened woody or perennial plant species were recorded during the survey, and the chances of threatened geophytic, annual or seasonal species being present are low. Some risk exists in relation to the impact of weeds on the site following the works, although the recommended hygiene and control measures should be adequate to reduce this risk to acceptable levels.

### Further assessment requirements

None

### Impact mitigation

- Existing weeds at each site, such as African Lovegrass present along track verges, should be managed prior to site activity to reduce potential for them to be spread by the vehicles and machinery to be used in the proposal.
- Machinery, vehicles and equipment used in the works must be washed and disinfected before and after onsite access to reduce the introduction and spread of weeds and pathogens such as *Phytophthora* (Cinnamon Fungus).
- Weed monitoring would be carried out at all sites after the completion of construction works and ongoing weed control would occur where noxious or invasive species are recorded. In particular, monitoring would be undertaken during the following late spring/early summer, and remedial action taken as required.
- Grasses and rushes removed from excavation areas should be excavated with roots in tact and stored in a cool, shady area for replacement after the works. They should be watered in well on replacement and the tops cut back to about 1/3 to improve chances of re-establishment. Follow-up watering may be required if conditions are hot and dry. If plants re-establish this will reduce the impact of excavations. If they die they will still help protect the soil and provide microhabitat in which plants have a better chance of establishing later.
- It is recommended that the network of tracks in the dune area should be closed to vehicles.

## 5.5 FAUNA VALUES

### 5.5.1 Approach and methodology

No targeted fauna surveys were undertaken due to the low impact nature of the proposal and the very limited area of habitat which is likely to be affected. Habitat evaluation was undertaken and opportunistic sightings of fauna were recorded during the vegetation survey.

## 5.5.2 Values at proposal site

### Species Assessment

#### Species observations at both sites

As *Banksia integrifolia* was in flower at the time of the survey, species observed consisted mostly of nectar-feeding bird species, Rainbow Lorikeet, New Holland Honeyeater, Eastern Spinebill and Little Wattlebird. Two lizard species which are common in the district, the Garden Skink (*Lampropholis guichenoti*) and Jacky Lizard (*Amphibolurus muricatus*) were seen, and a sloughed snake skin, probably a Red-Bellied Black Snake (*Pseudechis porphyriaceus*), was found at the Northern Site. Signs of mammals included small macropod tracks (not identified but probably juvenile Eastern Grey Kangaroo or Swamp Wallaby), macropod scat and Rabbit scat and diggings.

#### Habitat values

Fauna habitat features which might be of value to threatened fauna species were searched for but very few were found. There are no trees of hollow-bearing age at the Northern Site, and no trees which might become hollow-bearing at the Southern Site. There are no rock outcrops and little fallen timber of any size, and no water bodies. The main fauna resources offered by both sites are the seasonally abundant nectar resource provided by the two banksia species present, and the patchily dense groundcover of sedges, *Lomandra* and *Rhagodia candolleana*, which could provide shelter for ground-dwelling fauna.

The proximity to residential areas may also reduce the value of the area for native fauna, with the consequent likelihood of high predation levels by straying cats and dogs. The area appears to be a popular dog walking location for the local residents and tracks of domestic dogs were seen on tracks at both sites. The European Red Fox is likely to be present in the area.

#### Threatened fauna

No fauna species listed under Schedules 1 or 2 of the *Threatened Species Conservation Act 1995* or listed as nationally threatened under the *Environment Protection and Biodiversity Conservation Act 1999* were found at either site nor were any signs of their presence, such as diggings made by Bandicoot or Potoroo species, scratch marks on trees or Yellow-bellied Glider sap-feeding marks on trees, observed.

No fauna listed as migratory under the *EPBC Act* were recorded, although some are considered quite likely to occur there (White-bellied Sea-eagle, Rufous Fantail, Black-faced Monarch, White-throated Needletail). None of these species are considered threatened, and the proposed activity is very unlikely to have any impact on them, given its small size and brief period of operation (6 days). The White-bellied Sea-eagle is a bird of prey which hunts primarily along the sea shore, taking fish and waterbirds. The Rufous Fantail and Black-faced Monarch occur in moist or wet sclerophyll forest, primarily in gullies, and might find marginal habitat within the dune forest and scrub, but as little or no vegetation is likely to be cleared, there should be no impact on these species. The White-throated Needletail spends only the non-breeding part of its life cycle in Australia, where it lives entirely on the wing, hawking for insects above a range of habitat types. The proposal cannot affect this species.

An evaluation of threatened species known from the area (recorded on the DECCW Wildlife Atlas for the South East Coastal Plains subregion of the Southern Rivers CMA) determined that marginal habitat at best is present for 21 species on or adjacent to the sites, with a further 6 threatened species potentially utilising the adjacent beach. The habitat assessment is presented in Appendix D. Due to the proximity to residential areas and the scarcity of relevant resources however, their frequent occurrence and dependence on the site is unlikely (refer to Table D.2 in Appendix D for details).

Only two species are considered to have the potential to be resident in the vicinity, and potentially be impacted by the proposal: the Eastern Pygmy-possum and the White-footed Dunnart (both listed as Vulnerable under the TSC Act, and not listed under the EPBC Act). A Seven-part Test has been completed for these two species. No Seven-part Test has been completed for the remaining 27 species, on the grounds that they are unlikely to use

the sites other than on a casual basis for foraging, or are unlikely to be present due to the proximity of the site to a town, despite the presence of potentially suitable habitat, or that they are only rare vagrants to the region, which lies outside their normal distribution. These species are discussed briefly below.

Species which might utilise resources (nectar-bearing trees) on the sites, but which are rare vagrants to the region are the Regent Honeyeater, Swift Parrot and Purple-crowned Lorikeet, whose main migration routes are inland. Also in this category is the Orange-bellied Parrot, whose distribution is largely confined to Tasmania and southern Victoria, which might find feeding habitat on the adjacent foredune and beach, but only a single vagrant individual has been recorded from Sydney, which suggests that it must have passed through the region (R. Kesby, DECCW. Merimbula, pers. comm.). This species forages mainly in saltmarsh, which is not present on the site, but may also forage in frontal dune vegetation. The probability of any of these species being affected by the proposed activity is extremely low.

Other species which might utilise the adjacent beach, and are more commonly recorded in the region are the Hooded Plover and Little Tern, which nest on beaches in summer, the Sanderling, which is a rare summer visitor to beaches and mudflats that has been recorded from Wallagoot Lake and Nadgee Nature Reserve, the Pied Oystercatcher which commonly forages on local beaches for buried invertebrates but generally nests on off-shore islands, and the Osprey, a raptor which hunts for fish over the ocean or lakes and estuaries and builds a large stick nest on a tall dead tree with a good view over water. There is also one record of a pelagic turtle species nesting on Merimbula Beach, though this would be an extremely rare event, since marine turtles are largely tropical in their distribution (R. Kesby, DECCW. Merimbula, pers. comm.). It is considered unlikely that the proposed activity would have any direct or indirect impact on any of these species. The only impact on Merimbula Beach will be the discharging of pumped water into the tidal zone over a period of three days. If Hooded Plovers or Little Terns were nesting on the beach this could cause disruption, but neither are known to nest on Merimbula Beach and there is only one record of non-nesting Hooded Plovers from this beach (R. Kesby, pers. comm.). The Osprey is rarely recorded in the region and is not known to nest in the area.

There are several species which might find suitable feeding habitat at either site, but could not breed there due to a lack of tree hollows. These are the Barking Owl, Masked Owl, Sooty Owl (species which are not largely dependent on arboreal mammals as prey and might therefore find foraging habitat in the dunes), Gang-gang Cockatoo which feeds on eucalypt and wattle seed, as well as occasionally on exotic berries in nearby towns (J. Miles, pers. obs.) and five species of microbats, all of which require either tree hollows or caves for roosting and breeding. The Grey-headed Flying-fox might find foraging habitat in the flowering banksia and eucalypts, and the site is within reach of the two known camps in the region, at Bega and west of Pambula. However, as no trees are to be removed and very little ground vegetation cleared it is considered very unlikely that the proposed activity would have a negative impact on any of these species.

The Square-tailed Kite forages for nestling birds above the forest canopy. It could forage in the vicinity. There are regular sightings of this species from the coastal strip between Kalaru and Eden (Far South Coast Birdwatchers Newsletter, 1998-2009). However, as this species is migratory in south eastern Australia, departing for the north in winter (Pizzey and Knight, 1997) and has a large foraging territory, this low impact proposal is unlikely to affect it. The Pink Robin is migratory and is very rarely recorded, so is unlikely to be affected. The principal habitat of the Diamond Firetail in the region is the grassy woodlands of the farming areas of the Bega and Towamba Valleys, so it is very unlikely to use the forest or dune scrub habitat available on the site. Occasional coastal records are known from Bournda and Kalaru (Far South Coast Birdwatchers Newsletter, 1998-2009), but the species is so rare on the coast that it is extremely unlikely to be affected.

Two terrestrial and two arboreal mammals were found to have marginal habitat present on the sites. The Southern Brown Bandicoot and Long-nosed Potoroo have a very small likelihood of occurrence due to the proximity to residential areas and consequent elevated predation from straying cats and dogs. No diggings of bandicoot or potoroo species were seen. The Brush-tailed Phascogale could utilise forest in the area, but would be limited by the absence of tree hollows. The Koala would be unlikely to occur in the area, as it does not

include any of the preferred feed tree species recorded for the region, and there are no records for the immediate locality. The closest records are from Sapphire Coast drive, north of Merimbula (approximately 2km from the site), with a further nine records within 10 km of the site.

Only two species were considered to have better than marginal habitat on the sites, the Eastern Pygmy-possum and the White-footed Dunnart. The Eastern Pygmy-possum can utilise situations other than tree hollows for shelter, and is a nectar feeder which feeds on banksias extensively, as well as pollen, insects and soft fruits. The home range size is small (<1 hectare), so it is possible that the species could occur in the dunes south of Merimbula. This area is contiguous with less disturbed forest in North Ben Boyd National Park, where banksia species are also common. The White-footed Dunnart is a small terrestrial predator which feeds on invertebrates. It has been caught in pitfall traps in disturbed dunes on Twofold Bay (J. Miles, pers. obs.) and has been captured in similar habitat near Melbourne, “on the grassy foredune complex, backed by *Leptospermum laevigatum* scrub and woodland of banksia and eucalypt”, (Lunney, in Strahan, 1998) and south of Eden (pers. comm. B. Marshall). See Appendix E for the Seven-part Test on these two species.

### Introduced Species

Previous surveys in and adjacent to the proposal area have recorded the House Sparrow, European Wild Rabbit, European Red Fox, Black Rat and feral/domestic cats and dogs (Nicholas Graham Higgs and Associates 1994, 1995). Foxes, dogs and cats are adaptable predators likely to predate upon small native mammals and birds. Access tracks and disturbance at the sites currently provide opportunity for ingress to the site.

### Fauna Impact Assessment

#### Nature, scale and significance of potential impacts

The threatened fauna assessment, including habitat assessment (Appendix D) and Seven-part Test (Appendix E) concluded that no fauna species are likely to be adversely affected by the proposed activity. The risk could be reduced by searching the likely impact zone for species’ dens (eg. grassy Dunnart nests or occupied dens) immediately prior to the work commencing and application of the additional safeguards detailed below.

Refer to Seven-part Test (Appendix E) for assessment of impact on the White-footed Dunnart and Eastern Pygmy-possum.

#### Risk and uncertainty

Low

#### Further investigations required

Contractor should check the likely impact zone for species or species dens prior to commencing work or moving vehicles or equipment.

#### Mitigation measures

- Place materials/equipment on open areas or bare ground where possible, and thoroughly search any location for the presence of fauna before undertaking the activity.
- Avoid driving over logs and rocks that could provide fauna habitat – utilise existing tracks where possible.
- Do not otherwise disturb habitat features such as rocks and logs.
- Minimise night work including driving on the site after dark.
- Minimise noise where possible (refer to noise control, Section 5.8 [Noise])
- Do not leave pits/bores open/uncovered overnight.
- Check site tent for the presence of fauna before packing.

## 5.6 KEY THREATENING PROCESSES

Under the TSC Act, a Key Threatening Process is a process that threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities. Key Threatening Processes which are currently declared under the TSC Act and which are relevant to the proposal have been assessed in Section (g) of the seven part test (Appendix E). Under this assessment, it was found that the proposal has potential to contribute to three key threatening processes:

- The invasion of native vegetation by exotic perennial grass.
- Infection of native plants by *Phytophthora cinnamomi* (Cinnamon Fungus).
- The invasion and establishment of exotic vines and scramblers.

These three processes are all associated with the potential for the project to spread weeds and/or pathogens.

### Nature, scale and significance of potential impacts

*Phytophthora* is not currently present at the site but could be present at sites where the contractor has used their equipment previously, therefore there is a risk that it could be introduced to the site if adequate hygiene procedures are not followed. If this impact occurred, it could have a significant impact on EEC (at the northern site), habitat values, habitat connectivity and the viability of populations dependent on site habitat. It is unlikely, however, that impact would occur if the recommended safeguards are complied with.

Exotic grasses, vines and scramblers all currently exist at the site and could spread whether the activity occurs or not however the activity has potential to increase the spread of weeds. Like *Phytophthora*, this risk could be managed by appropriate hygiene procedures, as detailed in the flora impact *mitigation measures* (Section 5.4). This minimises the risk of impact so that it is likely to be low. The consequences of impact could however, be significant, and include impact on EEC, habitat values and the viability of species dependent on site habitat.

### Risk and uncertainty

Moderate

### Further investigations required

Contractor should assess potential for *Phytophthora* or weeds to be introduced.

### Mitigation measures

To ensure that the appropriate safeguards are applied, it is further recommended that the following safeguards are applied:

Safeguard	Responsibility	Timing
Induct/inform contractor of the nature of environmental risks, including key threatening processes, and how the proposed activity could contribute to impacts.	BVSC	Prior to works
Control weeds at the bore locations and access routes.	BVSC	Prior to works
Assess risk of introduction of <i>Phytophthora</i> .	Contractor	Prior to introduction of equipment
Thoroughly clean, and if risk of <i>Phytophthora</i> has been identified or risk assessment shows uncertainty, sterilize all equipment that will come in contact with ground,	Contractor	Prior to introduction of equipment

groundwater or vegetation.

Audit contractor to ensure compliance with hygiene protocols.	BVSC	Prior to introduction of equipment
Carry out follow-up site monitoring and weed control.	BVSC	6 monthly intervals for up to two years following completion

## 5.7 CULTURAL HERITAGE VALUES

An *Aboriginal Archeological Assessment* for the site has been prepared by NSW Archaeology. This is included in Appendix F. The assessment included community consultation as required under the new *Interim Community Consultation Requirements for Applicants*, as well as a search of the NSW DEC Aboriginal Heritage Information Management System. A surface assessment of the site was completed by Julie Dibden (Principal, NSW Archaeology), with Lawrence Bramblett and Terry Scott from the Eden Local Aboriginal Land Council. No Aboriginal objects were identified at any of the study sites.

The dune system adjacent to Merimbula Beach and encompassing the proposal areas has a high level of significance to Aboriginal people. In particular, there is potential for Aboriginal burials to have occurred within the dune system and for subsurface skeletal remains to be present within the study area. The Archaeological Assessment recommended that the activity proceed with a precautionary approach. This is detailed under *impact mitigation*, below.

### Nature, scale and significance of potential impacts

The works have potential to damage or destroy Aboriginal sites and artifacts, if they are present in the proposal area, particularly if subsurface remains are present beneath the bore locations. Impact on burial sites is likely to have a high significance to the local Aboriginal community. According to the *Archeological Assessment* (Appendix F):

- The potential for Aboriginal objects in the form of stone artifacts to be present in a test bore locations is considered to be low. If present at all, stone artifacts will be distributed in very low density only.
- The potential for Aboriginal objects in the form of shell midden to be present in the test bore locations is considered to be low.
- The potential for Aboriginal skeletal material and burial contexts to be present in the Merimbula Bay Barrier landform is high. Aboriginal skeletal material has been found previously within the landform and this is consistent with burial site locational patterning elsewhere along the south coast, however the exact location of burials cannot be predicted in respect of the proposed test bore sites. Potential for the activity to impact on Aboriginal remains is moderated by the following factors:
  - The small and discrete nature of the proposed impacts.
  - The fact that Kuskie (1995) conducted extensive subsurface test excavation in the area situated between the Northern and Southern Areas without encountering any human skeletal material.

Potential for impact would be further reduced by the application to a precautionary approach to carrying out the excavations, as detailed under *impact mitigation*, below.

### Risk and uncertainty

Low – moderate

### Further assessment requirements

Refer below – a precautionary approach to carrying out excavations has been recommended.

### Impact Mitigation

The Archaeology Report (Appendix F) proposes two possible courses of action to mitigate impacts. The second option has been supported by the DECCW and is presented here (refer to Appendix F for further details).

- Monitoring: A program of monitoring would entail making observations of the spoil from the top 2 metres of each of the test bores to determine whether or not Aboriginal skeletal material is present

#### *Monitoring details*

Monitoring during impact for the purposes of identifying cultural material that may be uncovered during earth disturbance can be implemented as a management strategy. Monitoring is a reactive rather than pro-active management strategy, and as such, is not an ideal management tool in cultural heritage management.

A number of factors relating to such an approach need consideration and these are listed in point form below:

1. Monitoring of approximately the top 2 metres of the test bore spoil is possible with a monitoring strategy.
2. Given that there is some potential to cause damage to either the skeletal material and/or the burial context, if encountered, during monitoring of test bore drilling works, this risk needs to be minimised.

An appropriate risk minimisation strategy has been identified to entail the following:

- The use of a hand auger for the top two metres of spoil in the test bores to minimise impacts to skeletal material if found;
  - The removal of spoil in 10 cm increments from the top two metres of the test bores.
3. A protocol relating to burials would need to be established prior to works commencing which would outline the appropriate scenario for:
    - Cessation of work at the test bore site in question;
    - Notification to relevant authorities; and
    - Continuation of works program. It is noted that the proponent would need to be able to continue with works in alternative locations while the relevant protocol was implemented for any burials uncovered.

## 5.8 OTHER SOCIAL AND ECONOMIC VALUES

The impact of the proposal on other socio-economic values is discussed in **Table 4**.

**Table 4: Impact of the proposal on other socio-economic values.**

Values at proposal site	Nature, scale and significance of potential impacts	Risk and uncertainty	Further assessment requirements	Impact mitigation
<b>Visual and aesthetic values</b>				
The sites provide a relatively undisturbed natural coastal landscape and accordingly high aesthetic values. Tracks in the area are well used, indicating regular recreational use. The proposal area is likely to have moderate to high visual and aesthetic value to the local community.	<p>The proposed activity would impact on visual and aesthetic values through the presence of equipment and machinery at sites, for a duration of approximately 6 weeks.</p> <p>Once this is removed, an additional seven metal bore caps would remain in place. These are relatively small and inconspicuous (refer to Figure 2-3) and therefore unlikely to significantly diminish the aesthetic values of the site.</p>	Low	None	<ul style="list-style-type: none"> <li>• Minimise the duration of the activity.</li> <li>• Minimise access and egress, as detailed below.</li> <li>• Rehabilitate the site as detailed in Section 5.4.5.</li> </ul>
<b>Infrastructure, traffic and services</b>				
<p>Services present near the proposal area include:</p> <ul style="list-style-type: none"> <li>• The main Merimbula – Pambula road, Arthur Kaine Drive</li> <li>• The current sewage plant outfall</li> <li>• 66 KV powerline and phone line within adjacent easement</li> </ul>	<p>The short duration and small scale of the activity minimise potential for the proposal to impact on any of these facilities:</p> <p><b>Arthur Kaine Drive:</b> Site access by up to 4 vehicles would occur occasionally over the 6 week activity period. This would include one mobilisation to each site by the drilling rig (four vehicles) followed by access for the pump test by one vehicle (four wheel drive ute).</p>	Low	None	<ul style="list-style-type: none"> <li>• The contractor should minimise vehicle movement and exercise due caution when accessing and leaving the site.</li> <li>• If in any doubt, the contractor would contact phone and power companies to ensure there would be no impact on these services.</li> </ul>



Values at proposal site	Nature, scale and significance of potential impacts	Risk and uncertainty	Further assessment requirements	Impact mitigation
	<p><b>Sewage outfall:</b> No impact is likely</p> <p><b>Power/phone infrastructure:</b> No impact is likely</p>			
<b>Economic Activities</b>				
No economic activities are known to occur within or in close range of the proposal areas. The proposal is not likely to impact on any economic activity occurring within the bushland area surrounding the site.	Nil	N/A	None	N/A
<b>Health and Safety</b>				
Equipment used at the site may pose a risk to recreational users of the subject area. Operators would be adequately trained to utilise equipment and manage risks, including dealing with the public.	Potential risk of injury. Low risk of serious injury or death to operators or the public. Metal caps are located off tracks therefore the risk of people running or riding into them would be low.	Low	Job Safety Assessment to be completed by contractor	<ul style="list-style-type: none"> <li>The contractor would ensure that the works are completed under adequate occupational health and safety standards and insurance. These would include completion of job safety assessments specific to the activity and sites, to identify and manage risks prior to completion of the work.</li> <li>All staff would be inducted so that they understand risks and appropriate management strategies.</li> <li>Equipment would not be left unattended or in a state that would pose a risk to the public.</li> <li>Staff training, equipment and practices would conform to occupational health and safety protocols.</li> </ul>
<b>Noise</b>				
Acoustic monitoring of existing conditions has not been undertaken, but the proposal area has low levels of	Noise impacts are the result of a complex interplay of factors. Noise impacts are influenced by the effects of distance, terrain and vegetation, meteorological	Low	None	<ul style="list-style-type: none"> <li>Noisy activities would be completed in the shortest practicable time.</li> <li>Construction activities would not occur prior to 7 am</li> </ul>

Values at proposal site	Nature, scale and significance of potential impacts	Risk and uncertainty	Further assessment requirements	Impact mitigation
<p>background noise including natural bush and beach sounds and intermittent noise from road traffic and aircraft at the adjacent airport.</p> <p>The closest residential receivers are located just over 100 metres away from the northern most bore site.</p>	<p>conditions (such as air temperature inversions and wind effects), the acoustic performance of built structures, the expectations and sensitivity of receivers, the type and timing of noise emissions and noises from other sources.</p> <p>The proposed activity is likely to increase noise intermittently. Noise and vibration would be produced as a result of:</p> <ul style="list-style-type: none"> <li>• Bore construction (drilling rig operation)</li> <li>• Site access/egress</li> <li>• Pumping of water (a generator is used to operate the pump)</li> </ul> <p>Noise is not expected to be excessive. Drilling through sand is generally quieter than harder substrates and the equipment used is designed to be operated with people working nearby, therefore noise emissions are reasonably low. Likewise, the generator that would be used during the 72 hour pump test is reasonably quiet. As the pump test would occur at the Southern Site, it is fairly remote from any sensitive noise receivers.</p> <p>The closest residents are located just over 100 metres away from the northern most bore site, within the Merimbula urban area. They are unlikely to be excessively impacted by noise from the operations. They would be informed of the operations to ensure that they are aware of the reason for the activity, understand how long the activity will take and who to</p>			<p>or after 6 pm, and not on Sundays or Public Holidays.</p> <ul style="list-style-type: none"> <li>• The concurrent use of multiple items of noisy equipment would be avoided where practicable.</li> <li>• Unnecessary noise emissions would be avoided by turning equipment off when it is unused for an extended period.</li> <li>• Plant and equipment would be maintained in optimal working condition.</li> <li>• Close by residents would be informed of the reason for the activity and who to contact if they have cause for complaint.</li> <li>• Any complaints would be dealt with quickly and effectively.</li> <li>• A complaints register detailing complaints and remedial actions would be retained by the contractor.</li> </ul>

Values at proposal site	Nature, scale and significance of potential impacts	Risk and uncertainty	Further assessment requirements	Impact mitigation
	contact if they have a complaint about noise.			
<b>Construction Resources and Waste</b>				
<p>The activity would utilise the following resources:</p> <ul style="list-style-type: none"> <li>• Diesel (operation of vehicles and equipment)</li> <li>• PVC pipes (bore lining)</li> <li>• Bentonite clay (bore capping)</li> <li>• Graded sand (gravel well screen)</li> <li>• Steel monuments (bore capping)</li> <li>• Concrete (bore capping)</li> <li>• Water (during drilling)</li> </ul> <p>The following waste products would be generated:</p> <ul style="list-style-type: none"> <li>• Spoil (several cubic metres). This would be spread on tracks or removed to an appropriate off-site location</li> <li>• Water (approximately 1.3 ML) - evacuated to beach during pump test</li> <li>• Packaging from bentonite and gravel screen (plastic bags and tubs) – removed to licensed waste transfer station and recycled where possible</li> <li>• Exhaust emissions</li> </ul>	<p>The majority of materials utilised in the activity are non-renewable, and most are not likely to be practicable to recover if the site was decommissioned. None of the materials used in the construction and operation of the test bores are however, in short supply at present, either locally or regionally.</p> <p>Fossil fuels are a finite resource and their use would contribute to greenhouse gas emissions and therefore would impact on climate and air quality. While the proposal would have a negligible impact on these values, safeguards would be implemented to ensure that impact is minimised.</p>	Low	None	<ul style="list-style-type: none"> <li>• In order to minimise resource use and wastage, the works would be carefully planned to ensure efficiency in all aspects of resource use.</li> <li>• All machinery and equipment would be of high quality and maintained in optimal operating condition so that fuel is used as efficiently and cleanly as possible.</li> <li>• The use of vehicles and equipment would be efficient in order to minimise the use of fossil fuels and associated impacts.</li> <li>• All employees would be informed of the need to maintain a clean and secure site.</li> <li>• All recyclable or reusable waste would be managed appropriately. Waste that is unsuitable for re-use or recycling would be disposed of at a licensed landfill site.</li> <li>• Littering or dumping of waste, disposal of surplus construction materials, or permitting such activities on any land on or around the site would not be permitted. Rubbish will not be burnt or buried at the site. Concrete wash would not be disposed of on site.</li> <li>• Construction litter would be contained within nominated sites. Secure rubbish bins would be provided at the site and emptied as required. Smaller objects that can be windblown would be disposed of</li> </ul>

Values at proposal site	Nature, scale and significance of potential impacts	Risk and uncertainty	Further assessment requirements	Impact mitigation
				<p>in hoppers.</p> <ul style="list-style-type: none"> <li>All loads of rubbish or any other material transported would be securely covered to ensure no spillage.</li> </ul>
<b>Fire</b>				
<p>The proposal area is vulnerable to fire. Although the native bushland would recover rapidly from fire, fires occurring at inappropriate intervals, intensity or times could have a negative impact on the long term viability of the community. There is also potential for a fire occurring on the site to affect nearby residences and other infrastructure.</p>	<p>The activity has potential to cause a fire, which could have a significant impact on adjacent environmental and social values. The risk of fire is however, low considering the timing and small scale of the activity. Appropriate safeguards would be in place to minimise the risk of fire.</p>	Low	Contractor's job safety assessment to address fire risk	<ul style="list-style-type: none"> <li>The job safety assessment completed under OH&amp;S requirements would address fire risk mitigation.</li> <li>Equipment would be maintained in good condition to minimise risk of sparking.</li> <li>Water would be available on site for fire fighting and fire extinguishers are carried on all vehicles.</li> <li>The activity is expected to take place during early spring, when fire danger is likely to be low. If the activity occurs during high fire danger weather, additional controls would be developed and applied to minimise risk.</li> </ul>

## 5.9 CUMULATIVE IMPACTS

### 5.9.1 Negative cumulative impacts

Negative cumulative impacts associated with the proposal include:

- **Native vegetation losses:** The bore locations would permanently occupy a total of approximately 7 square metres of bushland terrain. Where possible, sites where bare soil is exposed would be used, minimising any need to remove vegetation. Permanent loss of native vegetation would be negligible.
- **Extension of visible signs of human influence:** Installation of the bores would increase signs of human influence in an otherwise predominately natural environment however, this impact is likely to be very low, considering that only seven additional bores would be installed, and once capped, bore locations are relatively small and inconspicuous (refer to Figure 2-3).
- **Greenhouse gas emissions:** The activity would emit greenhouse gasses through the use of diesel to power vehicles, the drill and generator. The volume of emissions has not been quantified, however, considering the short duration and scale of the activity, emissions are likely to be low.
- **Consumption of finite/non-recoverable resources:** The activity would consume fossil fuels, steel, bentonite (clay), gravel, cement and plastics (piping and packaging). Apart from packaging and fuel, these products would remain on site and are unlikely to be recovered at any stage. The activity would, therefore, contribute to the cumulative consumption of resources, however, considering the scale of the activity, resource consumption would be low. Safeguards have been developed to ensure that, where possible, waste materials would be recycled.

### 5.9.2 Positive cumulative impacts

The positive cumulative impacts of the proposal include potential to improve the environmental and amenity value of Merimbula Beach through identifying an alternative to the use of the current sewage treatment plant ocean outfall.

The cumulative impacts are considered in the context of past environmental impacts and human development in the region. It is anticipated that overall negative cumulative impacts would be of a low level, with potential for offsets through improvements to local sewage management.

## 5.10 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The *Protection of the Environment Administration Act 1991* outlines a number of principles of ecologically sustainable development (ESD). These are presented below and discussed in relation to the proposal.

### The precautionary principle

According to the precautionary principle, if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be seen as a reason not to protect the environment. The use of the precautionary principle implies that proposals should be carefully evaluated to identify possible impacts and assess the risk of potential consequences.

The precautionary principle has been observed in the assessment of conservation values and environmental threats and impacts throughout this REF. A cautious approach has been adopted in relation to the potential use of habitat by threatened species. Measures have also been included to account for the inherent uncertainty

relating to the impacts of weather on the activity. Generally, throughout this assessment, there has been found to be a low level of uncertainty in regard to all factors assessed.

### **Inter-generational equity**

The principle of inter-generational equity requires the present generation to ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

The impacts of the proposal are likely to be localised and temporary, and would not significantly diminish the options regarding land and resource uses and nature conservation available to future generations. Based on the potential for the proposal to bring about social benefits (if an improved method of handling sewage outfall can be introduced) and the assessed impacts on the environment, it is considered that the development would be ecologically sustainable within the context of the above ESD principles.

### **Conservation of biological diversity and ecological integrity**

Conservation of biological diversity and ecological integrity are a fundamental consideration of ESD.

The impacts of the proposal on local populations of threatened species, threatened communities and their habitats have been assessed in detail in Sections 5.4, 5.5 and Appendices C, D and E. The activity is not likely to impact on long term biological diversity or ecological diversity.

### **Appropriate valuation of environmental factors**

This principle requires that environmental assets services should be appropriately valued through the use of mechanisms such as:

- (i) Polluter pays— those who generate pollution and waste should bear the cost of containment, avoidance or abatement.
- (ii) The users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.
- (iii) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

In general, achieving fulfilment of these principals requires the commitment of policy makers who are beyond the scope of this project, however, the objectives of these principles would generally be complied with by the contractor. For example, the contractor would be responsible for:

- Achieving the environmental objectives of the proposal, as set out in Section 2.1.3 and Table 2, in a cost effective and sustainable way
- utilising natural resources according to market availability and valuation; and
- avoiding or containing and appropriately disposing of potential pollutants and waste products resulting from the proposal, such as concrete, waste water, empty containers (refer to Section 5.8, *Construction Resources and Waste* for details).

## 6 SUMMARY OF IMPACTS

Table 5 summarises the likely impact of the proposed pipeline and associated infrastructure works.

**Table 5 Summary of the impacts of the proposed works**

CATEGORY OF IMPACT	SIGNIFICANCE OF IMPACTS		
	EXTENT & DURATION	NATURE	IMPACT ON SENSITIVE FEATURES
<b>Physical values</b>			
<b>Climate and air quality</b>	The proposed works would be of small scale and limited duration.	The works would involve the generation of emissions from machinery and dust.	Negligible
<b>Hydrology and catchment values</b>	The proposed works would be of small scale and limited duration. Water releases would occur over a 72 hour period during the proposed pump test only.	The works have the potential to impact on storm water flow and areas of erosive potential, likelihood of this occur would be minimised by the application of appropriate safeguards.	Low to moderate (safeguards would be applied)
<b>Geomorphology, geology and soils</b>	Low. Some enduring minor soil impacts would occur, including localised soil compaction. Impacts would be restricted to the immediate vicinity of the bores and the access tracks.	Soil disturbance would occur during construction. Soil stability will be protected using specific safeguards outlined in the REF.	Negligible.
<b>Biological values</b>			
<b>Flora</b>	Low. There is potential for around 60 square metres of minor trimming or compression of vegetation where drilling equipment will be situated. Impacts will be minimal by using existing tracks and open/bare areas where possible.	Some vegetation clearing, compression or trimming will occur. Any cleared vegetation will be chopped up and situated to allow for natural decomposition. Prescriptions relating to weed control are included in the REF.	EEC is present at the Northern Site however the impacts have been assessed as low. Impacts to flora are small in scale and almost entirely reversible if mitigation measures are stringently applied.
<b>Fauna</b>	Negligible	Some minor habitat disturbance would occur. The construction phase would create noise and activity which may disturb some diurnal species.	Low. Significant fauna resources would be avoided by the works.
<b>Key Threatening Processes</b>	Moderate	The proposal would increase risks of weed invasion and potential introduction of pathogen <i>Phytophthora</i> . These impacts are considered to not be significant if the prescription measures included in	Low. Impacts would be mitigated using specific safeguards in the REF.

CATEGORY OF IMPACT	SIGNIFICANCE OF IMPACTS		
	EXTENT & DURATION	NATURE	IMPACT ON SENSITIVE FEATURES
		this REF are undertaken.	
<b>Social and cultural values</b>			
<b>Aesthetic and visual values</b>	Low	Construction phase impacts would be prominent but temporary. The permanent visual impact would be small and inconspicuous in nature.	The site has considerable aesthetic and visual value but impacts can be mitigated.
<b>Cultural heritage values</b>	Low - moderate	There is potential to impact on Aboriginal human burials within the subsurface of the dunes, however the implementation of a subsurface test excavation would ensure that the risks of impact are minimised.	Low (safeguards would be in place to ensure that damage to possible Aboriginal objects is unlikely).
<b>Infrastructure and services</b>	Low	Infrastructure impacts are expected to be minimal. Measures to avoid and mitigate impacts are included in the REF.	Low (no features of particular sensitivity have been identified).
<b>Economic activities</b>	Negligible	No economic impacts will occur as a result of the activity	Negligible
<b>Human health and safety</b>	Low	There is potential for impact on the safety of construction workers and the public, however, the implementation of appropriate safeguards would ensure that impact is avoided if possible.	Low (safeguards would be put in place to ensure that the works do not impact on human health and safety).
<b>Noise impacts</b>	Low	Construction activities are likely to result in temporary noise emissions, however the equipment that would be used is reasonably quiet. Emissions are likely to be within EPA allowable limits in terms of level and duration.	Low. Receivers include residents (100m from the sites) and people pursuing active recreation. The impacts are likely to be manageable and temporary.
<b>Construction resources</b>	Low	Resources to be used would not be in short supply or entail unacceptable environmental impact.	Negligible
<b>Fire</b>	Low	The activity has potential to cause fire, however, the scale of timing of the works and the implementation of appropriate safeguards will insure that possible impact is low.	Low (job safety, equipment functionality and timing of the works will ensure that fire risks are managed).

This summary demonstrates that the activity is likely to have a low to moderate level of impact on the environmental factors assessed in this REF. The main impacts would involve localised, short term disturbance to soil, permanent and temporary impacts to vegetation and fauna habitat and temporary and permanent impacts to cultural and social values of the site. Specific safeguards have been included within this REF to avoid or mitigate many of the identified impacts.



## 7 CONCLUSIONS

This Review of Environmental Factors (REF) assesses the environmental impacts associated with the installation of seven test bores to investigate the potential use of exfiltration trenches for the disposal of treated effluent from the Merimbula Sewage Treatment Plant (STP). The sites are located on the coastal foredunes area between Merimbula Airport and the Merimbula Main Beach.

It is possible that the site contains Aboriginal burial sites or other artifacts, therefore it will be subject to archaeological investigations prior to works, as detailed in the Archaeology Assessment (**Appendix F**).

The Southern Site is dominated by Coastal Fore-dune scrub whilst the Northern Site is Coastal Sand Forest, an Endangered Ecological Community. Potential threatened fauna habitat (for Eastern Pygmy Possum and White-footed Dunnart) occurs within the site. There are several listed Key Threatening Processes relevant to the proposal including the invasion by exotic perennial grass, invasion and establishment of exotic vines and scramblers and infection of native plants by *Phytophthora cinnamomi* (Cinnamon Fungus).

While a total of 105 m<sup>2</sup> of vegetation and habitat would be temporarily impacted by location of equipment (entailing some crushing of vegetation over this area), only seven square metres would be excavated (removing all vegetation in this area). The majority of these areas are however, bare ground and therefore the actual amount of vegetation that would be removed is very small. This may be reduced by the re-establishment of some grasses and/or rushes. EEC would only be removed at the Northern Site. The area to be removed is small and the potential impact on the EEC and threatened species has been assessed as low.

The proposal has potential to have both positive and negative social and economic impacts. The range of key environmental, cultural, social, and economic values and risks relevant to the site and the proposal have been documented in the REF. The REF provides Assessments of Significance (pursuant to NSW *Threatened Species Conservation Act 1995*), of the impacts of the proposal on identified values and safeguards to avoid or minimise the impacts. All of the identified impacts are acceptable in the context of existing legislation and available mitigation measures.

Key mitigation measures outlined in the REF include:

- A monitoring strategy which would make observations of the spoil from the top 2 metres of each of the test bores to determine whether or not Aboriginal skeletal material is present. It would incorporate a risk management strategy and protocol in the event that burial remains are found.
- The control of significant weeds at the site using pre-works treatments, hygiene during construction and post-works monitoring.
- Communications and mitigation measures designed to reduce social impacts such as visual intrusiveness and disruption to recreational, residential and economic activities.

On the basis of the identified values and impacts, the proposal is not expected to produce a significant negative impact on the environment or the community, and a higher level of assessment is not warranted. In view of the environmental impact assessment and supporting investigations, it is concluded that the proposal is ecologically sustainable. It is recommended that the proposal be approved, subject to the effective implementation of the mitigation measures outlined in this REF.

## 8 ASSESSMENT PERSONNEL

Personnel	Role	Qualifications	Expertise and experience
Daniel a Brozek Cordier nghenvironmental	Project management Impact assessment Report writing and research	Bachelor of Science, Graduate Diploma of Env. Studies (Honours)	Environmental assessment, planning and management with nghenvironmental since 2003.
Jackie Miles nghenvironmental	Flora and Fauna Assessment	Bachelor of Science	Extensive experience in flora and fauna assessment within south eastern NSW.
Nicholas Graham- Higgs Director nghenvironmental	Site assessment Certified Environmental Practitioner signoff	Bachelor of Applied Science	Extensive experience in the preparation of over 1000 environmental impact assessment documents within south eastern NSW, including sensitive environments.

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## Appendix A **CLAUSE 228 CHECKLIST**

Part 5, Clause 228 of the *Environmental Planning and Assessment Regulation 2000* provides a list of general factors which are to be taken into account in the assessment of impacts. These factors are listed and discussed in checklist form below. Further detail on these matters is included in relevant sections of the REF.

***i) impacts or changes in relation to a community, locality or ecosystem***

The impact of the proposal in relation to the local community has been discussed in the following sections of the REF:

- *2.2 Justification of the Proposal* – describes how the proposal would provide information required to advance a longer term goal to reduce ocean outfall from the Merimbula STP and the negative community impact that this has. The proposal would contribute to a long term positive impact in regard to this objective.
- *4.8 Other Social and Economic Values* – details the impact of the proposal on a broad range of community values including aesthetics, infrastructure, traffic, services, economic activities, health and safety, noise, fire, resource consumption, recovery, recycling and waste. With the recommended safeguards in place, the proposal would have a low impact on these values.
- *4.7 Cultural Heritage Values* – discusses the impact of the proposal on the Aboriginal Community. With the recommended safeguards in place, the proposal would have a low impact on these values.
- *4.4 Flora Values, 4.5 Fauna Values and Appendix E* – provide details on the impact of the proposal on ecological communities. With the recommended safeguards in place, the proposal would have a low impact on these values.

***ii) reduction of the aesthetic, recreational, scientific or other environmental value***

Refer above, particularly Section 5.8. No notable scientific activities have been noted at the site, however there is always potential for scientific investigation to be carried out at any site. The proposal and the Archaeological investigation associated with it would provide valuable information.

***iii) effects on a locality, building or place with aesthetic, scientific, cultural or social significance***

Low, with the implementation of the the Archaeological investigation and mitigation measures to manage impacts.

***iv) impacts on habitat of fauna protected under the NPW Act***

Sections 5.4 *Flora Values*, 5.5 *Fauna Values* and Appendix E provide details on the impact of the proposal on fauna and fauna habitat. With the recommended safeguards in place, the proposal would have a low impact on the habitat of protected fauna.

***v) endangering of any species***

Sections 5.4 *Flora Values*, 5.5 *Fauna Values* and Appendix E provide details on the impact of the proposal on species. With the recommended safeguards in place, the proposal would be unlikely to impact on any native species.

***vi) long term environmental effects, degradation, pollution, risk to the safety or reduction in beneficial uses of the environment***

Sections 5.9 and 5.10 address the cumulative impacts of the proposal and ecological sustainability. Section 5.8 discusses effects associated with potential for risk of fire, pollution and safety.

The activity has potential to impact on the potential for people and native flora and fauna to derive benefits from the environment, including ecological, aesthetic and health benefits. Impact could occur as a result of environmental destruction or pollution, and may be short or long term, or occur as a result of cumulative impacts such as greenhouse gas emissions. All activities are likely to have an environmental impact through use of resources and production of waste products however, in the case of this proposal, the scale of the activity and materials involved are unlikely to result in a significant long term impact. Application of the recommended safeguards would minimise the long term impacts of the proposal.

**vii) waste disposal problems**

Section 5.8 (under *Construction Resources and Waste*) discusses the waste products associated with the proposal. The activity would create only small amounts of inert waste which would be disposed of appropriately, so that they do not contribute to pollution.

**viii) increased demand on resources (natural or otherwise) that are, or are likely to become, in short supply**

Section 5.8 (under *Construction Resources and Waste*) discusses the resources used in the proposal. The activity would utilise limited quantities of resources, most of which are unlikely to be recoverable or reusable, however these resources are not in short supply at present

**ix) any cumulative effect with other existing or likely future activities**

The cumulative impacts of the proposal are discussed in Section 5.9. The proposal may contribute to an accumulation of environmental impacts, however, they would offset current impacts associated with use of the ocean outfall to dispose of effluent from the Merimbula STP.



## Appendix B SEPP 71 CHECKLIST

Clause 8 of *SEPP 71 - Coastal Protection* lists a number of factors which must be considered by consent authorities in determining development of proposals affecting the coastal zone. The proposal would occur within the coastal zone, therefore these factors are listed and discussed in checklist form below. Further detail on these matters is included in relevant sections of the REF.

**(a) the aims of this Policy (listed below)**

***(a) to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast***

Detailed where relevant below.

***(b) to protect and improve existing public access to and along coastal foreshores to the extent that this is compatible with the natural attributes of the coastal foreshore***

The proposal would not permanently impact on access to the coast on or adjacent to Merimbula Beach.

***(c) to ensure that new opportunities for public access to and along coastal foreshores are identified and realised to the extent that this is compatible with the natural attributes of the coastal foreshore***

N/A

***(d) to protect and preserve Aboriginal cultural heritage, and Aboriginal places, values, customs, beliefs and traditional knowledge***

Aboriginal heritage issues have been investigated and addressed in the Archaeological Assessment (Appendix F) and Section 5.7 of the REF. The site is significant to the local Aboriginal community because of potential to have been the site of burials, and therefore it may host skeletal remains. The activity has potential to impact on these remains.

In order to minimise potential for impact, the involvement of, and consultation with the local Aboriginal community has been carried out as part of the archaeological assessment. A methodology for carrying out the activity has been developed in consultation with the local Aboriginal community and DECCW. This would ensure that potential for impact to occur as a result of the activity would be minimised (refer to Section 5.7).

***(e) to ensure that the visual amenity of the coast is protected***

The proposal would have a short term visual impact associated with the presence of vehicles and machinery. Long term impact would be very low, being restricted to the presence of an additional seven small steel bore caps (refer to Section 5.8 *Visual and Aesthetic Values*).

***(f) to protect and preserve beach environments and beach amenity***

The only impact of the activity on the beach environment would be associated with the release of groundwater to the beach during the 72 hour pump test. Safeguards have been developed to minimise the impact of this, so that it would be very low (refer to Section 5.3).

***(g) to protect and preserve native coastal vegetation***

The impact of the proposal on native coastal vegetation is assessed in detail in Section 5.4 and Appendix E. This assessment has found that, with the application of the recommended safeguards, the proposal would have a low, temporary impact on native coastal vegetation.

***(h) to protect and preserve the marine environment of New South Wales***

The only impact of the activity on the marine environment would be associated with the release of groundwater during the 72 hour pump test. As this would only involve the release of unaltered groundwater. It is unlikely that it would negatively impact on the marine environment.

The proposal may have a positive impact over the long term, if it contributes to a reduction in release of sewage effluent to the ocean.

***(i) to protect and preserve rock platforms***

The activity is unlikely to impact on rock platforms.

***(j) to manage the coastal zone in accordance with the principles of ecologically sustainable development (within the meaning of Section 6 (2) of the Protection of the Environment Administration Act 1991)***

The environmental sustainability of the proposal has been assessed in Section 5.10. It would utilise non-renewable resources and result in long term or permanent impacts, however the activity would have very minor impacts in their own right.

***(k) to ensure that the type, bulk, scale and size of development is appropriate for the location and protects and improves the natural scenic quality of the surrounding area***

The area that the proposed activity would occupy over the short and long term, and its general impacts, are very restricted. The activity has been planned in a way that has regard for the natural scenic quality of the receiving environment.

***(l) to encourage a strategic approach to coastal management.***

The proposal is part of a broad strategic approach on the part of Bega Valley Shire Council to improve coastal management through more environmentally sustainable management of sewage effluent. It is consistent with a strategic approach to coastal management.

***(b) existing public access to and along the coastal foreshore for pedestrians or persons with a disability should be retained and, where possible, public access to and along the coastal foreshore for pedestrians or persons with a disability should be improved***

Public access to the coast for pedestrians and disabled people is available at Merimbula. The proposal would not impact on public access.

***(c) opportunities to provide new public access to and along the coastal foreshore for pedestrians or persons with a disability***

N/A

***(d) the suitability of development given its type, location and design and its relationship with the surrounding area***

The activity is suitable for the proposal area given its proximity to the Merimbula STP and the objectives of the project. It would not have a significant impact on the receiving environment.

***(e) any detrimental impact that development may have on the amenity of the coastal foreshore, including any significant overshadowing of the coastal foreshore and any significant loss of views from a public place to the coastal foreshore***

The activity would not have a significant impact on the coastal foreshore.

***(f) the scenic qualities of the New South Wales coast, and means to protect and improve these qualities***

Refer to (a) (e), above.

***(g) measures to conserve animals (within the meaning of the Threatened Species Conservation Act 1995) and plants (within the meaning of that Act), and their habitats***

The proposal has been developed with safeguards to protect flora, fauna and their habitats. It has been assessed as being unlikely to have a significant impact on flora, fauna or their habitat – refer to Sections 5.4, 5.5 and Appendix E.

***(h) measures to conserve fish (within the meaning of Part 7A of the Fisheries Management Act 1994) and marine vegetation (within the meaning of that Part), and their habitats***

The proposal would not impact on fish, marine vegetation or their habitats (refer to Section (a)(h) above).

***(i) existing wildlife corridors and the impact of development on these corridors***

The proposal has been developed with safeguards to protect, fauna and their habitat. It has been assessed as being unlikely to have a significant impact on fauna or fauna habitat – refer to Section 5.5 and Appendix E.

***(j) the likely impact of coastal processes and coastal hazards on development and any likely impacts of development on coastal processes and coastal hazards***

Coastal processes and hazards may include wave and tidal action, storm activity and the impacts of climate change, which may involve sea level change. The activity would take place during a short duration and would be timed for suitable weather conditions. As it occurs within the dune area, not on the beach, it is not likely to be impacted by normal wave or tide action, or by storm activity. Any impact would not have significant environmental or project consequences.

The proposal would not be impacted by climate change as it takes place during a short time period, however the long term impacts of climate change may affect the later feasibility of dune exfiltration of effluent. This would require separate assessment if dune exfiltration is proposed (subsequent to the subject investigations).

***(k) measures to reduce the potential for conflict between land-based and water-based coastal activities***

N/A

***(l) measures to protect the cultural places, values, customs, beliefs and traditional knowledge of Aboriginals***

Refer to (a) (d), above.

***(m) likely impacts of development on the water quality of coastal waterbodies***

The proposed activity would involve assessment of water quality in the aquifer and surface locations around the subject site. It is unlikely, in its own right, to impact on water quality.

***(n) the conservation and preservation of items of heritage, archaeological or historic significance***

The proposal would not impact on any item of heritage significance (refer to **(a) (d)**, above, regarding Aboriginal heritage and archaeology).

***(o) only in cases in which a council prepares a draft local environmental plan that applies to land to which this Policy applies, the means to encourage compact towns and cities***

N/A

***(p) only in cases in which a development application in relation to proposed development is determined:***

***(i) the cumulative impacts of the proposed development on the environment***

The cumulative impacts of the proposal are discussed in Section 5.9. The proposal may contribute to an accumulation of environmental impacts, however, they would offset current impacts associated with use of the ocean outfall to dispose of effluent from the Merimbula STP.

***(ii) measures to ensure that water and energy usage by the proposed development is efficient***

Safeguards have been developed to ensure that the proposal would be carried out in a way that would ensure efficient use of energy and water resources (refer particularly to Section 5.8).

## Appendix C FLORA LIST

The table below provides a composite flora species list for the two exfiltration investigation sites.

Relative abundance is given by a cover abundance scale (modified Braun-Blanquet):

1	1 to a few individuals present, less than 5% cover
2	many individuals present, but still less than 5% cover
3	5 - < 20% cover
4	20 - < 50% cover
5	50 - < 75% cover
6	75 - 100% cover

Cover/abundance scores relate to general abundance over the relevant part of the site, not to representative quadrats.

\*Introduced species are preceded by an asterisk.

Location: N = northern cluster of sites near Fishpen  
S = Southern Site near airport

Scientific name	Common name	Family	Abundance	
			North	South
<b>TREES</b>				
<i>Acacia implexa</i>	Lightwood or Hickory	Fabaceae	0-2	0-3
<i>Acacia mearnsii</i>	Black Wattle	Fabaceae	1	
<i>Banksia integrifolia</i>	Coast Banksia	Proteaceae	2	3-4
<i>Banksia serrata</i>	Saw Banksia	Proteaceae	1-3	
<i>Eucalyptus botryoides</i>	Bangalay	Myrtaceae	3-4	
<i>Exocarpos cupressiformis</i>	Native Cherry	Santalaceae	1	
<i>Pittosporum undulatum</i>	Sweet Pittosporum	Pittosporaceae	1-3	
<b>SHRUBS, SUB-SHRUBS</b>				
<i>Acacia longifolia</i> ssp <i>sophorae</i>	Coast Wattle	Fabaceae	2	1
<i>Acacia suaveolens</i>	Sweet Wattle	Fabaceae	1	
<i>Amperea xiphioclada</i> var. <i>xiphioclada</i>		Euphorbiaceae	1	
<i>Aotus ericoides</i>		Fabaceae	1	
<i>Breynia oblongifolia</i>	Coffee Bush	Euphorbiaceae	1	
<i>Cassinia longifolia</i>	Dogwood	Asteraceae	1	
<i>Correa reflexa</i>	Common Correa	Rutaceae	1	
<i>Hibbertia acicularis</i>	Guineaflower	Dilleniaceae	1	1
<i>Hibbertia linearis</i>	Guineaflower	Dilleniaceae	1	2
<i>Monotoca elliptica</i>	Tree Broom Heath	Epacridaceae	1-2	2
<i>Rhagodia candolleana</i> ssp <i>candolleana</i>	Seaberry Saltbush	Chenopodiaceae		4
<i>Ricinocarpus pinifolius</i>	Wedding Bush	Euphorbiaceae	1	

Scientific name	Common name	Family	Abundance	
FERNS				
<i>Pteridium esculentum</i>	Bracken	Dennstaedtiaceae	0-4	4
<b>VINES AND TWINERS</b>				
<i>*Asparagus asparagoides</i>	Bridal Creeper	Asparagaceae	0-2	
<i>*Dipogon lignosus</i>	Dolichos Pea	Fabaceae		1
<i>Glycine clandestina</i>	Twining Glycine	Fabaceae	1	1
<i>Kennedia rubicunda</i>	Running Postman	Fabaceae	2	2
<i>Marsdenia rostrata</i>	Milk Vine	Asclepidiaceae	1	1
<b>FORBS</b>				
<i>*Arctotheca calendula</i>	Capeweed	Asteraceae	1	
<i>*Conyza sumatrensis</i>	Tall Fleabane	Asteraceae	1	1
<i>Crassula sieberiana</i>	Australian Stonecrop	Crassulaceae	1	
<i>Desmodium gunnii</i>	Southern Tick Trefoil	Fabaceae	1	
<i>Dichondra repens</i>	Kidney Weed	Convolvulaceae	2	2
<i>Gonocarpus teucroides</i>	Raspwort	Haloragaceae	1	1
<i>*Hypochaeris radicata</i>	Cat's Ear, Flatweed	Asteraceae	0-3	2
<i>Lagenifera stipitata</i>	Blue Bottle Daisy	Asteraceae	0-2	1
<i>*Lilium formosana</i>	Formosan Lily	Liliaceae	1	
<i>Opercularia varia</i>	Twiggy Stinkweed	Rubiaceae	1	1
<i>Oxalis ?rubens</i>		Oxalidaceae		1
<i>*Phytolacca octandra</i>	Inkweed	Phytolaccaceae	1	
<i>*Polycarpon tetraphyllum</i>	Four-leaved Allseed	Caryophyllaceae	1	
<i>Pratia purpurascens</i>	Whiteroot	Lobeliaceae	2	2
<i>Pterostylis</i> sp.	Greenhood Orchid	Orchidaceae	1	1
<i>Senecio linearifolius</i>		Asteraceae	1	1
<i>*Senecio madagascariensis</i>	Fireweed	Asteraceae	1	1
<i>*Solanum ?nigrum</i>	Black-berry Nightshade	Solanaceae	1	
<i>Solanum ?opacum</i>		Solanaceae	1	
<i>Solanum prinophyllum</i>	Prickly Nightshade	Solanaceae	1	1
<i>Solanum pungetium</i>	Prickly Nightshade	Solanaceae	1	1
<i>*Sonchus oleraceus</i>	Sow Thistle	Asteraceae	1	
<i>*Stellaria media</i>	Common Chickweed	Caryophyllaceae	1	
<i>*Taraxacum officinale</i>	Dandelion	Asteraceae	1	
<i>Trachymene anisocarpa</i>		Apiaceae	1	
<i>*Trifolium repens</i>	White Clover	Fabaceae	1	
<i>Veronica plebeia</i>	Common Speedwell	Scrophulariaceae		1
<i>Wahlenbergia gracilis</i>	Sprawling Bluebell	Campanulaceae	0-2	
<b>GRASSES</b>				
<i>Austrodanthonia racemosa</i> var. <i>racemosa</i>	Wallaby Grass	Poaceae	1	
<i>Cynodon dactylon</i>	Couch Grass	Poaceae	1	?3
<i>Echinopogon ovatus</i>	Hedgehog Grass	Poaceae		1
<i>*Ehrharta erecta</i>	Panic Veldtgrass	Poaceae	0-3	4
<i>*Eragrostis curvula</i>	African Lovegrass	Poaceae	0-3	0-3
<i>Imperata cylindrica</i> var. <i>major</i>	Blady Grass	Poaceae	2	1
<i>*Lagurus ovatus</i>	Hare's Tail Grass	Poaceae		2

Scientific name	Common name	Family	Abundance	
<i>Microlaena stipoides</i>	Weeping Grass	Poaceae	1-3	3
* <i>Pennisetum clandestinum</i>	Kikuyu	Poaceae	1	
<i>Poa poiformis</i>	Coast Tussock Grass	Poaceae	1	3
* <i>Sporobolus africanus</i>	Parramatta Grass	Poaceae	0-2	1
* <i>Stenotaphrum secundatum</i>	Buffalo Grass	Poaceae	0-2	
<i>Themeda australis</i>	Kangaroo Grass	Poaceae	1	
<b>GRAMINOIDS</b>				
<i>Isolepis nodosa</i>	Knobby Club-rush	Cyperaceae	1	
<i>Lepidosperma concavum</i>		Cyperaceae	3-4	4
<i>Lepidosperma gladiatum</i>		Cyperaceae		0-4
<i>Lomandra longifolia</i>	Spiny Mat-rush	Lomandraceae	1-3	2

## Appendix D THREATENED SPECIES HABITAT ASSESSMENT

### D.1 FLORA

#### Threatened flora habitat assessment, South East Coastal Plains sub-catchment of Southern Rivers CMA

Species and status	Ecology	Presence of habitat and nearest records	Likelihood of occurrence	Possible impact?
<b>TREES and SHRUBS</b>				
Bega Wattle <i>Acacia georgensis</i> V TSC V EPBC	This small tree grows on a rocky hill crest on Dr George Mountain, sea cliffs at Kianinny Bay in Tathra and cliff edges at various locations within Wadbilliga and South East Forests National Parks. It appears to be relatively long-lived for a wattle, and killed by fire, or extreme drought in the shallow soils in which it typically occurs.	Absent. Closest location is on cliffs south from Kianniny Bay.	None	No
Narrabarba Wattle <i>Acacia constablei</i> V TSC V EPBC	This shrub grows only on rocky rhyolite ridges in the Narrabarba area south of Eden.	Absent. Closest location is south of Eden.	None	No
Merimbula Star-hair <i>Astrotricha</i> sp. Wallagaraugh V TSC	This shrub grows in two disjunct locations, one in the Wallagaraugh River catchment south-west of Eden and one between Bournda and Merimbula, where it can be locally common along Sapphire Coast Drive. It grows in the understorey of dry eucalypt forest on infertile dry sandy soils, though generally on those derived from weathering of sandstone rather than on aeolian sands. Typical associated canopy trees are Red Bloodwood ( <i>Corymbia gummifera</i> ) and Silvertop	Absent. Closest location is near entrance to Merimbula tip, c. 4-5km north of the sites.	None, conspicuous species, not recorded.	No



Species and status	Ecology	Presence of habitat and nearest records	Likelihood of occurrence	Possible impact?
	Ash ( <i>Eucalyptus sieberi</i> ).			
Chef's Cap Correa <i>Correa baeuerlenii</i> V TSC V EPBC	This shrub grows in either rocky or riparian situations within forest, mostly in the coastal zone north of Bega, with some old records from the Batemans Bay area.	Absent. Closest records are north of Tathra.	None	No
Bodalla Pomaderris <i>Pomaderris bodalla</i> V TSC	This shrub or small tree has a scattered distribution between the Nerrigundah area in the coastal ranges west of Bodalla and the coast around Merimbula and Pambula. It generally grows in drainage lines, from rugged gully heads to the banks of tidal creeks (J. Miles, pers. obs.), frequently on soils derived from Ordovician metasediments.	Absent. Closest records are within Merimbula, 1-2km to the north and north-west of the sites.	None	No
Parris' Pomaderris <i>Pomaderris parrisiae</i> V TSC V EPBC	This shrub or small tree is mostly found along the edge of the coastal escarpment, with one record from the coast south of Eden. As <i>Pomaderris</i> species are difficult to separate, the coastal record may in fact belong to a different species. On the escarpment the species grows in moist eucalypt forest on ridges and exposed upper slopes, often in areas with a history of disturbance, such as track edges and powerline easements (J. Miles, pers. obs.)	Absent. Closest record is within the southern forests national park, about 40 km west of the site, or Nadgee National Park, a similar distance south.	None	No
Ralston's Leionema <i>Leionema ralstonii</i> V-TSC V-EPBC	This shrub grows almost exclusively on rhyolite outcrops, or occasionally Devonian sandstone close to rhyolite, in the Yowaka-Nullica area west from Pambula. It is part of a suite of rhyolite endemics, all listed as threatened: shrubs <i>Westringia davidii</i> , <i>Zieria formosa</i> , <i>Z. parrisiae</i> , <i>Z. buxijugum</i> and the orchid <i>Genoplesium rhyoliticum</i> , all restricted to the same area.	Absent, for any of the rhyolite endemics. Closest location is c. 13km south-west of the sites.	None	No
Matted Bush-pea	This small prostrate mat-forming shrub grows on shallow clay or sandy loam soils in open eucalypt forest, headland scrub or heath, on the coast and tablelands.	Absent. Nearest record is White Rock, c. 16km north of	Very low, reasonably visible species, not	No

Species and status	Ecology	Presence of habitat and nearest records	Likelihood of occurrence	Possible impact?
<i>Pultenaea pedunculata</i> E-TSC	Coastal records are scattered from Bermagui to White Rock south of Tathra, with a single record from coastal heath on Green Cape and one from a road verge behind Barragoot Beach (J. Miles, pers. obs.).	the sites.	recorded.	
Oval-leafed <i>Pseudanthus ovalifolius</i> E-TSC	This shrub has been recorded only once in the region, from the northern section of Ben Boyd National Park in "open dry forest on sandy ground" (K, McDougall, pers. comm.). It is more common in Victoria, where it is scattered in inland and coastal situations, none close to the NSW border. In Victoria it is said to grow on dry, sandy or shallow, shaley soils" (Walsh and Entwisle, 1999).	Present, but the absence of any recent records makes it very unlikely this species would occur. Only NSW record is c. 5km south of the sites.	Very low, reasonably visible species, not recorded.	No
Narrow-leafed <i>Wilsonia backhousei</i> V-TSC	This species grows in coastal saltmarsh and occasionally other saline situations such as among rocks (but not in mobile sand) on beaches or coastal estuaries.	Absent, both on dunes and on beach. Nearest record is Nelson Lagoon, c. 26km north of the sites.	None	No
Round-leafed <i>Wilsonia rotundifolia</i> E-TSC	This species grows in coastal saltmarsh and on inland saline or brackish lakes (such as Lakes George and Bathurst on the Southern Tablelands).	Absent. Closest location is Coila Lake, >30km to the north.	None	No
<b>FORBS</b>				
Yellow Loosestrife <i>Lysimachia vulgaris</i> var. <i>davurica</i>	A rare aquatic plant found in relatively undisturbed peaty wetlands of the east coast and NSW southern highlands (Wingecaribee Swamp). It also occurs in northern Asia and may be a natural introduction to Australia via migrating waterbirds. The only south coast record comes from a near-permanent swamp	Absent. Closest location is c. 20km north of the sites.	None	No

Species and status	Ecology	Presence of habitat and nearest records	Likelihood of occurrence	Possible impact?
E TSC	on the Bega River floodplain (J. Miles, pers. obs.).			
Tangled Bedstraw <i>Galium australe</i> E-TSC	This small inconspicuous perennial forb grows in a wide range of forest types in the coastal zone, with one record from a grassy headland. There is a single record from the SE Coastal Plain subcatchment, in the Towamba Valley. To the north there are more records in the Shoalhaven region, and there is a single record from Eurobodalla LGA. Habitat is difficult to predict, but does include one occurrence in coastal dune forest south of Jervis Bay.	Possibly present. Closest record is >30km south-west of the sites.	Very low due to paucity of records in the region. Species is inconspicuous, but as the sites are only small it would probably have been detected if present.	No
Square Raspwort <i>Haloragis exalata</i> subsp. <i>exalata</i> var. <i>exalata</i> V-TSC V-EPBC	This species grows in disturbed situations around the margins of coastal lakes and occasionally on the creeks which enter them (Miles and Cameron, 2007). A preliminary determination has been made to remove it from the NSW threatened flora listing, due to the large number of records from the south coast in recent years.	Absent, as there is no water on either site.	None	No
Tall Knotweed <i>Persicaria elatior</i> V-TSC V-EPBC	This ephemeral species grows in coastal wetlands or along small creeks. It tends to occur after floodwaters have retreated, or when drought lowers water levels (J Miles, pers. obs.).	Absent, as there is no water on either site. The closest record is from Cuttagee Creek, >30km north of the sites.	None	No
Coast Groundsel <i>Senecio spathulatus</i>	This species grows on coastal sand dunes. It has been recorded from the Sydney region and Cape Howe on the Victorian border, where it grows in unstable dunes and adjacent moist dune swales, with very little other vegetation other than	Absent as dunes are stable and well vegetated.	None	No

Species and status	Ecology	Presence of habitat and nearest records	Likelihood of occurrence	Possible impact?
E-TSC	Marram Grass, an introduced plant used for dune stabilisation (J. Miles, pers. obs.).			
Austral Toadflax <i>Thesium australe</i> V TSC V EPBC	This species is found in small populations across eastern NSW. On the coast it occurs in coastal headland grassland in Eurobodalla LGA, and in the Bega Valley it has been recorded in high diversity grassy woodland remnants within the farming areas at Bemboka and Numbugga. It is almost invariably associated with kangaroo grass ( <i>Themeda australis</i> ).	Absent. No kangaroo grass is present at site 1 and very little at site 2. Nearest location is >30km to the north-west.	None	No
Hidden Violet <i>Viola cleistogamoides</i> E TSC	This inconspicuous species has a single old record from Wonboyn "in black peaty soil" (K. McDougall, pers. comm.), and several recent records in coastal heath on shallow sandy soils over Devonian sandstone in Nadgee Nature Reserve and on Green Cape (J. Miles, pers. obs.). The vegetation type at Wonboyn is not recorded but is unlikely to have been heath. The species is more common in Victoria where it usually grows in heath, but "also on skeletal soils in dry forest and woodland, mostly near-coastal" (Walsh and Entwisle, 1996).	Absent, soils are not skeletal, nor peaty and vegetation type is not heath. Nearest location is c. 40km to the south-east.	None	No
<b>GRASSES</b>				
Australian Salt-grass <i>Distichlis distichophylla</i> E TSC	Grows in saltmarsh and other saline situations such as beaches, where rocks provide protection from erosion (J. Miles, pers. obs.).	Absent. Nearest records are at Wonboyn Lake, >40km south of the sites.	None	No
<b>ORCHIDS</b>				
Leafless Tongue Orchid	This species grows in coastal heathland or heathy forest on sandy soils of low fertility, in dry or poorly drained situations. There are 2 or 3 records in the region	Absent, forest types are not heathy. Nearest record is from	None	No

Species and status	Ecology	Presence of habitat and nearest records	Likelihood of occurrence	Possible impact?
<i>Cryptostylis hunteriana</i> V TSC V EPBC	to date, in open forest on Devonian sandstone or rhyolite. It is more commonly encountered in the Shoalhaven region on sandstone substrates. Flowering period is summer (late Nov to Feb).	southern Ben Boyd NP, c. 27km south of the sites.		
Thick-lip Spider Orchid <i>Caladenia tessellata</i> E TSC V EPBC	This species grows on the NSW South and Central Coast, with records from the Braidwood and Queanbeyan areas on the Southern Tablelands, (DECCW 2009). Generally found in grassy sclerophyll woodland on clay loam or sandy soils. Opinions differ as to whether it occurs in Victoria. The Flora of Victoria regards Victorian specimens as being <i>C. cardiochila</i> (Walsh and Entwisle, 1994), while Jones (2006) states that <i>C. cardiochila</i> is common and widespread in Victoria and <i>C. tessellata</i> uncommon to rare in southern and eastern Victoria, in heathy forest on well-drained sandy soil. Flowering period is spring (Sept-Oct) (Jones, 2006).	May be marginal habitat, but although predicted on the basis of records to north and south of the region, there are no records from the region.	Very low due to absence of any local records.	No
<b>ENDANGERED ECOLOGICAL COMMUNITIES</b>				
Coastal Saltmarsh EC TSC	Occurs in estuaries and on the margins of coastal lakes, in gently sloping areas where tidal flushing occurs.	Absent	None	No
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions EC TSC	Occurs in freshwater situations on floodplains of major and minor rivers	Absent	None	No

Species and status	Ecology	Presence of habitat and nearest records	Likelihood of occurrence	Possible impact?
Swamp Oak Floodplain Forest EC TSC	Occurs in freshwater and saline situations around estuaries and coastal lakes and on floodplains of major and minor rivers.	Absent	None	No
River-flat Eucalypt Forest on Coastal Floodplains EC TSC	Occurs on slightly higher elevation areas on the edges of major and minor river floodplains.	Absent	None	No
Littoral Rainforest EC TSC EC EPBC	Occurs within a few kilometres of the sea, on sand dunes, coastal headlands and on the shores of coastal lakes or estuaries.	Habitat present, but the EEC is not.	None, would have been detected if present.	No
Themeda Grassland on Seacliffs and Coastal Headlands EC TSC	Occurs on the most exposed parts of coastal headlands, usually on clay soils, grassland with a variable component of coastal headland and dune shrubs.	Absent	None	No
Bangalay Sand Forest of the NSW Sydney Basin and South East Corner Bioregions EC TSC	Occurs on coastal sand dunes and coastal lake-mouth sand bars, with occasional patches further inland around lake margins. Bangalay ( <i>Eucalyptus botryoides</i> ) is the most characteristic canopy dominant, but Blackbutt ( <i>E. pilularis</i> ) may also occur, and <i>E. botryoides</i> may occur in other vegetation communities.	Present on site 2 but not site 1	Present on Northern Site	Yes, 7 part test completed.
Brogo Wet Vine Forest in the South	Grows on sloping, often rocky sites on granodiorite in rainshadow coastal valleys south from the Moruya area (mostly in the Bega Valley). Characterised by	Absent	None	No

Species and status	Ecology	Presence of habitat and nearest records	Likelihood of occurrence	Possible impact?
East Corner Bioregion EC TSC	<i>Eucalyptus tereticornis</i> , <i>E. bosistoana</i> , <i>Ficus rubiginosa</i> , <i>Pittosporum undulatum</i> and a diverse grassy groundcover, with numerous vines and ferns.			
Dry Rainforest of the South East Forests in the South East Corner Bioregion EC TSC	Consists of isolated Port Jackson figs ( <i>Ficus rubiginosa</i> ) growing in similar situations to Brogo Wet Vine Forest.	Absent	None	No
Lowland Grassy Woodland in the South East Corner Bioregion EC TSC	A grassy woodland dominated by <i>Eucalyptus tereticornis</i> and <i>Angophora floribunda</i> , with <i>Acacia mearnsii</i> , <i>A. implexa</i> and <i>Bursaria spinosa</i> and a dense and diverse grassy understorey, growing usually on granodiorite in coastal rainshadow valleys of the Eurobodalla and Bega Valley LGAs.	Absent	None	No

**\* Listing:**

E TSC = listed as Endangered under Schedule 1 of the NSW *TSC Act 1995*

E EPBC = listed as Endangered under the Commonwealth *EPBC Act 1999*

V TSC = listed as Vulnerable under Schedule 2 of the NSW *TSC Act 1995*

V EPBC = listed as Vulnerable under the Commonwealth *EPBC Act 1999*

EC TSC = listed as an Endangered Ecological Community under Schedule 1 of the NSW *TSC Act 1995*

EC EPBC = listed as an Endangered Ecological Community under the Commonwealth *EPBC Act 1999*

CE EPBC = listed as a Critically Endangered Ecological Community under the Commonwealth *EPBC Act 1999*

## Conclusion

This assessment has identified that marginal habitat may be present for the following threatened species: *Galium australe* and *Caladenia tessellata*. However, there is only one record of the former from the region, from quite dissimilar habitat and >30km from the sites, and no records at all of the latter. Consequently no Seven-part Test has been completed for these species, as the likelihood of their occurrence on the site is extremely small and, with the recommended safeguards in place, the likelihood of impact is negligible.

The Endangered Ecological Community, Bangalay Sand Forest occurs on the Northern Site but not on the Southern site. A Seven-part Test has been completed for the EEC (Appendix E).

## D.2 FAUNA

### Threatened fauna habitat assessment, South East Coastal Plains sub-catchment of Southern Rivers CMA

Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
<b>BIRDS</b>				
<b>Australasian Bittern</b> <i>Botaurus poiciloptilus</i> V TSC	This species is found in wetlands, preferring shallow, vegetated freshwater or brackish swamps. A mixture of tall and short reeds is favoured for breeding. In Victoria the main habitats used are swamps with reed beds of <i>Typha</i> , <i>Phragmites</i> , <i>Juncus</i> or <i>Baumea</i> (Garnett 1992).	Absent	None	No
<b>Barking Owl</b> <i>Ninox connivens</i> V TSC	This species is found most commonly in savannah woodland, in addition to forest and woodland, and occasionally rainforest (Schodde & Tidemann 1986). During the day, this species will roost along creeklines, especially where <i>Acacia</i> forms dense thickets. It nests in hollows of large, old eucalypts. It lives alone or in pairs and occupy territories from 30 to 200 hectares where birds are present all year round (DECCW 2009).	Marginal due to lack of tree hollows.	Possible, but low probability due to rarity in the region	No, due to low impact of proposed works and lack of breeding habitat
<b>Black Bittern</b>	This species requires terrestrial and estuarine wetland habitats, generally with a dense vegetation cover and permanent water. It is common in northern	Absent	None	No



Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
<i>Ixobrychus flavicollis</i> V TSC	Australia, but scarce at the southern extremity of its range in coastal NSW (Garnett 1992). Preferred habitat is leafy waterside trees, including along small creeks (Simpson & Day 1989).			
<b>Black-faced Monarch</b> <i>Monarcha melanopsis</i> M EPBC	This species hunts for insects in the middle layers of rainforest, gullies, wet forest, and coastal scrubs. It is a spring-summer breeding migrant to SE Australia, returning to PNG in autumn-winter.	Present	Possible as the species is a relatively common summer visitor to region	No, due to low impact and timing of proposed works
<b>Black-tailed Godwit</b> <i>Limosa limosa</i> V TSC CAMBA, JAMBA M EPBC	A migratory wading bird that breeds in Mongolia and Eastern Siberia (Palearctic) and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the north and south coast, and inland. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats.	Absent	None	No
<b>Brown Treecreeper</b> <i>Climacteris picumnus</i> V TSC	The species occurs in eucalypt woodlands, mallee and drier open forest of eastern inland Australia (Schodde & Tidemann 1995). Pairs or groups of three to six hold a territory of 5 to 10 hectares. The presence of fallen timber is an important habitat component for foraging for this species.	Absent	Vagrant. The distribution of this species is west from the tablelands, coastal records are very rare.	No
<b>Cattle Egret</b> <i>Ardea ibis/ Bulbulcus ibis</i> CAMBA JAMBA	The Cattle Egret is found in grasslands, woodlands and wetlands. It also utilises pasture lands where drainage is poor, often associated with cattle. Originally found in Africa, Europe and Asia, the Cattle Egret is now found on nearly every continent, with birds in Australia originating from Asia.	Absent	None	No
<b>Comb-crested Jacana</b> <i>Irediparra gallinacea</i>	Occurs throughout coastal Australia and well inland in the north from the Kimberley to Sydney. Vagrants occasionally appear further south, possibly in response to unfavourable conditions further north in NSW (DECCW 2009).	Absent	None	No

Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
V TSC	Inhabits permanent wetlands with a good surface cover of floating vegetation, especially water-lilies (DECCW 2009).			
<b>Diamond Firetail</b> <i>Stagonopleura guttata</i> V TSC	This species occupies eucalypt woodlands, forests and mallee where a grassy understorey is present, preferring unfragmented woodlands. Its distribution is generally inland from the tablelands, but there are breeding populations in the Bega and Towamba Valleys. It feeds on the ground on grass seed and requires shrubs, tree saplings, dense vine tangles, mistletoe or dense outer foliage of eucalypts for nesting sites.	Marginal, as the species is generally not coastal and Coastal Sand Forest is not typical habitat.	Possible, but low probability due to rarity in the region.	No
<b>Eastern Ground Parrot</b> <i>Pezoporus wallicus</i> V TSC	This species is closely associated with heathlands and sedgeland. It is present in swampy areas, dry ridges and is tolerant to burned areas of these habitat types. It is sedentary with local seasonal movements (Pizzey & Knight 2002).	Absent	None	No
<b>Gang-gang Cockatoo</b> <i>Callocephalon fimbriatum</i> V TSC	In summer, this species is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, it moves to lower altitudes in drier, more open eucalypt forests and woodlands (particularly box-ironbark assemblages) (Shields and Crome 1992). This species requires large hollows in which to breed (Gibbons 1999, Gibbons and Lindenmayer 2000). It feeds on seeds of eucalypts, wattles and exotic berry-bearing bushes, often entering cleared land or towns to access the latter.	Present	Possible. Breeding resources (hollow-bearing trees) are absent.	No, due to low impact of proposed works and lack of breeding habitat
<b>Glossy-black Cockatoo</b> <i>Calyptorhynchus lathami</i> V TSC	This species prefers drier open forest or woodland with a very specific food requirement for the seeds of sheoaks ( <i>Allocasuarina</i> spp). Glossy-black Cockatoos nest in tree hollows, usually at considerable heights (Emison et al. 1987).	Absent. <i>Allocasuarina littoralis</i> , the principal food plant is not present.	None	No
<b>Great Egret</b> <i>Ardea alba</i>	Great Egrets occur throughout most of the world. They are common throughout Australia, with the exception of the most arid areas. Great Egrets prefer shallow water, particularly when flowing, but may be seen on any watered area, including	Absent	None	No

Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
CAMBA JAMBA	damp grasslands.  This species is regarded as relatively secure.			
<b>Hooded Plover</b> <i>Thinornis rubicollis</i> CE TSC	The Hooded plover prefers sandy surf beaches which are backed by dunes rather than cliffs. This is a migratory species which nests along the southern coast of NSW during the summer months. They forage in the shore wash zone searching for polychaetes, molluscs and crustaceans.	Present on the adjacent beach and foredune but not in the more stable vegetated dunes.	Very low	No
<b>Hooded Robin (south-eastern form)</b> <i>Melanodryas cucullata</i> V TSC	This species prefers lightly wooded country, including eucalypt woodland, acacia scrub and mallee. It requires structurally diverse habitats with shrubs, forbs, fallen timber and leaf litter to provide adequate hunting and foraging areas. The bulk of its distribution is inland from the tablelands.	Absent	Vagrant. The distribution of this species is west from the tablelands, coastal records are very rare.	No
<b>Latham's Snipe</b> <i>Gallinago hardwickii</i> CAMBA, JAMBA	This species breeds in northern Japan during the Australian winter. During the non breeding season it migrates to Australia to inhabit freshwater wetlands, especially those vegetated with rushes, reeds, sedges and tea tree. This species may utilise modified environments such as sewage treatment works, irrigation channels and flooded plains (Driscoll 1993).	Absent	None	No
<b>Little Tern</b> <i>Sterna albifrons</i> E TSC CAMBA, JAMBA	Habitat in southern NSW includes shallow inlets where it nests on sand spits or sand islands over the summer period. Locally this species has been observed foraging in the Bega River and Black Ada Lagoon (pers. comm. Kate Gillespie 2004). The Little Tern generally congregates in small flocks and breeding colonies, it generally breeds locally at the Bega River mouth (spit) or Bird Island at Wallagoot Lake in non-vegetated areas on bare sand.	Present on Merimbula Beach, but the species is not known to breed there.	None	No
<b>Masked Owl</b> <i>Tyto novaehollandiae</i> V TSC	Masked Owls establish permanent territories in forested areas adjacent to areas of dense and sparse ground cover in close proximity. Forests appear to provide roosting and nesting sites (large tree hollows, Peake et al. 1993), and the ground cover mosaic appears to provide adequate numbers of its terrestrial small	Foraging habitat is present, roosting and nesting sites are not.	Possible	No, due to low impact of proposed works and lack of

Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
	mammal prey (in the dense areas) and access to them (in the sparse areas) (Peake et al. 1993).			breeding habitat
<b>Olive Whistler</b> <i>Pachycephala olivacea</i> V TSC	This species is most common in montane forest and rare in coastal New South Wales (Blakers et al. 1984). In coastal areas, the species strongly favours riparian thickets, especially tea-tree thickets (Blakers et al. 1984, Emison et al. 1987).	Absent	None	No
<b>Orange-bellied Parrot</b> <i>Neophema chrysogaster</i> CE EPBC, CE TSC, M EPBC	This species breeds in the south-west of Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern South Australia and southern Victoria. There are occasional reports from NSW, with the most recent records from Shellharbour in 2003. Typical winter habitat is saltmarsh and strandline/foredune vegetation communities either on coastlines or coastal lagoons. Diet mainly comprises seeds and fruits of sedges and salt-tolerant coastal and saltmarsh plants.	Present on nearby foredune.	Vagrant. The species is very rarely recorded in the region.	No
<b>Osprey</b> <i>Pandion haliaetus</i> V TSC	This species is found around the coast of Australia except in the south-east where it is a vagrant (Blakers et al. 1984, Emison et al. 1987). The south coast of NSW represents the extreme southern limit of its distribution (Emison et al. 1987). They favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Food is fish and nesting requirements are tall dead trees or man-made structures close to water and with a good view over the water.	Foraging habitat is present offshore or in Merimbula Lake. Nesting requirements are not met on either site.	Vagrant.	No
<b>Painted Snipe</b> <i>Rostratula benghalensis s. lat.</i> E TSC, V EPBC M EPBC, CAMBA	In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp, with only the latter being a coastal location. It is most common in the Murray-Darling Basin. It prefers the fringes of swamps, dams and nearby marshy areas. The site is beyond the known distribution of this species.	Absent	None	No
<b>Pied Oystercatcher</b>	The Pied Oystercatcher is found in coastal areas in southern NSW. It prefers	Present on Merimbula Beach,	None	No

Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
<b><i>Haematopus longirostris</i></b> V TSC	mudflats, sandbanks and sandy ocean beaches and is less common along rocky or shingle coastlines. Although rarely recorded far from the coast, the Pied Oystercatcher may occasionally be found in estuarine mudflats and adjacent short pasture.	but not on either site.		
<b>Pink Robin</b> <b><i>Petroica rodinogaster</i></b> V TSC	In NSW, this species is generally found in the south-east as far north as Bombala. It breeds between October and January and disperses north and west into more open habitats in winter as far north as the central coast (DECCW 2009). It inhabits rainforest and moist, tall open eucalypt forest, particularly densely vegetated gullies.	Marginal at site 2, particularly since the site has been burnt, removing dense undergrowth of Pittosporum.	Possible but unlikely due to its local rarity and preference for dense, wet vegetation.	No
<b>Powerful Owl</b> <b><i>Ninox strenua</i></b> V TSC	The Powerful Owl prefers nest/roost sites in moist gullies (Fleay 1968, Pizzey 1980, Simpson and Day 1989) and requires large (>30 cm) hollows for nesting which generally occur in moist forest types and in riparian strips (Tanton, 1994). A large proportion of its diet is hollow dependent arboreal mammals, particularly Greater Gliders (Debus and Chafer, 1994). The majority of prey is taken within the forest canopy, rarely from the ground.	Marginal foraging habitat due to lack of tree hollows which would make potential prey species scarce. No nesting resources.	Very low	No, due to low impact of proposed works and marginal habitat
<b>Purple-crowned Lorikeet</b> <b><i>Glossopsitta porphyrocephala</i></b> V TSC	Nomadic. Commonly seen in the Grey Box and White Box woodlands in the Riverina region, and occasionally along the Murray Valley. Occasional sightings in box-ironbark habitats across the south-west slopes of NSW. The species is nomadic, with the pattern of distribution varying from year to year according to flowering conditions.	Marginal habitat with flowering banksias present in both sites.	Vagrant. The region is outside the normal distribution of this species.	No
<b>Rainbow Bee-eater</b> <b><i>Merops ornatus</i></b> M EPBC	This species inhabits open woodlands with sandy, loamy soil. It builds a burrow in sandy ground or steep banks such as road cuttings or creek banks. The species is a summer breeding migrant (Sept-Apr) to south-eastern Australia, but winters in northern Australia, Solomon Islands, PNG and Indonesia. It is a very rare vagrant	Present	Vagrant. The region is outside the normal range of this species.	No

Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
	to the far south coast.			
<b>Regent Honeyeater</b> <i>Xanthomyza phrygia</i> E TSC E EPBC M EPBC	<p>This species inhabits eucalypt forests and woodlands (Blakers et al. 1984). It is highly nomadic and can arrive at and vacate areas depending on local and regional flowering of favoured species. It feeds mostly on the flowers of eucalypts (particularly box and ironbark species), but also eats invertebrates and exotic fruits (Blakers et al. 1984). This species is now almost completely restricted to a few relatively intact extensive stands of its favoured tree species, mostly on the inland side of the Great Dividing Range (Garnett 1992). There are only two known key breeding regions remaining in NSW at Capertee Valley and the Bundarra-Barraba region. In some years non-breeding flocks converge on flowering coastal swamp mahogany and spotted gum woodlands and forests. Banksia species have been seen to be utilised by this species on the far south coast (Far South Coast Birdwatchers Newsletter, May/June 2001).</p>	<p>Marginal, as favoured eucalypt species are not present. Nectar-producing Banksia species are present at both sites.</p>	<p>Vagrant. The region is outside the normal range of this species.</p>	<p>No</p>
<b>Rufous Fantail</b> <i>Rhipidura rufifrons</i> M EPBC	<p>This species generally prefers wetter habitats than the common Grey Fantail. It is found in the undergrowth of rainforests, and wet eucalypt forests and gullies (Pizzey and Knight, 2003). From October to February it migrates to south east Australia. The nest is built in a horizontal fork of a tree up to 12m from the ground. Breeds in southern Australia, but is known to migrate to inland Australia, PNG, Solomon Islands, New Caledonia and Indonesia.</p>	<p>Present</p>	<p>Possible in summer</p>	<p>No, due to low impact and timing of proposed works</p>
<b>Sanderling</b> <i>Calidris alba</i> V TSC JAMBA CAMBA	<p>This species is mainly found on the northern and central coast of NSW with occasional sightings in the south (NPWS 2009). Breeding occurs in the Northern Hemisphere. During the non-breeding season these birds migrate to the Southern Hemisphere. Habitat at this time is low beaches of firm sand, near reefs and inlets, along tidal mudflats and on bare coastal lagoons. They prefer open sandy beaches exposed to open sea-swell, exposed sandbars and spits (Higgins &amp; Davies 1996).</p>	<p>Present on the adjacent Merimbula Beach, absent on the sites.</p>	<p>None</p>	<p>No</p>
<b>Satin Flycatcher</b>	<p>This species is normally found in heavily vegetated gullies in tall forests. During</p>	<p>Marginal, as forest may be too</p>	<p>Possible but not very</p>	<p>No</p>

Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
<b><i>Myiagra cyanoleuca</i></b> M EPBC	migration it is often found in coastal forests, woodlands and trees in open country. It breeds mostly in south-east Australia, nests on a dead branch 5-25m high under live foliage, regularly returning to the same locality to breed.	dry.	likely.	
<b>Sooty Owl</b> <b><i>Tyto tenebricosa</i></b> V TSC	Pairs establish large permanent territories (600-800ha) in rainforest and wet eucalypt forest (Blakers et al, 1984). The Sooty Owl prefers nest/roost sites in moist gullies (Fleay 1968, Pizzey 1980, Simpson and Day 1989) and moist gully environments for feeding. They prey on a variety of small to medium terrestrial (bush rats, antechinus, bandicoots) and arboreal mammals (Tanton, 1994; Blakers et al, 1984). They require large (>30cm) hollows for nesting.	Marginal foraging habitat but there are no roosting or nesting resources on either site.	Possible, given the large home range, and might forage in the vicinity.	No, due to low impact of proposed works and marginal habitat including no breeding habitat
<b>Sooty Oystercatcher</b> <b><i>Haematopus fuliginosus</i></b> V TSC	Sooty Oystercatchers occur around the entire coast of Australia, favouring rock platforms, islands and reefs for foraging (Pizzey and Knight, 2002). Preferred nesting habitat is boulder strewn areas on rocky islets, but they are known to nest on mainland promontories if Island refuges are not available (Pringle, 1987).	Absent	None	No
<b>Square-tailed Kite</b> <b><i>Lophoictinia isura</i></b> V TSC	This species prefers habitat in open eucalypt forest and, in the inland, woodland (Schodde & Tidemann 1995). The species hunts for small birds in the tree tops of the forest (Klippel 1992). A stick nest is built in a tall tree.	Present	Possible. No nests belonging to raptors were observed in the vicinity.	No, due to low impact of proposed works
<b>Striated Fieldwren</b> <b><i>Calamanthus fuliginosus</i></b> V TSC	This species is found in coastal swamp heaths and tussock fields of south-eastern NSW, into southern Victoria and the south-east of South Australia. It inhabits coastal areas around swampy, coastal heathlands, tussocky grasslands, low shrubby vegetation and margins of swamps. It forages through low undergrowth, feeding on insects and seeds.	Absent	None	No
<b>Superb Fruit-dove</b> <b><i>Ptilinopus superbus</i></b>	The species is mainly found from north-eastern Queensland to north-eastern NSW. However it is occasionally recorded further south, where it is largely	Absent	Rare vagrant. The region is outside its	No

Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
V TSC	confined to pockets of suitable habitat (DECCW 2009). It can be found in rainforest and similar closed forests such as mangroves where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees such as isolated figs, Pittosporum, Lillypilly and Blackberry or Lantana thickets.		normal distribution.	
<b>Swift Parrot</b> <i>Lathamus discolor</i> E TSC E EPBC	The Swift Parrot breeds in Tasmania, migrating to south and eastern NSW in autumn/winter where it inhabits eucalypt forests and woodlands (Blakers et al. 1984). Its principal range on the mainland is the box-gum woodlands of the south-west slopes. It feeds on flowers of eucalypts, and eats psyllids and exotic fruits (Blakers et al. 1984). In eastern NSW Swift Parrots favour habitat containing <i>Eucalyptus robusta</i> (Swamp Mahogany) and <i>Corymbia maculata</i> (Spotted Gum) (Brereton 1996).	Present, but marginal habitat as forest is lacking in favoured food trees.	Vagrant. The species is rarely recorded in the region.	No
<b>White-bellied Sea-Eagle</b> <i>Haliaeetus leucogaster</i> M EPBC CAMBA	This species occurs around coastal areas, islands and estuaries, but is also found in inland areas where there are large rivers, wetlands and reservoirs. On the far south coast it follows rivers inland and may be occasionally seen hunting away from water, (J. Miles, pers. obs.). It preys on fish and waterbirds and constructs a large stick nest in a tall tree overlooking water.	Present. Nest habitat unlikely due to absence of suitable trees.	Very likely to occur, but no nests were recorded. The species is quite common on south coast beaches.	No, due to low impact of proposed works
<b>White-throated Needletail</b> <i>Hirundapus caudacutus</i> M EPBC CAMBA JAMBA	This species has been recorded in the airspace above woodlands, forests and farmlands. It is often seen 'patrolling' favoured feeding grounds above ridges and hilltops. It feeds on flying insects, and in Australia it conducts all its activities on the wing. It breeds in the Northern Hemisphere and is a regular summer migrant to eastern Australia from mid-October until April.	Present	Possible, and likely as the species is a regular summer non-breeding migrant to the region.	No, as this species utilises only the air column, never coming to land in Australia
<b>MAMMALS</b>				
<b>Brush-tailed Phascogale</b>	This predominantly arboreal species is found in a variety of forest types, with its preferred habitat being "open dry sclerophyll forest with little ground cover on ridges up to 600 metres" (Cuttle 1983). It forages for invertebrates and	Present though absence of tree hollows would make it marginal.	Low	No, due to low impact of proposed works



Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
<b><i>Phascogale tapoatafa</i></b> V TSC	occasionally small vertebrates, mainly within the tree canopy. It shelters and breeds in tree hollows, stumps or old globular bird nests. Breeding females construct a nest of bark, feathers and fur within a large tree cavity with a small entrance. Individuals maintain large (20-70 hectare) exclusive territories (Soderquist, in Strahan, 1998).			and marginal habitat. No trees would be impacted
<b>Eastern Bentwing-bat</b> <b><i>Miniopterus schreibersii</i></b> V TSC	The Eastern Bentwing-bat is a common, although vulnerable species, that is likely to be widely distributed throughout the region and found in a wide range of habitats. It roosts and raises its young in caves and mine tunnels (Strahan 1983). Typically, the species forages in well timbered habitats, above the tree canopy (Dwyer, in Strahan 1998).	No suitable caves or tunnels present. Foraging habitat present.	Possible	No, due to low impact of proposed works on foraging habitat
<b>Eastern False Pipistrelle</b> <b><i>Falsistrellus tasmaniensis</i></b> V TSC	Little is known of the habitat requirements of this species. It is widely distributed in eastern NSW from the Dividing Ranges through to the coast (Parnaby, 1992; Strahan 1995). It is found in a range of habitats including dry and wet sclerophyll forest but appears to prefer wet sclerophyll forest (Hall and Richards 1979). This species roosts and breeds in tree hollows (Phillips and Inwards 1985).	Foraging habitat present, but both sites lack tree hollows.	Possible	No, due to low impact of proposed works on foraging habitat
<b>Eastern Freetail-bat</b> <b><i>Mormopterus norfolkensis</i></b> V TSC	This elusive, arboreal bat prefers wet sclerophyll forest and woodland. It roosts by day in tree hollows and fissures (Klippel, 1992) and feeds by hawking for insects.	Foraging habitat present, but both sites lack tree hollows.	Possible	No, due to low impact of proposed works on foraging habitat
<b>Eastern Pygmy-possum</b> <b><i>Cercartetus nanus</i></b> V TSC	Feeding largely on nectar and insects, the species is found from rainforest through sclerophyll forest to heathy woodland. Banksias and myrtaceous shrubs and trees are favoured as food sources (Turner & Ward in Strahan 1998). Its small size allows it to shelter in very small spaces during the day, and hollows in trees are favoured, though other locations include abandoned bird nests, spaces between the bark and wood of eucalypts and in tree forks, where it may build a	Present and Banksia species being abundant on both sites, the sites would provide ample foraging resources. The lack of tree hollows need not disqualify the sites as habitat,	Possible.	Low, due to low impact of proposed works. No trees will be removed.

Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
	small nest of shredded bark. The species appears to be mainly solitary, with each individual using several nests. It may spend much of the winter in torpor (Turner & Ward from Strahan 1998).	since the species can shelter in other situations.		
<b>Golden-tipped Bat</b> <i>Kerivoula papuensis</i> V TSC	Most records of this species in southern New South Wales are from sclerophyll forest, in proximity to rainforest patches (Walton et al. 1992), although they have also been recorded from recently logged dry sclerophyll forest (Churchill, 1998). It has been recorded roosting in a range of situations including abandoned bird nests, dense vegetation, buildings and caves (Churchill, 1998). They are specialist feeders on spiders which they pluck from their webs in flight (Churchill, 1998).	Present	Possible	No, due to low impact of proposed works
<b>Greater Broad-nosed Bat</b> <i>Scoteanax rueppellii</i> V TSC	Although little is known about this uncommon species, it has been recorded from a range of habitats, from woodland to rainforest, but appears to favour moister forest types (Hall and Richards, 1979). The species is known to roost in tree hollows (Richards 1983).	Foraging habitat present, but both sites lack tree hollows.	Possible	No, due to low impact of proposed works and no impact on trees
<b>Grey-headed Flying-fox</b> <i>Pteropus poliocephalus</i> V TSC V EPBC	This species roosts in large camps generally in wetter vegetation such as rainforest or swamp forest, and flies out at night to feed on blossom and native and exotic fruits over a wide area, including native forest and cleared land. Local Flying-fox camps have been recorded in the township of Bega (on Glebe Lagoon), and west of Pambula. Camps tend to be seasonal, with most animals moving away from the area in winter.	Foraging habitat present.	Possible and quite likely to forage in the vicinity, especially in the warmer months.	No, due to low impact of proposed works
<b>Koala</b> <i>Phascolarctos cinereus</i> V TSC	The Koala consumes a diverse range of eucalypt trees including <i>Eucalyptus globoidea</i> , <i>E. muelleriana</i> , <i>E. tereticornis</i> , <i>E. ovata</i> , <i>E. cypellocarpa</i> , <i>E. longifolia</i> , <i>E. bosistoana</i> and <i>E. viminalis</i> which have been identified as potential koala feed trees for the southern area of NSW (NPWS, 2009; Cork et al., 1990; Reed et al, 1990, Fanning, 1990, Jurskis et al, 1994). This species utilises a wide range of forest and woodland types. However on the far south coast they are generally recorded only in large areas of continuous forest. They are solitary with distinct	Marginal at site 2 as <i>E. botryoides</i> is not recorded as a local feed tree, however, the Koala does occur on similar (with a different dominant eucalypt species) on coastal sites on Raymond Island,	Possible but low probability due to scarcity of records in close proximity.	No, due to low impact of proposed works and negligible likelihood of presence

Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
	home ranges (Martin and Handasyde in Strahan 1998).	Gippsland Lakes (J. Miles, pers. obs.). No suitable habitat at site 1 due to absence of eucalypts.		
<b>Large-footed Myotis</b> <i>Myotis adversus</i> V TSC	This species roosts in small colonies in caves, mines, buildings and under bridges, and forages over water bodies ranging from small streams and dams to reservoirs for aquatic invertebrates and small fish (Richards, in Strahan, 1983, Parnaby, 1992).	Absent	None	No
<b>Long-nosed Potoroo</b> <i>Potorous tridactylus</i> V TSC V EPBC	This species is generally restricted to coastal lowlands and surrounding foothills (Joint Scientific Committee 1990). It inhabits coastal heath and dry and wet sclerophyll forests where it requires relatively dense undergrowth, with individuals being concentrated where soil is light and sandy (Johnston in Strahan, 1995). It feeds on roots, tubers, fungi and invertebrates, for which it digs, making a teacup shaped hole, distinctive from the conical holes of the more common bandicoot.	Marginal due to proximity to residential area and lack of a dense shrub layer. No diggings were seen which could indicate the presence of this species.	Very low	No, due to low impact of proposed works and low likelihood of presence
<b>Long-footed Potoroo</b> <i>Potorous longipes</i> E TSC E EPBC	This species has a limited distribution and is extremely rare. The only known population in NSW is located in the Sheepstation Creek area of Genoa Section of South East Forests National Park. It typically inhabits moist forest types between 150m and >1000m altitude, where high soil moisture content throughout the year is essential to allow its main food source of hypogeal fungi to persist. Home ranges vary from 20-60 ha, often overlapping (Claridge, Seebeck and Rose, 2007).	Absent, as site is dry eucalypt forest or scrub.	None	No
<b>Smoky Mouse</b> <i>Pseudomys fumeus</i> E TSC E EPBC	This species has been trapped in a diverse range of habitats, including montane and subalpine heath, tall open forest, open forest and woodland (Osborne and Preece 1986). Habitats in the Great Dividing Range are "usually dry slopes having stony, skeletal soils and a sparse to mid-dense understorey of sclerophyllous shrubs producing a range of plant food throughout the year. A diverse sclerophyll shrub understorey and a rocky substrate are also characteristic", Menkhorst and Seebeck (1981, pp. 94-95).	Absent	None	No

Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
<b>Southern Brown Bandicoot</b> <i>Isoodon obesulus</i> E TSC E EPBC	Found in a range of eucalypt forest types and heath, with a preference for shrubby understorey that is occasionally burnt to maintain a mosaic of vegetation in a suitable stage of regrowth to provide the range of food items required, including insects, fungi and other subterranean plant material. It constructs a nest of plant material on the ground and is therefore susceptible to fox predation. Individuals maintain a home range of up to 7 hectares, but these may overlap substantially (Braithwaite, in Strahan 1995).	Marginal due to proximity to residential area and lack of a dense shrub layer. No diggings were seen which could indicate the presence of this species.	Very low	No, due to low impact of proposed works and low likelihood of presence
<b>Spotted-tailed or Tiger Quoll</b> <i>Dasyurus maculatus</i> V TSC, E EPBC	This species is found in a variety of forest types, although it generally prefers moister environments such as rainforest and wet sclerophyll forest, breeding and sleeping in nests in rock caves or hollow logs or trees (Edgar 1983).	Absent due to lack of suitable shelter sites.	None	No
<b>White-footed Dunnart</b> <i>Sminthopsis leucopus</i> V TSC	Research on this species in a recently logged area in Mumbulla State Forest near Bega suggests that preferred habitat is treeless ridges and mid slopes with sparse ground cover (Lunney et al. 1989). It disappeared from this site three years after logging or fire, suggesting that dense groundcover is not favourable for its presence. It was not recorded in gullies. In Victoria, and south of Eden it has been captured in grassy foredune scrub (Lunney, in Strahan, 1995, J. Miles, pers. obs.). It constructs a bark nest beneath fallen timber or dense litter (Menkhorst and Knight 2004) and feeds on terrestrial invertebrates and skinks.	Present	Possible	Low, due to minor nature of impacts
<b>Yellow-bellied Glider</b> <i>Petaurus australis</i> V TSC	This species is restricted to tall mature eucalypt forest in a band between coastal and higher altitude forests along large portions of the Victorian, New South Wales and Queensland coasts (Russell 1983). Mature and over mature trees are important habitat elements because these trees produce suitable nesting hollows, and generally produce more flowers than younger trees. Areas with a diversity of tree species are favoured, in order to provide the continuity of resource supply (nectar, manna and other plant exudates, insects) required. At some times of year animals may be very dependent on sap, which is licked from	Absent due to small size of eucalypts, lack of hollows and presence of only a single eucalypt species. However, the species is known to be present in North Ben Boyd National Park, within a few kilometres of	None	No

Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
	incisions made in the bark of favoured trees to stimulate sap flow. On the far south coast Red Bloodwood ( <i>Corymbia gummifera</i> ) appears to be the most favoured sap feed tree species, though incisions have also been observed on <i>E. cypellocarpa</i> , <i>E. angophoroides</i> and <i>E. viminalis</i> (J. Miles, pers. obs.).	the site.		
<b>AMPHIBIANS</b>				
<b>Giant Burrowing Frog</b> <i>Heleioporus australiacus</i> V TSC V EPBC	This species has been recorded in forest including montane sclerophyll woodland, wet, damp and dry sclerophyll forest, and in the Sydney Basin, heath or heathy woodland. The majority of recordings in Victoria have been from individuals in burrows, in areas adjacent to water (Gillespie 1990). It breeds in semi-permanent to ephemeral sand or rock based small streams, and infrequently in dams with a sandy silt or clay base. It is also found in ephemeral to permanent artificial drainage ditches (DEWHA 2009). It is not restricted to watercourses. Radiotracking surveys have recorded the species up to 500m from water, from all parts of the landscape (ridges, slopes, gullies). As the species spends most of its time buried in the soil, is only detectable after heavy rain and is very difficult to survey for, it is probably under-detected and consequently suitable habitat is difficult to predict. In the Eden region it has generally been found to be associated with drier forest types on sandy soil, with sparse groundcover vegetation (Penman <i>et al.</i> , 2005), with breeding typically occurring in first and second order streams.	Absent as there are no suitable water bodies in the vicinity.	None	No
<b>Green and Golden Bell Frog</b> <i>Litoria aurea</i> E TSC V EPBC	Formerly, this species had a wide distribution but since 1990 recorded populations have become isolated, restricted to small, mostly coastal or near coastal populations. It is known to inhabit marshes, dams and stream-sides, particularly those containing bulrushes ( <i>Typha</i> spp.) or spikerushes ( <i>Eleocharis</i> spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow ( <i>Gambusia holbrooki</i> ); have a fluctuating water level and emergent vegetation (Pyke <i>et al.</i> 2002). Water bodies in forests,	Absent as there are no water bodies in the vicinity. There have been releases of captive-bred tadpoles of this species in swamps within North Ben Boyd National Park, <5km south of the sites.	None	No

Species and Status	Ecology	Presence of habitat	Likelihood of occurrence	Potential to be impacted
	woodlands and shrublands and open or disturbed areas are used.			
<b>Littlejohn's Tree Frog, Heath Frog <i>Litoria littlejohni</i></b>  V TSC V EPBC	This species' range extends from the Watagan Mountains on the central coast to Buchan in NE Victoria, within which area its distribution is patchy and confined to areas between 100 and 950m elevation. Surveys SW of Nowra found that the species breeds in second and third order streams within plateau country on sandstone, usually within heathy woodland though occasionally in tall wet forest (Daly & Craven, 2007). Its presence is associated with partially submerged timber and fallen dead shrubs. Tadpoles have also been recorded in ephemeral pools and roadside drains.	Absent	None	No
<b>Stuttering Frog <i>Mixophyes balbus</i></b>  V TSC, V EPBC	This species is found in rainforest and wet sclerophyll forests (Cogger 2000), requiring freshwater streams and riparian vegetation for breeding and habitation. They have not been recorded in riparian habitat that has been disturbed (Mahony et al. 1996).	Absent	None	No

**\* Listing:**

E TSC = listed as Endangered under Schedule 1 of the NSW *TSC Act 1995*  
 E EPBC = listed as Endangered under the Commonwealth *EPBC Act 1999*  
 V TSC = listed as Vulnerable under Schedule 2 of the NSW *TSC Act 1995*  
 V EPBC = listed as Vulnerable under the Commonwealth *EPBC Act 1999*

EC TSC = listed as an Endangered Ecological Community under Schedule 1 of the NSW *TSC Act 1995*  
 EC EPBC = listed as an Endangered Ecological Community under the Commonwealth *EPBC Act 1999*  
 CE EPBC = listed as a Critically Endangered Ecological Community under the Commonwealth *EPBC Act 1999*

## **Conclusion**

This assessment has identified that habitat may be present for the following threatened species: Eastern Pygmy-possum and White-footed Dunnart. A Seven-part Test has been completed for these species (**Appendix E**). Mobile species such as birds and bats, which may utilise the site, were assessed as not likely to be impacted by the works due to their mobility and the minor nature of the works.

## Appendix E SEVEN PART TEST

Section 5A of the *Environmental Planning and Assessment Act 1979 (EP&A Act)* specifies seven factors to be taken into account in deciding whether a development is likely to significantly affect threatened species, populations or ecological communities, or their habitats, listed at the NSW state level under the *Threatened Species Conservation Act 1995*.

The following Seven-part Test assesses the significance of the likely impacts associated with the proposed installation of monitoring bores in the dunes behind Merimbula Beach on the following species and endangered ecological community:

- White-footed Dunnart (*Sminthopsis leucopus*) V TSC
- Eastern Pygmy-possum (*Cercatetus nanus*) V TSC
- Bangalay Sand Forest Endangered Ecological Community (EEC).

V TSC = listed as Vulnerable under Schedule 2 of the NSW TSC Act 1995

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**a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

No flora or fauna species listed as threatened under the TSC Act were found on the site. Based on the assessment included in **Appendix D**, only two fauna species have the potential to be affected by the proposal, as suitable habitat is present and they are species with small home ranges which could reside entirely within the sites, rather than being occasional users of the vegetation in the vicinity. The Seven-part Test has been applied to these two species, but not to the many threatened fauna species which might utilise the site occasionally for foraging, but for which the likelihood of impact is otherwise extremely low.

### **White-footed Dunnart (*Sminthopsis leucopus*)**

This species appears to favour recently disturbed sites or vegetation types of low density (Lunney, in Strahan, 1998). It is distributed from Tasmania to the Shoalhaven district of NSW, in coastal to montane habitat, with a highly disjunct record from North Queensland. It can be difficult to detect, making generalisations about preferred habitat problematic. Although there are no nearby records of this species, this factor also means that a lack of records should not be taken as proof of its absence in the area.

A survey near Melbourne identified this species in coastal dune habitat, as did a survey on Twofold Bay south of Eden (nghenvironmental, 2006).

A study of the ecology of this species in Mumbulla State Forest found it inhabited logged or burnt areas on ridge crests and sparsely vegetated mid-slopes where tree cover was absent, building nests consisting of a shallow depression with a few pieces of bark or leaves under strips of bark or small logs. Home ranges of resident animals are very small (80-150 metres in length) and some males range very widely, presumably dispersing in search of new areas of suitable habitat. Up to 1025 metres movement in 24 hours was recorded by Lunney at Mumbulla State Forest. The ability to travel relatively long distances would be crucial to locating suitable patches of disturbed habitat in the landscape.



As frontal dunes are permanently treeless and often have quite an open groundcover as well, they may represent suitable habitat for this species on a long-term rather than transitory basis. If the species is present in the Merimbula dune system, it is likely to mostly inhabit the frontal dunes rather than the more heavily vegetated dunes in which the monitoring bores are proposed to be placed, although the powerline easement bisecting the dune system may also be suitable habitat. The Southern Site, with its dense groundcover of sedges and the succulent shrub *Rhagodia candolleana*, is unlikely to represent suitable habitat for the species, but the recently burnt Northern Site may be utilised by this species until the groundcover returns to its normal level of density. The proximity of the Northern Site to urban development reduces the likelihood of the species' presence at that site due to a high risk of predation by domestic and feral animals.

A viable local population is not known to occur in the Merimbula dune system, however there is a low likelihood that one is present. As the proposed activity will only result in a temporary disturbance of very small scale to the groundcover vegetation and no removal of canopy trees, it is unlikely that it will have any effect on this species. The most likely negative impact would be the killing of individual animals in their nests, since they are ground nesters. This risk would be ameliorated by applying the recommended safeguards, including utilising existing tracks, avoiding driving machinery over logs of any size, and not dumping material on top of potential nest sites. The application of these safeguards would ensure that there is a very low probability that the proposed activity would eliminate a population of this species. Being Dasyurids, individual animals are relatively short-lived (one season for males) and the females produce up to ten young at once, in mid-August to mid-September (Lunney, in Strahan, 1998), so the loss of an individual or two is very unlikely to be significant in terms of the long term viability of any local population.

#### **Eastern Pygmy-possum (*Cercartetus nanus*)**

This very small possum feeds primarily on nectar and pollen, with banksia species being favoured feed plants (along with eucalypts and bottlebrushes). Insects are also taken, and soft fruits may be important in some habitat types. The species has been recorded in a wide range of habitats from rainforest to heathy woodland, and including relatively young (20 year old) regrowth forest (Duncan and Taylor, 2001). Eastern Pygmy-possums may shelter in tree hollows, but can also utilise other nest sites such as in the forks of eucalypts, under loose bark, in rotting stumps, woody debris on the forest floor and in old bird nests.

The Northern Site is more likely to provide suitable nesting sites than the Southern Site, due to the presence of eucalypts and consequently more woody debris. It also has two species of Banksia, as opposed to one on the Southern Site, and a eucalypt, therefore providing a greater range of potential food resources as well.

The Eastern Pygmy-possum is difficult to detect, so an absence of local records need not indicate that the animal is not present (The closest records in the NPWS Wildlife Atlas are from approximately 4 kilometres south, in Ben Boyd National Park, south of Eden, refer to **Figure A.1**). An assessment of different survey methods in an area where the species was known to be present (Barren Grounds Nature Reserve in the Sydney Basin) found that it was very rarely detected by spotlighting, and only trapped in tree-mounted live traps, around which the bark had been liberally sprayed with honey and water mix. Traps on the ground and pitfall traps caught no animals in this study (Harris and Goldingay, 2005), however Duncan and Taylor (2001), in Tasmania, caught the species only in pitfall traps. All trapping methods have a relatively low success rate. Nest boxes have also been used to sample this species, but there may be a substantial wait for animals to take up residence in them.

A viable local population is not known to occur in the Merimbula dune system, but it is possible that one is present, especially as the area is contiguous with less disturbed forest in North Ben Boyd National Park, which

also has Banksia species present in the understorey, and a much greater diversity of eucalypts. The proximity of urban development, particularly at the Northern Site, may reduce potential for the specie's presence, although this does not preclude the possibility of occurrence (D. Brozek Cordier, pers. obs.).

As the proposed activity will only result in a temporary disturbance of very small scale to the groundcover vegetation and no removal of canopy trees, it is unlikely that it will have an effect on this species. The most likely negative impact would be the killing of individual animals in their nests, since they may nest in small cavities on or close to the ground. This risk would be ameliorated by application of the recommended safeguards, including avoiding driving machinery over logs of any size or dumping spoil on top of potential nest sites. There is a very low probability that the proposed activity would eliminate a population of this species.



Figure A.1 DECCW Wildlife Atlas Threatened Species Records – Eastern Pygmy Possum (pink).

**b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

There are no listed Endangered Populations in the relevant area.

**c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**

- **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**

- ***is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

One Endangered Ecological Community, **Bangalay Sand Forest** could suffer a minor negative impact from the proposal. This community is present at the Northern Site, but not the Southern Site.

Vegetation clearing requirements would be negligible (refer to Box 1). Existing tracks/easements would be used to access the proposed bore locations and bores would be located in disturbed or vegetation free areas. There would be some disturbance to ground vegetation and possibly some shrubs in the immediate vicinity of the bores, but the disturbed area is likely to be very small. The machinery to be used is highly manoeuvrable so should be able to operate without causing much damage to vegetation off-site. Slightly greater disturbance may be caused if test pits for archaeological remains are required prior to the work commencing, these could result in a square metre or two of sand being deposited, at least temporarily, on adjacent land, however the application of the recommended safeguards would see this occurring on tarpaulins, minimising the risk of any impact.

The activity includes a risk of introducing pathogens such as Cinnamon Fungus (*Phytophthora cinnamomi*) to the sites, and of introducing new weeds or spreading existing ones. The Banksia species which are a prominent component of Bangalay Sand Forest, and significant as a resource for fauna, belong to a family that is highly susceptible to Cinnamon Fungus (Proteaceae).

The proposal is likely to be a very low impact one, unless it results in the introduction of Cinnamon Fungus, or greatly exacerbates weed invasion. If the recommended safeguards are applied, it is unlikely to place the EEC at risk of local extinction, since it would occupy only a very small proportion of this community at the Northern Site. The bulk of this community has, however, already been lost to residential development in the Fishpen area, and the remaining area is under threat from uncontrolled public use and weed invasion.

The proposed works have a high potential to contribute to invasion by persistent weeds such as perennial exotic grasses (for example, the African Lovegrass already present on track verges on the site). This risk can be addressed by the recommended safeguards, including: removal of the existing infestations before works commence, thorough washing down of machinery prior to its arrival on the site to avoid introducing weeds from elsewhere, and monitoring of the site after the project is completed, with removal of any new infestations.

The proposal is not likely to adversely impact on the extent of Bangalay Sand Forest, nor is it likely to substantially or adversely modify the composition of Bangalay Sand Forest, to the extent that it's local occurrence is likely to be placed at risk of extinction.

**d) *In relation to the habitat of a threatened species, population or ecological community:***

- ***the extent to which habitat is likely to be removed or modified as a result of the action proposed, and***
- ***whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and***
- ***the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

The site may provide foraging or shelter habitat for the threatened fauna species identified in Appendices B and C, including those addressed in this Seven-part Test. There is abundant habitat of this type in the immediate vicinity, however, therefore it is unlikely that any habitat impacted by the proposal would be critically important to the survival of species potentially occurring at the sites. The proposal is not likely to permanently remove or

destroy any habitat (refer to Box 1). Some disturbance of vegetation, groundcover and soil, including crushing or minor breakage of shrubs, would have only a temporary impact. The proposal would not have the effect of fragmenting habitat because of the very small impact zone, unless it results in the introduction of Cinnamon Fungus, with possible long-term consequences for the health of the whole ecosystem. The application of the recommended hygiene safeguards would minimise potential for this to occur if adequately applied.

The proposal is not likely to result in the removal or significant modification of EEC as only very limited areas of vegetation would be temporarily impacted, and, with the recommended safeguards in place, none is likely to be permanently impacted.

**e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**

No areas of declared critical habitat have been declared for the study area.

**f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan.**

There is no Recovery Plan for any of the relevant fauna species or to the Bangalay Sand Forest EEC. Ten priority actions have been identified for the White-footed Dunnart ([www.threatenedspecies.environment.nsw.gov.au/tsprofile](http://www.threatenedspecies.environment.nsw.gov.au/tsprofile), 2009):

- Control feral predators and rabbits.
- Apply mosaic pattern hazard reduction techniques to ensure the same areas are not burned continuously.
- Avoid overgrazing by stock in areas of habitat.
- Apply forestry regimes that maintain floristic and structural diversity.
- Retain standing and fallen timber and other nest sites in areas of habitat.
- Prevent domestic cats and dogs from roaming in habitat areas.
- Protect habitat and retain linkages across the broader landscape.
- Use pitfall traps when surveying for the species, in addition to "Elliot" traps.
- Research into the relationship between this species and the seral stages of vegetation communities is required before its habitat needs can be fully understood.

The proposal is not inconsistent with any of these actions, as it should not have a significant impact on the animals or their habitat if the recommended precautions are followed.

Seven priority actions have been identified for the Eastern Pygmy-possum. These are as follows:

- Manage fire to protect habitat
- Raise community and land holder awareness
- Control feral predators
- Research appropriate fire and land management regimes for protection of habitat
- Research ecology, movements, habitat and population genetics

- Survey and map species distribution and habitat and identify high priority habitat

These are essentially consistent with those for the White-footed Dunnart, therefore the proposal is not likely to have a significant impact on recovery action for the Eastern Pygmy Possum either.

**g) Whether the proposed action constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Three identified Key Threatening Processes (KTP) are relevant to this proposal. Considering the scale of works and vegetation to be impacted, clearing of native vegetation and loss of hollow-bearing trees are not relevant to this proposal.

- The invasion of native vegetation by exotic perennial grass is a KTP relevant to this proposal. Bangalay Sand Forest is vulnerable to the introduction and spread of perennial grasses such as African Lovegrass, which favours dry sandy soils and Kikuyu and Buffalo Grass which favour wetter conditions. All of these, along with Panic Veldtgrass (*Ehrharta erecta*) are already present on both sites, though better established at the Southern Site, and are likely to be spread more widely by the disturbance associated with the proposal, and increased use of the tracks by vehicles and machinery. Application of the recommended safeguards, including washing of earth-moving machinery prior to arrival on the site and management of existing and any future weeds would minimise the spread of additional weeds at the site however, it is likely that current management and site use not connected with the activity will continue to spread weeds, particularly if the site remains open to vehicle access.
- Infection of native plants by *Phytophthora cinnamomi* (Cinnamon Fungus) is listed as a KTP. This soil borne pathogen kills plants, particularly those in susceptible families such as grass trees (*Xanthorrhoea* spp.), Proteaceae (including *Banksia* spp) and Fabaceae (peas and wattles). The need to bring tracked machinery onto the site increases the likelihood that this pathogen could be introduced, in soil adhering to the tracks. This risk could be reduced by careful washing of machinery and vehicles prior to entry onto the site.
- The invasion and establishment of exotic vines and scramblers is a KTP which could be relevant to this proposal. Bangalay Sand Forest is vulnerable to the introduction and spread of exotic vines such as Bridal Creeper (*Asparagus asparagoides*), which is already present on the Northern Site, and Dolichos Pea (*Dipogon lignosus*), sparsely present on the Southern Site. While increased use of the tracks by vehicles and machinery is unlikely to spread these weeds, the soil disturbance could encourage recruitment from seed already present on-site. Washing of earth-moving machinery prior to arrival on the site would help to prevent the introduction of additional weeds, but those already established are slightly likely to be spread, though not highly likely, given the relatively low impact of the proposal on vegetation. Action to control existing weeds at both sites and restrict vehicle access would help reduce the risk of invasion and establishment of exotic vines and scramblers.

## Conclusion

This assessment concludes that a small scale, temporary negative impact to the EEC **Bangalay Sand Forest** would occur at the Northern Site. It is unlikely to be significant in the local or regional context due to the relatively low impact nature of the proposal. Similarly, impacts on threatened fauna species are unlikely, and are unlikely to be significant if either of the two relevant species were to occur on the site (though there is no evidence that they do so).

The most likely means by which impacts could become significant would be through the introduction of Cinnamon Fungus to the site, in soil carried on vehicles or machinery. The risk of this will be minimised if machinery and vehicles are thoroughly washed down before being brought onto the site (though it should be noted that local residents and utilities authorities appear likely to drive vehicles through the dune system regularly).

## Appendix F **ARCHAEOLOGY ASSESSMENT**

## Appendix G **LETTER FROM DECCW RE. ARCHAEOLOGY**



## Appendix H **THREATENED SPECIES POTENTIALLY OCCURRING ON SITE**