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Land Management Plan for the Bundanon Trust Properties



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Controlled Document

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Land Management Plan for the Bundanon Trust Properties

1.0 INTRODUCTION

Total Earth Care P/L has been engaged by the Bundanon Trust to prepare this Land Management Plan (LMP) for 8 properties (lots) owned by the Trust, three contiguous properties that are held under a permissive occupancy, one property that has a lease **pending** from the Australian Commonwealth government, one contiguous property that is owned by M E Nolan and additionally (two narrow strips of land between the Shoalhaven River and the Eearie Park property boundary) over which grazing licenses are currently held.

The eight properties owned by the Trust are located on the banks of the Shoalhaven River on the South Coast of NSW near Nowra. These properties are; Bundanon (1 lot), Riversdale (3 lots), Eearie Park (1 lot) and Beeweeree (3 lots) while the permissively occupied and leased properties, which are unnamed, are landlocked but provide connectivity between Riversdale, Bundanon, Beeweeree and Eearie Park. Collectively the properties are referred to in this report as the Bundanon properties (Map 2).

Please refer to Appendix C: Land ownership and Section 149 certificates, for details of the properties.

The initial stage in the production of the LMP included desk top investigation of: the geo-physical, bio-physical, cultural, demographic constitution and land tenure of the site. On-ground flora and fauna surveys were then undertaken to validate, refine, refute or make current assessment of the conditions on site. Stake holders and regulatory government agencies were consulted and a basic legal/planning framework was established. The results of these investigations are substantially contained in the Appendices.

Secondly field surveys of the flora and fauna were conducted to establish the species that exist on site and their extent, locality and condition. The results of these surveys are contained within the Appendices. It must be noted that field surveys, in particular fauna surveys, are a snap shot in time and must be repeated over many years and many seasons to provide a comprehensive understanding of the composition of the Ecological Communities. It is also very important that flora surveys are repeated to monitor the stage of growth that a floristic assemblage is in and what anthropological impacts are occurring, especially weed growth.

The next stage in the production of the LMP was to prepare an Opportunities and Constraints paper which identified creative viable opportunities and constraints for the harmonious use of the Agricultural land and the Bushland. These opportunities were also considered in reference to the proposed future development as detailed in the Bundanon Masterplan Concept Study (Tonkin Zulaikha Greer October 2010). The LMP is also imbued with the essential ideals of artistic

creation, education and public visitation which are Objects of the Bundanon Trust Constitution. A range of Land Use Options were presented to the Trust Management Team and were culled on financial, ecological and sustainability grounds or on the grounds of lower comparative benefit.

Advice was sought from a heritage landscape architect, Mr Craig Burton of CAB design, to determine the general extent and nature of change that could occur on the properties without adversely effecting their heritage values. The advice received was informative and has allowed the production of the Land Management Plan to precede his report "Bundanon trust lands landscape assessment CAB Consulting 2011. (CAB 2011), and this should be read in conjunction with this report. Significantly this report advises that some of the current landscapes are the product of unplanned and unsympathetic change made by previous owners and managers. He is of the opinion that significant improvements can be made to how the properties function and how they are experienced by visitors, in particular he advised that the interpretation of the three properties have very distinct characters and these characters should be unambiguously expressed in the landscape design and land use patterns. Defining these characters requires a Landscape Planning Process, i.e. the production of a Landscape Master Plan, and the staged and sequential detailed analysis of discrete land units of the site and finally installation of each phase.

The most important recommendations made in this plan are that a Landscape Master Plan be produced that guides the location and intensity of development and land use and that detailed investigation of land units be undertaken prior to development proposals being commissioned by the board. The Land Management Plan therefore provides recommendations that are in sympathy with the advice provided by Craig but often require finessing via the Landscape Planning process.

The recommendations that have been made are two tiered. The first tier regards the purpose of each property and relates to the objects of the trust and the second tire relates to how those purposes can be fulfilled.

This version of the document completes the consultancy agreement between Total Earth Care Pty Ltd and the Bundanon Trust. Future versions of the core Land Management Plan and Appendices to it will be completed by Andrew McGahey on a philanthropic basis.

1.1 Updating the Plan

Comment and content will be continually sought from stakeholders and this controlled document will be reviewed and updated correspondingly. Discrete sections will be derived from the Land Management Plan and detailed action plans will be appended to it. The overall "living" document and the derived action plans will be presented to the Trust board for approval or otherwise.

Any new iterations will include a "List of Changes", as below, and explanation of the purpose of the changes within It.

1.2 List of Changes

Substantive Changes

A.

The board meeting also resulted in the formation of a committee to further consider, refine and develop the land management options.

The Land Management Committee met and determined that three aspects of the land management plan required immediate consideration:

I. The keeping of beef cattle was to be reconsidered with regard to financial viability via agistment, lease or freehold ownership.

Outcome:

Mr Henry Goodall and Mr Tony Emery have partially completed a financial analysis of this land use option. Although Tony Emery has requested that the latest results be presented in a new format they do not appear to provide a vastly different picture to what had already been calculated in the past. The financial benefits of running a beef cattle operation are marginal. It is recommended that all cattle be sold.

II. The heritage landscape curtilage required definition by a landscape architect so that the proposed land use options would not interfere with the heritage conservation.

Outcome: Appendix I: CAB 2011

The outcome of this is the CAB 2011 report discussed earlier. It is assumed that his advice will not differ significantly from the Consent authority officer who would consider a development application for Forestry.

If farm forestry or revegetation is not allowable under the Heritage act or rejected by council under its new LEP then the management of such a large area by means, other than by keeping of livestock, is impractical. The NSW Water Management Act, the Threatened Species Conservation Act and the Commonwealth Environment Protection and Biodiversity Conservation Act would also possibly muddy the legal waters regarding the enforcement of the Heritage Act. This is a legal conundrum that may require the assistance of the Environmental Defenders Office to unravel.

III. A request was made by the board that a 10 year bush regeneration / revegetation program be devised that would reduce the weed infestations on site to a stable maintenance weeding regime. The reason for this inclusion is to provide a reference point for the various methods, time periods and budgets that might be considered in the management of the properties.

Outcome: Land use plans

A Land Use Plan has been produced that treats each property separately. It can be found in Appendix C. It reiterates much of what has been presented in the draft of the LMP but relates that information to each site.

IV. The Status of the property as a Wildlife Refuge should be compared to the other Private Conservation Agreements that were available to the Trust.

Outcome:

The Environmental Defenders Office have communicated that they are very happy to assist in a explaining the benefits and process involved in engaging in a Private Conservation Agreement that would supercede the current Wildlife Refuge Status of the properties and provide a more robust legal instrument which is favoured by Government Grant Providers. The contact details of the EDO officer handling the trust enquiry is BJ Beom Jin Kim Solicitor Environmental Defender's Office (NSW) Telephone: 02 9262 6989.

He has advised that we should have a clear understanding of the proposed use of the land prior to organising a meeting so that the EDO advice can be clear and succinct. He will probably refer the Trust to a Private Legal firm who will assist philanthropically. This one action requires discrete consideration by the Trust Board.

V. Clarification was requested regarding the Carbon Farming Initiative.

Please refer to Appendix H for links to the legislation. A discussion regarding Carbon Farming and the management of Bundanon is premature.

VI. The Trust members raised the point that the basis for evaluation of the Land Management Options was not clear in the LMP.

In answer to that the process of assessing the Land Management Options was considered in the Options and Constraints Paper (March 2011) prior to the draft Land Management Plan being written. Only those Options that were deemed to be in keeping with the Objects of the Trust and which were financially viable, were considered within the framework (Priorities and Interrelationships) below. The Options put forward were then vetted by the Trust Staff and included in the Draft Land Management Plan.

Priorities and Interrelationships

The essential elements that the Land Management Plan must protect and nurture include in order of priority;

- A. The biological /ecological values of the property,
- B. The natural pre-european landscape,
- C. The aboriginal cultural heritage,
- D. The built/modified European landscape,
- E. The artistic legacy of Arthur (including the artists in residence program),
- F. The educational opportunities (Environmental, Resource use, Scientific)
- G. The rural life experience, (interaction with farm, bushland, river)
- H. The spirit of inclusiveness (international/local, community involvement, cultural events)

1.3 Minor changes and explanatory notes.

 It was asked by a trust Board Member "Who would be undertaking the Spring 2011 Survey?"

Andrew McGahey has volunteered to continue surveying the biota of the property in Spring 2011 and will endeavour to continue survey efforts indefinitely into the future.

• Map 14c has had a title change to "Paddocks" and the numbering of the Table of Contents has changed and several new Appendices have been added as noted in the text.





2 SITE DESCRIPTION

2.1 Geo-physical Environment

The Geology of the site is of the Permian and the Quaternary Periods. Please refer to Map 3 for the geology of the study area.

2.1.1 Permian Period

The geology of the Permian Period consists of sedimentary shales and sandstones of the Shoalhaven group. The soil parent materials are derived from the Berry Formation and the Megalong Conglomerates.

The highest areas of the site, between the western escarpment and the High voltage electricity easement, are overlayed with rock of the Berry Formation which includes undifferentiated Siltstones, Shales and sandstones. These sedimentary rocks remain undisturbed in the horizontal orientation that they were laid down.

The soils derived from this geology on site are situated on a gently undulating plateau and appear shallow and poorly drained. The Shale influences would provide the soil with moderate water holding and cation exchange capacity however the sand and silt components of the soil are generally low in fertility.

The Megalong Conglomerates derive the following formations

1. Nowra Sandstone is comprised of Quartz and Sandstone. These are located on the top of the ridgeline to the east of the High Voltage Electricity easement where the Berry Formation has been completely eroded.

The soils along this narrow ridge are extremely shallow or non existent; bare, rock outcrops predominate and deeply eroded fissures are common. Wide clefts in the parent rock have created deeper pockets of soils that have to a greater or lesser extent been eroded.

2. Wandrawandian Siltstone is comprised of Siltstone, Sandy siltstone which may be pebbly in part. This geology is situated on the side slopes of the narrow ridge line down to the river or to the river flats.

The soils overlying this rock are deeper than the ridgetop soils and have formed through the deposition of soils eroded from the Berry Formation and the Nowra Sandstone upslope, and by the in situ decomposition of the Wandrawandian Siltstone parent material.

3. Conjola Formation is comprised of Conglomerate, Sandstone and Silty sandstone. This geology is only found along the lower contours of the river flats within the Eearie park property. These are also deeper soils compared to the eroded plateau and ridges; although they are also erosional soils, the lower slopes would be influenced by deposition of alluvial material during flood events.

Historic aerial photographs of Bundanon in the 1940s show that extensive gravel beds have been exposed after a large flood event had removed finer textured top soils. These soils are more likely to be Quaternary Alluvium as described below but the coarse resolution/inaccuracy of the Geological survey effort might account for this anomaly in the mapping.

2.1.2 Quaternary period

Quaternary Alluvium, Gravels and Swamp deposits are also present in a very small area on the western boundary of the Eearie Park flood plain. This depositional zone appears to correlate with the location of a naturally occurring bedrock weir in the river. This shallow point in the river is understood to historically have been the first inland causeway used for moving stock by the early settlers. Quaternary sands are also present on the flood plains of the creeks and the creek/river confluence at Riversdale.

Reference: Wollongong 1:250,000 Geological Series SheetS1 56 -9 Second Edition NSWDepartment of Mines 1966.

Please refer to Map 3 for an overview of the Geology.



2.2 Topography and Aspect

The landscape can generally be described as being an eroded plateau of sedimentary rock. The Shoalhaven River, which drains 6920 square kilometres of land most of which is located westward of Bundanon, has gouged a deep trough through these sedimentary rocks to form the Shoalhaven River Valley. The distinctively horizontal bedding of the sandstone plateau has eroded to form 50 metre tall vertical cliffs. These imposing banded blocks of rock have forced the river to turn and change course along several reaches of the river. The most obvious of these colourfully layered cliffs is Pulpit rock which is located on the opposite bank of the river to the Bundanon homestead and is the subject of many of Arthur Boyd's landscape paintings. The pattern of shear rock faces on the outer bends of the river and wide flat paddocks on the inner bends is repeated along the property's river frontage. Smaller creeks that drain into the river from the Bundanon properties have further eroded the plateau to create fingers of rock that reach out to the river as it meanders past the property.

The river's tidal limit is approximately at the western boundary of Eearie Park. The Bundanon Properties are all located on the northern side of the Shoalhaven River where the flatter lands were used for cropping and grazing and the gentler side slopes were used for marginal grazing. These agricultural lands have a backdrop of tall cliffs and steep slopes rising to the north and west. The residential building at Eearie Park and the Bundanon complex of buildings all sit on low lying rises above the floodplain of the river and have extensive views to the south over wide flat paddocks. The Riversdale homestead and the Boyd Education Centre are located on an east facing side slope which provides uninterrupted views over a magnificent 8 kilometre long perfectly straight reach of the river and huge flat paddocks on the opposite bank. Riversdale also has views of rolling paddocks in a small enclosed valley to the North.

Please refer to Map 4 for an overview of the topography of the area.



2.3 Water Catchment Characteristics

The property has six Sub-catchments that feed the Shoalhaven River. Four of these subcatchments, and the Shoalhaven River, drain water from properties other then Bundanon. The remaining two drain water only from land controlled by the Bundanon Trust. This is of significant relevance in that pollutants such as agricultural chemicals, fertilisers and weed propagules and water borne pests and diseases are likely to be transported onto the Bundanon Properties from other properties higher in the Catchment.

Land management activities within a sub-catchment up-slope of the Bundanon Properties, such as road building, housing or clearing of land, increases the speed and volume of water that flows through the Bundanon Creeks. Land clearing would also increase the speed of soil erosion and the subsequent deposition of soil/sediment in the Bundanon Property creeklines. Conversely, dam building and contour ploughing or deep ripping of the land higher in the catchment will reduce the amount of water and silt that might reach a creek within Bundanon.

The Shoalhaven River additionally has tidal influences that impact upon it. Most importantly the tides increase the salinity of the water in the river adjacent to the Bundanon properties making it un-useable for farming. Additionally the salinity of ground water, used for irrigation, would also be increased especially during drought periods when irrigation water is most needed.

Please refer to Map 5 to view the creeklines on the property.



2.4 Landuse

2.4.1 Adjacent Land Use

The subject site is almost completely contained within the Shoalhaven river banks to the south. The exception to this is a privately owned property which abuts the western boundary of Eearie Park on the river flat country. NPWS protected lands (an island and opposite bank), grazing farmland, a soil extraction and green-waste composting facility and a commercial camping and caravan park are located on the opposite bank of the Shoalhaven River. The river is frequently used for recreational water skiing and boating. The wake caused by boat traffic has caused river bank erosion which threatens the vegetation and other life forms that require a fully vegetated and naturally eroded bank structure at water level. The river is a vector for weed seed and disease via flood events and recreational river users who alight on the Bundanon river banks.

Bundanon is surrounded by small animal grazing farms and rural lifestyle properties to the north and east.

These properties are ostensibly bush-blocks; no open/cleared paddocks are contiguous with the Bundanon boundaries. This continuous bushland surrounds the property and provides a significant buffer to the ecological communities within Bundanon.

Please refer to Map 6 for an overview of the adjacent land use.



2.4.2 Council Zonings and Development Controls

A number of different Council Planning Controls are zoned within Bundanon. These planning controls may have an impact on future development undertaken on the property. Shoalhaven Council is in the process of introducing a new LEP. Consequently, Council's 1985 LEP and its draft 2009 LEP has been considered in this document. Please refer to Maps 6A and 6B below. It has been assumed that the draft 2009 LEP will be approved by council.

2.4.2.1 1985 LEP

A list of the Council zonings and development controls that relate to the land as stated within the *Shoalhaven Council LEP 1985* is below and a full description is found in Appendix G Council Zonings.

Zone 1(a): Rural A - Agricultural Production Zone

Zone 1(d): Rural D - General Rural Zone

Zone 7 (d1): Environmental Protection D1 - Scenic Zone

Zone 7(e): Environmental Protection E - Escarpment Zone

2.4.2.2 Draft 2009 LEP

A list of the Council zonings and related development controls that are proposed for the land within *Shoalhaven Council's Draft 2009 LEP* are described below. A full description of each zoning is included in Appendix:G Council Zonings.

Zone E1: National Parks and Nature Reserves

Zone E2: Environmental Conservation

Zone E3: Environmental Management

Zone RU 1: Primary Production

Zone RU2: Rural Landscape

2.4.2.3 NSW Department of Agriculture Land Classification ALC

The Agricultural Land Classification (ALC) maps provided below (Map 7) were only ever made for regional planning purposes, and not designed for individual property planning. The map is at a scale of 1:50,000 and provides the maximum reliability scale of the ALC data for the Illawarra region.







2.5 Wildlife Corridors

Bundanon is a significant bushland link along the Northern bank of the Shoalhaven River. The vegetation on the Southern Bank of the river opposite Bundanon has been cleared where it is flat, and it has been isolated by a regional road where the topography is steep. Small birds and mammals that would historically have moved along the rivers southern bank are considerably disadvantaged by this loss of vegetation cover and food resources. Consequently, Bundanon's narrow strip riparian vegetation is of great ecological importance and should be weeded, broadened, and species enriched to replace the habitat that has been lost due to agricultural clearing along both banks of the river. Riversdale has contiguous bushland to the east which links rural properties along the northern bank of the Shoalhaven River.

Please refer to Map 8: Wildlife Corridors.



2.6 Built Infrastructure and Public Visitation.

Raw user statistics for 2008-2011 indicate that visitor numbers may vary between 13,000 and 30,000 people properties in any one year. The exact numbers cannot be apportioned to each of the properties individually because the statistics do not accurately differentiate between the properties however it is clear that attendance at artistic cultural events and the open days have the greatest attendance at Riversdale and Bundanon and that very few people visit Eearie Park.

Seasonal patterns in the visitation are linked to the events timetable as well as the day time non specific visitation is assumed to correlate with warm season tourist activity.

The peak quarterly visitation occurs in January, February and March when an average of 1544 visitors visited the properties per month.

The statistics that are currently being kept do not provide detailed information regarding resource use. In particular the seasonal variations in demand for power, water, sewerage outflow, and parking need to be better understood. Statistics should include the type of visitation (Catered, over night, power hungry events), for example if alternate power sources, solar and hydro generation are to augment current supplies then knowing the likely supply patterns will be required to locate appropriately sized assets. Sewerage use statistics are vital to the correct choice of system and its size.

Recommendation:

- Monitor all visitors
- Meter the water supply and recording volumes after vistitation/events and representative periods.
- Meter the day time use of power to assist in making informed management decisions regarding the size and time of Solar power generation required.

2.6.1 Current Land Use

Current Land Use				
Property	Cleared land	Bushland	Building/s precincts	
Riversdale 42.09 Ha	 10.2 Ha Heritage Landscape Curtilage Festivals / marquees Fire protection Overflow car parking River access Farm Management 	31.89 HaNature conservationEducation	 Public visitation Short term residential facilities Education Parking Artistic philanthropy Administration 	
Bundanon 348.62 Ha	 74 Ha (Not including north of haunted point) Heritage Landscape Curtilage Fire protection. Livestock farming Overflow carparking River access Farm Management 	 274.62 Ha Nature conservation Education Lot 12, 14 and 118 are a Gazetted Wildlife Refuge 	 Public visitation Short term residential facilities Artistic philanthropy Education Administration 	
Beeweeree 90.34Ha	 Vacant and unused some heritage values does include cleared electricity easement 	90.34Ha Nature conservation	 Historical location of Condie's farm buildings 	
Eearie Park 407.4 Ha	 39 Ha Livestock farming River access Farm Management 	368.40 HaNature conservationEducation	 Staff residence 	

Table 1 – Current Land Use

2.6.2 Services Summary

Services Summary					
Property	Irrigation	Sewerage	Power		
Riversdale	 Tank water for drinking that meets current requirements. Bore water for irrigation and grey /black water uses. Stored in two 20,000Litre tanks Creek water is also available. Fire fighting tanks do not exist. No water is caught from the Machinery shed and little is caught from the Murcutt Building. 	 Secondary treated Septic system. With capacity for chlorination of required. Treated water used for paddock irrigation. 	 Mains 		
Bundanon	 Tank water for drinking at each house building and a large concrete tank at the AIR buildings. Bore water for livestock irrigation is stored in a second large concrete tank. The bore /soak from which the water is drawn is requires maintenance. A second disused but reliable bore is located approximately 200m south of the homestead. 	 Septic systems at main house. The AIR studios are plumbed to a domestic size Bio filter/sprinkler. These both drain into the dam north of the homestead. 	 Mains 		
Eearie Park	 Tank water for domestic use. Bore water for irrigation /stock. The tank holding this water is falling over. 	 Septic 	 Mains High voltage transmission lines run through the property. 		

Table 2 – Services Summary

2.6.3 Built Heritage Items

For further information regarding the heritage of the site please refer to, "The Bundanon Trust Properties Heritage Management Plan", October 2007 Peter Freeman Pty Ltd

2.6.4 Aboriginal Heritage

For further information regarding the Aboriginal Heritage of the site please refer to Feary, S & Moorfcroft, H, "An Indigenous Cultural Heritage Management Plan for the Bundanon Trust Properties", Draft Report, June 2011

Aboriginal artefacts and Current European heritage listings are present on all four properties owned by the trust and must be respected with regard the to the recommendations made within the report. The land management Plan will require the cultivation of land and alteration to existing land uses and so must correspondingly consider the conservation requirements of these heritage items. Consideration of heritage items will be required whenever discrete actions for the Land Management Plan are developed.

3 FLORA

3.1 Vegetation Communities

The evolution of Australian Environmental Law and Ecological Sciences has lead to groups of native plants that grow in association with each other on a specific soil type, being described as distinct "floristic assemblages". These floristic assemblages provide an equally distinctive suite of native fauna species with their preferred habitat; when combined the flora, fauna and soil are considered to be an Ecological Community. Native animals do not generally restrict themselves to a single floristic assemblage but rather they have a preference for distinctive floristic structures, for example a low-heath, tall-forest, or ecotone therefore, they will have a 'range' which might include several ecological communities.

Floristic assemblages are the framework around which Ecological Communities are defined. These assemblages are described with reference to the dominant plant species, usually trees, and the other vegetation strata which might include mid-storey, shrub, vine, groundcover and forb layers. Comprehensive floristic descriptions might also include fungi, mosses, and lichens; however, these are not presently considered in the "scientific determinations" or legal descriptions of the Ecological Communities made by the Department of Environment and Climate Change Scientific Committee.

The floristic assemblages were mapped on site by the NSW Department of Environment and Conservation and the NSW Department of Natural Resources. This report, *Native Vegetation of Southeast NSW (NVSNSW)*, was based on the *South Coast - Illawarra Vegetation Integration (SCIVI) Project*, which aimed to integrate many previous vegetation classification and mapping works to produce a single regional classification and map plus information on regional conservation status of vegetation types. Please refer to Map 8 Vegetation Communities.

It should be noted that the accuracy of the NVSNSW is limited by various factors. The extent of these communities was established by aerial photography and by remote sensing/aerial imagery, therefore, further ground truthing is required to define community boundaries. Many of the more regionally and locally significant communities have naturally small spatial extents, and the methodology used to compile the data for NVSNSW may be too broad in scale to account for the limited distribution extents of some of these communities. Despite this, survey work up to this date by TEC has generally supported the overall pattern of distribution within study area of the community distribution as mapped by NVSNSW, however ground truthing needs to be carried out to further refine actual distribution for the purposes of well informed management. This mapping was first ground truthed by Mr Gary Leonard without the aid of Geographical Positioning Technology.

The Bundanon properties are mapped by NVSNSW as supporting 11 vegetation communities:

- 1. Warm Temperate Layered Forest
- 2. Southern Turpentine Forest
- 3. Temperate Dry Rainforest
- 4. Currambene-Batemans Lowlands Forest
- 5. Coastal Warm Temperate Rainforest
- 6. Yalwal Shale-sandstone Transition Forest
- 7. Riverbank Forest.
- 8. Southern Lowland Wet Forest
- 9. Illawarra Gully Wet Forest
- 10. Morton Mallee Heath
- 11. Shoalhaven Sandstone Forest

The descriptions of these communities are included in Appendix B. The floristics of these vegetation communities, along with notes on their abundance, degree of disturbance, distribution, conservation status and threats are also given. These communities show a variation in their adequacy or not in being well conserved both locally and regionally. Within the study area they likewise show a variety of abundance, intactness and threats to their conservation.

It is important to note that a sea-grass bed which is a breeding ground for native fish has been located and mapped in the river bed off the Eearie Park Island. The river and the sea grass beds are not owned by the Trust however Management activities on Trust Land might impact on the seagrasses. The Trust, as Ecological Guardians of the River, has an ethical obligation to inform authorities of any damage that might be caused by others to the river and its ecology.

Please refer to Map 9 Vegetation Communities below.



3.1.1 Threatened Flora and Endangered Ecological Communities (EECs)

Ecological Communities and individual plants and animals that are at threat of extinction are listed in the Schedules of the NSW Threatened Species Conservation Act 1995 (TSA Act) and/or the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC). These laws limit the development of land that might impact on the conservation of these 'listings'. Additionally the Bio-diversity Banking and Offset Scheme amendment to the TSC Act has created a mechanism whereby landowners who have listed species and/or communities on their land can be paid to conserve them. The study area has a listed individual endangered flora species, Nowra Heath Myrtle *Triplarina nowariensis*, however no EECs occur on site.

Large areas of bushland on site have been completely removed and cannot be regenerated. Current mapping should be referenced for all proposed revegetation works which aim to reinstate vegetation communities. If these areas are to be returned to bushland then they will require reconstruction. Historical records and nearby bushland remnants, growing on the same soils, at the same elevations and with similar aspects, have been used as the basis of a revegetation species list that replicates the original floristic assemblage.

3.2 Flora Species

512 species of plants were recorded by Mr Gary Leonard during surveys undertaken in 1995 and 1996 and were recorded in a joint report *Flora and Fauna of Bundanon, May 1996* co-authored by Mr Garry Daly.

This report was loosely based on past surveys by Daly (1995 a,b,c) and Mills (1985).

One of these plants, Nowra Heath Myrtle *Triplarina nowariensis*, is a protected species listed as endangered under the TSC Act and endangered nationally under the EPBC Act

Regionally and locally significant flora species as determined by Mills (1995) as referenced in Leonard 1996 that occur on site include:

- Leptospermum sejunctum (no common name) (2K = Geographic range in Australia less than 100km, poorly known conservation status -Rare or Threatened Australian Plants CSIRO 1995)
- Net-veined Wattle Acacia subtilinervis –(3RCA = Geographic Range in Australia greater than 100km, Rare but without any identifiable threat, Reserved with at least one population in a National Park, with 1000+ plants known in a conservation reserve - Rare or Threatened Australian Plants CSIRO 1995)
- Broad-leaf Hop-bush *Dodonaea rhombifolia* (3RCA = Geographic Range in Australia greater than 100km, Rare but without any identifiable threat, Reserved with at least one population in a National Park, with 1000+ plants known in a conservation reserve *Rare or Threatened Australian Plants* CSIRO 1995)

- Red Cedar *Toona ciliata*
- Downy Zieria Zieria cytisoides 196

Regionally and locally significant flora species as determined by Mills (1995) as referenced in Leonard 1996 that may occur on site include:

- Native Hydrangea Abrophyllum ornans,
- Hairy-leaved Doughwood Melicope micrococca
- Cheese Tree Glochidion ferdinandi var pubens
- Yellow Bloodwood Corymbia eximia
- Dogwood Jacksonia scoparia
- Australian Tree Fern/Cooper's Tree Fern Cyathea cooperi
- Weeping Boobialla Myoporum floribundum

Non-native (Exotic) flora were also surveyed, riverbanks, creeklines, road edges and paddock boundaries were intensively surveyed while unfarmed bushland areas were spot checked. The majority of the unfarmed bushland areas on site are free of weeds, while the bushland (marginal) areas that have been grazed have a reduced native plant cover and an elevated number and density of exotic plant species. Cleared grazing land is almost entirely covered in exotic, but desirable, agricultural species.

Some weed species have been classified as Noxious due to their impact on agricultural productivity and others because they are threatening to native ecosystems. Noxious weeds are classed by the *Noxious Weeds Act* 1993 in accordance with the severity of their impact and this classification corresponds with a 'control' requirement.

- (a) Class 1, State Prohibited Weeds,
- (b) Class 2, Regionally Prohibited Weeds,
- (c) Class 3, Regionally Controlled Weeds,
- (d) Class 4, Locally Controlled Weeds,
- (e) Class 5, Restricted Plants.
The property is relatively isolated and has a relatively small list of weeds species, however *Lantana camara,* (Lantana), *Senecio madagascariensis* (Fire weed), and *Rubus fruticosus agg sp* (Blackberry) are Noxious weeds at substantial densities and will require active and long-term control. The density of weeds found on site has been mapped and closely correlates to the Bushland resilience mapping. Weed mapping and Bushland Resilience will continue to be refined as work proceeds.

Please refer to Map 10 Weed Density and Map 11 Bushland Resilience.





3.3 Flora Habitat

As previously mentioned, flora species have a distribution based on a number of environmental factors such as soil, altitude, fire history, fauna interactions, climate and aspect etc. Some species of plants have very narrow or restricted ranges of distribution, and when these naturally or artificially restricted species are considered under any land management plan knowing their current or potential distribution is of a high priority in managing these plants. When these plants are rare or threatened, this priority becomes even more important. The study site contains one known population of a threatened plant species, Nowra Heath Myrtle Triplarena nowraensis, which occupies a narrow ecological niche as it grows in poorly drained or wet sandstone soils with an open or absent tree canopy. Targeted searches for this species should be undertaken over the long term to establish any changes in known range or extent of this species. In addition, targeted searches for suitable habitat should also be undertaken in order to monitor these areas for presence of this plant. Suitable habitat may not necessarily contain extant populations of this species, but should be given a high management priority in order to keep them viable for natural or artificial reintroductions. Some flora habitats show differing responses to different threats, such as fire, infrastructure development, pest species etc and each plant community, plant species and habitat must be managed with such considerations in mind.

3.4 Fire Management and Flora

The study site contains a wide range of plant communities and species, each with a differing ability and preference for fire interval, intensity, and seasonality. Various legislative instruments determine allowable and required use of fire relating to biodiversity, including flora and fauna species, habitat, and vegetation communities. Threatened species and threatened communities particularly are required to be managed within codes set up for their management.

Under the *Rural Fires Act* 1997, the Bush Fire Coordinating Committee (BFCC) must constitute a Bush Fire Managing Committee (BFMC) for each area in the State which is subject to the risk of bushfires, and must prepare a Bush Fire Risk Management Plan (BFRMP). The Shoalhaven BFMC has prepared such a plan in 2010, and classified vegetation types into fire threshold categories. These fire threshold categories prescribed minimum and maximum fire regimes for various broadly categorised vegetation units, in years, against minimum thresholds for

- Strategic Fire Advantage Zones (SFAZ) to protect human life, property and highly valued public assets
- Land Management Zones (LMZ) in areas subject to broad scale agriculture and native vegetation where the values within a SFAZ are not present

The vegetation communities described and mapped on the study site can be related to the particular broad vegetation communities as per the BFRMP as per Table 1

Vegetation Formation BFRMP	Vegetation Communities NVSNSW	Minimum SFAZ Threshold (in years)	Minimum LMZ Threshold (in years)	Maximum Threshold (in years)	Notes
Rainforest	 Warm Temperate Layered Forest, Temperate Dry Rainforest, Coastal Warm Temperate Rainforest, 	NA	NA	NA	Fire should be avoided
Wet Sclerophyll Forest (shrubby subformation)	 Southern Turpentine Forest, Riverbank Forest, Southern Lowland Wet Forest, Illawarra Gully Wet Forest 	25	30	60	Crown fires should be avoided in the lower end of the interval range
Wet Sclerophyll Forest (grassy subformation)	 Currambene- Batemans Lowlands Forest (in part), 	10	15	50	Crown fires should be avoided in the lower end of the interval range
Dry Sclerophyll Forest (shrub subformation)	 Yalwal Shale Sandstone Transition Forest (in part), Morton Mallee Heath (in part) 	7	10	30	Occasional intervals greater than 25 years may be desirable
Dry Sclerophyll Forest (shrub/grass subformation)	 Yalwal Shale Sandstone Transition Forest (in part), 	5	8	50	Occasional intervals greater than 25 years may be desirable
Heathlands	 Morton Mallee Heath (in part) 	7	10	30	Occasional intervals greater than 20 years may be desirable

Table 3: Fire Thresholds for Bundanon as per Shoalhaven BFRMP and commensurate NVSNSW communities

In addition to the prescribed thresholds listed above in the BFRMP, the Rural Fire Service has *Rules and Notes for Implementation of the Threatened Species Hazard Reduction List* (TSHRL) for *The Bush Fire Environmental Assessment Code* 2006. These Rules and Notes provide additional conditions that must be adhered to when threatened species, endangered populations or ecological communities are known to occur at a site. The only known listed entity under the TSC Act (1995) that occurs on the Bundanon study site is the Nowra Heath Myrtle *Triplarena nowraensis*. The TSHRL prescribes that Nowra Heath Myrtle *Triplarena nowraensis* must not be disturbed by fire more than once every 10 years and that, in relation to mechanical forms of hazard reduction, that no slashing occurs more frequently than every 10 years, and no trittering or tree removal must occur.





4 FAUNA

4.1 Historical Surveys

Primary sources include:

- I. Atlas data base 5km search December 2010,
- II. Daly and Leonard 1996

Other known reports /surveys but which are not primary sources for this report include;

- i) Daly (1995 a,b,c) at Bugong and Banagalee Reserve
- ii) Daly and Murphy (1996)
- iii) Mills (1995): a Flora and Fauna Survey of Bundanon.
- iv) Robinson (1987): Mammal surveys conducted in the 1970's and 1980's
- v) Wong 1993: an examination of populations of Brush Tailed Rock Wallabies.
- vi) Unpublished bird records from Banagalee Reserve held by Ms D Wright.

The Daly survey 1995 and Leonard Survey 1996 has been used as a spatial and temporal reference point to which the current survey could be compared. A summary of the 1995-1996 surveys include:

195 species of fauna were recorded a total of 13 of these species were threatened species listed on the *TSC Act* and/or the *EPBC Act*. Of these:

- 15 species were reptiles, including the Broad Headed Snake (Hoplocephalus bungaroides,) which is listed on Schedule 1 of the TSC Act as endangered;
- 7 species were amphibians including the Giant Burrowing Frog (*Heleioporus australiasicus*) which is listed on Schedule 2 of the *TSC Act* as vulnerable;
- 79 species of birds including the: Sooty owl (Tyto tenebricosa), Masked Owl (Tyto novaehollandiae), Powerful Owl (Ninox strenua). Gang-Gang Cockatoo (Callocephalon fimbriatum), Glossy Black Cockatoo (Calyptorhynchus lathami), which are listed on Schedule 2 of the TSC Act as vulnerable.
- 13 species of Terrestrial and Arboreal Mammals including: White Footed Dunnart (Sminthopsis leucopus), Yellow Bellied Glider (Petaurus australis), which are listed on Schedule 2 of the TSC Act as vulnerable.

7 bat species: Three listed species including Grey-headed Flying Fox (*Pteropus poliocephalus*), Large-eared Pied Bat (*Chalinolobus dwyeri*), Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*), and Large Footed Myotis (*Myotis macropus*—formally M. *adversus*) have been located on site. The Large Pied Bat (*Chalinolobus dwyeri*) was a significant recording in that it extended its known range by 40km to the south east.

Common Name	Scientific name	TCA 1995	EPBC 1994	
Broad-headed snake	Hoplocephalus bungaroides	Endangered	Vulnerable	
Powerful Owl	Ninox strenua	Vulnerable	-	
Grey Headed Flying Fox	Pteropus poliocephalus	Vulnerable	Vulnerable	
Glossy Black Cockatoo	Calyptorhynchus lathami	Vulnerable	-	
Rosenberg's Goanna	Varanus rosenbergi	Vulnerable	-	
Square-tailed Kite	Lophoictinia isura	Vulnerable	-	
Gang gang Cockatoo	Callocephalon fimbriatum	Vulnerable	-	
Barking Owl	Ninox connivens	Vulnerable	-	
Eastern Bent-wing Bat	Miniopterus schreibersii oceanensis	Vulnerable	-	

 Table 4:
 The most recent surveys have confirmed the continued presence on site of the following Threatened

 Fauna Species.

Maps 14A to 14D below show areas of core habitat for a number of threatened species found within the boundaries of Bundanon.

Common Name	Scientific name	TCA 1995	EPBC 1994		
Tiger Quoll,	Dasyurus maculatus	Vulnerable	Endangered		
Spotted-tail Quoll	maculatus				
Brush-tailed Rock	Petrogale penicillata	Endangered	Vulnerable		
Wallaby					
Black Bittern	Ixobrychus flavicollis	Vulnerable	-		
Masked Owl	Tyto novaehollandiae	Vulnerable	-		
Sooty Owl	Tyto tenebricosa	Vulnerable	-		

Table 5: Threatened species that have been reliably recorded close by to Bundanon

Threatened species that may occur but have not been reliably recorded close by to Bundanon include:

- Eastern Bristle-bird Dasyornis brachypterus
- Ground Parrot Pezoporous wallicus
- Koala *Phascolarctos cinereus* refer to significance of SEPP 44 Koala habitat and all recent records.









Common name	Scientific name	Leonard 1996	Council	NPWS
Striated Fairy Wren	Calamanthus fuligionosus	\checkmark		
Black-necked Stork	Xenorhynchus asiaticus	✓		
Feather-tail Glider	Acrobates pygmaeus	\checkmark		
Lewin's Rail	Rallus pectoralis	\checkmark		
Buff-banded Rail	Gallirallus phillipensis	\checkmark		
White-winged Triller	Lalage sueurii	\checkmark		
Origma	Origma solitaria	\checkmark		
Heathwren	Sericornis pyrrhopygius	\checkmark		
Scaly Thrush	Zoothera lunulata	\checkmark		
Rainbow Bee-eater	Merops ornatus	\checkmark		
Brown-headed Honeyeater	Melithreptus brevirostris	\checkmark		
Scarlet Honeyeater	Myzomela sanguinolenta	\checkmark		
Yellow-throated Scrubwren	Sericornis citreogularis	\checkmark		
Monarch Flycatcher	Monarcha melanopsis	✓		
Logrunner	Orthonyx temminckii	✓		
Catbird	Ailuroedus crassirostis	✓		
Maccoy's Skink	Nannoscincus maccoyii	✓		
Beautiful Firetail	Stagonopleura bella	✓		
Diamond Python	Morelia spilota	✓		
Australian Bass	Macquaria novemaculeata	\checkmark		
Australian Grayling**	Prototroctes maraena	\checkmark		
Mountain Galaxia	Galaxia brevipennis	✓		

Table 6: Regionally rare and locally significant fauna that occur on or have been recorded within the species' range close to the site and within the last 50 years.

**listed on the EPBC Act as Vulnerable

The significance of the species listed above has been established by reference to Leonard 1996, Shoalhaven Council and NPWS.

The following significant species were observed by TEC:

- Pheasant Coucal *Centropus phasianinus:* it should be noted that this species was considered by Daly (Leonard 1996) to be locally extinct, however, the TEC survey of 2010-11 included a sighting of this species on the south facing slopes adajacent to Eerie Park within the powerline easement.
- Scrub turkey Alectura lathami: Disused nests of this species were located at Bugong immediately to the west of Bundanaon (Daly and Murphy 1996). This species was relocated by humans from the central coast to Pittwater in northern Sydney in the late 1990's (pers observation) and since that time has aggressively recruited into country that had historically been occupied by Superb Lyre birds, *Menura novaehollandiae*. Reintroduction of the species has been suggested by Daly (Leonard 1996); if this recommendation is adopted the impact on other large ground nesting birds like the Superb Lyre bird should be carefully considered.

4.2 Species Not Recorded in Current Survey which may use Bundanon.

White Footed Dunnart (Sminthopsis leucopus)

The White Footed Dunnart is a cryptic species that was recorded adjacent to the Power Line Easement in 1996 (Daly and Murphy). It has not been recorded since, either during the survey by Daly and Leonard in 1996 nor despite targeted searches by TEC in 2010-11. This species prefers an open understorey vegetation structure and appears to range widely to take advantage of intermittent and distant food sources. The open structure of the side slopes that are dominated by *Corymbia maculata*, and the open woodland vegetation communities provide the habitat they prefer and should be surveyed as frequently as possible. Floral recruitment pulses, eg fire stimulated regeneration, which result in dense understorey structure are likely to be deleterious to this species. Ecological burning programs must be programmed and located to maintain a variety of habitat types including that which is preferred by the White Footed Dunnart.

Yellow Bellied Glider (Petaurus australis)

The yellow bellied glider was determined to be present on site by Daly in 1996 due to the occurrence of "v" shaped incisions in the sap wood of Eucalypt spp upon which it feeds. He notes that these incisions have been made in Grey Gums *Eucalyptus punctata* in Open Forest and woodland vegetation structures on site. One area of unusual u- shape incisions in *Acacia mearnsii* have been found on site adjacent to E. punctata woodland but the shape and the tree species are preferred by and are presumed to be signs of a Squirrel Glider (*Petuarus norfolcensis*). Targeted searches for the yellow bellied glider should continue via examination of potential feed and nesting trees. The species is known to have a very large home range and may travel up to 2km's per night while searching for food. Call play back, tree investigation and spotlighting failed to

locate this species in the 2010-11 surveys. The preferred habitat of this species is large hollow tree branches in smooth barked species. The conservation of this species depends upon the ongoing recruitment of feed and habitat trees. Weed control, planting programs and ecological burning are elements requiring careful and concurrent management to ensure their survival.

Microbat species: Large–eared Pied Bat (Chalinolobus dwyeri), Greater Broad-nosed Bat (Scoteanax rueppellii), Large Footed Myotis (Myotis macropus)

The bats that were recorded generally eat flying or crawling insects with the exceptions of the Large Footed Myotis (Myotis macropus) which also eats small fish and aquatic invertebrate species. The Greater Broad nosed bat Scoteanax rueppellii also notably eats other bat species. Water bodies, paddocks/cleared forest edges and riparian vegetation are important habitat elements, feeding grounds, for most of the species. Microbats in general are either short winged, slow flying but manoeuvrable and fly between trees in the forest mid/understorey and along canopied creeks or they are large winged and fly above the forest canopy. The large-eared pied bat is like many other bat species in that it shows a clear preference for roosting in caves that have rock texture, light, humidity and temperature levels that suit their needs. The other species listed below are more adaptable and are known to roost variably in tree hollows, man made structures and or vegetation. Most of the microbat species detected on site that roost in trees are known to move readily between a number of host trees and also have a large home range. Largeeared Pied Bat Chalinolobus dwyeri is a species that may well be roosting along the Bundanon Escarpment for there is an abundance of caves that have been formed by fractured cliffs leaving wide crevices and rock overhangs that are not completely dark. These light levels are thought to be preferred by this species "Sue Churchill Australian Bats 1998." Ongoing surveys should be undertaken during spring summer and autumn to not only to confirm the presence of the species below but also to locate roosts and maternity caves/hollows/shelters.

East- coast Freetail Bat (Mormopterus norfolkensis):

The East-coast Freetail bat *Mormopterus norfolkensis* is a small mircobat species that is listed as vulnerable under the TSA 1995. The species has not been observed onsite, however, it presence has been noted in Shoalhaven LGA (Leonard, 1996). Its main roosting preference is in hollows, but it will roost underneath delaminating bark and man-made structures. It is associated with a many of difference vegetation types many of which occur onsite. Given the presence of other microbat species onsite, it is possible that the East-coast Freetail Bat *Mormopterus norfolkensis* also occurs on Bundanon. The retention of old growth forests with hollows, and limited pesticide use is important for the conservation of the species.

Glider species: Squirrel Glider (*Petaurus norfolcensis*), Greater Glider (*Petauroides volans*), Feathertailed glider (*Acrobates pygmaeus*)

All glider species observed on Bundanon, or potentially found on Bundanon, have overlapping diet, habitat and tree species preferences. This makes management of the glider species

(Petaurus norfolcensis, Petauroides volans, Acrobates pygmaeus, Petaurus australis) straightforward and uncomplicated; in many circumstances, management measures put into place for owl species (Powerful, (Ninox strenua) Masked, (Tyto novaehollandiae) and Sooty (Tyto tembricosa) indirectly effectively manage glider populations. The greater glider has been observed in the past on Bundanon. The Squirrel Glider and Feathertailed Glider have not been observed on site, however, Leonard (1996) states that Feathertailed Gliders have been observed by staff after domestic cats brought them to the house. The Feathertailed Glider has similar diet preferences to the Yellow-bellied glider (Petaurus australis) which is found onsite, however, their foraging habitat differ slightly. Research has shown that Feathertailed Gliders and Greater Gliders have similar tree species preferences on the south coast, however, Feathertailed Gliders tend to utilise trees with smaller diameter at breast height (DBH) than the larger glider species. Squirrel Gliders show tree species preferences of Grey Box (Eucalyptus microcarpa), River Red Gum (Eucalyptus camaldulensis), Forest Red Gum (Eucalyptus tereticornis) and Red Ironbark (Eucalyptus sideroxylon) as well as banksias, acacias and xanthorrhoeas. All species nest in hollows and nest boxes and it is thought that the Feathertailed Glider colonise areas where nest boxes have been constructed. Management of these species should therefore ensure the survival of old growth hollow bearing trees and protect areas with suitable vegetation community structure with high levels of diversity in pollen and nectar bearing plants.

Koala (Phascolarctos cinerveus)

The Koala (*Phascolarctos cinerveus*) has a fragmented distribution along the east coast of NSW. Leonard (1996) states that the species was previously found along the Cambewarra escarpment, whilst an animal was shot approximately 50 years ago around 4kms north of the property. There have been no records of koala observations at Bundanon. However, the property does contain areas which would be suitable as koala habitat. Forests consisting of Grey Gum (*Eucalyptus microcarpa*), and Forest Red Gum (*Eucalyptus tereticornis*) do occur on Bundanon; consequently, it is possible that this species does occur on site. Potential Koala habitat should be protected and surveys should include targeted searches for Koala scats and scratchings within the Grey and Forest Red Gum Forests.

This is a substantial and expanding list of endangered and vulnerable fauna & flora. It is a list that highlights the great responsibility for its custodians.

General recommendations

Catching and investigating the stomach contents of feral predators and dead native (raptors/mammal/reptiles) could provide information that otherwise would be difficult to obtain. It is recommended that all carcases found on site be gutted and checked for native animals or frozen and checked by an ecologist.

5.0 BUSHLAND MANAGEMENT PLAN (BMP)

Bundanon requires a BMP to guide the actions that are required to preserve its bushland. A BMP firstly contains an inventory of the natural resources on the site then it assesses the relative value of those natural resources and determines the priority of actions required to manage those natural resources.

5.1 Sustainability of Management Actions.

Management Actions must be carefully planned to correlate with secured funding. Priority Actions may require ongoing resource allocation over decades and may be beyond the financial capability of the Trust to complete. While other Actions that have a lower priority may be required once and are very sustainable. The BMP must consider the sustainability of management actions before committing financial and human resources to the actions.

5. 2 Current Bushland Condition

Bundanon has a fantastic diversity of landforms, flora, and a stunningly diverse population of threatened animals. The Fauna surveys completed to date will be repeated again in Spring 2011 and it is hoped that additional threatened species found on or nearby Bundanon in past surveys will be recorded again and that management of these animals in the future will be prescriptive and effective. The Trust has a substantial task as custodian of this biological legacy. Two hundred years of burning, clearing and farming and fifty years of big yellow machines has resulted in the degradation of all of the bushland elements listed below. Unfortunately the land will never fully recover all that has been lost since European settlement; however, the causes of the degradation can be reduced or eliminated and the landscape of the past can be partially recovered. The propensity for recovery is referred to as 'resilience'.

Prior to colonisation the property would have been completely forested, however 'Timber Getting' and agricultural management of the land has, to a greater or lesser degree, permanently changed the floristics of most of the remnant bushland on the properties. The river banks and the timbered, flat, accessible and arable lands are assumed to have had the longest period and greatest extent of disturbance on site (See Map 8). Ecological community mapping categorises the most effected areas as being "Disturbed Agricultural" land. The use of this land for agriculture has created large gaps in the riparian, river flat and side slope forest communities and has significantly altered the movement of animals and plant genetic material to and along the river banks.

5.3 Resilience

The level of soil disturbance, which might be chemical, physical or hydrological, is a fundamental measure of the resilience of bushland. Resilience describes the ability of bushland to regrow without assistance and most directly relates to the presence of viable seeds and other native plant propagules in the soil. The ability of the native soil seedbank to regenerate is also strongly influenced by the presence of animals that eat plants and by the competition between native plants and non-native plants for nutrients, light and water. Non-native 'weed' species generally grow where the soil has been disturbed and the native vegetation has been cleared. Only a select few weed species can successfully compete with native plants in undisturbed bushland. These highly invasive species are of the greatest concern at Bundanon, the worst of these species is Lantana *Lantana camara*.

Highly resilient bushland is generally found at the top of catchments and is unaffected by agricultural farm fed creeks, roads and other disturbance. Paddocks that have been repeatedly tilled, fertilised and grazed have virtually no resilience. Bushland growing adjacent to paddocks and agricultural farm fed creeks are said to have 'edge effects' and might have a moderate or low resilience. Bushland with low resilience is generally the least valuable ecologically and has the highest cost to rehabilitate while conversely highly resilient bushland has the greatest ecological value and the lowest cost to regenerate. Resilience is used as the key guiding factor in determining the priorities for a bush regeneration program for resilience is directly related to the sustainability of the weeding process. The bushland resilience of the site is shown in Map 11 Bushland Resilience.

Early records of the Shoalhaven river indicate that the gravel flood plains and gently sloping river banks that have been turned into paddocks would have been vegetated with trees including: *Casuarina glauca,* Swamp Oak, *Casuarina cunninghamiana* River Oak, *Ceratopetalum apetalum* Coachwood, *Doryphra sassafras* Golden Sassafras, and *Toona ciliata* Red Cedar. The shade cast by these trees and their roots that bounds the soil on the river banks and protects the fish along the banks. These fish feed on the insects that fall from the vegetation along the river bank.

The fauna lost from bushland when it is cleared cannot be easily reintroduced and can take a long time to return; however regenerating the bushland that has been partially disturbed, and revegetating cleared land to recreate bushland, will provide additional habitat into which animals can recruit naturally or be reintroduced. The populations of most animal species living on site and on adjacent properties are likely to benefit from a bushland regeneration and revegetation program.

Resilience has been defined as "the manifested recovery of a plant community, species or ecosystem following disturbance, as well as the potential of the plant community, species or ecosystem to recover after disturbance" (DIPNR 2003). There are a number of site features and variables that can assist in predicting the likely resilience of a site, and consequently, in guiding the appropriate levels of bushland management (DIPNR 2003). Key features include:

 The nature and quality of existing native vegetation (identifies ongoing sources of propagules);

- The extent, nature, condition and diversity of structural elements present (indicates whether representatives of all principal elements of structure are likely to regenerate);
- The individual native species present (indicates the minimum range of diversity to be expected). The presence of certain disturbance-sensitive ground cover species (eg Aristida spp. Spear Grass spp., Dianella spp. Flax Lilly spp., and Lomandra filiformis (no common name) can be particularly good indicators of general resilience;
- The nature of reproductive habit and dispersal mechanisms of existing plant species (indicates the persistence and ease of spread);
- Observed recruitment and regeneration occurring;
- Remnant size and connectivity (proximity to other native vegetation);
- Land use and disturbance history, including fire history (may suggest the likely size and viability of the native propagule bank in the soil);
- The nature of current and ongoing level of disturbance (including adjacent land use) and whether this can be controlled or not (indicates the type and level of threat to regeneration); and
- Types of weed infestation and their extent and density (suggests the type and extent of weed management likely to be required).

The resilience of the vegetation communities on the site was assessed with reference to these parameters.

5.4 Bush Regeneration

Definition: Bush regeneration is the recovery of naturally occurring ecological communities that have degraded: soil, water, floral and/or faunal elements.

Soil can be degraded by changing its chemistry, structure or profile arrangement. Water can also be degraded by changing its chemistry, volume, rate of flow, period of flow, frequency of flow, depth, turbidity, biological oxygen demand and more. Flora is degraded by altered soil and water, pests and diseases, competition from non-local plant species, absence or change of frequency and heat of fire events, changed light levels and lost symbiotic relationships with fauna. Fauna are most profoundly affected by the loss of core habitat and the creation of disjunct habitats. This loss and separation are caused by vegetation clearing, development, roads, fences, water harvesting, and predation by and competition from feral animals. Stopping the causes of degradation is the first step in regenerating bushland.

5.4.1 Stopping the degradation

5.4.1.1 Clearing and past Agricultural Practices.

Trees would have been felled for building and fencing, and the remaining bush on flat ground was generally burned at frequent intervals and grazed until the bush stopped regenerating. Cropping has been the most degrading activities to the bushland on the site because it not only required the complete removal of the bushland on the flatter river front land but it also required the cultivation of the soil. Grazing was almost as destructive to the native biota as cropping, but it did not require the removal of all trees within marginal grazing land on the side-slopes where cropping was impractical.

Remedial action: Stop clearing any more bushland and allow natural regeneration to occur. The selective logging required for Routine Farming actions such as harvesting trees for fencing should be undertaken in a manner that does not remove habitat trees and is not concentrated in a small area.

5.4.1.2 Current Farming Activities

No crops have been grown at Bundanon in the recent past and cropping may no longer allowed by council Zoning within the flood zone of the river. (This requires clarification from council in light of the new LEP). In the recent past the amount of grazing land has been significantly reduced. Cattle are grazed on the River flats at Bundanon and Eearie Park but no livestock are grazed on the side slopes east of Haunted Point or any where at Riversdale. The grounds staffs, apart from the Property Manager Henry Goodall, are not specifically trained in livestock management and the area of flat land used for grazing has proven to be financially viable but too small to be financially lucrative. The paddocks are currently fenced for beef production as is the arrangement and type of watering troughs. There are no facilities for dairy farming apart from the agistment of dry cows. There are no vegetables, poultry, pigs or other livestock. There are some remnant orchard trees. Water is pumped directly to troughs or tanks from bores; a large depression (two dams) in the river flat behind the Bundanon Homestead has an unreliable store of ground water. Livestock operations of hard hoofed animals can be detrimental to land if stocking rates are too high and access to water troughs requires animals to erode steep banks. Soil compaction and siltation of water ways are also potential problems. Soil in holding yards will erode and create siltation problems downstream.

Remedial action: Maintain animal stocking rates (animals /hectare) at low levels and ensure that all paddocks have adequate water supplies via troughs for the stock and that these troughs are maintained. Rotate animals so that pasture around water troughs has time to regrow. Ensure that holding yards drain across well pastured paddocks before reaching waterways. Install troughs at the top of slopes rather than in hollows so that rain water does not pool around the troughs exacerbate soil erosion and compaction problems.

5.4.1.3 Future Farming Activities

The objects of the constitution of the Bundanon Trust require that an undetermined form of farming activity continue. The objects also explicitly require the conservation of the biota on the property and so the form that the farming activity takes has been assumed to be secondary to and should be respectful of the conservation objectives of the bequest.

Recommendation:

- Trial a small flock or Dorper sheep in smaller well fenced paddocks that can be extended upon if they prove to be financially viable.
- Install Private Native Forests that can be selectively logged to reduce the size of unproductive paddocks and which provide wildlife conservation benefits.
- Revegetate the paddock edges in a manner that creates a long term wildlife corridor but also provides for medium term Forestry income.

5.4.1.4 Forestry / Integrated Farming.

The definition of a Private Native Forestry given in the Private Native Forestry Code of Practice Fact Sheet No. 1 is: " is the management of native vegetation on privately owned land for the purpose of obtaining, on a sustainable basis, forest products including sawlogs, veneer logs, poles, girders, piles and pulp logs. "

The Code requires approval to harvest timber for the purposes of PNF through a PNF Property Vegetation Plan (PVP) that adopts the Code, or previous consent under the Native Vegetation Conservation Act 1997 or Soil Conservation Act 1934.

A PNF PVP is a legally binding agreement between a landowner and the Department of Environment, Climate Change and Water (DECCW).

Benefits of PNF PVPs are:

- they provide landowners with security to plan and invest
- they provide certainty against any future changes to environmental planning instruments and avoid the need for separate approvals under the *Threatened Species Conservation Act 1995*.

Once approved a PNF can be planted and large areas of bushland that require revegetating can be covered in trees which are thinned as forest products. The trees left behind can remain as the basis of wildlife coridors.

The wildlife corridors that are created will reap material benefits to both the aquatic and the terrestrial fauna and they will provide successional floristic structures that will be favoured by some species of animal. In the earliest stages it is assumed that Sugar and Squirrel Gliders will feed on sap rich wattles. As the plant community matures it is presumed that other fauna species that prefer older flowering species like the Endangered Swift Parrot (*Lathamus discolour*) might be attracted to winter flowering *Eucalyptus robusta* (Swampy Mahogany).

The trees that are planted and regenerate on the immediate river banks should be left forever while the trees growing beyond the top of the creek bank and further upslope should be planted in an arrangement that enables them to be selectively harvested and then replanted.

The arrangement of trees should also facilitate the creation of Wombat and Bandicoot habitat by creating large areas of grassland between even larger areas of trees. The arrangement of these trees should be included in a Landscape Master Plan who can provide a perspective of the views from the buildings, especially the three Homesteads. The arrangement of the trees must also integrate with the livestock operation in that the trees should provide shade and wind shelter and should encourage livestock to drop their manure under the canopy of trees. Wind breaks will also help reduce the evaporation of water from the paddocks and increase the yield from the paddocks. The arrangement of trees should also facilitate wildfire control.

The current arrangement of paddocks on both sides of the river and the paucity of bushland adjacent to the river has seriously detrimental effects on the movement of native animals within the riparian zone. Global warming and the continued loss of bushland to urban development and associated infrastructure in the region exacerbates this problem.

Remedial action: The resources required by the Trust to manage it's lands requires that the land be income producing or at least revenue neutral. Subsequently it is proposed that a series of bushland wildlife corridors be regenerated and/or reconstructed along the river foreshore that are wide enough to resist weed invasion. These corridors should be established by over-planting trees some of which can be harvested and the revenue reused for the management of the property. Agro-forestry is discussed in detail in Section 6 Agro –Forestry.

5.4.1.5 Soil degradation

There are four substantial soil degradation processes occurring on site;

1. River Bank Erosion

The rivers banks erode by a combination of wind, boat wash, tides and floods. The periodic loss of soil from high on the river flats should also be noted.

Remedial action: There is very little that can be done to stop the causes of the erosion but tree planting along the river banks can reduce the impact.

2. Creek Bank Erosion

The erosion of the banks of the creeks at Riversdale are caused by vehicles (at the northern crossing), wombats digging in the bank, and through the loss of density of riparian vegetation to smothering weeds that do not bind the soil as well as the native riparian species. Stream/creek bed erosion 'head cut' is also occurring which in turn undermines the banks, which then collapse

changing the whole profile of the creek. This erosion then fills pools in the creeks with silt and reduces their habitat value.

Remedial action: Rock cobbled fords should be installed across the creeks at Riversdale. These fords will also act as creek bed control structures that prevent 'head cut' occurring. A series of pools and riffles should also be installed by the placement of rocks to form bed control structures at critical points in the creek. The creek banks may also need stabilisation with biodegradable matting products and mulch. The creek banks will require weeding, revegetation, and regeneration to create wildlife corridors in the same manner described earlier. The selection of plant species in the ground cover layer will focus on the soil binding characteristics of the plants.

3. Road erosion and creek siltation

The third degradation process is the soil that is washed from the Bundanon road during rain events. Soil washing from the roads will slowly fill the creeks with silt and change the microclimatic conditions and ecology of the streams.

N.B The unsealed road's table drains and gutters are excellent frog habitat. 5 species, including 1 Myxophyes sp. (no common name) were found in the recent surveys. Two threatened frog species have been recorded near by and may potentially use these drains as habitat.

Remedial action: Very small silt traps should be installed beneath the inlet points of road culverts ie. on the low side of the roads at the point that water drains from the roads through tiny water courses and into the creeks. These should be dug out after each rain event. It may only be a shovel full at a time but it will make a difference. Larger creek culverts that pass under the road should also be cleared of silt that builds up on the upstream side of the road. These points generally become silted and reduce the function of the culvert, in turn rain events cause the creek banks upstream to become saturated and erode feeding more silt into the creeks. Inform the neighbours, via signs that explain where the creeks drain to, of the impact of silt in the creek. Passive interpretation of the problems may assist in farmers changing their practices to limit the siltation problems. No till farming methods are now considered to be best practice for many farming activities. The trust might also host seminars on new farming practices. The table drains and road gutters should be checked for threatened frog species by night surveying prior to the roads being regraded.

4. Topsoil Erosion

This is a natural process; however, the speed with which it appears to be occurring on site is greater than would naturally occur. The native plant community in these areas are depauperate of plants in the shrub and groundcover strata. Consequently, the soil is not being bound and there is a steady migration of topsoil from the steep side slopes above the northern and western paddock at Riversdale and north from Haunted Point. It is assumed that these two areas were grazed and burned, and in time lost their forb layer which had bound the soil. Now that grazing

no longer occurs, *Lantana camara* has infested the slopes but it provides little protection against erosion. The soil on these slopes is very smooth and with little groundcover seeds tend to be washed down-slope and do not germinate on the bared ground.

Remedial action: Eradicate the lantana and revegetate the slopes with harvestable trees. Concurrently a mosaic of native grassed areas should be established by collecting local native grass seed and directly broadcasting this seed into protected pockets from which the native grasses can recruit into the adjacent bushland. Soil imprinting should also be completed. This process is the creation of small pockets or dimples in the lands surface. These small depressions catch the fine soil that is eroding and create the micro-climatic conditions that are required for seed germination.

5.4.1.6 Water Quality Degradation

Water degradation in many ways generally it is a consequence of eroding soil being deposited into the creeks and rivers. Soil particles not only affect the clarity of the water, which impacts on ecological processes, but they also contain chemicals that become dissolved in and contaminate the water. Chemical alteration of the water can also wherever machinery chemicals are spilled and washed into waterways, or leach into the ground water. Agricultural chemical spray drift may also directly contaminate water bodies.

Remedial action: Siltation and erosion control will reduce most of the impacts of farm practices on water quality. Preventing chemical pollution, if indeed it does occur, is best achieved by staff training. Roads reduce soil infiltration rates and increase the speed that water is shed into the creeks. Silted water deposits in unnatural volumes and will slowly but inexorably fill the pools and riffle zones until the creeks bursts its banks. An over abundance of silt also destroys the habitat of small fish like climbing Galaxians and the breeding pools of frogs like Mixophyes spp. (no common name). The speed that water runs off roads also increases the erosive force of the water in the creeks that causes 'head cut' or erosion of the bed upstream.

5.4.1.7 Loss of fauna and their habitat

Fauna need a variety of habitats that intergrade between each other (Ecotones) to provide them with all their shelter, breeding and feeding requirements. Healthy bushland, agricultural lands, and even general rubbish will provide habitat that is favoured by some species. The Wombat and Macropod populations on site are obvious examples of how some native animals preferentially use man made landscapes. Habitat conservation should be considered in planning and operational matters concerning the property. The single greatest threat to animal habitat is weed infestation. Although some weeds provide habitat, like Lantana (*Lantana camara*) and Blackberry (*Rubus fruticosus agg spp.*) do for small birds, they do reduce habitat complexity and overall will reduce bio-diversity.

Remedial action: All naturally occurring habitat elements are important and should be preserved and regenerated, agricultural landscapes should be adapted for the concurrent use by native animals and stock. Non-natural habitats should be checked and replaced if they are to be disturbed. For example the derelict artists studio at Riversdale might be used as a micro-bat roost. Removing silt before it reaches creeks is an example of preserving microhabitats. The eradication of bushland weeds is discussed in detail below however with reference to maintaining habitat it is important that weed eradication is managed like fire in that it should be eradicated in a mosaic pattern and some should be burned while other areas might be slashed and other areas sprayed with herbicide. This variety of treatments will further diversify the habitats.

5.4.1.8 Threats to Flora.

Weeds are the single greatest threat to the Ecological Communities of Bundanon. A long-term, consistent, bush regeneration program will be required if Ecological Communities are to be preserved. Prior to 1788 native plants would regrow in all disturbed areas however exotic (foreign) species now supplant native species after most disturbance events. Weeds may not have a natural predator, pest or disease which reduces their vigour or fecundity in Australia. Some weeds of bushland are highly invasive and do not require a disturbance event to become established.

Three key bushland weed species are growing on site that infest undisturbed bushland. These are in order of the size of their infestations; Lantana camara (*Lantana camara*) (Blackberry) *Rubus fruticosus spp aggregate*, Cassia (*Senna pendula var glabrate*). These three weeds will take decades to remove and will continue to harm bushland if they are not contained and eradicated. It should also be noted that an infestation of the noxious weed of grassland and pastures Fireweed is currently uncontrolled.

5.4.2 Bush Regeneration methods

5.4.2.1 The Bradley Method

The Bradley method of bush regeneration is the traditional approach of regenerating bushland and it requires weed eradication to begin in highly resilient and weed free bushland and to proceed to progressively more weed infested and generally lower resilient bushland. The other key aspect of this approach is that work should proceed at the rate that the bush responds to the weeding works. It is also very time consuming. The Bradley Method would undoubtedly succeed in regenerating the bush on site but it would require an army of bush regenerators and a huge budget.

5.4.2.2 The Total Earth Care method

A generic approach to bush regeneration used by Total Earth Care which has proven to successfully regenerate bushland for twenty years is an adapted Bradley method and outlined below.

- All threatened plant species should be protected from weeds.
- The immediate habitat of threatened fauna should be protected from weeds.
- All noxious weeds should be eradicated, or otherwise contained with what resources can be reasonably allocated without withdrawing resources from the eradication of weeds that are detrimentally affecting highly resilient bushland.
- Highly resilient bushland have weed species eradicated that threaten the health of the native canopy species and in turn species that threaten the native lower strata should be controlled and then eradicated,
- Moderately resilient bushland have weed species eradicated that threaten the health of the native canopy species and in turn species that threaten the native lower strata should be controlled and then eradicated,
- Large weed infestations/monocultures of highly invasive and destructive weeds should be controlled in poor quality bushland by use of broadscale herbicide application and or mechanical methods.
- Lowly resilient bushland should be weeded.

The eradication of a specific weed before the treatment of other less deleterious weeds is called target weeding. It usually relates to vine and woody weed species that can smother entire plant communities.

The TEC method has been developed for large scale sites with minimal resources. It stops the degradation of high quality bushland by undertaking sustainable target weeding and through the concurrent control of threatening weed species monocultures. This maintains highly resilient bushland in better condition before committing resources to the management of weed species that generally grow in lowly resilient bushland and which require a greater resource input.

Regeneration programs that require the eradication of all weed species, not just destructive weeds, before progressing into adjacent weed infestations suffer from a serious pitfall. This pitfall stems from problem that if an area is not as resilient as expected then prolific native plant recruitment will not occur. If prolific native recruitment does not occur then weeds will generally regrow and extra maintenance will be required to stabilise it. Native recruitment may take years to occur. This type of program compels the regenerator to continue maintaining the area until it is stable, in the mean time high quality bushland may be being lost to a suite of destructive weeds. A Bushland Management Plan must be in place to guide the regeneration process.

A Bushland Management Plan must be adaptive. Weeds that can smother the entire plant community must be eradicated ahead of species that may only threaten the shrub or herb layer. As the initial target weeding program continues across an area of bushland, the response to the weeding should be monitored and the resilience of the bushland included in a resilience assessment map. Only then can a regeneration program be fine tuned to respond rather than be compelled to react to the presence of weeds. If a site proves to be very high maintenance then it is probably not worth regenerating until higher quality bushland has been regenerated. The Bushland Management Plan must allow for sites to be temporarily un-maintained after primary weeding proved that resilience was poorer than anticipated.

All weeding works must pay due regard to the presence of native animals and must avoid working around nests and hollows especially within breeding seasons.

5.4.3 Weed eradication at Bundanon

Map 10 'Weed Density' reveals the extent of weed infestations on site. Most of this weed is Lantana, but all three key species are relatively easy to control. Eearie Park, Bundanon and Riversdale have a combined size of 862 Hectares and the Crown Land Lease is an additional 180 Hectares.

There is approximately 168 Hectares of high density weed, 28.3 Hectares of moderately dense weed and 18.7 Hectares of low density weeds across all 3 sites and including the Crown Land. The low weed density areas that correspond with highly resilient bushland should be considered the highest priority for regeneration and then the high density weed growing on lowly resilient Bushland should be considered the lowest priority. All other areas should fall in between these two extremes. Some consideration should also be made to the land tenure and whether regeneration on Trust land should be treated especially given that there is an aboriginal land claim pending on the Crown Land.

5.4.3.1 Method of Control and the cost of weed removal

The three aforementioned invasive weed species respond well to manual removal, herbicide application, mechanical removal and burning and each method of control should be applied where site conditions allow. A raft of weeding methodologies is taught at TAFE NSW and most of these standard industry techniques could be applied to the project.

The fastest and therefore the most cost effective program to complete the removal of the three key weeds would take 5 years. The cost would be in the order of \$15 Million if the works were undertaken manually. This cost would decrease to approximately \$2.5 Million if manual removal were combined with using an excavator with a mulching head, a motorised herbicide sprayer and ecological burning.

Once these weeds were eradicated a new suite of weeds would undoubtedly take their place and a new program and additional funding would be required. The new suite of weeds will be unlikely to invade undisturbed bushland and are likely to be contained to a much smaller area that is lowly resilient and has disturbed soils.

A BMP must be based on reliable budgets over a known period before a weeding program and the appropriate methodology can be applied. What is certain is that if the weeds are not controlled soon the cost will rise exponentially and the bushland will suffer. It is strongly recommended that the Trust purchase an excavator with a flail mowing head that can be used to mow down the largest weed infestations. The mowing should proceed in a mosaic pattern that prepares the bushland for Ecological Burns. The purchase of this machine could be offset if a contract is awarded to the Trust to mow the bushland within the High Voltage power easement.

6.0 BUSHLAND REVEGETATION / PRIVATE NATIVE FORESTRY.

Farm Forestry is governed by the *Native Vegetation Act 2003* (NV Act) and the *Plantations and Reforestation Act* 1999 (PRA). All activities within 40 metres of a river are also governed by the provisions of the *Water Management Act* 2000. These acts dictate how existing native forests can be harvested and how new forests need to be registered. At present the State and Federal Government also support the planting of shrubs and groundcovers along creeklines through the provision of Grants. The *Water Management Act 2000* also prohibits the removal of *existing* native trees within the 40 metres. This is a direct impediment to land owners who want to use their land for forestry but are restricted in not being allowed to harvest the **existing** timber from within this zone to pay the start up costs of a registered forest. Recent advice from the Office of Water is that harvesting a planted forest is allowable, within lands over which the Office of Water has jurisdiction, if the forest / plantation has been registered. This LMP provides no recommendations to clear existing trees from within 40 metres from the river is within Office of Water Jurisdiction.

6.1 Carbon Trading Legislation and Forestry

There appear to be many benefits to growing trees on Bundanon. The Carbon credits (Carbon Farming Initiative Bill 2011) and the Greenhouse Gas Benchmark Rule (Carbon Sequestration) No.5 of 2003 requires that forests grown for carbon sequestration remain standing for 100 years, and that if the forest is felled or destroyed, the carbon credits gained must be relinquished. The wording in Rule no 5 is ambiguous and requires clarification by a lawyer, perhaps the EDO could approached for assistance if the forestry recommendation is taken up. It is also understood that this is not the case in New Zealand and that timber can be sold from registered carbon sequestration forests. It is therefore also uncertain how the KYOTO protocol treats this aspect of carbon sequestration.

What is unambiguous is that if a landowner plants trees and registers the forest in the manner required by the legislation the mass of these trees can be converted into carbon credits which can be sold. It is strongly recommended that the land currently dedicated to livestock be significantly reduced in size and replaced with native trees.

The reduction in stock numbers can also gain carbon credits as an abatement action and The Biochar Capacity Building Program may also be an avenue that can be integrated into the early stages of a farm forestry program. The value of Carbon and the financial benefits for forest owners will not be investigated until the political environment has settled and the process of registration and calculation of entitlements has ironed out any teething problems.

Please refer to Appendix H "Carbon Trading" for further information.

6.2 Farm Forestry

Farm Forestry is the planting of trees, that may be harvested but which also provide a secondary function such as being a windbreak or they may provide shade for livestock or reduce dry land salinity. On the Bundanon properties harvestable trees are proposed to be used to shading out weeds and create conditions that are conducive to native plant recruitment ie bush regeneration.

The trees that are selected for plantations within these corridors should be a mix of both local species and selected valuable timber species (royal species). Some royal species are *locally* occurring eg Toona ciliata (Red cedar) and might be harvested in 100 years for cabinet making. Additionally native tree species (both local and from other regions) that have special qualities such as being marine borer or termite resistant should be planted. Several of these species are currently difficult to source and are increasing in value, for example, Turpentines. These trees will, in the medium term, be revegetated beneath with a full complement of species in all vegetation strata. If the Carbon Trading legislation does allow harvesting within the 100 years then these trees might be harvested sooner.

6.2.1 Staged forest and/or plantation establishment

Protect and undertake the preliminary stages of a bush regeneration program within the remnant bushland growing along the riverbanks. The immediate riverbanks and the first 5 metres beyond the river banks are to be revegetated/regenerated in perpetuity.

- Decide how much land should be dedicated to forestry and how much land can be forested each year with an established budget.
- Engage a landscape architect, in concert with the property manager to determine the location of the forest, new paddocks, fences and water troughs, vi a master plan,
- Remove the existing perimeter fence and relocate it to it's new location.
- Spray and slash pasture grasses with herbicide in the entire area to be planted in the life time of the program. Repeatedly spray until all weeds are dead.
- Direct seed by "drilling" the soil with local Acacia species to achieve a plant density of twenty plants per square metre. These are short lived species that will fix nitrogen in the soil and be turned into mulch into which Eucalypt seeds will be directly seeded.
- Grow the wattles for approximately 5 years or until they reach 4 metres in height.
- Plant trees, generally Eucalypt species, that will either be harvested or will left as bushland indefinitely.
- Prune, thin and manage the trees.

Site	Task	Task Area m2	High Density Exotics	Moderate Density Exotics	Low Density Exotics	Very Low Density Exotics	Cleared of Vegetation
	Potential Plantation / Interpretation	67500					67500
	Potential Landscape Interpretation	15900					15900
	Indigenous Revegetation	263300	156000				107300
	Private Native Forest	445700	415600			30100	
Bundanon	General Livestock Paddock	464200					464200
	Sheep Paddock	45600					45600
	Bush Regeneration	1642300	269600	39800	38600	1233500	61000
	TOTAL	2944500					
	Non-Trust Lands - Regeneration	30500	30500				
	Indigenous Revegetation	369300	69800	77500	900	1900	219400
	Potential Interpretation / Private Native Forest	48600	34500	13000		1100	170000
Facula Daula O	Potential Interpretation / Indigenous Revegetation	6800		6800			
Learie Park &	Potential Development Site	17000		800			16300
Decweence	Bush Regeneration	4878100	130500	76600	121700	4549400	
	TOTAL	5319800					
	Non-Trust Lands - Regeneration	25600	10300	15300			
	Private Native Forest	31700					29200
	Potential GrazIng / Interpretation	4800					4800
	Riparian Regeneration	48800	48800				
	Indigenous Revegetation	29900	11100				18800
Pivoradalo	Potetial Indigenous Revegetation	11800	7900			500	3400
Riversdale	Potential Admin Building	3700				1500	2300
	Grazing	43600					43600
	Bush Regeneration	382700	92700			290000	
	TOTAL	557000					
	Non-Trust Lands - Regeneration	11400	11400				

Table 5: Land Use Options and Weed Densities The task descriptions have been drawn from CAB 2011. All figures are in square meters.

6.3 Wildlife Corridors and Forestry

Planting trees along the river banks at Bundanon has significant ecological benefits through it's creation of a much needed Wildlife Corridors as has been discussed earlier. The current accepted philosophy regarding the planting of wildlife corridors is that species from all strata should be planted at the outset of the revegetation program. This is a prohibitively expensive approach that cannot be applied readily to large scale revegetation programs by farmers who have limited resources. This philosophy also does not harness the natural successional process of bushland regeneration after catastrophic events like flood or a cliff collapse. An innovative program such as the one suggested below should provide an example that can be applied to all of the small creeklines on dairy farms along the east coast of NSW.

6.3.1 Plantation Establishment Costs and potential revenue.

Regeneration Revegetation and Forestry												
Revenue based on 1200 trees planted per hectare and 700 thinned for poles at 7 years and another 300 harvested at 15 years and 100 at 20 years leaving 100 trees /ha.												
	Expenditure							Revenue				
	5 year target weeding program	Soil preparation	Machine weeding	Burning	Planting and direct seeding	Total cost	Year 10 \$50.00/ m3	Year 15 \$100 / m3	Year 20 \$100 /m3	Total Revenue	Difference by area	Harvesteable Areas m2.
RIVERSDALE							\$25.00/each	\$120.00/each	\$300.00/each			
Private native forest	\$42,235	\$11,534			\$17,000	\$70,769	\$52,500.00	\$108,000.00	\$90,000.00	\$250,500.00	-\$127,279.30	30,000
Revegetation	\$73,549	\$3,463	\$3,800		\$33,000	\$113,812						
Riparian Regeneration	\$39,040				\$43,000	\$82,040						
Regeneration	\$82,456			\$28,703		\$111,159						
BUNDANON												
Private native forest	\$476,433	\$9,154	\$83,500	\$31,170	\$116,000	\$716,257	\$547,960.86	\$1,127,233.76	\$939,361.47	\$2,614,556.08	\$1,016,722.54	313,120
Revegetation	\$64,753	\$9,154	\$7,800		\$30,000	\$111,707						
Regeneration	\$749,649			\$20,220		\$769,869						
EERIE and BEEWEEREE												
Private native forest	\$56,930	\$17,000	\$6,900	\$2,588	\$54,000	\$137,418	\$269,500.00	\$554,400.00	\$462,000.00	\$1,285,900.00	-\$293,269.80	154,000
Revegetation	\$478,828	\$51,000	\$13,440		\$38,000	\$581,268						
Regeneration	\$851,357			\$9,128		\$860,485						
						\$3,554,783				\$4,150,956.08	\$596,173.44	
7.0 LIVESTOCK OPERATION

The Objects of the Trust's constitution require that the property continues to function as a farm in some capacity. Intensive cropping is not permissable without approval under the council Zoning because the paddocks are flood prone. Keeping another type of livestock that has better financial returns, helps maintain the paddocks and is more compatible with public visitation should be considered. Exotic animals such as Lama's and Angora goats or even Kangaroos might be considered but for ease of management and reliability of the market the sheep is a solid choice. In light of these factors it is recommended that a small herd of Dorper be trialled.

N.B. Planting forests and revegetating the property is believed to be a greater priority than running livestock and so in order to utilise the current staff to greatest benefit it is recommended to remove the cattle owned by the Bundanon Trust and focus on the reforestation project. Once some trees are established then the livestock Dorper operation can be expanded if it has proven to be viable. At that time it is suggested that state of the art irrigation, fencing and animal handling facilities be installed so that Bundanon can be used as an educational facility for world's best practice integrated farming.

7.1 Beef Cattle

Bundanon and Eearie Park have been used for growing cattle in the past. The property is nearly fully resourced for growing beef cattle apart from having strong fences and a truck for transporting animals. The financial return of the cattle operation has been marginal in the past and the costs to upgrade the fences to continue the operation is large and cannot be justified. No cattle can be run at Riversdale due to parking and OH&S concerns.

7.2 Agistment and Leasing

Agisting has been vetoed by the Trust Management because the movement of unknown people within the property cannot be regulated.

7.3 Sheep Farming

Growing wool is not an option in the region but growing meat sheep is. The Dorper breed that known to be resistant to foot problems in humid country. They are also very well regarded with respect to their

fecundity and their carcass weight. This breed also eats the noxious agricultural weed *Senecio madagascariensis* (Fire Weed) which is growing densely on Bundanon and Eearie Park. Growing sheep would require additional strands between the existing fencing and modification of the yards and water troughs. Sheep are also more manageable within the Riversdale setting and could be used to reduce the carbon foot print being made by the ride on lawn mowers. Some permanent fences and electric fences could be used at Riversdale to move the sheep around the property. Sheep might also graze beneath Plantation trees.

Several options relate to how the sheep could be grown. They might be lambs that are fattened up or a breeding flock could be kept. The stock numbers and establishment costs would need to be considered in light of the available paddock space and the space dedicated to forestry. A financial plan would need to be written once these parameters were established.

7.4 Vertical Integration

The meat that is grown on the property is best sold to visitors. On farm sales not only reduce "food miles" but the Trust would benefit by the value adding, especially when the property has a large commercial kitchen and animals are butchered for a known quantity of meals. Butchering on site would also be a great way to educate people regarding the reality of their choices and their interdependence on others. The financial benefits of this are substantial if the sale is predetermined.

7.5 Organic Farming

Organic beef and lamb growers are established in the region but the property manager Henry Goodall does have some concerns regarding the local parasites and whether they can be effectively controlled without chemical drenching. Organic farming is also complicated by the certification process. If a farm is to be certified organic then it must be chemical free, its practices must be ecologically sustainable and the livestock must be living on the property and breeding for two generations. If the meat is not to be sold off the farm then there seems little benefit apart from the intrinsic value of clean meat and sustainable farming practices. Organic farming is a very labour intensive and financially marginal business if the produce is being sold to a merchant.

7.6 Bundanon as an Exemplar

If Bundanon is to put forward as an exemplar of good farming practice then it should be a model that farmers can visit and see how forestry, conservation and livestock can be integrated. It should also demonstrate how a small conventional farm that is vulnerable to market swings can be protected by diversifying without losing income in the transitional period.

8.0 FIRE MANAGEMENT AT BUNDANON

8.1 Current Legislation and Planning Instruments Relating to Development.

8.1.1 Legislation relating to Bushfire Prone Land.

The following legislation relate to developments on fire prone land:

- The Rural Fires Act 1997.
- Environmental Planning and Assessment act 1979.
- The Threatened Species Conservation Act 1995 NSW
- The Environment Protection and Biodiversity Conservation Act
- Rural Fires and Environmental Assessment Amendment Legislation Act 1992

8.1.2 Planning instruments relating Bushfire Prone Land.

The following planning instruments relate to developments on fire prone land:

- Planning for Bush Fire Protection NSW Rural Fire Service.
- The Local Environment Plan
- Shoalhaven Bush Fire Management Committee Bush Fire Risk Management Plan May 2010

8.2 Fire Management Planning

8.2.1 Regional

The local RFS brigade, Shoalhaven City Council (SCC) and the NPWS are members of the Shoalhaven Bushfire Management Committee who produce the Shoalhaven City Council Bush Fire Risk Management Plan (SCCBFRMP 2010) for the region. This is the current overarching Bush Fire Planning tool in the Shoalhaven region. SCC is obliged to produce this document under the Rural Fires and Environmental Assessment Amendment Legislation Act 1992. This documents primary function is to declare which lands are 'Fire Prone' and thereby constrains development within those lands and obliges proponents to comply with the bushfire risk mitigation measures outlined in the Rural Fire Service Planning instrument Planning for Bush Fire Protection. The SCCBFRMP 2010 is a controlled document that guides the

programming of prescribed burns and installation of fire mitigation measures in the region. This plan has been developed after consideration of the topography, aspect, size, spatial arrangement, location and type of fire prone vegetation communities. Fire management resources including appliances (fire trucks etc), roads and firebreaks are also considered in establishing the risk of managing hazard reduction (prescribed) burns. The history of fire events and ongoing fire fuel load assessments are all included in a matrix of planning parameters that are used to produce the Shoalhaven Fuel Management Plan.

As well as planning and approving burns the RFS and NPWS may also assist in the preparation of and provide on ground support during hazard reduction and ecological burning. The SCCBFRMP 2010 requires constant revision to maintain its relevance and all proposed management actions on Bundanon should be considered with reference to this document.

8.2.2 Local.

Bundanon's public visitation creates responsibilities for the Trust that go well beyond the average rural land manager. The visitors are generally ignorant of the risk of bushfire the layout of the property and may in fact be the cause of bushfire especially if they are walking through forested sections of it. Consequently the Trust has the obligation to mitigate this risk. The first step to meeting this obligation is to prepare and annually review and update Fire Management Plan (FMP).

The finalised Land Management Plan will define land management units for the property that will then require categorising into four types of bush fire management zones within the Fire Management Plan.

These four Bush Fire Management Zones are standards within PFBFP and are:

I. Asset Protection Zone (APZ);

This is an area set around an asset (building, crop, livestock or item of cultural heritage) that must be actively managed to mitigate the impact of bush fire.

II. Strategic Fire Advantage Zone (SFAZ);

This is an area from which wildfire can be managed and prescribed burns can be controlled

(valleys, roads, rivers and fire breaks).

III. Land Management Zone (LMZ);

This is an area that has a discrete use and fire is managed sympathetically to that use (an floristic assemblage with a specific fire frequency, or an animal habitat that might only be burned at a specific time of year.

IV. Fire Exclusion Zone (FEZ).

This term self explanatory but may be required if for example a captive breeding program of Brush Tailed Rock Wallabies is contained within a fenced section of the property.

N.B This FMP must pay due regard to the SCCBFRMP 2010 and the parameters outlined below.

8.2.3 Fire history.

The Fuel Management Plan 1999 refers to a fire or series of fires that occurred in 1982. The author does not indicate whether the fire was a bush fire or prescribed burn nor does he provide details of the fire intensity or its exact location. It is presumed that only a relatively small area of the Bundanon ridgeline was burned as well as the power line easement and over heathland/woodland above the western escarpment of Eearie Park. No other burns are known to have occurred on the properties.

The lack of fire on the property has resulted in a build-up of fire fuels in the moist south facing slopes and along the ridgetops. These areas should be considered a high priority for burning on the grounds of Hazard Reduction. The thirty year period since 1982 is lack of fire at Bundanon is detrimental to the Ecological Communities on site. The time elapsed since this fire/s is so long that any fuel reduction benefit has been lost. The 30 year period between burns is too long for most of the Flora on site need for an Ecological burn.

The only known burn that has occurred since 1982 was a fire in 2002 which threatened but did not burn the property.

8.2.4 Fire, topography and aspect

Planning for Bush Fire Protection is the RFS development planning document used to assess the fire risk related to building in bush fire prone areas. Slope is one of several parameters used in a matrix to determine fire risk. If a bush fire can approach from downslope of a building then the building is at greater risk than if the fire approaches from above the building. The reasoning behind this is that a fire coming up a hill will always preheat the fuel in the vegetation layers above it and make them more combustible, whereas the heat generated from a fire coming down slope tends to rise into the already burned vegetation above it; however in extreme fire conditions this does not always happen. Ember attack will start spot fires downslope of the main fire front that then burn upslope and back into the fire front creating wildly unpredictable conditions.

The aspect of the land also impact on the risk of fire. The sun will heat and reduce the humidity of north and west facing slopes more than the East and south facing slopes along the east coast of NSW. The

implication of this for Bunandon is that the power easement, ridge lines and the west facing escarpment are more prone to fire than the south and east facing slopes and plains. The 1982 fires predictably occurred in these areas.

8.2.5 Climatic conditions and bush fires

Bush fires are strongly associated with weather periods of low humidity, hot days and strong winds. These conditions are combined with westerly winds between early November and late February. The Shoalhaven region has weather that is moderated by coastal rains and southerly winds average temperatures during the fire season peaking in January at 26.5oC. Rainfall at Bundanon is approximately 1,000mm per year while it is 1110mm in Nowra and 1270mm in Milton. Bundanon is a relatively dry location and considered fire prone because of the schlerophyllic plants that dominate the landscape preferring reduced humidity conditions.

8.2.6 Fire and the built environment

The peak body concerned with fire management in NSW is the NSW Rural Fire Service (RFS). The RFS is principally concerned with the protection of life, property and economic assets although the RFS considers the ecological and cultural parameters of bush fire planning more than they did in the past they are still very much a secondary concern.

"Areas of medium or low risk and cultural and environmental assets are likely to be managed by routine procedures and so do not require a specific application of resources. However, where possible and practicable the Shoalhaven BFMC will treat medium and low risks." Shoalhaven Bush Fire Management Committee Bush Fire Risk Management Plan May 2010

The buildings on the Bundanon Property are positioned between the toe of a steep escarpment and open paddocks and flood plains on the banks of the Shoalhaven River. This location provides excellent fire protection from fires that might come from the south across the river. Flames from the south cannot leap the River however the properties are vulnerable to ember attack from this direction. Fires that come from the north, west or east and fire that starts on Bundanon are a very serious concern given that the bushland that is a backdrop to the buildings is a substantial fire risk.

The protection of proposed and existing buildings will require the manual management of fire fuels and also hazard reduction burning. The positioning of new buildings may require the complete and/or selective clearing of bushland to provide the "asset protection zones" that are required by PFBFP. Building materials are very important factors in establishing how close a building envelope can be close to bushland.

The high voltage power easement has vegetation growing beneath on the high ground heath dominates gullies have forest communities. This easement is owned by Transgrid who maintain their easement by periodic slashing of the vegetation. Burning beneath or near by the power lines is prohibited due to the danger of the wires stretching when they are heated and due to the lines 'arcing' between each other when ash increases the conductivity of the air between the lines and to the ground. Maintenance of the power easement and allowable actions within the easement are clearly described on the TransGrid website

N.B. The Fuel Management Plan by Bushland and Environmental Service 1999 (FMP 1999) recommended that a prescribed burn be completed beneath the Power Lines in 1999. TEC do not concur with this recommendation and in fact strongly advise against any such burn.

8.2.7 Prescribed Burns (Ecological and Hazard Reduction Burns)

8.2.7.1 Burn Approval Process

In order to burn a discrete area of bushland it is necessary to:

- 1. Discuss the burn with the NSW RFS and council to establish the regional fire management planning constraints by reference to the SCCBFRC 1996
- 2. Discuss the burn with the NPWS local regional staff to establish regional flora and fauna issues,
- 3. Determine if and how threatened species that will be impacted by the burn,
- 4. Assess the weight of fire fuel in the area,
- 5. Define the burn area on a map,
- 6. Prepare a burn plan that deals with ecological, safety, timing and operational issues,
- 7. Clear a mineral earth trail around the burn area to contain the burn and resource the burn as required by the RFS conditions,
- 8. Have NSW RFS inspect the burn preparation,
- 9. Submit an application form to burn to the EPA and the NPWS,
- 10. Receive approval,
- 11. Inform neighbours and local authorities, EPA, council, and neighbours.
- 12. Induct all trained staff involved in the burn,
- 13. Burn

This process can be significantly fast tracked by having a Fire Management Plan for the property that has been contributed to by the RFS, NPWS and Shoalhaven City Council. A Fire Management Plan should provide a 5 year program of burns that has a 25 year overview. This document will guide the conservation of the ecological communities on site as well as protect individual species and reduce fire fuel loads. Fire can also significantly reduce the cost of weeding on the property. A Fire Management Plan that has been approved by the local authorities can be implemented progressively but in a timely manner. If this plan is comprehensive and if it is backed up by a consistent level of communication and clear demonstration of ability on behalf of the staff then Bundanon can benefit by the use of this essential land management tool.

N.B. A well planned burn can be part of a seasonal ritual that can be integrated into an artistic event or installation.

8.3 Fire and the Natural Environment

8.3.1 Fire behaviour and plant communities.

Bundanon is a property that has very large tracts of bushland within it and is completely encircled by bushland. The dominant bushland structure on site is forest as distinct from a grassland, woodland or rainforest which are also on site. Forest is considered to have a high bush fire risk potential, as described in the Rural Fire Service Publication "Planning for Bush Fire Protection" (PFBFP) and it requires management to mitigate the fire risk it poses. There are small areas of woodland, heathland and rainforest on site and large areas of grassland; these have significantly different fire management requirements. Burning bushland for prescriptive ecological outcomes is termed 'ecological burning'.

The floristic structure of a forest is such that a fire that begins close to the ground can climb from short plants (groundcovers), into the shrub layer, then through the small tree layer and into the canopy. This ladder of contiguous fuels allows fire to crown and then spread through the canopy. Once a fire is in the canopy they generally create their own wind which will preheat the bushland in front of them, creating explosively dry conditions. Embers that are pushed up and ahead of the fire front by the wind will then create spot fires. Understanding this simple process allows us to take a rung out of the fire ladder.

The starting point of most fires is on the ground in the leaf litter where very fine twigs and leaves act as kindling. If the weight of fire fuel on the ground is reduced then the likelihood of a fire starting is also significantly reduced additionally if the shrub layer is absent or scattered then the likelihood of fire reaching the canopy is also reduced. The volume of fuel on the ground is the principal determinate of fire risk in bushland and when combined with the heat content of the fuel and the rate of spread the fire (due to slope, wind and humidity) a measure of fire intensity can be determined. Measuring the weight

of fire fuel will be required annually to establish a robust fire management strategy. Burning to reduce fuel loads is termed hazard reduction burning.

Many Australian native plants have adapted themselves to the presence of fire. Their leaves and bark may burn but they will re-grow from buds beneath their bark of from thickened roots that reshoot from below the ground. Their seeds may only drop from fruiting capsules that a reprised open by the heat of a fire, or their seed coats may only imbibe water that has been infused with smoke or may in some other manner trigger the growth of a seeds embryo. Importantly, gum trees like Eucalypts, Corymbias, and Angophoras drop leaves and bark which are excellent fire fuels. These trees create fire prone conditions around themselves as a means of burning other plants that grow too close and which compete with them. The bare burned ground which has increased light levels due to the canopy being burned off creates a nutrient rich and light filled environment for growing seedlings from very small seeds. The seeds are literally the size of a full stop (.) and cannot grow if they are smothered by deep layers of leaf litter or grasses. These plants are commonly called schlerophyllic.

8.3.2 Fire frequency.

The more frequently bushland is burned the greater the dominance of plants that have adaptations that create fire conducive conditions. Eucalypts in schlerophyll communities drop fine twigs and curled oil rich leaves that form loose air filled layers that are perfectly set to burn. Burning too often can literally feed the fire. Burning too frequently will also reduce the diversity of species by killing plants that do not have time to reach maturity and that have not been given the opportunity to set new seed and replenish the soil seed bank in readiness for a new germination pulse that is stimulated by fire.

Rainforests generally grow in sheltered south facing slopes where humidity is higher and where fire is less frequent. Bushland that is not burned frequently will slowly be supplanted by species that do not like fire and these species will create microclimatic conditions that they are better adapted to. These plants are often called mesophyllic and their seedlings prefer lower light level on the ground and higher humidity. The leaves and twigs of the mesophyllic communities are made of light wood and their leaves lay flat on the ground which forms a moist layer of composting vegetation which is quickly recycled. In time mesophyllic plant communities will literally rot schlerophyll species and transform the community into rainforest which doesn't burn readily.

It is important that the right frequency of burning is implemented so that the floristic communities of plants that are growing at Bundanon remain as diverse and species rich as possible. If we burn bushland too often or too infrequently we will reduce the diversity of species and we will reduce the diversity of habitats that these plants create for the animals that live in the bush.

N.B: The forested side slopes between Haunted Point and the new driveway into Riversdale appear depauperate of native shrub and ground cover species. It has been assumed that these areas have been grazed repeatedly and it is also likely that they have been burned also in the distant past. These side slopes are now becoming infested with Lantana due to the lack of grazing. No fire records are known for the area which complicates the burning program because additional burning may further reduce species diversity. The age of the Lantana on site and the low average rainfall of the property < 1000mm indicates that no fire event or grazing has occurred for at least 15 years.

8.3.3 Fire and species diversity

Species diversity is a direct indicator of bushland's buffering capacity to change or its resilience. Recent scientific research into the effects of climate change demonstrate that plant and animals species will have to adapt to changes in temperature, or shift their distributions to better suit their climatic preferences; failure to do so will result in localised extinctions of species (Walther *et al.*, 2002). We do not know which plants will respond better to this change so it is prudent for us to conserve all plants species for their intrinsic sake but also for the animals that live among them.

Burning needs to be undertaken in a mosaic pattern for ecological purposes. If we burn a large tract of land we create a broad expanse of one age class of bushland which, like a community in a new subdivision in a big city, attracts a narrow demographic range of people to it. For example, an inner city suburb has a community that is demographically diverse and has a varied life experience that is robust it can better withstand external pressure and change. Diversity in habitat for animals is improved by providing some animals with an open ground cover/shrub layer like the Dunnart and a closed shrub layer adjacent to grassland like the Bandicoot. Burning a large area will also kill more animals than a small area burn because a small area burn will maintain refugia into which animals can retreat. Planning an ecological burn also requires consideration of the breeding cycles of animal species. There is no good time for burning from an animal's perspective however if we know that we have a rare micro bat on site that lives beneath the bark of a *Eucalyptus punctata* then we should avoid burning a stand of these trees in winter when the bat is torpid (hibernating). Please refer to Map 9 Core habitats. Burn planning within the core habitats must consider the lifecycles of the threatened species in these areas.

To complicate the fire planning process further different plant species like to be burned at different temperatures some prefer a cool burn and others prefer hot burns.

8.3.4 Fire as a tool.

Aboriginal people may have used fire as a means of clearing for access and growing grasslands that attracted their food species, there is some conjecture as to whether this was a deliberate land

management action for NSW east coast tribes. It is uncertain whether they were responsible or not for the pyrophyllic plant communities that have evolved on site but what is evident is that the communities are dependent on fire and burning is now necessary in the maintenance of healthy Ecological Communities. Fire must also be used to reduce the risk of fire in bushland to Bundanon's assets. Bundanon not only has built assets but the threatened species and the bushland that they live in is also a financial asset with respect to Bio-diversity Banking.

8.3.5 Fire Management training.

Fire management training is best undertaken via the Rural Fire Service. Trained staff are most valuable in preventing unplanned burns by monitoring the re-growth rates of bushland and the weight of fire fuel. They are also invaluable in monitoring the ecological response to burning.

8.4 Current condition of Asset Protection Zones.

Asset protection zones consist of an Inner and Outer Protection Zone. The Outer Protection Zone has more trees and shrubs while the Inner Protection Zone has scattered tree canopy and no shrubs and a managed grass/groundcover layer. These areas are prone to weeds if they are not managed properly but if they are managed well they can be turned into dense swathes of native grasses that some native herbivores and omnivores prefer as habitat.

The Asset Protection Zones immediately around the buildings should be maintained through a combination of physical fuel removal and by burning. Fire is an inexpensive way to reduce fuel loads, and to assist in the initial clearing of bushland for proposed developments. Physical removal, slashing and manual piling of leaf litter and vegetation creates compost piles that are favoured by birds, reptiles and mammals that eat invertebrates. Once these piles have decayed a little they can be burned to create an intense but contained hot fire that will stimulate the growth of fire obligate species. Cool burning of the grass layer will keep fuel loads down while maintaining species diversity. Trained staff is essential if fire is to be used appropriately in the integrated management of the bio-diversity and the built property assets.

8.4.1 Riversdale building interface.

8.4.1.1 Access and egress:

• Access road 1: All weather (concrete and bitumen) two wheel drive, two lane road built in accordance with the requirements of PFBFP i.e. at least 8 metres wide and shoulder, correct

pitch (no greater than 15 degrees), inner radius greater than 6 metres and outer radius (minimum 12 metres), height clearance (4 metres). Cross fall is less than 10 degrees and culvert capacity exceeds 15 tonnes.

 Access road 2: Unmaintained dirt (no surfacing material), 4wd only in wet weather. Road widths, pitch, vertical clearance and radiuses are not compliant with PFBFP. The road is currently blocked by dense Lantana. This road provides a secondary and important access for fire fighting vehicles and an escape route for people caught by fire burning along the Bundanon/Eearie Park access road.

Recommendations:

- 1. Access road 1: Maintain road surface and clear vegetation back at least 2 metres from road edges as re-growth occurs, especially at the hairpin bend where visibility is very important. Keep drains and gutters clear of vegetation/leaf litter.
- Access road 2: Clear Lantana, re-grade the road and install or maintain table drains and drainage channels. Consider resurfacing steep pitches to provide 2wd access. Install signposts indicating fire access and include the access road in the Fire Management plan. Clear vegetation back at least 2 metres from the road edges and remove overhanging branches as re-growth occurs. Make road compliant with the requirements of PFBFP.

8.4.1.2 Location of Buildings:

- All except one of the existing buildings are located within or above large grassed areas that are bounded by the river. These managed grasslands provide both a firebreak and an egress route to the river. The exception is a dilapidated artist's studio to the west of the administration building.
- The Boyd Education Centre has Development Approval consent conditions that were not met and that may have been amended (Bushfire protection audit August 2003). These conditions required that an Asset protection Zone be managed in the bushland upslope of the building. It is uncertain whether a Section 96 was sort to vary these conditions. The bushland upslope of the Boyd Education Centre is very prone to fire and mitigation measures must be undertaken to reduce this risk to acceptable levels.
- Install a gravity fed sprinkler system to protect the Boyd education centre and the other heritage listed buildings on the property.
- The proposed Collection Study and Entertainment Centre and Administrative offices buildings are both located immediately adjacent to fire prone bushland. Development related to the

education facilities is likely to be considered by the integrated development consent authority to have a heightened level of risk and have a Special Fire Protection Purpose. This extrapolates into larger fire breaks (Asset Protection zones) than routine development and more onerous fire management consent conditions. Alternatively or concurrently the fabric of the building may be required to comply with a more rigorous building code. Fire resistant building materials and the fire mitigating design of roofs, gutter lines, orifices (windows/doors/ventilation), and automatic sprinkler systems may be required. The current master plan concept study (Tonkin, Zulaikha and Greer) will require the buildings to be constructed of either windowless steel or concrete walls on the bushland side or they will be located within highly modified vegetation communities that have a managed groundcover and absent shrub layers.

Recommendations:

- Move proposed buildings away from bushland and landscape so that no bushland need be modified to accommodate the proposed buildings.
- Install PFBFP compliant landscaping in curtilage of alternative location prior to buildings being installed.
- Install a flammable materials (accelerants) shed. This shed should be a locked cage with roof with wide eaves and a concrete floor and should be set outside the APZ.

8.4.1.3 Surrounding vegetation:

The landscape vegetation immediately upslope of the Boyd Education Centre is unsightly and is dominated by a landscape species that is a weed of bushland (Dietes sp). The soil on this slope has been modified and the topsoil layer has been removed and is depleted. The plants growing in this area lack vigour due to the soil properties.

Recommendations:

Remove the *Dietes spp* and replant with a short term managed native grassland, and a long term shrub layer of *Macrozamia communis* Burrawang and *Allocasuarina littoralis* Black She-oak. This will comply with PFBFP and provide a very low maintenance landscape. The Allocasuarina spp (She-oaks) will also have a wonderful sound as the wind blows up the river. Cover the slope with 200mm of wood chip / mulch and allow the mulch to breakdown over several years to re-establish a deep soil profile prior to planting.

8.4.1.4 Asset protection Zones:

The land containing vegetation that is managed between the buildings and the fire risk is called an Asset protection Zone. The vegetation in this zone will be required to be modified so that the structural layers (levels) of the vegetation are discontinuous and that the volume of fire fuel is reduced below dangerous levels. The Asset protection zones upslope of the building is required to be 60 metres wide if a building has been constructed to the Building Codes of Australia Class 1 standards. If the Class is increased (to include steel and concrete) then the width of the asset protection zone can be reduced.

Recommendations:

Ensure that the architects and planners of the proposed development understand the limitations imposed by PFBFP and that buildings built adjacent to bushland that require asset protection zones will be set within a highly modified bushland environment, and that having scattered mature trees surrounding new buildings comes at the price of plant and animal species diversity in the shrub layer, understorey and midstorey within the APZ.

8.4.1.5 Fire fighting resources:

An inventory of the resources should be listed in the Fire Management Plan and should include:

- Staff job descriptions, responsibilities, functions and training.
- Water access points, dedicated fire fighting water tanks, sprinkler systems, hoses and pumps.
- Watertanker / Truck's,
- Personal Protection Equipment
- Extinguishers.

Recommendations:

- Commission a Fire Management Plan and Bushfire Emergency Plan
- Educate staff in the detail of the Bushfire Emergency Plan.
- Nominate a staff member as the Bushfire emergency coordinator.
- Train ground/interested staff in bush fire control.
- Install a series of gravity pressure metal water tank in the bushland high above the buildings.

- The number and location of these should be determined by the author of the Fire Management Plan.
- Install a diesel pump that can draw large volumes (>1,000 litres/minute) of water from the river in an emergency.
- Install a series of solar powered water bores that can trickle feed both fire dedicated and stock watering tanks set high in the bush above the buildings.
- Install a below ground high pressure/ high volume water reticulation system that draws water from dedicated water source and delivers water to roof mounted sprinklers and to fire fighting hydrants via pump or gravity.

8.4.1.6 Immediate fire threat:

All buildings currently being used at Riversdale have a narrow cleared or partially cleared area (Fire Break) to the west of them i.e. the bushland interface. The machinery shed also has a narrow band of bushland offset to the north and east. A small dilapidated and disused artist's studio is located in the bush above the Education Administration building. This building is completely surrounded by bushland and is very fire prone. None of the Asset Protection Zones (APZs) have been maintained as required by PFBFP or as per the Development Consent conditions. The forest to the west of the buildings has moderate fuel loads that would carry a fire. All Land owners have an obligation to maintain their properties in a manner that mitigates the potential of fire spreading from their land onto neighbouring properties.

Recommendations:

- Install and maintain asset protection zones in accordance with Planning for Bush Fire Protection.
- Classify all residential and administrative buildings on the property as requiring Special Fire Protection Purposes.
- Asset Zones should be a minimum 60 metres wide with 20 metres being an outer protection area and 40 metres being an inner protection area.
- Maintain Asset Protection Zones as required by Legislation.

8.4.2 Eearie Park building interface.

8.4.2.1 Access and egress:

 Access road: Generally does not conform with road specification established in Planning for Bush Fire Protection. Graded gravel two wheel drive in fine weather 4wd in poor weather. Two lanes but no passing on tight bends when trucks are turning. No passing bays not a minimum of at least 8 metres wide and shoulder, correct pitch (no greater than 15 degrees), inner radius less than 6 metres and outer radius (less than 12 metres), height clearance (4 metres). Cross fall is greater than 10 degrees and culvert capacity exceeds 15 tonnes.

Recommendations:

- Interim measures for Access road: Maintain graded road surface and clear vegetation back at least 2 metres from road edges as re-growth occurs, especially at the hairpin bends where visibility is very important. Keep drains and gutters clear of vegetation/leaf litter. Maintain 4metre height clearance. Install passing bays at 1km intervals.
- Long-term measures -rebuild the road to comply PFBFP.
- Proposed residential buildings at Eearie Park will require that the access road be rebuilt to comply with BFBFP.

8.4.2.1 Location of Buildings:

- An existing residential building and garage is located within a narrow band of tall heath vegetation. The southern downslope edge of this bushland joins with a large grassed paddock that is in turn bounded by the river. These managed grasslands provide both a firebreak and an egress route to the river. The upslope western edge of this bushland is a one lane graded farm access road that intergrades with Forest upslope of the road. Heathland and forest vegetation are located to the east and north of the building. This residential building is very vulnerable to bushfire because it has no effective Asset Protection Zone surrounding it.
- The proposed Secondary Education Research Retreat includes two clusters of buildings.
 - The first cluster is located on the western escarpment. Planning for Bush Fire Protection seeks to dissuade locating buildings on ridges especially where egress is thwarted by a precipitous cliff. The access road to this cluster would also be required to be a loop road that meets all other requirements for Special Fire Protection Purposes.
 - The second cluster is located on the river flat/foot hills of the escarpment. These buildings are well situated with regard to fire protection.

- Development related to education facilities is likely to be considered by the integrated development consent authority to have a heightened level of risk and have a Special Fire Protection Purpose. This extrapolates into larger fire breaks (Asset Protection zones) than routine development and more onerous fire management consent conditions. Alternatively or concurrently the fabric of the building may be required to comply with a more rigorous building code. Fire resistant building materials and the fire mitigating design of roofs, gutter lines, orifices (windows/doors/ventilation) and automatic sprinkler systems may be required. The current master plan concept study (Tonkin, Zulaikha and Greer) will require the buildings to be constructed of either windowless steel or concrete walls on the bushland side or they will be located within highly modified vegetation communities that have a managed groundcover and absent shrub layers.
- The high voltage transmission lines run southward along the ridge and over several small gullies that drain into the Riversdale creek before they drop down the south facing Eaerie park escarpment and then over the Shoalhaven River. These transmission lines require the vegetation growing beneath them to be cleared to reduce the threat of fire and stop trees making contact with the wires a vegetation management company ACME currently holds the contract to manage the vegetation until 2013. This transmission easement is very fire prone.
- Transgrid have recently conducted a feasibility study into the amplification of the power along the transmission easement this is likely to mean that there will be modifications to the stanchions and potentially widening of the easement. This will have implications for the threatened species that live along this ridge.

Recommendations:

- Discuss proposed location of the Proposed Escarpment Cluster of buildings with the Rural Fire Service.
- Undertake a very hot hazard reduction burn that clears the bushland within and adjacent to the proposed Escarpment Education Research Retreat Cluster site.
- Either relocate the proposed buildings away from ridge to a location that is not fire prone, or
- Modify the vegetation in the proposed location well before building works begin so that a native grassland Asset Protection Zone can be established before the buildings are installed. Post fire bush regeneration (seedling re-growth) should be selectively thinned of native shrubs and trees to retain only native grasses and herbs.
- Liaise with Transgrid regarding their proposal and also investigate the potential of having Bundanon staff undertake the vegetation management under the powerlines in order to better

conserve the threatened species. A contract with Transgrid may also be a way of offsetting the purchase of an excavator that is needed for the management of the site.

• Install a flammable materials (accelerants) shed. This shed should be a locked cage with roof with wide eaves and a concrete floor.

8.4.2.2 Surrounding vegetation:

The bushland immediately adjacent to the existing residential building is very prone to fire and is contiguous with very flammable vegetation communities. The bushland within the power easement will require periodic maintenance. The slashing of this vegetation will be required before 2013 and will be undertaken by the current clearing contractor ACME.

Recommendations:

Monitor the depth of fire fuel in the bushland adjacent to the buildings and easement.

8.4.2.3 Asset protection Zones:

The residential building does not have an effective APZ of 20 metres upslope and downslope and 30 metres along the same contour. If a building has been constructed to a higher Standard the Class 1 (Building Codes of Australia) then the width of the asset protection zone can be reduced.

Recommendations:

It is a very high priority to widen the Asset protection zone upslope and dowslope of the residential building so that it is 20 metres wide i.e. up to the road and down to the paddock. The bushland should also be cleared for 30metres to the west and east of the building. Ensure that the architects and planners of the proposed development understand the limitations imposed by PFBFP and that buildings built adjacent to bushland that require asset protection zones will be set within a highly modified bushland environment and that having scattered mature trees surrounding new buildings comes at the price of plant and animal species diversity in the shrub layer, understorey and midstorey within the APZ.

8.4.2.4 Fire fighting resources:

An inventory of the resources should be listed in the Fire Management Plan and should include:

• Staff job descriptions, responsibilities, functions and training.

- Water access points, dedicated fire fighting water tanks, sprinkler systems, hoses and pumps.
- Watertanker / Truck's, Personal Protection Equipment, Extinguishers, Machinery shed.

Recommendations:

- Commission a Fire Management Plan and Bushfire Emergency Plan
- Educate staff in the detail of the Bushfire Emergency Plan.
- Nominate a staff member as the Bushfire emergency coordinator.
- Train ground staff in bush fire control.
- Install a series of gravity pressure metal water tank in the bushland high above the buildings or install a pump if gravity generated pressure is insufficient.
- The number and location of these should be determined by the author of the Fire Management Plan.
- Install a diesel pump that can draw large volumes (>1,000 litres/minute) of water from the river in an emergency.
- Install a series of solar powered water bores that can trickle feed both fire dedicated and stock watering tanks set high in the bush above the buildings.
- Install a below ground high pressure/ high volume water reticulation system that draws water from dedicated water source and delivers water to roof mounted sprinklers and to fire fighting hydrants via pump or gravity.

8.4.2.5 Immediate fire threat:

- The residential property is under a potential threat of bush fire.
- The heath forest adjacent to the buildings has high moderate fuel loads that would carry a fire.
- All Land owners have an obligation to maintain their properties in a manner that mitigates the potential of fire spreading from their land onto neighbouring properties.

Recommendations:

Install and maintain asset protection zones in accordance with Planning for Bush Fire Protection.

8.4.3 Bundanon building interface.

8.4.3.1 Access and egress:

 Access road: Generally does not conform with road specification established in Planning for Bush Fire Protection. Graded gravel two wheel drive in fine weather 4wd in poor weather. Two lanes but no passing on tight bends when trucks are turning. No passing bays not a minimum of at least 8 metres wide and shoulder, correct pitch (no greater than 15 degrees), inner radius less than 6 metres and outer radius (less than 12 metres), height clearance (4 metres). Cross fall is greater than 10 degrees and culvert capacity exceeds 15 tonnes.

Recommendations:

- Interim measures for access road: Maintain graded road surface and clear vegetation back at least 2 metres from road edges as re-growth occurs, especially at the hairpin bends where visibility is very important. Keep drains and gutters clear of vegetation/leaf litter. Maintain 4metre height clearance. Install passing bays at 1km intervals.
- Long-term measures -rebuild the road to comply PFBFP .
- Proposed residential buildings at Bundanon will require that the access road be rebuilt to comply with BFBFP.

8.4.3.2 Location of Buildings:

- The existing buildings are located within or above large grassed areas that are bounded by the river. These managed grasslands provide both a firebreak and an egress route to the river.
- The Bundanon homestead is located well within a managed grass land landscape and is safe from bushfire.
- The proposed air studios and accommodation buildings are located immediately adjacent to fire prone bushland. Development related to education facilities is likely to be considered by the integrated development consent authority to have a heightened level of risk and have a Special Fire Protection Purpose. This extrapolates into larger fire breaks (Asset Protection zones) than routine development and more onerous fire management consent conditions. Alternatively or concurrently the fabric of the building may be required to comply with a more rigorous building code. Fire resistant building materials and the fire mitigating design of roofs, gutter lines, orifices (windows/doors/ventilation) and automatic sprinkler systems may be required. The current master plan concept study (Tonkin, Zulaikha and Greer) will require the buildings to be constructed of either windowless steel or concrete walls on the bushland side or they will be

located within highly modified vegetation communities that have a managed groundcover and absent shrub layers.

Recommendations:

- Move proposed buildings away from bushland and landscape so that no bushland need be modified to accommodate the proposed buildings.
- Install PFBFP compliant landscaping in curtilage of alternative location prior to buildings being installed.
- Install a flammable materials (accelerants) shed. This shed should be a locked cage with roof with wide eaves and a concrete floor and should be set outside the APZ.

8.4.3.3 Surrounding vegetation:

The bushland adjacent to the, Machinery shed, dance studio and the existing residential building and the single mans cottage are set adjacent to bushland and are fire prone. The asset protection zones around these buildings have a maintained shrub and groundcover layer and reduced fuel loads.

Recommendations:

- Continue maintaining the vegetation fire fuels at a low density.
- Install a flammable materials (accelerants) shed. This shed should be a locked cage with roof with wide eaves and a concrete floor.

8.4.3.4 Asset protection Zones:

The Asset protection zone upslope of the residential building is required to be 60 metres wide if a building has been constructed to the Building Codes of Australia Class 1 standards. If the Class is increased (to include steel and concrete) then the width of the asset protection zone can be reduced.

Recommendations:

Ensure that the architects and planners of the proposed development understand the limitations imposed by PFBFP and that buildings built adjacent to bushland that require asset protection zones will be set within a highly modified bushland environment and that having scattered mature trees surrounding new buildings comes at the price of plant and animal species diversity in the shrub layer, understorey and midstorey within the APZ.

 Maintain the asset protection zone for the dance studio as required by the Development consent.

8.4.3.5 Fire fighting resources:

An inventory of the resources should be listed in the Fire Management Plan and should include:

- Staff job descriptions, responsibilities, functions and training.
- Water access points, dedicated fire fighting water tanks, sprinkler systems, hoses and pumps.
- Watertanker / Truck's, Personal Protection Equipment, Extinguishers, Machinery shed

Recommendations:

- Commission a Fire Management Plan and Bushfire Emergency Plan
- Educate staff in the detail of the Bushfire Emergency Plan.
- Nominate a staff member as the Bushfire emergency coordinator.
- Train ground/interested staff in bush fire control.
- Install a series of gravity pressure metal water tank in the bushland high above the buildings.
- The number and location of these should be determined by the author of the Fire Management Plan.
- Install a diesel pump that can draw large volumes (>1,000 litres/minute) of water from the river in an emergency.
- Install a series of solar powered water bores that can trickle feed both fire dedicated and stock watering tanks set high in the bush above the buildings.
- Install a below ground high pressure/ high volume water reticulation system that draws water from dedicated water source and delivers water to roof mounted sprinklers and to fire fighting hydrants via pump or gravity.

8.4.3.6 Immediate fire threat:

The Dance studio, the single mans cottage and the adjacent residential building have partially cleared areas (Fire Break) on their bushland interface. The machinery shed also has a narrow band of bushland

between itself and the river. None of the Asset Protection Zones (APZs) have been maintained as required by PFBFP or in the case of the dance studio as per the Development Consent conditions. The forest adjacent to the buildings has high - moderate fuel loads that would carry a fire. All Land owners have an obligation to maintain their properties in a manner that mitigates the potential of fire spreading from their land onto neighbouring properties.

Recommendations:

- Install and maintain asset protection zones in accordance with Planning for Bush Fire Protection.
- Classify all residential and administrative buildings on the property as requiring Special Fire Protection Purposes.
- Asset Zones should be a minimum 60 metres wide with 20 metres being an outer protection area and 40 metres being an inner protection area.
- Maintain Asset Protection Zones as required by Legislation.

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Appendix A

Survey Methodology

Methods

Flora

Desktop surveys of past reports, topographical maps and vegetation mapping provided a framework for the survey effort. A NSW NPWS Atlas Data base search also provided records of TSC Act listed species that had been recorded within 5km and targeted searches for these species were undertaken. Ridges, gullies, side slopes and river flats generally provided variety of Soil landscapes that had strong correlation with vegetation assemblages. The previously mapped extent of vegetation communities was investigated and concurrently a list of native and exotic species was generated. The plant species list of Leonard 1996 was used as master list and species were checked off as they were encountered within each community/ assemblage, additional species found on site were added to this list, this was undertaken to provide a continuity of method that would enable comparative analysis to be undertaken over time. Species that have undergone taxanomic changes were edited to ensure the currency of their scientific classification.

Fauna

Desktop surveys of past reports, topographical maps, vegetation mapping and an Atlas Data base search provided a framework for the survey effort.

Herpetefauna

No specific survey was undertaken for snakes and lizards but incidental recordings were made as other surveys were undertaken and habitat elements were recorded and mapped for all herpetfauna.

Photographic records of TSC Listed species were taken.

Frog species were actively searched for over 7 days. Methods included morning and evening "call back" of Endangered or Vulnerable species (TSC Act 1995) that had been previously located on site or nearby.

Warm humid nights (100% humidity and 20-24 degrees Celsius) between the 17th and the 22nd of January 2011 provided excellent conditions for night time car surveys along roads and up minor creeks and drainage lines.

The river banks were accessed by canoe and water tanks, troughs and all permanent water bodies were checked. Day time surveys of tadpole species were also undertaken. Frog calls were also recorded.

Limitations

Herpetefauna

Searches for TSC ACT and EPBC ACT "listed" species were required to establish the presence of endangered species that require specific management actions applied to their conservation. Additionally the presence of a listed species creates an opportunity for a Bio-banking project. Two TSC ACT listed species were found on site, the first, the broad headed snake was found by Graham Smith (Sites Officer, Nowra Local Aboriginal Land Council); and was photographed by Dr Sue Feary, a consulting archaeologist and the second, the heath monitor, was found during the TEC survey. It is highly unlikely that any other listed reptiles will be found on site and although additional "listed" species may be present on site it was considered to be detrimental to undertake destructive hand searches by turning rocks. Pit fall traps are also considered to be destructive and not particularly productive. A new low impact trapping method using an above ground "tube" is considered to be the best environmentally sensitive and effective alternative. These traps are being considered by DECCW with regard to their efficacy and animal cruelty issues. It is likely that these will soon be accepted by DECCW as appropriate at which time additional surveys can be completed without harming the valuable habitat.

The notification of the presence of the Broad headed snake to the NSW NPWS and it's inclusion on the NPWS Atlas data base unfortunately will bring the population of the snake on site to the attention of unscrupulous reptile collectors. Leaving the rocks along the ridge line unturned, ie not searched under, will make the presence of these collectors more apparent and thereby more controllable.

Additional seasonal surveys may not only prove the presence of additional listed species but may also prove that the Heath Monitor is breeding on site.

Amphibians

Thick scrub vegetation within lot * Dp 751273 restricted access and impeded a thorough search of habitat that might be utilised by The Giant Burrowing Frog (*Heleioporous australasicus*) and the Southern Barred Frog (*Mixophyes balbus*). Additional tadpole and spotlight surveys in spring will be required to provide a more complete seasonal survey.

Megabats and Microbats

Megabats were searched for by spotlighting animals as they fed on pollen at night.

Microbats were searched for by use of an Anabat sound recordings being made in likely flyways within forests and over water bodies and within birds nests. Anabat recordings were also made by mounting the recorder on a car

and driving along roads with headlights on attracting bat prey items. No harp netting or trip wire trapping was undertaken. Some micro bat species are known to roost in the underside of hanging birds nests these nests were checked wherever they were found.

Limitations

The recordings that have been made are analysed by reference to acoustic signatures of individual bat species. Some bat calls are clear and unambiguous while others have regional variations and some micro bat calls can be confused with each other. Consequently the recordings that have been made have been graded in accordance with their veracity as either "definite" or "probable".

The presence of a bat flying over a property also gives no credence to the claim that the bat is roosting on site hence animal trapping would be required to conclusively determine which species may fly over the property and which species are roosting on site.

The site has rugged terrain and substantial lengths of broken rock and cliffs that may be roosting habitat for many bat species. So, although the presence of flying bats can be determined by sound recordings or trapping, the location of roosts can only be established by ongoing surveys demonstrating large numbers of bats in a discrete location and then a thorough visual search providing conclusive proof of a roost.

Some *Vespadelus* spp recordings proved that the Genus was definitely on site however the distinction between species *V pumilus* and *V vulturnus* proved inconclusive . Neither of the species that the call might have been made by are listed species. The recording of the listed threatened species *Miniopterus schreibersii oceanensis* (Eastern Bentwing bat) was considered "probable" and its occurrence is not unusual for although it is threatened it is commonly recorded due to its relatively large home range. This species is a cave dweller and may, like many of the other species, be roosting on site. If a species is roosting then extensive targeted surveys would be required to locate the roost. If it is a breeding colony then a dispersion of young between late January and March should be monitored.

Terrestrial mammals

Large mammal species are generally obvious and were observed feeding at dawn and dusk or were spotlighted during the night. Macropods species were visually identified and if possible were photographed.

Small mammals were surveyed by using cage or Elliot traps and/or by hair tubes set along a transect. Scat samples and animal bones were also found and are yet to be identified.

Limitations

The small home range of some animals reduces the effectiveness of trapping / hair tube sampling to the immediate area that the traps/tubes are set and necessitates ongoing seasonal surveys across the entire site to provide a comprehensive survey. This would require many years and a systematic program.

Arboreal mammals

Arboreal mammals were searched for by use of call play back and by spotlighting/eyeshine. Feeding incisions and climbing marks in trees were also searched for and photographed. Tree hollows, climbing marks and feeding incisions were noted during the day and stag watched at dusk and dawn. Likely stags have been mapped for future investigations.

Limitations

No tree mounted traps or tubes were set but once a nest or feeding area has been found then they should be used to positively determine the species that has been trapped.

Avifauna

Bird species were identified by call and by sight or by nest identification.

Additional survey efforts may still prove the continued presence of the remaining species located by Daly in 1995-96 however some species are unlikely to still occur. Ongoing surveys and species management should consider the following factors.

Brush-tailed Rock Wallaby

The Brush-tailed Rock Wallaby which was recorded by Daly as occurring nearby Bundanon in 1996 has not been recorded since despite high quality habitat on site. It is known to be a prey item of foxes, dogs and probably cats. Targeted searches along ridges and talus slopes failed to locate any scat or sign of the species. Large numbers of medium sized Macropods such as the Red-necked Wallaby and the Swamp Wallaby demonstrate that large predators are still in low enough numbers to not impact critically on the population of these species. If the Brush tailed Rock Wallaby has been predated to the point of localised extinction it is presumed that smaller but more agile predators such as Foxes and Cats are responsible.

Reintroduction of this species should be considered and a concurrent pest species management program should be undertaken. Fencing of some core habitat areas may also be considered.

Spotted Quoll

The Spotted Quoll has been listed by Daly in 1996 as having occurred on site in Appendix A of his report but is also discussed on page 23 as being "expected to occur on site" due to a sighting within 4km's of the site.

Subsequently it is assumed that it was not observed on site in 1996. The large home range of this animal does make its occurrence on site likely however it was last recorded in the vicinity in 2004 (NPWS Atlas) and it may still occur periodically. This species could range throughout all habitat types on site. Cage traps and sand traps baited with chicken failed to detect this species in the 2010-11 survey. Almost continuous surveys would be required to prove the presence or otherwise of this nomadic species.

Appendix B

Vegetation Descriptions as per Native Vegetation of Southeast NSW (NVSNSW)

Department of Environment & Conservation

Warm Temperate Layered Forest

Area Extant (ha): 21500 Estimated % remaining: 55-70% Area in conservation reserves (ha): 4500 Estimated % of pre-clearing area: 5-20%

This unit is a tall eucalypt forest characterised by an open eucalypt canopy, a dense small tree subcanopy and a moist shrubby understorey. Warm Temperate Layered Forest occurs predominantly south from the Hacking River along the Illawarra scarp, to Nowra and throughout the Kangaroo Valley. Localised occurrences are also recorded from sites as far south as Durras Mountain and as far north as Ku-ring-gai Chase National Park. Within this area it is found below 400m on sheltered slopes in gullies and on escarpments with loamy soils where mean annual rainfall exceeds 1000mm. Warm Temperate Layered Forest frequently adjoins Subtropical and Warm Temperate rainforest map units, and contains several rainforest taxa below its eucalypt canopy.

Warm Temperate Layered Forest is included within North Coast Wet Sclerophyll Forests vegetation class (Keith 2004). About half of its original range has been cleared, mainly in the Illawarra lowlands, adjoining lower slopes of the escarpment and in the Kangaroo valley.

Floristic Summary:

Trees: Acmena smithii, Livistona australis, Synoum glandulosum, Pittosporum undulatum, Cryptocarya glaucescens, Eucalyptus salignaXbotryoides, E. quadrangulata. **Shrubs:** Notelaea venosa, Clerodendrum tomentosum, Eupomatia laurina. **Climbers:** Eustrephus latifolius, Smilax australis, Pandorea pandorana, Geitonoplesium cymosum, Morinda jasminoides, Marsdenia rostrata, Tylophora barbata, Stephania japonica. **Groundcover:** Doodia aspera, Pseuderanthemum variabile, Oplismenus imbecillis, Gymnostachys anceps, Blechnum cartilagineum.

Distribution Pattern on the Bundanon Property as mapped by NVSNSW:

Below southern facing ridge of western valley.

Southern Turpentine Forest

Area Extant (ha): 62400 Estimated % remaining: >85% Area in conservation reserves (ha): 38300 Estimated % of pre-clearing area: 45-65%

This unit is a rather dense eucalypt forest with an open shrubby understorey, found between Bundanoon and the Upper Clyde River area on loamy soils derived from Permian Shoalhaven group sediments. It is widespread east of the Morton plateau on coastal lowlands near Conjola and Wandandian, and is also common in steep gorge country along tributaries of the Shoalhaven and upper Clyde Rivers including Kangaroo River, Bundanoon, Ettrema, Yarramunmun, Danjera, Yarrunga, Yalwal and Pigeon House Creeks. Within this distribution Southern Turpentine Forest typically occurs on sheltered slopes below 600 m ASL with an annual rainfall between 950 and 1300mm. On lower slopes adjacent Tallowa Dam this unit grades into Yalwal Shale-Sandstone Transition Forest and in moist sheltered locations may grade into Escarpment Foothills Wet Forest or Coastal Warm Temperate Rainforest. On the coastal plain near Wandandian, Southern Turpentine Forest grades into Currambene Lowlands Forest. Here there has been some clearing on the fringe of the rural districts, although large areas occur in Morton and Conjola National Parks and adjacent state forests.

Southern Turpentine Forest belongs to the Southern Lowland Wet Sclerophyll Forests vegetation class (Keith 2004).

Floristic Summary:

Trees: Syncarpia glomulifera, Corymbia gummifera, Eucalyptus piperita, E. scias. **Shrubs:** Persoonia linearis, Leucopogon lanceolatus, Acacia obtusifolia, Tetratheca thymifolia, Elaeocarpus reticulatus, Banksia spinulosa. **Climbers:** Billardiera scandens. **Groundcover:** Dianella caerulea, Entolasia stricta, Pteridium esculentum, Lepidosperma urophorum.

Distribution Pattern on the Bundanon Property as mapped by NVSNSW:

Mainly highest parts along central ridge.
Temperate Dry Rainforest

Area Extant (ha): 7500 Estimated % remaining: >90% Area in conservation reserves (ha): 3500 Estimated % of pre-clearing area: 40-50%

This unit is a simple closed forest characterised by a dense tree canopy, lianes, a mesic shrub stratum and a sparse patchy groundcover. This dry rainforest has a widespread distribution as small occurrences in gullies and on lower slopes of gorges and foothills below 400m ASL, predominantly south of Nowra in the Ettrema Gorge and the Clyde, Deua and Tuross hinterlands. Within this distribution Temperate Dry Rainforest typically occupies dry shale gullies with an annual rainfall from 850 – 1250mm. North of the Shoalhaven, Temperate Dry Rainforest is largely replaced by Grey Myrtle Dry Rainforest in the Blue Mountains and Cumberland Plain margins, while south of Cobargo it grades into and is replaced by Southeast Dry Rainforest.

Temperate Dry Rainforest is within the Dry Rainforests vegetation class (Keith 2004). It is highly sensitive to fire, and remnants on private lands are likely to be subject to grazing and weed invasion.

Floristic Summary:

Trees: Backhousia myrtifolia, Acmena smithii, Pittosporum undulatum. **Shrubs:** Pittosporum revolutum, Breynia oblongifolia, Ficus coronata, Notelaea venosa, Rapanea howittiana. **Climbers:** Morinda jasminoides, Cissus hypoglauca, Eustrephus latifolius, Pandorea pandorana, Smilax australis, Marsdenia rostrata, Geitonoplesium cymosum, Parsonsia straminea. **Groundcover:** Doodia aspera, Pseuderanthemum variabile, Oplismenus imbecillis.

Distribution Pattern on the Bundanon Property as mapped by NVSNSW:

At mouth of western valley.

Currambene-Batemans Lowlands Forest

Area Extant (ha): 24700 Estimated % remaining: 55-75% Area in conservation reserves (ha): 5800 Estimated % of pre-clearing area: 5-20%

This unit is a eucalypt forest with an open shrub layer and a dense grassy groundcover, found on coastal lowlands on sandstones and shales below 100m ASL. Its distribution is primarily between Bomaderry and Cudmirrah, with the largest stands around Currambene State Forest between Nowra and Culburra. Small woodlots and remnant trees suggest the distribution may have extended northward along the extensively cleared footslopes between Bomaderry and Berry and on the lower slopes of Kangaroo Valley. Isolated records also exist to the south, from Tabourie and Termeil Lakes, Batemans Bay and Mogo areas, but these were not mapped by the current project.

Currambene-Batemans Lowlands Forest shares a number of species with Murramarang Lowlands Forest found further south. Examples are represented in a number of small conservation reserves, though the expansion of Nowra and its satellites and high frequency fires and grazing pose threats to some stands.

Currambene Lowlands Forest are transitional between Southern Lowlands Wet Sclerophyll Forests and South East Dry Sclerophyll Forests (Keith 2004).

Floristic Summary:

Trees: Allocasuarina littoralis, Corymbia gummifera, C. maculata, Eucalyptus pilularis. **Shrubs:** Pimelea linifolia, Banksia spinulosa, Persoonia linearis, Lomatia ilicifolia. **Climbers:** Billardiera scandens, Hardenbergia violacea. **Groundcover:** Entolasia stricta, Lomandra longifolia, Dianella caerulea, Lepidosperma laterale, Pteridium esculentum, Imperata cylindrica, Themeda australis, Lomandra multiflora, L. obliqua.

Distribution Pattern on the Bundanon Property as mapped by NVSNSW:

Mainly surrounding 'Bundanon' and on slopes downstream on east of study area.

Coastal Warm Temperate Rainforest

Area Extant (ha): 15200 Estimated % remaining: 85-95% Area in conservation reserves (ha): 7900 Estimated % of pre-clearing area: 35-50%

This unit is a closed forest with a dense tree canopy, a subcanopy of small trees, lianes, an open layer of mesic shrubs and a fern-dominated groundcover. This rainforest is widely distributed across the study area in small patches, with local concentrations along the Illawarra scarp north from Cambewarra, along the escarpment in the Clyde district and along the Murramarang Range on the coast north of Durras. It is found in moist sheltered gullies and on sheltered escarpment slopes on loam to clay loam soils from 0 - 400m ASL with a mean annual rainfall greater than 900mm. Coastal Warm Temperate Rainforest is related to Sandstone Scarp Warm Temperate Rainforest which can be differentiated from this unit by its restriction to higher elevations (above 400m ASL), and the absence of lowland taxa (eg *Livistona*). Coastal Warm Temperate Rainforest belongs to the Northern Warm Temperate Rainforests vegetation class (Keith 2004). Much of its orignal distribution remains extant and it is represented within several large conservation reserves. Repeated fires may pose a threat to some stands.

Floristic Summary:

Trees: Acmena smithii, Livistona australis, Ceratopetalum apetalum, Cryptocarya glaucescens, Synoum glandulosum. **Small Trees:** Tasmannia insipida, Eupomatia laurina, Ficus coronata, Psychotria loniceroides. **Shrubs:** Cyathea australis. **Climbers:** Morinda jasminoides, Smilax australis, Microsorum scandens, Marsdenia rostrata, Palmeria scandens, Pandorea pandorana, Parsonsia straminea, Cissus hypoglauca, Pyrrosia rupestris, Arthropteris tenella, Eustrephus latifolius. **Groundcover:** Lastreopsis microsora, Blechnum cartilagineum, B. patersonii, Asplenium australasicum, Doodia aspera.

Distribution Pattern on the Bundanon Property as mapped by NVSNSW:

Between mouth of western valley and bottom of valley slopes.

Yalwal Shale-Sandstone Transition Forest

Area Extant (ha): 21100 Estimated % remaining: >85% Area in conservation reserves (ha): 15300

Estimated % of pre-clearing area: 55-75%

This unit has a wide distribution in the valleys of the lower Shoalhaven River and its tributaries (Kangaroo River and Yarramunmun, Danjera, Bundundah, Bundanoon and Ettrema Creeks), from Lake Yarrunga through Yalwal east to Colymea Creek. Within this distribution Yalwal Shale-Sandstone Transition Forest occurs on ridges and slopes between 100-250m elevation, primarily on loamy soils derived from Conjola conglomerate and Wandrawandian siltstone. On lower valley slopes where metasediments underlying the Sydney Basin are exposed, this unit merges into Ettrema Gorge Forest . With increasing rainfall and/or shelter Yalwal Shale-Sandstone Transition Forest is replaced by Southern Turpentine Forest. Yalwal Shale-Sandstone Transition Forest shares some species with Sydney Hinterland Transition Woodland, both occuring on soils derived from sandstone strata with a significant clay content, though with widely separate distributions.

Yalwal Shale-Sandstone Transition Forest belongs to the Sydney Hinterland Dry Sclerophyll Forests vegetation class (Keith 2004). Large areas are in Morton National Park, and only a small proportion has been cleared.

Floristic Summary:

Trees: Corymbia gummifera, Eucalyptus punctata, Syncarpia glomulifera. **Shrubs:** Persoonia linearis, Lomandra obliqua, Macrozamia communis, Podolobium ilicifolium. **Climbers:** Glycine clandestina, Hardenbergia violacea. **Groundcover:** Entolasia stricta, Pomax umbellata, Patersonia sericea, Lepidosperma laterale, Lomandra multiflora, Phyllanthus hirtellus, Dianella revoluta, Goodenia hederacea, Panicum simile, Lomandra confertifolia ssp rubiginosa.

Distribution Pattern on the Bundanon Property as mapped by NVSNSW:

Mainly on slopes on west of property.

Riverbank Forest

Area Extant (ha): 9400 Estimated % remaining: 60-85% Area in conservation reserves (ha): 3900 Estimated % of pre-clearing area: 25-45%

Riverbank Forest is a distinctive tall River Oak forest with an open shrub layer and a dense or patchy groundcover of grasses and forbs. It is found on sand/gravel alluvium strewn with cobbles along swift-flowing reaches of streams, at elevations from 20-800m ASL. Riverbank Forest occurs widely across the study area along major streams including the Coxs, Abercrombie, Wollondilly, Shoalhaven, Deua and Brogo River systems, and Araluen and Wandella Creeks. This Map Unit occurs on a range of substrates, however none of the sites assigned to this unit were located on Hawkesbury or Narrabeen Sandstones, where similar habitat is occupied by Sandstone Riparian Scrub (FOW p58).

Riverbank Forest is part of the Eastern Riverine Forests vegetation class (Keith 2004). Some areas of Riverbank Forest have been cleared, although some regrowth has occurred. Its riparian habitat is susceptible to weed invasion and degradation where livestock are unconstrained. Significant examples are represented within the Warragamba Special Area along the Wollondilly and Kowmung Rivers, and in Abercrombie River, Tarlo River and Morton National Parks.

Floristic Summary:

Trees: Casuarina cunninghamiana. **Shrubs:** Hymenanthera dentata, Urtica incisa. **Climbers:** Stephania japonica, Pandorea pandorana. **Groundcover:** Microlaena stipoides, Lomandra longifolia, Oplismenus aemulus, Dichondra repens.

Distribution Pattern on the Bundanon Property as mapped by NVSNSW:

At water's edge, particularly along Eearie Park and The Island.

Southern Lowland Wet Forest

Area Extant (ha): 25900 Estimated % remaining: >85% Area in conservation reserves (ha): 9200 Estimated % of pre-clearing area: 25-45%

This unit is a rather dense eucalypt forest with an understorey of shrubs and grasses, and is distributed from Conjola to Batemans Bay, predominantly east of the Clyde River, with northern outliers at Tapitallee and Colymea. Within this distribution Southern Lowland Wet Forest occurs below 250m ASL on open hillslopes and gullies with loamy soils where mean annual rainfall ranges from 1000 to 1300mm. On more sheltered slopes, Southern Lowland Wet Forest grades into Clyde Gully Wet Forest, which generally occupies sheltered gullies of more elevated terrain to the west.

Southern Lowland Wet Forest belongs to Southern Lowland Wet Sclerophyll Forests vegetation class (Keith 2004). Most of its original distribution is currently included within state forests and conservation reserves.

Floristic Summary:

Trees: Corymbia maculata, Eucalyptus pilularis, E. paniculata. **Shrubs:** Elaeocarpus reticulatus, Persoonia linearis, Leucopogon lanceolatus, Macrozamia communis, Breynia oblongifolia, Notelaea longifolia, Hibbertia aspera, Synoum glandulosum. **Climbers:** Cissus hypoglauca, Eustrephus latifolius, Tylophora barbata, Pandorea pandorana. **Groundcover:** Dianella caerulea, Entolasia stricta, Lomandra longifolia, Pteridium esculentum, Schelhammera undulata, Lepidosperma urophorum.

Distribution Pattern on the Bundanon Property as mapped by NVSNSW:

At base of cliffs in western valley.

Illawarra Gully Wet Forest

Area Extant (ha): 7100 Estimated % remaining: 50-70% Area in conservation reserves (ha): 1900 Estimated % of pre-clearing area: 5-20%

This unit is a tall eucalypt forest with a moist open understorey, primarily distributed from the Hacking River catchment along the Illawarra scarp south to Mt Keira, on coastal lowlands near Berry and scattered through coastal foothills and lowlands from Nowra south to Batemans Bay. A disjunct occurrence is recorded in the north at Pittwater. Within this distribution Illawarra Wet Gully Forest occurs on sheltered slopes and gullies with loamy soils with an annual rainfall in the range of 1000-1700mm. On the northern Illawarra escarpment, Illawarra Wet Gully Forest occupies elevations up to 400m ASL however south of Nowra rarely exceeds 200m ASL. With increasing soil fertility Illawarra Wet Gully Forest units (RF p112 and RF p113) in areas long protected from fire.

Illawarra Wet Gully Forest is related to Central Coast Wet Forest, but lacks several taxa restricted to the north coast forests. More than a third of its original range has been cleared, mainly in the Illawarra lowlands. Highly fragmented stands amongst the suburbs at its disjunct north-east limit include an abundance of *Corymbia maculata* (spotted gum) and are identified as Pittwater Spotted Gum Forest listed on Schedule 1 of the NSW *Threatened Species Conservation Act* (1995). Illawarra Wet Gully Forest is included within the North Coast Wet Sclerophyll Forests vegetation class (Keith 2004).

Floristic Summary:

Trees: Livistona australis, Syncarpia glomulifera, Eucalyptus pilularis, E. paniculata. **Shrubs:** Synoum glandulosum, Breynia oblongifolia, Notelaea longifolia. **Climbers:** Eustrephus latifolius, Tylophora barbata, Hibbertia scandens, Glycine clandestina, Hibbertia dentata, Geitonoplesium cymosum. **Groundcover:** Lomandra longifolia, Pteridium esculentum, Dianella caerulea, Entolasia stricta, Oplismenus imbecillis, Imperata cylindrica, Pseuderanthemum variabile.

Distribution Pattern on the Bundanon Property as mapped by NVSNSW:

Small area east of 'Bundanon'.

Morton Mallee-Heath

Area Extant (ha): 37600 Estimated % remaining: >95% Area in conservation reserves (ha): 33700 Estimated % of pre-clearing area: 80-95%

Morton Mallee-Heath has an open to dense shrub canopy with emergent mallees and a thick groundcover of sedges and forbs. This unit occurs on damp shallow sandy loams on sandstone, at elevations from 10m to 750m, where mean annual rainfall varies from 900-1400mm. Morton Mallee-Heath is widespread on Permian Shoalhaven Group sandstones on the Morton plateau from Tallong south to Wog Wog and east to Yerriyong and Porters Creek, extending east to the coast, where it is scattered from Booderee to Meroo Point on Shoalhaven Conjola Formation sandstones.

Morton Mallee-Heath is transitional between the Sydney Montane Dry Sclerophyll Forests and Sydney Montane Heaths vegetation classes (Keith 2004). Much of the original distribution is within conservation reserves, where altered fire regimes and unauthorised use of off-road vehicles pose the main threats.

Floristic Summary:

Trees: Eucalyptus sclerophylla, Corymbia gummifera. **Shrubs:** Leptospermum trinervium, Hakea teretifolia, Banksia ericifolia, B. spinulosa, Epacris microphylla, Hakea laevipes, Banksia paludosa, Isopogon anemonifolius, Lambertia formosa, Persoonia mollis ssp leptophylla. **Groundcover:** Lepyrodia scariosa, Patersonia sericea, Lindsaea linearis, Gonocarpus tetragynus, Goodenia bellidifolia, Ptilothrix deusta.

Distribution Pattern on the Bundanon Property as mapped by NVSNSW:

On slopes behind Eearie Park.

Shoalhaven Sandstone Forest

Area Extant (ha): 56500 Estimated % remaining: 80-95% Area in conservation reserves (ha): 30900 Estimated % of pre-clearing area: 40-55%

Shoalhaven Sandstone Forest (DSF p148) is equivalent to DSF 148 identified by Tindall *et al.* (2004), and is an open eucalypt forest or woodland with an abundant sclerophyll shrub stratum and a groundcover dominated by sedges. This unit occurs on sandstone plateaux up to 700m ASL in the lower Shoalhaven district from Meryla south as far as Pigeon House Mountain, where average annual rainfall is 950-1600mm. Large stands occur at Meryla and Wingello State Forests, to the west of Mt Skanzi (Kangaroo Valley), west of Nowra (Bamarang and Colymea) and ascending the Morton plateau from Parma Creek Nature Reserve to Sassafrass. Within this distribution Shoalhaven Sandstone Forest occurs on sandy loam soils derived primarily from Hawkesbury or Nowra sandstone, or the Berry formation.

Shoalhaven Sandstone Forest shares several species with Morton-Budawang Sandstone Woodland, which occurs in higher country further west on the Morton plateau and on the Budawang ranges to the south.

Shoalhaven Sandstone Forest belongs to the Sydney Coastal Dry Sclerophyll Forests vegetation class (Keith 2004). Examples are represented in Morton National Park and Parma Nature Reserve. Large areas outside reserves generally have not been subject to intensive land uses.

Floristic Summary:

Trees: Corymbia gummifera, Eucalyptus sclerophylla, E. sieberi. **Shrubs:** Lambertia formosa, Persoonia levis, Banksia spinulosa, Petrophile pedunculata, Leptospermum trinervium, Lomatia ilicifolia, Bossiaea heterophylla, Hakea laevipes, Platysace linearifolia, Pimelea linifolia, Tetratheca thymifolia. **Groundcover:** Lomandra obliqua, Patersonia sericea, Entolasia stricta, Caustis flexuosa, Cyathochaeta diandra.

Distribution Pattern on the Bundanon Property as mapped by NVSNSW:

Particularly below Southern Turpentine Forest on highest parts of eastern Access Road and above Riversdale.

Appendix C

Proposed Bundanon Trust Land Uses

The Land Use Program is founded on three basic precepts. The first is that no works will occur on leased land until the Trust Land has been regenerated. The second is that the cost of a conventional bush regeneration program is prohibitively expensive and so a combination of grazing, broad spraying, machine clearing, burning and plantation forestry is proposed to manage weeds. The third precept is that the forestry and a livestock operation and the savings made by minimising slashing and mowing will pay for the program.

Each property is described below and management recommendations are provided as each management issue is discussed. If and when a recommendation is adopted an action Table will be created that relates the recommendation to a list of Actions and a critical path for it's completion.

Riversdale

Overview

The land at Riversdale is managed as a landscaped parkland with bushland surround and is used for passive recreation. The views of the river and the borrowed landscape vista of the farmland beyond are spectacular and the Land Management Plan is obliged to maintain and enhance them. The bushland views to the North, South and West create a sense of being wrapped within a cloak of bush. The pattern of open paddocks (leading to a poorly defined building precinct and carpark) that first greets the visitor dilutes the impressive "Longreach" vista. The expansive views from the Boyd education centre foyer would be made even more impressive if smaller and more intimate spaces or rooms were tantalisingly encountered, but passed by, on the visitors first journey to the property. The paddocks are neither linked nor separated from the river and the connection between the paddocks and the creeks is also disjunct. The creeks, where they are adjacent to the paddocks, do not have a sense of space that belongs to themselves and the experience of the creeks and the river is lost within the vacant space of the paddocks. The paddocks are currently mown, edged and whipper snipped regularly. The financial and environmental cost of this management regime is very difficult to justify indefinitely

The rural life experience at Riversdale is limited and the property is too small and has too many visitors to accommodate a cattle based livestock operation. Cropping is impractical for numerous reasons and keeping cattle also has safety implications for public visitation and the education function of the property. No livestock are currently grazed on site.

All revenue earned from the property is currently earned from the educational and artistic programs and events. The Southern Rivers Catchment Management Authority has provided Grant funding to regenerate the creeklines and some bushland adjacent. These funds fall well short of what is required to regenerate the whole of Riversdale's bushland.





Broadscale land use recommendations

The bushland and paddocks at Riversdale should continue to be used first and foremost as: ecological, educational, cultural and artistic resources, this can be facilitated by:

- Regenerating all bushland areas,
- Connection with the river should be re-established via a wharf adjacent to Cooke's property,
- Revegetating the margins of the paddocks and thereby creating discrete spaces or "rooms" of the paddocks,
- Revegetating the creekline edges adjacent to the paddocks to re-create the beautifully enclosed feeling of a bushland creek. This is important to the visitors sense of exploration, investigation and belonging,
- Widening the riparian vegetation corridors to enhance the visitors experience of Riversdale and significantly improving the ecological function of the creeklines and riverbank by connecting them to the bushland on the perimeters of the paddocks,
- Installing and enclosing pathways, causeways and bridges within the riparian corridors and bushland surrounds,
- Installing a vegetated corridor in the valley between the permanent car-park and the machinery shed, linking the bush to the creek,
- Installing a Private Native Forest (PNF), to be harvested, in the paddock located between the two creeks. Many trees will remain unharvested and the paddock will eventually be fully regenerated.
- Growing aboriginal bushfood, medicinal and utilitarian plant species for inclusion in interpretive walks.
- Install solar power on the roof of any new buildings,
- Install fire fighting sprinklers on the roofs or in the bushland adjacent to the buildings.
- Install and irrigation system that can "water" livestock and irrigate the paddocks to increase grazing productivity,
- Grazing Dorper sheep to;
 - o reduce Fire weed infestations without using herbicide,
 - reduce CO2 production from mowers,
 - o reduce cost of mowing,
 - o assist in the design of fences that are sheep and wombat compatible,
 - retain the rural life experience/farm function required in the trust objects.
 N:B Grazing dorper sheep should firstly be trialled with a small herd at Bundanon to prove their suitability in particular with regard to their feet and foot rot.

Specific recommendations.

Water and Sewerage

Potable Water

Potable water is collected from the four buildings roofs in the Riversdale complex. No water is collected from the maintenance shed nor the derelict artist studio or potting shed located in the bush near the sewerage system. Roof water is firstly collected in underground rainwater tanks. One of these tanks is located under the southern end of the Boyd Education Centre building and the other is located below the main office building. The water in these tanks is then pumped to directly into the reticulation systems in the buildings. Excess water from the roof is released onto the grass below the building.

Recommendations:

- Install metres and monitor water use. Install two 10,000 litre tanks near the top gate of the Cooke's property and pump water to the. ie, (above the Boyd Education Centre),
- Install and maintain inlet and outlet filters to all tanks.
- Install first flush devices to remove animal faeces.
- o Install additional tanks if required to supply water during drought periods.
- Install new tanks, to proposed buildings, that have been appropriately sized for anticipated requirements.
- Plumb tanks so that they drain concurrently ie do not allow tank water in the last tank in series to stagnate.
- Allow excess stormwater to flush tanks clean of old water and to fill tanks that would normally be filled from the bore. This will assist in removing corrosive minerals. Any new tanks should be made of concrete or steel to resist fire.

Bore water.

The toilets/ablution facilities and garden water supply is sourced from a bore located at the bottom of the gully to the north of the driveway in the main paddock adjacent to the avenue of *Erythrina x sykesii* (Coral Trees).

Two galvanised steel tanks set approximately 100 metres from the Boyd Education Centre and 20 metres higher than it recieve this water and remain full via a pressure sensetive electric pump. Water pressure falling from these tanks is correspondingly high.

This water may be potable and might be used in drought but should be tested by a laboratory. The use of this water for fire fighting is contingent upon mains power.

Water from the bore should be pumped daily using a new solar powered pump and used to irrigate the Private native forest and gardens.

Recommendations:

- o Install an emergency generator to provide power to the pump during blackouts and fires.
- Install a solar powered pump to draw the water into header tanks that then gravity feed the reticulation / grey water/ fire fighting system.
- Additional fire proof header tanks may need to be installed.

Creek/Dam

There are no dams on site but water can be drawn from the non-tidal sections of the creek ie upstream of the road culvert.

Recommendations:

- Installing a dam for grey water/stock / garden watering/ fire fighting and landscape aesthetical purposes.
- Check the integrity of the dam walls annually to monitor the rate of siltation and for potential instability.
- Dedge dams as required.
- Collapse Wombat holes when the wombats are out.
- Checked dam walls for yabbie and rabbit burrows.
- The dam would be best located either above the driveway adjacent to the Coral Trees. N:B Soil excavated from the proposed development of the administration building could be used to build a dam wall. Or the dam could be located in paddock number 2.

Dedicated Fire Fighting Water supply.

No dedicated water tanks have been installed for bush fire protection purposes.

Recommendations:

- Install a series of dedicated fire proof tanks high in the bush to maximise gravity pressure.
- Feed tanks from the bore via a solar powered pump.
- A trailer mounted pump (low pressure high volume) and flat hose irrigation system should be bought that can move water between tanks during drought and refill tanks from the dams or fill fire tankers very quickly.

Sewerage system

A "Diston Sewerage Purification" plant , which is capable of chlorination treatment, currently provides primary treatment of all sewerage on site. The treated water is dispersed into the central paddock via a sprinkler system. This system's capacity is based on a calculation table that cannot be located, so advise regarding the additional capacity available for future use cannot be readily provided. The plumber (Sleight plumbing 4234 0909) who installed the system has advised that Council were very concerned about the absorption capacity of the soil and the release of polluted water into the river. Any new sewerage system or an upgrade of the current system would require compliance with Australian standard AS3500.

Larger visitation events have required additional facilities to cater for the anticipated visitor numbers.

Recommendations:

• Engage a sewerage treatment specialist who can investigate the soil conditions and the anticipated loads and the current capacity and can recommend an appropriate upgraded system or replacement system to cater for future needs. It is important that this advice is received before proposed buildings are sited. The area of land, the slope and soil type required for the

release of treated effluent may influence the location of buildings. Additionally if energy hungry pumps are to be dispensed with then the system should be located to be gravity dependent.

- Install a sewerage system which cleans the water to near potable standards so that it can be used for irrigation or grey water reuse without health concerns.
- Retrofit the derelict artists studio above the Boyd Education Centre as a fire proof, emergency generator and pump filter building.

Riversdale						
Riversdale Fire Fighting /non-potable reticulation/forestry/livestock/paddock irrigation						
Description	UNIT	QTY	RATE	Total		
Solar powered pump	Each	3	\$12,000.00	\$36,000.00		
Inlet & Outlet filters	item	4	\$350.00	\$1,400.00		
Tank & Stortz valves	each	12	\$350.00	\$4,200.00		
First flush unit	each	1	\$110.00	\$110.00		
10,000 litre gal tank	Each	12	\$3,000.00	\$36,000.00		
2" irrigation line	50M ROLL	80	\$388.65	\$31,092.00		
Fittings	JOINER	80	\$30.00	\$2,400.00		
Sprinklers	Each	50	\$150.00	\$7,500.00		
Concrete footing	Each	12	\$1,500.00	\$18,000.00		
Installation	ltem	4	\$1,000.00	\$24,000.00		
Dam building	ltem	1	\$10,000.00	\$10,000.00		
Trailer mounted pump	ltem	1	\$10,000.00	\$10,000.00		
Flat hose 50mm	LNM	500	\$7.00	\$3,500.00		
Connectors cam lock	Each	12	\$20.00	\$240.00		
Emergency Generator	ltem	1	\$4,500.00	\$4,500.00		
DA Consent estimate	ltem	1	\$2,500.00	\$2,500.00		
Water troughs including fittings		6	\$500.00	\$3,000.00		
Second Hand Forestry fire truck	ltem	1	\$30,000.00	\$30,000.00		
Total				\$224,442.00		

Power

Power supply protection.

All properties are vulnerable to power loss during major storm and bush fire events.

In order to protect essential services, telecommunications, water pumps, fridges and alarms it is recommended that a diesel powered emergency generator be installed.

If this recommendation is accepted it should be the design of the new administrative building should accommodate a fire protected room.

Recommendations:

Install an appropriately sized back up generator at Riversdale.
 70- 90 KVA Cost \$19,000.00 - \$21,000.00
 N:B Power use will require monitoring prior to choosing the appropriate generator.

Solar Power efficiency and CO2 production

A Solar powered electrical generator can significantly reduce the amount of fossil fuel generated power used at all three properties at Bundanon.

A 5KW System that runs without problems for 15 years would cost \$25,000 to install and service during it's life time. In that time it can conservatively generate 150,000 KW of power or \$40,000.00 worth of power at today's rates or \$90,000.00 at an average cost of \$0.65 over 15 years.

N:B Based on (5 Kwh x 8 hours x 80% efficiency)and (Currently power prices are 0.28 cents / KWH and are anticipated to rise by 20% next year. A conservative increase of 10% per year extrapolated over the next 15 years would increase the cost of power to 1.30

If the government / power companies pay for excess power fed back into the grid then the system can be very profitable but at present and for the purposes of this assessment it has been assumed that no payment is made by electricity suppliers. Currently suppliers will only charge for electricity that is used in excess of the amount that a solar system feeds back into the grid *and only at the same time that the electricity is being used*. Subsequently if a system produces the same amount or more power as is being used then that power is effectively free.

The most efficient Solar power system currently available should be installed on the roof of the machinery shed. The connection to the main/sub-main must be considered with regard to metering and so must the need for inverters for the number of power phases required. Government grants are currently available to offset the interest on finance retro fitting is the borrowing costs are offset.

Recommendation

 Monitor the power usage during daylight hours and install an appropriately sized solar generator to offset as much Green house gas as possible.
 Cost at least \$25,000.00 (saving over 15 years approximately \$50,000.00)

Future power generation

The most efficient Solar power system available at the time the new buildings are being designed should be installed on the roofs all new buildings to provide as much power as the roof area/ building design

will allow that feeds into . The size, location and cost of these recommendations cannot be provided at this time.

Recommendation

 Accommodate the design, installation and cost of a solar system at the concept stage of any building programs.
 Cost uncertain.

Solar pumps / bores

Solar powered pumps should be used to lift water into header tanks that can store energy as gravity (potential energy) as well as being used for irrigation.

Recommendation:

- Install a very small hydro generator to demonstrate how water power generation can work. Cost \$2,500
- Install a Solar pump which can offset the cost of running the current electrical bore pump.
 Cost \$12,000.00 (Cost included above in water and sewerage)

Soils

Bushland topsoil

The soils in the un-grazed steep bushland areas have relatively deep mulch layers and have greater plant species richness. The soils are generally silty-sandy soils and are highly erodable.

The bushland topsoils that have been grazed are generally on steeper ground and are situated below rock outcrops. They have generally lost their native vegetation cover (which binds the soil surface) and are subsequently eroded and depleted. The organic soil horizon is very thin and the volume of decaying mulch is similarly thin the fertility is correspondingly low. The steepness of the ground suggests that surface erosion has removed much of the organic matter and the A-soil horizon. Much of this bushland has also been infested with Lantana which has allelopathic properties ie it releases chemical compounds that inhibit the growth of other plants. The life in the soils Organic horizon is relatively low compared with healthy bushland. Healthy bushland starts with healthy soil.

Recommendation:

 Regenerate native plants to improve soil organic matter percentages and to assist in binding the soil surface. The depth of leaf litter and the density of vegetation cover directly correlates with the variety and richness of soil micro and meso-fauna (invertebrates etc) and soil fungi that live in the soil and in turn to the variety and richness or vertebrate species. The cost of regeneration is discussed in "Bush Regeneration" below.

Paddock topsoil

The soils in the paddocks are silty - sandy soils that have some structure. If consistent with the silt content they should have moderate colloidal capacity, moderate water holding capacity and with the sand content should also be well drained and have reasonable air filled porosity. At first inspection they appear to be moderately fertile and suitable for a wide range of agricultural uses.

Recommendations:

 Seek advice from an agronomist regarding a suitable range and frequency of soil tests that relate to the approved use of the paddocks. Soil testing is expensive and inexact and should be used to provide information regarding general trends across the paddocks and to locate problem areas. It is not envisaged that soil testing will be used to ameliorate (modify) soil chemistry over time but rather to inform the land manager as to the appropriate use of the land.

Soil Erosion and Sedimentation

The soils within the arable lands on site are stable (non-eroding) apart from the creek and river banks which have been de-stabilised through:

- the action of the Wombats digging into the creek and river banks,
- the wave, wind, a tide action of the river,
- the erosion of the creek bed and banks at the crossing between the eastern and central paddocks,
- Rain/sheet erosion on the four wheel drive track leading to Cooke's top gate and beyond and between the main carpark and the sewerage system.
- Sheet erosion and siltation are a significant problem on the upslope side of the Boyd Education Centre where the drainage system is inadequate.
- The Studio building is rotting and prone to white ant attack because soil is pushed up against it's southern wall.

Recommendations:

- Reshape the land on the high side of the Boyd Education Centre and beside the southern wall of the Studio.
- Survey all points of erosion and sedimentation and compile a sedimentation and erosion control plan. Generally soil erosion and siltation should be fixed by:

(Creeks and River banks.)

Consulting with the CMA and agreeing on where and how to:

- reshape erosion points with machinery,
- installing erosion control matting, and
- plant stabilising plants.
- Installing rock cobbled causeways across the creeks.
- *Remove silt from deep pools in the creeks,*
- Cost is dependent upon designs.

(Access roads)

- Maintaining roads in a condition suitable for fire fighting and evacuation purposes and day to day use.
- Installing table drains and diversion channels and resurfacing / filling large holes in the road surface as required.
- Maintaining sedimentation pits on the main driveway .
- The cost of this should include the cost of burying the irrigation lines that run up the hill to Cooke's top Gate.

Roads and Parking

All roads are in good condition apart from the fire access trail behind the Boyd education centre. This track is heavily eroded and completely blocked by dense Lantana.

Currently all weather parking has been provided for approximately 40 cars. However this is somewhat restricted and problematic for the car parking area also serves as a bus turning area. Re-designing the car parking - entrance (foyer) is likely to occur during the relocation of the

administrative building. Pers comm CEO Deborah Ely.

Event/overflow fine weather dependent parking is provided as a roped off area of the first paddock on the right of the entrance road. This paddock does have gentle undulations which will fill with water during large rain events. This paddock also has clearly been shaped by past flood events and will flow with water when the minor creeks break their banks.

Parking in the paddock is limited to dry weather and when soil moisture content is below field capacity. Parking on the turf when the moisture content is greater than field capacity will result in excessive soil compaction and may also result in the unsightly death or damage to the pasture. If rain occurs while cars have are parked on the grass then they may be bogged and require removal and the pasture may require remediation.

Event/overflow parking is infrequently needed in this paddock and improving the conditions for parking cannot be justified but if it is required frequently in the future the paddock would need modification. Modifications might include regrading to remove small undulations, definition to guide drivers to predetermined car spaces and the higher traffic areas may need to be reinforced with sub-surface anti-compaction matting.

Recommendations

- Reconsider the layout of the current all weather car parking facilities when locating the new administration building and "foyer" in the recommended landscape Master Plan.
- Consider the location of a permanent reinforced overflow (paddock) carpark in the Landscape Master plan.

Gardens

The gardens are relatively weed free and maintained in a homely condition. The home paddock orchard has some remnant trees in various condition. The orchard trees appear under fed and should be fertilised and pruned. Grass has been growing right up to their stems this grass should be carefully removed in a 2 metre diameter ring around the stem. The ring should be mulched and fertilised. The land immediately around the buildings are used regularly by visitors and are kept very tidy. Two bunya pines *Araucaria bidwilli* and a row of *Erythrina x sykesii* line the driveway.

One smaller Coral tree is competing heavily with the northern Bunya Pine and should be removed. Coral Trees are considered a weed of bushland and creek systems and are also "very" prone to dropping large limbs. It is strongly advised that these trees be removed and replaced with *Brachychiton acerifolious* the Illawarra Flame tree, which has significance as a tree used by aboriginal people and is far more beautiful and less dangerous than the Coral Trees.

The current mowing and weeding program is required to maintain a high level of visual aesthetics.

The gardens around the homestead complex have been altered many times since they were originally planted. The garden is currently a mix of plants from different periods and many are species that have only become recently available for ornamental horticulture in Australia.

An exact re-creation of the original garden is impossible to achieve due to a lack of knowledge of the original layout and the orginal plant species composition. Re-creating the garden would not interpret the more recent history of the property. It is considered important that the basic structure of the modern garden should reflect it's original purpose ie of a source of food firstly and an ornamental garden secondly.

Subsequently it is recommended that the historical garden layout/s be researched and interpreted in a manner that is sympathetic to the properties heritage. With regard to the use of "period" plants I also recommend that the Illawarra Seed Savers network be contacted and that "Heritage "seeds be grown on site to help conserve older varieties of plants that are not commonly available and which may be very important when genetically engineered varieties succomb to a catastrophic event.

A volunteer gardening group is understood to assist with the maintenance of the gardens. Their involvement in this process is very important and should be actively fostered.

Recommendations

- Weed, mulch, prune and fertilise the orchard as described above.
- *Continue current maintenance effort.*
- Remove and replace all Coral Trees with Flame trees over time.
- Receive a quote from tree lopping contractor to ascertain the cost of these works and include these in an annual maintenance budget,
- Research and include an appropriate interpretation of the garden in the recommended Landscape Master Plan. Seek a quote for this assessment,
- Invite contributions from the Illawarra Seed Savers network and any volunteers who have an interest in the garden.

Paddocks

Five open paddocks spread across the Riversdale property.

A narrow band of native trees (predominantly short lived Acacia species) has regrown along the river and creek banks and is slowly encroaching into the paddocks. Many of these trees are reaching senescence and will soon die. This creek margin is densely infested with weed species.

The edge to area ratio of this narrow bushland margin is very high and consequently the impact of weeds on the remnant bushland is very high and costly to manage. If the bushland margin was broader and the edge to area ratio decreased the cost of managing the weeds within it would be reduced. The paddock sizes are relatively small and the distance small birds and other prey animals must travel through open ground to reach protective cover is also relatively short. Widening the bushland and reducing the paddock width will provide greater protection for native animals moving across the paddocks.

Very importantly the breadth of this riparian margin has a very strong correlation with the number and diversity of native animal species that would use the riparian corridor.

The CAB 2011 author regards the old paddock arrangements and fences to have historical importance. He advises how much cleared land must be maintained to conserve the heritage of the landscape curtilage. Please refer to the CAB 2011 report. With regard to Riversdale widening the bushland corridor can be achieved in most areas without impacting on the heritage curtilage.

These small paddocks are also an appropriate size for a breeding program for the Brush Tailed Rock Wallaby (BTRW). Paddock # 2 in particular is suitable because a wombat proof perimeter fence (concrete and sheet piled) could feasibly be installed around. This enclosure includes an area of broken rocky ground (Protection) and open pasture (Feeding).

General recommendations:

- Widen the bushland margins to a minimum of 50 metres
- Only mow paddocks at times when Sheep cannot be grazed.
- *Replace the mowing regime with animal grazing, preferably Dorper Sheep, or even Kangaroos.*
- Direct any future Grant funding toward the maintenance of works that have begun. (The CMA grant that is currently funding the regeneration program will be exhausted before the bushland being regenerated reaches a stable state.)
- Continue liaising with NPWS, the Ian Potter Foundation and the University of Adelaide regarding a Brush tailed Rock Wallaby breeding program.
- Undertake trials of new Wombat gates that can be installed in existing fences. These gates might concurrently be used to apply pharmaceuticals to treat mange.

Paddock 1:

This paddock is located on the toe of a south facing spur of the northern escarpment. This spur separates two creeks (East and West) and extends down to their confluence which is at the road culvert. The paddock includes flat land on the flood plain of the two creeks and then steepens as the distance away from the creeks increases. A boundary fence (the only fence in the paddock) which is in marginal condition runs between and over the back of the spur. An unstable 4wd creek crossing is located approximately 200 metres north of the culvert on the Eastern creek. There is no vehicle access across the western creek. The paddock is inaccessible during rain. Both arms of the creek have been substantially eroded by Wombats, which are a significant erosion and sedimentation vector. The paddock is not currently used for keeping livestock and is mowed at great environmental and financial expense. The paddock is used as a dispersion area for treated sewerage effluent. Weeds growing within it or along it's margins with the creek and adjacent bushland include Fireweed, Lantana, Moth vine , Senna and a host of herbaceous weeds. The CAB 2011 report shows that this paddock can be completely revegetated.

Recommendations:

- Remove non archaeological fence lines.
- Install 2 cobbled 4wd and pedestrian creek crossings (causeways) at the upstream corners of the paddock.
- Retire the paddock and earn carbon credits.
- Continue the CMA funded bush regeneration program along the creeks.
- Source additional funding to meet shortfall in the CMA funding.
- Widen the bushland margin to a nominal 30 metres from the creeks and create a fully structured riparian plant community. This will reduce the size of the paddock from 3 Hectares to approximately 2.35 Hectares.
- Plant and direct seed with native species where bushland resilience proves to be low on along the creeks.
- Submit a Development Application to council and the CMA to establish a private native forest (PNF) with a fully structured forest plant community. The native forest may include tree species that are not locally occurring but are high value timber species that may be used for building on Bundanon in the future. The shrub and ground cover species will be of species that will create an ecotone of Yalwal Shale Sandstone Transition Forest and Southern Lowland wet forest species.
- Establishing this forest /carbon sink will require compilation of a detailed plan/program and approval from Shoalhaven Council via a DA and integrated consent (concurrence from SRCMA).
- The forest should be planted in a pattern that will facilitate the harvesting of the trees in the future and the concurrent installation of paths and creation of rooms within the forest.
- Eradicate all weeds within the paddock especially along the top boundary line.
- Stage the planting of natives by firstly installing a cover crop of Acacia species. This will improve the soil condition and create shade to eradicate weeds without using excessive amounts of herbicide.
- Maintain and continue to increase the native species diversity through natural recruitment (bush regeneration) planting and direct seeding.
- Install bushwalks and forestry access trails for harvesting tree species. These should be surfaced with a flexible material that is sympathetic with the environment. A conifer exudate based

product is preferred. The path surface and steps will only be required when traffic levels create compaction and erosion problems.

- Install timber posts salvaged from site to delineate, interpret the old paddock alignments.
- Irrigate the trees with a bore water irrigation system each night.

N:B All of the recommendations above are predicated on the assumption that Landscape Master Plan will be prepared.

Paddock 2:

This paddock is located to the right hand side of the driveway as you enter the property opposite Paddock 4. It has a derelict fence on its eastern boundary hidden within a band of regenerating Acacias and Lantana. The paddock is currently used for overflow parking. The contours clearly show signs that the paddock is a secondary flow line that carries water when the eastern creek floods it also holds water after rain. The surface is undulated at the southern end near the driveway and is not flat or wide enough to accommodate large numbers of cars frequently. The northern end of the paddock is broad and flat and cold be used for group activities or erecting a large marquis.

A causeway over the eastern creek at the northern end of the paddock provides the only vehicle access to Paddock 1. The consulting Landscape architect has indicated that changing the shape of the paddock with trees would improve the visitors experience of the property.

Recommendation:

- Remove non archaeological fence lines.
- Continue the CMA funded bush regeneration program along the creek.
- Source additional funding to meet shortfall in the CMA funding.
- Eradicate all weeds within the paddock and in the bushland along it's eastern boundary.
- Retire some of the paddock and earn carbon credits.
- Widen the bushland margin to a nominal 10 metres from the creeks and create a fully structured riparian plant community. This will reduce the size of the paddock from 1.25 Hectares to approximately 1 Ha.
- Plant and direct seed with native species where bushland resilience proves to be low along the creek and along the bushland margin upslope of the paddock.
- Extend the bushland to create a carbon sink.
- Stage the planting of natives by firstly installing a cover crop of Acacia species. This will improve the soil condition and create shade to eradicate weeds without using excessive amounts of herbicide.
- Maintain and continue to increase the native species diversity through natural recruitment (bush regeneration) planting and direct seeding.
- Maintain forestry access trails for harvesting tree species.
- Install timber posts salvaged from site to delineate and interpret the old paddock alignments.
- Fence the paddock with dog fencing and Wombat gates and run Dorper sheep to keep the pasture down.

N:B All of the recommendations above are predicated on the assumption that Landscape Master Plan will be prepared.

Paddock 3:

This Paddock is located south of the western creek between the driveway and the permanent carpark. The western boundary of the paddock is lined with bushland. The narrow strip of land between the driveway and the creek (downstream of the road culvert) is weed infested and unstable and is contiguous with this paddock.

An access track runs along the western edge of the paddock between the permanent carpark and the garden shed and sewerage system. The garden shed and sewerage system are located in the bush upslope of the paddock's western boundary.

A machinery shed is located on the creek flats at the north western corner of the paddock and is accessed across a low flat contour across the pasture on an informal track.

An avenue of coral trees and two Bunya pines line the driveway near the car parking area on the southern edge of this paddock.

South of the western creeks flood zone is creek flat is a broad ridge which falls from the western paddock boundary eastward to the driveway. The northern slope of this ridge has very good solar access. On the southern side of this ridge is a gently sloping gully that drains water from the western bushland into a small pipe under the driveway and into the tidal reach of the creek ie downstream of the driveway culvert. This pipe's entrance is in need of maintenance and reshaping.

On the southern side of this gully on the slope that runs up to the permanent car park is a water bore and pump that provides water for the gardens and showering.

It is anticipated that the permanent car park will be replaced, in the medium term , with a new administrative building and a relocated parking area. The Landscape architect's thoughts are that the northern slope of the ridge might remain a paddock while the southern slope and the gully below the permanent carpark might be revegetated. His reasoning for this is two fold. Firstly that creating a vegetation screen between the permanent carpark and the northern slope would disguise the location of the machinery shed and the northern section of the paddock from a southern vista and concurrently reduce the visual impact of the administrative building when visitors enter the property, ie a north/eastern vista . The second reason is that revegetating the gully provides another substantial link for wildlife between the bushland and the creek.

The bushland along the creek is heavily weed infested and has been primary weeded. The bushland gully directly west of the machinery shed has also been "primary" weeded.

Recommendations

- The paddock should be reduced by widening the riparian bushland boundary (along the creeks) upslope to the driveway and upslope to the machinery shed access track.
- The north facing slope of the paddock should remain as a paddock and be fenced along the ridge line and reduced in size to approximately 6,000 m2.
- The northern fence of this paddock should be erected on the high side of the machinery shed access track and upslope of the driveway,
- Fence the paddock with dog proof fencing and Wombat gates and run Dorper sheep to keep the pasture down.
- *Revegetate the gully between the ridgeline and the proposed administration building and driveway. The gully will not be planted with shrub species because of the risk of fire.*

- Maintain the road access, along the northern boundary line, between the permanent carpark, the garden shed and the sewage system.
- The riparian areas that have been primary weeded should be regenerated.
- The primary weeded area west of the machinery shed should be regenerated.

Paddock 4.

This is the first paddock that greets the visitor. It is the smallest and is located on the left hand side (between the driveway and the river) as you enter the property. The paddock is not fenced.

This paddock has been used intensively in the past as the drawings in the CAB report 2011 describe. The soil/landform in this paddock has been changed and reshaped as evidenced by the large mounds and depressions. Some of this mounding may be the result of floods depositing soil. The boundaries of this paddock are the road to the North, a steep rocky slope to the East, the river to the South and a small tidal creek to the west. The creek and river banks are highly eroded through river (tide, flood, boat and wind) action. Wombats are also a significant erosion and sedimentation vector. This paddock is mowed (at great Environmental and financial expense) and given the deposition of soil is a little unsightly.

Weeds growing within it or along it's margins include Fire weed, Lantana, Moth vine and Senna. Some other non-native species including a Jacaranda are growing close to the confluence of the creek with the river. These trees seem associated with some old fence lines and perhaps a building and might be retained to assist in the interpretation of the history of the site.

This paddock has a very small water catchment influencing it and given it's historical disturbance will likely require some re-contouring to improve it's aesthetic appeal.

This paddock could also include pedestrian pathways that link the carpark, a river walk, a creek walk and a bridge that crosses the creek.

Recommendation:

- Eradicate all weeds but do not necessarily undertake costly bush regeneration until the final purpose of the paddock has been decided.
- Consider reshaping this paddock and creating a landscape "room" that might occasionally be used as an overflow event carpark.
- Reshape and replant the higher contour of the eroding river bank to accommodate an ampitheatre "room" where people can passively engage with the river.
- Install paths that link the rooms and the bridge.
- Re establish a bushland margin and the walls of the landscape "rooms" with native vegetation. In particular a screen of trees should shield the view of the rooms from the Riversdale homestead precinct.
- Stage the planting of natives by firstly installing a cover crop of Acacia species.
- Maintain and continue to increase the native species diversity through natural recruitment (bush regeneration) planting and direct seeding.
- Install post and rail fences built from fence posts salvaged from Eaerie park to delineate, interpret the old paddock alignments and define the carpark. The fence could also be grazed by a small herd of Dorper sheep.

• *Reduce the size of the paddock from 1.0 Hectare to approximately 0.5 Hectare.*

N:B All of the recommendations above are predicated on the assumption that Landscape Master Plan will be prepared.

Paddock 5.

This paddock surrounds the building precinct and is bounded by the driveway, the lowest reach of the creek, the river, the Cooke's property boundary to the south the Boyd education centre and the permanent carpark to the west.

This paddock is used extensively by the public, it requires a very high maintenance standard and cannot be surrounded with permanent fencing. The mowing regime is constant in the summer months.

The bushland to the west has few weeds but Cooke's boundary, the river banks and adjacent bushland and the creek banks are heavily infested with weeds. The river's bank along this reach is very unstable and eroded. They require stabilisation by being reshaped, matted and replanted. A hydrological engineer and the SRCMA must be consulted regarding these works.

Pedestrian access to the river should be improved and boat access should also be provided. Beneath the power line easement on Cooke's boundary is suggested as a sensible location. The exact manner in which this is done must be very carefully planned and cannot be budgeted for at this time.

Recommendations:

- Commission a landscape master plan to guide the design of the precinct and proposed buildings,
- Regenerate the bushland on the boundaries of the paddock and plant trees in a manner in a manner that maintains the views.
- Install a permanent fence along the southern boundary (Cook's property) using dog proof mesh and Wombat gates,
- Install a gate to allow Cook's access to Bundanon and vica versa during the bush fire season.
- o Redesign and install a garden around the homestead precinct,
- Recontour the slope below the Boyd Education Centre to create an amphitheatre , immediately above the river bank,
- The slope behind the Boyd education centre needs to be redesigned.
- Install short lengths of permanent dog proof fencing along the bushland interface where access to the river is not required,
- Install temporary electric fencing to the ends of this permanent fencing to contain a herd of Dorper sheep,
- Graze a small herd of Dorper sheep around the buildings when no visitors are on site.
- Reshape the creek banks and stabilised as outlined below.
- Install a small jetty.

Fencing

Most paddocks are not fenced at all or only have one boundary fenced and those fences that are present are in poor condition. Some require replacement while others are in fair condition. The definition for the historic curtilage includes those fences / posts that relate to the period of the historic properties and will require conservation. A boundary fence with a gate leading to Cooke's property should be installed to allow fire access and to properly delineate the boundary.

Wombats are problematic in that they do not respect fences and will ruin any conventional fences to reach their foraging grounds. It is proposed that Wombat gates and tunnels be installed in the fences where Wombat "runs" are located. It is also proposed that wombats be guided to these gates and tunnels by electrifying the fences and using felled trees as funnels. Electrifying the fences may also stop wild dogs from entering the paddocks. A solar powered unit should be used.

The cost of fencing is enormous and must be offset by a corresponding revenue stream. The sale of Dorper meat and slipe wool and the saving on mowing can offset the cost at current market rates over a long time but the scale of the fencing program will require it to be undertaken in stages.

It has been proposed that Dorper sheep be grazed on the property. The fencing required for Dorper is a dog mesh type fence with two strands of barbed wire on top. The installed cost is \$17.00 / metre +5 gates and approximately 2,420 metres of fencing would be required. Ideally but not essentially all permanent fences should also be electrified. In the interim and to capitalise on the savings derived from not mowing, a temporary electric fence can be used, to keep the sheep around the property. The labour costs associated with moving electric fences should be minimised by installing all permanent fences as quickly as possible. The paddock around the Boyd Education Center should be partially fenced with permanent fencing and partially with Electric fences so that they can be removed when the site is being used but the grass can be grazed when it is not being used.

Recommendations:

- Install 2,420 meters of dog (Dorper) fencing and 5 gates. Cost \$42,000.00
- o Install 2,420 metres of electric fencing . Cost \$4,500.00 (not- including power unit)
- o Install 1,600 metres of electric fence. Cost \$4,500.00 (including power unit)
- Seek grant funding to trial a system of Wombat sensitive fencing. Cost: \$5,000.00 (Allowance).

Drainage

The Consulting Landscape architect has included many recommendations in his report CAB 2011 about how the landscape might be modified to better facilitate the use of the property.

Apart from changing the landform of some paddocks and general design comments he also recommends that:

- The land around the Boyd Education Centre needs to be reshaped to stop stormwater entering the Boyd education centre,
- The soil filled against the "studio" building needs to be removed to stop rot and white ant entry, and

• The land around the car-park needs to be reshaped to provide an entrance to the paved "foyer" (the area in front of the Boyd Education Centre) in light of the modifications required in points 1 and 2.

I concur with the Landscape Architect regarding the need to manage the stormwater in these areas. These changes should be made as a matter of urgency. An estimate of these costs cannot be provided until a Landscape Master plan has been completed.

Bushland

The bushland has been extensively logged and disused fences indicate that the regrowth areas have also been grazed. The historic grazing is likely to have occurred prior to the introduction of many weed species reaching the property and prior to motorised pasture improvements ie tilling, exotic pasture grasses being sown and the soil being ameliorated with Phosphate based fertilisers.

The bushland has signs of tree felling, understorey clearing and burning and grazing. It is also highly likely that fires would have been used, too frequently and out of season, to control bushland regrowth. The steep and moderately sloped land below rocky ledges would have been grazed. These pressures have lead to the organic soil horizon, where seed would be stored, being eroded and a correspondingly diminished understorey and paucity of native plants has resulted.

The resilience and weed density (condition) of the bushland is provided later in the LMP however it is noteworthy that the bushland /farmland / creekline interfaces are problematic management zones for any land holder. Bushland will be affected detrimentally by weeds, herbicides, pesticides and fertilisers.

The interface with the creeks and the river down slope of the paddocks is generally in poor condition. The gullies that drain into the paddocks also have a higher density of weeds.

Sediment laden run off from eroding creek banks and paddocks also impacts negatively on bushland. The southern boundary (Cooke's Boundary) appears to be aligned with a strip of Lantana growing beneath the power lines that cross the river and supply Bundanon and Cooke's with power. However the "real" boundary is many metres to the south within the cleared home paddock on the Cooke's property.

Recommendations:

- Re-establishing the southern boundary by weeding and installing a permanent fence,
- Grow a native hedge along Cooke's boundary ,
- Install the fence and hedge before the Lantana is removed because the Lantana has created a useful physical barrier.

The creek banks and some of the surrounding bushland margin near the machinery shed have been partially weeded. This weeding effort has been funded by a grant administered by the Southern Rivers Catchment Management Authority. The funds remaining in this grant are minimal and the maintenance weeding required over the next 5 years to return the bushland to a stable condition cannot be funded by the CMA grant alone.

Noxious weeds must be treated as required by the Noxious Weeds Act 1993.

The management of the bushland areas should be undertaken as recommended below. The recommendations provided above that relates to the five paddocks, overlaps with the bushland regeneration program because the programming of these works must consider the adjacent land use.

Riversdale				
The cost estimates in this Table relate only to the paddock infrastructure (apart from wire fencing) and have been provided as a tool to stage implementation. The paddock numbers reflect their priority.				
Description				
Landscape design master plans and detail	\$20-25,000			
Surveying	\$5,000			
	\$30,000			
Paddock 1				
Description				
Grant applications	\$5,000			
Cobbled Causeways				
Excavator 12 tonne	\$6,000			
Supervision	\$1,000			
Materials	\$5,000			
Total Costs Paddock 1	\$17,000			
Paddock 2				
NA				
Paddock 3:				
Reshaping the pipe entrance				
Excavator 12 tonne	\$1,000			
Supervision	\$300			
Materials	\$500			
Total Costs Paddock 3	\$1,800			

Description				
Paddock 4:				
Reshaping				
Excavator 12 tonne	\$20,000			
Supervision	\$6,000			
Bridge supply and install	\$65,000			
300 metre Post and 3 rail Fencing,+ gate	\$30,000			
Total Costs Paddock 4	\$121,000			
Paddock 5:				
Reshaping amphitheatre				
Excavator 12 tonne	\$10,000			
Supervision	\$3,000			
Total Costs Paddock 5	\$13,000			

Bundanon

Overview

The land at Bundanon is managed as a landscaped parkland and beef cattle farm with bushland surrounds and is used ostensibly as a low volume tourism destination and as an artists retreat. The views of the farmland and the rocky escarpments and bushland landscapes are spectacular and the Land Management Plan is obliged to maintain and enhance them. The bushland covering the steep escarpment behind is equally enormous in scale.

The river / paddocks interface is trimmed with a line of small Casuarina's and senescing Wattle trees (Acacias) which are in poor condition and neither link nor separate the river from the paddocks. The large open paddocks are an impressive foreground for an expansive vista and they deserve an equally substantial forest of trees as a backdrop and screen to the river. The poor condition and narrow strip of riparian vegetation is also likely to be depauperate of animal species and should be revegetated and regenerated to provide a corridor for the local wildlife. Widening this riparian vegetation is a large job that would be very difficult to achieve using the standard and costly methods of mulching and planting. It is important that a cost effective long term method is employed. A low cost long term method is discussed later in the LMP.

The paddocks are currently mown, edged and whipper snipped regularly. The financial and environmental cost of this management regime is very difficult to justify indefinitely

The rural life experience at Bundanon is limited because there are no domestic fowl or working dogs and most of the cattle have been sold the orchard is no longer tended and their is no vegetable garden. The property is too small and has too many functions to accommodate a financially viable cattle livestock operation. Fodder (lucerne) cropping may be a viable stream of revenue in the medium term for the property is drought proof and fodder can be sold profitably during drought times. Using the abundant water available at Bundanon is a commercial advantage that should be used to generate income for the management of the property. The legal right to crop the land should be gained via a Property Vegetation Plan so that if in the future cropping is undertaken it can be done quickly to take advantage of a buoyant market or to alleviate a drought.

Bundanon is in the unique position of being at the tidal limit of the river so it is unlikely that the CMA or the Office of Water will have any concerns about how much water is drawn from the water table because it would be immediately replenished by the river/sea. Using that water to irrigate the paddocks and private native forests will substantially increase the productivity of the farm. Pasture irrigation is considered a very valuable but distant goal.

All revenue earned from the property is earned from the educational and artistic programs and events.





Broadscale land use recommendations

The bushland and paddocks at Bundanon should continue to be used first and foremost as ecological, educational, cultural and artistic resources, this can be facilitated by:

- Regenerating all bushland areas,
- Connection with the river should be re-established by refurbishing the steps at the beach, reestablishing past landings and by planting and regenerating the adjacent bushland.
- Widening the riparian vegetation corridor to enhance the visitors experience of Bundanon and significantly improving the ecological function of the riverbank.
- Installing and enclosing pathways within the riparian corridors and bushland surrounds,
- Installing a private native forest (PNF), to be harvested, in the disused paddock and adjacent bushland north of Haunted point.
- Growing aboriginal bushfood, medicinal and utilitarian plant species for inclusion in interpretive walks.
- Install solar power on the roof of any new buildings,
- Install fire fighting sprinklers on the roofs or in the bushland adjacent to the buildings.
- Install a bore fed irrigation system that can "water" livestock and irrigate the paddocks to increase grazing productivity,
- Grazing Dorper sheep to;
 - o reduce Fire weed infestations without using herbicide,
 - reduce CO2 production from mowers,
 - o reduce cost of mowing,
 - o design fences that are sheep and wombat compatible,
 - retain the rural life experience/farm function required in the trust objects.
 N:B Grazing dorper sheep should firstly be trialled with a small herd at Bundanon to prove their suitability in particular with regard to their feet and foot rot.

Water and Sewerage

Potable

Water resources are provided for all staff, short term residents and incidental visitors. Water tanks collect water from every roof within the homestead precinct. Events require additional facilities to cater for the anticipated visitor numbers. Future buildings will require their own dedicated tanks.

Recommendations:

- Install metres and monitor water use.
- Install and maintain inlet and outlet filters to all tanks.
- Install first flush devices to remove animal faeces.
- Install additional tanks if required to supply water during drought periods.
- Install new tanks to proposed buildings that have been appropriately sized for anticipated requirements.
- Plumb tanks so that they drain concurrently ie do not allow tanks to stagnate.
- Allow excess stormwater to flush tanks clean of old water and to fill tanks that would normally be filled from the bore. This will assist in removing corrosive minerals. Any new tanks should be made of concrete or steel to resist fire.

These recommendations apply to all properties.

Bore

Water for stock is pumped from a bore/soak at the south eastern corner of the main clearing. This bore feeds a large concrete water tank which in turn fills the water troughs. The troughs are suited to watering cattle not sheep. The soak is reliable however the sandy soil collapses around the inlet hose for the pump and requires frequent maintenance.

Recommendations:

- A series of solar powered pumps and irrigation lines should be installed to draw the water into header tanks that then gravity feed the reticulation / grey water / fire fighting system.
- Additional fire proof header tanks will need to be installed.
- Install a sand filtering sump within the soak and locate the inlet pipe within it or broaden the soak so that it fills in less frequently ,
- o Install a solar pump at the bore near the gate at the road to the river,

Dam

Bundanon has one large dam near the homestead and one smaller dam to the north and east of the homestead. The smaller dam has wombat holes dug into it's walls.

These dams appear to be fed by a subterranean aquifer and surface run off. They are understood to be unreliable. The quality of the water is unknown. The water would need to be tested before being used for human consumption because the Septic system drains into the catchment of both these dams. A third small dam /soak is located on the flood plain north of Haunted point.

Recommendations:

- Check the depths of the dams and the integrity of the dam walls each year,
- Monitor the rate of siltation and for potential instability.
- Dredge dams as required.
- o Collapse Wombat holes when the wombats are out,
- Check the dam walls for yabbie and rabbit burrows.
- Constantly fill the two dams near the homestead with bore water using a solar pump.

Dedicated Fire Fighting Water supply.

No dedicated water tanks have been installed for bush fire protection purposes.

Recommendation:

- Install dedicated 2 x 1,000 litre dedicated fire proof water tanks installed high in the bush to maximise gravity pressure,
- o Plan to increase the water capacity as new buildings are installed and
- These tanks should be fed from the bore via a solar powered pump.

- Purchase a trailer mounted pump (low pressure high volume) and a flat hose irrigation system.
 This should be bought that can move water between tanks during drought and refill tanks from the dams or fill fire tankers very quickly.
- N:B The cost estimates items have been included in the recommendations for Riversdale.

Sewerage system

One septic tanks services the main homestead complex while another Bio sprinkler system services the Artists in Residence complex and another services the musicians cottage. A septic system is connected to the visitors ablution block. The septic systems would be contaminating the dam's downslope.

Recommendations:

• Engage a sewerage treatment specialist who can investigate the soil conditions and the anticipated loads and the current capacity and can recommend an appropriate upgraded system or replacement system to cater for future needs. It is important that this advice is received before and proposed buildings are sited. The area of land, the slope and soil type required for the release of treated effluent may influence the location of buildings. Additionally if energy hungry pumps are to be dispensed with then the system should be located to be gravity dependent. N:B The cost estimates items have been included in the recommendations for Riversdale.

Bundanon							
Fire Fighting /non-potable reticulation/forestry/livestock/paddock irrigation							
Description	UNIT	QTY	RATE	Total			
Solar powered pump	Each	3	\$12,000.00	\$36,000.00			
Inlet & Outlet filters	item	4	\$350.00	\$1,400.00			
Tank & Stortz valves	each	12	\$350.00	\$4,200.00			
First flush unit	each	1	\$110.00	\$110.00			
10,000 litre gal tank	Each	12	\$3,000.00	\$36,000.00			
2" irrigation line	50M ROLL	200	\$388.65	\$77,730.00			
Fittings	JOINER	200	\$30.00	\$6,000.00			
Sprinklers	Each	100	\$150.00	\$15,000.00			
Concrete footing	Each	12	\$1,500.00	\$18,000.00			
Installation	ltem	4	\$30,000.00	\$24,000.00			
DA Consent estimate	ltem	1	\$2,500.00	\$2,500.00			
Water troughs including		20	\$500.00	\$3,000.00			
fittings							
Total				\$223,900.00			

Power

Power supply protection.

All properties are vulnerable to power loss during major storm and bush fire events.

In order to protect essential services, telecommunications, water pumps, fridges and alarms it is recommended that a diesel powered emergency generator be installed.

If this recommendation is accepted it should be the design of any new buildings should accommodate a fire protected room.

Recommendations:

Install an appropriately sized back up generator at Riversdale.
 70- 90 KVA Cost \$19,000.00 - \$21,000.00
 N:B Power use will require monitoring prior to choosing the appropriate generator.

Solar Power efficiency and CO2 production

A Solar powered electrical generator can significantly reduce the amount of fossil fuel generated power used at all three properties at Bundanon.

A 5KW System that runs without problems for 15 years would cost \$25,000 to install and service during it's life time. In that time it can conservatively generate 150,000 KW of power or \$40,000.00 worth of power at today's rates or \$90,000.00 at an average cost of \$0.65 over 15 years.

N:B Based on (5 Kwh x 8 hours x 80% efficiency)and (Currently power prices are \$0.28 cents / KWH and are anticipated to rise by 20% next year. A conservative increase of 10% per year extrapolated over the next 15 years would increase the cost of power to \$1.30)

If the government / power companies pay for excess power fed back into the grid then the system can be very profitable but at present and for the purposes of this assessment it has been assumed that no payment is made by electricity suppliers. Currently suppliers will only charge for electricity that is used in excess of the amount that a solar system feeds back into the grid *and only at the same time that the electricity is being used*. Subsequently if a system produces the same amount or more power as is being used then that power is effectively free.

The most efficient Solar power system currently available should be installed on the roof of the machinery shed. The connection to the main/sub-main must be considered with regard to metering and so must the need for inverters for the number of power phases required. Government grants are currently available to offset the interest on finance retro fitting is the borrowing costs are offset.

Recommendation

 Monitor the power usage during daylight hours and install an appropriately sized solar generator to offset as much Green house gas as possible.
 Cost at least \$25,000.00 (saving over 15 years approximately \$50,000.00)

Future power generation

The most efficient Solar power system available at the time the new buildings are being designed should be installed on the roofs all new buildings to provide as much power as the roof area/ building design

will allow that feeds into . The size, location and cost of these recommendations cannot be provided at this time.

Recommendation

 Accommodate the design, installation and cost of a solar system at the concept stage of any building programs.
 Cost uncertain.

Solar pumps / bores

Solar powered pumps should be used to lift water into header tanks that can store energy as gravity (potential energy) as well as being used for irrigation.

Recommendation:

- Install a very small hydro generator to demonstrate how water power generation can work. Cost \$2,500
- Install a Solar pump which can offset the cost of running the current electrical bore pump. Cost \$12,000.00 (Cost included above in water and sewerage)

Soils

Bushland topsoil

The soils in the un-grazed steep bushland areas have relatively deep mulch layers and have greater plant species richness. The south facing slopes behind the Bundanon north of the homestead are protected from the northern aspect and are well vegetated and correspondingly the soils have higher levels of organic matter. The soils are generally silty-sandy soils and are highly erodable.

The bushland topsoils that have been grazed are generally on steeper ground and are situated below rock outcrops they have lost their native vegetation cover (which binds the soil surface) and are subsequently depleted. The organic soil horizon is very thin and the volume of decaying mulch is similarly thin and the fertility is correspondingly low. The steepness of the ground suggests that surface erosion has removed much of the organic matter and the A-soil horizon. Much of this bushland has also been infested with Lantana which has allelopathic properties ie it releases chemical compounds that inhibit the growth of other plants.

Recommendations:

 Regenerate native plants to improve soil organic matter percentages and to assist in binding the soil surface. The depth of leaf litter and the density of vegetation cover directly correlates with the variety and richness of soil micro and meso-fauna (invertebrates etc) and soil fungi that live in the soil and in turn to the variety and richness or vertebrate species. The cost of regeneration is discussed in "Bush Regeneration" below.

Paddock topsoil

The soils in the paddocks are silty - sandy soils that have some structure. If consistent with the silt content they should have moderate colloidal capacity, moderate water holding capacity and with the sand content should also be well drained and have reasonable air filled porosity. At first inspection they appear to be moderately fertile and suitable for a wide range of agricultural uses.

Recommendations:

 Seek advice from an agronomist regarding a suitable range and frequency of soil tests that relate to the approved use of the paddocks. Soil testing is expensive and inexact and should be used to provide information regarding general trends across the paddocks and to locate problem areas. It is not envisaged that soil testing will be used to ameliorate (modify) soil chemistry over time but rather to inform the land manager as to the appropriate use of the land. N:B Cost estimates for a full testing program cannot be provided until the use is approved.

Soil Erosion and Sedimentation

The soils within the arable lands on site are stable (non-eroding) apart from the river banks which have been de-stabilised through:

- the action of the Wombats digging into the river banks,
- the wave, wind, a tide action of the river,
- Rain/sheet erosion on the four wheel drive tracks leading across the paddocks and to Haunted Point and the Ampitheatre.

Recommendation:

• Survey all points of erosion and sedimentation and compile a sedimentation and erosion control plan.

Cost: \$5,000.00 approximately.

Generally all points of soil erosion / siltation should be fixed by:

Creeks and River banks.

Consulting with the CMA and agreeing on where and how to:

- reshape erosion points with machinery,
- installing erosion control matting, and
- plant stabilising plants.
- Remove silt from creeks and silt traps on the high side of the main access road, (this may be the responsibility of council)

Access roads

• Install table drains and diversion channels and resurfacing / filling large holes in the road surface is required.

Cost estimates cannot be provided until a SECP has been completed.

Parking

All weather parking for approximately 20 cars and specific bus parking has been provided at the homestead complex.

Event/overflow parking is provided as a roped off area on flat grassed paddocks to the west of Arthur Boyd's studio. This parking is weather dependent and does compact soil and can result in the unsightly death or damage to the pasture.

Approximately 10 car parking spaces are also provided at the outdoor / dance studio and adjacent to the Ramsay art centre building.

Informal car parking space is adjacent to the artist in residence house set in the bush.

Parking in the paddock is limited to dry weather and when soil moisture content is below field capacity. Parking on the turf when the moisture content is greater than field capacity will result in excessive soil compaction and may also result in the unsightly death or damage to the pasture. If rain occurs while cars have are parked on the grass then they may be bogged and require removal and the pasture may require remediation.

Event/overflow parking is infrequently needed in this paddock and improving the conditions for parking cannot be justified but if required in the future the paddock would need modification.

Recommendations

- Reconsider the layout of the current all weather car parking facilities in the recommended Landscape Master Plan.
- Consider the location of a permanent reinforced, bog proof, overflow (paddock) carpark in the Landscape Master plan.

Gardens

The gardens are relatively weed free and maintained in a homely condition. The home paddock orchard has some remnant trees in various condition. The orchard trees appear under fed and should be fertilised and pruned. Grass has been growing right up to their stems this grass should be carefully removed in a 2 metre diameter ring around the stem. The ring should be mulched and fertilised. The land immediately around the buildings are used regularly by visitors and are kept very tidy.

The gardens and orchard around the homestead complex have been altered many times since they were originally planted. The garden is currently a mix of plants from different periods and many are species that have only become recently available for ornamental horticulture in Australia.

An exact re-creation of the original garden is impossible to achieve due to a lack of knowledge of the exact layout and plant species composition and re-creating the garden would not interpret the more recent history of the property. It is considered important that the basic structure of the modern garden should reflect it's original purpose ie of a source of food firstly and an ornamental garden secondly.

Subsequently it is recommended that the historical garden layout/s be researched and interpreted in a manner that is sympathetic to the properties heritage. With regard to the use of "period" plants I also recommend that the Illawarra Seed Savers network be contacted and that "Heritage "seeds be grown on

site to help conserve older varieties of plants that are not commonly available and which may be very important when genetically engineered varieties succomb to a catastrophic event.

A volunteer gardening group is understood to assist with the maintenance of the gardens. Their involvement in this process is very important and should be actively fostered. No costings have been provided for the maintenance appears well in hand and is essential to the presentation of th properties.

Recommendations

- Weed, mulch, prune and fertilise the orchard as described above.
- *Continue current maintenance effort.*
- *Remove and replace all Coral Trees with Flame trees over time.*
- Research and include an appropriate interpretation of the garden in the recommended Landscape Master Plan.
- Invite contributions from the Illawarra Seed Savers network and any volunteers who have an interest in the garden.

Paddocks

The large paddocks located to the south/west, south and south /east of the Bundanon homestead must remain as open paddocks to preserve the Historic Landscape curtilage. Slashing these paddocks is environmentally and financially very costly. The objects of the trust require that Bundanon remains a functioning farm consequently it is advised that a grazing operation be continued. Cattle are grazed within the main paddocks south of the homestead and in the bull paddock.

These paddocks are not heavily grazed and the pasture is currently very tall and should be slashed after being grazed to improve the pasture density.

A narrow band of native trees (predominantly native primary colonising Acacia species) has regrown along the riverbanks and they are slowly encroaching into the paddocks.

The edge to area ratio of this narrow bushland margin is very high and consequently weeds can infest the bushland easily. The impact of weeds on the remnant bushland is very high and costly to manage. If the bushland margin was broader and the edge to area ratio decreased the cost of managing the weeds within it would be reduced. Very importantly the breadth of this margin has a very strong correlation with the number and diversity of native animal species that would use the riparian corridor that this margin creates. For conservation purposes it is recommended that the bushland margin be widened to a minimum of 100 metres.

The author has received advice from the landscape architect Mr Craig Burton regarding the importance of the old paddock arrangements and fences and how much cleared land must be maintained to conserve the heritage of the landscape curtilage. Please refer CAB 2011. Widening the bushland margin by 100 metres is advice based on ecological grounds and is in conflict with the modest widening considered acceptable by Mr Craig Burton. Please refer to CAB 2011 Map 11. Craig's over arching advice is that all of the properties require a landscape master plan and that discrete areas defined within a master plan should be designed at a fine (detailed) resolution. This advice also relates to the extent of the expansion of the bushland margin. The Trust board will be required to find the middle ground between the ecological and heritage focused recommendations. It should be noted that the urgency of

widening the bushland corridor is tempered by the availability of resources, and the relative priority of the recommendations. Overlaid on this conundrum and confounding it further is the urgent need to resolve the question of whether to run livestock on the property.

The paddock fences are in various states. Some require replacement while others are in fair condition. The decisions of the board, regarding whether to run livestock and how wide the riparian margin should be, will inform the LMP with regard to which fences require removal, repair or replacement. A recommendation has been made above to farm Dorper Sheep. This requires the installation of perimeter fences that are sheep proof (Dog netting is required) and that have Wombat gates. It is anticipated that sheep will prefer to eat Fire weed and may be contained within the internal cattle fencing. If they are not contained and if their grazing patterns do not help control the Fire weed because they can move too quickly between paddocks then an electric hot wire can be mounted on the existing fences. The staged repair and/or replacement of fencing is anticipated.

The historic curtilage includes fences and posts that relate to each period of the historic properties and they will require conservation.

A complex of farm sheds, out door materials storage and livestock yards is situated on the low side of the access road to Bundanon. These facilities will require maintenance and /or upgrading depending upon the boards decision regarding keeping livestock.

Recommendations:

- Control and implement a 5 year control program of the dense infestations of Senecio madagascariensis. It is a notifiable noxious weed that must be controlled.
- Use Dorper sheep to control the Fire weed.
- Install Sheep proof fences along the boundaries and
- Install electric fences within the internal fence where required.
- Install water troughs that are suitable for sheep.
- Improve the pedestrian access to the river at the old landing places, Haunted point, due east of the Homestead, west of the machinery shed, and on the current beach.
- Source additional grant funding to meet the shortfall in current funding.
- Widen the bushland margin to a nominal 100 metres from the river and create a fully structured riparian plant community.
- Plant and direct seed with native species where bushland resilience proves to be low on along the river.
- Submit a Development Application to council and the CMA to establish a private native forest (PNF) with a fully structured forest plant community. The native forest may include tree species that are not locally occurring but are high value timber species that may be used for building on Bundanon in the future. The shrub and ground cover species will be of species that will create an ecotone of Yalwal Shale Sandstone Transition Forest and Southern Lowland wet forest species.
- Establishing this forest /carbon sink will require compilation of a detailed plan/program and approval from Shoalhaven Council via a DA and integrated consent (concurrence from SRCMA).
- The forest should be planted in a pattern that will facilitate the harvesting of the trees in the future and the concurrent installation of paths and creation of rooms within the forest.
- Eradicate all weeds within the paddock especially along the top boundary line.

- Stage the planting of natives by firstly installing a cover crop of Acacia species. This will improve the soil condition and create shade to eradicate weeds without using excessive amounts of herbicide.
- Maintain and continue to increase the native species diversity through natural recruitment (bush regeneration) planting and direct seeding.
- Install bushwalks and forestry access trails for harvesting tree species. These should be surfaced with a flexible material that is sympathetic with the environment. A conifer exudate based product is preferred. The path surface and steps will only be required when traffic levels create compaction and erosion problems.
- Install timber posts salvaged from site to delineate, interpret the old paddock alignments.
- Irrigate the trees with a bore water irrigation system each night.

N:B All of the recommendations above are predicated on the assumption that Landscape Master Plan will be prepared.

Paddocks

There are two types of Paddocks at Bundanon that have been described in *Map # 12 "Bundanon Land Use."*

- I. Sheep Paddocks, that include the Homestead, Gardens and orchard and
- *II.* General Livestock Paddocks, which are south of the entrance road and East of the Sheep paddocks.

Please note that all fencing is prone to the impact of flood and the Wombat damage.

The paddocks must be maintained as visually pleasing vistas to comply with the objects of the trust. They should be managed without undue production of greenhouse gasses and with minimal cost. As reiterated earlier in the LMP running a beef production operation is financially marginal and the paddocks have significant infestations of Fire weed.

Sheep Paddock.

In the Appendix:K Bundanon Paddock Plan 2010 the paddocks around the Homestead have been called the Bull Paddock, the Single Mans Hut Paddock and the Lagoon paddock. This area has been called the sheep paddock within this LMP because sheep can be run around the Homestead safely. They do not pose a public safety/liability risk.

The Bull paddock has water troughs suitable for keeping cattle. The other Sheep Paddocks have no animals in them currently and are maintained as landscaped gardens and the pasture is mown. The other sheep paddocks adjoin a dam. It is important to keep all livestock out of this dam/soak. It is preferable to have water troughs away from the dam so the animals don't muddy the dam edges, get wet feet potentially get caught in the mud.

The fences in these paddocks are in various condition. All fences will need to be restrained and dog mesh will need to be attached to them. Many will need rewiring where Kangaroos and Wombats have been pushing through, alike many other fences across all properties. Some fence posts and star pickets will also need replacing. A complete overhaul (new steel pickets, replacement of rotted straining posts, rewiring) of fencing should be considered every 20 years. One paddock has a pedestrian gate and path that leads from the bush to the Homestead. The pasture in these paddocks is in reasonable condition but some fire weed is present that will need eradicating. The boundary fence in these paddocks is approximately 1,200 metres in length.

General Livestock Paddocks

These paddocks are much larger and have 4,000 metres of cattle type perimeter fence and 11,500 of internal fencing. Some lengths of fencing also have electric fencing attached. The paddocks are irrigated and gated however sections of the fencing do need maintenance and/or replacement. A bore, pump and gravity header tank supply the paddocks with water. The pasture is long and at present a very small herd of cattle are being grazed.

Recommendations:

- Remove all cattle from Bundanon,
- Trial running a 100 head herd of Dorper sheep in the Sheep Paddock (segmented with electric fences) to keep the grass down around the house.
- Use a combination of sheep and electric fences, tractors slashing and herbicide to control weeds and pasture length within the general Livestock paddock until the Dorper sheep operation proves suitable and profitable,

- o If the Dorper operation does prove profitable and suitable then expand the operation,
- Reduce the size of the paddocks by regenerating/revegetating a 100 metre wide riparian margin (wildlife corridor) ie the Indigenous Revegetation area,
- Remove all reusable fencing within this margin. Leave some posts to interpret past land use patterns,
- Install a Sheep proof perimeter fence and wombat gates along the boundary of this riparian margin,
- Install more fences, adapt the yard fencing and water troughs for sheep and install a pasture irrigation system,
- Revegetate the potential plantation / interpretation areas, (Some tree thinning of the tree plantation may occur but the area should essentially remain bushland that is representative of the low lying wet vegetation communities. Casuarina and paper bark forest.)
- Establish a Private Native Forest north and north-west of Haunted point.
- Regenerate all bushland,

Please refer to Map # 19 "Bundanon Land Use".

DORPER SHEEP							
The cost estimates in this Table relate to the production of a 1,000 head flock of conventionally (non-organic) grown Dorper sheep bought as 3-4 month old wether weaners castrated and drenched. The sheep are then expected to be slaughtered by a local butcher at one year and sold at Bundanon and to a local Butcher. The figures are also based over 10 years with 900 head at Bundanon and 100 head at Riversdale. 4 Hours per week has been put aside for their management. The current cost of managing fire weed with herbicide and labour is assumed to be halved . Minimal pasture improvement has been allowed for but pasture irrigation is strongly recommended if the sheep prove suitable climatically. The revenue from the sale of lamb may increase to as much as \$500,000 if all lamb produced is sold on Bundanon. Other Dorper sheep operations are currently operating near by.							
Description	Unit	Qty	Rate	Total			
Expenditure			40.00				
Electric fence (Riversdale)	Lnm	1600	\$3.00	\$4,800			
Electric fence (Bundanon)	Lnm	15,000	\$3.00	\$45,000			
30kg lambs	Each	10,000	\$60.00	\$600,000			
Drenching	Each	10,000	\$1.50	\$15,000			
Transport	Each	10,000	\$10.00	\$100,000			
Management	Hrs	10,000	\$45.00	\$450,000			
Irrigation	Each	1	\$25,000.00	\$25,000			
Irrigation	Each	1	\$50,000.00	\$50,000			
Butchering costs	Each	10,000	\$45.00	\$450,000			
Fencing Riversdale	Lnm	2,240	\$17.00	\$38,080			
Riversdale post and rail	Lnm	300	\$100.00	\$30,000			
Fencing Bundanon Boundary fences	Lnm	4,850	\$17.00	\$82,450			
Pasture improvement	Allow	10	\$10,000	\$100,000			
Total cost				\$1,990,330			
Revenue							
3330 x 30 kg sheep sold on farm	kg	100,000	\$15.00	\$1,500,000			
6660 x 30 kg sheep sold as carcass	Kg	200,000	\$5.00	\$1,000,000			
Slipe wool (skins)	Each	10,000	\$25.00	\$250,000			
Mowing saving over 10 years based on 25 hours every three weeks at \$45.00 /hr.	Week	173	\$1,125.00	\$194,625			
Fire weed control				\$100,000			
Total Revenue				\$3,044,625			
Gross Profit				\$1,054,295			

Bundanon					
The cost estimates in this Table relate only to the paddock infrastructure (apart from fencing and sheep production) and have been provided as a tool to stage implementation.					
Description					
Landscape design master plans and detail	\$20-25,000				
Surveying	\$5,000				
Install 50 new hardwood box steps to the river in three places	\$15,000				
Install a new solar pump in the old bore.	\$12,000				
Grant applications	\$5,000				
Broaden soak or install filtered sump					
Excavator 20 tonne	\$5,000				
Supervision	\$1,000				
Total Costs	\$68,000				

Drainage

The Table drains on the road to Bundanon will require periodic monitoring and maintenance as will the access track to the amphitheatre and to Haunted point.

Recommendation:

• Complete an Erosion Control and Sedimentation Plan as recommended above.

Bushland

The bushland has been extensively logged and disused fences indicate that the regrowth areas within the bushland have also been grazed especially North / North west of Haunted Point. The historic grazing is likely to have occurred prior to the introduction of many weed species reaching the property and prior to motorised pasture improvements ie tilling, exotic pasture grasses being sown and the soil being ameliorated with Phosphate based fertilisers.

The bushland has signs of tree felling, understorey clearing and burning and grazing. It is also highly likely that fires would have been used too frequently and out of season in order to control bushland regrowth. The steep and moderately sloped land below rocky ledges would have been grazed. These pressures have lead to the organic soil horizon, where seed would be stored, being eroded and a correspondingly diminished understorey and paucity of native plants has resulted.

The resilience and weed density (condition) of the bushland was provided later in the LMP however it is noteworthy that the bushland /farmland / creekline interfaces are problematic management zones for any land holder. Bushland will be effected detrimentally by weeds, herbicides, pesticides and fertilisers. The interface with the creeks and the river down slope of the paddocks are generally in poor condition and the gullies and wetter slopes have a higher density of weeds.

Sediment laden run off from the eroding river banks and paddocks also impacts negatively on bushland. The cleared and grazed land north of Haunted point has been unused for many years. A large section of this land has Acacia species regenerating on it. These trees are reaching senescence and will die within the next few years. Other sections of this land are covered with grass weeds and Lantana.

Recommendations:

- o All bushland south and west of Haunted point to Beeweeree should be regenerated,
- All bushland north and west of Haunted point that has not been grazed in the past should be regenerated,
- The bushland margins of the river should be extended, via planting and direct seeding, to approximately 100m width,
- The management of the bushland areas should be undertaken as recommended in earlier in "Bush regeneration".
- The bushland forest that has been grazed north/west of Haunted point should be regenerated and supplementary planted as a Private Native Forest,
- The land that has been cleared and grazed north of Haunted point should be weeded and replanted as a Private Native Forest with a native forest under story. The method of preparing this forest is detailed below in 6.3 Staged Forest establishment. Those areas that are dominated by senescing Acacias should be replanted by conventional means. However trials of direct seeding timber tree species should also be undertaken.
- Additional tree planting should be undertaken in those paddocks described as Potential Planting Interpretation on Map # 12 "Bundanon Land Use."

Eearie Park

This property is very large and is mostly high quality weed free bushland that requires little management. The exception to this is a rainforest gully at the western end of the site which has weeds threatening it. The property has a long river frontage that is discontinuous in that the it is separated by a property that is owned by others and by two grazing leases located on the river frontage. In total the river frontage that is effectively under the management of Bundanon is 4km long however approximately only 600m of it is absolute river frontage. Most of the leased land is weed infested. A large high voltage power easement cuts a 60 metre wide and 3km long swathe from north to south through the bushland.

A single dwelling, which was used by Arthur Boyd and Sidney Nolan as a studio, overlooks a large pasture fenced into multiple paddocks down to the tree lined river. This vista has heritage value and the LMP is obliged to maintain it. A rough "fishing and camping" shed is set back approximately from the river. The fences are in various conditions. The pasture is long and weed infested and dotted with Wombat holes.

This property is the least urgent management priority of the three properties because it has virtually no public visitation. However it is of the highest importance for it's commercial potential as a live-in conference centre was ranked highest in the Opportunities and Constraints paper. Additionally the planning and approval process for the development of this property is not confounded by heritage issues like the other two properties. The need to move children away from the Riversdale residential area (child protection laws) is also expedited by the development of a residential building at Eearie Park. Condie's farm also has great commercial and educational opportunities as an adventure playground / ropes course. Both of these proposed land uses have relatively short lead times and so can be contributing to the ongoing development of the property soon.

The residential building is an older building which undoubtedly needs maintenance but which might be a waste of money if the site is developed soon.

The bushland riparian margin has some sections that are moderately resilient, stable and wide sections of bushland while other sections are weed infested and depauperate of native species.





Water and Sewerage

Potable Water

Potable water is collected in tanks from the roof of the house at Eearie Park. One tank adjacent to the old cattle yards is filled by a pump from a bore and is listing on its footing and is in poor condition. The proposed residential buildings will require water and sewerage the exact size of that system cannot be estimated but the following recommendations should be considered at the planning phase.

Recommendations:

- Relocate this unused tank and install on a reinforced concrete slab or solid ground elsewhere on the property. Potentially as a dedicated fire fighting tank for the residence. Cost\$1,000
- Rebuild, demolish or replace the shed at the river to make sure it is not a public liability problem.
 Collect a small tank of potable water from the shed roof. The cost of this has not been estimated.
- Install and maintain inlet and outlet filters to all tanks.
- Install first flush devices to remove animal faeces.
- Install additional tanks if required to supply water during drought periods.
- Install new tanks to proposed buildings that have been appropriately sized for anticipated requirements.
- Plumb tanks so that they drain concurrently ie do not allow tanks to stagnate.
- Allow excess stormwater to flush tanks clean of old water and to fill tanks that would normally be filled from the bore.
- Any new tanks should be made of concrete or steel to resist fire. This will assist in removing corrosive minerals. These recommendations apply to all properties.

Bore

One functioning bore is on site at present . Bore water would be very useful in supplying the proposed residential buildings with grey water and for establishing plants.

Recommendations:

• A solar powered pump and irrigation lines should be installed to draw the water into header tanks that then gravity feed the reticulation / grey water / fire fighting system. Additional fire proof header tanks may need to be installed.

Dam water.

A dam is located to the south and east of the house. Additional dams may also be considered within the recommended Landscape Master plan.

Recommendation:

- The depths of the dams and the integrity of the dam walls should be checked annually to monitor the rate of siltation and for potential instability.
- They should be dredged as required.
- Wombat holes should be collapsed, when the wombats are out, as soon as they are found. The dam walls should also be checked for yabbie and rabbit burrows.

Dedicated Fire Fighting Water supply.

No dedicated water tanks have been installed for bush fire protection purposes.

Recommendation:

- A series of dedicated fire proof tanks should be installed high in the bush to maximise gravity pressure. These tanks should be fed from the bore via a solar powered pump.
- A trailer mounted pump low pressure high volume and flat hose irrigation system should be bought that can move water between tanks during drought and refill tanks from the dams or fill fire tankers very quickly. The cost of this has been included in the

Sewerage system

- A septic system services the house. The septic system may well be contaminating the dam.
- No toilet facilities or water is provided at the River / beach car parking area.
- N:B Lisa Rawlinson is a local woman from Gerroa who is unquestionably the Australian expert on sewerage treatment for small towns. She will be visiting the site on Friday the 4th November to give me free advice on the basic parameters that need to be considered in design of appropriate systems at all three properties.

Recommendations:

• Engage a sewerage treatment specialist who can investigate the soil conditions and the anticipated loads and the current capacity and can recommend an appropriate upgraded system or replacement system to cater for future needs. It is important that this advice is received before and proposed buildings are sited. The area of land, the slope and soil type required for the release of treated effluent may influence the location of buildings. Additionally if energy hungry pumps are to be dispensed with then the system should be located to be gravity dependent.

Power

Power supply protection.

All properties are vulnerable to power loss during major storm and bush fire events.

In order to protect essential services, telecommunications, water pumps, fridges and alarms it is recommended that a diesel powered emergency generator be installed.

If this recommendation is accepted it should be the design of any new buildings should accommodate a fire protected room.

Recommendations:

Install an appropriately sized back up generator at Eerie Park when it is developed.
 70- 90 KVA Cost \$19,000.00 - \$21,000.00

N:B Power use will require monitoring prior to choosing the appropriate generator.

Solar Power efficiency and CO2 production

A Solar powered electrical generator can significantly reduce the amount of fossil fuel generated power used at all three properties at Bundanon.

A 5KW System that runs without problems for 15 years would cost \$25,000 to install and service during it's life time. In that time it can conservatively generate 150,000 KW of power or \$40,000.00 worth of power at today's rates or \$90,000.00 at an average cost of \$0.65 over 15 years.

N:B Based on (5 Kwh x 8 hours x 80% efficiency)and (Currently power prices are 0.28 cents / KWH and are anticipated to rise by 20% next year. A conservative increase of 10% per year extrapolated over the next 15 years would increase the cost of power to 1.30

If the government / power companies pay for excess power fed back into the grid then the system can be very profitable but at present and for the purposes of this assessment it has been assumed that no payment is made by electricity suppliers. Currently suppliers will only charge for electricity that is used in excess of the amount that a solar system feeds back into the grid *and only at the same time that the electricity is being used*. Subsequently if a system produces the same amount or more power as is being used then that power is effectively free.

The most efficient Solar power system currently available should be installed on the roof of the machinery shed. The connection to the main/sub-main must be considered with regard to metering and so must the need for inverters for the number of power phases required. Government grants are currently available to offset the interest on finance retro fitting ie the borrowing costs are offset.

Recommendation

Monitor the power usage during daylight hours and install an appropriately sized solar generator to offset as much Green house gas as possible.
 Cost at least \$25,000.00 (saving over 15 years approximately \$50,000.00)

Future power generation

The most efficient Solar power system available at the time the new buildings are being designed should be installed on the roofs all new buildings to provide as much power as the roof area/ building design will allow that feeds into . The size, location and cost of these recommendations cannot be provided at this time.

Recommendation

 Accommodate the design, installation and cost of a solar system at the concept stage of any building programs.
 Cost uncertain.

Solar pumps / bores

Solar powered pumps should be used to lift water into header tanks that can store energy as gravity (potential energy) as well as being used for irrigation.

Recommendation:

• Install a very small hydro - generator to demonstrate how water power generation can work. Cost \$2,500 • Install a Solar pump which can offset the cost of running the current electrical bore pump. Cost \$12,000.00 (Cost included above in water and sewerage)

Soils

Bushland topsoil

The soils in the un-grazed steep bushland areas have relatively deep mulch layers and have greater plant species richness. The soils are generally silty-sandy soils and are highly erodable.

The bushland topsoils that have been grazed are generally on steeper ground and are situated below rock. They have generally lost their native vegetation cover (which binds the soil surface) and are subsequently depleted. The organic soil horizon is very thin and the volume of decaying mulch is similarly thin and the fertility is correspondingly low.. The steepness of the ground suggests that surface erosion has removed much of the organic matter and the A-soil horizon. Much of this bushland has also been infested with Lantana which has allelopathic properties ie it releases chemical compounds that inhibit the growth of other plants.

These soils require the regeneration of native plants to bind them and provide leaf litter (organic matter) for them to be replenished. The depth of leaf litter and the density of vegetation cover directly correlates with the variety and richness of soil micro and meso fauna (invertebrates etc) and soil fungi that live in the soil and in turn to the variety and richness or vertebrate species. Healthy bushland starts with healthy soil.

Recommendations:

• Regenerate all bushland.

Paddock topsoil

The soils in the paddocks are silty - sandy soils that have some structure. If consistent with the silt content they should have moderate colloidal capacity, moderate water holding capacity and with the sand content should also be well drained and have reasonable air filled porosity. At first inspection they appear to be moderately fertile and suitable for a wide range of agricultural uses.

Soil Erosion and Sedimentation

The soils within the arable lands on site are stable (non-eroding) apart from the creek and river banks which have been de-stabilised through:

- the action of the Wombats digging into the creek banks,
- the wave, wind, a tide action of the river,

• Soil erosion is also evident on the four wheel drive tracks leading from the main driveway to the house and from the main driveway to the power easement. The access tracks beneath the power easement are also eroding.

Recommendations:

• Survey all points of erosion and sedimentation and compile a sedimentation and erosion control plan. Generally all points of soil erosion / siltation should be fixed by:

Creeks and River banks.

Consulting with the CMA and agreeing on where and how to:

- reshape erosion points with machinery,
- installing erosion control matting, and
- plant stabilising plants.
- Remove silt from creeks and silt traps on the high side of the main access road, (this may be the responsibility of council)

Access roads

- Survey all points of erosion and sedimentation and compile a sedimentation and erosion control plan.
- Install table drains and diversion channels and resurface / fill large holes in the road surface as required.

N:B The erosion that is occurring along the access tracks within the Power easement are the responsibility of Transgrid, the utility owner and should be fixed at their expense. There is an opportunity here for the tracks to be fixed up to a standard that accommodates Bundanon's need for walking / bike trails. Transgrid have communicated a willingness to engage Bundanon through a contract to maintain the easement.

Cleared land

Eearie Park is managed as a cattle farm but no livestock are currently kept on site, the pasture is overgrown and heavily infested with the Noxious Fire weed which must be controlled and eradicated. The Beeweeree paddocks are completely overgrown with Lantana and other woody weed species. This land is a management problem in that it provides little revenue and without spending substantial sums of money on Sheep fencing the property is financially unviable. The land beneath the powerline easement is relatively weed free apart from where it joins the river. The location of proposed new buildings is restricted to Fire and Flood safe land.

Map 20 Eerie Park and Beeweeree Land use describes an area that is suitable for new residential development. The basic financial model produced as part of the Options and Constraints Paper for a corporate function centre located here looked favourable.

Recommendations

- Survey the property and establish flood lines and fire asset protection Zone boundaries
- Locate new buildings within the area defined in Map 20.
- *Revegetate / reafforest as described below,*
- Seek a contract with Transgrid to manage the powerline easement to protect native wildlife rather than have uncaring contractors manage the line.
- o Buy an excavator to undertake the power line slashing, weeding and other jobs,
- Install a ropes course/adventure playground or camping area at Condies farm within the proposed Forest plantation .Cost approximately \$300,000 for a ropes course flying fox and basic camping flets.
- Control the Fire weed using conventional methods until a forest can be established. Allow \$7,500.00 per year.

Parking

A carport within the house precinct is the only formal car parking on site.

Informal parking for neighbours and Bundanon staff/visitors is located next to the beach on the river but people are not encouraged to access the river via this route. This beach is accessed across the main paddock. This paddock does have gentle undulations which will fill with water during large rain events. This paddock also has clearly been shaped by past flood events and will flow with water when the river breaks it's banks.

Parking in the paddock is limited to dry weather and when soil moisture content is below field capacity. Parking on the turf when the moisture content is greater than field capacity will result in excessive soil compaction and may also result in the unsightly death or damage to the pasture. If rain occurs while cars have are parked on the grass then they may be bogged and require removal and the pasture may require remediation.

Recommendations

• Consider the layout of an all weather car parking facility and the location of a permanent reinforced overflow (paddock) carpark in the recommended Landscape Master Plan.

Gardens

The home gardens are maintained by the tenant to a standard that satisfies his personal need because it is not within a public use precinct.

The gardens are maintained in a relatively weed free state however bushland vegetation does grow too close to the house to provide adequate bushfire protection.

One Coral tree is growing adjacent to where the cattle yards used to stand. Coral Trees are considered a weed of bushland and creek systems and are also "very" prone to dropping large limbs. It is strongly advised that these trees be removed and replaced with Brachychiton acerifolious the Illawarra Flame

tree , which has significance as a tree used by aboriginal people and is far more beautiful and less dangerous than the Coral Trees.

The current mowing and weeding maintenance undertaken by the caretaker should continue and include maintenance of the Fire Asset Protection Zone recommended later in the report.

Recommendations:

- *Remove Coral Tree and replace with an Illawarra flame.*
- Clear a fire Asset Protection Zone around the house.

Paddocks

A band of native trees (predominantly native primary colonising species) has regrown along the river and creek banks and is slowly encroaching into the paddocks.

The edge to area ratio of this narrow bushland margin is very high and consequently the impact of weeds on the remnant bushland is very high and costly to manage. If the bushland margin was broader and the edge to area ratio decreased the cost of managing the weeds within it would be reduced. Very importantly the breadth of this margin has a very strong correlation with the number and diversity of native animal species that would use the riparian corridor that this margin creates. For conservation purposes it is recommended that the bushland margin be widened to a minimum of 100 metres. The paddocks in Eearie Park are very heavily infested with Fire weed which must, being a notifiable noxious weed, be controlled. The Beeweeree Park paddocks are dominated by very dense *Lantana camara*.

The author has received advice from the landscape architect regarding the importance of the old paddock arrangements and fences and how much cleared land must be maintained to conserve the heritage of the landscape curtilage. Please refer to his report Appendix I: CAB 2011.

In this instance widening the bushland corridor can be achieved in most areas without impacting on the heritage curtilage. The view from the caretakers house is a favoured painting vista of Sidney Nolan and Arthur Boyd. The views from this house must be maintained / interpreted within a landscape master plan. It is also anticipated that the paint splattered floor of the house will be retained within whatever building supersedes the house. The current management regime of mowing the paddocks is Environmentally poor practice and should cease.

Recommendations

- Widen the bushland margin to a minimum 100m wide.
- Install a private native forest, in the manner described below, that can be harvested over time in a pattern that permanent rooms within the landscape,
- Conserve heritage fence alignments,
- Maintain the heritage vista from the house.
- Maintain the fire weeds by spraying, slashing and hand weeding in the short term.

Fencing

Most paddocks are fenced and the fences are in varying condition. The approved recommendation will inform the LMP with regard to which fences require removal, repair or replacement. The definition for the historic curtilage includes those fences / posts that relate to the period of the historic properties will require conservation.

The fences in Beeweeree park cannot be seen because of the density of weed. It is expected that any remnant fencing will be in poor condition and would only have archaeological value.

Wombats are problematic in that they do not respect fences and will ruin any conventional fences to reach their foraging grounds. A system of Wombat sensitive fencing should be trialled and installed to educate/research.

Recommendations:

• Remove all fences and reuse posts at Riversdale and Bundanon,

Drainage

The access road to the house and to the paddocks is in very poor condition.

Recommendations:

- upgraded and table drains installed.
- Inspect and inform council of the road conditions.

Bushland

The bushland has been extensively logged and disused fences indicate that the regrowth areas have also been grazed. Most of this grazing has occurred between the access road to Bundanon and the escarpment to the north. The historic grazing is likely to have occurred prior to the introduction of many weed species reaching the property and prior to motorised pasture improvements ie tilling, exotic pasture grasses being sown and the soil being ameliorated with Phosphate based fertilisers.

The bushland has signs of tree felling, understorey clearing and burning and grazing. It is also highly likely that fires would have been used, too frequently and out of season, to control bushland regrowth. The steep and moderately sloped land below rocky ledges would have been grazed. These pressures have lead to the organic soil horizon, where seed would be stored, being eroded and a correspondingly diminished understorey and paucity of native plants has resulted.

The resilience and weed density (condition) of the bushland is provided later in the LMP however it is noteworthy that the bushland /farmland / creekline interfaces are problematic management zones for any land holder. Bushland will be affected detrimentally by weeds, herbicides, pesticides and fertilisers.

The interface with the creeks and the river down slope of the paddocks is generally in poor condition. The gullies that drain into the paddocks also have a higher density of weeds.

Sediment laden run off from eroding creek banks and paddocks also impacts negatively on bushland.

Recommendations

- Noxious weeds must be treated as required by the Noxious Weeds Act 1993.
- The management of the bushland areas should be undertaken as recommended below.

Visitor Numbers

No visitation numbers are available for Eearie Park because there are no formal facilities on the property to cater for visitors and the property is used primarily as a thorough fare to Bundanon.

Most visitors to the property are river users who beach their water craft at the south-western corner of the property.

Non specific day visitation numbers are not recorded but may be as high as a thousand people each year. Seasonal patterns would correlate strongly with warm season active recreational activity.

Eearie The cost estimates in this Table relate only to general recommendations not covered earlier that will not be covered in development proposals. Description Landscape design master plans and detail \$20-25,000 \$5,000 Surveying Install a new solar pump in the old bore. \$12,000 Grant applications \$5,000 Buy a 12 - 20 tonne Excavator with attachments \$180,000-240,000 **Total Costs** \$68,000

Appendix D

Bundanon Trust

Land ownership details

LAND AND INTERESTS IN LAND REFERRED TO IN THE DEFINITION OF "BUNDANON" IN ARTICLE 2 OF THE CONSTITUTION.

"Bundanon" means all the interests in:

(a) the land described below located in the Parish of Illaroo, County of Camden in the Shire of Shoalhaven namely

(i) an estate in fee simple in respect of portions 14 and 118 and being the land described in Certificates of Title Volume 8356 Folio 119 and Volume 14547 Folio 183;

(ii) as Lessee in respect of Lot 12 under Deposited Plan 751273 Special Lease 1998/1;

(iii) a permissive occupancies in respect of an unnamed portion known as "the Island" under permissive occupancy numbered 1964/38;

(iv) a permissive occupancy in respect of portion 13 and 15 together with interconnecting unnamed Crown reserve under permissive occupancy numbered 1973/28:

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(the "Bundanon property")
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(b) the land located in the Parish of Illaroo, County of Camden in the Shire of Shoalhaven, being an estate in fee simple in portions 16 and 17 being the land described in Folio Identifier 16/751273 and Folio Identifier 17/751273;

(the "Condies property")

(c) the land located in the Parish of Illaroo, County of Camden in the Shire of Shoalhaven, being an estate in fee simple in Lots 101, 224 and 227 Deposited Plan 751273 being the whole of the land described in Certificates of Title Volume 751273 Folios 101, 224 and 227 respectively. Lot 101 is a qualified and limited title pursuant to subsections 28J(1), 28J(1A) and 28T(4) of the Real Property Act 1900; together with a right of way over the land the subject of a Deed of Grant made 31 May 1974 and registered in No 513 Book 3156

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(the "Riversdale property") and
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(d) the land located in the Parish of Illaroo, County of Camden in the Shire of Shoalhaven, being an estate in fee simple in Lot 5 Deposited Plan 622583 being the land described in Folio Identifier 5/622583 such land excludes the roads shown in the Deposited Plan and 30.48 metres of the highwater mark.

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(the "part Eearie Park property")
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Appendix E

Flora Inventory

Land Management Plan for the Bundanon Trust Properties

Appendix F

Fauna Inventory

Land Management Plan for the Bundanon Trust Properties

Appendix G

Council Zonings

Council Zonings

A list of the Council zonings and development controls that relate to the land as stated within the *Shoalhaven Council LEP 1985* and the Draft LEP 2009 is below.

Shoalhaven Council LEP 1985

Zone 1(a): Rural A - Agricultural Production Zone

The objectives of this zone are to conserve and maintain the productive potential of prime crop and pasture land and to ensure that this productive potential is not threatened by nonagricultural land uses. Agriculture is permitted within this zone without development consent, with the exception of land to which clause 21, 23, 25, 27 applies. Clauses which apply to Bundanon are outlined below. The following activities are prohibited within this zone:

- junk yards
- motels
- motor showrooms
- offensive or hazardous industries (other than those which are reliant on prime crop or pasture land)
- residential flat buildings
- service stations
- sexual services premises
- shops
- warehouse

- bulk stores
- bulky good premises
- caravan parks
- car repair stations
- cluster housing
- commercial premises
- dual occupancy development (other than development resulting in attached dwellings
- generating works involving windpowered generators
- hotels
- industries (other rural industries or extractive industries)

Development consent is required for developments other than agriculture and those which are prohibited.

Zone 1(d): Rural D - General Rural Zone

The objectives of this zone are to provide opportunities for a range of rural land uses and other development which require remoteness from urban areas while taking into account the potential for high intensity bushfires and managing this risk accordingly. The objectives also aim to ensure that the design and management of development is consistent with the protection of important natural and cultural environments, the conservation of renewable resources, the maintenance of opportunities for economic development of extractive resources, minimising conflicts between land uses, and any plans for public infrastructure.

Agriculture and forestry are permitted within this zone without development consent, with the exception of land to which clause 21, 23, 25, 27 applies. Clauses which apply to Bundanon are outlined below. The following activities are prohibited within this zone:

- bulk stores
- bulky good premises
- caravan parks
- car repair stations

- cluster housing
- commercial premises
- dual occupancy development (other than development resulting in attached dwellings

- generating works involving windpowered generators
- industries (other rural industries, extractive industries, offensive or hazardous industries)
- junk yards
- motor showrooms

- residential flat buildings
- service stations
- sexual services premises
- shops
- warehouse

Development consent is required for developments other than agriculture and those which are prohibited.

Zone 7 (d1): Environmental Protection D1 - Scenic Zone

The objectives of this zone are to conserve and enhance scenic quality, to protect natural and cultural features of the landscape which contribute to scenic value, and to ensure that development is integrated with the landscape values of the area. All development requires development consent. The following may be undertaken with development consent:

- agriculture
- bed and breakfast accommodation
- camping and caravan parks
- clearing of trees
- dams
- drainage
- dwelling-houses
- generating works (other than windpowered generators)

All other development is prohibited.

Zone 7(e): Environmental Protection E - Escarpment Zone

The objectives of this zone are to protect the scenic, ecological, educational, and recreational values of escarpment areas, to conserve and reinstate (where possible) the natural vegetation to protect steep slopes from erosion and slippage, and to maintain the role of escarpments as habitat links between conservation areas. All development requires development consent. The following may be undertaken with development consent:

- agriculture
 dwelling-houses
 - uwening-nouse:
- bed and breakfast accommodation
- home activities

- home activities
- refreshment rooms
- roads
- tourist facilities
- turf farming
- utility installations (other than gas holders)

- passive recreation facilities
- roads
- tourist facilities
All other development is prohibited.

Clause 21: Land of Ecological Sensitivity

This clause applied to land marked as such on the Shoalhaven Council LEP 1985 map. The objectives of this clause is to minimise adverse impacts of development on natural features including flora, fauna, landforms, and ecological processes. The consent of Council is required for all development, including forestry and agriculture, on land to which this clause applies. Prior to granting consent Council must take into account the objectives of this clause and the adequacy of the measures proposed by the applicant to avoid, mitigate, or remedy and negative impacts of the development on the ecological values of the land and within its vicinity.

Clause 22 - Activities in Zone 1(c), 7(a), 7(c), 7(d1), 7(d2), 7(e), 7(f1), 7(f2) and 7(f3)

Trees with a height of 3m or greater cannot be ringbarked, cut down, topped, lopped, or destroyed without the consent of Council.

Clause 23 - Protection of Streams

This clause applied to any perennial watercourse within Zones 1(a), 1(b), 1(c), 1(d), 1(e), or 1(g). 'Perennial stream' has been defined in the 1985 LEP as meaning "land shown by a continuous blue line on the latest version 1:25,000 scale topographic map for the land to which this clause applies produced by the NSW Land Information Centre and available for public viewing at the office of the Council". The objectives of the clause are to protect water quality, aquatic habitats and riparian communities, to guard against erosion and sedimentation, to protect that scenic and recreational values of the watercourses and their riparian community, and enhance the function of watercourses and their associated vegetation as habitat corridors. Development occurring within 50m of the centre of the watercourse, or from the bank of the watercourse where the watercourse is greater than 20m wide, requires Council consent. Prior to granting consent Council must take into account the objectives of this clause and the adequacy of the measures proposed by the applicant to avoid, mitigate, or remedy and negative impacts of the development on the ecological and aesthetic values of the watercourse and within its vicinity.

Clause 25 - Steep Lands

This clause applies to land within Zone 1(a), 1(b), 1(c), 1(d), 1(e) with a slope of greater than 20% (1:5). The objectives of this clause are to protect against erosion, protect water quality, and protect visual amenity. Council requires consent for any development, including agriculture and forestry, on land to which this clause applies. Before granting consent Council must taken into account the objectives of this clause and the adequacy of the measures proposed by the applicant to avoid, mitigate, or remedy and negative impacts of the development on soils, water quality, or visual amenity.

Division 6: Development in Scenic Preservation Areas (Clauses 41-44)

This division applies to land which is marked as Scenic Preservation Area on the Shoalhaven Council LEP 1985. This division stipulates that development or vegetation clearing within areas

marked as Scenic Preservation Area must be given consent by Council. Prior to giving its consent, Council must decide whether it will impose conditions relating to the use of prescribed materials used on external surfaces of buildings, or the number, type and location of trees to be retained and extent of landscaping to be carried out. Please see the 1985 LEP for definitions of 'prescribed materials' and 'external surfaces'.

Shoalhaven Council LEP 1985

Zone E1: National Parks and Nature Reserves

The objectives of this zone is to identify land to be reserved under the *National Parks and Wildlife Act 1974* and to enable the management and appropriate use of this reserved land. Development is permitted without consent includes uses authorised under the *National Parks and Wildlife Act 1974*.

Zone E2: Environmental Conservation

The objectives of this zone is to protect, manage, and restore areas of high ecological, scientific, cultural or aesthetic values; to prevent development which could destory, damage or negativly affect the aforementioned values; to protect water quality and the ecological integrity of water supply catchments, the scenic, ecological and educational values of wetlands, rainforests, escarpment areas and fauna habitat linkages; and to conserve and restore natural vegetation to prevent erosion and slipping on steep slopes. No development is permitted without consent. The following development is permitted with consent:

- aquaculture
- bed and breakfast accommodation
- dwelling houses
- emergency services facilities
- environmental facilities
- environmental protection works
- home businesses

The following development is prohibited:

- business premises
- hotel or motel accommodation
- industries
- multi dwelling housing
- recreation facilities (major)

- home industries
- recreation areas
- research stations
- roads
- sewerage systems
- water recreation structures
- water supply systems
- residential flat buildings
- retail premises
- seniors housing
- service stations
- warehouse or distribution centres

Zone E3: Environmental Management

The objectives of this zone is to protect and manage areas with special ecological, scientific, cultural or aesthetic values and features including coastal and foreshore areas; to maintain the stability of coastal land forms; and allow for a limited range of development that does not

negatively effect the aforementioned values. Home occupations are permitted without consent. The following is permitted with consent:

- animal boarding or training establishments
- aquaculture
- boast repair facilities
- boat sheds
- building identification signs
- cellar door premises
- charter and tourism boat facilities
- dual occupancies (attached)
- dwelling houses
- emergency service facilities
- environmental protection works
- extensive agriculture
- forestry
- group homes
- helipads

The following is prohibited:

- hotel and motel accommodation
- industries
- multi dwelling housing
- residential flat buildings
- retail premises

- home-based child care
- home businesses
- home industries
- information and education facilities
- kiosks
- markets
- recreation areas
- research stations
- roads
- roadside stalls
- secondary dwellings
- sewerage systems
- tourist and visitor information
- water recreation structures
- water supply systems
- seniors housing
- service stations
- serviced apartments
- warehouse or distribution centres

Zone RU 1: Primary Production

The objectives of this zone are to encourage sustainable primary industry production by maintaining and enhancing the natural resource base; encourage diversity in primary industry and minimise fragmentation and alienation of resource lands; and conserve and maintain the productive potential of prime crop and pasture land and the potential for economic extraction of mineral, sand or hard rock resources. Extensive agriculture and home occupations are permitted without consent. The following is permitted with consent:

- agriculture
- air transport facilities
- boat repair facilities
- boat sheds
- building identification signs
- cellar door premises
- cemeteries
- charter and tourism boat facilities
- community facilities
- crematoria

- dairies (pasture based)
- depots
- dual occupancies (attached)
- dwelling houses
- educational establishments
- entertainment facilities(in conjunction with tourist accommodation)
- environmental facilities
- environmental protection works

- extractive industries
- farm buildings
- food and drink premises
- forestry
- group homes
- home-based child care
- home businesses
- home industries
- horticulture
- information and education facilities
- marinas
- markets
- mining
- moorings
- offensive industries
- places of public worship
- recreational facilities (indoor)
- recreation facilities (major)
- research stations
- roads
- roadside stalls
- rural industries
- tourist and visitor accommodation
- veterinary hospitals
- water recreation structures
- water supply systems

The following development is prohibited:

- hotel and motel accommodation
- pubs
- serviced apartments

Zone RU2: Rural Landscape

The objectives of this zone are to encourage sustainable primary industry production by maintaining and enhancing the natural resource base; to maintain the rural landscape character of the land; to provide for a range of land uses including extensive agriculture and developments which require remoteness from urbane areas. Extensive agriculture and home occupations are permitted without consent. The following is permitted with consent:

- agriculture
- air transport facilities
- boat repair facilities
- boat sheds
- building identification signs
- business identification signs
- caravan parks
- cellar door premises
- cemeteries
- charter and tourism boat facilities
- community facilities
- crematoria
- dairies (pasture based)
- depots
- dual occupancies (attached)
- dwelling houses
- educational establishments
- entertainment facilities(in conjunction with tourist accommodation)
- environmental facilities
- environmental protection works
- extractive industries
- farm buildings
- food and drink premises
- forestry
- freight transport facilities
- funeral homes
- group homes
- hazardous industries
- home-based child care
- home businesses
- home industries
- horticulture
- information and education facilities

- marinas
- markets
- moorings
- offensive industries
- places of public worship
- recreational areas
- recreational facilities (outdoor)
- recreation facilities (major)
- research stations
- roads
- roadside stalls
- rural industries
- tourist and visitor accommodation
- veterinary hospitals
- water recreation structures
- water supply systems

The following development is prohibited:

- hotel and motel accommodation
- pubs
- serviced apartments

Appendix H

Carbon Trading (notes)

The Carbon Farming Initiative, the bill provides for: the types of abatement projects eligible for Australian carbon credit units (ACCUs); requirements for recognition as an offsets entity; eligibility for offsets projects; participation by holders of Aboriginal and Torres Strait Islander land; characteristics of methodology determinations; permanence arrangements for sequestration projects; reporting requirements for offsets projects; a framework for auditing offset reports; the issue and exchange of ACCUs; monitoring and enforcement powers; merits review of decisions; the establishment and functions of the Domestic Offsets Integrity Committee and the Carbon Credits Administrator; and the publication of information and the treatment of confidential information.

House of Representatives: Intro. 24/3/11; Passed 16/6/11

- Carbon Credits (Consequential Amendments) Bill 2011
- Part of a package of three bills to establish the Carbon Farming Initiative, the bill amends the: Anti-Money Laundering and Counter-Terrorism Financing Act 2006 to provide that financial institutions and other persons who buy Australian carbon credit units (ACCUs) are subject to reporting and other obligations; Australian Securities and Investments Commission Act 2001 and Corporations Act 2001 in relation to the regulation of financial services for ACCUs; Australian Securities and Investments Commission Act 2001, Competition and Consumer Act 2010 and National Greenhouse and Energy Reporting Act 2007 to provide for the appropriate exchange of information between administrators; and the National Greenhouse and Energy Reporting Act 2007 to extend the arrangements for reporting transfer certificates beyond 30 June 2011.
- House of Representatives: Intro. 24/3/11; Passed 16/6/11
- PM Carbon Tax Plebiscite Bill 2011
- (Introduced by Mr Abbott LP)
- The bill: provides for a national plebiscite to be held by 26 November 2011 to ascertain whether the electorate supports the introduction of a price on carbon; requires the Electoral Commissioner to provide the minister with a statement of the results of the plebiscite; and requires the minister to table the statement in both Houses of Parliament.
- House of Representatives: Intro. 4/7/11; Negatived at 2nd reading 15/9/11
- PS Carbon Tax Plebiscite Bill 2011 [No. 2]
- (Introduced by Senator Abetz LP)
- The bill: provides for a national plebiscite to be held by 26 November 2011 to ascertain whether the electorate supports the introduction of a price on carbon; requires the Electoral Commissioner to provide the minister with a statement of the results of the plebiscite; and requires the minister to table the statement in both Houses of Parliament.
- Senate: Intro. 21/6/11; 2nd reading adjourned 21/6/11, 7/7/11, 15/9/11

Appendix I

Landscape Assessment CAB 2011

Appendix J

Shoalhaven Noxious Weeds List

List generated from NSW Dept Primary Inustries Website October 2011. Will require regular revision. (http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed)

Weed	Class	Legal requirements
African boxthorn [Lycium ferocissimum]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
African feathergrass [Pennisetum macrourum]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
African lovegrass [Eragrostis curvula]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
African turnipweed [Sisymbrium runcinatum]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
African turnipweed [Sisymbrium thellungii]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Alligator weed [Alternanthera philoxeroides]	2	The plant must be eradicated from the land and the land must be kept free of the plant
Anchored water hyacinth [Eichhornia azurea]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Annual ragweed [Ambrosia artemisiifolia]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Arrowhead [Sagittaria montevidensis]	4	The plant must not be sold propagated or knowingly distributed
		This is an All of NSW declaration
Artichoke thistle [Cynara cardunculus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Athel pine [Tamarix aphylla]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Bathurst/Noogoora/Hunter/South American/Californian/cockle burr [Xanthium species]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Bear-skin fescue [Festuca gautieri]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Bitou bush [Chrysanthemoides monilifera subspecies rotundata]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Black knapweed [Centaurea nigra]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Blackberry [Rubus fruticosus aggregate species] except cultivars Black satin Chebalem	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must
Chester Thornless Dirkson Thornless Look		not be sold propagated or knowingly distributed
Choster HIGHIESS DIRSCH HIGHIESS LUCH		

Ness Murrindindi Silvan Smooth stem Thornfree		This is an All of NSW declaration
Boneseed [Chrysanthemoides monilifera 2 subspecies monilifera]	2	The plant must be eradicated from the land and the land must be kept free of the plant
Bridal creeper [Asparagus asparagoides] 4	ŀ	The plant must not be sold propagated or knowingly distributed
Broomrapes [Orobanche species] 1 Includes all Orobanche species except the		The plant must be eradicated from the land and the land must be kept free of the plant.
native O. cernua variety australiana and O. minor		This is an All of NSW declaration
Burr ragweed [Ambrosia confertiflora] 5	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Cabomba [Cabomba species] 5 Includes all Cabomba species except C	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
furcata		This is an All of NSW declaration
Cayenne snakeweed [Stachytarpheta 5 cayennensis]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Chilean needle grass [Nassella neesiana] 4	ļ	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed
Chinese violet [Asystasia gangetica 1 subspecies micrantha]		The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Clockweed [Gaura parviflora] 5	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Corn sowthistle [Sonchus arvensis] 5	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Crofton weed [Ageratina adenophora] 4	ļ	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Dodder [Cuscuta species] 5	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
native species C australis C tasmanica		This is an All of NSW declaration
and C victoriana		
East Indian hygrophila [Hygrophila 4 polysperma]	ļ	The plant must not be sold propagated or knowingly distributed
English broom [Cytisus scoparius]		See Scotch broom
Espartillo [Amelichloa brachychaeta, 5 Amelichloa caudata]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Eurasian water milfoil [Myriophyllum 1 spicatum]		The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Fine-bristled burr grass [Cenchrus brownii] 5	5	The requirements in the Noxious Weeds Act 1993 for a

		notifiable weed must be complied with
		This is an All of NSW declaration
Fireweed [Senecio madagascariensis]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Fountain grass [Pennisetum setaceum]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Gallon's curse [Cenchrus biflorus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Giant Parramatta grass [Sporobolus fertilis]	3	The plant must be fully and continuously suppressed and destroyed
Glaucous starthistle [Carthamus glaucus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Golden dodder [Cuscuta campestris]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Golden thistle [Scolymus hispanicus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Gorse [Ulex europaeus]	3	The plant must be fully and continuously suppressed and destroyed
Green cestrum [Cestrum parqui]	3	The plant must be fully and continuously suppressed and destroyed
Groundsel bush [Baccharis halimifolia]	3	The plant must be fully and continuously suppressed and destroyed
Harrisia cactus [Harrisia species]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed
		This is an All of NSW declaration
Hawkweed [Hieracium species]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Heteranthera [Heteranthera reniformis]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Horsetail [Equisetum species]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Hydrocotyle [Hydrocotyle ranunculoides]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Hygro [Hygrophila polysperma]		See East Indian hygrophila
Hymenachne [Hymenachne amplexicaulis and hybrids]	s 1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Karoo thorn [Acacia karroo]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration

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Kochia [Bassia scoparia]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
trichophvlla	1	This is an All of NSW declaration
Kosters curse [Clidemia hirta]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Lagarosiphon [Lagarosiphon major]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Lantana [Lantana species]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed
Leafy elodea [Egeria densa]	4	The plant must not be sold propagated or knowingly distributed
		This is an All of NSW declaration
Lippia [Phyla canescens]	4	The plant must not be sold propagated or knowingly distributed by any person other than a person involved in hay or lucerne production and the growth of the plant must be managed in a manner that reduces its spread and continuously inhibits its reproduct
		This is an All of NSW declaration
Long-leaf willow primrose [Ludwigia longifolia]	4	The plant must not be sold propagated or knowingly distributed
Mexican feather grass [Nassella tenuissima]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Mexican poppy [Argemone mexicana]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Miconia [Miconia species]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Mikania [Mikania micrantha]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Mimosa [Mimosa pigra]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Mistflower [Ageratina riparia]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed
Mossman River grass [Cenchrus echinatus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Nodding thistle [Carduus nutans]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Noogoora burr [Xanthium species]		See Bathurst/Noogoora/Hunter/South American/Californian/cockle burr
Pampas grass [Cortaderia species]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and

			continuously inhibits its reproduction
Parthenium weed hysterophorus]	[Parthenium	1	The plant must be eradicated from the land and the land must be kept free of the plant.
			This is an All of NSW declaration
Pond apple [Annona glabra]		1	The plant must be eradicated from the land and the land must be kept free of the plant.
			This is an All of NSW declaration
Prickly acacia [Acacia nilotica	a]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
			This is an All of NSW declaration
Prickly pear [Cylindropuntia s	pecies]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed
			This is an All of NSW declaration
Prickly pear [Opuntia species] Includes all Opuntia species ficus-indica] es except O.	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed
			This is an All of NSW declaration
Privet (Broad-leaf) [Ligustrum	n lucidum]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its flowering and reproduction
Privet (Narrow-leaf/Chinese sinense]	e) [Ligustrum	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its flowering and reproduction
Red rice [Oryza rufipogon]		5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
			This is an All of NSW declaration
Rhus tree [Toxicodendron su	ccedaneum]	4	The growth of the plant must be managed in a manner that prevents any above ground part the plant from encroaching within 2 metres of the property boundary and the plant must not be sold propagated or knowingly distributed
			This is an All of NSW declaration
Rubbervine [Cryptostegia gra	ndiflora]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
			This is an All of NSW declaration
Sagittaria [Sagittaria platyphy	/lla]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
			This is an All of NSW declaration
Salvinia [Salvinia molesta]		2	The plant must be eradicated from the land and the land must be kept free of the plant
Scotch broom [Cytisus scopa	rius]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Senegal tea plant [spilanthoides]	[Gymnocoronis	1	The plant must be eradicated from the land and the land must be kept free of the plant.
			This is an All of NSW declaration
Serrated tussock [Nassella tri	ichotoma]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed
Siam weed [Chromolaena od	orata]	1	The plant must be eradicated from the land and the land

		must be kept free of the plant.
		This is an All of NSW declaration
Smooth-stemmed turnip [Brassica barrelieri subspecies oxyrrhina]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Soldier thistle [Picnomon acarna]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Spotted knapweed [Centaurea stoebe subspecies micranthos]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
St. John's wort [Hypericum perforatum]	3	The plant must be fully and continuously suppressed and destroyed
Texas blueweed [Helianthus ciliaris]	5	The requirements in the Noxious Weeds \mbox{Act} 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration
Tropical soda apple [Solanum viarum]	2	The plant must be eradicated from the land and the land must be kept free of the plant
Water caltrop [Trapa species]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Water hyacinth [Eichhornia crassipes]	3	The plant must be fully and continuously suppressed and destroyed
Water lettuce [Pistia stratiotes]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Water soldier [Stratiotes aloides]	1	The plant must be eradicated from the land and the land must be kept free of the plant.
		This is an All of NSW declaration
Willows [Salix species]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
habylonica S x reichardtii S x		This is an All of NSW declaration
caledondron		
Witchweed [Striga species]	1	The plant must be eradicated from the land and the land
Striga species except the native Striga	•	must be kept free of the plant.
ounga species except the native Stinga		This is an All of NSW declaration
Vellow burrhead [] impocharis flava]	1	The plant must be eradicated from the land and the land
	I	must be kept free of the plant.
	-	I his is an All of NSW declaration
renow nutgrass [Cyperus esculentus]	5	ne requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
		This is an All of NSW declaration

Control class	Weed type	Example control requirements
Class 1	Plants that pose a potentially serious threat to primary production or the environment and are not present in	The plant must be eradicated from the land and the land must be kept free of the plant.
	the State or are present only to a limited extent.	The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 2	Plants that pose a potentially serious threat to primary production or the environment of a region to which the	The plant must be eradicated from the land and the land must be kept free of the plant.
	order applies and are not present in the region or are present only to a limited extent.	The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 3	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.	The plant must be fully and continuously suppressed and destroyed.*
Class 4	Plants that pose a potentially serious threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.*
Class 5	Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the	There are no requirements to control existing plants of Class 5 weeds.
	State, to spread in the State or outside the State.	However, the weeds are "notifiable" and a range of restrictions on their sale and movement exists.

Appendix K

Bundanon Paddock Plan 2010