LOGO DEVELOPMENT ACT 1993

GUIDELINES

For the preparation of a

PUBLIC ENVIRONMENTAL REPORT

For the

Kangaroo Island Golf Course Resort Proposal

by Programmed Turnpoint Pty Ltd

DAC LOGO

Development Assessment Commission South Australia

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1 INTRODUCTION

1.1 On 19 February 2014, the Minister for Planning ('the Minister') made a declaration in the *South Australian Government Gazette* for a proposed Golf Course Resort development on Kangaroo Island to be assessed as a Major Development under the provisions of Section 46 of the *Development Act 1993*.

1.2 The proposed development comprises an 18 hole golf course, clubhouse (with function facilities), tourist accommodation, residential development and associated infrastructure. The site is located on the Dudley Peninsula, between Pelican Lagoon and Pennington Bay, at the eastern end Kangaroo Island. The subject land is a 200 hectare site that comprises a mix of cleared farmland and natural coastal ecosystems.

1.3 On 2 June 2014, a delegate of the Commonwealth Minister for the Environment determined that the proposed development was a 'controlled action' requiring assessment and a decision on approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) before it can proceed. The delegate also decided that the proposed development would be assessed through the State government assessment process under the current bilateral agreement between the Commonwealth of Australia and the State of South Australia relating to environmental impact assessment (the bilateral agreement).

1.4 The Development Assessment Commission (DAC) is an independent statutory authority that has the task of determining the appropriate level of assessment for a Major Development, namely an Environmental Impact Statement (EIS); Public Environmental Report (PER) or a Development Report (DR), and setting Guidelines.

1.5 Following consideration of the implications of the proposal, the DAC has determined that the proposal will be subject to the processes and procedures of a Public Environmental Report (PER), as set out in Section 46C of the *Development Act 1993*. A PER was considered appropriate due to a range of issues to be investigated, including:

- The extent of departure from existing zone policies within the relevant Development Plan.
- The sensitivity of the coastal location and the potential for visual impact on the landscape values of the coast.
- Potential impacts on the surrounding coastal environment (especially from human disturbance and habitation).
- The economic implications and sustainability of the proposal, particularly the economic impact of the development with respect to the local tourism industry and the broader community on Kangaroo Island.

- Construction impacts, including native vegetation clearance, disturbance to native fauna (especially threatened species), substantial earthworks, noise, dust, odour and vibration.
- Operational impacts, including human disturbance to fauna, effects of golf course irrigation and management (such as the use of fertilisers, herbicides and pesticides), 'edge effects' between the golf course and the natural environment, stormwater and wastewater management (including reuse).
- Traffic generation and implications for the local road network.
- Infrastructure requirements (especially the provision of power and water).
- Bushfire protection requirements.

1.6 It should be noted the *Development Act 1993* requires a PER to be publicly exhibited for a period of at least 30 business days, and for a public meeting to be held during this period.

1.7 The DAC has now prepared Guidelines for the proposed Kangaroo Island Golf Course Resort, based on the significant issues relating to the proposed development. The PER should be prepared in accordance with these Guidelines and should describe what the proponent wants to do, what the environmental effects will be and how the proponent plans to manage the project.

1.8 The PER should be prepared to cover both the construction and ongoing operation of the development and, where possible, should outline opportunities to incorporate best practice design and management.

1.9 For the purposes of environmental impact assessment under the *Development Act 1993*, the meaning of 'environment' is taken to include an assessment of environmental (biological and physical), social and economic effects associated with the development and the means by which those effects can be managed.

1.10 An opportunity for public comment will occur when the completed PER is released for public exhibition. At that time, an advertisement will be placed in *The Advertiser* and *The Islander* newspapers to indicate where the PER is available and the length of the public exhibition period. During the exhibition period, written submissions on the proposal can be made to the Minister for Planning.

1.11 The DAC's role in the assessment process is now fulfilled. The Minister will continue with the assessment process under Section 46 of the *Development Act 1993* from this point. The object of Section 46 is to ensure that matters affecting the environment, the community or the economy to a significant extent are fully examined and taken into account in the assessment of this proposal.

1.12 The documentation and the analyses from the assessment process will then be used by the Governor in the decision-making process, under Section 48 of the *Development Act 1993*, to decide whether the proposal can be approved, and the conditions that would apply.

1.13 In accordance with the requirements of the bilateral agreement, the State of South Australia will also provide an assessment report to the Commonwealth Environment Minister for the purposes of Part 9 of the EPBC Act.

1.14 The key stages in the assessment process under the Major Developments or Projects provisions of the *Development Act 1993* are shown in Figure 1.

INSERT FIGURE 1 – PER PROCESS FLOW CHART

2 BACKGROUND

2.1 The proponent of the proposed Kangaroo Island Golf Course Resort is Programmed Turnpoint Pty Ltd, a provider of construction and maintenance services to the golf, horse racing, landscape and sports turf industries in the Australia and Pacific region.

2.2 Programmed Turnpoint P/L proposes to develop a world class, links style golf course resort on the southern coastline of Kangaroo Island. The proposal comprises the following components:

- 18 hole golf championship length golf course and associated international standard practice facilities.
- Clubhouse and dining/function facilities, with associated parking. The clubhouse facility also includes 20 accommodation suites (i.e. tourist accommodation).
- Accommodation Lodges, comprising 20 twin bedroom suites with self-contained facilities.
- Staff accommodation (i.e. for up to 10 staff), including a separate dwelling for the golf superintendant.
- Discreetly located maintenance compound (including a $1200m^2$ maintenance shed) to accommodate golfing equipment, wash down bays, green keeping machinery and general back of house storage requirements.
- Five freehold residential allotments, which could be used for limited unit/villa development and leased back to the golf course when not in use by the private owners. The residential component would be developed during stage 1, to be sold to assist the financing of later stages of the development.
- New entry road from Hog Bay Road, incorporating road widening/slip lanes (as required) to provide access to all elements of the proposal.
- Power and water supply to the site, including a water storage dam (and potentially including wind and solar technology to augment existing power supplies).
- Storm water and sewage infrastructure for the capture, treatment, storage and re-use of recycled water throughout the development (where possible).
- Coastal walking trail.

It should be noted the Major Development declaration included a desalination plant, which is no longer part of the proposal.

2.3 Refer to Appendix B for a copy of the relevant plans of the proposal.

2.4 The DAC has determined that the proposal will be subject to the processes and procedures of a Public Environmental Report (PER), as set out in Section 46C of the *Development Act 1993*.

2.5 The proponent has been advised by the Minister for Planning that a Public

Environmental Report is required to assist the Government in assessing the environmental, social and economic impacts of the proposal.

2.6 The DAC has prepared these Guidelines for the proponent, based on the significant issues relating to the proposed development. These Guidelines identify the issues associated with the proposal that must be addressed in the PER.

3 THE PUBLIC ENVIRONMENTAL REPORT PROCESS

3.1 A PER, as defined in Section 46C of the *Development Act 1993*, includes a description and analysis of issues relevant to the development and the means by which those issues can be addressed.

3.2 The PER should detail the expected environmental, social and economic effects of the development. The PER must consider the extent to which the expected effects of the development are consistent with the provisions of any Development Plan, the Planning Strategy and any matter prescribed by the Regulations under the Act. The PER should also state the proponent's commitments to meet conditions (if any) placed on any approval that may be given to avoid, mitigate or satisfactorily control and manage any potential adverse impacts of the development on the environment. Further to this, any other information required by the Minister must be considered.

3.3 In preparing the PER, the proponent should bear in mind the following aims of the PER and public review process:

3.3.1 To provide a source of information from which interested individuals and groups may gain an understanding of the proposal, the need for the proposal, the alternatives, the environment that would be affected, the impacts that may occur and the measures to be taken to minimise these impacts.

3.3.2 To provide a forum for public consultation and informed comment on the proposal.

3.3.3 To provide a framework in which decision-makers may consider the environmental aspects of the proposal in parallel with social, economic, technical and other factors.

3.4 Following the release of the Guidelines adopted by the DAC:

3.4.1 The PER must be prepared by the proponent in accordance with these Guidelines.

3.4.2 The PER is referred to the Kangaroo Island Council and to any prescribed authority or body, and to other relevant authorities or bodies for comment.

3.4.3 Public exhibition of the PER document by advertisement is undertaken for a least 30 business days. Written submissions are invited.

3.4.4 A public meeting is held in the locality by the Department of Planning, Transport and Infrastructure (Planning Division) during the period for making submissions, in order to provide information on the development or project, to explain the PER document and processes, and to assist interested persons to make submissions under the Act.

3.4.5 Copies of the submissions from the public, Council, relevant government agencies and other interested parties will be given to the proponent soon after closing of the public comment period.

3.4.6 The proponent must then prepare a written response in a 'Response Document' to the matters raised in all submissions. The proponent is nominally given two months to provide this to the Minister.

3.4.7 The Minister then prepares an Assessment Report, taking into account any submissions and the proponent's response to them. Comments from any other authority or body may be considered as the Minister thinks fit.

3.4.8 The Assessment Report and the Response Document are to be kept available for inspection and purchase at a place and period determined by the Minister. Availability of each of these documents will be notified by advertisements in *The Advertiser* newspaper and local press.

3.4.9 Copies of the PER, the Response Document and the Assessment Report will be given to the Kangaroo Island Council for distribution purposes.

3.4.10 The Governor is the relevant decision maker under Section 48 of the Act, when a development application is subject to the PER process.

3.4.11 In arriving at a decision, the Governor must have regard to:

- The provisions of the appropriate Development Plan and Regulations.
- If relevant, the Building Rules.
- The Planning Strategy.
- The PER, Response Document and Assessment Report.
- If relevant, the *Environment Protection Act 1993.*
- If relevant, the objects of the *River Murray Act 2003* and any obligations under the Murray-Darling Basin Agreement.
- If relevant, the objects of the *Adelaide Dolphin Sanctuary Act 2005.*
- If relevant, the objects of the *Marine Parks Act 2007.*

3.5 The Governor can at any time, and prior to completion of the assessment process, determine that the development will not be granted authorisation. This may occur if it is clear that the development is inappropriate or cannot be managed properly. This is commonly referred to as an "early no".

Australian Government Involvement in the Assessment Process

On 8 May 2014 the proponent submitted a Referral Notice for the proposal (i.e. proposed action) to the Australian Government Department of the Environment, in accordance with the Commonwealth EPBC Act.

On 2 June 2014 a delegate of the Commonwealth Minister for the Environment made a decision that the Kangaroo Island Golf Course proposal requires assessment and approval under the EPBC Act (referral no. 2014/7201). This was because the proposed action is considered likely to have a significant impact on the following matters protected by the EPBC Act:

- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A).

The Commonwealth of Australia has a Bilateral Agreement with the State of South Australia, under Section 45 of the EPBC Act, to accredit the South Australian environmental assessment processes. A delegate of the Commonwealth Minister for the Environment has decided that the proposal will need to be assessed through the State assessment under the Bilateral Agreement. The agreement makes it possible to undertake a single assessment, following the South Australian environmental impact assessment processes, and minimise duplication between State and Australian governments. Following assessment, the State of South Australia will provide an assessment report to the Commonwealth Minister for the Environment, who will then make a decision whether or not to approve the proposed action under Part 9 of the EPBC Act.

In accordance with the Bilateral Agreement (*Development Act 1993* provisions), the proposal will undergo a streamlined assessment process in co-ordination with Australian Government Department of the Environment. This means there will only be one PER document prepared, one period of public consultation undertaken and one Response/Supplementary PER document (and possibly one Assessment Report) prepared to satisfy the legislative requirements of each jurisdiction.

The Australian Government Department of the Environment has had input into the preparation of these Guidelines in regard to issues related to the EPBC Act.

4 THE PUBLIC ENVIRONMENTAL REPORT DOCUMENT

4.1 The Guidelines set out the major issues associated with the proposal and their degree of significance, as determined by the Development Assessment Commission. It describes each issue and then outlines the way that these issues should be dealt with in the Public Environmental Report.

4.2 In these Guidelines the terms "description" and other similar terminology should be taken to include both quantitative and qualitative materials as practicable and meaningful. Similarly, adverse and beneficial effects should be presented in quantitative and/or qualitative terms as appropriate.

4.3 The main text of the PER should be clear and precise and presented in terms that are readily understood by the general reader. Technical details should be included in the appendices so that the PER forms a self-contained entity.

4.4 The document should give priority to the major issues associated with the proposal. Matters of lesser concern should be dealt with only to the extent required to demonstrate that they have been considered to assist in focussing on the major issues.

4.5 The following should be included in the PER:

SUMMARY

The PER should include a concise summary of the matters set out in section 46C of the *Development Act 1993* and include all aspects covered under the headings set out in the Guidelines below, in order for the reader to obtain a quick but thorough understanding of the proposal and the resulting environmental impacts.

INTRODUCTION

The introduction to the PER should briefly cover the following:

- Background to, and objectives of, the proposed development.
- Details of the proponent.
- Staging and timing of the proposal, including expected dates for construction and operation.
- Relevant legislative requirements and approval processes.
- Purpose and description of the PER process.

NEED FOR THE PROPOSAL

- The specific objectives that the proposal is intended to meet, including market demand and environmental standards.
- Expected local, regional and state benefits and costs, including

those that cannot be adequately described in monetary or physical terms (eg. effects on aesthetic amenity).

- A summary of environmental, economic and social arguments to support the proposal, including the consequences of not proceeding with the proposal.

DESCRIPTION OF THE PROPOSAL

The description of the proposal should include the following information:

- The nature of the proposal and location (including a description of the principal components and any off-site infrastructure requirements).
- Land tenure and ownership details (or leasing arrangements) for all land parcels likely to be affected by the proposal (including off-site infrastructure).
- A project plan to outline objectives, constraints, key activity schedule and quality assurance.
- Site layout plans (including an indicative land division plan, if relevant).
- The construction and commissioning timeframes (including staging).
- A description of the existing environment (including the immediate and broader location).
- Details of all buildings and structures associated with the proposed development (including plant and infrastructure).
- Any other infrastructure requirements and availability.
- Details on the operation of the proposed development.
- The relevant Development Plan zones.
- Management arrangements for the construction and operational phases (including Environmental Management and Monitoring Plans).

4.6 The PER must include the following:

ASSESSMENT OF EXPECTED ENVIRONMENTAL, SOCIAL AND ECONOMIC EFFECTS

The assessment of effects should include all issues identified in Section 5 of these Guidelines and cross referenced to supporting technical references.

CONSISTENCY WITH GOVERNMENT POLICY

The *Development Act 1993* requires the PER to state the consistency of the expected effects of the proposed development with the relevant Development Plan and Planning Strategy (i.e. Region Plan).

The PER should also demonstrate that the proposed action is consistent with any relevant EPBC Act guidelines or plans that may be relevant to the proposed action.

AVOIDANCE, MITIGATION, MANAGEMENT AND CONTROL OF ADVERSE EFFECTS

The proponent's commitment to meet conditions proposed to avoid, mitigate, satisfactorily manage and/or control any potentially adverse impacts of the development on the biological, physical, social or economic environment, must be clearly stated as part of the PER.

The design of the proposal should be flexible enough to incorporate changes to minimise any impacts highlighted by this evaluation or by post-construction monitoring programs.

4.7 The PER should also provide the following additional information:

SOURCES OF INFORMATION

The sources of information (e.g. reference documents, literature searches, research projects, authorities consulted) should be fully referenced, and reference should be made to any uncertainties in knowledge. Where judgments are made, or opinions given, these will need to be clearly identified as such, and the basis on which these judgments or opinions are made will need to be justified. The expertise of those making the judgments including the qualifications of consultants and authorities should also be provided.

APPENDICES

Technical and additional information relevant to the PER that is not included in the text should be included in the appendices (maps, graphs, tables, photographs, reports etc). A glossary may also be appropriate.

OTHER

Appropriate plans, drawings and elevations are needed for a decision to be made. As much information as possible is required on the design and layout of the proposal.

5 THE MAIN ISSUES

5.1 PLANNING AND ENVIRONMENTAL LEGISLATION AND POLICIES

5.1.1 Describe the proposal's consistency with and/or variance from the Kangaroo Island Development Plan and Planning Strategy (including the Kangaroo Island Structure Plan).

5.1.2 Describe the proposal's consistency with the 'National Landscapes Experience Development Strategy for Kangaroo Island'(2014) and the 'Brand for Kangaroo Island'(especially to demonstrate that the proposal would deliver an 'extraordinary' tourism development and describe how the proposal is consistent with the principles of ecologically sustainable development.

5.1.3 Describe the proposal's consistency with the Kangaroo Island Natural Resources Management Plan.

5.1.4 Describe the proposal's consistency with the South Australian Tourism Commission 'Design Guidelines for Sustainable Tourism Development' (2007).

5.1.5 Describe the relevant requirements of the *Environment Protection Act 1993* and associated policies and guidelines, and how these would be complied with.

5.1.6 Describe any relevant EPBC Act policies, guidelines or plans, and how these would be complied with and/or demonstrate that the implementation of the proposal will not be inconsistent with any relevant EPBC Act policies, guidelines or plans.

5.1.7 Consider relevant protocols, agreements and strategies including: 'Tackling Climate Change, SA's Greenhouse Strategy 2007 – 2020', the *Climate Change and Greenhouse Emissions Reduction Act 2007* and the *National Greenhouse and Energy Reporting Act 2007.*

5.1.8 Describe the proposal's consistency with State and Commonwealth legislation and initiatives relating to conservation or protection of the biological environment and heritage items.

5.1.9 Consider any other relevant plans or studies that relate to the area.

5.1.10 Identify legislative requirements and the range of approvals needed to complete the proposed development.

5.1.11 Describe any changes that may need to be made to the Development Plan policies for the site (especially for the residential component).

5.2 NEED FOR THE PROPOSAL

5.2.1 Justify the rationale for the proposal from an environmental, economic (especially market demand), social and sustainability perspective, including the reasons for its proposed location, scale and staging.

5.2.2 Justify the selection of the proposed location from an environmental and economic perspective in comparison with alternative sites on Kangaroo Island.

5.2.3 Outline current and predicted demand for the facility.

5.2.4 Outline the expected local, regional and state benefits and costs, including those that cannot be adequately described in monetary or physical terms (such as effects on aesthetic amenity).

5.2.5 Assess the "do nothing" option (i.e. the consequences of not proceeding with the proposal).

5.3 ENVIRONMENTAL ISSUES

5.3.1 Describe the impact of past and current land management practices on the environmental values of the site, especially any environmental problems or degrading factors that may need to be addressed.

Native Vegetation

5.3.2 Quantify and detail the extent, condition and significance of native vegetation (individual species and communities) that currently exist on site (or affected by off-site infrastructure requirements) and would be preserved and, if appropriate, rehabilitated.

5.3.3 Quantify and detail the extent, condition and significance of native vegetation (individual species and communities) that may need to be cleared or disturbed (directly or indirectly) during construction (including ancillary clearing for the proposed development of residential allotments, walking trails, areas required for bushfire safety and all infrastructure, such as the water supply pipeline and power transmission line).

5.3.4 Describe the ability of communities or individual species (especially those listed as uncommon or threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the South Australian *National*

Parks and Wildlife Act 1972) to recover, regenerate or be rehabilitated.

5.3.5 Identify measures to minimise and mitigate vegetation clearance (including incorporating remnant stands in the layout design) and to compensate for the loss of native vegetation and habitat.

5.3.6 Outline proposed revegetation works (including the location, densities and types of locally indigenous species to be planted) and how this relates to existing native vegetation.

5.3.7 Describe the effect of introduced weed species and increased human habitation on native vegetation, before and after construction, including species that may originate from the golf course, landscaped areas or gardens.

5.3.8 Describe measures to deliver significant environmental benefit to the existing native vegetation, whether intact stratum or scattered patches/trees, as required by the *Native Vegetation Act 1991*.

Native Fauna

5.3.9 Quantify and detail the abundance, condition and significance of native fauna populations that currently exist or may depend on habitat on site or along the routes of infrastructure for the proposal. Any fauna surveys conducted must meet the requirements of any relevant EPBC Act survey guidelines.

5.3.10 Describe direct and indirect impacts to fauna associated with the proposal, the extent of expected fauna and/or habitat loss or disturbance during the construction and operation phases (both on and around site) and the ability of communities and individual species to recover, especially for resident or migratory birds and threatened or significant species (including those listed under the EPBC Act and the South Australian *National Parks and Wildlife Act 1972*).

5.3.11 Detail appropriate buffer distances that would be required for the construction and operational phases between the proposed development (including coastal access points) and threatened species, especially feeding areas, nesting sites and roosting sites.

5.3.12 Outline the effect of light and noise pollution on nocturnal animals.

5.3.13 Outline the risk of road-related fauna death and injury (including from construction vehicles) and the risk of bird strike associated with any large glass windows.

5.3.14 Provide information on the expected levels of noise (and where relevant vibration) associated with the construction and operation of the facility, identifying all potential sources, and describe the extent to which emissions can be reduced and contained to acceptable levels to minimise effects upon the wider locality (especially native fauna populations that occur on and around the site).

5.3.15 Outline how native fauna that is likely to interact with the golf course development (such as kangaroos, wallabies and possums) and how this would be managed.

5.3.16 If wind turbines are to be used, describe the potential impacts on native fauna.

5.3.17 Identify impact avoidance, minimisation and mitigation measures and their effectiveness, including measures to minimise access roads and subsidiary tracks acting as fauna barriers or as a corridor for feral animals.

5.3.18 Describe how the proposal will not be inconsistent with any relevant EPBC Act Threat Abatement Plans and/or Recovery Plans.

Coastal Environment

5.3.19 Describe the effect of the proposed development on coastal dunes, limestone and calcrete formations of the site (and associated heathland shrubland communities) and outline management and rehabilitation measures for these areas.

5.3.20 Describe measures to be adopted for the remediation of sand drift, should it occur within the dune system as a direct result of the development.

5.3.21 Identify the impact of coastal erosion due to expected sea level rise of 0.3 metre to 2050 and 1.0 metre to 2100.

5.3.22 Detail how the proposed coastal walking trail would avoid impacts on sensitive coastal landforms of the area and associated flora, fauna and habitat (especially for the Eastern Osprey, listed as Endangered under the *National Parks and Wildlife Act 1972*, and the Hooded Plover, listed as Vulnerable under the Act).

5.3.23 Describe the ongoing management requirements of the coastal walk.

Marine Environment

5.3.24 Describe the existing marine and aquatic communities (especially invasive species and species listed under the EPBC

Act) potentially impacted by the project, including those associated with Pelican Lagoon.

5.3.25 Describe the direct and indirect impacts (including potential discharges from the development, such as contaminated groundwater or surface water resulting from golf course irrigation) on marine/aquatic communities and the proposed measures to mitigate impacts.

Geology and Soils

5.3.26 Describe the hydrogeology of the site in relation to soil types, geology and surface drainage patterns, including any drainage to Pelican Lagoon and the marine environment.

5.3.27 Outline the interaction between erosion processes and the proposed development (especially sand drift and 'blow-outs').

5.3.28 Describe how any calcrete outcrops would be impacted by construction of the golf course layout.

Groundwater and Site Contamination

5.3.29 Describe the known existing groundwater and land related environmental conditions, including possible site contamination.

5.3.30 Undertake a preliminary site investigation, conducted by a site contamination consultant in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, to identify whether a potentially contaminating land use has occurred on the proposed site. If the existence of potential site contamination is identified, appropriate assessment and remediation strategies must be undertaken to ensure the land is suitable for the proposed uses.

5.3.31 Detail the measures to be taken to manage and monitor any groundwater resources.

5.3.32 Detail the potential impacts on the underlying groundwater from nutrients and chemicals leaching from the golf course.

5.3.33 Identify impact avoidance, minimisation and mitigation measures and their effectiveness.

Sustainability and Climate Change

5.3.34 Outline the principles to be followed to demonstrate that the development would be environmentally sustainable.

5.3.35 Describe the measures associated with orientating all of the built components for the best possible energy efficiency, having regard to alternative or renewable energy sources, sustainable design and low emission design measures.

5.3.36 Outline waste management strategies for residential uses and commercial facilities (including measures to deter scavenging by native or feral species) and the potential for incorporating recycling and resource recovery.

5.3.37 Outline measures to minimise or reduce materials and resources used during the construction and operational phases, including the use of on-site (or local) and recycled materials.

5.3.38 Describe the arrangements to control and manage activities, particularly to ensure that the proposed development is environmentally sustainable in the long-term.

5.3.39 Describe implications of climate change with respect to the proposal and measures to minimise, reduce and ameliorate greenhouse gas emissions, particularly the use of alternative or renewable energy sources and off-sets.

5.4 ECONOMIC ISSUES

5.4.1 Provide a full economic analysis of the proposal, including the long term economic viability of the project.

5.4.2 Detail the potential economic benefits and costs of the development to the Kangaroo Island economy and the State economy (such as employment and investment opportunities), including the "multiplier effect".

5.4.3 Outline the opportunity for tourism and investment on Kangaroo Island to be enhanced as a result of the proposal.

5.4.4 Outline the potential for the project to attract and enhance the business operations of other allied industries and commercial ventures.

5.4.5 Describe strategies to manage the site, should the project fail during the period between the commencement of earthworks and final completion of the golf course.

5.5 SOCIAL ISSUES

5.5.1 Detail the likely size and composition of the construction workforce and employees required during operation, particularly information on employment opportunities for the local community.

5.5.2 Outline the impact on existing tourism and recreation services and facilities (including opportunities).

5.5.3 Describe any potential conflict with adjoining primary production activities, including measures to ameliorate any such conflict.

5.5.4 Describe the proximity and relationship with the proposed land division and likely future dwellings on those sites. Detail any interface issues (such as noise) likely to arise between the land division and the surrounding land (including the golf course) and proposed mitigation strategies.

5.5.5 Describe the impact of noise emissions and vibration on existing sensitive receivers (if any) or sensitive receivers to be introduced as part of the proposed development (especially potential new residents) during construction and operation. Detail strategies to minimise any potential impacts to an acceptable level.

5.5.6 Identify the impact on the heritage significance of any known heritage places on or adjacent the site, including National, State or local heritage places entered on the South Australian Heritage Register, or identified after consultation with the Heritage Branch of the Department for Environment, Water and Natural Resources.

5.6 DESIGN MATTERS

Built Form

5.6.1 Describe the rationale and design intent for the major elements of the proposed development (including reference to the *Principles of Good Design* (2014), prepared by the Office for Design + Architecture SA) and measures to mitigate their visual impact.

5.6.2 Provide design guidelines for the proposed residential component.

5.6.3 Provide conceptual plans for all components of the proposal (including building envelopes, cross-sections and three dimensional representations) that show the scale, style, context and overall form of the development.

5.6.4 Provide details of construction materials to be used for all buildings and structures (including colours and finishes).

5.6.5 Detail the extent of any landscaping or screen plantings, especially the use of locally indigenous plant species suited to local conditions.

Visual Effects

5.6.6 Describe the visual effect of the proposed development on scenic quality in this locality when viewed from important viewing points, including from surrounding land (especially from Mount Thisby and the Hog Bay Road) and the sea.

5.6.7 Describe the effect on visual amenity and landscape quality, especially the effects of the built form of buildings and structures (including the access road, earthworks, water and power supply infrastructure) and the impact on the coastal environment.

5.7 INFRASTRUCTURE

5.7.1 Outline the requirements for and likely location of infrastructure for gas, electricity, sewerage, stormwater management, waste management and communications systems.

5.7.2 Detail the extent to which the facility would generate the need for upgraded infrastructure beyond the site boundaries, especially any broader impacts for the Kangaroo Island community (including strategic implications for Council and/or utility providers).

5.7.3 Detail emergency services arrangements to be implemented during the operation of the development.

5.7.4 Outline opportunities to incorporate best practice infrastructure design and construction, especially potential flow-on benefits for the Kangaroo Island community.

Water

5.7.5 Describe the provision of an adequate water supply for the proposed development (both potable and non-potable), including information on the quality of water required, treatment, storage and use.

5.7.6 Describe any proposal to extract groundwater at the site.

5.7.7 Describe the impacts of developing a wastewater treatment system, especially the expected volume to be treated, disposal method and how it would be managed to maximise reuse/recycling (including storage requirements). Outline how the treatment system elements would be installed, if it is a phased development. If the disposal method involves irrigation to the golf course or any other areas of land, a draft Irrigation Management Plan should be prepared.

5.7.8 Describe stormwater and grey water management strategies to maximise recycling (including recycled water storage requirements) and the potential impact on groundwater resources, surface water resources and the marine and coastal environment (including Pelican Lagoon). In particular, with regard to golf course, runoff and the transport of nutrients and chemicals used in the day to day maintenance of the course.

5.7.9 Outline the strategies for wastewater and stormwater management for the residential component of the proposed development (including treatment, storage and reuse).

5.7.10 Describe the impact of the development on existing water resources, including the need for a water supply pipeline to the site. Details regarding the proposed location of infrastructure (including storage on site), distance from the supply source and procedural/administrative requirements for establishing infrastructure outside of the site.

5.7.11 Describe the impact of the development on current users of water resources in the district, including irrigated primary production.

5.7.12 Describe the integrated water management strategy, especially Water Sensitive Urban Design (WSUD) measures (including ways in which water use would be minimised), and the use and management of alternative water sources (i.e. wastewater, grey water and stormwater).

5.7.13 Outline the measures proposed to manage and treat stormwater runoff from hard surfaces which are not being used for harvesting water supply, especially access roads and carparks.

Power

5.7.14 Describe the provision of an adequate power supply for the development, including potential impacts associated with a transmission line corridor to the site.

5.7.15 Outline the implications of connecting to the power grid for the existing infrastructure and current users.

5.7.16 Identify ways in which power use can be minimised or supplemented, especially using alternative energy sources (such as wind turbines) and energy efficiency measures.

Access

5.7.17 Outline the level of traffic generation and vehicle movements to and from the site, especially details of vehicle types and distribution (including the hours that vehicles would access the site) during the construction period and operational phase.

5.7.18 Outline and analyse the impacts on local and other roads (including their junctions), especially the safety and adequacy of the Hog Bay Road / Davies Road junction.

5.7.19 Outline the need for and the implications of any upgrading of road infrastructure.

5.7.20 Identify alternative access arrangements for emergency services.

5.7.21 Detail the proposed access and on-site car parking arrangements, including information about road width and associated drainage measures and maintenance requirements.

5.7.22 Describe any proposed coastal access (including the maintenance of current public access and the potential future enhancement of access) and the measures to avoid or minimise impacts.

5.7.23 Describe what plans would be put in place to control public access from the Crown leasehold land.

Land Tenure

5.7.24 Describe what processes and approvals would be undertaken to reconcile encroachments on the Crown leasehold land dedicated for conservation purposes.

5.7.25 Detail the measures to be taken to define the golf course from the Crown leasehold land.

5.8 CONSTRUCTION AND OPERATION

5.8.1 For each component, provide a site construction plan and outline strategies to minimise effects on the local environment.

5.8.2 Outline the staging and timing of construction (including the time of year works are likely to occur).

5.8.3 Describe the level of cut and fill required (including for access and infrastructure requirements) and the effect on the natural topography of the site.

5.8.4 Where possible, identify the source and origin of construction materials for buildings and infrastructure (such as road making) and the opportunity for the use of on-site (or local) and recycled materials.

5.8.5 Describe the measures proposed for the disposal of excavated material and construction waste.

5.8.6 Provide information about the transport and storage of any construction materials to minimise effects on the local environment.

5.8.7 Identify measures to stabilise disturbed areas and areas susceptible to soil erosion.

5.8.8 Detail measures for the implementation of environmentally acceptable work practices.

5.8.9 Provide information about the potential accommodation arrangements for the construction workers and employees.

5.8.10 Detail the proposed monitoring of impacts during and after construction, including reporting and auditing measures.

5.8.11 Detail what will be included in an environmental management and monitoring plan, for both construction and operational activities for all components of the development.

5.8.12 Detail the encumbrances or similar mechanisms to control and manage activities on adjoining land.

5.8.13 Detail long-term management agreements for operation of the development, including the ownership of land and infrastructure.

5.9 RISK AND HAZARD MANAGEMENT

5.9.1 Describe strategies for ensuring public safety during construction and operation.

5.9.2 Detail fire management processes and measures to reduce bushfire risk, especially those which minimise vegetation clearance and land disturbance.

5.9.3 Detail the availability of water for fire-fighting purposes.

5.9.4 Describe strategies for emergency evacuation during medical emergencies and/or bushfire risk.

5.9.5 Describe procedures to prevent, minimise and manage pollution spills or sewage leaks (especially given the porous substrate and proximity to the coast and Pelican Lagoon). Outline measures for the bunding of hazardous materials storage areas

5.9.6 Describe management strategies to prevent the introduction of weed species and pathogens during construction and operation (especially *Phytophthora cinnamomi*), including strategies to manage or avoid creating mosquito breeding habitats.

5.9.7 Describe strategies for the control of wind and water erosion during construction and operation.

5.10 ABORIGINAL HERITAGE AND NATIVE TITLE

Aboriginal Heritage

5.10.1 Describe the measures taken to identify and record any Aboriginal sites, objects or remains, including consultation details with relevant Aboriginal parties.

5.10.2 Detail plans for the possible discovery of Aboriginal ancestral remains and any Aboriginal sites or objects of archaeological, anthropological or historical significance under the *Aboriginal Heritage Act 1988.*

5.10.3 Detail any other measures to ensure compliance with the *Aboriginal Heritage Act 1988.*

5.10.4 Detail consultation undertaken with the Aboriginal people during the preparation and development of the assessment document.

Native Title

5.10.5 Identify any Native Title issues in respect of the requirements of the *Native Title Act 1993* (Commonwealth) and the *Native Title Act 1994* (South Australia).

5.10.6 Describe the impact on the appropriate Native Title Claimants and the consequent impact on the potential ongoing enjoyment of native title rights (if any) by native title holders.

6 AVAILABILITY OF GUIDELINES

6.1 Copies of the Guidelines will be made available at the following locations:

Department of Planning, Transport and Infrastructure
5th Floor Public Counter
136 North Terrace
Adelaide SA 5000

Kangaroo Island Council
Corner of Dauncey and Murray Streets
Kingscote SA 5223

Electronic copies can also be downloaded from the following web sites:

www.dac.sa.gov.au
www.sa.gov.au

APPENDIX A

Development Act 1993, Section 46C—PER process—Specific provisions

(1) This section applies if a PER must be prepared for a proposed development or project.

(2) The Minister will, after consultation with the proponent—

(a) require the proponent to prepare the PER; or

(b) determine that the Minister will arrange for the preparation of the PER.

(3) The PER must be prepared in accordance with guidelines determined by the Development Assessment Commission under this subdivision.

(4) The PER must include a statement of—

(a) the expected environmental, social and economic effects of the development or project;

(b) the extent to which the expected effects of the development or project are consistent with the provisions of—

(i) any relevant Development Plan; and

(ii) the Planning Strategy; and

(iii) any matters prescribed by the regulations;

(c) if the development or project involves, or is for the purposes of, a prescribed activity of environmental significance as defined by the *Environment Protection Act 1993*, the extent to which the expected effects of the development or project are consistent with—

(i) the objects of the *Environment Protection Act 1993*; and

(ii) the general environmental duty under that Act; and

(iii) relevant environment protection policies under that Act;

(ca) if the development or project is to be undertaken within the Murray-Darling Basin, the extent to which the expected effects of the development or project are consistent with—

(i) the objects of the *River Murray Act 2003*; and

(ii) the *Objectives for a Healthy River Murray* under that Act; and

(iii) the general duty of care under that Act;

(cb) if the development or project is to be undertaken within, or is likely to have a direct impact on, the Adelaide Dolphin Sanctuary, the extent to which the expected effects of the development or project are consistent with—

(i) the objects and objectives of the *Adelaide Dolphin Sanctuary Act 2005*; and

(ii) the general duty of care under that Act;

(cc) if the development or project is to be undertaken within, or is likely to have a direct impact on, a marine park, the extent to which the expected effects of the development or project are consistent with—

(i) the prohibitions and restrictions applying within the marine park under the *Marine Parks Act 2007*; and

(ii) the general duty of care under that Act;

(d) the proponent's commitments to meet conditions (if any) that should be observed in order to avoid, mitigate or satisfactorily manage and control any potentially adverse effects of the development or project on the environment;

(e) other particulars in relation to the development or project required—

(i) by the regulations; or

(ii) by the Minister.

(5) After the PER has been prepared, the Minister—

(a) —

(i) must, if the PER relates to a development or project that involves, or is for the purposes of, a prescribed activity of environmental significance as defined by the *Environment Protection Act 1993*, refer the PER to the Environment Protection Authority; and

(ia) must, if the PER relates to a development or project that is to be undertaken within the Murray-Darling Basin, refer the PER to the Minister for the River Murray; and

(ib) must, if the PER relates to a development or project that is to be undertaken within, or is likely to have a direct impact on, the Adelaide Dolphin Sanctuary, refer the PER to the Minister for the Adelaide Dolphin Sanctuary; and

(ib) must, if the PER relates to a development or project that is to be undertaken within, or is likely to have a direct impact on, a marine park, refer the PER to the Minister for Marine Parks; and

(ii) must refer the PER to the relevant council (or councils), and to any prescribed authority or body; and

(iii) may refer the PER to such other authorities or bodies as the Minister thinks fit,

for comment and report within the time prescribed by the regulations; and

(b) must ensure that copies of the PER are available for public inspection and purchase (during normal office hours) for at least 30 business days at a place or places determined by the Minister and, by public advertisement, give notice of the availability of copies of the PER and invite interested persons to make written submissions to the Minister on the PER within the time determined by the Minister for the purposes of this paragraph.

(6) The Minister must appoint a suitable person to conduct a public meeting during the period that applies under subsection (5)(b) in accordance with the requirements of the regulations.

(7) The Minister must, after the expiration of the time period that applies under subsection (5)(b), give to the proponent copies of all submissions made within time under that subsection.

(8) The proponent must then prepare a written response to—

(a) matters raised by a Minister, the Environment Protection Authority, any council or any prescribed or specified authority or body, for consideration by the proponent; and

(b) all submissions referred to the proponent under subsection (7),

and provide a copy of that response to the Minister within the time prescribed by the regulations.

(9) The Minister must then prepare a report (an ***Assessment Report***) that sets out or includes—

(a) the Minister's assessment of the development or project; and

(b) the Minister's comments (if any) on—

(i) the PER; and

(ii) any submissions made under subsection (5); and

(iii) the proponent's response under subsection (8); and

(c) comments provided by the Environment Protection Authority, a council or other authority or body for inclusion in the report; and

(d) other comments or matter as the Minister thinks fit.

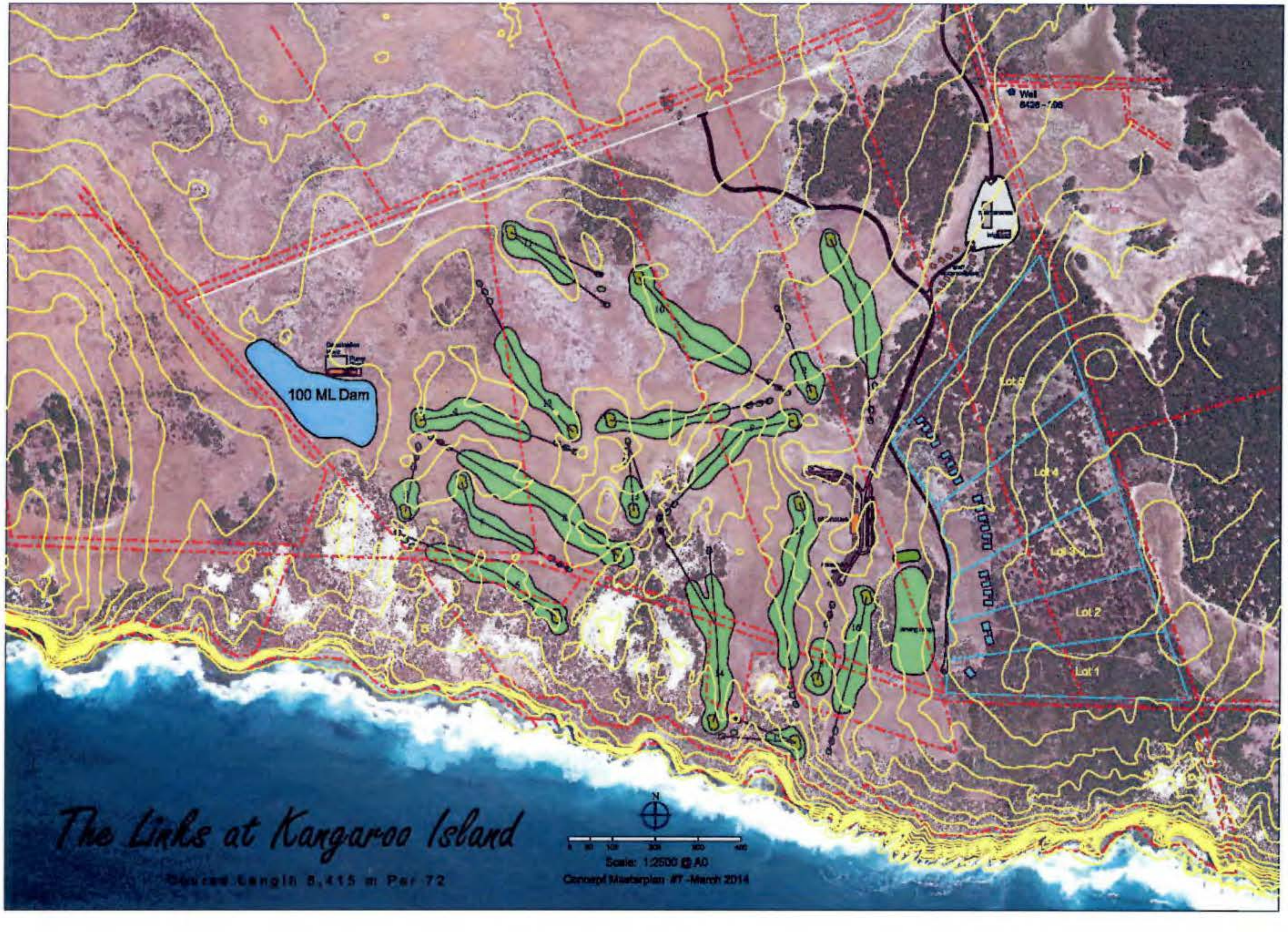
(10) The Minister must, by public advertisement, give notice of the place or places at which copies of the Assessment Report are available for inspection and purchase.

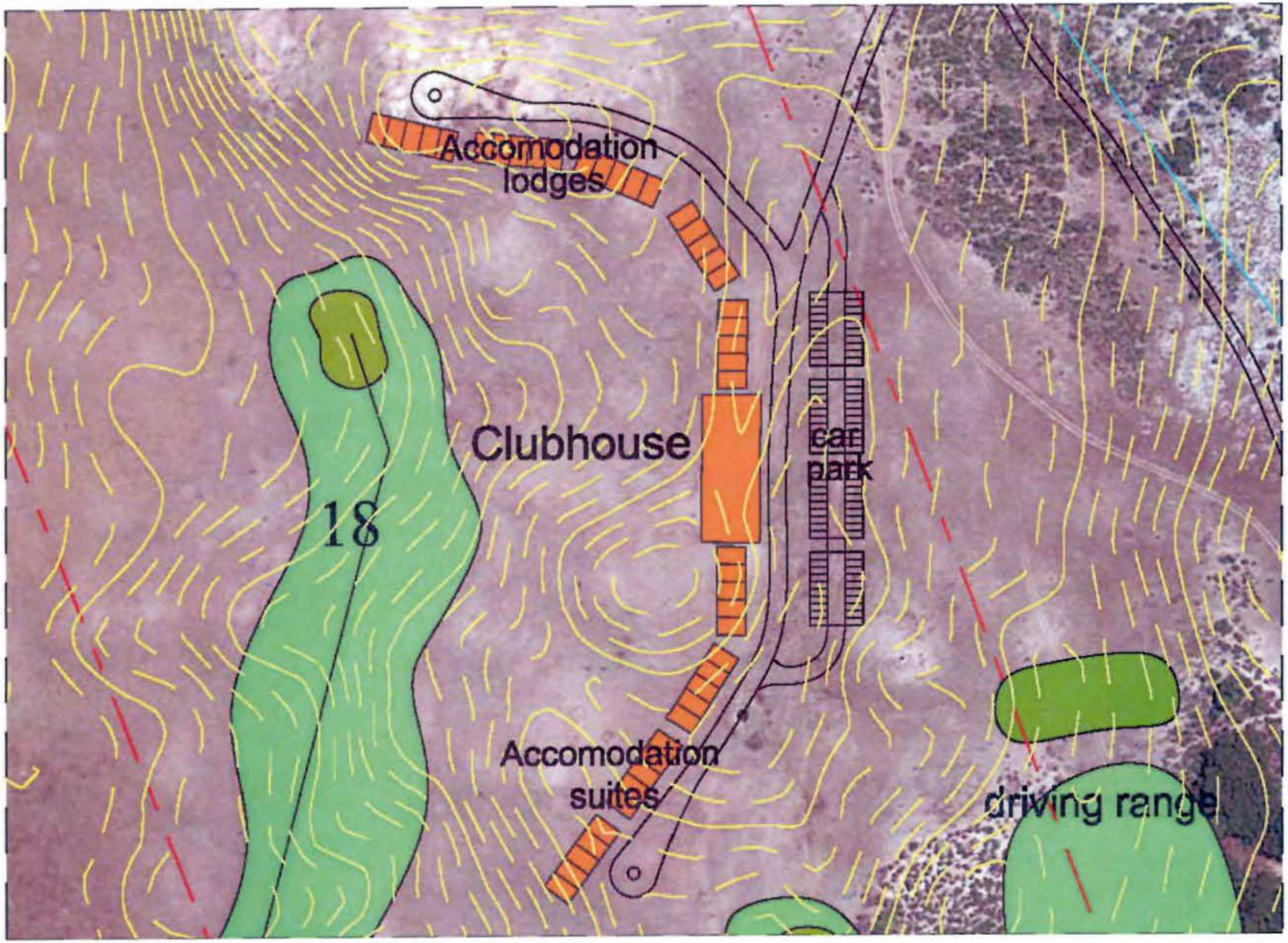
(11) Copies of the PER, the proponent's response under subsection (8), and the Assessment Report must be kept available for inspection and purchase at a place determined by the Minister for a period determined by the Minister.

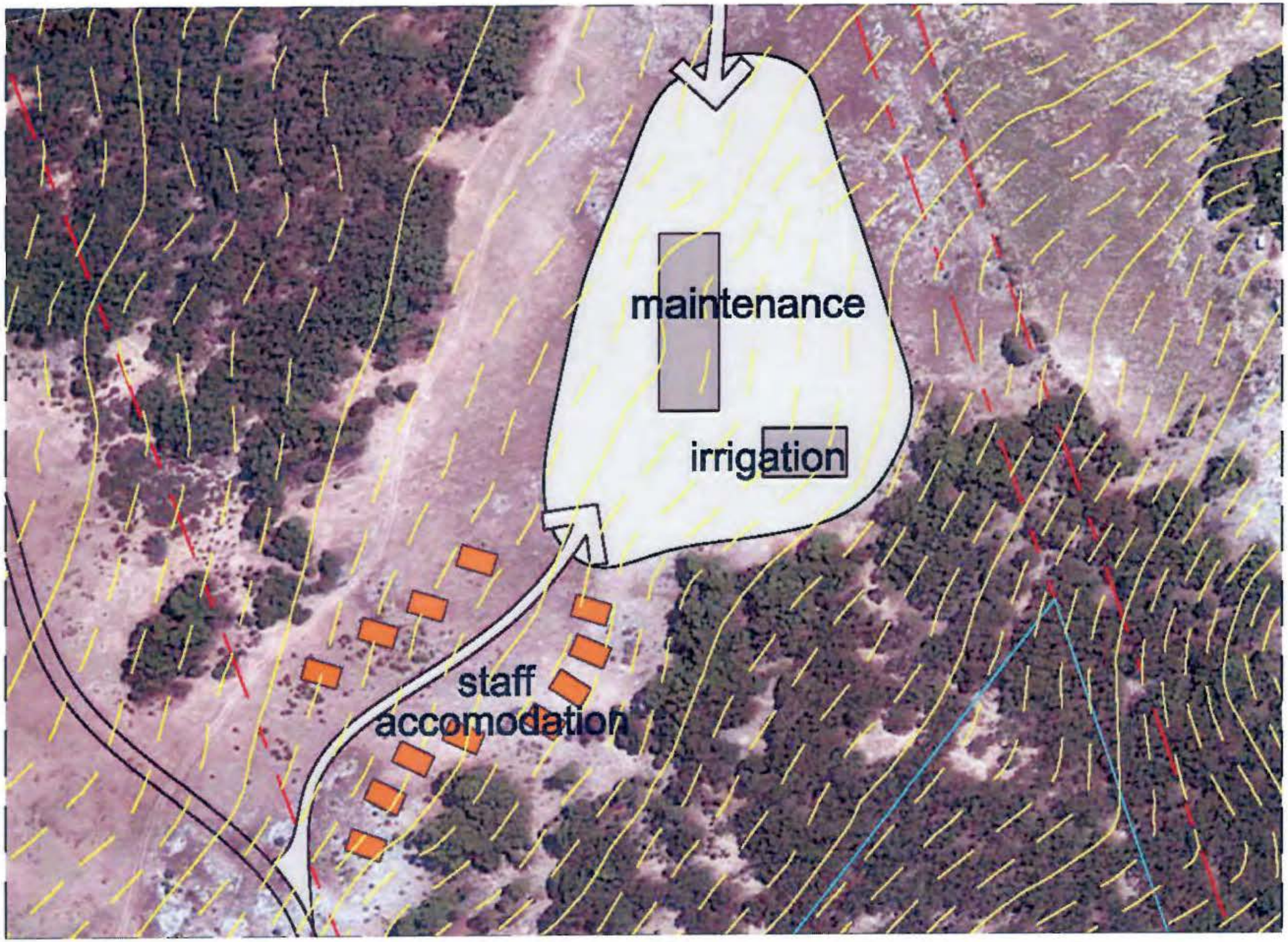
(12) If a proposed development or project to which a PER relates will, if the development or project proceeds, be situated wholly or partly within the area of a council, the Minister must give a copy of the PER, the proponent's response under subsection (8), and the Assessment Report to the council.

APPENDIX B

Relevant Plans of the Proposal


100 ML Dam
Lot 1
Lot 2
Lot 4
The Links at Kangaroo Island
Course Length 5,415 m Par 72
N
Scale: 1:2500 @ A0
Concept Masterplan #7 -March 2014


Accomodation
lodges
Clubhouse
car
park
18
Accomodation
suites
driving range


maintenance
irrigation
staff
accomodation

Appendix B -

Major Development Assessment Process

MAJOR DEVELOPMENT DECLARED

DEVELOPMENT APPLICATION LODGED

- Whole of Government review of application
- Development Assessment Commission briefing and site visit

6 WEEKS – DPTI

GUIDELINES & LEVEL OF ASSESSMENT

- Guidelines drafted
- Development Assessment Commission set guidelines and level of assessment (EIS, PER or DR)
- Minister's approval to release guidelines

12 WEEKS - Proponent

PROPONENTS REPORT PREPARED

- Applicant prepares report based on guidelines and assessment level
- Adequacy check undertaken by assessment officer / case manager
- Final report submitted

PUBLIC AND AGENCY CONSULTATION

- 6 week consultation period
- Public engagement meeting at Kangaroo Island

6 WEEKS Consultation Period

RESPONSE DOCUMENT

- Proponent prepares response to matters raised through consultation
- Adequacy check undertaken by assessment officers and case Manager
- Request final application document from proponent

6 to 8 WEEKS – Proponent

ASSESSMENT REPORT

- Prepare draft assessment report
- Informal referral of draft report to proponent, council, agencies
- Minute to minister with final assessment report attached

4 to 6 WEEKS

DECISION MADE

- Cabinet submission
- Final decision made by Cabinet and Governor

Appendix C -

Property Details

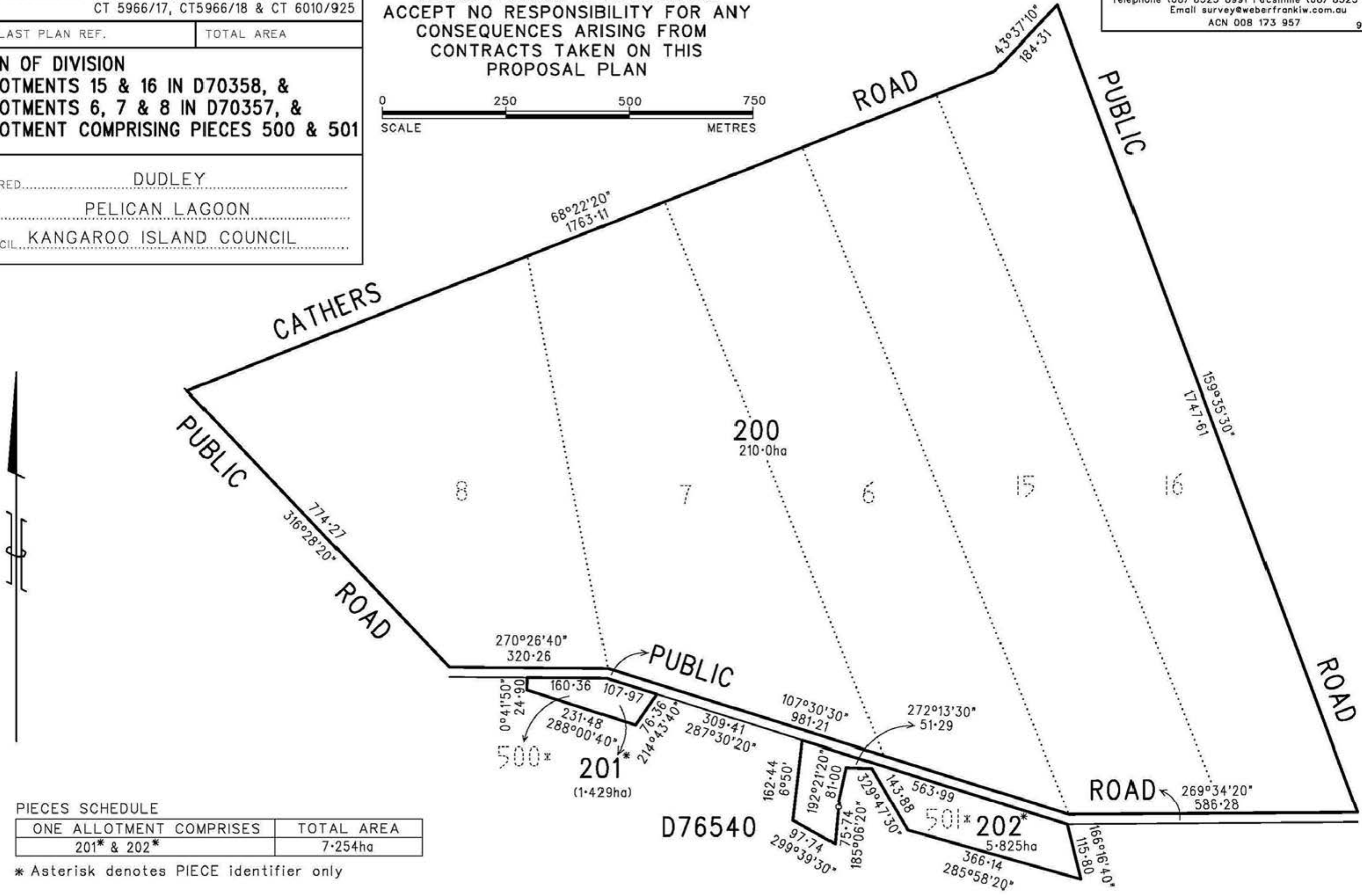
DEVELOPMENT NUMBER	
TITLE REFERENCE	CT 5966/25, CT 5966/24, CT 5966/16, CT 5966/17, CT5966/18 & CT 6010/925
O.B./LAST PLAN REF.	TOTAL AREA

PLAN OF DIVISION
ALLOTMENTS 15 & 16 IN D70358, & ALLOTMENTS 6, 7 & 8 IN D70357, & ALLOTMENT COMPRISING PIECES 500 & 501

HUNDRED DUDLEY
AREA PELICAN LAGOON
COUNCIL KANGAROO ISLAND COUNCIL

AREAS AND DIMENSIONS MAY VARY DUE TO DEVELOPMENT APPROVAL CONDITIONS AND/OR FINAL SURVEY. WEBER FRANKIW & ASSOCIATES ACCEPT NO RESPONSIBILITY FOR ANY CONSEQUENCES ARISING FROM CONTRACTS TAKEN ON THIS PROPOSAL PLAN

WEBER FRANKIW AND ASSOCIATES PTY.LTD.
Surveying Consultants
CAD Ref:187201div
178 Main Road McLaren Vale South Australia 5171
Telephone (08) 8323 8991 Facsimile (08) 8323 9686
Email survey@weberfrankiw.com.au
ACN 008 173 957
9/7/14



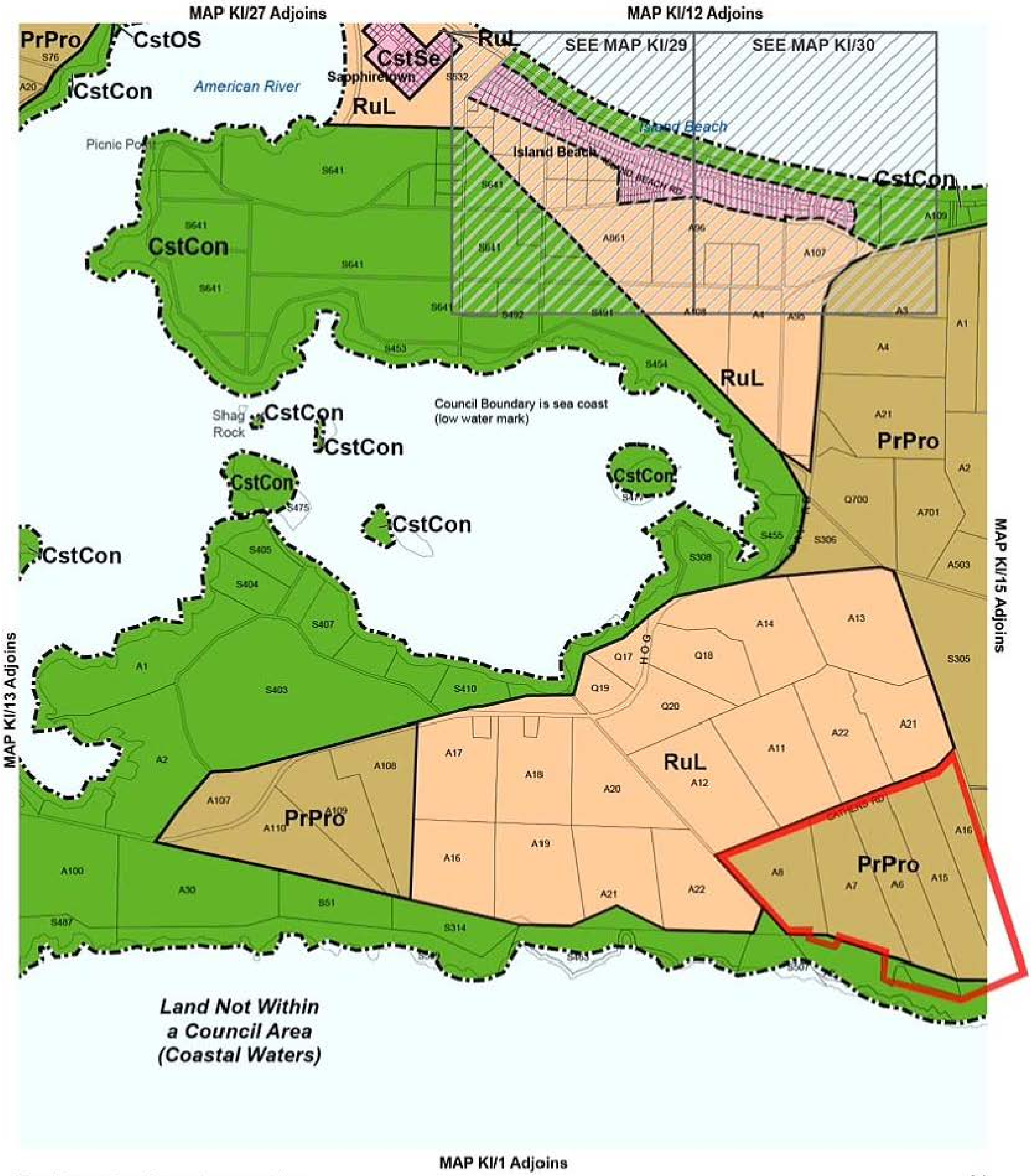
PIECES SCHEDULE

ONE ALLOTMENT COMPRISES	TOTAL AREA
201* & 202*	7·254ha

* Asterisk denotes PIECE identifier only

Appendix D -

Zone Map



See enlargement map for accurate representation.
Lamberts Conformal Conic Projection, GDA94

N

0 2,000 m

Subject Site

Zones

CstCon	Coastal Conservation
CstOS	Coastal Open Space
CstSe	Coastal Settlement
PrPro	Primary Production
RuL	Rural Living
	Zone Boundary
	Development Plan Boundary

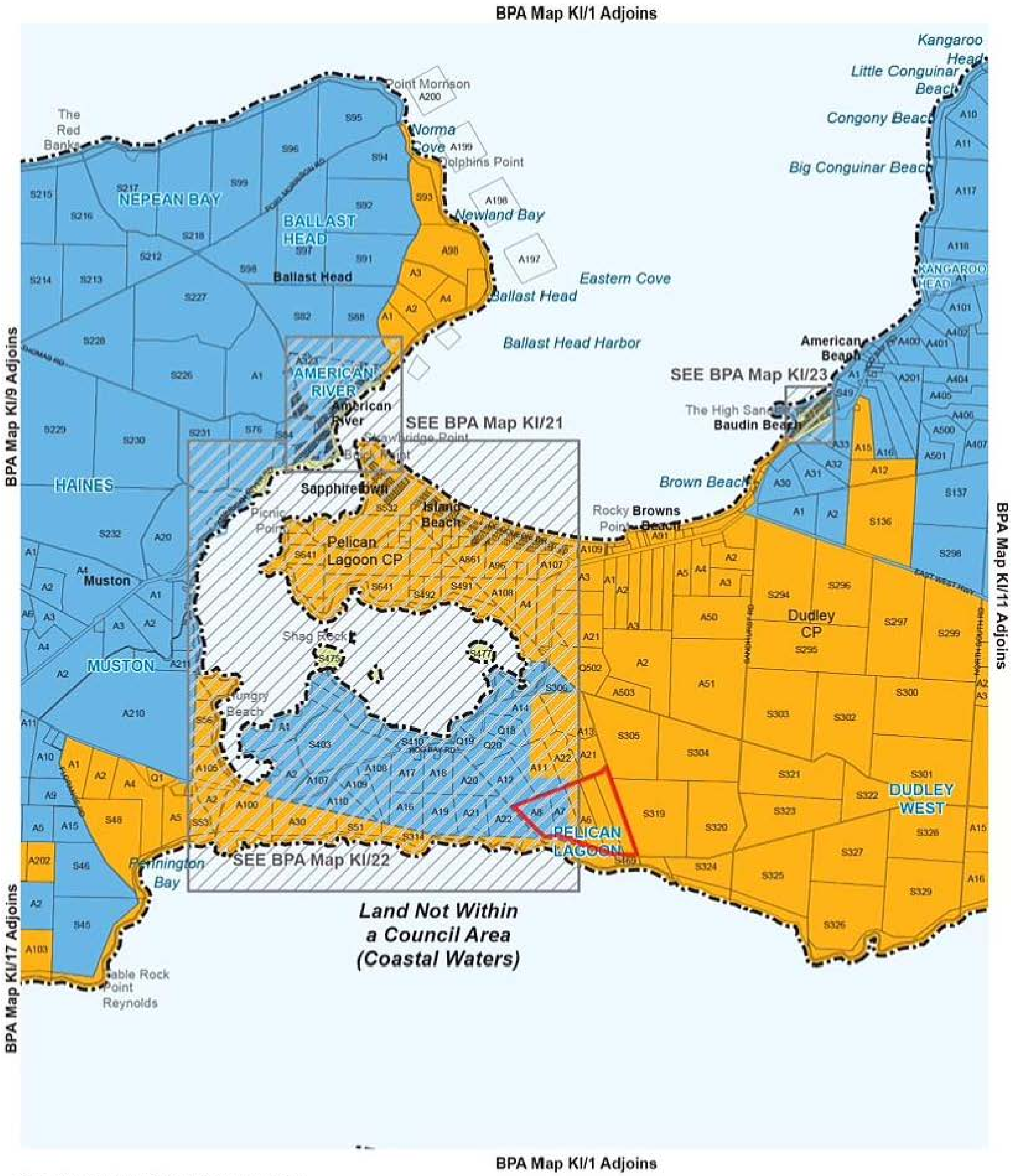
Zone Map KI/14

KANGAROO ISLAND COUNCIL

Consolidated - 20 February 2014

Appendix E -

Bushfire Protection Area



See enlargement map for accurate representation.

Bushfire Protection Area
BPA Map KI/10
BUSHFIRE RISK

Subject Site
High Bushfire Risk
Medium Bushfire Risk
General Bushfire Risk
Development Plan Boundary

KANGAROO ISLAND COUNCIL

Consolidated - 20 February 2014

Appendix F -

Kangaroo Island Aerial


INVESTIGATOR STRAIT
North Cape
KINGSCOTE
BACKSTAIRS
PASSAGE
SOUTHERN OCEAN
Cape Couedic
KANGAROO ISLAND

Appendix G -

Project Master Plan


LEGEND
Golf Fairway
Golf Green
Private Villas
Clubhouse/Resort
Maintenance
Storage Dam
Title Boundary
Coastal Walk
1m Contours
Power Alignment
Water Alignment
RL 40
RL 90
RL 80
Lot 5
Lot 4
Lot 3
Lot 2
Lot 1
solar collectors
maintenance
irrigation
driving range
100 ML Dam
Clubhouse
The Links at Kangaroo Island
Course Length 6,415 m Par 72
Working Masterplan - February 2014
Scale: 1:2500 @ A0

Appendix H -

Aplin Cook Gardener

Built Form and Principles of Good Design

Site Plan

- Buildings located on the eastern side of the site set back approx. 800m from the north boundary for the residential and club building, and 400m for the maintenance buildings.
- Located 400m from sea and cliff edge.
- Buildings are located in three groups:

  1. Club Pavilion with lodge and hotel accommodation
  2. Residential buildings on 5 separate lots
  3. Maintenance facilities and staff accommodation

Visitor arrival

- Visitor approach from north access road along swales, grassland and between trees to arrive at a porte cochere on the east side of the Club Pavilion, then park in a car park located in a swale.
- Visitors enter the Club Pavilion and experience the spectacular views to the west, north and south for the first time.

Club Pavilion

- Club Pavilion is located on the west side of a knoll for long views to the golf course to the west, the sea to the south and Pelican Lagoon to the north.
- The building is two storey with golf function on a lower level that is cut into the hill, and bar, restaurant and function rooms on an upper level for views of the course and sea.
- The porte-cochere is at the upper level.
- The road slopes down to a golf bag unloading canopy at the lower level.
- Service access for deliveries and garbage collection is recessed into the landscape at the lower level where it is screened from view by retaining walls.

Lodges, Hotel Rooms

- Lodge and hotel suite accommodation is north and south of the Club Pavilion as separate groups of units generally following contour lines.
- Separate groups of 4 and 6 lodges.
- Separate groups of 6 and 8 hotel rooms.
- Access is via a 3m path for pedestrians and golf carts.

Spa

- The Spa is located with a short walking distance from the clubhouse to the south east.

Car and bus parking

- Car parking is located to the immediate east of the clubhouse in a large swale area. Screen planting to 3m high is proposed on the periphery of the car park area.

Residential accommodation

- Five lots
- Describe location in open grassland with views over the Lodges and Hotel Suites.
- Describe access road and foot/golf cart path

Maintenance Facilities and Staff Accommodation

- Describe location – screened by trees from access road.
- Staff accommodation located on grass land adjacent to tree line with views to Pelican Lagoon.
- Describe buildings and facilities.

Principles of Good Design (2004)

All building elements will include the following design initiatives;

- High levels of insulation;
- Use of high performance glass and large overhangs where required for energy efficiency;
- Passive solar heating, day-lighting and natural cooling from cross ventilation;
- Solar hot water heating;
- A photovoltaic farm in the Maintenance area (ref above) located on the ground for easy maintenance;
- Minimisation of water use with low maintenance landscaping using indigenous species;
- Recycling of waste;
- Reuse of grey water for irrigation;
- Use of roof water for lavatory flushing and irrigation;
- Use of low emissivity building materials;
- Siting of buildings on previously cleared ex grazing land;
- Use of low maintenance building materials;
- Retention of road and hard surfaces runoff through appropriate erosion controls and channelling to site low point;
- Maximisation of utilisation of low embodied building materials;
- Use of local materials including field limestone for walls;
- Use of timber from certified sources;
- Minimum use of pressure treated timber;
- Use of high efficiency heating and cooling equipment, lights, appliances and water fixtures;

Visual impact

- Setbacks from roads, sea.
- Club Pavilion set into hill.
- Lodges, hotels, along contour lines, below ridge lines of knolls and in saddles between them.
- Car park in swale, screened with landscaping.
- Residential accommodation along contours against a backdrop of existing mallee trees.
- Maintenance screened by trees.
- Staff accommodation set against a backdrop of trees, well off the access road.

Land Sale and Design Approval Process

- Current owner – Programd Pty Ltd.
- Purchaser submissions – detailed development proposal prior to purchase.
- Assessment of submission and Programd's preliminary approval.
- Construction criteria.
- Requirement to commence and complete construction within a period from purchase date.

Background and Vision

- The design to be wholly in the context of the adopted architectural themes for the clubhouse accommodation buildings.
- The units will overview the golf course and as such must incorporate design measure to ensure the "blending in' of the buildings into the background landscape.

Design Criteria

- Design quality – to be determined.
- Density – maximum of 2 storeys.
- Number of dwellings per lot – 8 maximum per allotment.
- Size of dwellings – limited to 4 maximum bedrooms.
- Location within zones on each site – to be determined.
- Building location – within zones on each site.
-

Key considerations and sustainable design principles.

- Verandahs
- Solar penetration in winter, shade in summer
- Passive environmental controls
- Solar PV panels (or contribution to central scheme?)
- Natural ventilation
- Wind control
- Acoustic privacy
- Security
- Energy and water efficiency

Materials

- list required wall and roof materials, colour palette – to be determined
- Roof form – pitched to 18 deg. Max.

Landscape

- Integration with the landscape
- Retain the existing natural landscape where possible.
- No fences.

Access roads

- ROW for access road
- Body corporate to maintain.
- One access driveway.
- Construction and maintenance of driveway.
- Construction and maintenance of footpath for pedestrians and golf carts.

Car parking

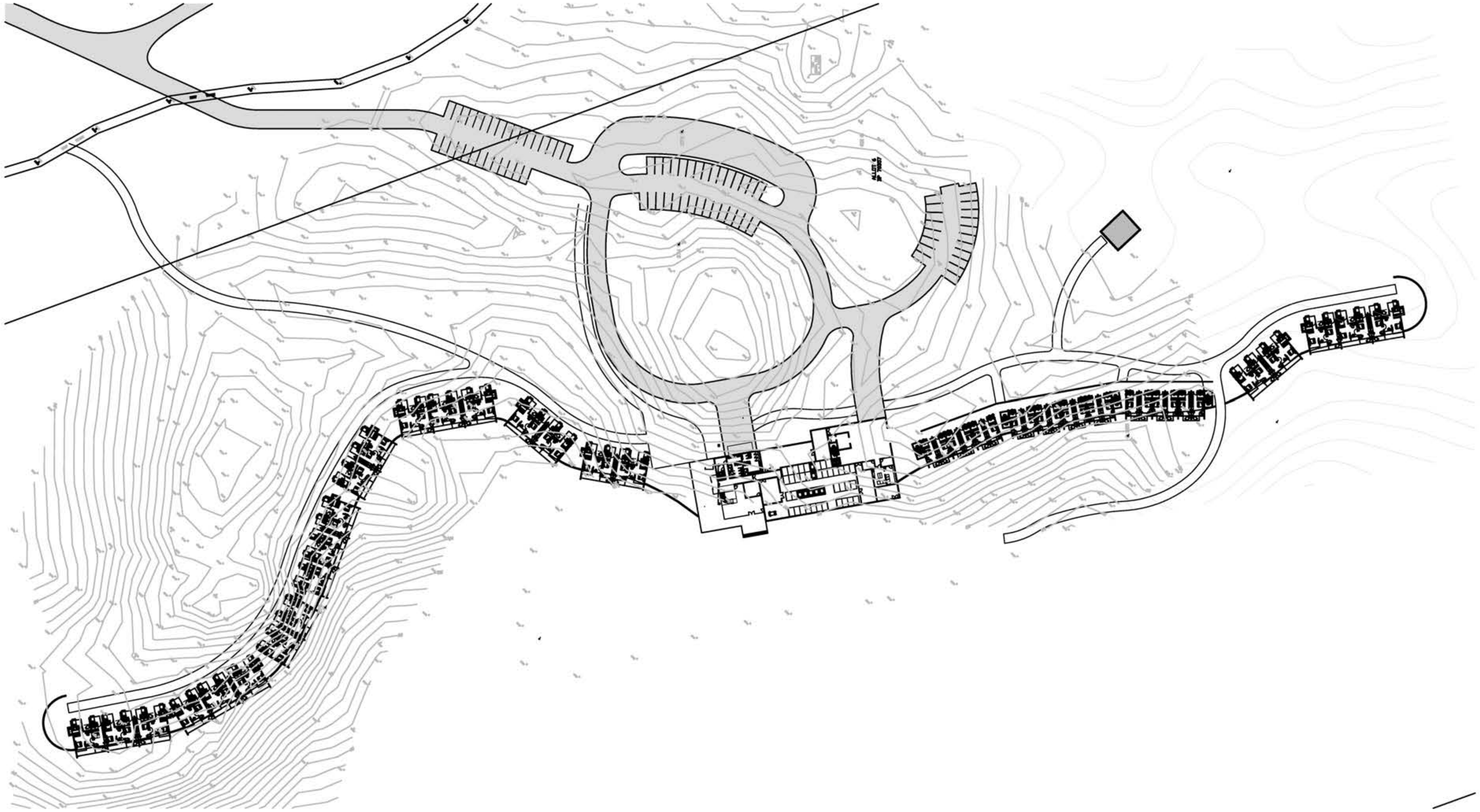
- Open carports or enclosed garages.

Sustainability rating

- To be determined.
- Can use principles of green star rating without getting certification.

Maintenance

Describe responsibility for maintenance and minimum requirements will be body corporate responsibility.



CLUBHOUSE, LODGES & HOTEL ACCOMMODATION

SITE PLAN

0 5 10 30m

SCALE 1:750 @ A1 / 1:1500 @ A3

PRELIMINARY

26.08.2014
SK001 | -
14020
PROPOSAL

KANGAROO ISLAND GOLF COURSE RESORT

PENNINGTON BAY, KANGAROO ISLAND SA 5222

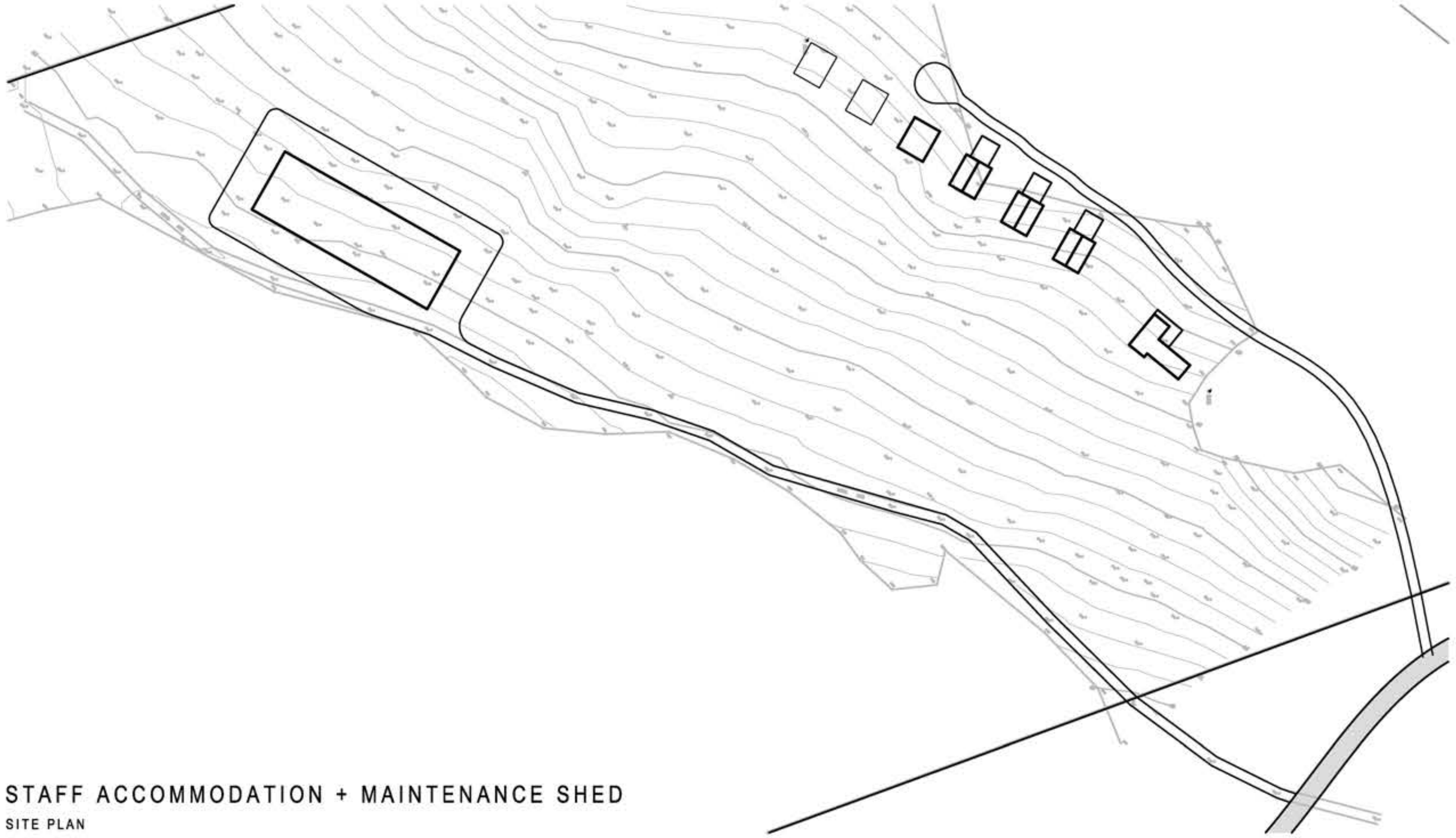
PROGRAMMED TURNPOINT PTY. LTD.

APLIN COOK GARDNER

ARCHITECTURE INTERIOR DESIGN

236 GRENFELL STREET, ADELAIDE SA 5000

A1 841 x 594



STAFF ACCOMMODATION + MAINTENANCE SHED

SITE PLAN

0 10 20 50m

SCALE 1:1000 @ A1 / 1:2000 @ A3

PRELIMINARY

VILLAS + CONDOS

SITE PLAN

0 10 20 50m

SCALE 1:1000 @ A1 / 1:2000 @ A3

26.08.2014
SK002 | -
14020
PROPOSAL

KANGAROO ISLAND GOLF COURSE RESORT

PENNINGTON BAY, KANGAROO ISLAND SA 5222

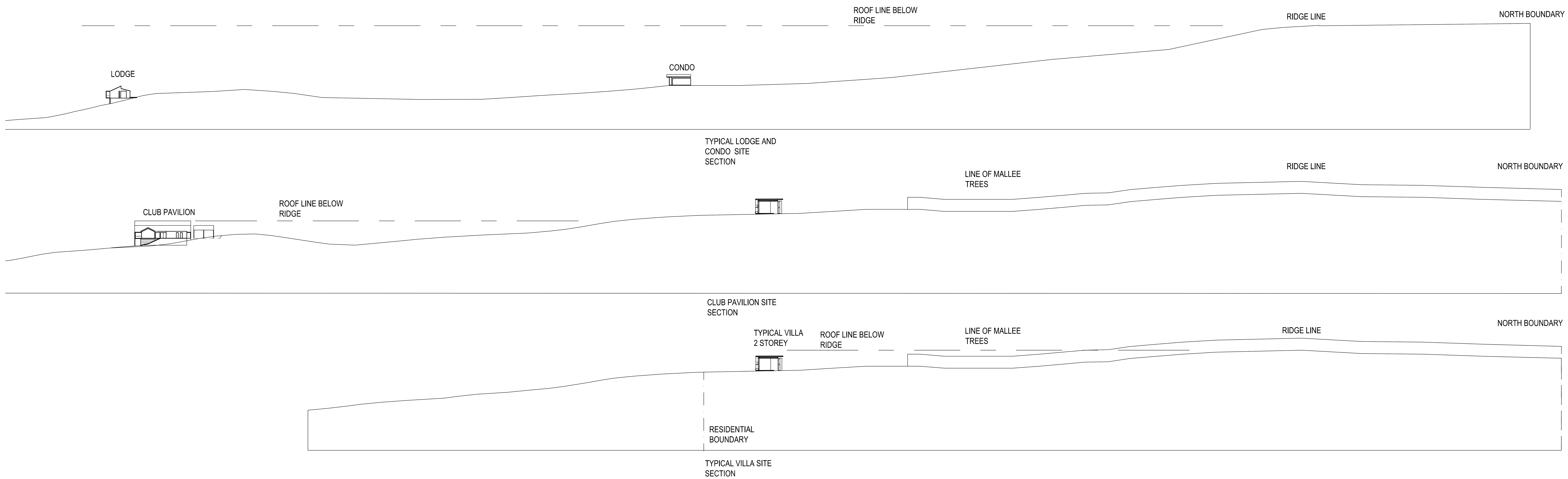
PROGRAMMED TURNPOINT PTY. LTD.

APLIN COOK GARDNER

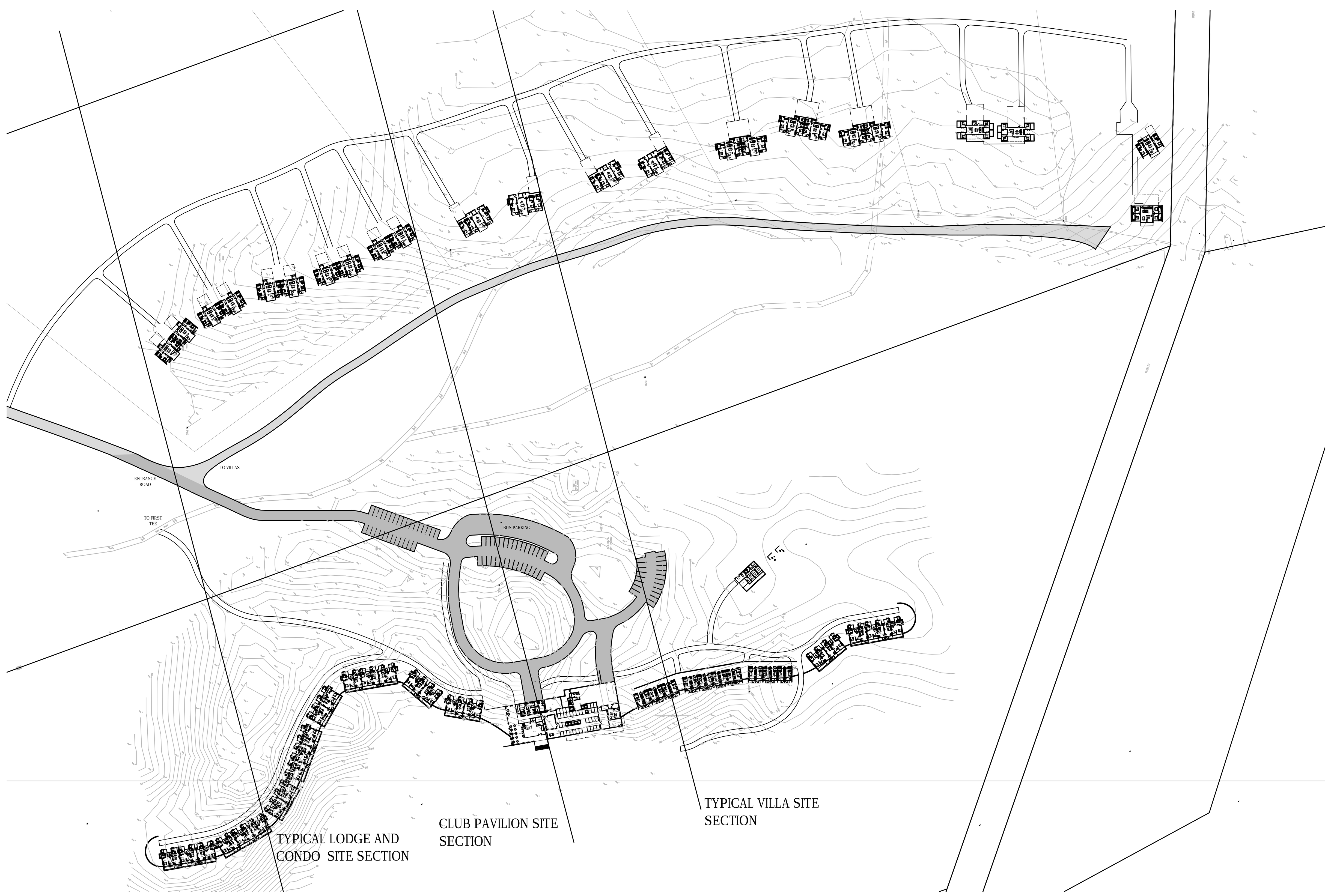
ARCHITECTURE INTERIOR DESIGN

236 GRENFELL STREET, ADELAIDE SA 5000

A1 841 x 594



SITE SECTIONS 1:1000



PRELIMINARY

CLUBHOUSE, LODGES & HOTEL ACCOMMODATION

SITE SECTIONS PLAN 1:2000

03.03.2015
SK005 | -
14020
PROPOSAL

KANGAROO ISLAND GOLF COURSE RESORT

PENNINGTON BAY, KANGAROO ISLAND SA 5222

PROGRAMMED TURNPOINT PTY. LTD.

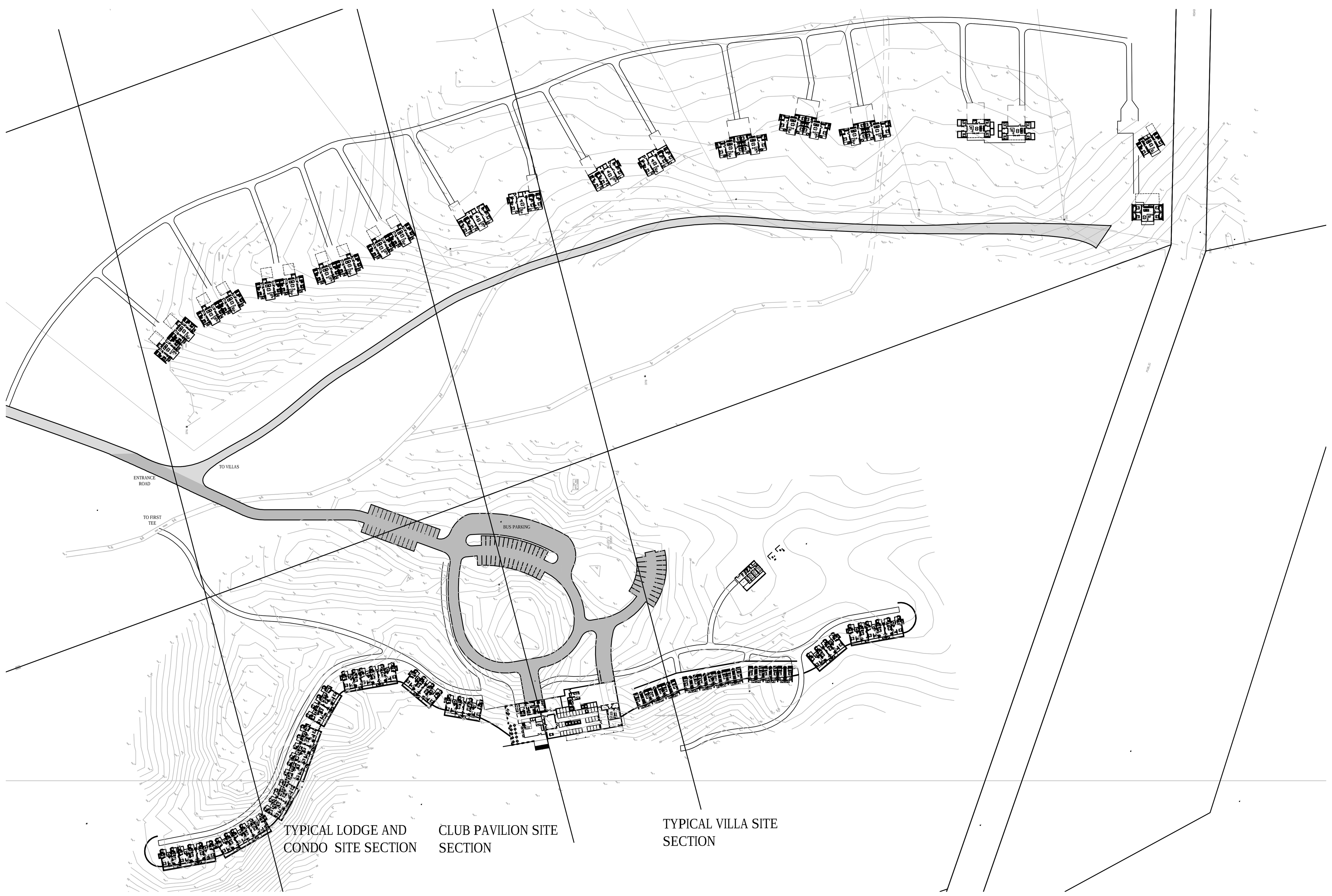
APLIN COOK GARDNER

ARCHITECTURE INTERIOR DESIGN

236 GRENFELL STREET, ADELAIDE SA 5000

A1 841 x 594

SITE SECTIONS 1:1000



CLUBHOUSE, LODGES & HOTEL ACCOMMODATION

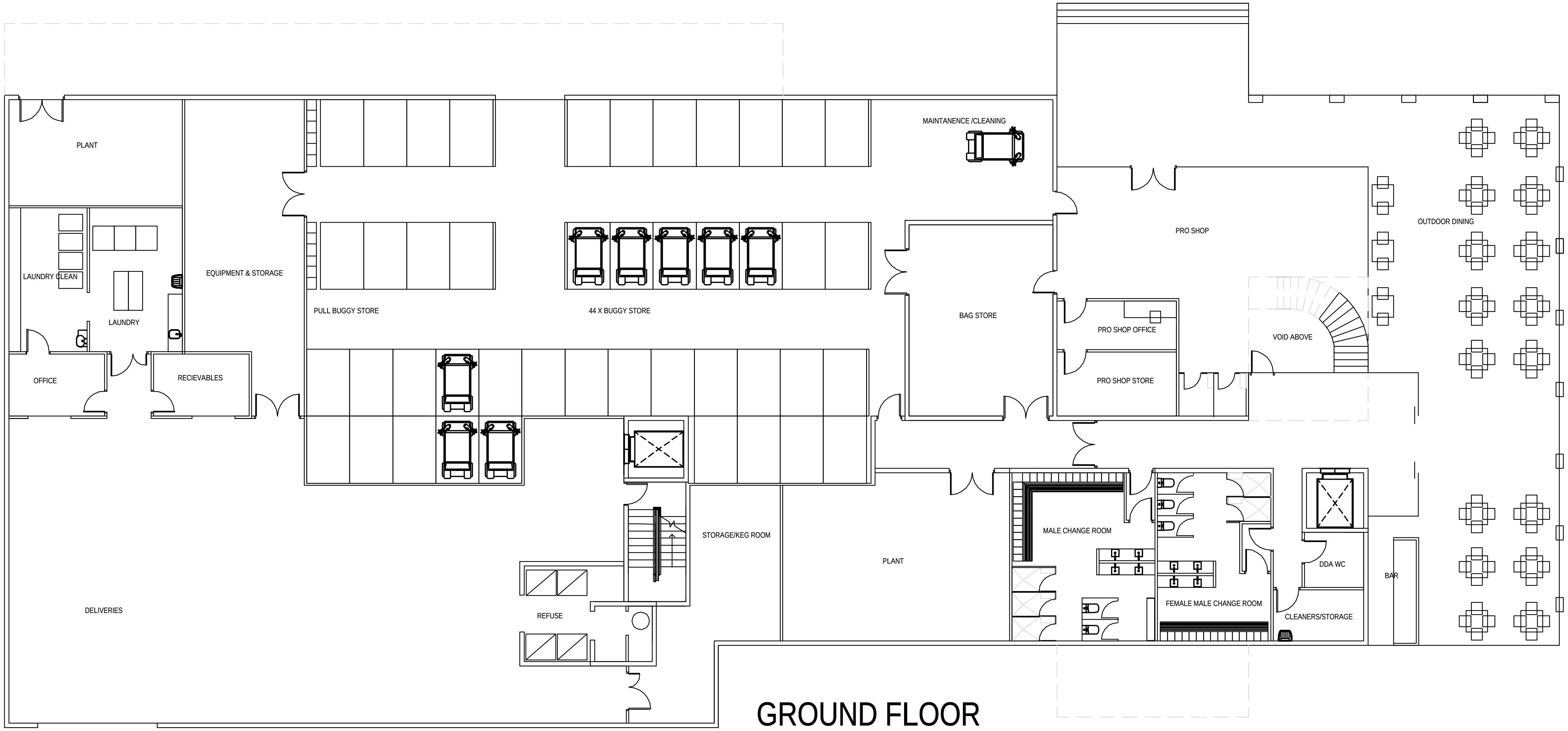
SITE SECTIONS PLAN 1:2000

03.03.2015
SK005 | A
14020
PROPOSAL

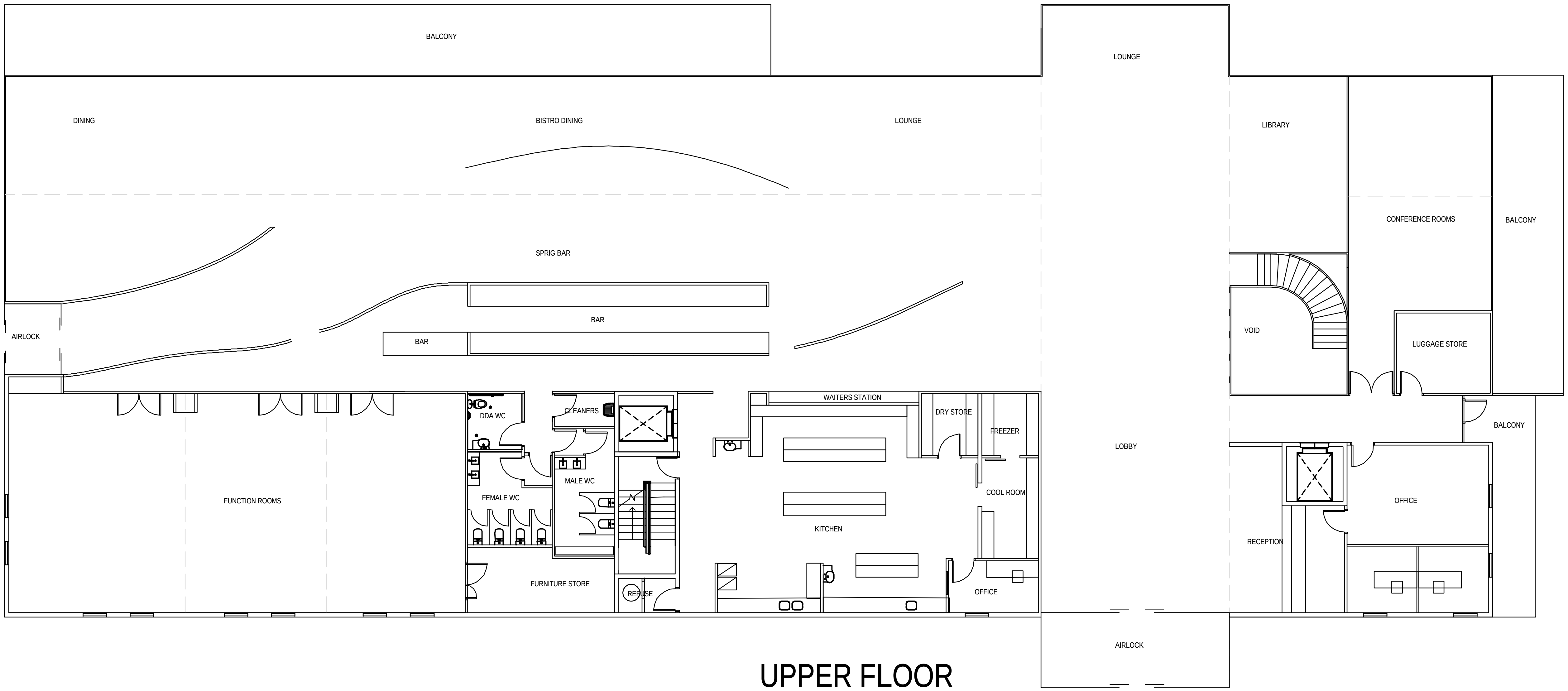
KANGAROO ISLAND GOLF COURSE RESORT

PENNINGTON BAY, KANGAROO ISLAND SA 5222

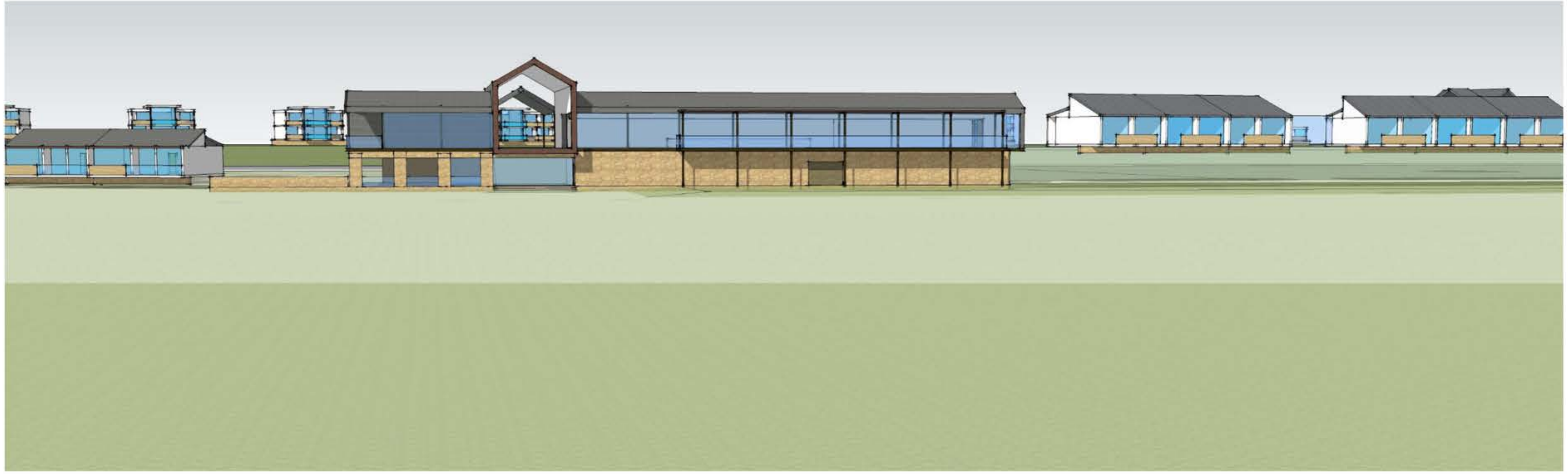
PROGRAMMED TURNPOINT PTY. LTD.



GROUND FLOOR

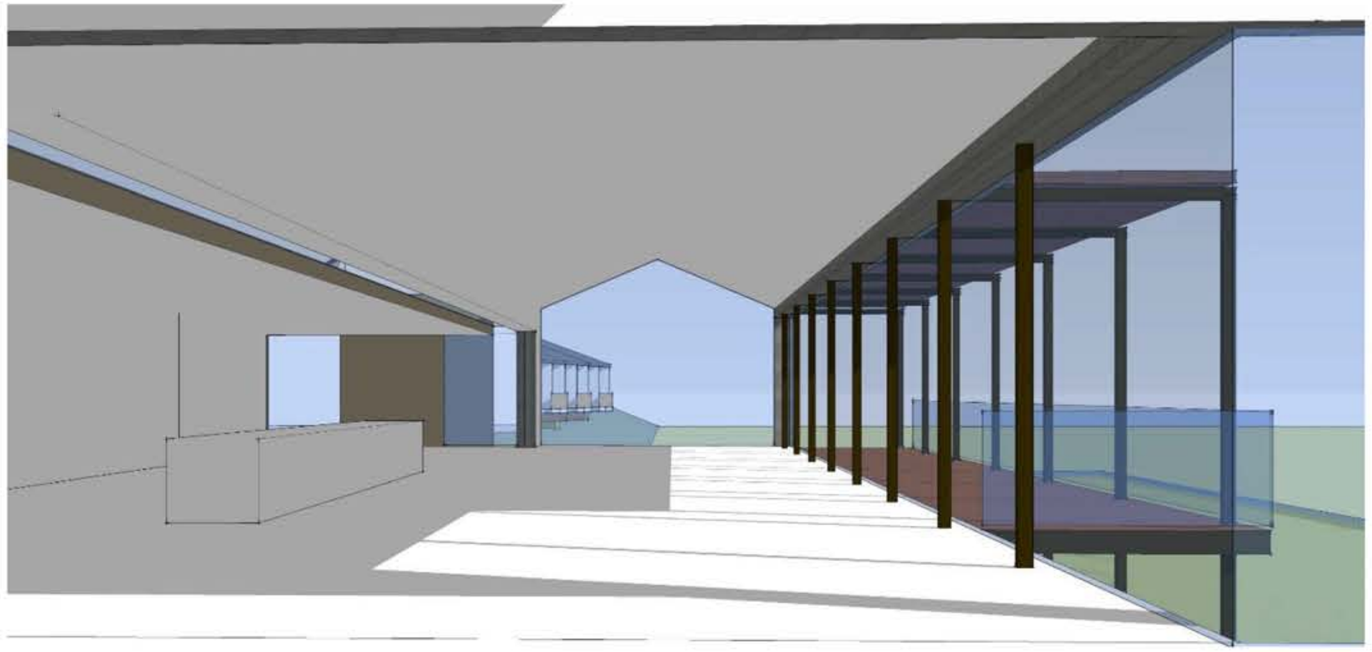

BALCONY
LOUNGE
DINING
BISTRO DINING
LOUNGE
LIBRARY
CONFERENCE ROOMS
BALCONY
SPRIG BAR
VOID
LUGGAGE STORE
AIRLOCK
BAR
BAR
WAITERS STATION
DRY STORE
FREEZER
DDA WC
CLEANERS
LOBBY
BALCONY
MALE WC
FEMALE WC
COOL ROOM
FUNCTION ROOMS
OFFICE
KITCHEN
RECEPTION
FURNITURE STORE
REFUSE
OFFICE
AIRLOCK

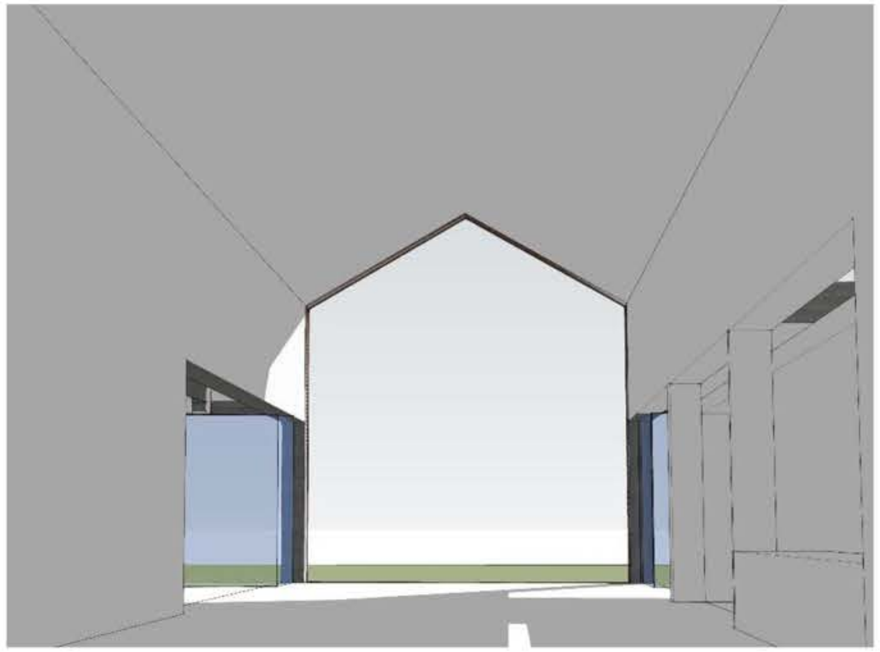
UPPER FLOOR



APLIN COOK GARDNER

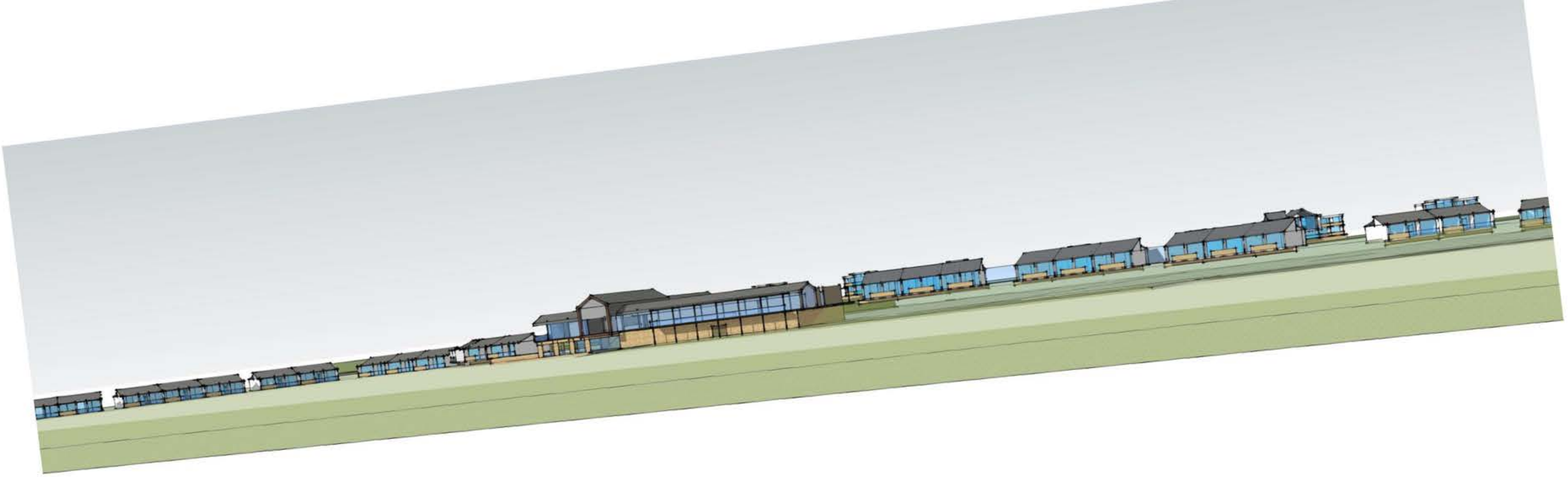
ACG STUDIO : ARCHITECTURE . INTERIOR DESIGN . PROJECT MANAGEMENT

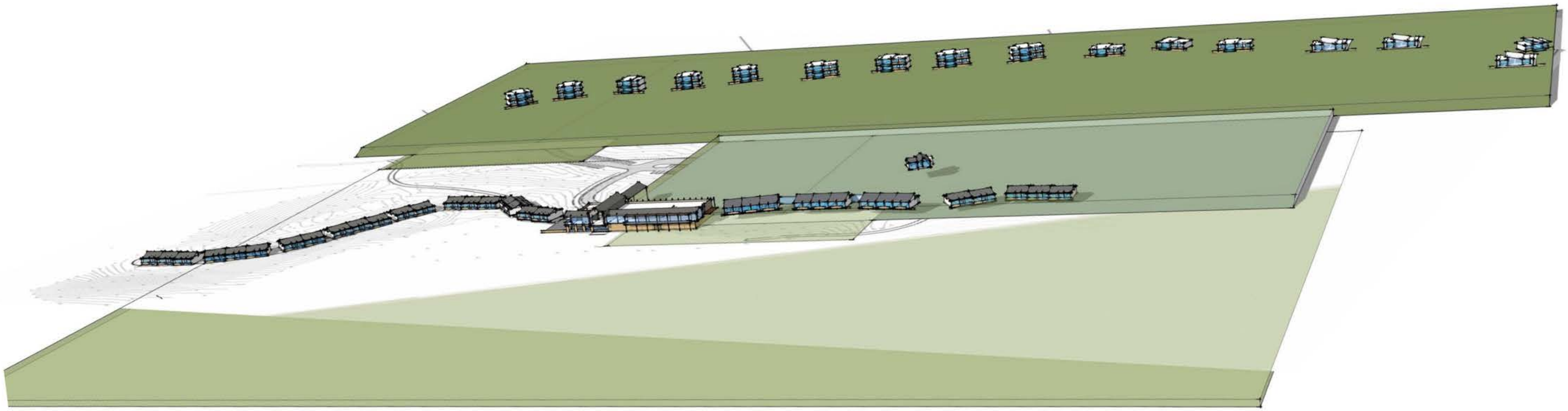




APLIN COOK GARDNER

ACG STUDIO : ARCHITECTURE . INTERIOR DESIGN . PROJECT MANAGEMENT





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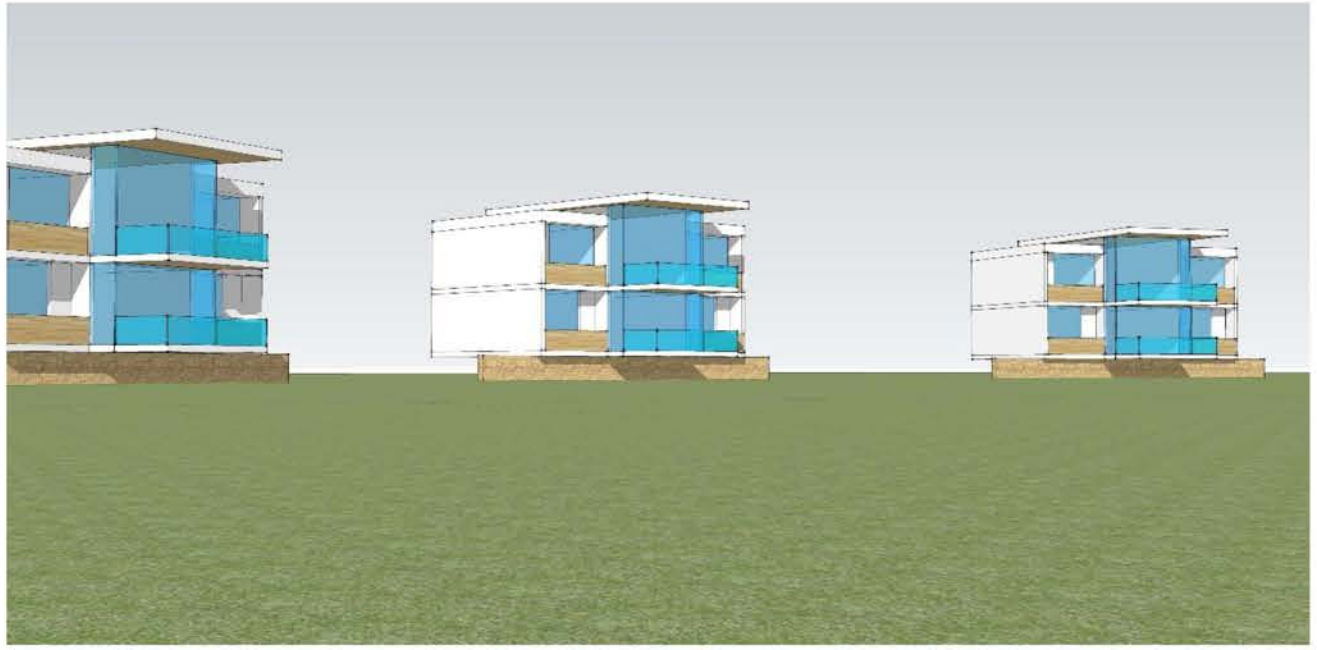

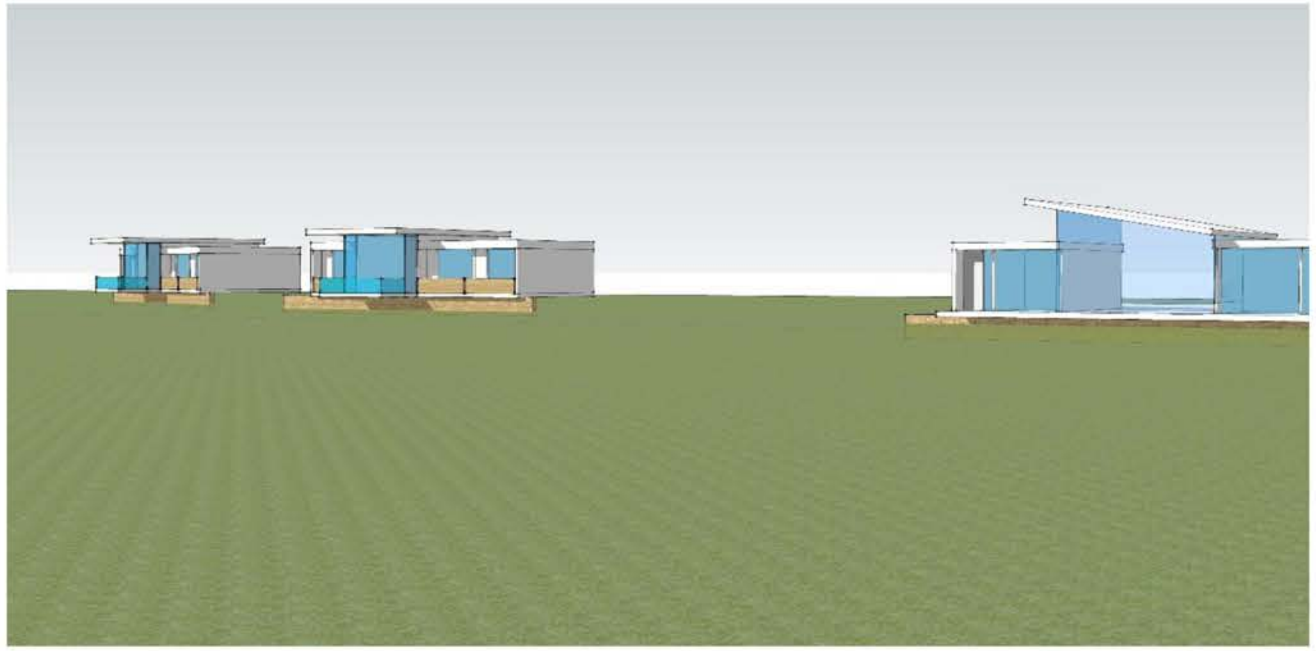

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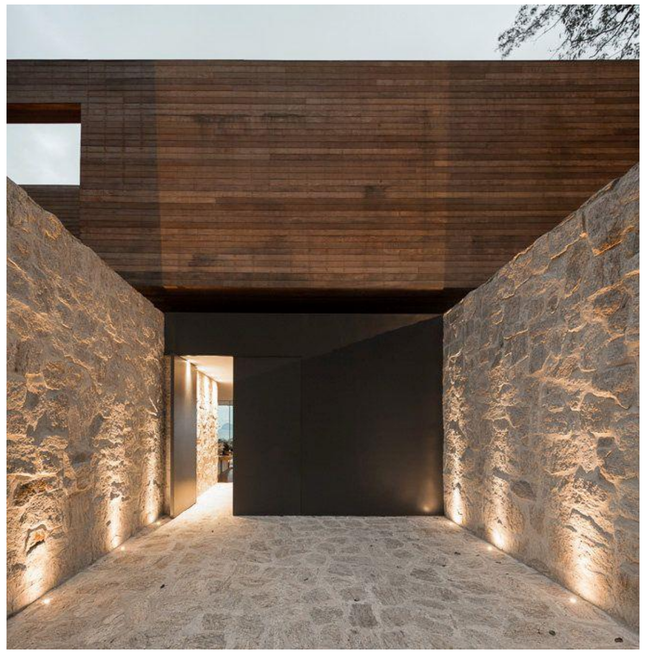
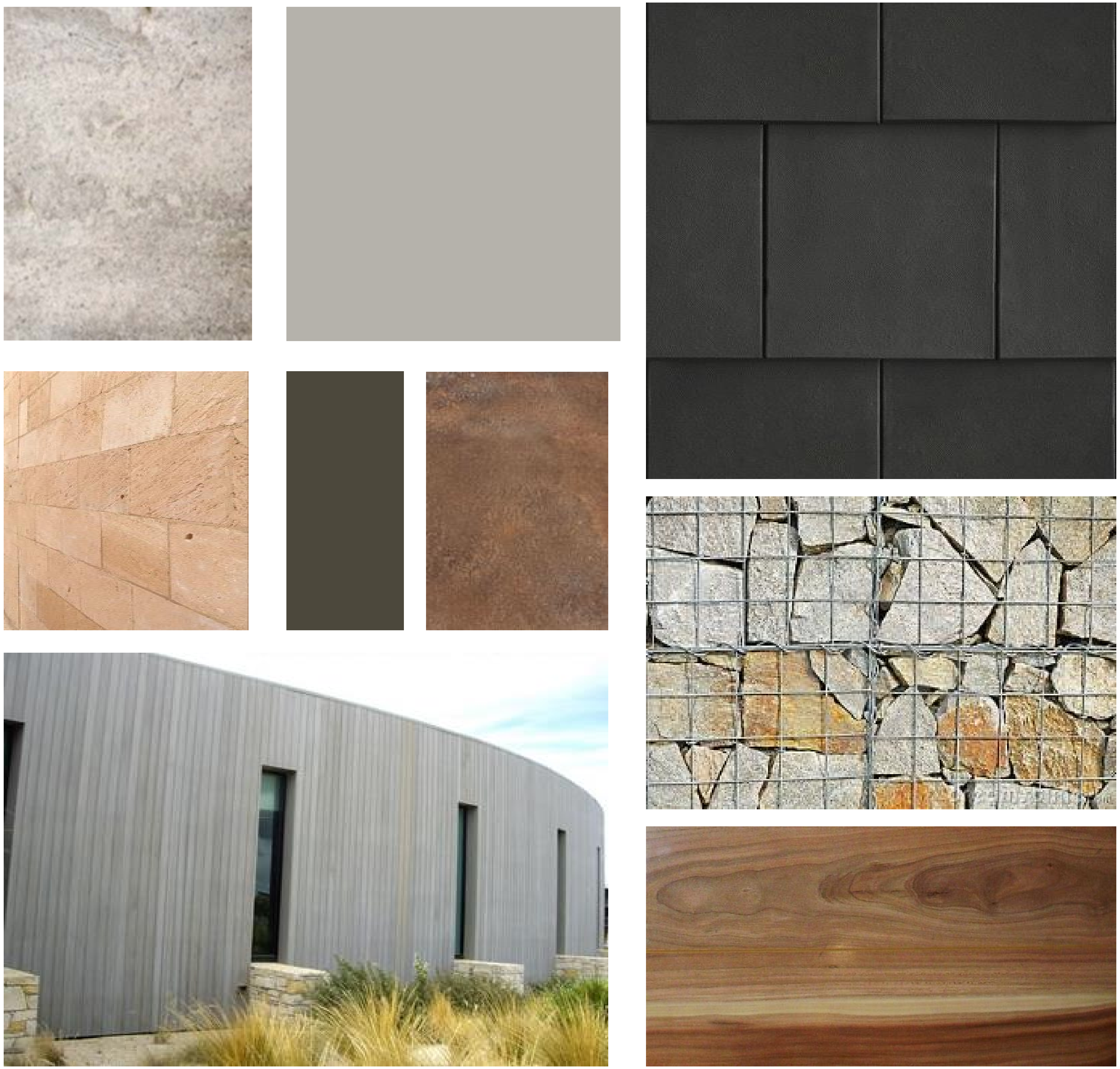


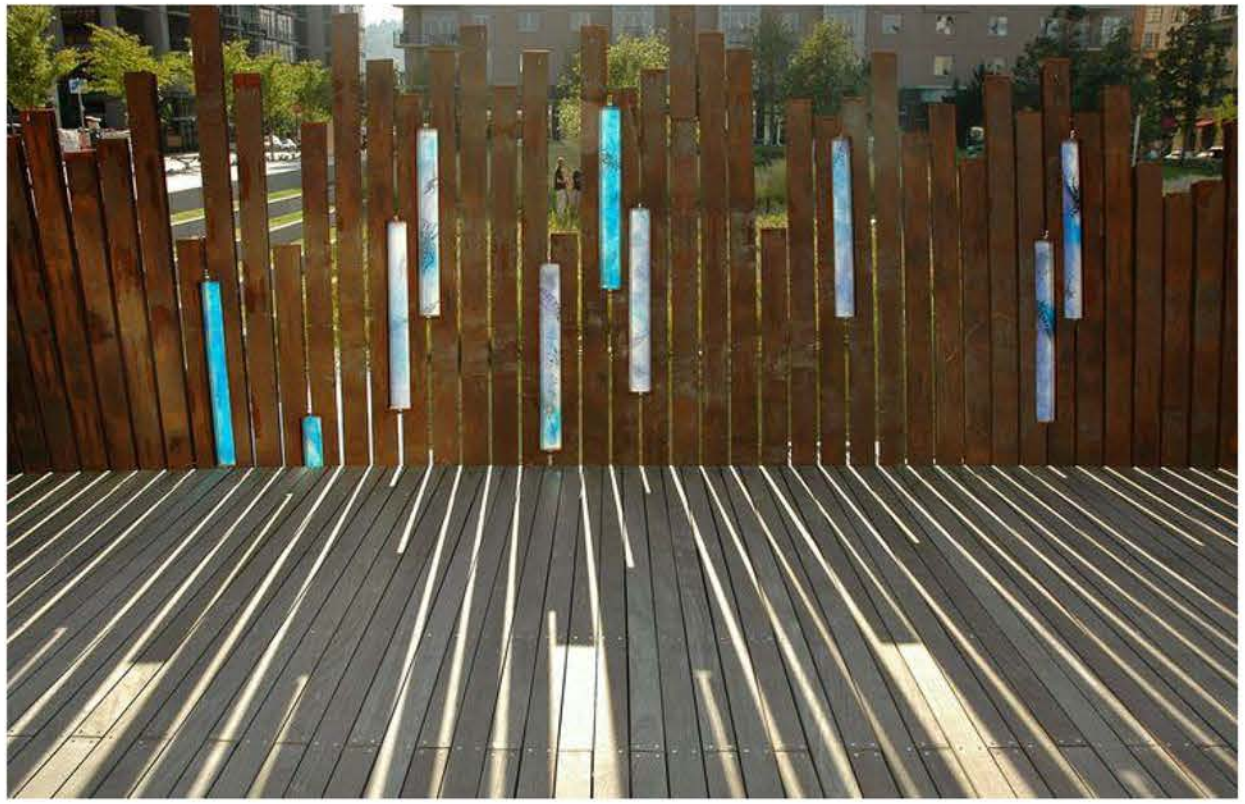

club pavilion and accommodation



club pavilion and accommodation

APLIN COOK GARDNER

ACG STUDIO : ARCHITECTURE . INTERIOR DESIGN . PROJECT MANAGEMENT


RODERICK C. GLEN 2014


RODERICK C. GLEN
2014

Appendix I -

SA Water

SA Water

Tuesday, 16 September 2014

SOUTH AUSTRALIAN
WATER CORPORATION

SA Water
250 Victoria Square / Tarntanyangga
Adelaide SA 5000

GPO Box 1751
Adelaide SA 5001

Telephone +61 8 8204 1000

ABN 69 336 525 019

Mr Justin Trott
Programmed Turnpoint
PO Box 3403
Mornington VIC 3931

Dear Mr Trott

Water Availability for Pelican Lagoon Golf Course

I am writing in response to your request for up to 150ML per annum of water for irrigation purposes to the proposed Pelican Lagoon Kangaroo Island Golf Course.

SA Water has received advice from Kangaroo Island Natural Resources Management Board (NRM Board) regarding the extent of the NRM Board's authority under the NRM Act 2004 and the Kangaroo Island Natural Resources Management Plan 2009.

SA Water advises that the water resource is available from our Middle River reservoir under the following conditions:

- the water will only be available in winter-period months from mid-May to mid-October
- the water will only be available when Middle River is spilling
- no increase to the storage capacity of the reservoir is required

Any changes to the timing and conditions of water taken would require reassessment by the NRM Board.

SA Water will continue to work with Programmed Turnpoint to determine the specific infrastructure and operational arrangements required to deliver the water to the Golf Course site.

Yours sincerely

Mark Wilson
Senior Manager Business Development

Government
of South Australia

Appendix J -

SA Power

Hundred of Dudley
in the area named
PELICAN LAGOON
KANGAROO ISLAND COUNCIL

LEGEND

	PROPOSED 11kV OVERHEAD MAINS
	PROPOSED 3x95mm² 11kV XLPE CABLE
	PROPOSED 3x300mm² 11kV XLPE CABLE
	EXISTING 33kV OVERHEAD MAINS
	PROPOSED 33kV OVERHEAD MAINS
	PROPOSED 300mm² 33kV XLPE CABLE
	PROPOSED POLE
	PROPOSED 11kV POLEMOUNT TRANSFORMER
	PROPOSED PADMOUNT TRANSFORMER
LS	PROPOSED 11kV LOAD SWITCH
R	PROPOSED 11kV RECLOSER
VR	PROPOSED 11kV VOLTAGE REGULATOR STATION
R	PROPOSED 33kV RECLOSER

GENERAL NOTES

1. Due to the schematic nature of the drawing it shall not be scaled. The position and equipment shown are indicative only and should be verified on site.

ZONE:MGA-54-GDA94	HBFRA HIGH BUSHFIRE RISK AREA
MAP REF:642634r	FEEDER NO: SD-443 FEEDER NAME: 33kV FEEDER
GRID REF: 213606 E 6029973 N	SUBSTATION NO: SSD-314 SUBSTATION NAME: AMERICAN RIVER
	ASSET OWNER: SAPN
	PROJECT DEFINITION: NC-001069 / NOTIFICATION TYPE CS / PROJECT TYPE RC
210751 E 6027977 N	SKETCH

REV	DETAILS OF REVISION	RVD	CKD	APD	DATE	REV	DETAILS OF REVISION	RVD	CKD	APD	DATE	REV	DETAILS OF REVISION	RVD	CKD	APD	DATE

DRAWN	LUKE GEORGEFF	28-05-14
DESIGNED	LUKE GEORGEFF	28-05-14
CHECKED		
PROJECT MANAGER	LUKE GEORGEFF ST MARYS (08) 8275 0938	

Head Office:
1 Anzac Highway
Keswick South Australia 5035

Postal address:
GPO Box 77
Adelaide South Australia 5001

Corporate switchboard
08 8404 5667
(9.00am - 5.00pm
Monday to Friday)

SA Power Networks
www.sapowernetworks.com.au

THE LINKS AT KANGAROO ISLAND
33kV MOD 3 SUBSTATION & 11kV EXTENSION
CATHERS ROAD, PELICAN LAGOON

SCALE			SHEET 1 OF 2	REV
1:4000	A1	100708915		

SA Power Networks

Our Ref: CS-100708915

Tuesday, 28 July 2014

Department of Planning,
Transport and Infrastructure
c/o: sally.smith@sa.gov.au

Attention: Sally Smith

Dear Sir,

SA Power Networks' Response to your request for an Indicative Estimate

Re: Proposal to Establish New Electricity Supply Connections for the Kangaroo Island Golf Resort at Lot 8 – Lot 16 Cathers Road, Pelican Lagoon.

We acknowledge receipt of your request for an Indicative Estimate dated 14 April 2014 and all information received 14 July 2014 from Mr. Justin Trott concerning your proposal to Establish New Electricity Supply Connections for the Kangaroo Island Golf Resort at Lot 8 – Lot 16 Cathers Road, Pelican Lagoon ('**Project**').

From our initial analysis based on the information you provided with your request, we believe that your proposed work is of a Negotiated Connection Service type under our current service classification. (Please refer to Annexure 2 for a high-level process flow for this type of connection service provided by us.) More information about our Negotiated Connection Services is available on our website at:
http://www.sapowernetworks.com.au/centric/customers/necfconnections/comminddevconnections.jsp

This letter seeks to advise you of:
1. An Indicative Estimate for your proposed work.
2. What you need to do next if you decide to proceed with the required work.

1. **Indicative Estimate**

Option A: (Pump station load and 11kV overhead extension along Cathers Road included)

SA Power Networks has made assumptions with best intentions on both the scope and line route that may be available or suitable, and estimate the project to be in the order of **$1.9mil (GST inclusive).** This amount includes an augmentation component in the order of $65,500 (GST Inclusive).

This estimate is based on the information that you have provided within your initial enquiry dated 14 April 2014 and all information received 14 July 2014.

The scope of works includes:

- A total maximum capacity of 400 volt, 688 ampere (475kVA), three phase service
- Establish a new substation site and install modular substation with telecommunications tower (tee-off from existing 33kV line near Hog Bay Road and Davies Road, Pelican Lagoon).
- From the modular substation install 11kV over head extension approximately 1.7km along Davies Road and approximately 2.1km along Cathers Road, with 11kV tee-offs to proposed transformer sites located at the Pump Station and Maintenance Shed, with further underground 11kV extension approximately 600m to Club House Precinct.
- Installation of 200kVA pole mounted transformer at Pump Station site;
- Installation of 200kVA pole mounted transformer at Maintenance Shed;
- Installation of 315kVA pad mount transformer at Club House Precinct;
- Connection and Metering Works; and
- Project management – SA Power Network's overall project management of this work.

This estimate does not include any costs associated with vegetation (tree) clearance along the proposed route.

Customer works (you are responsible for the following at your own expense):

- The costs of civil works eg, trenching, conduits, conduit installation **is not included** in this estimate.

- There are easements required across your land and that of third parties. You as the registered proprietor of the land to be supplied shall grant to SA Power Networks all easements required on your and neighbouring land for no monetary consideration on such terms and conditions as SA Power Networks considers appropriate. You are responsible for the cost of all such easements and **no cost** for this has been included in this estimate. You are also responsible for the notification of other authorities eg, Local Government, to gain approval for access on their land where appropriate.

SA Power Networks are committed to working with our customers to investigate practical, sustainable strategies to lower charges to our customers and to defer the costly requirements of distribution expansion.

While giving consideration to this indicative estimate cost, you might wish to take notice of the following facts:

- A Distribution Use of System Rebate may be deducted from our offer once we receive your electrical load details. This rebate has not been included in this Indicative estimate but maybe in the order of **$100,000 (GST Inclusive).**

- Demand Management is a method of managing the customer's pattern of energy use on the distribution network, so as to minimise the supply cost to customers whilst maintaining or enhancing customer service. Supply costs include costs of projects associated with augmentation of, or extension to, the distribution network.

- The amount outlined in this indicative estimate is based on the demand requested in your connection enquiry. We are available to discuss possible demand management strategies that may be available to you to reduce your requested demand.

The Electricity Act 1996 and Regulations prescribe penalties of up to $10,000 for persons who erect buildings or structures in the proximity to powerlines. In addition the Court can order the removal or modification of the building and payment of compensation for the cost of rectifying the situation. Persons intending to erect buildings or structures in the proximity to powerlines should consult with the Office of the Technical Regulator (telephone: 8226 5500) for further information regarding the clearances that must be maintained between powerlines and buildings and structures.

This is an **indicative estimate only** and does not commit SA Power Networks or any other contractor to undertake the connection works at the estimated cost. That is, this letter does not constitute a binding offer by SA Power Networks to carry out the connection works at the figure referred to in this letter. In addition, this estimate is based on the information that you have provided to SA Power Networks and, as such, if this information is incomplete or inaccurate, SA Power Networks reserves the right to vary its estimate of the costs involved in carrying out the connection works. In particular this estimate is given without the benefit of other authorities' requirements or a detailed site inspection.

Option B: (Pump station load and 11kV overhead extension along Cathers Road <u>excluded</u>)

SA Power Networks has made assumptions with best intentions on both the scope and line route that may be available or suitable, and estimate the project to be in the order of **$1.7mil (GST inclusive).**This amount includes an augmentation component in the order of $43,500 (GST Inclusive).

This estimate is based on the information that you have provided within your initial enquiry dated 14 April 2014 and all information received 14 July 2014.

The scope of works includes:

- A total maximum capacity of 400 volt, 500 ampere (345kVA), three phase service
- Establish a new substation site and install modular substation with telecommunications tower (tee-off from existing 33kV line near Hog Bay Road and Davies Road, Pelican Lagoon).
- From the modular substation install 11kV over head extension approximately 1.7km along Davies road, with 11kV tee-offs to proposed transformer sites located at the Maintenance Shed and further underground 11kV extension approximately 600m to Club House Precinct.
- Installation of 200kVA pole mounted transformer at Maintenance Shed;
- Installation of 315kVA pad mount transformer at Club House Precinct;
- Connection and Metering Works; and
- Project management – SA Power Network's overall project management of this work.

This estimate does not include any costs associated with vegetation (tree) clearance along the proposed route.

Customer works (you are responsible for the following at your own expense):

- The costs of civil works eg, trenching, conduits, conduit installation **is not included** in this estimate.

- There are easements required across your land and that of third parties. You as the registered proprietor of the land to be supplied shall grant to SA Power Networks all easements required on your and neighbouring land for no monetary consideration on such terms and conditions as SA Power Networks considers appropriate. You are responsible for the cost of all such easements and **no cost** for this has been included in this estimate. You are also responsible for the notification of other authorities eg, Local Government, to gain approval for access on their land where appropriate.

SA Power Networks are committed to working with our customers to investigate practical, sustainable strategies to lower charges to our customers and to defer the costly requirements of distribution expansion.

While giving consideration to this indicative estimate cost, you might wish to take notice of the following facts:

- A Distribution Use of System Rebate may be deducted from our offer once we receive your electrical load details. This rebate has not been included in this Indicative estimate but maybe in the order of **$60,000 (GST Inclusive).**

- Demand Management is a method of managing the customer's pattern of energy use on the distribution network, so as to minimise the supply cost to customers whilst maintaining or enhancing customer service. Supply costs include costs of projects associated with augmentation of, or extension to, the distribution network.

- The amount outlined in this indicative estimate is based on the demand requested in your connection enquiry. We are available to discuss possible demand management strategies that may be available to you to reduce your requested demand.

The Electricity Act 1996 and Regulations prescribe penalties of up to $10,000 for persons who erect buildings or structures in the proximity to powerlines. In addition the Court can order the removal or modification of the building and payment of compensation for the cost of rectifying the situation. Persons intending to erect buildings or structures in the proximity to powerlines should consult with the Office of the Technical Regulator (telephone: 8226 5500) for further information regarding the clearances that must be maintained between powerlines and buildings and structures.

This is an **indicative estimate only** and does not commit SA Power Networks or any other contractor to undertake the connection works at the estimated cost. That is, this letter does not constitute a binding offer by SA Power Networks to carry out the connection works at the figure referred to in this letter. In addition, this estimate is based on the information that you have provided to SA Power Networks and, as such, if this information is incomplete or inaccurate, SA Power Networks reserves the right to vary its estimate of the costs involved in carrying out the connection works. In particular this estimate is given without the benefit of other authorities' requirements or a detailed site inspection.

2. What you need to do next?

If you do wish to proceed with this proposal we will need final details of your requirements so that a firm Offer for the works can be prepared. You are thus required to:

1. Complete the ***Connection Enquiry Pro-forma*** set out in Annexure 1 and provide the information referred to in Table 1 of that form.
2. Return the completed ***Connection Enquiry Pro-forma*** and the requested information to us at the address set out at the top of the form.
3. Pay the appropriate ***Offer Preparation Fee*** set out in the Connection Enquiry form. Please read on to find out more on this fee.

If you do not wish to proceed with the proposal, please indicate your decision by ticking the box next to "Option 2" in the Annexure 1.

3. What is an Offer Preparation Fee?

We are entitled under the National Electricity Rules to charge a fee for preparing offers in response to connection enquiries from customers. Our offer preparation fee is based on our current estimate of the likely cost of the electricity infrastructure work for your Project. In the case of a large project (i.e. where the project cost is likely to exceed $100,000) our offer preparation fee is based on our estimate of the actual cost to prepare the offer.

Please note that this fee is non-refundable. However, if you elect to accept our offer the amount of the fee will be deducted from the final amount payable to us in relation to the Project. A tax invoice for the fee will be issued to you on receipt of your payment.

If you do not accept our offer before the end of the prescribed validity period and you subsequently request us to prepare another offer for the same Project, we may require you to make a further Connection Enquiry and pay a further fee for the preparation of that new offer. You must pay this further fee before we start to prepare the new offer.

Please select the type of offer you would like to receive by ticking the appropriate box in the attached Connection Enquiry form.

If you need any assistance or information please contact Luke Georgeff at our St Marys office on (08) 8275 0938 or email luke.georgeff@sapowernetworks.com.au

Yours faithfully,

AHaines

Andrew Haines
ACTING MANAGER CUSTOMER SOLUTIONS

Encl:

Annexure 1 - Connection Enquiry Pro-Forma (including Table 1 – Further Information Required)
Annexure 2 - SA Power Networks - Negotiated Connection Service Process Flow (high-level)
Annexure 3 – Connection Policy 2013 - 2015

Annexure 1

CONNECTION ENQUIRY PRO-FORMA

SA Power Networks Ref:	CS-100708915
Date:	Tuesday, 28 July 2014
SA Power Networks Project Manager:	Luke Georgeff
Contact details:	33 Ayliffes Road, St Marys SA 5042 Telephone (08) 8275 0938 Facsimile (08) 8275 0901 Email luke.georgeff@sapowernetworks.com.au

Please indicate your decision regarding this project by ticking *one* of the following two boxes.

I/We hereby agree that:

1.	**OPTION A:** SA Power Networks to undertake all work (both contestable and non-contestable) for the Project $ 5,544 (GST inclusive) (GST Inclusive) Offer Fee based on the estimated project cost.	☐
2.	**OPTION B:** SA Power Networks to undertake all work (both contestable and non-contestable) for the Project $ 5,544 (GST inclusive) (GST Inclusive) Offer Fee based on the estimated project cost.	☐
3.	**DO NOT PROCEED:** I/We do *not* wish to proceed with this project	☐

By ticking box 1, signing this Acceptance Form and returning it to the SA Power Networks Project Manager nominated above, you are entering into a binding legal contract and undertaking a commitment to pay the amounts referred to in this Contract. That Contract is constituted by this letter (including all of its attachments).

I have enclosed payment for the Offer Preparation Fee as selected above and request a Tax Invoice to be prepared and issued to the undersigned.

Alternatively if you require a Tax Invoice prior to making payment of the appropriate Fee outlined above, please complete the attached Annexure 1(CONNECTION ENQUIRY PRO-FORMA) and return to our office. SA Power Networks will not commence preparation of the Offer and where appropriate, the Design Specification until payment is received.

SA Power Networks Ref:	CS-100708915
Date:	Tuesday, 28 July 2014
SA Power Networks Project Manager:	Luke Georgeff
Contact details:	33 Ayliffes Road, St Marys SA 5042 Telephone (08) 8275 0938 Facsimile (08) 8275 0901 Email luke.georgeff@sapowernetworks.com.au

If the signatory is not the Customer, then the signatory warrants that they are authorised to accept the Offer for and on behalf of the Customer.

Signed by, or for and on behalf of, the Customer:

.... **Date** ....

Signature

Name of signatory: (print) ....

Relationship to Customer: (print) ....

Customer's ABN: (print) ....

Company Name: (print) ....

Address for forwarding Invoices: (print) ....

Contact Phone: Mobile .... **Office:** ....

Please note: if unable to provide an ABN, the Customer must provide a 'Reason for not quoting an ABN' statement on the appropriate Australian Taxation Office form obtainable at *http://www.ato.gov.au/uploadedFiles/Content/MEI/downloads/BUS38509n3346_5_2012.pdf.*

TABLE 1. FURTHER INFORMATION REQUIRED FROM YOU

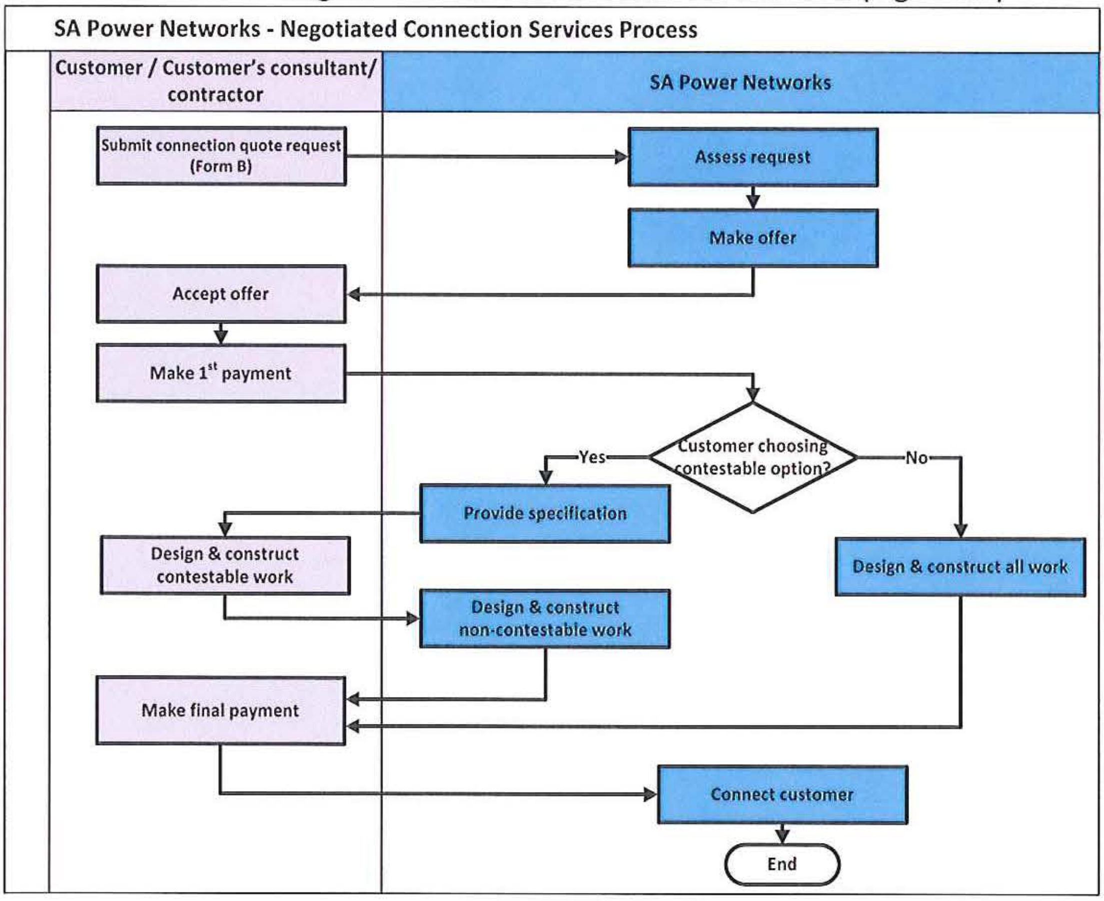
Please provide the requested information for each ticked item.

Information required	Description	Information, Notes & Feedback (attach information separately as required)
1 ☑	**Program Dates** • Construction Start & Completion • Forecast connection date • "Your Works Program"	
2 ☑	**Supply Type –** 3 phase , single phase, other **Proposed use/Type of installation** **Load details**	
3 ☑	**Tenancy Type –** commercial, industrial, residential, apartments or combination	
4	**Customer's electrical load requirements (i.e. Maximum Demand – Existing** (AS3000))	**Not Applicable.**
5 ☑	**Customer's electrical load requirements (i.e. Maximum Demand – Proposed** (AS 3000))	
6 ☑	**Load Operation Cycle – Existing & Proposed** operation cycle (i.e. typical operating times of plant & equipment)	
7 ☑	**Motor Starting** - Magnitude & incidence per day of anticipated plant inrush currents (i.e. for motors include DOL / Soft Start characteristics)	
8 ☑	**Harmonic distortion** expected if any (in % odd / even terms)	
9 ☑	**Main Switch Board** details • Consumer mains size / number of cables	
10 ☑	**Embedded Generator Details** • AS 4777 compliant Inverter details, including make, model and accreditation number • Capacity of photovoltaic array or other energy source • Contractors/installers name • Contractors/installers Electrical License number • Contractors/installers BCSE accreditation number • Customer's acceptance of the terms and conditions of the Small Embedded Generator Connection Agreement.	
11 ☑	**Drawings & Plans** • Site Plans - detailed site / location / elevation / plans • Survey Plans - • Sewer and Road Designs	
12 ☑	**Land Title Status** (i.e. Torrens, Community, Strata, Other) Installation address	

13	☑	**Easements** acquisition responsibility: • SA Power Networks overall (if constructed by SA Power networks) • Customer overall (if constructed by Contractor)	
14	☑	**Metering**: • Quantity & Type • Preliminary metering arrangement anticipated (for future confirmation) • Account and / or existing meter numbers & serial numbers for all existing site services	
15	☑	**Retailer** • Name of Retailer for proposed single customer consumers greater than 160MWh / annum & where existing tariff structure will not be retained.	
16	☑	**Contact Details** - If other than the customer, the nominated agencies and their respective point of contact acting on behalf of the customer re: • Overall Project Management • Electrician. • Builder.	

Annexure 2

SA Power Networks - Negotiated Connection Service Process Flow (high-level)



Appendix K -

Botanical Enigmerase (Local Ecologist Consultant)

KANGAROO ISLAND GOLF COURSE RESORT PROPOSAL

PER Environmental Report

31 OCTOBER 2014

BOTANICAL ENIGMERASE

Michelle Haby- 0407 619 229
Daniel Rowley- 0467 319 925
ABN- 59 766 096 918

PO Box 639
Kingscote SA 5223
enigmerase@bigpond.com

This report was researched and prepared by

Botanical
Enigmerase

Email: enigmerase@bigpond.com.au

for

Programmed Turnpoint
1A Fuji Crescent
Mornington VIC 3931

Michelle Haby is a Native Vegetation Council accredited consultant, accredited to prepare data reports for clearance consent under Section 28 of the *Native Vegetation Act 1991* and applications made under one of the *Native Vegetation Regulations 2003*. Michelle has also undertaken training in the BushRAT method and Bushland Condition Monitoring for a BushRAT Registered Consultant.

DISCLAIMER
Any representation, statement, opinion or advice, expressed or implied in this publication is made in good faith, but on the basis that Botanical Enigmerase is not liable (whether by reason of negligence, lack of care or otherwise) to any person for any damage or loss whatsoever, which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in respect to any representation, statement of advice referred to here.

Partners of Botanical Enigmerase are either employees or past employees of the Department of Environment, Water and Natural Resources (DEWNR). Any representation, statement, opinion or advice, expressed or implied in this publication does not reflect that of the Department.

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LIST OF FIGURES

LIST OF TABLES

PER- ENVIRONMENTAL BRIEF SUMMARY

Flora	
Vegetation Survey Methodology	• 10 30m x 30m quadrats surveyed in accordance with *Heard* and *Channon 1997.* • BushRat Biodiversity analysis of each quadrat. • To occur in Spring each year.
Rated Plant Species	• No nationally threatened or state listed plant species were identified. • Three regionally significant plant species were identified.
Native Vegetation Significance	• Four native vegetation communities occur on the property • One community is regarded as Rare on Kangaroo Island.
Native Vegetation Clearance	• 0.8ha of a total of approximately 65ha (or 1%) is proposed to be cleared. • A total SEB of 3.2ha or $3,209.60 may be required. • No native vegetation clearance is associated with the construction of power transmission or water supply infrastructure. • Clearance of Davies Road in accordance with the Kangaroo Island Council Roadside Vegetation Management Plan.

Native Vegetation Rehabilitation	• Management of browsing pressure from kangaroos is required prior to a native vegetation rehabilitation program being implemented.
	• Trial plantings of *Vittadinia australasica var. australasica* in conjunction with other native plants.
	• Native vegetation rehabilitation could occur via-
	  ○ The use of fire;
	  ○ Natural regeneration; and
	  ○ Revegetation programs.

Native Vegetation Clearance Mitigation	• Modifications to road access ways. • Modifications to allotment alignments. • Relocation of "Driving Range". • Minor Fairway adjustments.
Management of Introduced Species	• Control of introduced plant species • Restricting movement of golf course grasses • Landscaping with locally indigenous plant species
Fauna	
Fauna Survey Methodology	• Remote Cameras. • Area Search Survey. • Opportunistic sightings.
Fauna Description	• Impacts on four fauna species, other than kangaroos, requires consideration and minor mitigation.
Impacts on Fauna	• Minimal. • Dam design should consider measures to reduce impacts on fauna.
Fauna Buffer Requirements	• No construction works occur within 2km of the active osprey nest site and within 200m of the coastline during the breeding season.
Impacts on Nocturnal Fauna	• Minimal.

Road Impacts on Fauna	• Control speed of all vehicles.
Window Impacts on Fauna	• Building designs should consider design aspects that assist in reducing bird strikes.

Recommendations

1. Undertake the flora and fauna surveys on the property on an annual basis, in the first instance, to monitor the effects of management change.
2. Develop an integrated introduced plant control and native vegetation rehabilitation program that controls, and where possible eradicates introduced (especially proclaimed) plants, prevents the escape of golf course grasses and revegetates landscaped areas with locally indigenous plant species.
3. An active kangaroo management program needs to be developed and implemented to manage the population, enable vegetation and landscape rehabilitation and to manage introduced plant species.

BACKGROUND

Kangaroo Island is the third largest island in Australia covering approximately 4,500 km² located off the Fleurieu Peninsula in South Australia. Kangaroo Island has a resident population of approximately 4,200 people.

Due to the relative isolation, Kangaroo Island is free from rabbits and foxes and has a relatively low number of introduced plant species. This, along with being isolated from mainland Australia, has resulted in Kangaroo Island having a high level of endemic flora and fauna. Kangaroo Island remains covered with approximately 55% native vegetation.

Of the remaining native vegetation on Kangaroo Island approximately 55% is contained within Government Reserves and managed by the Department of Environment, Water and Natural Resources. Another 9% is contained within Heritage Agreements protected under the *Native Vegetation Act 1991* with the remaining in private ownership (*Willoughby et al 2001*). A total of 30% of Kangaroo Island is dedicated as a protected area.

Programmed Turnpoint Pty Ltd are proposing to establish a "Kangaroo Island Golf Course Resort" on an approximately 220 hectare site, excluding the coastal reserve, between Pennington Bay and Pelican Lagoon on the eastern end of Kangaroo Island. The land comprises of cleared farmland and native vegetation.

The proposed Kangaroo Island Golf Course Resort is proposed to consist of an 18 hole golf course, clubhouse with function facility, tourist accommodation, residential development and associated infrastructure, Figure 1.

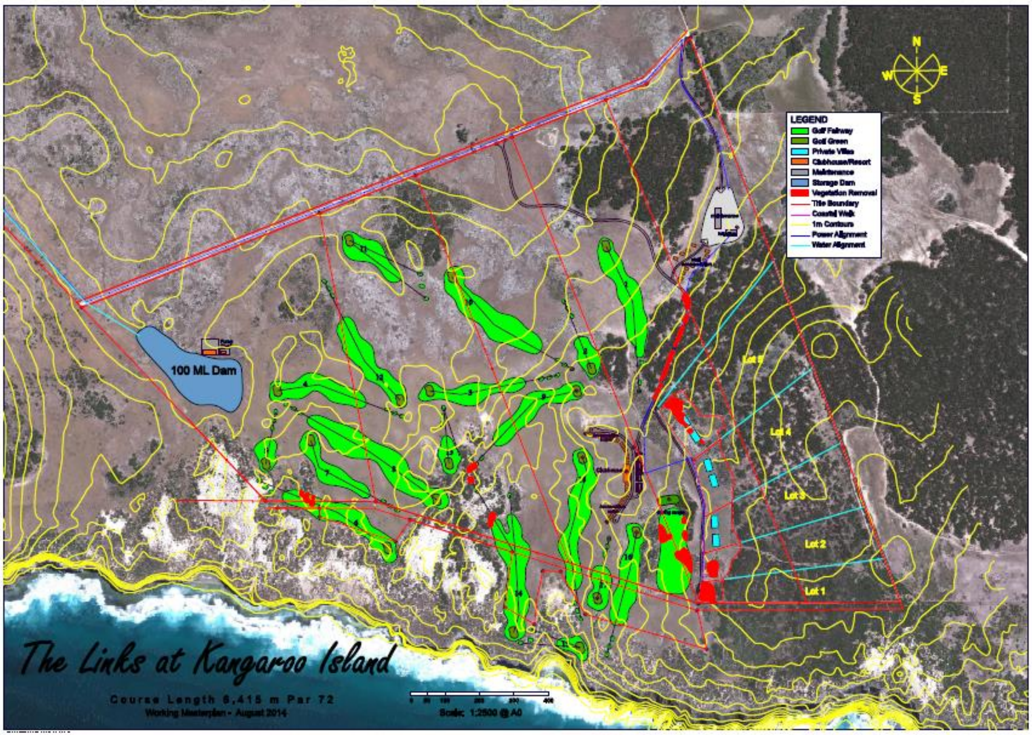

Figure 1- Kangaroo Island Golf Course Resort Proposal

On 19 February 2014 the proposed development was gazetted under the provisions of Section 46 of the Development Act 1993 as a Major Development. The Development Assessment Commission has determined that a Public Environmental Report (PER) is required to be developed for the project.

Programmed Turnpoint Pty Ltd commissioned Botanical Enigmerase to provide input into the PER through the “PER- Environmental Brief” as per Appendix 1.

FLORA

The property where the proposed Kangaroo Island Golf Course Resort is planned to be established is approximately 220ha in size. There is approximately 65ha of native vegetation on the property of which it is proposed 0.8ha be cleared for the proposal.

The proponents of the proposal are also proposing to lease an area of coastal reserve adjoining the property. There is no native vegetation clearance proposed in this area.

Vegetation Survey Methodology

The vegetation on the property of the proposed Kangaroo Island Golf Course Resort was surveyed during October 2014 in accordance with the methodology outlined in *Heard and Channon 1997*. Ten 30m x 30m quadrats were located on the property. The quadrats are located near proposed native vegetation clearance and in different vegetation communities, including cleared land, Figure 2.

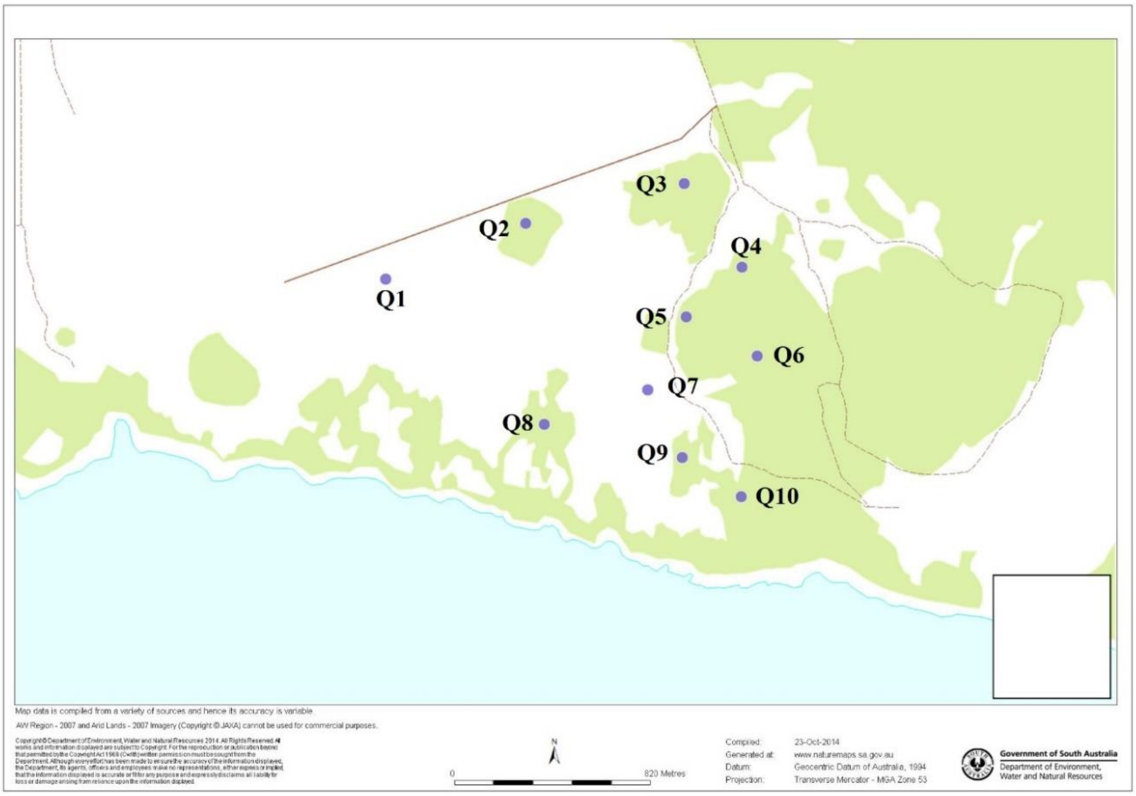

Figure 2- Vegetation Survey Quadrat Locations

Additionally each quadrat was also surveyed using the "BushRat" methodology developed by the Native Vegetation Council to assist in assessing native vegetation clearance applications, (*Native Vegetation and Biodiversity Management Unit 2013*).

The vegetation surveys undertaken on the site as a result cover all habitats, are easily duplicable to enable future monitoring to assess change and assist in determining requirements for native vegetation clearance. The detailed results of the vegetation survey of each quadrat is located in Appendix 2. The results are summarised below where appropriate.

It is recommended that the quadrat survey be undertaken on an annual basis, in the first instance, during spring to determine the positive and negative impacts of the proposal.

Rated Plant Species

The property where the proposed Kangaroo Island Golf Course Resort is proposed to be established was assessed to determine the potential for plant species listed under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act*. The *EPBC Act* “on-line tool” was utilised to determine potential plant species on the property. Coordinates from the centre of the property with a 2km buffer were used to provide the “EPBC Act Protected Matters Report” on 14 August 2014.

The “EPBC Act Protected Matters report” was cross reference with *Taylor 2003* to determine the likelihood of the species being recorded on the property based on whether or not the property contained the preferred habitat. This assessment determined that the property contains the preferred habitat of *Pomaderris halmaturina ssp. halmaturina,* Table 1.

Scientific Name	Common Name	EPBC Act Status	Potential Habitat on Property (*Taylor 2003*)
Caladenia ovata	Kangaroo Island Spider-orchid	Vulnerable	No
Caladenia tensa	Greencomb Spider-orchid	Endangered	No
Euphrasia collina ssp. osbornii	Osborn's Eyebright	Endangered	No
Pomaderris halmaturina ssp. halmaturina	Kangaroo Island Pomaderris	Vulnerable	Yes- KI0204
Ptilotus beckerianus	Mulla mulla	Vulnerable	No
Spyridium eriocephalum var. glabrisepalum	MacGillivray Spyridium	Vulnerable	No

Table 1- Potential EPBC Act Flora Species

The vegetation surveys of the quadrats identified 35 native plant species, Table 2. Of these species none are rated as nationally threatened or state listed. Two, *Eucalyptus gracilis* and *Eucalyptus oleosa ssp. ampliata,* are rated as regionally significant by *Gillum 2014*.

The only rated species observed on the property are tree species which maybe as a consequence of the high browsing pressure from kangaroos. The kangaroos maybe preventing other rated species from re-establishing on the property.

Scientific Name	Common Name	Status (*Gillam 2014*)		
		Nat	State	KI
Acacia longifolia ssp. sophorae	Coastal Wattle			LC
Acacia paradoxa	Kangaroo Thorn			LC
Acacia triquetra	Mallee Wreath Wattle			LC
Acaena novae-zelandiae	Biddy Biddy			LC
Acrotriche patula	Prickly Ground-berry			LC
Austrostipa flavescens	Spear-grass			LC
Cassytha melantha	Coarse Dodder-laurel			LC
Clematis microphylla	Old Man's Beard			LC
Comesperma volubile	Love Creeper			LC
Correa reflexa var. insularis	Round-leaf Correa			NT
Daucus glochidiatus	Native Carrot			LC
Dianella brevicaulis	Short-stem Flax-lily			LC
Dianella sp.	Flax-lily			LC
Dichondra repens	Tomb Thumb			LC
Dodonaea humilis	Dwarf Hop-bush			LC
Eucalyptus diversifolia ssp. diversifolia	Coastal White Mallee			LC
Eucalyptus gracilis	Yorrell			VU
Eucalyptus oleosa ssp. ampliata	Red Mallee			RA
Eucalyptus rugosa	Coastal White Mallee			LC
Eutaxia microphylla	Common Eutaxia			LC
Geranium potentilloides var. potentilloides	Downy Geranium			NT
Lasiopetalum discolor	Coast Velvet-Bush			LC
Leucopogon parviflorus	Coast Beard-Heath			LC
Melaleuca gibbosa	Slender Honey-myrtle			LC
Melaleuca lanceolata	Dryland Tea-tree			LC
Olearia axillaris	Coast Daisy-bush			LC
Orthrosanthus multiflorus	Morning Flag			LC
Parietaria sp.	Nettle			LC
Poaceae sp.				
Pomaderris paniculosa ssp. paralia	Coast Pomaderris			LC
Pterostylis sp.	Greenhood			
Rhagodia candolleana ssp. candolleana	Sea-berry Saltbush			LC
Senecio odoratus	Scented Groundsel			LC
Veronica hillebrandii	Rigid Speedwell			LC
Vittadinia australasica var. australasica	Sticky New Holland Daisy			LC

Table 2- Native Plant Species Identified

Native Vegetation Significance

The property where the proposed Kangaroo Island Golf Course Resort is proposed to be established was assessed to determine the potential Listed Threatened Ecological Communities under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act*. The *EPBC Act* "on-line tool" was utilised to determine potential ecological communities on the property. Coordinates from the centre of the property with a 2km buffer were used to provide the "EPBC Act Protected Matters Report" on 14 August 2014.

The "EPBC Act Protected Matters" report identified "Kangaroo Island Narrow Leafed Mallee (*Eucalyptus cneorifolia*) Woodland" as a potential ecological community on the property. The vegetation survey along with an assessment of the vegetation communities on "*NatureMaps*" has determined that this community does not exist on the property.

NatureMaps combined with the vegetation survey results were used to determine the native vegetation communities on the property. Four native vegetation communities, Figure 3, were identified on the property with one, KI0406, classified by *Willoughby 2001* as Rare on Kangaroo Island, Table 3.

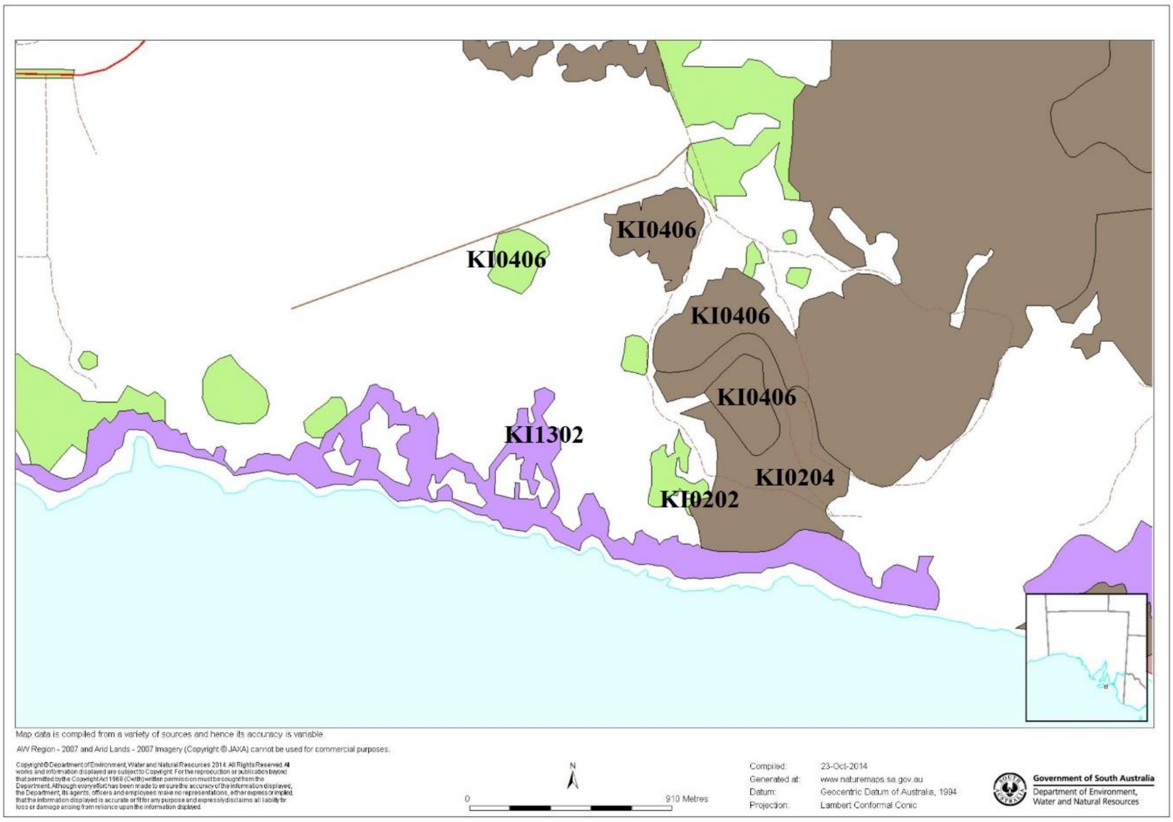

Figure 3- Native Vegetation Communities

The over browsing by the kangaroo population on the site is potentially reducing the diversity of the vegetation communities. An analysis of the fire history of the property based on *NatureMaps* data indicates there is no recorded fire on the property (there is a recorded nearby fire in 1954). This may also suggest the vegetation communities are senescent.

SA VEG ID	Description	Status on KI (*Willoughby 2001*)
KI0202	*Eucalyptus diversifolia ssp. diversifolia, +/-Eucalyptus albopurpurea, Eucalyptus rugosa mid open mallee forest over Melaleuca lanceolata, Lasiopetalum schulzenii, Acacia uncifolia, +/-Hakea vittata, +/-Hakea mitchellii, +/-Banksia marginata, +/-Acacia myrtifolia var. myrtifolia, +/-Xanthorrhoea semiplana ssp. tateana shrubs over +/-Pultenaea rigida var. rigida, +/-Correa reflexa (NC), +/-Pomaderris obcordata*	
KI0204	*Eucalyptus diversifolia ssp. diversifolia, +/-Eucalyptus rugosa, +/-Eucalyptus oleosa ssp. ampliata mid mallee woodland over Melaleuca lanceolata, Acacia uncifolia, Lasiopetalum schulzenii shrubs over Orthrosanthus multiflorus, Correa sp, Pomaderris paniculosa ssp. paniculosa, Senecio odoratus, Myoporum insulare shrubs*	
KI0406	*Eucalyptus rugosa, Eucalyptus oleosa ssp. ampliata, Eucalyptus diversifolia ssp. diversifolia, +/-Eucalyptus cneorifolia, +/-Eucalyptus gracilis mid mallee woodland over Melaleuca lanceolata, +/-Acacia uncifolia shrubs over Acrotriche patula, Dodonaea humilis, Lasiopetalum schulzenii, +/-Leucopogon parviflorus shrubs*	Rare
KI1302	*Melaleuca lanceolata, +/-Eucalyptus diversifolia ssp. diversifolia mid open shrubland over Melaleuca gibbosa, Spyridium phylicoides, Spyridium halmaturinum var. halmaturinum over Correa sp, Pultenaea acerosa, Beyeria lechenaultii, Eutaxia microphylla var. microphylla shrubs*	

Table 3- Native Vegetation Communities

Native Vegetation Clearance

The vegetation survey of the ten quadrats included a “BushRat” survey of each quadrat which has been used to develop a “Vegetation Condition Score” for each quadrat, Appendix 2. The Vegetation Condition Score within the “BushRAT Summary Scoresheet” has been used to compare the condition of each quadrat.

Quadrats 1 and 7 are located in cleared land and as a result have been excluded from determining the average “Vegetation Condition Score” for the native vegetation on the property. The condition of the native vegetation on the property has been determined to be “Moderate”, Table 4.

It is understood that a total of 0.8ha of native vegetation is proposed to be cleared as part of the proposal, which is approximately 1% of the total native vegetation on the property. The Native Vegetation Council Policy provides a ratio of clearance off-sets required based on the condition of the native vegetation to be cleared and if there is threatened species present, Appendix 3. Based on this information it is suggested that an off-set of 4:1 is appropriate.

As a result the set aside area required for the clearance is 3.2ha.
Using the payment formula, Appendix 3, the owners could choose to pay $3,209.60 to the Native Vegetation Fund.

Condition	Very poor	Poor	Moderate	Good	Excellent
Vegetation Condition Score	**<13**	**14-30**	**31-47**	**48-63**	**>64**
Q1			31		
Q2			32		
Q3			47		
Q4			41		
Q5			38		
Q6			39		
Q7		24			
Q8			32		
Q9			39		
Q10			44		
Average ex Q1 and Q7			**39**		

Table 4- Vegetation Condition Score

Native vegetation clearance associated with roadways and buildings, including fire related clearance, is exempt from requiring a set aside and as a result the set aside area can be reduced. The property owners may also modify the design of the proposal to reduce clearance requirements.

The proposed power transmission line will not require any native vegetation clearance as the proposed alignment is fully cleared of native vegetation, Figure 4. The proposed plan will however impact on the visual amenity of the area, Figure 5.

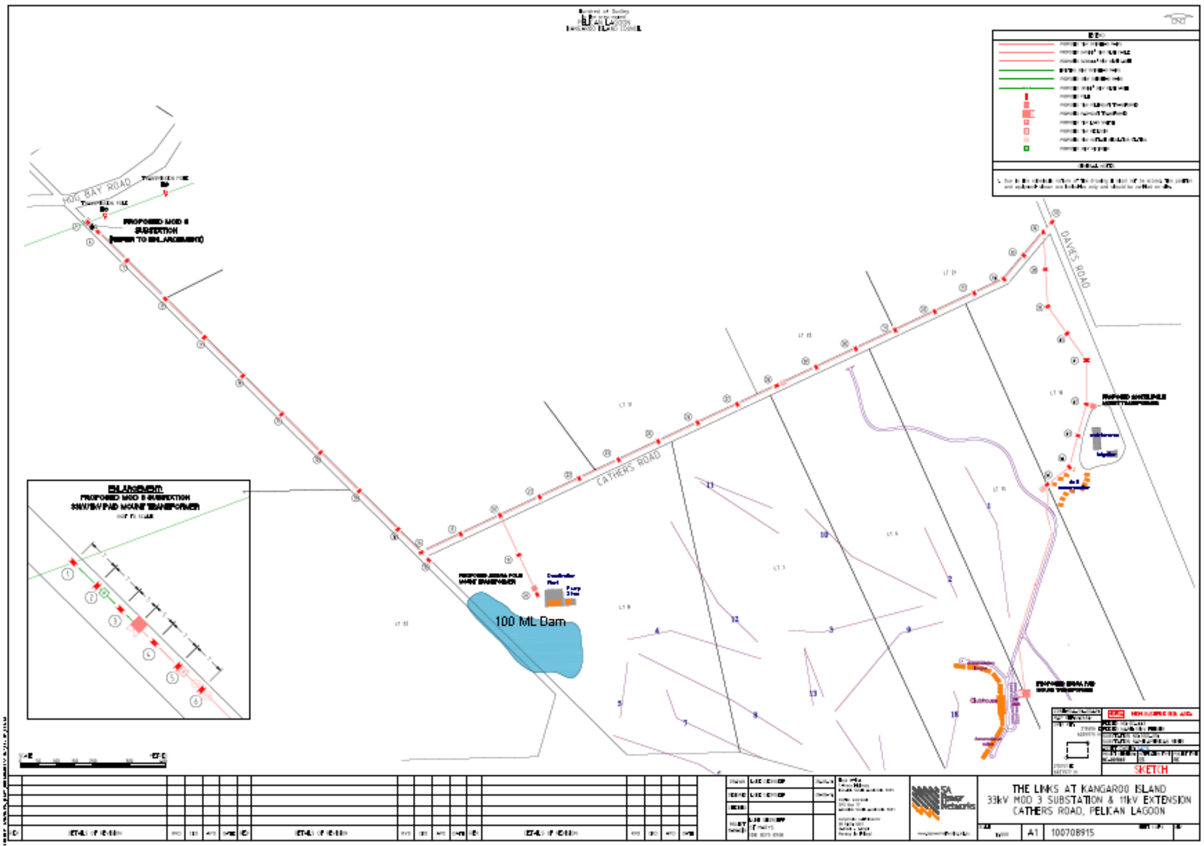

Figure 4- Proposed Power Transmission Line

Figure 5- Proposed Power Transmission Line Route along Cathers Road

The water supply lines should be constructed to avoid native vegetation clearance. The site for the proposed dam does not contain native vegetation, Figure 6.

Figure 6- Proposed Dam Site

Access to the property is along Davies Road from Hog Bay Road. Parts of this road are narrow and overgrown with native vegetation, Figure 7. The native vegetation will require clearance in accordance with the Kangaroo Island Council Roadside Vegetation Management Plan to enable construction and operational vehicles to access the site.

Figure 7- Davies Road

Native Vegetation Rehabilitation

The “BushRat” assessment of each of the quadrats indicated that high grazing pressure corresponds with low plant species diversity and regeneration. The grazing pressure is related to the high density of kangaroos on the property.

Rehabilitation of the native vegetation on the property will require active management of the kangaroo population to be successful. The kangaroo population however, is high in the area generally, not just the property, as a result culling of the population on the property will not achieve the desired outcome. The establishment of the golf course, ie green grass, and permanent water will also attract kangaroos to the site.

Exclusion of kangaroos to areas, or all, of the property will be required to enable the native vegetation to rehabilitate and increase biodiversity. Following the reduction in the kangaroo population it will be possible to introduce active native vegetation rehabilitation programs such as the introduction of fire and/or direct revegetation programs.

Locally it has been shown that kangaroos do not eat *Vittadinia australasica var. australasica,* Sticky New Holland Daisy. As the population of *Vittadinia* increases the population of kangaroo’s decreases. Trial plantings of *Vittadinia* could be undertaken in conjunction with other native plants to determine if this is a successful form of rehabilitation.

Native Vegetation Clearance Mitigation

The proposal for the Kangaroo Island Golf Course Resort proposes to clear approximately 1% of the native vegetation on the property, or 0.8ha of 65ha of the native vegetation. This amount of clearance is considered of little significance at the property scale and even smaller at the landscape scale.

Subject to the proposal meeting the requirements of the *Native Vegetation Act 1991* and the Native Vegetation Council the proposal will have a very minimal impact on native vegetation.

The native vegetation removal could be reduced if the proposal was modified in the following ways-

1. The proposed entrance road way be relocated along existing tracks rather than through the native vegetation. This however would require a rearrangement of Golf Fairways 1 and 2.
2. Reconfigure the private allotments (1-5) so that the "Private Villas" can all be located on cleared land which will result in less distance between each villa. Of particular concern is the two villas proposed on Lot 1 as this is possibly the most diverse native vegetation on the property.
3. Relocate the "Driving Range", possibly where fairways 16 and 17 are currently proposed. This will result in to extra fairways required in the area near the dam.
4. Some minor adjustments of other fairways will reduce the incidental clearance proposed.

Management of Introduced Plant Species

The vegetation survey of the quadrats identified 18 introduced plant species within the quadrats of which 3 are proclaimed, Table 5. It was generally noted that many of the weed species were located in areas frequently occupied by kangaroos.

Scientific Name	Common Name	Proclaimed
Aira sp.		
Anagallis arvensis	Scarlet Pimpernel	
Asparagus asparagoides f. asparagoides	Bridal Creeper	Yes
Asphodelus fistulosus	Onion Weed	
Avena barbata	Wild Oats	
Bromus diandrus	Great Brome	
Bromus hordeaceus	Soft Brome	
Diplotaxis tenuifolia	Lincoln Weed	Yes
Ehrharta longifolia	Veldt Grass	
Hypochaeris glabra	Smooth Catsear	
Lagurus ovata	Hare's Tail Grass	
Lycium ferocissimum	African Boxthorn	Yes
Medicago sp.	Medic	
Melilotus sp.	Meliot	
Sonchus oleraceus	Common Sow-thistle	
Tribolium sp.	Desmazeria	
Trifolium sp.	Clover	
Vulpia sp.	Fescue	

Table 5- Introduced Plant Species

To prevent the spread of species associated with the management of the golf course especially the grasses for fairways, tees and greens it is recommended that the grasses not be allowed to produce seed heads. If seed is produced the kangaroos will transport it into the native vegetation where the grass may colonise. It is also recommended a "spray" surround be established around the areas planted with golf course grass to prevent creeping into the native vegetation.

Landscape areas should be planted with locally indigenous plant species to prevent the escape of garden varieties to the surrounding native vegetation.

The quadrat survey, if undertaken annually, will determine if the management practices adopted are successful.

It is therefore recommended that the proponents of the proposed Kangaroo Island Golf Course Resort develop an integrated introduced plant control and native vegetation rehabilitation program that controls, and where possible eradicates introduced (especially proclaimed) plants, prevents the escape of golf course grasses and revegetates landscaped areas with locally indigenous plant species.

FAUNA

The property where the proposed Kangaroo Island Golf Course Resort is proposed to be established, and the surrounding area, has a high density of kangaroos. The area is used extensively by tour operators for viewing kangaroos.

Fauna Survey Methodology

Ten remote cameras were placed on the property of the proposed Kangaroo Island Golf Course Resort over an 8 day period between 14 and 22 October 2014 for a total of 1696 hours, Figure 8.

Appendix 4 provides the results of the remote camera deployment. Each camera was placed approximately 300mm above the ground in an attempt to minimise capture of kangaroos. Cameras were placed in locations overlooking areas that were used by mammals such as “game trails”.

Each camera was programmed to take three rapid-fire photos following detection of motion, followed by 1 minute pause before commencing detection of further motion. This setting was used to minimise multiple detection of individuals. The number of individuals in each three rapid-fire frames was recorded as a “trigger”.

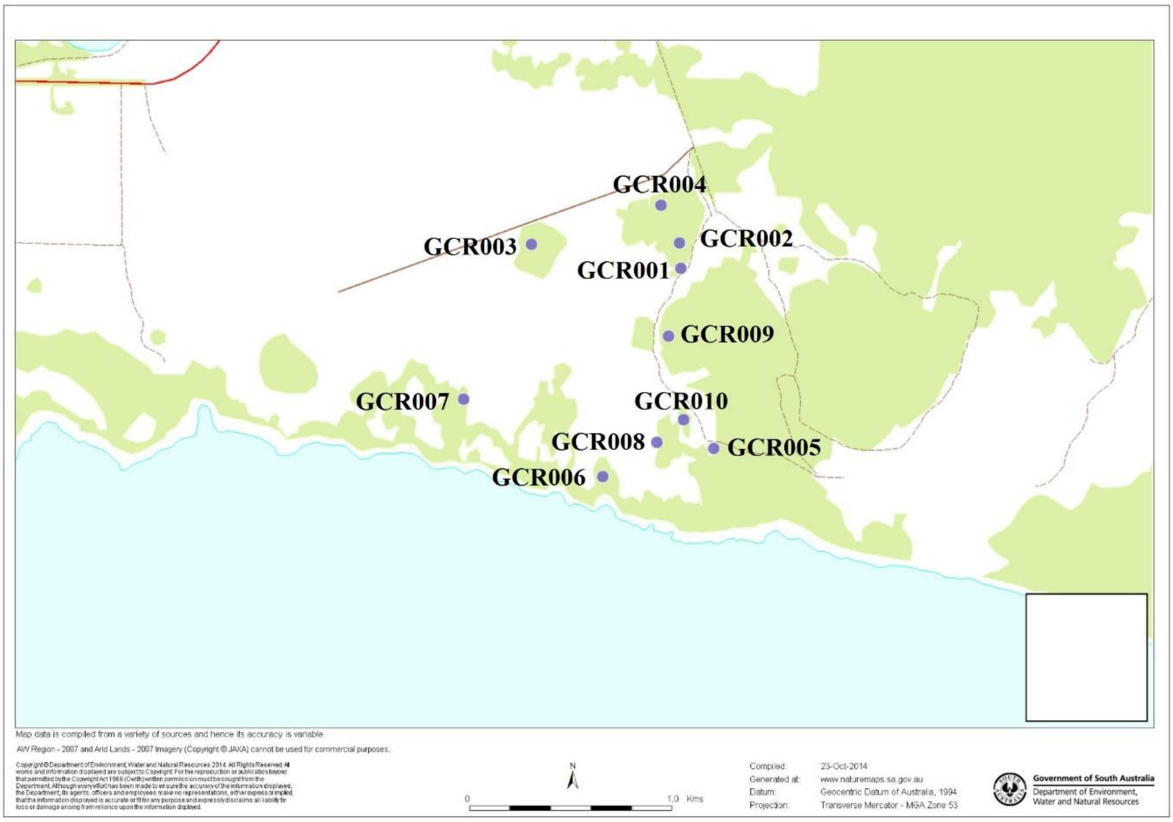

Figure 8- Remote Camera Locations

Envisage Environmental Services conducted a bird survey of the area on 19 October 2014 using the "Area Search" methodology. Four Areas were identified on the property of approximately 3-5 hectares in size and were surveyed for up to 1 hour depending on the number of birds observed, Figure 9. Opportunistic sightings of birds on or near the property were also recorded. The species observed and the number of each species was recorded.

The areas identified to be searched were of varying habitats and in locations where plant species were flowering to assist in maximising the results. Appendix 5 provides the detailed results of the bird survey.

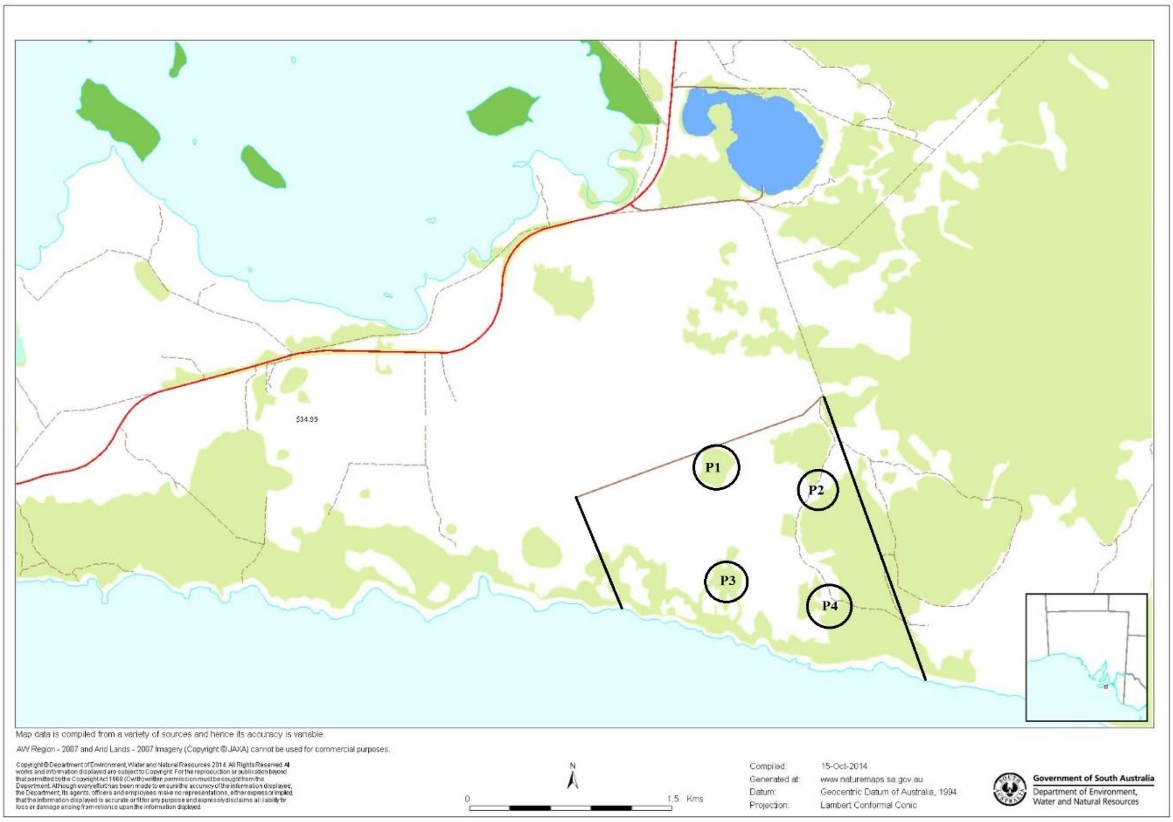

Figure 9- Bird Survey Areas

Fauna Populations

The property where the proposed Kangaroo Island Golf Course Resort is proposed to be established was assessed to determine the potential for fauna species listed under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act*. The *EPBC Act* "on-line tool" was utilised to determine potential terrestrial fauna species on the property. Coordinates from the centre of the property with a 2km buffer were used to provide the "EPBC Act Protected Matters Report" on 14 August 2014.

The "EPBC Act Protected Matters report" was cross reference with *Baxter 1995* and *Gillam 2014* to determine the likelihood of the terrestrial fauna species being recorded on or utilising the property, Table 6. Fauna species that are exclusively marine, such as whales and fish, have been eliminated from this analysis as the project will not impact on these species.

Scientific Name	Common Name	EPBC Act Status	Likelihood
BIRDS			
Botaurus poiciloptilus	Australasian Bittern	Endangered	Only 3 KI Records
Calyptorhynchus lathami halmaturinus	Glossy Black Cockatoo	Endangered	No potential Habitat
Diomedea epomophora epomophora	Southern Royal Albatross	Vulnerable	Mostly offshore sightings
Diomedea epomophora sanfordi	Northern Royal Albatross	Endangered	Mostly offshore sightings
Diomedea exulans antipodensis	Antipodean Albatross	Vulnerable	
Diomedea exulans exulans	Tristan Albatross	Endangered	
Diomedea exulans (sensu lato)	Wandering Albatross	Vulnerable	Mostly offshore sightings
Macronectes giganteus	Southern Giant-Petrel	Endangered	Mostly offshore sightings
Macronectes halli	Northern Giant-Petrel	Vulnerable	Mostly offshore sightings
Rostratula australis	Australian Painted Snipe	Endangered	
Sternula nereis nereis	Australian Fairy Tern	Vulnerable	Not recorded in area
Thalassarche cauta cauta	Shy Albatross	Vulnerable	Mostly offshore sightings
Thalassarche cauta steadi	White-capped Albatross	Vulnerable	
Thalassarche melanophris	Black-browed Albatross	Vulnerable	Mostly offshore sightings
Thalassarche melanophris impavida	Campbell Albatross	Vulnerable	
MAMMALS			
Isoodon obesulus obesulus	Southern Brown Bandicoot (Eastern)	Endangered	Sightings close by
Neophoca cinerea	Australia Sea-lion	Vulnerable	No potential habitat
Sminthopsis aitkeni	Kangaroo Island Dunnart	Endangered	No potential habitat (*Gates 2009)*

Table 6- Potential EPBC Act Terrestrial Fauna Species

The analysis of the potential *EPBC Act* Terrestrial Fauna occurring on the property determined that the Southern Brown Bandicoot (Eastern), *Isoodon obesulus obesulus,* has the potential to occur on the property as sighting have occurred in close proximity to the property in similar vegetation communities, Figure 10.

Southern Brown Bandicoots prefer to live in areas with thick low vegetation. Many studies have been undertaken in various areas across Australia on how bandicoots respond to fire and other disturbances with varying results. *Paull (1999)* suggests that by approximately 5 years post fire, habitat reaches an optimum level for Southern Brown Bandicoots which is maintained until at least 10 years since fire. Given there has been no recorded fire on the property since at least 1954 and there is very little low vegetation, it is unlikely that bandicoots currently exist on the property.

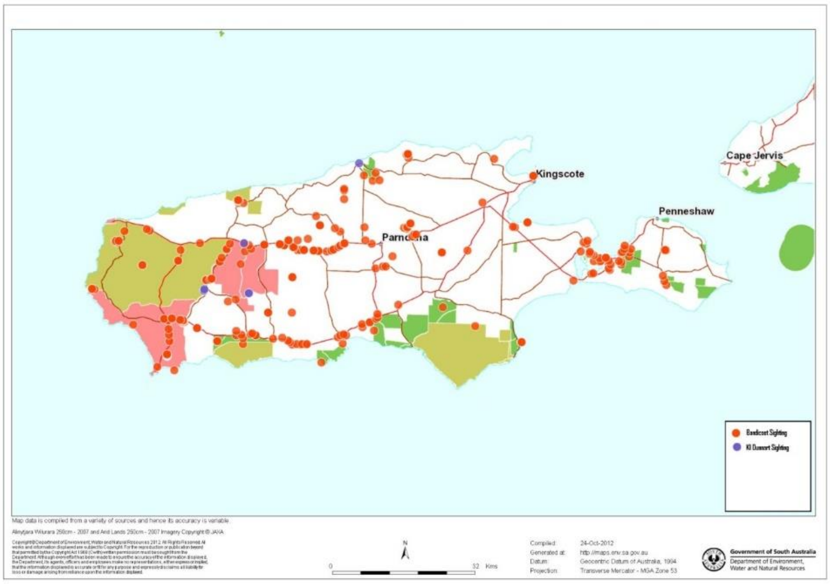

Figure 10- Records of Southern Brown Bandicoot and Kangaroo Island Dunnart on Kangaroo Island

The “EPBC Act Protected Matters Report” was further analysed to consider other fauna species listed in the report. The following analysis excludes species considered above and species that are exclusive marine, Table 7.

Scientific Name	Common Name	Likelihood
BIRDS		
Apus pacificus	Fork-tailed Swift	Rarely recorded
Ardea alba	Great Egret	No potential habitat
Ardea ibis	Cattle Egret	Possible but generally no potential habitat
Arenaria interpres	Ruddy Turnstone	Possible on shoreline
Calidris acuminata	Sharp-tailed Sandpiper	Possible but generally no potential habitat
Calidris ruficollis	Red-necked Stint	Possible but generally no potential habitat
Gallinago hardwickii	Latham’s Snipe	No potential habitat
Haliaeetus leucogaster	White-bellied Sea-Eagle	No nest sites near property
Meropus ornatus	Rainbow Bee-eater	Records only near Kelly Hill Caves
Myiagra cyanoleuca	Satin Flycatcher	One record on KI
Pandion haliaetus	Osprey	Nest site close to property
Phalacrocorax fuscescens	Black-faced Cormorant	Possible but generally no potential habitat
Puffinus carneipes	Flesh-footed Shearwater	Mostly offshore sightings
Thinornis rubricollis rubricollis	Hooded Plover	No beach for breeding
MAMMALS		
Arctocephalus forsteri	New Zealand Fur-seal	No potential habitat
Arctocephalus pusillus	Australian Fur-seal	No potential habitat

Table 7- Other Fauna of *EPBC Act* Significance

The analysis of other fauna listed in the "EPBC Act Protected Matters Report" indicates that the Osprey is the primary species of concern.

The "Remote Camera" and the "Area Search" surveys identified the following fauna species utilising the property. Opportunistic sightings recorded while on-site are also listed, Table 8. There were two rare fauna species observed using the property during the survey periods.

Scientific Name	Common Name	Status (*Gillam 2014*)		
		Nat	**State**	**KI**
Acanthiza lineata	Striated Thornbill			LC
Acanthiza pusilla	Brown Thornbill			LC
Anthochaera carunculata	Red Wattlebird			LC
Anthus australis	Australian Pipet			LC
Aquila audax	Wedge-tailed Eagle			LC
Calamanthus (Hylacola) cautus	Shy Heathwren		R	RA
Corvus mellori	Little Raven			LC
Eolophus roseicapilla	Galah			LC
Gliciphila melanops	Tawney-crowned Honeyeater			NT
Gymnorhina tibicen	Australian Magpie			LC
Lichenostomus cratitius	Purple-gaped Honeyeater			LC
Malurus cyaneus	Superb Fairywren			LC
Phaps chalcoptera	Common Bronzewing			LC
Phylidonyris novaehollandiae	New Holland Honeyeater			LC
Phylidonyris pyrrhopterus	Crescent Honeyeater			LC
Rhipidura albiscapa	Grey Fantail			LC
Sericornis frontalis	White-browed Scrubwren			LC
Strepera versicolor	Grey Currawong			LC
Sturnus vulgaris	Common Starling	Introduced		
Turnix varius **	Painted Buttonquail		R	EN
Zosterops lateralis	Silvereye			LC
MAMMALS				
Felus domestica	Cat	Introduced		
Macropus eugenii decres	Tammar Wallaby			LC
Macropus fuliginosus	Western Grey Kangaroo			LC
Tachygklossus aculeatus	Short-beaked Echidna			NT
Trichosurus vulpecula	Common Brushtail Possum			LC
REPTILES				
Liopholis whitii	White's Skink			LC
Varanus rosenbergi	Heath Goanna		V	NT

** Known to occur in the area but not observed as part of the surveys

Table 8- Fauna Species Observed

Impacts on Fauna

The analysis of potential and observed fauna on the property of the proposed Kangaroo Island Golf Course Resort identified two mammal species and three bird species of potential concern that maybe impacted upon by the proposed development. Table 9 describes the impacts on these species

Species	Impacts
Shy Heathwren	• The clearance of native vegetation will impact on area available
Osprey	• Disturbance from noise during construction and operation • Aircraft noise
Painted Buttonquail	• The clearance of native vegetation will impact on area available
Southern Brown Bandicoot	• While unlikely to occur on the property at present, works will disturb population if in the area
Western Grey Kangaroo	• The proposal will assist in increasing the population by providing further food and water supply

Table 9- Impacts on Fauna Species of Concern

The proposed 100ML Storage Dam will attract wildlife and as a result will also be a hazard to wildlife. The dam design should incorporate measures to minimise the opportunity of wildlife to be trapped in the dam. Measures such as the following should be considered-

- Fencing kangaroos out of the site.
- If the dam is to be "plastic" lined then a roof or wildlife escape opportunities should be incorporated.

The power line infrastructure to be installed to the property will provide no greater hazard to wildlife than other power lines installed across Kangaroo Island.

Fauna Buffer Requirements

Based on the analysis undertaken on the proposed Kangaroo Island Golf Course Resort proposal, buffer distances from Osprey sites need to be considered. The "EPBC Act Referral" refers to an active and abandoned Osprey nest to the west of the proposed site. Table 10 details the distance from these nest sites to the key components of the proposal.

	Active Nest	Abandoned Nest
Proposed Dam	1,600m	800m
Closest proposed Golf Fairway	1,800m	700m
Closest proposed Built Infrastructure	2,600m	1,800m

Table 10- Distance from Osprey Nest

Ospreys at D'Estree Bay successfully nest extremely close to a road and visitor viewing area. The Osprey nest site close to the proposed development is relatively isolated and as a result the Ospreys that utilise this nest site will tolerate less disturbance and noise than at other sites.

Ospreys also can generally collect food within close proximity of the shoreline using cliffs and high branches as viewing areas before capturing the fish. Collection of food within close proximity of the nest site, when active, is critical for the success of the nesting.

The nesting period for Ospreys is generally from August to December. During this period excessive disturbance can reduce the nesting success especially if the disturbance is not a usual occurrence or is new. Ospreys will however become used to ongoing disturbance.

To reduce the impacts on the Osprey and to maximise the Osprey nesting success it is therefore recommended that no construction works occur within 2km of the active nest site and within 200m of the coastline during the breeding season.

Breeding seasons can vary from season to season so it will be important to determine the actual commencement of the breeding season when undertaking construction. Sometimes, but very rarely, the Ospreys may change nest sites or an additional pair may utilise an abandoned nest, it will therefore be important to also assess both the currently active and abandoned sites.

Natural Resources Kangaroo Island have developed a "Fly Neighbourly Policy" that incorporates appropriate aircraft buffers around sensitive wildlife sites. If the resort proposal is to include aircraft accessing the site on a regular basis, consultation with Natural Resources Kangaroo Island should occur.

Impacts on Nocturnal Fauna

The remote camera surveys generally identified that the kangaroos are most active during daylight hours or early morning and late afternoon. The Tammar Wallaby and Common Brushtail Possum were mostly active at night and stayed within the native vegetation.

On three occasions the remote cameras detected bats during the night.

The development is proposed to occur outside the areas habited by the majority of nocturnal animals and as a result the impact will be extremely minimal.

Road Impacts on Fauna

The primary fauna species likely to be impacted upon along the roads leading to and within the proposed Kangaroo Island Golf Course Resort road network is the kangaroos.

The proponents of the proposal should implement strict speed restrictions, including traffic control devises such as "humps", within the resort area and require all contractors to adhere to reduced speed limits while travelling along Davies Road.

The reduction in speed will also ensure other fauna species have a greater chance of avoiding impacts with vehicles.

Window Impacts on Fauna

Birds strike windows for three reasons-

1. Birds see a reflection of the trees, sky and landscape but do not see the window;
2. Lights attract the birds at night; and
3. Birds see their reflection, attacking it during breeding season.

To prevent birds striking windows the first place to commence is to design the windows so they do not reflect the landscape. This can be achieved by-

- Design the windows so they are slightly tilted downwards, slightly off vertical. The window as a result will reflect the ground and not the landscape.
- Install double-hung windows, which have the screen on the outside of the glass.

- Do not install windows directly behind each other, ie so it is possible to see in one window and out the next creating a light tunnel through the building.
- Cover the glass with a one-way transparent film that permits people on the inside to see out, but makes the window appear opaque on the outside.

During the operation phase of the resort and buildings the use of shutters and curtains will prevent bird strike, especially during the night.

RECOMENDATIONS

Following are the key recommendations of the outcomes of the PER- Environmental Brief-

1. Consider modifications to road access ways, allotment alignments, relocation of “Driving Range” and minor fairway adjustments to reduce native vegetation clearance.

2. Trial plantings of *Vittadinia australasica var. australasica* in conjunction with other native plants to determine if this reduces kangaroo browsing on revegetation areas.

3. Dam design should consider measures to reduce impacts on fauna.

4. No construction works occur within 2km of the active Osprey nest site and within 200m of the coastline during the breeding season.

5. Building designs should consider design aspects that assist in reducing bird strikes.

6. Undertake the flora and fauna surveys on the property on an annual basis, in the first instance, to monitor the effects of management change.

7. Develop an integrated introduced plant control and native vegetation rehabilitation program that controls, and where possible eradicates introduced (especially proclaimed) plants, prevents the escape of golf course grasses and revegetates landscaped areas with locally indigenous plant species.

8. An active kangaroo management program needs to be developed and implemented to manage the population, enable vegetation and landscape rehabilitation and to manage introduced plant species.

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APPENDIX 1- PER- ENVIRONMENTAL BRIEF

Flora	
Vegetation Survey Methodology	Outline survey methodology – timing –location-extent-methods-native vegetation accreditation. Establish appropriate number of quadrats to be used immediately around the proposed locations of built form, ie, the clubhouse, lodges, condominium, roads, possible clearance for golf construction. Use Heard and Channon's *"Guide to a Native Vegetation Survey (Agricultural Region): Using Biological Survey of South Australian Methodology".*
Rated Plant Species	Reference individual species recorded against the Commonwealth Department of the Environment and Heritage schedules of the *Environment Protection and Biodiversity Conservation Act 1999* and South Australia's *National Parks and Wildlife Act 1972* to assess for conservation status.
Native Vegetation Significance	Quantify and detail the extent, condition and significance of native vegetation (individual species and communities) that currently exist on-site and that would be preserved and, if appropriate, rehabilitated.
Native Vegetation Clearance	Quantify and detail the extent, condition and significance of native vegetation (individual species and communities) that will need to be cleared or disturbed during construction including ancillary clearing for the proposed development of residential allotments, walking trails, areas required for bushfire safety, golf fairway construction, and all infrastructure such as the water supply pipeline and power transmission line.
Native Vegetation Rehabilitation	Describe the ability of plant communities or individual species to recover, regenerate or be rehabilitated.
Native Vegetation Clearance Mitigation	Identify measures to minimise and mitigate vegetation clearance (including incorporating remnant stands in the layout design) and to compensate for the loss of native vegetation and habitat.
Management of Introduced Species	Describe the effect of introduced weed species and increased human habitation on native vegetation, before and after construction, including species that may originate from the golf course and landscaped areas.

Fauna	
Fauna Survey Methodology	Outline survey methodology, eg, avifauna survey – bird species and density to be determined using transect counts for habitats where clearance for building construction and access is proposed. Fauna survey must be conducted according to the requirements of the EPBC Act survey guidelines.
Fauna Description	Quantify and detail the abundance, condition and significance of native fauna populations that currently exist or may depend on habitat on site or along the routes of infrastructure for the proposal.
Impacts on Fauna	Describe direct and indirect impacts to fauna associated with the proposal, the extent of expected fauna and/or habitat loss or disturbance during the construction and operation phases (both on and around site) and the ability of communities and individual species to recover, especially for resident or migratory birds and threatened or significant species.
Fauna Buffer Requirements	Detail appropriate buffer distances that would be required for the construction and operational phases between the proposed development (including coastal access points) and threatened species, especially feeding areas, nesting sites and roosting sites.
Impacts on Nocturnal Fauna	Outline the effect of light and noise on nocturnal animals.
Road Impacts on Fauna	Outline the risk of road related fauna death and injury (including from construction vehicles).
Window Impacts on Fauna	Outline the risk of bird strike associated with any large glass windows.
Recommendations	
Make recommendations for the inclusion of specific management and mitigation measures to be incorporated in any Environmental Management Plan to be adhered to during construction and operational phases of the project.	

APPENDIX 2 BUSHRAT SURVEY RESULTS

NVBMU Biodiversity Rapid Assessment Summary Scoresheet

Date: 13/10/14	Latitude: 35° 50' 41"
Quadrat: 1	Longitude: 137° 48' 59"
Benchmark Vegetation Community: Anthropogenically altered lan	

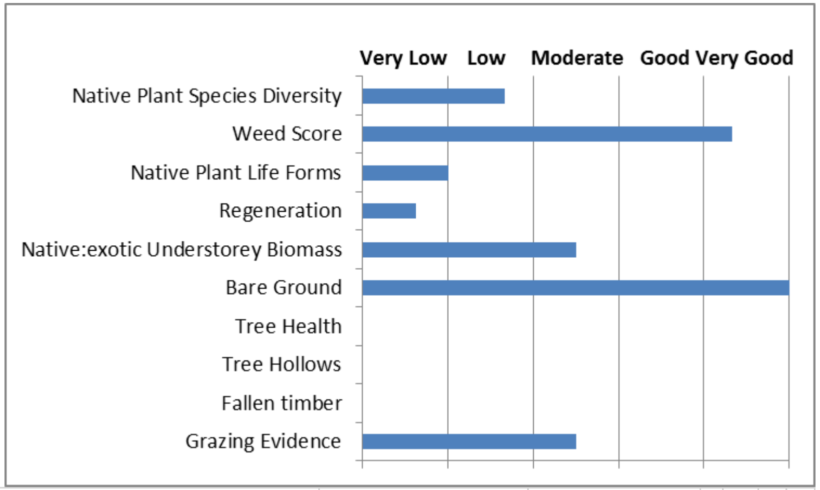
VEGETATION CONDITION SCORE (max in	score
Native Plant Species Diversity (15)	5
Weed Score (15)	13
Native Plant Life Forms (10)	2
Regeneration (8)	1
Native:exotic Understorey Biomass (10)	5
Bare Ground (3)	3
Tree Health (5)	
Tree Hollows (5)	
Fallen timber (5)	
Grazing Evidence (4)	2
TOTAL (ADD UP ALL POINTS)	31
If community is naturally treeless x TOTAL by 1.23	
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	31

CONSERVATION SIGNIFICANCE SCORE:	score
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E ecosystem/ecological	0
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E plant species present[2].	0
1 pt for each State-R, 2 pts for each State-V,	1 x r bird
3 pts for each State-E or Nationally-V, 4 pts	1 r seen
for each Nationally-E fauna species for which suitable habitat is present. Double points for a sighting. [3]	3
% native vegetation remaining in IBRA Assoc.	85%
0-2% = 5 pts; >2-5% = 4 pts; >5-10% = 3 pts; >10-20%= 2 pts; >20-50%= 1 pt; >50% = 0 pts	0
1 pt if Site contains a riparian zone,	
2 pts if contains swamp/wetland (+/- riparian zone)	0
CONSERVATION SIGNIFICANCE SCORE	3

LANDSCAPE CONTEXT SCORE	score
2 pts if site is the only substantial connection between 2 or more remnants[1] >20 ha, 1 pt if site is degraded (scattered trees in part, fragmented etc)	1
Site Shape Score	
3 pts if Cleared perimeter:Area (km/km²)<6, 2 pts if P:A 6 to<12, 1pt if P:A 12 to <18	0
Size of remnant[1] patch (incl. native veg on adjacent properties) score	
Patch size less than 2 ha 0 pts	
Patch size 2-5 ha 1 pt	
Patch size 5-10 ha 2 pts	
Patch size 10-20 ha 3 pts	
Patch size 20-100 ha 4 pts	
Patch size 100-500 ha 5 pts	
Patch size >500 ha 6 pts	0
Distance to remnant area of more than 50 hectares score	
>3km 0 pts	
1-3km 1 pt	
<1km 2 pts	
contiguous 3 pts	2
LANDSCAPE CONTEXT SCORE	3

Sum adjusted Vegetation Condition, Conservation significance and Landscape Context Scores for the UNIT BIODIVERSITY SCORE	37
Total Biodiversity Score (UBS x siz	3.33

Cleared perimeter(m)	Size(ha)	P:A Ratio	
0	0.09	0.00	
Total no. native species	Adjust for Spring[4]	Environmental Association	
8	6.4	Gantheaume	
Weed species (Top 5 Cover x Invasiveness, annuals in bold)	Cover (max 6)	Invasive Threat Category (max 5)	C x I
Asphodelus fistulosus	2	2	4
Avena barbarta	2	2	4
Diplotaxis tenuifolia	2	2	4
Erharta longifolia	2	2	4
Medicago sp.	2	2	4
		Total Cover x Threat Invasion	20



Vegetation Species List

Date: 13/10/14	Latitude: 35° 50' 41"
Quadrat: 1	Longitude: 137° 48' 59"

Sceintific Name	Common Name	Cover Abundance	Status N	SA	KI	IN
Acacia paradoxa	Kangaroo Thorn	5%			LC	
Acaena novae-zelandiae	Biddy Biddy	1%			LC	
Acrotriche patula	Prickly Ground-berry	25%			LC	
Annagallis arvensis	Scarlet pimpernel	1%				*
Asphodelus fistulosus	Onion Weed	5%				*
Austrostipa sp.	Spear grass	<1%				
Avena barbarta	Wild Oats	2%				*
Bromus diandrus	Great Brome	<1%				*
Clematis microphylla	Old Mans Beard	2%			NE	
Comesperma volubile	Love Creeper	<1%			LC	
Dichondra repens	Tomb Thumb	<1%			LC	
Diplotaxis tenuifolia	Lincoln Weed	2%				*
Erharta longifolia		1%				*
Lagurus ovata	Hare's Tail Grass	1%				*
Medicago sp.	Medic	1%				*
Pomaderris paniculosa ssp. paralia		<1%			LC	
Sonchus olerasicus	Common Sow-thistle	1%				*
Vittadinia australasica var. australasica	Sticky New Holland Daisy	1%			LC	

NVBMU Biodiversity Rapid Assessment Summary Scoresheet

Date: 13/10/14	Latitude: 35° 50' 33"
Quadrat: 2	Longitude: 137° 49' 18"
Benchmark Vegetation Community: Anthropogenically altered lar	

VEGETATION CONDITION SCORE (max in	score
Native Plant Species Diversity (15)	4
Weed Score (15)	15
Native Plant Life Forms (10)	1
Regeneration (8)	1
Native:exotic Understorey Biomass (10)	10
Bare Ground (3)	0
Tree Health (5)	
Tree Hollows (5)	
Fallen timber (5)	
Grazing Evidence (4)	1
TOTAL (ADD UP ALL POINTS)	32
If community is naturally treeless x TOTAL by 1.23	
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	32

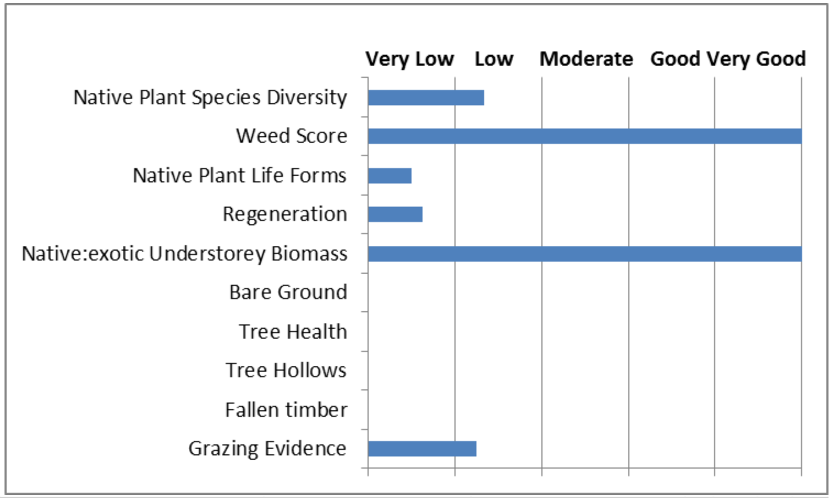
CONSERVATION SIGNIFICANCE SCORE:	score
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E ecosystem/ecological	0
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E plant species present[2].	0
1 pt for each State-R, 2 pts for each State-V, 3 pts for each State-E or Nationally-V, 4 pts for each Nationally-E fauna species for which suitable habitat is present. Double points for a sighting. [3]	1 x r bird 1 r seen 3
% native vegetation remaining in IBRA Assoc.	85%
0-2% = 5 pts; >2-5% = 4 pts; >5-10% = 3 pts; >10-20%= 2 pts; >20-50%= 1 pt; >50% = 0 pts	0
1 pt if Site contains a riparian zone, 2 pts if contains swamp/wetland (+/- riparian zone)	0
CONSERVATION SIGNIFICANCE SCORE	3

LANDSCAPE CONTEXT SCORE	score
2 pts if site is the only substantial **connection** between 2 or more remnants[1] >20 ha, 1 pt if site is degraded (scattered trees in part, fragmented etc)	2
Site Shape Score	
3 pts if Cleared perimeter:Area (km/km^2)<6, 2 pts if P:A 6 to<12, 1pt if P:A 12 to <18	0
Size of remnant[1] patch (incl. native veg on adjacent properties) score	
Patch size less than 2 ha 0 pts	
Patch size 2-5 ha 1 pt	
Patch size 5-10 ha 2 pts	
Patch size 10-20 ha 3 pts	
Patch size 20-100 ha 4 pts	
Patch size 100-500 ha 5 pts	
Patch size >500 ha 6 pts	1
Distance to remnant area of more than 50 hectares score	
>3km 0 pts	
1-3km 1 pt	
<1km 2 pts	
contiguous 3 pts	2
LANDSCAPE CONTEXT SCORE	5

Sum **adjusted Vegetation Condition, Conservation significance** and **Landscape Context Scores** for the

UNIT BIODIVERSITY SCORE	40
Total Biodiversity Score (UBS x siz	176

Cleared perimeter(m)	Size(ha)	P:A Ratio	
848	4.4	19.27	
Total no. native species	Adjust for Spring[4]	Environmental Association	
7	5.6	Gantheaume	
Weed species (Top 5 Cover x Invasiveness, annuals in bold)	Cover (max. 6)	Invasive Threat Category (max. 5)	C x I
Asparagus asparagoides f. asparagoides	1	5	5
Erharta longifolia	1	2	2
Lagurus ovata	1	2	2
Trifolium sp.	1	2	2
			0
		Total Cover x Threat Invasion	11



Vegetation Species List

Date: 13/10/14	Latitude: 35° 50' 33"
Quadrat: 2	Longitude: 137° 49' 18"

Sceintific Name	Common Name	Cover Abundance	Status			
			N	SA	KI	IN
Acacia paradoxa	Kangaroo Thorn	2%			LC	
Acrotriche patula	Prickly Ground-berry	2%			LC	
Asparagus asparagoides	Bridal Creeper	<1%				*
Austrostipa flavescens	Spear Grass	<1%				
Clematis microphylla	Old Man's Beard	<1%			NE	
Dianella sp.	Flax-lily	<1%			LC	
Erharta longifolia		<1%				*
Lagurus ovata	Hare's Tail Grass	<1%				*
Melaleuca lanceolata	Dryland Tea-tree	50%			LC	
Orthrosanthus multiflorus	Morning Flag	1%			LC	
Trifolium sp.	Clover	<1%				*

NVBMU Biodiversity Rapid Assessment Summary Scoresheet

Date: 13/10/14	**Latitude: 35° 50' 27"**
Quadrat: 3	**Longitude: 137° 49' 44"**
Benchmark Vegetation Community: KI 6	

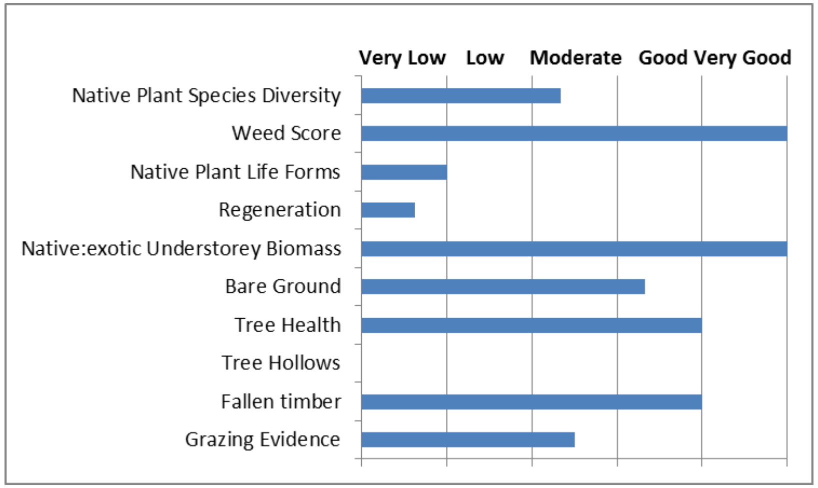
VEGETATION CONDITION SCORE (max. in	score
Native Plant Species Diversity (15)	7
Weed Score (15)	15
Native Plant Life Forms (10)	2
Regeneration (8)	1
Native:exotic Understorey Biomass (10)	10
Bare Ground (3)	2
Tree Health (5)	4
Tree Hollows (5)	0
Fallen timber (5)	4
Grazing Evidence (4)	2
TOTAL (ADD UP ALL POINTS)	47
If community is naturally treeless x TOTAL by 1.23	
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	47

CONSERVATION SIGNIFICANCE SCORE:	score
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E ecosystem/ecological	0
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E plant species present[2].	0
1 pt for each State-R, 2 pts for each State-V, 3 pts for each State-E or Nationally-V, 4 pts for each Nationally-E fauna species for which suitable habitat is present. Double points for a sighting. [3]	1 x r bird 1 r seen 3
% native vegetation remaining in IBRA Assoc.	85%
0-2% = 5 pts; 2-5% = 4 pts; >5-10% = 3 pts; >10-20%= 2 pts; >20-50%= 1 pt; >50% = 0 pts	0
1 pt if Site contains a riparian zone, 2 pts if contains swamp/wetland (+/- riparian zone)	0
CONSERVATION SIGNIFICANCE SCORE	3

LANDSCAPE CONTEXT SCORE	score
2 pts if site is the only substantial **connection** between 2 or more remnants[1] >20 ha, 1 pt if site is degraded (scattered trees in part, fragmented etc)	2
Site Shape Score	
3 pts if Cleared perimeter:Area (km/km^2)<6, 2 pts if P:A 6 to<12, 1pt if P:A 12 to <18	2
Size of remnant[1] patch (incl. native veg on adjacent properties) score	
Patch size less than 2 ha 0 pts	
Patch size 2-5 ha 1 pt	
Patch size 5-10 ha 2 pts	
Patch size 10-20 ha 3 pts	
Patch size 20-100 ha 4 pts	
Patch size 100-500 ha 5 pts	
Patch size >500 ha 6 pts	3
Distance to remnant area of more than 50 hectares score	
>3km 0 pts	
1-3km 1 pt	
<1km 2 pts	
contiguous 3 pts	2
LANDSCAPE CONTEXT SCORE	9

Sum **adjusted Vegetation Condition, Conservation significance** and **Landscape Context Scores** for the **UNIT BIODIVERSITY SCORE**	59
Total Biodiversity Score (UBS x siz	708

Cleared perimeter(m)	**Size(ha)**	**P:A Ratio**	
1428	12	11.90	
Total no. native species	**Adjust for Spring[4]**	**Environmental Association**	
13	10.4	Gantheaume	
Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max 6)	**Invasive Threat Category** (max 5)	**C x I**
Asparagus asparagoides	1	5	5
Trifolium sp.	1	2	2
Aira sp.	1	1	1
			0
			0
		Total Cover x Threat Invasion	8



Vegetation Species List

Date: 13/10/14	Latitude: 35° 50' 27"
Quadrat: 3	Longitude: 137° 49' 44"

Sceintific Name	Common Name	Cover Abundance	Status N	SA	KI	IN
Acrotriche patula	Prickly Ground-berry	1%			LC	
Aira sp.		1%				*
Asparagus asparagoides	Bridal Creeper	<1%				*
Austrostipa sp.	Spear Grass	<1%				
Cassytha melantha	Coarse Dodder-laurel	1%			LC	
Daucus glotchidiatus	Native Carrot	1%			LC	
Dodonaea humilis	Dwarf Hop-bush	<1%			LC	
Eucalyptus gracilis	Yorrell	10%			VU	
Eucalyptus rugosa	Coastal White Mallee	25%			LC	
Galium sp	Bedstraw	<1%				
Melaleuca lanceolata	Dryland Tea-tree	25%			LC	
Orthrosanthus multiflorus	Morning Flag	1%			LC	
Parietaria sp.	Nettle	<1%			LC	
Pterostylis sp.	Greenhood	<1%				
Trifolium sp.	Clover	1%				*
Vittadinia australasica var. australasica	Sticky New Holland Daisy	<1%			LC	

NVBMU Biodiversity Rapid Assessment Summary Scoresheet

Date: 13/10/14	Latitude: 35° 50' 38"
Quadrat: 4	Longitude: 137° 49' 54"
Benchmark Vegetation Community: KI 6	

VEGETATION CONDITION SCORE (max in	score
Native Plant Species Diversity (15)	3
Weed Score (15)	15
Native Plant Life Forms (10)	1
Regeneration (8)	0
Native:exotic Understorey Biomass (10)	10
Bare Ground (3)	3
Tree Health (5)	4
Tree Hollows (5)	0
Fallen timber (5)	2
Grazing Evidence (4)	3
TOTAL (ADD UP ALL POINTS)	41
If community is naturally treeless x TOTAL by 1.23	
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	41

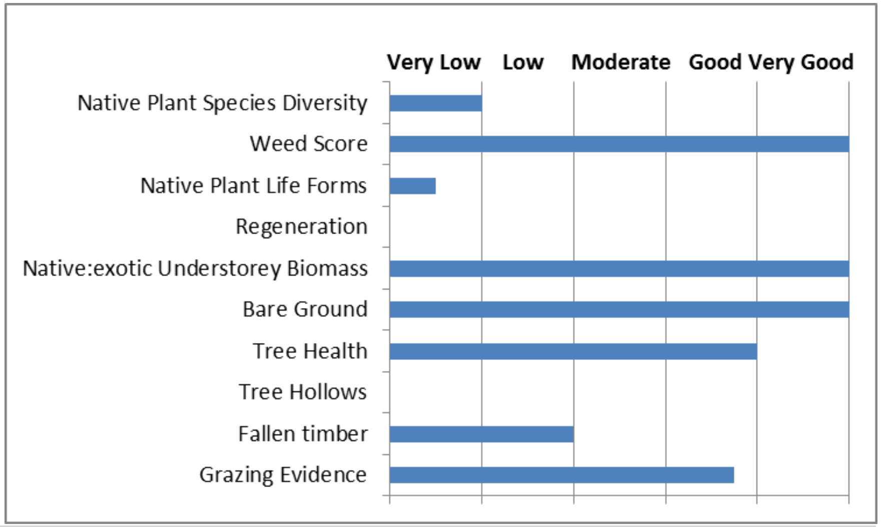
CONSERVATION SIGNIFICANCE SCORE:	score
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E ecosystem/ecological	0
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E plant species present[2].	0
1 pt for each State-R, 2 pts for each State-V,	1 x r bird
3 pts for each State-E or Nationally-V, 4 pts	1 r seen
for each Nationally-E fauna species for which suitable habitat is present. Double points for a sighting. [3]	3
% native vegetation remaining in IBRA Assoc.	85%
0-2% = 5 pts; >2-5% = 4 pts; >5-10% = 3 pts; >10-20%= 2 pts; >20-50%= 1 pt; >50% = 0 pts	0
1 pt if Site contains a riparian zone,	
2 pts if contains swamp/wetland (+/- riparian zone)	0
CONSERVATION SIGNIFICANCE SCORE	3

LANDSCAPE CONTEXT SCORE	score
2 pts if site is the only substantial **connection** between 2 or more remnants[1] >20 ha, 1 pt if site is degraded (scattered trees in part, fragmented etc)	2
Site Shape Score	
3 pts if Cleared perimeter:Area (km/km^2)<6, 2 pts if P:A 6 to<12, 1pt if P:A 12 to <18	3
Size of remnant[1] patch (incl. native veg on adjacent properties) score	
Patch size less than 2 ha 0 pts	
Patch size 2-5 ha 1 pt	
Patch size 5-10 ha 2 pts	
Patch size 10-20 ha 3 pts	
Patch size 20-100 ha 4 pts	
Patch size 100-500 ha 5 pts	
Patch size >500 ha 6 pts	4
Distance to remnant area of more than 50 hectares score	
>3km 0 pts	
1-3km 1 pt	
<1km 2 pts	
contiguous 3 pts	3
LANDSCAPE CONTEXT SCORE	12

Sum **adjusted Vegetation Condition, Conservation significance** and **Landscape Context Scores** for the

UNIT BIODIVERSITY SCORE	56
Total Biodiversity Score (UBS x siz	4816

Cleared perimeter(m)	Size(ha)	P:A Ratio	
5124	86	5.96	
Total no. native species	Adjust for Spring[4]	Environmental Association	
6	4.8	Gantheaume	
Weed species (Top 5 Cover x Invasiveness, annuals in bold)	Cover (max 6)	Invasive Threat Category (max 5)	C x I
			0
			0
			0
			0
			0
		Total Cover x Threat Invasion	0



Vegetation Species List

Date: 13/10/14	Latitude: 35° 50' 38"
Quadrat: 4	Longitude: 137° 49' 54"

Sceintific Name	Common Name	Cover Abundance	Status N	SA	KI	IN
Cassytha melantha	Coarse Dodder-laurel	1%			LC	
Eucalyptus gracilis	Yorrell	10%			VU	
Eucalyptus oleosa ssp. amplinata	Red Mallee	10%			RA	
Eucalyptus rugosa	Coastal White Mallee	20%			LC	
Melaleuca lanceolata	Dryland Tea-tree	25%			LC	
Poaceae sp.		<1%				

NVBMU Biodiversity Rapid Assessment Summary Scoresheet

Date: 13/10/14	Latitude: 35° 50' 45"
Quadrat: 5	Longitude: 137° 49' 45"
Benchmark Vegetation Community: KI 6	

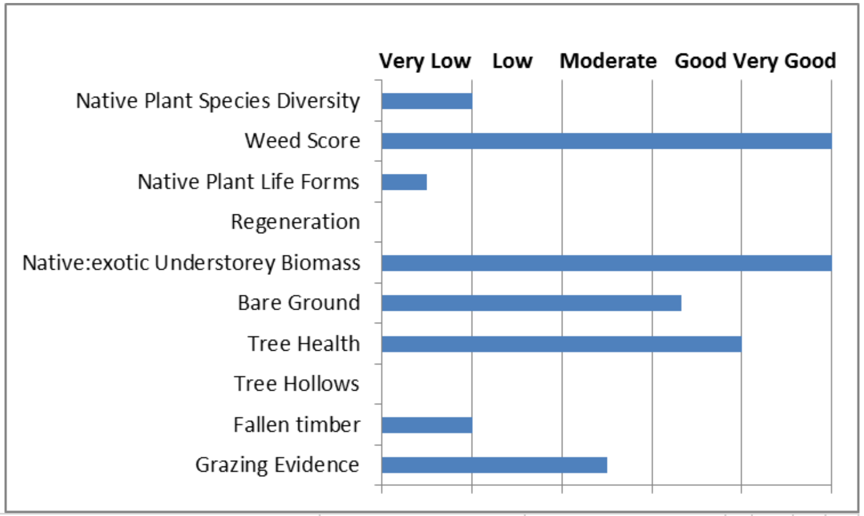
VEGETATION CONDITION SCORE (max in	score
Native Plant Species Diversity (15)	3
Weed Score (15)	15
Native Plant Life Forms (10)	1
Regeneration (8)	0
Native:exotic Understorey Biomass (10)	10
Bare Ground (3)	2
Tree Health (5)	4
Tree Hollows (5)	0
Fallen timber (5)	1
Grazing Evidence (4)	2
TOTAL (ADD UP ALL POINTS)	38
If community is naturally treeless x TOTAL by 1.23	
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	38

CONSERVATION SIGNIFICANCE SCORE:	score
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E ecosystem/ecological	0
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E plant species present[2].	0
1 pt for each State-R, 2 pts for each State-V,	1 x r bird
3 pts for each State-E or Nationally-V, 4 pts for each Nationally-E fauna species for which suitable habitat is present. Double points for a sighting. [3]	1 r seen 3
% native vegetation remaining in IBRA Assoc.	85%
0-2% = 5 pts; >2-5% = 4 pts; >5-10% = 3 pts; >10-20%= 2 pts; >20-50%= 1 pt; >50% = 0 pts	0
1 pt if Site contains a riparian zone, 2 pts if contains swamp/wetland (+/- riparian zone)	0
CONSERVATION SIGNIFICANCE SCORE	3

LANDSCAPE CONTEXT SCORE	score
2 pts if site is the only substantial connection between 2 or more remnants[1] >20 ha, 1 pt if site is degraded (scattered trees in part, fragmented etc)	2
Site Shape Score	
3 pts if Cleared perimeter:Area (km/km^2)<6, 2 pts if P:A 6 to<12, 1pt if P:A 12 to <18	3
Size of remnant[1] patch (incl. native veg on adjacent properties) score	
Patch size less than 2 ha 0 pts	
Patch size 2-5 ha 1 pt	
Patch size 5-10 ha 2 pts	
Patch size 10-20 ha 3 pts	
Patch size 20-100 ha 4 pts	
Patch size 100-500 ha 5 pts	
Patch size >500 ha 6 pts	4
Distance to remnant area of more than 50 hectares score	
>3km 0 pts	
1-3km 1 pt	
<1km 2 pts	
contiguous 3 pts	3
LANDSCAPE CONTEXT SCORE	12

Sum adjusted Vegetation Condition, Conservation significance and Landscape Context Scores for the UNIT BIODIVERSITY SCORE	53
Total Biodiversity Score (UBS x siz	4558

Cleared perimeter(m)	Size(ha)	P:A Ratio	
5124	86	5.96	
Total no. native species	Adjust for Spring[4]	Environmental Association	
4	3.2	Gantheaume	
Weed species (Top 5 Cover x Invasiveness, annuals in bold)	Cover (max. 6)	Invasive Threat Category (max. 5)	C x I
			0
			0
			0
			0
			0
		Total Cover x Threat Invasion	0



Vegetation Species List

Date: 13/10/14	Latitude: 35° 50' 45"
Quadrat: 5	Longitude: 137° 49' 45"

Sceintific Name	Common Name	Cover Abundance	Status			
			N	SA	KI	IN
Eucalyptus gracilis	Yorrell	10%			VU	
Eucalyptus oleosa ssp. amplinata	Red Mallee	10%			RA	
Eucalyptus rugosa	Coastal White Mallee	5%			LC	
Melaleuca lanceolata	Dryland Tea-tree	10%			LC	

NVBMU Biodiversity Rapid Assessment Summary Scoresheet

Date: 13/10/14	Latitude: 35° 50' 50"
Quadrat: 6	Longitude: 137° 49' 57"
Benchmark Vegetation Community: KI 6	

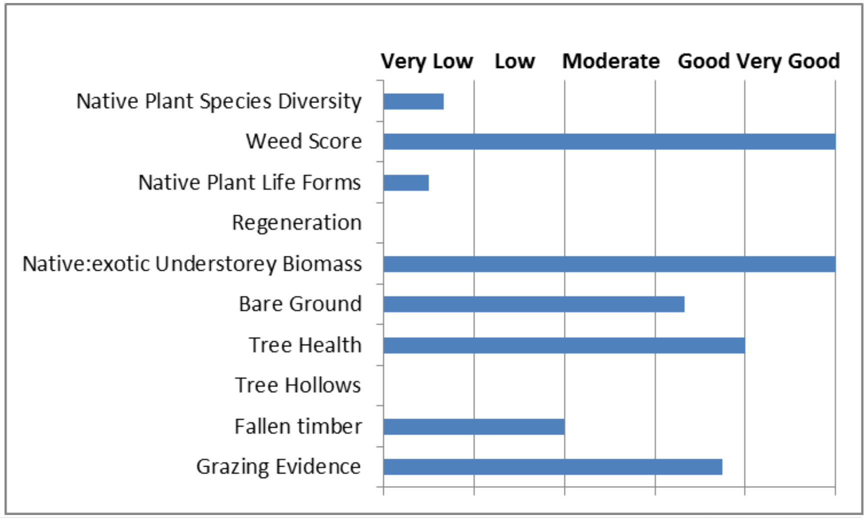
VEGETATION CONDITION SCORE (max in	score
Native Plant Species Diversity (15)	2
Weed Score (15)	15
Native Plant Life Forms (10)	1
Regeneration (8)	0
Native:exotic Understorey Biomass (10)	10
Bare Ground (3)	2
Tree Health (5)	4
Tree Hollows (5)	0
Fallen timber (5)	2
Grazing Evidence (4)	3
TOTAL (ADD UP ALL POINTS)	39
If community is naturally treeless x TOTAL by 1.23	
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	39

CONSERVATION SIGNIFICANCE SCORE:	score
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E ecosystem/ecological	0
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E plant species present[2].	0
1 pt for each State-R, 2 pts for each State-V, 3 pts for each State-E or Nationally-V, 4 pts for each Nationally-E fauna species for which suitable habitat is present. Double points for a sighting. [3]	1 x r bird 1 r seen 3
% native vegetation remaining in IBRA Assoc.	85%
0-2% = 5 pts; >2-5% = 4 pts; >5-10% = 3 pts; >10-20%= 2 pts; >20-50%= 1 pt; >50% = 0 pts	0
1 pt if Site contains a riparian zone, 2 pts if contains swamp/wetland (+/- riparian zone)	0
CONSERVATION SIGNIFICANCE SCORE	3

LANDSCAPE CONTEXT SCORE	score
2 pts if site is the only substantial connection between 2 or more remnants[1] >20 ha, 1 pt if site is degraded (scattered trees in part, fragmented etc)	2
Site Shape Score	
3 pts if Cleared perimeter:Area (km/km ^{2})<6, 2 pts if P:A 6 to<12, 1pt if P:A 12 to <18	3
Size of remnant[1] patch (incl. native veg on adjacent properties) score	
Patch size less than 2 ha 0 pts	
Patch size 2-5 ha 1 pt	
Patch size 5-10 ha 2 pts	
Patch size 10-20 ha 3 pts	
Patch size 20-100 ha 4 pts	
Patch size 100-500 ha 5 pts	
Patch size >500 ha 6 pts	4
Distance to remnant area of more than 50 hectares score	
>3km 0 pts	
1-3km 1 pt	
<1km 2 pts	
contiguous 3 pts	3
LANDSCAPE CONTEXT SCORE	12

Sum **adjusted Vegetation Condition, Conservation significance** and **Landscape Context Scores** for the UNIT BIODIVERSITY SCORE	54
Total Biodiversity Score (UBS x siz	4644

Cleared perimeter(m)	Size(ha)	P:A Ratio	
5124	86	5.96	
Total no. native species	Adjust for Spring[4]	Environmental Association	
3	2.4	Gantheaume	
Weed species (Top 5 Cover x Invasiveness, annuals in bold)	Cover (max. 6)	Invasive Threat Category (max. 5)	C x I
			0
			0
			0
			0
			0
		Total Cover x Threat Invasion	0



Vegetation Species List

Date: 13/10/14	Latitude: 35° 50' 50"
Quadrat: 6	Longitude: 137° 49' 57"

Sceintific Name	Common Name	Cover Abundance	Status			
			N	SA	KI	IN
Cassytha melantha	Coarse Dodder-laurel	1%			LC	
Eucalyptus rugosa	Coastal White Mallee	50%			LC	
Melaleuca lanceolata	Dryland Tea-tree	25%			LC	

NVBMU Biodiversity Rapid Assessment Summary Scoresheet

Date:	Latitude: 35° 50' 55"
Quadrat: 7	Longitude: 137° 49' 39"
Benchmark Vegetation Community: Paddock, assessed against Cc	

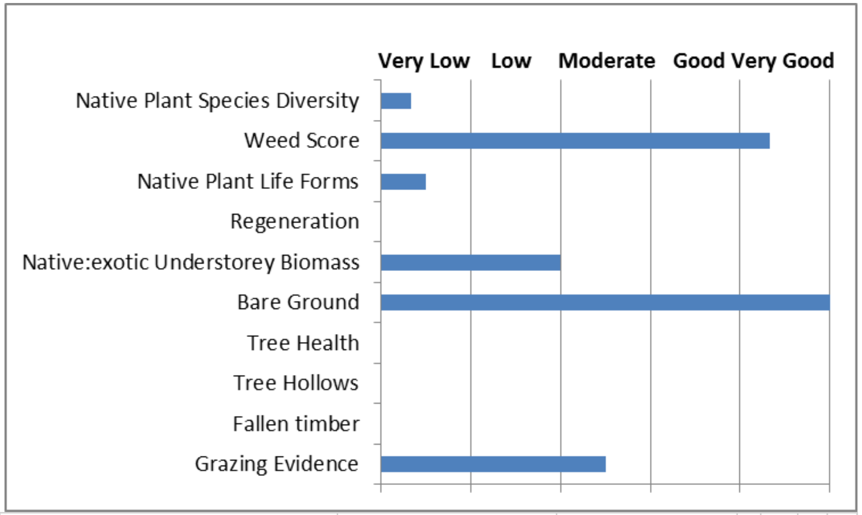
VEGETATION CONDITION SCORE (max in	score
Native Plant Species Diversity (15)	1
Weed Score (15)	13
Native Plant Life Forms (10)	1
Regeneration (8)	0
Native:exotic Understorey Biomass (10)	4
Bare Ground (3)	3
Tree Health (5)	0
Tree Hollows (5)	0
Fallen timber (5)	0
Grazing Evidence (4)	2
TOTAL (ADD UP ALL POINTS)	24
If community is naturally treeless x TOTAL by 1.23	
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	24

CONSERVATION SIGNIFICANCE SCORE:	score
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E ecosystem/ecological	0
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E plant species present[2].	0
1 pt for each State-R, 2 pts for each State-V,	1 x r bird
3 pts for each State-E or Nationally-V, 4 pts for each Nationally-E fauna species for which suitable habitat is present. Double points for a sighting. [3]	1 r seen 3
% native vegetation remaining in IBRA Assoc.	85%
0-2% = 5 pts; >2-5% = 4 pts; >5-10% = 3 pts; >10-20%= 2 pts; >20-50%= 1 pt; >50% = 0 pts	0
1 pt if Site contains a riparian zone, 2 pts if contains swamp/wetland (+/- riparian zone)	0
CONSERVATION SIGNIFICANCE SCORE	3

LANDSCAPE CONTEXT SCORE	score
2 pts if site is the only substantial connection between 2 or more remnants[1] >20 ha, 1 pt if site is degraded (scattered trees in part, fragmented etc)	1
Site Shape Score 3 pts if Cleared perimeter:Area (km/km^2)<6, 2 pts if P:A 6 to<12, 1pt if P:A 12 to <18	0
Size of remnant[1] patch (incl. native veg on adjacent properties) score Patch size less than 2 ha 0 pts Patch size 2-5 ha 1 pt Patch size 5-10 ha 2 pts Patch size 10-20 ha 3 pts Patch size 20-100 ha 4 pts Patch size 100-500 ha 5 pts Patch size >500 ha 6 pts	0
Distance to remnant area of more than 50 hectares score >3km 0 pts 1-3km 1 pt <1km 2 pts contiguous 3 pts	2
LANDSCAPE CONTEXT SCORE	3

Sum adjusted Vegetation Condition, Conservation significance and Landscape Context Scores for the UNIT BIODIVERSITY SCORE	30
Total Biodiversity Score (UBS x siz	2.7

Cleared perimeter(m)	Size(ha)	P:A Ratio	
0	0.09	0.00	
Total no. native species	Adjust for Spring[4]	Environmental Association	
1	0.8	Gantheaume	
Weed species (Top 5 Cover x Invasiveness, annuals in bold)	Cover (max. 6)	Invasive Threat Category (max. 5)	C x I
Diplotaxis tenuifolia	3	2	6
Asphodelus fistulosus	3	2	6
Avena barbata	2	2	4
Vulpia sp.	2	2	4
Hypochaeris glabra	2	2	4
		Total Cover x Threat Invasion	24



Vegetation Species List

Date: 20/10/14	Latitude: 35° 50' 55"
Quadrat: 7	Longitude: 137° 49' 39"

Sceintific Name	Common Name	Cover Abundance	Status N	SA	KI	IN
Asphodelus fistulosus	Onion Weed	10%				*
Avena barbata	Wild Oats	5%				*
Bromus diandrus	Great Brome	10%				*
Bromus hordeaceus	Soft Brome	1%				*
Diplotaxis tenuifolia	Lincoln Weed	10%				*
Hypochaeris glabra	Smooth Catsear	1%				*
Lagurus ovatus	Hare's Tail Grass	1%				*
Medicago sp.	Medic	1%				*
Vittadinia australasica var. australasica	Sticky New Holland Daisy	40%			LC	
Vulpia sp.	Fescue	3%				*

NVBMU Biodiversity Rapid Assessment Summary Scoresheet

Date: 210/10/14	Latitude: 35° 51' 0"
Quadrat: 8	Longitude: 137° 49' 22"
Benchmark Vegetation Community: KI 8.2	

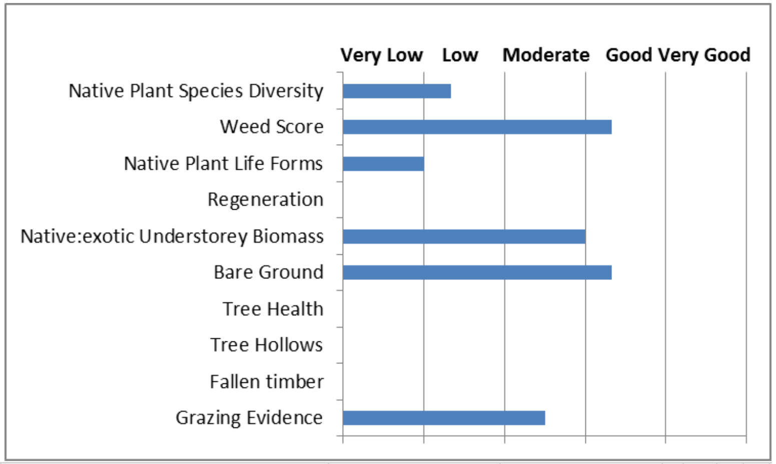
VEGETATION CONDITION SCORE (max in	score
Native Plant Species Diversity (15)	4
Weed Score (15)	10
Native Plant Life Forms (10)	2
Regeneration (8)	0
Native:exotic Understorey Biomass (10)	6
Bare Ground (3)	2
Tree Health (5)	0
Tree Hollows (5)	0
Fallen timber (5)	0
Grazing Evidence (4)	2
TOTAL (ADD UP ALL POINTS)	26
If community is naturally treeless x TOTAL by 1.23	1.23
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	32

CONSERVATION SIGNIFICANCE SCORE:	score
2 pts for each State-R, 4 pts for each State-V,	
6 pts for each State-E or Nationally-V, 8 pts for	
each Nationally-E ecosystem/ecological	0
2 pts for each State-R, 4 pts for each State-V,	
6 pts for each State-E or Nationally-V, 8 pts for	
each Nationally-E plant species present[2].	0
1 pt for each State-R, 2 pts for each State-V,	1 x r bird
3 pts for each State-E or Nationally-V, 4 pts	1 r seen
for each Nationally-E fauna species for which	
suitable habitat is present. Double points for a	
sighting. [3]	3
% native vegetation remaining in IBRA Assoc.	85%
0-2% = 5 pts; >2-5% = 4 pts; >5-10% = 3 pts;	
>10-20%= 2 pts; >20-50%= 1 pt; >50% = 0 pts	0
1 pt if Site contains a riparian zone,	
2 pts if contains swamp/wetland (+/- riparian zone)	0
CONSERVATION SIGNIFICANCE SCORE	3

LANDSCAPE CONTEXT SCORE	score
2 pts if site is the only substantial	
connection between 2 or more remnants[1]	
>20 ha, 1 pt if site is degraded	
(scattered trees in part, fragmented etc)	2
Site Shape Score	
3 pts if Cleared perimeter:Area (km/km^2)<6,	
2 pts if P:A 6 to<12, 1pt if P:A 12 to <18	1
Size of remnant[1] patch (incl. native	
veg on adjacent properties) score	
Patch size less than 2 ha 0 pts	
Patch size 2-5 ha 1 pt	
Patch size 5-10 ha 2 pts	
Patch size 10-20 ha 3 pts	
Patch size 20-100 ha 4 pts	
Patch size 100-500 ha 5 pts	
Patch size >500 ha 6 pts	2
Distance to remnant area of more than	
50 hectares score	
>3km 0 pts	
1-3km 1 pt	
<1km 2 pts	
contiguous 3 pts	3
LANDSCAPE CONTEXT SCORE	8

Sum **adjusted Vegetation Condition, Conservation significance** and **Landscape Context Scores** for the	
UNIT BIODIVERSITY SCORE	42.98
Total Biodiversity Score (UBS x size)	300.9

Cleared perimeter(m)	Size(ha)	P:A Ratio	
1148	7	16.40	
Total no. native species	Adjust for Spring[4]	Environmental Association	
9	7.2	Gantheaume	
Weed species (Top 5 Cover x Invasiveness, annuals in bold)	Cover (max 6)	Invasive Threat Category (max 5)	C x I
Asparagus asparagoides f. asparagoides	2	2	4
Diplotaxis tenuifolia	2	2	4
Lagurus ovatus	2	2	4
Asphodelus fistulosus	2	2	4
Avena barbata	2	2	4
		Total Cover x Threat Invasion	20



Vegetation Species List

Date: 20/10/14	35° 51' 0"
Quadrat: 8	Longitude: 137° 49' 45"

Sceintific Name	Common Name	Cover Abundance	Status N	SA	KI	IN
Acacia longifolia ssp. sophorae	Coastal Wattle	5%			LC	
Acrotriche patula	Prickly Ground-Berry	5%			LC	
Aira sp.	Hair Grass	<1%				*
Annagallis arvensis	Scarlet Pimpernel	<1%				*
Asparagus asparagoides f. asparagoides	Bridal Creeper	3%				*
Asphodelus fistulosus	Onion Weed	2%				*
Avena barbata	Wild Oats	1%				*
Bromus diandrus	Great Brome	1%				*
Clematis microphylla	Old Man's Beard	5%			LC	
Comesperma volubile	Love Creeper	1%			LC	
Diplotaxis tenuifolia	Lincoln Weed	2%				*
Eutaxia microphylla	Common Eutaxia	5%			LC	
Geranium potentilloides var. potentilloides	Downy Geranium	<1%			NT	
Lagurus ovatus	Hare's Tail Grass	5%				*
Leucopogon parviflorus	Coast Beard-Heath	25%			LC	
Medicago sp.	Medic	<1%				*
Melilotus sp.	Melilot	<1%				*
Olearia axillaris	Coast Daisy-bush	25%			LC	
Orthrosanthus multiflorus	Morning Flag	5%			LC	
Sonchus olerasicus	Common Sow-Thistle	<1%				*
Triboliumsp.	Desmazeria	<1%				*

NVBMU Biodiversity Rapid Assessment Summary Scoresheet

Date: 20/10/14	Latitude: 35° 51' 4"
Quadrat:	Longitude: 137° 49' 45"
Benchmark Vegetation Community: KI 8.2	

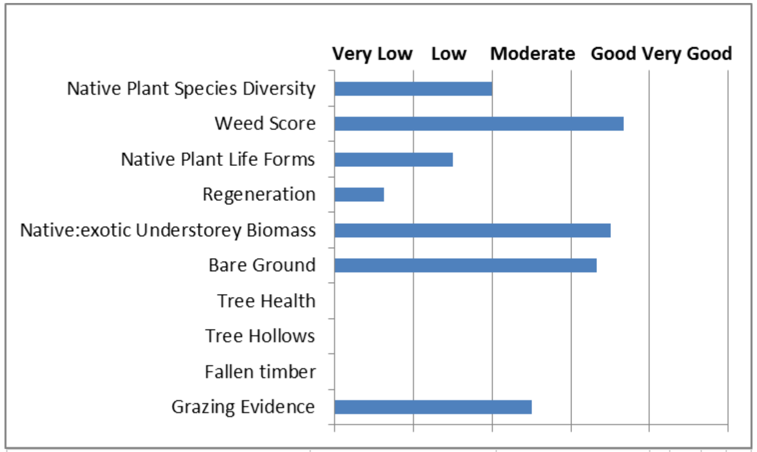
VEGETATION CONDITION SCORE (max. in	score
Native Plant Species Diversity (15)	6
Weed Score (15)	11
Native Plant Life Forms (10)	3
Regeneration (8)	1
Native:exotic Understorey Biomass (10)	7
Bare Ground (3)	2
Tree Health (5)	0
Tree Hollows (5)	0
Fallen timber (5)	0
Grazing Evidence (4)	2
TOTAL (ADD UP ALL POINTS)	32
If community is naturally treeless x TOTAL by 1.23	1.23
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	39

CONSERVATION SIGNIFICANCE SCORE:	score
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E ecosystem/ecological	0
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E plant species present[2].	0
1 pt for each State-R, 2 pts for each State-V, 3 pts for each State-E or Nationally-V, 4 pts for each Nationally-E fauna species for which suitable habitat is present. Double points for a sighting. [3]	1 x r bird 1 r seen 3
% native vegetation remaining in IBRA Assoc.	85%
0-2% = 5 pts; >2-5% = 4 pts; >5-10% = 3 pts; >10-20%= 2 pts; >20-50%= 1 pt; >50% = 0 pts	0
1 pt if Site contains a riparian zone, 2 pts if contains swamp/wetland (+/- riparian zone)	0
CONSERVATION SIGNIFICANCE SCORE	3

LANDSCAPE CONTEXT SCORE	score
2 pts if site is the only substantial **connection** between 2 or more remnants[1] >20 ha, 1 pt if site is degraded (scattered trees in part, fragmented etc)	2
Site Shape Score 3 pts if Cleared perimeter:Area (km/km^2)<6, 2 pts if P:A 6 to<12, 1pt if P:A 12 to <18	0
Size of remnant[1] patch (incl. native veg on adjacent properties) score	
Patch size less than 2 ha 0 pts	
Patch size 2-5 ha 1 pt	
Patch size 5-10 ha 2 pts	
Patch size 10-20 ha 3 pts	
Patch size 20-100 ha 4 pts	
Patch size 100-500 ha 5 pts	
Patch size >500 ha 6 pts	1
Distance to remnant area of more than 50 hectares score	
>3km 0 pts	
1-3km 1 pt	
<1km 2 pts	
contiguous 3 pts	3
LANDSCAPE CONTEXT SCORE	6

Sum **adjusted Vegetation Condition, Conservation significance** and **Landscape Context Scores** for the UNIT BIODIVERSITY SCORE	48.36
Total Biodiversity Score (UBS x size	145.1

Cleared perimeter(m)	Size(ha)		P:A Ratio	
761	3		25.37	
Total no. native species	Adjust	for Spring[4]	Environmental Association	
14	11.2		Gantheaume	
Weed species (Top 5 Cover x Invasiveness, annuals in bold)	Cover (max 6)		Invasive Threat Category (max. 5)	C x I
Diplotaxis tenuifolia	2		2	4
Lycium ferocissimum	2		3	6
Asparagus asparagoides f. asparagoides	1		2	2
Asphodelus fistulosus	2		2	4
Medicago sp.	1		2	2
			Total Cover x Threat Invasion	18



Vegetation Species List

Date: 20/10/14	Latitude: 35° 51' 4"
Quadrat: 9	Longitude: 137° 49' 45"

Sceintific Name	Common Name	Cover Abundance	Status N	SA	KI	IN
Acacia triquetra	Mallee Wreath Wattle	20%			LC	
Acrotriche patula	Prickly Ground-Berry	20%			LC	
Annagallis arvensis	Scarlet Pimpernel	<1%				*
Asparagus asparagoides f. asparagoides	Bridal Creeper	1%				*
Asphodelus fistulosus	Onion Weed	5%				*
Austrostipa flavecens	Spear-grass	<1%			LC	
Bromus diandrus	Great Brome	<1%				*
Clematis microphylla	Old Man's Beard	3%			LC	
Correa reflexa var. insularis	Round-leaf Correa	2%			NT	
Diplotaxis tenuifolia	Lincoln Weed	5%				*
Eutaxia microphylla	Common Eutaxia	1%			LC	
Lagurus ovatus	Hare's Tail Grass	1%				*
Lasiopetalum discolor	Coast Velvet-Bush	10%			LC	
Leucopogon parviflorus	Coast Beard-Heath	3%			LC	
Lycium ferocissimum	African Boxthorn	3%				*
Medicago sp.	Medic	1%				*
Melaleuca gibbosa	Slender Honey-myrtle	1%			LC	
Olearia axillaris	Coast Daisy-Bush	10%			LC	
Orthrosanthus multiflorus	Morning Flag	5%			LC	
Rhagodia candolleana ssp. candolleana	Sea-berry Saltbush	1%			LC	
Sonchus olerasicus	Common Sow-thistle	<1%				*
Veronica hillerbrandii	Rigid Speedwell	<1%			LC	
Vittadinia australasica var. australasica	Sticky New Holland Daisy	1%			LC	

NVBMU Biodiversity Rapid Assessment Summary Scoresheet

Date: 20/10/14	Latitude: 35° 51' 9"
Quadrat: 10	Longitude: 137° 49' 55"
Benchmark Vegetation Community: KI 8.6	

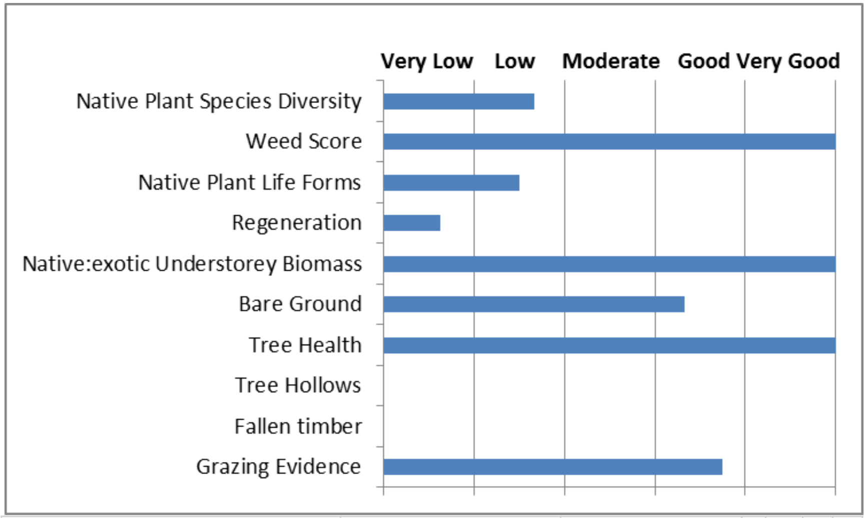
VEGETATION CONDITION SCORE (max in	score
Native Plant Species Diversity (15)	5
Weed Score (15)	15
Native Plant Life Forms (10)	3
Regeneration (8)	1
Native:exotic Understorey Biomass (10)	10
Bare Ground (3)	2
Tree Health (5)	5
Tree Hollows (5)	0
Fallen timber (5)	0
Grazing Evidence (4)	3
TOTAL (ADD UP ALL POINTS)	44
If community is naturally treeless x TOTAL by 1.23	
If community is not benchmarked for regen x 1.11	
ADJUSTED TOTAL SCORE	44

CONSERVATION SIGNIFICANCE SCORE:	score
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E ecosystem/ecological	0
2 pts for each State-R, 4 pts for each State-V, 6 pts for each State-E or Nationally-V, 8 pts for each Nationally-E plant species present[2].	0
1 pt for each State-R, 2 pts for each State-V, 3 pts for each State-E or Nationally-V, 4 pts for each Nationally-E fauna species for which suitable habitat is present. Double points for a sighting.[3]	1 x r bird 1 r seen 3
% native vegetation remaining in IBRA Assoc.	85%
0-2% = 5 pts; >2-5% = 4 pts; >5-10% = 3 pts; >10-20%= 2 pts; >20-50%= 1 pt; >50% = 0 pts	0
1 pt if Site contains a riparian zone, 2 pts if contains swamp/wetland (+/- riparian zone)	0
CONSERVATION SIGNIFICANCE SCORE	3

LANDSCAPE CONTEXT SCORE	score
2 pts if site is the only substantial connection between 2 or more remnants[1] >20 ha, 1 pt if site is degraded (scattered trees in part, fragmented etc)	2
Site Shape Score	
3 pts if Cleared perimeter:Area (km/km^2)<6, 2 pts if P:A 6 to<12, 1pt if P:A 12 to <18	3
Size of remnant[1] patch (incl. native veg on adjacent properties) score	
Patch size less than 2 ha 0 pts	
Patch size 2-5 ha 1 pt	
Patch size 5-10 ha 2 pts	
Patch size 10-20 ha 3 pts	
Patch size 20-100 ha 4 pts	
Patch size 100-500 ha 5 pts	
Patch size >500 ha 6 pts	4
Distance to remnant area of more than 50 hectares score	
>3km 0 pts	
1-3km 1 pt	
<1km 2 pts	
contiguous 3 pts	3
LANDSCAPE CONTEXT SCORE	12

Sum **adjusted Vegetation Condition, Conservation significance** and **Landscape Context Scores** for the **UNIT BIODIVERSITY SCORE**	59
Total Biodiversity Score (UBS x siz	5074

Cleared perimeter(m)	Size(ha)		P:A Ratio	
5124	86		5.96	
Total no. native species	**Adjust**	**for Spring[4]**	**Environmental Association**	
12	9.6		Gantheaume	
Weed species (Top 5 Cover x Invasiveness, annuals in bold)	**Cover** (max 6)		**Invasive Threat Category** (max 5)	**C x I**
Lagurus ovatus	1		2	2
Melilotus sp.	1		2	2
				0
				0
				0
			Total Cover x Threat Invasion	4



Vegetation Species List

Date: 20/10/14	Latitude: 35° 51' 9"
Quadrat: 10	Longitude: 137° 49' 55"

Sceintific Name	Common Name	Cover Abundance	Status			
			N	SA	KI	IN
Acacia triquetra	Mallee Wreath Wattle	5%			LC	
Acrotriche patula	Prickly Ground-berry	3%			LC	
Austrostipa flavescens	Spear-grass	<1%			LC	
Dianella brevicaulis	Short-stem Flax-lily	<1%			LC	
Eucalyptus diversifolia ssp. diversifolia	Coastal White Mallee	40%			LC	
Lagurus ovatus	Hare's Tail Grass	<1%				*
Lasiopetalum discolor	Coast Velvet Bush	3%			LC	
Melaleuca lanceolata	Dryland Tea-tree	40%			LC	
Melilotus sp.	Meliot	<1%				*
Olearia axillaris	Coast Daisy-bush	<1%			LC	
Orthrosanthus multiflorus	Morning Flag	1%			LC	
Senecio odoratus	Scented Groundsel	2%			LC	
Veronica hillerbrandii	Rigid Speedwell	<1%			LC	
Vittadinia australasica var. australasica	Sticky New Holland Daisy	<1%			LC	

APPENDIX 3- NATIVE VEGETATION COUNCIL SEB POLICY

The following guidelines are to be used to determine the area of set-aside (SEB – Significant Environmental Benefit area) required where the "*Scattered Tree SEB Interim Guidelines*" do not apply:

Where proposed clearance is considered to be minor and of limited biodiversity impact, eg lopping of overhanging limbs only or minor clearance of shrubs in areas otherwise considered as highly disturbed:

No SEB area

Where proposed clearance is in areas dominated by introduced species, the area of native vegetation is largely reduced to scattered trees, indigenous understorey flora reduced to scattered clumps and individual plants:

SEB area to be based on an area of: 2:1

Where the proposed clearance is of mostly intact overstorey vegetation but there is still considerable weed infestation amongst the understorey flora:

SEB area to be based on an area of: 4:1

Where the proposed clearance is of mostly intact overstorey vegetation with moderate but not severe weed infestation amongst the understorey flora. Clearance is **not** seriously at variance with the Principles:

SEB area to be based on an area of: 6:1

Where the proposed clearance is of mostly intact overstorey and understorey vegetation, weed infestation is moderate to low, but the original vegetation is still dominant. Clearance is assessed by the Native Vegetation Council to be at variance with the Principles:

SEB area to be based on an area of: 8:1

Where the proposed clearance is of diverse vegetation with very little weed infestation. Clearance is assessed by the Native Vegetation Council to be seriously at variance with the Principles:

SEB area to be based on an area of: 10:1

Property owners have the choice to either set aside an area of native vegetation as an offset for the clearance in accordance with the above guidelines or make a payment to the Native Vegetation Fund. The following formula is used to determine the payment-

Payment formula – Clearance Applications, Regs other than 5(1)(a) and (ab)

PAYMENT = (SEB area [ha] x land value [$ per ha]) + (area to be cleared [ha] x management costs [$800 per ha])

ie for this proposal

PAYMENT = (3.2ha x $803/ha) + (0.8ha x $800/ha) = $3,209.60

APPENDIX 4 REMOTE CAMERA RESULTS

Remote Camera Results

Settings

	Sensitivity	Pics per Trigger		Picture Interval		Quiet Period	Camera Height			
	Very High		3		Rapid Fire	1 Minute		~300mm		

	GCR001	**GCR002**	**GCR003**	**GCR004**	**GCR005**	**GCR006**	**GCR007**	**GCR008**	**GCR009**	**GCR010**	**Total**
Install Date	14/10/2014	14/10/2014	14/10/2014	14/10/2014	14/10/2014	14/10/2014	14/10/2014	14/10/2014	14/10/2014	14/10/2014	
Remove Date	22/10/2014	22/10/2014	22/10/2014	22/10/2014	22/10/2014	22/10/2014	22/10/2014	22/10/2014	22/10/2014	22/10/2014	
Hours Active	192	133	192	192	192	144	75	192	192	192	1696
Zone	53H	53H	53H	53H	53H	53H	53H	53H	53H	53H	
Lattitude	755575	755571	754820	755476	755743	755180	754476	755454	755515	755591	
Longitude	6029721	6029849	6029842	6030041	6028808	6028665	6029058	6028840	6029377	6028955	
Results (Triggers)											
Western Grey Kangarc	170	96	112	6	59	2	13	106	60	78	702
Tamar Walaby	3	1	76		65			4		3	152
Brush Tailed Possum	1				12	1			4	1	19
Cat	1				2			1		1	5
Australian Magpie							2		1		3
Bat								3			3
Echidna					1						1
Little Raven						1				1	2
Silvereye						1					1

APPENDIX 5 BIRD SURVEY RESULTS

Bird Area Search

Date: 19/10/14

Patch	P1	P2	p3	P4	Opportunistic
Wegde-tailed Eagle					1
Australasian Pipit					2
Australian Magpie					3
Australian Raven		1		1	
Brown Thornbill		5			
Common Bronzewing					1
Common Starling	3				
Crescent Honeyeater			2		
Galah				2	
Little Raven		5			
Purple-gaped Honeyeater		3	2		
Tawny-crowned Honeyeater		1			
New Holland Honeyeater			1		
Red Wattlebird		1	2		
Silvereye	10	10	5	20	
Striated Thornbill	3	20			
Superb Fairywren	20		7	10	
Shy Heathwren		2			
White-browed Scrubwren				5	
Grey Currawong		2			
Grey fantail		1			
White's Skink burrows		2			
General Opportunistic Sightings (other than above) at other times					
Quail (unknown species)					2
Wegde-tailed Eagle					8
Heath Goanna burrows					

Appendix L -

EBS Ecology (Ecologist and Cultural Heritage consultant)

Kangaroo Island Golf Course Development

Ecology and Heritage Assessment

Kangaroo Island Golf Course Development Ecology and Heritage Assessment

22 January 2015

Version 3

Prepared by EBS Group for Programmed Turnpoint

Document Control					
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CITATION: EBS Group (2015) *Kangaroo Island Golf Course Development Ecology and Heritage Assessment.* Report to Programmed Turnpoint. EBS Ecology, Adelaide.

Front cover photo: View looking south-west over Coastal Mallee veg association 11: *Eucalyptus rugosa* +/- *Eucalyptus albopurpurea* over *Melaleuca lanceolata.*

ABBREVIATION OF TERMS

AHA	Aboriginal Heritage Act 1988 (SA)
BDBSA	Biological Databases of South Australia
DEWNR	Department of Environment, Water and Natural Resources
DSD-AAR	Department of State Development, Aboriginal Affairs and Reconciliation
DPTI	Department of Planning, Transport and Infrastructure
DOE	Australian Government Department of the Environment
EBS	Environmental Biodiversity Services
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
IBRA	Interim Biogeographical Regionalisation of Australia
GIS	Geographic Information System
GPS	Global Positioning System
KI	Kangaroo Island
NPW Act	*National Parks and Wildlife Act 1972*
NRMB	Natural Resource Management Board
NRM Act	*Natural Resources Management Act 2004*
BTA	Native Title Act 1993 (Commonwealth)
NV Act	*Native Vegetation Act 1991*
NVC	Native Vegetation Council
PER	Public Environmental Report
SA	South Australia
SAM	South Australian Museum
SEB	Significant Environmental Benefit
ssp.	subspecies
spp.	species (plural)
TEC	Threatened Ecological Community
WONS	Weed of National Significance (as listed by the Australian Government)

EXECUTIVE SUMMARY

EBS assessed the proposed Kangaroo Island Golf Course Development to identify the ecological and heritage constraints for the project.

Native vegetation

Approximately 140 ha (64%) of the project area contains native vegetation. Eleven vegetation associations were recorded, with the dominant broad associations being tall shrubland, mallee woodland and low shubland. The condition of the vegetation ranged from excellent (SEB 9:1) to very poor (SEB 0:1), with the average condition being moderate (SEB 5:1 to 6:1). Vegetation associations dominated by *Eucalyptus rugosa* (Coastal White Mallee) (i.e. vegetation associations 5 and 11) are considered regionally rare.

Native vegetation clearance

The design of the Masterplan has been an iterative approach. Programmed Turnpoint took onboard a number of previous recommendations made by EBS Ecology and revised the Masterplan to reduce the required native vegetation clearance.

A total of 14.14 ha containing native vegetation (i.e. of SEB 1:1 or greater) is within the proposed development footprint. Should all native vegetation within the proposed development footprint require clearance, the maximum SEB offset requirement is: **70.01 ha** or **$67,527** payment into the Native Vegetation Fund. The SEB calculations are summarised in Table 19.

Flora

One threatened flora species was recorded within the project area during the field survey: *Eucalyptus phenax* subsp. *compressa* (Kangaroo Island Mallee), rated rare in SA. The species was of scattered occurrence within Mallee vegetation association 5. One state rare species, *Caladenia sanguinea* (Crimson Daddy-long-legs) is considered as possibly occurring.

Fauna

Three threatened fauna species were recorded in the project area:

- Heath Goanna (*Varanus rosenbergi*) – vulnerable in SA
- Common Brushtail Possum (*Trichosurus vulpecular*) – rare in SA
- Scarlet Robin (*Petroica boodang*) – subspecies may be considered threatened.

Other threatened fauna species are known along the coast, in close proximity to the project area:

- Hooded Plover (*Thinornis rubricollis*) – vulnerable in SA

- Sooty Oystercatcher (*Haematopus fuliginosus*) – rare in SA
- Osprey (*Pandion haliaetus*) – endangered in SA.

The following additional threatened fauna species are considered as having the potential to occur within the project area, based on nearby records and habitat suitability:

- Southern Brown Bandicoot (SA mainland and KI ssp) (*Isoodon obesulus obesulus*) – nationally endangered
- Southern Emuwren (Kangaroo Island ssp) (*Stipiturus malachurus halmaturinus*) – rare in SA
- Shy Heathwren (*Calamanthus (Hylacola) cautus*) – rare in SA
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*) – EPBC Act migratory and endangered in SA, possible flyover
- Cattle Egret (*Ardea ibis*) – rare in SA, possible flyover.

A number of EPBC Act migratory bird species are also known or likely to occur along the coast.

In general, if vegetation clearance is minimised, the direct impact to the above species is considered to be neglible. Of concern is the potential indirect impact on coastal birds, in particular Osprey, White-bellied Sea-Eagle and shorebirds, associated with the increased human activity.

A major consideration for the project is the management of high kangaroo numbers and grazing pressure, which is likely to increase with the increased availability of feed and water under an irrigated golf course scenario.

Key recommendations are summarised as follows (see Section 10 for further detail):

- Finalise the infrastructure layout and the native vegetation clearance requirement. Once infrastructure locations are finalised, seek advice from the Commonwealth Department of the Environment and consider submitting an EPBC referral with respect to the matters of national significance;
- Seek approval from the NVC regarding the vegetation clearance that is required and provide an appropriate SEB offset and management plan;
- Avoid the clearance of native vegetation and trees where possible and where alternative options are available;
- micro-site infrastructure components to minimise damage and removal of native vegetation across the site (refer to vegetation association/condition maps);
- Implement an environmental management plan for the site as well as develop (in conjunction with DEWNR and adjoining landholders), a Kangaroo Management Plan;

- Implement a buffer zone of at least 1 km between construction zones and known active Osprey nests, and discourage general activity within 1 km of known nests during sensitive breeding times;
- Implement a buffer zone of at least 2 km between construction zones and active White-bellied Sea Eagle nests;
- Implement a buffer zone of at least 200 m between construction zones and the coast during the breeding season of coastal raptors, to prevent disturbance;
- Where possible, buffer areas of native remnant vegetation from future development; a buffer zone of 100 m is recommended as best practice, to prevent further degradation from surrounding influences and allow for restoration;
- Select appropriate stockpile areas/machinery parking areas and general lay down areas (if required) where no clearance/damage to native vegetation will be required;
- Adopt best practice environmental management measures during construction and operation; and
- Implement speed limit restrictions (day and night) and limit vehicle activity at night to prevent fauna road kill.

Heritage

EBS Heritage was engaged to undertake a cultural heritage and risk assessment for the current project location. The cultural heritage assessment includes a review of all relevant legislation as well as background research and searches of South Australian and Commonwealth heritage registers. The risk assessment involved an on-ground assessment by an archaeologist to assess the likelihood of works and proposed excavation activities encountering heritage items in the project area.

The *South Australian Aboriginal Heritage Act 1988* does not mandate a need for an Aboriginal heritage survey there is no legislative requirement to conduct a cultural heritage survey at the current project location. However, the *AHA 1988* does provide a legal obligation for the construction of the proposed golf course to not ‘damage, disturb or interfere’ with an ‘aboriginal site’ whether this site is recorded or not. In light of this and resulting from the desktop and site inspection, the following recommendations are made:

- Programmed could conduct a cultural heritage survey over the entire proposed project location with the relevant Aboriginal stakeholder group. This will identify any sites of cultural heritage as well as the potential anthropological significance of the project area within the wider landscape. Consultation with the relevant Aboriginal groups will also ensure that the project runs smoothly and builds and maintains key relationships in the area for future running of the club facilities.
- A cultural heritage survey may be undertaken with the relevant Aboriginal stakeholder group over areas assessed as being of “high” and ‘moderate” risk to encounter cultural material. This will identify any sites in the area and provide an anthropological context for the site in the context of the wider landscape. There is current no Native Title claim held over Kangaroo Island.

- Programmed Turnpoint may wish to engage the relevant Aboriginal custodians to monitor earthworks in areas of high risk and to participate or lead cultural awareness training before construction commences. While there is no legal requirement for this, it will facilitate smooth project delivery and establish good relationships with the local Aboriginal community.
- If Programmed Turnpoint does not wish to undertake a cultural heritage survey for the project area, EBS Heritage recommends as a risk management tool; the implementation of a site discovery procedure for all earthmoving works as well as a site induction to ensure all project members are aware of the nature of objects that may be found.
- There is an extremely HIGH risk of encountering heritage items in dune formations and in areas immediately adjacent to the dunes.
- There is a high to moderate risk of encountering heritage items in deposits immediately adjacent to drainage channels.
- There is no listed European heritage identified in the current project location.

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1 INTRODUCTION

EBS Group was engaged by Programmed Turnpoint Pty Ltd to conduct an ecological and heritage assessment of the proposed Kangaroo Island Golf Course Development.

1.1 Project proposal

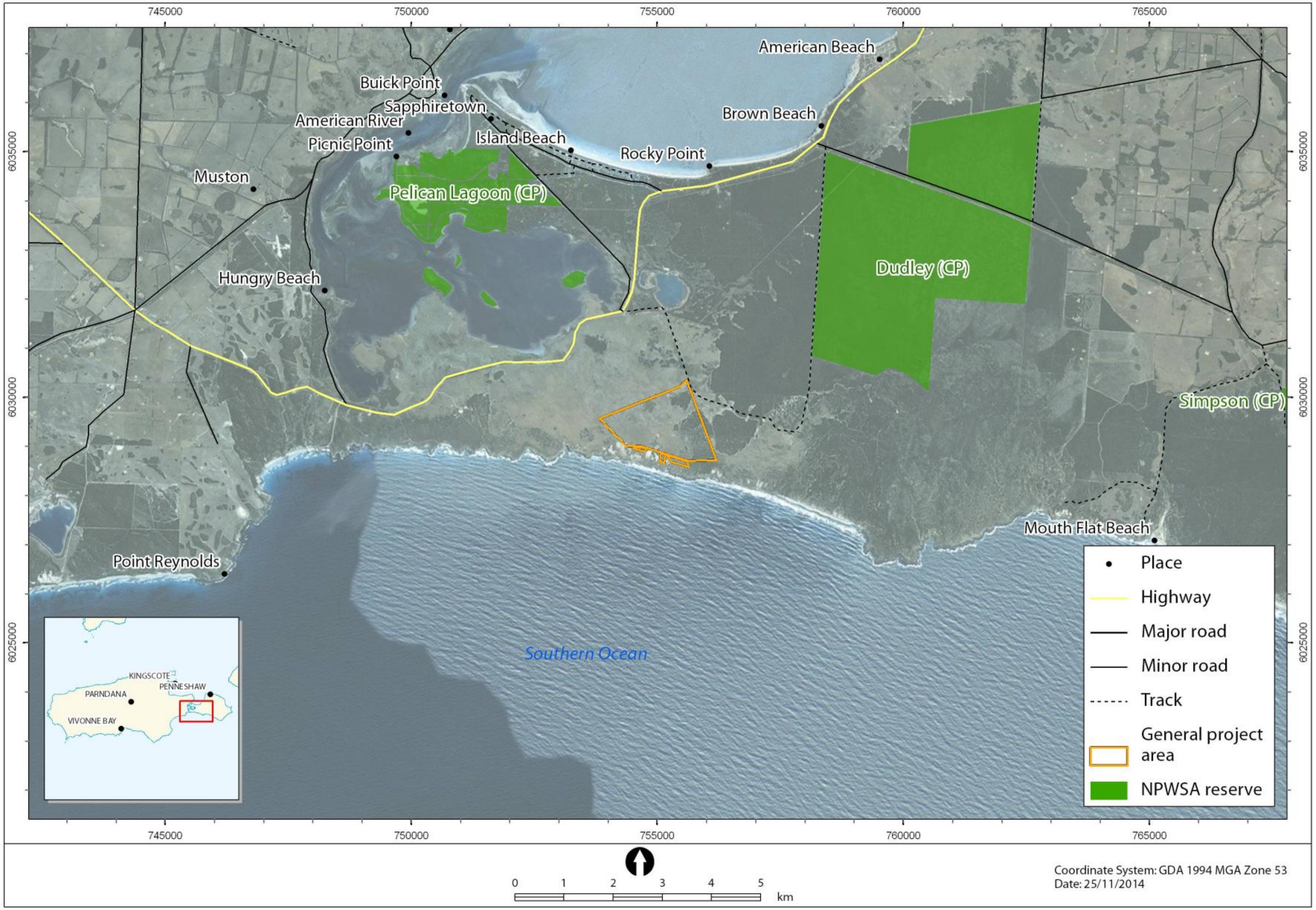
The proposed Kangaroo Island Golf Course is to be located between Pennington Bay and Pelican Lagoon on the eastern side of Kangaroo Island, with views of the rugged coastline and the Southern Ocean (Map 1). The project area is 217.24 ha and is comprised of cleared farmland and scattered patches of native vegetation.

The proposal is to develop an 18 hole Greg Norman Championship length golf course and associated facilities of international standard, with the aim being to be within the top 100 courses in the world. The proposal includes the development of a clubhouse and function facilities, accommodation lodges and associated infrastructure (Map 2).

1.2 Objectives

The assessment was undertaken in line with the project brief provided by Programmed Turnpoint Pty Ltd (dated 23/9/2014). The broad objectives of the assessment were to:

- Identify the flora, fauna and vegetation communities present
- Identify matters of national significance under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) relevant to the project area and review the proposal under the Significant Impact Guidelines of the EPBC Act
- Identify the flora, fauna and vegetation communities of national, state or local environmental significance likely to be impacted upon
- Determine vegetation clearance requirements and Significant Environment Benefit (SEB) calculations under the *Native Vegetation Act 1991* (NV Act)
- Identify objects/sites of national, state or local heritage significance (Aboriginal and European) known on or adjacent to the proposed project area
- identify known or potential cultural heritage risks within the project site
- Outline proposed revegetation works/offsets
- Recommend management strategies to minimise and mitigate potential impacts associated with the project.



Map 1. Location of proposed Kangaroo Island Golf Course.

Map 2. Kangaroo Island Golf Course proposed development footprint.

2 BACKGROUND INFORMATION

2.1 Project area and surrounds

Much of the project area is cleared however patches of mallee woodland and shrubland remain scattered throughout the area, particularly on the eastern side. To the east of the project area is a large expanse of intact native vegetation (see Map 1). A large proportion of the surrounding vegetation is formally protected, including Dudley Conservation Park (1,768 ha) approximately 2.5 km north-east of the project area and a number of Heritage Agreements under the *Native Vegetation Act 1991*, the nearest being less than 1 km east of the project area (HA 1131).

Directly south of the project area are coastal dunes and rugged coastal cliffs. The project area has a direct view of the cliffs and Southern Ocean and is subject to strong, southerly winds.

American River Wetland System, approximately 2 km north of the project area, is classified as a wetland of national importance (Department of the Environment 2014). The Pelican Lagoon complex is approximately 1.5 km north of the project area (DEWNR 2014). The American River-Pelican Lagoon wetland system is a hotspot for threatened species (Gillam and Urban 2014).

2.2 Regional environmental setting

Kangaroo Island supports a wide variety of habitats including mallee woodlands, shrublands, coastal dunes, clifftops and wetlands. Forty-five endemic flora species and a number of endemic mammal and bird species occur on the island (Gillam and Urban 2014). KI provides critical habitat to a range of important wetland and sea bird populations; migratory and non-migratory waders; and breeding sites for the Australian sea lion and the New Zealand fur seal. The island is free of foxes and rabbits which have lead to the widespread loss of native species on the mainland (Kangaroo Island Natural Resources Management Board 2009; Willoughby et al. 2001)..

Around 40% of the original vegetation on Kangaroo Island remains intact, with 55% conserved in reserves largely in the western and southern areas, plus around 10% managed for biodiversity conservation in private landholdings, private protected areas (Heritage Agreements) and roadsides (Gillam and Urban 2014; Kangaroo Island Natural Resources Management Board 2009).

Interim Biogeographical Regionalisation of Australia (IBRA) is a landscape-based approach to classifying the land surface across a range of environmental attributes, which is used to assess and plan for the protection of biodiversity. The state has been classified into bioregions, which are further classified into subregions and environmental associations. The project area falls within the Kanmantoo bioregion, Kangaroo Island subregion and Gantheaume environmental association. Native vegetation remnancy within the Gantheaume environmental association is high (88 %), of which most is formally conserved. A summary of environmental landscape features and native vegetation remnancy is summarised in Table 1.

The project area also falls within the South Coast Regional Ecological Area (REA), which covers the west and south coast of KI and represents one of six biogeographically distinct areas described for KI. The South Coast REA contains large continuous blocks of native vegetation capable of maintaining native flora and fauna populations in the long term (Willoughby et al. 2001).

Interim Marine and Coastal Regionalisation of Australia (IMCRA) is an ecosystem-based classification for marine and coastal environments. The coastal zone adjoining the project area falls within the Eyre IMCRA, which covers the western and southern coastline of KI from Cape Torrens back around to Cape Willoughby. The Eyre IMCRA is described as being a moderate to high energy coastline with pleistocene dune rock cliffs, headlands and shore platforms (Interim Marine and Coastal Regionalisation for Australia Technical Group 1998).

Southern Kangaroo Island experiences seasonally strong winds. Seasonal upwelling of nutrient-rich cold water close to the coast results in high biomass creating significant feeding areas for sea birds, whales and fur seals (Baker 2004).

2.2.1 Administrative boundaries

The project area is within the jurisdiction of the Kangaroo Island Council and the Kangaroo Island Natural Resources Management Board.

2.2.2 Previous surveys conducted

The nearest DEWNR flora survey sites are approximately 2.5 km west (Pennington Bay are) and 3.5 km north east (Dudley CP). The nearest DEWNR fauna survey site is approximately 3 km north east (Dudley CP).

Table 1. IBRA bioregion, subregion and environmental association environmental landscape summary.

Kanmantoo IBRA bioregion	
Temperate, well defined uplands of Cambrian and Late Proterozoic marine sediments, and a lateritized surface becoming increasingly dissected northwards, with eucalypt open forests and woodlands and heaths on mottled yellow and ironstone gravelly duplex so	
Kangaroo Island IBRA subregion	
The island is characterised by an undulating upland plain with an extensive laterite cover which gives rise to mottled-yellow duplex soils. The plain rises to an average height of 100 - 150m and is bounded by a densely dissected scarp falling steeply to t	
Remnant vegetation	Approximately 52% (228982 ha) of the subregion is mapped as remnant native vegetation, of which 62% (142541ha) is formally conserved
Landform	Central Island; dissected tableland with moderate to very steep slopes. Coastal fringe & eastern area; coastal dune formations with small plains,swamps, lagoons, lunettes. Undulating old dune formations largely stripped of sands exposing dune limest*
Geology	Small areas of sandy acidic yellow soils with a laterite layer on the tableland remnants. Ironstone gravels on tableland. Commercial gypsum mining
Soil	Calcareous sand soil of minimal development, Coherent sandy soils, Sand soils with mottled yellow clayey subsoils, Cracking clays
Vegetation	Mallee heath and shrublands
Conservation significance	98 species of threatened fauna, 199 species of threatened flora. 15 wetlands of national significance.
Gantheaume IBRA environmental association	
Remnant vegetation	Approximately 88% (68418 ha) of the association is mapped as remnant native vegetation, of which 76% (51851ha) is formally conserved
Landform	Undulating plain on calcarenite with overlying dunes. Cliffs alternate with lakes and beaches along the coastline.
Geology	Calcarenite, sand, sandstone, alluvium and sand.
Soil	Weakly structured reddish sands, whitish sands and grey self-mulching cracking clays.
Vegetation	Open scrub of coastal mallee and/or coastal white mallee, low open heath of coast cushion bush and saltbush and low woodland of swamp paperbark.
Conservation significance	66 species of threatened fauna, 79 species of threatened flora. 3 wetlands of national significance.

IBRA version 7 (Source: DEWNR 2014).

3 COMPLIANCE AND LEGISLATIVE SUMMARY

3.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the Act as 'matters of national environmental significance'. The nine matters of national environmental significance protected under the Act are:

- World Heritage properties
- National Heritage places
- wetlands of international importance (listed under the Ramsar Convention)
- listed threatened species and ecological communities
- migratory species protected under international agreements
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)
- a water resource, in relation to coal seam gas development and large coal mining development.

Any action that has, will have, or is likely to have a significant impact on matters of national environmental significance requires referral under the EPBC Act. Substantial penalties apply for undertaking an action that has, will have or is likely to have significant impact on a matter of national environmental significance without approval.

The EPBC Act Significant Impact Guidelines provide overarching guidance on determining whether an action is likely to have a significant impact on a matter of national environmental significance. In terms of nationally threatened species, the guidelines define an action as likely to have a significant impact if there is a real chance or possibility that it will:

- lead to a long term decrease in the population
- reduce the area of occupancy of the species
- fragment an existing population
- adversely affect critical habitat
- disrupt breeding cycles
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in the establishment of invasive species that are harmful to the species
- introduce disease that may cause the species to decline
- interfere with the recovery of the species.

3.2 Native Vegetation Act 1991

In South Australia native vegetation is protected by the Native Vegetation Act 1991 (NV Act) and the associated Native Vegetation Regulations 2003. Regulations are exemptions to the Act. They provide a mechanism (if certain criteria are met) to clear native vegetation without a formal clearance application or associated fee.

The Act establishes the Native Vegetation Council (NVC) – an independent body appointed by the Governor of South Australia. The NVC is responsible for making decisions about a wide range of matters concerning native vegetation in South Australia, including whether to approve native vegetation clearance via some of the Regulations.

In some cases, in order to take advantage of an exemption under a regulation, the proponent/landholder must offset the clearance by providing an environmental gain, called a Significant Environmental Benefit (SEB). There is also a requirement for a Management Plan describing how the clearance will be conducted to minimise impacts and how the SEB offset will be managed into the future. The Management Plan must be endorsed by the NVC.

Under *Regulation 5(1)(c) Development subject to Section 48 of the Development Act*, Native vegetation may be cleared for a development that is given 'Major Project Status' under the Development Act 1993. The NVC is provided opportunity to make comment to the Minister administering the Development Act. A SEB offset and Management Plan are required, as described above.

The landowner may achieve the SEB offset by works on the property, such as managing existing remnant native vegetation, restoring degraded native vegetation or revegetating cleared areas. Alternatively, the proponent may make a payment to the NVC through the Native Vegetation Fund, with the funds enabling similar works elsewhere within the same region of the State.

3.3 National Parks and Wildlife Act 1972

Vascular plants and vertebrate animals (e.g. mammals, birds, reptiles and amphibians) are protected in South Australia under the threatened species schedules of the *National Parks and Wildlife Act 1972* (NPW Act): Schedule 7 (endangered species), Schedule 8 (vulnerable species) and Schedule 9 (rare species). The criteria used to define threatened species in South Australia are generally based on categories and definitions from the IUCN Red List Categories and Criteria.

The current schedules do not include non-vascular plants, fish, insects, butterflies, spiders, scorpions and other invertebrates, fungi and other life forms which do not have a current legal conservation status in South Australia.

South Australian freshwater and marine fish, some marine invertebrates and crustaceans are protected under the *Fisheries Management Act 2007*. Some of these species have been identified as threatened and recommended for listing under the NPW Act but currently do not have a legal conservation status.

Under the NPW Act, persons must not:

- take a native plant on a reserve, wilderness protection area, wilderness protection zone, land reserved for public purposes, a forest reserve or any other Crown land.
- take a native plant of a prescribed species on private land.
- take a native plant on private land without the consent of the owner (such plants may also be covered by the *Native Vegetation Act 1991*).
- take a protected animal or the eggs of a protected animal without approval.
- keep protected animals unless authorised to do so.
- use poison to kill a protected animal without approval.

3.4 Natural Resources Management Act 2004

Under the *Natural Resources Management Act 2004* (NRM Act), landholders have a legal responsibility to manage declared pest plants and animals and prevent land and water degradation.

Key components under the Act include the establishment of regional Natural Resource Management (NRM) Boards and development of regional NRM Plans; the ability to control water use through prescription, allocations and restrictions; requirement to control pest plants and animals, and activities that might result in land degradation.

A 'duty of care' is a fundamental component of this Act, i.e. ensuring one's environmental and civil obligation by taking reasonable steps to prevent land and water degradation. Persons can be prosecuted if they are considered negligent in meeting their obligations.

3.5 Aboriginal Heritage Act 1988 (SA)

The *South Australian Aboriginal Heritage Act (AHA)* is administered by the Department of State Development, Aboriginal Affairs and Reconciliation division. Any Aboriginal site, object or remains whether previously recorded or not, is covered under the blanket protection of this Act. The *AHA* provides the following definition of an Aboriginal site in Section 3:

"Aboriginal site" means an area of lands;

a) *That is of significance to Aboriginal tradition or;*

b) *That is of significance according to Aboriginal archaeology, anthropology or history.*

It is an offence under section 23 of the *AHA* to damage, disturb, or interfere with an Aboriginal site, objects or remains unless written authorisation from the Minister for Aboriginal Affairs and Reconciliation has been obtained. Penalties for an offence under this section are up to $10,000 or six months imprisonment in the case of an individual and $50,000 in the case of a corporate body.

The project area may contain Aboriginal sites, objects or remains covered by this Act. There is no legal requirement under the *AHA* to undertake an Aboriginal cultural heritage survey and most surveys are undertaken as a risk management/due diligence strategy to ensure no project delays are encountered during the construction phase.

3.6 Native Title Act 1993

The Commonwealth *Native Title Act 1993* is part of the Commonwealth's response to the High Court's decision in *Mabo v Queensland* (No.2) and adopts the common law definition of native title, defined as the rights and interests that are possessed under the traditional laws and customs of Aboriginal people in land and waters and that are recognised by the common law. These rights may exist over Crown Land but do not exist over land held as freehold title.

The *Native Title Act 1993* recognises the existence of an Indigenous land ownership tradition where connections to country have been maintained and where acts of government have not extinguished this connection. The current project area is within the claimed native title lands of the Ramindjeri (SC2010/003) and under the *Native Title Act*, consultation should occur between the client and the Ramindjeri representatives if any land subject to Native Title is to be affected.

3.7 Heritage Places Act 1993 (SA)

The South Australian Heritage Places Act 1993 relates to the protection of European heritage in South Australia. The Act includes the SA Heritage Register (Part 3) which constitutes a list of all "State Heritage Places" and "State Heritage Areas". Section 16 of the Act establishes a set of criteria to be used to assess whether a place qualifies for listing on the register. Buried cultural material relating to the non-Aboriginal settlement and exploration of Australia had relevance under this Act if the area is listed as a "State Heritage Place" or "State Heritage Area". It is also a requirement under s.27(2) that the discovery of any non-Aboriginal 'archaeological artefact' of 'heritage significance' be reported to the South Australian Heritage Council. Under s.36 of the Act, it is an offence to damage a heritage place included in the SA Heritage Register.

Non-Aboriginal heritage (early colonial and European) is not afforded the same blanket protection as aboriginal heritage and, as such, the client has no statutory obligation to manage any unlisted non-Aboriginal heritage. Any potential impact of the project on State or Locally listed heritage places would require approval under the South Australian Development Act 1993.

4 METHODS

4.1 Desktop assessment

4.1.1 Flora and fauna

A review of relevant literature, data and aerial imagery was undertaken for the project site and the immediate surrounds. Information was obtained from the following databases:

- EPBC Protected Matters Online Search Tool
- Bird Atlas
- Atlas of Living Australia
- Naturemaps (DEWNR online mapping), and
- Biological Database of South Australia.

The information was used to identify:

- biological surveys previously undertaken in the area
- flora and fauna species known to occur in the area
- conservation significant flora and fauna species likely to occur in the area
- vegetation communities in the area
- key habitat requirements for conservation significant species
- important fauna habitat characteristics.

4.1.2 Heritage

A review of relevant literature, previous reports and register searches was undertaken for the project site and the immediate surrounds. This information was used to compile a risk assessment for the project area which is outlined in detail in Section 7.4 and classifies the project site into areas of 'high' 'moderate' and 'low' likelihood to contain heritage items.

Information was obtained from the following searches:

- Central Archive and Register of Aboriginal Sites and Objects maintained by the Department of State Development, Aboriginal Affairs and Reconciliation (DSD-AAR).
- South Australian Museum Database
- Australian Heritage Inventory
- South Australian Library
- South Australian Archives.

4.2 Field survey

A combined ecology/heritage field survey was conducted from the 11th to the 14th of November 2014. Field investigations focused on ground-truthing and supplementing the data collected during the desktop assessment. The ecology survey also focused on providing a comprehensive site assessment to meet the legislative and supplied Public Environmental Report (PER) guideline requirements, while the heritage field survey focused on the risk assessment and assessing the requirements for a cultural heritage survey.

4.2.1 Vegetation associations and condition

Data was collected as per the requirements of the *Native Vegetation Act 1991*. Vegetation associations were mapped and native vegetation patches were assigned a condition rating based on the Native Vegetation Council Significant Environmental Benefit (SEB) criteria, adapted from Stokes et al. (1998) and DWLBC (2005) (see Table 2). The condition ratings reflect the quality of the vegetation and the level of disturbance. The extent of impact of the development on the native vegetation was assessed.

4.2.2 Flora

All flora species observed were recorded, including the locations of any threatened flora species (if present) and significant weed infestations. Species nomenclature used in this report follows that used in the Biological Database of South Australia (BDBSA) as at November 2014.

Table 2. Assessment criteria for the condition of vegetation communities.

Condition	SEB ratio	% indigenous cover	Overstorey condition description	Understorey condition description	Indicators	NVC Interim Policy (1.2.11)
Very Poor	**0:1**	<10%	No overstorey stratum remaining.	Complete destruction of indigenous understorey* (by grazing &/or introduced plants).	Vegetation structure no longer intact (e.g. removal of one or more vegetation strata). Scope for regeneration, but not to a state approaching good condition without intensive management. Dominated by very aggressive weeds. Partial or extensive clearing (> 50% of area). Evidence of heavy grazing (tracks, browse lines, species changes, complete depletion of soil surface crust).	Where proposed clearance is considered to be minor and of limited biodiversity impact, e.g. lopping of overhanging limbs only or minor clearance of shrubs in areas otherwise considered as highly disturbed.
	1:1	10-19%	Scattered trees in poor health and/or representing an immature stand.	Almost complete destruction of indigenous understorey* (by grazing &/or introduced plants) - reduced to scattered clumps and individual plants.		Where proposed clearance is in areas dominated by introduced species, the area of native vegetation is largely reduced to scattered trees, indigenous understorey reduced to scattered clumps and individual plants.
	2:1	20-29%	Scattered trees either immature in good health or mature in poor/moderate health. Alternatively, the dominant overstorey stratum is largely intact and is an immature stand (or regrowth), and is generally in poor health.			
Poor	**3:1**	30-39%	Dominant overstorey stratum is largely intact and is a moderately healthy mature stand.	Heavy loss of native plant species (by grazing &/or introduced plants). The understorey* consists predominately of alien species, although a small number of natives persist.	Vegetation structure substantially altered (e.g. one or more vegetation strata depleted). Retains basic vegetation structure or the ability to regenerate it. Very obvious signs of long-term or severe disturbance. Weed dominated with some very aggressive weeds. Partial clearing (10 – 50% of area). Evidence of moderate grazing (tracks, browse lines, soil surface crust extensively broken).	Where the proposed clearance is of mostly intact overstorey vegetation but there is still considerable weed infestation amongst the understorey flora.
	4:1	40-49%	Dominant overstorey stratum is largely intact and is a healthy mature stand with high wildlife habitat value (e.g. hollows).			
Moderate	**5:1**	50-59%	Dominant overstorey stratum is largely intact – any condition+	Moderate loss of native understorey diversity. Weed-free areas small. Substantial invasion of aliens resulting in significant	Vegetation structure altered (e.g. one or more vegetation strata depleted). Most seed sources available to regenerate original	Where the proposed clearance is of mostly intact overstorey vegetation with moderate but not severe weed infestation amongst

Condition	SEB ratio	% indigenous cover	Overstorey condition description	Understorey condition description	Indicators	NVC Interim Policy (1.2.11)
				competition, but native understorey* persists; for example, may be a low proportion of native species and a high native cover, or a high proportion of native species and low native cover.	structure. Obvious signs of disturbance (e.g. tracks, bare ground). Minor clearing (<10% of area). Considerable weed infestation with some aggressive weeds. Evidence of some grazing (tracks, soil surface crust patchy).	the understorey flora. Clearance is not seriously at variance with the Principles.
	6:1	60-69%	Dominant overstorey stratum is largely intact – any condition+	Moderate but not severe weed infestation amongst the understorey flora.		
Good	**7:1**	70-79%	Original overstorey stratum is still dominant and intact – any condition+	Understorey only slightly modified. High proportion of native species and native cover in the understorey*; reasonable representation of probable pre-European vegetation.	Vegetation structure intact (e.g. all strata intact). Disturbance minor, only affecting individual species. Only non-aggressive weeds present. Some litter build-up.	Where the proposed clearance is of mostly intact overstorey and understorey vegetation, weed infestation is moderate to low, but the original vegetation is still dominant. Clearance is assessed by the NVC to be at variance with the Principles.
	8:1	80-89%	Original overstorey stratum is still dominant and intact – any condition+	Understorey only slightly modified. High proportion of native species and native cover in the understorey*; reasonable representation of probable pre-European vegetation.		
Excellent	**9:1**	> 89%	Original vegetation is still dominant and intact. Overstorey individuals in good condition and represent a mature stand.	Diverse vegetation with very little weed infestation.Understorey largely undisturbed, minimal loss of plant species diversity. Very little or no sign of alien vegetation in the understorey*; resembles probable pre-European condition.	All strata intact and botanical composition close to original. Little or no signs of disturbance. Little or no weed infestation. Soil surface crust intact. Substantial litter cover.	Where the proposed clearance is of diverse vegetation with very little weed infestation. Clearance is assessed by the NVC to be seriously at variance with the Principles.
	10:1		Original vegetation is still dominant and intact. Overstorey individuals in good condition and represent a mature stand, with high habitat value (e.g. hollows).			

* Or all strata if the upper and lower strata are difficult to distinguish.
\+ Ratio assessment will largely depend upon condition of understorey associated with an intact overstorey stratum.
Adapted from *Guide to Roadside Vegetation Survey Methodology for South Australia* (Stokes et al. 1998) and *Guidelines for a Native Vegetation Significant Environmental Benefit Policy* (DWLBC 2005).

4.2.3 Fauna

Fauna survey was conducted in line with the EPBC Act survey guidelines (Commonwealth of Australia 2010; 2011). The fauna habitat present was assessed for its suitability for threatened species known to occur in the broader area. The species targeted during the field survey were determined based on the desktop assessment, existing records and habitat suitability, namely:

- Glossy Black-Cockatoo
- Osprey
- Southern Brown Bandicoot
- Southern Emuwren
- White-bellied Sea-Eagle.

Survey for coastal raptors was undertaken from vantage points to detect birds in flight, and area searches on foot to detect birds or signs of occupancy in suitable habitat, as per Dennis (2007).

Survey for Southern Brown Bandicoot involved indirect detection methods, i.e. daytime search for signs such as diggings and scats (Commonwealth of Australia 2011).

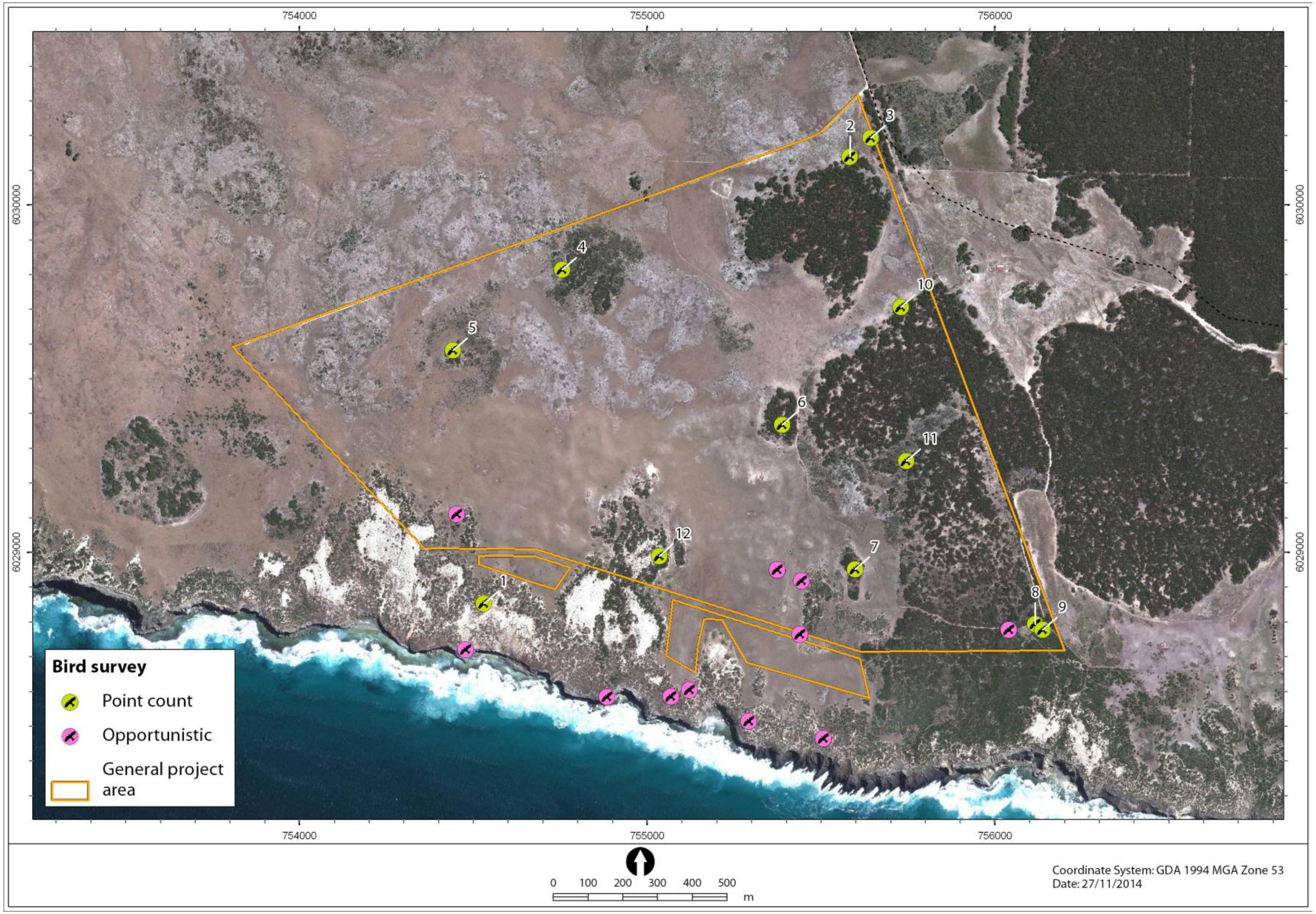
All fauna species observed (e.g. via sightings, scats, diggings, tracks, burrows) during the survey were recorded. Targeted survey was undertaken for birds (see below).

Species nomenclature used in this report follows that used in the Biological Database of South Australia (BDBSA) as at November 2014.

4.2.4 Birds

Bird survey was undertaken across the project site and in the adjacent coastal areas, in particular the Golf Fairway and Green. The focus of the survey was to record the bird species utilising the site, bird activity and usage of the site and adjacent areas. Twelve survey locations were established, generally around vegetation association transition zones, to ensure coverage of all potential habitat types. Each site was surveyed for between half an hour to one hour (depending on habitat) in the morning (<11 am) and afternoon (>3 pm) using a point-count technique (Map 3). The surveyor recorded all birds that could be positively identified by sight or within 100 m of the site, in similar habitat. A call play-back survey technique was used where it was deemed appropriate.

In addition, targeted bird survey was undertaken, focusing on key habitats for threatened bird species identified as potentially occurring in the area. The coastal fringe was surveyed to identify: nesting sites e.g. for Osprey, and foraging behaviour e.g. for White-bellied Sea-eagle, and observations of seabirds e.g. Tern, Albatross, Giant Petrels etc that may utilise the area.



Map 3. Bird survey locations.

4.2.5 Heritage

A ramble survey approach was employed by the EBS Heritage archaeologist, this involved walking across areas of exposed soil to assess intactness of soil profiles, and targeting any environmental landforms associated with heritage sites in South Australia. The following was completed as a result of the site inspection and assessment:

- Representative photographs across the project site
- Identify and map areas of observed cultural heritage
- Identify and map areas of potential cultural heritage
- Identify areas with a high likelihood of contain in situ cultural heritage sites.

4.3 Limitations

4.3.1 Ecology

Flora and fauna records were sourced from the BDBSA. The BDBSA only includes verified flora and fauna records submitted to DEWNR or partner organisations. It is recognised that knowledge is poorly captured and it is possible that significant species occur that are not reflected by database records. The spatial reliability of the BDBSA data ranges hence the records assessed may not be an accurate reflection of the species occurring in the area. Although much of the BDBSA data has been through a variety of validation processes, the lists may contain errors. DEWNR give no warranty that the data is accurate or fit for any particular purpose of the user or any person to whom the user discloses the information.

DEWNR floristic mapping has been derived from aerial imagery and limited ground-truthing; field survey found inaccuracies in the DEWNR vegetation association descriptions.

4.3.2 Heritage

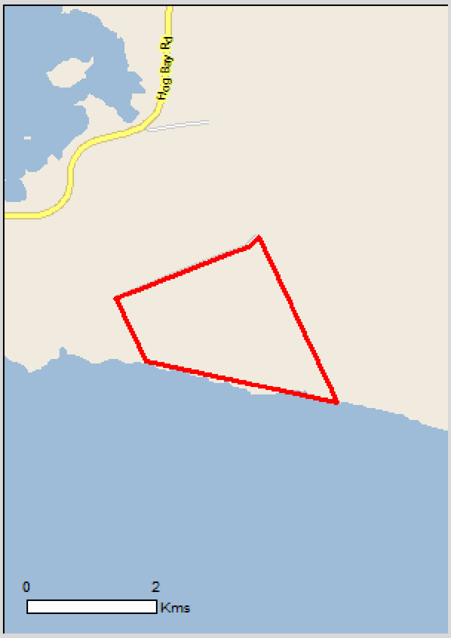
The project site is largely covered by vegetation and as such, the on ground site visibility was quite low across most areas. Where soil tracts were visible, these were observed and assessed to determine soil profiles and likelihood of containing in situ heritage sites.

5 ECOLOGY DESKTOP ASSESSMENT

5.1 Matters of national environmental significance

The EPBC Act Protected Matters Report identified the following matters of national environmental significance that may have relevance to the project area (Table 3).

Table 3. Matters of National Environmental Significance.

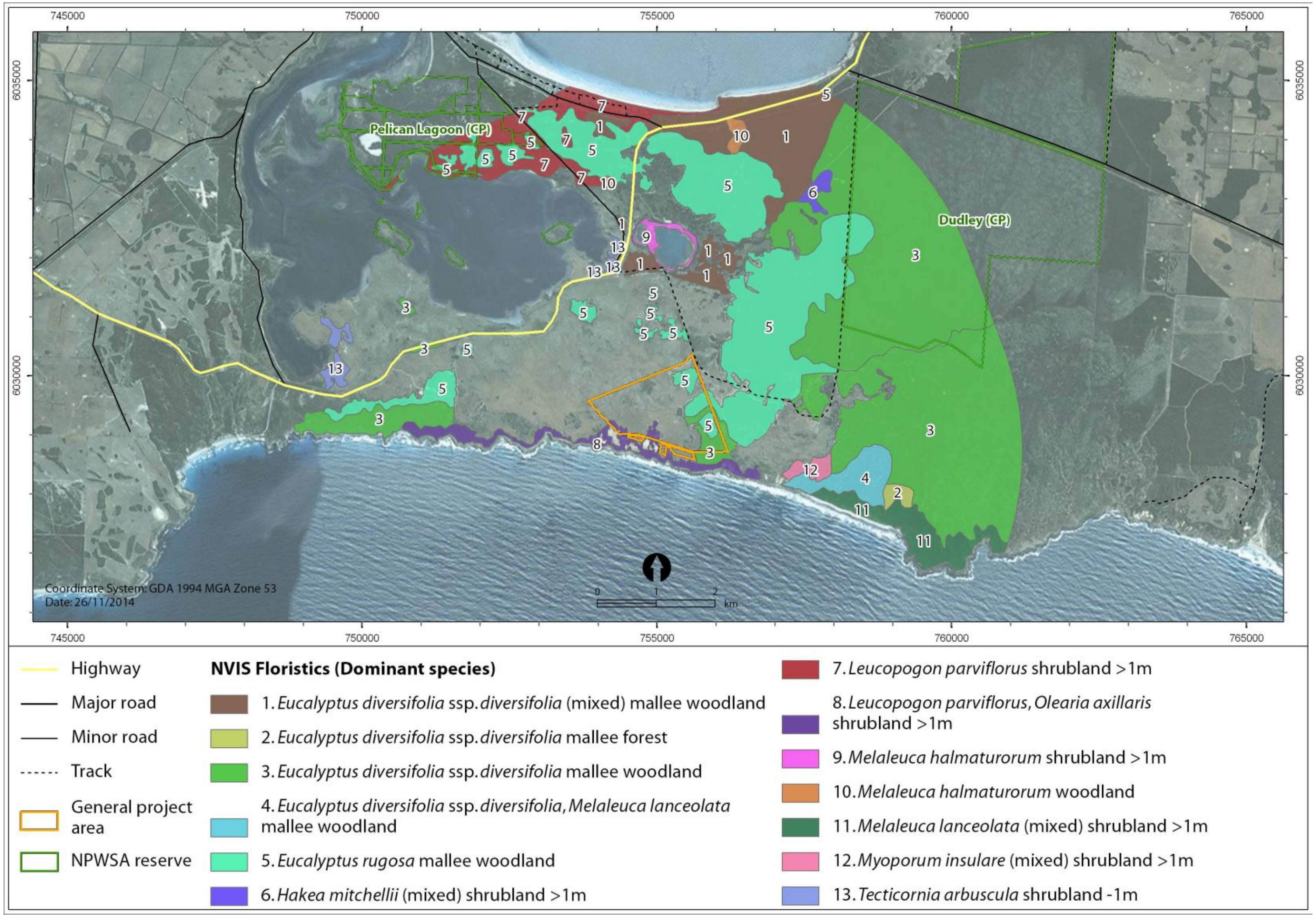
Search area	Matters of National Environmental Significance	
	World Heritage Properties	None
	National Heritage Places	None
	Wetlands of International Importance	None
	Great Barrier Reef Marine Park	None
	Commonwealth Marine Areas	None
	Listed Threatened Ecological Communities	1
	Listed Threatened Species	31
	Listed Migratory Species	35
	Listed Marine Species	60
	Whales and Other Cetaceans	12
	Other Matters Protected by the EPBC Act	
	Commonwealth Heritage Places	None
	Critical Habitats	None
	Commonwealth Land	None
	Commonwealth Reserves Terrestrial	None
	Commonwealth Reserves Marine	None

5.1.1 Vegetation

Remnant vegetation has been mapped by DEWNR as part of the native vegetation information system (NVIS) floristic analysis and mapping project. The mapping is based on work by Ball and Carruthers (1998), interpretation of imagery and floristic data derived from Biological Survey of SA vegetation sites. Three native vegetation communities are mapped by DEWNR within the project area:

- *Eucalyptus diversifolia* ssp. *diversifolia* mallee woodland
- *Eucalyptus rugosa* mallee woodland
- *Leucopogon pariflorus* / *Olearia axillaris* shrubland > 1 m (DEWNR 2014).

The locations of the mapped communities are shown in Map 4. Given the NVIS mapping is largely derived from remote assessment, it can be inaccurate.



Map 4. NVIS Mapping – vegetation communities (data sourced from DEWNR).

5.1.2 Threatened ecological communities

The EPBC Protected Matters Search identified one nationally threatened ecological community as potentially occurring within the project area:

- Kangaroo Island Narrow-leaved Mallee (*Eucalyptus cneorifolia*) Woodland - Critically Endangered.

Field survey confirmed that this ecological community is not present within the project area.

DEWNR has identified ten threatened ecosystems occurring on Kangaroo Island (DEH in progress). Field survey confirmed that none of these were present within the project area.

5.1.3 Conservation significant flora

Two nationally threatened flora species have records within 5 km of the project area (DEWNR 2014):

- *Beyeria subtecta* (Kangaroo Island Turpentine Bush)
- *Glycine latrobeana* (Clover Glycine).

An additional eight state listed species have records within 5 km of the site (DEWNR 2014) (Table 4). The location of records within the BDBSA are shown on Map 5.

One state rare species, *Caladenia sanguinea* (Crimson Daddy-long-legs) is considered as possibly occurring. All other threatened flora species identified from database searches are considered unlikely to occur within the project area, based on habitat suitability and field survey results (Table 4).

Table 4. Conservation significant flora species potentially occurring within the project area.

Scientific name	Common name	Conservation status				Source of information	Most recent sighting (BDBSA)	Likelihood of occurrence within project area
		Aus	SA	KI status	KI trend			
Asterolasia muricata	Lemon Star-bush		R	RA	-	2	1962	Unlikely
Beyeria subtecta	Kangaroo Island Turpentine Bush	VU	E	EN	-	2	1992	Unlikely
Caladenia ovata	Kangaroo Island Spider-orchid	VU	E	EN	DD	1		Unlikely (based on Taylor 2008)
Caladenia sanguinea	Crimson Daddy-long-legs		R	NT	DD	2	1986	Possible – scattered records across KI. In scrubs, woodland and wooded heaths in laterite or in shallow soil pockets over limestone.
Caladenia tensa	Greencomb Spider-orchid	EN		RA	DD	1		Unlikely – only 3 records on KI between Vivonne Bay and Emu Bay
Correa backhouseana var. *orbicularis*	Round-leaf Correa		R	LC	0	2	1985	Unlikely
Euphrasia collina ssp. *osbornii*	Osborn's Eyebright	EN	E	VU	DD	1		Unlikely
Gahnia hystrix	Spiky Saw-sedge		R	RA	0	2	1989	Unlikely
Glycine latrobeana	Clover Glycine	VU	V			2	1989	Unlikely
Grevillea halmaturina ssp. *halmaturina*	Prickly Grevillea		R	NT	-	2	2000	Unlikely
Microlepidium pilosulum	Hairy Shepherd's-purse		R	NT	0	2	1996	Unlikely
Pomaderris halmaturina ssp. *halmaturina*	Kangaroo Island Pomaderris	VU	V	VU	-	1		Unlikely
Pterostylis melagramma	Tall Greenhood		E	VU	DD	2	1989	Unlikely
Ptilotus beckerianus	Ironstone Mulla Mulla	VU	V	VU	-	1		Unlikely
Spyridium eriocephalum var. *glabrisepalum*	MacGillivray Spyridium	VU	E	EN	-	1		Unlikely
Spyridium spathulatum	Spoon-leaf Spyridium		R	NT	0	2	1989	Unlikely

Conservation status

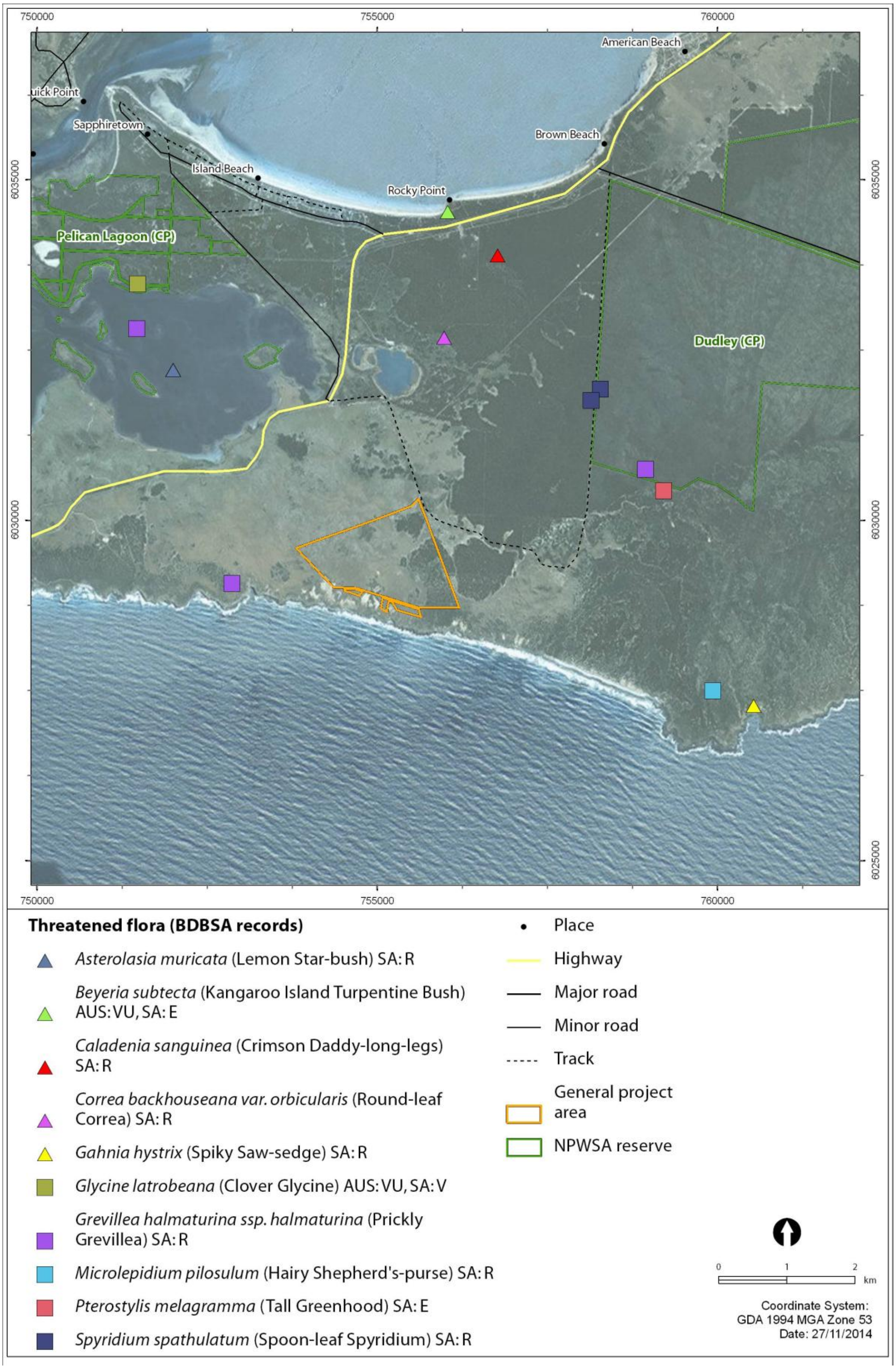
Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). **SA**: South Australia (*National Parks and Wildlife Act 1972*). **Conservation Codes**: **CE**: Critically Endangered. **EN/E**: Endangered. **VU/V**: Vulnerable. **R**: Rare. **ssp.**: the conservation status applies at the sub-species level. An asterisk denotes ratings that need to be qualified for a variety of reasons, such as changes to taxonomy or nomenclature since listing or because a species assessed as 'presumed extinct' had to be listed under the Endangered category. Further details are available from the Vascular Plant Metadata document on the DEWNR website.

Regional status for Kangaroo Island is sourced from Gillam and Urban (2013). **Regional status**: **RE**: Regionally Extinct. **CR**: Critically Endangered. **EN**: Endangered. **VU**: Vulnerable. **RA**: Rare. **NT**: Near Threatened. **LC**: Least Concern. **DD**: Data Deficient. **NE**: Not Evaluated. **Regional Population**: **--**: Definite Decline. **-**: Probable Decline. **0**: Stable/No Change. **+**: Probable Increase. **++**: Definite Increase. **DD**: Data Deficient.

Likelihood of occurrence has been assigned based on a review of existing information e.g. Atlas of Living Australia website (2014); Bates (2011); Taylor (2008); Willoughby et al. (2001).

Source of Information

1. EPBC Act Protected Matters Report (DOE 2014a) – no buffer applied to project area.
2. Biological Database of South Australia data extract (DEWNR 2014a) - 5 km buffer applied to project area.



Map 5. BDBSA threatened flora records (Source: DEWNR 2014).

5.1.4 Conservation significant fauna species

Six nationally threatened fauna species have records within 5 km of the site (DEWNR 2014):

- Black-browed Albatross (*Thalassarche melanophris*)
- Blue Petrel (*Halobaena caerulea*)
- Glossy Black-Cockatoo (Kangaroo Island ssp) (*Calyptorhynchus lathami halmaturinus*)
- Shy Albatross (*Thalassarche cauta cauta)*
- Southern Brown Bandicoot (SA mainland and KI ssp) (*Isoodon obesulus obesulus*)
- Southern Giant Petrel (*Macronectes giganteus*).

One state listed species has records within 5 km of the site, Southern Emuwren (Kangaroo Island ssp) (*Stipiturus malachurus halmaturinus*) (DEWNR 2014). The location of records within the BDBSA are shown on Map 6.

A number of additional species listed under the EPBC Act as threatened, migratory and marine were identified in the EPBC search as potentially occurring or having habitat potentially occurring within the area; many of these species are strictly coastal or oceanic species. Whilst these species are unlikely to utilise the project area, impacts to coastal species could occur associated with increased human activity along the coast. Exclusively marine species were excluded from the assessment as they are not considered relevant to the project area.

The threatened species identified from database searches and their likelihood of occurring within the project area are summarised in Table 5. In addition to the species listed in Table 5, a further three reptile species and 11 bird species are considered regionally threatened (see Appendix 1).

Table 5. Threatened and migratory fauna species potentially occurring within the project area.

Scientific name	Common name	Conservation status				Source of information	Most recent sighting (BDBSA)	Likelihood of occurrence within project area
		Aus	SA	KI status	KI trend			
BIrd								
Apus pacificus	Fork-tailed Swift	Ma, Mi		RA	-	1		Unlikely
Ardea alba	Great Egret	Ma, Mi(W)		RA	0	1		Possible fly-over
Ardea ibis	Cattle Egret	Ma, Mi(W)	R	RA	0	1		Possible fly-over
Arenaria interpres	Ruddy Turnstone	Ma, Mi(W)	R	EN	--	1,2	2000	Unlikely
Biziura lobata	Musk Duck		R	RA	0	2	1998	Unlikely
Botaurus poiciloptilus	Australasian Bittern	VU	V			1		Unlikely
Burhinus grallarius	Bush Stonecurlew		R	NT	0	2	2000	Unlikely – not vegetated enough
Calidris acuminata	Sharp-tailed Sandpiper	Ma, Mi(W)		VU	--	1,2	1984	Unlikely
Calidris alba	Sanderling		R	RA	DD	2	1986	Unlikely
Calidris ruficollis	Red-necked Stint	Ma, Mi(W)		RA	-	1,2	2001	Unlikely
Calyptorhynchus funereus	Yellow-tailed Black Cockatoo		V	RA	-	2	1999	Unlikely
Calyptorhynchus lathami halmaturinus	Glossy Black-Cockatoo (Kangaroo Island ssp)	EN	E	EN	+	1,2	1998	Unlikely
Charadrius leschenaultii	Greater Sand Plover		R			2	1984	Unlikely
Cladorhynchus leucocephalus	Banded Stilt		V	NT	0	2	1986	Unlikely
Diomedea epomophora epomophora / Diomedea epomophora (sensu stricto)	Southern Royal Albatross	VU, Ma, Mi	V			1		Unlikely
Diomedea epomophora sanfordi / Diomedea sanfordi	Northern Royal Albatross	EN, Ma, Mi	E			1		Unlikely
Diomedea exulans (sensu lato)	Wandering Albatross	VU, Ma, Mi	V			1		Unlikely
Diomedea exulans antipodensis / Diomedea antipodensis	Antipodean Albatross	VU, Ma, Mi				1		Unlikely
Diomedea exulans exulans / Diomedea dabbenena	Tristan Albatross	EN, Ma, Mi				1		Unlikely
Falco peregrinus	Peregrine Falcon		R	VU	0	2	2004	Unlikely
Gallinago hardwickii	Latham's Snipe	Ma, Mi(W)	R	CR	DD	1		Unlikely
Haematopus fuliginosus	Sooty Oystercatcher		R	RA	0	2	2012	Known – coast

Scientific name	Common name	Conservation status				Source of information	Most recent sighting (BDBSA)	Likelihood of occurrence within project area
		Aus	SA	KI status	KI trend			
								line
Haematopus longirostris	(Australian) Pied Oystercatcher		R	RA	0	2	2012	Possible – coast line
Haliaeetus leucogaster	White-bellied Sea-Eagle	Ma, Mi(T)	E	CR	--	1,2	1998	Possible – fly over
Halobaena caerulea	Blue Petrel	VU				2	1984	Unlikely (mostly offshore)
Lewinia pectoralis	Lewin's Rail		V	VU	DD	2	2005	Unlikely
Limosa lapponica	Bar-tailed Godwit		R	CR	DD	2	1986	Unlikely
Lophoictinia isura	Square-tailed Kite		E			2	1980	Unlikely
Macronectes giganteus	Southern Giant Petrel	EN, Ma, Mi	V			1,2	1988	Unlikely (mostly offshore)
Macronectes halli	Northern Giant-Petrel	VU, Ma, Mi				1		Unlikely (mostly offshore)
Merops ornatus	Rainbow Bee-eater	Ma, Mi(T)		VU	-	1		Unlikely
Myiagra cyanoleuca	Satin Flycatcher	Ma, Mi(T)	E			1		Unlikely
Myiagra inquieta	Restless Flycatcher		R	VU	DD	2	1998	Unlikely
Numenius madagascariensis	Far Eastern Curlew		V	CR	--	2	2005	Unlikely
Numenius phaeopus	Whimbrel		R	CR	DD	2	1985	Unlikely
Pandion haliaetus	Osprey	Ma	E	CR	0	1	2004	Known
Petroica boodang	Scarlet Robin		ssp	NT	0	2	1998	Known
Puffinus carneipes	Flesh-footed Shearwater	Ma, Mi	R			1		Unlikely
Rostratula australis / Rostratula benghalensis (sensu lato)	Australian Painted Snipe	EN, Ma, Mi(W)	R			1		Unlikely
Sternula nereis nereis	Australian Fairy Tern	VU	E	CR	--	1		Unlikely
Stipiturus malachurus halmaturinus	Southern Emuwren (Kangaroo Island ssp)		R	RA	0	2	1998	Possible
Thalassarche cauta cauta / Thalassarche cauta (sensu stricto)	Shy Albatross	VU, Ma, Mi	V			1,2	1990	Unlikely (mostly offshore)
Thalassarche cauta steadi / Thalassarche steadi	White-capped Albatross	VU, Ma, Mi	ssp.			1		Unlikely (mostly offshore)
Thalassarche chlororhynchos	Yellow-nosed Albatross	VU (for ssp.	E			2	1979	Unlikely (mostly

Scientific name	Common name	Conservation status				Source of information	Most recent sighting (BDBSA)	Likelihood of occurrence within project area
		Aus	SA	KI status	KI trend			
		carteri)						offshore)
Thalassarche melanophris	Black-browed Albatross	VU, Mi	ssp			1,2	1900	Unlikely (mostly offshore)
Thalassarche melanophris impavida / Thalassarche impavida	Campbell Albatross	VU, Ma, Mi	V			1		Unlikely (mostly offshore)
Thinornis rubricollis	Hooded Plover	Ma	V	EN	-	1,2	2012	Unlikely (restricted to coastal zone)
Turnix varius	Painted Buttonquail		R	EN	--	2	2000	Unlikely
Mammal								
Arctocephalus pusillus	Australian Fur-seal	Ma	R	RA	+	1		Unlikely
Isoodon obesulus obesulus	Southern Brown Bandicoot (SA mainland and KI ssp)	EN	V	NT	DD	1,2	2005	Possible
Neophoca cinerea	Australian Sea-lion	VU, Ma	V	VU	0	1		Unlikely
Sminthopsis aitkeni	Kangaroo Island Dunnart	EN	E	CR	-	1		Unlikely
Trichosurus vulpecula	Common Brushtail Possum		R	LC	0	2	1990	Known
Reptile								
Caretta caretta	Loggerhead Turtle	EN, Ma, Mi(Ma)	E			1		Unlikely
Chelonia mydas	Green Turtle	VU, Ma, Mi(Ma)	V			1		Unlikely
Dermochelys coriacea	Leatherback Turtle	EN, Ma, Mi(Ma)	V			1,2	1994	Unlikely
Varanus rosenbergi	Heath Goanna		V	NT	--	2	1990	Known

Conservation status

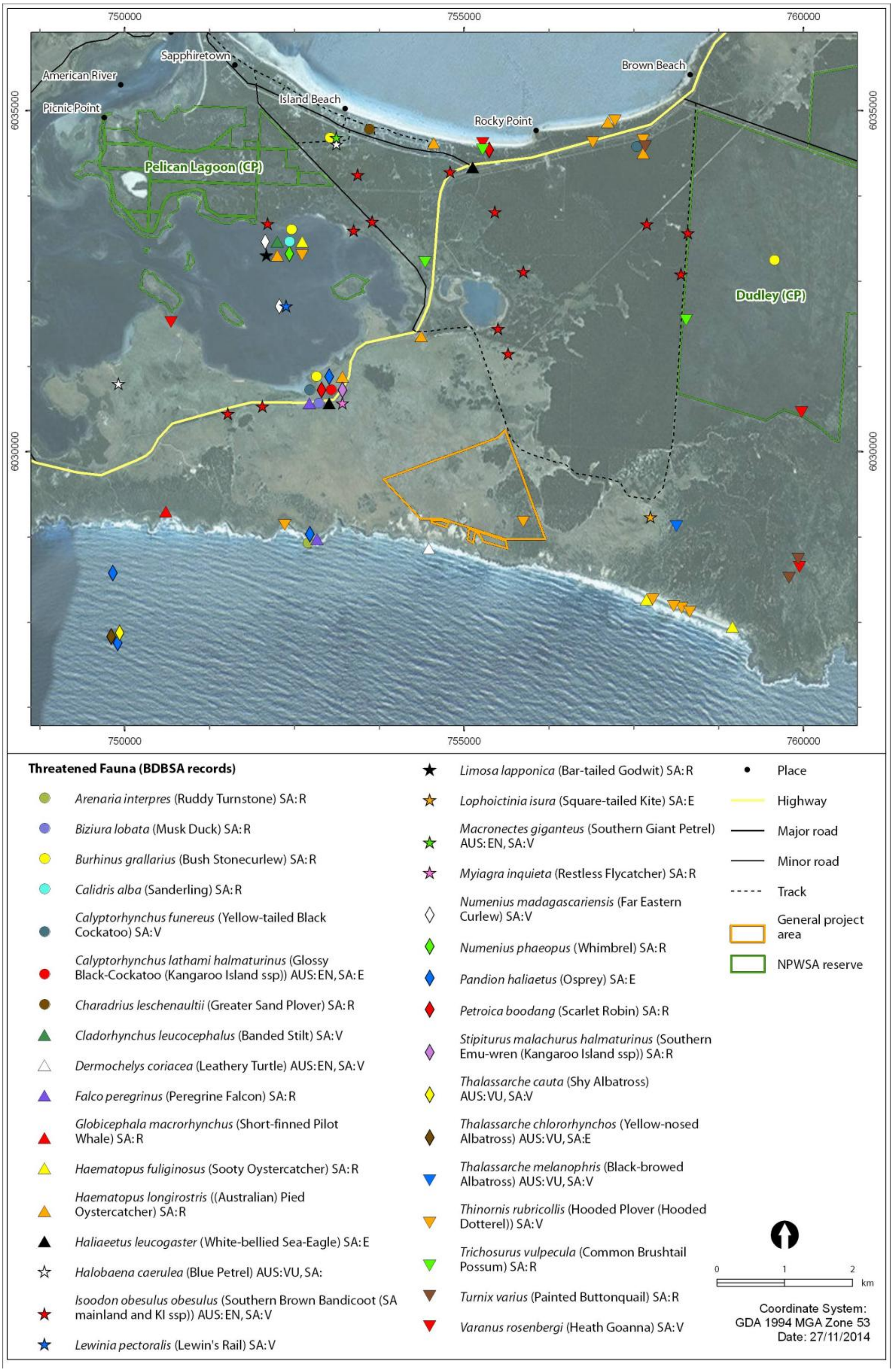
Aus: Australia (Environment Protection and Biodiversity Conservation Act 1999). **SA**: South Australia (National Parks and Wildlife Act 1972). **Conservation Codes**: **CE**: Critically Endangered. **EN/E**: Endangered. **VU/V**: Vulnerable. **R**: Rare. **ssp**.: the conservation status applies at the sub-species level. **Mi**: listed as migratory under the EPBC Act. **Ma**: listed as marine under the EPBC Act. * listed as Migratory under a different scientific name on the EPBC Act.

Regional status for Kangaroo Island is sourced from Gillam and Urban (2013). **Regional status**: **RE**: Regionally Extinct. **CR**: Critically Endangered. **EN**: Endangered. **VU**: Vulnerable. **RA**: Rare. **NT**: Near Threatened. **LC**: Least Concern. **DD**: Data Deficient. **NE**: Not Evaluated. **Regional Population**: **--**: Definite Decline. **-**: Probable Decline. **0**: Stable/No Change. **+**: Probable Increase. **++**: Definite Increase. **DD**: Data Deficient.

Note: Exclusively marine species have not been included in this assessment.

Source of Information

1. EPBC Act Protected Matters Report (DOE 2014a) – no buffer applied to project area.
2. Biological Database of South Australia data extract (DEWNR 2014a) - 5 km buffer applied to project area.



Map 6. BDBSA threatened fauna records (Source: DEWNR 2014).

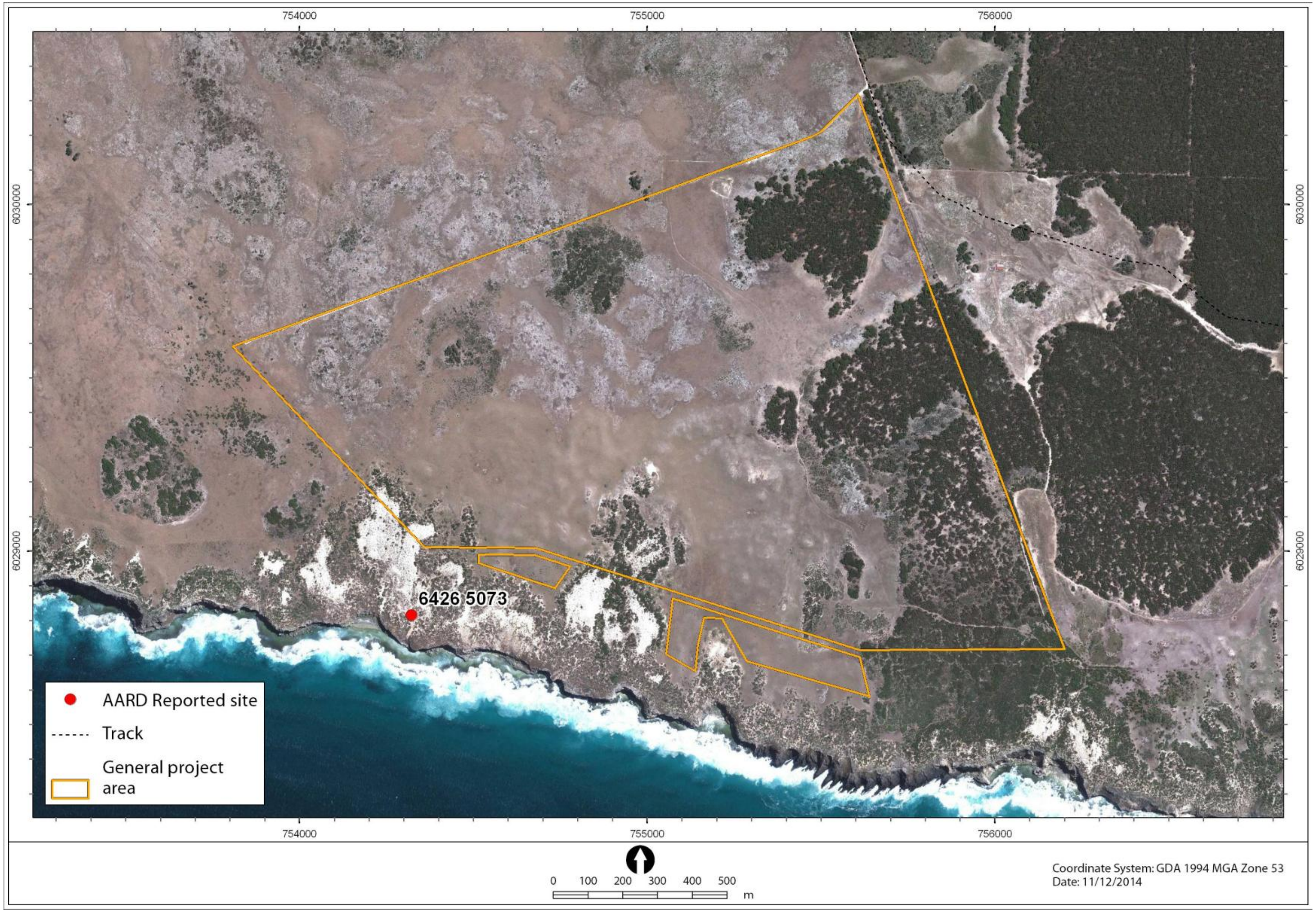
6 HERITAGE DESKTOP ASSESSMENT

6.1 Heritage Register Searches

6.1.1 DSD-AAR Register Search

The Central Archive is maintained by Aboriginal Affairs and Reconciliation (AAR) and includes the Register of Aboriginal Sites and Objects. The Central Archive is a record of previously recorded heritage sites in South Australia and permits existing recorded sites from being identified within new project areas. It should be noted that the Central Archive is not an exhaustive list of all heritage sites in the area; it contains only those that have been reported and/or registered.

EBS Heritage conducted a DSD-AAR Register search on the 2nd of November 2014 for a 5 km area around the proposed project area. There were no registered sites within the current project area and one reported site just outside the survey area in the south-western sand dunes (see Map 7). The absence of sites in the project area does not indicate that there is no possibility of sites through this area.



Map 7. Reported Heritage Sites AAR Register.

6.1.2 SA Museums Database

The SA Museum Database contains information regarding culturally sensitive finds such as human remains. Where possible, the database contains information on how the item came into the collection, the location where it was found and the date it was acquired. The SA Museum database is made up of objects collected during the 20th century and many are provenanced to the nearest town or pastoral property. Additionally, human remains recorded on the SA Museum database were sometimes provenanced to the nearest major road or the police station where the remains were processed. There is rarely any precise indication of where the burial may have been collected from. The database was searched for "Kangaroo Island" and 1 item was found, although this item does not seem to be from the vicinity of the project area. Additionally, there are a large number of stone tools found for "Kangaroo Island" with no description of location found.

Table 6. SAM Results.

Registry Number	Location	Date Acquired/Registered	Description
A57868	Kangaroo Island	26 May 1972	Skull and part skeleton

Although the SAM database is not a complete list of objects found in the area, it can provide an indicative guide for the types of materials found in the general region.

6.1.3 Heritage Places Database

EBS Heritage conducted a search of the South Australian Heritage Places Inventory, the Australian Heritage Database and the South Australian Places databases for the project area and surrounds (Map 8). No items were recorded for any of the databases within the current project area.

Australian Heritage Database

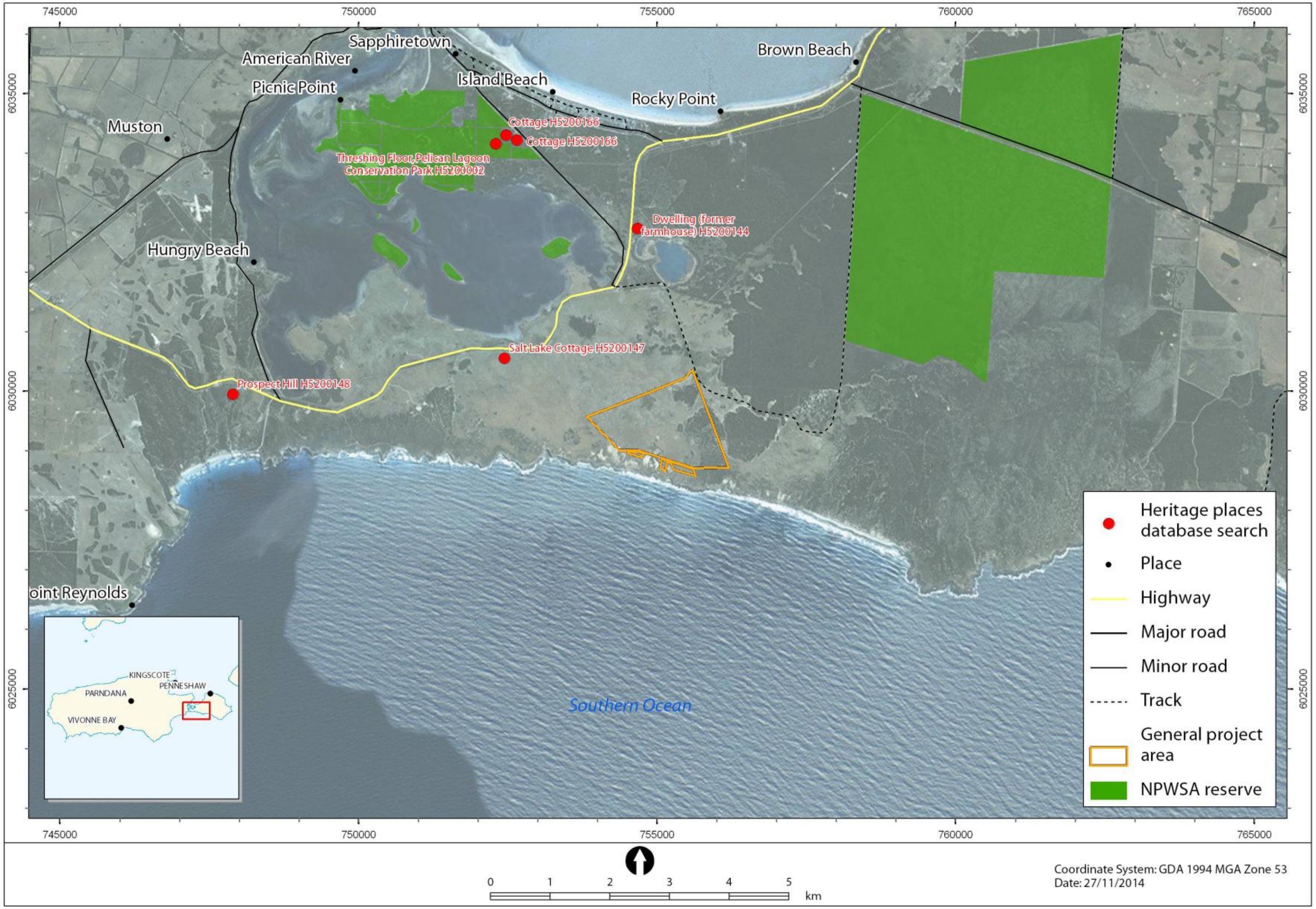
The Australian Heritage Database includes details about South Australia's World Heritage Places, National heritage Places, Commonwealth Heritage Places and overseas places of historic significance to Australia. This register was searched on the 25th November 2014 two entries were found; Cape Gantheaume Conservation Park (Register of the National Estate) and Loch Vennachar Historic Reserve (Register of the National Estate); neither of which are in or near the current project area.

Australian Heritage Places Inventory

The Australian Heritage Places Inventory includes details of South Australia's local heritage and State heritage places, as well as State heritage areas and Commonwealth, National and World heritage places. This register was searched on the 25th of November 2014 and yielded no results.

South Australian Heritage Places Database

The South Australian Heritage Places Database includes details about South Australia's local and State heritage places. There are over 100 listings for Kangaroo Island on this register although none are within or in close proximity to the current project area.



Map 8. Heritage Places.

6.2 General Project Area Background Research

The question of when Kangaroo Island was first inhabited remains a subject of debate. Aboriginal people certainly were present at least 16,100 BP according to radiocarbon dates taken from for the earliest human occupation of Seton rockshelter (Lampert 1981:107). At this early age, sea levels were much lower than today and Kangaroo Island was a highland area approximately 15 kilometres inland. Approximately 9,500 years ago, rising seas flooded what is now known as “Backstairs Passage” cutting off Kangaroo Island from the mainland (Draper 1999:13). The isolation of Kangaroo Island is recorded in the Ngurunderi Dreaming of the Ngarrindjeri people of the Lower Murray and Coorong region. In this creation story, the Ancestral Being Ngurunderi pursued his two errant wives westwards from the Murray mouth along the Encounter Bay coast; here they attempted to evade him by walking out in the shallows towards Kangaroo Island. Ngurunderi spotted them and angrily commanded the ocean to rise up and flood the passage drowning the two women (Berndt 1940). Ngurunderi then crossed to Kangaroo Island, where he travelled around and created a number of other important sites (Kingscote, Admiral’s Arch etc) and finally he cleansed himself in the ocean and passed on to the spirit world, decreeing that the souls of the deceased would follow him (Berndt 1940). This is why Ngarrindjeri, Ramindjeri and Kaurna people even today view the island as a spiritual place known as “*Karta*” the island of the dead. Aboriginal people did not live on the island at the time of European exploration and colonisation.

Although Howchin (1903) reported the presence of archaeological artefacts on Kangaroo Island, this was not verified until Tindale and Maegraith (1931) recorded several archaeological sites during agricultural clearing. Analysis of the archaeological material excavated on Kangaroo Island indicates that the Aboriginal population lived permanently there and used all of the resources at their disposal (Draper 1999). When Aboriginal people left Kangaroo Island is somewhat debated, with some evidence indicating it occurred a few hundred years before the first whalers and sealers arrived, although no evidence as to why the island was abandoned (Draper 1999).

6.3 The Ramindjeri People

References to the Ramindjeri appear in Tindale’s journals and they appear to have lived at Encounter Bay and around Cape Jervis, as well as Kangaroo Island (Tindale 1974). Tindale describes their territory as “*At Encounter Bay, west to Tunkalilla, east of Cape Jervis, Mount Hayfield and Inman valley; east to Middleton, thence across to Goolwa and Currency Creek, not along coast sand hills east of Middleton. Five or more hordes, the tribal name is in the style of hordal names father east; it is possible therefore that Rormear originally was the proper tribal designation but the last survivors insisted on form here given*” (Tindale 1974).

The Ramindjeri were amongst some of the first Aboriginal people in South Australia to come into regular contact with Europeans with Kangaroo Island based sealers raiding Ramindjeri lands for women in the early 19th century.

6.4 European Heritage

Kangaroo Island was first sighted in 1802 by Captain Matthew Flinders in the *Investigator* on his voyage of discovery which saw him circumnavigate Australia from west and included the charting of the South Australian coastline. Flinders made land on Kangaroo Island and named it thus for the abundance of Kangaroos witnessed. In 1805 there were European sealers and whalers on the island, as well as some Aboriginal people from Tasmania and from the South Australian mainland (Eyre Peninsula etc) who had been taken there by the Europeans (Cumpston 1970). The sealers and whalers were pushed from the island when it was officially settled in the 1830's.

6.5 Aboriginal Sites and Environmental Features

Archaeological and anthropological sites are often found to be associated with very specific environmental features and therefore if these landforms are found in the project area, represent a higher risk of encountering heritage sites at these locations. The following information is recorded here to assist with future risk management in regards to potential and unknown heritage sites within the current study area.

Although not exhaustive, the following can be used as a general guide to where cultural heritage sites may be located within particular landscape features. Only landscape features relevant to the project area are discussed;

- Long term water sources can be associated with mythological and anthropological sites, while less reliable water sources and swamps are associated with medium sized sites. Temporary water sources are associated with ephemeral sites and opportunistic sites. Dreaming stories are often related with large water bodies, in particular, the ocean and rivers, both of which can indicate the path taken across the earth by a mystical being.
- Drainage channels can have archaeological sites located on either side; these can sometimes be used to traverse the landscape while also having a source of water. These sites can be small, ephemeral and tend to be temporary or opportunistic.
- Water holes made by water and enlarged by people can also be ephemeral and temporary sources of water, as well as landmarks to navigate the landscape. Waterholes are also associated with dreaming and creationist stories.
- Rocky outcrops (quarries, rock art, rock holes, stone arrangements, ceremonial religious rites, stone artefact scatters).
- Sand dunes (stone artefact scatters, shell middens, campsites or ovens).
- Bush or forested areas (stone artefact scatters, campsites of ovens).

7 FIELD SURVEY RESULTS

7.1 Vegetation associations

Eleven vegetation associations were described for the project area (Table 7, Map 9). Vegetation condition ranged from excellent (SEB 9:1) to very poor (SEB 0:1) (Table 7, Map 10). Each vegetation association is described in more detail below. The majority of the vegetation was in moderate condition (SEB 5:1 to 6:1). The vegetation within the development footprint which is proposed for clearance is summarised in Section 9.

Table 7. Overall summary of vegetation associations.

ID	Vegetation association	SEB condition ratio	Area (ha)
1	Exotic Grassland +/- *Orthrosanthus multiflorus* +/- *Vittadinia australasica* var. *australasica*	0:1	80.64
1	Exotic Grassland +/- *Orthrosanthus multiflorus* +/- *Vittadinia australasica* var. *australasica*	1:1	1.43
2	*Leucopogon parviflorus* / *Olearia axillaris* tall shrubland	5:1	11.94
3	*Eucalyptus diversifolia* mallee over +/- *Melaleuca lanceolata*	5:1	0.34
3	*Eucalyptus diversifolia* mallee over +/- *Melaleuca lanceolata*	8:1	3.31
3	*Eucalyptus diversifolia* mallee over +/- *Melaleuca lanceolata*	9:1	5.68
4	*Eucalyptus oleosa* / *Eucalyptus gracilis* / *Eucalyptus rugosa* mallee	4:1	2.48
5	*Eucalyptus rugosa* / *Eucalyptus gracilis* / *Eucalyptus oleosa* +/- *Eucalyptus phenax* subsp. *compressa* +/- *Eucalyptus albopurpurea* mallee	5:1	13.90
5	*Eucalyptus rugosa* / *Eucalyptus gracilis* / *Eucalyptus oleosa* +/- *Eucalyptus phenax* subsp. *compressa* +/- *Eucalyptus albopurpurea* mallee	8:1	13.69
6	*Melaleuca lanceolata* tall shrubland over *Acacia paradoxa* / *Acrotriche patula* / *Acacia triquetra* / *Beyeria lechenaultii*	6:1	1.39
6	*Melaleuca lanceolata* tall shrubland over *Acacia paradoxa* / *Acrotriche patula* / *Acacia triquetra* / *Beyeria lechenaultii*	7:1	14.03
7	*Acrotriche patula* / *Orthrosanthus multiflorus* very open shrubland	3:1	38.05
7	*Acrotriche patula* / *Orthrosanthus multiflorus* very open shrubland	4:1	2.56
8	*Acacia paradoxa* / *Acrotriche patula* / *Leucopogon parviflorus* tall shrubland	6:1	8.43
8	*Acacia paradoxa* / *Acrotriche patula* / *Leucopogon parviflorus* tall shrubland	8:1	3.56
8	*Acacia paradoxa* / *Acrotriche patula* / *Leucopogon parviflorus* tall shrubland	8:1	0.22
9	*Eucalyptus gracilis* mallee over *Acrotriche patula*	5:1	0.87
10	*Leucopogon parviflorus* / *Lasiopetalum discolor* tall shrubland	8:1	1.30
11	*Eucalyptus rugosa* +/- *Eucalyptus albopurpurea* mallee over Melaleuca lanceolata	8:1	13.41

Vegetation associations 5 and 11 are considered rare and restricted on Kangaroo Island (Willoughby et al. 2001); threatened ecological communities are not formally recognised under the NPW Act.

Association 1- Exotic Grassland +/- *Orthrosanthus multiflorus* +/- *Vittadinia australasica* var. *australasica*

The cleared and exotic dominated areas are widespread throughout the project area, and associated with those areas behind the coastal dunes which are not characterised by surface limestone. Amongst the most dominant weeds, *Avena barbata* (Oats), *Lagurus ovata* (Hare's Tail Grass) and *Diplotaxis tenuifolia* (Lincoln Weed), scattered *Lycium ferocissimum* (African Boxthorn) are prominent and patches of *Asphodelus fistulosus* (Onion Weed). Scattered natives persist throughout the association, including *Orthrosanthus multiflorus* (Morning Flag) and *Vittadinia australasica var. australasica* (Sticky New Holland Daisy). Small occurrences of *Acaena novae-zelandiae* (Biddy Biddy) and *Enchylaena tomentosa* (Ruby Saltbush) were also recorded and it is likely that additional scattered natives are also persisting throughout, however the vegetation is considered very poor overall with an assigned SEB ratio of 0:1.

Figure 1. Typical view within Exotic Grassland +/- *Orthrosanthus multiflorus* +/- *Vittadinia australasica* var. *australasica.*

Association 2 - *Leucopogon parviflorus/ Olearia axillaris* tall shrubland

This vegetation association dominates the coastal dunes which extend into the project area. The shrubland is dominated by *Leucopogon parviflorus* (Coast Beard-heath) and *Olearia axillaris* (Coast Daisy-bush) with other prominent native species such as *Austrostipa stipoides* (Coast Spear-grass), *Clematis microphylla* (Old Man's Beard), *Ficinia nodosa* (Knobby Club-rush), *Tetragonia implexicoma* (Bower Spinach), *Threlkeldia diffusa* (Coast Bonefruit) and *Acrotriche patula* (Prickly Ground-berry) throughout. Historically this area appears to have been heavily infested with *Lycium ferocissimum* (African Boxthorn), which are now mounted up in regular piles along the back of the dunes in the cleared land. The infestation was probably spreading from the adjacent cleared areas into the dunes and scattered Boxthorn still persists throughout the dune shrubland community. The other most persistent weed species include *Lagurus ovata* (Hare's Tail Grass) and *Diplotaxis tenuifolia* (Lincoln Weed). Condition was therefore assessed as moderate with the overstorey intact, but with a reasonable level of understorey degradation due to weed invasion.

Table 8. Summary of vegetation association 2. *Leucopogon parviflorus/ Olearia axillaris* tall shrubland.

Representation	Dominant community associated with the coastal dune system
Conservation rating	None
Vegetation condition	5:1 - Moderate
Overstorey species	*Leucopogon parviflorus* (Coast Beard-heath) and *Olearia axillaris* (Coast Daisy-bush)
Midstorey species	*Clematis microphylla* (Old Man's Beard), *Myoporum insulare* (Common Boobialla) *Tetragonia implexicoma* (Bower Spinach)
Understorey species	*Austrostipa stipoides* (Coast Spear-grass), *Ficinia nodosa* (Knobby Club-rush), *Threlkeldia diffusa* (Coast Bonefruit) and *Acrotriche patula* (Prickly Ground-berry)
Threatened species	None
Declared weeds	*Lycium ferocissimum* (African Boxthorn), *Diplotaxis tenuifolia* (Lincoln Weed)

Figure 2. *Leucopogon parviflorus/ Olearia axillaris* tall shrubland.

Association 3 – *Eucalyptus diversifolia* mallee over +/- *Melaleuca lanceolata*

Three areas were found to be dominated by this association. The small area on the north-eastern side of the project area contains a more mature stand, but is associated with limestone soils, in comparison to the two patches closer to the coast which contain sandy soils. The dominant overstorey is considered an intact stratum over a sometimes patchy understorey of *Leucopogon parviflorus* (Coast Beard-heath), *Orthrosanthus multiflorus* (Morning Flag), *Eutaxia microphylla* (Common Eutaxia), *Acacia longifolia ssp. sophorae* (Coastal Wattle), *Senecio odoratus* (Scented Groundsel), *Acrotriche patula* (Prickly Ground-berry) and *Melaleuca gibbosa* (Slender Honey-myrtle). These patches are in reasonable condition, particularly those associated with the sandy coastal soil directly behind the dunes which are in good condition, despite high levels of kangaroo and wallaby grazing throughout.

Table 9. Summary of vegetation association 3. *Eucalyptus diversifolia* mallee over +/- *Melaleuca lanceolata*.

Representation	Small patches at the south-eastern corner of the project area
Conservation rating	None
Vegetation condition	5:1 – 8:1 – Moderate to Good
Overstorey species	*Eucalyptus diversifolia* (Coastal White Mallee)
Midstorey species	*Melaleuca lanceolata* (Dryland Teatree), *Leucopogon parviflorus* (Coast Beard-heath), *Eutaxia microphylla* (Common Eutaxia), *Acacia longifolia ssp. sophorae* (Coastal Wattle), *Melaleuca gibbosa* (Slender Honey-myrtle).
Understorey species	*Orthrosanthus multiflorus* (Morning Flag), *Senecio odoratus* (Scented Groundsel) and *Acrotriche patula* (Prickly Ground-berry)
Threatened species	None
Declared weeds	*Diplotaxis tenuifolia* (Lincoln Weed)

Figure 3. *Eucalyptus diversifolia* mallee over +/- *Melaleuca lanceolata.*

Association 4 – *Eucalyptus oleosa* / *Eucalyptus gracilis* / *Eucalyptus rugosa* mallee

A single centrally located patch was dominated by this mallee community associated with prominent surface limestone. The overstorey is intact however the only evidence of understorey vegetation is restricted to the edges of the patch. The most prominent species include *Leucopogon parviflorus* (Coast Beard-heath), *Orthrosanthus multiflorus* (Morning Flag), *Senecio odoratus* (Scented Groundsel) *Clematis microphylla* (Old Man's Beard), *Acrotriche patula* (Prickly Ground-berry), *Austrostipa exilis* (Heath Spear-grass) and *Vittadinia australasica var. australasica* (Sticky New Holland Daisy).

The interior contains very few scattered individuals. This is probably due to high levels of grazing and surface litter, which are both suppressing seedling recruitment. The condition is therefore assessed as poor.

Table 10. Summary of vegetation association 4. *Eucalyptus oleosa / Eucalyptus gracilis / Eucalyptus rugosa* mallee.

Representation	One centrally located patch
Conservation rating	None
Vegetation condition	SEB 4:1 - Poor
Overstorey species	*Eucalyptus oleosa ssp. ampliata* (Red Mallee), *Eucalyptus gracilis* (Yorrell), *Eucalyptus rugosa* (Kingscote Mallee)
Midstorey species	*Leucopogon parviflorus* (Coast Beard-heath), *Senecio odoratus* (Scented Groundsel) *Clematis microphylla* (Old Man's Beard),
Understorey species	*Acrotriche patula* (Prickly Ground-berry), *Austrostipa exilis* (Heath Spear-grass), *Orthrosanthus multiflorus* (Morning Flag), *Vittadinia australasica var. australasica* (Sticky New Holland Daisy)
Threatened species	
Declared weeds	None

Figure 4. *Eucalyptus oleosa / Eucalyptus gracilis / Eucalyptus rugosa* mallee.

Association 5 - *Eucalyptus rugosa* / *Eucalyptus gracilis* / *Eucalyptus oleosa* +/- *Eucalyptus phenax* subsp. *compressa* +/- *Eucalyptus albopurpurea* mallee

This association dominates two large patches to the east of the project area. Both areas are characterised by surface limestone and sparse understorey vegetation. The patches are separated by approximately 100 m clearance, but are very similar in structure and species composition; however the more northern patch has significantly less understorey structure. They both possess an intact overstorey but the only evidence of understorey vegetation in the northern patch is mainly restricted to the edges of the patch. The overstorey includes patches of the state rare *Eucalyptus phenax* ssp. *compressa* (Kangaroo Island Mallee), the regionally vulnerable *Eucalyptus gracilis* (Yorrell) and the regionally rare *Eucalyptus oleosa* ssp. *ampliata* (Red Mallee). The most prominent understorey species include *Leucopogon parviflorus* (Coast Beard-heath), *Acrotriche patula* (Prickly Ground-berry), *Clematis microphylla* (Old Man's Beard), *Rhagodia candolleana* ssp. *candolleana* (Sea-berry Saltbush), *Senecio odoratus* (Scented Groundsel), *Orthrosanthus multiflorus* (Morning Flag), *Austrostipa exilis* (Heath Spear-grass) and *Vittadinia australasica* var. *australasica* (Sticky New Holland Daisy). A number of weed species are scattered mainly around the edges, including *Lycium ferocissimum* (African Boxthorn), *Diplotaxis tenuifolia* (Lincoln Weed) and *Asphodelus fistulosus* (Onion Weed).

Table 11. Summary of vegetation association 5. *Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax* subsp. *compressa +/- Eucalyptus albopurpurea* mallee.

Representation	Two large patches to the east of the project area
Conservation rating	None
Vegetation condition	5:1 – 8:1 Moderate to Good
Overstorey species	*Eucalyptus rugosa* (Kingscote Mallee), *Eucalyptus gracilis* (Yorrell), *Eucalyptus oleosa ssp. ampliata* (Red Mallee), *Eucalyptus phenax* subsp. *compressa* (Kangaroo Island Mallee) +/- *Eucalyptus albopurpurea* (Purple-flowered Mallee)
Midstorey species	*Leucopogon parviflorus* (Coast Beard-heath), *Senecio odoratus* (Scented Groundsel) *Clematis microphylla* (Old Man's Beard), *Rhagodia candolleana* ssp. *candolleana* (Sea-berry Saltbush)
Understorey species	*Acrotriche patula* (Prickly Ground-berry), *Austrostipa exilis* (Heath Spear-grass), *Orthrosanthus multiflorus* (Morning Flag), *Vittadinia australasica var. australasica* (Sticky New Holland Daisy)
Threatened species	*Eucalyptus phenax* subsp. *compressa* – rare in SA This association is considered regionally rare (Willoughby et al. 2001)
Declared weeds	*Lycium ferocissimum* (African Boxthorn), *Diplotaxis tenuifolia* (Lincoln Weed), *Asphodelus fistulosus* (Onion Weed)

Figure 5. *Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax* subsp. *compressa +/- Eucalyptus albopurpurea* mallee.

Association 6 - *Melaleuca lanceolata* tall shrubland over *Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*

This community was observed in small patches of higher ground amongst the low very open shrublands in the central areas of the project area. The small pockets are also characterised by surface limestone, but differed from neighbouring areas by the presence of *Melaleuca lanceolata* (Dryland Teatree) as the dominant overstorey and a denser mid and understorey stratum. Some of most dominant understorey species include *Acacia paradoxa* (Kangaroo Thorn), *Acrotriche patula* (Prickly Ground-berry), *Acacia triquetra* (Mallee Wreath Wattle) and *Beyeria lechenaultii* (Pale Turpentine Bush). Other prominent species include *Leucopogon parviflorus* (Coast Beard-heath), *Orthrosanthus multiflorus* (Morning Flag), *Vittadinia australasica var. australasica* (Sticky New Holland Daisy), *Clematis microphylla* (Old Man's Beard) and *Austrostipa exilis* (Heath Spear-grass). A number of weed species were detected also, including the more prominent *Avena barbata* (Oats) and *Lagurus ovata* (Hare's Tail Grass), with the odd *Asphodelus fistulosus* (Onion Weed) and *Lycium ferocissimum* (African Boxthorn) scattered throughout. The overall condition of these patches ranged from moderate to good, with the variation generated by level of weed invasion and diversity of understorey.

Table 12. Summary of vegetation association 6 - *Melaleuca lanceolata* tall shrubland over *Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*.

Representation	Small patches of higher ground amongst the low very open shrublands in the central areas of the project area
Conservation rating	None
Vegetation condition	6:1 – 7:1 Moderate to Good
Overstorey species	*Melaleuca lanceolata* (Dryland Teatree)
Midstorey species	*Acacia paradoxa* (Kangaroo Thorn), *Acrotriche patula* (Prickly Ground-berry), *Acacia triquetra* (Mallee Wreath Wattle) and *Beyeria lechenaultii* (Pale Turpentine Bush), *Leucopogon parviflorus* (Coast Beard-heath), *Clematis microphylla* (Old Man's Beard)
Understorey species	*Orthrosanthus multiflorus* (Morning Flag), *Vittadinia australasica var. australasica* (Sticky New Holland Daisy), *Austrostipa exilis* (Heath Spear-grass).
Threatened species	
Declared weeds	*Asphodelus fistulosus* (Onion Weed) and *Lycium ferocissimum* (African Boxthorn).

Figure 6. *Melaleuca lanceolata* tall shrubland over *Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii.*

Association 7 - *Acrotriche patula / Orthrosanthus multiflorus* very open shrubland

This association encompasses the open limestone dominated plains behind the coastal dune system. All examples are fairly degraded with obvious high levels of kangaroo and wallaby grazing and high levels of weed dominance. The condition rating assigned to this community is therefore poor. The dominant shrubland species are scattered across the landscape, including *Acrotriche patula* (Prickly Ground-berry) and *Orthrosanthus multiflorus* (Morning Flag), with lower densities of *Acacia paradoxa* (Kangaroo Thorn),*Vittadinia australasica var. australasica* (Sticky New Holland Daisy), *Austrostipa exilis* (Heath Spear-grass) and *Acaena novae-zelandiae* (Biddy Biddy). The dominant and most widespread weeds are *Avena barbata* (Oats), *Lagurus ovata* (Hare's Tail Grass) and *Diplotaxis tenuifolia* (Lincoln Weed).

Table 13. Summary of vegetation association 7. *Acrotriche patula / Orthrosanthus multiflorus* very open shrubland.

Representation	Large areas of open limestone dominated plains behind the coastal dune system
Conservation rating	None
Vegetation condition	3:1 - Poor
Overstorey species	*Acrotriche patula* (Prickly Ground-berry), *Orthrosanthus multiflorus* (Morning Flag) and *Acacia paradoxa* (Kangaroo Thorn)
Understorey species	*Vittadinia australasica var. australasica* (Sticky New Holland Daisy), *Austrostipa exilis* (Heath Spear-grass) and *Acaena novae-zelandiae* (Biddy Biddy)
Threatened species	
Declared weeds	*Diplotaxis tenuifolia* (Lincoln Weed)

Figure 7. *Acrotriche patula / Orthrosanthus multiflorus* very open shrubland.

Association 8 - *Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus* tall shrubland

This community is similar to Association 6 where many common species are consistent however the dominant overstorey species differ. Like Association 6, it also occupies higher elevations than the neighbouring low very open shrublands in the central areas of the project area. The limestone dominated landscape is also an important influence on the vegetation. The dominant overstorey in the shrubland community includes *Acacia paradoxa* (Kangaroo Thorn), *Acrotriche patula* (Prickly Ground-berry), and *Leucopogon parviflorus* (Coast Beard-heath). Other less prominent and scattered natives include *Clematis microphylla* (Old Man's Beard), *Orthrosanthus multiflorus* (Morning Flag), *Senecio odoratus* (Scented Groundsel) and *Austrostipa exilis* (Heath Spear-grass). A number of weed species were detected also, including the more dominant *Avena barbata* (Oats) and *Lagurus ovata* (Hare's Tail Grass), with the odd scattered *Asphodelus fistulosus* (Onion Weed) and *Asparagus asparagoides* (Bridal Creeper). The overall condition of these patches ranged from moderate to good, with the variation attributed to levels of weed invasion and diversity of understorey stratum.

Table 14. Summary of vegetation association 8. *Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus* tall shrubland.

Representation	Large areas of open limestone dominated plains in the north-western and south-eastern areas of the project area
Conservation rating	None
Vegetation condition	6:1 – 8:1 – Moderate to Good
Overstorey species	*Acacia paradoxa* (Kangaroo Thorn), *Acrotriche patula* (Prickly Ground-berry), and *Leucopogon parviflorus* (Coast Beard-heath)
Midstorey species	*Clematis microphylla* (Old Man's Beard), *Orthrosanthus multiflorus* (Morning Flag) and *Senecio odoratus* (Scented Groundsel)
Understorey species	*Austrostipa exilis* (Heath Spear-grass)
Threatened species	
Declared weeds	*Diplotaxis tenuifolia* (Lincoln Weed), *Asparagus asparagoides* (Bridal Creeper), *Asphodelus fistulosus* (Onion Weed)

Figure 8. *Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus* tall shrubland.

Association 9 - *Eucalyptus gracilis* mallee over *Acrotriche patula*

A small patch of mallee eucalypt associated with an area of higher elevation located at the north-western end of the project area. This association was moderately degraded with much of the understorey absent, which is most probably the result of overgrazing by kangaroos. Given the slight elevation over much of the site, it likely provides a useful vantage point for wildlife such as the kangaroos, as well as the dominant *Eucalyptus gracilis* (Yorrell) providing shade and shelter from the prevailing coastal winds. The understorey consists of climbing species *Cassytha melantha* (Coarse Dodder-laurel) and *Clematis microphylla* (Old Man's Beard), with scattered *Acrotriche patula* (Prickly Ground-berry), *Leucopogon parviflorus* (Coast Beard-heath) and *Olearia axillaris* (Coast Daisy-bush). The dominant and most widespread weeds are *Avena barbata* (Oats), *Lagurus ovata* (Hare's Tail Grass), *Diplotaxis tenuifolia* (Lincoln Weed), *Asphodelus fistulosus* (Onion Weed) and a small *Asparagus asparagoides* (Bridal Creeper) occurrence.

Table 15. Summary of vegetation association 9 - *Eucalyptus gracilis* mallee over *Acrotriche patula*.

Representation	A small patch of mallee eucalypt in a higher elevated site located at the north-western end of the project area.
Conservation rating	None
Vegetation condition	6:1 - Moderate
Overstorey species	*Eucalyptus gracilis* (Yorrell)
Midstorey species	*Cassytha melantha* (Coarse Dodder-laurel) and *Clematis microphylla* (Old Man's Beard)
Understorey species	*Acrotriche patula* (Prickly Ground-berry), and *Leucopogon parviflorus* (Coast Beard-heath) and *Olearia axillaris* (Coast Daisy-bush).
Threatened species	None
Declared weeds	*Diplotaxis tenuifolia* (Lincoln Weed), *Asphodelus fistulosus* (Onion Weed) and *Asparagus asparagoides* (Bridal Creeper)

Figure 9. *Eucalyptus gracilis* mallee over *Acrotriche patula.*

Association 10 - *Leucopogon parviflorus* / *Lasiopetalum discolor* tall shrubland

This small patch of coastal heath was recorded from the south-eastern corner of the project area. The shrubland is in good condition with a reasonable diversity of species and low incidence of weeds. The dominant shrubland species include *Leucopogon parviflorus* (Coast Beard-heath) and *Lasiopetalum discolor* (Coast Velvet-bush) with lower occurrences of *Olearia axillaris* (Coast Daisy-bush), *Clematis microphylla* (Old Man's Beard), *Eutaxia microphylla* (Common Eutaxia), *Orthrosanthus multiflorus* (Morning Flag), Scaevola crassifolia (Cushion Fanflower), *Vittadinia australasica* var*. australasica* (Sticky New Holland Daisy), *Melaleuca gibbosa* (Slender Honey-myrtle) and *Senecio odoratus* (Scented Groundsel). This area is considered to be in good condition with lower levels of grazing impacts most probably due to the density of the coastal heath, however there are many braided animal tracks throughout.

Table 16. Summary of vegetation association 10- *Leucopogon parviflorus / Lasiopetalum discolor* tall shrubland.

Representation	A small patch of coastal heath was recorded from the south-eastern corner of the project area
Conservation rating	None
Vegetation condition	8:1 - Good
Overstorey species	*Leucopogon parviflorus* (Coast Beard-heath)
Midstorey species	*Lasiopetalum discolor* (Coast Velvet-bush), *Olearia axillaris* (Coast Daisy-bush), *Clematis microphylla* (Old Man's Beard), *Scaevola crassifolia* (Cushion Fanflower),

	Melaleuca gibbosa (Slender Honey-myrtle), *Eutaxia microphylla* (Common Eutaxia) and *Senecio odoratus* (Scented Groundsel).
Understorey species	*Orthrosanthus multiflorus* (Morning Flag), *Vittadinia australasica var. australasica* (Sticky New Holland Daisy) and *Euphrasia collina* ssp*. tetragona* (Cost Eyebright) and *Dichondra repens* (Kidney Weed).
Threatened species	
Declared weeds	*Diplotaxis tenuifolia* (Lincoln Weed),

Figure 10. *Leucopogon parviflorus / Lasiopetalum discolor* tall shrubland.

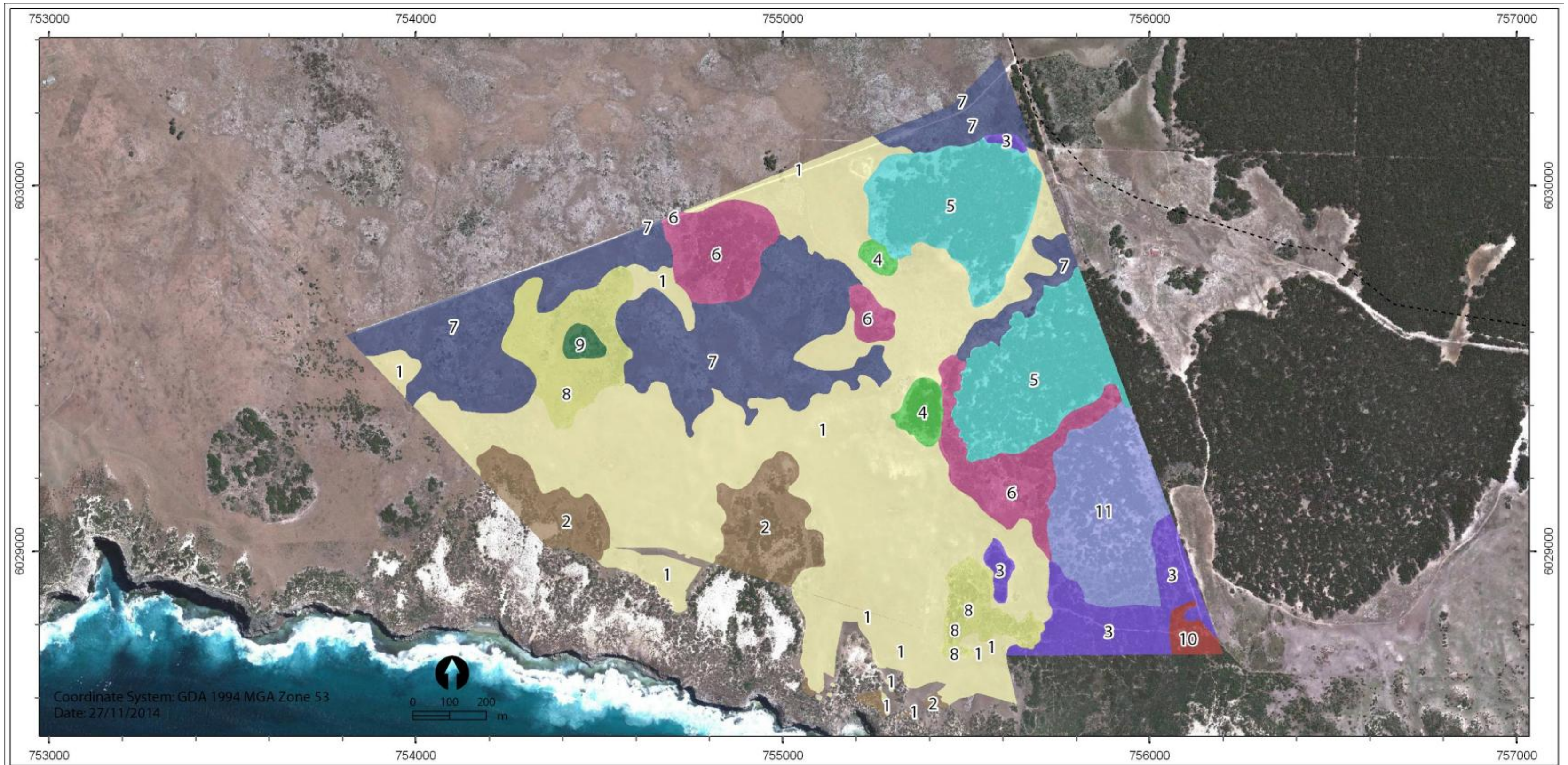
Association 11 - *Eucalyptus rugosa* +/- *Eucalyptus albopurpurea* mallee over *Melaleuca lanceolata*

This association dominates large area in the south-eastern section of the project area. The eucalypt mallee community is characterised by sandy limestone soils and dominated by *Eucalyptus rugosa* (Kingscote Mallee) with scattered occurrences of *Eucalyptus albopurpurea* (Purple-flowered Mallee). The understorey is patchy at times and is dominated by a mix of species including *Acrotriche patula* (Prickly Ground-berry), *Lasiopetalum discolor* (Coast Velvet-bush), *Myoporum insulare* (Common Boobialla), *Senecio odoratus* (Scented Groundsel), *Orthrosanthus multiflorus* (Morning Flag), *Melaleuca gibbosa* (Slender Honey-myrtle) and *Eutaxia microphylla* (Common Eutaxia). There were no weeds recorded for this areas, however it is likely there are small infestations present on edges and possible in the interior of the patch (e.g. Bridal Creeper). The patch was assigned a condition rating of good.

Table 17. Summary of vegetation association 11 - *Eucalyptus rugosa +/- Eucalyptus albopurpurea* mallee over *Melaleuca lanceolata*.

Representation	A large area in the south-eastern section of the project area
Conservation rating	None
Vegetation condition	8:1 - Good
Overstorey species	*Eucalyptus rugosa* (Kingscote Mallee), *Eucalyptus albopurpurea* (Purple-flowered Mallee)
Midstorey species	*Acrotriche patula* (Prickly Ground-berry), *Lasiopetalum discolor* (Coast Velvet-bush), *Olearia axillaris* (Coast Daisy-bush), *Melaleuca gibbosa* (Slender Honey-myrtle), *Eutaxia microphylla* (Common Eutaxia) and *Senecio odoratus* (Scented Groundsel) and *Myoporum insulare* (Common Boobialla)
Understorey species	*Orthrosanthus multiflorus* (Morning Flag)
Threatened species	This association is considered regionally rare (Willoughby et al. 2001)
Declared weeds	

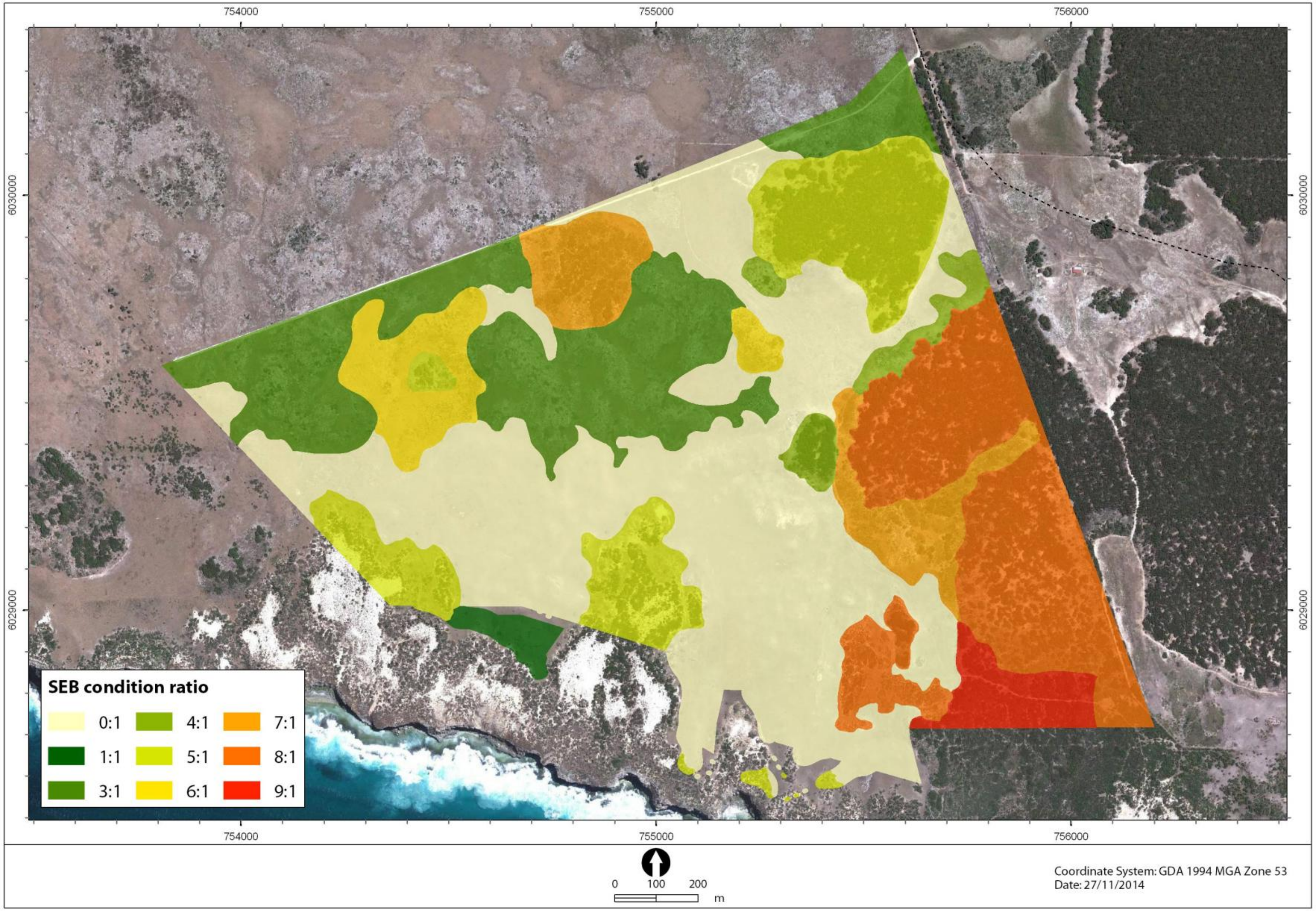
Figure 11. *Eucalyptus rugosa +/- Eucalyptus albopurpurea* mallee over *Melaleuca lanceolata.*



Vegetation association

1. Exotic Grassland +/- *Orthrosanthus multiflorus* +/- *Vittadinia australasica* var. *australasica*
2. *Leucopogon parviflorus*/ *Olearia axillaris* tall shrubland
3. *Eucalyptus diversifolia* mallee over +/- *Melaleuca lanceolata*
4. *Eucalyptus oleosa* / *Eucalyptus gracilis* / *Eucalyptus rugosa* mallee
5. *Eucalyptus rugosa* / *Eucalyptus gracilis* / *Eucalyptus oleosa* +/- *Eucalyptus phenax* subsp. *compressa* +/- *Eucalyptus albopurpurea* mallee
6. *Melaleuca lanceolata* tall shrubland over *Acacia paradoxa* / *Acrotriche patula* / *Acacia triquetra* / *Beyeria lechenaultii*
7. *Acrotriche patula* / *Orthrosanthus multiflorus* very open shrubland
8. *Acacia paradoxa* / *Acrotriche patula* / *Leucopogon parviflorus* tall shrubland
9. *Eucalyptus gracilis* mallee over *Acrotriche patula*
10. *Leucopogon parviflorus* / *Lasiopetalum discolor* tall shrubland
11. *Eucalyptus rugosa* +/- *Eucalyptus albopurpurea* mallee over *Melaleuca lanceolata*

Map 9. Vegetation associations mapped within the project area.



Map 10. Vegetation condition mapped within the project area.

7.2 Flora

Sixty-two flora species were recorded within the project area, including sixteen introduced species. One conservation rated species was recorded:

- *Eucalyptus phenax* ssp. *compressa* (Kangaroo Island Mallee) - rare in SA.

The most significant weed issues present were *Lycium ferocissimum* (African Boxthorn), *Diplotaxis tenuifolia* (Lincoln Weed) and *Asphodelus fistulosus* (Onion Weed). Active control works were evident for African Boxthorn, with the plants lefts insitu in large piles.

7.3 Fauna

This section summarises the fauna observed during the field survey. Species of conservation significance are further discussed in Section 8. The locations of significant fauna observations made during the field survey are shown on Map 11.

7.3.1 Birds

Twenty-three bird species were observed. This includes species observed in close proximity to the project area. Three of the species are rated as threatened in SA (NPW Act):

- Osprey (*Pandion haliaetus*) – endangered in SA. One bird was observed flying low over the coastline.
- Scarlet Robin (*Petroica boodang*) - The sub-species of Scarlet Robin on Kangaroo Island is considered an intermediate between the Mount Lofty Ranges sub-species (rated rare in SA), the Eyre Peninsula sub-species (rated vulnerable in SA) and the as yet unnamed subspecies on Yorke Peninsula. For the purpose of this report, the precautionary approach has been taken and the species has been considered as threatened. One bird was observed at Point Count site 6, in mallee vegetation.
- Sooty Oystercatcher (*Haematopus fuliginosus*) – rare in SA. Two birds were opportunistically observed on the beach directly south of the project area.

7.3.2 Mammals

Five mammal species were recorded:

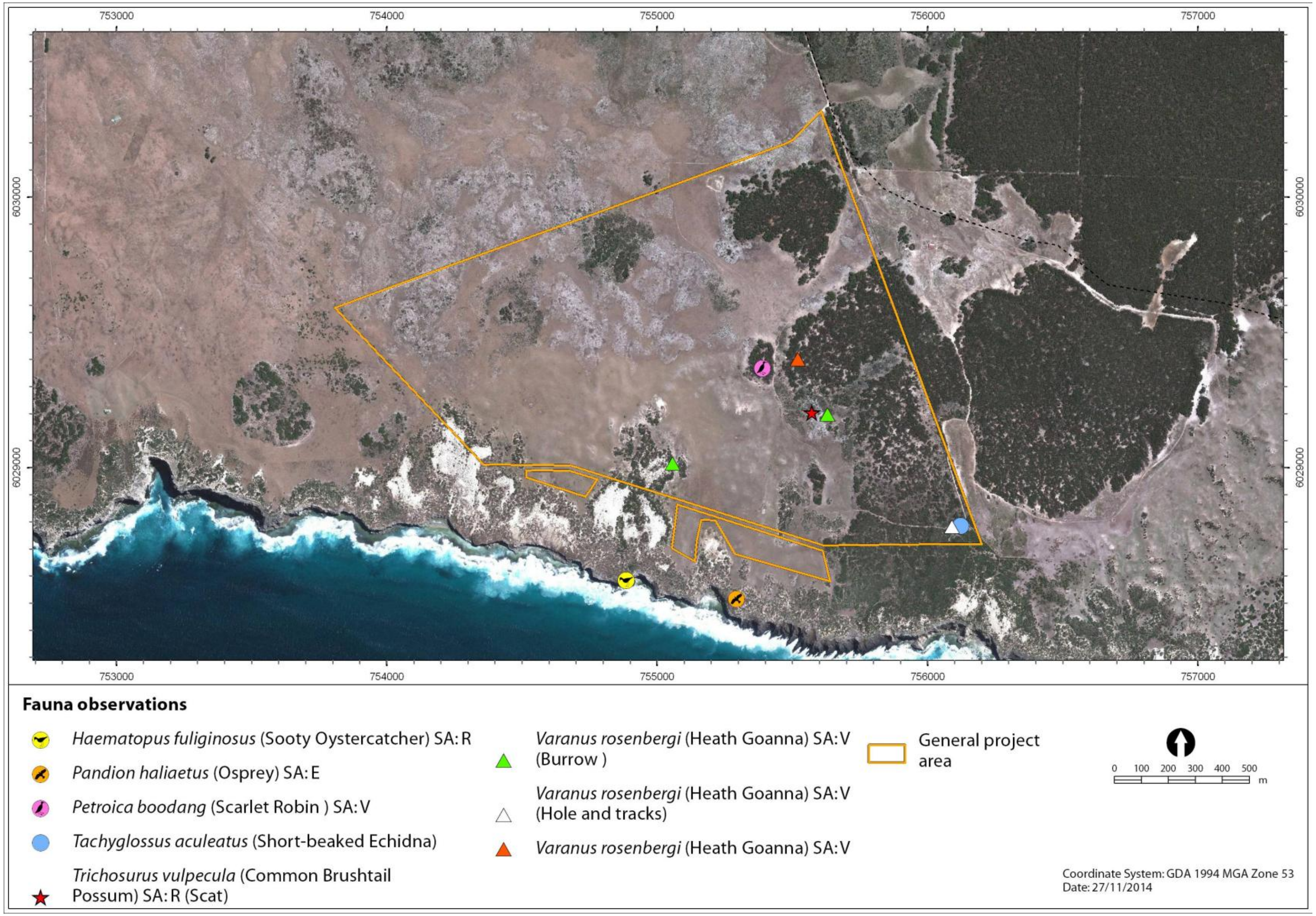
- Western Grey Kangaroo (*Macropus fuliginosus*) - observed in high abundance (estimated approximately 400 individuals) across the project area.
- Tammar Wallaby (*Macropus eugenii decres*) - three individuals observed directly north of the project area in roadside vegetation.

- Short-beaked Echidna (*Tachyglossus aculeatus*) - diggings and scats observed.
- Common Brushtail Possum (*Trichosurus vulpecular*) – rare in SA. Scats observed.

Other small mammal species are likely to be present however targeted survey was not undertaken.

7.3.3 Reptiles

Three individuals of the state vulnerable Heath Goanna (*Varanus rosenbergi*) were observed. Other reptile species are likely to be present however targeted survey was not undertaken.



Map 11. Significant fauna observations.

7.4 Identified Cultural Heritage

An EBS Heritage archaeologist conducted a site inspection of the proposed Golf Course and recorded two locations of potential cultural heritage significance. These were a manuport (manually portable stone-with hammer damage) and an enlarged waterhole; both of which have significance for Aboriginal people and are associated with sites elsehwere in South Australia. The Manuport was of a similar stone to other manuports excavated from known sites on Kangaroo Island and of a similar lithic technology. The location of these two features is shown on Map 12.

7.5 Cultural Heritage Risk Assessment

EBS Heritage has conducted a site inspection and analysis of the existing environmental features in the project area to provide Programmed Turnpoint with a cultural heritage risk assessment. The results of this have been broken down into 'risk' categories; high, moderate and low which can be seen on Map 13. The risk assessment is based on a combination of information from the site inspection, background research and what is known of the association between cultural heritage sites and certain landforms. EBS Heritage consultants recorded two isolated cultural heritage objects/sites within the project area (see Map 12) these consisted of a rock hole and a large river cobble (manuport) similar to those found at other archaeological sites and consistent with the lithic technology present at other sites on the island.

High Risk: identifies landforms where traditionally cultural heritage sites have been found and where there is a high risk of proposed works encountering unidentified heritage sites. This risk has been assessed on the understanding that the areas have also not experienced high levels of disturbance or clearing through farming or other uses. Areas traditionally considered to be of 'high' risk include undisturbed natural waterways and dune systems. Areas identified as "high' risks are also areas where potential heritage items were identified during the site inspection (see Map 13).

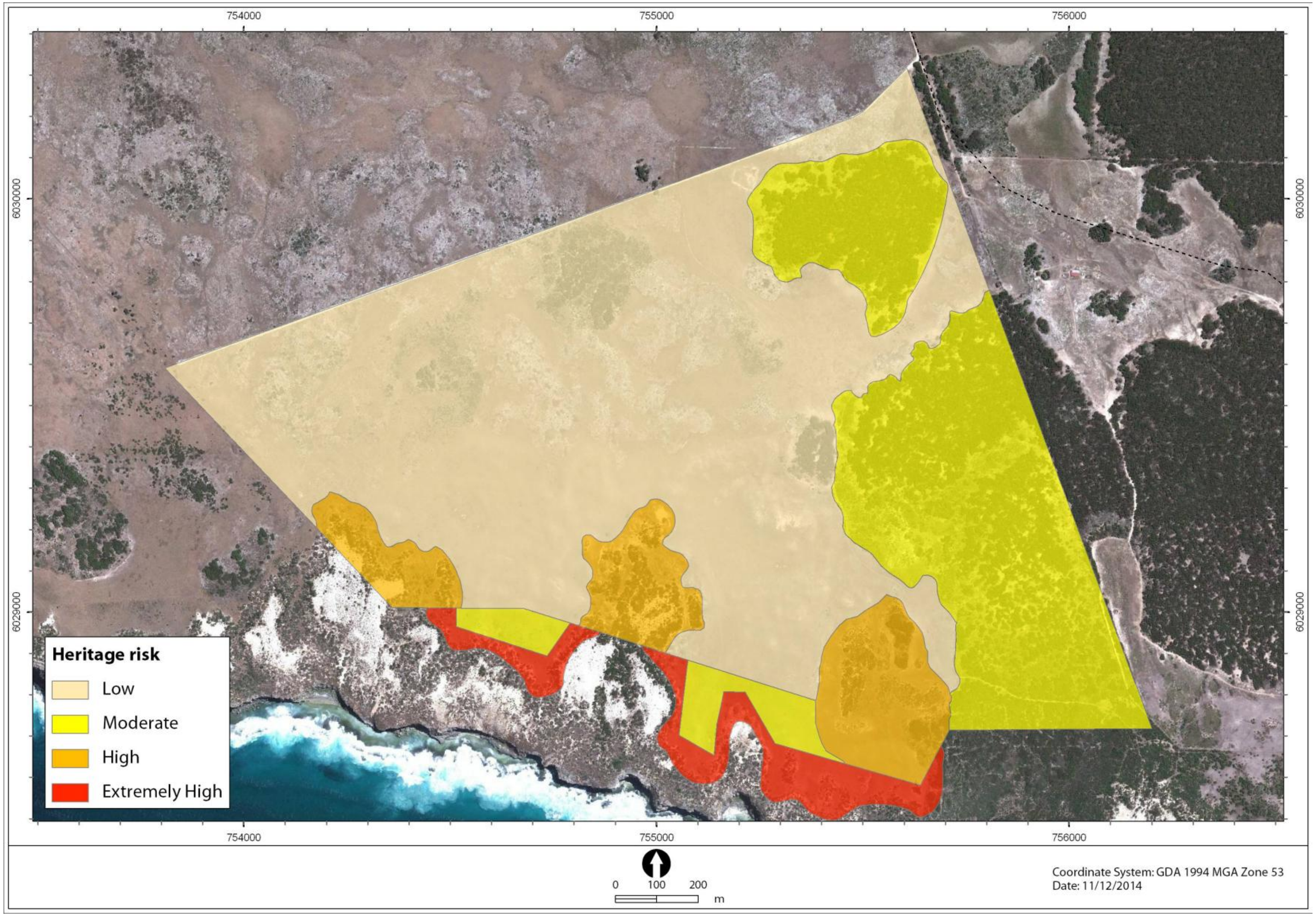
Moderate Risk: identifies landforms where traditionally opportunistic use cultural heritage sites have been found and where there is a moderate risk of proposed works encountering unidentified heritage sites. This risk has been assessed on the understanding that these areas have experienced some level of modern disturbance (clearance etc.). Areas considered to be of 'moderate' risk include secondary waterways or areas which may have once been classified as 'high' but have been impacted by modern clearing and grazing.

Low Risk: identifies areas where there is a very low or no chance of encountering cultural heritage site and where there is a low likelihood of proposed works impacting heritage sites. Areas assessed as having a 'low' risk are areas with considerable modern impact or where there are very low soil profiles.

7.5.1 Discussion

The important relationship between environmental landforms and cultural heritage sites has been highlighted here to clarify that while there are no registered sites within the current project area, this may be due to any number of reasons; such as a lack of survey or modern disturbance (clearing, grazing). Understanding the environmental landscape can assist in determining the likelihood of heritage sites. Consultation with the relevant Aboriginal communities can also help to clarify whether these landforms are commonly associated with cultural heritage sites.

Map 12. Heritage artefacts.



Map 13. Heritage risk.

8 DISCUSSION

8.1 Vegetation

In general, the native vegetation within the project area was degraded and lacked understorey cover and diversity due to heavy grazing pressure. Some of the vegetation patches on the eastern boundary of the the project area were in good condition with an intact understorey stratum. Areas in good condition were generally those with surface limestone.

Access to the property is via Davies Road which is narrow and surrounded by intact mallee vegetation. Roadside vegetation is often a hotspot for threatened plant species. It is envisaged that some clearance will be required to widen the road for equipment and vehicle access. It is recommended that the area is surveyed for threatened plant species. Any clearance is subject to NVC approval and should be undertaken in accordance with the Kangaroo Island Council Roadside Vegetation Management Plan.

The area has obviously not been burnt for a long time. Controlled burning could be used as a management tool to encourage natural regeneration, and in turn this may also improve the habitat suitability of the area for the Southern Brown Bandicoot.

Remnant vegetation should be retained and managed for conservation. This should include the coastal dune shrublands, mallee patches and shrublands. The management of vegetation will need to incorporate weed management of woody and herbaceous exotics throughout these areas, in particular, *Lycium ferocissimum* (African Boxthorn), *Diplotaxis tenuifolia* (Lincoln Weed) and *Asphodelus fistulosus* (Onion Weed). Grassy exotics such as *Avena barbata* (Oats) and *Lagurus ovata* (Hare's Tail Grass) will be more difficult to control and caution will need to be exercised when controlling amongst native plants, particularly the small herbaceous species and native grasses. Weed management programs will need to include suitable follow up activities to effectively manage exotics throughout the project area.

Suppression of weed species throughout many of the remnants in conjunction with reduction in grazing pressure will likely encourage natural regeneration of native understorey species. However a number of the mallee patches, where natural regeneration is currently being suppressed by high levels of grazing by macropods, will require revegetation to restore degraded understories. Any revegetation undertaken will need to be adequately protected from grazing animals to promote seedling survival in the longer term.

8.2 Substrate

Much of the site is covered by surface limestone. It is envisaged that mechanical removal may be required to develop the golf course greens. This will need to be done in a sensitive manner with consideration of potential heritage issues (see Section 10.2) and stockpiled where there will be no impact on native vegetation. The coastal dunes are sensitive to erosion. Development and access within the coastal dunes is discouraged.

8.3 Overabundant species

8.3.1 Kangaroos

Western Grey Kangaroos (*Macropus fuliginosus*) were recorded in high numbers; most sightings occurred when animals were flushed from patches of vegetation. Tammar wallabies are also reported to occur in high numbers however only a few individuals were seen during the EBS survey. A more accurate population estimate could be achieved via targeted spotlight survey at night, when they venture out of the native vegetation and into open pasture to feed. The number of kangaroos and tammar wallabies and associated grazing pressure is only likely to increase under an irrigated scenario where kangaroos have access to green feed and a permanent water source.

There may be an increase in road related deaths of the Western Grey Kangaroo and the Tamar Wallaby associated with vehicle traffic to the site. Speed restrictions and discouraging people driving to/from and within the site at night will help to reduce the incidence of vehicle collision with kangaroos.

Management of kangaroos will be a necessity to successfully restore native vegetation and achieve SEB offsets on site, as well as a reality to maintain a golf course to the desired international standard. A Kangaroo Management Plan should be developed in conjunction with DEWNR and surrounding landholders, identifying the management aims, control strategies to be adopted and any potential issues. Management options may include:

- Monitoring of kangaroo numbers
- Fencing (e.g. around the golf course perimeter; around native vegetation patches to be restored or around revegetation areas)
- Culling to reduce total population size.

Figure 12. The Western Grey Kangaroo was recorded in high numbers within the project area.

The Department of Environment, Water and Natural Resources (DEWNR) is responsible for the conservation and management of abundant kangaroo species in South Australia. A permit to destroy wildlife (non-commercial/damage mitigation) may be issued by DEWNR under section 53(1)(c) of the *National Parks and Wildlife Act 1972*. The permit allows for the permit holder to destroy a specified number of kangaroos that are causing, or are likely to cause, damage to the environment, or to stock, crops or other property. The permit holder, or the person listed on the permit to shoot kangaroos, must hold a current firearms licence (DEWNR 2013).

8.3.2 Avifauna

The introduction of a storage dam to hold water for the irrigation of the proposed golf course, and the creation of green grassed areas may result in attracting bird species such as the Australian Wood Duck (*Chenonetta jubata*) and Australian White Ibis (*Threskiornis molucca*), which otherwise may not occur within the local landscape. These species are particularly attracted to green grass areas as well as a constant water supply for drinking. The storage dam facility will be fenced and covered to reduce evaporation, which is also considered essential to prevent fauna access. Potential changes in avifauna use of the area should be addressed within a site environmental management plan.

8.4 Conservation significant flora

Eucalyptus phenax ssp. *compressa* (Kangaroo Island Mallee) is endemic to SA. It has a restricted distribution, occurring in scattered locations on north-eastern Kangaroo Island and the southern Fleurieu Peninsula (DEH 2008). This species had a scattered and patchy distribution within vegetation association 5. Clearance of this association should be avoided to prevent impact on this species.

Caladenia sanguinea **(Crimson Daddy-long-legs) – listed as rare under the NPW Act**

Caladenia sanguinea (Crimson Daddy-long-legs) has scattered records across the island. It grows In scrubs, woodland and wooded heaths in laterite or in shallow soil pockets over limestone. Although this species was not observed, the habitat description matches some of the habitat available in the project area and given the wide occurrence of the species across the island, the likelihood of occurrence within the project area was considered possible.

The habitat description of some of the other threatened flora species identified from database searches also broadly matches that in the project area, however a review of the known records suggested that these species have a restricted distribution and hence their presence within the project area was considered unlikely.

8.5 Conservation significant fauna

Out of the conservation significant fauna listed below, five species are known to occur within or in close proximity to the project area: Common Brushtail Possum, Heath Goanna, Hooded Plover, Osprey, Scarlet Robin and Sooty Oystercatcher. Three species were determined as likely to have potential habitat and or potentially occur on site, being the Shy Heathwren, Southern Emu-wren and the White-bellied Sea-eagle. Three species were determined as possibly occurring on site: Cattle and Great Egrets, and the Southern Brown Bandicoot. These species and the potential impacts associated with the proposed development on these species is The nationally threatened Glossy Black Cockatoo and the Kangaroo Island Dunnart were determined as unlikely to occur within the project area for the reasons discussed below.

8.5.1 Species known to occur on site

Common Brushtail Possum (*Trichosurus vulpecular*) - listed as rare under the NPW Act

The Common Brushtail Possum is typically found in open eucalypt forest and woodland areas; it prefers dead hollow tree branches and tree trunks for refuge. Scats were observed within the project area during the field survey confirming the presence of the species. Possums typically utilise hollows to roost, however no hollows were observed within the project area. Removal of native vegetation, in particular large trees should be minimised to prevent habitat loss for this species.

The Common Brushtail Possum is an adaptable species and is unlikely to be negatively impacted by the proposed development. In contrast, there may be an issue with possums impacting on revegetation efforts as well as possums being attracted to visitor areas and alternative food sources.

Heath Goanna (*Varanus rosenbergi*) – listed as vulnerable under the NPW Act

Heath Goanna are found in heath, open forest, sand dune, coastal and woodland habitats. Individuals require large areas of habitat and termite mounds for nesting purposes. They feed on road kill, birds, eggs, small mammals, invertebrates and other reptiles. Two observations of the Heath Goanna were observed; one within the project area (Figure 13) and one situated outside. There were also diggings and burrows detected within the project area (Figure 14).

An increase in road traffic associated with the development could result in an increase in Heath Goanna road deaths, which could have a significant impact on the local population. Any road kill should be reported to the KI Natural Resources Centre (KINRMB 2014). Speed limit restrictions should be enforced and road kill removed from the roadside to reduce the potential for impact on this species.

Figure 13. A Heath Goanna was observed running into its burrow.

Figure 14. Heath Goanna diggings and burrows were detected within the project area.

Hooded Plover (*Thinornis rubricollis*) – listed as vulnerable under the NPW Act

Hooded Plover occur mainly on sandy ocean beaches, with most found around the tideline. The total population in SA is estimated at 540 birds (Natt and Weston 1995), with 220 birds counted on Kangaroo Island in 2012 (Gillam and Urban 2013). Hooded Plover generally prefer beaches backed by dunes rather than by cliffs. The species is non-migratory, although recent colour-band sightings have shown that birds will move several hundred kilometres. Breeding is carried out on ocean beaches; nests are a depression in the sand usually in association with dry seaweed and located above average high tide levels up into the primary dunes. The nesting season extends from August to February. Given the vulnerablility of nest sites and the potential for disturbance to shorebirds, it is recommended that human access along the coastline is minimised. Pets (e.g. dogs and cats) should be prohibited from the golf course site.

Osprey (*Pandion haliaetus*) – listed as endangered under the NPW Act

The Osprey typically occurs within coastal waters and estuaries. Osprey are common around rocky shorelines, island and reefs and breed autumn to spring typically on a high coastal headland, cliff top or offshore island. Although high rock stacks were not observed along the coastal fringe of the project area, a known Osprey nest has been recorded east of the site (Map 14). A single Osprey was observed flying low along the coastal fringe directly adjacent to the project area (Figure 16).

Ospreys mainly feed on fish and will rarely take molluscs, crustaceans and insects (Clancy 1989). They usually forage diurnally, but have also been observed hunting prey at night (Hollands 2003). They occupy large territories that are used for breeding (Marchant and Higgins 1993) but are mostly resident or sedentary around breeding territories.

The breeding population in South Australia was estimated at 52 pairs in 2005 (Dennis 2007a). Breeding sites on Kangaroo Island are considered vulnerable to human disturbance (Dennis 2007a).

The main threat to the Osprey is considered to be loss, degradation or alteration of habitat for urban or tourism development (Clancy 1989, 1991; Dennis 2007a; Olsen 1998).

Ospreys typically shy away from human contact and can be easily flushed if disturbed around either the nest and/or during foraging behaviour. The noise and activity during construction, and human activity during operation of the golf site could result in this sensitive species no longer utilising the general area and abandoning nearby nesting locations. Protecting breeding habitat by establishing buffer zones around both active and non-active nest sites will aid in minimising impact to this species. EBS recommends that a buffer of 1000 m be adopted around known Osprey nests during sensitive breeding times, in line with Richardson and Miller (1997). If the species is found to utilise the immediate area around the golf course (e.g. for nesting or foraging), then further management measures may be necessary.

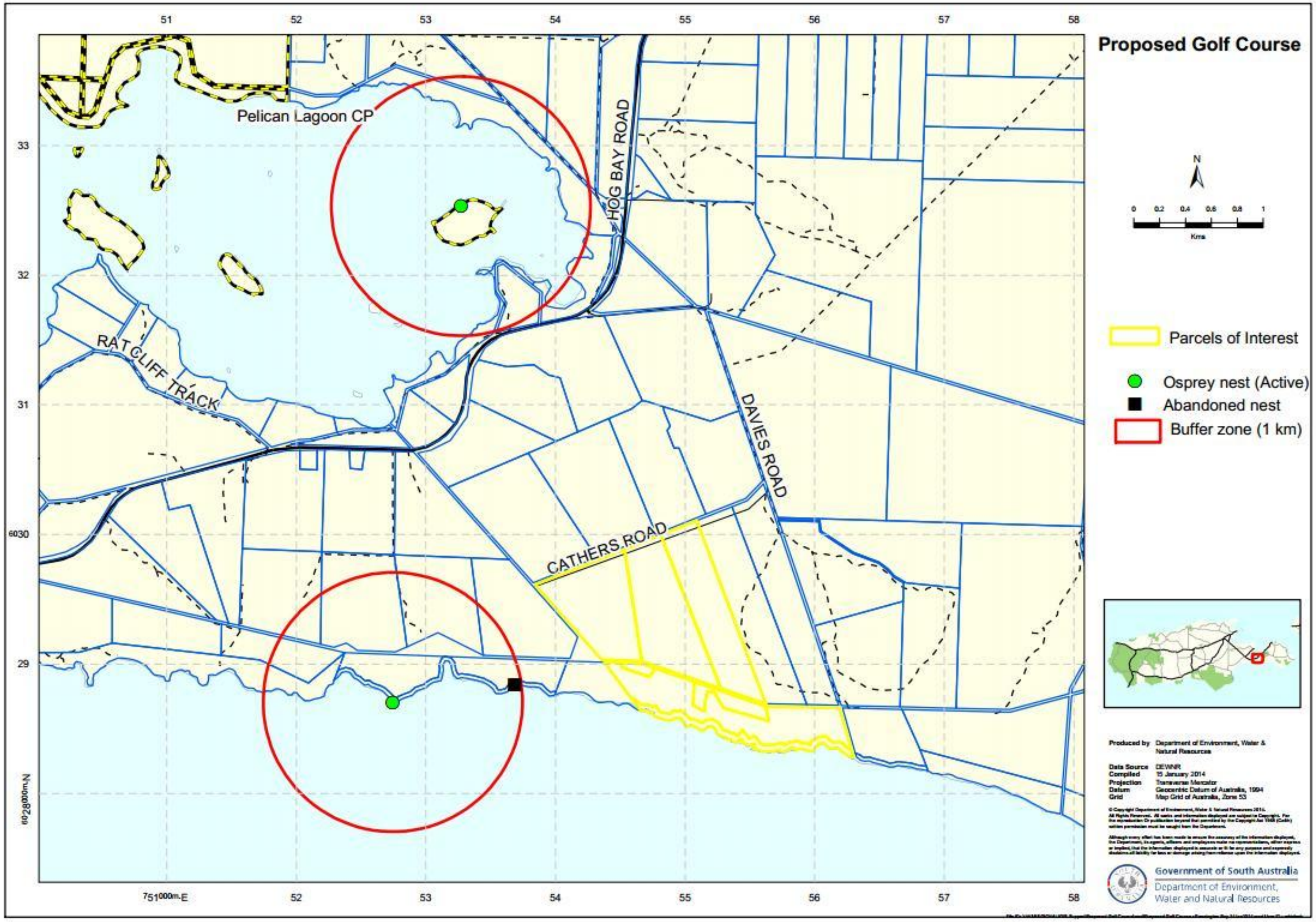
Scarlet Robin (*Petroica boodang campbelli*) – listed as vulnerable under the NPW Act

The population of Scarlet Robin on Kangaroo Island is intermediate between the two subspecies: *Petroica boodang boodang* (South-East SA, Mount Lofty Ranges, Southern Flinders Ranges) classified as state Rare and *Petroica boodang campbelli* (Eyre Peninsula) classified as state Vulnerable, and that on the southern tip of Yorke Peninsula which has not yet been identified to subspecies level. In this case, EBS has taken the precautionary principle and has defined the population of Scarlet Robin on Kangaroo Island to be the one with the most significant conservation rating of vulnerable.

A single male Scarlet Robin was observed within the project area at bird point count site 6 which was located within Association 4: *Eucalyptus oleosa* / *Eucalyptus gracilis* / *Eucalyptus rugosa* mallee. It was perched on a tree and responded to call playback technique (Figure 15).

Direct impact on this species may be caused by the removal of suitable habitat; impact should be minimised in the way of limiting the removal of potential habitat for this species (which is represented by Association 4 in Map 9).

Figure 15. A male Scarlet Robin was observed foraging at bird point count 6.



Map 14. Location of active and abandoned Osprey nest sites (DEWNR).

Sooty Oystercatcher (*Haematopus fuliginosus*) – listed as rare under the NPW Act

The Sooty Oystercatcher is strictly coastal, typically found within 50 m of the coastline. It prefers rocky shores but can also be observed on coral reefs or sandy beaches near mudflats. The Sooty Oystercatcher breeds in colonies generally on the ground amongst pebbles or shells on rocky shores or cliffs.

A single Sooty Oystercatcher was observed along the same stretch of coast as the Osprey, which was situated outside of the project area (Figure 16). It was foraging on a coastal shelf and was flushed as the observer walked along the coastline. Given the sensitive nature of the Sooty Oystercatcher, it is recommended that disturbance along the coastline (which abuts the project area), is minimised.

Figure 16. Coastline where both the Osprey and Sooty Oystercatcher were observed.

8.5.2 Suitable habitat and or likely to occur on site

Shy Heathwren (*Hylacola catua*) – listed as rare under the NPW Act

Whilst no individuals were recorded within the project area, there was suitable habitat identified for this species at bird count site 11 (Figure 17), located within Association 11 (Map 9): *Eucalyptus rugosa* +/- *Eucalyptus albopurpurea* mallee over *Melaleuca lanceolata*. Shy Heathwren prefer mallee and coastal thickets with dense low cover; grass tussocks on sandplains. Pairs typically forage on the ground among low vegetation and debris. Breeding occurs during August and November with the survey falling within this breeding period.

Figure 17. Potential Shy Heathwren habitat.

Direct impact on this species may be caused by the removal of suitable habitat (i.e. Association 11). The current development footprint does not impact on this association. If the species is present the suitability of the habitat could be indirectly impacted by the presence of human activity. Visitors should be discouraged from walking into intact vegetation patches.

Southern Emu-wren (Kangaroo Island ssp) (*Stipiturus malachurus halmaturinus*) – listed as rare under the NPW Act

Whilst no individuals were recorded within the project area, suitable habitat was identified for this species at bird point count site 12 (Figure 18) which was located within Association 2 (Map 9): *Leucopogon parviflorus*/ *Olearia axillaris* tall shrubland. This species typically favours dense, low cover, damp heaths, sedges, sand-dune and sandplain heaths. Figure 18 shows the dunes within the project area. Breeding occurs August through to December; call-back technique was used to encourage birds to respond given that they usually stay well under cover.

Figure 18. Potential Southern Emu-wren habitat.

Direct impact on this species may be caused by the removal of suitable habitat Impact should be minimised in the way of limiting the removal of potential habitat for this species.

White-bellied Sea-eagle (*Haliaeetus leucogaster*) – listed as endangered under the NPW Act / marine and migratory under the EPBC Act

On Kangaroo Island, the population of White-bellied Sea-Eagles have been monitored from 1985 to 1995, and then again in 2005. An average of seventeen territories have been located, which represents approximately 30% of the South Australian breeding population (Dennis and Baxter 2006).

The White-bellied Sea-Eagle generally foraged over in-shore coastal waters (Marchant & Higgins 1993; Smith 1985) however have also been recorded foraging over open terrestrial habitats such as grasslands (Marchant & Higgins 1993; Sedgwick 1978).

White-bellied Sea-eagle have suffered a significant population decline, predominantly attributed to human related disturbance causing nest failure. In SA, White-bellied Sea-eagle generally nest on exposed coastal cliffs/ cliff ledges with little or no screening and where disturbance invariably occurs above the nest. Guard-roosts are situated within line-of-sight of a nest, up to 800 m away from the nest

(Dennis et al. 2011). The breeding period is typically May through to September. Dennis (2011) found that the level of disturbance significantly affected fledging outcomes on Kangaroo Island.

The coastal zone adjoining the project area is suitable foraging and breeding habitat for White-bellied Sea-Eagles and they have historically been known to nest on the coastal cliffs. There were no signs of breeding identified along the coastline during the survey. This species could fly-over the project area between foraging and nesting locations.

Impact to this species is likely to be in the way of noise disturbance during the construction of the proposed golf course and increased human activity along the coast line. Should White-bellied Sea-Eagles be found to utilise the area, a buffer zone should be adopted to minimise disturbance and the effects of human activity on breeding outcomes. Dennis et al. (2011) recommends a buffer zone of at least 2 km around active nests. A general buffer zone around the coast is recommended given the number of coastal bird species sensitive to disturbance. Vehicle and visitor access around the coast should be limited and restricted to defined locations. Walking tracks should be designed away from the coast line edge. Additional management measures may be necessary if the species is found to utilise the immediate area.

8.5.3 Species determined as possibly occurring on site

Cattle Egret (*Ardea ibis*) – listed as rare under the NPW Act and EPBC Act migratory, and Great Egret (*Ardea alba*) EPBC Act migratory

Both Egret species were determined having the potential to occur but would most likely be fly-over species and would not be negatively impacted by the development.

The Cattle Egret is found in grasslands, woodlands and wetlands, and has a preference for moist areas with tall grass, or shallow open wetlands, and the margins of wetlands. It also uses pastures and croplands, especially where drainage is poor. They are partially migratory, moving during winter.

The Great Egret is partially migratory, with northern hemisphere birds moving south from areas with cold winters. They prefer shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands. The Great Egret has been reported in a wide range of wetland habitats. (Kushlan & Hancock 2005). Great Egrets can be seen alone or in small flocks, often with other egret species, and roost at night in groups.

The provision of water and irrigated areas for the golf course could create conditions favourable for these species.

Southern Brown Bandicoot (*Isoodon obesulus obesulus*) – listed as endangered under the EPBC Act

The habitat within the project area is not considered optimal for the Southern Brown Bandicoot, which prefer areas of dense ground and shrub cover (Haby 2005). No diggings or sign were observed during daytime searches. Given the species is known from nearby records, individuals may utilise or move through the vegetation on the eastern boundary of the project site, which is physically connected to larger, more intact native vegetation patches. Whilst impact is unlikely, habitat removal should be limited where possible.

8.5.4 Deemed unlikely to occur but warrants discussion

Glossy Black Cockatoo (Kangaroo Island ssp) (*Calyptorhynchus lathami halmaturinus*) - listed as endangered under the EPBC Act

The KI subspecies of the Glossy Black Cockatoo is currently restricted to Kangaroo Island. The area of occupancy is considered to be stable at present (Garnett & Crowley 2000), but it has declined since the arrival of European settlers, with the subspecies now absent from mainland South Australia (Crowley et al. 1999; Mooney & Pedler 2005). Recent reports from the Glossy Black-Cockatoo Recovery Team suggest the subspecies may breed in the American River area, which is situated near to the project area.

Twenty-five percent of the original Drooping Casuarina (*Allocasuarina verticillata*) vegetation habitat used by the Glossy Black-Cockatoo (Kangaroo Island) has been cleared (Crowley et al. 1998). Currently, the long-term survival of the Glossy-Black Cockatoo (Kangaroo Island) depends on the persistence of the single, small population on Kangaroo Island, which contains all known individuals of this subspecies in the wild (Mooney & Pedler 2005).

The Glossy Black-Cockatoo (Kangaroo Island) inhabits woodlands that are dominated by Drooping Sheoak (*Allocasuarina verticillata*) and often interspersed with taller stands of Sugar Gum (*Eucalyptus cladocalyx*). There were no individuals recorded within the project area and no suitable habitat was observed. The species is highly specialised and reliant on casuarina seeds. No casuarina trees were identified within the project area. Breeding is March through to August whereby birds typically inhabit large hollows in a dead tree. There were no large hollows identified on site. There is likely to be no impact on this species.

Kangaroo Island Dunnart (*Sminthopsis aitkeni*) – listed as endangered under the EPBC Act

The Kangaroo Island Dunnart has been recorded in a variety of habitats. Over half of the known records are from open low mallee with an overstorey of Kangaroo Island Mallee-ash and a sparse and variable understorey. Some records are from areas of Coastal Mallee (*Eucalyptus diversifolia*) (Gates 2009). Whilst some of the mapped vegetation within the project area matches the description of potential habitat in Gates (2009), the species is not considered to be present due to a lack of records in the area and the fragmented nature of the vegetation. Most of the recent records of the species are from the western end of the island where the vegetation is more intact (Gates 2009). There is likely to be no impact on this species.

8.6 General impacts on fauna

The direct removal of habitat associated with the proposed clearance of vegetation will have a local impact on resident fauna species, but this impact is considered to be insignificant at the population level. Some fauna species may benefit or be attracted to the area due to an increase in green feed and available water associated with the development.

8.6.1 Noise and light related impacts

Light and noise associated with construction may have short-term impacts on fauna utilisation of the area. The nocturnal species present (e.g. kangaroos, possums, bandicoots) will adapt to noise and light associated with the golf course operations. Potentially the most significant issue is the disturbance to coastal raptors (as discussed above).

Light around buildings may attract insects and bats. The affect of increased night light on birds is unknown but could affect the suitability of habitat for sensitive bird species. The golf course design should consider low light options and night time screens on windows to reduce the level of artificial light.

8.6.2 Road related impacts

As above, the increased traffic to and from the site may result in an increase in fauna road kill. This is best managed by reducing speed limits to the site, enforcing speed restrictions and installing speed lowering devices (e.g. speed humps) within the site, and discouraging vehicle travel around dusk/dawn and during the night. Any road kill should be moved away from the road to prevent further death of fauna which may feed on carrion (e.g. Heath Goanna, coastal raptors).

As identified above, the creation of access tracks/roads around the coastal zone is discouraged to reduce the likelihood of disturbance to sensitive coastal bird species.

8.6.3 Bird strike impacts

There is potential for birds to fly into large windows, e.g. on the proposed clubhouse. Whilst the impact is likely to be insignificant at a landscape level, it is encouraged that the designer considers options in relation to the placement of windows i.e. which direction they face, and how they reflect the sun and other visual screens around buildings to prevent impacts.

8.7 Heritage

The important relationship between environmental landforms and cultural heritage sites has been highlighted here in order to clarify that while there are no registered sites within the current project area, this may be due to a number of reasons; such as lack of survey or modern clearing. Understanding the environmental landscape can assist in determining the likelihood of heritage sites being present within a project area. Consultation with the relevant Traditional Owners of an area can also help clarify whether these landforms are associated with cultural heritage sites.

The project area is located on a relatively flat area behind a series of large coastal dunes; these dunes have a very high likelihood of containing cultural material. Likewise the areas immediately behind the dunes; would have provided access to the dune system, sustained wildlife and freshwater, while providing protection from the ocean wind. These areas have a moderate to high risk of containing insitu cultural heritage materials. The risk of encountering cultural heritage in the project area declines as you move further away from the coastline.

9 NATIVE VEGETATION CLEARANCE AND SEB OFFSET

9.1 Native vegetation clearance requirements

Under Regulation *5(1)(c) Development subject to Section 48 of the Development Act*, native vegetation may be cleared for a development that is given 'Major Project Status' under the *Development Act 1993*. The NVC is provided opportunity to make comment to the Minister administering the Development Act. A SEB offset and management plan are required.

The native vegetation clearance requirements for the project were determined using the working Masterplan infrastructure layout provided by the client (dated 22/12/2014) and the vegetation association mapping undertaken by EBS Ecology, with analysis undertaken using ArcGIS software (see Map 15).

Previous recommendations made by EBS Ecology were taken on board by Programmed Turnpoint and where possible, the golf course layout was revised to minimise vegetation clearance as follows:

- Realignment of the entry road to the clubhouse precint
- Adjustments to the location of the Driving Range, Fairway 1, Fairway 5, Fairway 6, Fairway 8, Fairway 9, Fairway 10, Fairway 12 and Fairway 15.

As a result, the impact on high quality vegetation has been reduced and the total required clearance of native vegetation was reduced from 17.24 ha to 14.14 ha.

Table 18 summarises the total clearance area for the proposed infrastructure components. The development footprint covers a total of 45.06 ha, of which 14.14 ha fall within areas mapped as native vegetation. It should be noted that the proposed water pipeline extended outside of the project area; clearance requirements outside of the designated project area have not been assessed. Also, it is envisaged that walking tracks/tracks for golf buggies may be required between fairways. No allowance has been made for such tracks within the infrastructure layout provided by the client, hence this has not been factored into the clearance estimates.

Clearance specifications were not provided by the client for the overhead and underground powerlines or the water pipeline. EBS has based the calculations in this report on a clearance width of 0.5 m for the underground powerline and water pipeline. Pole locations were not indicated for the overhead powerline, only a proposed route. SEB clearance figures were estimated as follows:

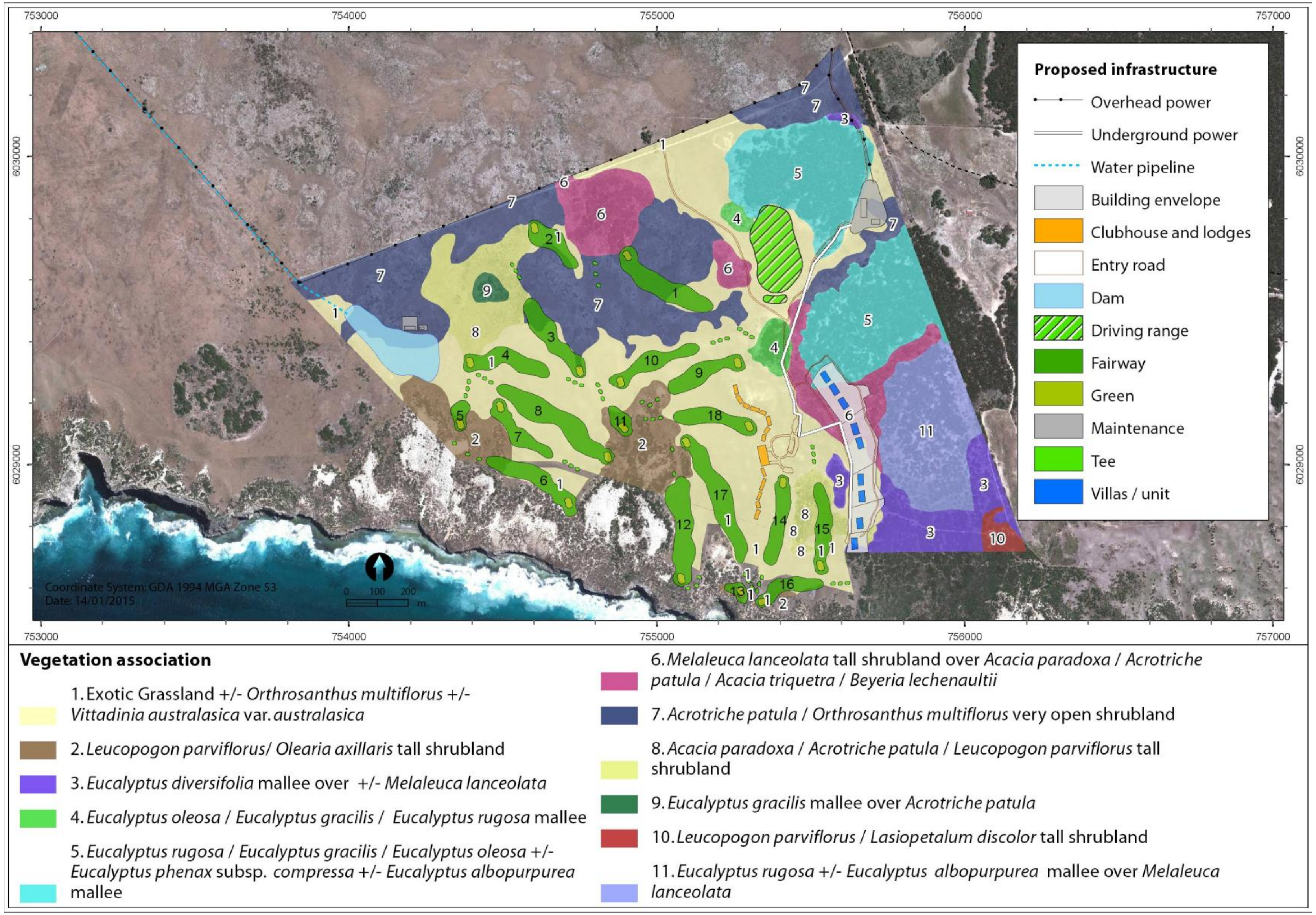
- Working off a hard copy plan, poles were measured to be approximately 100 m apart
- The number of poles that would fit into each vegetation association at 100m apart was calculated
- A clearance estimate of 273 mm diameter was applied to each pole (as per preliminary advice from Justin Trott 28/11/2014).

Table 18. Summary of vegetation clearance area for proposed infrastructure components (based on revised Masterplan dated 22/12/2014).

Infrastructure component	Total footprint (ha)	Total native vegetation clearance (ha)
Building Envelope	5.6711	3.6096
Clubhouse and Lodges	0.5841	0.0000
Entry Road	1.9102	0.7813
New Dam	3.7200	1.6441
New Driving Range	3.6900	0.0524
New Fairway	25.1440	6.1521
New Green	1.1892	0.4070
New Maintenance	1.6100	0.7498
New Tees	0.7635	0.2686
Overhead transmission line*	0.0007	0.0005
Powerline underground**	0.1288	0.0612
Villas Units	0.6562	0.4081
Water Pipeline**	0.0095	0.0051
Total	**45.06**	**14.14**

* Overhead transmission line clearance estimated by EBS – may need refinement

** Undeground powerline and water pipeline clearance specifications not provided by client. Estimates based on 0.5 m width clearance.



Map 15. Proposed infrastructure over mapped vegetation associations.

9.2 What is a significant environmental benefit (SEB)

Even though the development falls under *Regulation 5(1)(c) Development subject to Section 48 of the Development Act,* approval for native vegetation clearance is conditional on providing a significant environmental benefit (SEB). An SEB can be achieved through several options including managing and/or formally protecting an area of native vegetation for conservation purposes (Heritage Agreement), undertaking a revegetation program on the site of the operation or within the same region of the State or alternatively, making a payment into the Native Vegetation Fund. The primary aim of the SEB is to achieve a net environmental gain, which contributes to improving the biodiversity values of the region, rather than simply off-setting the vegetation clearance.

9.3 SEB calculations

The following section calculates the area and the proposed payments that would be required to offset the proposed removal of the remnant native vegetation.

The SEB requirements for remnant vegetation clearance was calculated based on the Native Vegetation Council (NVC) policy document Guidelines for a Native Vegetation Significant Environmental Benefit Interim Policy (DWLBC 2005).

Approximately 14.14 ha of native vegetation is present within the proposed development footprint (as per Table 18). A breakdown of all the clearance areas is provided in Appendix 6.

All native vegetation within the development footprint was considered as patches of intact or degraded remnant vegetation (as opposed to scattered trees). The SEB offset area for vegetation patches is derived by multiplying the clearance area by the appropriate SEB ratio. The ratio is assigned according to the condition of the vegetation proposed for clearance (as per Appendix 6).

As the development falls under *Regulation 5(1)(c) Development subject to Section 48 of the Development Act,* an assessment against the Native Vegetation Act Principles of Clearance of Native Vegetation is not required. However if any of the principles are contravened for a particularly clearance area, then the SEB figure for that area increases to at least 8:1 (as per the NV Policy 1.2.11: Priorities for set-aside areas).

Clearance of vegetation association 5: *Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax* subsp. *compressa +/- Eucalyptus albopurpurea* mallee is deemed to be at variance with the following Principles of Clearance:

- *Principle (c) - includes plants of a rare, vulnerable or endangered species;*

  Association 5 comprises the State rare *Eucalyptus phenax* ssp. *compressa*
- *Principle (d) - the vegetation comprises the whole, or a part, of a plant community that is rare, vulnerable or endangered;*

Association 5 contains *Eucalyptus rugosa* as the dominant overstorey, which is considered a rare community. Association 11 is also considered the rare community however none of this association falls within the clearance footprint (see Willoughby ety al. 2001).

For the purpose of the SEB calculations, patches of vegetation association 5 to be impacted have been assessed as SEB 8:1.

Should a payment into the Native Vegetation Fund be the preferred option to satisfy the required SEB, the following formula is utilised to convert required set-aside area into dollar value:

Formula for calculating SEB payment into Native Vegetation Fund =

(land value[1] per ha x required SEB in ha) + (management fee per ha[2] x area cleared)

Where:

[1] Land value (Local Government Area values updated by Valuation SA) = $803 (Kangaroo Island, last updated 2009)
[2] Management fee = $800 per ha (flat rate calculated by the Native Vegetation Council)

Should all native vegetation within the proposed development footprint require clearance, the maximum SEB offset requirement is: **$70.01 ha** or **$67,527** payment into the Native Vegetation Fund. The SEB calculations are summarised in Table 19.

Table 19. Native vegetation clearance and SEB calculations for the proposed development footprint.

Vegetation association	SEB ratio^	Total Estimated Clearance (ha))	Management fee ($)	Land Value per ha ($)^	Required SEB (ha)	SEB payment into NV Fund ($)
1	0:1	30.92131799	-	-	-	-
1	1:1	1.4558792	800	803	1.4558792	2333.774358
2	5:1	1.958361051	800	803	9.791805255	9429.50846
3	5:1	0.0239339	800	803	0.1196695	115.2417285
3	8:1	0.01399137	800	803	0.11193096	101.0736569
3	9:1	0.2552932	800	803	2.2976388	2049.238516
4	4:1	0.09188441	800	803	0.36753764	368.6402529
5	5:1	0.30859574	800	803	2.46876592	2229.295626
5	8:1	0.683898718	800	803	5.471189744	4940.484339
6	6:1	0.0386593	800	803	0.2319558	217.1879474
6	7:1	2.887417557	800	803	20.2119229	18540.10814
7	3:1	4.442502377	800	803	13.32750713	14255.99013
7	4:1	0.3154365	800	803	1.261746	1265.531238
8	6:1	0.211562923	800	803	1.269377538	1188.560501
8	8:1	1.45237029	800	803	11.61896232	10491.92297
Grand Total		**45.06 (14.14 is native vegetation)**			**70.01**	**67526.56**

^ based on the condition of the vegetation and land values at the time of the assessment. Land values last updated 2009.

* Association 5 has been assessed as 8:1 (even though 0.31 ha was classified as SEB condition 5:1) because clearance is at variance with Native Vegetation Clearance Principles c and d.

Note: the proposed pipeline outside of the project area was not assessed and therefore has not been included in the SEB calculations. Access tracks between fairways have not been factored into the clearance estimates

9.4 Potential SEB offsets within the subject site

Approximately 140 ha of the 217 ha site was mapped as containing native vegetation (i.e. SEB 1:1 or above). Only some of these areas are considered suitable for SEB offsets. Offsets could include:

- Revegetation within mallee patches where the understorey is lacking.
- Revegetation within the better condition shrubland associations where cover/diversity is lacking
- Revegetation buffers around existing quality vegetation patches

- Weed control, focusing on the better quality vegetation patches
- Weed control and restoration within the adjacent coastal dunes.

SEB offsets need to be outlined within a Managment Plan for approval by the NVC. Programmed Turnpoint would need to negotiative with the NVC and the landholder should offsets be considered within the dunes outside of the project area. NVC would need guarantees that such areas would be managed into perpetuity.

Areas of very poor to poor condition (e.g. very open shrubland of SEB 2:1) are not considered a good option for offsets. Revegetation is not necessary or appropriate in intact vegetation (e.g. SEB 7:1 to 9:1), however such areas may benefit from weed control.

Kangaroo management will be essential to successfully achieve revegetation offsets. SEB areas must be managed for conservation, therefore access/use of SEB offset areas for other purposes will need to be restricted.

10 RECOMMENDATIONS

10.1 Ecology

Legislation and compliance

- Finalise the infrastructure layout and the native vegetation clearance requirement
- Seek approval from the NVC regarding the vegetation clearance that is required and provide an appropriate SEB offset and management plan
- Once the infrastructure locations are finalised, as a precautionary approach consider submitting an EPBC referral for the project, with respect to the following matters of national significance: Southern Brown Bandicoot. Advice should first be sought from the Commonwealth Department of the Environment.
- If development is to have any impact (direct or indirect) on the coastal zone, undertake further survey and consider whether an EPBC referral is required in relation to EPBC listed/migratory species.

Native vegetation clearance

- Avoid the clearance of native vegetation where alternative options exist
- Avoid clearance of *Eucalyptus rugosa* mallee associations (Associations 5 and 11) which are considered regionally rare
- Avoid clearance of the state rare *Eucalyptus phenax* subsp. *compressa* (present within vegetation association 5)
- Avoid tree clearance where possible
- Reconsider the placement/ micro-site infrastructure components to minimise damage and removal of native vegetation across the site (refer to vegetation association/condition maps):
    - Relocate the proposed “Private Villas” (1-5) into previously cleared land to avoid clearance of native vegetation.

Relocate the following to avoid vegetation:

- Consolidate clearance requirements by aligning pipeline and roadside clearances and existing tracks.

Protect ecological values

- Implement an environmental management plan for the site
- Discourage visitor/human access into intact vegetation patches

- If vegetation clearance is required, avoid the breeding season for nesting birds (generally spring-summer)
- Undertake construction outside of the key breeding times for sensitive coastal raptors
- Implement a buffer zone of at least 1 km between construction zones and known active Osprey nests, and discourage general activity within 1 km of known nests during sensitive breeding times
- Implement a buffer zone of at least 2 km between construction zones and active White-bellied Sea Eagle nests
- Implement a buffer zone of at least 200 m between construction zones and the coast during the breeding season of coastal raptors, to prevent disturbance
- Manage areas outside the development footprint for conservation
- Develop, in conjunction with DEWNR and adjoining landholders, a Kangaroo Management Plan; implement plan to manage kangaroo impacts as necessary to achieve native vegetation management objectives
- Limit/discourage access to the coastal area to reduce potential for impact on sensitive coastal bird species
- Prohibit pets on the site
- Limit artificial lighting across the site at night
- Design windows on buildings to ensure that they do not reflect the landscape, to reduce the potential for bird strike
- Direct flights should not be undertaken to the site due to the significant potential for disturbance to Osprey and White-bellied Sea Eagle.
- Where possible, buffer areas of native remnant vegetation from future development. A buffer zone of 100 m is recommended as best practice, to prevent further degradation from surrounding influences and allow for restoration.
- Allow natural regeneration of remnant native vegetation and provide active revegetation (where suitable, and based on vegetation mapping for the area) in degraded areas.
- Where possible, revegetation should aim to expand vegetation patches and re-establish connections (or lessen the distance) between patches.
- Fence high value areas, where suitable, to control grazing pressure and public access, and allow for restoration.
- Undertake annual monitoring at set locations (e.g. chosen point count sites) to monitor the impact of the development on flora and fauna utilisation of the area.

Site management

- Ensure vegetation clearance is restricted to the designated clearance envelope and that all trees not directly affected are protected from injury, including root damage during the construction phase.
- Clearance/construction work should be supervised at all times and carried out sensitively to ensure minimum disturbance to fauna and no disturbance to native vegetation outside the extent of works. The project area and areas designated for clearance should be clearly delineated.
- Select appropriate stockpile areas/machinery parking areas and general lay down areas (if required) where no clearance/damage to native vegetation will be required. If clearance is required, seek relevant approvals through the Native Vegetation Council.
- Avoid clearance of nesting trees during the active bird breeding season (i.e. spring). If removal of trees with hollows or nests is required, then hollows and nests should be stored in a secure place to avoid damage, and as soon as possible, relocated in suitable trees nearby.
- Native fauna disturbed during vegetation clearance/construction should if possible be relocated to suitable habitat nearby.
- Adopt best practice environmental management measures during construction and operation including:
    - management of vegetative material removed from the site (e.g. no spreading of material contaminated with weed propagules amongst native vegetation)
    - vehicles and equipment cleaned to ensure they are free of plant material and soil, to reduce the dispersal of exotic flora species and soil pathogens into, out of, and within the project area
    - use of certified weed free clean fill
    - appropriate waste management
    - protect native vegetation patches from disturbance/trampling
    - policies on firewood collection
    - monitoring and control of declared and environmental weeds
    - minimising the disturbance footprint, e.g. through access planning
- Provide staff training and awareness, including inductions for on-site personnel on flora and fauna management
- Implement speed limit restrictions (day and night) and limit vehicle activity at night to prevent fauna road kill
- Remove road kill away from the roadside to reduce the likelihood of Heath Goanna deaths
- Select locally native flora species where possible for landscaping. Where this is not possible ensure selected species do not have weed potential.

- Monitor the distribution of introduced landscape plant species to ensure they do not spread outside of designated landscaped areas; undertake control works if necessary

Biodiversity offsets

- SEB offsets are achieved on or adjoining the site where possible, e.g.:
    - active management of African Boxthorn and other significant weeds within the coastal dunes (under agreement with landholder and NVC)
    - active revegetation of understorey within mallee habitats.

10.2 Heritage

EBS Heritage was engaged to conduct a cultural heritage and risk assessment for the current project area. This assessment identified a number of potential cultural heritage risks in the area, but has noted that the site is within a landscape where many other types of sites may be found (cultural and archaeological).

The *South Australian Aboriginal Heritage Act 1988* does not mandate a need for an Aboriginal heritage survey there is no legislative requirement to conduct a cultural heritage survey at the current project location. However, the *AHA 1988* does provide a legal obligation for the construction of the proposed golf course to not ‘damage, disturb or interfere’ with an ‘aboriginal site’ whether this site is recorded or not. In light of this and resulting from the desktop and site inspection, the following recommendations are made;

- Programmed could conduct a cultural heritage survey over the entire proposed project location with the relevant Aboriginal stakeholder group. This will identify any sites of cultural heritage as well as the potential anthropological significance of the project area within the wider landscape. Consultation with the relevant Aboriginal groups will also ensure that the project runs smoothly and builds and maintains key relationships in the area for future running of the club facilities.

- A cultural heritage survey may be undertaken with the relevant Aboriginal stakeholder group over areas assessed as being of “high” and ‘moderate” risk to encounter cultural material. This will identify any sites in the area and provide an anthropological context for the site in the context of the wider landscape. There is current no Native Title claim held over Kangaroo Island.

- Programmed Turnpoint may wish to engage the relevant Aboriginal custodians to monitor earthworks in areas of high risk and to participate or lead cultural awareness training before construction commences. While there is no legal requirement for this, it will facilitate smooth project delivery and establish good relationships with the local Aboriginal community.

- If Programmed Turnpoint does not wish to undertake a cultural heritage survey for the project area, EBS Heritage recommends as a risk management tool; the implementation of a site discovery procedure for all earthmoving works as well as a site induction to ensure all project members are aware of the nature of objects that may be found.

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12 APPENDICES

Appendix 1. BDBSA fauna list (5 km buffer) (Source: DEWNR 2014).

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
			Aus	SA	KI status	KI trend	
	Amphibian						
	Litoria ewingii	Brown Tree Frog			LC	0	10/11/1990
	Bird						
	Acanthiza lineata	Striated Thornbill			LC	0	25/11/2001
	Acanthiza pusilla	Brown Thornbill			LC	0	25/11/2001
	Acanthorhynchus tenuirostris	Eastern Spinebill			LC	0	06/04/2000
	Anthochaera carunculata	Red Wattlebird			LC	0	25/11/2001
	Anthus australis	Australian Pipit			LC	0	18/11/2004
	Aquila audax	Wedge-tailed Eagle			LC	0	09/11/2000
	Arenaria interpres	Ruddy Turnstone		R	EN	--	09/11/2000
	Biziura lobata	Musk Duck		R	RA	0	01/12/1998
	Burhinus grallarius	Bush Stonecurlew		R	NT	0	16/04/2000
	Cacomantis flabelliformis	Fan-tailed Cuckoo			LC	0	01/12/1998
	Calidris acuminata	Sharp-tailed Sandpiper			VU	--	03/03/1984
	Calidris alba	Sanderling		R	RA	DD	05/03/1986
	Calidris canutus	Red Knot			EN	DD	10/02/1984
	Calidris ferruginea	Curlew Sandpiper			EN	--	30/06/1984
	Calidris ruficollis	Red-necked Stint			RA	-	25/11/2001
	Calyptorhynchus funereus	Yellow-tailed Black Cockatoo		V	RA	-	24/12/1999
	Calyptorhynchus lathami halmaturinus	Glossy Black-Cockatoo (Kangaroo Island ssp)	EN	E	EN	+	01/12/1998
	Charadrius bicinctus	Double-banded Plover			EN	DD	16/02/1985
	Charadrius leschenaultii	Greater Sand Plover		R			10/02/1984
	Charadrius ruficapillus	Red-capped Plover			LC	0	10/11/2012
	Chroicocephalus novaehollandiae	Silver Gull			LC	0	18/11/2004
	Circus approximans	Swamp Harrier			VU	0	02/11/1990
	Cladorhynchus leucocephalus	Banded Stilt		V	NT	0	05/06/1986
	Colluricincla harmonica	Grey Shrikethrush			LC	0	01/12/1998
	Coracina novaehollandiae	Black-faced Cuckooshrike			LC	0	01/12/1998
	Corvus coronoides	Australian Raven			NT	0	25/11/2001
	Corvus mellori	Little Raven			LC	+	05/01/1999
	Corvus sp.						10/11/1990
	Coturnix pectoralis	Stubble Quail			LC	0	09/11/2000
	Cygnus atratus	Black Swan			LC	0	25/11/2001
	Daption capense	Cape Petrel					04/08/1985
	Egretta novaehollandiae	White-faced Heron			LC	0	01/12/1998
	Elanus axillaris	Black-shouldered Kite			LC	++	01/12/1998
	Eolophus roseicapilla	Galah			LC	0	09/11/2000
	Epthianura albifrons	White-fronted Chat			LC	0	24/12/1999
	Falco berigora	Brown Falcon			LC	++	01/12/1998
	Falco cenchroides	Nankeen Kestrel			LC	0	18/11/2004

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
			Aus	SA	KI status	KI trend	
	Falco peregrinus	Peregrine Falcon		R	VU	0	18/11/2004
	Glossopsitta porphyrocephala	Purple-crowned Lorikeet			LC	0	25/11/2001
	Grallina cyanoleuca	Magpielark			LC	0	01/12/1998
	Gymnorhina tibicen	Australian Magpie			LC	0	25/11/2001
	Haematopus fuliginosus	Sooty Oystercatcher		R	RA	0	11/11/2012
	Haematopus longirostris	(Australian) Pied Oystercatcher		R	RA	0	09/11/2012
	Haliaeetus leucogaster	White-bellied Sea-Eagle		E	CR	--	01/12/1998
	Halobaena caerulea	Blue Petrel	VU				15/09/1984
	Himantopus leucocephalus	White-headed Stilt			LC	0	02/12/1984
	Hirundo neoxena	Welcome Swallow			LC	0	18/11/2004
	Hydroprogne caspia	Caspian Tern			EN	0	09/11/1990
	Larus pacificus	Pacific Gull			VU	0	25/11/2001
	Lewinia pectoralis	Lewin's Rail		V	VU	DD	21/04/2005
	Lichenostomus cratitius	Purple-gaped Honeyeater			LC	0	06/04/2000
	Limosa lapponica	Bar-tailed Godwit		R	CR	DD	05/03/1986
	Lophoictinia isura	Square-tailed Kite		E			07/02/1980
	Macronectes giganteus	Southern Giant Petrel	EN	V			01/06/1988
	Malurus cyaneus	Superb Fairywren			LC	0	18/11/2004
	Melithreptus brevirostris	Brown-headed Honeyeater			LC	0	06/04/2000
	Microcarbo melanoleucos	Little Pied Cormorant			LC	0	25/11/2001
	Morus serrator	Australasian Gannet					30/12/1987
	Myiagra inquieta	Restless Flycatcher		R	VU	DD	01/12/1998
	Neochmia temporalis	Red-browed Finch			LC	0	24/12/1999
	Nesoptilotis leucotis	White-eared Honeyeater			NT	0	06/04/2000
	Ninox boobook	Southern Boobook			LC	0	01/12/1998
	Numenius madagascariensis	Far Eastern Curlew		V	CR	--	06/02/2005
	Numenius phaeopus	Whimbrel		R	CR	DD	05/11/1985
	Pachycephala pectoralis	Australian Golden Whistler (Golden Whistler)			LC	0	25/11/2001
	Pachycephala rufiventris	Rufous Whistler					09/04/2000
	Pachyptila belcheri	Slender-billed Prion					02/08/1985
	Pachyptila desolata	Antarctic Prion					02/08/1985
	Pachyptila sp.						01/07/1979
	Pachyptila turtur	Fairy Prion					02/08/1985
	Pachyptila vittata	Broad-billed Prion					02/08/1985
	Pandion haliaetus	Osprey		E	CR	0	18/11/2004
	Pardalotus punctatus	Spotted Pardalote			LC	0	17/02/2000
	Pardalotus striatus	Striated Pardalote			LC	0	18/11/2004
*	*Passer domesticus*	House Sparrow					01/12/1998
	Pelecanus conspicillatus	Australian Pelican			VU	0	25/11/2001
	Petrochelidon nigricans	Tree Martin			LC	0	22/03/1986
	Petroica boodang	Scarlet Robin		ssp	NT	0	01/12/1998
	Phalacrocorax carbo	Great Cormorant			RA	0	18/11/2004
	Phalacrocorax sulcirostris	Little Black Cormorant			NT	0	09/11/2000

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
			Aus	SA	KI status	KI trend	
	Phalacrocorax varius	[Australian] Pied Cormorant			LC	0	18/11/2004
	Phaps chalcoptera	Common Bronzewing			LC	+	09/11/2000
	Phaps elegans	Brush Bronzewing			NT	0	07/11/1990
	Phylidonyris novaehollandiae	New Holland Honeyeater			LC	0	25/11/2001
	Phylidonyris pyrrhopterus	Crescent Honeyeater			LC	0	25/11/2001
	Platycercus elegans	Crimson Rosella			LC	0	25/11/2001
	Pterodroma lessonii	White-headed Petrel					12/01/1993
	Puffinus gavia	Fluttering Shearwater					01/01/1976
	Recurvirostra novaehollandiae	Red-necked Avocet			RA	DD	05/10/1985
	Rhipidura albiscapa	Grey Fantail			LC	0	06/04/2000
	Rhipidura leucophrys	Willie Wagtail			LC	0	01/12/1998
	Sericornis frontalis	White-browed Scrubwren			LC	0	25/11/2001
	Stipiturus malachurus	Southern Emuwren		R			01/12/1998
	Strepera versicolor	Grey Currawong			LC	0	18/11/2004
*	*Sturnus vulgaris*	Common Starling					18/11/2004
	Thalassarche cauta	Shy Albatross	ssp	ssp			01/06/1990
	Thalassarche chlororhynchos	Yellow-nosed Albatross	ssp	ssp			01/07/1979
	Thalassarche melanophris	Black-browed Albatross	VU	ssp			01/01/1900
	Thalasseus bergii	Greater Crested Tern			LC	0	24/12/1999
	Thinornis rubricollis	Hooded Plover (Hooded Dotterel)		V	EN	-	11/11/2012
	Threskiornis moluccus	Australian White Ibis			LC	++	01/12/1998
	Trichoglossus haematodus	Rainbow Lorikeet			LC	0	25/11/2001
	Tringa nebularia	Common Greenshank			EN	0	05/06/1986
	Turnix varius	Painted Buttonquail		R	EN	--	06/04/2000
	Vanellus miles	Masked Lapwing			LC	0	05/01/1999
	Vanellus tricolor	Banded Lapwing			RA	0	01/12/1998
	Zosterops lateralis	Silvereye			LC	0	18/11/2004
	Mammal						
*	*Capra hircus*	Goat (Feral Goat)					23/10/1990
	Cercartetus concinnus	Western Pygmy-possum			LC	DD	10/11/1990
	Delphinus delphis	Short-beaked Common Dolphin					11/02/2007
	Globicephala macrorhynchus	Short-finned Pilot Whale		R			13/06/1974
	Isoodon obesulus obesulus	Southern Brown Bandicoot (SA mainland and KI ssp)	EN	V	NT	DD	01/05/2005
	Macropus eugenii decres	Tammar Wallaby			LC	DD	03/05/1996
	Macropus fuliginosus	Western Grey Kangaroo			LC	DD	10/11/1990
	Mesoplodon layardii	Strap-toothed Whale					13/02/1956
*	*Mus musculus*	House Mouse					01/09/2000
	Rattus fuscipes	Bush Rat			LC	0	10/11/1990
	Tachyglossus aculeatus	Short-beaked Echidna			NT	--	10/11/1990
	Trichosurus vulpecula	Common Brushtail Possum		R	LC	0	09/11/1990
	Tursiops truncatus	Common Bottlenose Dolphin					06/10/2007
	Vespadelus regulus	Southern Forest Bat			LC	DD	01/11/1990
	Reptile						

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
			Aus	SA	KI status	KI trend	
	Aprasia striolata	Lined Worm-lizard			LC	0	06/11/1990
	Austrelaps labialis	Pygmy Copperhead			LC	0	16/11/1990
	Bassiana duperreyi	Eastern Three-lined Skink			LC	0	16/11/1990
	Christinus marmoratus	Marbled Gecko			LC	0	16/11/1990
	Dermochelys coriacea	Leathery Turtle	EN	V			01/01/1994
	Hemiergis peronii	Four-toed Earless Skink			LC	0	13/09/2000
	Lampropholis guichenoti	Garden Skink			LC	0	27/09/2000
	Lerista bougainvillii	Bougainville's Skink			LC	0	08/11/1990
	Lerista dorsalis	Southern Four-toed Slider			RA	0	06/11/1990
	Liopholis multiscutata	Bull Skink			RA	0	06/11/1990
	Liopholis whitii	White's Skink			LC	0	01/09/2000
	Menetia greyii	Dwarf Skink			RA	0	16/11/1990
	Morethia obscura	Mallee Snake-eye			LC	0	16/11/1990
	Notechis scutatus	Eastern Tiger Snake			LC	0	02/11/1990
	Underwoodisaurus milii	Barking Gecko			LC	0	29/09/2000
	Varanus rosenbergi	Heath Goanna		V	NT	--	10/11/1990

Conservation status

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). **SA**: South Australia (*National Parks and Wildlife Act 1972*). **Conservation Codes**: **CE**: Critically Endangered. **EN/E**: Endangered. **VU/V**: Vulnerable. **R**: Rare. **ssp**.: the conservation status applies at the sub-species level. **Mi**: listed as migratory under the EPBC Act (**Ma**: Marine; **W**: Wetland; **T**: Terrestrial). **Ma**: listed as marine under the EPBC Act. *****: Species is listed under a different scientific name on the EPBC Act - Threatened Species list. Note that migratory species that are very widespread, vagrant, or only occur in small number are not identified by the EPBC Protected Matters Search.

Regional status for Kangaroo Island is sourced from Gillam and Urban (2013). **Regional status**: **RE**: Regionally Extinct. **CR**: Critically Endangered. **EN**: Endangered. **VU**: Vulnerable. **RA**: Rare. **NT**: Near Threatened. **LC**: Least Concern. **DD**: Data Deficient. **NE**: Not Evaluated. **Regional Population**: **--**: Definite Decline. **-**: Probable Decline. **0**: Stable/No Change. **+**: Probable Increase. **++**: Definite Increase. **DD**: Data Deficient.

Of the records above, only one record is from the project area, being Hooded Plover (*Thinornis rubricollis*).

Appendix 2. BDBSA flora list (5 km buffer) (Source: DEWNR 2014).

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
			Aus	SA	KI status	KI trend	
	Acacia acinacea	Wreath Wattle			VU	DD	15/11/1989
	Acacia cupularis	Cup Wattle			LC	0	04/09/1996
	Acacia leiophylla	Coast Golden Wattle			LC	0	16/12/2004
	Acacia ligulata (NC)	Umbrella Bush					16/11/1989
	Acacia longifolia ssp. sophorae	Coastal Wattle			LC	+	01/01/1986
	Acacia paradoxa	Kangaroo Thorn			LC	0	04/09/1996
	Acacia triquetra	Mallee Wreath Wattle			LC	0	06/09/1996
	Acacia uncifolia	Coast Silver Wattle			LC	0	06/09/1996
	Acaena novae-zelandiae	Biddy-biddy			LC	0	16/11/1989
	Acetabularia peniculus						01/02/1956
	Acianthus pusillus	Mosquito Orchid			LC	0	07/06/1987
	Acrosorium ciliolatum						07/09/1996
	Acrotriche cordata	Blunt-leaf Ground-berry			LC	0	06/09/1996
	Acrotriche depressa	Native Currant			LC	0	15/11/1989
	Acrotriche patula	Prickly Ground-berry			LC	0	06/09/1996
	Actites megalocarpus	Coast Sow-thistle			LC	0	15/11/1989
	Adenanthos macropodianus	Kangaroo Island Gland-flower			LC	0	29/09/1962
	Adriana klotzschii (NC)	Coast Bitter-bush					16/11/1989
	Adriana quadripartita	Coast Bitter-bush			LC	0	11/12/1980
*	*Aira caryophyllea*	Silvery Hair-grass					16/11/1989
*	*Aira cupaniana*	Small Hair-grass					14/11/1989
	Allocasuarina striata	Stalked Oak-bush			LC	0	14/11/1989
	Alyxia buxifolia	Sea Box			LC	0	06/09/1996
	Amanita clelandii						29/07/2005
	Amanita kammala						17/07/2006
	Amphibolis antarctica	Sea Nymph					26/08/1950
*	*Anagallis arvensis*	Pimpernel					06/09/1996
	Angianthus preissianus	Salt Angianthus			LC	0	02/11/1990
	Antithamnion gracilentum						09/10/1996
	Antrocentrum nigrescens						21/08/1948
	Antrodiella citrea						17/07/2006
	Apalochlamys spectabilis	Showy Firebush			LC	0	07/05/1989
	Aphanes australiana	Australian Piert			RA	DD	29/09/1989
	Aphanes australiana (NC)	Australian Piert					04/09/1996
	Apium annuum	Annual Celery			LC	0	06/09/1996
*	*Arenaria leptoclados*	Lesser Thyme-leaved Sandwort					14/11/1989
*	*Arenaria serpyllifolia (NC)*	Thyme-leaved Sandwort					14/11/1989
*	*Argyranthemum frutescens ssp. foeniculaceum*	Teneriffe Daisy					05/05/2011
	Asparagopsis armata						07/09/1996
*	*Asparagus asparagoides f.*						01/06/2005
	Asperococcus bullosus						19/11/1987
	Asperococcus fistulosus						26/08/1950

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
			Aus	SA	KI status	KI trend	
*	*Asphodelus fistulosus*	Onion Weed					01/01/1986
	Asterolasia muricata	Lemon Star-bush		R	RA	-	29/09/1962
	Astroloma conostephioides	Flame Heath			LC	0	15/11/1989
	Astroloma humifusum	Cranberry Heath			LC	0	15/11/1989
	Atriplex cinerea	Coast Saltbush			LC	0	04/09/1996
	Audouinella humilis						10/01/1948
	Audouinella macula						10/01/1948
	Audouinella saviana						10/01/1948
	Austrofestuca littoralis	Coast Fescue			RA	0	27/01/1973
	Austrophyllis alcicornis						21/08/1948
	Austrostipa exilis	Heath Spear-grass			LC	0	16/11/1989
	Austrostipa flavescens	Coast Spear-grass			LC	0	06/09/1996
	Austrostipa hemipogon	Half-beard Spear-grass			LC	0	16/11/1989
	Austrostipa sp.	Spear-grass					14/11/1989
	Austrostipa stipoides	Coast Spear-grass			LC	0	06/09/1996
*	*Avena barbata*	Bearded Oat					15/11/1989
	Bachelotia antillarum						18/01/1948
	Beyeria lechenaultii	Pale Turpentine Bush			LC	0	17/10/2001
	Beyeria subtecta	Kangaroo Island Turpentine Bush	VU	E	EN	-	07/10/1992
	Billardiera cymosa (NC)	Sweet Apple-berry					15/11/1989
	Billardiera versicolor	Yellow-flower Apple-berry			LC	0	15/11/1989
	Boronia coerulescens ssp. coerulescens	Blue Boronia			RA	0	29/10/1962
	Bostrychia tenuissima						19/01/1950
	Botryocladia sonderi						26/08/1950
	Brachyscome exilis	Slender Daisy			RA	DD	17/09/1994
	Brachyscome lineariloba	Hard-head Daisy			VU	0	17/09/1994
*	*Briza maxima*	Large Quaking-grass					14/11/1989
*	*Briza minor*	Lesser Quaking-grass					16/11/1989
*	*Bromus diandrus*	Great Brome					01/01/1986
*	*Bromus hordeaceus ssp. hordeaceus*	Soft Brome					15/11/1989
	Brongniartella australis						21/08/1948
	Bryopsis plumosa						16/01/1950
	Bulbine semibarbata	Small Leek-lily			LC	0	15/11/1989
*	*Cakile maritima ssp. maritima*	Two-horned Sea Rocket					04/09/1996
	Caladenia filamentosa var. filamentosa (NC)	Red Spider-orchid					15/11/1989
	Caladenia latifolia	Pink Caladenia			LC	0	06/09/1996
	Caladenia sanguinea	Crimson Daddy-long-legs		R	NT	DD	29/10/1986
	Caladenia sp.	Spider-orchid					15/11/1989
	Calandrinia calyptrata	Pink Purslane			NT	0	15/11/1989
	Callitris canescens	Scrubby Cypress Pine			NT	0	16/11/1989
	Callitris gracilis	Southern Cypress Pine			NT	0	14/11/1989
	Callitris rhomboidea	Oyster Bay Pine			NT	0	08/04/1963

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
			Aus	SA	KI status	KI trend	
	Calocera guepinioides						19/06/2004
	Calytrix glaberrima	Smooth Heath-myrtle			LC	0	28/12/1985
	Calytrix tetragona	Common Fringe-myrtle			LC	0	06/09/1996
	Capreolia implexa						20/12/1990
*	*Cardamine hirsuta*	Hairy Bitter-cress					04/09/1996
*	*Carduus tenuiflorus*	Slender Thistle					15/11/1989
	Carpobrotus rossii (NC)	Native Pigface					06/09/1996
*	*Carthamus leucocaulos*	Glaucous Star-thistle					18/02/1987
	Cassinia uncata (NC)	Sticky Cassinia					14/04/1988
	Cassytha melantha	Coarse Dodder-laurel			LC	0	16/11/1989
	Cassytha pubescens	Downy Dodder-laurel			LC	0	06/09/1996
*	*Catapodium rigidum*	Rigid Fescue					16/11/1989
	Caulerpa cactoides						26/08/1950
	Caulerpa flexilis						26/08/1950
	Caulerpa obscura						10/01/1948
	Caulerpa remotifolia						10/01/1948
	Caulerpa simpliciuscula var. laxa						10/01/1948
	Caulocystis cephalornithos						01/02/1956
	Caulocystis uvifera						06/02/2008
*	*Centaurium erythraea*	Common Centaury					15/11/1989
	Centroceras clavulatum						10/01/1948
	Ceramium puberulum						26/08/1950
	Ceramium pusillum						27/10/1995
*	*Cerastium balearicum*	Chickweed					06/09/1996
*	*Cerastium glomeratum*	Common Mouse-ear Chickweed					16/11/1989
*	*Cerastium semidecandrum (NC)*	Small Mouse-ear Chickweed					16/11/1989
	Chaetomorpha billardieri						28/08/1948
	Chaetomorpha capillaris						19/01/1950
	Chaetomorpha valida						01/02/1956
	Champia affinis						26/08/1950
	Champia zostericola						26/08/1950
*	*Chenopodium album*	Fat Hen					01/01/1986
	Chiracanthia arborea						06/02/2008
	Chondria capreolis						21/08/1948
	Chondria curdieana						21/08/1948
	Chondria harveyana						26/08/1950
	Chondria succulenta						21/08/1948
	Choreonema thuretii						18/01/1948
	Choretrum chrysanthum/glomeratum	Sour-bush					28/01/1988
	Choretrum glomeratum	White Sour-bush			LC	0	15/11/1989
	Chroodactylon ornatum						10/01/1948
*	*Cirsium sp.*	Thistle					15/11/1989

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
			Aus	SA	KI status	KI trend	
	Cladophora coelothrix						16/01/1950
	Cladophora laetevirens						11/04/1947
	Cladophora vagabunda						10/01/1948
	Cladostephus spongiosus						18/01/1948
	Clematis leptophylla				NE		08/08/1961
	Clematis microphylla var. microphylla (NC)	Old Man's Beard			NE		16/11/1989
	Codium duthieae						26/08/1950
	Codium mamillosum						26/08/1950
	Codium muelleri						26/08/1950
	Codium pomoides						04/06/1947
	Codium spongiosum						12/04/1967
	Coeloclonium tasmanicum						26/08/1950
	Colpomenia peregrina						25/08/1986
	Comesperma volubile	Love Creeper			LC	0	04/09/1996
	Coronidium adenophorum	Branched Everlasting			LC	0	06/12/1963
	Correa backhouseana var. coriacea	Thick-leaf Correa					14/04/1988
	Correa backhouseana var. orbicularis	Round-leaf Correa		R	LC	0	30/06/1985
	Correa pulchella	Salmon Correa			LC	0	28/08/1971
	Correa reflexa (NC)	Common Correa					06/09/1996
	Correa reflexa var. insularis	Round-leaf Correa			NT	0	15/07/1989
	Cortinarius veronabrunneus						25/07/2005
	Cotula vulgaris var. australasica	Slender Cotula			LC	0	17/09/1994
	Craspedia variabilis	Billy-buttons			VU	DD	01/11/1991
	Crassula sieberiana ssp. tetramera (NC)	Australian Stonecrop					06/09/1996
	Cutleria multifida						21/08/1968
	Cyrtostylis reniformis	Small Gnat-orchid			RA	DD	15/11/1989
	Cyrtostylis robusta	Robust Gnat-orchid			LC	0	06/09/1996
	Cystophora botryocystis						21/08/1948
	Cystophora grevillei						04/06/1947
	Cystophora intermedia						09/10/1996
	Cystophora polycystidea						23/01/1947
	Cystophora racemosa						26/08/1950
	Cystophora siliquosa						09/10/1997
	Cystophora subfarcinata						18/01/1948
	Cystoseira trinodis						27/10/1995
	Dacrymyces deliquescens						19/06/2004
	Dampiera lanceolata var. insularis	Kangaroo Island Dampiera			RA	-	18/04/2000
	Dasya hookeri						26/08/1950
	Dasya quadrispora						26/08/1950
	Dasya villosa						07/09/1996
	Daucus glochidiatus	Native Carrot			LC	0	04/09/1996
	Dianella brevicaulis	Short-stem Flax-lily			LC	0	06/09/1996

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
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	Dianella brevicaulis/revoluta var.	Black-anther Flax-lily					28/01/1988
	Dianella revoluta var. revoluta	Black-anther Flax-lily			LC	0	06/09/1996
	Dictyomenia harveyana						22/08/1963
	Dictyosphaeria sericea						26/08/1950
	Dictyota alternifida						18/01/1948
	Dictyota dichotoma var. intricata						02/11/1947
	Dictyota furcellata						06/02/2008
	Diplocladia patersonis						21/08/1948
*	*Diplotaxis tenuifolia*	Lincoln Weed					16/11/1989
	Distromium flabellatum						21/08/1948
	Ditria expleta						04/06/1947
	Dodonaea humilis	Dwarf Hop-bush			LC	0	17/10/2001
	Dodonaea sp.	Hop-bush					15/11/1989
	Dodonaea viscosa ssp.	Sticky Hop-bush					28/01/1988
	Dodonaea viscosa ssp. angustissima	Narrow-leaf Hop-bush			LC	0	04/09/1996
	Drosera macrantha ssp. planchonii	Climbing Sundew			LC	0	15/11/1989
	Ecklonia radiata						18/01/1948
	Ectocarpus siliculosus						06/09/1946
	Elisiella arbuscula						21/11/1968
	Enchylaena tomentosa var. tomentosa	Ruby Saltbush			LC	0	15/11/1989
	Enteromorpha clathrata						26/08/1950
	Enteromorpha compressa						26/08/1950
	Enteromorpha paradoxa						12/01/1950
	Eriochilus cucullatus	Parson's Bands			NT	DD	14/04/2000
*	*Erodium cicutarium*	Cut-leaf Heron's-bill					16/11/1989
*	*Erodium moschatum*	Musky Herons-bill					01/01/1986
	Eucalyptus albopurpurea	Purple-flowered Mallee Box			LC	0	16/11/1989
	Eucalyptus cneorifolia	Kangaroo Island Narrow-leaf Mallee			LC	-	15/11/1989
	Eucalyptus diversifolia (NC)	Coastal White Mallee					06/09/1996
	Eucalyptus diversifolia ssp. diversifolia	Coastal White Mallee			LC	0	17/10/2001
	Eucalyptus gracilis	Yorrell			VU	-	25/09/1994
	Eucalyptus oleosa (NC)	Red Mallee					15/11/1989
	Eucalyptus oleosa ssp. ampliata	Red Mallee			RA	0	29/04/1994
	Eucalyptus rugosa	Coastal White Mallee			LC	0	06/09/1996
	Euchiton sphaericus	Annual Cudweed			LC	0	12/10/1985
*	*Euphorbia paralias*	Sea Spurge					04/09/1996
	Euphrasia collina ssp. tetragona	Coast Eyebright			NT	0	06/09/1996
	Eutaxia microphylla	Common Eutaxia			LC	0	15/11/1989
	Exocarpos cupressiformis	Native Cherry			NT	-	28/01/1988
	Ficinia nodosa	Knobby Club-rush			LC	0	06/09/1996
*	*Foeniculum vulgare*	Fennel					24/04/1988

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
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	Frankenia pauciflora var. fruticulosa	Southern Sea-heath			NT	DD	15/11/1989
	Frankenia pauciflora var. gunnii	Southern Sea-heath			DD	DD	01/01/1986
*	*Fumaria muralis ssp.*	Wall Fumitory					01/01/1986
	Gahnia deusta	Limestone Saw-sedge			NT	0	14/09/2003
	Gahnia hystrix	Spiky Saw-sedge		R	RA	0	15/11/1989
	Galium binifolium (NC)	Reflexed Bedstraw					14/11/1989
	Galium leptogonium	Reflexed Bedstraw			NT	0	14/11/1989
	Galium migrans (NC)	Loose Bedstraw					16/11/1989
*	*Galium murale*	Small Bedstraw					06/09/1996
	Gelidium crinale						27/10/1995
	Gelidium pusillum						20/12/1990
	Genoplesium nigricans	Black Midge-orchid			RA	DD	15/11/1989
	Genoplesium rufum	Red Midge-orchid			RA	DD	01/04/2000
*	*Geranium molle var. molle*	Soft Geranium					16/11/1989
	Geranium potentilloides var. potentilloides	Downy Geranium			NT	0	15/11/1989
	Geranium retrorsum	Grassland Geranium			NT	0	04/09/1996
	Geranium solanderi var. solanderi	Austral Geranium			NT	0	01/01/1986
	Gigartina brachiata						07/01/1990
	Gigartina sonderi						31/12/1999
	Gloiosaccion brownii						26/08/1950
	Glycine latrobeana	Clover Glycine	VU	V			14/11/1989
	Gnaphalium indutum ssp. indutum	Tiny Cudweed			LC	0	16/11/1989
	Gonocarpus mezianus	Broad-leaf Raspwort			LC	0	06/09/1996
	Goodenia varia	Sticky Goodenia			LC	0	17/10/2001
	Goodia lotifolia var. (NC)	Golden-tip					14/11/1989
	Goodia lotifolia var. lotifolia (NC)	Golden-tip					16/11/1989
	Goodia medicaginea	Western Golden-tip			NT	0	15/11/1989
	Gracilaria chilensis						31/05/1947
	Gracilaria cliftonii						26/08/1950
	Gramineae sp.	Grass Family					06/09/1996
	Grevillea dilatata	Holly-leaf Grevillea			LC	0	01/11/1964
	Grevillea halmaturina ssp. halmaturina	Prickly Grevillea		R	NT	-	18/04/2000
	Grevillea ilicifolia var. ilicifolia (NC)	Holly-leaf Grevillea					15/11/1989
	Grevillea linearifolia (NC)	Prickly Grevillea					15/11/1989
	Griffithsia crassiuscula						26/08/1950
	Griffithsia teges						26/08/1950
	Gulsonia annulata						11/02/1956
	Hakea mitchellii	Heath Needlebush			LC	0	04/01/1988
	Hakea vittata	Limestone Needlebush			NT	0	14/04/1988
	Haliptilon roseum						26/08/1950
	Halophila australis	Paddle Weed			RA	DD	19/11/1987

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			Aus	SA	KI status	KI trend	
	Halydictyon arachnoideum						21/08/1948
	Haplodasya tomentosa						17/11/1967
	Haplodasya urceolata						17/11/1967
	Haraldia australica						26/08/1950
	Hardenbergia violacea	Native Lilac			RA	0	15/11/1989
*	*Hedypnois rhagadioloides (NC)*	Cretan Weed					06/09/1996
	Helichrysum leucopsideum	Satin Everlasting			LC	0	06/09/1996
?	*Helichrysum luteoalbum*	Jersey Cudweed			LC	0	16/11/1989
*	*Heliotropium curassavicum*	Smooth Heliotrope					18/02/2010
	Hemichroa pentandra	Trailing Hemichroa			NT	0	15/11/1989
	Herposiphonia calothrix						23/01/1947
	Heterodoxia denticulata						16/01/1948
	Heterosiphonia gunniana						20/12/1990
	Heterothamnion episiliquosum						09/10/1997
	Hibbertia aspera (NC)						16/11/1989
	Hibbertia pallidiflora	Round-leaf Guinea-flower			LC	0	06/09/1996
	Hibbertia riparia	Bristly Guinea-flower			LC	0	17/10/2001
	Hibbertia riparia (NC)	Guinea-flower					04/09/1996
	Hibbertia sp.	Guinea-flower					14/04/1988
	Hincksia sordida						31/05/1947
	Hormosira banksii f. banksii						24/01/1944
	Hormosira banksii f. pumila						18/01/1948
*	*Hornungia procumbens*	Oval Purse					19/07/2007
	Hydrocotyle sp.	Pennywort					15/11/1989
	Hydrolithon farinosum						26/08/1950
	Hypnea charoides						06/02/2008
	Hypnea valentiae						06/02/2008
*	*Hypochaeris glabra*	Smooth Cat's Ear					16/11/1989
*	*Hypochaeris radicata*	Rough Cat's Ear					16/11/1989
	Hypoglossum revolutum						26/08/1950
	Hypoxis glabella var. glabella	Tiny Star			LC	0	06/09/1996
*	*Iris albicans*	Flag Iris					24/09/1983
*	*Isolepis marginata*	Little Club-rush					06/09/1996
	Ixodia achillaeoides ssp. alata	Hills Daisy			LC	0	06/09/1996
	Jania micrarthrodia						20/12/1990
	Jania verrucosa						20/12/1990
	Juncus bufonius	Toad Rush			LC	0	15/11/1989
	Kunzea pomifera	Muntries			NT	0	15/11/1989
*	*Lagurus ovatus*	Hare's Tail Grass					06/09/1996
	Lasiopetalum discolor	Coast Velvet-bush			LC	0	17/10/2001
	Lasiopetalum schulzenii	Drooping Velvet-bush			LC	0	17/10/2001
	Laurencia clavata						22/08/1963
?	*Laurencia filiformis f. filiformis*						21/08/1948

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
			Aus	SA	KI status	KI trend	
	Laurencia majuscula						12/01/1950
	Laurencia shepherdii						26/08/1950
	Leiocarpa supina	Coast Plover-daisy			NT	0	06/09/1996
	Lepidium foliosum	Leafy Peppercress			RA	DD	01/01/1986
	Lepidosperma canescens	Hoary Rapier-sedge			LC	0	01/03/1961
	Lepilaena marina	Sea Water-mat			NT	0	12/08/1987
	Leptoceras menziesii	Hare Orchid			NT	DD	24/09/1989
	Leucophyta brownii	Coast Cushion Bush			LC	0	06/09/1996
	Leucopogon lanceolatus var. lanceolatus	Lance Beard-heath			RA	0	15/12/1991
	Leucopogon parviflorus	Coast Beard-heath			LC	0	17/10/2001
	Leucopogon rufus	Ruddy Beard-heath			LC	0	16/11/1989
	Lichen sp.						16/11/1989
	Lobelia gibbosa	Tall Lobelia			LC	0	04/01/1986
	Lobelia gibbosa (NC)	Tall Lobelia					16/11/1989
	Lobophora variegata						04/06/1947
	Logania crassifolia	Coast Logania			LC	0	15/11/1989
	Logania linifolia	Flax-leaf Logania			NT	0	29/09/1962
	Logania ovata	Oval-leaf Logania			LC	0	17/10/2001
*	*Lolium loliaceum*	Stiff Ryegrass					15/11/1989
*	*Lolium rigidum*	Wimmera Ryegrass					27/01/1973
*	*Lolium sp.*	Ryegrass					14/11/1989
	Lophocladia kuetzingii						11/04/1947
	Luzula meridionalis	Common Wood-rush			RA	DD	12/10/1986
*	*Lycium ferocissimum*	African Boxthorn					01/01/2010
	Maireana oppositifolia	Salt Bluebush			LC	0	15/11/1989
	Malva preissiana	Australian Hollyhock					29/08/1964
	Malva preissiana (NC)	Australian Hollyhock			NT	0	01/01/1986
*	*Marrubium vulgare*	Horehound					19/12/1987
	Mazoyerella australis						10/01/1948
	Medeiothamnion protensum						26/08/1950
*	*Medicago polymorpha var. polymorpha*	Burr-medic					01/01/1986
	Melaleuca acuminata ssp. acuminata	Mallee Honey-myrtle			NT	0	07/07/1995
	Melaleuca gibbosa	Slender Honey-myrtle			LC	0	06/09/1996
	Melaleuca halmaturorum	Swamp Paper-bark			NT	0	15/11/1989
	Melaleuca lanceolata	Dryland Tea-tree			LC	0	06/09/1996
	Melaleuca lanceolata ssp. lanceolata (NC)	Dryland Tea-tree					14/11/1989
*	*Melilotus indicus*	King Island Melilot					04/09/1996
*	*Mesembryanthemum crystallinum*	Common Iceplant					01/01/1986
	Microcybe pauciflora ssp. pauciflora	Yellow Microcybe			NT	0	13/12/1964
	Microlepidium pilosulum	Hairy Shepherd's-purse		R	NT	0	06/09/1996
	Microseris lanceolata	Yam Daisy			LC	0	06/09/1996
	Microtis arenaria	Notched Onion-orchid			LC	0	01/01/1986

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	Microtis frutetorum				RA	DD	16/11/1989
	Microtis sp.	Onion-orchid					04/09/1996
	Millotia muelleri	Common Bow-flower			RA	0	26/09/1992
*	*Minuartia mediterranea*	Slender Sandwort					06/09/1996
	Mitrasacme paradoxa (NC)	Wiry Mitrewort					16/11/1989
	Moss sp.						16/11/1989
	Muehlenbeckia adpressa	Climbing Lignum			LC	0	16/11/1989
	Muehlenbeckia gunnii	Coastal Climbing Lignum			LC	0	04/09/1996
	Mycena minya						19/06/2004
	Myoporum insulare	Common Boobialla			LC	0	06/09/1996
	Myoporum petiolatum	Sticky Boobialla			RA	-	08/08/1961
	Myoporum viscosum	Sticky Boobialla			RA	-	16/11/1989
	Myoporum viscosum (NC)	Sticky Boobialla					16/11/1989
	Neogoniolithon brassica-florida						12/01/1950
	Nitraria billardierei	Nitre-bush			RA	0	01/01/1986
*	*Olea europaea ssp. europaea*	Olive					01/01/1986
	Olearia axillaris	Coast Daisy-bush			LC	0	06/09/1996
	Olearia brachyphylla	Short-leaf Daisy-bush					04/10/1997
	Olearia minor	Heath Daisy-bush					30/09/2012
	Olearia ramulosa	Twiggy Daisy-bush			LC	0	06/09/1996
	Olearia rudis	Azure Daisy-bush			LC	0	17/10/2001
	Opercularia turpis	Twiggy Stinkweed			LC	0	06/09/1996
	Orthrosanthus multiflorus	Morning Flag			LC	0	17/10/2001
	Oxalis perennans	Native Sorrel			NT	0	30/08/1986
	Oxalis perennans (NC)	Native Sorrel					04/09/1996
*	*Oxalis pes-caprae*	Soursob					04/09/1996
	Pachydictyon paniculatum						18/01/1948
	Pachydictyon polycladum						12/01/1945
*	*Papaver aculeatum*	Bristle Poppy					14/11/1989
*	*Parapholis incurva*	Curly Ryegrass					15/11/1989
*	*Parentucellia latifolia*	Red Bartsia					16/11/1989
	Parietaria australis	Smooth-nettle			DD	DD	22/09/2004
	Parietaria debilis (NC)	Smooth-nettle					06/09/1996
	Pelargonium littorale	Native Pelargonium			LC	0	06/09/1996
*	*Petrorhagia dubia*	Velvet Pink					16/11/1989
*	*Petrorhagia nanteuilii*						01/01/1986
	Peyssonnelia capensis						10/01/1948
	Pheladenia deformis	Bluebeard Orchid			LC	0	16/11/1989
	Pholiota communis						03/07/2007
	Phyllangium divergens	Wiry Mitrewort			LC	0	01/10/1988
	Pimelea flava ssp. flava	Yellow Riceflower			LC	0	08/08/1961
	Pimelea glauca	Smooth Riceflower			LC	0	15/11/1989
	Pimelea serpyllifolia ssp. serpyllifolia	Thyme Riceflower			LC	0	06/09/1996

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	Pimelea sp.	Riceflower					28/01/1988
	Pimelea stricta	Erect Riceflower			NT	-	14/11/1989
*	*Pinus halepensis*	Aleppo Pine					06/03/1992
	Plantago hispida	Hairy Plantain			NT	0	12/10/1990
	Poa crassicaudex	Thick-stem Tussock-grass			LC	0	15/11/1989
	Poa halmaturina	Kangaroo Island Poa			LC	0	14/11/1989
	Poa poiformis var. poiformis	Coast Tussock-grass			LC	0	06/09/1996
	Podolepis rugata var. littoralis	Coast Copper-wire Daisy			NT	0	15/11/1989
	Podotheca angustifolia	Sticky Long-heads			LC	0	16/11/1989
	Pogonolepis muelleriana	Stiff Cup-flower			RA	0	17/09/1994
	Pollexfenia pedicellata						23/08/1963
	Polysiphonia blandii						22/08/1963
	Polysiphonia daveyae						21/08/1948
	Polysiphonia decipiens						21/11/1968
	Polysiphonia mollis						26/08/1950
	Polysiphonia succulenta						25/08/1986
	Pomaderris obcordata	Wedge-leaf Pomaderris			LC	0	06/09/1996
	Pomaderris oraria (NC)	Coast Pomaderris					16/11/1989
	Pomaderris paniculosa ssp.						01/01/1986
	Pomaderris paniculosa ssp. paniculosa	Mallee Pomaderris			LC	0	04/09/1996
	Pomaderris paniculosa ssp. paralia	Coast Pomaderris			LC	0	14/11/1989
	Poranthera microphylla	Small Poranthera			NT	0	19/11/1989
	Poranthera microphylla (NC)	Small Poranthera					16/11/1989
	Porphyra lucasii						27/07/1947
	Posidonia australis	Southern Tapeweed					20/12/1990
	Prostanthera aspalathoides	Scarlet Mintbush			RA	-	17/10/2001
	Protokuetzingia australasica						26/08/1950
	Pterosiphonia pennata						27/10/1995
	Pterostylis alata (NC)	Tall Shell-orchid					15/11/1989
	Pterostylis erythroconcha	Red Shell-orchid			LC	0	07/07/1995
	Pterostylis longifolia (NC)	Tall Greenhood					06/09/1996
	Pterostylis melagramma	Tall Greenhood		E	VU	DD	15/11/1989
	Pterostylis nana	Dwarf Greenhood			NE		06/09/1996
	Ptilocladia australis						25/08/1963
	Puccinellia stricta (NC)	Australian Saltmarsh-grass					15/11/1989
	Pultenaea acerosa	Bristly Bush-pea			LC	0	15/11/1989
	Pultenaea canaliculata	Soft Bush-pea			NT	0	04/11/1990
	Pultenaea penna	Feather Bush-pea			NT	0	27/12/1943
	Pultenaea rigida var. rigida (NC)	Rigid Bush-pea					06/09/1996
	Pultenaea tenuifolia	Narrow-leaf Bush-pea			NT	0	06/09/1987
	Pultenaea vestita	Feather Bush-pea			RA	DD	15/11/1989
	Pultenaea vestita (NC)	Feather Bush-pea					06/09/1996
	Pultenaea viscidula	Dark Bush-pea			NT	0	15/11/1989

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
			Aus	SA	KI status	KI trend	
	Ranunculus sessiliflorus var. sessiliflorus	Annual Buttercup			LC	0	12/10/1986
*	*Ranunculus trilobus*	Three-lobed Buttercup					04/10/1997
	Rhagodia candolleana ssp. candolleana	Sea-berry Saltbush			LC	0	06/09/1996
	Rhizoclonium riparium						19/01/1950
	Rhodymenia foliifera						26/08/1950
	Rosenvingiella polyrhiza						10/01/1948
*	*Rostraria sp.*						16/11/1989
	Rumex brownii	Slender Dock			LC	0	29/10/1986
*	*Rumex crispus*	Curled Dock					01/01/1986
	Ruppia tuberosa	Widgeon Grass			RA	DD	29/08/1987
	Rytidosperma setaceum	Small-flower Wallaby-grass			LC	0	16/11/1989
*	*Sagina apetala*	Annual Pearlwort					20/11/1990
*	*Salvia verbenaca var. verbenaca*	Wild Sage					19/10/1985
	Samolus repens	Creeping Brookweed			LC	0	15/11/1989
	Sarcocornia blackiana	Thick-head Samphire			LC	0	15/11/1989
	Sarcocornia quinqueflora	Beaded Samphire			LC	0	15/11/1989
	Sarcotrichia dolichocystidea						10/01/1948
	Sargassum decipiens						26/08/1950
	Sargassum distichum						26/08/1950
	Sargassum fallax						26/08/1950
	Sargassum heteromorphum						26/08/1950
	Sargassum lacerifolium						22/08/1963
	Sargassum paradoxum						21/11/1968
	Sargassum sonderi						06/09/1946
	Sargassum spinuligerum						26/08/1950
	Scaberia agardhii						18/01/1948
	Scaevola angustata	Coast Fanflower			RA	DD	14/11/1989
	Scaevola crassifolia	Cushion Fanflower			LC	0	06/09/1996
	Schenkia australis	Spike Centaury			LC	0	16/11/1989
	Schoenus nitens	Shiny Bog-rush			RA	DD	14/09/1996
	Scirpus sp. (NC)						16/11/1989
	Scytosiphon lomentaria						07/09/1986
	Sebaea ovata	Yellow Sebaea			LC	0	16/11/1989
	Senecio odoratus	Scented Groundsel			LC	0	12/10/1981
	Senecio odoratus var. (NC)	Scented Groundsel					14/04/1988
	Senecio odoratus var. odoratus (NC)	Scented Groundsel					04/09/1996
	Senecio pinnatifolius (NC)	Variable Groundsel					06/09/1996
	Senecio pinnatifolius var. maritimus	Variable Groundsel			NT	0	15/11/1989
*	*Senecio vulgaris*	Common Groundsel					01/01/1986
*	*Sherardia arvensis*	Field Madder					01/01/1986
*	*Silene gallica var. gallica*	French Catchfly					29/10/1986
*	*Silene nocturna*	Mediterranean Catchfly					16/11/1989

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
			Aus	SA	KI status	KI trend	
*	*Sisymbrium orientale*	Indian Hedge Mustard					01/01/1986
*	*Solanum linnaeanum*	Apple Of Sodom					31/10/1986
*	*Solanum nigrum*	Black Nightshade					01/01/1986
*	*Solanum triflorum*	Three-flower Nightshade					18/02/2010
*	*Sonchus oleraceus*	Common Sow-thistle					04/09/1996
*	*Sonchus oleraceus (NC)*	Common Sow-thistle					01/01/1986
	Sonchus sp.	Sow-thistle					15/11/1989
*	*Spergularia media*	Coast Sand-spurrey					14/11/1989
*	*Spergularia media (NC)*	Coast Sand-spurrey					15/11/1989
*	*Spergularia sp.*	Sand-spurrey					04/09/1996
	Spinifex sericeus (NC)	Rolling Spinifex					04/09/1996
	Spongoclonium australicum						07/09/1996
	Sporolithon durum						12/01/1948
	Spyridia dasyoides						30/12/1999
	Spyridia filamentosa						26/08/1950
	Spyridia tasmanica						21/08/1948
	Spyridium eriocephalum var.	Heath Spyridium					14/04/1988
	Spyridium halmaturinum	Kangaroo Island Spyridium			LC	0	30/09/1995
	Spyridium nitidum	Shining Spyridium			LC	0	29/09/1962
	Spyridium phylicoides	Narrow-leaf Spyridium			LC	0	06/09/1996
	Spyridium spathulatum	Spoon-leaf Spyridium		R	NT	0	15/11/1989
	Stackhousia aspericocca ssp. Cylindrical inflorescence (W.R.Barker 1418)	Bushy Candles			LC	0	06/09/1996
	Stackhousia spathulata	Coast Candles			NT	0	06/09/1996
*	*Stellaria media*	Chickweed					06/09/1996
	Stilophora rhizodes						02/11/1947
	Stylidium armeria ssp. armeria	Grass Trigger-plant			NT	DD	26/11/1962
	Suaeda australis	Austral Seablite			LC	0	15/11/1989
	Swainsona lessertiifolia	Coast Swainson-pea			LC	0	16/11/1989
	Tecticornia arbuscula	Shrubby Samphire			RA	0	15/11/1989
	Tetragonia implexicoma	Bower Spinach			LC	0	04/09/1996
	Thelymitra sp.	Sun-orchid					15/11/1989
*	*Thinopyrum junceiforme*	Sea Wheat-grass					04/09/1996
	Thomasia petalocalyx	Paper-flower			LC	0	14/11/1989
	Threlkeldia diffusa	Coast Bonefruit			LC	0	06/09/1996
	Thryptomene ericaea	Heath Thryptomene			LC	0	09/08/1983
	Thysanotus patersonii	Twining Fringe-lily			LC	0	15/11/1989
	Thysanotus racemoides	Rush Fringe-lily			NT	0	15/11/1989
	Trachymene pilosa	Dwarf Trachymene			LC	0	15/11/1989
*	*Trifolium campestre*	Hop Clover					16/11/1989
	Triglochin centrocarpum (NC)	Dwarf Arrowgrass					06/09/1996
	Tulostoma albicans						25/07/2005
	Ulva lactuca						10/01/1948

*	Scientific name	Common name	Conservation status				Most recent BDBSA sighting
			Aus	SA	KI status	KI trend	
*	*Urospermum picroides*	False Hawkbit					29/10/1986
*	*Urtica urens*	Small Nettle					01/01/1986
*	*Valerianella discoidea*	Lesser Corn-salad					15/12/2010
*	*Verbascum creticum*	Cretan Mullein					22/07/2000
*	*Veronica arvensis*	Wall Speedwell					14/11/1989
	Veronica hillebrandii	Rigid Speedwell			LC	0	06/09/1996
*	*Vicia sativa ssp. nigra*	Narrow-leaf Vetch					01/01/1986
*	*Vinca major*	Blue Periwinkle					30/08/1986
	Vittadinia australasica var. australasica	Sticky New Holland Daisy			LC	0	16/11/1989
	Vittadinia dissecta var. hirta	Dissected New Holland Daisy					14/04/1988
	Vittadinia sp.	New Holland Daisy					16/11/1989
*	*Vulpia bromoides*	Squirrel-tail Fescue					16/11/1989
*	*Vulpia myuros f. megalura*	Fox-tail Fescue					01/01/1986
*	*Vulpia myuros f. myuros*	Rat's-tail Fescue					16/11/1989
	Wahlenbergia gracilenta	Annual Bluebell			LC	0	16/11/1989
	Westringia eremicola	Slender Westringia			RA	0	15/11/1989
	Wilsonia backhousei	Narrow-leaf Wilsonia			RA	0	18/04/1999
	Wilsonia humilis	Silky Wilsonia			RA	0	18/04/1999
	Zostera tasmanica	Tasman Grass-wrack			NT	-	20/12/1990
	Zygophyllum billardierei	Coast Twinleaf			LC	0	01/10/1992
	Zygophyllum billardierei (NC)	Coast Twinleaf					06/09/1996
	Zygophyllum flavum	Coast Twinleaf			NT	0	15/11/1989

Conservation status

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). **SA**: South Australia (*National Parks and Wildlife Act 1972*). **Conservation Codes**: **CE**: Critically Endangered. **EN/E**: Endangered. **VU/V**: Vulnerable. **R**: Rare. **ssp**.: the conservation status applies at the sub-species level. An asterisk denotes ratings that need to be qualified for a variety of reasons, such as changes to taxonomy or nomenclature since listing or because a species assessed as 'presumed extinct' had to be listed under the Endangered category. Further details are available from the Vascular Plant Metadata document on the DEWNR website.

Regional status for Kangaroo Island is sourced from Gillam and Urban (2013). **Regional status**: **RE**: Regionally Extinct. **CR**: Critically Endangered. **EN**: Endangered. **VU**: Vulnerable. **RA**: Rare. **NT**: Near Threatened. **LC**: Least Concern. **DD**: Data Deficient. **NE**: Not Evaluated. **Regional Population**: **--**: Definite Decline. **-**: Probable Decline. **0**: Stable/No Change. **+**: Probable Increase. **++**: Definite Increase. **DD**: Data Deficient.

Of the records above, only one record is from the project area, being *Lycium ferocissimum* (African Boxthorn).

Appendix 3. Flora species observed within the project area during the field survey.

*	Scientific name	Common name	Conservation status				Vegetation association										
			Aus	SA	KI status	KI trend	1	2	3	4	5	6	7	8	9	10	11
	Acacia longifolia ssp. sophorae	Coastal Wattle			LC	+		●	●							●	
	Acacia paradoxa	Kangaroo Thorn			LC	0			●		●	●	●	●			
	Acacia triquetra	Mallee Wreath Wattle			LC	0			●			●				●	●
	Acaena novae-zelandiae	Biddy-biddy			LC	0	●						●				
	Acrotriche patula	Prickly Ground-berry			LC	0		●	●	●	●	●	●	●	●	●	●
	Adriana quadripartita	Coast Bitter-bush			LC	0										●	
*	*Aira sp.*	Hair-grass												●			
*	*Anagallis arvensis*	Pimpernel								●							
*	*Asparagus asparagoides f. asparagoides*	Bridal Creeper							●					●	●		
*	*Asphodelus fistulosus*	Onion Weed					●				●	●		●	●		
	Austrostipa exilis	Heath Spear-grass			LC	0			●	●	●	●	●	●			
	Austrostipa stipoides	Coast Spear-grass			LC	0		●									
*	*Avena barbata*	Bearded Oat					●			●		●	●	●	●		
	Beyeria lechenaultii	Pale Turpentine Bush			LC	0						●		●			
*	*Briza minor*	Lesser Quaking-grass												●			
*	*Bromus diandrus*	Great Brome						●									
*	*Bromus rubens*	Red Brome												●			
*	*Carthamus lanatus*	Saffron Thistle												●			
	Cassytha melantha	Coarse Dodder-laurel			LC	0			●	●	●				●		
	Clematis microphylla	Old Man's Beard			NE			●	●	●	●	●		●	●	●	
	Dianella brevicaulis	Short-stem Flax-lily			LC	0			●							●	
	Dichondra repens	Kidney Weed			LC	0										●	

*	Scientific name	Common name	Conservation status				Vegetation association										
			Aus	SA	KI status	KI trend	1	2	3	4	5	6	7	8	9	10	11
*	*Diplotaxis tenuifolia*	Lincoln Weed					●	●	●		●		●	●	●	●	
	Enchylaena tomentosa var.	Ruby Saltbush			LC	0	●										
	Eucalyptus albopurpurea	Purple-flowered Mallee Box			LC	0											
	Eucalyptus diversifolia ssp. diversifolia	Coastal White Mallee			LC	0			●		●			●		●	
	Eucalyptus gracilis	Yorrell			VU	-				●	●				●		
	Eucalyptus oleosa ssp. ampliata	Red Mallee			RA	0				●	●						
	Eucalyptus phenax ssp. compressa	Kangaroo Island Mallee	R		RA	-					●						
	Eucalyptus rugosa	Coastal White Mallee			LC	0				●	●						●
	Euphrasia collina ssp. tetragona	Coast Eyebright			NT	0										●	
	Eutaxia microphylla	Common Eutaxia			LC	0			●			●				●	●
	Ficinia nodosa	Knobby Club-rush			LC	0		●									
	Geranium potentilloides var. potentilloides	Downy Geranium			NT	0				●							
	Goodia medicaginea	Western Golden-tip			NT	0						●					
	Helichrysum leucopsideum	Satin Everlasting			LC	0		●									
	Hibbertia pallidiflora	Round-leaf Guinea-flower			LC	0										●	
*	*Hypochaeris radicata*	Rough Cat's Ear									●						
*	*Lagurus ovatus*	Hare's Tail Grass					●	●		●		●	●	●	●		
	Lasiopetalum discolor	Coast Velvet-bush			LC	0			●					●		●	●
	Leucophyta brownii	Coast Cushion Bush			LC	0		●									
	Leucopogon parviflorus	Coast Beard-heath			LC	0		●	●	●	●	●			●	●	
*	*Lolium sp.*	Ryegrass												●			
*	*Lycium ferocissimum*	African Boxthorn					●	●			●	●	●				
	Melaleuca gibbosa	Slender Honey-myrtle			LC	0		●	●					●		●	●

*	Scientific name	Common name	Conservation status				Vegetation association										
			Aus	SA	KI status	KI trend	1	2	3	4	5	6	7	8	9	10	11
	Melaleuca lanceolata	Dryland Tea-tree			LC	0		●	●		●			●		●	●
	Myoporum insulare	Common Boobialla			LC	0		●					●			●	●
	Olearia axillaris	Coast Daisy-bush			LC	0		●		●		●		●	●	●	
	Orthrosanthus multiflorus	Morning Flag			LC	0	●	●	●	●	●	●	●	●	●	●	●
	Pimelea flava ssp. dichotoma	Diosma Riceflower			LC	0			●								
	Pimelea serpyllifolia ssp. serpyllifolia	Thyme Riceflower			LC	0										●	
	Pimelea stricta	Erect Riceflower			NT	-			●			●					●
	Pomaderris paniculosa ssp. paralia	Coast Pomaderris			LC	0						●				●	
	Rhagodia candolleana ssp. candolleana	Sea-berry Saltbush			LC	0		●			●						
	Scaevola crassifolia	Cushion Fanflower			LC	0			●							●	
	Senecio odoratus	Scented Groundsel			LC	0			●	●	●	●		●		●	●
	Senecio pinnatifolius group				NT	0		●									
	Tetragonia implexicoma	Bower Spinach			LC	0	●	●									
	Threlkeldia diffusa	Coast Bonefruit			LC	0		●									
*	*Trifolium sp.*	Clover												●			
	Vittadinia australasica var. australasica	Sticky New Holland Daisy			LC	0	●		●	●	●	●	●		●	●	
*	*Vulpia bromoides*	Squirrel-tail Fescue						●									

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Regional status for Kangaroo Island is sourced from Gillam and Urban (2013). **Regional status**: **RE**: Regionally Extinct. **CR**: Critically Endangered. **EN**: Endangered. **VU**: Vulnerable. **RA**: Rare. **NT**: Near Threatened. **LC**: Least Concern. **DD**: Data Deficient. **NE**: Not Evaluated. **Regional Population**: **--**: Definite Decline. **-**: Probable Decline. **0**: Stable/No Change. **+**: Probable Increase. **++**: Definite Increase. **DD**: Data Deficient.

Appendix 4. Fauna species observed within the project area during the field survey.

*	Scientific name	Common name	Conservation status				Point Count Sites													
			Aus	SA	KI status	KI trend	1	2	3	4	5	6	7	8	9	10	11	12	OPP	Total
	Bird																			
	Acanthiza pusilla	Brown Thornbill			LC	0		4				3				3				10
	Anthochaera carunculata	Red Wattlebird			LC	0			1		3									4
	Corvus coronoides	Australian Raven			NT	0		7	30	1	1							3		42
	Eolophus roseicapilla	Galah			LC	0	6												2	8
	Falco cenchroides	Nankeen Kestrel			LC	0				1							1			2
	Grallina cyanoleuca	Magpielark			LC	0			2											2
	Gymnorhina tibicen	Australian Magpie			LC	0	25			1	2						2		28	58
	Haematopus fuliginosus	Sooty Oystercatcher		R	RA	0													2	2
	Hirundo neoxena	Welcome Swallow			LC	0	5												2	7
	Hydroprogne caspia	Caspian Tern			EN	0													1	1
	Larus pacificus	Pacific Gull			VU	0													1	1
	Malurus cyaneus	Superb Fairywren			LC	0	2	4	2	3	4		20	4	4		28	2		73
	Pandion haliaetus	Osprey		E	CR	0													1	1
	Pardalotus striatus	Striated Pardalote			LC	0		2			1	2								5
	Petroica boodang	Scarlet Robin		V**	NT	0						1								1
	Phaps chalcoptera	Common Bronzewing			LC	+			1											1
	Phylidonyris pyrrhopterus	Crescent Honeyeater			LC	0					1						1			2
	Rhipidura albiscapa	Grey Fantail			LC	0			2							1				3
	Sericornis frontalis	White-browed Scrubwren			LC	0	2		2	1	2				2	2	22	2	3	38
	Strepera versicolor	Grey Currawong			LC	0			1			1		1			2			5
*	*Sturnus vulgaris*	Common Starling					25											20	180	225
*	*Turdus merula*	Common Blackbird					5											9	12	26
	Zosterops lateralis	Silvereye			LC	0	10	6	6	15	11	10	12	3	10		30	10		123
	Mammal																			
	Macropus eugenii decres	Tammar Wallaby			LC	DD													3	3
	Macropus fuliginosus	Western Grey Kangaroo			LC	DD		Y		Y	Y		Y				Y		Y	~ 400
	Tachyglossus aculeatus	Short-beaked Echidna			NT	--													Scats, diggings	

*	Scientific name	Common name	Conservation status				Point Count Sites													
			Aus	SA	KI status	KI trend	1	2	3	4	5	6	7	8	9	10	11	12	OPP	Total
	Trichosurus vulpecula	Common Brushtail Possum		R	LC	0													Scats	
	Reptile																			
	Varanus rosenbergi	Heath Goanna		V	NT	--													3	3

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). **SA**: South Australia (*National Parks and Wildlife Act 1972*). **Conservation codes: CE**: Critically Endangered. **EN/E**: Endangered. **VU/V**: Vulnerable. **R**: Rare. *****: Introduced. **: The sub-species of Scarlet Robin on Kangaroo Island is considered an intermediate between Mount Lofty Ranges ssp (SA: R), Eyre Peninsula ssp (SA: V) and the as yet unnamed ssp. on Yorke Peninsula. For the purpose of this report, the precautionary approach has been taken and a rating of SA:V has been assigned.

Regional status for Kangaroo Island is sourced from Gillam and Urban (2013). **Regional status**: **RE**: Regionally Extinct. **CR**: Critically Endangered. **EN**: Endangered. **VU**: Vulnerable. **RA**: Rare. **NT**: Near Threatened. **LC**: Least Concern. **DD**: Data Deficient. **NE**: Not Evaluated. **Regional Population**: **--**: Definite Decline. **-**: Probable Decline. **0**: Stable/No Change. **+**: Probable Increase. **++**: Definite Increase. **DD**: Data Deficient.

Appendix 5. Bird survey point count site descriptions.

Point Count Site ID	Easting	Northing	Veg ID	Vegetation Description
1	754531	6028853	-	Coastal shrubland – outside of project area
2	755583	6030139	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*
3	755644	6030194	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*
4	754756	6029814	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*
5	754442	6029582	9	*Eucalyptus gracilis mallee over Acrotriche patula*
6	755389	6029368	4	*Eucalyptus oleosa / Eucalyptus gracilis / Eucalyptus rugosa mallee*
7	755599	6028952	3	*Eucalyptus diversifolia mallee over +/- Melaleuca lanceolata*
8	756117	6028794	10	*Leucopogon parviflorus / Lasiopetalum discolor tall shrubland*
9	756138	6028778	10	*Leucopogon parviflorus / Lasiopetalum discolor tall shrubland*
10	755730	6029707	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*
11	755746	6029263	11	*Eucalyptus rugosa +/- Eucalyptus albopurpurea mallee over Melaleuca lanceolata*
12	755035	6028990	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*

Appendix 6. Vegetation clearance details for project proposal.

Infrastructure description	Clearance area (ha)	Vegetation ID	Vegetation association	SEB condition	Fairway ID
Building Envelope	0.516536	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Building Envelope	0.777378	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Building Envelope	0.423322	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Building Envelope	1.18209	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Building Envelope	0.858299	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Building Envelope	0.00555764	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Building Envelope	0.00043797	3	*Eucalyptus diversifolia mallee over +/- Melaleuca lanceolata*	8:1	0
Building Envelope	0.205582	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	0
Building Envelope	0.18114	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	0
Building Envelope	0.45984	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	8:1	0
Building Envelope	0.0198501	3	*Eucalyptus diversifolia mallee over +/- Melaleuca lanceolata*	9:1	0
Building Envelope	0.0392055	3	*Eucalyptus diversifolia mallee over +/- Melaleuca lanceolata*	9:1	0
Building Envelope	0.131293	3	*Eucalyptus diversifolia mallee over +/- Melaleuca lanceolata*	9:1	0
Building Envelope	0.0148724	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Building Envelope	0.0720962	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Building Envelope	0.000840756	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Building Envelope	0.0729125	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Building Envelope	0.0729125	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Building Envelope	0.0424424	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Building Envelope	0.0190272	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Building Envelope	0.0267293	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Building Envelope	0.065163	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Building Envelope	0.0729125	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Building Envelope	0.0290574	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0

Infrastructure description	Clearance area (ha)	Vegetation ID	Vegetation association	SEB condition	Fairway ID
Building Envelope	0.0729125	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Building Envelope	0.00081629	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Building Envelope	0.0652893	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Building Envelope	6.18622E-07	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Building Envelope	0.0538853	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	0
Building Envelope	0.0128868	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	0
Building Envelope	0.0292469	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	0
Building Envelope	0.0101364	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	0
Building Envelope	0.0729125	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	8:1	0
Building Envelope	0.00774952	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	8:1	0
Building Envelope	0.000879539	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	8:1	0
Building Envelope	0.0324723	3	*Eucalyptus diversifolia mallee over +/- Melaleuca lanceolata*	9:1	0
Building Envelope	0.0111933	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Building Envelope	0.00890228	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Clubhouse and Lodges	0.0375	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Clubhouse and Lodges	0.0375	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Clubhouse and Lodges	0.0375	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Clubhouse and Lodges	0.0259188	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Clubhouse and Lodges	0.0259188	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Clubhouse and Lodges	0.0385621	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Clubhouse and Lodges	0.0259188	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Clubhouse and Lodges	0.0259188	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Clubhouse and Lodges	0.0379925	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Clubhouse and Lodges	0.0269684	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Clubhouse and Lodges	0.0255446	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0

Infrastructure description	Clearance area (ha)	Vegetation ID	Vegetation association	SEB condition	Fairway ID
Clubhouse and Lodges	0.0371566	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Clubhouse and Lodges	0.174729	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Clubhouse and Lodges	0.0269322	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
ENTRY Road	1.00879	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
ENTRY Road	0.180214	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
ENTRY Road	0.0717268	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	5:1	0
ENTRY Road	0.0664501	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	5:1	0
ENTRY Road	0.0763584	4	*Eucalyptus oleosa / Eucalyptus gracilis / Eucalyptus rugosa mallee*	4:1	0
ENTRY Road	0.0386593	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	6:1	0
ENTRY Road	0.0118264	3	*Eucalyptus diversifolia mallee over +/- Melaleuca lanceolata*	8:1	0
ENTRY Road	0.0376323	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	0
ENTRY Road	0.0609756	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	8:1	0
ENTRY Road	0.0239109	3	*Eucalyptus diversifolia mallee over +/- Melaleuca lanceolata*	5:1	0
ENTRY Road	0.0605545	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
ENTRY Road	0.0347218	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
ENTRY Road	0.0199808	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
ENTRY Road	0.00975975	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
ENTRY Road	0.000840756	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
ENTRY Road	0.0424424	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
ENTRY Road	0.0267293	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
ENTRY Road	0.0290574	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
ENTRY Road	0.0652893	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
ENTRY Road	6.18622E-07	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
ENTRY Road	0.0128868	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	0
ENTRY Road	0.0101364	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	0

Infrastructure description	Clearance area (ha)	Vegetation ID	Vegetation association	SEB condition	Fairway ID
ENTRY Road	0.000879539	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	8:1	0
ENTRY Road	0.00890228	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
ENTRY Road	0.00125027	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Dam	1.99902	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Dam	1.63233	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
New Dam	0.0766794	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Dam	0.0117996	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	0
New Dam	1.72849E-06	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
New Driving Range	3.45576	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Driving Range	0.181846	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Driving Range	0.0506206	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	5:1	0
New Driving Range	0.00173201	4	*Eucalyptus oleosa / Eucalyptus gracilis / Eucalyptus rugosa mallee*	4:1	0
New Entry Road	0.310945	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Entry Road	0.0136917	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Entry Road	0.00125027	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Entry Road	0.00125027	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Fairway	0.765764	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	1
New Fairway	0.926944	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	3
New Fairway	1.3374	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	4
New Fairway	0.217919	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	5
New Fairway	0.00214316	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	6
New Fairway	1.055	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	7
New Fairway	2.53339	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	8
New Fairway	0.452245	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	12
New Fairway	0.0521911	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	11
New Fairway	1.23228	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	10

Infrastructure description	Clearance area (ha)	Vegetation ID	Vegetation association	SEB condition	Fairway ID
New Fairway	1.25027	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	9
New Fairway	1.56109	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	17
New Fairway	0.72699	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	14
New Fairway	1.20334	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	18
New Fairway	0.0232627	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	1
New Fairway	0.0306223	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	6:1	2
New Fairway	0.0274978	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	6:1	3
New Fairway	0.0810838	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	6:1	4
New Fairway	0.79871	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	15
New Fairway	1.32375	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	1:1	6
New Fairway	0.177073	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	12
New Fairway	0.14731	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	17
New Fairway	0.0949176	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	14
New Fairway	0.0894029	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	15
New Fairway	0.00533753	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	15
New Fairway	0.00664566	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	15
New Fairway	0.0475668	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	2
New Fairway	1.29126	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	1
New Fairway	0.223112	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	2
New Fairway	0.605119	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	3
New Fairway	0.11566	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	15
New Fairway	0.733096	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	2
New Fairway	0.0495372	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	8
New Fairway	0.0987391	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	12
New Fairway	0.173429	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	13
New Fairway	0.391042	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	11

Infrastructure description	Clearance area (ha)	Vegetation ID	Vegetation association	SEB condition	Fairway ID
New Fairway	0.00467258	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	9
New Fairway	0.0260798	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	17
New Fairway	0.000793868	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	16
New Fairway	3.18229E-05	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	18
New Fairway	0.15176	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	5
New Fairway	0.274412	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	6
New Fairway	0.00872412	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	7
New Fairway	0.0684574	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	13
New Fairway	0.101888	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	16
New Fairway	0.00741259	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	16
New Fairway	1.42002	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	12
New Fairway	0.607605	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	17
New Fairway	0.366631	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	16
New Fairway	0.41491	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	14
New Fairway	0.218386	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	15
New Fairway	0.0561558	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	3
New Fairway	0.0419299	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	4
New Fairway	0.0660646	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	7
New Fairway	0.0309381	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	8
New Fairway	0.0660645	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	10
New Fairway	0.0660646	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	9
New Fairway	0.0644803	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	17
New Fairway	0.0660645	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	14
New Fairway	0.0660646	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	18
New Fairway	0.0241347	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	6:1	4
New Fairway	0.0660646	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	1:1	6
New Fairway	0.0660646	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	1

Infrastructure description	Clearance area (ha)	Vegetation ID	Vegetation association	SEB condition	Fairway ID
New Fairway	0.00990872	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	3
New Fairway	0.0660645	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	2
New Fairway	0.0351265	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	8
New Fairway	0.019039	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	12
New Fairway	0.0388052	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	13
New Fairway	0.0660646	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	11
New Fairway	0.00158433	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	17
New Fairway	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	16
New Fairway	0.0660646	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	5
New Fairway	0.0272594	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	13
New Fairway	0.00672631	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	16
New Fairway	0.0470256	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	12
New Fairway	0.0660646	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	15
New Green	0.0561558	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	3
New Green	0.0419299	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	4
New Green	0.0660646	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	7
New Green	0.0309381	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	8
New Green	0.0660645	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	10
New Green	0.0660646	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	9
New Green	0.0644803	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	17
New Green	0.0660645	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	14
New Green	0.0660646	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	18
New Green	0.0241347	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	6:1	4
New Green	0.0660646	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	1:1	6
New Green	0.0660646	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	1
New Green	0.00990872	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	3
New Green	0.0660645	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	2

Infrastructure description	Clearance area (ha)	Vegetation ID	Vegetation association	SEB condition	Fairway ID
New Green	0.0351265	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	8
New Green	0.019039	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	12
New Green	0.0388052	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	13
New Green	0.0660646	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	11
New Green	0.00158433	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	17
New Green	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	16
New Green	0.0660646	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	5
New Green	0.0272594	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	13
New Green	0.00672631	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	16
New Green	0.0470256	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	12
New Green	0.0660646	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	15
New Maintenance	0.753605	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Maintenance	0.102788	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	5:1	0
New Maintenance	0.312131	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	4:1	0
New Maintenance	0.0342903	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
New Maintenance	0.176101	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
New Maintenance	0.117359	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Maintenance	0.117359	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Maintenance	0.0472843	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Maintenance	0.0472843	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
New Maintenance	0.00098862	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	5:1	0
New Maintenance	0.00098862	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	5:1	0
New Maintenance	0.00165275	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	4:1	0
New Maintenance	0.00165275	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	4:1	0
New Maintenance	1.72849E-06	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
New Maintenance	0.012994	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0

Infrastructure description	Clearance area (ha)	Vegetation ID	Vegetation association	SEB condition	Fairway ID
New Maintenance	0.012994	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
New Maintenance	0.0466094	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
New Maintenance	0.0466094	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	1
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	1
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	1
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	10
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	10
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	10
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	4
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	4
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	4
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	5
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	5
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	5
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	8
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	8
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	8
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	7
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	7
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	7
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	11
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	11
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	11
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	15
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	15
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	15

Infrastructure description	Clearance area (ha)	Vegetation ID	Vegetation association	SEB condition	Fairway ID
New Tees	0.0141389	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	6:1	3
New Tees	0.00959017	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	6:1	3
New Tees	0.000360553	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	6:1	3
New Tees	0.0141389	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	2
New Tees	0.0141389	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	2
New Tees	0.0141389	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	2
New Tees	0.00454874	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	3
New Tees	0.0137784	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	3
New Tees	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	12
New Tees	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	9
New Tees	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	9
New Tees	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	12
New Tees	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	9
New Tees	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	17
New Tees	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	18
New Tees	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	18
New Tees	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	18
New Tees	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	12
New Tees	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	6
New Tees	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	6
New Tees	0.0141389	2	*Leucopogon parviflorus/ Olearia axillaris tall shrubland*	5:1	6
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	17
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	17
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	13
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	13
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	13
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	16

Infrastructure description	Clearance area (ha)	Vegetation ID	Vegetation association	SEB condition	Fairway ID
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	16
New Tees	0.0141389	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	16
New Tees	0.0115734	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	14
Power Alignment_overhead	0.000023	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Power Alignment_overhead	0.000115	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
Power Alignment_overhead	0.000069	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
Power Alignment_overhead	0.000138	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Power Alignment_overhead	0.000046	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
Power Alignment_overhead	0.000115	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
Power Alignment_overhead	0.000023	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Power Alignment_overhead	0.000046	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	5:1	0
Power Alignment_overhead	0.000023	3	*Eucalyptus diversifolia mallee over +/- Melaleuca lanceolata*	5:1	0
Power Alignment_overhead	0.000046	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
Power Alignment_overhead	0.000023	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
underground cable	0.067613	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
underground cable	0.001727	3	*Eucalyptus diversifolia mallee over +/- Melaleuca lanceolata*	8:1	0
underground cable	0.013794	4	*Eucalyptus oleosa / Eucalyptus gracilis / Eucalyptus rugosa mallee*	4:1	0
underground cable	0.014987	5	*Eucalyptus oleosa / Eucalyptus gracilis / Eucalyptus rugosa mallee*	5:1	0
underground cable	0.025668	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
underground cable	0.005012	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	0
Villas units	0.0720962	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Villas units	0.0729125	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Villas units	0.0729125	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Villas units	0.0190272	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0

Infrastructure description	Clearance area (ha)	Vegetation ID	Vegetation association	SEB condition	Fairway ID
Villas units	0.065163	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Villas units	0.0729125	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Villas units	0.0729125	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Villas units	0.00081629	6	*Melaleuca lanceolata tall shrubland over Acacia paradoxa / Acrotriche patula / Acacia triquetra / Beyeria lechenaultii*	7:1	0
Villas units	0.0538853	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	0
Villas units	0.0292469	8	*Acacia paradoxa / Acrotriche patula / Leucopogon parviflorus tall shrubland*	8:1	0
Villas units	0.0729125	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	8:1	0
Villas units	0.00774952	5	*Eucalyptus rugosa / Eucalyptus gracilis / Eucalyptus oleosa +/- Eucalyptus phenax subsp. compressa +/- Eucalyptus albopurpurea mallee*	8:1	0
Villas units	0.0324723	3	*Eucalyptus diversifolia mallee over +/- Melaleuca lanceolata*	9:1	0
Villas units	0.0111933	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0
Water Pipeline	0.00513224	7	*Acrotriche patula / Orthrosanthus multiflorus very open shrubland*	3:1	0
Water Pipeline	0.00434649	1	*Exotic Grassland +/- Orthrosanthus multiflorus +/- Vittadinia australasica var. australasica*	0:1	0

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Appendix M -

INFRAPLAN (Traffic Consultant)

infraPlan

policy – strategy – planning – infrastructure – transport

The Links at Kangaroo Island
Proposed Golf Course

Traffic Impact Assessment
November 2014

Client	Justin Trott General Manager – Golf Division Programmed Turnpoint 1A Fuji Crescent Mornington VIC 3931
Consultant Contact	Amol Kingaonkar Senior Traffic Engineer InfraPlan (Aust) P/L Level 1, 22-26 Vardon Avenue Adelaide SA 5000 p: +8227 0372 e: amol@infraplan.com.au ABN: 29582803072

Version	Date	Author	Reviewer	Review Date
1	07.11.2014	AK	SLB	12.11.2014
2	01.12.2014	AK	SLB	02.12.2014

Table of Contents

1 Introduction

InfraPlan has been engaged by Programmed Turnpoint Pty Ltd to undertake a traffic impact assessment for the proposed golf course/resort development (referred to as The Links) on Kangaroo Island towards submission to the Development Assessment Commission (DAC).

This document summarises the assumptions, calculations and methodology adopted to assess the impact of likely traffic generated from the proposed development (‘development’) and recommended measures to mitigate any impacts on the surrounding road network.

In the preparation of this report, we have undertaken the following tasks:

- Estimation of traffic generation considering use of the subject site
- Assessment of car parking demand and provision (including carpark layout)
- Assessment of the location, type and functioning of the access point off Hog Bay Road
- Assessment of traffic movements into, out of and within the subject site
- Evaluation of the impact of traffic on the surrounding street network within the immediate vicinity of the subject site

The following Australian Standards and guidelines were considered applicable and adopted while assessing the proposed development.

- Kangaroo Island Council Development Plan (**DP**)
- Roads and Maritime Service (**RMS**) - Guide to Traffic Generating Developments
- Department of Planning, Transport and Infrastructure (**DPTI**) – Trip Generation Rates for assessment of development proposal
- Institute of Transportation Engineers (**ITE**) – Trip Generation Handbook 6th Edition
- AS2890.1:2004-Part 1: Off-street car parking
- AS2890.6:2009-Part 6: Off-street parking for people with disabilities
- Desktop sight distance assessment for Davies Road junction with Hog Bay Road

2 Existing Conditions

2.1 Location

The proposed Kangaroo Island golf course site located approx. 2.5km south of Hog Bay Road accessed by Davies Road. Key geographic locations close to the development site include Dudley Conservation Park to the east and Pelican Lagoon Conservation Park to the north-west of the development site.

A locality plan and vicinity map showing the location of the development site relative to the surrounding road network are included as **Figure 1** below.

Figure 1: Site location and existing access via Hog Bay Road/Davies Road

2.2 Land Use

As per the most recent Development Plan of Kangaroo Island Council (adopted Feb-2014), the subject site falls under Primary Production (PriPro) Zone.

Under existing conditions however, the subject site is not used for farming activities and is mostly uninhabited.

2.3 Access and Road Network

Kangaroo Island is accessible by air and sea; no road connection exists connecting it to mainland South Australia.

Kingscote Airport is the only airport on Kangaroo Island with four daily return flights to Adelaide.

Kangaroo Island Sealink port provides sea connection to the island from mainland South Australia, currently operating eight daily return services from Cape Jervis (mainland SA) to Kangaroo Island.

Hog Bay Road is the only road connection to the development site from the two entry points to Kangaroo Island – Kingscote Airport and Kangaroo Island Sealink Port.

Davies Road an existing dirt road that provides the only road connection from the development site to Hog Bay Road.

Cathers Road (oriented east-west) is a local road joining Davies Road to the east. Cathers Road runs parallel along northern boundary of the development site.

2.4 Existing Traffic Conditions

Hog Bay Road is a two lane, two-way undivided road connecting Penneshaw and Kingscote. Hog Bay Road has been classified as *Minor Arterial* as per most recent development plan adopted by Kangaroo Island Council.

Hog Bay Road has a posted speed limit of 100km/hr with advisory speed restrictions for curved sections.

As such advisory signs for curve ahead, side road access and student drop-off/pick-up location have been observed near Davies Road junction. These signs are intended to alert motorist of potential vehicle and/or school children entering/crossing Hog Bay Road.

DPTI had undertaken traffic counts on Hog Bay Road in 2012 at a location approximately 4km on either side (north & west) of Davies Road junction. The average annual daily traffic (AADT) on Hog Bay Road is in the order of 900 vehicles per day (vpd) with 12% heavy vehicles (up to 110 heavy vehicles per day)

These counts indicate a morning peak traffic period occurring between 10.30 and 11.30am. Morning peak timing appears to coincide with first ferry from mainland SA which arrives around 9.45am at KI Sealink port.

The morning peak volume was observed to be in the order of 100 vehicles (both directions) with approximately 60% – 40% split (westbound – to Kingscote/northbound – to Penneshaw). Similarly, the afternoon peak traffic period was observed to occur between 4.30 and 5.30pm with approximately 80 veh during peak hour with 70% – 30% split for northbound and westbound traffic flows.

As can be expected with a vacation-oriented destination such as Kangaroo Island, traffic from the Sealink port towards Kingscote (westbound) is heavy on Fridays and towards the Sealink port

(Penneshaw) on Monday mornings. On other weekdays and Saturday/Sunday up to a 20% fall in daily traffic can be observed.

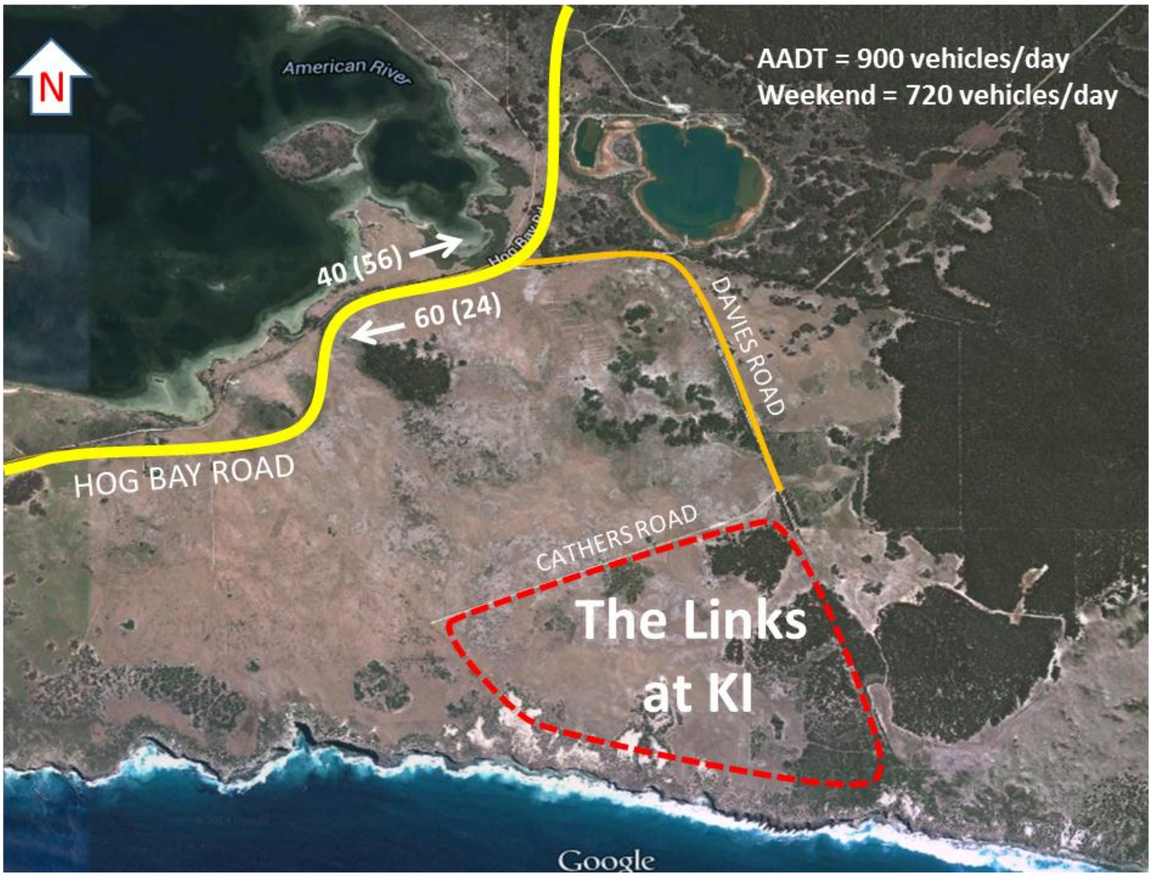

Figure 2: Existing Traffic Counts

2.5 Crash Analysis

Five years of crash data was sourced from DPTI and reviewed to determine if there are any safety issues at Davies Road junction with Hog Bay Road.

No crashes have been reported at the subject junction during past five year period from 2009 to 2013.

3 Development Proposal

3.1 Proposed Development

Programmed Turnpoint have proposed creation of a golf course resort type facility on Kangaroo Island. As explained earlier in this report the proposed golf course would be located to the south west of Dudley Conservation Park and accessible from Hog Bay Road.

Key features of the proposed development are summarized below:

- 18 hole golf course
- Clubhouse with dining/function facilities
- Parking for visitors
- Up to 70 Guest Accommodation Suites/Lodges (180 equivalent single bed); a mix of self-contained and serviced rooms
- Up to 40 private villas to be built on 5 separate lots; these villas can be leased to golf course management for use by visitors when not used by the owners of these villas.
- Up to 9 units for on-site staff accommodation, and
- 1 separate dwelling for the golf superintendent.

The proposal also includes amalgamation of six existing lots into one big lot used for the golf course and a group of 5 titles as a community. These five lots, each with capacity to have up to eight villas, will be sold to individual buyers. The actual number of total villas built on these five lots will be dependent on the individual buyer; it is quite likely that the full potential of 40 villas may not materialize.

<u>Construction</u>

Turnpoint has communicated that it intends to contract local traders (supplies + workers) for golf course construction activity.

It is understood that during construction, a team of 15-20 workers will be stationed onsite or in available accommodation on Kangaroo Island (at either Kingscote or Penneshaw). Onsite accommodation for construction workers would potentially reduce vehicular movement on Hog Bay Road.

Table 1: Land Use Details

Land Use	Units/Area
Golf Course	18 Hole
Guest Accommodation – Hotel Suites and Lodge Suites	70
Club House	1750 m^2
Private Villas (upper limit)	40
Staff Accommodation Units	10

3.2 Club House, Private Villas and Guest Accommodation

Based on communication with the client it is understood that

- the proposed club house and guest accommodation (30 self-contained suites & 40 accommodation lodges) are intended for use primarily by visitors to the golf course
- the club house would serve food and would be licenced premise, catering to a diverse visitor group that would include interstate and overseas visitors
- private villas would be leased to golf course when not occupied by the owner; thus providing additional accommodation for golf course visitors.

3.3 Staff Accommodation

Client has communicated to infraPlan that up to 30 staff could be required on a needs basis:

- Up to 10 professionals for Golf Course maintenance
- Up to 3 professionals for pro-shop and training etc.
- Up to 6 professionals for club house – food, beverages and service
- Up to 10 helping staff on needs basis for cleaning, kitchen etc.

It is understood that there is a provision of up to 10 units for on-site staff accommodation. These units would be able to accommodate all off the staff working at the facility. Local staff working at the facility would also be able to make use of these staff units if required.

3.4 Parking Provision

The proposed golf course would have a parking provision to accommodate 80 cars and likely up to 10 mini-bus/vans.

Parking will be accessible via a new road connection off Cathers Road.

Proposed new two-lane access road will be designed and constructed in accordance with applicable Australian Standards.

4 Traffic Generation

4.1 Traffic Generation

Given the location of the proposed development, isolated on Kangaroo island with limited accessibility via air and seaport, for the purposes of traffic impact assessment, this facility should not be treated as a conventional golf course (near a metropolitan/suburban area), but rather be considered as an *island resort* type facility.

Island resort facilities typically attract visitors that would be expected to stay for longer durations (such as 3-4 days) rather than visiting for a few hours to play golf as is the case with a conventional golf course.

While existing residents of Kangaroo Island will be expected to visit the proposed facility such local trips are anticipated to have marginal share in total trip generation and majority of visitors are expected to be from mainland SA, interstate and/or overseas.

It is understood that the proposed golf course facility could have up to two thirds of its visitors arriving from interstate/overseas thus less dependent on private vehicle travel.

It is understood that since the majority of visitors are expected to arrive by plane at Kingscote Airport, the management would be considering a shuttle service (with up to 10 person capacity) from the airport to the facility. Such a bus service will be run concurrently with flight arrival/departure times and guests will be transported in groups thereby reducing number of vehicular trips to/from the airport.

The proposed development will have a group of five allotments that can have up to 40 private villas. These villas are considered to be used as second home or vacation/recreation home. Given the nature of this development as a resort type facility, owners of individual villas would be expected visiting occasionally and not occupy them permanently. As such when not occupied by individual owners of these villas will be leased to Golf Course to be used for guest accommodation on needs basis.

4.1.1. DPTI and RMS (RTA) Guidelines on Traffic Generation

The Department of Planning, Transport and Infrastructure (DPTI) published '*Trip Generation Rates for Assessment of Development Proposals*' in September 2013. This publication compares trip generation rates from the USA, the UK, New Zealand and Australia to provide ready to use rates for estimating peak hour and daily trips for various land uses.

No trip generation rates for Golf Course or Vacation/Recreation Home however, were readily available in these DPTI Trip Generation Guidelines.

Roads and Maritime Services (RMS) in New South Wales has published a '*Guide to Trip Generating Developments'* that also provides ready to use trip generation rates and parking rates for various land uses. These rates are derived from numerous trip generation surveys conducted by RMS in New South Wales (NSW) in 1990s. RMS trip generation guidelines are widely used by traffic professionals across Australia to estimate traffic generation from new developments. This document is often referred to by traffic engineering and transport planning professionals in the absence of suitable South Australian reference material.

However in this instance, no trip generation rates for the land use type Golf Course or Vacation/Recreation Home were readily available in the RMS Trip Generation Guidelines.

4.1.2. ITE Trip Generation Handbook

The Institute of Transportation Engineers (**ITE**) USA has developed a Trip Generation Manual (8th Edition) that provides ready to use trip generation rates and equations to estimate traffic generated from a proposed development. The ITE Trip Generation Manual is used worldwide by traffic engineers as a basis for estimating trips generated from new developments. In the absence of available relevant Australian guidelines, the ITE has been used as an appropriate source of reference material.

The category **'Land Use 430: Golf Course'** from the ITE Trip Generation Manual was referred to estimate trips generated by the proposed *golf course facility*. The ITE Handbook includes the following about Land Use 430:

The golf course contained in this land use include 9-, 18-, 27- and 36-hole municipal courses and private country clubs. Some sites have driving ranges and clubhouses with a pro shop and/or restaurant, lounge, and banquet facilities. Many of the municipal courses do not have any of these facilities.

Table 2: Trip Generation Estimate: Golf Course

	Time	Trip Rate/Hole	No of Holes	New Trips	50% Discount – golf course resort
Weekday	AM Peak	2.22	18	40	**20**
	PM Peak	2.74	18	50	**25**
Saturday	Peak Hour	4.59	18	83	**41**
Sunday	Peak Hour	4.43	18	80	**40**

As explained previously the proposed facility is not a conventional Golf Course but rather a resort type facility and would be expected to generate significantly lower trips than estimated using ITE's trip generation rates as shown in Table 2 above.

Given the type of development, its relatively remote location & restricted accessibility from the mainland, operation and intended users (largely interstate and overseas), infraPlan considers a 50% discount be applied to ITE's trip generation rates.

After applying this 50% discount to ITE Trip Generation Rates, the proposed golf course would likely generate up to 20 morning peak hour trips, 25 afternoon peak hour trips during weekdays and up to 42 Peak hour trips have been estimated on weekend (Saturday/Sunday).

It should also be noted that since golf course maintenance and club house support staff would remain on-site negligible employee trip to/from the development on a daily basis are expected.

'Land Use 260: Recreational Home' from the ITE Trip Generation Manual was referred to estimate trips generated by the proposed *villa component of golf course facility*. The ITE Handbook includes the following about Land Use 260:

Recreational homes are usually located in a resort containing local services and complete recreational facilities. These dwellings are often second homes used by the owner periodically or rented on a seasonal basis.

The development proposal includes the creation of 5 lots that can have up to eight villas built on each. This translates to an upper potential of 40 villas being built on these lots. It is understood that the final decision on the number of villas to be built on individual lots however, depends on the owners. Adopting a conservative approach however, all 40 villas have been considered for the purpose of trip estimation.

Private villas are intended to be used by the respective home owners as a second home for weekend stays and recreational activities and thus not considered as a regular dwelling unit generating daily traffic.

Table 3 below provides peak hour and daily trip estimates for Recreational Homes using ITE Trip Generation Handbook.

Table 3: Trip Generation Estimate: Private Villas – Recreational Homes

LUC 260: Recreational Home	Time	Trip Rate/Home	No of Villas	New Trips	50% discount for Golf Course use
Weekday	AM Peak	0.16	40	7	**4**
	PM Peak	0.26	40	11	**6**
	Daily	3.16	40	127	64
Saturday	Peak Hour	0.36	40	15	**8**
	Daily	3.07	40	123	62
Sunday	Peak Hour	0.36	40	15	**8**
	Daily	2.93	40	118	59

As indicated in Table 3 above, peak hour trip generation ranges from 7 to 15 trips during peak hours and up to 127 daily trips.

It is proposed that private villas, when not used by the owner, will be leased back to golf club for guest accommodation. While there are no trip generation studies or other information on such an arrangement is readily available, infraPlan have adopted a conservative approach by considering up to half of these 40 villas be occupied by the owners and half available for golf course guest. Thus a 50% discount was applied to trips generated from private villas.

After discount for golf course use, private villas are estimated to generate up to 8 peak hour trips with less than 65 daily trips.

4.1.3. Trip Chaining

It should be noted that the traffic movements generated by the proposed golf course are expected to differ from that of a conventional golf course near a metropolis or a suburban location. Visitors to this facility are expected to stay overnight, for multiple nights, thus ITE trip rates are not directly applicable for peak hour and daily traffic estimates.

The proposed guest accommodation should not be considered as a separate traffic generator as it is primarily intended for visitors to the golf course. Guest accommodation is considered to generate negligible trips due to the highest level of trip chaining with golf course use.

4.1.4. Summary of Trips generated by the proposed development

After discounting for trip chaining, the proposed addition of the golf course facility is estimated to generate:

- 24 trips during morning peak hour (20 golf course, 4 private villas)
- 31 trips during afternoon peak hour (25 golf course, 6 private villas)

As mentioned above the proposed facility would have a shuttle service connecting to Kingscote Airport. Guests arriving by plane would be travelling from the airport to the facility in these shuttle buses with a capacity to accommodate up to 10 persons at a time.

Visitors arriving by seaport and local visitors are considered to arrive by private vehicle.

Assuming a 70 – 30 split (70% guests arriving by plane, 30% locals or those arriving via seaport, using private vehicle) estimated trips generated by the proposed development would be:

- Approximately 14 trips to/from Kingscote Airport and approximately 10 trips to/from KI Sealink Port during morning peak hour
- Approximately 18 trips to/from Kingscote Airport and approximately 13 trips to/from KI Sealink Port during afternoon peak hour

With a shuttle bus service with capacity to carry 10 guests at a time, trips to/from Kingscote Airport would be reduced further.

Thus estimated number of trips generated by the proposed development during **Weekdays**:

- 4 shuttle bus trips to/from airport and 10 trips to/from sealink port during morning peak hour
- 4 shuttle bus trips to/from airport and 13 trips to/from sealink port during afternoon peak hour
- thus a total of approximately 14 trips during morning peak hour and approximately 17 trips during afternoon peak hour.
- **Weekday Daily** trips have been assumed to be in the order of 170 trips/day.

Thus estimated number of trips generated by the proposed development during **Weekends**:

- 48 trips during weekend peak hour (40 golf course, 8 private villas)

Using 70-30 split, this translates to 28 trips to/from the airport and 20 trips to/from Sealink port

- 6 shuttle bus trips to/from airport and 20 trips to/from the Sealink port during peak hour
- thus a total of approx. 26 trips during peak hour
- **Weekend Daily** trips have been assumed to be in the order of 260 trips/day.

5 Parking and Access

5.1 Parking Demand

The proposed golf course facility is proposed to have

- 80 car parking spaces
- up to 10 mini-bus/shuttle parking spaces

The Development Plan of Kangaroo Island Council does not include any specific land use related parking requirements for a Golf Course. There are also not relevant DPTI publications quantifying relevant requirements, nor relevant advice in the RMS Guide to Traffic Generating Developments.

The ITE however also has publication called '*Parking Generation'* that provides ready to use rates for estimating parking demand from new developments. The ITE Parking Generation handbook provides the following rate for *Land Use Code 430: Golf Course*:

- Golf Course (No. of Holes) = 8.68 car parks / hole

Therefore, this implies that 156 car parks are required for a golf course with 18 holes.

It should, however, be noted that the proposed facility is significantly dissimilar in terms of its function and accessibility (due to its location on an island) as compared to conventional golf courses. Estimated trips generated from the proposed facility are expected to be fairly low as explained in Section 4 of this report.

Thus parking generation provided in ITE is therefore considered to be conservative and a proposed 80 car parking spaces are deemed to be adequate for the proposed facility. In consideration of the actual number of trips into and out of the facility each day, this is considered to be an adequate provision.

Proposed parking layout was reviewed for compliance with AS2890.1 and AS2890.6 and was found to be in general compliance with the Australian Standards.

It is understood that private villas will have their own parking. Compliance with applicable Australian Standards will need to be checked at the time of DA for individual villas.

5.2 Delivery Vehicle Access

The proposed facility will make use of the existing supplies services to Kingscote. Under existing conditions delivery trucks from mainland SA use the Sealink ferry to travel to Kingscote. It is understood that these existing service providers be contracted for supplies to the proposed facility.

A delivery/supplies truck, already travelling along Hog Bay Road Therefore no additional freight/delivery trips were estimated to be generated from the proposed development.

5.3 Site Access off Hog Bay Road

The existing road connection to Hog Bay Road in form of Davies Road and Cathers Road will be used to provide access to the proposed development.

Davies Road and Cathers Road would be upgraded to meet applicable Australian Standards for carriageway width and other requirements.

6 Impact on the Surrounding Road Network

6.1 Road Capacity

Hog Bay Road is estimated to have an average daily traffic in the order of 900 vehicles. There is sufficient capacity available on Hog Bay Road to accommodate an additional approximate 250 daily trips generated by the proposed golf course facility.

6.2 Intersection Operations

An additional 25 peak hour trips or 1 trip every two minute is not expected adversely impact on Davies Road junction with Hog Bay Road. The impact of development generated traffic is deemed to be marginal.

6.3 Sight Distance

The Davies Road junction with Hog Bay Road is an existing junction and considered to be in compliance with applicable Australian Standards for stopping sight distance.

A preliminary sight distance assessment has been undertaken using Google tools (Map, Earth and Street View) and Nearmap was undertaken by InfraPlan to determine any issues associated with sight lines.

Davies Road meets Hog Bay Road at a horizontal curve in the alignment of Hog Bay Road. It was further estimated that Davies Road meets Hog Bay Road near the bottom of a vertical sag curve with 2% grade on either side.

As per Table 5.5: Truck Stopping Sight Distance provided in *Austroads Guide to Road Design Part 3 – Geometric Design* (AGRD-3)

- stopping sight distance of 201m (including adjustments for 2% down grade) would be required for a truck travelling at a speed of 100km/hr on Hog Bay Road

Clear sight lines for a distance in excess of 210m on Hog Bay Road were deemed available on either side of Davies Road junction.

No issues with sight lines and sight distance have been identified for Davies Road Junction with Hog Bay Road.

Caution should be exercised when interpreting results of this preliminary assessment and actual sight distance and sight lines should be verified on site.

6.4 Turn Lanes

As explained in section 2 of this report, Hog Bay Road has a posted speed limit of 100km.hr and estimated to carry approximately 100 vehicles during peak hour.

The proposed development is estimated to generate approximately 27 trips during peak hour (during weekend).

As per Figure 4.9: Warrants for turn treatments for the major roads at unsignalized intersections provided in *Austroads Guide to Road Design Part 4A – Unsignalized and Signalized intersections*

- For a major highway with design speed ≥ 100km/hr, channelized or auxiliary turn lanes are warranted if major road volumes ≥ 150 veh/hr and turn volumes are ≤ 40 veh/hr

Estimated traffic generated from the proposed development is not deemed to warrant channelized turn lanes at Davies Road Junction with Hog Bay Road.

7 Summary

In summary:

- An 18 hole golf course with club house and guest accommodation is proposed to be built on Kangaroo Island
- The proposal includes amalgamation of five lots (A6 to A8, A15 & A16) into one big lot for use as golf course and creation of five smaller lots to be sold as community title
- Up to 70 units accommodation (up to 180 equivalent single beds) will be available on-site for visitors to the proposed golf course supported by club house including food & beverage services
- Up to 30 staff - a mix of full time and casual staff – has been considered for the proposed facility
- The proposed 80 on-site parking spaces have been deemed sufficient to meet the demand generated by this facility. Sufficient land provision is available should there be additional demand for parking spaces.
- The proposed parking area for shuttle buses is deemed sufficient to park up to 6 buses.
- The proposed development offers a resort type facility for golf lovers. Visitors to this facility would be expected to stay for multiple nights.
- Majority of the guests have been considered to be interstate and overseas visitors, thus arriving by plane and with low reliance on private cars.
- The proposed facility will include a shuttle service to/from Kingscote Airport to facilitate guest travel. This would significantly reduce vehicular trips generated by this development.
- Five private lots have a potential of up to eight villas on individual lots. A potential of total 40 villas. It may take years however to realize full potential of these villas.
- During weekdays, the proposed facility is estimated to generate up to 14 vehicular trips during morning peak hour, up to 17 vehicular trips during afternoon park hour and up to 170 daily trips.
- During weekends, the proposed facility is estimated to generate up to 26 vehicular trips during peak hour with up to 260 daily trips.
- The estimated 17 peak hour trips or approximately 1 trip every 3 minutes during weekdays are not expected to adversely impact traffic movement on Hog Bay Road.
- The estimated 26 peak hour trips or approximately 1 trip every 2 minutes during weekends are not expected to adversely impact traffic movement on Hog Bay Road.
- It is understood that, a team of up to 20 workers be stationed on-site during construction resulting in negligible trip generation during construction.
- It is also understood that local trades and supplies be used during construction as feasible thereby reducing the need for additional freight movement via the Sealink ferry.

- Sufficient sight distance (in excess of 210m) is deemed to be available at the junction of Davies Road with Hog Bay Road.
- No turn lanes (right/left) were deemed to be warranted due to traffic likely to be generated from the proposed development.

8 Conclusions

Based on the analysis presented in this report the proposed golf course is not expected to adversely impact on the surrounding road network.

Desktop assessment of Davies Road junction with Hog Bay Road indicated that no turn lanes or other modifications to the existing access, were deemed to be warranted by the traffic to/from the proposed golf course facility.

Infrastructure upgrades relating to lighting and signage at Davies Road/Hog Bay Road junction, pavement treatment and stormwater/drainage works from Hog Bay Road to the golf course will need to be assessed and undertaken separately.

Yours faithfully,

Amol Kingaonkar

Senior Traffic Engineer
infraPlan (Aust) Pty Ltd

Appendix N -

The Economic Impacts and Benefits of Tourism in Australia a General Equilibrium Approach

THE ECONOMIC IMPACTS AND BENEFITS OF TOURISM IN AUSTRALIA
A GENERAL EQUILIBRIUM APPROACH

By Larry Dwyer, Peter Forsyth, Ray Spurr and Thiep Ho

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TECHNICAL REPORTS

The technical report series present data and its analysis, meta-studies and conceptual studies, and are considered to be of value to industry, government and researchers. Unlike the Sustainable Tourism Cooperative Research Centre's Monograph series, these reports have not been subjected to an external peer review process. As such, the scientific accuracy and merit of the research reported here is the responsibility of the authors, who should be contacted for clarification of any content. Author contact details are at the back of this report.

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Summary

The STCRC Modelling Project in Perspective

This project reports on the STCRC research project on Computable General Equilibrium (CGE) modelling in tourism. Several points are worth noting:

- The report seeks to do several things, including describing the role of CGE analysis in tourism, outlining the work that has been done in Australia and overseas in examining tourism issues using CGE approaches, describing the model being developed by the project research team, and illustrating how the model can be used to examine actual tourism issues.
- While standard CGE models are being used to examine tourism questions, the current project is one of only two worldwide devoted to developing models with detailed tourism sectors (the other project is based at Nottingham University in the UK). These detailed models are capable of exploring tourism issues in much greater depth than hitherto possible.
- There is increasing recognition of the inadequacy of the models which have been extensively used to evaluate tourism's economic impacts. CGE models are designed to avoid these inadequacies and thus they provide a far superior approach to economic evaluation.
- The STCRC project is breaking new ground in several directions, for example in the application of CGE models to evaluation of special events, and in the measurement of the benefits from tourism flows.
- The model developed by the project team can be adapted for use with other evaluation frameworks, such as cost benefit analysis.
- The model is capable of being extended into new areas, for example, through linking up with environmental impact models, to evaluate the environmental impacts of tourism, such as on greenhouse gas emissions.
- The model developed by the research team is readily adapted to examine a wide range of tourism policy questions - models such as this provide, for the first time, a means of rigorously evaluating the economic dimensions of tourism policies.

A New Approach to Estimating Economic Impacts of Tourism

Techniques such as multiplier analysis using an Input-Output (I-O) model are still very commonly used to make estimates of the economic impact of changes in tourism expenditure. It is argued that this approach to economic evaluation, typically undertaken in the tourism context, is both incomplete and misleading and that economic evaluation in tourism thus fails to achieve best practice.

The mechanisms that determine the impact of changes of tourism expenditure on output and employment in real world economies are highlighted. Key mechanisms that determine the size of tourism's economic contribution to a destination will be identified. In addition to 'leakages' that have occupied much attention from tourism economists, factor supply constraints, exchange rate appreciation and the government's fiscal policy stance each play a role in affecting the magnitude of the economic impacts of tourism shocks.

I-O analysis continues to be used worldwide in order to estimate the economic impacts of changes in tourism expenditure on regions and national economies. It is argued that the restrictive assumptions underlying I-O modelling make it an unsuitable instrument for estimating the economic impacts of tourism growth (or decline) of interest to policy makers. Given advances in computable general equilibrium modelling over the past two decades, researchers and policy makers now have workable, flexible and inexpensive models which represent the whole economy, in which resource constraints and feedback effects are explicitly recognised. For measuring changes in both overall economic activity, and in particular aspects of activity, such as employment, tax receipts, imports, exports, and outputs of specific industries, I-O analysis has been superseded by computable general equilibrium modelling.

The nature and scope of CGE modelling is discussed, as well as the types of assumptions upon which it is based, its advantages over I-O analysis, and some qualifications to its use. Some applications of CGE modelling to tourism growth, in Australia and internationally, illustrate the power and flexibility of CGE models to estimate the economic impacts of tourism in contrast to the results typically generated by I-O models.

The STCRC Modelling Project

This study reports on the work done so far by the STCRC Economic Modelling Project. As will be noted, while a comparatively new technique, CGE models have been used a number of times to explore the economic impacts of tourism, both in Australia, and to a lesser extent, overseas. The present project builds on this work in a number of ways.

The model which the team has developed is based on the multi regional MMRF model, of the Monash Centre of Policy Studies. This model incorporates CGE models for each state of Australia. For present purposes, attention is focussed on New South Wales, and the other states are aggregated into the Rest of Australia (RoA). Results are also given for Australia as a whole.

The original model has been updated in several important ways. In particular, the data base has been updated to 2000/01. Its structure, and treatment of the tourism sector, has been made consistent with that of the national Tourism Satellite Account. The tax structure has also been updated, and the model incorporates the Goods and Services Tax, which is of particular significance for the tourism sector.

A key feature of the model has been the explicit incorporation of tourism sectors. Typically, CGE models do not incorporate a tourism sector. Since the focus of the present project is on tourism, specific tourism sectors were incorporated - these include international visitors, interstate and intrastate visitors, and international outbound tourism. Allowance has been made for different tourist types (business, holiday etc). This enables much greater detail and accuracy in analysing tourism's economic impacts.

The model as developed is capable of being used to analyse a wide range of tourism issues. In particular, it has been employed in the assessment of the economic impact of special events (Chapter 6). Up to now, CGE models have only rarely been used for this purpose.

The model has also been adapted to provide a measure of the net economic benefits from changes in economic activity. Changes in economic activity, such as in GDP, are not a good measure of the net gain to the economy. They are measures of additional output, and very often, there is a cost to obtaining this output. Additional resources must be used to produce this output, and these resources have a cost, which must be deducted from the value of the increased output. The model yields measures of benefits from changes in economic activity stimulated by tourism, which can be directly used for policy purposes.

CGE Modelling of Tourism Growth in Australia

Results of CGE modelling to simulate the economic impacts of an increase in international, interstate and intrastate tourism to the Australian state of New South Wales, and on the RoA, are discussed. The model used has been designated the M2RNSW model. This is a modified version of the M2R model, a multi-regional computable general equilibrium tourism model the basic structure of which is an adaptation of the standard MONASH Multi-regional Forecasting (MMRF) model. The model has been adapted to take account of the new tax system in Australia, especially the introduction of the GST.

Types of simulations undertaken are:

- The effects of a ten per cent increase in the world demand for Australian tourism;
- The effects of a ten percent increase in international tourism to New South Wales (with no change in travel to the RoA);
- The effects of a ten percent increase in interstate tourism to New South Wales where the increase replaces: (a) domestic travel in the RoA and overseas; and (b) expenditure on other goods and services in the RoA;
- The effects of an increase in intrastate tourism in New South Wales, where the increase replaces: (a) travel by NSW residents to other States and overseas; or (b) spending on other (non tourism) goods and services from all sources.

Both the intrastate and interstate tourism markets are potentially important generators of income and jobs for New South Wales. The impacts from the intrastate markets depend upon the extent to which growth in intrastate tourism replaces tourism in the RoA. Increases in interstate tourism, however, are associated with relatively large economic impacts on the receiving state, regardless of whether the substitution relates to other tourism or to (non-tourism) goods and services.

Depending on what is given up by intrastate tourists to finance their trip, intrastate tourism may have greater impacts per dollar expended than the more emphasised 'glamour' markets of international and interstate tourism. Further research is needed to determine the extent to which expenditure on both interstate and intrastate tourism represents substitution from intrastate tourism in RoA or from other goods and services foregone.

In terms of the impacts per visitor, New South Wales GSP and employment gain most from intrastate visitation, provided the expenditure is sourced from RoA tourism expenditure foregone (that is from NSW tourists choosing to travel within NSW rather than to the RoA). Next comes increased interstate tourism from the RoA to NSW. This implies that promotional spending in domestic tourism markets may have greater cost effectiveness than international marketing expenditure in both the short and long runs, at least from the perspective of the state undertaking the promotion (though this need not be true for the nation as a whole)

The results also have implications for government support of programs designed to promote greater domestic tourism such as the "See Australia" program. The simulations indicate that increased tourism to New South Wales from interstate can generate substantial economic impacts for that state but can adversely affect GSP and employment in other states and territories. The economic impacts of such programs on a given state will depend upon its industrial structure, and the proportion of a state's population that visit within, and outside that state. The extent of gains will also depend upon what domestic tourists give up to finance their trips. These issues have been neglected in the research literature to date.

From an Australia wide perspective, expenditure by international tourists creates more GDP and employment, supporting the allocation of scarce resources into the marketing of Australia internationally. However, the modelling suggests that positive economic impacts occur at the national level from changes in domestic tourism as well. For example, in both of the short-run intrastate scenarios, and in one of the two short-run interstate scenarios, where the increased tourist expenditure replaces expenditure on goods and services in the RoA, there were positive GDP and employment effects for Australia as a whole. In the long-run the modelling for of the intrastate and interstate scenarios showed positive impacts on GDP for Australia as a whole (for the long run scenarios total employment at the national level is determined by macroeconomic and labour market structure and does not change). These outcomes were not dependent on any switching of Australian outbound tourism by Australians into domestic tourism, which could provide further positive economic impacts. These will be examined in a future study.

The greatest gains nationally are associated with international tourism in both the short and long runs. However, the greatest gains to the New South Wales state economy, per dollar of additional tourism expenditure, are associated with domestic tourism (except in the case of intrastate tourism which replaces expenditure by NSW residents on other goods and services). From the perspective of Tourism New South Wales, it may well be more cost effective to allocate resources to generate additional domestic tourism rather than to cooperative marketing of Australia as a destination.

Underpinning the above results are the changes in output and employment of industries as a result of changes in the amount and patterns of tourism expenditure. Industries in the State that experience the most positive growth in sectoral output and employment in both the short and long run, and irrespective of the origin of increased tourism expenditure, include Air Transport and Hotels. The simulations reveal that some industries decline as a result of the increased tourism, both in New South Wales and the RoA. The industries that experience a decline in output and employment tend to be export-oriented industries in the primary sector (eg. Mineral Products, Oil), or import competing manufactured products (eg. Chemicals, Motor vehicles, TCF and Wood products).

Economic Impacts of Events using CGE Models

The CGE model, and the I-O model embedded within it, is used to evaluate the economic impacts of events. A major use of I-O analysis in the tourism field has involved estimation of the economic impacts of events. To determine the extent to which I-O and CGE models produce different estimates of an event's economic impacts, the authors undertook simulations of two representative events using the two approaches. These events are a large event, with the expenditure characteristics of the Formula 1 Grand Prix, and another smaller event, such as might be held in a rural city. The results show that the two techniques give very different results; in particular, the impacts estimated using the CGE approach are much smaller than when estimated using the I-O model embedded within the CGE model. The CGE approach is also able to provide estimates of impacts on a wide range of economic variables which the I-O model is incapable of.

For New South Wales, the assumed host State, the Input-output model yields much larger multiplier values, and thus correspondingly larger projections of impacts on output, GSP, and employment than the CGE model for both the large and the small event. The two models differ in their results regarding the magnitude of the impacts on Australia as a whole and RoA of changes in output, Gross State Product, and employment associated with the both the large and the small event.

The I-O model also projects greater impacts on real output and GDP in Australia than in New South Wales while, in contrast, the CGE model projects smaller changes in Australia than in the State. Differences here are due to reduced output, GSP and employment in RoA associated with the event, which are projected outcomes of the CGE but not the I-O model.

The comparison also reveals that two major (related) types of information are gained by using CGE rather than I-O analysis. One type relates to the impact of event related expenditure on output, GSP and employment in the RoA - the I-O model can only handle the impacts within the state holding the event, and it ignores the (primarily negative) impacts elsewhere. The second relates to the positive and negative impacts on output, value added and employment in other industries, in the host state, and in other states.

Objections to Use of CGE

Some possible objections to the use of CGE analysis of economic impacts are considered. The objections which are based on practical rather than conceptual considerations, are argued to carry little weight. I-O analysis makes fewer assumptions than does CGE analysis, but the assumptions it does make about production processes are highly stylised, and open to the same types of criticism. The real objection to I-O analysis is that it avoids making assumptions about how the rest of the economy works by ignoring it. It is preferable to have a complete representation of the economy, even if this involves making some further assumptions. A strength of CGE analysis is that many of its assumptions can be varied and the sensitivity to them tested. It is conceded that there is a case for using a local I-O model to estimate the local effects of an event or project, providing information of relevance to local decision makers. However, the results of such studies are only of partial guidance to higher-level decision-makers, such as state or national governments, who will be interested in impacts on the overall economies within their jurisdiction. For this, CGE models will be required.

Extensions of the Research Program

The study explores some extensions of the research program to encompass issues such as the development of Tourism Satellite Accounts, and the scope for incorporating dynamic considerations into CGE modelling so that the development path of the economy and deviations from that path can be investigated.

The study also addresses the issue of the measurement of the benefits of tourism growth. Unfortunately, tourism researchers continue to confuse the ‘impacts’ and the ‘benefits’ of tourism growth, ignoring the fact that tourism growth has an economic cost, since it requires the use of scarce resources. To measure the net benefits of a tourism change, we need to identify in what ways the revenues gained from additional tourism are not equal to the opportunity costs of the inputs used in supplying it. Benefits are measured by taking the change in real state/national income (which excludes income payable overseas) and subtracting the cost of additional factors employed. With measures of net benefits we are able to get to the bottom line of policies and projects that involve costs to government or affected parties and benefits from greater economic activity.

The way in which CGE models can be used to evaluate the benefits from tourism is illustrated by means of an application to New South Wales.

Additional Research

There is a very extensive range of issues that can be explored using the CGE technique. The agenda for future research in this area will be to extend the analysis to different tourism destinations, to include detailed analyses of the different expenditure patterns of different tourists and to model the different government policy settings that help determine tourism’s economic impacts.

Specific research projects might include:

- estimations of the economic impacts of different types of tourists;
- comparison of results under alternative assumptions about the economic environment;
- incorporating environmental costs of tourism into net benefit estimates;
- measuring regional impacts of tourism growth;
- estimates of the economic impacts of tourism in developing countries;
- economic impacts of outbound tourism;
- economic impacts of specific sectors- eg cruising, backpackers;
- modelling the economic impacts of aviation policy changes;
- exploring the impacts of changes in taxation of tourism;
- evaluating tourism promotion;
- exploring the infrastructure requirements of tourism growth;
- estimating the implications of tourism growth on resources; eg water or energy;
- the impact on the economy of changes in tourism competitiveness.

These are only some of the many issues that can be examined in future using CGE modelling. The challenge now facing tourism researchers and planners world-wide is to demonstrate an awareness of these issues in their estimates of the economic contribution of tourism to both developed and developing destinations.

Chapter 1

Introduction

The importance of tourism to economies is now well recognised. As a result, when tourism changes or policy shifts are being considered, there is an interest in determining what impact on the economy they might have. However, the approach to economic evaluation typically undertaken in the tourism context, is both incomplete and misleading. Techniques such as multiplier analysis within an Input-Output model are still very commonly used to make estimates of the economic impact of changes in tourism expenditure. These techniques are recognised to have serious limitations, and as a result, alternative techniques have been developed to address the problems. Computable General Equilibrium (CGE) models are now extensively used, especially in Australia, the UK, the US and Canada, to estimate impacts of a wide variety of changes and policies, across most sectors of the economy. CGE techniques have been used in the tourism context, but so far, not extensively. Economic evaluation in tourism thus fails to achieve best practice.

The authors have used CGE modelling to simulate the economic impacts of an increase in international, interstate and intrastate tourism to the Australian state of New South Wales, and on the RoA. The model used has been designated the M2RNSW model. This is a modified version of the M2R model, a multi-regional computable general equilibrium tourism model the basic structure of which is an adaptation of the standard MONASH Multi-regional Forecasting (MMRF) model. The model has been adapted to take account of the new tax system in Australia, especially the introduction of the GST. Since the earlier model was developed, the Australian Tourism Satellite Account (TSA) has been published and the updated model has been made consistent with the TSA. One of the first applications of the model has been to estimate the economic impacts of two representative events, and to compare the results with those obtained by using Input Output techniques- the results are quite different.

The report is structured as follows:

- Chapter One provides a basic introduction to the report.
- Chapter Two highlights the mechanisms which determine the impact of growth of tourism on output and employment in real world economies. Key mechanisms that determine the size of tourism's economic contribution to a destination are identified. In addition to 'leakages' that have occupied much attention from tourism economists, factor supply constraints, exchange rate appreciation and the government's fiscal policy stance each play a role in affecting the magnitude of the economic impacts of inbound tourism.
- Chapter Three discusses the traditional approach to economic impact estimation. Until recently, I-O analysis has been used worldwide in order to estimate the economic impacts of changes in tourism expenditure on regions and national economies. It is argued that the restrictive assumptions underlying Input-Output modelling make it an unsuitable instrument for estimating the economic impacts of tourism growth of interest to policy makers. Given advances in computable general equilibrium modelling over the past two decades, researchers and policy makers now have workable and flexible models which represent the whole economy, in which resource constraints and feedback effects are explicitly recognised. For measuring changes in both overall economic activity, and in particular aspects of activity, such as employment, tax receipts, imports, exports, and outputs of specific industries, I-O analysis has been superseded by computable general equilibrium modelling.
- Chapter Four begins with a brief outline of the nature and scope of CGE modelling, the types of assumptions upon which it based, its advantages over I-O analysis, and some qualifications to its use. It then discusses applications of CGE modelling to tourism growth in Australia and internationally, exploring the power and flexibility of CGE models to estimate the economic impacts of tourism in contrast to the results typically generated by I-O models. While CGE analysis is being used extensively to estimate economic impacts of changes in a great variety of different industry and policy contexts world wide, tourism researchers have been slow to appreciate its advantages over traditional assessment techniques.
- Chapter Five highlights some recent results from the STCRC economic modelling project for changes in tourism in New South Wales and the RoA. Types of simulations undertaken are (i) The effects of a ten per cent increase in the world demand for Australian tourism; (ii) The effects of a ten percent increase in international tourism to New South Wales (with no change in travel to RoA); (iii) The effects of a ten percent increase in interstate tourism to New South Wales where the increase replaces: (a) domestic travel in RoA and overseas; and (b) expenditure on other goods and services in RoA; (iv) The effects of an increase in intrastate tourism in New South Wales, where the increase replaces: (a)

travel by NSW residents to other states and overseas; or (b) spending on other (non-tourism) goods and services from all sources. The economic simulations are based on four key assumptions about the federal government fiscal policy stance, two key assumptions about the wage setting environment, and four key assumptions about the aggregate level of employment. Short run and long run simulations are compared and some implications for policy are discussed.

- In Chapter Six, the CGE model, and the I-O model embedded within it, is used to evaluate the economic impacts of events. A major use of I-O analysis in the tourism field has involved estimation of the economic impacts of events. To determine the extent to which IO and CGE models produce different estimates of an event's economic impacts, the authors undertook simulations of two representative events, both large and small, using the two approaches. The results show that the two techniques give very different results; in particular, the impacts estimated using the CGE approach are much smaller than when estimated using the I-O model embedded within the CGE model. The CGE approach is also able to provide estimates of impacts on a wide range of economic variables, which the I-O model is incapable of estimating.
- Chapter Seven discusses some objections to the use of CGE analysis of economic impacts of tourism. The objections, which are based on practical rather than conceptual considerations, are discussed and generally discarded.
- Chapter Eight explores some extensions of the above research program to encompass issues such as the development of Tourism Satellite Accounts, and the scope for incorporating dynamic considerations into CGE modelling so that the development path of the economy and deviations from that path can be investigated. This section also addresses the issue of the measurement of the benefits of tourism growth. Unfortunately, a good proportion of tourism researchers continue to confuse the 'impacts' and the 'benefits' of tourism growth, ignoring the fact that tourism growth has an economic cost, since it requires the use of scarce resources. To measure the net benefits of a tourism change, we need to identify in what ways the revenues gained from additional tourism are not equal to the opportunity costs of the inputs used in supplying it. The way in which CGE models can be used to evaluate the benefits from tourism is illustrated by means of an application to New South Wales. Benefits are measured by taking the change in real state/national income (which excludes income payable overseas) and subtracting the cost of additional factors employed. With measures of net benefits we are able to get to the bottom line of policies and projects which involve costs to government or affected parties and benefits from greater economic activity. Measures of impacts of tourism developments on GDP or other measures of activity leave the key question unanswered, and provide only limited guidance for policy making. Through use of the models now available, it is feasible to make estimates of the magnitude of benefits that flow from a range of different tourism developments, and this makes rigorous evaluation of them possible.
- Chapter Nine outlines a wide range of tourism issues which can be explored using the CGE approach, and some conclusions are drawn in Chapter Ten.

The challenge now facing tourism researchers and planners world-wide is to demonstrate an awareness of these issues in their estimates of the economic contribution of tourism to both developed and developing destinations. As a result of these considerations we conclude that, in a CGE model which incorporates a realistic set of economy-wide constraints, the effects of inbound tourism growth cannot be anticipated *a priori*. The agenda for future research in this area should be to extend the analysis to different tourism destinations, and to include detailed analyses of the appropriate behavioural characteristics of the economic agents that are included in model specification and of the government policy settings that determine the context for their behaviour.

Chapter 2

The Economic Impacts of Tourism Growth

Tourist expenditure represents an injection of ' new money ' into a destination (Frechtling 1987, Fletcher 1994a, Archer & Cooper 1995). The expenditure injection is regarded as having three types of impacts - direct, indirect and induced.

The direct impacts are reflected in the increased sales revenues of firms catering to tourist needs for different goods and services. Some of these firms are within, and others are outside, what may be regarded as 'the tourist industry'. These firms and organisations, in turn, purchase goods and services from various suppliers within and outside of the destination region.

Indirect effects result from 'flow-ons' when direct suppliers purchase inputs from other firms in the region which, in turn, purchase inputs from other firms and so on. Almost every industry in the economy is affected to some extent by the indirect effects of the initial tourist expenditure.

Induced effects arise when the recipients of the direct and indirect expenditure - owners of firms and their employees - spend their increased incomes. This, in turn, sets off a process of successive rounds of purchases by intermediate firms, plus further consumption, adding to Gross Domestic Product and employment (Archer 1977a, Jackson 1986, Holloway 1989, Fletcher 1994a)

Given the indirect and induced effects of tourist expenditure, the ultimate increase in income within the destination may exceed the initial expenditure increase. Tourism economists have thus tended to focus upon the so called 'multiplier effects' of tourism expenditure.

Factors Limiting Size of Economic Impacts

Industry Linkages and Leakages

Tourism economists, have devoted a good deal of attention to the effects of 'leakages' of tourism expenditure, resulting from taxes, savings and imports, on the values of tourism multipliers (Bull 1995, Tribe 1999). Perhaps most attention has been devoted to the issue of leakages from tourist expenditure on goods and services which have an import content, an issue of particular concern to developing countries (Sinclair 1998). The extent to which production and employment in the destination is affected by visitor expenditure does depend importantly on the strengths of the business linkages between tourism and other sectors, and the stronger the links between businesses within a destination, the lower the level of 'leakages' from imports (Mathieson & Wall 1982, Archer & Fletcher 1996, Tribe 1999). The greater the extent to which tourism development generates increased production in the primary, secondary and tertiary sectors of the economy, the greater is the tourism multiplier and consequent impact of injected expenditure on Gross Regional Product and employment.

While the size of the 'multiplier effect' will be reduced by 'leakages' of expenditure into imports, taxes and savings, other key mechanisms which determine the size of the economic impacts resulting from increased tourism demand have tended to be neglected. These include: factor supply constraints, exchange rate appreciation and current government economic policy. As we shall argue, recognition of the relevance of these factors to economic impact assessment has implications for the appropriate economic estimation technique to be employed.

Factor Supply Constraints

The tourist industry expands output to meet additional demand by employing additional labour, land, capital plant and equipment. Some of these may be in limited supply eg particular labour skills or workers for particular shifts or locations. In the absence of offsetting productivity improvements price increases are necessary to attract resources into tourism, increasing industry costs, and making a destination less price competitive. The size of the cost increases depends on the supply of different factors, whether these factors account for a significant proportion of the tourist industry total production costs, and how quickly extra supplies can be made available. A destination's ability to increase the supply of goods and services required by tourists in response to an increase in inbound tourism, without offsetting increases in the costs of production, depends to a large extent on the characteristics of the industries which service tourist demands, such as retail services, hospitality; and transportation (Wanhill 1988, Sinclair 1998). When an economy is at or near to full employment, the increased tourism demand imposes cost pressures as the price of scarce resources are bid up. If other industries employ the same resources they also face cost pressures resulting from the increased tourism demand. This may particularly affect trade-exposed sectors that face world prices for their products and hence are unable to pass on cost increases without losing market share. Any loss of market share by domestic producers means that the net gain to overall Gross Domestic Product and employment from further tourism will be lower. Also, location requirements can lead to rising land prices as the tourist industry attempts to attract land away from other uses.

We can make some observations about *factor inputs* into the main sectors of the tourism industry.

Labour

An expanding tourism industry will place additional pressure on the demand for various types of labour- skilled, semi-skilled and unskilled. The constraints are perhaps most evident, however, in the case of labour which has some skills component.

There is a limit to which the tourism industry can immediately meet its higher demand for skilled and semi-skilled occupations by attracting trained workers from other industries or from immigration. The retail and hospitality sectors are labour intensive with wages comprising the largest single cost item. In Australia around 20% of the hospitality labour force is classified as skilled (eg. chefs, senior management), with 40% semi skilled (Industry Commission). It is not important that levels of skill be precisely defined. It suffices to recognise that different sectors of the tourism industry have different labour requirements and that constraints on the available supply can impede development of any sub-sector. Because skills take time to acquire the wages for some occupations would normally be bid up in the short term as tourism faces an excess demand for labour. Thus firms and organisations competing for a fixed supply of inputs will compete against each other putting upward pressure on wages.

The extent to which wage pressures on particular skills is translated into actual wage increases relative to other occupations depends on the wage setting environment. In many economies, the labour market is characterised by institutional rigidities that constrain wages awarded to government employees such as those employed in the aviation sector. This limits its ability to attract additional skilled labour in the short term from other industries, and in the long term through training. If relative wages are able to adjust in response to skills shortages this would induce people to acquire skills, to immigrate to a country or region, stay in the industry or re-enter the industry.

The expanding tourism industry will, in any case, put upward pressure on other costs and prices, feeding eventually into the Consumer Price Index (CPI) as a result of pressure for general wage increases to maintain real wages. Thus if increased real wages spill over to other industries, they will impose a cost burden on the profit margins of those industries. Unless these industries are willing to suffer reduced profitability, they will raise prices. This increases input prices generally, further reducing industry cost competitiveness. This will lead to a further contraction of output in non-tourist industries and Gross Domestic Product (GDP) growth will be smaller.

Over time, particular skills shortages in tourism may become less pronounced depending on the pace of skills acquisition relative to industry growth and relative to prospects of factor substitution to economise on skills in short supply. In the longer run labour of all types may be relatively scarce because of demographic constraints. The tourism industry will then face greater competition from other growing industries for the labour that is available.

Land

Land is required for capital infrastructure such as roads and airports. Land for tourism development is often required near the urban and coastal fringe where it competes with retail and residential development (Dwyer & Edwards 2001). Land prices increase according to their scarcity value. In particular, land near attractive environmental resources, eg. beaches, nature reserves, becomes more in demand by the hospitality sector as tourism develops, increasing land values. Additionally, tourists demand the services of natural resource areas such as national parks. These resources are often managed by government agencies and funded by taxpayers.

Increased land values due to tourism development will impact on the costs of other industries (Dwyer & Forsyth 1993). These costs could include unpriced losses to the quality of life as well as higher prices for residential or conservation purposes. If an increase in tourism demand leads to a greater share of desirable sites being absorbed by the tourism industry at less than market prices, as a result of designation of certain areas as ‘designated’ tourist zones, this will reduce the supply available to other uses such as fishing and forestry and will increase cost pressures in those industries as they must use their existing resources more intensively.

If land used for tourism development is not priced correctly the cost pressures imposed on alternative users will not be reflected in prices to tourists. Hence tourism will effectively be subsidised relative to other activities. Conversely, if land is allocated to other activities at less than market prices cost pressures will be imposed on the tourist industry some of which may be passed on to tourists as increased congestion or crowding of particular sites.

Capital
Expenditure on capital in response to increased tourism expenditure is undertaken by both private and public sector stakeholders. Lack of suitable infrastructure and tourism industry facilities can pose a constraint to tourism flows both to and from a country. In other cases, lack of entrepreneurship on the part of domestic investors to involve themselves with the tourism industry, coupled with a reluctance by domestic financial institutions to make funds available for tourism developments, has led to foreign direct investment to fill this gap (Dwyer & Forsyth 1994a).

Expansion in tourism will lead to greater use of existing capital plant and equipment such as buildings, aircraft and coaches. If wages rise relative to the costs of employing capital then capital /labour ratios tend to rise. Some new investment (eg. fast food outlets) can expand capital stocks relatively easily. But sometimes the long lead times required for new investment (eg. aircraft, cruise shipping terminals) will mean that existing capital needs to be used more intensively in the short run, pushing up operating costs and thence prices to tourists. Thus, increased tourism demand may lead to more intensive use of airport infrastructure (runways and air traffic control facilities). Until then, passengers may face costs associated with congestion and flight delays.

Lack of suitable infrastructure to support tourism development is one of the greatest constraints to growth in this sector in developing countries (Inskeep 1991, Gunn 1994). New resort developments located in coastal regions can lead to increased use of local roads, requiring greater expenditure on road maintenance and repair. Tourism expansion generates additional demand for water, sewerage, sanitation facilities, telecommunications and the provision of energy. Some of these additional infrastructure costs may be paid for by the tourism industry, and, by extension, tourists. Typically, higher operating costs or costs of new investment will be funded through higher taxes, which in turn reduce the positive economic impacts of tourism growth over the longer term. Thus, in the absence of full cost recovery on infrastructure, both short run operating costs and the long run costs of capital expansion will be met, at least in part, by the wider community.

In the medium to longer term, additional investment in the tourism industry will result in an expansion of the physical capital stock. However, finance for this investment must come from somewhere. In a closed economy, with no links to international capital markets, funding for tourism investment will add to the demand for savings, bidding interest rates up, and leading to crowding out of investment in other sectors. In an open economy (such as most economies today, including Australia) the increased demand for funds will be met from inflows of capital from abroad. This enables an increase in production as measured by GDP. However, it will also lead to an increase in income payable abroad, to the lenders of the finance. The income accruing to residents in the country will not increase.

Exchange Rate Appreciation
By reducing reliance on commodity exports, expansion of a country’s tourism industry can improve its terms of trade and it may also reduce the volatility of the terms of trade (Adams & Parmenter 1991). However, the nature of the exchange rate regime is a crucial determinant of the economic impacts of foreign inbound tourism. Additional tourism leads to an increased demand for the nation’s currency, and thus upward pressure on its price. Changes in real exchange rates are an important determinant of destination price competitiveness (Dwyer, Forsyth & Rao 2000a, 2000b, 2001).

Under a flexible (nominal) exchange rate, characterising most of the world’s industrial economies including Australia, the net impact on aggregate demand may be quite small or even zero. Tourism expands at the expense of industries producing other tradeable goods or services. This reduces the multiplier effect on income and employment, although there may be a small positive impact on employment if tourism is more labour intensive than the industries it replaces. The actual trade balance is determined by the real exchange rate, with domestic prices moving to reallocate resources. An expansion of international tourism will strengthen the real exchange rate leading to a reduction in other exports and/or an increase in demand for imports at the expense of the demand for domestic import competing commodities. Most obviously affected will be the traditional export sectors - agriculture, mining and manufacturing - which suffer reduced competitiveness on world markets due to real exchange rate appreciation. Moreover, if the increased tourism demand leads to an increase in investment this will increase foreign borrowing and possibly, foreign direct investment for a period, and push the real exchange rate even higher. This will further reduce traditional exports and increase imports.

Fiscal Policy
The government fiscal policy stance can help to play a part in determining the size of the economic impacts from tourism growth. In most countries tourism development is inescapably linked to the public sector. For example, expansion of air and land transport implies increased demand for airport facilities, road and rail transport facilities, utilities, and other infrastructure, much of which is provided by government or semi-government authorities and financed wholly or partly through tax revenue. Linkages between private firms and public sector

enterprises can have important implications for patterns of growth. Further, the level and composition of taxes, the relative size of the public sector, and the relative efficiency of resource use all have a substantial impact on the size and distribution of the economic impacts.

A government may use the additional tax revenues generated by additional tourism profits and employment to reduce income and corporate tax rates. If the cause of any existing unemployment is rigid real wages that are higher than the market clearing wage then the impact on unemployment of reduced tax rates could be large. This is because reduced taxes imply increased private consumption, investment spending, and exports depending on the type of tax involved.

If a government invests in additional infrastructure spending to support tourism expansion, for example through construction of new tourism related infrastructure such as roads, wharves, and airport landing facilities, there will be a positive effect on spending but it must be financed. However, if fiscal policy is directed towards maintaining a fixed Public Sector Borrowing requirement (PSBR) then taxes would have to rise to offset growth in government expenditure. This moderates the growth in private consumption leading to downward pressure on the output of consumption-oriented industries. Under the circumstances, any expansion of tourism generates more additional investment than can be financed by the addition to domestic saving which is generated. Hence the trade balance is driven towards deficit. This is associated with a strengthening of the real exchange rate, which crowds out activity in the traditional export sectors and reduces the positive effects on employment growth.

The above discussion highlights the fact that, unless there is significant excess capacity in tourism related industries, the primary effect of an economy-wide expansion in inbound tourism is to alter the industrial structure of the economy rather than to generate a large increase in aggregate economic activity. Its effect will thus show up mainly as a change in the *composition* of the economy rather than as a net addition to activity.

Chapter 3

Estimating the Economic Impacts of Tourism Growth

Input-Output Analysis

The technique most often used to quantify economic impacts of tourism demand change is Input-Output (I-O) analysis (Fletcher 1994b, Frechtling & Horvath 1998). I-O models estimate the increase in economic activity associated with a change, such as an event, by calculating the increase in output directly, and adding the extra output in related industries, such as supplier industries. Input-Output analysis has been used to estimate the income and employment effects of tourism in several countries, for example, Antigua (Pollard 1976), Bahamas and Bermuda (Archer 1977b, Archer 1995), Hong Kong (Lin & Sung 1983), Korea (Song & Ahn 1983), Australia, Mauritius (Archer 1985), Puerto Rico (Ruiz 1985), Singapore (Khan, Seng & Cheong 1989; Heng & Low 1990), Ireland (Baum 1991, Henry & Deane 1997), India (Pavaskar 1987), the Seychelles (Archer & Fletcher 1996). I-O models have also been employed to estimate the economic contribution of tourism to regions within countries (Witt 1987, West 1993, Adams & Parmenter 1993, West & Gamage 2001). In many of these studies, the high income, value added and employment multipliers associated with Input-Output models imply that tourism often emerges as a 'catalyst' for national and sub-regional economic growth, particularly in developing countries. Rarely are the exaggerated multipliers from adoption of the I-O technique acknowledged.

Limitations of Input-Output Analysis

There are some well known limitations to I-O analysis and, by implication, the tourism multipliers that the technique generates. Indeed, the assumptions underlying construction of I-O models are so unrealistic that they affect the validity of the results obtained by the technique (Briassoulis 1991; Dwyer & Forsyth 1998, Johnson 1999, Blake, Durbarry, Sinclair & Sugiyarto 2000).

The I-O model contains no price mechanism and so it cannot capture the effects of changing factor costs within its framework. The constant technical coefficients used in I-O analysis also assume away changes in input mix due to price induced substitution between factors.

The method assumes that there are no constraints limiting the capacity of industry or government to expand production to meet the additional demands of tourists.

The restrictive assumptions imply that interactive effects between economic sectors are ignored. In its focus on the industry which is being directly affected, and on its *direct* relationships with other parts of the economy. The method assumes that there are no constraints limiting the capacity of industry to expand production to meet the additional demands of tourists. It assumes that resources, such as labour, land and capital, flow freely to the tourism and related industries. These resources are effectively assumed to be not used elsewhere; they do not come from other industries, and do not result in reductions in output elsewhere. I-O analysis does not allow for effects through the trade sector, for example, through foreign tourism demand pushing up exchange rates and discouraging other exports, and resulting in increased imports. It does not allow for the impacts of different constraints on the Public Sector Borrowing Requirement which affects levels of taxation and government spending and, hence, economic impacts of the increased tourism expenditure. It does not allow for the workings of the labour market and the possibility of real wage increases in tourism employment. As a consequence, I-O estimates of impacts, on economic activity generally or on specific variables such as employment, are usually overestimates, very often by large margins. Indeed, such estimates can even get the direction of the change wrong.

Effectively, the only circumstances under which the measured change in activity (GDP or employment) would equal the actual net change in activity would be when *all* the resources, including labour, natural resources and capital goods, would have been unemployed and available in the absence of the tourism expenditure. Even granted that there is some unemployment of labour in most economies, this is highly unlikely.

Some researchers have attempted to overcome limitations of the technique by incorporating the effects of changes in the consumption patterns that occur as income rises (Sadler, Archer & Owen 1973), and others have introduced capacity constraints into the basic model (Wanhill 1988, Fletcher & Archer 1991, West & Gamage 2001); but such refinements fail to fully capture the feedback effects that typically work in opposite directions to the initial change in tourism expenditure.

Chapter 4

Need for a General Equilibrium Perspective to Economic Impact Estimation

The General Equilibrium Perspective

General equilibrium effects are not always that easy to observe directly, or to appreciate the significance of. However, it is possible to see them at work when there are big changes to the economy. Excellent examples are the mineral boom in Australia in the 1970s and the North Sea oil boom in Britain in the 1980s (see Forsyth 1986). It was initially thought that the Australian mineral boom would be positive for Australia's manufacturing industry; after all, it would be the recipient of orders for equipment from the booming mining sector. I-O analysis would suggest that it would be a winner from the boom. The reality was otherwise. The mineral boom led to a sharp rise in the value of the Australian dollar; this put real pressure on import competing industries, and especially the manufacturing sector. The net effect was a contraction of manufacturing. It was also expected that the mining boom would lead to a significant shift of the current account into surplus. The reality was that the exchange rate appreciation brought the current account more or less back to where it was. Very much the same processes were at work in Britain during the oil boom; the exchange rate appreciated sharply, devastating the manufacturing sector. When changes are large, the workings of the general equilibrium effects are evident; for smaller changes, they are still present, though naturally less obvious.

For any tourism destination, economy – wide effects must be taken into account in determining tourism's economic contribution to Gross Domestic Product and employment. Making resources available for an activity means that alternative economic activities have fewer resources, and thus their production will fall. When consumers spend on new activities, such as a special event, they divert their spending away from other goods and services, leading to less production in the industries, which produce those goods and services. In the competition for scarce resources, increased costs reduce the competitiveness of other sectors in the economy, particularly export-oriented and import-competing industries, diminishing output and employment levels. Where resources are drawn away from traditional export-oriented industries, these industries will experience increased production costs. Where cost pressures reduce the competitiveness of a nation's tourist industry, relative to other destinations, this may result in increased outbound tourism, implying a loss of production and employment opportunities from domestic tourism. Such effects can be magnified when the increased demand for the home currency pushes up its price, discouraging other exports and import competing industries.

Although an increase in tourism demand may, in part, be met by a net increase in domestic output, it will also tend to 'crowd out' other sectors of domestic economic activity, reducing output and employment in other sectors. While I-O analysis generates high employment multipliers, the reality is that employment effects depend on how the labour markets in the economy work. An increase in demand for labour may lead to wage increases as well as more people being employed. Furthermore, labour is not a single, undifferentiated, resource; demand for certain skills may increase, and skilled labour may be diverted from other industries, even though unemployment exists. To calculate how a change in tourism affects output or activity in the economy overall, a model which incorporates these feedback effects, and which takes account of how critical markets in the economy like the labour market are structured, is essential. Since the difference between 'gross' and 'net' effects will normally be quite substantial, partial approaches, such as I-O models, are insufficient (Dwyer & Forsyth 1998; Dwyer, Forsyth, Madden & Spurr 2000).

In reality, economies are general equilibrium systems, or systems which are integrated wholes, in which an overall balance must be preserved, and in which indirect and feedback mechanisms are important, along with direct mechanisms. Any measures of the extent to which a change, such as a boom in tourism, will impact on economic activity must take this into account and allow for the negative as well as the positive impacts. Thus when there is a change in tourism (or any other economic change) the primary result of this is one of change in the *pattern* of economic activity. There may be, but there need not be, a net *increase* in economic activity. (Dwyer, Forsyth, Madden & Spurr 2000).

Once a CGE perspective is adopted, I-O models come to be seen as essentially an interim measure. When first developed, the general equilibrium effects of changes were recognised, but it was not possible to handle them in empirical models. Now that computable general equilibrium models are available, we have at our disposal workable and flexible models that represent the whole economy and in which resource constraints and feedback effects are explicitly recognised.

Computable General Equilibrium Modelling

Over the past two decades there has been rapid development of computable general equilibrium models. These models incorporate an I-O framework, but they also model markets for goods and services and factor markets, recognise resource limitations, model consumer spending, allow for government spending and taxing, and allow for external constraints. Computable General Equilibrium models allow for the inclusion of constraints absent from I-O calculations.

A typical CGE model gives us impacts on a range of variables which may be of interest to policymakers. It will give a measure of the overall change in economic output, through the effect on GDP (or Gross State Product in the case of a state economy). It will also provide output results for individual industries. The impact on key variables, such as employment, imports and exports will also be part of the model's output. If the government sector is incorporated explicitly in the model being used, the effects on government revenue, spending and surplus can be determined.

A typical CGE model has a high degree of empirical content in the form of detailed commodity flows, labour market data and national accounts data. A CGE model represents the economy as a system of flows of goods and services between sectors. The goods and services include both produced commodities and primary factor services (labour, land, capital). The sectors include the household sector, several industry sectors, government and the foreign sector. Flows between sectors are represented in an I-O table or social accounting matrix where each row of the I-O table corresponds to a commodity grouping, each column to a sector, and each element of the table shows the money value of usage of the relevant commodity by the relevant sector (McDougall 1995).

Commodity flows in a simple CGE model include: flows of commodities from industries to households, governments, export markets and investment; flows of commodities from industries to other industries for use in current production (*intermediate usage*); imports of commodities from abroad to meet domestic demand, and flows of primary factor services from households to industries. This means that the detailed theoretical structure and overall accounting framework are calibrated to actual conditions in a particular year. Responses within the model to changes in economic conditions are guided by parameters, the values of which are estimated from actual data in the economy.

A CGE model is characterised by four types of variables (McDougall 1995).

Behavioural Assumptions

The behavioural assumptions of a CGE model link the sectors and specify how each sector responds to external shocks including shocks normally affecting the sector directly and shocks transmitted through inter-sectoral linkages. CGE models rely on the constrained optimisation approach of standard microeconomic theory (eg. consumer theory, production theory). CGE models include more general specifications of the behaviour of consumers, producers and investors than those allowed in I-O models. In particular, they make specific assumptions about the availability of factors of production - to what extent their supply can be increased, and to what extent there is an excess supply of some factors (as with unemployment of labour). Substitution possibilities are incorporated reflecting the sensitivity of the behaviour of agents in the model to changes in relative prices as well as quantity variables.

Microeconomic theory provides the general structure for the behavioural assumptions used in the CGE model. These are incorporated into the model using empirical information in the form of behavioural parameters (eg. income elasticities and price elasticities of demand). Not every sector need be modelled in terms of optimising behaviour. The government and foreign sectors especially are often given a less systematic treatment. The parameter setting may be done on the basis of econometrics, literature search, expert opinion or judgement.

Equilibrium Conditions

For a relationship to qualify as an equilibrium condition it is necessary that deviations from it should not persist through time. If this criterion is satisfied, then, given time to adjust to an external shock, we can expect to find the economy close to equilibrium. Whether a particular equilibrium condition is appropriate in a particular application depends on the time frame of analysis. Equilibrium conditions may be either sectoral or economy wide. Economy wide equilibrium conditions and other economy wide constraints create indirect linkages between sectors. The character of a CGE model depends to a great extent on these indirect linkages.

Exogenous Variables

The range of applications of a CGE model also depends on the external shocks that it can respond to (exogenous variables). These may include tax and subsidy rates, government outlays, export demand, technological change, changes in visitor expenditure etc.

Exogenous variables typically include:

- policy variables (eg. Public Sector Borrowing Requirement)
- variables governing conditions in the rest of the world (eg. world interest rates)
- variables associated with labour and capital markets (eg. aggregate employment, rate of technological

change, economy wide rate of return on capital)
- variables relating to size and composition of visitor expenditures
- details about particular industries (eg. current levels of output, employment, industry mix).

Economic Environment

Outside of the model a detailed scenario (or economic environment) is compiled about likely developments through the forecast period in variables which are exogenous for the forecasting simulations. The economic environment consists of assumptions made about economic aggregates or which apply across the economy as a whole (eg. real wage levels, labour and non-labour tax rates, the trade balance, government borrowing levels and so on) and assumptions at the firm or consumer level (eg. about supply response of firms, substitution among inputs, demand for particular exports, the competitiveness of imports and so on). CGE models can make explicit assumptions about government policy settings. Governments can spend, but if they do they must raise taxes (or debt) and this means that other actors in the economy, consumers and firms, must spend less; this in turn has economic effects. CGE models can incorporate a more realistic set of economy wide constraints on the supply side of the economy. They also recognise that the economy is linked to the rest of the world via a foreign exchange market; when the demand for exports increases, the exchange rate rises, discouraging other exports and encouraging imports.

CGE modelling techniques and software systems are now routinely available. CGE models can either be quite basic, incorporating a few sectors and the links between them, or very detailed. Models may be used for static, comparative static, dynamic or comparative dynamic analysis and can be formulated at a number of spatial levels including single-country models with only top-down regional disaggregation such as ORANI or MONASH (eg. Adams & Parmenter 1991); stand-alone models of regional economies (eg. Meagher & Parmenter 1990); multi-regional bottom-up models such as MONASH-MRF (Peter 1994) and Federal (Madden 1996), and multi-country models (eg. Hertel 1997). There is fertile ground here for the application of such models to tourism growth including that involving multi-destination markets.

Acceptance of CGE Analysis in Other Sectors

Within most economies worldwide, tourism is lagging in the sense that it is one of the few sectors in which there is still considerable reliance on superseded techniques of economic evaluation. In Australia, CGE Analysis is extensively used in simulating the effects of shocks on different industries. Its first major use was in analysing tariff protection; in particular to model the effects throughout the economy of reducing tariffs. Since then it has been used for analysing the economy wide effects of microeconomic reform. There are many examples of practical CGE applications. The debate over tax reform which took place in Australia in 1999/2000 provides one good example of the uses to which CGE models are being put. Models were used by various interested parties to examine the effects of the Goods and Services Tax; the "battle of the models'" was an effective way of narrowing down the range of assumptions adopted. Significantly, Input-Output based models were dismissed early on in the debate as inadequate. CGE models have also been used to examine the effects of quite specific projects, such as the City Link private toll road project in Melbourne (Allen Consulting Group).

These days, the main authorities responsible for providing economic advice to governments in Australia, such as the Productivity Commission, would expect any claims of effects on economic activity of some change, made by opponents or proponents, to be made on the basis of analysis employing a CGE approach. This is also true of agencies with control over the purse strings, such as Finance departments. State treasuries are now familiar with CGE analysis, and often expect evaluations of changes to economic activity to be assessed on this basis. Some have been developing their own in-house capabilities in analysis, while others have been relying on research centres and consultants. Considerable consulting expertise now exists, and some consulting organisations and research centres, including the Centre for International Economics, and the Monash Centre of Economic Policy Studies have been pioneers of the application of CGE analysis, including to tourism (CIE 1988, Adams & Parmenter 1991). In particular, the Monash Centre of Policy Studies, is an international leader in the development of CGE models Internationally, CGE models are being used by researchers and private and public sector agencies to explore a variety of issues affecting different economies. CGE analysis is being employed to explore the economic impacts of policy initiatives and frameworks and broader changes as diverse as hazardous waste management, trade liberalisation, tariff protection, environment-economy interactions, structural adjustment, agricultural stabilisation programs, technological change, labour market deregulation, financial market deregulation, taxation changes, macroeconomic reform, economic transition, international capital linkages, public infrastructure, and industry sector studies (Dixon & Parmenter, 1996; Yao & Liu 2000; Harrison, Jensen, Pedersen & Rutherford 2000). With a few exceptions, tourism researchers seem to be relatively unaware of this extensive and evolving CGE modelling literature with its potential to inform impact analysis and policy making in their own field.

CGE Modelling in Tourism

CGE analysis has broad applicability in tourism as a tool for impact and benefit analysis. Whenever the objective is to determine how a change in the tourism sector, or a change affecting it, will impact on overall economic activity or output, and on particular aspects of the economy, such as employment or imports, CGE analysis can be used. Some types of issues which can be explored using CGE analysis are as follows:

- What impact will a change in domestic or international tourism, have on economic activity in a country or region? What impact will an increase in outbound tourism have on activity in the home country?
- What impact on economic activity within a state will intrastate tourism have?
- What impact on state or national activity will a special event, such as a Formula One Grand Prix or a music festival in a small town, have?
- How will a tourism specific tax, such as a bed tax, affect economic activity?
- How will a general tax change, such as the introduction of a Goods and Services Tax (GST) or Value Added Tax (VAT), impact on the tourism sector and on output generally?
- How will changes in international aviation regulation impact on tourism activity and activity in the economy as a whole?
- How will tourism crises, such as that of September 2001, impact on the economy?

This is not an exhaustive list; rather it is a sample of the types of issues which can be handled using this type of analysis. Granted that models are available, the main problem is how to incorporate the changes being considered in the context of the model. Most models do not have a "tourism" sector as such, but they do have the industries which constitute the tourism sector (accommodation, transport etc). It is then a matter of specifying what the tourism sector consists of, and then setting out how the change being considered will impact on the components of this sector.

The Australian Experience of CGE Modelling in Tourism

Over the past decade or so there has developed a considerable body of work applying CGE analysis to tourism questions in Australia. Indeed there is much more CGE analysis in tourism in Australia than in any other country. This is in part a reflection that Australia has been a world leader in developing this type of analysis. The IMPACT project, begun in the 1970s, led to the development of the ORANI and MONASH models are at the frontier of this branch of analysis (Dixon, Parmenter, Sutton & Vincent 1982; Dixon & Parmenter 1996). Thus, in 1988/89, when the IAC investigated Travel and Tourism, it was natural that it sought to measure the impact of tourism on the economy using a CGE model (IAC, 1989a, 1989b). At least one submission to this inquiry, from Qantas, which was prepared by the Centre for International Economics, also used a CGE approach to analyse the issues it was concerned about (CIE, 1988).

In the early 1990s the Bureau of Tourism Research commissioned CGE analysis of the economic impact of tourism, using the ORANI model (Adams & Parmenter 1992). Since then, there has been considerable work done using a CGE framework. Skene explored the impacts of tourism on employment using CGE approaches (Skene 1993a, 1993b). The successor body to the IAC, the Industry Commission, also explored the impacts of tourism on the economy using the ORANI model (Industry Commission, 1996a, Appendix B). The effects on individual states have been explored using state-wide CGE models (Madden & Thapa 2000). Much of the analysis that has been carried out to date has examined the effects of changes in tourism flows (for example, the effects of an increase in inbound tourism). Recently, the effects of the post-September 2001 tourism crisis on the economy were modelled by Econtech, a private modelling consultant, for the Tourism Industry Working Group (TIWG 2001). The Queensland Government Treasury has developed a CGE modelling capability to examine the contribution of tourism expenditures to the Queensland economy (Woollett, Townsend & Watts 2001). The approach can be used to examine many other types of change. So far, the CGE approach has not been used very often to examine the economic impact of events; important exceptions to this have been the evaluation of the impacts of the Formula 1 Grand Prix by the Industry Commission (1996b) and the evaluation of the Sydney Olympic Games on the NSW economy (CREA and NSW Treasury and CREA 1997).

Earlier work on tourism's contribution to the Australian economy can be categorised in terms of the different underlying assumptions made with respect to (i) the workings of the labour market, and (ii) government policy settings.

Assumptions about the labour market have included: no skills shortages in tourism or related industries (IAC 1989, CIE 1989, Adams & Parmenter 1991); labour shortages resolved by increased real wages to occupations in short supply (IAC 1989); real wage increases paid only to some occupations in short supply (IAC 1989); money wages fixed in all occupations (Skene 1993a,b); real wages fixed for all occupations (Skene 1993a,b). The simulations indicate that the effects of an increase in inbound tourism expenditure on a host destination will depend importantly on the wage setting environment characterising its labour markets. When there are no skills shortages, an elastic supply curve of labour implies minimal upward pressure on wages allowing greater expansionary impacts on income and employment. Given that destinations often face skills shortages in tourism related occupations, the expansionary impact of increased tourism demand will be reduced. Increases in wage rates in some occupations and increased prices in traditional exports and import competing industries, coupled with exchange rate appreciation, can reduce economic activity in other sectors, resulting in lower overall economic gains from the increase in tourism demand.

Assumptions about government policy have included: no excess capacity in factor markets, PSBR constraint (Adams & Parmenter 1991); excess capacity, PSBR constraint (Adams & Parmenter 1991); excess capacity, domestic absorption constraint (Adams & Parmenter 1991); PSBR fixed with real government expenditure fixed (Skene 1993a,b); PSBR endogenous with tax rates fixed (Skene 1993a,b). The studies show that if wage increases are constrained, and extra labour used would otherwise have been unemployed, the types of 'crowding out' effects as noted above are less substantial. Thus Skene (1993b) employed the assumption of fixed real wages under two policy settings: where government borrowing is fixed and where it is endogenous. With real government borrowing fixed, any projected changes in government revenue and expenditure have direct implications for tax rates on labour and non-labour incomes. Average tax rates are projected to fall, stimulating economic activity and generating employment. With real government borrowing taken to be endogenous, and government spending fixed, the expansionary impact on employment and GDP is much smaller.

These studies also indicated that tourism growth affects the industrial structure of host economies. Thus, expansion results in the service industries catering directly to tourists (eg. air transport, hotels, restaurants, entertainment/leisure, retail trade) and also in those industries indirectly supplying tourism related activities (aircraft maintenance and construction, suppliers of investment goods to the tourism industry). Industries which decline in the face of additional tourism growth are those that have a large proportion of exports in their sales and/or face considerable import competition. Non-tourism exports which experience a decline include agriculture, mining, food and metals processing, as do import competing industries such as transport equipment, chemicals, textiles, clothing, footwear (Adams & Parmenter 1993, 1995). These industrial effects explain why a given percentage expansion of tourism in each state will have different effects on the growth prospects for those states. This is mainly due to variations across the States in the composition of their industrial activity. The results depend on different commodity compositions of tourism expenditure across States, differences in the industrial composition of Gross State Product (GSP) and local multiplier effects (Adams & Parmenter 1993).

These results could not be produced by conventional I-O models that omit crowding out mechanisms. They highlight the potential of CGE modelling to produce results that are unlikely to be anticipated without the aid of the model.

Experience in Other Countries

CGE models have been used to study the economic contribution of tourism to the USA (Blake, Durbarry, Sinclair & Sugiyato 2000), the economic impacts of tourism in Spain (Blake 2000), in Indonesia (Sugiyarto, Blake & Sinclair 2002) and in Hawaii (Zhou, Yanagida, Chakravorty & Leung 1997). More recently, Blake, Sinclair and Sugiyarto (2002) apply CGE analysis to estimate the effects of Foot and Mouth disease on tourism expenditure and its economic impact in the UK.

In doing this work, a number of problems have had to be resolved. One of these is how to incorporate tourism into a model, which has no specific “tourism” industry. In much the same way that synthetic tourism satellite accounts are developed, a tourism sector, buying from other industries, is set up within the model. The developments over the past decade have yielded models which have resolved the main difficulties, and which can be applied with confidence to tourism questions.

Chapter 5

The STCRC Economic Modelling Project

Modelling Tourism to New South Wales: An Initial Study

Initial work under the project involved the adaptation of a multi-regional computable general equilibrium model, M2R, which was itself an adaptation of the standard MONASH Multi-regional Forecasting (MMRF) model to measure and analyse the economic contribution of tourism to the NSW state economy. The CGE model was created by incorporating 12 “dummy” tourism industries in each region into an existing model that captures in detail the behaviour of producers in 50 standard industries and a representative consumer household in each of the two regions (NSW and the RoA), and of exporters, importers and investors and two tiers of government (Madden & Thapa 2000).

The main result on the overall economic contribution of tourism to NSW was that the estimated total of $14 billion of direct tourism expenditures in 1998 from overseas, interstate and intrastate, contributes about 7% of NSW gross state product (equivalent to about $13 billion). The contribution to NSW real household consumption was an increase of 6.6% ($7.7 billion) and the contribution to NSW employment a 7.4% increase or about 250,000 jobs. The study found that the boost to the NSW economy from tourism came mainly from inter-state tourism into NSW. The contribution of inter-state tourism into NSW was about 1.5 times more than the contribution of overseas tourism, even though the direct expenditures of overseas tourists in NSW was estimated to be 17% higher than the direct expenditure of inter-state tourists to NSW. It was also found that an increase in *intrastate* tourism would provide a significant short-run boost to NSW activity and employment, whatever the level of substitution between tourism products by destination. The degree to which the positive economic impact is sustained in the long-term, however, depends critically on the degree of substitution of intrastate tourism for interstate travel by NSW residents.

The simulations indicated that the boost to the NSW economy from NSW-destination tourism came at the expense of the other states and territories in Australia. Real state gross output (GSP) in RoA was 4.1% lower and real household consumption 3.2% lower due to the expenditure made by all three categories of tourists in NSW. The largest negative inter-regional effect was due, as expected, to the expenditure made by inter-state tourists who travel to NSW. The tourism expenditure they incurred in their visits to NSW destinations lowered real GSP in the RoA by 4.1%, and decreased real household consumption by 3.2%. This was the result of expenditure being diverted away from their region to NSW. Moreover, the effect of the volume of overseas tourism into NSW was not benign on other regions. Real state GSP, real household consumption and even employment were all lowered in the RoA mainly because resources were pulled into NSW from the other regions.

The study also showed that while many NSW industries have higher employment as a result of tourism to NSW, some mining and metal products industries are squeezed by the real exchange rate effects of overseas tourism. The industries with the largest positive employment effects are those which experience substantial direct purchases by travellers, particularly Hotels and Air Transport.

Modelling Tourism to New South Wales: Recent Results

In 2002, the M2R model was extensively revised and redesignated as the M2RNSW model. (For discussion of the model and its assumptions see Appendix A.) The model was adapted to take account of the new tax system in Australia, especially the introduction of the GST. The way in which the tourism sector is handled in the model is also being refined to allow for explicit treatment of categories such as Australian outbound tourism. Since the earlier model was developed, the Australian Tourism Satellite Account (TSA) has been published and the updated model has been made consistent with the TSA.

The Context

In 2000, approximately 4,946,000 tourists visited Australia, pumping foreign exchange equivalent to A$15.4 billion into the economy. Tourism to Australia has been increasing at 9.6 per cent per annum over the past decade and is forecast to increase by 6.6 per cent annually until at least 2010. Export earnings generated by tourism are projected to grow by an average 6.8 per cent to $29.6 billion in 2010 in 2000-01 dollar terms (Tourism Forecasting Council, October 2001).

The State of New South Wales (NSW) is visited by around two thirds of all inbound tourists. In the year 1999/2000 2,517,000 numbers of inbound tourists visited New South Wales for at least one night and spent A$4.5 billion in the State. Domestic tourism to New South Wales in 1999/2000 was comprised of 18,330,000 intrastate visitors, and 7,463,000 interstate visitors. In total, domestic visitors to the State spent $14.7 billion.

The state capital, Sydney, which hosted the Olympic Games 2000, is Australia's largest city and major tourism gateway.

The base year for the simulations undertaken in this study was 1998. The base employment for New South Wales for that year is 2,862, 942 jobs, one-third of total employment in Australia of 8,596,209 jobs. Base Gross State Product was $1,403,160,000 million.

Types of Simulations

The following simulations were undertaken:

- The effects of a ten per cent increase in the world demand for Australian tourism.
- The effects of a ten percent increase in international tourism to New South Wales - with no change in travel to the RoA.
- The effects of a ten percent increase in interstate tourism to New South Wales where the increase replaces:
  - (i) domestic travel in the RoA and travel overseas; and
  - (ii) expenditure on other goods and services in RoA.
- The effects of an increase in intrastate tourism in New South Wales, where the increase replaces:
  - (i) travel by NSW residents to other States; and travel overseas;
  - (ii) spending on other (non tourism) goods and services from all sources.

Table 1 provides a summary of the maximum impacts of the set of simulations for each type of tourism increase. The table shows key impacts for New South Wales, for the RoA and for (total) Australia (NSW plus RoA). Only the short run results appear here. These short run simulations assume that industry capital stocks are fixed and that there are no changes in industry investment.

Table 1. Summary of maximum impacts on New South Wales and RoA of simulations of ten percent increase in tourism, short run, 2000-01

Source of Increased Tourism Expenditure		Increased Tourism Expenditure	Impact on Real Gross State Product		Impact on Employment	
		A$ million	A$ million	per cent	jobs	per cent
Intrastate tourism in NSW substituted for NSW tourism to RoA	NSW RoA Australia	1,032 -1,032 0	734 -615 119	0.308 0.142 0.018	11,238 -10,891 347	0.369 -0.179 0.017
Interstate Tourism to NSW with full substitution from RoA expenditure on other G&S	NSW RoA Australia	540 0 540	382 -210 172	0.160 -0.049 0.026	6,111 -3,772 2,338	0.201 -0.062 0.032
Interstate tourism to NSW with full substitution from intra-tourism in RoA	NSW RoA Australia	540 -540 0	322 -383 -60	0.135 -0.089 -0.009	4,992 -6,672 -1680	0.164 -0.110 -0.012
International tourism to NSW	NSW RoA Australia	636 0 636	364 -121 244	0.153 -0.028 0.107	6,012 -2,736 3,276	0.197 -0.045 0.042
Intrastate tourism in NSW substituted for other goods and services	NSW RoA Australia	1032 0 1032	354 168 522	0.148 0.039 0.078	4,998 3,696 8,694	0.164 0.061 0.098
International tourism to Australia	NSW RoA Australia	636 1,074 1,710	249 471 718	0.104 0.109 0.107	3,666 8,013 11,679	0.120 0.132 0.128

In the short run simulations undertaken, the most expansionary government policy stance is that where the (Federal and State) government budget deficits are fixed and income and payroll tax rates can vary. These results appear in Table 1. The fall in average tax rates in these simulations results in the largest increases in real household disposable income and real household consumption, leading to the largest increase in employment and the largest change in real GDP.

Interestingly, the greatest gains in State GSP and employment are associated with an increase in intrastate tourism by New South Wales residents, where the additional expenditure replaces that which would otherwise have been spent on interstate tourism by New South Wales residents to RoA. In the simulations undertaken, Real GSP in the State increased by 0.308 per cent while employment increased by 0.369 per cent. The next highest impact markets are, in order, interstate tourism (with full substitution from RoA expenditure on other goods and services), international tourism to New South Wales, and intrastate tourism by State residents, where the additional substitution replaces that which would have been spent on other goods and services, and finally interstate tourism to New South Wales (with full substitution from tourism in RoA). International tourism to Australia is associated with the smallest effects on the State, with impact on GSP and employment of 0.104 per cent and 0.120 per cent respectively.

Since the base volume of tourist expenditure is different for each origin market the assumed ten per cent increase in tourist expenditure implies different increases in tourist expenditure in New South Wales. The initial expenditure changes, which range between $540 million for the interstate tourism market, $636 million for the international tourism scenarios, and $1,032 million for the intrastate scenarios, are shown in Column Two of Table 1. To provide a more meaningful comparison of the differential impacts of expenditure injections from the different origin markets we can estimate the economic impacts on the State of a one million dollar change in tourist expenditure. The estimates are set out in Table 2, which provides a summary of the maximum impacts of the set of simulations for each type of tourism increase for the short run.

Table 2. Economic impacts of $1 million increase in tourist expenditure by origin market, short run, 2000-01

Source of Change in Tourist Expenditure		Increase in GSP /GDP per $1 million Increase in Tourism Expenditure	Increase in Employment per $1 million Increase in Tourism Expenditure
		$ Million	Jobs
Intrastate tourism in NSW substituted for NSW tourism to RoA	NSW Australia	0.711 0.115	10.89 0.34
Interstate tourism to NSW substituted for other G&S	NSW Australia	0.707 0.319	11.32 4.33
Interstate tourism to NSW substituted for tourism in RoA	NSW Australia	0.597 -0.111	9.24 -3.11
International tourism to NSW	NSW Australia	0.572 0.383	9.45 5.15
International tourism to Australia	NSW Australia	0.393 1.289	5.76 18.36
Intrastate tourism in NSW substituted for other G&S	NSW Australia	0.343 0.506	4.84 8.42

Table 2 reveals that a one million dollar increase in tourism expenditure in New South Wales from intrastate tourism, substituted for RoA interstate tourism, or a similar increase in interstate tourism to NSW, substituted for RoA expenditure on non-tourism goods and services, have the greatest impact on GSP and employment in the State at A$711,000 in GSP and 10.89 jobs and A$707,000 in GSP and 11.32 jobs respectively. The next highest impact market interstate tourism substituted for intra-tourism in RoA (A$597,000 and 9.24 jobs). The next largest gains in GSP and employment come from international tourism to New South Wales (A$573,000 and 9.45 jobs). Interestingly, the second smallest job creating tourism market for the State (but not for the nation) is international tourism to Australia. At A$393,000 GSP and 2.14 jobs created per one million dollars expenditure this is below the impact of intrastate tourism with full substitution from other goods and services at A$343,000 and 4.84 jobs).

Overview of Results and Issues for Further Research

The simulation results indicate that the economic impacts of an increase in tourism to New South Wales depend upon key macroeconomic variables including the wage setting environment, the aggregate level of employment, and the government fiscal policy stance. The results also differ according as to whether a short-run or long-run perspective is taken.

In the short-run, the simulations indicate that the most favourable context for economic impacts are a fixed income real wage, fixed national employment and a fixed government budget deficit (allowing for variation in the income and payroll tax rates). In the long-run, with flexible real wages assumed, the most favourable context for economic impacts are: fixed national employment, assumed fixed state unemployment rates, a variable state labour supply and population accommodated by interstate migration. Further research is required to determine which assumptions about macroeconomic variables best accord with reality.

The results are set out in detail in Appendix B. They may be summarised as follows:

- Both the intrastate and interstate tourism markets are potentially important generators of income and jobs for New South Wales. The impacts from the intrastate markets depend upon extent to which growth in intrastate tourism replaces tourism in RoA. Increases in interstate tourism, however, are associated with relatively large economic impacts on the State regardless of whether the substitution relates to other tourism or to (non-tourism) goods and services.
- Depending on what is given up by intrastate tourists to finance their trip, intrastate tourism may have greater impacts per dollar expended than the more emphasised ‘glamour’ markets of international and interstate tourism. Further research is needed to determine the extent to which expenditure on both interstate and intrastate tourism represents substitution from intrastate tourism in RoA or from other goods and services foregone.
- In terms of the impacts per visitor, New South Wales GSP and employment gain most from intrastate visitation, provided the expenditure is sourced from RoA tourism expenditure foregone (that is from NSW tourists choosing to travel within NSW rather than to the RoA). Next is the increased interstate tourism from the RoA to NSW. This implies that promotional spending in domestic tourism markets may have greater cost effectiveness than international marketing expenditure. Of course, decisions to allocate resources between different types of tourism promotional programs require, among other things, knowledge of the relevant elasticities of promotion. Further research is required on this.
- The results also have implications for government support of programs designed to promote greater domestic tourism such as the “See Australia” program. The simulations indicate that increased tourism to New South Wales from interstate can generate substantial economic impacts for that state but can adversely affect GSP and employment in other states and territories. The economic impacts of such programs on a given state will depend upon its industrial structure, and the proportion of a state’s population that visit within, and outside that state. The extent of gains will also depend upon what domestic tourists give up to finance their trips. These issues have been neglected in the research literature to date.
- From an Australia wide perspective, expenditure by international tourists creates more GDP and employment, supporting the allocation of scarce resources into the marketing of Australia internationally. However, the modelling suggests that positive economic impacts from changes in domestic tourism occur at the national level as well. For example, in both of the short-run intrastate scenarios, and in one of the two short-run interstate scenarios (where the increased tourist expenditure replaces expenditure on goods and services in the RoA) there were positive GDP and employment effects for Australia as a whole. In the long-run the modelling all of the intrastate and interstate scenarios had positive impacts on GDP for Australia as a whole (total employment at the national level is determined by macroeconomic and labour market structure in the long-run scenarios and does not change). These outcomes were not dependent on any switching of Australian outbound tourism by Australians into domestic tourism. This could provide further positive economic impacts, which will be examined in a future study.
- In the short run, the greatest gains to the New South Wales economy, per dollar of additional tourism expenditure, are associated with domestic tourism (except in the case of intrastate tourism which replaces expenditure by NSW residents on other goods and services). From the perspective of Tourism New South Wales, it may well be more cost effective to allocate resources to generate additional domestic tourism rather than to cooperative marketing of Australia as a destination.
- The greatest gains nationally, however, are associated with international tourism.
- Underpinning the above results are the changes in output and employment of industries as a result of changes in the amount and patterns of tourism expenditure. Industries in the State that experience the most positive growth in sectoral output and employment in both the short and long run, and irrespective of the origin of increased tourism expenditure, include Air Transport and Hotels. The simulations reveal that some industries decline as a result of the increased tourism, both in New South Wales and the RoA. The industries that experience a decline in output and employment tend to be export-oriented industries in the primary sector (eg. Mineral Ores, Brown Coal, and Oil), or import competing services such as Water transport and manufactured products (eg. Chemicals, Motor vehicles, Metal products, TCF and Wood products).
- The simulations reinforce the findings of Adams and Parmenter (1999) that some States that simply maintain their market share of a growing tourism market may experience a fall in their Gross State Product and overall employment, depending on the composition of their industry. Once this result is

more fully appreciated by state tourism authorities it is likely to produce additional pressures on cooperative marketing arrangements (Dwyer 2003).

- The findings are of a preliminary nature and further research is needed before full confidence can be placed on them. At the same time, further analysis of the validity of the assumptions is called for. Further discussion is needed to determine which of the different assumptions underlying the simulations are most robust in reflecting the context in which an economy actually works. We need to ensure that these assumptions reflect as accurately as possible the realities of the macroeconomic environment.
- The simulations undertaken illustrate that when one wants to quantify the impact of growth in visitor expenditure on a host economy, one must first define the key features of the economy on which the impact is to take place. Only some of the results of different simulations have been shown here. Overall, the results show that impact of higher visitor spending can be highly sensitive to the assumptions one makes about the economy. Assumptions about macroeconomic settings appear to have much greater impact on the net results than do the precise size or composition of changes in visitor spending. In other words, the results illustrate that the extent of real medium to long-term gains depend on how the initial gains are used.

Chapter 6

Economic Evaluation of Events Using CGE Models

Evaluation of Events

The value of the CGE approach in analysing tourism issues can be demonstrated through applying it to evaluating special events. One of the first applications of the model developed under the STCRC project has been to consider two realistic, though hypothetical events. These are based on real life events that took place in Victoria. The economic impacts on NSW of events with the same expenditure patterns were estimated using both the CGE and Input Output approaches. The CGE model estimates much smaller economic impacts than the Input Output model.

Economic evaluation of events has invariably been carried out using I-O models. Estimates are made of the increase in expenditure that an event brings to a region, and these are used to calculate the impacts on economic activity (output, jobs etc). Normally, the impact on output is estimated as being well above the initial expenditure injection; typically it will be about twice the injection. These event evaluations are often commissioned by promoters wishing to gain government support for an event, and sometimes governments undertake studies when they are determining whether to support an event. The high positive impacts on output and jobs are always a selling point for the event.

The problems with using I-O models in the events context are very much the same as encountered in other contexts. Because the negative impacts of the event are ignored, the estimated impact on output is grossly excessive. While CGE models are now being used increasingly in the assessment of tourism's economic impacts, they have not yet been used extensively to evaluate events. There are some important examples of their use- for example the analysis of the Formula 1 Grand Prix by the Industry Commission (1996b) and the study of the Sydney Olympics done by the NSW Treasury and the Centre for Research in Regional Economics (NSW Treasury and CREA 1997). It is a matter of time before the technique is used much more extensively.

CGE model will give a smaller, but much more accurate, assessment of the impact of an event on output than an I-O model will. However, its advantages go beyond this. Because it is a much more comprehensive model of the economy, a CGE model will provide a lot more information on a range of different impacts, such as on tax revenues. Many CGE models can be used without adaptation to study events. However, some modifications can be made which make it easier to simulate events and can improve the accuracy with which the model captures the special characteristics of an event. The modifications made to the model by the team will be described briefly.

CGE analysis can, in principle, be applied to all types of events, small and large, local and economy wide. The level of disaggregation of the model used determines the extent to which local effects can be estimated. If the lowest level of disaggregation is a state, it will be feasible to estimate the effects on the state of an event that takes place in a rural city, though not the local effects on that city. The size of the event makes no difference to the appropriate technique for analysis- small events draw resources away from other parts of the economy, just as large events do, and so CGE analysis is the correct technique for evaluation. It is always necessary to consider both positive and negative effects of an event on the economy, including the small events.

Additional Perspectives from the CGE Approach

One advantage of the CGE approach is that it uses a much more comprehensive model of the economy, and thus it is capable of estimating a much wider range of impacts and aspects of the event. The traditional approach to event evaluation is simply incapable of providing estimates of these impacts.

The Choice of Jurisdiction

The CGE model used in the project has been developed thus far for application to the state of NSW, the RoA, and Australia as a whole. Other models exist which explicitly model each of the state economies, though they do not include detailed tourism sectors. It is feasible to estimate impacts on a state of an event taking place within its borders, the impact on other states, and the impact on the Australian economy as a whole. CGE models do not normally exist for local areas or rural cities. Thus it will not be feasible to use the CGE approach to estimate the local impacts. When the area is distant from the centre of economic activity in the state - for example a rural city some distance from the main city - then the local effects can be estimated using I-O analysis. I-O analysis will give a tolerably accurate estimate of the change in economic activity in a region. This estimate must be used with caution since much of the additional activity is created by labour and services which temporarily move to the event location - the impact on the local economy will be smaller than the estimated overall addition to economic activity in the region. This would not be an option for estimating the local effects of an event taking place within the main centre of economic activity (say, within Sydney, Melbourne or the Gold Coast) – however. I It is not clear what local effects would mean in this context, since a suburb in which an event takes place is inextricably linked to the city's economy. There is no "local economy" in any real sense.

For most policy purposes, the state level is a low enough level of disaggregation. Except for very small events, events are usually approved by sought by and subsidised by state governments. These governments are interested in the state wide impacts of the events. They may sometimes be also interested in the local impacts of events that take place in rural economies, given their interest in rural development- however, if they are, they will also be interested in the impacts elsewhere in the state and on the state as a whole. The impact on economic activity in the state will be typically much smaller than the local impact on a rural area because resources and activity will be drawn from the rest of the state into the area hosting the event, thereby reducing output and jobs elsewhere. CGE models can estimate the state wide impacts which I-O analysis is unable to estimate accurately. A national government might also be interested in the impact of events (especially the larger ones) on the national economy. The impact on the national economy will normally be significantly smaller than the impact in the host state, again because resources are drawn away from other states to the host state, thus reducing economic activity in other states. Because of the negative impacts on other states, the national government may be much less enthusiastic about events (which, to a significant extent, may reallocate economic activity between states rather than add to economic activity) than state governments might be.

Regional and National Impacts

As noted above, a multi regional CGE model, such as developed under this project, is capable of examining the impacts of an event on the home state, other states and the nation. The CGE approach can also estimate the impact of intrastate visits to the event- these are ignored by I-O models. Intrastate patronage of an event can have an impact on economic activity in that state because it results in a change of spending patterns within the state. The overall impact on activity is not likely to be large, but it is sensible to check whether this is so. The impact on specific variables, such as tax revenues, however, could be significant if different goods and services in the state are taxed differently.

Multi State Events

Some events, such as the Rugby World Cup, take place in more than one state. They encourage flows of visitors both into, and out of, a state. Because a multi regional CGE model incorporates several states, it is a simple matter to examine the impacts on a specific state, or on each of the states (host and non-host states) in the federation of the event. Since I-O models are effectively based on one jurisdiction (eg local area or state), and do not model what happens beyond that jurisdiction, they are not suitable for analysis of this type of event.

Tax Revenue Implications

CGE models incorporate governments' taxing and spending. Tax receipts depend on several aspects of economic activity- incomes, sales of specific goods, and profits. These will be affected both positively and negatively by an event. Using a CGE model it will be possible to estimate the impact on tax revenues, which an event will have. An I-O model is incapable of estimating the net tax impact of an event because it ignores the negative impacts on economic activity in some parts of the economy. Sometimes, event studies based on I-O analysis do purport to measure the tax implications - which of course are positive. These must be regarded as highly misleading - the net tax implications of an event could well be negative. In any case, the actual net increase in tax revenue will be much lower than as estimated using I-O techniques.

Event Subsidies

Events are often subsidised by governments. When this happens, tax revenues must be found to pay for the subsidies, or other spending must be reduced. How subsidies are financed will have an impact on economic activity within the state. With a CGE model, the implications of the options for funding the subsidies can be explored. I-O models are incapable of examining this aspect of events.

Inter-Industry Effects

When an event occurs, there will be industries that are positively affected by the event, but here will also be other industries that are negatively affected. Because the event draws resources away from other parts of the economy, it will lead to a reduction in some other industries. CGE models estimate how these other industries are affected (Dwyer, Forsyth & Spurr 2003) By contrast, an I-O analysis will only pickup the positive, and not the negative impacts of the event on other industries.

Differential Impacts of Interstate and Overseas Visitors

Not all sources of expenditure into a state have identical impacts. When overseas visitors come to an event, their expenditure has an impact on the exchange rate. The exchange rate is pushed up, and other export industries are negatively affected. This reduces economic activity in the host and other states. By contrast, when interstate visitors come to an event in the host state, there is no effect on the exchange rate- thus their expenditure has a different impact on the host state from that of overseas visitors' expenditure. The effect on the non-host states will also differ, since interstate visitors shift expenditure away from their home state to the host state, thereby reducing activity in their home state. These effects can be estimated using CGE models, however they are ignored in I-O models, which only recognise "injected expenditure" as a whole, and cannot recognise how different sources of expenditure can have different impacts.

Adapting CGE Models to Study Events

Just about any CGE model with an inter-industry sector can be used to study events. However, sometimes it is cumbersome to fit events into the framework, and it is possible to adapt the model to handle events more readily. It is also possible to provide more detail in them to enable more accurate estimates of impacts. These adaptations have been made in this CGE project.

Modelling the Multi State Economy

The impacts of an event on a state depend critically on how integrated that state is with the rest of the economy. Is the state essentially a separate economy, or is it simply a geographical slice of a broader economy? How integrated are labour markets? If an event pushes up the demand for labour, is this supplied by workers coming from interstate, or from within the state? Furthermore, if it is supplied from within the state, does the extra labour required come from other industries, bid away by higher wages, or from unemployment? When demand for goods and services is increased by the presence of the event, they can be supplied from within the state, from interstate, or overseas. If labour markets are highly integrated, an event will tend to have a large impact on economic activity in the state, as production in that state increases, but there will not tend to be a large impact on unemployment in the state, if the jobs go to migrants from interstate. On the other hand, if goods markets are highly integrated, the impacts on economic activity within the state tend to be smaller due to the 'importation' of products from interstate. The results in terms of impacts on economic activity within a state are sensitive to how the integration of the state's economy with the rest of the economy has been modelled. Clearly, it is desirable that this be done as realistically as possible.

Displacement Effects

The CGE approach recognises that when an event pushes up the demand for goods and services, this will push up prices, especially for items that are in short supply, and this will crowd out other activities, thereby lowering the net addition to economic activity. These displacement effects are particularly important in the events situations, given the fact that events tend to have a sharp but temporary boost to demand in a concentrated area. Many services, such as accommodation, cannot readily expand to match demand; prices are pushed up, and other demands are rationed away. It is easier for an economy to handle a 10% increase in accommodation demand if it is spread over the whole year and whole economy than if happens for one week in a specific area. The impact on economic activity is likely to be smaller in the latter case than the former because supplies are constrained. It is possible to adapt the model to test for this:

- By running the model for short periods, such as a week, rather than for a year, and having a much larger proportional shock to the economy coming from the event. This will make a difference if the model being used is not highly linear- it will not make a difference if the model is essentially linear (and a shock which is ten times the size of another shock will have exactly ten times the impact).
- By running the model with outputs of key services, that are expected to be in relatively fixed supply, such as accommodation, fixed to the level in the base case, or base case plus a predetermined margin of excess capacity.

Both these options were tested in the modelling of events.

Introducing an "Events" Industry

The model we have developed incorporates special "tourism" dummy industries. These reflect the expenditure patterns of different types of tourists, such as domestic business visitors and Interstate VFR visitors. The dummy industries buy goods and services from other industries and supply tourism services to visitors. This is a convenient means of modelling the impacts of different types of tourists. A further development of the model, to enable it to handle events more readily, is to introduce "events" industry dummies. These treat events as new industries, buying goods and services, and labour, from other industries, and selling their services (tickets, sponsorship) to patrons. The expenditure and revenue patterns of an event can then be easily incorporated into the model.

Events Case Studies

Two events were analysed using the CGE model. Both are based on the expenditure patterns for real events, however the event demand shocks are applied to the NSW model (good data for New South Wales events were not available). The first case study, of a large event, modelled the impacts of holding an event with the characteristics and expenditure patterns of the Formula One Grand Prix, as held in Victoria. Visitor spending and event running costs were assumed to be the same as for the Victorian event, though the event was assumed to break even with ticket sales and sponsorship this assumption can be easily relaxed. A smaller, regional, event was modelled on the basis of the Motorcross event held at Benalla in Victoria.

Both case studies only considered the impacts of expenditure from interstate and overseas - i.e. the expenditure injected into the economy. This included expenditure in running the event, pro rated according to the shares of each source in ticket sales and sponsorship. Expenditure from within the state is normally ignored in I-O studies, and since one objective of these case studies was to compare results with those of I-O studies, this practice was adopted here. Since expenditure from intrastate can affect results, it would be more correct to include it, though it is not likely to make a large difference to the results on output and jobs. It would be a simple matter to include it.

The expenditure shock for both events included the expenditure of visitors from interstate and overseas, on both the event and associated services, such as accommodation. Expenditure by visitors on tickets was excluded, but an equivalent amount of expenditure on running the event was included. The expenditure associated with the Grand Prix type event totalled \$51.25m, and the Motorcross event totalled \$2.24m.

The simulations undertaken assumed the short run – i.e. that the capital stock was fixed. This is realistic granted the short duration of these special events. Labour supply assumptions are critical to results on economic activity. Two extremes were modelled. The first of these assumed that there was a fixed real wage, and an abundant supply of labour (from unemployment). The second assumed that there was a fixed level of employment within each state. This assumption corresponds to a state labour market in which increases in the demand for labour are met by wages being pushed up. As neither of these extremes is realistic, we averaged to results of the two cases to form a plausible scenario.

The comparison reveals that two major (related) types of information are gained by using CGE: (1) the impact of event related expenditure on output, GSP and employment in RoA, and (2) the adverse impacts on output, value added and employment in various industries, in the host State, or interstate, or both.

Results

The results from the simulations are summarised in Tables 3 and 4. Both CGE and I-O models were run, and the results from them can be compared. Only some of the key results are reported here – more extensive results are reported in Dwyer et al. (2003).

Table 3. Economic impacts, large event

Macro Variables **Total Shock \$51.25m**	**NSW (IO)**	**RoA (IO)**	**Aus (IO)**	**NSW (CGE)**	**RoA (CGE)**	**Aus (CGE)**
Change in Real Output (\$m)	111.957	8.109	120.066	62.638	-17.552	45.086
Change in Real GDP/GSP (\$m)	38.904	4.362	43.267	22.135	-8.438	13.697
Change in Employment (No of Jobs)	521.146	70.713	591.859	367.107	-148.416	218.691

Table 4. Economic impacts, small event

Macro Variables **Total Shock \$2.24m**	**NSW (IO)**	**RoA (IO)**	**Aus (IO)**	**NSW (CGE)**	**RoA (CGE)**	**Aus (CGE)**
Change in Real Output (\$m)	4.309	0.455	4.764	2.4933	-0.815	1.678
Change in real GDP/GNP (\$m)	1.633	0.248	1.881	1.044	-0.354	0.690
Change in Employment (No. of jobs)	22.387	3.597	25.984	16.773	-5.670	11.103

Relative Size of Impacts

It is clear from both the tables that the estimated change in output (GSP/GDP) is much smaller for the CGE simulations than for the I-O simulations. This is to be expected. If anything, the CGE results may be on the high side, allowing, as they do, a strong response in terms of additional labour coming into productive activities.

Interstate Impacts

The negative impacts of these events on the RoA economy is evident from the table. Only CGE simulations are able to pick these effects up- while numbers are reported for the I-O simulations, they do not mean very much, since this technique only records the positive impacts outside of the host state (e.g. from additional demands for goods and services of other states from the state hosting the event).

The negative impacts on other states come about because of :

- The switch of expenditure from the RoA into New South Wales as interstate visitors attend the event, and
- The increase in demand for resources, such as labour, bidding resources away from other states, reducing economic activity in them.

Inter-Industry Effects

The more comprehensive results, reported in Dwyer, Forsyth and Spurr (2003), indicate that several industries are negatively impacted upon by the events. Some industries show increases in activity- this is especially true of industries that are directly related to the event, such as road transport and accommodation. Other industries are negatively impacted upon; these include industries which are competitors in export markets for tourism and events- including agricultural and mining industries, and to a lesser extent, some manufacturing. The patterns of impacts are fairly similar for both events, though there are some differences. For example, air transport is negatively affected by the Motorcross event (travel to which would mainly be by road), but positively affected by the Grand Prix event.

It is possible to obtain estimates of inter-industry effects using I-O techniques, however the results have little meaning. All of the impacts are either positive or zero, as expected, granted that all the technique is incapable of capturing any negative effects.

Relative effects of interstate and overseas visitor expenditure

The different impacts of interstate and overseas inbound visitors can be analysed using CGE analysis. We would expect different impacts partly because the expenditure patterns of the two types of visitor are different, and because the impacts on expenditure in the RoA will be different (interstate visitors funding their visits by reducing their expenditure at home). These issues are explored in Table 5, which breaks up the CGE results reported in Table 3 into results for interstate and inbound overseas visitors. Results for the large event only are reported- there would be similar results for the small event.

Table 5. Differential impacts of inbound and interstate expenditure

	Inbound	Interstate	Total
Expenditure Shock ($m)	22.769	28.481	51.25
Impact on NSW			
GSP ($m)	8.242	13.893	22.135
Employment	131.027	236.079	367.107
GSP Multiplier	0.362	0.488	0.432
Employment Multiplier	5.755	8.289	7.163
Impact on Rest of Australia (RoA)			
GSP ($m)	– 2.951	– 5.487	– 8.438
Employment	– 67.279	– 81.137	– 148.416
GSP Multiplier	– 0.130	– 0.193	– 0.165
Employment Multiplier	– 2.955	– 2.849	– 2.896
Impact on Australia			
GDP ($m)	5.291	8.406	13.697
Employment	63.749	154.942	218.691
GDP Multiplier	0.232	0.295	0.267
Employment Multiplier	2.800	5.440	4.267

The impacts on New South Wales do differ, with the multipliers associated with interstate expenditure being greater than those with inbound expenditure. This is probably the consequence of different expenditure patterns. As expected, the impacts on the RoA of interstate expenditure are negative and larger in absolute size than the impacts of inbound expenditure. This is partly because of the switching effect - interstate visitors switch out of expenditure at home to fund their visits. However, significantly, there is a strong negative effect of inbound tourism to New South Wales on the RoA. This is not a result that a typical I-O study would pick up. It comes about as a result of the impact on the exchange rate of additional tourism exports, which would have the effect of discouraging the export of other goods and services from the RoA. Further, as economic activity increases in New South Wales, granted the limited nature of resources, the supply of resources and economic activity in other states will fall.

A Perspective on Event Evaluation

The results described here show that the conventional approach to event evaluation, based on I-O models, gives highly inaccurate results. Many observers are sceptical of the large boosts to economic activity that events are often claimed to have (see ACT Auditor General, 2002). This scepticism is well placed - these results are only obtained by using a fundamentally flawed technique that ignores all the negative impacts on the economy Dwyer, Forsyth & Spurr 2003b). Given the ready availability of CGE models, and the relative ease with which they can be adapted to evaluate events, there is no longer any reason for relying on defective methodologies.

A further advantage of the CGE approach, which has been highlighted here, is that it provides much more information on how an event impacts on the host region, and elsewhere. It also provides estimates of impacts on other industries and on tax revenues. Critically, a multi-region model such as the one used here enables us to evaluate the impact of an event on the host region, on non-host regions and the nation as a whole. Typically, the economic impact of events will be negative on non-host regions, and the national impact will be much smaller than the impacts on the host region. Taking a broad perspective, events can be seen to have been grossly oversold as stimulants for economic activity. A re-assessment of governments' policies towards events is overdue.

The CGE simulations reported here have sought to measure the impacts on economic activity, as measured by such variables as GDP or GSP. As discussed elsewhere in this report, changes in GDP do not equate to measures of additional *net benefits* to the economy. The additional output requires additional resources, such as labour, and because these resources have a cost, the net benefits will be invariably smaller, often much smaller, than the value of the additional output. Further analysis is needed to measure the net benefits resulting from additional output stimulated by an event. Determining these net benefits is an essential step in conducting a rigorous cost benefit analysis of an event, which compares total benefits (including other benefits such as resident consumer benefits from attending the event) to total costs (including any environmental costs from hosting the event). Conducting such a cost benefit analysis should be an essential requirement before a government incurs a real cost by committing funds to encourage an event.

Chapter 7

Objections to CGE Approaches

Cost and Availability

CGE models are sometimes criticised as too time consuming to build and too complicated to use (Mules 1999, Hunn & Mangan 1999). However, CGE modelling techniques and software systems are now routinely available, and the data should be assessed in terms of its importance for the question to be investigated, other than just in terms of the ease of data mobilisation (McDougall 1995). The claim that CGE modelling is too demanding in its input requirements can easily be countered, particularly when it is appreciated that the structure of I-O analysis omits key mechanisms for the subject of study. In fact, I-O models are dominated by CGE models in the sense that a CGE model will incorporate an I-O model as part of its structure. Essentially, all that is required to derive this is for all relative prices to be treated as exogenous variables. The CGE model also provides us with a mechanism for investigating the sensitivity of the results to changes in assumptions about the parameters.

It is sometimes maintained that the cost of undertaking CGE analyses is prohibitive, and simpler techniques such as I-O are more cost effective. This claim is not necessarily true. Assuming that a CGE model and an I-O model are available, the cost of analysing a change with them would be much the same; most of the cost is in preparing the inputs and in interpreting the outputs, not in developing or running the model.

It does cost more to develop a CGE model from the beginning, but in most cases, it is unnecessary to do this. In Australia, for example, several models, national and regional, have been developed, with more under construction. Research Centres (Centre of Policy Studies, Centre for Regional Economic Analysis) have developed models that can be readily used, and most of the main economic consulting firms have their own models or access to a model. There may be problems of availability for small economies, but models do exist even for quite small economies, such as Fiji or Jersey. Building new models may be time consuming, but it is not an especially demanding exercise; PhD students regularly build them. Some agencies in Australia (state treasuries) are spending considerable sums in developing their own CGE models, but this is in order to have substantial in-house expertise with which to examine a very wide range of issues (tax, industry policy, major projects), and not just for tourism.

Granted, however, that the costs of developing CGE models from scratch are greater than those of I-O models, a typical simulation using them will be priced above a simulation using an I-O model. While the incremental costs of a simulation using a CGE model will be about the same as one using an I-O model, research centres or consultants will normally charge a premium to cover the cost of model development or for the intellectual property. However, with the increasing use of CGE models, this premium is falling. For example, a study which might cost $30,000 using an I-O model could cost around $40,000 using CGE, with a model development component of $10,000. Publicly funded research centres do not always have to recoup this premium, and sometimes are able to undertake an impact study using CGE analysis for much the same cost as when using I-O analysis. A study of the post-September 2001 tourism slump on the Australian economy is reported as having cost around $40,000. This was done at short notice by a commercial firm (TIWG 2001)

It is recognised, of course, that estimating the economic impacts of tourism growth in certain contexts may not justify the expense of constructing a new CGE model if no suitable model already exists, eg. in small regional economies or sub-state regions. These are typically very open to commodity and factor flows and face no external account constraint. Relative prices can safely be regarded as being set outside such economies. In these circumstances, the range of mechanisms encompassed by a CGE model, over and above those included in an I-O model, may not be of much practical importance. In such cases I-O analysis can be employed to estimate economic impacts as long as its assumptions and deficiencies are acknowledged and it is recognised that the positive impacts cannot be extrapolated to the wider national or even state level. And, since CGE simulations indicate that intrastate ’transferred’ expenditure has important impacts the I-O results will, at best, provide only partial estimates of tourism’s impacts The practical advantage of using I-O modelling in certain contexts is, however, a separate issue from its conceptual status.

Are the Results Much Different?

One stream of criticism of the use of CGE modelling is that it is claimed that it yields very similar results to I-O analysis; hence the additional complexity and cost (if the development of a CGE model from scratch is required) of the more rigorous technique are not justified.

This view is quite unfounded. It is quite possible that the results from using the two techniques will be totally different. Refer, for example, to the events comparison study in the previous chapter. The comparison illustrates how the change in activity, estimated using the I-O approach, can be large and positive, but estimated using the CGE approach be substantially smaller (or even negative). Suggested rules, such as that of adjusting I-O results downwards by some percentage to allow for the offsetting effects that CGE analysis recognises, simply miss the point.

It is true that, *sometimes*, I-O and CGE analyses will come up with changes in activity of a similar order of magnitude. This could happen if the CGE model being used embodied assumptions about resource supplies (eg easy access to unemployed resources), which approximate those on which I-O analysis relies. In short, if essentially implausible assumptions are fed into a CGE analysis, it can give similar outputs to an I-O analysis. With more plausible assumptions, which recognise resource limitations and the ways labour markets work, CGE and I-O approaches will typically give very different results, with the measured change in economic activity being significantly lower under the former. It does matter which approach is more complete and more correct as a representation of the economy.

Indeed, these considerations highlight one of the practical advantages of using CGE models for policy analysis. As with all kinds of models, results are sensitive to the assumptions made. The I-O approach locks one into extreme assumptions about input availability (free availability with no constraints) and feedback effects from other markets (they do not exist). By contrast, it is possible to test a wide range of assumptions within a CGE approach. For example, the labour markets can be modelled differently; at one extreme, unemployed labour can be freely available, and at the other extreme, additional demand for labour leads to no more employment, but only higher wages. Assumptions in between these extremes can also be used (Dwyer & Forsyth 1998) CGE models also typically allow for alternative assumptions about government tax and spending policies, exchange rate mechanisms, and consumer behaviour (Dwyer, Forsyth, Madden & Spurr 2000)

The results of I-O analyses tend to be rather predictable; the final change in activity is some multiple of the initial change in expenditure. By contrast, those of a CGE analysis are far less so; quite often, unexpected results turn up. This suggests that the model is capturing the complexities and interrelationships in the economy that are missed in more simple approaches. In a real economy, the ultimate consequences of some change on variables such as economic activity cannot be easily predicted. In this respect, the CGE approach is a valuable research device, which goes beyond simplistic rules of thumb.

The Underlying Assumptions

Empirical and quantitative work in economics relies on underlying assumptions, even though this may not always be apparent. For example, there is a considerable body of work measuring demand elasticities, or the sensitivity of tourism demand to variables such as price and income. This work relies on assumptions about consumer behaviour. Taken at face value, these assumptions about how people behave may appear “unrealistic”, however they enable the measurement problem to become tractable. As long as the assumptions made are not too unrealistic, they enable measures that are reasonable approximations to be made.

The same is true for quantitative models that are used to make estimates of impacts on economies, such as I-O and CGE models. CGE models are more comprehensive, and incorporate more markets and processes; hence more assumptions must be made. These involve how markets work, how taxes are levied, how production is structured, and how consumers behave. The assumptions will be based on available empirical work, which in turn will embody assumptions, and they will be chosen to give the best practical representation of the economy. To make models tractable, simplifying assumptions must be made. For example, many CGE models assume constant returns to scale, or that a doubling of output will entail a doubling of cost (Skene 1993a,b) For some industries, including tourism industries, this will be a reasonable assumption. For other industries, such as the motor vehicle industry, this may not be the case (though scale economies are probably not as significant as is often assumed). It is becoming easier to model increasing returns, and some models now incorporate them. Nevertheless, this simplification is not likely to introduce too much error into the results.

I-O analysis makes fewer assumptions than does CGE analysis, but the assumptions it does make about production processes are highly stylised, and open to the same types of criticism (Braissoulis 1991) However the real objection to Input-Output analysis is that it avoids making assumptions about how the rest of the economy works by ignoring it. It is preferable to have a complete representation of the economy, even if this involves making some further assumptions. As noted above, one of the strengths of CGE analysis is that many of its assumptions can be varied and the sensitivity to them tested.

CGE in Analysing Local Impacts

It is often stated that CGE analysis is inappropriate to evaluate small, local events, and that I-O analysis is sufficient for this purpose (Mules 1999). As with other claims, this has to be heavily qualified.

If it is the local effects of an event, or project, which are of interest, the state-wide or economy-wide CGE analysis will not be required. In principle, it would be feasible to construct a local CGE model for the local area, and this could be used to analyse changes to it. However this will probably be costly, and unwarranted. Alternatively, a local I-O analysis could be undertaken. Since, as with CGE models, a suitable ready-made model is not likely to be available, it will be necessary to construct one, taking into account the structure of the local economy, and its links with the broader economy. This is not a trivial task, but it will be a simpler one than constructing a CGE model of the area. The I-O assumption of freely available resources is closer to the truth in the local case, because labour and capital can flow to the area from other areas. It will be necessary to distinguish between local residents and others who come to the region if aspects such as the impact of the event on local unemployment are of interest (often this is not done).

The information that such a study produces will be of interest to local decision-makers. For example, the local council of a town might undertake such a study to determine whether to support a festival in the town or to extend the airport. However, the information produced is not of much relevance to higher-level decision-makers, such as state or national governments, except to the extent that they are concerned about local impacts. Even when they are, they will also be concerned about state-wide impacts.

A state or regional government will be interested in the impact on economic activity in the state as a whole; this cannot be determined from a local I-O analysis. Rather, a state-wide CGE model will be required. Such a model will take account of the effects of the event or project on resources available to be used elsewhere in the state, and it will allow for the fact that visitors to the town will lessen their expenditure elsewhere to fund their visit to the town. For example, a State Government agency will be interested in how different events, such as a music festival or a Grand Prix, will affect economic activity in the State as a whole, as well as in the area where the events occur. Any net increase in economic activity in the state as a whole will tend to be much smaller than the increase in activity in the immediate local area. Local impact studies will not provide public sector decision-makers with enough guidance as to whether they should support local events financially or otherwise, since they will also need to know the overall state-wide impacts. Likewise, national governments will be interested in the impacts of events or projects on activity in the nation, not just the impact in particular states or regions.

The size of the change that is being contemplated is not something that should determine which type of analysis is appropriate. Small changes can be analysed using CGE analysis just as readily and correctly as large changes. Clearly, as always, the cost of the analysis should be commensurate with the benefits from obtaining information about it. Neither CGE nor I-O analyses are costless. A local I-O analysis, which adequately captures the unique features of the locality, may well be more expensive than a run of an existing CGE model. It is not the case that small or medium sized events or shocks should be analysed using I-O analysis.

In summary, there is a case for using a local Input-Output model to estimate the local effects of an event or project, providing information of relevance to local decision makers. The results of such studies are only of partial guidance to higher level decision-makers, such as state or national governments, because these will be interested in impacts on the overall economies within their jurisdiction. For this, CGE models will be required.

Chapter 8

Extensions

Tourism Satellite Accounts

Tourism Satellite Accounts (TSAs) have been introduced in a number of countries (including Australia) in recent years and they are receiving increasing attention as a tool for providing increased information on the contribution of tourism to national economies. A TSA is a means of measuring the size of the tourism sector in an economy, or measuring the “contribution” of tourism to the economy, in a manner which is consistent with the country’s National System of Statistical Accounts. The World Tourism Organisation has developed a detailed framework for their introduction (WTO 1999).

While a TSA can be a substantial step forward, the information it provides is essentially static and descriptive. From the point of view of analysing the economic impacts of tourism a TSA provides a useful tool, akin to the statistical data available for any area of industry analysis from a country’s national accounting system. It also plays an extremely valuable role in standardising definitions and assembling data in a manner which is comprehensive, internally consistent and balanced. In doing so it provides a consistent and credible basis on which to build further research and analysis.

The TSA’s essential contribution is that, for the first time, it identifies aggregate official figures, within the national accounts, for a tourism “industry”. Without a TSA, tourism data is disbursed across a wide range of other industries from which they cannot readily be separated. Because the TSA is developed in a manner which is consistent with the national accounting system as a whole, it makes it possible to compare tourism with other sectors of the economy and to examine its components. For example, tourism’s share of GDP and employment, the relative importance of identified tourism components to overall tourism activity, and their contribution to other non-tourism industries can all be identified.

CGE models go much further than TSAs – with them it is possible to tell what impact a change - such as a 10% increase in inbound tourism, will have on variables in the economy, including GDP, employment and exports. They can also be used to project the impact of changes in the overall economy on the tourism sector and its component parts and to estimate the economic effects of changes in government policies. TSAs cannot be used for these purposes.

Where a TSA is already in place, it will provide the statistical basis for much of the tourism specific data required in the development of any CGE model which contains an explicit tourism sector. The absence of TSAs until recently in most countries helps to explain why few existing CGE models identify a tourism “industry” or incorporate any detailed breakdown of tourism data. Even where CGE models have sought to identify tourism,, the absence until recently of consistent definitions and data inputs from the national accounts meant that their results have not been readily replicable or comparable from one model to another.

CGE modellers will usually require much more detailed information than TSAs currently provide, for example, about the direction and breakdown of tourism expenditures and where they occur, and about the breakdown of capital investment in infrastructure which serves multiple users of which tourism may be only one. Sometimes this information must be imputed. TSAs which provide provincial or regional level data are, as yet, extremely rare, creating a further gap for CGE models which are directed at analysing economic impacts at anything other than the level of the national economy.

As long as a CGE model has an explicit tourism sector, it will embody a TSA within it. It will thus be possible to generate a simulated TSA, where an official TSA does not exist, as an output of the CGE model. The degree of accuracy and detail in the CGE derived TSA will depend on the source of the information it is developed from, and on the degree of detail incorporated in the model. A TSA generated as an output of a model may not be as accurate or detailed as one which has been specifically constructed by a government statistical agency. The official TSA will often draw on expensive, specifically commissioned, surveys to fill data gaps. However, if the assumptions and definitions adopted to build the tourism specific components of the CGE model are consistent with those of any official TSA structure then the resulting CGE generated TSA should be broadly consistent with what would be produced in a fully constructed TSA.

This issue is of interest at the state or local level where TSA’s are rarely available. A CGE model, which is constructed with an explicit tourism sector in a manner consistent with the national TSA, and which draws on national TSA definitions and data, can provide an appropriate and cost effective tool for producing simulated TSA’s at the state/provincial level. This type of extension of a CGE model is one which could logically be explored using the NSW CGE model developed for the STCRC CGE project (Dwyer, Forsyth, Spurr & Ho 2003).

Dynamics and Endogenous Growth

Most analysis of the economic impacts of tourism is done using a static framework; in other words, using an approach which models the economy at a point of time, and examines shifts from one point of time to another. When the issue addressed involves what difference a change in tourism makes to variables in the economy, this type of analysis is sufficient. However, when there is an interest in the adjustment process, for example, how long it takes for a shift in tourism flows to influence other variables in the economy, then a dynamic framework is required. Dynamics can be readily incorporated in CGE models, so that the development path of the economy, and changes from that path, can be investigated. Several CGE models are dynamic - for example, the most comprehensive model of the Australian economy, the MONASH model, is a dynamic one (Adams & Parmenter 1992).

A recent development in economics has been that of "endogenous growth" models (Van Sinderen & Roelandt 1998). These models rely on the existence of various external economies, by which one firm or industry can enhance the performance of other sectors in the economy. For example, lower transport costs may enable other industries to take advantage of economies of scale or gains from greater specialisation. It would be possible to build CGE models which take account of these effects. Alternatively, results from conventional models can be adjusted to take these effects into account. Oxford Economic Forecasting has estimated that aviation has a positive effect on the productivity of other sectors; when examining the impact of tourism changes, it adjusts the results of its models to take this effect into account (Oxford Economic Forecasting 1999).

Measuring Benefits or Welfare Gains

Typically, the impact on economic activity is much greater than the net welfare gain to members of the community (Dwyer & Forsyth 1993). This is because additional activity requires additional resources, and these are not costless. For most policy decisions, governments wish to know how much better off residents are as a result of some decision. For example, suppose a government is considering supporting a special event and it will require $1m of taxpayers' money to subsidise it, but if it goes ahead the addition to GDP will be $6m. Is this a worthwhile expenditure? The answer is that it is worthwhile if the net benefits are positive. If an event requiring a subsidy of $1m produces an addition to GDP of $6m and a net benefit of $2m, then it is worthwhile; however if the net benefit gain was only $0.8m (that is, less than $1 million in taxpayer subsidy required), it would be a poor investment, regardless of the impact on GDP.

If additional tourism is to produce net benefits for the destination, there will have to be some divergence between the prices paid and the costs of provision, either directly in the tourism industry or in other industries indirectly affected by it. There are several ways in which this could come about - prices may not equal costs, there may be externalities, there may be unemployment, and there may be terms of trade effects (Dwyer, Forsyth & Spurr 2003).

To measure the net benefits of a tourism change, we need to identify in what ways the revenues gained from additional tourism are not equal to the opportunity costs of the inputs used in supplying it. With tourism services, which are supplied in quite competitive markets, the prices charged for the outputs, and thus the value of the additional output, will tend to be close to the cost of supply, which in turn reflects the cost of the inputs used. To the extent that this is so, the net benefit from additional output will tend to be small, especially relative to the gross change in the value of output.

Once the importance of costs of supply is recognised, it is in principle straightforward to adjust outputs of a CGE model to take them into account (Dwyer, Forsyth, Spurr & Ho 2003). Indeed, some CGE models are explicitly designed to measure changes in welfare- see Dixon et al. (2002). To do so, one subtracts the cost of additional inputs used to produce the increase in activity. Thus the cost of additional labour used (wage by quantity), the cost of additional capital services and cost of additional natural resources must be subtracted from the change in the value of the increased economic activity, as measured by the change in GNP or National Income. Such a measure can be also be derived as an output of the CGE model simulations which were presented in Chapter Five. Thus, the authors have estimated a benefits measure for the economic impacts of tourism to New South Wales from different origin markets.

Application: Measuring the Benefits of Additional Tourism to NSW

The way in which CGE models can be used to evaluate the benefits from tourism can be illustrated by means of the following application to NSW. Benefits are measured by taking the change in real state/national income (which excludes income payable overseas) and subtracting the cost of additional factors employed.

The cases considered correspond to those in Table 1. Employment in Australia is allowed to vary – an interpretation of this might be that unemployment is the result of too high a real wage, which does not change when activity increases. As a result, employment increases.

In Table 6, the calculation of net benefits is shown. An increase of 10% in foreign tourism expenditure to

NSW only is supposed; this would result in an increase in revenues of $636m. Real GDP/GSP increases by less than this, since there is some crowding out of other industries. Some of this gain is due to additional inputs of labour, both in NSW and Australia. This is the main deduction required to obtain the net benefit of an assumed increase in tourist expenditure. Since this is a short run case, capital and land are fixed, and thus there are no additional payments to these. This would not be so for the long run case.

Table 6. Calculation of net benefits, 10% increase in international tourism to NSW ($m)

	New South Wales	Australia
Expenditure Change	636	636
Change in GSP/GDP	364	244
Cost of Additional Labour	268	165
Cost of Additional Capital	0	0
Cost of Additional Land	0	0
Change in Payroll Tax	9	6
Net Benefit Change	96	85

Source: Calculations as described in text

The net benefits arising from a range of different sources of changes to tourism in NSW are presented in Table 7. The benefits to NSW, and to Australia as a whole are shown. The first case, an increase in international tourism to NSW alone, is the same as that shown in Table 6. The second case is one in which intrastate tourism in NSW increases by 10%; it is financed by NSW residents reducing their expenditure on tourism to the RoA. NSW gains, but the RoA loses; there is an overall gain to Australia. Thirdly, the case of a 10% increase in interstate tourism from the RoA, financed by reductions in tourism expenditure in the RoA is shown. Again NSW gains at the expense of the RoA. There is an overall negative benefit for Australia as a whole. It may seem surprising that the second and third cases are so different; this can come about as a result of different expenditure patterns of tourists from NSW and from the RoA, and also from different industrial structures in NSW compared to RoA. Finally, the case of a 10% increase in international tourism to the whole of Australia is shown; both NSW and the RoA gain in this case.

Table 7. Net benefit: Different sources of additional tourism to NSW ($m)

Source		Expenditure Change	GSP/GDP Change	Net Benefit Change
International Tourism NSW Only	NSW	636	364	96
International Tourism NSW Only	Australia	636	244	85
Interstate Tourism to NSW	NSW	540	322	101
Interstate Tourism to NSW	Australia	0	-60	-14
Additional Intrastate Tourism	NSW	1032	734	235
Additional Intrastate Tourism	Australia	0	119	57
International Tourism to Australia	NSW	636	249	84
International Tourism to Australia	Australia	1710	720	231

Source: Calculations as described in text

The outputs of the CGE simulations can be adjusted to allow for considerations not captured by the model. It is not possible here to make estimates of externality costs and effects of underpriced infrastructure, but the size of the employment benefits may be approximated. The opportunity cost of labour in Australia (and elsewhere) is an unknown quantity; extra jobs are valuable to reduce unemployment, though those who gain the jobs incur costs as a result of this employment. The net gain to them is less than the wage they enjoy, though it is not zero. To illustrate how employment benefits could be incorporated, suppose that hitherto unemployed workers would be willing to work for two thirds of the market wage rate, but not below this. The difference this makes to the measure of net benefits is shown in Table 8. It is significant, indicating that measures of benefits are very sensitive to the view taken of how the labour market works.

Table 8. Calculation of net benefits: Alternative cost of labour ($m)

Source		Change in GSP/GDP	Benefit Change-Full Labour Cost	Benefit Change-2/3 Labour Cost
International Tourism NSW Only	NSW	364	96	185
International Tourism NSW Only	Australia	244	85	140
Interstate Tourism to NSW	NSW	322	101	178
Interstate Tourism to NSW	Australia	-60	-14	-29
Additional Intrastate Tourism	NSW	734	235	408
Additional Intrastate Tourism	Australia	119	57	80
International Tourism to Australia	NSW	249	84	84
International Tourism to Australia	Australia	720	231	398

Source: Calculations as described in text

Some observations are in order. As expected, the net benefits are significantly smaller than the changes in real economic activity. There is a net cost to states other than NSW in some simulations, as these states experience falls in economic activity as well. Given the scope for inaccuracy, it may be taken that other states neither gain nor lose much from an international tourism boom in NSW, though they do lose if tourism increases in NSW are at the expense of tourism in the RoA.

Other adjustments should ideally be made, although there are data limitations. Thus, it may be necessary to make some allowance for subsidised or unpriced services that are used by tourists, or by other industries which expand or contract as a result of the change. Whether this is necessary depends on how these services are incorporated into the CGE model. For example, is the level of road provision exogenous to the model, in the sense that the government is assumed to provide a certain amount of capacity regardless of road use? If so, some adjustment for greater use of roads as a result of tourism should be made. If the road services are already incorporated as inputs into other industries (for example, if an expansion in tourism results in greater provision of roads and the cost of this is deducted from the gain in State or National Income), no further adjustment is needed. Currently, in the model we are using, as with most other CGE models, there is no link between tourism demand and road use and road costs, though the model is being revised to incorporate such a link. It is necessary to also allow for externalities of tourism and all other industries if an accurate measure of net benefits is to be obtained.

There is no guarantee that the net benefit from additional tourism expenditure will be positive; it is perfectly possible that increased economic activity will lead to lower welfare for the community. This could come about if the cost of supplying inputs to enable the increase in activity were greater than the value of the increased production. A situation in which this could occur would be where foreign tourists purchased the output of a highly subsidised product; the revenue from the additional output could be below the cost of the inputs used. It is more likely, however, that the reverse will be the case, and that the net benefits from additional activity will be positive. This will tend to be the case when the output is taxed (as many tourism services are) and costs of inputs are below the value of output. If the value of the extra output is exactly equal to the cost of inputs used in supplying it, there will be no net benefit from the additional activity, positive or negative.

The approach adopted by the authors to net benefit estimation is that of adjusting the estimates of impacts on activity using the project's CGE model. The use of a CGE model is appropriate for this purpose since CGE models are recognised as the most rigorous means of estimating quantitative impacts in economies. It is particularly appropriate in the tourism context, because the benefits which tourism produces are the total of small gains and losses spread throughout the economy, and an economy-wide approach to evaluation is needed. The approach suggested is operationalised using a CGE model of the New South Wales and Australian economies. The outputs of this approach provide us with a means of applying cost benefit analysis to tourism policies; this yields a rigorous means of evaluating tourism policies that involve costs as well as benefits.

Chapter 9

Issues for Further Research

In this report, we have outlined how CGE models can be used to estimate the economic impacts and benefits of tourism generally. One experiment we conducted was of a change in tourism demand- this could come about because of natural growth, promotion, or a fall in the exchange rate. The model could equally well be used to track the impacts of a negative shock to demand, as occurred in September 2001. We also showed the relevance of the CGE approach to evaluating the economic impacts of special events. This is just the tip of the iceberg- there is a vast range of issues which can be explored using this technique. The agenda for future research in this area should be to extend the analysis to different tourism destinations, and to include detailed analyses of the appropriate behavioural characteristics of the economic agents that are included in model specification and of the government policy settings that determine the context for their behaviour. The outcome should be a model which can be used to analyse the economic impacts of a wide range of tourism market developments and scenarios and government policy options. We flag some specific topics here.

Economic Impacts of Different Types of Tourists

The studies which have been discussed in this report have each focussed on aggregate expenditure by all short-term visitors to various destinations. In Australia, data for inbound tourism is available in disaggregated form, both by country of origin and by purpose of visit. It would be relatively straightforward to produce disaggregated results showing the contributions by various visitor groups (eg. holiday, business, VFR travellers) to total expenditure and hence to the economic impact of changes in expenditure. Another, and perhaps more useful way to disaggregate the results would be to look at expenditure by groups of visitors according to length of stay, types of accommodation used and so on irrespective of country of origin. For example, as Skene (1993b) notes, it could be the case that the economic impact of younger, long stay, fully independent, budget travellers, is quite different from the impact of older, short stay visitors on high standard organised tours. Other special interest markets that could be explored might include cruising and conventions and meetings tourism.

Alternative Assumptions about the Economic Environment

There is a variety of assumptions about the economic environment which could be examined. For example, experience has shown that directing tax cuts to corporate taxes only is likely to be even more expansionary than adopting uniform labour and non labour tax cuts (Skene 1993b). CGE modelling allows us to specify the particular types of adjustments to the tax system made by government(s), whether or not constrained by a PSBR. Given differences in taxation regimes world-wide, there is scope for modelling international differences in tourism’s economic impacts based on assumptions regarding local taxation structures.

Also, investment in the simulations reported above is only keeping pace with demand driven changes in economic activity. There is no examination of the effects of, say, a tourism-related investment boom, with associated 'crowding out' of other activity (Dwyer & Forsyth 1994). Analysis with a CGE model is one way to assess the economy-wide effects of more tourism-oriented investment, including the merits of domestic versus foreign investment. There is still much confusion about the impacts of foreign direct investment in tourism on a host economy (Dwyer & Forsyth 1996). Since construction is a ‘local industry’, dollar for dollar it may have greater expansionary impact on regional locations than tourist expenditure.

The economy-wide framework can also provide a treatment of various distortions that operate in the economy to influence the provision of tourism services and other goods and services. It may be that the economic contribution from foreign tourism can be enhanced more effectively by removing existing impediments to its development - impediments that are serving no useful economic purpose - than by devoting additional scarce resources to promoting a country as a tourist destination. Some, such as domestic taxes, tariffs on imports and wage-cost loadings, operate to raise prices of tourist services and hence discourage their consumption. Others, such as restrictions on shopping hours or air service agreements, discourage consumption of tourism services directly. Use of CGE modelling can help determine how important such factors are in influencing the economic contribution of tourism (Centre for International Economics 1989).

Incorporating Environmental Costs of Tourism

Further, there may be social, environmental and other costs not picked up in a CGE model that are perhaps, not being outweighed by the benefits of tourism. Conventional CGE modelling does not incorporate the costs of environmental degradation or loss of scenic attractions that are valued by consumers for their contribution to quality of life, but which do not enter into industry costs of production. Nor does I-O analysis. But, in indicating changes in the mix of industries associated with tourism growth, CGE modelling does provide a superior basis for undertaking cost benefit analysis than does I-O modelling. CGE modelling, with its fuller supply side specification can provide the basis for an environmental impact assessment and a more balanced assessment of the costs and benefits of tourism.

Measuring Regional Impacts

With respect to the impacts of increased inbound tourism on regions using CGE models, the relative merits of different CGE approaches needs further study. Madden and Thapa (2000) claim that, as well as modelling differences in industrial patterns and local multiplier effects which are picked up by other methods, their approach takes into account differences in sales and cost patterns of individual industries in different regions thereby providing a better modelling of the regional effects of international tourism. They also claim that their method is capable of providing more information about interregional differences in the effects on prices and investment. These issues need further exploration.

Economic Impacts of Tourism in Developing Countries

While the examples used for illustrative purposes in this paper have primarily been Australian, the results hold generally for all tourism destinations. It seems fair to say that discussions of the economic impacts of tourism undertaken in studies world-wide have not, in general, reflected any detailed awareness of many of the issues addressed in this paper. Certainly the use of CGE modelling of tourism's impacts is sparse outside of Australia. The challenge for tourism researchers and planners is to extend use of the technique to the study of tourism growth in both developing and developed countries and to regions within them.

The results would seem to have particular relevance for tourism expansion in developing areas (Sugiyato, Blake & Sinclair 2002). The discussion reveals that achievement of standard economic objectives from tourism growth - increased household incomes, employment, foreign exchange earnings, increased government taxation base for financing development, and so on - may not be as straightforward as the literature has tended to imply. While the policy emphasis has thus far been on reducing leakages of tourist expenditure and the forging of stronger links between tourism and other sectors (Dwyer 2000), the overall industry mix in tourism destinations, and its implications for tourism's economic contribution to development, requires much more attention than it has hitherto been accorded by researchers. The results also reveal the essential interdependence between sectors in the development process. No longer can it simply be assumed, without attention to the mix of industries in a given destination, that tourism growth is a 'catalyst for', or even necessarily compatible with, growth in other economic sectors. No longer can emphasis be placed on the growth of this one particular sector while neglecting the impacts that its growth will have on other sectors.

Economic Impacts of Outbound Tourism

The way in which the tourism sector is being handled in the model is being refined, allowing for explicit treatment of categories such as Australian outbound tourism (a substitute for domestic tourism). The outbound tourism sector seems to have been much neglected by researchers and its economic effects largely un-examined.

Analysing the Taxation of Tourism

The model as constructed incorporates a detailed tax structure. It is feasible to make this structure more detailed however, if, for example, a new tax on some aspect of tourism were levied. This makes the model highly suitable for investigating tourism taxation issues. Using the model, it is possible to assess how heavily tourism is taxed in New South Wales and in Australia generally, and to compare this level of taxes with those of other sectors. This is possible for both tourism as an export industry and as a supplier to the domestic market. The model may be used to assess the economic impacts of changes in taxation, both general taxation as it affects the tourism industry, and in specific tourism taxes. The results from such studies can be used to examine how packages of taxation and support designed for the industry will impact on the industry itself, and on the economy more widely.

Assessing the Economic Impacts of Specific Sectors

It is well recognised that different tourists have different impacts. Indeed, there has been a long standing interest in the "yield" of different tourists (Dwyer & Forsyth 1997). CGE models provides a means of analysing this issue. Different tourists have different impacts on the economy because their expenditure levels and patterns differ. Impacts on specific variables, such as government revenue, can differ because tourists spend different proportions of their budget on the highly taxed commodities such as fuel (domestic tourists spend more on fuel than do international visitors). It has already been seen (in Chapter 5) that the impacts on GDP of different sources of tourists (interstate, inbound) can differ significantly. The impacts of different tourists, such as cruise tourists, backpackers, and tourists from different countries, on output, employment and on government revenues can be estimated using the model.

Aviation Policy Changes

Aviation policies can impact on tourism flows and expenditure, and thus they will have impacts on the economy. With many aviation policy questions, the main issue may well be that of how they will affect tourism and thus the economy. For example, consider the proposed strategic alliance between Qantas and Air New Zealand- one of the key issues which policy makers will face will be that of whether it stimulates tourism, and if so, what the benefits from doing this will be. These benefits will need to be set against any costs to the economies that the alliance may bring. The model provides a means of assessing the impacts of the alliance on output and employment, and the net benefits which result. The model can be used for analysing a broad range of aviation questions, such as what the benefits and costs of opening up a previously restricted route market will be.

Evaluating Tourism Promotion

The main benefit from spending on tourism promotion comes about because more tourists come and they spend more. It is possible to make estimates of how promotion impacts on tourism flows and expenditure. However, this is not enough to answer the question of whether promotion is worthwhile. Is $100 spent to attract an additional tourist a good investment or not? To answer this question, it is necessary to determine what benefits for the economy the additional tourist brings (Dwyer & Forsyth 1994). The model provides a means of determining this, since it can estimate the impacts on output and employment, and the net benefits from changes in these can be calculated.

Exploring the Infrastructure Requirements of Tourism Growth

Tourists use the infrastructure, both that provided by local governments, such as beaches and parks, and by higher level governments, such as roads. Providing infrastructure is costly- sometimes infrastructure is charged for (eg. airport services) and sometimes it is not (most roads in Australia). It is possible to use the model to explore infrastructure questions. Where users pay for the infrastructure they make use of, the infrastructure is already built into the model. A major extension of the model, currently underway, is to incorporate unpriced infrastructure (such as roads) into it. CGE models do not invariably build this link into their structure; however, when models are used to examine the impacts and benefits of tourism, it is important that the link be recognised. By doing this, more accurate measures of economic impacts and benefits of tourism can be obtained. It will also make it possible to use the model when forecasting the infrastructure requirements of tourism growth.

Estimating the Implications of Tourism Growth for Resource Use

The tourism industry requires resources that are in scarce supply, such as water and energy, and tourism growth will have implications for resource use. However this relationship is not simple since an increase in tourism could even lead to less water or energy being used. This is because of the inter industry effects of the growth of one sector in the economy such as tourism. As has been shown earlier, some industries will contract as a result of tourism growth, and their use of resources will decline- the net impact is not apparent *a priori*, as it depends on which industries expand and contract, and their water or energy intensiveness. The model provides us with a means of estimating the direct and indirect effects of tourism growth on the use of resources.

Changes in Tourism Competitiveness

Tourism competitiveness changes for many reasons. Australia’s tourism competitiveness may fall if its exchange rate rises. Productivity growth in the tourism sector, the arrival of low cost airlines lowering air fares, and the price level changes in other countries can all affect tourism competitiveness (Dwyer & Kim 2003). With information about demand elasticities, it is possible to estimate the changes in tourism flows and expenditure as a result of changes in competitiveness, and then it is possible to use the model to estimate the economic impacts. Is a rise in tourism competitiveness desirable from Australia’s overall point of view? Using the model, it is possible to answer this question.

Tourism Satellite Accounts

Where CGE models have been applied to tourism in the past they have generally been used for analysing economic impacts and policy options at the national level. While the model developed under this project is equally at home being used for Australia as a whole, it is of particular interest for its capacity to be used for applied analysis at the state level. So far it has been developed for the state of New South Wales but its application to other Australian states would be relatively straight forward, requiring only the input of appropriate tourism data. An interesting side benefit of this is the potential to simultaneously develop state level Tourism Satellite Accounts as a spin off from the CGE model development. These state level TSAs would be fully consistent with the model and thus with outcomes from its application. They would also be consistent with the national TSA developed by the Australian Bureau of Statistics which was drawn on to develop the tourism data component of within the model. A consequent opportunity presents itself for analysis of tourism impacts and policy options, which incorporate fully consistent comparisons between Australian states and between any one state and the nation as a whole.

Chapter 10

Conclusion

As a result of the development of more sophisticated modelling techniques in recent years, the economic impacts of tourism is set to become a more fertile ground for research. In a CGE model which incorporates a realistic set of economy wide constraints, the effects of tourism growth cannot be anticipated a priori - the increased output of the tourism industry may be more than offset by contractions in output elsewhere in the economy and effects on the trade balance depend on whether the net increase in aggregate demand is greater or less than the increase in domestic demand.

As a result of these considerations we conclude that, in a CGE model which incorporates a realistic set of economy - wide constraints, the effects of inbound tourism growth cannot be anticipated *a priori*.

The discussion has also shown that the use of I-O modelling to estimate economic impacts provides only a partial, and sometimes misleading, picture. CGE models can allow for detailed inter-industry analysis together with supply-side constraints and an active price mechanism. They also include more general specifications of the behaviour of consumers, producers, investors, and employees than those allowed for in I-O analysis, as well as flexibility in allowing for different macroeconomic policy stances of government. CGE modelling explicitly recognises the 'crowding out' effects that occur when the expansion of one industry has an adverse impact on others. The effects of increased inbound tourism on income and employment in an economy are very much also dependent on the assumptions made about the workings of labour markets, the effect on the exchange rate, and current government policy.

The relevance of the findings here go beyond their immediate interest to tourism economists. They demand the attention of tourism planners and tourism marketers as well as public policy makers. Tourism continues to be regarded by many public sector policy makers as a catalyst for economic development. In various tourism destinations around the world, tourism planning continues to be based on estimates of economic potential that ignore the effects of tourism development on industry composition The implications for tourism planning arise from the realisation that, since tourism growth can impact adversely on the size of other industry sectors, it no longer suffices to consider the economic impacts of tourism in isolation from inter- industry effects.

To be credible, assessments of tourism’s economic impacts will need to be made using best practice techniques, such as CGE analysis, rather than techniques with acknowledged limitations.

Appendix A: The M2RNSW Model

The model used in this study to estimate the contribution of tourism to the NSW economy is the M2RNSW model, which is a modified version of the M2R model the basic of which is an adaptation of the Monash Multi-regional Forecasting (MMRF) model of Australia. A detailed description of the MMRF model is given in Naqvi and Peter (1996). See Han, Madden and Pant (1998) for a description of M2R (NSW).

The MMRF model contains a full multi-regional specification and data base for Australia, defined at the level of eight regions (comprising the six states and two territories of Australia). A two-region model is created by preserving the separate identity of only the New South Wales state, while all the remaining seven regions of MMRF are aggregated into a single RoA region. The two region model, which we label M2RNSW , is an adaptation of the standard MMRF model with the number of regions reduced to two (NSW and the RoA), but with a larger degree of industry disaggregation. An industry classification of 42 non-tourism industries is used for the M2RNSW model, which is then extended to a 56 industry tourism version of the model by introducing fourteen (14) tourism industries. These fourteen new tourism industries are distinguished by the source of the traveller (4 categories: intrastate, interstate, overseas and outbound) and the purpose of travel (4 categories: holiday, visiting friends & relatives, business & conference, other; for the outbound there are only two purposes: business and households). Each of these new tourism industries purchases a range of products from the *42* standard industries identified in the model, and on-sells them to the actual travellers at cost price. This level of disaggregation of total tourism expenditure is important because the expenditure pattern and the extent of substitutability with other consumption goods vary among the fourteen components of total tourism expenditure.

There is also a representative household in each region, together with a state government. The Commonwealth Government is modelled as interacting with each region, providing public services, taxing and distributing transfer payments.

Assumptions

Behavioural

All industries in both regions are modelled as minimising the costs of producing a given level of output insofar as their production technology and the input prices they face will permit them. Producers thus choose their inputs in accordance with the relative price and substitutability of the inputs.

The fourteen tourism industries are so-called “dummy industries”. They assemble tourism goods from the various standard industries and on-sell them to the travellers at cost. Such a treatment of the tourism industry implies that there is no value added directly created in the 14 dummy industries and hence the capital stock, employment and other components of value added need not be estimated. The resulting CGE model can focus on the tourism industries purely from the demand side.

The representative regional households in the model divide their disposable income between expenditure on goods and services and savings. They maximise the satisfaction they can obtain from their expenditure budget by making purchases in accordance with the pattern of their preferences and of relative prices.

The model assumes that goods and services from different sources (local, interstate, and overseas) are not perfect substitutes. The model also covers the behaviour of investors (who allocate their investable funds to attempt to maximise their rate of return), import and export agents, and, as indicated above, two tiers of government.

For specifying the tourism version of this model, the core task consisted of preparing a column of final demand for each of the 14 artificially created tourism industries in each region and to re-balance the two region data base for all other industries and agents specified.

Structural

The results of the contribution simulations are, as with all economic modelling, conditioned by the various assumptions underlying the model. While there are many such assumptions, the macroeconomic assumptions are the key to the broad nature of the results. The main assumptions for the simulations reported here are:

- in the long run, the rate of unemployment for the Australian economy is not affected by changes in the level of aggregate demand. It is assumed that the national unemployment rate is determined in the long-run by labour market conditions, population levels etc., with changes in the level of the aggregate demand for labour being fully accommodated by changes in the national real wage rate. It is further assumed that changes in regional population (via changes in interstate migration rates) act to equalise the level of unemployment between regions;

- tourism expenditure in the long-run does not affect the real rate of return on capital; tourism expenditure affects the real exchange rate through movements in domestic prices, with the nominal exchange rate and import prices held fixed. In reality there may be some effect of tourism on the nominal exchange rate, but this would simply alter the balance in the effect on the real exchange rate between changes in the domestic price level and the nominal exchange rate. The effects on the real exchange rate and other economic variables are not altered by this assumption.

- in the long-run the Australian government sterilises the effect of tourism on the balance of trade by appropriate tax policy. This assumption only alters the compositional distribution of real GDP. That is, it merely turns any positive effect of tourism on the nation's trade balance into real consumption benefits.
- real state government current consumption varies in accordance with state population. This contrasts with the normal assumption of government consumption altering by the same percentage as private consumption. The relevant MMRF equation was altered in this case, as were the equations relating to current and capital grants from the Commonwealth. These grants were made to move in line with the state population and the government's price index.
- there are no long-term effects of tourism on the NSW and RoA public borrowing requirements, with both governments altering tax rates to accommodate this.

The Tourism Model Database

A major database task was required to implement the two-region tourism CGE model. For each of the fourteen tourism industries, the total expenditure of that tourism category was decomposed by the 42 standard commodities of the model. Then, expenditure on each commodity was split between the three geographical sources of supply for each commodity (NSW, RoA and overseas). Following this, the purchasers' price of each commodity from each source was split into its basic price received by the producer, the price component due to the different types of margin services, eg. transport costs, retail and wholesale mark-ups, and insurance costs, and the price component due to state and Commonwealth taxes. The new tourism industries were then subtracted from existing values of industries' rows and columns of the standard M2RNSW data-base. Finally, it was necessary to reconcile any incompatibilities between the tourism data and the original database, and to re-balance the new database.

In the M2RNSW model, the database has been updated and its base year is 2000-01. Further, the tourism data was derived by using the information from the BTR (Bureau of Tourism Research) and ABS's TSA (Tourism Satellite Account) of Australia. The model's tourism database has been made consistent with the TSA data.

Solution

The model was solved using an Euler multistep solution procedure designed to minimise any linearisation errors using the GEMPACK program (Harrison & Pearson 1996).

Appendix B: Economic Impacts of Tourism to New South Wales and the Rest of Australia

The manner in which the economic contribution of tourism in NSW is simulated is to estimate the effects on the NSW economy of tourism expenditure being increased by 10 percent (the increase in tourism demand can come from overseas or domestic tourists). The contribution of tourism is then taken as the difference between the values of the economic variables actually observed (with 10 percent increase in tourism demand from a particular origin market) and values that would have been observed in the complete absence of the demand increase.

Assumptions

Assumption of Uniform Increase in International Tourism across Australia

For overseas tourism, with a uniform increase in tourism demand for Australia, the simulations assume that foreign demand for Australia as a tourist destination increases by 10 percent (= $ 1.71 billion, using 2000-01 tourism data from the TSA) and is evenly distributed across the six Australian states plus two territories according to their existing market shares. NSW, with 37.2 per cent of the Australian inbound tourism market thus gains 37.2 per cent of the increased tourism expenditure (representing an increase of $635.9 million) with the remaining 62.8 per cent allocated to the RoA. If the result of this simulation is that the 10 percent increase of overseas tourism is estimated to change an economic variable in New South Wales by *x* per cent, then the contribution of a 10 percent increase in overseas tourism to that variable is deemed to be *x* per cent. The same technique is applied to project the effects of increased tourism expenditure to NSW from other origin markets.

Assumption of Increase in International Tourism to NSW only

In the simulations the effects of a ten percent increase in international tourism to New South Wales assume constant demand for tourism to the RoA. In these simulations the State is assumed to gain 100% of the increased tourism expenditure to Australia.

Assumptions with 10% Increase in Interstate Tourism to NSW

In the case of the additional expenditure on interstate tourism to NSW from RoA, this can come at the expense of RoA's intrastate tourism (to compensate for the increase in interstate tourism) or through RoA's reduced expenditure on non-tourism goods and services. In the first case, where full substitution from the RoA's intrastate tourism is assumed, the increased tourism is proportionate to each other state's market share of interstate tourism to NSW.

Assumptions with 10% Increase in NSW Intrastate Tourism

The scenario for increased intrastate tourism in NSW presents a particular complication in that the additional expenditure can come at the expense of interstate tourism (i.e. NSW tourism expenditure in RoA) or through reduced expenditure on non-tourism goods and services purchased from all sources (local New South Wales and imported).

The economic simulations are based on four key assumptions about the federal government fiscal policy stance, two key assumptions about the wage setting environment, and four key assumptions about the aggregate level of employment.

Assumptions about Government Fiscal Policy Stance

The economic contribution of increased inbound tourism to a destination will depend on the nature of current government policy. When there is an increase in tourism demand, there is likely to be a change in the government's budgetary position. Tourists buy goods and services that are taxed and this adds to government revenue. Other industries will also expand or contract and, depending on the tax rates in different industries, there can be a positive or negative overall impact on government revenue.

Suppose an increase in tourism expenditure has a positive effect on revenue - the government will need to determine how it is going to respond, and its choice will affect economic activity. It could allow the budget surplus (deficit) to increase or decrease. It could increase expenditure, with consequent further impacts on economic activity. Alternatively, it could cut tax rates, also having an impact on activity. In analysing the impacts of additional tourism expenditures, we need to allow for the different possible responses by the governments that find their fiscal position altered. There is flexibility in CGE modelling to allow government revenue and expenditure to change independently. The gap between aggregate revenue and expenditure is filled by a broad measure of public borrowing.

In the specific simulations reported in this paper, the assumptions about the *Federal and State government fiscal policy stance* were:

- The budget deficits (government expenditure less government revenue) are variable, but income and payroll tax rates are fixed.
- The budget deficits are fixed, but income and payroll tax rates can vary (Neutral budget deficit).
- The budget deficit is variable, income and tax rates can vary, but nominal government consumption and investment expenditure is fixed.
- The budget deficit is variable; income and tax rates can vary but real government consumption and investment expenditure, and subsidies, are fixed.

Assumptions Relating to the Wage Setting Environment

The economic impacts of an increase in inbound tourism in the State of NSW will depend critically on the assumptions made about the extent of wages flexibility in the economy. The effects of tourism growth on macroeconomic and microeconomic variables in NSW will differ according to the ability of the tourism sector to obtain labour without resulting in higher wages (that is, whether or not there is a pool of unemployed labour ready to move into the tourism industry).

Specific assumptions are as follows:

- Fixed real wage (defined as the average nominal wages received by workers in the State of NSW divided by the national CPI), with flexible State real wage (deflated by State CPI). Nominal wage rates received by workers in NSW are assumed to move with the national CPI. In this case, employment is free to vary.
- Flexible real wage (defined as the average nominal wages received by NSW workers divided by the national CPI), with flexible State real wages (deflated by NSW CPI).) - this assumption corresponds to the fixed employment cases.

Assumptions relating to the Aggregate Level of Employment

These are:

- Fixed national employment and fixed regional aggregate employment (and unemployment).
- Fixed national employment with variable regional employment/unemployment

In some of the long-run simulations it is assumed that there can be different movements in regional unemployment rates, regional labour supply and population and interregional migration. Some long-run simulations also assume a fixed national population. Thus,

- Fixed national aggregate employment

Specific assumptions include:

- Fixed state labour supply and population
- Flexible state unemployment rates
- No changes in interstate migration
- Fixed state employment rates
- Flexible state labour supply and population accommodated by interstate migration
- Fixed national population

The projected impacts of the increased tourism were found to differ according to the type of visitation, and the particular macroeconomic policy context. They also depend on whether a short-run or long-run perspective is adopted.

Short Run Simulations

Table 9 provides a summary of the maximum impacts of the set of simulations for each type of tourism increase undertaken by Dwyer, Forsyth, Spurr and Ho (2002) The table shows key impacts for NSW, for the RoA and for (total) Australia (NSW plus RoA). These short run simulations assume that industry capital stocks are fixed and that there are no changes in industry investment.

Table 9. Summary of maximum impacts on New South Wales and RoA of simulations of ten percent increase in tourism, short run, 2000-01

Source of Increased Tourism Expenditure		**Increased Tourism Expenditure**	**Impact on Real Gross State Product**		**Impact on Employment**	
		A$ million	A$ million	per cent	jobs	per cent
Intrastate tourism in NSW substituted for NSW tourism in RoA	NSW RoA Australia	1,032 -1,032 0	734 -615 119	0.308 0.142 0.018	11,238 -10,891 347	0.369 -0.179 **0.017**
Interstate Tourism to NSW with full substitution from RoA expenditure on other G&S	NSW RoA Australia	540 0 540	382 -210 172	0.160 -0.049 0.026	6,111 -3,772 2,338	0.201 -0.062 0.032
Interstate tourism to NSW with full substitution from tourism in RoA	NSW RoA Australia	540 -540 0	322 -383 -60	0.135 -0.089 -0.009	4,992 -6,672 -1680	0.164 0.110 -0.012
International tourism to NSW	NSW RoA Australia	636 0 636	364 -121 244	0.153 -0.028 0.107	6,012 -2,736 3,276	0.197 -0.045 0.042
Intrastate tourism in NSW substituted for other goods and services	NSW RoA Australia	1032 0 1032	354 168 522	0.148 0.039 0.078	4,998 3,696 8,694	0.164 0.061 0.098
International tourism to Australia	NSW RoA Australia	636 1,074 1,710	249 471 718	0.104 0.109 0.107	3,666 8,013 11,679	0.120 0.132 0.128

The estimates in Table 9 assume a fixed budget deficit and fixed income real wages and a fixed nominal exchange rate. In reality there may be some effect of tourism on the nominal exchange rate, but this would simply alter the balance in the effect on the real exchange rate between changes in the domestic price level and the nominal exchange rate. The effects on the real exchange rate and other economic variables are not altered by this assumption.

An assumption about the flexibility or fixity of real wages is needed because the effects of tourism growth on macroeconomic and microeconomic variables in a tourism destination differ depending on the ability of the tourism sector to obtain labour without resulting in higher wages (that is, whether or not there is a pool of unemployed labour ready to move into the tourism industry). Employment generation is generally greater where real wages are fixed, irrespective of the government’s fiscal policy stance. Real wages may be fixed if there is unemployment in the economy or if there are no shortages of labour with the skills necessary to serve the increased demand for tourism goods and services. The assumption of fixed real wages implies that the supply of labour to all industries is perfectly elastic. That is, the supply can be increased indefinitely without an increase in real wage levels. With labour prices constrained, most of the adjustment in the labour market occurs in the transfer of persons from unemployed or outside the workforce, to employment. It also implies that any initial price pressure reflected in the Consumer Price Index leads to an increase in money wages sufficient to maintain a constant level of real wages.

The economic contribution of increased inbound tourism to a destination will also depend on the nature of current government fiscal policy. When there is an increase in tourism demand, there is likely to be a change in the government’s budgetary position. Tourists buy goods and services that are taxed and this adds to government revenue. Other industries will also expand or contract, and, depending on the tax rates in different industries, there can be a positive or negative overall impact on government revenue.

Suppose an increase in tourism expenditure has a positive effect on revenue- the government will need to determine how it is going to respond, and its choice will affect economic activity. It could allow the budget surplus (deficit) to increase or decrease. It could increase expenditure, with consequent further impacts on economic activity. Alternatively, it could cut tax rates, also having an impact on activity. In analysing the impacts of additional tourism expenditures, we need to allow for the different possible responses by the governments that find their fiscal position altered. There is flexibility in CGE modelling to allow government revenue and expenditure to change independently. The gap between aggregate revenue and expenditure is filled by a broad measure of public borrowing.

In an environment of fixed real wages, the largest gains in employment and real GDP occur when the government fixes the budget deficit. With real government borrowing fixed, any projected changes in government revenue and expenditure have direct implications for rates of income and payroll taxes. Average tax rates are projected to fall, stimulating economic activity and generating employment. From the production side, the cut in the payroll tax rate reduces the price of labour, leading to a further decrease in the product real wage. From the demand side, the cut in the income tax rates contributes to an increase in the household disposable income, leading to a larger increase in household real consumption and hence a larger expansion in employment.

In the short run simulations undertaken, the most expansionary government policy stance is that where the (Federal and State) government budget deficits are fixed and income and payroll tax rates can vary. These results appear in Table 9. The fall in average tax rates in these simulations results in the largest increases in real household disposable income and real household consumption, leading to the largest increase in employment and the largest change in real GDP. In respect of the budget deficit itself, the most improvement in the deficit occurs when nominal government consumption and investment expenditure is fixed, regardless of whether real wages are fixed or variable.

Interestingly, in the simulations undertaken by Dwyer, Forsyth, Spurr and Ho (2002), the greatest gains in NSW GSP and employment were associated with an increase in intrastate tourism by NSW residents. The additional expenditure replaced that which would otherwise have been spent on interstate tourism by NSW residents to the RoA. In the simulations undertaken, Real GSP in the State increased by 0.308 per cent while employment increased by 0.369 per cent. The next highest impact markets are, in order, interstate tourism (with full substitution from RoA expenditure on other goods and services), international tourism to New South Wales, and intrastate tourism by NSW residents, where the additional substitution replaces that which would have been spent on other goods and services, and finally interstate tourism to NSW (with full substitution from intra-tourism in RoA). International tourism to Australia is associated with the smallest effects on the State, with impact on GSP and employment of 0.104 per cent and 0.120 per cent respectively.

Table 9 reveals that those markets that potentially contribute the largest gains to the State may produce lower impacts to the RoA and Australia. For only two origin markets- an increase in international tourism to Australia, and an increase in intrastate tourism substituted for other goods and services, are the gains positive for both New South Wales and RoA. In each of the other cases, the RoA suffers reduced Real GSP and employment. However, for Australia as a whole, that is including the effects in NSW, the results are positive in five of the six scenarios. In the case of increased interstate tourism to New South Wales with full substitution from intra-tourism in RoA, the nation as a whole experiences reduced GDP and employment.

Comparison of Results by Source of Change

Since the base volume of tourist expenditure is different for each origin market the assumed ten per cent increase in tourist expenditure implies different increases in tourist expenditure in New South Wales. The initial expenditure changes, which range between $540 million for the interstate tourism market, $636 million for the international tourism scenarios, and $1,032 million for the intrastate scenarios, are shown in Column Two of Table 9. To provide a more meaningful comparison of the differential impacts of expenditure injections from the different origin markets we can estimate the economic impacts on the State of a one million dollar change in tourist expenditure. The estimates are set out in Table 10, which provides a summary of the maximum impacts of the set of simulations for each type of tourism increase for the short run.

Table 10 reveals that a one million dollar increase in tourism expenditure in New South Wales from intrastate tourism, substituted for RoA interstate tourism, or a similar increase in interstate tourism to NSW, substituted for RoA expenditure on non-tourism goods and services, have the greatest impact on GSP and employment in the State at A$711,000 in GSP and 10.89 jobs and A$707,000 in GSP and 11.32 jobs respectively. The next highest impact market interstate tourism substituted for intra-tourism in RoA (A$597,000 and 9.24 jobs). The next largest gains in GSP and employment come from international tourism to New South Wales (A$573,000 and 9.45 jobs). Interestingly, the second smallest job creating tourism market for the State (but not for the nation) is international tourism to Australia. At A$393,000 GSP and 2.14 jobs created per one million dollars expenditure this is below the impact of intrastate tourism with full substitution from other goods and services at A$343,000 and 4.84 jobs).

Table 10. Economic impacts of $1 million increase in tourist expenditure by origin market, short run, 2000-01

Source of Change in Tourist Expenditure		Increase in GSP /GDP per $1 million Increase in Tourism Expenditure	Increase in Employment per $1 million Increase in Tourism Expenditure
		$ million	jobs
Intrastate tourism in NSW substituted for NSW tourism to RoA	NSW Australia	0.711 0.115	10.89 0.34
Interstate tourism to NSW substituted for other G&S	NSW Australia	0.707 0.319	11.32 4.33
Interstate tourism to NSW substituted for tourism in RoA	NSW Australia	0.597 -0.111	9.24 -3.11
International tourism to NSW	NSW Australia	0.572 0.383	9.45 5.15
International tourism to Australia	NSW Australia	0.393 1.289	5.76 18.36
Intrastate tourism in NSW substituted for other G&S	NSW Australia	0.343 0.506	4.84 8.42

Table 10 also reveals which of the selected markets generate the greatest impacts for Australia per million dollar tourism expenditure increase. By far the greatest gains to GDP and employment for the nation as a whole are associated with international tourism ($1.289 million contribution to GDP and 18.36 jobs). This is followed by intrastate tourism in New South Wales substituted for other goods and services ($506,000 and 8.4 jobs respectively). The next greatest impacts for Australia are associated with international tourism to New South Wales ($383,000 and 5.15 jobs). This is followed by interstate tourism to New South Wales substituted for RoA expenditure on other goods and services ($319,000 and 4.33 jobs) and intrastate tourism in NSW substituted for interstate tourism to RoA ($115,000 and 0.34 jobs). For interstate tourism to New South Wales, substituted for intra-tourism in RoA, the impacts on Australia overall are negative (although the impact is small).

These differential impacts are associated with the different spending patterns of different types of tourists. The largest gains in GSP and employment for NSW come from intrastate and interstate tourism because domestic tourists spend relatively more on domestic goods and services than international tourists. The 10 percent increase in international tourism in NSW produces a better result for NSW than the case of increased international tourism to Australia also due primarily to a smaller increase in the price of output. Intuitively, the uniform case also generates high demand and output for RoA, leading to an increase in its prices. Since NSW also demands inputs from RoA, this contributes to an increase in NSW prices. As a result, the increase in real international exports in NSW, in the case of a 10 percent increase in international tourism in NSW, is larger than that in the uniform case, leading to a larger increase in employment and GSP.

Long Run Simulations

The long run is characterised by variable capital (capital stocks used by industries can be changed, and borrowing/lending abroad can be varied) and investment and variable real wages, nationally and regionally. The additional economic activity in the domestic economy, generated by the increase in tourism, generates an increase in investment and capital. In the simulations undertaken, the same assumptions were made regarding the government fiscal policy stance. National employment is assumed to be fixed while regional employment is flexible, implying that an increase in employment in one region (State or RoA), implies a decrease in employment in the other. Further, changes in regional labour supply are assumed to be accommodated by regional migration, implying no changes in regional unemployment in the long run.

In the simulations undertaken by Dwyer, Forsyth, Spurr and Ho (2002), the greatest impacts on GSP and employment in New South Wales, in the long run, for each of the origin markets, occurred under the assumptions of a fixed budget deficit, fixed national employment, fixed state unemployment rates, flexible state labour supply, and population accommodated by interstate migration. Table 11 provides a summary of these impacts.

Table 11. Summary of maximum impacts on New South Wales of simulations of ten percent increase in tourism, long run, 2000-01

Source of Increased Tourism Expenditure		Increased Tourism Expenditure	Impact on Real Gross State Product		Impact on Employment (% & number of jobs) and on Real Wages	
		A$ million	A$ million	per cent	Jobs	per cent
Intrastate tourism in NSW substituted for NSW tourism to RoA	NSW RoA Australia	1032 -1032 0	2,722 -2451 271	1.142 -0.567 0.040	33,343 -33,343 0	1.095% -0.549% 0 jobs Real Wages: $17.4 million
Interstate Tourism to NSW with full substitution from RoA expenditure on other G&S	NSW RoA Australia	540 0 540	1,440 -1282 158	0.604 -0.297 0.024	17,483 -17,483 0	0.574 -0.288 0 Real Wages: $45.8 million
Interstate tourism to NSW with full substitution from intra-tourism in RoA	NSW RoA Australia	540 -540 0	1,492 -1,339 153	0.626 -0.310 0.023	18,239 -18,239 0	0.599% -0.301% 0 Real Wages: $5.3 million
International tourism to NSW	NSW RoA Australia	636 0 636	1,366 -1,123 243	0.573 -0.260 0.036	16,672 -16,672 0	0.548 -0.275% 0 Real wages: $218.4million
International tourism to Australia	NSW RoA Australia	636 1,074 1,710	246 47 292	0.103 0.011 0.044	1,432 -1432 0	0.047% -0.024% 0 Real wages: $577.5 million
Intrastate tourism in NSW substituted for other goods and services	NSW RoA Australia	1,032 0 1,032	258 -224 34	0.108 -0.052 0.005	3,395 -3,395 0	0.112% -0.056% 0 Real Wages: $76.2 million

The projected gains for the long run simulations are greater than those for the short run, since increases in the CPI and the real exchange rate are relatively smaller than for the short run case. This reflects the fact that the capital stock is no longer fixed, and can be augmented to enable additional production. This can be funded by borrowing abroad given savings does not change much.

In these long run simulations, the national income real wage is endogenous. It is determined by macroeconomic circumstances rather than influenced by changes in sectoral demand and supply of the type analysed here. The state nominal wage rates are assumed to move by the same percentage, which is assumed to be equal to the percentage change in national CPI plus that in the national income real wage. With a fixed level of employment nationally, the increase in capital supplied to meet the additional tourism demand means an increase in the marginal productivity of labour. This produces a smaller change in output price and the CPI, and a larger increase in the income real wage and real household disposable income and consumption. As a result, there is a stronger increase in real GSP in New South Wales (Dwyer, Forsyth, Spurr & Ho 2002). The simulations confirm this for increases in intrastate tourism (with full substitution of tourism elsewhere in Australia), interstate tourism and international tourism to New South Wales.

Again, the greatest gains in State GSP and employment are associated with intrastate tourism, where the additional expenditure replaces that which would otherwise have been spent outside of the State. In the wider set of simulations undertaken, Real GSP in the State increased by 1.142 per cent while employment increased by 1.095 per cent. These increases are around three times the size of the projected increases in the short run. The next high impact markets are, in order, interstate tourism (on either substitution assumption), international tourism to New South Wales, intrastate tourism that replaces expenditure other goods and services in New South Wales, and international tourism to Australia. For increased intrastate tourism that replaced expenditure on other goods and services and for international tourism to Australia the long run effects on GSP and employment are smaller than the short run effects due to the higher real wage. In the short run, higher employment is associated with lower product real wage (equal to the nominal wage paid by producers minus the price of value added). In the long run, a lower level of employment is associated with the higher real wage.

Table 11, reveals that some of those markets that potentially contribute the largest gains to New South Wales in the long run may produce negative impacts to the RoA. For each different origin market there are negative impacts on GSP and employment in RoA. However the national results, for Australia as a whole, are positive in all cases.

Table 12 reveals that a dollar expenditure injection into New South Wales from interstate tourism substituted for intratourism in RoA has the greatest impact on GSP and employment in the State in the long run. An additional one million dollar expenditure from this market generates A$2.76 million GSP and 33.78 jobs. The next highest impact market is interstate tourism to New South Wales substituted for expenditure on other goods and services (A$2.67 million and 32.38 jobs respectively) followed by intrastate tourism to New South Wales substituted for tourism in RoA (A$2.64 million contribution to GSP and 32.3 jobs). Next in terms of gains in GSP and employment come from international tourism to New South Wales (A$2.15 million and 26.2 jobs). Once again, international tourism to Australia provides a relatively small boost to GSP and jobs in the State (A$0.387 million contribution and 2.25 jobs), while the smallest projected impacts on GDP are again associated with intrastate tourism with full substitution from other goods and services (A$0.250 million and 3.3 jobs).

Table 12. Economic impacts of $1 million increase in tourist expenditure by origin market, long run, 2000-01

Source of change in Tourist Expenditure		Increase in GSP /GDP per $1 million increase in Tourism Expenditure	Increase in Employment per $1 million increase in Tourism expenditure
		$million	jobs
Intrastate tourism in NSW substituted for tourism in RoA	NSW Australia	2.64 0.263	32.31 0
Interstate tourism to NSW substituted for other G&S	NSW Australia	2.67 0.293	32.38 0
Interstate tourism to NSW substituted for intra-tourism in RoA	NSW Australia	2.76 0.283	33.78 0
International tourism to NSW	NSW Australia	2.15 0.382	26.22 0
International tourism to Australia	NSW Australia	0.387 0.459	2.25 0
Intrastate tourism to NSW substituted for other G&S	NSW Australia	0.250 0.033	3.29 0

Table 12 also reveals which of the selected markets generate the greatest long run impacts for Australia per million dollar tourism expenditure. The greatest contribution to GDP is associated with international tourism to Australia ($0.459), increased international tourism to New South Wales ($0.382 million), interstate tourism in New South Wales substituted for other goods and services ($0.293 million), interstate tourism in New South Wales substitutes for tourism in RoA ($0.283 million), intrastate tourism in New South Wales substituted for tourism in RoA ($0.263 million), and lastly intrastate tourism to New South Wales substituted for other goods and services ($0.033 million)

Industry Effects

Underpinning the above results are the changes in output and employment of industries as a result of changes in the amount and patterns of tourism expenditure. The following represents a preliminary discussion of some of the main changes in employment in different industries resulting from increased tourism in different origin markets. Only the greatest percentage changes in employment are shown based on estimated changes in industry output.

Short Run

Table 13 indicates the positive short run impacts on employment for key industry sectors, while Table 14 indicates those key industries that experience negative effects on employment in the short run. The assumptions underpinning the results are the same as for the results in Tables 9 and 10.

Table 13. Positive employment effects on selected industries in New South Wales of a ten percent increase in demand for New South Wales tourism, by origin market, short run (%)

International tourism to Australia		International tourism to NSW		Interstate tourism to NSW with full substitution from intra-tourism in RoA		Interstate Tourism to NSW with full substitution from RoA expenditure on other G&S		Intrastate tourism in NSW substituted for NSW tourism to RoA		Intrastate tourism in NSW substituted for other goods and services	
NSW	**RoA**	**NSW**	**R0A**	**NSW**	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**
Air Trans 2.4087	Air trans 4.3474	Air Trans 1.7533	Air Trans 0.7312	Hotels 1.9493	Dwel l. 0	Hotels 1.9943	Air Trans 0.9493	Hotels 3.6300	Water trans 0.0153	Hotels 3.3752	Brown coal 0.4839
Hotels 1.4756	Hotels 1.2141	Hotels 1.5916	Welfare 0.0177	Air trans 0.6400		Air trans 0.8093	Trans serv 0.3036	Petrol. Ref. 0.9133	Dwell. 0	Petrol ref. 0.9987	Oil 0.3273
Educ. 0.4305	Cult/rec 0.4025	Educ 0.4659	Admin Other Serv 0.0064	Elect. Other 0.3010		Petrol refining 0.4115	Alum. Mag 0.0734	Retail trade 0.6871		Trans serv. 0.7903	Water trans 0.1830
Cult/rec 0.3855	Trans serv 0.3946	Rail trans 0.3943	Cult/rec 0.0058	Elect/gas 0.2989		Cult/rec 0.3888	Rail trans 0.0566	Elect. Other 0.6769		Road transp 0.3803	Urban gas dist 0.1536
Rail trans 0.3475	Educ. 0.3946	Road trans 0.3904	Dwelling 0	Elect. Supply 0.2977		Elect. Other 0.3696	Oil 0.0505	Elect/gas 0.6724		Min ore 0.2897	Elect. Black 0.1421
Road trans 0.3476	Road trans 0.3074	Cult/ rec 0.3771		Motor vehicles 0.2852		Elect/gas 0.3671	Min ore 0.0183	Urban gas dist. 0.6538		Motor veh 0.2885	Air trans 0.1507
Retail trade 0.3014	Retail Trade 0.2931	Retail Trade 0.3078		Elect. Black 0.2628		Urban Gas dist 0.3669	Const. 0.0007	Motor vehicles 0.6407		Cult/re c 0.2838	Elect. Black 0.1421

Table 14. Negative employment effects on selected industries in New South Wales of a ten percent increase in demand for New South Wales tourism, by origin market, short run (%)

International Tourism to Australia		International Tourism to NSW		Interstate tourism to NSW with full substitution from intra-tourism in RoA		Interstate Tourism to NSW with full substitution from RoA expenditure on other G&S		Intrastate tourism in NSW substituted for NSW tourism to RoA		Intrastate tourism in NSW substituted for other goods and services	
NSW	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**
Water trans -1.0503	Water trans -0.3422	Water trans -0.4515	Brown Coal -0.3674	Dwell 0	Hotels -0.970	Dwell 0	Brown coal -1.142	Air transp. -0.958	Hotels -1.788	Insure -0.3083	Dwell. 0
Metal prod -0.6688	Metal Prod -0.6056	Metal Prod -0.2245	Water trans -0.3045	Brown Coal 0	Brown Coal -0.744	Brown Coal 0	Elect. Brown -0.312		Air transp. -1.363	Elect. Supply -0.2367	
Other Manuf -0.5305	Oil -0.4384	Other Man -0.1828	Metal prod -0.2578	Oil 0	Elect. Brown -0.203	Oil 0	Urban gas dist -0.312		Brown coal -1.203.	Elect/gas -0.2214	
Chem -0.3747	Min ore -0.3256	Chem -0.0945	Oil -0.2028	Nat. Gas 0	Elect. Black -0.195	Nat. Gas 0	Elect black -0.279		Petrol. Ref. -0.391	Elect. Other -0.2214	
Alum Magnes -0.3423	Chem -0.3214	Agric -0.0275	Chem -0.1812	Elect. Brown 0	Urban gas dist. -0.195	Elect. Brown 0	Elect supply -0.274		Trans serv. -0.348	Repairs -0.2116	

Impacts on Industry in New South Wales

Industries in the State that experience the most positive growth in sectoral output and employment include Air Transport and Hotels. The state's Air Transport industry receives the greatest boost from the expenditure of international tourists, whereas hotel sector output and employment responds most positively to expenditure from interstate and intrastate markets. Expenditure by international tourists also generates positive growth in the outputs of industry sectors such as Education, Culture/Recreation, Retail Trade and Rail and Road Transport.

Interstate tourism to New South Wales impacts most positively on the output of Hotels and Air Transport and also Power Generation related industries. Intrastate tourism impacts positively on Hotels in the state but also on Petroleum Refining, Retail Trade, Motor Vehicles and Culture/Recreation. Again, there is a positive effect on employment in Power Generation.

Industries in the State that experience the most negative percentage decline in output and employment as a result of increased international tourism include Water Transport, Metal Products, Other Manufacturing, Chemicals, Agriculture and Aluminium/Magnesium. These are primarily import competing or export sectors. It is noticeable that, except for the growth in direct tourism employment in Hotels and Air Services, the percentage reductions in the traditional export and import competing sectors are generally higher than the positive increases in other industries.

For interstate tourism to New South Wales, , no industries within the State experience a decline in output or employment although Dwellings, Brown Coal, Oil, Natural Gas, and Electric Brown Coal, experience no change in these variables. For increased intrastate tourism funded by foregoing a trip to RoA, Air transport in New South Wales experiences a decline in employment. In the case where intrastate tourism to New South Wales is a substitute for expenditure on other (non tourism) goods and services, there is a decline in employment in several services sectors with the greatest reductions experienced in Insurance, Electric Power generation and Repairs.

Impacts on Industry in RoA

Several industries in RoA experience positive growth in sectoral output and employment from international tourism growth to Australia consistent with existing state market shares, and to a lesser extent, increased international tourism to the state. For the across- the- board international tourism growth, the state industry sectors most positively affected include Air Transport Services, Hotels, Culture/Recreation, Transport Services, Education, Road Transport and Retail Trade. For an increase in international tourism only to New South Wales, increased employment occurs only in the industry sectors of Air Transport, Welfare, Administrative Services and Culture/Recreation.

For increased tourism to New South Wales from domestic tourism (interstate and intrastate), there are no positive effects on the output of any industry in the RoA. As indicated in Table 13, the only industry with non-negative growth as a result of the increased domestic tourism to New South Wales was Dwellings with zero growth.

Industries in the State that experience the most negative percentage decline in output and employment in RoA as a result of increased international tourism include Water Transport, Metal Products, Oils, Mineral Ore, and Chemicals. For interstate tourism, industry sectoral employment most adversely affected in percentage terms include Power generation, Brown Coal, and, for tourism substituted for other tourism, Hotels. For intrastate tourism substituted for tourism outside the state, the largest percentage decreases in employment in RoA occur in Hotels, Air Transport, Brown Coal, Petroleum Refining, and Transport Services. For intrastate tourism that is a substitute for expenditure on other goods and services, there are no negative effects on industry employment in RoA.

Long Run

Table 15 indicates the positive long run impacts on employment for key industry sectors, while Table 16 indicates those key industries that experience negative effects on employment in the long run. The assumptions underpinning the results are the same as for the results in Tables 11 and 12.

Table 15. Positive employment effects on selected industries in New South Wales of a ten percent increase in demand for New South Wales tourism, by origin market, long run (%)

International tourism to Australia		International tourism to NSW		Interstate tourism to NSW with full substitution from intra-tourism in RoA		Interstate Tourism to NSW with full substitution from RoA expenditure on other G&S		Intrastate tourism in NSW substituted for NSW tourism to RoA		Intrastate tourism in NSW substituted for other goods and services	
NSW	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**
Air Trans 1.8659	Air trans 2.6669	Air Trans 2.3542	Dwell 0	Hotels 2.0314	Dwell. 0	Hotels 2.0145	Dwell 0	Hotels 3.627	Dwell 0	Hotels 2.805	Dwel l 0
Hotels 1.2349	Hotels 0.9421	Hotels 1.6774		Motor vehicles 1.4065		Motor veh 1.3417		Motor Veh 2.648		Petrol ref. 0.703	
Educ. 0.4401	Educ 0.2533.	Motor veh 0.9804		Air trans 1.1864		Air trans 1.1509		Retail trade 1.537		Motor veh 0.647	
Cult/rec 0.2997	Cult/rec 0.2415	Educ 0.9305		Cult/rec 0.7554		Cult/rec 0.7407		Cult/rec 1.507		Transp. Serv 0.557	
Retail trade 0.2971	Retail trade 0.2136	Retail trade 0.7404		Retail trade 0.7282		Retail trade 0.7091		TFC, wood, paper 1.333		Air transp 0.299	
Rail trans 0.1853	Health 0.1214	Cult/rec 0.6997		TFC, wood, paper 0.6874		TFC, wood, paper 0.6424		Food, drink 1.264		Road transp 0.283	
Road trans 0.1713	Road trans 0.0835	Health 0.6198		Food and drink 0.6443		Food, drink 0.6276		Wholesale Trade 1.164		Cult/ rec 0.247	

Table 16. Negative employment effects on selected industries in New South Wales of a ten percent increase in demand for New South Wales tourism, by origin market, long run (%)

International Tourism to Australia		International Tourism to NSW		Interstate tourism to NSW with full substitution from intra-tourism in RoA		Interstate Tourism to NSW with full substitution from RoA expenditure on other G&S		Intrastate tourism in NSW substituted for NSW tourism to RoA		Intrastate tourism in NSW substituted for other goods and services	
NSW	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**	**NSW**	**RoA**
Water trans -1.3091	Water trans -1.3120	Water trans- 0.0046	Water trans -0.6741	Dwell 0	Hotels -0.960	Dwell 0	Insure -0.428	Air trans -0.100	Hotels -1.838	Insure -0.339	Water trans -0.125
Metal prod -0.8478	Metal Prod -0.9734	Alum mag -0.0029	Metal prod -0.5915	Brown Coal 0	Petrol ref -0.446	Brown Coal 0	Retail trade -0.4228		Air trans -1.271	Repairs 0.167	Metal prod -0.121
Other Manuf -0.7684	Oil -0.9513		Oil -0.4979	Oil 0	Motor veh -0.407	Oil 0	Urban gas dist -0.397		Cult/ rec -0.759	Water -0.154	Hotels -0.106
Alum mag -0.6349	Alum mag -0.6769		Chem. -0.5133	Nat. Gas 0	Cult/ rec -0.398	Nat. Gas 0	Brown coal -0.370		Motor veh -0.737	Welfare -0.146	Chem -0.108
Min ore -0.5429	Chem -0.6326		TFC, Wood, paper -0.4478	Elect. Brown 0	Retail trade -0.394	Elect. Brown 0	TFC, wood, paper -0.367		Retail trade -0.684	Urban gas dist. -0.100	Air tranp. -0.101

Impacts on Industry in New South Wales

Industries in the State that experience the most positive growth in sectoral output and employment in the long run from each origin market include Air Transport and Hotels.

Expenditure from international tourism has the greatest percentage impacts on employment in Hotels and Air Transport. Other industries positively affected include Education, Culture/Recreation, Retail Trade, Rail and

Road Transport, Motor Vehicles and Health. Interstate and intrastate tourism, irrespective of whether it is a substitute for other tourism of for other goods and services, has the greatest percentage employment effects on Hotels, Motor Vehicles, Air Transport, Culture/Recreation, Retail Trade, TFC, Wood and Paper, Food and Drink, Transport Services and Wholesale Trade.

Industries in the state that experience the greatest percentage decline in employment in the long run from international tourism include Water transport, Metal Products, other Manufacturing, Aluminium Magnesium and Mineral Ores. For interstate tourism, regardless of what it is a substitute for, no industries in the state experience adverse employment effects in the long run. For the increase in intrastate tourism that substitutes for tourism to RoA, industries the only industry experiencing reduced employment is Air transport. For the increase in intrastate tourism that substitutes for expenditure on other goods and services, employment decreases most in percentage terms in Insurance, Repairs, Water, Welfare and Urban gas Distribution. Interestingly these are all service sectors.

Impacts on Industry in RoA

International tourism evenly distributed to Australian states according to existing market shares will lead to increased output and employment in Air transport, Hotels, Education, Culture/recreation, retail trade, Health and Road transport. For all other origin markets, there are no positive impacts on industry output and employment in RoA.

International tourism evenly distributed to Australian states according to existing market shares will lead to reduced output and employment particularly in Water transport, Metal Products, Oil, Aluminium Magnesium, Chemicals, and TFC, Wood and paper. These are primarily import competing industry sectors. For increased interstate tourism to New South Wales with full substitution from intrastate tourism in RoA, adverse output and employment effects occur in Hotels, Petroleum Refining, Motor vehicles, Culture/Recreation and Retail Trade. Where the increased interstate tourism is substituted for other goods and services, the largest percentage reductions in employment occur in Insurance, Retail trade, Urban Gas Distribution, Motor vehicles and TFD, Wood and paper. For increased intrastate tourism in New South Wales, irrespective of how it is funded, the largest percentage employment reductions occur in Hotels, Water transport, Air transport, Retail trade, Motor vehicles and Culture/Recreation. The adverse impacts on employment in RoA are greater for the case where intrastate tourism is substituted for tourism outside the state. This is to be expected as the RoA forgoes receipt of tourist expenditure when visitors remain within New South Wales.

The results reflect the particular industry structure of the State of New South Wales and RoA and depend on particular assumptions about labour and capital markets, exchange rate movements, and government fiscal policy. However, they have general significance. They highlight the fact that in real world economies with factor constraints, an expanding tourism industry is likely to have adverse impacts on other industry sectors. Thus tourism development may be a ‘catalyst’ for the growth of some industries in an economy but not for others.

More detailed analysis of industry effects is needed and this will be the subject of further research. It is clear, however, that use of a standard input-output framework for estimating the affects of an expanded demand for tourism would ignore the adverse employment impacts on other sectors in the economy and thus provide a very incomplete picture of tourism’s links with other sectors. While the assumptions used to generate these results, can, and should, be subject to critical examination, the use of CGE models in place of Input-output models implies that researchers must avoid simplistic statements concerning tourism’s alleged complementary links with all other industries.

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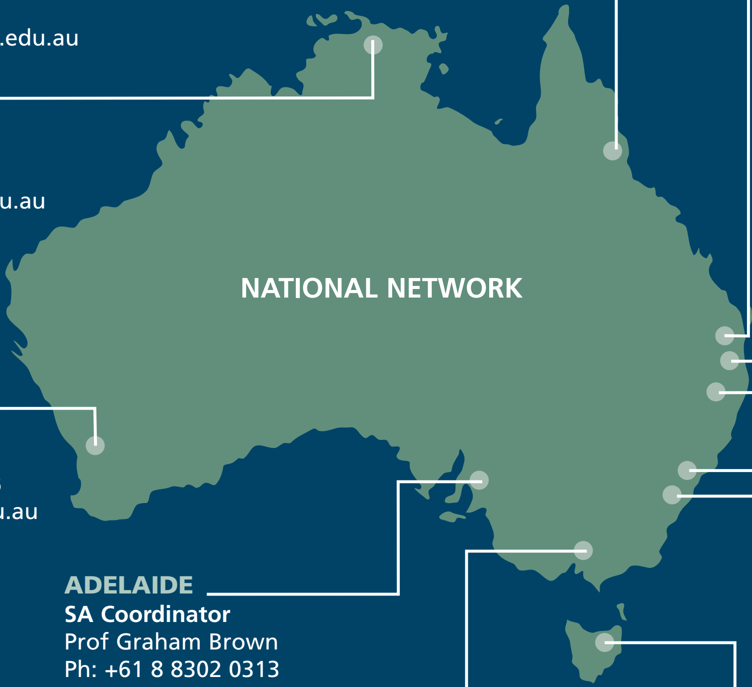

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Appendix O -

Environmental Management Plan (EMP)

Kangaroo Island Golf Resort,

Dudley Peninsula,

Kangaroo Island, SA.

ENVIRONMENTAL MANAGEMENT PLAN

CONTENTS

1 PURPOSE AND APPLICATION

The purpose of this *management plan* is to provide:

- Information on how to avoid and minimise environmental impact, which is preferable to the less cost-effective option of controlling or treating discharges to the environment, or undertaking remedial action.

- Information on the likely impact of construction activities on the environment and how this is to be assessed.

- Guidelines for undertaking risk assessment and management.

- A clear statement of environmental performance objectives for each segment of the environment.

- Suggested best practice environmental measures to meet the performance objectives based on available experience.

- Provide a framework within which due diligence obligations can be met and environmental damage avoided.

2 PRE-CONSTRUCTION PLANNING AND DESIGN

Integrating environment protection at the project planning stage ensures that measures to avoid and minimise pollution can be built into the project design and work schedule. This approach is more cost-effective than establishing controls once the project commences.

Once a site has been selected, it is necessary to conduct an environment assessment that identifies which parts of the environment may be vulnerable to damage from construction activities.

Making a risk assessment is a useful way in which to approach this aspect of site management. Environmental risk deals with the probability of an event causing an undesirable effect. There are three elements to consider when defining risk·. They are:

- A time frame over which the risk or risks are being considered.

- A probability of the occurrence of one or more events.

- A measure of the consequences of those events.

Based on the site assessment, project design information and the construction work program, a risk assessment of all aspects of the project can be executed. This assessment in turn leads to a strategy to manage all significant risks to the environment.

2.1 Environmental assessment

Understanding which segments of the environment are vulnerable is a prerequisite to identifying and managing environmental risks.

The assessment should not only consider the environmental impacts on a site, but whether or not off-site effects are possible.

An initial assessment of the site should be conducted to identify sensitive environmental areas or uses that require protection. These may include:

- sensitive or endangered flora and fauna;
- aquatic plants and animals, if a natural waterway is affected;
- groundwater recharge areas.

Depending on whether or not the construction site is near houses, schools or hospitals, the impact of air discharges, noise and vibration on the health and amenity of adjacent residents will need to be included in the assessment.

Once the project has been approved, but before construction commences, it is important to initiate an environmental monitoring program to collect baseline data on all sectors of the environment.

ENVIRONMENTAL ASSESSMENT

Objective

To identify or obtain information on any relevant environmental impact that the construction project may cause.

Suggested measures

Identify sensitive environmental areas or uses that may be affected by construction activities.

Identify whether residents adjacent to the site could be affected by pollution from construction activities or suffer reduced amenity.

Monitor baseline air and water quality and ambient noise levels adjacent to the construction site.

Conduct an assessment of expected noise levels from construction activities which may affect the surrounding community.

Conduct a desk study to identify potentially contaminated sites in the construction area, and sample and analyse soils that are suspected of being contaminated before construction commences.

2.2 Risk assessment

Risk assessment is defined as the identification and characterisation of the nature of existing and potential adverse effects to humans and the environment resulting from exposure to environmental hazards.

Risk is a function of the probability of an event occurring and the degree of damage that would result should it happen.

Information from the environment assessment is required in order to conduct a risk assessment. Details of the project design and the work program are also needed.

The assessment allows significant risks to be identified so that they can be targeted for action.

This initial risk assessment needs to be regularly reviewed. An ongoing risk assessment is therefore an integral part of the Environmental Management System (see section 3.1). This involves a review of existing risks and identification of new risks detected through the surveillance or monitoring program.

Risk assessment can be divided into six steps.

Information gathering

A risk assessment requires information about site conditions. This information is used in conjunction with information collected during the environmental assessment (see section 2.1).

The following information needs to be collected before construction commences:

- a map of soil types and their erosion potential
- climate, weather patterns and stream flows
- topography and natural geographic features (including whether site is in a floodplain)
- the construction schedule
- changes to the topography of the site during each stage of the project
- a map of existing vegetation identifying areas to be retained
- details of areas of cleared land at each stage of the development, and period of time that each section will be exposed
- changes to drainage and identification of sources of clean and contaminated stormwater

calculation of stormwater flows within micro-catchments within the site, based on a one-in-two-year storm event (two-year ARI with intensity of six hours), for each stage of the project

location of stockpiles, batters, haul roads and cuts

nature and location of works that will occur within 50 metres of a
natural waterway or other sensitive environmental area

Hazard identification

Hazard identification involves identifying activities that could lead to an adverse effect on the environment, impair human health, result in a nuisance, or decrease the amenity of residents adjacent to a construction site.

It is necessary to consider both direct and potential causes of hazard, which could cause water, air, land or noise pollution. Hazards may arise out of features of the site, or the nature of construction activities. For example, clearing vegetation from large areas and exposing erodible soil is a high-risk activity which may lead to dust generation and sediment run-off.

Proposed pollution prevention and control measures should be considered when identifying hazards, because if they fail, there will be an adverse impact on the environment.

Hazard analysis

Hazard analysis considers the likelihood of an environmental hazard being realised.

This analysis is based on previous experience, historical data for the failure rate of structures and systems, and includes the impact of site-specific conditions which may influence risk levels. For example, if large areas of land are cleared of vegetation, the probability of a stream crossing collapsing is low, while the potential for dust problems is high.

The level of risk is also a function of time. The longer a risk is allowed to continue, the more likely it is that there could be an undesirable consequence.

Consequence analysis

Consequence analysis determines the effect on the environment should a risk be realised. For example, if a temporary river crossing should collapse it could be disastrous for a waterway. The failure of a sediment fence will have less impact on the river.

Two factors that should be considered in the consequence analysis are:

significant long-term consequences, such as permanently altering the ecology of an environmental system

significant short-term consequences, where the effects are temporary

The consequence analysis is independent of the probability of an event occurring.

Determining the overall risk

The overall risk is a function of the probability of a measure, structure or system failing, or of an event or activity causing environmental damage, and the magnitude of the environmental damage, should it fail.

Determining risk levels is an iterative process. The objective of the process is to reduce risk to acceptable levels by implementing an action plan.

Ranking

Wherever possible, risks should be quantified using scientific data, experience and judgement. Unfortunately, when risk assessment methodology is applied to construction activities, many risks cannot be quantified because of the lack of historical data. In addition, site-specific factors, such as site topography, have a major effect on risk levels.

The magnitude of the risk is either estimated or ranked in order of importance. Ranking involves listing risks relative to one another, from high to low.

Ranking risks, based on uncertain and limited data, requires a high degree of judgement. It is therefore important that this step is conducted by an expert with experience in assessing risks on major construction sites.

Rankings need to be reviewed as actions are taken to eliminate or reduce the risk.

RISK ASSESSMENT

Objective

To identify and rank all potential risks that may arise from the construction of major projects.

Suggested measures

Collect all relevant information needed to conduct a risk assessment of construction activities.

Identify, assess and rank risks to all segments of the environment, human beings, nuisance and loss of amenity from plans of the proposed development.

Once construction commences, review the risk assessment as risk management strategies are implemented, inspection or monitoring identifies new risks or when there are changes to the project.

2.3 Risk management

Risk management is the development of an action plan, including measures and strategies, which reduces significant risks to acceptable levels.

Risk management should be applied to pre-construction planning for the most cost-effective environmental outcomes.

Risk assessment and management should be continually updated during the construction phase.

Precautions and measures to prevent environmental problems are preferred to structural controls that either reduce or control risks.

Avoiding risks

The most effective approach is to avoid risk by modifying the design. Selecting a route that bypasses a sensitive environmental area, avoiding areas with high erosion potential, or retaining existing topography wherever practical rather than undertaking major land-shaping, are examples of risk avoidance.

Reducing risks

There are several strategies that can be implemented to reduce environmental risks.

For example, sequence works so that small sections of the site are worked on at any one time. If rehabilitation is commenced immediately works are completed, the risk of erosion, contaminated run-off and dust is reduced. Keeping haul roads to a minimum and routing them to avoid erodible areas, such as sloping terrain, will also help reduce dust and erosion problems. Another way of reducing risk is to avoid scheduling works on areas that pose a very high risk of erosion during periods when heavy rains and strong winds are expected.

These are some of the approaches that can be taken to reduce risk.

Increase inspection, surveillance and monitoring frequency so that new or underestimated risks are quickly identified and managed, and any failures or imminent failures in controls are promptly identified and repaired.

Implement a preventative maintenance program for pollution-control installations to reduce the risk of equipment failure.

Implement contingency plans, such as ensuring that corrective action on a failing control measure is prompt. Such contingency plans will reduce the environmental impact of a hazard.

Controlling risks

It is possible to manage risks by installing control measures. For example, by constructing a sediment pond it is possible to trap silt and treat contaminated water. Paving haul roads to reduce the generation of dust is another control which can be adopted.

Large structural controls need to be planned and installed before construction commences. These include, but are not restricted to, sediment retention basins and artificial wetlands to treat contaminated stormwater, and structures to reduce water velocities.

As a general principle, various sediment interception and control devices should be installed as close to the source as possible. For example, install wheel washes and rumble grids to prevent dirt being taken off-site rather than instituting road sweeping.

RISK MANAGEMENT

Objective

To implement risk management strategies to reduce all significant risks to the environment to acceptable levels.

Suggested measures

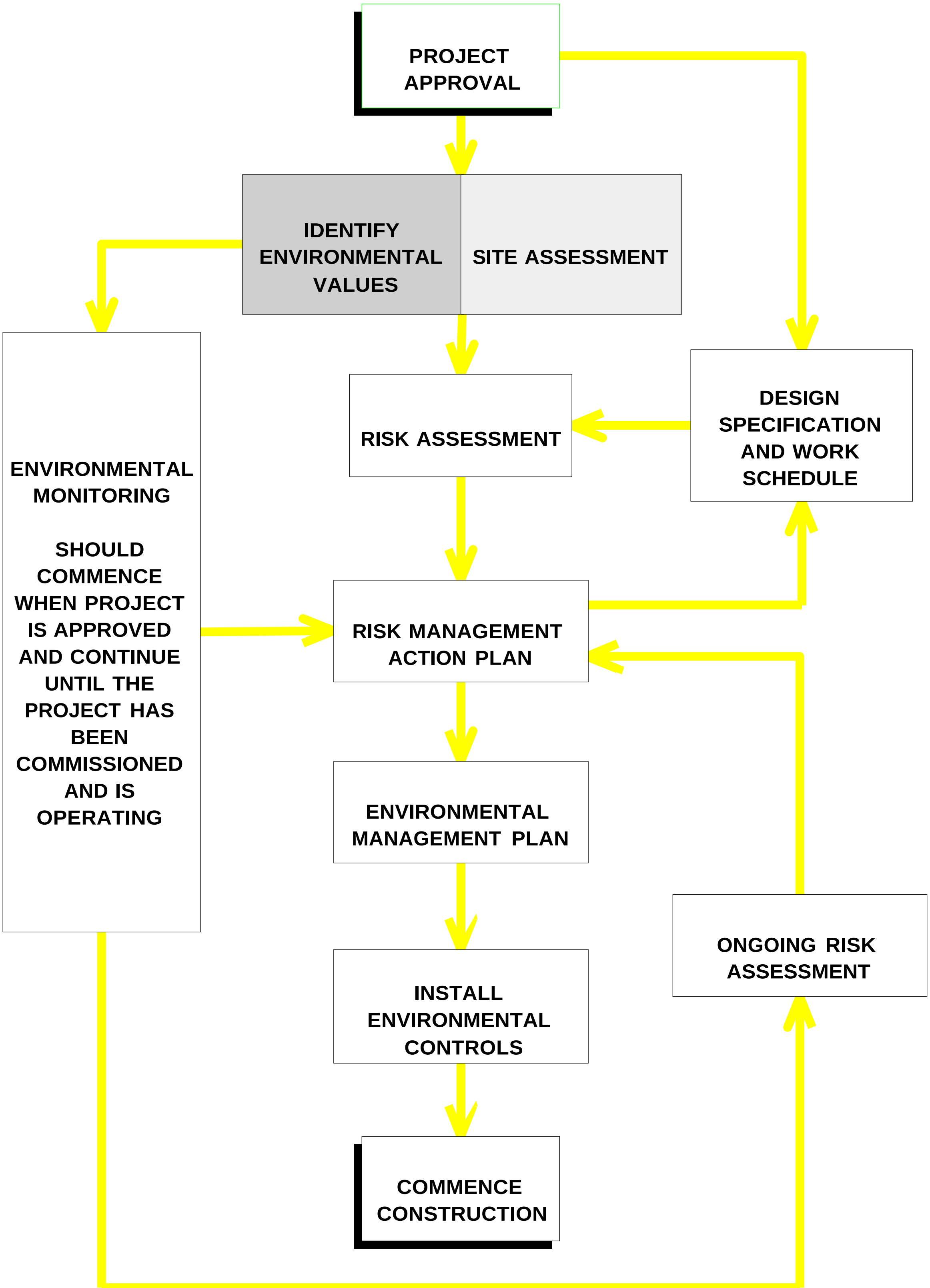
Develop an action plan to manage all significant risks to the environment.

Implement, wherever possible, risk management measures at the planning stage of the construction project.

Select risk management options, in order of preference, based on avoiding risk, reducing risk and controlling risk.

Identify major control structures, like sediment basins, stormwater diversion drainage and artificial wetlands, and install them before other construction activities commence.

Install controls as close to the source of the problem as possible.



The relationship between risk assessment, the risk management action plan, the environmental management plan and monitoring

3 ENVIRONMENTAL MANAGEMENT PLAN

3.1 Environmental management plan

The environmental management plan contains all aspects of a project's environmental management, and should be prepared by the contractor before work commences on any construction project.

Once the environmental site and risk assessments, and risk management steps have been completed (see section 2), then implementation of risk management measures is achieved via the environmental management plan.

A pre-requisite for the environmental management plan is for the constructing company to have an environmental management system in place. The environmental management system establishes quality systems to ensure consistently high environment outcomes for the project as a whole. British Standard 7750[2], which has gained wide international acceptance, or the soon to be adopted ISO 14000 series[3] should be used.

3.2 Best practice documents

The environmental management plan should contain best practice source documents which can be used to address significant environmental risks. These are generic, and should be applied to site conditions via the segment environmental control plan.

Sections 4 to 9 present some general principles upon which best practice can be based.

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2 British Standard Institute, Specification for environmental management systems, BS 7750, 1992.

3 International Standards Organisation, *Environmental management systems*, Draft International Standard ISO/DIS 14001 and 14004.

control devices are

3.3 Segment environmental control plan

On large sites, it is normal to divide the area into segments. A control plan should be prepared for each segment. Segment boundaries are selected on the basis of natural features, the placement of sub-catchments, or association with different contractors.

A number of elements of the plan will be the same for each segment, such as hours of operation and controls on noise and emissions from vehicles. However, each segment may require area-specific controls.

The controls are taken from the action plan arising out of the risk management process (see section 2.3).

The main components of a segment environmental control plan are as follows:

Work scheduling

Actions taken to reduce or avoid environmental impact by rescheduling works, or prohibiting or limiting certain activities from times of the year when unfavorable climatic conditions exist, should be stated.

Land disturbance

Map the existing topography and changes to the landform of each segment, as construction progresses.

The map should identify critical areas for protection which may be easily erodible, such as highly erodible soils, steep slopes, haul roads, or bare areas.

Stormwater management

It is important to have accurate information about on-site drainage for each micro- catchment so that adequately designed for the expected flow and load. Such information should be available for each change in landform that affects a micro-catchment.

Specifications for diversion drains and temporary stormwater controls to reduce on-site volumes should be included in the plan.

Control installations and measures

The plan should identify the position and design specification of structures and measures taken to control:

- sediment run-off
- dirt on roads
- noise and vibration
- dust

A schedule for installation of these controls should be included in the plan.

Soil stockpiles and batters

The plan should address how stockpiles and batters are to be managed.

It should include the location of all stockpiles, the interval before they are used, how they are to be stabilised, and what control measures are to be implemented while they are being stabilised.

For permanent batters and temporary or final slopes that have been cut during construction, the plan should indicate how these are to be stabilised and what control measures are to be implemented while stabilisation takes place.

Special operational precautions

When work is being done near an environmentally sensitive area, then special precautions should be identified in the plan

Contingency plans

Site-specific contingency plans are required for significant risks that have not been controlled. For example, the plan should include procedures for managing stormwater from intense storm events or repairing a control structure should it fail.

Rehabilitation

A rehabilitation plan should be developed as soon as possible after the design is finalised.

A schedule for stabilising and revegetating cleared areas should be given, and an ongoing program to maintain rehabilitated areas should also be included.

The site should be rehabilitated so that the impact on the environment is minimal.

Maintenance, inspections and surveillance

A maintenance and inspection program should be provided for all control structures and measures. Ongoing surveillance of the site is required to ensure that new risks are identified as they arise. This allows the environmental management plan to be adjusted to ensure that any new risks are adequately managed.

Ongoing risk assessment and management

Construction sites are continuously changing. It is therefore important that the initial risk assessment (see section 2.2) is updated for each segment. This needs to be integrated into the inspection program.

Updating the plan

The plan should be updated to address deficiencies identified by the monitoring or audit program and as new risks are identified through surveillance.

ENVIRONMENTAL MANAGEMENT PLAN

Objective

To develop an environmental management plan to reduce the adverse impact of construction activities on the environment.

Suggested measures

A environmental management system should be in place, as a pre-requisite to preparing an environmental management plan.

Prepare an environmental control plan for defined segments of the site for large sites, or a whole-of-site plan for smaller sites.

The plan should implement the risk management action plan, include detailed specifications on site-specific controls and include a rehabilitation program in the plan.

Base the measures in the plan on best practice.

Update the plan to meet new risks or where inspections, monitoring or audit reveal that measures are ineffective.

Update the plan to achieve ongoing improvement.

4 LAND DISTURBANCE

Large projects usually involve extensive land disturbance, involving removing vegetation and reshaping topography. Such activities make the soil vulnerable to erosion. Soil removed by erosion may become airborne and create a dust problem or be carried by water into natural waterways and pollute them.

Measures to address the impact of land disturbance on the environment should be included in the planning and design phase of the project, before any land is cleared.

These measures should be placed into the framework of the segment environment control plan (see section 3.3).

4.1 Erosion

When considering land disturbance and its consequences, priority should be given to preventative rather than treatment measures.

To develop effective erosion controls it is necessary to obtain information on the erosion potential of the site where soil disturbance is planned. Erosion potential is determined by the erodibility of the soil (type and structure), vegetative cover, topography, climate (rainfall and wind), and the nature of land-clearing. Erosion potential will also be affected by the type, nature and intensity of earthwork.

Erosion potential of rainfall can be calculated using the universal soil loss equation[4,5].

Information on predicted soil losses from land disturbance should be used to plan and engineer control solutions.

Ground cover provides the most effective means of preventing erosion. Consequently, sediment run-off and dust controls depend on retaining existing vegetation or revegetating and mulching disturbed areas as soon as possible.

The following measures should be taken to minimise erosion:

- Keep land clearance to a minimum.
- Avoid wherever possible clearing areas of highly erodible soils and steep slopes which are prone to water and wind erosion.
- Revegetate and mulch progressively as each section of works is completed. The interval between clearing and revegetation should be kept to an absolute minimum.
- Coordinate work schedules, if more than one contractor is working on a site, so that there are no delays in construction activities resulting in disturbed land remaining unstabilised.

- Program construction activities so that the area of exposed soil is minimised during times of the year when the potential for erosion is high, for example during summer when intense rainstorms are common.
- Stabilise the site and install and maintain erosion controls so that they remain effective during any pause in construction. This is particularly important if a project stops during the wetter months.
- Keep vehicles to well-defined haul roads.
- Keep haul roads off sloping terrain wherever practical.
- Designed the slope of a cut to minimise the angle of incline.
- Cultivating the cut surface will increase infiltration of rainfall and decrease the velocity of water across the slope during rain and therefore reduce erosion.

MINIMISING EROSION

Objective

To minimise the quantity of soil lost during construction due to land-clearing.

Suggested measures

Schedule measures to avoid and reduce erosion by phasing the work program to minimise land disturbance in the planning and design stage.

Keep the areas of land cleared to a minimum, and the period of time areas remain cleared to a minimum

Base control measures to manage erosion on the vulnerability of cleared land to soil loss, paying particular attention to protecting slopes.

Mulch, roughen and seed cleared slopes and stockpiles where no works are planned for more than 28 days, with sterile grasses.

Keep vehicles to well-defined haul roads.

Rehabilitate cleared areas promptly.

4.2 Management of contaminated stormwater

Soil eroded during land disturbance can wash away and contaminate stormwater.

If contaminated stormwater enters a drainage line or stormwater drainage system, it will eventually discharge into an adjacent waterway and pollute it.

The type of sediment controls suitable for a particular situation depend on the nature of the site, in terms of such factors as rainfall patterns, soil type and topography. These factors need to be taken into account when selecting appropriate controls and ensuring that designs are adequate.

There are a number of ways of minimising sediment run-off.

Reduce stormwater on the site

If uncontaminated water enters part of the site that has been cleared, it will quickly pick up sediment and need to be treated. Additional water may also add to the erosion potential, increasing the risk of pollution.

It is therefore desirable to divert clean stormwater away from those parts of the site where soil is to be exposed. This can be done by constructing diversion banks and intercept drains around the site while ensuring that the water discharging from such banks or drains is disposed of without causing erosion.

Wherever possible, the new stormwater drainage system should be installed before any land disturbance activities commence. If possible on-site inlets should not be connected until the site has been stabilised and rehabilitated. In this way, silt-laden stormwater cannot escape the site via this route and pollute surface waters. It will have to be treated on-site.

Water velocities

There is a direct relationship between the velocity of water flowing over exposed soil and the rate of erosion.

Installation of rock structures on the site to retard water flows is an effective measure to reduce erosion in areas where high water flows are expected.

It is desirable to minimise continuous slopes where flowing water can scour.

To prevent scouring, drainage lines may need to be lined or velocity-reducing structures, such as crushed rock or geotextile placed in the drainage line.

Slopes

Any natural drainage lines that discharge water on to the top of a slope should be directed to grassed areas by intercept drains. Otherwise water will run down the slope, eroding it. Perimeter banks or sediment fences should also be constructed at the toe of the slope to contain sediment run-off.

STORMWATER MANAGEMENT

Objective

To minimise the generation of contaminated stormwater.

Suggested measures

Minimise the quantity of uncontaminated stormwater entering cleared areas.

Establish cut-off or intercept drains to redirect stormwater away from cleared areas and slopes to stable (vegetated) areas or effective treatment installations.

Reduce water velocities.

4.3 Designing erosion and sediment control devices

There are a large number of control devices that will suit most circumstances. These *Guidelines* are restricted to addressing the general principles behind erosion and sediment controls rather than providing detailed design specifications.

Most damage is done in the initial part of a storm, between 30 minutes and two hours into a storm, and during prolonged storms.

Designs of control structures, therefore, need to account for peak run-off flows.

Where it is not possible to schedule works to avoid times of the year when high rainfall is expected, then additional controls may be required, such as installing extra sediment traps or enhancing the capacity of existing controls.

Sediment interception and settling

Sediment detention dams, ponds or basins hold sediment-contaminated run-off long enough for suspended sediment to settle out. Clarified water can then be discharged to stream.

Permanent structures that will provide ongoing sediment control, after a site has been rehabilitated, should be designed using a 50-year-recurrence interval. Examples of permanent structures are wetlands and major sediment detention dams.

Temporary sediment control structures should be designed to take predicted flows, based on a one-in-two-year storm (two-year ARI with intensity for six hours) and sub-catchment areas, while contingency plans should be in place to account for extreme storm events. Use the Universal Soil Loss Equation[8] to estimate long-term average annual yield of sediment from small uniform sections of catchments. Run-off and sediment control structures should be designed and constructed to accept the expected peak flows and sediment loads.

Interception and chemical treatment

Fine colloidal clays suspended in run-off require a long time to settle, often exceeding the economic or practical detention storage capacity. Flocculants may need to be added to hasten settlement.

Residual flocculant in suspension should not be released if it degrades water quality or the aquatic habitat in natural waterways. Chemical sludge will require off-site disposal to a landfill licensed to accept such wastes.

Sediment filtering

Adequate controls should be placed on all drainage lines. Silt loads should be treated as close to their source as possible using effective sediment traps such as geotextile fences and straw bales.

In-stream controls

When the site is intersected by a stream, then in-stream controls such as a rock weir are required to reduce water velocity and trap sediment. Special precautions should be taken when cleaning behind a weir to ensure that trapped sediment is not resuspended.

Inspection, maintenance and cleaning

The effectiveness of sediment control devices depends on an adequate inspection, maintenance and cleaning program. Inspections, particularly during storms, will show whether devices are operating effectively (see section 9.1). Where a device proves inadequate, it should be quickly redesigned to make it effective.

SEDIMENT CONTROLS

Objective

To minimise the impact of contaminated stormwater on receiving waters.

Suggested Measures

Install erosion and sediment control measures, if possible before construction commences.

Identify drainage lines and install control measures to handle predicted stormwater and sediment loads generated in the mini-catchment.

Design and install appropriate erosion and sediment run-off control measures appropriate to site conditions to handle a one-in-two-year storm event (two-year ARI with intensity of six hours), for temporary structures, and a one-in-fifty year storm event, for permanent structures.

Establish an adequate inspection, maintenance and cleaning program for sediment run-off control structures.

Ensure that contingency plans are in place for unusual storm events.

Continually assess the effectiveness of sediment control measures and make necessary improvements.

There are a large number of erosion and sediment run-off control devices which are available. The selection and design will depend on site-specific considerations and it is beyond the scope of these to outline how to design such installations.

4.4 De-watering work sites

After rain, pooled water is often pumped off-site. Often this water is contaminated with suspended sediment so it is essential that its disposal should not contribute to water pollution.

To remove water from the work area, the pump intake should be kept as close to the surface of pool as possible. Floating intakes should be used when the depth of water is sufficient. Care must be taken to avoid pumping from the bottom of ponds, and constant supervision is required during pumping operations to ensure this does not happen.

Treatment is required before discharging run-off to a natural waterway or stormwater system, where turbidity exceeds 30 NTU[9] and is higher than upstream measurements. Hourly measurements of discharge water quality should be taken.

Contaminated water pumped off the site should, wherever possible, be directed to vegetated areas. Precautions should be made to ensure that such areas don't become waterlogged and have adequate capacity to effectively remove suspended solids.

Where vegetated areas are not available, then water should be directed to existing or specially provided sediment control structures.

Pumping to natural waterways should be supervised through the operations.

In urban areas it may be possible to discharge contaminated run-off to sewers. Such a discharge will require approval of the relevant sewerage authority.

This option is of limited usefulness as de-watering the site will usually be required during or immediately after rainfall, when the sewers are also be near capacity and unable to accept any additional volume.

DE-WATERING WORK SITES

Objective

To ensure that de-watering operations do not result in turbid water entering natural waterways.

Suggested measures

Treat contaminated water pumped into the stormwater system or a natural waterway to remove sediment if the turbidity exceeds 30 NTU.

Ensure that the level of suspended solids in waters pumped into natural waterways never exceeds the regulatory water quality standard.

De-water by pumping water, wherever practical, on to vegetated area of sufficient width to remove suspended soil, or to sediment control devices.

Supervise all pumping and implement precautions to ensure that turbidity of pumped water is minimised.

Monitor every hour during a pumping operation the turbidity of water pumped directly to a natural waterway or a drainage system discharging to a natural waterway .

4.5 Dust control

Many of the measures taken to reduce dust problems are the same as those taken to minimise erosion and sediment run-off.

Additional measures, not mentioned in the sections on erosion or sediment control, are outlined below.

Prevent the generation of dust in preference to applying dust suppression measures.

Ensure in the project schedule that the area of cleared land is minimised during the drier months of the year, when dust generation is at its greatest.

Pave and water haul roads. The frequency of watering will be determined by weather conditions and the erodibility of the soil. If additives in the water are used to increase its dust suppression properties, the chemical should have no adverse environmental impact on adjacent water bodies.

Water areas other than haul roads, if they are a source of dust.

Ensure that smooth surfaces are deep ripped and left rough and cloddy to reduce the wind velocity at the soil surface.

Construct wind fences if this is appropriate for the site.

As a contingency measure, in areas that do not have access to a reticulated water supply, water stored on-site should never be less than 2,000 litres per hectare of disturbed land surface.

Wherever watering is used to suppress dust, ensure it does not create contaminated run-off that will contaminate surface waters.

DUST CONTROL

Objective

To ensure there is no health risk or loss of amenity due to emission of dust to the environment.

Suggested measures

Implement a dust prevention strategy, developed at the project planning stage.

Take dust suppression measures, such as promptly watering exposed areas when visible dust is observed.

Install wind fences wherever appropriate.

4.6 Management of stockpile and batters

Stockpiles and batters are a potential source of dust and sediment run-off.

Additional controls to those covered previously are outlined below.

Locate stockpiles away from drainage lines to where they are protected from wind.

Minimise the number and size of stockpiles.

Keep topsoil separate from underburden when stockpiling soil.

Construct the stockpile with no slope greater than 2:1 (horizontal to vertical). A less steep slope may be required where the erosion risk is high.

Mulch, roughen and seed with sterile grasses any batter or topsoil stockpile which is to be maintained for longer than 28 days.

Treat underburden stockpiles in the same way, but check whether they need a layer of topsoil to provide a media for grass seeds before seeding.

Circle all unstabilised stockpiles and batters with silt fences or a drainage system that will collect and correctly dispose of contaminated water (see section 4.2).

Locate stockpiles within ten metres of a waterway *only* if no other alternatives exist. This situation should be identified in the risk assessment.

Hand water or install temporary sprinklers to suppress dust from unstabilised stockpiles and batters.

Finish and contour any stockpiles located on a floodplain so as to minimise loss of material in a flood or rainfall event.

MANAGEMENT OF STOCKPILES AND BATTERS

Objective

To manage soil stockpiles so that dust and sediment in run-off are minimised.

Suggested measures

Minimise the number of stockpiles, and the area and the time stockpiles are exposed.

Keep topsoil and underburden stockpiles separate.

Locate stockpiles away from drainage lines, at least 10 metres away from natural waterways and where they will be least susceptible to wind erosion.

Ensure that stockpiles and batters are designed with slopes no greater than 2:1 (horizontal/vertical).

Stabilise stockpiles and batters that will remain bare for more than 28 days by covering with mulch or anchored fabrics or seeding with sterile grass.

Establish sediment controls around unstabilised stockpiles and batters.

Suppress dust on stockpiles and batters, as circumstances demand.

4.7 Working in waterways and floodplains

The responsible drainage body must be consulted if there are any works that will impact on a waterway. Changes to the physical nature of a waterway require prior approval from the responsible drainage authority.

At the design stage, consider all options to avoid working in a natural waterway.

Procedures

Where it is not possible to avoid working in a stream, then additional precautions should be taken.

Minimise the time during which work in a waterway is required, and the extent of works.

Schedule works for the driest months of the year and the lowest flow of the waterway.

Avoid times of the year when aquatic population may be under stress, such as during migration spawning, or when food may be scarce.

Establish protocols to minimise downstream damage.

Stabilise any disturbance to a levee or any other bank so that erosion is avoided.

Measure turbidity continuously immediately downstream from the areas in which work is occurring, and modify work practices where continuous monitoring shows degraded water quality.

If working in a concrete channel, use appropriate machinery to avoid damage to structures.

Stream crossings

If in-stream activities require construction of a stream crossing, it should be installed during low-water flows with downstream weirs in place to trap any released sediment.

Three types of access crossings may be considered.

- Culvert: this type of crossing may be effective in controlling erosion while in use, but will cause erosion during installation and removal.

- Ford: this type of crossing may only be used during periods of low flow. A ford is not appropriate if construction will continue during wet periods of the year.

- Bridge: this type of crossing must be used for major waterways and for other waterways with high flows.

The crossing should be protected against erosion, both to prevent excessive sedimentation in the waterway, and to prevent washout of the crossing.

The crossing should be positioned perpendicular to the flow and located at the narrowest part of the stream. Damage to the stream bed and banks should be avoided. The crossing should be engineered to be stable under the expected vehicle loads. Drainage over the surface of the crossing and access road should have adequate controls to ensure that sediment run-off to the stream is minimised.

If a cofferdam is used, minimum downstream flows should be maintained that will sustain the aquatic ecology.

Stream crossings also act as sediment traps. Cleaning sediment out behind a crossing should follow the same procedure as for weirs.

Contingency planning

As mentioned in section 4.3, it is best practice to design pollution measures and controls to account for a one-in-two-year storm event (two-year ARI with intensity of six hours).

Contingency plans should also be in place for more intense storm events, particularly where works are planned to occur within a floodplain.

The contingency plan should consider the consequences on the environment of 5, 10, 20 and 100-year-frequency floods.

The contingency plan should address:

- methods to limit stormwater entering excavation areas
- enhancement of existing measures and installation of additional controls, when an intense storm event is forecast
- siting of construction facilities
- clean-up procedures, including disposal of excess water
- a flood warning system
- procedures for preventing the loss of spoil, fuel, chemicals or other materials that could adversely affect the environment
- notification of relevant authorities if unplanned incidents occur that could pose a risk to the environment

Reinstatement plan

Prior to works being undertaken on, near or within a waterway, a reinstatement plan should be prepared and submitted for approval to the responsible drainage authority. The plan should include:

- proposed changes to the waterway
- the impact on adjacent vegetation
- the type and form of flood protection works
- erosion and sediment run-off controls
- proposed methods for reinstatement of the waterway bed and banks
- a revegetation plan addressing a period of no less than 12 months and including proposed species and locations, methods for weed control and ongoing maintenance until a satisfactory level of established plants is achieved.

WORKING IN WATERWAYS AND FLOODPLAINS

Objective

To minimise stress on aquatic communities when working in a waterway.

Suggested measures

- Plan in-stream works so that the contact time is minimised.
- Establish special practices so that impacts on the waterway and disturbance of its banks are minimised.
- Stabilise banks and in stream structure so that they do not contribute to the sediment load.
- Maintain minimum flows to ensure the viability of aquatic communities and ensure that there are no barriers to the passage of fish up and downstream.
- Avoid times of the year when environmental damage is expected to be highest.
- Construct in-stream crossings during low flows, designed to be stable under expected vehicle loads and flow regimes, that do not contribute to the sediment load in the stream.
- Design crossings so that drainage off the crossing does not contribute sediment load to the stream.
- Prepare a contingency plan for high-rain events.
- Prepare a reinstatement plan if work in a stream is planned or the structure of a waterway will be altered.

5 NOISE AND VIBRATION

While no specific statutory controls exist for noise from construction sites, all noise nuisance should be reduced wherever possible from vehicles, fixed machinery within the site, blasting, general construction activities, and from movements of vehicles servicing the site.

5.1 Operating hours

One of the most effective means of reducing noise nuisance from construction activities, where there are residents nearby, is to limit the times of operation of noisy equipment vehicles, and operations.

There are occasions when it is necessary to work beyond these times. Exceptions can be made in cases where an activity that has commenced cannot be stopped, such as a concrete pour, and deliveries may need to be made outside normal working hours to avoid a major traffic hazard.

Documentation justifying out-of-hours work should be maintained and authorised by site management. Local residents who are affected by such activities should be notified beforehand.

Even with such restricted hours, every effort should be made to reduce the noise of all site activities.

5.2 Vehicles and equipment

Noise from vehicles and powered machinery and equipment on-site should not exceed the manufacturer's specifications, based on the installation of a silencer. Equipment should be regularly serviced. Attention should also be given to muffler maintenance and enclosure of noisy equipment.

5.3 Traffic

There is a conflict between operational efficiency and local amenity, with regard to traffic flows in and out of a construction site. During normal business hours when traffic densities are high, deliveries of materials and large equipment can cause severe traffic snarls and even pose a danger to other vehicles. Out-of-hours deliveries will cause noise pollution from trucks moving past nearby houses.

5.4 Noise abatement

Depending on the location of the facility, suitable noise suppression or abatement measures may be required, such as the provision of earthen embankments or other noise screens.

5.5 Vibration

On road constructions, impact pile-driving may be used to establish a base for foundations. These operations can give rise to high levels of ground vibrations.

The magnitude of the nuisance created by vibrations depends on the nature of soils transmitting the vibration and the distance to the nearest building.

NOISE AND VIBRATION

Objective

To ensure nuisance from noise and vibration does not occur.

Suggested measures

Fit and maintain appropriate mufflers on earth-moving and other vehicles on the site.

Enclose noisy equipment.

Provide noise attenuation screens, where appropriate.

Where an activity is likely to cause a noise nuisance to nearby residents, restrict operating hours to between 7 am and 6 pm weekdays and 7 am to 1 pm Saturday, except where, for practical reasons, the activity is unavoidable.

Noise should not be above background levels inside any adjacent residence between 10 pm and 7 am.

Advise local residents when unavoidable out-of-hours work will occur.

Schedule deliveries to the site so that disruption to local amenity and traffic are minimised.

Conduct a study on the impact of ground vibration from construction activities, where these operations occur within 50 metres of a building and take appropriate action.

Minimise air vibrations.

6 WASTE MINIMISATION

When choosing between waste minimisation options, the following hierarchy for waste management is preferred:

(i) waste avoidance and/or reduction

(ii) reuse

(iii) recycling

Diverting the waste stream in these ways means that waste treatment and waste disposal options can be reduced.

Construction sites should pursue this hierarchy and seek out waste reduction opportunities.

To identify opportunities it is necessary to consider all aspects of the project and the wastes it generates.

Waste can be minimised by using improved technology, recycled or reused on-site, or by making purchasing decisions that favour recycled products.

Wherever possible, include performance measures and targets for reduction, reuse and recycling options in the environmental management plan.

Waste minimisation opportunities include:

- obtaining construction materials, paints, lubricants and other liquids in reusable packaging or containers
- using noise barriers made from recycled materials
- using overburden to construct temporary noise barriers.
- using contaminated water out of sediment dams for dust suppression and irrigating adjacent vegetated land
- sending waste concrete from demolition activities to a concrete recycler instead of landfill
- segregating and recycling solid wastes generated by construction activities, offices and mess-rooms
- collecting lubricating oil from the construction vehicle fleet and sending it to a recycler

WASTE MINIMISATION

Objective

To minimise the waste load discharged to the environment.

Suggested measures

- Carry out a waste minimisation assessment which examines opportunities for waste avoidance reduction, reuse and recycling.
- Reduce wastes by selecting, in order of preference, avoidance, reduction, reuse and recycling.
- Incorporate waste minimisation targets and measures into the environmental management plan.

7 CONTAMINATED MATERIAL AND WASTES

On large construction sites, it is possible that old tips will be uncovered or the land found to be contaminated. Where this occurs contaminated material or soil may need to be disposed of.

Disposal methods adopted depend on the nature of the material. To obtain this information, a comprehensive sampling and analysis program is required so that the correct route for disposal can be determined. For an old tip, sampling should also ascertain the odour levels, presence of methane, groundwater levels and leachate quality.

7.1 Solid inert wastes

Solid inert waste found on construction sites usually consists of building rubble, but may also include as demolition material, concrete, bricks, timber, plastic, glass, metals, bitumen, trees and shredded tyres. Such wastes should be reused, recycled, or disposed of to a landfill site licensed to take such wastes.

7.2 Putrescible wastes

Old tips that accepted municipal rubbish also contain putrescible wastes.

Putrescible wastes are defined as waste able to be decomposed by bacterial action. It usually consists of discarded food, domestic garbage, commercial wastes, grass and garden clippings and prunnings.

As many old tips were not licensed by EPA it is possible that other wastes were buried, and the inspection and analytical program should be designed to detect other materials if they are present.

Old tips may also contain contaminated leachate and gases, such as methane and odorous sulphur gases.

The biological and chemical condition of the tip will depend on its age and contents.

Excavating putrescible wastes could give rise to the following problems:

- escape of methane and odorous landfill gases
- release of contaminated leachate
- production of litter
- prevalence of seagulls and vermin

Precautions will need to be taken during excavation to ensure that these problems are adequately controlled.

The controls for the excavation, disposal and rehabilitation of the remainder of the tip are outlined below:

Contain, extract and treat or dispose of contaminated water to the sewerage system, provided the appropriate approvals from the appropriate water board have been obtained.

Extract and flare landfill gases, if sufficient quantities are present.

Control odours during excavation by minimising the working surface area and immediately covering with a clean fill. A deodoriser might also be needed to minimise emissions of malodorous gases to the atmosphere.

Limit leachate generation by minimising infiltration or ingress of water into the landfill through installation of cut-off drains, banks or bunds around the excavation areas.

Cap excavated areas with an impermeable material (0.5 metre minimum).

Transport of the excavated putrescible waste to a licensed landfill may also cause problems. Old putrescible wastes can be highly odorous, and additional measures may need to be taken, such as using sealed and covered containers.

7.3 Low-level contaminated soil

Old tips may contain soil contaminated with chemicals such as heavy metals and hydrocarbons. Construction sites may also intersect contaminated sites, with elevated levels of heavy metals, hydrocarbons or other toxic chemicals.

The classification of contaminated soil depends on the concentrations of the contaminants and their leachability, as described in an EPA information bulletin[11].

The bulletin describes levels of contaminants (Table 1) which define clean fill, and can therefore be disposed of without restriction.

The bulletin also describes levels of pollutants (Table 2) which define heavily contaminated soil. Disposal of prescribed wastes and heavily contaminated soil is discussed in section 7.4.

However, if contaminant concentrations and leachabilities are between the limits in Tables 1 and 2, the soil is classified as low-level contaminated and should be disposed of at an appropriately licensed landfill, with a letter of approval from EPA.

7.4 Prescribed wastes

If on-site materials that have to be excavated are prescribed waste, as defined by the *Environment Protection (Prescribed Waste) Regulations* 1987, it will need to be transported in accordance with the *Environment Protection (Transport) Regulations* 1987 to a landfill licensed to accept such wastes.

It should be noted that care should be taken handling prescribed wastes, so that they do not pose a health risk to workers.

CONTAMINATED MATERIAL AND WASTES

Objective

To ensure that all contaminated material uncovered on a construction site are excavated and disposed of in an environmentally responsible manner.

Suggested measures

Assay material uncovered on-site prior to disposal. If the wastes include putrescible wastes, then also analyse leachate and landfill gases.

Excavate material in a manner which avoids off-site environmental problems.

Seal remaining contaminated material or wastes, where only part of the tip has been excavated, to ensure that there is no off-site effect now or in the future.

Transport odorous wastes in covered vehicles.

Dispose of contaminated material in a landfill licensed to take the type of contaminated material or wastes uncovered.

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11 Environment Protection Authority, *Classification of Wastes*, Publication 448, 1995.

8 OTHER ENVIRONMENTAL ISSUES

8.1 Emergency procedures

Procedures should be in place, and staff trained to deal with any emergency, which could cause major environmental damage.

Adequate equipment, such as spill kits, should be kept on-site to deal with emergency spills.

The EPA should be contacted immediately an emergency occurs on (03) 9628 5777.

8.2 Air Quality

There are three potential sources of air pollution on construction sites. They are exhaust gases from vehicles and machinery and exhaust material from chippers. Dust was addressed in section 4.

AIR QUALITY

Objective

To ensure there is no health risk or loss of amenity due to emission of exhaust gases to the environment.

Suggested measures

Ensure that all vehicles and machinery are fitted with appropriate emission control equipment, maintained frequently and serviced to the manufacturers' specifications.

Smoke from internal combustion engines should not be visible for more than ten seconds

8.3 Litter

On construction sites, there are two main sources of litter, building material washed away during a storm and deposited into waterways, and rubbish thrown away by construction workers.

Litter is often caused by thoughtlessness of staff and the unavailability of suitable litter bins on the construction site.

LITTER

Objective

To ensure that all litter is disposed of in a responsible manner, and is not released into the environment.

Suggested measures

Maintain a high quality of housekeeping and ensure that materials are not left where they can be washed or blown away to become litter.

Provide bins for construction workers and staff at locations where they consume food.

Conduct ongoing awareness with staff of the need to avoid littering.

8.4 Storage of chemicals and fuels

Although it may be necessary to store fuels and chemicals on project sites, this inevitably creates an environmental risk. Spills can severely pollute waterways and land.

Reducing the quantities of chemicals and fuel stored on-site to minimum practicable levels is desirable. Infrequently used chemicals should be ordered just before they are needed. It may be possible to use a mini-tanker to refuel vehicles, instead of relying on a central fuelling point.

There are several approaches that can be taken to reduce the risk of fuel spills. Steps could include designing storage units to prevent vehicles or fork-lifts puncturing tanks, fitting automatic cut-offs to fuel dispensers, and making units vandal resistant.

Installing bunds will prevent spilt fuel escaping and causing environmental damage. Bunds should be designed and installed in accordance with EPA guidelines[12].

Key design issues addressed in the guidelines are height of bund walls, construction material, vehicular access, and stormwater management. Roofed bunds are strongly preferred.

Should a spill occur, then it is necessary to have a contingency plan in place to deal with the clean-up. It should consider issues such as cleaning up spilled material on the site, containing and cleaning up spills which have entered waterways, disposal or reuse of recovered residues, and contacting key company and government agency personnel to advise them of the emergency.

STORING FUELS AND CHEMICALS

Objective

To ensure that fuel and chemical storage is safe, and that any materials that escape do not cause environmental damage.

Suggested measures

Minimise fuels and chemicals stored on-site.

Install bunds and take other precautions to reduce the risk of spills.

Implement a contingency plan to handle spills, so that environmental damage is avoided.

8.5 Road cleaning

Some sites require vehicles to move on and off the site. It is possible that these vehicles will transport soil off the site and deposit it on the adjacent roads.

Prevention of soil being deposited on roads is preferable to cleaning them afterwards.

All points on the site where vehicles regularly leave should have rumble grids and wheel washes installed. In wet weather it may be necessary to hose mud off vehicle wheels as they traverse the grid.

All exits leading to the above mentioned controls should be paved with gravel. Top dress these paths periodically , and remove sediment from the wheel wash.

Where there is only occasional use of road crossings (twice a day or less), or where there is insufficient space on the site to install a rumble grid and wheel wash then (at least) daily road sweeping should be instituted. Care should be taken to ensure that road sweeping does not give rise to dust problems.

The number of times a day that road cleaning occurs should be determined by the frequency of road usage and the state of the roads, which should be inspected often.

Installation of litter traps lined with filter cloth in side-entry pits will trap soil in stormwater spilt on roads during rain.

Where soil is being transported for off site disposal, then all loads should be covered.

KEEPING ROADS CLEAN

Objective

To ensure that roads are kept clean of soil.

Suggested measures

Install wheel washes and rumble grids at all main road crossings.

Ensure that the roads are swept at least once a day on uncontrolled road crossings when construction vehicles are travelling off the site.

Install litter traps lined with filter cloth in all side-entry pits .

Cover all loads of soil being taken off site for disposal.

8.6 Protecting infrastructure

In built-up areas, care needs to be taken in working near existing infrastructure services such as drainage and sewerage pipes.

It is important to ensure that any existing drainage or sewerage pipes that intersect the construction site or are adjacent to it are not overstressed or damaged by movement or placement of construction plant or materials, or

Appropriate machinery must be used within concrete channels to avoid damage to structures.

8.7 Phytophthora management strategy.

Phytophthora cinnamomi is known to be one of the greatest threats to native flora and by extension fauna following the destruction of their habitat. The soil born fungus attacks the root systems of plants causing server dieback and ultimately death in the plant

Given there are no control methods once this fungus takes effect in a given area, control methods become critical in the site management and therefore spread of this destructive pathogen. Spread of this fungus is typically via the use of earthmoving machinery and equipment, plant material and water.

Objective:

Protect the integrity of the site area by minimizing the risk of Phytophthora infestations and spread to the site during construction and operation activities.

Suggested measures:

Provide warning signs on site to notify users of the potential threat of the pathogen.

Restrict operational vehicles to sealed or crushed limestone designated access roads, delivery and parking areas.

Restrict pedestrian / alking access to tracks and designated walkways on site.

Prohibit access to areas on site that are experiencing ponding of water.

Provide general information to employees and guests to increase understanding of the risks of spreading Phytophthora and required behavior to minimise its proliferation.

Undertake regular inspections of the site to identify any areas of potential Phytophthora infestations and notify DEH immediately.

9 INSPECTIONS, MONITORING AND AUDITS

9.1 Inspections

The frequency of inspections depends on the risks posed to the environment by each construction activity or the nature of the site . These recommendations should be taken as minimum frequencies. The frequency of inspections, monitoring and auditing recommended below is based on experience of large freeway construction.

Installation	Possible problems	Frequency	Remedial action
Drainage	New drainage lines not controlled	At least once every two days in areas where earth-moving is occurring Weekly elsewhere	Install appropriate sediment controls on new drainage lines
Sediment controls, silt fences and traps	Not controlled effectively	Daily in dry weather Within first two hours of a storm# Three times a day during prolonged rainfall#	Remove sediment from trap Replace barrier or filter material Redesign installation Improve maintenance
Haul roads	Dust Soil on paved roads	At least daily	Pave haul roads with gravel or impervious sealant Install wheel wash and rumble grid Manually wash vehicle wheels Increase road cleaning frequency
Cut-off and diversion drains	Water not diverted away from sensitive areas	Weekly	Replace or repair damaged drains Redesign ineffective drains Relocate incorrectly placed drains

Installation	Possible problems	Frequency	Remedial action
In-stream weirs	Ineffective during low flow	Weekly in dry weather	Educate sediment trapped behind weir
	Release of trapped sediment during storms	24 hours before forecast rain	Clean out behind weir if filled to 25% capacity
Stream crossings	Unstable Releasing sediment and soil into stream	When in use, but no less than weekly	Stop use until installation has been redesigned
Vegetated buffer zones	Accidentally cleared	Weekly	Revegetate Review procedures to ensure no recurrence
Retardation and settlement basins and artificial wetlands	Sediments not effectively removed	Weekly	Redesign installation Increase retention times Add flocculants*
Stockpiles and bare slopes	Erosion	Weekly	Minimise exposure to run-off and action of wind Ensure stabilisation measures are effective
Unvegetated areas	Dust	Daily during dry weather	Increase use of water spray on unvegetated areas Protect untrafficked areas temporarily with mulch or geo-fabric blanket
Vehicles and machinery	Noise pollution	Initially when vehicle or machinery is introduced to the site and thereafter monthly	Ensure that mufflers and noise-shielding are effective
	Exhaust gases		Ensure that emission controls are effective and motors well maintained

Installation	Possible problems	Frequency	Remedial action
Chemical storage areas	Spills	Weekly	Clean-up contaminated area Improve bunding
Litter controls	Litter on and off-site	Daily on and off-site	Clean-up litter originating on-site Review number and placement of rubbish bins Ensure materials are not stored in such a manner that they could contribute to litter Speak to staff about the litter disposal

9.2 Monitoring

Regular monitoring of air and water and taking of noise measurements is required to determine whether standards, established by the Environmental Management Plan, are being complied with. This should commence before construction to provide a baseline against which data collected during construction can be compared.

Chemical measurements should be conducted by a laboratory registered by the National Association of Testing Authorities (NATA), and in situ measurements should be made under the supervision of a suitably qualified person from a NATA laboratory.

Monitoring should provide information on whether standards are being complied with and sensitive sections of the environment protected. The following recommendations should be treated as minimum monitoring requirements relating only to the direct impact of construction activities. Other monitoring programs may be required for major road projects to determine their future impact on traffic emissions.

Area of risk	Purpose	Monitoring activity	Remedial action
Noise	Determine whether a noise nuisance exists	As required by complainants at their homes	Review and enhance noise control measures
		Monitor noise continuously at a representative residence near construction activities	
Air quality (dust)	Determine whether a dust nuisance exists	Daily during dry weather for dust deposits at locations that indicate impact on adjacent residents or at site boundary	Improve controls on dust emissions

Area of risk	Purpose	Monitoring activity	Remedial action
Water quality (chemical and biological)	Quantify downstream chemical and biological impact Identify ineffective sediment control installations	Design chemical and biological monitoring program by regularly surveying upstream and downstream sites, in consultation with water resource manager, to assess impact on stream ecology under all flow conditions Install continuous monitors for turbidity* and flow	Revise on-site controls if regulatory standards are breached Revise risk assessment and management Identify and repair failed control installation
Sediment controls, silt fences and traps	Determine whether the installation is operating effectively	Measure turbidity on the input and output side of control devices during wet weather inspections (see inspection table in section 9.1)	Redesign control devices
Discharge from retention ponds, artificial wetlands and sediment dams	Determine whether retention structures are effectively removing sediment	Weekly for suspended solids, conductivity, pH and dissolved oxygen, and daily during rainfall	Redesign retention structures
River crossings	Determine whether crossings are stable	Measure turbidity up and down stream from the crossing when in use (see inspection table in section 9.1)	Stabilise structure
Pumping contaminated water to the stormwater system or natural waterway	Ensure that natural waters are not adversely affected by pump-out water	Measure turbidity every hour during pumping	Stop pumping if turbidity exceeds regulatory standards

Area of risk	Purpose	Monitoring activity	Remedial action
Excavated material	Detect old fill material that may contain contaminated soil or rubble	Daily in areas being excavated	Analyse fill material suspected of being contaminated Remove contaminated material to a landfill licensed to accept the wastes (see section 7) and ensure that necessary approvals have been obtained

9.3 Auditing

Independent audits should be conducted on environmental performance and systems by experts in construction activities and environmental management. Different people can be used for each type of audit.

INSPECTIONS, MONITORING AND AUDITING

Objective

Conduct checks on significant environmental risks to ensure that they are adequately managed and control systems are operating effectively.

Suggested measures

Establish a baseline monitoring program before construction commences.

Prepare an inspection, monitoring and auditing program, designed to match the environmental risks.

Ensure that remedial action is taken promptly when monitoring,, inspections or audit results reveal a problem in environment management.

Ensure that all monitoring is conducted by a NATA registered laboratory, either directly, or under supervision.

Arrange for regular independent audits of environmental performance and the environmental management system.

APPENDIX 1 - CHECKLIST

This Checklist summarises the specific environmental issues that need to be addressed on the construction site. Provision is made in the list for the manager to check off each issue as it relates to the site. The issues are listed in the same order as they appear in the *Guidelines*.

Issue	Action taken	Section
Compliance with legislative requirements	Collect copies of all relevant legislation, regulations and government policy.	1
	Ensure management is aware of their requirements and implements due diligence systems to ensure compliance.	1
	Use documents collected to set minimium standards in the environmental management plan.	1
Pre-construction planning		
Environmental assessment	Assess all possible impacts that the project will have on the environment.	2.1
	Determine whether construction activities will intersect a contaminated site or old tip.	2.1
	Assess impact of the development on the amenity of adjacent residents.	2.1
	Commence monitoring all segments of the environment to determine background conditions.	2.1
Risk assessment information	Collect all relevant information on the site, and adjacent areas, that may be affected by the development.	2.2
	Collect relevant weather and climate information.	2.2
	Obtain design plans, work schedules and work programs that may contribute to environmental risk.	2.2
	Obtain map of site topography and generate maps of changes in topography, as a result of the development.	2.2
	Calculate stormwater flows in each micro-catchment for each phase of the development.	2.2
	Map changes of vegetative cover and the position of stockpiles and batters, as a function of time.	2.2
	Collect information on stream flows of any natural waterways that will be affected by the development.	2.2
Assessing and managing risks	Identify all hazards to the environment.	2.2

	Quantify hazards, whever possible.	2.2
	Determine consequences of each hazard.	2.2
	Calculate total risk level for each hazard.	2.2
	Rank risks.	2.2
	Identify all significant risks.	2.3
	Develop an action plan to address all significant risks.	2.3
	Wherever possible seek to avoid risks or minimise them by modifying the project design or planned work program and schedule.	2.3
	Based on information of monitoring, inspection and surveillance, update risk assessment, management and the environmental management plan.	3.3
Pre-construction works	Install stormwater drainage system (particularly to divert stormwater around the site) and major sediment controls prior to the project's commencement.	2.3
Environmental management plan	Construction company must have an environmental management system in place before preparing the environmental management plan for the project.	3.1
Environmental management system	Ensure that all staff are adequately trained.	3.1
	Ensure that all procedures are written down.	3.1
	Ensure that control and quality assurance systems are in place to ensure effectiveness of the environmental management system.	3.1
	Prepare an environment management plan based on the risk management action plan.	3.1
Prepare plan	List special work procedures to avoid or reduce environmental harm.	3.2
	Map cleared areas, as a function of time.	3.2
	Map changes of landform as a function of time and identify control measures on the map and position of soil stockpiles and batters.	3.2
	Include any special operational procedures required to protect the environment in the work site manual.	3.2
	Ensure that written contingency plans have been prepared and adequately resourced.	3.2
	Ensure that best pactice documents for the site are prepared and implemented.	3.2
	Document maintenance, inspection and surveillance schedule.	3.2

	Prepare a rehabilitation plan.	3.2
	Update plan, as required.	3.2
Land disturbance		
Erosion	Characterise erosion potential of the site during each phase of the development.	4.1
	Take action to minimise clearance of vegetation.	4.1
	Implement controls and re-schedule works to reduce erosion.	4.1
	Stabilise cleared areas as soon as possible.	4.1
	Avoid working on areas vulnerable to erosion, wherever possible.	4.1
Stormwater management	Reduce quantity of contaminated stormwater entering project site.	4.2
	Reduce water velocities, wherever possible.	4.2
	Reduce stormwater flows over bare slopes.	4.2
Erosion and sediment control devices	Design control devices to handle expected peak water flows.	4.3
	Treat intercepted water, if required, priorito discharge to the environment.	4.3
	Install control devices, as required.	4.3
	Install in-stream weirs, as required.	4.3
	Implement a maintenance and inspection schedule for control devices.	4.3, 9.1, 9.2
	Prepare contingency plan and ensure it is adequately resourced.	4.3
	Improve design of control measures, if they don't operate effectively.	4.3
De-watering work site	Establish procedures to ensure that contminated water is not pumped into a natural waterway without adequate treatment.	4.4
	Ensure procedures are in place to ensure that pumping operations are supervised and monitored.	4.4
Dust control	Implement a dust prevention strategy.	4.5, 4.6
	Pave haul roads.	4.5
	Ensure adequate watering or treatment of areas that could give rise to dust.	4.5
Stockpiles and batters	Implement a management program to minimise erosion and sediment runoff from stockpiles and bare batters.	4.6
	Stabilise stockpiles and batters, if they are to remain bare for more than 28 days.	4.6
	Establish sediment controls around unstabilised stockpiles and batters.	4.6
Working in waterways and floodplains	Consult responsible drainage body for approval.	4.7

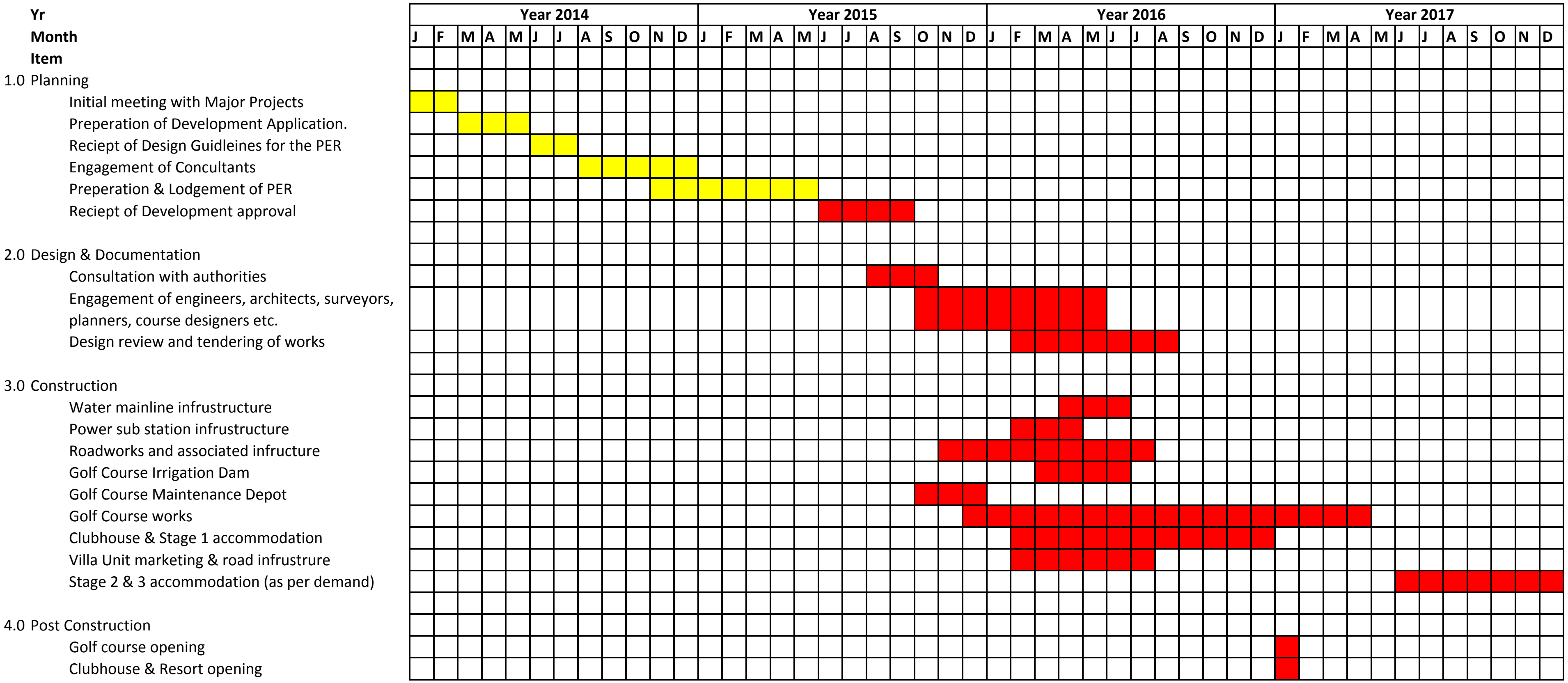
	Establish procedures to minimise impact on waterway.	4.7
	Design and construct stream crossings, if required, to minimise impact on the waterway.	4.7
	Ensure that written contingency plans have been prepared and adequately resourced.	4.7
	Prepare and submit a re-instatement plan to the relevant drainage authority for approval.	4.7
Noise and Vibration	Establish procedures that comply with limits on working hours.	5.1
	Implement procedures so that adjacent residents are advised of out of hours works.	5.1
	Regularly service machinery and vehicles.	5.2
	Reduce noise to acceptable levels.	5.2
	Schedule deliveries so that they do not cause impairment of local amenity.	5.3
	Install appropriate noise abatement structures, if required.	5.4
	Take measures to ensure that vibration does not impact on adjacent residents.	5.5
Waste minimisation	Implement a waste minimisation assessment.	6
	Set waste minimisation targets.	6
	Implement programs to reduce waste that needs to be disposed of.	6
Contaminated material and soil	Analyse material uncovered on site that could be contaminated or contain wastes.	7
	Establish procedures to excavate contaminated material or waste so as not to cause environmental problems, and seal remaining material.	7
	Establish and implement procedures for appropriate transport and disposal of contaminated material or waste.	7
Emergency procedures	Establish procedures for emergency situations.	8.1
Air Quality	Implement adequate maintenance regime for vehicle and machinery exhausts.	8.2
	Install controls on equipment or vehicles that are polluting the atmosphere.	8.2
Litter	Establish procedures to avoid the generation of litter.	8.3
	Install adequate litter bins on site.	8.3
	Implement staff awareness program.	8.3

Storage of chemicals and fuels	Establish procedures to minimise the quanities of chemicals and fuels required to be stored on site.	8.4
	Install bunding around storage areas.	8.4
	Implement adequately resourced contingency plans.	8.4
Road cleaning	Install wheel washes and rumble grids, as required.	8.5
	Implement a program for adequate cleaning of roads, if required.	8.5
	Install lined litter traps in side entry pits, if required.	8.5
	Ensure that trucks taking soil off site are covered.	8.5
Protecting infrastructure	Obtain a Works Approval.	8.6
Phytophthora Management Strategy	Implement works program to inform and educate users of the dangers of the fungus. Adopt audits and regular inspections to monitor its presence.	8.7
Inspections, monitoring and audits	Implement an adequate program of inspections, monitoring and audits.	9.1, 9.2, 9.3

Appendix P -

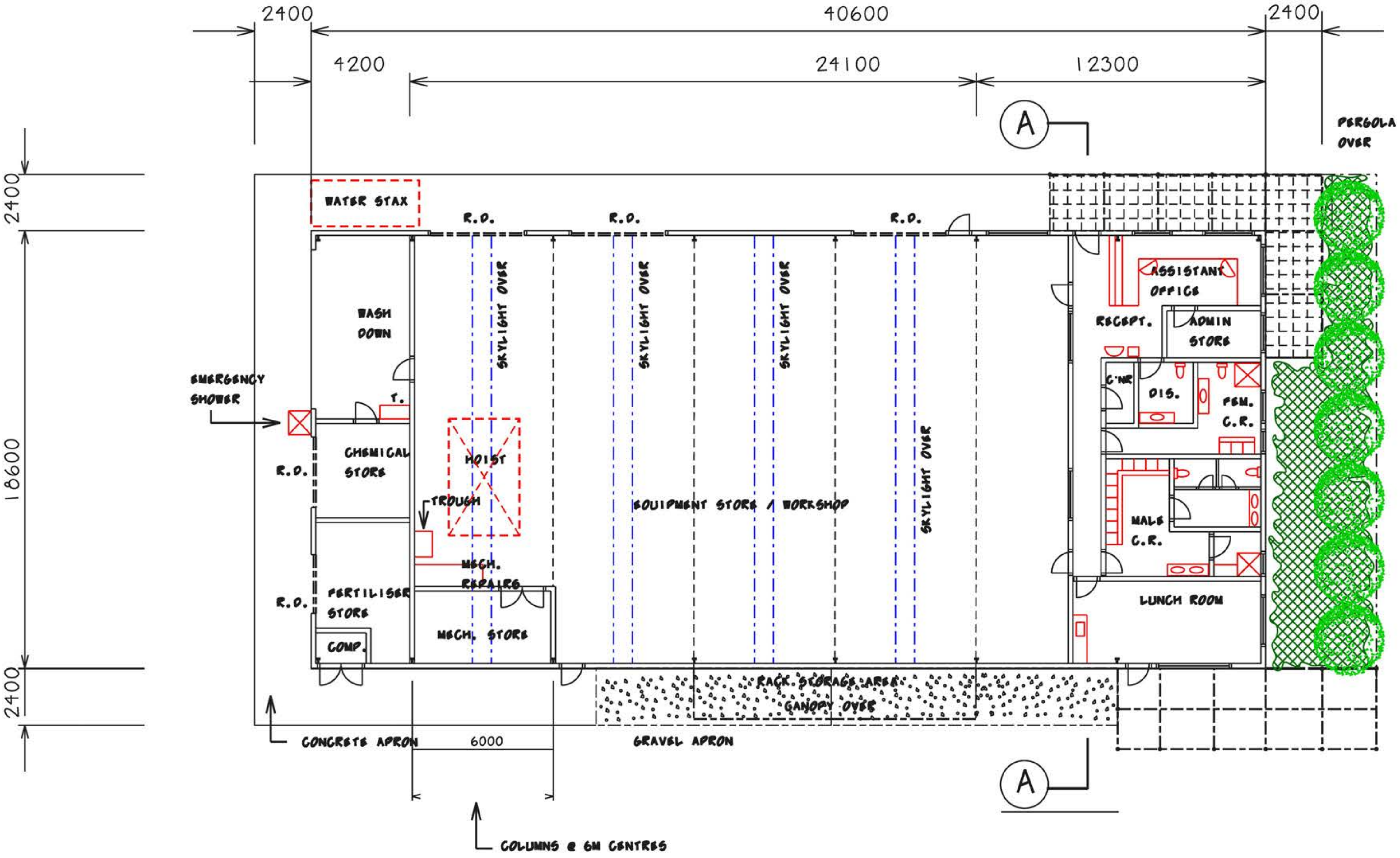
Indicative construction program

Kangaroo Island Golf Resort
Indicative Construction Program



Appendix Q -

Typical Maintenance Compound



FLOOR PLAN

NOTES:

1. HARDSTAND AREA TO BE DRAINED TO PITS CONNECTED TO WATER STAX FOR CLEANING & THEN PUMPED TO STORAGE TANK IN S.E. CORNER OF SITE.

2. STORMWATER FROM ROOF TO BE COLLECTED & PUMPED TO TANK IN S.E. CORNER OF SITE.

Kangaroo Island
Maintenance Building Concept Plan

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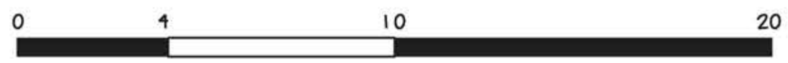
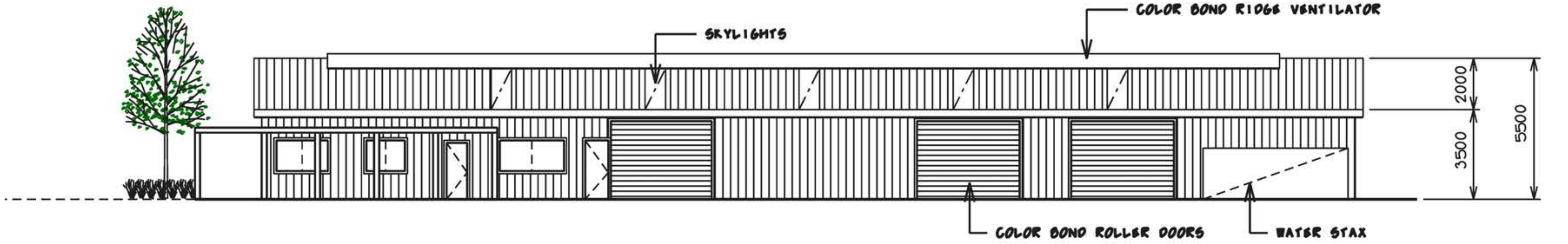
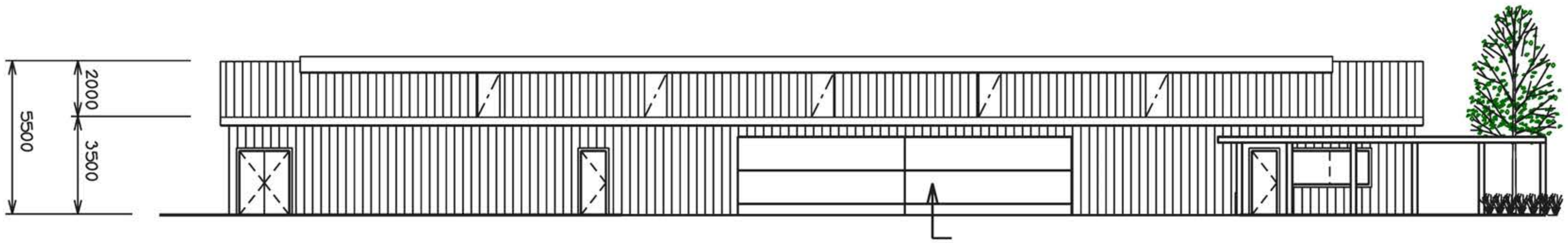


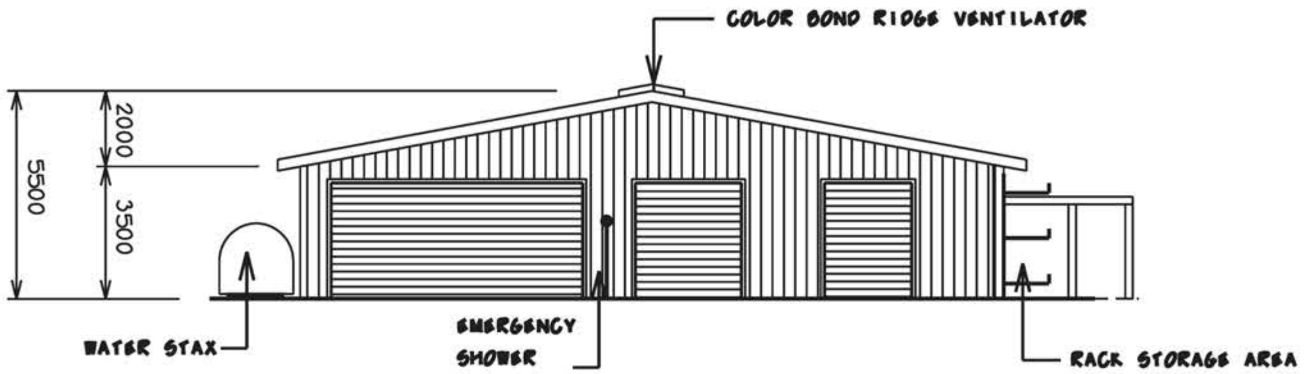
Programmed Turnpoint P/L



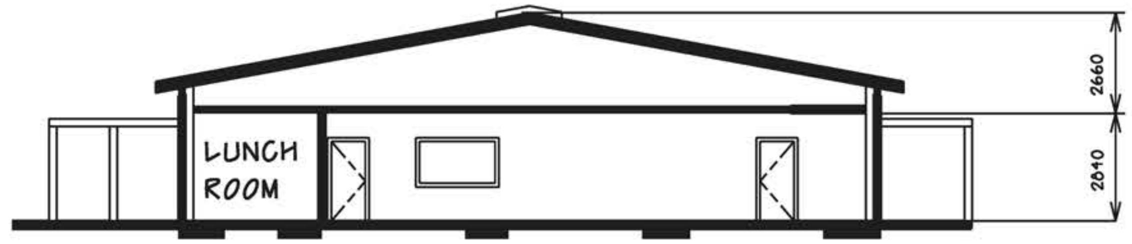
NORTH ELEVATION



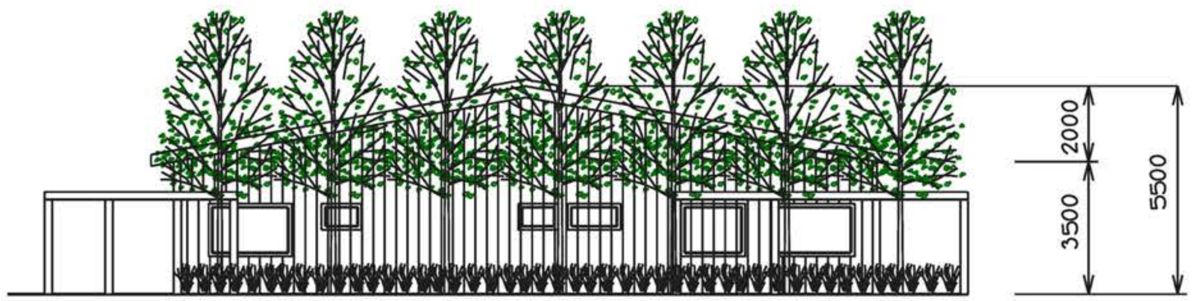
SOUTH ELEVATION



WEST ELEVATION



TYPICAL SECTION AA



EAST ELEVATION

Kangaroo Island
Maintenance Building Concept Plan

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SHEET 2 OF 2

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Appendix R -

Okolina PTY LTD – Hydrogeological summary

The Links at Kangaroo Island

Hydrogeological Summary

March 2014

Prepared for

PROGRAMMED Turnpoint

by

Okolina Pty Ltd

March 2014

Author: Marion Santich

Contents

Figures

1. Introduction

This report presents a summary of local hydrogeology to inform drilling investigations in relation to potential long term groundwater supplies for a future development, The Links (golf course and facilities) at Kangaroo Island, South Australia. Figure 1 shows the site of this development and the broader area of hydrogeological review.

The scope of work input to this report is:

- research and collation of available hydrogeological literature;
- a review of drillhole data; and
- the production of maps with relevant data.

2. Hydrogeology

The occurrence of groundwater for usable supplies on Kangaroo Island is dependent on site specific underlying geology. In general, the groundwater resources across the island are limited in both quantity and quality with good quality groundwater available only in short supplies.

Geologic formation distribution for Kangaroo Island has been developed from stratigraphic or hydrostratigraphic interpretations reported in South Australia's drillhole database (Alcoe and Berens, 2012) and groundwater resources are known to reside within:

- Cambrian fractured rock aquifers;
- Permian glacial sediments;
- Tertiary limestone and sandstone;
- Consolidated Quaternary aeolianite (dune deposits); and
- River alluvium.

2.1 Site Specific

In the vicinity of the development area, both the Quaternary sediments of the Bridgewater Formation and the Saint Kilda Formation have both been identified from drillhole logs from ground surface to a depth of greater than 40 m (Figure 2). None of the drillhole logs have indicated complete intersection of these formations by identifying a deeper unit (Alcoe and Berens, 2012) hence the total depth of these formations in the area is unknown.

The Bridgewater and Saint Kilda Formations consist of Quaternary sands and are often interspersed due to the nature of wind driven deposition. The Bridgewater Formation generally comprises poorly consolidated yellow pinkish-brown fine to coarse fossiliferous calcareous sand that may be locally capped by calcrete. The Saint Kilda Formation consists of undifferentiated marine sediment that is calcareous, fossiliferous sand and mud of intertidal sand flats, beaches and tidal marshes.

The Bridgewater Formation has been logged on site in the abandoned drillhole 6426-38 as calcareous sand and variably consolidated sandstone with fragments of limestone. The lithological log is provided in Appendix A and gives an indication of the stratigraphy to be encountered in drilling investigations.

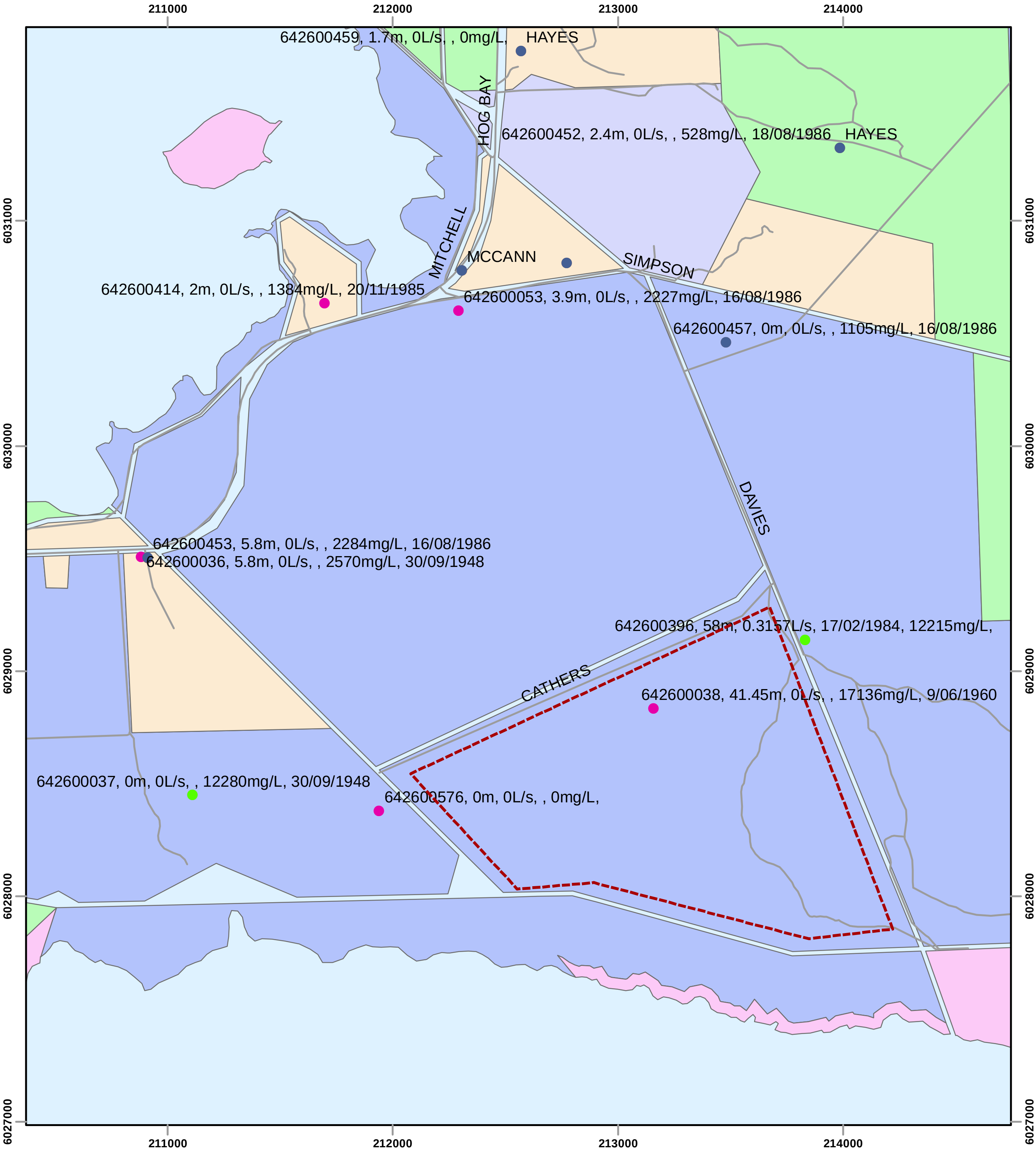
The Bridgewater Formation is one of the main aquifers on Kangaroo Island having high permeability due to the presence of solution features in some areas. The unconsolidated sand aquifers of the Saint Kilda Formation, which intersperses the Bridgewater Formation, may also provide a groundwater source. Recharge to the unconfined aquifers occurs by infiltration and within the Bridgewater Formation the percolation through solution cavities can stratify above more saline, higher density saline water, hence variable quality, quantity and accessibility can occur in short distances.

Regional surface geology mapping (Fairclough, 2008) shows the Bridgewater Formation to be present across the site with small areas of the Saint Kilda Formation nearby (Figure 3). On the local scale these formations may be interspersed across site, with the Bridgewater Formation predominant, and are likely to be very similar in terms of groundwater salinity and yield.

Groundwater data, presented on Figure 1, shows drillholes in the site vicinity intersecting high salinity water at 12,000 to 17,000 mg/L to a depth of 40 to 60m. Yields are either undefined or very low with the deepest bore yielding less than 0.5 L/s. Summary information from drillholes in the vicinity of the development site is provided in Appendix A.

Relatively good quality groundwater of 1,000 to 3,000 mg/L has been found at shallow depth, with no yields recorded, approximately 3 km north of the site. These wells most likely access alluvium of limited groundwater supply and suitable for stock watering rather than larger water requirements.

Whilst the deeper units have not been intersected in the vicinity of the development site, regional stratigraphy indicates the Quaternary sediments along the southern coast to be directly underlain by the Cambrian basement rocks of the Kanmantoo Group. The Kanmantoo basement rocks typically have few of the joints and fractures that form fractured rock aquifers and in addition, any joints and fractures have been infilled with clayey weathering material resulting in high salinity due to mineral dissolution (Barnett and Dodds, 2000). This regional basement geology contributes to the regional high salinity with the tight and impermeable rocks acting as a barrier to recharge.



Legend

Development site

Drillholes
Label: unit no., depth & date, yield & date, salinity & date

- Status unknown
- Abandoned
- Backfilled
- Operational

Land Use

- AGRICULTURE
- FORESTRY
- LIVESTOCK
- MINE_QUARRY
- RESERVE
- RESIDENTIAL
- RURAL_RESID
- VACANT

N

500 250 0 500 1,000 Meters

GDA 1994 MGA Zone 54

The Links at Kangaroo Island Drillhole Data

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Data Sources:
DEWNR SA Drillhole Database
DPTI SA Generalised Landuse Data

Figure 1

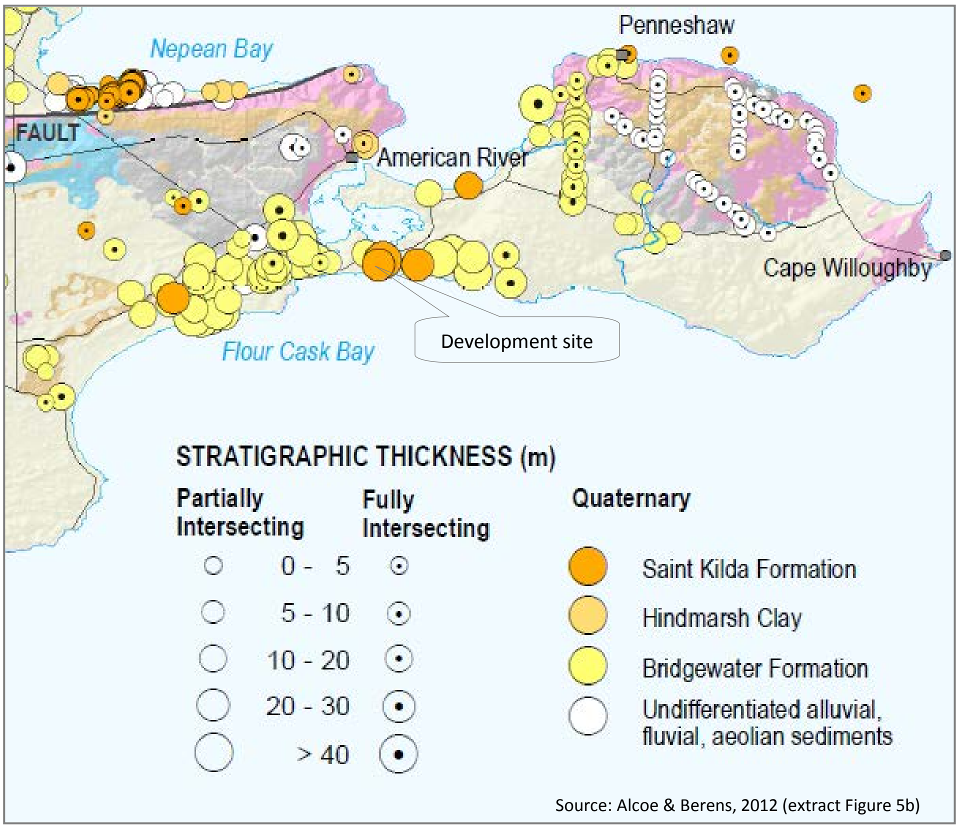

Figure 2 Local stratigraphic thickness

Figure 3 Regional surface geology

3. Groundwater use potential

The south coast has the thickest cover of the Bridgewater Formation, logged near Flour Cask Bay, and good quality groundwater may be found where higher recharge occurs. It is unlikely that this will be located within the development site as the lowest salinity groundwater occurs in the southwest where that highest rainfall occurs and drillhole data does supports this.

Throughout Kangaroo Island water wells predominantly have yields of less than 1 L/s, which will not accommodate the needs of high volume use. Supplies suitable to meet the demands of golf course irrigation and the related facilities will need to target brackish aquifers with higher yields of over 3 to 5 L/s and a borefield with a balancing storage will likely be required to meet desalination and distribution flow rates.

Drilling investigations will be required to confirm groundwater suitability and variability across the site in terms of salinity and yield for consideration as a desalination water supply option.

4. Recommendations for further investigations

It is recommended that:

- on site drilling investigations target the Bridgewater Formation and drill into the basement rocks below to completely intersect the formation. This will allow the maximum yield and any salinity stratification to be identified. The estimated total drillhole depth is 60 metres.
- the initial investigation well be located close to any identified surface storage site. A borefield connected to the balancing surface storage via a ring or individual supply mains is likely to be required to meet demand and delivery flow rates. These wells will need to be spaced around the site to avoid interference between wells and it is considered prudent to undertake investigative drilling across the site to determine yield and salinity variations.
- current yield and salinity information be obtained from existing well 6426-396 if able to be accessed. This well, situated immediately northeast of the site across Davies Road, is recorded as being cased to 58 metres but has no status defined.

Indicative investigation drilling sites are located on Figure 4 and whilst potential development configurations have been considered the drilling sites should be confirmed on ground in accordance site landscape and infrastructure plans.

Legend

- Investigation drilling sites
- Development site

N

500 250 0 500 Meters

GDA 1994 MGA Zone 54

The Links at Kangaroo Island
Investigation drilling sites

Data Source: Google Earth imagery

okolina water resources planning & project development

Figure 4

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Alcoe, DW and Berens, V, 2012, Non-prescribed groundwater resources assessment – Kangaroo Island Natural Resources Management Region. Phase 1 - Literature and Data Review, DFW Technical Report 2012/02, Government of South Australia, through Department for Water, Adelaide

Barnett, SR and Dodds, AR, 2000, Groundwater resources on Kangaroo Island, Report Book PIRSA 2000/15, Government of South Australia, through Primary Industries and Resources South Australia, Adelaide

Fairclough, MC. 2008, Kingscote Special Map Sheet, South Australia Geological Survey, Geological Atlas 1:250 000 Series Sheet SI 53-16

Government of South Australia, 2014 Groundwater data
https://www.waterconnect.sa.gov.au/Systems/GD/

Appendix A Drillhole summary information

Summary Information: 6426-38

Name		**Permit No.**	
Class	WW	**Status**	ABD
Obswell No.		**Network(s)**	
Purpose		**Aquifer**	

Previous Next Data Download

Depth

Original Drilled Depth (m)	41.45	**Date**	09/06/1960
Maximum Depth (m)	41.45	**Date**	09/06/1960
Latest Open Depth (m)	41.45	**Date**	09/06/1960
Ref Elev (m AHD)		**Date**	
Cased To (m)		**Min Diameter (mm)**	

Latest Groundwater Readings

SWL (m)	40.54	**RSWL (m AHD)**		**Date**	09/06/1960
EC (µS/cm)	28184	**TDS (mg/L)**	17136	**Date**	09/06/1960
Yield (L/sec)		**Date**			

Location

MGA Easting	755074.31	**MGA Northing**	6029809.43	**MGA Zone**	53				
Latitude	**Degrees** 35		**Minutes** 50		**Seconds**	33.911		**Decimal**	-35.8427531
Longitude	**Degrees** 137		**Minutes** 49		**Seconds**	27.072		**Decimal**	137.8241867
250,000 map sheet	SI5316 KINGSCOTE	**100,000 map sheet**	6426 Kingscote	**50,000 map sheet**	2	**10,000 map sheet**	34	**2,500 map sheet**	
Hundred	DUDLEY	**Plan**	D70357	**Parcel**	A6	**Title**	CT5966/16		

Lithological Log: 6426-38

Name		**Permit No.**	
Class	WW	**Status**	ABD
Obswell No.		**Network(s)**	
Purpose		**Aquifer**	

Previous Next Data Download

Depth From (m)	Depth To (m)	Major Lith Code	Minor Lith Code	Description
0	0.3	SAND	LMST	Light brown fine sand with nodu;les of limestone
0.3	3.66	SDST		Buff fune grained friable calcareous sandstone
3.66	14.33	SDST	SAND	Cream medium grained calcareous sand and sandstone with shell fragments
14.33	17.98	LMST	SDST	White sandy limestone and cream medium grained calcareous sandstone
17.98	22.56	SDST		Light brown medium grained dense calcareous sandstone
22.56	28.65	SAND	LMST	Buff medium grained calcareous sand with fragments of grey limestone
28.65	32.61	SDST		Brownish grey medium grained friable calcareous sandstone
32.61	35.36	SAND		Cream fine calcareous sand
35.36	40.54	SAND	LMST	Light brown sllightly clayey fine calcareo;u;s sand and framents of limestone
40.54	41.45	SDST		Cream medium grained calcareous sandstone

Summary Information: 6426-396

Name		**Permit No.**	14051
Class	WW	**Status**	
Obswell No.		**Network(s)**	
Purpose		**Aquifer**	

Previous Next Data Download

Depth

Original Drilled Depth (m)	58	**Date**	17/02/1984
Maximum Depth (m)	58	**Date**	17/02/1984
Latest Open Depth (m)	58	**Date**	17/02/1984
Ref Elev (m AHD)		**Date**	
Cased To (m)	57.5	**Min Diameter (mm)**	125

Latest Groundwater Readings

SWL (m)	54.5	**RSWL (m AHD)**		**Date**	01/07/1986
EC (µS/cm)	20625	**TDS (mg/L)**	12215	**Date**	
Yield (L/sec)	0.32	**Date**	17/02/1984		

Location

MGA Easting	755765.32	**MGA Northing**	6030073.51	**MGA Zone**	53				
Latitude	**Degrees** 35		**Minutes** 50		**Seconds**	24.702		**Decimal**	-35.840195
Longitude	**Degrees** 137		**Minutes** 49		**Seconds**	54.28		**Decimal**	137.8317446
250,000 map sheet	SI5316 KINGSCOTE	**100,000 map sheet**	6426 Kingscote	**50,000 map sheet**	2	**10,000 map sheet**	34	**2,500 map sheet**	q
Hundred	DUDLEY	**Plan**	H110200	**Parcel**	S319	**Title**	CT5941/476		

Summary Information: 6426-576

Name		**Permit No.**	44016
Class	WW	**Status**	ABD
Obswell No.		**Network(s)**	
Purpose	STK	**Aquifer**	

Previous Next Data Download

Depth

Original Drilled Depth (m)	30	**Date**	19/03/1998
Maximum Depth (m)	30	**Date**	19/03/1998
Latest Open Depth (m)	0	**Date**	19/03/1998
Ref Elev (m AHD)		**Date**	
Cased To (m)		**Min Diameter (mm)**	

Latest Groundwater Readings

SWL (m)		**RSWL (m AHD)**		**Date**	
EC (µS/cm)		**TDS (mg/L)**		**Date**	
Yield (L/sec)		**Date**			

Location

MGA Easting	753829.08	**MGA Northing**	6029430.43	**MGA Zone**	53				
Latitude	**Degrees**	35	**Minutes**	50	**Seconds**	47.362	**Decimal**	-35.8464893	
Longitude	**Degrees**	137	**Minutes**	48	**Seconds**	37.926	**Decimal**	137.8105349	
250,000 map sheet	SI5316 KINGSCOTE	**100,000 map sheet**	6426 Kingscote	**50,000 map sheet**	2	**10,000 map sheet**	34	**2,500 map sheet**	r
Hundred	DUDLEY	**Plan**	D48559	**Parcel**	A22	**Title**	CT5495/701		

Drillers Log: 6426-576

Name		**Permit No.**	44016
Class	WW	**Status**	ABD
Obswell No.		**Network(s)**	
Purpose	STK	**Aquifer**	

Previous Next Data Download

Log Date	Logger Name	Comments
19/03/1998	FAULKNER B	

Depth From (m)	Depth To (m)	Lith Code	Description
0	1	LMST	limestone
1	30	SAND	sand

Summary Information: 6426-37

Name		**Permit No.**	
Class	WW	**Status**	
Obswell No.		**Network(s)**	
Purpose		**Aquifer**	

Previous Next Data Download

Depth

Original Drilled Depth (m)		**Date**	
Maximum Depth (m)		**Date**	
Latest Open Depth (m)		**Date**	
Ref Elev (m AHD)		**Date**	
Cased To (m)		**Min Diameter (mm)**	

Latest Groundwater Readings

SWL (m)		**RSWL (m AHD)**		**Date**	
EC (µS/cm)	20735	**TDS (mg/L)**	12280	**Date**	30/09/1948
Yield (L/sec)		**Date**			

Location

MGA Easting	753007.32	**MGA Northing**	6029552.5	**MGA Zone**	53				
Latitude	**Degrees**	35	**Minutes**	50	**Seconds**	44.169	**Decimal**	-35.8456024	
Longitude	**Degrees**	137	**Minutes**	48	**Seconds**	5.065	**Decimal**	137.801407	
250,000 map sheet	SI5316 KINGSCOTE	**100,000 map sheet**	6426 Kingscote	**50,000 map sheet**	2	**10,000 map sheet**	34	**2,500 map sheet**	r
Hundred	DUDLEY	**Plan**	D48559	**Parcel**	A21	**Title**	CT5495/700		

Appendix S -

Kangaroo Island Council Development Plan

Appendix S.

KANGAROO ISLAND COUNCIL DEVELOPMENT PLAN

Its structure is such that it outlines ***objectives*** for the particular uses and then sets out definitive ***principles of development control*** PDCs.

<table>
<tr><td colspan="2">KEY PROVISIONS OF THE KANGAROO ISLAND COUNCIL DEVELOPMENT PLAN – Consolidated 20 February 2014</td></tr>
<tr><td>STATE STRATEGIC SETTING – The following strategic setting excerpts are considered particularly relevant this proposal.</td><td>PRELIMINARY ASSESSMENT OF PROPOSAL</td></tr>
<tr><td>Economic Activity

The creation of economic initiatives and employment opportunities, combined with appropriate land use allocation, is sought to establish a robust and sustainable economic climate that contributes to the wellbeing of the local community.

Tourism

Tourism has shown growth over recent years and it is anticipated that tourism numbers will increase in the future. It is of extreme importance that Kangaroo Island Tourism is managed in a manner that ensures that the experiences of visitors continue to match their Kangaroo Island expectations and perceptions.

Tourism to Kangaroo Island has historically been largely dependent on the natural resources of the Island and people's perception of the quality of these resources. The concept of a 'clean and green' image for the Island is a fundamental component of tourism and other industries, and its continuing success will be dependent on a well-managed natural environment.</td><td>- The proposal is directly relevant and wholly consistent with the strategic setting.
- The proposal is a unique economic initiative using degraded farm land. It will generate a range of employment opportunities that do not currently exist. Twenty full-time staff to be employed across the golf and clubhouse precincts with potential for up to 50 full and part-time staff when all accommodation is developed and operating.
- The proposal will 'piggyback' on the national and international image and attraction of KI whilst adding a further stimulus to visit the Island, ie, golf tourism.
- 18 Hole Greg Norman Championship length golf course and associated practice facilities of international standard with the aim of being inside the top 100 courses in the world.
- It allows a definitive reinforcement of the tourist industry through increasing accommodation choice and options.
- It is expected that the proposed accommodation will additionally be used as a base for exploring the Island's other tourist attractions and will therefore be used mainly for multi-night stays.
- It will provide an additional attraction to the existing range of tourist attractions on the Island</td></tr>
</table>

A range of sustainable tourism facilities, accommodation and products must be developed to suit a range of visitor budgets and experiences. However, tourism development must also consider the impact of increasing numbers on the natural environment so as not to diminish the very reason that attracts so many visitors to the Island in the first instance. *It is expected that the Island will continue to develop as a pre-eminent sustainable, nature-based tourism destination, but there is also a need to provide opportunities in other tourism markets around the themes of outdoor adventure and leisure activities, the coast, niche food and wine products, heritage and culture. These markets should add depth to the Island's appeal as a visitor destination and encourage longer stays.*	whilst not offering any threat nor 'competition' to these attractions. - Initially it is aimed at generating approximately 15,000 golf rounds per annum with potential to grow to up to 25,000 rounds per year. - A typical daily spend of $300 to $350 excluding accommodation. - The proposal uses three principle attractions of the Island as its keynote drawcards; Spectacular coastal scenery; a strong sense of isolation in an almost pristine environment; and kangaroos. - The proposal capitalises on its immediate and surrounding environment. - Retention and enhancement of the environment is consistent with the potential of the development. - The proposal is consistent with the Island's aims of increasing its visitor numbers in the next twenty years.
Environment and Resources *The environment of Kangaroo Island is characterised by extensive areas of National Park and Conservation Parks, accounting for nearly 30 per cent of the Island. Kangaroo Island has:* - *spectacular coastal features* - *clean beaches* - *freshwater streams* - *unspoilt natural settings* - *a small resident population* - *a diversity of native fauna and flora (including rare and endangered species)* - *a rare seal colony* - *no rabbits or foxes; and is relatively pollution free with contamination free conditions.* *Kangaroo Island offers an unspoilt Australian nature, wildlife and rural experience with the distinctive difference of an Island setting. Opportunities to see Australian wildlife (including rare species) in natural habitats, the spectacular coastlines, bush landscapes and the mystique of the Island's isolation, small population and heritage, make Kangaroo Island a compelling*	- The site offers direct access to the principle characteristics and attractions of Kangaroo Island. - It utilises a degraded tract of pastureland while the scale and design of the development is aimed at blending in to the surrounding environment taking advantage of its natural assets. It is therefore appropriate that the development is entirely in harmony with its surrounds. - It provides a golf course that takes its users to the edge of the Southern Ocean and across a 'links' style golf layout that affords spectacular views of the rugged southern coastline and the northern aspects of Pelican Lagoon with its quiet waters and bushland abutting Navigator Strait. - The design of all the elements, including maintenance sheds and staff quarters, will be of an exceptionally high level to ensure minimal intrusion into the landscape. - Siting of buildings takes advantage and cognisance of the existing contours and physiography with sustainable architectural principles being employed to ensure energy efficiency through orientation, access, aspect and form.

travel destination for local, national and international visitors.	- The bulk of the building development will be located in generally open areas to reduce the threat of fire. - A limited amount of vegetation clearance is proposed and this is compensated for by extensive net gain plantings to reinforce the natural settings of the visitor accommodation and clubhouse facilities. - Golf courses provide a perfect nursery for the future propagation and ongoing biodiversity y of large areas of native vegetation. A lot of this diversity and quantum of available plant material has been lost over the years due to the pasteurisation and farming techniques of successive land owners. Given the size of the subject site, enormous opportunities exist to rehabilitate the site and return a significant amount of the native grasslands and coastal heathlands back to the site.
People, Towns And Housing *The social wellbeing of the community is dependent however on strengthening and improving the economy, the provision and maintenance of services and infrastructure, and the creation of training and employment opportunities in particular to retain a balanced age profile on the Island.* *Education/Employment* *The community must find ways to provide additional education, training and job opportunities.*	- Will generate a range of employment opportunities that do not currently exist. Twenty full-time staff to be employed across the golf and clubhouse precincts with potential for up to 50 full and part-time staff when all accommodation is developed and operating. - The project is estimated to be in the order of $14M, with the golf course, clubhouse and lodges making up 80% of the total costs. - Aimed at generating approximately 15,000 golf rounds per annum with potential to grow to up to 25,000 rounds per year. - A typical daily spend of $300 to $350 excluding accommodation. - Initial revenue estimates of $4,500,000 pa (course spend) and $2,000,000 pa (accommodation). Add share of revenue derived from transport. e.g., hire car, air travel to Island, ferry costs, and incidental expenditure on seeing Island's other attractions. - Work and use of Island resources during construction phases - Education opportunities generated, e.g., turf management, golf course management, irrigation expertise, catering and hospitality.

	- Aim to engage the majority of employees from Island population.
Infrastructure *Energy* *Single wire earth return lines power much of the Island. The supply of three phase power is limited and an improved power supply network is essential to facilitate further economic development.* *Given the difficulty and expense of providing electricity from traditional sources to the area, technological improvements are likely to result in the potential for renewable energy sources (such as biomass, solar and wind power) being investigated and developed on Kangaroo Island.* *Water Supply and Waste Disposal* *Middle River Dam provides water to Kingscote and Parndana and operates at capacity during summer periods. During times of significant drought this system cannot cope with demand and subsequently other sources must be utilised.* *Council must work with State authorities and private developers to secure a reliable, safe and sustainable water supply for industry, the community and visitors to the Island. In addition, new development should incorporate maximum on-site water capture and storage (such as using larger water tanks) to alleviate the problems of water supply.* *Currently most hard waste is recycled or transported to landfill sites off the Island.*	o Investigations underway. o Current negotiations with South Australia Water suggest that sourcing water from the Middle River Dam via proponent supplied infrastructure from a tapping point near the Kingscote Racecourse to the subject site some 35km away to the south. This pipe line would be laid within the existing road easement of Hog Bay Road. Current storage capacities indicate the Dam holds 580ML with a total annual demand of 360ML. During the period of June to September, it is envisaged the project will be able to source in excess of 100ML, via the project provided pipeline, into the onsite storage dam for later use throughout the development. o Local seawater desalination, whilst technically quite achievable, also has an energy demand along with challenges to do with a sea water intake and disposal of brine and the environmental associated with such solutions. Sourcing brackish or saline water from a deep bore or New Lake provides an interesting potential opportunity that may provide a number of advantages over seawater desalination. Should desalination be adopted it is likely to be through the use of reverse osmosis in which case the energy demands of this process are intended to be off-set by state of the art energy recovery technology to minimise the net energy required per unit of water produced. o The water products that are intended to be investigated are potable water, reclaimed water for non-potable uses and turf and landscape irrigation water. o *Econocycle treatment system for the treatment of wastewater on the site.* - Hard waste recycled or transported to landfill sites off the Island.

GENERAL SECTION	

Coastal Areas *Objectives* *1 The protection and enhancement of the natural coastal environment, including environmentally important features of coastal areas such as mangroves, wetlands, sand dunes, cliff-tops, native vegetation, wildlife habitat, shore and estuarine areas.* *3 Preservation of areas of high landscape and amenity value including stands of vegetation, shores, exposed cliffs, headlands, Islands and hill tops, and areas which form an attractive background to urban and tourist areas.* *Principles Of Development Control* *1 Development should be compatible with the coastal environment in terms of built-form, appearance and landscaping including the use of walls and low pitched roofs of non-reflective texture and natural earth colours.*	
Coastal Areas – Environmental Protection *2 The coast should be protected from development that would adversely affect the marine and onshore coastal environment, whether by pollution, erosion, damage or depletion of physical or biological resources, interference with natural coastal processes or any other means.* *3 Development should not be located in delicate or environmentally-sensitive coastal features such as sand dunes, cliff-tops, wetlands or substantially intact strata of native vegetation.* *5 Development should be designed so that solid/fluid wastes and stormwater runoff is disposed of in a manner that will not cause pollution or other detrimental impacts on the*	- The proposal includes the construction of 4 golf holes that will encroach on the coastal reserve. Construction methods will ensure full protection of this environment regarding erosion, damage or depletion of physical or biological resources. - Construction will include removal of invasive noxious weeds (African Boxthorn) and extensive indigenous planting to protect against erosion. - The retention and enhancement of an intact and protected coastal cliff top area is essential to the viability of the golf course. It is therefore essential to afford all measures required to effect this situation. - Solid/fluid wastes and effluent disposal systems will prevent pollution to the marine and on-shore environment of this coastal area.

marine and on-shore environment of coastal areas. *6 Effluent disposal systems incorporating soakage trenches or similar should prevent effluent migration onto the inter-tidal zone ...*	- Preliminary advice from The Department of Environment, Water and Natural Resources indicated concern over the following: - *The area has high conservation values comprising rare coastal vegetation communities and the proximity to a high value marine environment.* - *There is potential impact on nearby threatened breeding raptors (Eastern Osprey).* - *Areas subject to a Crown Land perpetual lease cannot be developed.* - *Coastal areas contain sand dunes with a known drift hazard..* - *There are potential impacts on remnant native vegetation.* - *Potential impacts on a coastal/marine environment through leaching of fertiliser and brine discharge.* - *Bushfire hazard.* - These are responded to: - The precise nature of the existing vegetation communities and their conservation status will be established upon completion of the flora and fauna survey which will be carried out as part of a PER or EIS as required. - There are no proposed helicopter flights proposed for the development. - A comprehensive argument will be prepared to support use of the crown land perpetual lease purely for the purpose of golf. - A vegetation management plan will be part of recommendations arising from the F & F survey. - It is unlikely at this point that the desalinisation plant (if used as the main source of potable water) would discharge brine to the ocean on account of cost. Any fertiliser used on fairways and greens would be applied at rates entirely conducive to the receiving environment. - A bushfire management plan is to be prepared for the whole area.
Coastal Areas – Land Division *23 Land in coastal areas should only be divided if:*	- The proposal includes the creation of 5 allotments for the purpose of providing alternative accommodation to that offered by lodges and the suites.

(a) it or the subsequent development and use of the land will not adversely affect the management of the land, adjoining land or the coast *(b) Sand dunes, wetlands and substantially intact strata of native vegetation are maintained or consolidated within single allotments.* *26 Subdivision of land that has frontage to the coast should make provision for a reserve that is at least 50 metres in width along such frontage.*	- All allotments are removed from the coastline. - Specific building footprints and block-by-block building and development guidelines are to be included by legal agreement on the new land titles thus ensuring development that is both planned and mindful of vegetation retention and effective land management in an environmentally sensitive area. - These inclusions on new title will be outlined in detail in any later assessment document required (EIS, PER etc.)
Design and Appearance *Objectives* *1 Development of a high architectural standard that responds to and reinforces positive aspects of the local environment and built form.* *Principles Of Development Control* *1 The design of a building may be of a contemporary nature and exhibit an innovative style provided the overall form is sympathetic to the scale of development in the locality and with the context of its setting with regard to shape, size, materials and colour.* *3 Buildings should be designed to reduce their visual bulk and provide visual interest through design elements such as:* *(a) articulation* *(b) colour and detailing* *(c) small vertical and horizontal components* *(d) design and placing of windows* *(e) variations to facades.* *17 The external materials and colours of a building should not result in a detrimental impact upon the existing character of the locality.*	o *The scale and design of the development is aimed at blending in to the surrounding environment and taking advantage of its natural assets. It is therefore appropriate that the development is entirely in harmony with its surrounds.* o The design of all the elements, including maintenance sheds and staff quarters, will be of an exceptionally high level to ensure minimal intrusion into the landscape. o The bulk of the building development will be located in generally open areas to reduce the threat of fire. • Site selection criteria adopted for the Clubhouse included: • Orientation to the west, south-west and north-west providing extensive views of the coast to the south-west and Pelican Lagoon/American River to the north-west. • Out of/below the distant, off-site view lines from Prospect Hill (8 km distant). This (Prospect Hill) is a high point along the southern coast of Pennington Bay and is used as both a popular stop-off scenic point for tourists in buses and

	cars, as well as being a key viewing spot on the established coastal walk. • Allow for substantial building to blend into the landscape through use of muted building materials, roof pitches and dark cladding to allow a visual blending-in of the structures with their immediate landscape. Building materials are based around the precepts of being bushfire resistant, hardiness in a particularly 'salty' environment and of low visual impact, e.g., 'colourbond' in dark grey and dark olives. • Direct and immediate connection with the golf course layout. • Afford a degree of shelter from the prevailing winds. • Minimise vegetation clearance. • Easy vehicle access for cars and small trucks. • Use the contours for best building siting.
Energy Efficiency *Objectives* *1 Development designed and sited to conserve energy and minimise waste.* *Principles Of Development Control* *1 Development should provide for efficient solar access to buildings and open space all year around.* *5 Development should be designed to minimise consumption of non-renewable energy through designing the roof of buildings with a north facing slope to accommodate solar collectors.*	• The clubhouse and surrounding accommodation pods will all have effective solar access. • Building design will allow for north facing roof lines to allow effective solar collectors.
Hazards – Bushfire *7 Development in a Bushfire Protection Area should be in accordance with those provisions of the Minister's Code: Undertaking development in Bushfire Protection Areas that are designated as*	- A detailed Bushfire Management Plan will be an integral part of further assessment required (PER/EIS etc.). A management plan for the proposed land division and the residential development will be included in the BMP.

mandatory for Development Plan Consent purposes. *8 Buildings and structures should be located away from areas that pose an unacceptable bushfire risk as a result of one or more of the following:* *(a) vegetation cover comprising trees and/or shrubs* *(b) poor access* *(c) rugged terrain* *(d) inability to provide an adequate building protection zone* *(e) inability to provide an adequate supply of water for fire-fighting purposes.* *12 Land division for residential or tourist accommodation purposes within areas of high bushfire risk should be limited to those areas specifically set aside for these uses.*	
Hazards – Containment of Chemical and Hazardous Materials *22 Hazardous materials should be stored and contained in a manner that minimises the risk to public health and safety and the potential for water, land or air contamination.*	Herbicide and pesticide use An Environmental Management Plan (EMP) will be prepared in the course of golf course construction. The EMP describes a set of policies to aspire to in the management of various elements. The Plan outlines mechanisms by which the policies will be accomplished. It also sets specific criteria by which the degree of achievement of the policies can be measured. The EMP proposes a process of measuring this performance through a monitoring program. This is particularly pertinent to the use and management of herbicide and pesticides. Adoption of and adherence to the EMP will ensure that the environmental impact of the change of land use from grazing to golf course will be minimal for those elements specifically addressed. -
Infrastructure *Objectives*	Power, water and other infrastructure utilities and services have been subject to investigation relating to practicability, cost and timing. Power is to be predominantly available from connection to the SA Power grid.

1 Infrastructure provided in an economical and environmentally sensitive manner. *5 The efficient and cost-effective use of existing infrastructure.* *Principles Of Development Control* *1 Development should not occur without the provision of adequate utilities and services, including:* *(a) electricity supply* *(b) water supply* *(c) drainage and stormwater systems* *(d) waste disposal* *(e) effluent disposal systems* *(f) formed all-weather public roads* *(g) telecommunications services* *(h) social infrastructure, community services and facilities.* *2 Development should only occur only where it provides, or has access to, relevant easements for the supply of infrastructure.*	Water is to be predominantly available through connection with the reticulation from Middle River Dam. Waste disposal is to be per on-site treatment and resuse. Hard waste is planned to be disposed of offsite utilising Council facilities Davies and Cathars Roads are planned to be upgraded and on-site access are to be made gravel roads to minimum Council standard.
Land Division – Design and Layout *Objectives* *1 Land division that occurs in an orderly sequence allowing efficient provision of new infrastructure and facilities and making optimum use of existing underutilised infrastructure and facilities.* *3 Land division that is integrated with site features, including landscape and environmental features, adjacent land uses, the existing transport network and the availability of infrastructure.* *Principles Of Development Control* *1 When land is divided:*	

(a) stormwater should be capable of being drained safely and efficiently from each proposed allotment and disposed of from the land in an environmentally sensitive manner *(b) a sufficient water supply should be made available for each allotment* *(c) provision should be made for the disposal of wastewater, sewage and other effluent from each allotment without risk to health* *(d) proposed roads should be graded, or be capable of being graded to connect safely and conveniently with an existing road or thoroughfare.*	
Natural Resources *Objectives* *1 Retention, protection and restoration of the natural resources and environment.* *2 Protection of the quality and quantity of South Australia's surface waters, including inland, marine and estuarine and underground waters.* *3 The ecologically sustainable use of natural resources including water resources, including marine waters, ground water, surface water and watercourses.* *5 Development consistent with the principles of water sensitive design.* *6 Development sited and designed to:* *(a) protect natural ecological systems* *(b) achieve the sustainable use of water* *(c) protect water quality, including receiving waters* *(d) reduce runoff and peak flows and prevent the risk of downstream flooding* *(e) minimise demand on reticulated water supplies* *(f) maximise the harvest and use of stormwater*	

(g) protect stormwater from pollution sources. *7 Storage and use of stormwater which avoids adverse impact on public health and safety.* *8 Native flora, fauna and ecosystems protected, retained, conserved and restored.* *9 Restoration, expansion and linking of existing native vegetation to facilitate habitat corridors for ease of movement of fauna.* *10 Minimal disturbance and modification of the natural landform.* *11 Protection of the physical, chemical and biological quality of soil resources.* *12 Protection of areas prone to erosion or other land degradation processes from inappropriate development.* *13 Protection of the scenic qualities of natural and rural landscapes.* *PRINCIPLES OF DEVELOPMENT CONTROL* *1 Development should be undertaken with minimum impact on the natural environment, including air and water quality, land, soil, biodiversity, and scenically attractive areas.* *3 Development should not significantly obstruct or adversely affect sensitive ecological areas such as creeks, wetlands, estuaries and significant seagrass and mangrove communities.* *4 Development should be appropriate to land capability and the protection and conservation of water resources and biodiversity.*	
Natural Resources – Water Sensitive Design *5 Development should be designed to maximise conservation, minimise consumption and encourage re-use of water resources.*	

6 Development should not take place if it results in unsustainable use of surface or underground water resources. *7 Development should be sited and designed to:* *(a) capture and re-use stormwater, where practical* *(b) minimise surface water runoff* *(c) prevent soil erosion and water pollution* *(d) protect and enhance natural water flows* *(e) protect water quality by providing adequate separation distances from watercourses and other water bodies* *(f) not contribute to an increase in salinity levels* *(g) avoid the water logging of soil or the release of toxic elements* *(h) maintain natural hydrological systems and not adversely affect:* *(i). the quantity and quality of groundwater* *(ii). the depth and directional flow of groundwater* *(iii). the quality and function of natural springs.* *14 Stormwater management systems should:* *(a) maximise the potential for stormwater harvesting and re-use, either on-site or as close as practicable to the source* *(b) utilise, but not be limited to, one or more of the following harvesting methods:* *(i). the collection of roof water in tanks* *(ii). the discharge to open space, landscaping or garden areas, including strips adjacent to car parks* *(i). the incorporation of detention and retention facilities* *(ii). aquifer recharge.*	
Natural Resources – Biodiversity and Native Vegetation *27 Development should retain existing areas of native vegetation and where possible contribute to revegetation using locally indigenous plant species.*	- Will be considered in broader ecological assessment - Consultation with Native Vegetation groups through whole of government engagement - It is noted that the site has a significant vegetation coverage towards its eastern boundaries. This is also the area where the

28 Development should be designed and sited to minimise the loss and disturbance of native flora and fauna, including marine animals and plants, and their breeding grounds and habitats. *29 Native vegetation should be conserved and its conservation value and function not compromised by development if the native vegetation does any of the following:* *(a) provides an important habitat for wildlife or shade and shelter for livestock* *(b) has a high plant species diversity or includes rare, vulnerable or endangered plant species or plant associations and communities* *(c) provides an important seed bank for locally indigenous vegetation* *(d) has high amenity value and/or significantly contributes to the landscape quality of an area, including the screening of buildings and unsightly views* *(e) has high value as a remnant of vegetation associations characteristic of a district or region prior to extensive clearance for agriculture* *(f) is growing in, or is characteristically associated with a wetland environment.* *32 Where native vegetation is to be removed, it should be replaced in a suitable location on the site with locally indigenous vegetation to ensure that there is not a net loss of native vegetation and biodiversity.* *34 Development should promote the long-term conservation of vegetation*	site's high points occur. The principle building siting (clubhouse and its ancillary accommodation 'pods') are generally located to the immediate west of this band of vegetation. This is an intentional siting to ensure the buildings fit below ridgelines that may be visible from distant viewing areas to the west on the coast. It means that for this construction there will be minimal vegetation clearance. - The new land division with proposed residential development are partially in the main vegetation band and detailed development guidelines for these new divisions will ensure that any vegetation clearance required will be offset through a net gain policy ensuring full compensation in planting volume and type.
Natural Resources – Soil Conservation *37 Development should not have an adverse impact on the natural, physical, chemical or biological quality and characteristics of soil resources.* *38 Development should be designed and sited to prevent erosion.* *39 Development should take place in a manner that will minimise alteration to the existing landform.*	

Orderly and Sustainable Development *Objectives* *2 Development occurring in an orderly sequence and in a compact form to enable the efficient provision of public services and facilities.* *Principles Of Development Control* *1 Development should not prejudice the development of a zone for its intended purpose.* *2 Land outside of townships and settlements should primarily be used for primary production and conservation purposes.* *3 The economic base of the region should be expanded in a sustainable manner.* *7 Where development is expected to impact upon the existing infrastructure network (including the transport network), development should demonstrate how the undue effect will be addressed.*	The proposed development is consistent with the objectives of the pertinent zones. See below for further discussion on Coastal Conservation Zone and Primary Production Zone.
Tourism Development *Objectives* *1 Environmentally sustainable and innovative tourism development.* *2 Tourism development that assists in the conservation, interpretation and public appreciation of significant natural and cultural features including State or local heritage places.* *3 Tourism development that sustains or enhances the local character, visual amenity and appeal of the area.* *4 Tourism development that protects areas of exceptional natural value, allows for appropriate levels of visitation, and demonstrates a high*	- The proposed development is consistent with the general objectives of the Tourist Development. - The site is regarded as degraded pasture land and the proposed development will provide a much needed boost to the range of tourist accommodation aimed at the upper end of the tourist accommodation demand. - Golf tourism is a worldwide industry aimed at attracting golfers who will primarily visit a course for its innate attractions but will stay on in the vicinity to enjoy other attractions of the region (KI). In this instance the attractions of the Island are many and it is expected that users of the new facility will use the location as a base for an extended exploration of the various elements of the Island that make it a global draw card. - The key to the golf's fundamental attraction will lie in the quality of the golf layout (A Greg Norman 'Signature' course), its location, its

quality environmental analysis and design response which enhances environmental values. *5 Tourism development in rural areas that does not adversely affect the use of agricultural land for primary production.* *6 Tourism development that contributes to local communities by adding vitality to neighbouring townships, regions and settlements.* *7 Increased opportunities for visitors to stay overnight.* *8 Ensure new development, together with associated bushfire management minimise the threat and impact of bushfires on life and property while protecting the environment.* *Principles Of Development Control* *1 Tourism development should have a functional or locational link with its natural, cultural or historical setting.* *2 Tourism development and any associated activities should not damage or degrade any significant natural and cultural features.* *3 Tourism development should ensure that its scale, form and location will not overwhelm, over commercialise or detract from the intrinsic natural values of the land on which it is sited or the character of its locality.* *4 Tourism development should, where appropriate, add to the range of services and accommodation types available in an area.* *5 Any upgrading of infrastructure to serve tourism development should be consistent with the landscape and the intrinsic natural values of the land and the basis of its appeal.* *6 Car parking should be designed in clusters instead of large expanses.*	ambience including weather, views, wildlife, arrival experience, service and accommodation quality. In each of these characteristics the facility will excel making it a 'must play' item on interstate and international golfing visitors. - The proposal is commercially aimed at providing a locale where visitors will stay for a minimum of two nights playing at least one round of golf and utilising the well-appointed and fully serviced accommodation to stay longer and explore the Island. - Located between the two principle settlements on the Island – Kingscote and Penneshaw it benefits from relatively easy access from both the main airport and the car ferry. It is understood that a new car ferry direct from Adelaide to Kingscote will accentuate the benefits of its location in the near future. - As previously stated extensive employment opportunities will be generated whilst its revenue stream will have a significant multiplier effect in the local economy.

Tourism Development Outside Townships and Settlements *9 Tourist developments located within areas of high conservation value, high indigenous cultural value, high landscape quality or significant scenic beauty should demonstrate excellence in design to minimise potential impacts or intrusion.* *10 Tourism developments in rural areas should be sited and designed to minimise adverse impacts on ... (b) the natural, cultural or historical setting of the area.* *13 Development comprising multiple tourist accommodation units (including any facilities and activities for use by guests and visitors, including conference facilities) should:* *(a) ensure buildings and structures are clustered on the same allotment* *(b) for larger scale developments (ie those proposing or resulting in more than 25 accommodation units), have direct or convenient access to a sealed public road.* *14 Tourism developments in rural areas:* *(b) may involve the provision of facilities and accommodation associated with outdoor adventure, recreation and leisure activities.* *18 Tourism development, particularly in remote areas should be designed to minimise energy and water demands and incorporate alternative, sustainable technologies that use renewable energy sources and/or treat and reuse stormwater and wastewater to minimise reliance on mains services*	
Transportation and Access *Objectives* *2 Development that:* *(a) provides safe and efficient movement for all motorised and non-motorised transport modes* *(b) ensures access for vehicles including emergency services, public*	The site is located some 3 km from the Hogs Bay Road linking Penneshaw with Kingscote. An all-weather road is proposed to be constructed from the main construction site to Hogs Bay Road

infrastructure maintenance and commercial vehicles (c) *provides off street parking* (d) *is appropriately located so that it supports and makes best use of existing transport facilities and networks.* *Principles Of Development Control* *Movement Systems* *2 Development should be integrated with existing transport networks, particularly road corridors, as shown on Overlay Maps - Transport, and designed to minimise its potential impact on the functional performance of the transport networks.* *4 Roads should be sited and designed to blend with the landscape and be in sympathy with the terrain.* *8 Development should provide safe and convenient access for all anticipated modes of transport including cycling, walking, public and community transport, and motor vehicles.* *9 Development at intersections, pedestrian and cycle crossings, and crossovers to allotments should maintain or enhance sightlines for motorists, cyclists and pedestrians to ensure safety for all road users and pedestrians.* *Access* *21 Development should have direct access from an all-weather public road.* *22 Development should be provided with safe and convenient access which:* (a) *avoids unreasonable interference with the flow of traffic on adjoining roads* (b) *accommodates the type and volume of traffic likely to be generated by the development or land use* *27 Driveways, access tracks and parking areas should be designed and constructed to:*	

(a) follow the natural contours of the land *(b) minimise excavation and/or fill* *(c) minimise the potential for erosion from run-off* *(d) avoid the removal of existing vegetation* *(e) be consistent with Australian Standard AS 2890 Parking facilities.*	
Waste – Waste Water and Waste Treatment Systems *Objectives* *1 Development that, in order of priority, avoids the production of waste, minimises the production of waste, reuses waste, and recycles waste for reuse, treats waste and disposes of waste in an environmentally sound manner.* *2 Development that includes the treatment and management of solid and liquid waste to prevent undesired impacts on the environment including, soil, plant and animal biodiversity, human health and the amenity of the locality.* *Principles Of Development Control* *1 Development should be sited and designed to prevent or minimise the generation of waste (including wastewater) by applying the following waste management hierarchy in the order of priority as shown below:* *(a) avoiding the production of waste* *(b) minimising waste production* *(c) reusing waste* *(d) recycling waste* *(e) recovering part of the waste for re-use* *(f) treating waste to reduce the potentially degrading impacts* *(g) disposing of waste in an environmentally sound manner.* *2 The storage, treatment and disposal of waste materials from any development should be*	

achieved without risk to health or impairment of the environment. *Wastewater* *7 The disposal of wastewater to land should only occur where methods of wastewater reduction and reuse are unable to remove the need for its disposal, and where its application to the land is environmentally sustainable.*	

COASTAL CONSERVATION ZONE	
Objectives *2 Low-intensity recreational uses located where environmental impacts on the coast will be minimal.* *3 Development that contributes to the desired character of the zone.*	• The proposal is consistent with the objectives of the zone because the proposal is relatively low intensity and environmental impacts on the coast will be minimal. • The development, with its visually sensitive buildings, affords a good 'fit' with the existing landform and will maintain the character of the zone whilst a relatively small area of the overall proposal is within the Coastal Conservation Zone.
DESIRED CHARACTER *The zone defines the coastal areas of high landscape or conservation value and incorporates policy to ensure the preservation of the coastal landscape resource.* *... the coastal environment plays an important role in Kangaroo Island's economy and the tourist attraction provided by the coastal environment, coastal scenery and abundant wildlife is expected to see growth in visitor numbers that will need to be appropriately managed and catered for. The provision of facilities, including tourist accommodation and recreational facilities, may be established in the zone provided they are sited and designed in a manner that is subservient to the natural and coastal environment and adverse impact on natural features, landscapes, habitats and cultural assets is minimised.*	

The preference is that tourism development, including any associated access driveways and ancillary structures, be located on cleared areas or areas where environmental improvements can be achieved. Development should be located away from fragile coastal environments and significant habitat or breeding grounds. *In order to reinforce the Island's scenic and landscape experiences, tourism development should maintain a strong visual impression of a sparsely developed or undeveloped coastline from public roads and land-based vantage points.* *The design and siting of tourist accommodation should ensure emphasis is given to raising consciousness and appreciation of the natural, rural, coastal and cultural surroundings.*	
Land Use *Principles Of Development Control* *1 The following forms of development are envisaged in the zone:* - *tourism/visitor facilities* - *tourist accommodation.*	
Form and Character *5 Development should not be undertaken unless it is consistent with the desired character for the zone.* *6 Development should be designed and sited to be compatible with conservation and enhancement of the coastal environment and scenic beauty of the zone.* *7 Development should:* *(a) not adversely impact on the ability to maintain the coastal frontage in a stable and natural condition*	• The proposal includes the construction of a world-class championship golf course that will build its reputation on the precise environmental assets the site offers. By its very nature the proposal must ensure that the assets such as the high landscape and amenity value including stands of vegetation, shores, exposed cliffs, headlands, Islands and hill tops are protected and retained. These are the elements that will render the overall facility its fundamental worth. Furthermore, the proposal will maintain and enhance public access to the coastal areas whilst taking sound and proper land management initiatives to ensure the areas where the golf course meets the coast are protected

(b) minimise vehicle access points to the area that is the subject of the development *(c) be landscaped with locally indigenous plant species to enhance the amenity of the area and to screen buildings from public view* *(d) utilise external low reflective materials and finishes that will minimise glare and blend in with the features of the landscape.* *11 Development should not prejudice the landscape quality and natural bushland of the zone.* *12 Tourist accommodation should complement the natural landscape and be designed in a way that minimises impact on the natural environment.*	through extensive planting and dune stabilization measures. • The proposal includes a consistent building design to ensure the main structures blend in to their immediate environs. This is particularly so with the assiduous siting of the clubhouse and its associated accommodation lodges which avoid the high points of the site and major incursions to the existing vegetation while being constructed of muted, natural earth colors and tones with low pitched roof lines. Again, it is a quintessential characteristic of the design that it shows full respect to the surrounds so that its veracity is fully established in a high quality landscape. • The proposed building areas are well removed from the coastline (some 450m) while golf course construction will avoid cliff tops and sand dunes. Construction methods will ensure stabilization of any potential dune 'creep' through new grass and low shrub planting.

PRIMARY PRODUCTION ZONE	
Objectives *6 Development that contributes to the desired character of the zone.*	
Desired Character *Development within the zone will retain native vegetation and protect existing ecosystems to ensure the heritage and environmental significance of Kangaroo Island can continue to underpin the Island's character and values.* *The intent of the zone is primarily to strengthen the role and value of primary production. The quality of Island produce is high and the burgeoning food and wine industries is a testimony to this.*	• In this zone there is no inconsistency between the proposal and the zone with regard to 'Tourist Accommodation' apart from the possibility that there may be some exceeding of the height limit of 6.5 m above natural ground level. The location of the proposed development is on degraded, unused, and generally cleared pasture land with a low capability for farming or horticulture. • A range of accommodation is proposed and this will significantly augment the tourist facilities in the Dudley segment of the Island through the provision of a world-class golf experience and access to the many coastal walks available abutting the property.

However, the opportunity also exists to provide tourist accommodation and tourism activities within the zone where such development is designed to put people back in touch with the natural and rural environment, or would positively contribute to the Island's tourism experiences. It is expected that such development will cater primarily for the "get away" nature or adventure orientated market which is environmentally conscious, although other niche tourism development opportunities will also be considered where they strengthen the Island's tourism appeal. *The design and siting of tourist accommodation should ensure emphasis is given to raising consciousness and appreciation of natural surroundings and should be sited where is does not undermine the primary intent of the zone for primary production. Tourism development will be encouraged in areas that are of low capability for farming or horticulture.*	• The development's traffic generation would not expect to unreasonably interfere with the flow of traffic on the Hogs Bay Road and would not result in a need for upgrading of this network.
Land Use *Principles Of Development Control* *1 The following forms of development are envisaged in the zone:* - *conference facility (in association with tourist accommodation or tourism facilities)* - *tourist accommodation (including through the diversification of existing farming activities and conversion of farm buildings)* - *tourism activities and facilities*	
Form and Character *13 Development should not be undertaken unless it is consistent with the desired character for the zone.* *Tourism Development*	o Apart from the obvious natural assets of the site and its environs the only existing tourism offering in the locality is the coastal walk along Pennington Bay. o The proposal includes an upgrade of this track within its boundaries and will thereby compliment this activity. However, its fundamental nature will see an entirely new tourist attraction that is developed around the site's natural assets while increasing the range

17 Tourism developments should not exceed a building height of 6.5 meters above natural ground level. *18 Tourism development:* *(a) should not be located on land that has a high capability for farming or horticulture, or compromise established rural activities* *(b) may comprise a range of tourist accommodation, recreational and leisure activities at various scales that complement the existing tourism offerings in the locality.*	of upper-end accommodation in the eastern part if the Island (Dudley Peninsula).

Conclusion

There is significant consistency with the proposal's fundamental nature and both statutory and strategic provisions of the Kangaroo Island Planning Scheme.