CASINO MANAGEMENT AREA EIS

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ARCHAEOLOGICAL REPORT
CASINO MANAGEMENT AREA
NORTHERN REGION
STATE FORESTS OF NEW SOUTH WALES

by

Roger Hall & Kim Lomax

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ABSTRACT

This report has four main aims: 1/ to outline the broad nature of Aboriginal cultural heritage to provide a framework in which to develop effective strategies for Aboriginal consultation; 2/ to describe the archaeological potential of Crown-timber lands within the Grafton District; 3/ to identify the nature of past and ongoing impacts of forestry operations on the predicted archaeological resource; and 4/ to recommend measures for mitigating future impacts.

Previous literature and discussions with Aboriginal Land Council representatives are used to identify the types of Aboriginal sites that may occur in Crown-timber lands, and the range of issues involved in assessing the value of these sites to Aboriginal people. This information provides the basis for making recommendations regarding the need for regular, locally-based consultation with Aboriginal communities as a measure for incorporating Aboriginal values into forest management.

The report sets out an environmental model as a basis for selecting sample archaeological survey areas and for predicting the location of archaeological materials. The study area is divided into a number of "archaeològical landsystems" each with different environmental constraints for site location. Predictive statements are made concerning the likely nature of the archaeological resource within these landsystems in terms of a standard set of environmental variables. The field survey then generates data that is used to test some of the assumptions made in the initial projections.

Seventy-four stone artifact scatters (Artifact Occurrences) were located during the survey. These sites range in size from a single artifact to potentially many hundreds of stone artifacts, although most are small. Two rockshelter sites were located: one containing a single axe and one with a deposit of archaeological materials. One scarred tree was also located.

The dispersed but continuous nature of the archaeological record is demonstrated by the survey. Terrain is identifed as a major environmental variable in predicting the pattern of site distribution within landsystems. The results of the survey indicate the need for further research to validate and refine some of the patterns identified during the current study.

The general history of non-Aboriginal activities and predicted impacts in forests is described. This in addition to the general pattern of site distribution, is used to prioritise areas requiring mitigation measures to offset future impacts.

It is argued that archaeological values are best maintained by identifying and protecting representative archaeologically sensitive areas rather than limiting mitigation measures to the narrow set of known sites. The approach envisaged is the formulation of a reserve methodology that maintains archaeologically representative areas. This approach will run concurrently with the existing site-based management methodology as defined by current legislation to ensure that sites of significance outside of reserve areas are protected.

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1. INTRODUCTION

1.1 Scope

This is a report on an Aboriginal archaeological investigation of the Casino District comprising the former Casino and Murwillumbah Districts (hereafter also referred to as the "study area") undertaken for the Forestry Commission's Casino Environmental Impact Statement. As very little archaeological survey had been undertaken previously in the forests of the study area, this study is perforce a broad predictive assessment of the archaeological resource and the impacts upon it. In tandem with a regional predictive approach, the study has a substantial field component designed to develop, and to some extent test, the predictive assessment.

Although there had been little archaeological survey in the study area's forests a number of sites of Aboriginal significance had been recorded through consultations with Aboriginal communities. Some of these sites are located within state forest and other Crown-timber lands. Information concerning these sites is reviewed with an eye to showing the broad range of Aboriginal values that may be represented in forests and to provide a framework in which to address them in the future.

1.2 Aims

The aim of this study is to:

(a) Develop a predictive model of site location and archaeologically sensitive areas that can be used by the Forestry Commission as the basis for planning and management of Aboriginal archaeological sites.

(b) Consider the impact of the proposed activities on the archaeological resource and recommend an on-going monitoring programme that aims to protect a representative portion of the resource.

(c) Consult with Aboriginal Land Councils regarding this archaeological work and future strategies for consultation regarding management for Aboriginal values.

1.3 The Study Area

The study area is all native hardwood state forests (including proposed state forest) together with Crown-timber lands proposed for dedication as state forests within the Casino Forestry District (see appendix 1a & b). The area available for harvesting is approximately 146 000 ha and covers 36 state forests.

2. GENERAL APPROACH

It is important at the outset to distinguish cultural values, particularly those held by Aboriginal people, from scientific values established by archaeologists. While their may be some degree of overlap and inter-dependence between the two value systems they nevertheless require different modes of assessment. This report is primarily a study of archaeological values, although it also discusses the nature of Aboriginal values to provide a framework for future consultations between the Forestry Commission and the Aboriginal community.

For the purposes of this study the two value systems are addressed in the following way. Previous literature and discussions with Aboriginal Land Council representatives are used to identify the types of Aboriginal sites or values that may be represented in Crown-timber lands, and the range of issues involved in assessing these and how they may be incorporated into management procedures. With regard to archaeology, a land systems-based environmental model is set out for mapping different levels of archaeological sensitivity across the study area, predicting impacts and developing site management guidelines.

2.1 Predictive Modelling

Due to the large size of the study area it was decided that the only practical survey strategy would employ an approach known as predictive modelling often used in regional archaeological studies (e.g. Cosgrove 1990; Hughes & Sullivan 1984; Witter 1984a). This approach uses known Aboriginal settlement/economic patterns or site locations supplemented by field testing to model where economic sites are likely to be on the landscape. First, the previous literature is reviewed to find basic patterns in site distribution. Second, these patterns are then modified according to the particular environmental characteristics for specific areas to form a predictive model of site location. Thirdly a sampling and survey strategy is designed that will test the model so formulated. The results of the survey are then used to refute, confirm or modify aspects of the model.

2.2 Use of Land Systems

In order to develop and test such a model it is necessary to have an environmental framework that acts as a common reference for 1/ erecting the model and 2/ testing the model.

The environmental framework utilised here is referred to as a "land systems model". This characterises the total environment of the study area in terms of a number of variables likely to affect prehistoric site location, for example the availability of water and ruggedness of the terrain. In addition a number of variables likely to affect site detection are also measured (ie ground cover vegetation, geomorphological regime). To formulate a predictive model the survey is designed to sample the total range of the environment, giving equal attention to measuring environmental variables where sites do not occur as to where sites do occur.

Many of the variables relevant to prehistoric site location relate to topography (terrain) and the availability of resources that could be utilised by hunter-gatherers. In the case of areas of marked relief such as much of the study area, topography is a useful indicator of a number of ecological parameters influencing past Aboriginal use of the forest. Rugged terrain has the affect of limiting usable land to areas of relative flatness, which in turn means that the location of travelling routes and camp site locations conforms to specific characteristics of the terrain. Hence where terrain restricts human movements site location is both more restricted and predictable than for areas where the topography is flat such as lowland areas. Secondly, with the ecological variability that comes with high relief there is a tendency for food resources to be configured on the landscape in the same way over long periods of time. This also is likely to enhance the "predictability" of the location of hunting and gathering sites in upland areas. Of course the problems of predicting where sites might be located in lowland forests or in flat plateau areas are correspondingly greater and will be discussed below (cf. Foley 1981).

3. ABORIGINAL CONSULTATION

The present study area falls within the Far North Coast Regional Aboriginal Land Council's boundary. The author initially discussed the project and scope of consultation that would be necessary with Dallas Donnelly, Coordinator of the Far North Coast Regional Aboriginal Land Council.

Subsequently the author was invited by the Regional Aboriginal Land Council to address their Annual General Meeting on 28 February 1992 at which all Local Land Council representatives were present to explain upcoming archaeological survey work for the Grafton and Casino Environmental Impact Statements.

Several points were made in the course of this meeting. Firstly the Land Councils expected local people be paid to work with the archaeologist whenever he was in the field in their areas. Secondly, elders had the final say on what was significant in an area. And finally Local Aboriginal Land Councils wanted to see a draft report before it was incorporated in the Environmental Impact Statement.

The study area includes parts of the following Local Aboriginal Land Councils (see Appendix 2a&b):

Yaegl (based at Maclean) which covers the southern part of Gibberagee and Banyabba State Forests; Bogal (based at Coraki) which covers a large tract of forests between Mount Marsh and Doubleduke State Forests; Casino-Boolangle (Casino) which covers forests to the east of the Richmond Range and north of Rappville; Baryulgil which covers forests to the south-west of Mt. Belmore State Forest; Jana-Ngalee (based at Malabugilmah) which covers forests to the west of Mt. Belmore State Forest; Jubullum (based at Tabulam) which covers forests on the west side of the Richmond Range and to the north of Mount Pikapene; Gugin Gudduba (based at Kyogle) which covers Bungabbee State Forest and part of the top of Richmond Range State Forest; Ngulingah (based at Lismore) and Jali (based at Wardell) which do not contain areas of forest managed by the Forestry Commission with the exception of the Big Scrub Flora Preserve which overlaps with the northern boundary of Ngulingah Local Aboriginal Land Council; Tweed-Byron (based at Tweed Heads) which covers all the Murwillumbah forests.

Letters and maps were sent to each of these Local Aboriginal Land Councils and to the Regional Aboriginal Land Council explaining the aims and scope of the project and setting a schedule of meetings to discuss it. Consequently meetings were held with each of the following Local Aboriginal Land Councils to discuss the project. The following representatives were present at the meetings:

Casino Boolangle	Robert Cameron
Gugin Gudduba	John Roberts
Bogal	Alan Williams Harry Brown
Baryulgil	Karen Freeburn Robert King
Jana-Ngalee	Albert Robinson (senior) Mary Robinson
Jubullum	Eric Walker Una Walker
Tweed-Byron	Sam Lever Frank Krasna

Dallas Donnelly of the Regional Aboriginal Land Council was to have attended a meeting involving several of the Local Aboriginal Land Councils held at the Region's office but at the last moment was unable to attend and no one else was able to replace him from the Region at short notice. The outcomes of these meetings were outlined in a letter that was sent to the Regional Aboriginal Land Council.

The meetings discussed the scope of the work, appointment of a local representative to work with the author in the field and an appropriate fee scale.

At these meetings the maps showing the relationship of the respective Local Aboriginal Land Council boundaries to Crown-timber land boundaries were given out (see appendix 2a&b). People were asked to render what assistance they could in the way of letting people in their area know what the author was doing and for any information or concerns relating to sites and the survey work proposed to be relayed back. It was understood that at the next Local Aboriginal Land Council meeting these matters would be discussed and an Aboriginal assistant appointed to work with the author in the field.

Reservations were expressed by the Local Aboriginal Land Councils regarding the amount that could be achieved in the space of time available for fieldwork (see below). They did not want to see the issue of Aboriginal sites sold short. It was explained that the aim of the archaeological study was merely to sample forested areas in the time that was available and only draw conclusions from the study that were reasonable in view of the obvious limitations on survey coverage. Also the author would not be representing Aboriginal interests other than to describe its broad nature so that the Forestry Commission can develop effective consultation with communities. It was agreed that the Regional Land Council and each Local Land Council would receive a draft report to comment on.

The following people, listed with the Local Aboriginal Land Councils they represent, worked with the author in the field some or all of the time indicated for each Local Aboriginal Land Council.

Yaegl	2 days	Joanne Randall
Bogal	5 days	Alan Williams Lewis Williams Ron Nixon Harry Brown (Coordinator)
Baryulgil	4 days	Bob King
Malabugilmah	4 days	Albert Robinson Jnr.
Jubullum	4 days	Eric Walker Steve Walker Kevin Walker
Casino	5 days	Robert Caldwell
Gugin Guddaba	2 days	John Roberts
Tweed-Byron	5 days	William Follent

Apart from discussions with people who participated in the archaeological fieldwork and Local Aboriginal Land Council meetings brief consultations were held with several other Aboriginal community members in the region including Ken Gordon (Malabugilmah), Audley Hickling (Casino Local Aboriginal Land Council), and John Roberts (Chairman, Far North Coast Regional Aboriginal Land Council). The Regional Land Council also made a submission to the EIS consultants (appendix 11) and provided comments on the draft report (appendix 13).

A report written by Aboriginal consultant William Follent on his survey work with the author in the Murwillumbah forests has been included at the request of the Tweed Byron Local Aboriginal Land Council (appendix 12).

4. HISTORICAL CONTEXT

The history of Aboriginal land use is briefly outlined. This is to provide the context for a description of site types that may occur in forests and also to show the main historic themes associated with them. This then leads into a general consideration of Aboriginal values that may apply to forests in the study area.

4.1 Sources and Approaches

The possible sources that could be used in a construction of an Aboriginal history of the study area are secondary sources, unpublished documentary evidence such as settlers diaries, and oral history. To deal with each of these sources comprehensively requires separate projects and is beyond the scope of the present impact assessment. Some previous studies that have utilised this material are reviewed below in order to provide a broad understanding of Aboriginal cultural heritage. Information concerning pre-contact land use patterns is summarised in some detail due to its relevance to predicting archaeological site locations.

4.2 Traditional Land Use

The study area is within the territory of the Bundjalung. Traditionally the Bundjalung occupied an area of 36 000 square kilometres between the Brisbane River and the Clarence River, and inland as far as Tenterfield in the south and Warwick in the north (Gardner 1991). The term "Bundjalung" refers to a "collection of territorially distinct groups or clans, speaking a set of related dialects and sharing a common core of cultural features" (Gardner 1991). The Bundjalung have remained a "coherent, self-identifying group in continuous occupation of their traditional lands" (Gardner 1991:9). This is at odds with experiences of many tribal people elsewhere where the dislocation resulting from the reserve system was such that it destroyed their traditional local identity.

There have been a number of reviews of ethnohistoric sources dealing with traditional land use patterns for the Northern River country (the area corresponding to the Grafton and Casino Forestry Districts) (Byrne 1987; Coleman 1982; McBryde 1974,1982; Pierce 1978; Piper 1976; Sabine 1970; Steele 1984; Sullivan 1978). Also of relevance is Lilley's (1984) study of south-east Queensland and Feary's (1989) study of Aboriginal use of forests in the south coast of New South Wales.

There are very few references to Aboriginal use of forests other than fairly general ones regarding Aborigines coming or going into forests for hunting. This is not surprising considering that early European observers would generally have been outside forests looking in and avoiding the thicker scrub and forests (Byrne 1987). Nevertheless from these studies it is possible to derive a number of models of Aboriginal land use that may be applicable to Crown-timber lands in the study area.

From her analysis of historic sources Sullivan (1978) concluded that there were two subsistence economies in the Richmond and Tweed River areas, one focused on the coast with some seasonal movement inland in winter and one primarily exploiting the inland riverine environment with some peripheral movement into upland forests when the lowlands were flooded. Citing the observations of early settlers, Sullivan says the Aborigines moved inland in the winter (moving mostly along the rivers) and returned to the coast during the spring.

McBryde (1974) emphasises a more seasonal model for the Clarence. She suggests that tribal groups moved in an annual round between the coast and foothills of the tablelands. In a similar vein Sabine (1970) notes that according to oral tradition Aborigines from Nymboida in the foothills visited the coast in the late summer and winter months.

Coleman (1982) emphasises a more sedentary, less seasonal model for groups on the north coast saying they moved from major site to major site along the coast rather than making extensive, frequent forays inland. Similarly to Coleman, Byrne (1986:47) suggests a very strong orientation towards the coast in the Maclean Shire by the Yuraygir (based at the Clarence River mouth) with low-level use of the Maclean Shires uplands (Coast Range) by small highly mobile groups engaged in hunting and gathering the relatively dispersed resources of this area. Byrne's model maintains that major lines of movement were located along the Clarence River valley with secondary lines of movements along ridge lines and spurs in the uplands.

In his study of Aboriginal use of New South Wales rain forests Byrne (1987) provides a general model for forests of the north coast uplands. As for the Maclean uplands Byrne characterises the Aboriginal landuse of these areas as largely transitory with movements of small mobile groups along watercourses and/or ridge lines as dictated by topography. Small camp sites would be located along these lines of movement. These sites could also be predicted to occur in rockshelters where present.

A model for the Aboriginal use of sub-coastal lowlands and uplands such as the study area has been put forward for south-east Queensland (Lilley 1984). This model proposes the existence of two separate land using populations, one focused on inland and the other on coastal resources. Particularly relevant to the present study is Lilley's model of the movements and changing group size of the inland population based on an assessment of the seasonal availability of key food resources. The model proposes that during summer when rainfall was high and non-perennial streams were flowing, small mobile dispersed groups of people were focused along major tributary streams in the foothills. This provided access to associated fringing/aquatic zones as well as upland and lowland resources. In winter when streams were generally dried up except for in the riverine zones, the population was focused on the lowland rivers. Because of the lack of available water, group movement in winter is seen as occurring short distances along or around these focal water sources.

The nature of coastal and the immediate hinterland economies has been considered by Feary (1989) in relation to the south coast of New South Wales and may be instructive for the present case. Like Lilley she suggests that Aboriginal groups were divided territorially into those that exploited the coast and those that exploited the hinterland. This division into two different land-using groups she suggests is reflected in the archaeology of the two zones.

For the coastal groups base camps are located on or within the vicinity of the coast. Smaller sites are also expected to occur within a days foraging range (3-12 km) reflecting the movements of people from these base camps in search of food and resources. The absence of major archaeological sites greater than this distance from the coast is offered as evidence in support of this model of group movement restricted to the coast.

She suggests that the hinterland using group did not have access to the coast and focused on a strategy exploiting a wide range of locally abundant resources. Base camps are predicted to occur on the boundary between forests and swamps or grassland adjacent to major watercourses. The remains of open camp sites of varying sizes (stone artifact scatters) are widely distributed throughout the country reflecting the opportunistic use of a wide range of locally abundant resources.

To summarise the models generally envisage occupation of forests (as defined by the present location of state forest) as transitory and occurring on a seasonal basis by small mobile groups.

4.3 Aboriginal History

Parallel with the archaeologist's concern for land use patterns has been the investigations by historians and anthropologists of the interaction between white and black culture (Prentis 1972;1984). Although anthropologists in the early days focussed on reconstructing pre-contact social organisation (Radcliffe-Brown 1929, Tindale 1974) there has been a shift towards looking at the interaction of the cultures since by both anthropologists and historians (e.g. Creamer 1975; Morris 1989; Prentis 1984).

In the last two decades white historians have shifted to view history more from the point of view of the Aborigines. This is epitomised by the increasingly wider acceptance now that Australia was invaded rather than settled and that Aborigines fought hard against the invasion and are still oppressed by processes that began then (Reynolds 1981). There is much history yet to be absorbed by the broader community regarding the treatment of Aboriginal people not only during the initial phase of white "settlement" but also under the Aboriginal Protection Welfare Board. Some of the events during this time and places associated have attained deep symbolic significance to Aboriginal people, symbols of their struggle against personal and institutionalised racism. Some of these will be mentioned below.

In the past Aboriginal history has been written by white academics. However, recently histories or Aboriginal site interpretations have been written by Aboriginal people who are now gradually moving towards an active role in creating their past and using it to transform the present (e.g. Kelly 1979; Nayutah & Finlay 1988). It was noted during consultations for this study that In many communities there is a strong traditional Aboriginal cultural resurgence and talk of revitalising the contemporary culture by reactivating initiation sites. This move is often linked with the sharing of culture with whites, specifically the education of children about Aboriginal culture.

Places associated with Aboriginal history during and after the invasion, for example; massacre sites, burial grounds and missions/reserves are of great significance to Aboriginal people. Many of these latter sites if not actually in state forest or other Crown-timber lands, are very near to them and people's historic associations with such places extend into the surrounding forested country.

Initially mountainous country to the west of Grafton and Casino were refuges from the onslaught of white invasion, they then became part of the environment of Aborigines living on reserves and a work place (Byrne 1987;Rich 1990). For example regional bullock trails and droving trails are known to Aborigines throughout the study area.

Forests and the clearance of forests played a significant role in the interaction of black and white cultures (Byrne 1987; Sullivan 1978; Walters 1988). At first it was the cedar getters who used Aborigines as cedar spotters and then as labourers to get timber to the Tweed, Clarence and Richmond Rivers. This process advanced upstream from the coast. When the cedar was exhausted the settlers moved in and began clearing the lands along the rivers gradually moving further upstream into the more mountainous and hilly country and gradually broadening the band of cleared land. By this time there were violent clashes between Aborigines and settlers although the process of settlement continued inexorably with Aborigines either being forced to participate as servants in white society to survive or forced back even further into more rugged country to carry on the fight. Both on the tablelands and on the other side of the escarpment in the current study area, Aborigines carried on guerrilla warfare up until the 1870s (Campbell 1978; Prentis 1972).

This pattern of dispossession progressing from the lowlands to the highlands is aptly captured by the words of an early pastoralist in his rendition of what was said to him by an Aboriginal man during a peace parley on the Upper Clarence(Yugilbar station):

> Begone, begone and take away your horses - why do you come hither among the mountains to disturb us? Return to your houses in the valley, you have the river and the open country, and you ought to be content, and leave the mountains to the black people. Go back - keep the plains, and leave us the hills. (Ogilvie cited in Farwell 1973).

Eventually the surviving Aborigines adopted fringe dwelling and economic dependence on white settlers as the only means for their continued existence. Most runs in the open parts of the study area employed Aborigines as stockmen, shepherds and servants (Rich 1990:99).

After the 1880's official reserves or "missions" were established under the Aboriginal Protection Board and people were made to live on small blocks under the control of Government appointed managers. On the North Coast many of the mission communities were able to maintain links with their former lands (Byrne 1985:10). This continuing link with tribal lands enabled important ceremonies such as initiations and burials to be continued late into the century. Even today traditional knowledge of ceremonial and occupation sites is retained by some elders.

4.4 Aboriginal Values

The only means to establish the Aboriginal significance of places is through oral histories or testimonies from Aboriginal people. Apart from the inclusion of a submission made by John Roberts (Chairman Far North Coast Regional Aboriginal Land Council) and the consultations described above this has not been formally attempted in this report. Rather a list of values is provided to illustrate the range and complex nature of the issues to be considered in future consultations. Whilst this list is discussed in terms of economic, religious/spiritual, political and cultural values it should be noted that these values are conceptually intermingled and are separated only to convey a general feeling of the issues involved.

The following statement provides a position statement on Bundjalung values regarding sites in forests. This statement is part of a submission to the EIS consultants by John Roberts in September 1992 on behalf of the Far North Coast Regional Aboriginal Land Council. A copy of this submission is included in appendix 11.

> To the Bundjalung people the forest areas have the value of:
> * protecting and maintaining sites.
>
> The function of sites are:
> * personal identity for all Bundjalung people
> * cultural continuity of Bundjalung culture
> * accessibility of spiritual power to all Bundjalung people
>
> The value of sites to Bundjalung are:
> * essential for Bundjalung individuals to attain adulthood and full identity
> * essential for continuity of Bundjalung culture
> * essential for spiritual dimension of Bundjalung culture to exist.

The following list is compiled from observations made by researchers of Aboriginal sites in forests and all have been reiterated to the author explicitly or implicitly during the course of archaeological fieldwork with local Aboriginal people or consultations with land councils.

4.4.1 Economic Value

Traditionally forests have been a source of food and valued resources for Aborigines. Since the arrival of Europeans forests have continued to be utilised as a source of food and traditional medicines by Aboriginal people During the reserve/mission period great reliance was placed on this source (Byrne 1987). Not many field trips were made during the present archaeological survey where the delights of eating "porcupine" were not mentioned. In the bush older people often comment on the many edible and medicinal plants used by the old people. People from many different communities in the Casino District regularly hunt in the bush for game.

In addition to providing food and resources forests are historically a source of employment for Aboriginal people, however contemporary employment of Aboriginal people in the forest industry is lower than in the past (Byrne !987:107; Feary 1989:190).

4.4.2 Religious/spiritual Value

Traditionally and historically forests have been places of considerable religious and spiritual value to Aboriginal people both in terms of tracts of country and specific sites. Traditionally the ritual maintenance of sacred places and sites has ensured the continuing health of both the land and its people. Whilst historically the visiting of sites by Aboriginal people has been disrupted, a knowledge of sacred sites and places in forests is retained by Aboriginal elders (Bowdler 1983; Byrne 1987).

Whilst not all Aboriginal people retain specific knowledge of Aboriginal sacred sites there is a widespread belief that sites in general (including archaeological sites) have an inherent religious/spiritual significance to Aboriginal people (cf. Feary 1989:192). Generally this perception of sites militates against the idea that non-Aboriginal people can comment on the significance of sites whether they be sacred or non-sacred. For example, the author was often told by representatives of Local Land Councils that sites should be identified by members of the local Land Council rather than by white consultants.

4.4.3 Political value

All Aboriginal sites regardless of whether they are archaeological sites, mythological or ceremonial sites can be interpreted as evidence of prior ownership by Aboriginal people. On this basis they are of considerable political value to Aboriginal people (cf. Feary 1989:192; Bowdler 1983:26-7).

4.4.4 Cultural value

Aboriginal sites, whether they relate to pre-European tradition, the historic period or are simply sites identifed by archaeologists, are important symbolic and educational elements in the cultural resurgence presently taking place amongst Aboriginal communities. They have the potential to empower Aboriginal people by providing tangible evidence of their cultural identity. Uncleared often rugged land such as that occupied by forests are regarded as an important receptacle of the Aboriginal sites that have survived colonisation (Feary 1989). Not only this, Byrne (1987:109) suggests that the landscape itself in mountainous areas is part of Aboriginal cultural heritage because its "untouched" appearance provides a link to the traditional landscape.

5. SITES OF CULTURAL SIGNIFICANCE TO ABORIGINAL COMMUNITIES

The preceding section has provided a broad framework in which to consider in this section specific detail concerning the range and possible distribution of different Aboriginal site types in the study area and what kind of significance might be attributed to them.

5.1 General concepts

There is a range of Aboriginal site types varying both in degrees and types of significance. Sites types also range in their degree of commonness from common to rare. Many site types are likely to be rare on Crown-timber lands in the study area, however a discussion of them as a whole is relevant to developing a broad understanding of Aboriginal cultural heritage. In addition a comprehensive knowledge of the range of site types that may possibly occur within Crown-timber lands is a necessary prerequisite to the development of effective strategies to mitigate future impact.

A distinction may first be drawn between Aboriginal archaeological sites and the broader term, Aboriginal sites. Archaeological sites are the physical remains of past human activities, including modifications to the landscape. Physical evidence for activity can range from a stone artifact to a bora ground surrounded by carved trees. The full range of archaeological site types that could potentially occur in the area are described in the next section.

Aboriginal sites also encompass sites of Aboriginal significance which do not necessarily contain artifacts or modifications to the landscape. An example is a natural landscape feature that has mythological and/or ceremonial associations, such as a mountain peak or a water hole. Another example is a traditional or historic campsite where no archaeological remains have yet been recorded.

Aboriginal sites (including archaeological sites) encompass both the pre-contact (prehistoric) and post-contact (historic period). Many sites of significance to Aboriginal people pertain to the historic period, such as missions, burial grounds and camping places. Many of these sites of Aboriginal significance have been recorded in the vicinity of state forests, and as yet unrecorded sites may occur in state forest.

Whether or not Aboriginal communities retain traditional or historic knowledge of them, all archaeological sites are of potential significance to Aboriginal people in the context of their general sense of community with past generations (Bowdler 1983:26). The author's discussions with north coast Local Aboriginal Land Councils often revealed people did not distinguish between historical and prehistoric sites and were concerned equally with each (cf. Rich 1990).

North-east New South Wales is exceptional in New South Wales for the large number of pre-contact and post-contact Aboriginal sites that have been identified by Aboriginal people. These include bora grounds, stone arrangements and carved trees which are of particular importance to Aboriginal people because of their ceremonial nature (Bowdler 1983; Byrne 1989; Creamer 1980; Rich 1990).

A large number of sacred sites, particularly natural mythological sites, have been recorded in the upper Richmond and Tweed valleys. Many of these were recorded by the National Parks and Wildlife Service Sacred Sites Team from information provided by the Githebul people at Muli Muli (Woodenbong). Most of these sites are associated with mountain tops. There are three natural mythological sites, one rock engraving and one ceremonial stone arrangement located in the study areas' state forests (see table 1). Other sacred sites have also recently been recorded in Washpool State Forest (Goagun Aboriginal Place).

5.2 Determining Aboriginal Significance of Places/Sites

Determining the Aboriginal significance of places and identifying and recording sites that have no archaeological residue cannot be done using the normal techniques of archaeological survey. Identifying sites requires historical research and documentation of oral history told by Aboriginal elders. Even then not all information may be revealed to an uninitiated person. However in cases where sites have been threatened by development such as logging, enough information about them has been revealed to ensure they are protected.

In recent years the Aboriginal significance of forests in the study area has been dramatically highlighted in several instances when in order to protect certain sacred sites Aboriginal people drew their existence to the attention of the Forestry Commission. The most recent of these involved Washpool State Forest. Over ten years ago when the Washpool EIS was done, the Aboriginal significance of the area had been hinted at. Preliminary investigations revealed that more information might be forthcoming but to acquire it would require detailed investigation and long term consultation with local Aboriginal people. When forestry operations were poised to move into an area in Washpool State Forest in 1989, local Aboriginal people then came forward in order to protect sacred sites that were located there. As a result of investigations by an Aboriginal Consultant, Trevor Donnelly (1990) and consultations between the Forestry Commission and local Aboriginal people, the declaration of an Aboriginal Place (Goagun) has been proposed for much of Washpool State Forest. Currently a Management Plan is being prepared for the area by the Forestry Commission in conjunction with the Regional Aboriginal Land Council and local Aboriginal communities.

had begun without further consultation

5.3 Known Aboriginal Historic Sites and Ceremonial/mythological Sites

There has been no study of Aboriginal historic sites or ceremonial/mythological sites relating specifically to state forests within the study area. However a recent study undertaken by Rich (1990) provides a useful inventory of sites of potential

Aboriginal historic significance for the region as a whole. The inventory derives from an examination of historical sources and National Parks records for north-east New South Wales. It is broken up into site types which in turn are based on historic themes. The inventory provides a useful framework for considering the potential for Aboriginal historic sites in the present study. Similarly, previous sacred site survey work in the region is reviewed to examine the potential for locating sites of a ceremonial or mythological nature.

5.3.1 Warfare/Massacre Sites

Although violence between Aborigines and whites occurred frequently in the Clarence, Richmond and Tweed valleys, there is little detail on specific events and locations. Generally fighting was sporadic and concentrated around the fringes of white settlement. There are a number of locations where massacres of Aborigines are known to have occurred including, Clarence and Rocky Rivers near Tabulam in 1841 (after the killing of Peter Pagan); at Ettrick in 1843; North Arm of the Richmond River and Evans Head; and at Fingal (Rich 1990:121-123).

5.3.2 Occupation Sites

These are places where Aboriginal people lived (other than reserves) after their traditional land use patterns were disrupted by white occupation of their land. Fringe camps emerged mid-last century around Lismore, Murwillumbah and Tweed Heads where they were exploited as a source of labour for whites. Aborigines also lived on camps at stations such as Yugilbar, Tabulam, Lismore, Unumgar and Dyraaba where friendly relations had been established with the whites (Rich 1990:124-5).

5.3.3 Resource Places

Places where Aborigines obtained resources such as food, water, ochre and clay (Byrne 1989:61). A number of food places have been recorded on the coast near Yamba (Godwin and Creamer 1984). An ochre quarry has been recorded near Tabulam 4 km north-west of Sugarloaf State Forest. Eric Walker and Robert Caldwell told the author of particularly fine sources of ochre used in the past by Aborigines at Tabulam. No other resource sites have been described in the literature elsewhere in the study area, however this is due to lack of research in this respect rather than lack of such places.It is likely that other resource places and occupation sites are known to people in areas that have been continually occupied by Aborigines since last century.

5.3.4 Mythological/Belief Sites

These are natural features of the landscape which have not been modified by Aboriginal people, for example water holes, rocks, caves, streams and mountains. They usually relate to mythological events. Often elders know a place was a mythological site, but they do not retain the story that went with it (Byrne 1989:19). A large number of these sites have been recorded in the north east of New South

Wales. Sites in the vicinity of Crown-timber lands within the study area are listed in table 1.

Natural mythological sites may have a ritual significance, sometimes related to initiation (Godwin and Creamer 1984). For example the Mungoo Mungoo tree located in the Richmond Range State Forest within the study area. This is one of the few natural feature sites in north-east New South Wales which is not a mountain top. This was recorded by Creamer from information provided by a Githebul elder, Euston Williams, who explained that the tree could speak to people in their own dialect and impart strength to young men going into battle or on hunting expeditions (Byrne 1987:97). The tree in recent years has fallen over as a result of natural processes. This tree was visited in recent years by Aboriginal people (Robert Caldwell; Eric Walker).

Mt. Brown, also within Richmond Range State Forest and just to the north of the Mungoo Mungoo tree is a *juraveel* (increase site) for the carpet snake (Byrne 1987).

In the study area, there is a natural mythological site with ceremonial significance recorded in Mebbin State Forest at Hanging Rock. There are others in National Park and other areas outside State Forest.

Ken Gordon of Malabugilmah also told the author of a previously unrecorded natural feature site, which was a female ceremonial site, located on Ewingar State Forest (discussed below). He says that women were brought there if they were unable to have children.

5.3.5 Reserves

Areas set aside by the government as places for Aborigines to live. There are a large number of these in the study area mostly gazetted between 1887 and 1920. Those located nearest to the main tracts of forest are Baryulgil, Tabulam, Mallanganee, a number around Maclean and Yamba, and Terania Creek.

In some instances people were camped at places before reserves were established. Eric Walker of Tabulam, remembers a number of specific campsites in the vicinity of the reserve at Tabulam which date to the reserve period and possibly before.

5.3.6 Employment Places

Employment sites are places where Aboriginal people were employed, mostly in the rural sector, for example Yugilbar Station near Baryulgil (Rich 1990:125). A more recent employment place of great historical significance to Aborigines in the west of the study area is the Baryulgil asbestos mine. The mine was located 500 metres from the Baryulgil Square community. The closing of this mine in 1979 and the health problems associated with it culminated in the government offering to build new houses at a new location. As many people did not want to leave their homes, two separate settlements were created, one remaining at Baryulgil Square itself and one at Malabugilmah.

5.3.7 Ceremonial/Other Cultural Sites

Corroborees concerning traditional beliefs were still commonly carried out on the north coast up until late last century and more rarely early this century. Two important kinds of ceremonies were initiations and increase rituals. Initiation sites may have comprised bora rings, stone arrangements, and carved trees, although none or not all of the physical signs of the ceremonial site may have survived. Ceremonies have been held in historic times at Tabulam (Eric Walker pers. comm. 1992), Busbys Flat, Wyan, Broadwater, Coraki, Kyogle, Nimbin and other places (Rich 1990).

5.3.8 Burials/Cemeteries

These are places where Aborigines were buried from early contact times through to the mid-twentieth century often in or near missions and reserves. Burials have been recorded on Yugilbar Station at Baryulgil. Few other sites have yet been recorded elsewhere. None of the recorded sites are located in the vicinity of state forest.

6. PREVIOUS ARCHAEOLOGICAL WORK

6.1 Previous. studies

Although there has been substantial amounts of archaeological research in parts of north-east New South Wales, little of it pertains directly to upland forested areas away from the coast or riverine environments. Due in part to this lack of research forest environments have been characterised as marginal in terms of their resource richness, archaeological potential and attractiveness to Aboriginal occupation (cf. Bowdler 1983:47). With work recently done in the north coast forests and elsewhere it is clear that many archaeological sites exist in forested areas and they can be expected to occur even in rugged escarpment country.

Little systematic archaeological work has been undertaken in the state forests of the study area. As stated above most research work has concentrated on the coast, estuaries and major rivers (Coleman 1982; McBryde 1974,1982). Until recently the majority of sites inland were sacred sites recorded by the National Parks and Wildlife Service's Sacred Sites Survey Team (Creamer 1980; Kelly 1980). There has been some EIS archaeological survey undertaken in forests managed by the Forestry Commission in the last decade or so.

This early work undertaken for the Forestry Commission consisted of three archaeological surveys carried out by Bell (1980,1981) and Coleman and Lourandos (1981). Bell conducted limited surveys in thickly vegetated areas in Washpool and Doyles River State Forests and found only a few isolated artifacts. Coleman and Lourandos surveyed the Black Scrub State Forest near Bellingen but also found very little. The lack of surface visibility in these wet forest types is likely to be the principal reason for the lack of archaeological materials located during these surveys.

More recent EIS archaeological surveys have covered a broad range of sclerophyll forests on the north coast (Byrne 1992; Collins 1991a; Collins 1991b; Collins and Morwood 1991; Comber 1991; Morwood and Collins 1991; Navin and Officer 1990; Packard 1992). By far the most common kind of site recorded is the remains of open camp sites or activity sites represented by stone artifact scatters. The following basic patterns in site distribution have been identified. These patterns do not represent settlement patterns as such but where Aborigines discarded stone artifacts over a long period of time.

Morwood and Collins (1991) have conducted a survey of Yarrahapinni and Way Way State Forests. They found sparse scatters of artifacts occurring at gradients below 10^{o} in both rain forest and dry sclerophyll forest mainly on ridge lines and creek flats. Collins (1991b) also found a similar pattern in her survey of the Duck Creek EIS Area.

Another recent study of state forests in the Wingham Management Area by Collins and Morwood (1991) also found a similar pattern. This work is particularly relevant to the present study area as it covers forests from the top of the escarpment to the lowlands. Other than the usual open campsite consisting of a few stone artifacts they were also able to locate a chert quarry and stone artifact reduction site and two scarred trees. Similarly as for their previous surveys of the Yarrahapinni and Way Way State Forests they concluded that the most important factor determining Aboriginal campsite location is the availability of flat land surfaces regardless of either forest type or terrain .

Recently (Navin and Officer 1990) carried out a survey of a proposed ELCOM transmission line through the foothills from Coffs Harbour to Grafton. The survey identified both a range of site types and a high frequency of archaeological sites including stone artifact scatters, stone quarry sites, scarred trees and rockshelter sites. This report provides a comprehensive discussion of the archaeology of the north coast hinterland area remote from the coast. In their review of the historical evidence they emphasise the importance of river corridors and the coastal hinterland as a focus for economic activity and for ceremonial gatherings.

Like Morwood & Collins (1991) and Collins and Morwood (1991) they also report a high probability of sites occurring on flat areas of ridge lines and spurs in hilly areas with slopes generally having low archaeological sensitivity except where rockshelters occur. However, they suggest that the sites located along ridge lines and spurs will be mostly small artifact scatters of low-medium archaeological significance and that major sites will be located elsewhere such as stream flats. The results of their survey indicated that the highest site densities are found in the uplands area, while lower site densities are located along stream flats. This pattern, the authors suggest, is not a true reflection of site densities but is rather a consequence of the differing geomorphological regimes between the two land systems, with sites uncovered in the uplands by erosion, and sites located along stream banks covered by sedimentation. With these processes in mind the authors have identified areas with the highest archaeological sensitivity and significance (apart from rockshelters) as stream flats and areas of elevated ground adjacent to wetlands and floodplains. Areas identifed as having archaeological potential but lower significance are flat areas on ridge lines and spurs.

Navin and Officer calculated a site density of one archaeological site per 1.6 km of transmission line. They note that this is a higher density than that achieved for previous small scale development studies in the coastal hinterland or even on the coast itself. Interestingly, the authors see this not as reflecting a high archaeological sensitivity for their study area but rather as a realistic value for the region as a whole. They also suggest that a site complex consisting of a group of stone artifact scatters, a pebble quarry, scarred trees, historic Aboriginal campsite and a burial near Coutts Crossing on the Orara River was a focus of Aboriginal occupation in the region.

Piper (1976) has surveyed intensively for rockshelters in the Upper Tweed valley. He has located a number of rock shelter sites including sites located in rugged mountainous terrain.

Byrne (1987) has undertaken spot-checking survey work in several different areas of state forest as part of his study of the Aboriginal significance of rainforests. He surveyed parts of Wollumbin, Nullum and Mebbin State Forest. The results of this work will be discussed below in the analysis of results from the current survey work.

The sites recorded by Piper and Byrne within the Crown-timber lands of the study area are listed in table 1.

6.2 Aboriginal Sites and Places in State Forest and Other Crown-timber lands.

Aboriginal archaeological sites and other sites of Aboriginal significance within and in the vicinity of state forest and within other Crown-timber lands in the study area are shown in table 1. The inclusion of sites outside Crown-timber lands is for comparative purposes.Sites located in similar environments to that of Crown-timber lands will expand our knowledge of the type and numbers of Aboriginal sites likely to occur in Crown-timber lands. A number of known sites, mainly shell middens, occur within vacant crown land on the coastal margin, however these sites are not listed because of the unsuitability of these areas for timber production and the atypical nature of sites here compared to productive forests away from the coast. The inventory of sites shown in table 1 is based on information from the National Parks and Wildlife Service Aboriginal sites register and the Foresty Commission's Preferred Management Priority Classification maps.

To determine the location of sites in relation to Crown-timber land boundaries, a 1:250 000 Aboriginal archaeological site location transparency supplied by NPWS was overlain on a series of photocopier reduced 1:125 000 Forestry Commission Project Maps which show land tenure. The Project Maps were first gridded at 10 km intervals. This gridding enabled the maps to be overlain accurately ensuring that the distortion that occurred when photocopying the Project Maps had a minimal effect upon the accuracy of the boundaries when plotted on the 1:250 000 site location transparency. Sites which were found to be located on or in close proximity to Crown-timber land boundaries were also plotted using the NPWS grid reference on to 1:25 000 Forestry Commission Forest Type Maps to determine their position more accurately.

It should be noted that errors are likely to be present in the site location data supplied by NPWS due to conversions of earlier imperial grid references to metric and changes in the use of different scale base maps by NPWS at different times as well as original recorder inaccuracies.

Table 1. Previously recorded Aboriginal sites within state forest (typed **bold**), sites located within other Crown-timber lands (typed plain), and sites within the vicinity (4 km) of state forest but not on Crown-timber lands (*).

NPWS site number	Site name	State forest/ vicinity to	Site type
Former Casino District			
03-6-0026 Tree	**Mungoo Mungoo Tree**	**Richmond**	**Nat.Myth.Ritual**
Bonalbo	**Mount Brown Aboriginal Area**	**Richmond**	**Nat.Myth.Ritual**
Washpool/ Malara Creek	**Goagun Aboriginal Place**	**Washpool**	**Aboriginal Area**
Washpool	**Redbank Creek**	**Washpool**	**Aboriginal Area**
*03-6-0024	Bonalbo, The Three Sisters	2 km east of Richmond	Nat.Myth.Ritual.
*03-6-0008	Tabulam, Nijimbun Cave	4 km north-west of Sugarloaf	Nat.Myth.Ritual.
*03-6-0009	Tabulam, Old Mission Cave	4 km north-west of Sugarloaf	Shelter/cave art
*03-6-00(13-14)	Tabulam, The Three Hills	4 km north-west of Sugarloaf	Bora/Ceremonial
*03-6-0017	Tabulam	4 km north-west of Sugarloaf	Ochre Quarry
12-3-0031	**Cabbage Tree Creek**	**Mt. Pikapene**	**Shelter/cave art**
*12-3-0030	Cherry Tree State Forest, Busby Creek 1	border of Pikapene	Shelter/cave art
*12-3-0024	Busbys Flat, Cherry Tree State Forest	2 km south-south west of Royal Camp (Pt.)	Open camp site/ Shelter/cave art
*02-3-0002	Busbys Flat Cherry Tree State Forest	2 km south-south west of Royal Camp (Pt.)	Shelter/cave deposit/ art
*12-3-0003	Busbys Flat Cherry Tree State Forest	2 km south-south west of Royal Camp (Pt.)	Bora/Ceremonial
12-3-0001	Sandy Arm Busbys Flat	leasehold 2 km south-south west of Royal Camp (Pt.)	Shelter/cave art
*12-3-00(11-12)	Fullers State Forest	border of Fullers	Shelter/cave art
*12-3-0014	Mt. Neville, Cabbage Tree Creek	Nature Reserve adjoining Mt. Belmore	Shelter/cave art
*12-3-0016	Cabbage Tree Creek, Mt. Neville	Nature Reserve adjoining Mt. Belmore	Shelter/cave art

Table 1 continued.

NPWS site number	Site name	state forest/ vicinity to	Site type
*12-6-0121	Cabbage Tree Creek, Grafton	Nature Reserve adjoining Mt. Belmore	Shelter/cave art
*12-3-0019	Kungabaran Mountain, Mt. Pickabooba	2 km west of Keybarbin	Carved tree Bora/ceremonial
*12-3-0020	Kungabaran Hill, Mt. Pickabooba	1 km west of Keybarbin	Bora/ceremonial Stone arrangement
12-3-0017	**Mt. Marsh, Aboriginal Area**	**Mt. Marsh**	**Rock engraving**
*12-3-0025	Camira creek 1	2 km west of Camira	Rock engraving/ shelter cave deposit
*12-3-0026	Camira Creek	2 km west of Camira	Shelter cave deposit/ cave art
*04-4-0006	Bently	1 km south of Bungabbee	Bora/ceremonial
*04-4-0014	Bently	2 km south of Bungabbee	Nat. Myth. Ritual.
*04-4-0018	Bungabbee, Bently	3 km south of Bungabbee	Bora/ceremonial
12-3-0027	**Sportsman Creek**	**Banyabba**	**Open camp site**
*12-3-0009	Coaldale, Banyabba Nature Reserve	Nature Reserve adjoining Banyabba	Stone arrangement

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NPWS site number	Site name	state forest/ vicinity to	Site type
04-4-0029	**Hanging Rock, Mebbin**	**Mebbin**	**Nat.Myth.Ritual.**
13-1-0091	**Byrill Creek 1**	**Mebbin**	**Open camp site**
13-1-0084	**Byrill Creek 2**	**Mebbin**	**Open camp site**
13-1-0083	**Byrill Creek 3**	**Mebbin**	**Open camp site**
13-1-0085	**Hanging Rock 1**	**Mebbin**	**Open camp site**
13-1-0082	**Hanging Rock 2**	**Mebbin**	**Open camp site**
*04-1-0032	Bar mountain	<1 km east of Mebbin	Nat. myth.Ritual.
*04-1-002,18, 23,28,30 (33-45)	Mebbin Springs	3-5 km east of Mebbin	Open camp sites, Scarred trees

Table 1 continued.

NPWS site number	Site name	State forest/ vicinity to	Site type
04-1-0019	**Nullum State Forest,**	**Nullum**	**Shelter/cave art/ deposit**
13-1-0088	**Prowamba Road 1**	**Nullum**	**Open camp site**
13-1-0087	**Prowamba Road 2**	**Nullum**	**Open camp site**
13-1-0089	**Jerusalem Mountain**	**Nullum**	**Shelter**
*04-1-00(9-16)	Miginbill	<1 km west of Nullum	Open camp sites, Shelter/deposit. Axe grinding groove
13-1-0090	**Mt. Warning Stone Arrangement**	**Wollumbin**	**Stone arrangement**
*04-1-0030,31, 33,34	Terania Creek	<1 km north-north-west of Whian Whian	Shelter/deposit
*04-4-0027	Terania Creek, Whian Whian Cave	1 km north-north-west of Whian Whian	Shelter/deposit

6.3 Potential Archaeological Site Types and their General Locations

6.3.1 Artifact Scatters

Artifact scatters may occur anywhere across the landscape. The typical locations for these sites are on ridge lines, spurs (variously defined) and along streams and swamps. Stone artifact sites located on ridge lines are generally small. A common interpretation placed on these ridge line sites is that they were pathways that people used to traverse the countryside (Byrne 1984; Feary 1989; Cosgrove 1990). Sites located in the vicinity of streams and swamps on flats, footslopes and spurs are generally larger and more complex. These sites are often difficult to find as they may be buried deep in the soil or covered by dense vegetation.

6.3.2 Rockshelter Occupation and Art Sites.

Rockshelters suitable for occupation can occur in most rock strata although sandstone and limestone weather in a way that produces many more potential shelters than do other rock types. From the distribution of previously recorded rockshelter sites in north-east New South Wales, it appears that Jurrassic sandstone is the most suitable for rock shelters. Belts of shelter occupation sites occur in Jurrassic sandstone in the major river valleys to the south of the study area especially near Grafton and also on the western slopes of the tablelands (McBryde

1974). Most shelters here are located on streams, both because this is where rocks tend to outcrop and because campsites generally are located near water.

Rock outcrops on steep slopes or on the tops of hills are unlikely to have much evidence of occupation in them, although art sites and stone arrangements may occur in these locations. Several rockshelters with art work have been recorded on the Richmond Range between Cherry Tree and Mt. Marsh State Forests.

Suitable sandstone for both occupation and art sites occurs within the study area along the extent of the Richmond Range from Sugarloaf State Forest to Banyabba Nature Reserve and north-east parallel with the coast.

In the Murwillumbah area suitable sandstone is confined to the lowlands south of state forest. However Piper (1976) found several rockshelter sites in volcanic country to the north and several have been recorded immediately to the north-west of Whian Whian State Forest in what is now National Park.

Rockshelters are likely to be rare outside areas where there are sandstone cliffs, however isolated shelters could occur anywhere where rock cliffs coincide with stream flats or flat ridge tops.

It is possible that local pastoralists, timber-getters or Aboriginal people may know the presence of rockshelter sites. In the course of the survey several informants mentioned the location of rockshelter art sites. Some of this information pertaining to state forest will be presented below in the results.

6.3.3 Quarries/Primary Reduction Sites

A quarry is defined as a stone source where Aborigines obtained stone or ochre for artifact manufacture. A stone source may be a vein outcrop or a surface deposit of loose rock or pebble. These sources are generally located where rock outcrops in ranges or along watercourses with pebble beds.

A primary reduction site is the location of the earliest stage of the stone artifact manufacturing process. This is the location where the initial production of the stone artifact blanks takes place before the tools are used and further modified. Primary reduction sites are generally located at or within close proximity to quarry sites.

Until recently the only quarry sites recorded in north-east New South Wales were located on the tablelands and coastal headlands. These sites were predominantly axe quarries, although McBryde noted that the source of raw materials for artifacts in her Clarence and Orara Rivers excavations were from local shingle beds (Binns and McBryde 1972; Byrne 1989).

In recent surveys of north coast forests small quarries of loose surface rock have been found (Comber 1991, Collins and Morwood 1991; Navin and Officer 1990). These are likely to be widespread in areas where the geology is suitable (see below).

6.3.4 Axe Grinding Grooves

These are the abrasion scars resulting from the sharpening of stone axes on rock. These sites can be identified by smooth linear or ovoid depressions in sandstone outcrops. Sandstone is chosen for grinding as it has the necessary abrasive properties and water is used as the whetting agent. As a consequence these sites are invariably located within sandstone outcrops in close proximity to water.

Most of the known axe grinding groove sites in north-east New South Wales occur in the Jurrassic sandstone belt near Grafton or in sandstone to the west of Glen Innes. The most likely location for this kind of site within the study area are on creeks flowing out of the Richmond Range, where both suitable sandstone and water is available.

6.3.5 Scarred trees

These are trees from which bark or wood have been removed for the making of shelters and implements such as containers, shields and canoes. They are very common in riverine areas where old trees survive on farms. Away from rivers they are fairly rare, especially in upland forested areas such as the study area where most scarred trees have been destroyed by tree-felling and bushfires.

6.3.6 Carved Trees

These are trees which have linear designs or figurative patterns carved onto their bark or wood. They often surround bora grounds. As with scarred trees land clearing activities or natural attrition have already destroyed most of these sites on the north coast (Lane 1978; Byrne 1989).

6.3.7 Stone Arrangements

These consist of stone cairns or linear arrangements which may have ceremonial significance. Our knowledge of the distribution of this site type is less certain than for others. These sites could occur anywhere where the ground surface is relatively flat and rock outcrops, regardless of surrounding terrain. However, there is a tendency for these sites to occur on fairly remote vantage points (Byrne 1989). There are many potential locations throughout the study area although it is likely that stone arrangements will occur on relatively few of them, especially given the level of disturbance that has occurred on some of the most prominent vantage points.

This type of site, because of its greater obtrusiveness, could be routinely checked for by foresters when preparing harvesting plans for coupes and if found avoided during subsequent logging. Although recognising such sites will require training.

A stone arrangement has been recorded on Mount Warning, Wollumbin State

Forest. Two other stone arrangements have been recorded one at Kungabaran Mountain in the vicinity of Keybarbin State Forest and one recorded in Banyabba Nature Reserve.

6.3.8 Boras

Bora grounds are places where initiation ceremonies were performed. The most common form consists of earthen rings 2 to 40 metres in diameter. Bora grounds occur only in south-eastern Australia and are generally rare. In north-east New South Wales they are more common than anywhere else in south-eastern Australia. They mainly occur on soft sediments in or near river valleys, although they occasionally occur on high places on rocky ground where they may be associated with stone arrangements (McBryde 1974; Satterthwait and Heather 1987). Suitable stream flats occur in many parts of the study area however most of them, (particularly the more substantial ones most likely to have bora rings) have been impacted by pastoral activities and land clearing.

Several ceremonial sites that occur within state forests of the study area have already been described. In addition four boras are located within several kilometres of state forest in the study area.

6.3.9 Rock Engravings

An Aboriginal rock engraving has been recorded on Mt. Marsh in Mt. Marsh State Forest.

6.3.10 Burials

Traditional burials occur singly and in groups. They tend to be found in sediments near streams, although they may also occur in caves (Byrne 1989).

Very few burials have been recorded in areas of rugged terrain, or are likely to be recorded, due to the following factors. People are most likely to be buried in the vicinity of the main focus of occupation (i.e. river valleys) and where soft sediments are available. Where soft sediments are present in the uplands they tend to have already suffered a fair degree of disturbance.

Cave burials are likely to be restricted to sandstone outcrops within the study area. It is likely that local pastoralists, timber-getters or Aboriginal people will know the location of unrecorded burial sites. For example Ken Gordon of Malabugilmah (originally Nymboida) is aware of unrecorded burial caves in the hills near Buccarumbi in the Grafton area (pers. comm., 1992).

6.4 Site Location Summary

This section has established that there is a close relationship between the location of archaeological sites and certain characteristics of the environment related to terrain and geology. For stone artifact sites and rockshelter occupation and art sites the requirements are quite specific and predictable, mainly to do with topographic constraints on movement, ecological productivity and the nature of the local geology. We are on less certain ground with ceremonial archaeological sites (e.g. boras) except to say these are generally rare particularly in areas remote from the major river valleys. Natural feature mythological and/or ceremonial sites most frequently occur on prominent landmarks, and thus may occur in state forest, although these too will be rare.

On the basis of the environmental, archaeological and historical evidence discussed above stone artifact sites are likely to be the most common site type in the forests of the study area. Generally speaking ceremonial/mythological sites, burials, historic campsites and massacre sites will be rare within state forests, particularly given the level of disturbance forests have already undergone, although surviving sites will be highly significant and every effort should be made to identify them and provide for their management. Their locations will be difficult to predict or to establish through sample survey techniques.However as yet unrevealed knowledge concerning such sites is undoubtedly held by local people and may be revealed through oral history investigations.

7 LAND SYSTEMS AND ARCHAEOLOGICAL PREDICTIONS

7.1 General Environment

The geographical diversity of the study area provides a wide range of environments all of which would have been utilised by Aborigines during their seasonal round of activities. The lush vegetation of the coastal plain and riverine lowlands, much of which is cleared, gives way to the drier eucalypt forests of the uplands and rainforest of the volcanic plateaux. Much of this uplands is presently retained in state forests. The following environmental information is drawn from the Forestry Commission's Management Plans (1983, 1984 & 1988).

Most of the former Casino District is dry sclerophyll forests with some wet sclerophyll or rain forests in gullies and more extensive tracts of wet forest in Ewingar and Richmond Range State Forests. The Murwillumbah forests are predominately wet sclerophyll and rainforest.

The western boundary of the study area is the Great Dividing Range (Gibraltar Range). East of the Gibraltar Range the country falls abruptly towards the Clarence River, then rises gradually towards the Richmond Range. The Richmond Range extends from the north-west quarter of the study area south-east towards Grafton, from Banyabba State Forest it extends north-east to Evans Head. The Richmond Range forms the watershed between the Clarence River basin to the south and Richmond River basin to the north. The Richmond River basin covers a large area surrounding Casino and Lismore, much of it does not contain state forest.

The Murwillumbah forests extend from the Richmond River basin in the south and comprise a series of discrete volcanic ranges which enclose the upper Tweed River south of Murwillumbah.

Most of the study area's forests cloak the Gibraltar Range, the Richmond Range, and the volcanic ranges of Murwillumbah. Most of the forested terrain is elevated, dissected country except for low-lying, often swampy forests in the south-east of the study area.

The climate is warm subtropical with a summer/autumn rainfall peak. Rainfall varies according to altitude, distance to coast and latitude. The Casino lowlands and south part of the Richmond Range receive less annual rainfall (1000-1100 mm) than the northern Richmond Range and the higher altitude Gibraltar Range (1400 mm). The climate is more tropical in the Murwillumbah forests, where mean annual rainfall ranges from 1400 to 2000 mm.

The lower altitude inland land systems are likely to remain drier for longer in the dry period between April and the commencement of the summer rains in October. Frosts are almost non-existent in the lowlands and fairly rare in the highlands (10-20 frosts per year in the Casino forests).

In the former Casino Management Area sandstone predominates except in the Escarpment Ranges (Washpool and Ewingar State Forests) where there are granites and metamorphosed sediments with abundant quartz veins. Basalt and rhyolites cover most of state forest in the Murwillumbah forests and extend south-westward into the former Casino Management Area as far as the Richmond Range and Bungabbee State Forests.

In the central and eastern part of the former Casino Management Area (Braemar, Bungawalbin, Whiporie, Gibberagee, Tabbimoble, Doubleduke and Mororo State Forests), extensive areas of Quaternary alluvial sediments overlie sandstone.

7.2 Predictive Modelling

As explained above, a predictive model requires the subdivision of the study area into environmental strata that we assume had distinctive sets of constraints on possible prehistoric land use patterns and conditions affecting the preservation of sites. For example, forests near the coastal margin would have offered a greater abundance and diversity of resources than the dissected plateaux of the escarpment country. Thus it may be expected that the nature of prehistoric land use patterns would have differed between the two areas. It follows that the spatial distribution and form of archaeological remains would also differ. Another example, this time regarding effects on site preservation/visibility, is that sites in lowland areas will be less visible because they are more likely to be covered by sediments than in dissected hill country where the whole landscape is generally eroding thus making sites quite visible.

The study area was divided into the following land systems, each presumed to have a different set of constraints on land use and site visibility patterns: Lowlands, Coastal Ranges, Ranges, Escarpment Ranges and Volcanic Ranges. Each of these land systems will be described in turn. Archaeological predictions based on an assessment of the environmental parameters of each land system is also provided. Location maps of the land systems are provided in appendix 1 a& b.

7.3 Coastal Ranges

These are the distinctive sandstone ridges and intervening lowlands located a few kilometres inland parallel with the coast on the eastern edge of the Clarence-Morton Basin (from Doubleduke to Gibberagee State Forests). The sandstone ridges rise abruptly from the surrounding lowlands and coastal plain.

The latter areas were the focus of Aboriginal settlement according to the historical record and oral tradition. However it is uncertain what role the sandstone ranges played in the coastal economy. Byrne (1986) thinks they were fairly peripheral and predicts that only minor archaeological sites will be present within the Coastal Ranges. Other work in similar situations on the south coast showed an absence of sites in some areas, but an abundance in others. It is unclear to what extent these differences are due to survey methodology rather than to real differences in the archaeological record (Feary 1989).

The question is largely unresolved for the north coast. Given the variability of findings elsewhere it would come as no surprise whether there were relatively few or numerous sites in the Coastal Ranges. Although my feeling is that until shown otherwise you would expect a fairly consistent spread of sites from the coast to the highlands. This is due to the nature of stone artifact scatters which appear to be scattered widely through the country irrespective of focus of land use.

The geology is a mixture of sandstones and conglomerates. Sandstones are poor in flakeable material for making artifacts. However, the conglomerates may have provided a local source of raw material for making stone artifacts. Outside the local conglomerates, the nearest source of raw materials are likely to be outcrops of basalt located to the north, pebbles washed down rivers and the coastline. Rockshelter producing sandstones (Kangaroo Creek and Grafton formations) are present in Doubleduke State Forest.

Predictions:

Small transitory sites will occur widely throughout the Coastal Ranges along ridges. Larger sites would be expected on the swamps/wetlands bordering either side of the ranges and also in the vicinity of swamps within the interior of the Coastal Ranges (e.g. along Bungawalbin Creek in Doubleduke State Forest).

Shellfish could be expected to occur within archaeological sites on the eastern edge of Devils Pulpit and Mororo State Forest bordering Bundjalung National Park.

If suitable low sandstone cliffs occur in proximity either to wetlands, creeks or swamps occupation deposits may occur within them. Rockshelters higher up the ranges are unlikely to have occupation deposits, but artwork or burials may be present within them.

7.4 Lowlands

This land system comprises the gently undulating country of the Clarence and Richmond River basins and their low hills with a relief between 0-90 metres except for a few isolated peaks. The land system is characterised by shallow and ephemeral creeks and numerous swamps and wetlands. Lowland open forests offer a diverse range of plant and animal foods throughout the year. In summer when rainfall is high the numerous swamps and wetlands fill providing resource rich environments (cf. Lilley 1984).

The geology of the Lowlands consists predominantly of Kangaroo Creek and Grafton sandstones and substantial Quaternary deposits of alluvial sediments. The Quaternary alluvial deposits are located mainly around Rappville and Whiporie and areas fringing the Richmond Range. Conglomerates are present on the coastal edge of the Richmond Ranges. Material suitable for the manufacture of artifacts will occur in these local conglomerates and possibly in some stream shingle beds. Sandstone outcrops suitable for rockshelter formation are likely to be rare outside lowlands fringing the Richmond Range.

Predictions:

Sites could be expected to occur here in large numbers, particularly around swamps and wetlands. Large campsites could be expected on lower slopes and low spurs near the more substantial creeks/swamps.

As with the Coastal Ranges, in areas of broken terrain, smaller transitory campsites or activity sites could be expected on ridges

In more gently undulating terrain not associated with highly productive swamps sites can be expected to be relatively sparse and small.

Because of the generally low relief and the sandstone geology of this land system most land surfaces will be actively aggrading. This will have the effect in many areas of covering archaeological deposits with sediment in all topographic situations except for ridge lines and spurs, thus making it difficult to find sites in the lower part of the toposequence.

7.5 Ranges

The Ranges land system is comprised of lines of hills, mountains or plateau which form a dominant ridge generally more than 8 km long and have an average elevation of at least 200 m. They are separated from the Escarpment Ranges by broad valleys and are remote from the coast. Hilly or undulating country which is not formed into such ridges is classified as Lowlands. Most of the land system consists of the Richmond Range although there are other lines of hills not contiguous with the Richmond Range which are included in this unit.

The geology is a mixture of different kinds of sandstone with some conglomerate. There are extensive outcrops of basalt in the Richmond Range State Forest (north-west part of the study area). The presence of basalt implies the presence also of other stone materials particularly suited to artifact manufacture. Silcrete, a siliceous rock favoured by Aborigines throughout south-eastern Australia, forms in sediments near basalt flows. Also contact metamorphic rocks which are particularly suited to artifact manufacture may occur in association with basalt. Sources of stone generally in this unit would not be limited to bedrock outcrops but would also occur in stream shingle beds throughout the area.

Possibly the best rockshelter-producing sandstones are the younger quartz sandstone (Kangaroo Creek and Grafton formations) which dominate in Mount Belmore and Mount Marsh State Forests. Several rockshelters sites have already been recorded in the vicinity of Mt. Belmore and Mt. Marsh State Forests. Rockshelters with archaeological deposits have been recorded in the sandstone of the Grafton Formation in the vicinity of Royals Camp and Fullers State Forest

Another geological resource available to Aborigines in this unit is ochre. Iron-rich nodules containing small deposits of ochre were noted frequently in Ranges around Tabulam and Baryulgil. It is possible that particularly good sources of ochre were confined to a geological strata called the Marburg Formation. This occurs widely east of the Clarence River along the Richmond and associated ranges (Vaness 1992).

Predictions:

Given the nature of the topography archaeological sites will be predominantly restricted to ridge lines and drainage lines.

Quarries and stone artifact reduction sites could occur anywhere stone outcrops in accessible places principally along ridges and streams.

If suitable low sandstone cliffs occur in proximity either to wetlands, creeks or swamps occupation deposits may occur within them. Rockshelters higher up the ranges are unlikely to have occupation deposits, but artwork or burials may be present within them.

It is predicted that major base camps would have been located on the non-perennial streams that rise in the ranges and flow down towards the Clarence or Richmond Rivers. These camps may have been summer bases, used when the streams were flowing in the uplands and lowlands (cf. Lilley 1984). From these camps Aborigines had access to resources in the lowlands, uplands and non-perennial streams. In addition to these potential food resources, shingle stream beds in the Ranges and foothills would have provided abundant material for making stone artifacts.

7.6 Escarpment Ranges

This land system comprises Washpool, Billilimbra and Ewingar State Forests and is dominated by large tracts of land over 600 metres in elevation, comprising steep hills and small areas of plateau. Relief ranges between 90 to 300 metres. The Escarpment Ranges land system represents the "falls country" to the east of the tablelands and can be envisaged as a discrete outlying block of the New England Plateau separated from the Plateau by the gorge of the Timbarra (Rocky) River. It is strongly dissected with v-shaped valley bottoms and narrow ridge tops with steep slopes intervening.

Raw materials suitable for stone artifact manufacture would be widely available within the argillites, volcanics and contact zones which occur in this land system. Stone artifact raw material sources would not be limited to bedrock outcrops but would also occur in stream shingle beds throughout the area.

Recently a number of ceremonial sites have been documented for the Washpool State Forest and others are said to occur in the general area. The oral history associated with these sites points to the importance of inter-regional travel through the escarpment area (Donnelly, T 1990).

Predictions:

Stone artifact scatters of various sizes would be expected to occur throughout the land system on ridge lines and drainage lines. These would reflect the exploitation of local resources as well as movements between the tablelands and lowlands.

Major sites would be expected to occur along the major rivers and streams in the area.

Quarries and reduction sites could occur anywhere stone outcrops in accessible places principally along ridges and streams.

7.7 Volcanic Ranges

This land system comprises all the state forests in the former Murwillumbah District with the addition of Bungabbee State Forest. Most of these are largely volcanic with the exception of Mooball, parts of Nullum and Mebbin State Forests which consist of sandstones and metasediments. These forests are generally elevated landforms that rise quite sharply from the surrounding lowlands. In most parts they are strongly dissected except for plateaux near Minyon Falls in Whian Whian State Forest and Blackbutt Plateau in Nullum State Forest.

This land system is characterised by a geology which we would expect to provide a diverse range of stone raw materials suitable for the manufacture of artifacts. Suitable stone artifact raw materials present within this land system include various acid (glassy) volcanic rocks (such as rhyolite, obsidian and ignimbrites), contact metamorphic rocks and metasediments.

Byrne (1987) surveyed a series of forest tracks in Mebbin, Wollumbin and Nullum State Forests and found a number of open sites which he characterised as small transit camps. He found occupation appeared to be concentrated in the more accessible forests such as Mebbin and Nullum as opposed to the Tweed, MacPherson and Nightcap Ranges. The location of these sites showed that Aborigines were operating in areas where there was rainforest although the sites themselves were located on hardwood ridge tops.

Predictions:

We would expect relatively light use of those parts of the land system which are remote, rugged and relatively inaccessible. Archaeological sites in these area will be smaller and fewer than in other land systems. More substantial archaeological sites could be expected to occur in those parts of the land system which are accessible from the lowlands.

Stone artifact sites will be widespread throughout the land system except in the more inaccessible forests. Sites will tend to be confined to ridges and drainage lines.

Sites will be difficult to locate in wet sclerophyll and rainforest due to the deep surface sediments and high degree of bioturbation that occurs in these environments, particularly in gullies and plateaux.

Most sites will comprise stone artifacts made from volcanic materials

7.8 Other Influences

In addition to the environmental characteristics described above, past land uses (especially logging) would have had an impact on site integrity and distribution. This factor is considered below in Impact Assessment.

8 SURVEY METHODOLOGY

8.1 Background to Methodology

Recent work in north-east forests and elsewhere has shown that stone artifact scatters are very common in most forested areas regardless of what we think the historical model of Aboriginal land use might have been. Stone artifacts include stone artifact manufacturing and resharpening flakes (by-products) and stone tools. The latter are far less frequently located in the field than the manufacturing by-products which are relatively common. Stone tools include three broad categories: small flake tools for cutting and scraping, barbs for spears and large tools for chopping and pounding often made from pebbles. The presence of these stone artifacts throughout forested areas is not surprising when we consider the following factors. Firstly, stone artifacts were in daily use by Aborigines and were discarded not just at campsites but anywhere people went, so for example we might expect to find an abundance of them along regular pathways or some where a kangaroo was butchered. Secondly, stone artifacts naturally survive for a long time and depending on the age of the land surface on which they are found can represent an accumulation of thousands of years of occupation.

It has been customary in archaeological surveys to distinguish “isolated artifacts” from “sites”. Sites are presumed to be internally coherent representations of a particular activity or related set of activities, while isolated finds are merely “background noise” - the result of less consequential activities.The distinction between isolated finds and sites in the field is usually made on the basis of an artifact number/density threshold. It is assumed that any reconstruction of past land use patterns can rely totally on “sites” so defined.The results below will show that archaeological material generally occurs as diffuse scatters and that there is no obvious threshold for separating out the more essential elements of the archaeological record. The dispersed nature of hunting and gathering activities, and the way stone artifacts were casually discarded at innumerable locations, has had specific consequences for how “sites” form to make up the archaeological record. Over time, stone artifact residues of discrete activities have tended to blend into one another across the landscape. The problem is compounded by the fact that the number of artifacts in a site is as much a function of conditions of exposure (e.g. narrow track) as it is the real size or artifact numbers of a site. In recognition of these problems, the analysis of site distribution requires that the individual artifact be taken as the basic unit of analysis. Artifacts can then be grouped into units on the basis of revealed patterns rather than for arbitrary reasons.

At the same time there is a need to use the “site” concept for analytical convenience and management purposes. Current practice is to give artifacts site status if there is more than one within a certain distance from another. This "certain" distance varies from 30 m (Byrne 1992), to 50 m (Navin and Officer 1990) to 100 m (National Parks site recording guidelines). There is no hard and fast rule for this as it depends on the particular research problems at hand. For present purposes the following notional site definition is used: two or more artifacts within 100 m of each other and more than 100 m from the nearest other artifact or site. For purposes of analysis however the individual artifact is taken as the minimum unit. This requires that those individual artifacts which are not closer than 100 m to the nearest other recorded artifacts must be incorporated in the analysis. Because of the rather arbitrary nature of the terms "site" and "isolated finds", the term "Artifact Occurrence" is used here to refer to both.

Traditionally the problem with surveying forests has been the lack of ground surface visibility. Attempts have often been made to use random sampling techniques, but even when 1 x 1 km square quadrats are used effective sampling is in fact confined to opportunistic exposures such as tracks or burnt areas (e.g Egloff 1984; Collins and Morwood 1991; cf. Byrne 1992). It is therefore logical to adopt areas of high surface visibility as the primary survey units and then to calculate to what extent the sample you capture by these means is representative of the environment. The term for the survey unit is hereafter referred to as Trajectory, after Packard (1991), these will be further defined below. Survey units can be chosen that cover environmental strata in a non-random but controlled way. In order to judge the representativeness of the sample attention has to be given to recording the environmental context for Trajectories regardless of whether sites are present or not. The recording system used for this has been adapted from Paul Packard's (1991) scheme for south-east New South Wales forests (see below).

8.2 Sampling

The land systems described above were adopted as the main sampling strata. These were sub-divided into sub-strata on the basis of local variations in environment which imply slightly different land use and site visibility patterns. These sub-strata comprise topographic divisions termed landform patterns, such as plains, rises, low hills, hills, mountains and plateaux (after McDonald et al. 1984). Each of these landform patterns comprise a number of landform or toposequence elements, for example hills may consist of ridges, upper slopes, mid-slopes, lower slopes, flats and stream channels (after McDonald et al. 1984; appendix 4). The toposequence was the basic sample unit employed in this study (Hall 1991,1992; Packard 1991; Richards 1992).

The primary aim of the survey was to acquire an environmentally representative sample. This was done by allocating the survey time available (32 days) amongst the land systems relative to the proportion of the study area's forests they occupied. Within each land system the sampling strategy was to choose Trajectories that covered the full range of toposequence elements from valley bottom to ridge top. This would then be repeated for as many times as possible for different landform patterns within each land system as time constraints permitted. The discussion of survey coverage below will discuss the nature of the sample that was captured using this method.

Beyond the need to survey a representative sample of the environment for surface sites, the sampling design incorporated the following:

* a sample survey of sandstone cliffs and other rock outcrops for rockshelter and other sites in Doubleduke, Mt. Marsh, Mt. Belmore, and Royal Camp State Forests.

* the involvement of Local Aboriginal Land Councils in the survey. This was done by spending survey time in their area that was proportional to the amount of state forest within their Local Aboriginal Land Council areas (see Appendix 2a & b).

* negotiations concerning the location of survey Trajectories with Land Council representatives who had their own views on where survey efforts should be focused. However, it was always possible to reach a consensus on where to survey because of the flexible nature of the sampling strategy, which could accommodate any special interest area.

* inclusion of areas with a range of logging histories, including unlogged areas. This was done in order to investigate the effects of logging on archaeological sites.

Thus 4 days were allocated to surveying Escarpment Ranges; 15 days Ranges; 6 days Coastal Ranges and Lowlands; and 7 days Volcanic Ranges. The fieldwork was undertaken over the period July - September 1992.

8.3 Survey and Recording Methodology

The recording methodology used for this study is adapted from Packard (1991). There are four main tiers used in this approach: Trajectories, Components, sites and artifacts.

A Trajectory is an area selected for survey where there is likely to be some archaeological visibility. That is, it is possible to see artifacts on the ground surface (ie. where it is not too densely vegetated and the ground is not significantly disturbed). A Trajectory can be of any shape or size. In forested areas the most common Trajectories are tracks, regenerating logging coupes or dumps, burnt areas and small eroding patches such as those along creek banks.

All Trajectories consist of one or more Components (Packard 1991). Components are differentiated on the basis of changes in key environmental variables (e.g. slope, vegetation, toposequence) and variables affecting archaeological visibility (e.g. surface visibility, geomorphological regime). A Component form, comprising a list of environmental variables, was filled out for each new Component as the survey progressed through a Trajectory. The same set of environmental information was recorded for each Artifact Occurrence so that site locational analysis could be undertaken. To ensure that this information was consistent standardised recording forms were used in the field. Examples of the Trajectory, Component, Artifact

Occurrence/Site recording forms are included in appendix 5 of this report (see also appendix 4 for a glossary of terms). In addition a NPWS Site Recording Form was filled out for Artifact Occurrences where there was more than one artifact (It has been the policy of NPWS to define as a site any location where two or more artifacts occur).

Trajectory names refer to the nearest road, track or place. Components in each Trajectory are numbered sequentially. Artifact Occurrence or site names follow the Trajectory name, Component and site number, for example Sugarloaf Fire Trail 1-1.

One of the main variables recorded during the survey requires some further explanation - topography (see also appendix 4). This was defined at three levels, from large to small scale: land systems, landform patterns and toposequence elements. As explained above these constituted the main sampling strata used in this study. An additional classification of topography was also made. A distinction was made between Dominant Ridge systems and Subsidiary Ridges (depicted in appendix 4). This was done on the grounds that Aboriginal use of the two areas would be different. The Dominant Ridges would be likely candidates for major pathways going to and from places (such as the major ridges in Ewingar State Forest) whereas Subsidiary Ridges would tend to be used more often when exploiting the local area's resources (e.g. accessing valley bottoms).

The factors which reduce surface and archaeological visibility such as vegetation cover and redeposited sediments were also recorded for each component. These are referred to as Detection Limiting Factors (after Packard 1991).

Surface visibility was estimated in percentages for each Component. Further to this a percentage estimate was made of archaeological visibility (Witter 1984b). This is calculated as the area of surface visibility minus that portion where the ground is too disturbed or covered by lag deposit to permit the observation of Aboriginal artifacts. Archaeological visibility is expressed as a percentage of Component area and is either equal to or less than surface visibility (see below).

The survey team consisted of one, and sometimes two archaeologists, accompanied by one or more Local Aboriginal Land Council representatives. Generally a "core" artifact survey team was maintained. This involved two or more persons, including one archaeologist walking along the selected Trajectory observing for artifacts. Other members of the team would venture away from the Trajectories and search for more obtrusive sites, particularly stone arrangements and rock shelters. Although survey coverage cannot be calculated the same way as for Trajectories for these other site types some indication of coverage for them is given below. When artifacts were located an archaeologist began recording the artifact and site locational details while the other person continued flagging artifacts in the vicinity.

Artifacts were recognised on the basis of the standard features of percussion flaking, the main ones are the presence of a bulb of percussion, striking platform and/or negative flake scars. Other stone included as artifacts comprised edge-ground hatchets and locally exotic pebbles or rocks, sometimes with evidence of pitting or bashing. Artifacts located by the team were recorded on the spot and returned to their original position. All artifacts that occurred within the Trajectory and its Components were individually recorded except in a few cases where time did not permit. In the latter cases artifacts were counted in terms of the main artifact type classes and raw materials. The stone artifacts were recorded according to the system of attributes described in appendix 6. A gazetteer of individual stone artifacts recorded during the survey is given in appendix 9.

8.4 Coverage Analysis

Packard (1992) has discussed the different ways in which the results of a survey of this kind can be treated. They may be treated lineally, that is concentrating on lengths sampled, or areally, that is multiplying the lengths and widths of the various Components sampled. Also we may use either artifact numbers or Artifact Occurrence numbers to calculate archaeological densities.

Artifact density by area is the more accurate measure for comparing relative densities of archaeological material between locations. However this measure has to be used with caution. Often the sample size for particular environmental strata are too small and one large site with a hundred artifacts for example will give an inflated figure for the unit as a whole. Biases as a result of inadequate sample size must be considered when using this measure.

To some extent site densities will offset the problem of small sample size as high density artifact clusters will register as only one site location, so a single positive finding in a small sample area will not overly skew the results. However information will be lost concerning the amount of archaeological material in given areas.

Artifact density could meaningfully be calculated for area or linear distance, bearing in mind the problem of sample size, but this is not the case for sites. Because only fractions of sites are revealed by exposures, site densities calculated for area surveyed will give an over-inflated figure. Site densities calculated on the basis of linear coverage will give a more realistic portrayal of site distribution, although there are biases here too. The survey tended to concentrate on landform features arranged lineally across the landscape. Since these are also the most likely locations for sites, site and artifact densities have to be seen strictly in the context of the environmental features that were surveyed and not as applying to, for example, whole square kilometres irrespective of the landform features present.

For comparing this study with others a linear measurement is best. This is because there will be less variation between studies in terms of simple linear measurements than measurements based on a combination of length, width and estimated archaeological visibility (see below).

For the purposes of comparisons within a single study, however, it is possible to control to some extent variations in sample quality using a version of Witter's (1984) coverage analysis (cf. Packard 1992). This analysis calculates "effective coverage" from surface visibility and various other Site Detection Limiting Factors as follows:

Effective coverage = (Raw survey area X Archaeological visibility)

Where Raw survey area = Component length by width.
Archaeological visibility = percentage of the ground surface where there are no Detection Limiting Factors.

Of course it is often difficult to maintain consistency using this method or to always be able to judge to what extent Detection Limiting Factors are operating. But the method is an improvement on lack of systematic controls over survey visibility bias.

Generally for an area to be considered to have archaeological visibility the top soil had to be partially intact or to have been removed by wind or water so as to leave lag deposits of artifacts on B or C horizons. Where the top soil was intact or partially intact, the surrounding landscape had to be eroding for archaeological visibility to be registered. In situations such as flat areas or sandy coastal areas, especially along streams where the landscape may have been aggrading, archaeological visibility was difficult to judge. In such situations archaeological visibility was only registered for areas where sub-soil or substrate was visible.

9. RESULTS

In this section survey data is presented and analysed in order to generate a predictive model of site type and location. The analysis involves a simple pattern recognition approach which attempts to identify correlations between selected environmental variables and archaeological site and artifact densities. Initially the general nature of the sample captured by the survey is discussed and a broad overview of the findings by land system is presented. Then more detailed analyses are undertaken of the relationship between key environmental variables and the distribution of Artifact Occurrences. These analyses give due consideration to sample biases and problems of site visibility.

9.1 Survey Coverage

9.1.1 Trajectories

The general locations of the areas sampled by Trajectories are shown in appendix 3a & b. One or more Trajectories were surveyed in most state forests. This seemed to give an even geographic coverage of the various land systems in addition to involving each of the Local Aboriginal Land Councils in the archaeological survey. The main gap in coverage is those forests between Camira Creek and Ellangowan State Forests in the Lowlands land system. In the time available for surveying Coastal Ranges/Lowlands land systems survey coverage of the two was rationalised by concentrating on the Coastal Ranges and its fringing lowlands. Trajectories, although technically located in the Coastal Ranges land system, include low-lying areas which are on the boundary between Lowlands and Coast Ranges. Thus the results for Coastal Ranges can to some extent be taken as reflective of the site distribution for Lowlands.

The data from the Component recording sheets for all the Trajectories are included in appendix 7 and summarised in tables 2 & 3. A total of 35 Trajectories were surveyed ranging in length from 10 to 3325 metres with a median length of 1160 metres and mean of 1188 metres. The length of all Trajectories combined is 43.3 km, comprising 298 Components. Taking into account the widths of the individual Components the total area surveyed was approximately 129 900 square metres.

The mean and median width of the Trajectories was 3 metres, roughly the standard width of areas on tracks that were surveyed. This may seem a narrow width for tracks, but generally those chosen for survey were those that had been least formed and thus no wider than a bulldozer blade. Also vegetation or ground litter often formed a natural boundary to the Component that reduced its diameter to less than the original width of the track. Components were often even narrower than this. For example cuttings or road batters, even if they were alongside a track, were classed as a separate Component (because of different visibility constraints) and may have been only 0.5 to 1 metre wide. The widest Components were log dumps up to 40 metres wide (portion which was examined) although these generally had the worst visibility for archaeological sites due to the amount of ground churning that had occurred within them, so even though a relatively large area was surveyed the effective coverage was considered fairly low.

Mean surface visibility for Trajectories was approximately 57%. Such a relatively high reading is to be expected as Trajectories were chosen on the basis that they had potential archaeological visibility. After allowing for other Site Detection Limiting factors, mean archaeological visibility was 43%.

Table 2 lists the results of the survey by Trajectory separately for each of the former Forestry Districts. Table 3 lists the results of the survey by land system.

Table 2. Results of survey - linear survey coverage (m), effective survey coverage (m^2), Artifact Occurrence per km and artifact density per 100 m^2 by Trajectory.

Trajectory	Number of Compnts.	Sum of length (m)	Sum of effective coverage (m^2)	Sum of artifact number	Sum of Artifact Occurr.	*Artifact density per 100m^2	*Artifact Occurrence per km
former Casino District							
Babyl Ck Rd	5	790	378	8	2	2.0	
Billilimbra Rd	1	5	20	0	0		
Branch Ck	1	50	40	13	1		
Broadwater Ck Rd	16	1620	1633	4	4	0.2	2.5
Bulldog Rock	2	120	64	46	1		
Cambridge Res.	7	1060	0	0	0	0.0	
Camp Forest	6	980	1500	4	1	0.3	
Dome Mt.	10	1920	772	2	2	0.3	1.0
Elkhorn Rd	1	600	600	0	0	0.0	
Forty Acre Rd	3	300	800	3	2	0.4	
Gorge Creek	5	250	200	7	2	4.0	
Island Rd	8	1310	520	16	4	3.1	3.0
Jackybulbin Ck	8	3325	1485	1	1	0.1	0.3
Lollback Ck	3	220	190	2	1	1.1	
Lookout	3	700	310	3	1	1.0	
Mackellar Range	18	2380	4610	9	6	0.2	2.5
Malara Ck Firet	2	500	340	13	1	4.0	
Mangrove Ck	16	1780	2292	22	4	1.0	2.3
McFayden Rd	3	1250	600	1	1	0.2	1.0
Mt. Belmore	5	410	673	33	1	5.0	
Mt. Marsh 1	7	1820	622	1	1	0.2	0.6
Mt. Marsh 2	11	2300	1030	1	1	0.1	0.4
Mt. Marsh 3	14	1460	453	6	5	1.3	3.4
Mt. Marsh 4	7	710	570	13	1	2.3	
Mt. Marsh 5	10	1380	670	6	4	1.0	3.0
Nogrigar Rd	4	21	301	33	4	11.0	
Oaky Ck	4	500	642	34	1	5.0	
Oil Rig Rd	8	2200	4115	1	1	0.0	0.5
Paw Paw Rd	3	300	345	4	1	1.2	
Peacock Ck Rd	13	1160	1078	7	6	0.7	5.2
Pine Rd	5	480	755	2	1	0.3	
Pyrocarpa	4	1500	700	0	0	0.0	0.0
Royal Camp	2	1000	400	1	1	0.3	1.0
Sugarloaf Firet	8	1020	766	6	2	0.8	2.0
Tullymorgan Rd	9	900	1730	2	2	0.1	
Total		**36321**	**31204**	**304**	**66**		
Former Casino District Average						**1.0**	**1.9**

Table 2 continued.

Trajectory	Number of Compnts.	Sum of length (m)	Sum of effective coverage (m^2)	Sum of artifact number	Sum of Artifact Occurr.	*Artifact density per $100m^2$	*Artifact Occurrence per km
former Murwillumbah District							
Baranbali Rd	4	410	282	0	0	0.0	.
Burringbar	2	160	225	0	0	0.0	.
Christies Ck Rd	2	80	11	1	1	.	.
ClaypotRd	6	210	355	1	1	0.3	.
Cooradilla Rd	1	50	30	0	0	.	.
Duffys Break	5	730	656	0	0	0.0	.
EasternBoundary	6	490	490	1	1	0.2	.
Flahertys Firet	4	1210	550	0	0	0.0	0:0
Forty Spur Rd	5	170	167	3	1	2.0	.
Fosters Spur	3	950	425	1	1	0.3	.
Jerusalem Mt. Rd	6	320	557	0	0	0.0	.
Koonyum Rd	3	220	460	0	0	0.0	.
Middle Ridge Rd	4	210	68	12	3	.	.
Palmvale Spur Rd	1	200	240	0	0	0.0	.
Rayners Track	7	710	1154	0	0	0.0	.
Scrub Ridge Rd	1	30	9	0	0	.	.
Wabba Rd	1	60	108	0	0	0.0	.
Wild Dog Rd	5	760	275	0	0	0.0	.
Total		**6970**	**6062**	**19**	**8**		
Former Murwillumbah District Average						**0.6**	**1.3**

*Only calculated for Trajectories with more than 1000 m of linear coverage or 100 m^2 of effective coverage

Table 3. Whole study area - land systems survey coverage and Artifact Occurrence densities.

Land system	No. of Comp.	Sum of length (m)	Sum of effective coverage (m^2)	Sum of Artifact Occurr.	Sum of artifact number	Artifact Occurrence per km	Artifact density per100m^2
Escarpment Ranges	10	1247	1326	6	92	4.8	6.9
Ranges	108	14210	9315	31	114	2.2	1.2
Coastal Ranges	80	15065	14140	19	52	1.3	0.4
Volcanic Ranges	88	9850	11314	15	62	1.5	0.5
Lowlands	12	2920	1172	3	3	1.0	0.3
Total	**298**	**43292**	**37267**	**74**	**323**		
Study Area Average						**1.7**	**0.9**

9.1.2 Geomorphological Biases in the Survey Sample

As indicated in table 3, Escarpment Ranges and Ranges have substantially higher artifact and Artifact Occurrence densities than the Lowlands, Coastal Ranges and Volcanic Ranges land systems. To examine possible causes for this apparent variation in artifact density between land systems it is necessary to first examine the different geomorphological regimes sampled for each land system. It was noted previously that there was some concern as to whether the aggrading nature of some land systems (Lowlands and low-lying parts of Coastal Ranges in particular) would make it difficult to detect sites. To establish the nature of this bias in the data, Artifact Occurrence per kilometre was plotted against geomorphological regimes for each land system (figure 1; see appendix 5 for geomorphological categories).

Figure 1 shows that more area was surveyed in eroding landscapes than in aggrading in all land systems. This in part reflects the fact that a large part of most land systems are eroding. It also reflects that even though relatively larger areas are aggrading in the Lowlands/Coastal Ranges than in other land systems, the actual areas chosen for survey were geomorphologically similar to those in other land systems (e.g. ridges). Thus we cannot attribute the magnitude of difference between the lowland/coastal/volcanic land systems and other upland land systems simply to geomorphological biases. Other reasons for the difference are investigated below. There remains however to consider here what general biases are in the data due to varying geomorphological regimes.

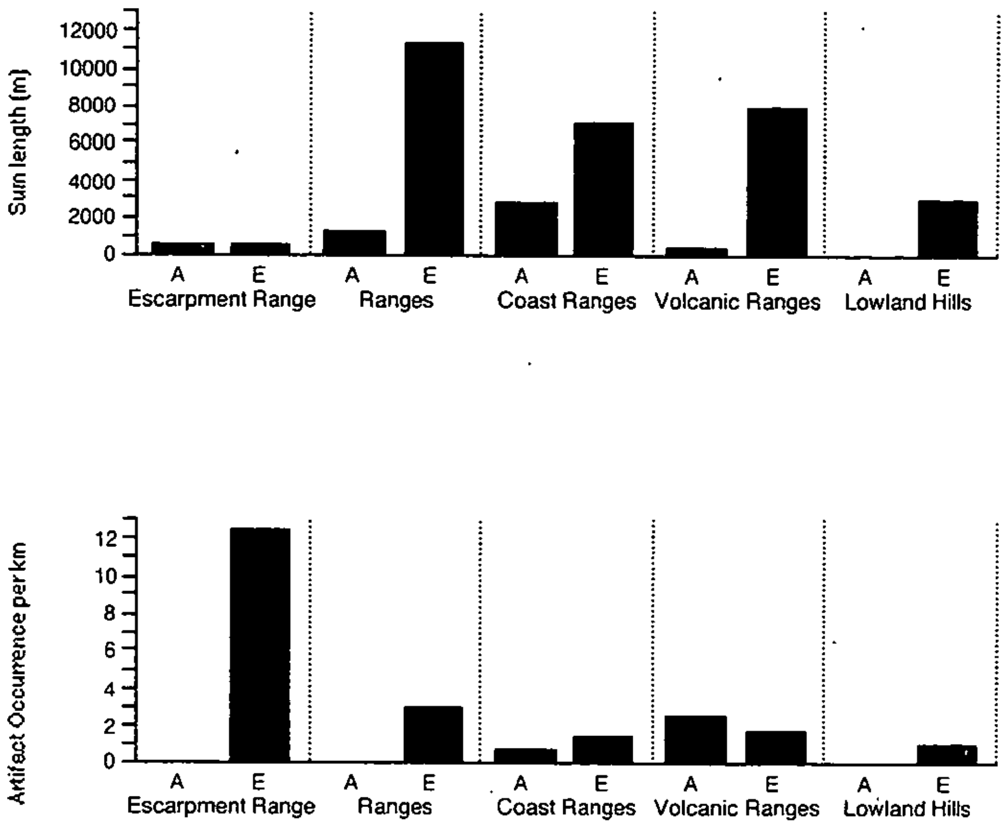

Figure 1. Linear survey coverage and Artifact Occurrence per km for aggrading (A) and eroding (E) land surfaces for each land system.

The frequency of Artifact Occurrences per km is higher in eroding landscapes than in aggrading landscapes, except in Volcanic Ranges. This tends to confirm the presumption that site/artifact density is under-represented in aggrading environments. The anomalous result in Volcanic Ranges (sites occurring at a higher density in aggrading as opposed to eroding landscapes) is due to the small sample size for aggrading environments in this land system - one artifact was found in a small aggrading area where the ground had been churned up (ClaypotRd 5-1).

The low artifact densities for aggrading environments indicates the difficulty of locating sites under these geomorphological regimes. Caution will have to be applied when making inferences on the basis of site or artifact densities regarding Aboriginal site location in aggrading environments. This is of particular concern when we consider that sites formed in aggrading environments where soil is accumulating are likely to have a relatively greater range of material preserved in their original context and the potential to be dated. By contrast, sites in eroding environments are much more likely to be redeposited and/or dissipated.

9.1.3 Survey Coverage for Other Sites

During the survey, the survey team scanned areas either side of the formal sampling Trajectories for sites other than stone artifact sites. The survey team also specifically sampled sections of rock outcrops and cliffs. The former might bear evidence of stone arrangements or quarries and the latter of occupation deposits and/or art sites. Coverage information is shown on the Trajectory location map Appendix 3a & b. Table 4 describes the rock outcrop locations surveyed and comments on sites found or potential for sites.

Table 4. Results of rock outcrop locations surveyed

Rock outcrop location	Comments	Sites
Cliffs around spur, top of Doubleduke S.F.	A few small shelters, upper slope	None
Lookout Doubleduke S.F.	Flat rock, No shelters	None
Rocky knob, Devils Pulpit S.F.	Flat rock, No shelters	None
Low cliffs Royal Camp S.F.	Watercourse, accessible shelters	No sites located, high potential
Low cliffs Mt. Marsh S.F.	Head of gully No suitable shelters	None
Mt. Belmore S.F.	Small shelters, High cliffs difficult access	Edge-ground hatchet, shelter
Foot of Mt. Brown Richmond Range S.F.	Small shelter Sandstone boulder	Stone artifact deposit, shelter
Bulldog Rock Ewingar S.F.	Granite ridge, two small shelters, flat rock	None

9.2 Site Types

As would be expected, the main site type found during the survey were stone artifact sites. The survey for rockshelter sites netted two sites (one in Richmond Range State Forest and one in Mt. Belmore State Forest) which suggests many other archaeological sites are likely to occur in suitable sandstones. These sites are discussed in detail below. The only other site type recorded was a scarred tree. The scar is of cultural origin, although not necessarily Aboriginal, and is also described below.

The following analysis deals with the large number of Artifact Occurrences found during the survey.

9.3 Distribution of Artifact Occurrences

Artifact Occurrences varied a great deal in size and content, although most are small, comprising less than five artifacts (this will be discussed further below). It is important to understand at the outset that each of these sites is not necessarily intrinsically important from an archaeological point of view. Rather it is the pattern of Aboriginal land use that these sites represent that is important. From an archaeological point of view our interest is in identifying a range of stone artifact site types and preserving them in a range of landscapes (see below).

In several surveys undertaken recently on the North Coast and other forested areas in south-eastern Australia, it has become obvious that all forested regions have a constant background "noise" or low density of stone artifact sites. In other words no region or even locality is absent of these sites, nor is the range of site types likely to be dramatically different within each area. Table 5 displays the archaeological site densities from recent surveys using similar methodologies. The average site density for the various surveys is 1.9 Artifact Occurrences per one linear kilometre. Note also that the proportion of different sized sites (based on number of artifacts in sites) is similar between study areas.

Table 5. Comparative forest study areas, relative percentage of stone Artifact Occurrence size classes and Artifact Occurrence per km.

Study Area	stone artifact occurrence size class 1-4	5-20	21-50	51-100	100+	total Artifact Occurrences	total linear km surveyed	Artifact Occurrence per km
Cann River[1]	82%	10%	5%	1%	2%	165	53.0	3.0
Snowy River[1]	76%	7%	8%	4%	4%	121	82.0	1.5
Cobberas[1]	65%	19%	8%	4%	3%	98	43.0	2.3
Gloucester[2]	*	*	*	*	*	25	26.0	1.0
Kempsey/Wauchope[3]	65%	25%	5%	2%	2%	55	38.0	1.4
Grafton[4]	73%	19%	6%	0%	2%	50	27.7	1.8
Casino/Murwillbah	81%	14%	5%	0%	0%	74	43.3	1.7
Total						588	313.0	
Average								1.9

1Hall 1991; 2Byrne 1992; 3Packard 1992; 4Hall & Lomax 1993
* data not available

The implications of the differences between the studies will not be discussed here, rather the comparison is used simply to show the broad similarity of the archaeological pattern for south-east Australian forests in general.

Seventy-four Artifact Occurrences were recorded in state forests during the present survey. A description of them with grid references is contained in appendix 8. Their general location is indicated by reference to their Trajectory name as shown on the Trajectory location map (appendix 3a & b).

The sample results of the survey are listed for the key environmental variables in Figures 2 to 10. These figures present the coverage information paired with the Artifact Occurrence and artifact density information. This is to enable a visual assessment of sample adequacy for each case.

9.3.1 Topography

Topography, as an environmental variable, was considered at four different levels: land system, landform patterns, local ridge system and toposequence elements. Toposequence can have such a strong influence on specific site placement that comparisons between any broader topographic units or other environmental strata, such as vegetation, should only be done after examining the relevant samples in terms of its constituent toposequences. For this reason it is appropriate that we examine correlations between archaeological densities and toposequences first.

Figure 2 displays the relative proportion of effective coverage achieved for each toposequence within each land system. Effective survey coverage is greatest for Ranges, Coastal Ranges and Volcanic Ranges. A wide range of toposequences are also sampled in these land systems.

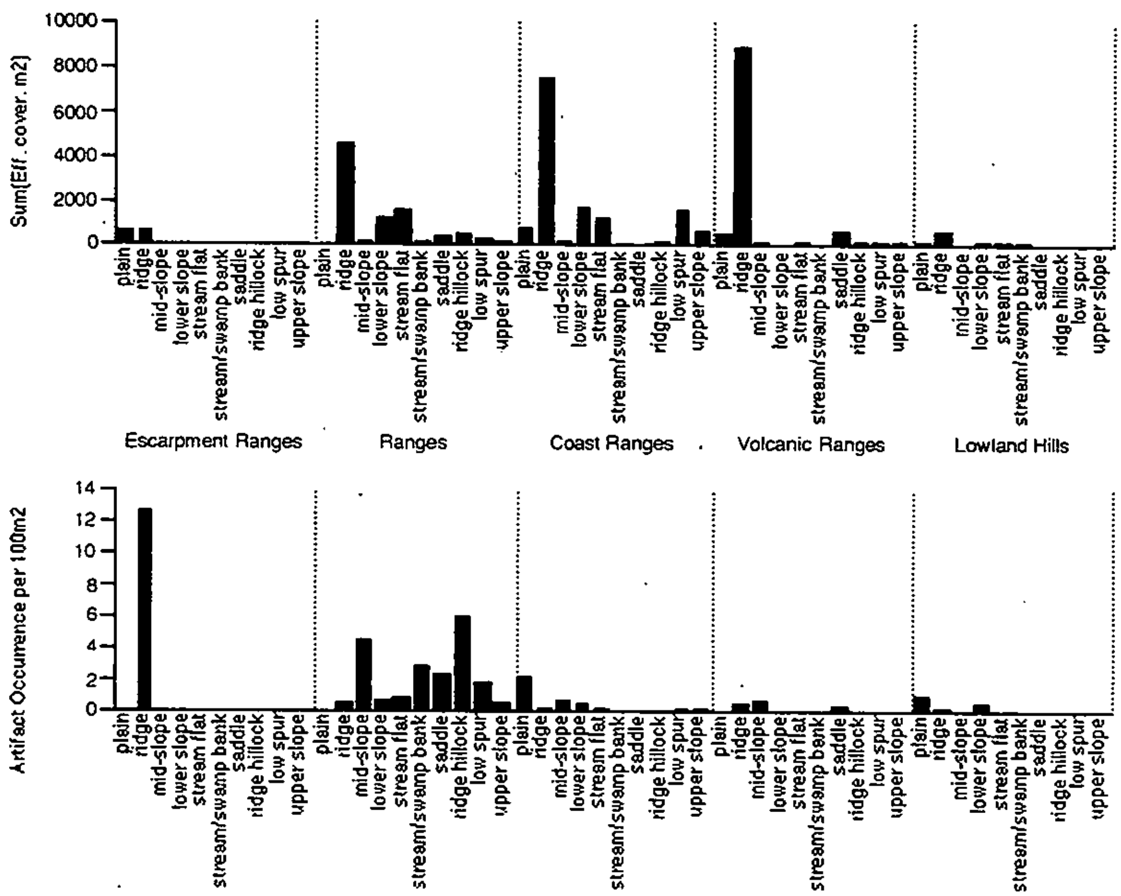

Figure 2. Effective survey coverage(m^2) and artifact density per 100 m^2 for Components surveyed in each toposequence in each land system

The sample is biased to ridge lines in all land systems. One of the main reasons for this bias is that the tracks which provided the mainstay of the survey are located mainly along ridges due to engineering constraints.

One salient point that emerges from a comparison of land systems is the lower artifact densities in Coastal Ranges and Volcanic Ranges as compared with Ranges. Sample sizes are too small for the other land systems to address the question of their relative overall artifact densities.

Although overall sample size for the study area is small this in itself is not adequate to explain the difference in relative artifact density between the Ranges, Coastal Ranges and Volcanic Ranges land systems. Ranges consistently show the presence of artifacts, across virtually the whole range of toposequences, even within toposequences where the sample size is very small. Even allowing for the smaller sample size, artifacts in Volcanic Ranges appear to be distributed over a narrower range of toposequence. Furthermore, artifact densities over a number of toposequence elements in Ranges land system are higher than for any of those in Coastal Ranges, Volcanic Ranges and Lowlands Hills.

A substantial proportion of the artifacts found in Escarpment Ranges, Ranges and Volcanic Ranges were located on ridge toposequences, whereas in Coastal Ranges and Lowlands, sites are more likely to occur in low-lying areas, namely plains, lower slopes and mid slopes. Within Ranges, for which we have the largest sample, saddle, ridge hillock, stream bank/flat and low spurs (located near drainage lines) have the highest artifact densities. Thus artifact location in the more dissected country is focussed towards ridge lines and drainage lines whereas in less dissected country it is not.

The paucity of artifacts in toposequence elements associated with drainage lines (flats, stream banks, low spurs) in most land systems should be treated cautiously. Firstly, the sample size for drainage line toposequences is too small to be considered representative. And secondly the aggrading nature of flats means that sites when present are often covered by sediment. This may also be the case for the low spurs sampled in Coastal Ranges, some of which at least were in aggrading environments. Therefore the failure for these elements to distinguish themselves as high artifact density locations we should regard for the present as a sampling problem rather than a real lack of archaeological materials.

The relatively high density of artifacts on mid slopes within Ranges appears anomalous, however there is an explanation if we examine the sample in more detail. The sample for mid-slope comprised a large proportion of "benches" (mid-slope minimal), these are flat areas with steep slopes above and below. These would have served as naturally defined pathways in the same way as ridges. This reinforces the premium that was put on flat spaces within areas of broken relief as places to stop.

The difference in artifact densities for toposequences between the various toposequences and between the high relief (Ranges, Escarpment Ranges, Volcanic Ranges) and low relief (Coastal Ranges and Lowlands) land systems is likely to be due to two factors: the constraints imposed by topography on the movements of Aborigines about the landscape and the relative availability of stone artifact raw materials in these land systems. In the more dissected land systems (Escarpment Ranges, Ranges and Volcanic Ranges) movement tends to be confined to specific narrow toposequences which were the focus of the survey and hence relative artifact densities for these toposequences are high. Whereas within the Coastal Ranges and Lowlands, where the terrain is flatter, there is relatively less constraint on movements and hence site location would not always be restricted to specific, bounded toposequences. Hence the lower artifact densities for these toposequences and the less chance there is for intersecting sites generally across the landscape.

Local availability of stone artifact raw material also influences artifact density. Within Escarpment Ranges, Ranges and Volcanic Ranges rock outcrops and stream beds provide abundant sources of suitable stone artifact raw materials. By comparison the Coastal Ranges and Lowlands are far less rich in available stone artifact raw materials and so we would expect to find fewer stone artifact primary reduction sites so to increase overall artifact densities for these land systems. The influence of geology on artifact density is considered further below.

Another factor appears to come into play with regard to the relative lack of archaeological material in Volcanic Ranges compared with Ranges and Escarpment Ranges. In Volcanic Ranges archaeological visibility was more difficult to judge, due to the deep sediments and compost associated with wet sclerophyll/rainforest, particularly on plain/plateau landform patterns. This may account for low artifact densities despite our best efforts to estimate it in the field according to the method described above. Another reason may well be the relatively inaccessible nature of some areas that were surveyed compared to ranges in other land systems, for example near Mt. Jerusalem and the Koonyum Range. Moving around within these areas is relatively easy but they are separated from the surrounding lowlands by escarpments which may have tended to reduce visitation to them (cf. Byrne 1987).

Within Coastal Ranges/Lowlands land systems the highest artifact densities were found in the plain toposequence. The finding of the most substantial sites in Coastal Ranges/Lowlands land systems within the "plain" toposequence element has interesting implications. Plain refers to broad areas of flat to very gently sloping terrain which do not have any direct association with water courses or any obvious topographic features which would be used as pathways (such as ridges). Therefore the usual site location predictions based on more broken topography do not work. Sites could occur anywhere on them. Presumably sites do occur on them at relatively high densities given what was found in the small sample, although of course this would need to be confirmed through further survey work.

The other interesting aspect of this concerns the nature of sites that may occur in areas not naturally bounded by a topographic features such as a watercourse, spur or ridge. It would be reasonable to expect, for example, that sites on plains may have low densities of artifacts because they can be more spread out. However one of the sites found on the plains (Mangrove Ck 16-2) was a discrete relatively high density Artifact Occurrence with similar characteristics to those found in areas which have natural topographic boundaries.

Until more sites have been found in areas with unbroken topography it is difficult to say anything more about the distribution and types of sites in such areas. However at least the results to date show that sites are likely to occur not only in areas of terrain which have specific, bounded topographies but also occur, and are presumably widespread throughout undifferentiated gentle terrain.

Ridge lines (including ridge, saddle and ridge hillock elements) have a constant background density of artifacts, at least in the more dissected Escarpment Ranges, Ranges and Volcanic Ranges country (figure 2). To examine whether there was local variation in this distribution, artifact densities were plotted against the local configuration of ridges (Ridge System - see appendix 4). It was hypothesised that Dominant Ridges, that divide the major stream catchments would have been the main pathways through the forests of the more dissected country. Subsidiary Ridges that run laterally off the Dominant Ridges would have had less intense use as pathways, but would have provided access to local stream catchments/resources.

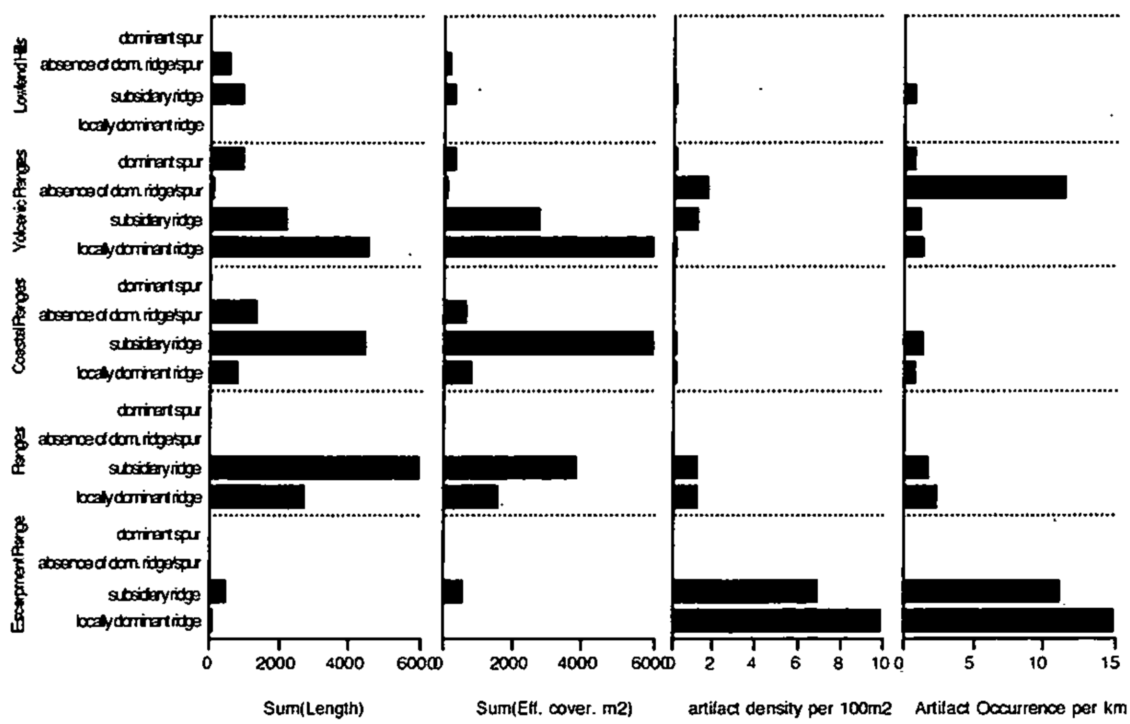

Figure 3. Linear survey coverage (m). effective coverage (m^2), artifact density per 100 m^2 and Artifact Occurrence per km for ridge toposequence within local Ridge System type

Figure 3 displays artifact and site densities for ridge toposequence elements within Ridge System type for each land system. The graph shows that Artifact Occurrence per km and artifact density per 100 m^2 does not vary systematically according to local Ridge System and only in one case - the Escarpment Range land system -

does Dominant Ridge have higher artifact densities than Subsidiary Ridge. The result for Escarpment Ranges however is based on a very small sample for Dominant Ridge. Even so it is predicted that Locally Dominant Ridges in Escarpment Ranges have higher artifact densities, than Subsidiary Ridges. A much larger sample of this land system in the Grafton Management Area (Hall and Lomax 1992), demonstrates quite clearly a higher artifact density on Dominant ridges relative to Subsidiary Ridges, reflecting the more intense use of Dominant Ridges. This pattern is to be expected for Escarpment Ranges where the same limited number of ridges would have been regularly used as regional pathways.

In the Lowlands land system the country varies from gently undulating to low hills (generally less than 90 metres relief). Dominant Ridge systems are not the norm, and where they occur they are fairly discrete and the surrounding country comprises undifferentiated low ridges or rises and plains. This also applies to some extent to Coastal Ranges and Volcanic Ranges. Figure 3 shows that in these land systems artifact and site densities do not vary between Ridge Systems. This in part reflects the overall lesser number of sites on ridges in these land systems and also that people were much less constrained by the topography to use Dominant Ridges because they had other options of moving around the regional landscape.

9.3.2 Water/Drainage System

Previous work suggested that occupation would have been focussed on streams/swamps where plant, animal and other resources are concentrated. Thus it was expected that sites would show a tendency to be located near water sources. Figure 4 displays coverage and Artifact Occurrence/artifact densities for Components surveyed at various distances from third-order streams or larger. The sample size is fairly even for the different distance to water classes, except for greater than 2000 metres where there was little survey coverage.

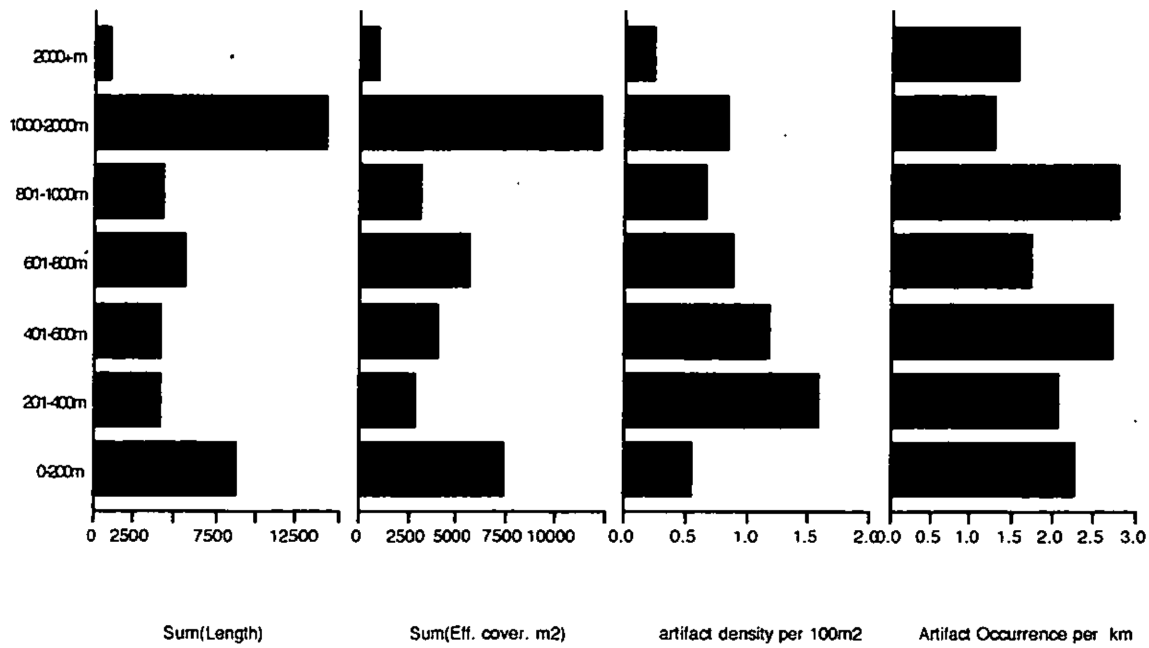

Figure 4. Linear survey coverage (m), effective survey coverage (m^2), artifact density per 100 m^2 and Artifact Occurrence per km for Components surveyed at various distances from third order streams.

While the distribution of Artifact Occurrences is relatively even across the distance to water classes, there appears to be a gradual decline in artifact density after 400 m. Thus although site density is not influenced by distance to water, presumably the size of the sites (and thus artifact density) decreases. The trend is reversed slightly at 1000-2000 m, showing that there is not a simple correlation between proximity to water and site location and that large sites may also occur at remote distances from water.

The pattern may be made clearer if we examine the distribution of different sized sites (measured in terms of numbers of artifacts). The early models of Aboriginal use of rugged forested country suggested that we will only find small "activity" sites along ridge lines (i.e. the furthest points from water) (e.g. Byrne 1984; Egloff 1984). Figure 5 shows that there is no clear trend regarding the proximity of larger sites to water, although of the four largest sites found during the survey two are located further than one kilometre from the nearest third-order stream (Mt. Belmore 3-1, Bulldog Rock 1-1). These results have to be treated cautiously due to the potential sample bias resulting from the emphasis of survey on ridge lines remote from streams and the small sample and problems of detecting sites on flats and stream banks referred to previously.

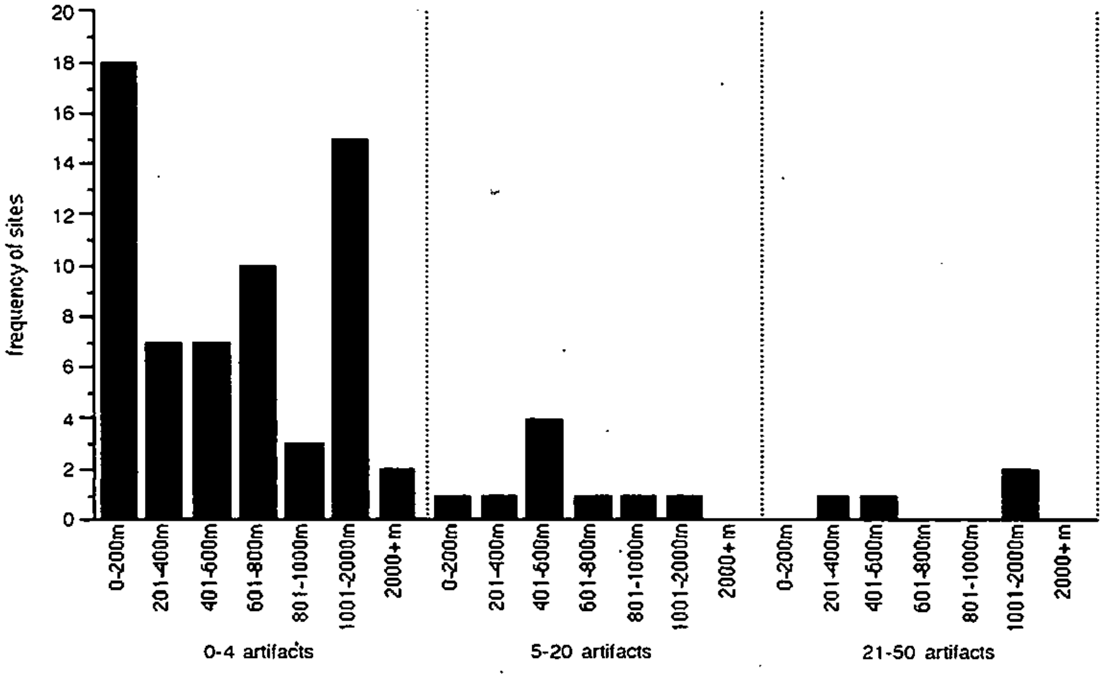

Figure 5. Frequency of stone artifact site size classes for Components surveyed at various distances from third order or larger streams

The presence of some larger sites at considerable distances from water underlines the point that there is a complex of variables (cultural and environmental) influencing site location and it cannot be tied to any single environmental factor.

9.3.3 Vegetation

Figure 6 shows the coverage and Artifact Occurrence/artifact density results for different vegetation communities within the survey area. Note communities separated by "/" indicates that the artifacts/sites are located within 100 m of two vegetation communities. The large proportion of sample area surveyed in interface zones reflects the emphasis on ridges which tend to be natural boundaries between vegetation communities. The sample is spread fairly evenly over the major vegetation communities.

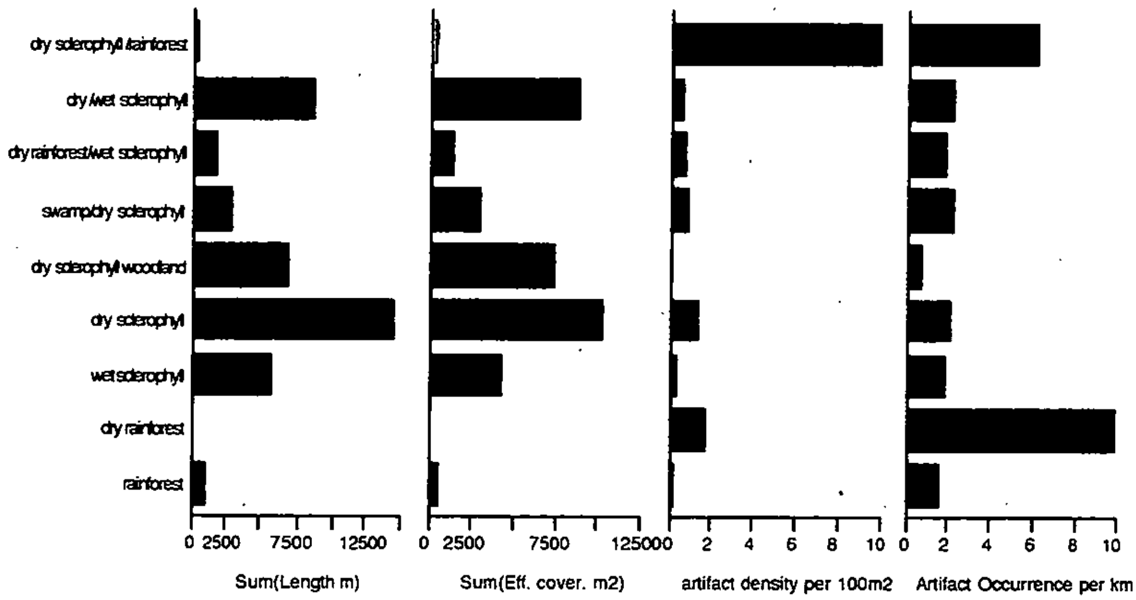

Figure 6. Linear survey coverage (m), effective coverage(m^2), artifact density per 100 m^2 and Artifact Occurrence per km for Components surveyed in different vegetation communities.

Artifact Occurrence densities appear to be fairly even for most forest types, about 2 Artifact Occurrences per km. Artifact densities fluctuate more widely (the more extreme fluctuations are due to sample size), although most are between 0.5 and 2.0 per 100 m^2.

Dry sclerophyll was the most surveyed of the forest types. A substantial portion of this vegetation community was surveyed in each of the land systems over a range of toposequences (see figures 7 & 8). Artifact densities for this forest type are relatively high in Escarpment Ranges, Ranges and Coastal Ranges and relatively low in Volcanic Ranges and Lowlands. These low artifact densities for Volcanic Ranges and Lowlands are probably a result of small sample bias rather than real lower densities for these land systems. In the case of Volcanic Ranges many of the sites recorded in dry sclerophyll forest were included in the sample for dry/wet sclerophyll forest because of their location on the interface of these two communities. This may also partly account for the low artifact density for dry sclerophyll forests for this land system.

Dry/wet sclerophyll forest is well represented in Coastal Ranges and Volcanic Ranges where it was sampled over a range of toposequences. It has artifact densities in the average range of 0.5 to 2.0 artifacts per 100 m^2. The sample for this vegetation community in other land systems is inadequate to properly assess its archaeological potential.

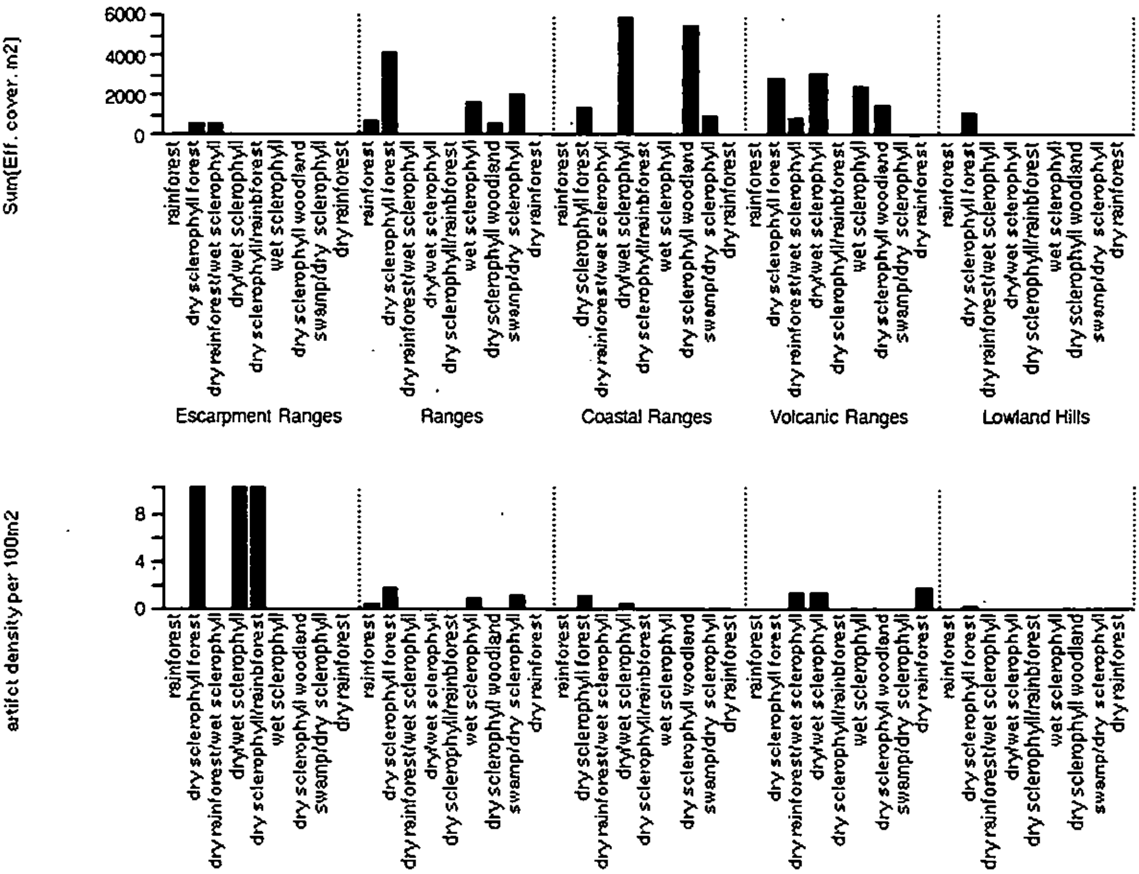

Figure 7. Effective survey coverage (m^2) and artifact density per 100 m^2 for Components surveyed in different vegetation communities within each land system

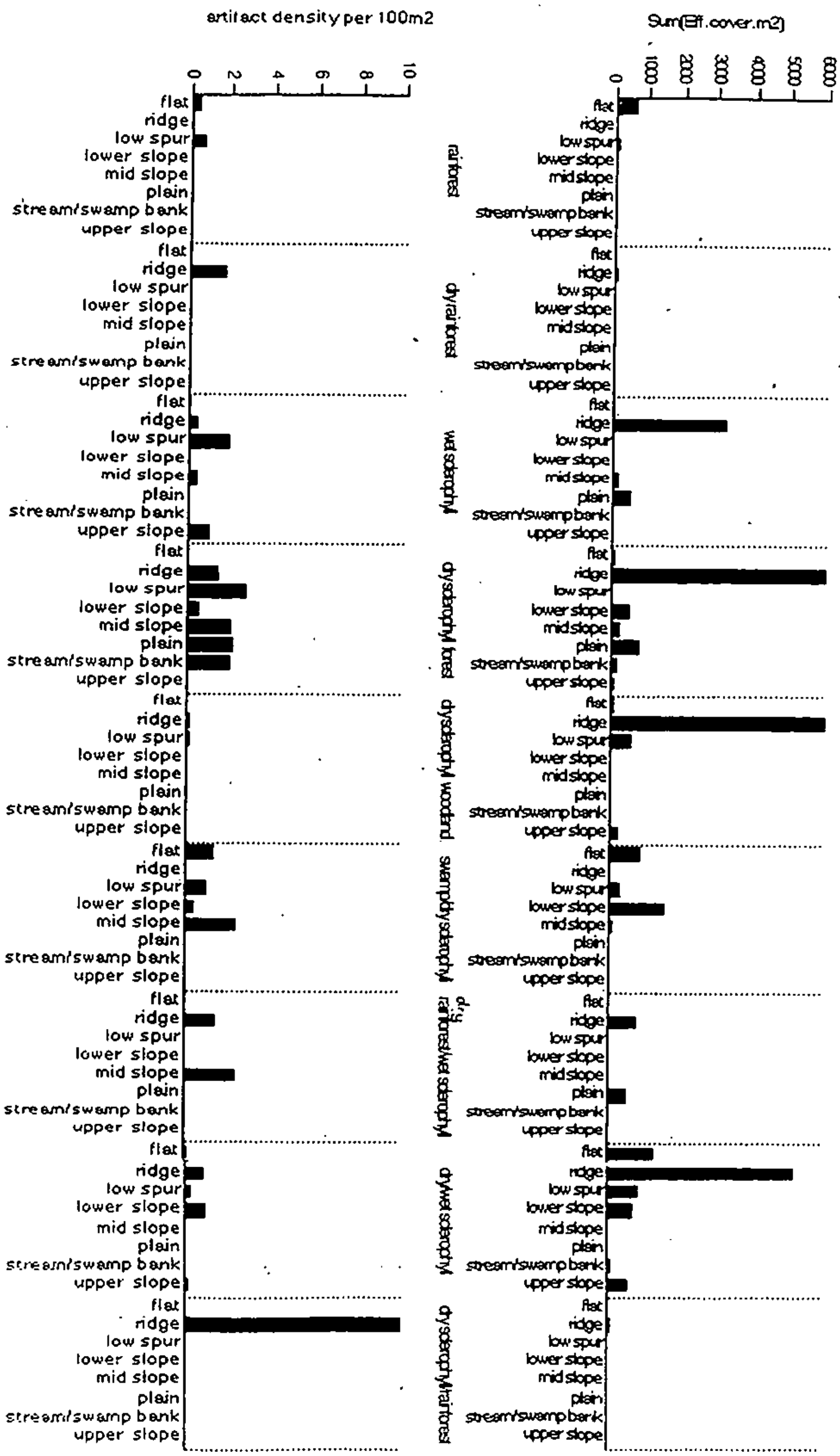

Figure 8. Effective survey coverage (m^2) and artifact density per 100 m^2 for Components surveyed in different vegetation communities for each toposequence

Rainforest, wet sclerophyll forest and dry sclerophyll woodland have exceptionally low artifact densities, although their Artifact Occurrence density is similar to the other vegetation types. That is these communities have particularly small artifact sites although not necessarily less of them. In the case of rainforest and wet sclerophyll this may relate to the presence of thicker soils, compost and bioturbation. These factors would have the effect of not only making sites more difficult to find in the first place, but also of dissipating them over a larger area of soil volume.

In contrast to rainforest/wet sclerophyll, dry sclerophyll woodland has eroding ground surfaces that would tend to reveal artifacts if they were present. Thus the relative lack of artifacts in this vegetation community is a more surprising result than the low density in the wet forest types. Figures 7 & 8 show that a relatively large area of dry sclerophyll woodland was surveyed in Coastal Ranges and Volcanic Ranges, and most of this is on ridge tops. This forest type is situated on dry, rocky ridges that are remote from water sources. The main locations of dry sclerophyll woodland surveyed were the Koonyum Range to the west of Mullumbimby and the top of the Richmond Range near the coast. Possibly the lack of resources in these dry landscapes is the reason for their absence of sites.

Swamp sclerophyll/dry sclerophyll forest is only represented in the Ranges and Coastal Ranges sample. These two land systems along with Lowlands are where swamp sclerophyll forest is most abundant. Like some of the other forest types (e.g. rainforest) it occurs on the lower elements of the toposequence i.e. flats and lower slopes. It is characterised by water courses, swamps and grasslands. We would expect this vegetation community to have been fairly attractive to Aborigines in terms of the plant and food resources it would have offered. It rates fairly highly in Ranges but has only low artifact densities in Coastal Ranges.

Dry sclerophyll/rainforest was sampled in Escarpment Ranges only. This sample albeit small indicated a high Artifact Occurrence rate and high artifact density for this vegetation community. The site (Nogrigar 4-1) which comprises the sample for dry sclerophyll/rainforest is situated on a hardwood ridge within a mosaic of hardwood and rainforest. Byrne (1987) has suggested that such mosaic environments would have been intensively exploited by Aborigines for their rich plant and animal resources.

A small area of dry rainforest was surveyed in Mebbin State Forest and one Artifact Occurrence located. This result is shown on figure 7 as a high Artifact Occurrence rate and a slightly above average artifact density for dry rainforest. Although this result is based on a very small sample Byrne (1987) has also recorded five Artifact Occurrences in Mebbin State Forest, one of which (NPWS site number 13-1-84) was re-recorded for the purposes of artifact analysis (discussed below). These combined results indicate that there is a high potential to locate artifacts in dry rainforest.

Small samples of dry rainforest/wet sclerophyll forest were surveyed in Volcanic Ranges and Escarpment Ranges (figures 7 & 8). Average artifact densities were found in this vegetation type in the Volcanic Ranges on ridge and mid-slope elements. In the Escarpment Ranges, a fairly flat area (plain toposequence) was surveyed near Hongkong Creek where nothing was found, although the soil was thick and strongly bioturbated so it was very difficult to gauge archaeological visibility.

9.3.4 Slope

Figure 9 shows the coverage and Artifact Occurrence/artifact density results for different slope classes in the survey sample. The graph shows that artifact density falls off gradually with increase in slope. In part this appears to reflect the sample size which also decreases with rise in slope. However an investigation of evenly sized samples from the original sample population supported the same patterning for artifact density as shown on the graph. Other studies have also showed a similar result (Collins and Morwood 1991; Packard 1992; Byrne 1992). This relationship is likely to be the result of people having selected level or gently sloping ground for pathways or campsites.

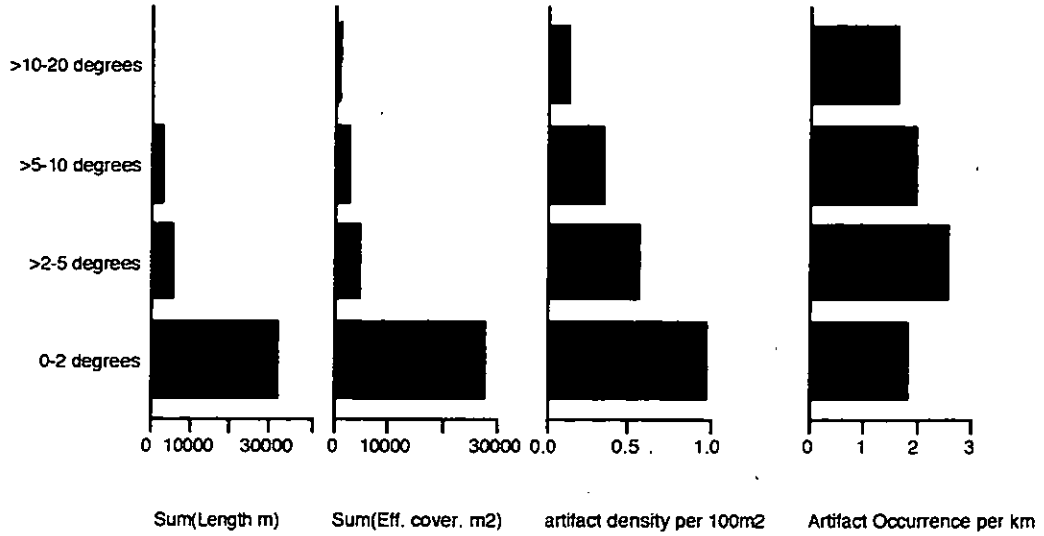

Figure 9. Linear survey coverage (m), effective coverage (m^2), artifact density per 100 m^2 and Artifact Occurrence per km for Components surveyed within different slope classes

Interestingly the number of Artifact Occurrences does not decline correspondingly with artifact density. This reflects the fact that while activities resulting in the discard of only a few artifacts may have been carried out on sloping ground, activities of longer duration that resulted in the discard of more artifacts were carried out on flat ground. It may also be that artifacts originally discarded on relatively flat ground are gradually moving down slope from their original position.This is particularly noticeable on eroding tracks in the study area where artifacts were observed as part of lag deposits on slopes.

9.3.5 Geology

Geology is likely to have an important bearing on the nature of stone artifact sites. Although there are many reasons both cultural and environmental influencing the choice of camp site or activity site locations, people are likely to have utilised stone more when it was locally available. This will have two effects: greater densities of artifacts will be found near the sources of stone than away from them, and the raw materials used for the manufacture of stone artifacts will reflect the local geology.

To examine the relationship of geology to sites, we can plot the frequency of raw materials from which artifacts are made against land system (figure 10). Since we have a broad idea of the geology of each land system it should be possible to perceive broad correlations between the local geology, raw material composition and abundance of artifacts.

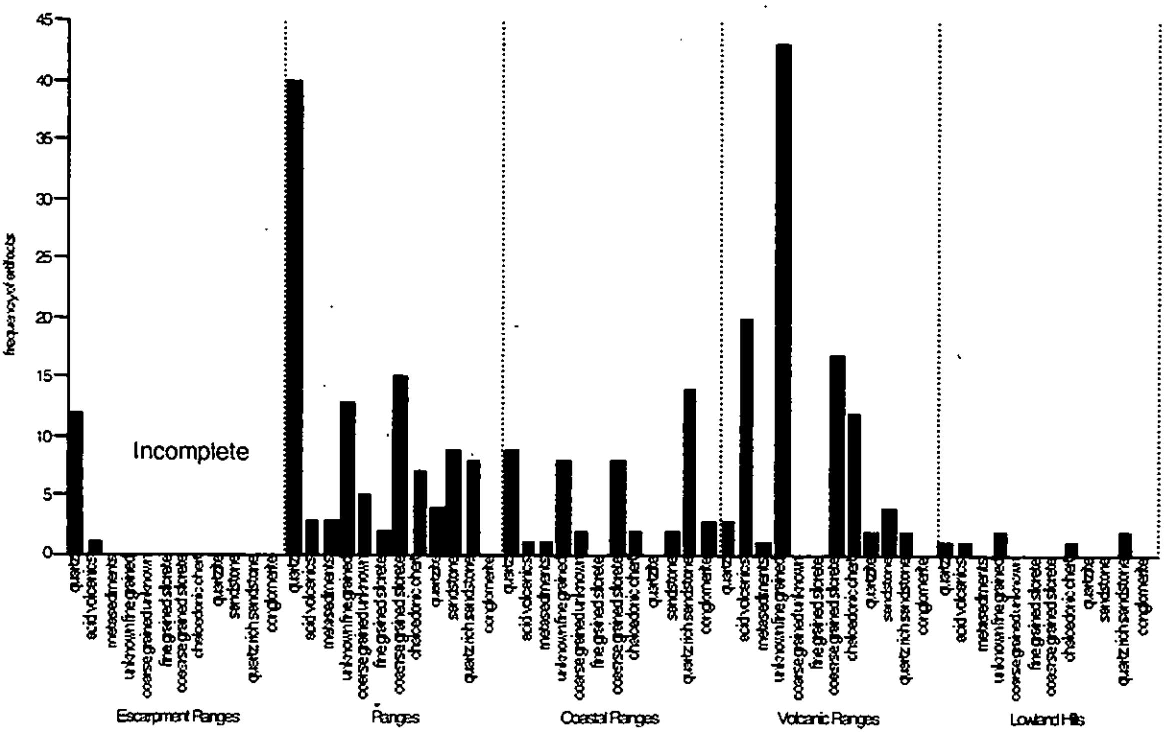

Figure 10. Stone artifact raw material frequencies by land system

Escarpment Ranges stone artifact assemblages consist predominantly of quartz . It should be noted that the sample in the graph represents only one of three sites recorded in Escarpment Ranges. Information is not available for the other two sites however it was noted during the survey that they were comprised of 90% quartz. During the survey of the Escarpment Ranges quartz was noted to be of particularly fine quality. All the quartz artifacts found in Ewingar State Forest were semi-translucent, which is usually a sign of quartz having good flaking properties. Normally quartz assemblages only have a minor portion of such good quality quartz, suggesting that in the present case, good quality quartz was locally abundant. The local abundance of quartz is confirmed by the geology which comprises granites and metasediments, both of which have an abundance of quartz veins. Thus, in Escarpment Ranges there is a correlation between the local geology and the type of raw material used for the manufacture of stone artifacts. Also it is likely that artifacts in the Escarpment Ranges may be particularly abundant due to the availability of this fine quality quartz.

The Ranges have a substantial percentage of quartz (35%) in addition to a mix of other stone artifact raw materials. On the basis of our limited knowledge of the geology of the Ranges it is not possible to assess in detail to what extent the proportions of raw materials in artifact assemblages reflects the local geology. Most of the stone artifact raw materials identified in archaeological sites in this land system during the survey could derive from the Ranges (namely pebble beds, conglomerates and quartz veins) although some were probably brought in from outside this land system. For example the semi-translucent quartz artifacts located during the survey in the western part of the Ranges are likely to have come from quartz outcrops in the Escarpment Ranges.

On the basis of the geology silcrete outcrops are likely to be present in the north of the Richmond Range and east along the coastal arm of the Richmond Range. Large flakes of silcrete were found in archaeological sites within Richmond Range State Forest. The presence of these large flakes indicates that a source of silcrete is in close proximity to this site. An actual source of silcrete was found in association with a small scatter of artifacts on Paw Paw Road (Paw Paw Rd 1-1). The source comprised nodules up to 40 cm in length eroding out of sandstone on top of a ridge. A number of sites found in the Richmond Range State Forest were composed predominantly of silcrete. Silcrete quarries and silcrete primary reduction sites could be expected to occur in the north of Richmond Range State Forest.

Only a few pieces of acid volcanics and metasediments were found in the Ranges, these were most likely to have been brought from the Escarpment Ranges. Lithic sandstone, quartz-rich sandstone and quartzite, which together comprise 18% of artifacts in Ranges are likely to derive from the local conglomerate or pebble beds.

In Coastal Ranges materials which we know are locally available - quartz-rich sandstone, sandstone and conglomerite - comprise 38% of the assemblage. The silcrete could come from nearby outcrops of basalt or further to the north where basalt outcrops extensively. Interestingly quartz comprises a comparatively minor percentage of the assemblage reflecting perhaps the distance from good quality sources of the stone (that is the Escarpment Ranges).

Volcanic Ranges show the clearest correspondence between artifact raw material type and local geology. Most of the stone artifacts located during the survey of this land system are manufactured from acid volcanics (including ignimbrite), "unknown fine grained" and silcrete. This clearly reflects the local geology as acid volcanics are the predominate rock type throughout the ranges south of Murwillumbah. Most of the silcrete artifacts were recorded in Bungabbee State Forest. This forest is located on the southern edge of the Lismore basalt flow where it meets the sediments of the Richmond basin. This is a likely location for silcrete to outcrop. The "unknown fine grained" generally refers to material that is either acid volcanic or contact metamorphic, so it also refers to locally available stone sources.

The sample from Lowlands is too small to comment on.

In summary, local geology does have a strong influence on the type of stone used in local artifact manufacture. It is uncertain however to what extent local availability of stone has affected the quantity of stone in assemblages. It seems likely that sources would have been more restricted in the Ranges and Lowlands nearer the coast where the only sources within forests would have been pebbles derived from conglomerates. Further to the west and north, a greater range and possibly abundance of raw materials were available for making stone artifacts and thus more artifacts may be expected to occur in these areas. This may account in part for the lower overall densities of artifacts found in Coastal Ranges as compared with Ranges and Escarpment Ranges.

9.3.6 Conclusions

Artifact Occurrences have been found across the full range of environments in the study area. In summary the following correlations between environmental variables and site location for the study area are noted. In Escarpment Ranges, Ranges and Volcanic Ranges, sites are strongly focused on narrow, linear toposequences sloping less than 10°, in particular ridge line elements, drainage line elements (lower slopes, stream flats/banks), low spurs near drainage lines and minimal mid-slopes (benches)(figure 2). On ridge lines, site location is particularly strongly correlated with high and low points, that is, ridge hillocks and saddles.

In Lowlands, Coastal Ranges and Volcanic Ranges relatively fewer sites were detected. In the case of the first two land systems this appears to be because they are more dispersed across the landscape and are not as strongly focused on drainage lines and ridge lines, thus a given sample area is less likely to register artifact densities as high as those for linear toposequences that were sampled in highlands. The lower density of artifacts in the lowland group of land systems may also be linked to the lack of stone resources in the lowlands. The reasons for the relative paucity of material in Volcanic Ranges appear to be more complex but are thought to relate to the topographic isolation of parts of the land system and difficulty of detecting sites in plateau/plain landform patterns especially in wet forest areas.

10. SITE TYPES

In this section information concerning the physical form and contents of the Artifact Occurrences is analysed to produce a preliminary site typology. Then, on the basis of the environmental correlations for site location established above and the characterisation of site type, we can proceed to revise/refine the original predictive statements for the archaeology of the study area. This can then be used as a basis for predicting impacts on the archaeological resource.

Detailed information was recorded regarding site structure and contents. The data for the 74 Artifact Occurrences recorded during the survey are presented in appendices 8-10. As most of the sites are very similar in structure and contents, the information can be compressed into a few key variables. The main characteristics of a site are its area and the number, density and range of artifacts present (contents), and the extent to which these contents are *in situ* (remain in the original position they were discarded). Each of these variables will be discussed in turn in order to characterise the stone artifact sites located during the survey.

10.1 Site Area and Artifact Density

Recorded site length varies from a few metres to 250 m in length and generally they are only a few metres wide, depending on the dimensions of the window of exposure they were recorded in (usually a track). Most sites are under 200 square metres in area with a few sites thousands of square metres in area due to the fortuitous circumstance of their exposure. Most sites have average artifact densities less than 10 artifacts per 100 square metres although there are a few sites that have much higher artifact densities with over 70 artifacts per 100 square metres.

Site area on its own is not a useful means for characterising overall site structure because it ignores one of the main structural characteristics of sites - artifact densities. The latter varies widely between sites regardless of their area. Also, often site area is entirely dependent on artificial Component boundaries. Similarly, artifact density on its own is an inadequate measure for comparing the internal structure of sites, as it does not take into account the overall size of sites. For example a site of a few square metres may give as high a density as a site of several thousand square metres. Because of these problems it was found that raw numbers of artifacts gives the best single index of the sites overall substance in terms of area and artifact density combined.

10.2 Artifact Number

It is important to emphasise that artifact counts reflect what was visible within a Component and not real site boundaries. In some cases it was obvious that large numbers of artifacts were obscured by soil and vegetation. In a few cases it was possible to estimate real site boundaries by fortuitous exposures and "natural" limits imposed by the topography (e.g. low spur bounded by a bend in a creek). Therefore we should regard the Components as small windows into a much broader, invisible distribution of artifacts. Nevertheless what we have captured within each "window" does give an idea of the range of site sizes and artifact densities for the study area.

Figure 11 shows the frequency of each artifact number size class for the study area. Sixty Artifact Occurrences (81%) have 1-4 artifacts. Ten Artifact Occurrences (14%) have between 5 -20 artifacts. Four Artifact Occurrences (5%) have 21-50 artifacts. By far the most common site size class is less than 5 artifacts and large sites are rare.

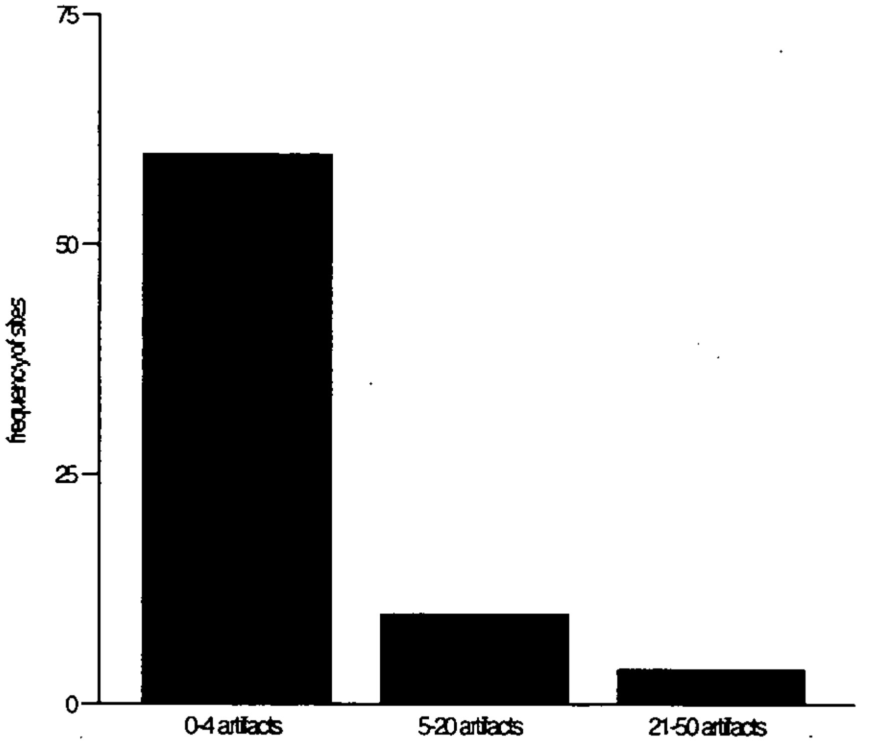

Figure 11. Frequency of each Artifact Occurrence size class for study area.

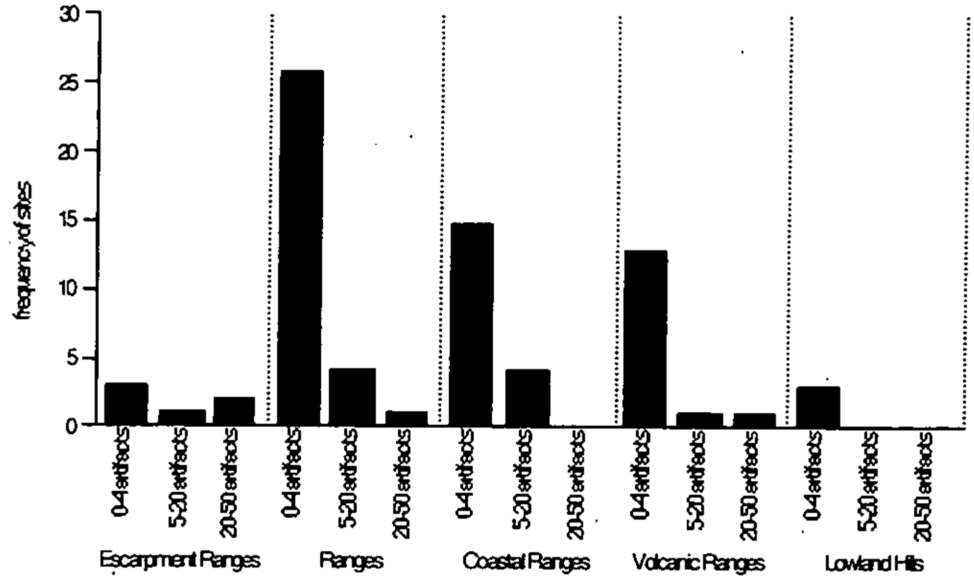

Figure 12. Frequency of each Artifact Occurrence size class for land system.

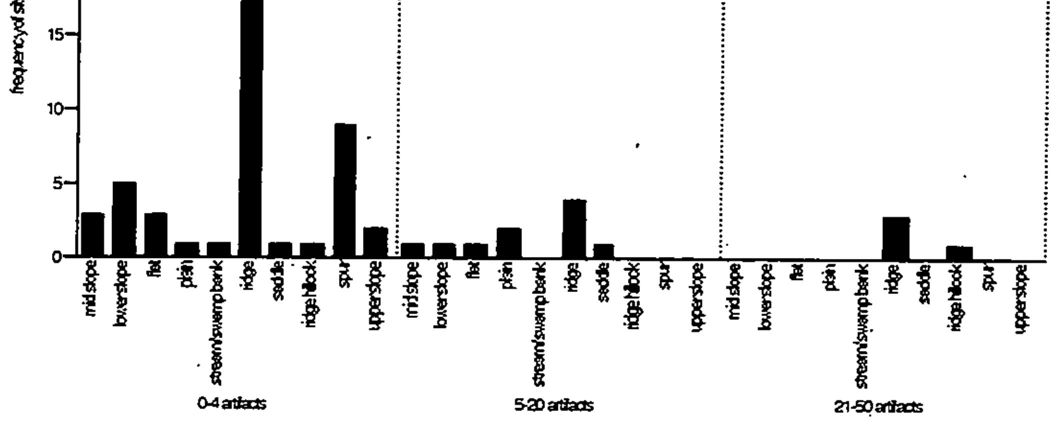

Figure 13. Frequency of each Artifact Occurrence size class for toposequence

Figures 12 & 13 show that the smallest sites (1-4 artifacts) occur across all toposequence elements and land systems. They occur most frequently on ridges and low spurs. The largest sites located during the survey are present in the Escarpment Ranges, Ranges and Volcanic Ranges. These sites occur on ridges, particularly on ridge hillocks and saddles. Investigations elsewhere suggest it is likely that large sites will also occur in close proximity to drainage lines, especially on low spurs (Hall and Lomax 1992). As discussed previously, aggrading sediments can make it difficult to find sites on flats and so the failure of the present survey to find large sites in these locations should not discount drainage line toposequences as potential locations for large sites. Also our sample size for flats and low spurs is too small on which to base a definitive assessment of their potential for large sites.

Likewise the absence of larger sites in the Coastal Ranges should not be taken as a general absence of larger sites in this land system due to the overall small sample size of the study and problems of detecting sites in aggrading environments. For the present it will be hypothesised that large sites will occur within Coastal Ranges but at a lower frequency than other land systems. Similarly, the absence of larger sites in Lowlands should not be taken as a general absence of such sites in this land system as it is not possible to establish this on the basis of the present sample.

10.3 Site Contents

Sites are formed by the discard of stone artifacts resulting from one or more similar or different activities carried out over a certain period of time. The range and number of artifacts and the area over which they were discarded will depend on the nature, duration and frequency of activities preformed at a particular location. For example we would expect a single activity that occurred once in a short space of time (e.g. butchering a kangaroo or repairing a spear) to leave a residue of only a few artifacts of one or two types in a small area. On the other hand a campsite which people occupied periodically over many years will contain a large number and range of artifact types over a much greater area. Put more simply sites can be seen as ranging from simple to complex (representing the range of activities) and in terms of their size small to large (the area occupied during the performance of the stone using activity/ies). This relationship is illustrated in figure 14.

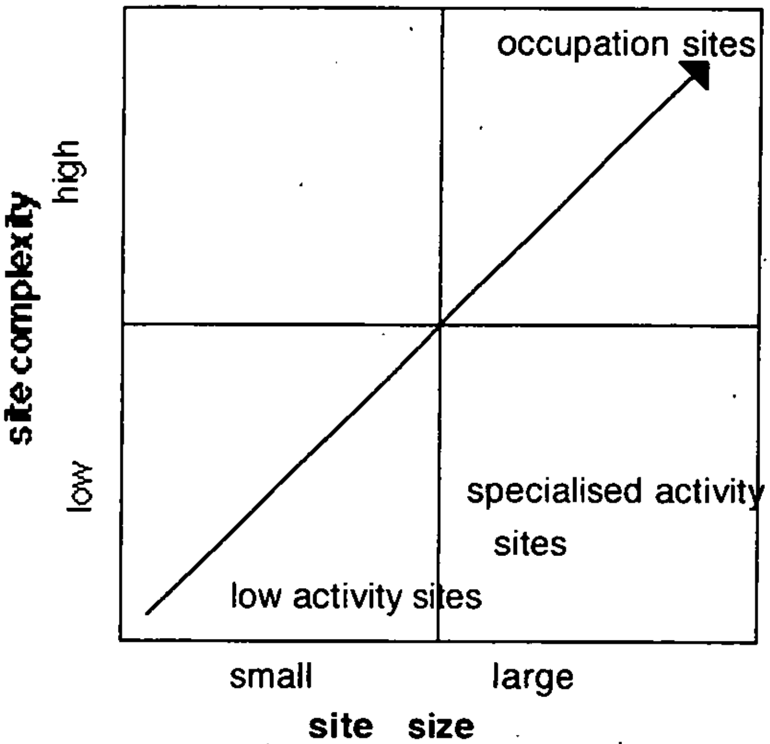

Figure 14. Schematic representation of the relationship between site size and complexity

To characterise sites located during the present survey in terms of their complexity sites are scored individually according to two criteria: diversity of technological categories and diversity of stone artifact raw material types present. The sites ranking is determined according to the sum total of these scores from lowest (least complex) to highest (complex).

Scoring for these criteria is briefly outlined. Sites are scored a point for the presence of each of the following artifact categories: anvil, micro-debitage(<1cm), hatchet, flaked pebble, manuport, core, microliths and retouched piece. Sites also score a point for each different raw material category present at the site.

The presence of site furniture is also noted as a potential indicator of site function. Site furniture is defined within the context of this report as large stone artifacts such as anvils and grindstones or any other large manuport which has been brought to and left at a site as a potential permanent or semi permanent site feature.

The results of the site scoring is summarised in the following discussion in terms of three arbitrarily defined levels of increasing complexity. These levels are defined as low complexity (<5 score points), low-moderate complexity (>5<10 score points) and complex (>10 score points). Results for all the sites are presented in appendix 10.

One site previously recorded by Byrne (1987) and re-visited during the current survey has been included in the analysis (N.P.W S. site number 13-1-84).

Sixty-four (85%) sites are of low complexity, eight sites (10%) are low-moderate complexity, while four sites (5%) are complex.

In terms of the site size classes discussed previously the low complexity sites are generally within the 1-4 artifact and 5-20 artifact site size classes. Low-moderate complexity sites are within the 5-20 and 21-50 artifacts and complex sites within the 21-50 class.

10.4 Site Types

On the basis of site size, complexity and the types of stone artifacts present it is possible to categorise sites into a number of site types.

10.4.1 Occupation/ Primary Reduction Sites

These are large and complex sites. The wide range of artifact categories including site furniture at these sites indicate that they have a generalised function and that a range of activities were carried out. They are probably located in close proximity to stone raw material sources and are characterised by primary reduction flakes and stone working debitage. These sites may be located near water (Oaky Ck 4-1), however they may also occur at some distance from water (Mt. Belmore 3-1).

Oaky Creek 4-1
Mt. Belmore 3-1

10.4.2 Primary Reduction Sites

These sites are large sites with low-moderate complexity scoring. The lower range of artifact categories present at these sites and predominance of a particular raw material indicate that these are specialised stone reduction sites. These sites are probably located near stone sources.

Nogrigar Rd 4-1
Bulldog Rock 1-1

10.4.3 Low-moderate Complexity Sites

These sites are of low-moderate complexity and size. Some of these sites are characterised by extensive low density deposits of artifacts that represent the accumulated discard of stone artifacts along Aboriginal pathways. Higher density sites within this class may represent the discard from small transitory campsites. In Ranges and Escarpment Ranges these transitory campsites may be expected to occur widely on ridge lines especially on saddles and/or ridge hillocks.

NPWS (13-1-84)	IslandRd2-1	Mt. Marsh 4,1-1
IslandRd1-1	MangroveCk16-2	BranchCk1-1

GorgeCk1-1 MiddleRidge2-1

10.4.4 Single Activity/ Off Site activity Sites

These are small sites of low complexity where activities such as the hunting or butchering of an animal are performed away from main occupation sites. These sites will be characterised by artifact maintenance debitage and discarded stone tools. Site furniture will rarely be associated with these sites. These sites can be expected to occur along ridge lines and drainage lines in areas of dissected country and anywhere throughout areas of country where movement is not constrained by topography.

BabylCkRd3-1	BabylCkRd4-1	BroadwaterCkRd1-1
BroadwaterCkRd3-1	BroadwaterCkRd12-1	BroadwaterCkRd14-1
CampForestRd1-1	ChrisitesCkRd2-1	ClaypotRd5-1
DomeMtn3-1	DomeMtn4-1	EasternBoundaryTrl2-
1 FortyAcreRd2-1	FortyAcreRd3-1	FortySpurRd2-1
Fosters Spur1-1	GorgeCreek5-2	IslandRd6-1
IslandRd4-1	JackybulbinCk1-1	LollbackCk2-1
Lookout1-1	MackellarRange5-1	MackellarRange12-1
MackellarRange13-1	MackellarRange16-1	MackellarRange17-1
MackellarRange18-1	MalaraCkFt1-1	MangroveCk7-1
MangroveCk11-1	MangroveCk16-1	McFaydenRd2-1
MiddleRidge3-1	MiddleRidge4-1	Mt Marsh 1,6-1 Mt
Marsh 2,7-1	Mt. Marsh 3,1-1	Mt. Marsh 5,1-1 Mt.
Marsh 5,5-1	Mt. Marsh 5,8-1	Mt. Marsh 5,10-1
NogrigarRd1-1	NogrigarRd2-1	NogrigarRd3-1
OilRig3-1	PawPawRd1-1	PeacockCkRd4-1
PeacockCkRd7-1	PeacockCkRd8-1	PeacockCkRd10-1
PeacockCkRd11-1	PeacockCkRd12-1	PineRd2-1
RoyalCamp1-1	SugarloafFt1-1	SugarloafFt3-1
TullymorganRd6-1	TullymorganRd7-1	

10.5 Site Structure

Structured sites have the greatest potential for providing behavioural information and hence have the greatest scientific significance. They possess high levels of spatial (horizontal) and/or temporal (vertical) patterning. Generally large sites containing high frequencies of artifacts have the greatest structure. The level to which a site maintains its structure declines in proportion to the level of disturbance that the site has undergone. Levels of disturbance in the study area in general will be assessed in detail below. Here I will only discuss the type of environments where sites with structural integrity will be formed and provide examples from the current survey that come nearest to this situation.

The most significant sites would be those that are temporally patterned. That is those sites that have stratified deposits (layered deposits of archaeological materials). These sites are likely to occur only in environments were the soil is aggrading such as stream banks/terraces, stream flats, plains, lower slopes and saddles and where the land surface has not been eroded. Such locations are rare in most state forests where much of the landscape has been steadily eroding or subject to intensive bioturbation or disturbance

Most of the sites located during the survey are shallow, low density, surface deposits of stone artifacts with little or no structure. There are however a few obvious exceptions, distinguished not so much on their potential for *insitu* material but on their large size and high artifact density. These sites are listed in Table 6.

Table 6. Sites located during the survey with potential site structure

Site name/ State Forest	Toposequence	Potential for archaeological deposit
Nogrigar Rd 4-1 Ewingar S.F	Ridge	May have shallow deposits of *in situ* material in remnant pockets
Bulldog Rock 1-1 Ewingar S.F.	Ridge saddle	May have shallow deposits of *in situ* material in remnant pockets
Oaky Creek 4-1 Bungabbee S.F.	Ridge	May have shallow deposits of *in situ* material in remnant pockets
Mt. Belmore 3-1 Mt. Belmore S.F.	Ridge hillock, bench	May have shallow deposits of *in situ* material in remnant pockets

10.6 Other sites

10.6.1 Rockshelters

A number of rock outcrops were surveyed for rockshelters during the survey. The areas surveyed have been described in table 4. While the sample is small it does provide an indication of high potential for rockshelter formations in the middle and coastal section of the Richmond Range. This will be further discussed below.

Two rockshelters with evidence of occupation were found (see appendix 8 for details):

Mount Belmore Axe Shelter
Mt. Belmore State Forest

Camp Forest Rd Shelter
Richmond Range State Forest

Mt. Belmore Axe Shelter

This site comprises a small shelter containing a single edge-ground hatchet. The site was recorded with Robert Caldwell from Casino Local Aboriginal Land Council. The shelter has only a few square metres of floor space and 1.5 m high ceiling. It has a smooth rock floor with no sediments. The rock shelter is difficult to approach as it is located 15 metres down the face of a cliff near the top of Mt. Belmore. Because of the rockshelters location and size it has never served as an occupation site, but simply as a place where an axe was cached.

The hatchet is an exceptional find for three reasons. Firstly, it has been cached rather than lost or discarded as is usually the case. Secondly, it retains some resin around the butt where it was hafted. Organic remains such as this are extremely rare in the field as they tend to decompose relatively rapidly. The resin has probably survived as a consequence of the dry environment of the shelter.

The third and most unusual aspect of this find is that the hatchet is a hammer-dressed piece of quarried igneous rock. An extensive study of the distribution of hatchets of the Clarence and Richmond valleys by Binns and McBryde (1972) has indicated that hammer-dressed hatchets were not present in this area and that only locally available pebbles of metasediments were used for the manufacture of hatchets. The Mt. Belmore hatchet probably derives from a quarry on the tablelands.

Camp Forest Road Shelter

This shelter was recorded with Eric Walker from Jubullum Aboriginal Local Aboriginal Land Council. It comprises an outlying sandstone boulder with a slight overhang providing a floor space that extends 14 m lengthwise, but is only an average of 2 m deep with the ceiling 2 m at its highest. Four stone artifacts, comprising three silcrete flakes and one flaked pebble chopper were found within the shelter. More significantly the shelter appears to have a substantial deposit of fine sediments (possibly a metre or more in depth) thus it has a high potential for containing stratified archaeological material. The site is likely to have received regular visitation by Aborigines as it is situated on the banks of a perched lagoon that would have been rich in resources. The area surrounding the site has been logged in the past although this does not seem to have disturbed deposits in the shelter.

This site is one of only a few shelter occupation sites known in the uplands of the region and hence is of high regional significance.

10.6.2 Scarred Trees

This type of site does not survive well in upland forested areas which are subject to frequent fires and over the years have been extensively logged. Nevertheless, a tree stump bearing a cultural scar, 125 cm long and 49 cm wide and roughly oval in shape was located during the survey along Duffys Break Road in Whian Whian State Forest. The scar may not be of Aboriginal origin although it appears definitely to be cultural. The reasons for determining that the scar is of cultural origin is as follows: it is on a large, well-formed stump with no other irregularities, unlike a natural butt scar the scar terminates above the ground surface, and finally the scar has an unusually broad, symmetrical, rounded shape, rather than narrow elongate shape typical of natural scars. The historic age of the scar is indicated by the fact that the scar itself had substantially regrown over the heartwood before board holes were cut into the scar to fell the tree.

Scarred trees are one of the more common sites in the riverine country, although likely to be rare in uplands. Several unrecorded scarred trees, including canoe scars, were pointed out to the author by local Aborigines near the Clarence River at Baryulgil.

10.6.3 Ochre Locations

During the survey red and yellow ochre was commonly found within ferruginous nodules of sandstone on ridges in the Richmond Range and outlying spurs. Aboriginal informants frequently identified it and recalled its use in the old days. No signs of past ochre gathering or quarrying are likely to remain but it is quite likely that this was one of the activities carried out in forests of the Richmond Range and other sandstone ranges nearby where there are ferruginous horizons in sandstone soils.

10.7 Potential Archaeological Site Locations

The following observations concerning potential site locations in forests in the Mt. Pikapene/Mt. Belmore area are based on discussions with local informants:

* A cave in Royal Camp State Forest was found recently by forestry workers. It did not contain any archaeological material that was apparent to the finders, but may have occupation deposits (Ray Francis, Forestry pers comm 1992).

* Sandstone cliffs suitable for rockshelter formation occur in the central Richmond Range between Mt. Pikapene and Mt. Marsh State Forests and outlying sandstone ridges (Ray Francis, Forestry pers comm 1992).

* A bora ring is reputedly located on the boundary of Mt. Pikapene State Forest (Ray Francis, Forestry pers comm 1992)

* A local landowner who grazes cattle on the Dome Mountain section of Mt. Marsh, and has an interest in Aboriginal sites, said there was about 10 acres of flat rocky terrain on Dome Mountain which he had searched for stone arrangements but had been unable to find any.

10.8 Sites of Aboriginal Significance

As stated previously this survey has not attempted any detailed investigation of the Aboriginal significance of places. However one previously unrecorded site of Aboriginal significance was brought to the attention of the author by Ken Gordon of Malabugilmah. The site is a natural feature female ceremonial site located in Ewingar State Forest. He says that women were brought there if they were unable to have children, although this is only one aspect of the site's significance. Ken Gordon requested that the site's location not be made public, although it can be recorded for management purposes.

In addition Ken Gordon and Bob King and his son Robert King (Baryulgil) indicated the location of potential sites to the south-east of Ewingar State Forest. Any operations in this area should be proceeded by consultations with the local Aboriginal community to ensure unrecorded sites are not impacted.

Subsequent to survey work carried out in the north-east section of Mt. Marsh with Bogal Local Aboriginal Land Council, Harry Brown the Coordinator of Bogal has indicated to the author that there are sites of significance to Aboriginal people there, but at this stage is unable to elaborate on their precise nature until further investigations are carried out.

11 THE PREDICTIVE MODEL AGAIN

In this section of the report the original predictive statements are re-examined in the light of the survey results.

11.1 Coastal Ranges and Lowlands

Sites are widely dispersed over the landscape, rather than confined to topographically defined lines of movement or near water. As a consequence a relatively low density of artifacts were found on ridge toposequence elements. Higher densities of Artifact Occurrences and artifacts were found on flatter parts of the terrain.

The fewer and smaller sites located in this land system reflects the lack of topographic constraints on human movement rather than lower intensity of occupation. This would tend to disperse movements across the landscape rather than confining them to the ridge lines and drainage lines that were the main elements investigated during the survey.

It was expected that sites in low-lying areas may not be archaeologically visible due to the aggrading environment. While this is likely to be the case in some areas, it has now been demonstrated that a substantial proportion of sites will be visible. Several sites including one with low to moderate complexity (Mangrove Creek 16-2) were found on flats and plains in lowlands fringing the Richmond Range. While the sample is too small to make any firm predictions regarding the overall density of sites in lowlands, this does suggest that sites will be widespread on streams, flats, plains and lower slopes.

No large base camp sites were found during the survey, however such sites are likely to occur on the major wetlands that fringe state forest in this area.

A small area of sandstone cliffs was inspected for archaeological sites. Although the survey work did not find any rockshelter sites, it did confirm that the sandstones in Coast Ranges do form suitable rockshelters. There is likely to be many shelters near the Richmond Range where cliffs are common. The sample acquired so far is too small to infer the level of use of rockshelters in the Coastal Ranges

11.2 Escarpment Ranges and Ranges

In these land systems there is a strong correlation between topography and artifact density. Artifacts occur at a continuous - highly variable but generally low - density along ridge lines and stream banks/flats and low spurs throughout these land systems. The highest recorded Artifact Occurrence and artifact density in these land systems were on ridge hillocks, saddles and benches.

The largest and most complex sites in the study area were found in these land systems comprising evidence of both intensive stone working and more generalised campsite activities. The absence of major sites associated with drainage line toposequence elements (flats, stream banks, low spurs) should be treated cautiously due to the small sample size and problems of detecting sites on flats. It is likely that major sites may occur anywhere within the Ranges land system where there are ridges, low spurs and stream flats.

Large base camps were predicted to occur near streams on the periphery of Ranges. The sample of such areas is too small to assess this adequately, however a number of sites of moderate complexity were found in these areas and it remains highly likely that this will be a relatively rich archaeological zone.

Quarries were also expected to occur in the Ranges/Escarpment Ranges land system. Based on the geology these are most likely to occur at the northern end of the Richmond Range and in the Escarpment Ranges where raw materials for stone artifacts are most abundant. Actual quarries were not found but several reduction sites and sites with large chunks of flaked material in Ewingar and Richmond Range State Forests suggest quarries are located nearby.

Within these land systems locally Dominant Ridges such as that on which Bulldog Rock Road is located may have a higher density of artifacts than subsidiary ridges. This is a reflection of their function as regional pathways

From local information and observations during fieldwork, it appears that rockshelter occupation sites will generally be rare outside sandstone country. Within the sandstone country, one of the most promising areas for rockshelter sites is between Mt. Pikapene and Mt. Marsh State Forest.

11.3 Volcanic Ranges

The results of the survey of this land system are considered alongside previous survey work by Byrne (1987). It was suggested above that some more inaccessible parts of Volcanic Ranges, may have been lightly used, namely the Nightcap Range which includes Whian Whian State Forest. It was also anticipated that archaeological visibility in the wet forests that predominate in these areas would make it difficult to find sites.

As in Ranges and Escarpment Ranges, due to the dissected nature of much of the terrain, sites occur at fairly regular intervals along ridges or benches, except in particularly rugged areas such as Mt. Jerusalem. No sites were found on plains or flats. Site detection problems in these types of environments, in addition to the generally poor survey sample for these toposequences make it difficult to infer much from this negative result.

An average density of Artifact Occurrences were found in wet sclerophyll/rainforests in Volcanic Ranges (nearly 2 Artifact Occurrence per km), however these sites are small when compared to those located elsewhere. This may relate to the presence of thicker soils, compost and bioturbation. These factors would have the effect of not only making sites more difficult to find in the first place, but also of dissipating them over a larger area of soil volume thus making it difficult to detect high densities of artifacts.

This suggestion is reinforced by the fact that the highest densities of sites and artifacts were found on dry ridges in dry rainforest areas, such as in Mebbin State Forest or dry hardwood ridges in wet sclerophyll areas, such as in Nullum State Forest. Interestingly little was found in the Trajectories on the dry hardwood ridge Koonyum Range even though surface conditions were suitable for detecting archaeological sites. Koonyum Range is a particularly barren place and it is possible that lack of resources in this area did not provide an attractive environment for long term Aboriginal occupation.

The sample for this land system is too small to resolve the issue of the relative intensity of use of different areas. Generally speaking however, the dramatic topography of the area, which includes small plateaux, escarpment and dissected hills interspersed with lowlands, has resulted in unexpected patterns of site distribution. This is complicated by the question of site visibility in wet forests, particularly on flat or plains.

As expected most sites comprise stone artifacts made from volcanic materials. No large sites were found in Volcanic Ranges during the current survey, although two sites of low to moderate complexity were recorded. This lack of larger sites is likely to be a reflection of sample size and a further range of site types can be expected to occur in this land system including stone artifact raw material quarries, stone reduction and occupation sites.

12 IMPACT ASSESSMENT

12.1 General

In the past much more emphasis has been placed on maintaining biological values of forests than on cultural values (Gollan 1992). There seems to have been the assumption that if there is nothing of known significance then any impact on the cultural resource is minimal. Unlike biological resources the archaeological resource is both non-renewable and relatively unknown (Byrne 1992). Each site is part of a unique record of past events and once gone it is gone forever. Most sites in forests are not "obvious" and identifying specific "significant" sites for preservation is a time-consuming task and achievable only after long term research. However there are reasonable mitigation strategies that can be implemented alongside continued development of an area which will be discussed further below.

12.2 Natural Processes Affecting the Archaeological Resource

There has been a tendency to regard as intact the archaeological resource in areas of forest that have not been logged (Byrne 1992). Not only may the archaeological resource have been subject to numerous other historical land uses (e.g. pastoral and mining) they have also been subject to natural processes of "disturbance" since the time they were first formed. All artifacts immediately become subject to post-depositional processes of change after they have been discarded and it is these processes that are integral to the formation of archaeological sites. For instance natural erosion may cause the movement of artifacts on ground surfaces that are sloping. Whilst this may not be observable in a life time, over a period of centuries such a process will cause artifacts to move from the top of a ridge to the bottom of a gully.

A more subtle but possibly dramatic effect on sites' structure is the simple process of trees growing. For any given hectare of forest most artifacts that have been deposited over the last few thousand years would have been moved by the mere act of trees growing. This combined with the processes of erosion mentioned above have probably ensured that sites more than a few thousand years old in forests will not have survived (Gollan 1992). However some older sites may be present in certain depositional contexts such as rockshelters. These older sites will be of high scientific significance.

12.3 Human Processes Affecting the Archaeological Resource

The main impact on the ground surface of the study area over the last 150 years has been associated with timber extraction, the pastoral industry and to a lesser extent mining. The following account of these impacts is based on information contained in the body of the EIS document concerning land use history, the specialist report on European heritage undertaken for the EIS by Blackmore (1992) and Byrne's (1992) discussion of the general effects of forestry operations on the archaeological resource.

Grazing cattle, land clearance and possibly changes to fire regime, would have had an effect on archaeological sites. These effects would have been both direct (as in land clearing) and indirect (changes or increases in the pattern of erosion resulting from land clearance, grazing and fires).

There is little information on the history of pastoral activities such as grazing in state forests in the study area although we can assume that there has been grazing of cattle over much of the former Casino District since at least the early part of this century. There is little grazing in the Murwillumbah forests currently, and there is no information available concerning its early history. Possibly the relatively inaccessible nature of some of the Murwillumbah forests would have limited their use for grazing. The more direct impacts of pastoral activities would have been limited to the broader valleys or flatter areas where land clearance was undertaken.

Mining activity, mainly associated with gold was widespread in the Escarpment Ranges. Extensive reef and alluvial mining occurred in parts of Ewingar State Forest around Solferino and Lionsville and at Bulldog Creek. This involved extensive ground disturbance that would have impacted archaeological sites. However outside these localised areas, mining activity has probably had relatively little impact on the archaeological resource in the study area.

Forestry activities have a long history of impact on the ground surface of the study area. Rainforests were worked by cedar-getters from the 1840s. Once the cedar was exhausted toward the end of the last century, hoop pine was logged. This activity was first undertaken in easily accessible coastal areas and along the Clarence, Richmond and Tweed Rivers, but by the 1870s cedar was pursued well into the upper Richmond. These were selective logging operations but the extraction of the logs using bullock teams, would have caused ground disturbance of an unprecedented type (Byrne 1992).

From the 1880s hardwood was increasingly cut for sleepers, bridges and wharves. The forestry industry remained confined to the lowlands and foothills until the 1930s when commercial hardwood harvesting extended into the Richmond Range, Gibraltar Range, and Murwillumbah forests. By the Second World War the demand for hardwood had grown tremendously and there was widespread use of motorised vehicles and the commencement of large-scale forest road construction. The use of heavy machinery and the increase in the scale and intensity of logging produced a new order of ground disturbance. Bulldozers facilitated the building of roads and logging in previously inaccessible areas of rugged terrain. Bridle paths and unmade fire-trails throughout much of the study area were replaced by roads trafficable by log trucks. Regular roading and harvesting extended to Mt. Marsh, Richmond Range, Ewingar and most of Murwillumbah forests in the 1950s and 60s.

The coastal and lowlands forests have been heavily cut over for many decades, particularly Bungawalbin, Braemar, Ellangowan, Myrtle and Carwong State Forests. Since the 1950s harvesting has been concentrated within Banyabba, Doubleduke and Tabbimoble State Forests. More recently, harvesting has continued in Devils Pulpit State Forest from 1973, Banyabba State Forest from 1976, Gibberagee State Forest from 1977 and Royal Camp State Forest since 1980. Presumably there has been some measure of ground disturbance over most of the ground surface in this area.

Harvesting of accessible hardwood sawlogs commenced in 1959 in the northern parts of Ewingar State Forest. From 1964, the harvesting rate increased and extended into central areas (known as Lionsville). Operations have continued to the present, extending over much of the easier terrain of Ewingar State Forest. Over the same period harvesting has extended over a large proportion of the Richmond Range forests. Much of the logging consists of re-cutting areas selectively logged prior to 1960.

Most areas in Murwillumbah forests have been fairly heavily cut over, in particular the more accessible forests such as Whian Whian and Mebbin State Forest (Forestry Commission 1984).

Only relatively small areas of "old growth forest" remain completely unlogged. The major unlogged areas are the north-east part of Mount Marsh State Forest, parts of Billilimbra and Washpool State Forests (including Redbank area), and 200 ha in Nullum State Forest (Blackbutt Plateau).

12.4 Specific Impacts on Archaeological Sites

Archaeological sites can be regarded as having two dimensions from which their value derives. Their physical elements and their structure. Some site types are more vulnerable to disturbance than others. For example sites with large physical elements (i.e. scarred trees and stone arrangements) are likely to be destroyed by a single impact whereas stone artifact sites which are less vulnerable to disturbance may withstand a number of impacts before they are completely destroyed. The current survey has probably tended to record sites at the upper limit of disturbance caused by forestry operations. Thirty-nine percent of the survey was undertaken in areas that have been heavily impacted by logging, 26% in areas selectively logged, 31% in areas which have sustained minimal disturbance from logging operations and 4% in areas disturbed by other processes. Most of the survey trajectories were along logging access tracks that have remained in use or fire trails. These tracks have been as intensively disturbed as any part of a logging area with the exception of log dumps.

The following discussion describes firstly the affects on the stone artifacts themselves and secondly the effects on site structure (after Byrne 1992).

Damage to artifacts occurs mainly as the result of direct pressure from the tyres or tracks of vehicles on tracks, especially if artifacts occur on compact surfaces such as clay or rock against which they are crushed. Off tracks, this will generally only apply to a relatively small part of each logging operation, although the effect will be cumulative with each cutting cycle. Forty of the 99 flakes and blades recorded by the survey on tracks were broken in half. Some of these breaks would have occurred during artifact manufacture but most have probably resulted from the passage of vehicles on compact surfaces. Of six flakes recorded in an undisturbed context, only one was broken.

As discussed previously, the movement of artifacts from their original position is the most pervasive cause of degradation to sites. Apart for the natural processes of site disturbance outlined previously, the dislocation of artifacts resulting from roading and logging is a new order of disturbance which virtually destroys the behavioural patterning of the site. It is axiomatic that forestry activities in unlogged or "old growth areas" have a higher potential to disturb sites with scientific significance than the same activities in previously logged areas (Packard 1992).

The state of preservation of sites throughout the study area varies according to the extent of recent and historical ground disturbances.The actual processes associated with logging operations which will disturb or destroy sites are ground churning, compaction and subsequent erosion. The intensity of these disturbances will vary greatly from locality to locality depending on the precise location of logging operations over the years and the intensity of each operation. Most loggable areas within the study area (with the exception of part of Mt. Marsh State Forest and Blackbutt Plateau in Nullum State Forest) have been subject to fairly intensive logging over the last 50 years.

The effect of this on the archaeological resource will have been cumulative degradation rather than complete destruction of the resource. Each cutting cycle leaves some areas intact or only partially degraded. This degradation will increase until a hypothetical end-point is reached, the maximum possible disturbance of all areas (Byrne 1992).

Even though there has been a long history of disturbance to sites in the study area, large numbers of intact and partially intact sites will remain, particularly in areas that have not yet been subject to logging operations. These sites together with their distribution can provide us with a great deal of information concerning past lifeways. The question becomes "...in what way is it possible to mitigate or ameliorate the progressive degradation of this surviving body of artifacts and data?" (Byrne 1992:17).

For most forests in the study area future disturbance over the next decade will be at a relatively low intensity and occur in areas that have already been subject to high levels of disturbance. The situation is different in regard to those areas that have not been logged. Here the construction of additional roads and logging operations will constitute a high level of disturbance to sites that have otherwise not been impacted by cultural processes of site disturbance.

12.5 Impact of Proposed Forestry Activities

The Proposal

The proposed activities in the Casino District mainly involve logging remnant stands of trees or thinning regrowth in areas where there has already been some level of disturbance. In general there will be small operations occurring in many places throughout the District.

12.5.1 Former Casino District

* continued logging in Richmond Range forests. These operations will cover a number of state forests and mainly involve the logging of areas previously selectively logged.

* current logging of residual timber stands in Ewingar forests.

* a proposal to log "old growth" parts of Mt. Marsh, specifically compartments 428, 429, 432, and 434 and parts of 430 and 431 having an area of about 3 300 ha. This will involve new roading.

* continued small operations throughout Lowland and Coastal Ranges state forests.

* Proposal for roading and harvesting in Washpool and Billilimbra State Forests. This is subject to preparation of Goagun Aboriginal Place Management Plan by the Forestry Commission in conjunction with Local Aboriginal Land Councils for Washpool State Forests and also subject to a Wilderness proposal that covers much of Billilimbra and the north part of Washpool State Forest.

12.5.2 Former Murwillumbah Management Area

Harvesting operations will involve integrated logging of regrowth areas throughout most of the Management Area over the next 10 years. Initially harvesting will be located in Mebbin and Wollumbin State Forests and in thinning blackbutt regrowth in Whian Whian State Forest.

All roading has been completed, future roading will be limited to opening up old logging roads or to construction of "snig shorteners".

12.5.3 Impacts of Proposed Activities

According to the model of site location above, Ranges and Escarpment Ranges are likely to have a density of one to two Artifact Occurrences per km or one to two artifacts per 100 square metres of roading and harvesting operations along flat or gently sloping ridges, low spurs, mid-slope benches, lower slopes and stream banks. In some places, mainly on saddles and ridge hillocks, artifacts form higher density clusters of low to moderate complexity representing both transitory activity and camping sites. Relatively larger and more complex occupation sites will also be present but far less common on saddles and ridge hillocks. It is anticipated that complex sites will also occur in association with drainage line toposequences, notably low spurs, lower slopes and flats.

Logging operations in these land systems will be most intense on the upper parts of the toposequence (ridges, upper slope, saddles and low spurs). As most of these toposequences have high archaeological sensitivity, the impact of logging operations in these land systems on archaeological sites will be relatively high. In areas of "old growth" forest where sites have not been impacted by previous logging operations the impact of logging to archaeological sites will be greater.

Within the Coastal Ranges and Lowlands the majority of archaeological sites in areas where there is commercial timber have already been impacted by forestry operations. Unlike the Ranges and Escarpment Ranges sites in these land systems are not as strongly associated with specific toposequences but are thought to be widely dispersed over the landscape. As there is not a strong correspondence between archaeological site location and forestry operations, further logging operations will not result in a high initial impact to archaeological sites in the Coastal Ranges and Lowlands land systems. However repeated cutting cycles will have the effect of adding to the cumulative degradation and eventual destruction of the archaeological resource in these land systems. This will differ from the impact experienced in the Ranges and Escarpment Ranges where sites have been less impacted by previous logging, but will be more heavily impacted by proposed logging because of the correspondence between archaeological site location and forestry operations as explained above. Figure 15 is a schematic representation of the hypothesised impact trajectory for the archaeological resource in the Ranges and Escarpment Ranges versus the Coastal Ranges and Lowlands for the study area.

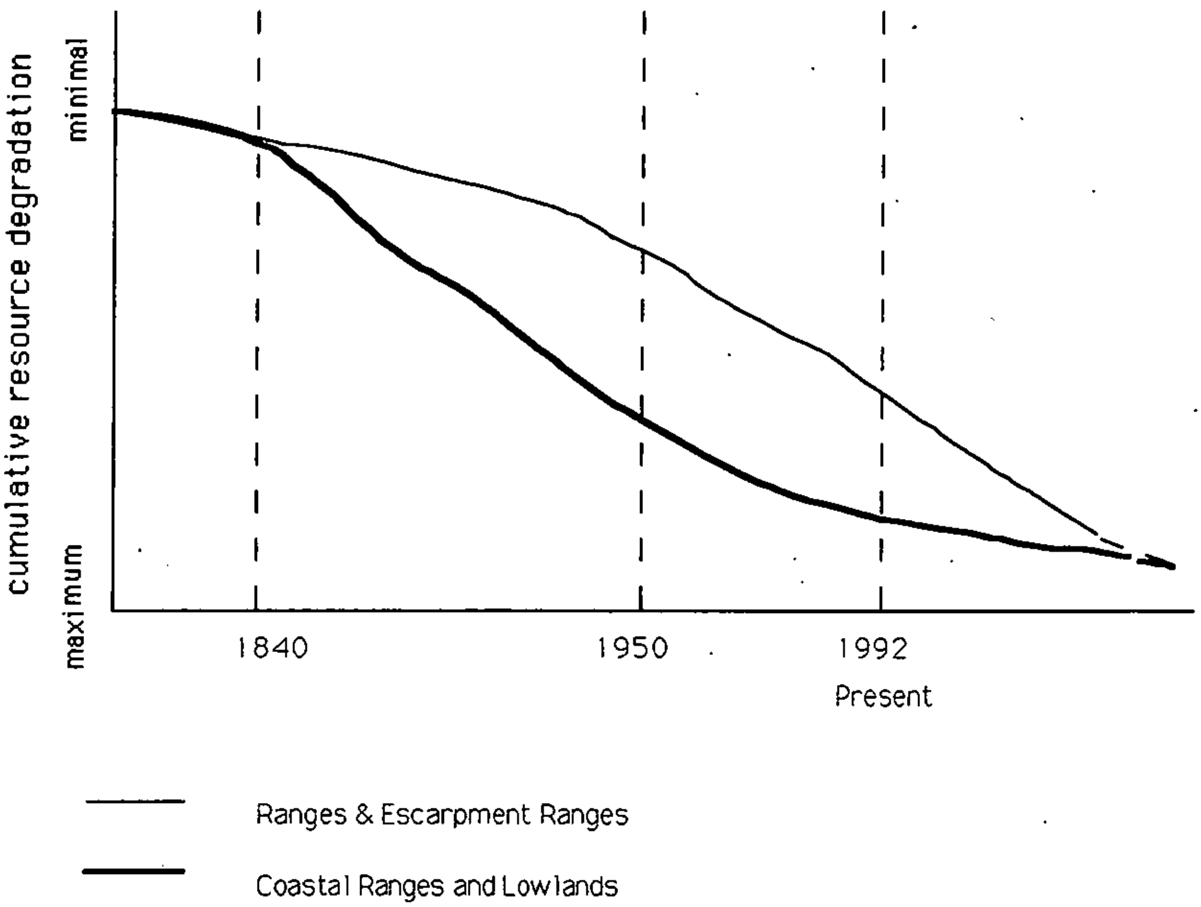

Figure 15. Hypothesised Impact trajectory for Ranges and Escarpment Ranges versus Coastal Ranges and Lowlands

The geology along certain parts of the Richmond Range is particularly suited to rockshelter formations, for example between Sugarloaf and Mt. Marsh State Forests. Archaeological deposits and rock art may be present in these rockshelters. These will not necessarily be impacted by forestry activities, but an awareness of the sensitivity of such areas within planning and operational procedures will ensure that such sites are not impacted.

Similarly other generally rare archaeological site types such as stone arrangements may occur anywhere in the study area on prominent geographic points that have not already suffered disturbance and an acknowledgement of them within planning and operational procedures would aid in mitigating impact.

12.5.4 Conclusion

The projected logging and roading operations can be expected to contribute to the cumulative impact and progressive degradation of the archaeological record in forests as outlined above. In areas where the impact has already been fairly intense such as Mebbin State Forest and much of the coastal and Richmond Range State Forests, the effect of further small operations in these areas will be relatively minor in the short term, although should be subject to long term management strategies.

As the measure of prior disturbance to an area declines the impact new activities has on the archaeological resource is commensurately greater. So attention to assessing the need for mitigative measures should first be given to areas that have not yet been logged, which are relatively few, and then progressively applied to other areas.

13. PRELIMINARY ASSESSMENT OF PROTECTED AREAS

13.1 Management Rationale

The management approach adopted here follows National Parks and Wildlife Service policy which proposes that the ultimate objective of cultural resource management is the retention of a representative sample of the archaeological resource in forests. Given the widely dispersed nature of the archaeological resource in forested environments the most appropriate methodology for retaining a representative sample of this resource is through the adoption of an area-based management strategy.

The rationale for the adoption of an area-based management approach has been discussed in detail by Byrne (1991). In short, an area-based management approach assesses archaeological representativeness in the broad context of maintaining intact suites of landform features with archaeological potential (namely drainage lines and ridge lines/spurs) in each forest group. This is based on the premise that most sites are stone artifacts distributed more or less continuously along such landform features at highly variable densities. Even if we don't know the specific land use pattern in an area we can capture a representative sample of it by reserving such tracts of land.

In this section a preliminary assessment is made of the extent to which areas currently excluded from logging provide protection for archaeological sites given our current understanding of their distribution.

13.2 Assessment of the PMP System

13.2.1 PMP System - General

All State forests are assessed and classified according to a "Preferred Management Priority" (PMP) classification. This recognises particular values and forms a basis for applying management prescriptions to maintain these values. Forests are divided into a number of zones. Of particular concern here are categories 1.1.2 to 1.1.9. These eight zones protect values including research, recreation, visual resource, and flora and fauna. The type and intensity of logging operations is controlled to levels considered compatible with the values specified.

Category 1.1.9 is for the protection of Aboriginal sites. To date this has included all known sites. Sites here refers both to point sites such as rockshelters and also to Aboriginal places that cover a relatively large area such as a mountain top. The previously recorded sites in the study area are currently designated under this category (see table 1). The largest area zoned PMP 1.1.9 is Goagun Aboriginal Place which comprises the whole of the Desert Creek catchment. Logging is not necessarily excluded from these areas, rather it provides an indication that Aboriginal and/or archaeological values are present and that any plans for the area must take them into account.

Of more concern to us here is the extent to which the PMP system as a whole gives protection to Aboriginal sites in the rest of the study area.

The main areas protected under the PMP system are fauna strips along all major creeks in the study area. These extend for 40 metres either side of creeks. This together with the exclusion of logging in rainforest (see below) give partial protection to drainage line toposequence sites. In most instances the 40 m fauna strips will not protect all drainage line toposequences, specifically archaeological sites located on low spurs and lower slopes may not be protected within these strips. Furthermore archaeological sites may extend for hundreds of metres from a stream and extensive sites such as these would not be adequately protected by the fauna strips.

Protection to the full range of drainage line Aboriginal sites could be facilitated merely by strengthening existing strip reserves and extending them to other streams. Widening of the stream buffers to 100 metres for third order streams or larger, for example, would give adequate protection to the majority of drainage line archaeological sites. Ideally the width of these reserve strips should be varied according to local topography to encompass stream flats, lower slopes and low spurs.

A complementary strategy would be to strengthen the reserve for riparian and swamp vegetation areas. This would effectively cover most sites on stream and swamp banks/flats. These areas are particularly important archaeologically because of their potential to contain stratified archaeological sites.

A number of Flora Reserves or Preserves are protected from any future disturbance. Notable contributions of these reserves to the preservation of a representative sample of the archaeological record are summarised below for each of the main forest groups in the study area.

13.2.2 Coastal Ranges/Lowlands

Here there are only two substantial reserves, Selection Flat Forest and Pyrocarpa Flora Reserves. Selection Flat Forest Flora Reserve in Myrtle State Forest comprises swamps (swamp sclerophyll) with flats rising to higher land (dry sclerophyll). Pyrocarpa Flora Reserve samples an area of dry hardwood ridge line. Dry hardwood ridges are also well represented for the Coastal Ranges and Lowlands outside the formal reserve system by virtue of their non-commercial nature (see below). In this respect Pyrocarpa merely strengthens the sample maintained outside the formal reservation system rather than broadening the range of forest types reserved within these land systems.

13.2.3 Murwillumbah Forests

Here there are a large number of mostly small Flora Reserves, Forest Preserves and other reserved areas, comprising mainly rainforest and wet sclerophyll in gullies and plains/plateaux. These are scattered throughout the forests. Big Scrub and Minyon Falls Reserves are the largest and they reserve a substantial portion of the plains/plateau landform pattern in Whian Whian State Forest.

13.2.4 Ewingar/Richmond Range Forests

There are a number of Flora Reserves, Forest Preserves and other reserves throughout these forests. They mainly comprise wet sclerophyll and rainforest areas on small plains/plateau and gullies.

13.2.5 Rainforest Areas

Broader protection is given to sites by the restrictions on logging rainforests. Rainforest occurs widely throughout the study area in drainage lines, gullies and on plateau.

Rainforest comprises about 20% of Murwillumbah forests, mainly in Whian Whian and Nullum State Forests. About 15% of Ewingar forests is rainforest located mainly on the Gibraltar Range Plateau in the southern portion of Ewingar State Forest. About 11 % of Richmond Range forests are rainforest. Here Subtropical and Warm Temperate rainforest are restricted mainly to the Cambridge Plateau where they are associated with fertile basaltic soils. Dry rainforest comprises a large continuous area on Mt. Pikapene State Forest and in Richmond Range State Forest.

Most of the Subtropical and Warm Temperate Rainforest in the study area have been logged, however this logging was restricted to a 50% canopy retention and pockets of intact ground surface will be retained. In addition a proportion of the total occurrence of rainforest remains undisturbed within Flora Reserves, particularly in the Murwillumbah forests. Thus rainforests provide an important, permanently protected area containing both intact and minimally disturbed archaeological sites.

13.2.6 Unloggable Areas

Steeply sloping and rocky areas and areas with low timber site quality are not logged. Within the study area these include:

* Extensive areas of dry hardwood forests in the sandstone ridges of the Coastal Ranges land system.

* Cliffed areas throughout the study area.

* Areas of low timber site quality on subsidiary ridges, spurs, steep gullies and drainage lines within the Escarpment Ranges and Ranges land systems (for example the leasehold lands on the fall from Ewingar State Forest to the Timbarra River).

* Low-lying swampy areas with low timber site quality. These are extensive in Lowlands and Coastal Ranges

It is important to note that the unloggable nature of most terrain containing rockshelters will tend to protect most potential rockshelter/art site locations in the Richmond Range or wherever else they may occur. However attention needs to be given to ensuring that rockshelters are not inadvertently damaged during roading along ridges.

13.2.7 National Park

Large areas of forest in or contiguous to the study area are currently set aside in National Parks or Nature Reserves. While these cover a substantial amount of forest in the region, they do not necessarily preserve a representative portion of the local forest archaeological record. Furthermore forest types represented in National Parks may be those already adequately protected in state forest either on the basis of their lower timber site quality or because they are rainforest areas. In these two respects National Parks forests do not provide a complete reserve replacement to state forest areas although they are likely to compensate for losses in nearby areas of state forest. The latter applies especially to Murwillumbah Management Area, the southern part of Ewingar forests and the southern part of the Richmond Ranges, which are all contiguous to larger areas of National Park/Nature Reserve. Future more detailed analysis of the adequacy of the current reserve system (see below) will need to consider forest in general (irrespective of tenure) as the sampling universe from which to identify a representative sample.

13.2.8 Conclusions

The existing system of protected forest areas and areas of non-commercial forest samples adequately the following elements throughout the study area: steep slopes/gullies, plateau, low site quality dry hardwood ridges and areas likely to contain rockshelters. A substantial sample of drainage line toposequences and low-lying swampy areas is also protected throughout the study area by virtue of the strip reserves, rainforest and low site quality (e.g. swamp sclerophyll). In addition to this, on a regional level, sites in Escarpment Ranges, southern part of Ranges and Volcanic Ranges are partially represented by what is likely to be contained in National Parks/Nature Reserves. Thus a substantial part of the regional archaeological record is likely to be contained in areas which will not be developed.

The main gaps in the reserve system are areas which have the following criteria: high correspondence between archaeological site location and proposed operations, low-moderate previous logging intensity, remote and/or environmentally distinct from National Parks/Nature Reserves, and which are not substantially sampled in the present state forest reserve system. Potential areas which match these criteria are the upper linear toposequence elements (mid-slope, ridge, ridge hillock, saddle and low spurs) in high quality dry or wet sclerophyll forest. For example in the middle and upper portion of the Richmond Range (north of Mt.

14. GENERAL COMMENTS ON ABORIGINAL SIGNIFICANCE

The value placed on forests today by Aborigines will not necessarily be traditional religious values although it is a widely held misconception that these are the only valid ones. The range of Aboriginal values attached to forests based on the work of previous researchers and the author's own discussions with Aboriginal people in the region have been discussed above. In the process it was shown that identifying values attached to specific areas is an involved process, requiring long term consultation with people throughout the region. It was also seen as inappropriate that an archaeologist should attempt such work.

A newly emerging value is that of "heritage" (Byrne 1992). This refers to the new significance forests are acquiring for Aborigines with the discovery of prehistoric occupation sites there. This value is an important one as regards the EIS area, where it has now been shown that prehistoric Aboriginal sites are widespread. The fact that it is a newly emerged value does not demean its significance as a value. All societies attach heritage importance to archaeological discoveries and modern Aboriginal society is no different in this regard (Byrne 1992:30).

The values that have been used to generate the model of archaeological site location and significance and the recommendations made are those of an archaeologist. They may coincidentally satisfy some concerns of Aboriginal people concerning sites in forests. It may also be possible to accommodate Aboriginal concerns based on the general strategy recommended here. Whatever the case this is up to the Aboriginal community to determine.

15 MANAGEMENT AND RECOMMENDATIONS

15.1 Legislation

There are two State Acts that offer protection to Aboriginal sites: Aboriginal Places and Relics are protected under the *National Park and Wildlife Act, 1974*. Aboriginal Places are sites without physical remains such as mythological sites with demonstrated significance to Aboriginal people. The Minister must declare them. Relics are defined as:

"material evidence...relating to indigenous and non-European habitation of...New South Wales, being habitation both prior to and concurrent...(with Europeans)..., and includes Aboriginal remains".

It is an offence under the Act to knowingly disturb or destroy Aboriginal Places or Relics without the consent of the Director of the National Parks and Wildlife Service.

The *Environmental Planning and Assessment Act, 1979* also offers broad protection to Aboriginal sites through its requirement that Environmental Impact Statements must be prepared for certain developments and that these must include an assessment of archaeological and anthropological values.

Sites and areas are also protected under the federal *Aboriginal and Torres Strait Islander Heritage Protection Act, 1986*. This provides for the protection of areas and objects of significance to Aboriginal people in accordance with Aboriginal tradition. This Act allows Aborigines to apply to the Minister to seek protection for significant Aboriginal areas and objects. It operates concurrently with the State Acts referred to above.

The *New South Wales Heritage Act, 1977* is designed to protect places of European heritage but, in certain cases, the broad definition of "an item of environmental heritage" could be used to include Aboriginal sites and allow for the placement by the Minister of Interim Conservation Orders pending further investigations.

15.2 Management Strategy

A four tiered management approach is suggested for mitigation of impacts on Aboriginal sites:

1. A medium to long term strategy for dealing with archaeological sites as a whole, including those not yet recorded but predicted to occur - referred to hereafter as the "unknown resource". This involves the gradual identification of archaeologically representative areas and development of appropriate management prescriptions to protect these areas.

2. Management of known sites in accordance with legislation.

3. Regular consultation with the Local Aboriginal Land Councils.

4. Training of Forestry Commission field staff in site identification.

Each of these will be discussed in turn along with specific recommendations pertaining to them.

15.3 Maintenance of an Archaeologically Representative Sample

15.3.1 General

With the exception of large scale roading the impact of logging activities on sites is incremental. It is my opinion that short-term loss of recorded and unrecorded stone artifact sites as a result of the continuance of logging and associated activities would be compensated for by the preservation of sites in the Forestry Commission's and National Park's reserve system supplemented by measures described below (after Byrne 1992).

The rationale for an area-based management strategy has been described above. The National Parks and Wildlife Service is also considering the use of a reserve methodology for protecting Aboriginal archaeological sites (Gollan 1992). This approach has three main justifications. First and most importantly, it maintains the integrity of the archaeological record in forests better than purely site-based management which does not take into account the spatial aspect of the archaeological record (see above). Secondly, the setting aside of relatively large areas compensates for the reliance on sample surveys to predict which areas are archaeologically sensitive (Byrne 1991). Thirdly, it can be easily accommodated within the Commission's existing multi-layered Preferred Management Priority classification system and is already largely facilitated by existing protected/semi-protected areas.

The first step is to identify the main gaps in the current reserve system (including new reserves that arise out of the Environmental Impact Assessment process) based on the predictive model developed in this report. It is not possible to choose specific areas for filling gaps in the reserve system in the time frame of the EIS. However the setting of a specific time frame to implement a reserve system approach to management of the archaeological resource should be seen as a reasonable approach to minimising impact on Aboriginal archaeological sites in the EIS area.

A broad indication of the main potential gaps in the reserve system is given below to help prioritise future work.

15.3.2 Gaps in the Reserve System

The main gaps in the reserve system are areas which have the following criteria: high correspondence between archaeological site location and proposed operations, low-moderate previous logging intensity, remote and/or environmentally distinct from National Parks/Nature Reserves, and which are not substantially sampled in the present state forest reserve system. The upper toposequences (mid-slope, ridge, ridge hillock, saddle and low spurs) of locally Dominant Ridges and Subsidiary Ridges in higher site quality dry and wet sclerophyll forests were seen as the main areas potentially matching these criteria. This is more especially the case in high relief areas where there is a high correspondence between specific, discrete toposequences and the location of archaeological sites. Assessment of the adequacy of the reserve system and its possible supplementation should be directed first towards such areas, especially in unlogged or lightly logged areas. Appraisal of the adequacy of the reserve system could then be implemented in step with operational priorities, preferably before a major cutting cycle commences in a forest.

For an example, the reserve in the Richmond Range forests might comprise samples of low gradient sections (less than 10 degrees) of the following topographic features: Dominant Ridges and Subsidiary Ridges, including not only ridges and low spurs, but mid-slopes, lower slopes and drainage line elements. Sample areas should be located both within the dissected hills landform pattern and the low hills landform pattern that predominate in this land system and should include unlogged portions. If necessary, supplementation of the reserve system could be facilitated by expanding the buffer zone along streams or around areas already protected/semi-protected due to low timber site quality or other factors.

In the Gibraltar Range (Ewingar forests) the importance of rainforest and drainage line reserves in maintaining a significant portion of the archaeological sites in these areas has been discussed above. If these were extended in places to encompass wet and dry sclerophyll ridges, this would capture the entire suite of microenvironments and thus the full range of potential sites in these forests.

15.3.3 Future Work

The assessment of the adequacy of the reserve system in protecting a representative sample of the archaeological record should incorporate the testing of site location models developed in this report.

Field testing in some areas can be undertaken by visual inspection by an archaeologist. In places where vegetation or ground litter is too dense, it will be necessary to use other techniques. This could involve the moving aside of leaf litter or shovel pit testing. Both these methods can quickly test areas for confirmation of their archaeological significance.

15.3.4 Recommendations for the Unknown Resource

*** The Forestry Commission should determine the representativeness of the likely archaeological record in the reserve system on state forest, concentrating first on**

commercially viable areas which have been least disturbed. Representativeness here is to be assessed in the broad context of maintaining intact suites of landform features with archaeological potential (namely drainage lines and ridge lines) in each forest group. This would need to take into account what is expected to be contained in National Parks.

* Design and implement a methodology for the archaeological investigation of specific landform features both to test the model of site location and to determine gaps in the representativeness of the archaeological record in the reserve system.

* Assess the need to supplement the reserve system with additional archaeological sample areas.

15.4 Management of Known Sites

15.4.1 Previously Recorded Aboriginal Sites

All of the previously recorded sites (listed in table 1) with the exception of open campsites represent site types which are probably very rare archaeologically or of high Aboriginal significance. Management strategies incorporating Aboriginal values will have to be developed by consultation with Aboriginal communities (see below). The following recommendations are minimum management requirements pending anticipated on-going consultation with Aboriginal communities.

* Any operations within the vicinity of Aboriginal places (natural ritual/mythological sites) should be preceded by consultation with the Local Aboriginal Land Council. It should be noted that "vicinity" will vary according to the particular site and must be established with the Aboriginal community. As a general rule however, if forestry operations are planned within a few kilometres of known sites of significance to Aboriginal people then the relevant Local Aboriginal Land Council should be consulted to determine what would constitute encroachment on the significance of a site/place.

* It is recommended that the Mungoo Mungoo tree (NPWS site no. 3-6-26) be retained in its present state pending consultation with the relevant Local Aboriginal Land Council regarding its future management.

* Previously recorded archaeological sites described in table 1, other than open campsites, should be permanently avoided during future operations.

*** All previously recorded open camp sites (see table 1) are located on roads. No immediate protective measures are warranted except that they should be further investigated before any road upgrading is undertaken (and see general legal requirements below).**

15.4.2 Sites Recorded During the Survey

Most Artifact Occurrences identified during the survey were located on tracks which are presently in use. While it is a legal requirement that sites and relics not be knowingly damaged, continued use of existing tracks is not usually construed as causing further damage to sites of this nature. Road widening or re-forming may however constitute "damage" to a site. With this in mind the following general recommendation applies to all sites:

*** If road development or maintenance work or other forestry activities are likely to damage any site or relic the Forestry Commission must apply to the National Parks and Wildlife Service for a Consent to Destroy. All current sites should be placed on PMP maps so that this provision may be observed. It is relevant to note here that it is Forestry Commission policy, based on consultations with the National Parks and Wildlife Service and Aboriginal communities, that all Aboriginal site locations are kept confidential except for management purposes. They should not be recorded directly onto PMP maps but rather on overlays not available for public perusal.**

Sixty (60) of the Artifact Occurrences located during the survey are of low archaeological value. They appear to be single activity sites generally comprising one to four artifacts that occur in disturbed contexts. Much of what value they can impart (their location and type) has been recorded by this survey. They are all located on tracks or nearby and most were found in areas that have already undergone some degree of logging. Practically speaking these sites cannot be further damaged as they have already experienced the impacts which could occur to them in the future. It is likely that many of them could not even be located again given that they are individual artifacts less then 3 cm long.

The thrust of management should be to preserve representative areas as described above. In my opinion any loss or degradation of recorded or unrecorded sites will be compensated for by the preservation of sites in the reserve system supplemented by the measures described above. Nevertheless all relics are protected under the *National Parks and Wildlife Service Act 1974* and it will be necessary to apply for a permit if operations are planned where sites of this kind are located.

*** The Forestry Commission should negotiate with National Parks on the matter of the future management of the following sites of low archaeological significance:**

BabylCkRd3-1	BabylCkRd4-1	BroadwaterCkRd1-1
BroadwaterCkRd3-1	BroadwaterCkRd12-1	BroadwaterCkRd14-1
CampForestRd1-1	ChrisitesCkRd2-1	ClaypotRd5-1
DomeMtn3-1	DomeMtn4-1	Eastern Bound.Trl2-1
FortyAcreRd2-1	FortyAcreRd3-1	FortySpurRd2-1
Fosters Spur1-1	GorgeCreek5-2	IslandRd6-1
IslandRd4-1	JackybulbinCk1-1	LollbackCk2-1
Lookout1-1	MackellarRange5-1	MackellarRange12-1
MackellarRange13-1	MackellarRange16-1	MackellarRange17-1
MackellarRange18-1	MalaraCkFt1-1	MangroveCk7-1
MangroveCk11-1	MangroveCk16-1	McFaydenRd2-1
MiddleRidge3-1	MiddleRidge4-1	Mt. Marsh 1,6-1
Mt. Marsh 2,7-1	Mt. Marsh 3,1-1	Mt. Marsh 5,1-1
Mt. Marsh 5,5-1	Mt. Marsh 5,8-1	Mt. Marsh 5,10-1
NogrigarRd1-1	NogrigarRd2-1	NogrigarRd3-1
OilRig3-1	PawPawRd1-1	PeacockCkRd4-1
PeacockCkRd7-1	PeacockCkRd8-1	PeacockCkRd10-1
PeacockCkRd11-1	PeacockCkRd12-1	PineRd2-1
RoyalCamp1-1	SugarloafFt1-1	SugarloafFt3-1
TullymorganRd6-1	TullymorganRd7-1	

Further management recommendations are made for sixteen (16) Artifact Occurrences which have some structure and complexity and/or occur in undisturbed contexts (listed in table 7).

Table 7. Sites for interim preservation

Site Name	Toposequence	State Forest
Oaky Creek4-1	ridge	Bungabbee
Mt. Belmore 3-1	ridge hillock,bench	Mt. Belmore
Nogrigar Rd 4-1	ridge	Ewingar
Bulldog Rock 1-1	ridge	Ewingar
NPWS (13-1-84)	ridge	Mebbin
IslandRd2-1	ridge, saddle	Devils Pulpit
IslandRd1-1	lower slope	Doubleduke
Middle Ridge 2-1	ridge	Nullum
Mt. Marsh 4,1-1	saddle, ridge hillock	Mt. Marsh
MangroveCk16-2	plain	Giberagee
BranchCk1-1	flat	Sugarloaf
GorgeCk1-1	lower slope, mid-slope	Richmond Range
* Mt. Marsh 3,14-1	low spur	Mt. Marsh
* Mt. Marsh 3,11-1	low spur	Mt. Marsh
* Mt. Marsh 3,8-1	low spur	Mt. Marsh
* Mt. Marsh 3,10-1	low spur	Mt. Marsh

* located in context undisturbed by forestry activities

*** Further disturbance to the sites listed in Table 7 must be avoided (as per the guidelines above). However their loss or further degradation would be compensated for by the preservation of archaeologically representative areas within the reserve system as described. Until this has been implemented these sites should be preserved on the basis that they are the only sites so far recorded in the forests of the study area that are of a moderately complex nature and/or they are located within contexts undisturbed by forestry activities.**

*** The following three sites are rare examples of their kind in the study area.They are not under any immediate threat but their location should be noted on Forestry Commission PMP maps to ensure that they are not impacted by any future forestry activities.**

Mt. Belmore Axe Shelter
Camp Forest Rd Shelter
Duffys Break Scarred Tree

15.5 Recommendations for Aboriginal Values

All land systems should be considered to have the potential to contain sites of significance to Aborigines. Forests also have values to Aboriginal people not contained in specific sites, for example, they are generally held to be important for acquiring "bush-tucker". To mitigate potential impact on possible sites, and to provide an avenue for a voice in forest management generally regular liaison should be maintained with Local Aboriginal Land Councils.

*** The District Forester should maintain on-going liaison with the Local Aboriginal Land Councils whose boundaries take in the EIS area regarding the Aboriginal value of sites or forests in the region. In particular the Forestry Commission should consult with Local Aboriginal Land Councils over harvesting plans for forests where there is a well known Aboriginal historical association. This applies, for example, to the forests near Baryulgil and Tabulam.**

The following issues were raised in discussions the author had with local Aboriginal people and will need to be followed up in future consultations:

* employment of Aboriginal people as Aboriginal Site Custodians

* resolution of the Management Plan for Goagun Aboriginal Place

* the possibility that there may be unrecorded sites of Aboriginal significance in Mt. Marsh State Forest

* the possible presence of unrecorded sites of Aboriginal significance in the south-east of Ewingar forests

* the future of the Mungoo Mungoo tree (NPWS 03-6-026)

In commenting on a draft of this report, the Far North Coast Regional Aboriginal Land Council made the recommendation that a "complete anthropological investigation" be carried out of all state forests (see appendix 13). It is therefore recommended:

***That the Forestry Commission should negotiate with the Far North Coast Regional Aboriginal Land Council on the best way of achieving a satisfactory assessment of state forests.**

*** Should the Commission seek consent from the National Parks and Wildlife Service to disturb/destroy known archaeological**

sites in the area it will be necessary to consult with the relevant Local Aboriginal Land Councils regarding their opinion on whether disturbance/destruction is appropriate or what salvage measures are required.

*** The Commission should not carry out any programme of public interpretation of archaeological sites within forests without consultation with Local Aboriginal Land Councils**

*** The Commission should seek to incorporate into its management strategy the findings of any future study specifically targeting the Aboriginal value of forests in the study area.**

*** The location of the natural feature female ceremonial site described by Ken Gordon of Malabugilmah should be kept confidential, although marked on Forestry's P.M.P. maps to ensure that the Aboriginal significance of this site is taken into account in planning future operations.**

15.6 Recommendation for Training of Forestry Commission Personnel

A potentially effective way of lessening impacts to highly significant obtrusive archaeological sites (such as stone arrangements and rockshelters) is to have marketing foremen, surveyors and foresters, actively seeking such sites while carrying out their duties. This would serve as a preliminary step to further assessment of sites or potential sites by an archaeologist and the Local Aboriginal Land Council.

*** The Forestry Commission should organise a regional workshop programme for forestry field staff to familiarise them with the more obtrusive sites - rock shelters, stone arrangements, bora rings and quarries - and to establish procedures for the routine checking and recording of such sites when inspecting logging/roading areas.**

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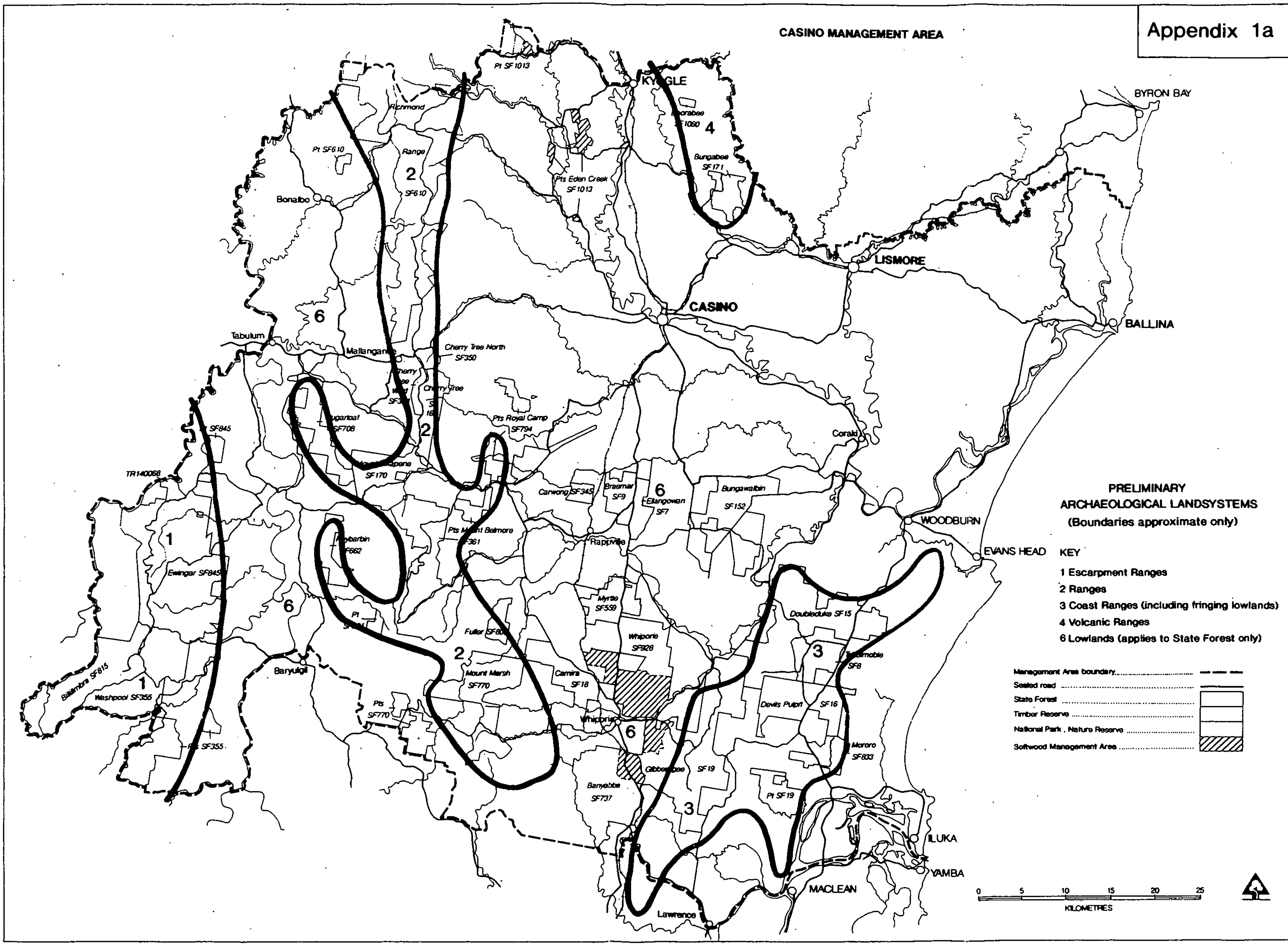
APPENDICES

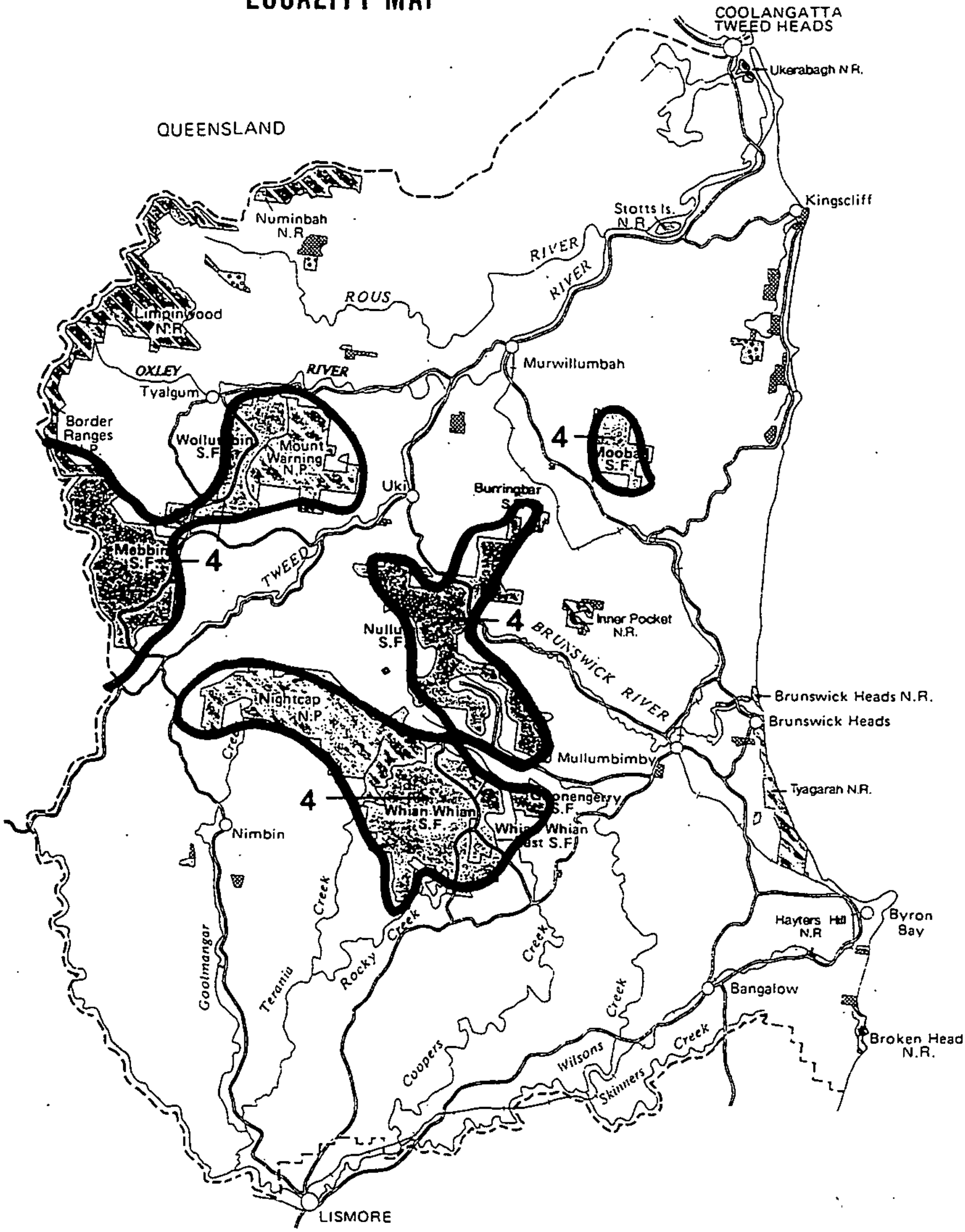
Appendix 1a


CASINO MANAGEMENT AREA
PRELIMINARY
ARCHAEOLOGICAL LANDSYSTEMS
(Boundaries approximate only)
KEY
1 Escarpment Ranges
2 Ranges
3 Coast Ranges (including fringing lowlands)
4 Volcanic Ranges
6 Lowlands (applies to State Forest only)
Management Area boundary
Sealed road
State Forest
Timber Reserve
National Park, Nature Reserve
Softwood Management Area
KILOMETRES
KYOGLE
BYRON BAY
LISMORE
CASINO
BALLINA
Bonalbo
Tabulum
Mallanganee
Coraki
WOODBURN
EVANS HEAD
Rappville
Baryulgil
Whiporie
Lawrence
MACLEAN
ILUKA
YAMBA

MURWILLUMBAH MANAGEMENT AREA

Appendix 1b

LOCALITY MAP



PRELIMINARY ARCHAEOLOGICAL LANDSYSTEMS
(Boundaries approximate only)

KEY

4 Volcanic Ranges

Scale

0 5 10 15 20km

Management Area Limits

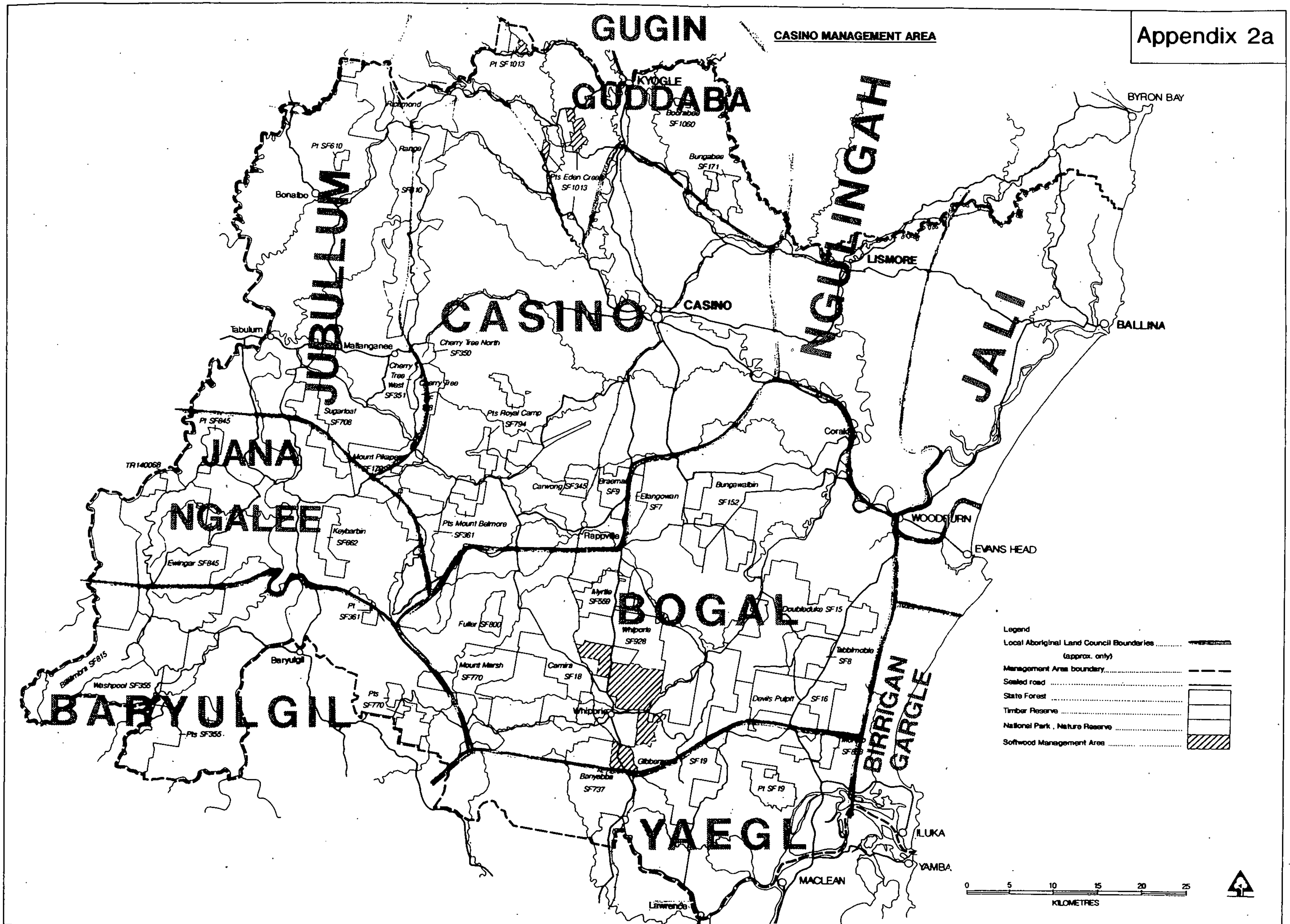
State Forest

National Park

Vacant Crown Land

Leasehold Land

Appendix 2a

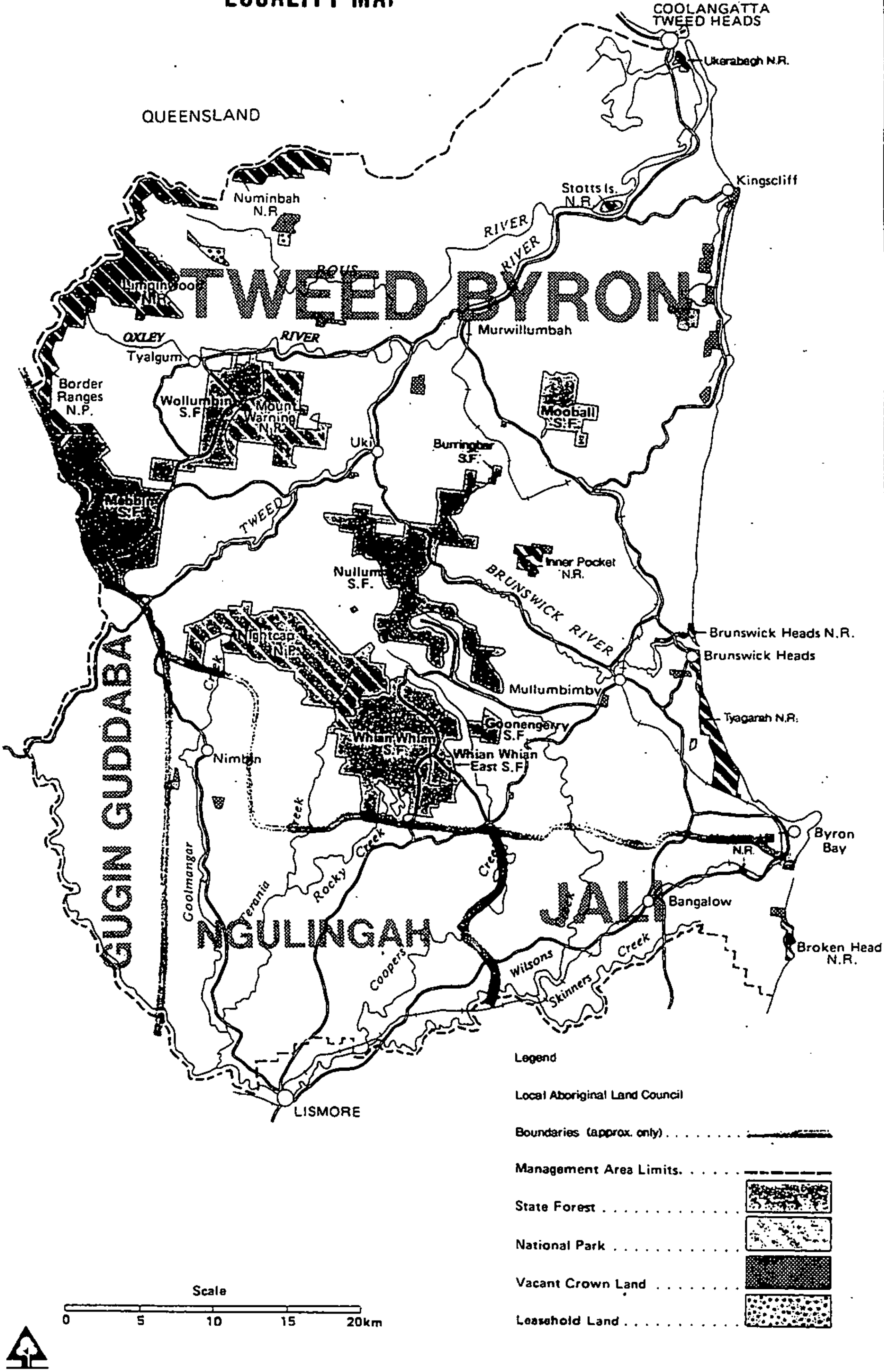


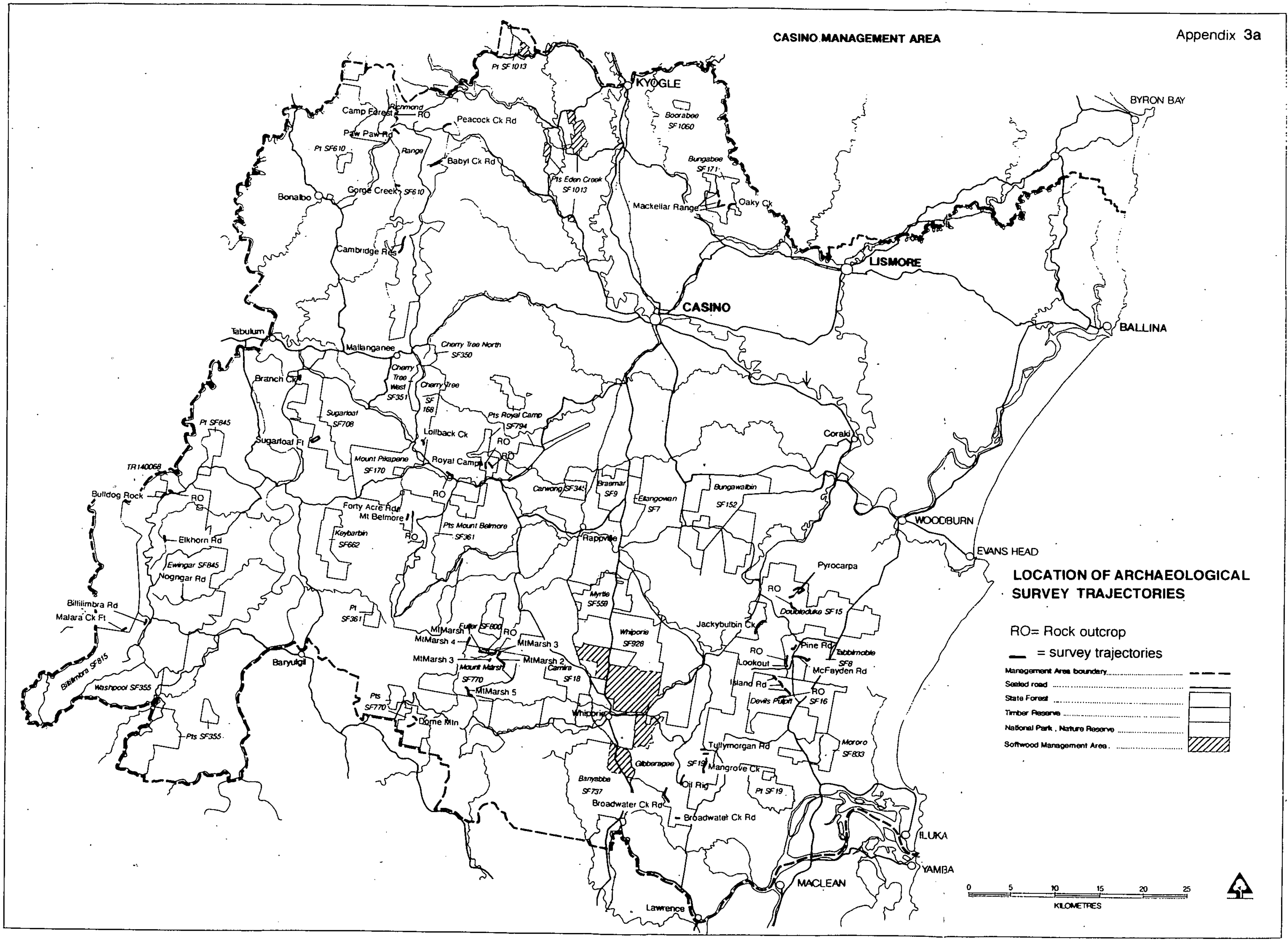
CASINO MANAGEMENT AREA
GUGIN
GUDDABA
NGULINGAH
JUBULLUM
CASINO
JALI
JANA
NGALEE
BOGAL
BARYULGIL
BIRRIGAN GARGLE
YAEGL
KYOGLE
BYRON BAY
LISMORE
CASINO
BALLINA
WOODBURN
EVANS HEAD
Coraki
Rappville
Whiporie
Baryulgil
Tabulum
Mallanganee
Bonalbo
Richmond
Range
ILUKA
YAMBA
MACLEAN
Lawrence
Pt SF 1013
Boorabee SF1060
Bungabee SF171
Pts Eden Creek SF1013
Pt SF610
SF610
Cherry Tree North SF350
Cherry Tree West SF351
Cherry Tree
Pts Royal Camp SF794
Sugarloaf SF708
Pt SF845
TR140068
Mount Pikapene
Carwong SF345
Braemar SF9
Ellangowan SF7
Bungawalbin SF152
Keybarbin SF662
Pts Mount Belmore SF361
Ewingar SF845
Myrtle SF569
Doubleduke SF15
Pt SF361
Fuller SF800
Whiporie SF928
Tabbimoble SF8
Mount Marsh SF770
Camira SF18
Bezaleel SF815
Washpool SF355
Pts SF770
Davis Pulpit
SF16
Pts SF355
Gibberagee
SF19
Banyabba SF737
Pt SF 19
Legend
Local Aboriginal Land Council Boundaries (approx. only)
Management Area boundary
Sealed road
State Forest
Timber Reserve
National Park, Nature Reserve
Softwood Management Area
0 5 10 15 20 25
KILOMETRES

MURWILLUMBAH MANAGEMENT AREA

Appendix 2b

LOCALITY MAP

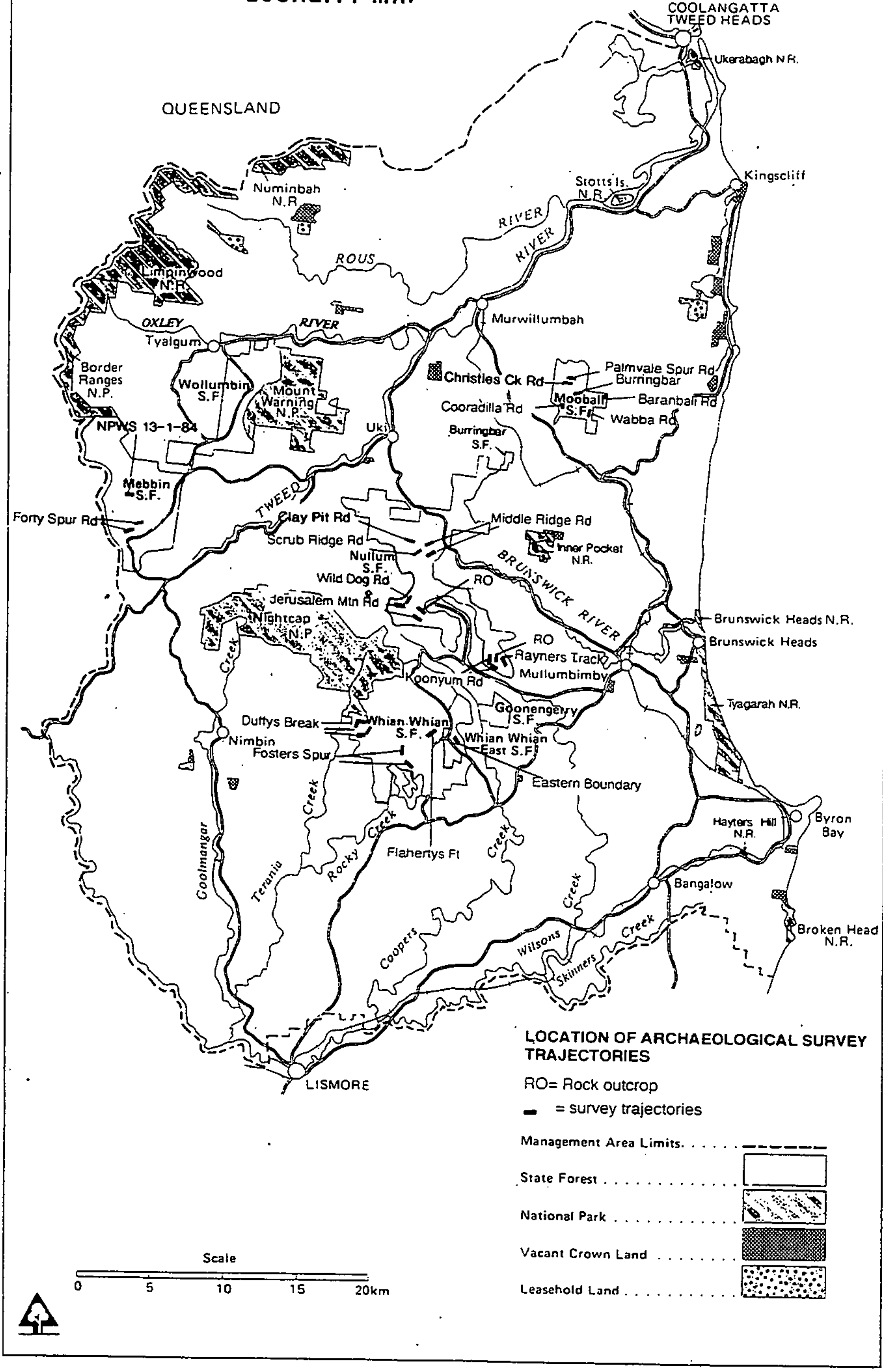



Appendix 3a
CASINO MANAGEMENT AREA
LOCATION OF ARCHAEOLOGICAL SURVEY TRAJECTORIES
RO= Rock outcrop
= survey trajectories
Management Area boundary
Sealed road
State Forest
Timber Reserve
National Park, Nature Reserve
Softwood Management Area
0 5 10 15 20 25
KILOMETRES
KYOGLE
LISMORE
CASINO
BYRON BAY
BALLINA
WOODBURN
EVANS HEAD
ILUKA
YAMBA
MACLEAN
Lawrence
Bonalbo
Tabulam
Mallanganee
Baryulgil
Coraki
Rappville
Whiporie
Pt SF 1013
Boorabee SF1060
Bungabee SF171
Pts Eden Creek SF1013
Camp Forest
Richmond
RO
Peacock Ck Rd
Paw Paw Rd
Pt SF610
Range
Babyl Ck Rd
Gorge Creek
SF610
Mackellar Range
Oaky Ck
Cambridge Res
Cherry Tree North SF350
Cherry Tree West SF351
Cherry Tree
SF 168
Branch Ck
Sugarloaf SF708
Pts Royal Camp SF794
Pt SF845
Sugarloaf Ft
Lollback Ck
Mount Pikapene SF170
Royal Camp
TR140068
Bulldog Rock
Forty Acre Rd
Mt Belmore
Carwong SF345
Braemar SF9
Ellangowan SF7
Bungawalbin SF152
Keybarbin SF662
Pts Mount Belmore SF361
Elkhorn Rd
Ewingar SF845
Nogngar Rd
Pyrocarpa
Myrtle SF559
Doubleduke SF15
Billilimbra Rd
Malara Ck Ft
Pt SF361
Jackybulbin Ck
MtMarsh
Fuller SF800
MtMarsh 4
MtMarsh 3
MtMarsh 2
Whiporie SF928
Pine Rd
Tabbimoble SF8
Lookout
McFayden Rd
Island Rd
Devils Pulpit
SF16
Mount Marsh SF770
Camira SF18
MtMarsh 5
Billilimbra SF815
Washpool SF355
Pts SF770
Dome Mtn
Pts SF355
Tullymorgan Rd
Mororo SF833
Gibberagee
SF19
Mangrove Ck
Oil Rig
Banyabba SF737
Pt SF19
Broadwater Ck Rd

MURWILLUMBAH MANAGEMENT AREA

Appendix 3b

LOCALITY MAP



LOCATION OF ARCHAEOLOGICAL SURVEY TRAJECTORIES

RO= Rock outcrop

▬ = survey trajectories

Management Area Limits. . . . . .

State Forest . . . .

National Park . . . .

Vacant Crown Land . . . .

Leasehold Land . . . .

APPENDIX 4

Glossary Including Schematic Representation of Toposequence Elements, Ridge Toposequence Elements and Local Ridge System Categories

GLOSSARY

Toposequence/Landform Element:

Crest	stands above all, or almost all, points in the adjacent terrain; characteristically smoothly convex upwards.
Ridge	compound element comprising a narrow crest and immediately adjoining slope with crest length being greater than the width of the element
Upper slope	adjacent below a crest, ridge or flat and not adjacent above a flat or depression
Mid slope	not adjacent below a crest, ridge or flat and not adjacent above a flat or depression
Lower slope	not adjacent below a crest, ridge or flat and above a flat or depression
Simple slope	adjacent below a crest, ridge or flat and adjacent above a flat or depression
Flat	level or very gently inclined surface and adjacent to watercourse
Plain	level or very gently inclined surface and not adjacent to watercourse
Saddle	lower, relatively level point on crest or ridge
Low spur	compound element comprising flat or gently inclined ridge extending from footslopes of locally dominant or subsidiary ridge or crest to stream flat or bank

Component Form:

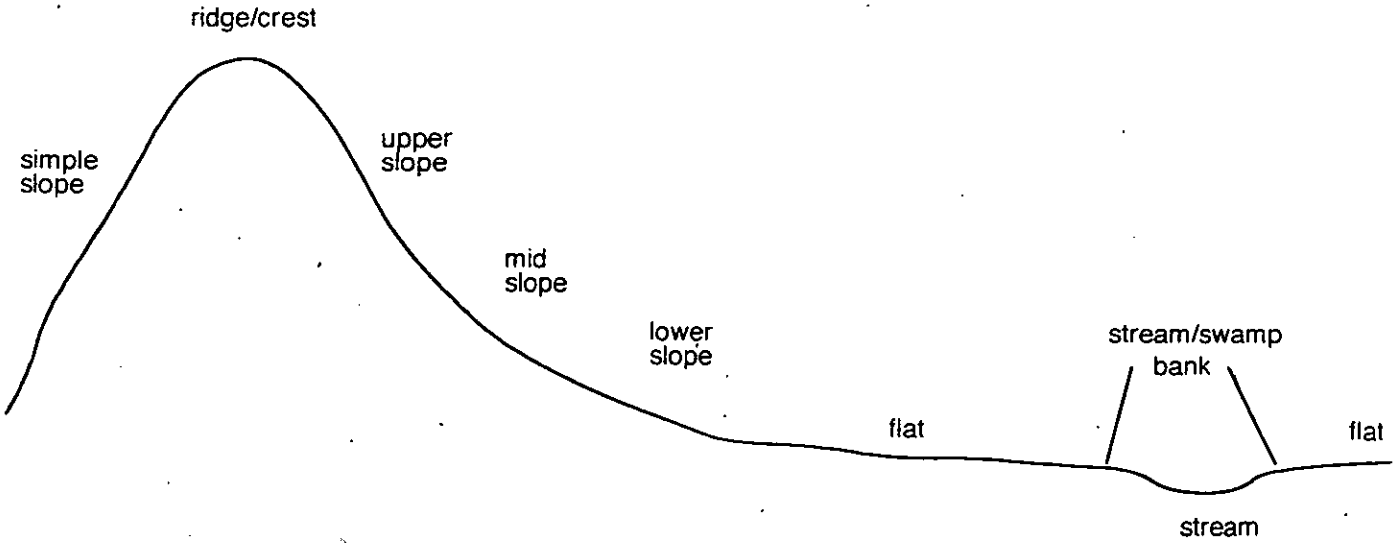
Bulldozer push	where bulldozer or similar has merely pushed over vegetation with only limited ground disturbance, usually only one bulldozer blade wide
Unformed track	where vegetation and ground surface has been cleared over a variable width with relatively shallow ground disturbance and no imported gravels, surface forming, major drainage works or infilling
Formed track	where gravels have been imported for surface forming and infill, and drainage works and banking have been carried out, usually wider than other types of track.

Cutting	ground surface, soil, sediment and bedrock exposed in a usually sloping cross-section in places along the sides of roads and formed tracks
Quarry	gravel pit, sand quarry, borrow pit etc.
Logged coupe	area of ground with significant ground surface and subsurface exposures through logging and ancillary works
Logging dump	as above, but where ground disturbance is most intense
Regenerating coupe/dump	where ground surface has stabilised and vegetation has taken
Animal track/ camp	minimal ground disturbance, but reasonable exposure resulting from the regular movements of animals
Natural	no obvious signs of any animal or human process of disturbance

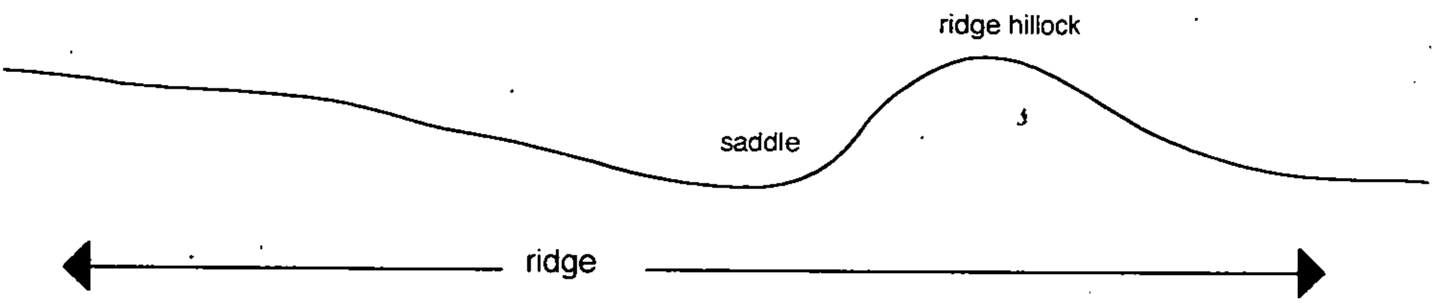
Stream order:

Stream-order	First-order streams are unbranched streams at the head waters of catchments. Where two such streams join they become a second-order stream. Where two second-order streams join, they become a **third-order** stream and so on

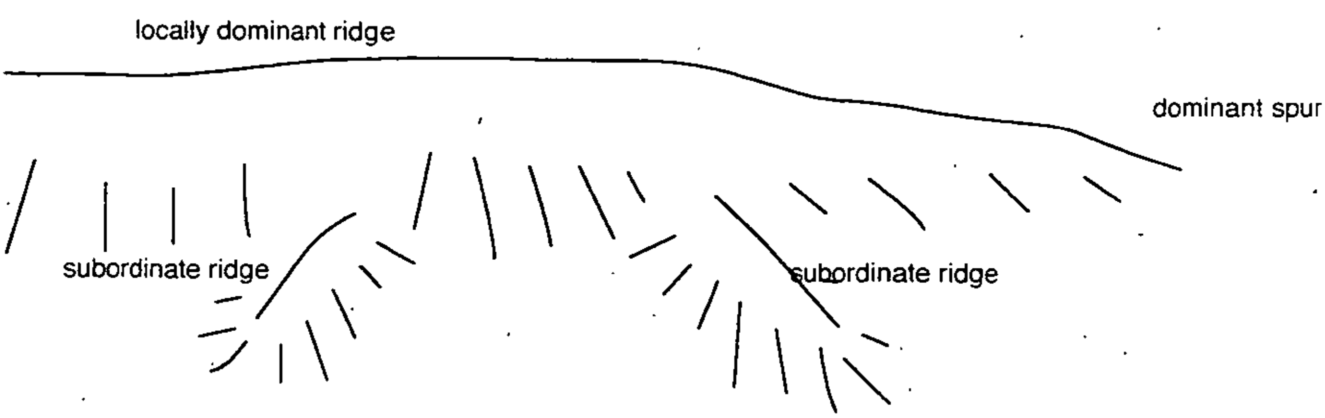
Toposequence elements



Ridge toposequence elements



Local ridge system categories



APPENDIX 5

Coverage Data Recording Form

Environmental Component Recording Form

Site Recording Form

NORTH-EAST FORESTS ARCHAEOLOGICAL SURVEY

COVERAGE DATA

Trajectory name: ____________________ Date: ____________________

Survey team: ____________________

1:25 000 Forestry map: ____________________ Weather: ____________________

Component No:	Toposequence	length(m)	depth(m)	width(m)	area(m2)	Surface visibility	Arch. visibility	Estimated effective coverage	sites & isolated artifacts

NORTH-EAST FORESTS ARCHAEOLOGICAL SURVEY
ENVIRONMENTAL COMPONENT RECORDING FORM

1. Sample Trajectory Name __________ **2. Component No.** ________

3. Geology
1. recent sand & gravels
2. argillites, greywacke & slate
3. argillites with minor quartz veins
4. argillites with abundant quartz veins & intermediate volcanics
5. sandstone, siltstone & shale
6. conglomerate, sandstone & shale
7. quartz sandstone
8. granitic rocks
9. acid volcanics
10. basalt

4. Land system
1. escarpment ranges
2. ranges
3. coastal ranges
4. volcanic ranges
6. lowlands
7. escarpment range foothills

5. Landform pattern
1. plain (0-9m)
2. flood plain
3. hills (90-300m)
4. low hills(30-90m)
5. mountains (>300m)
6. plateau
7. rises (9-30m)
8. escarpment

6. Local ridge system category
1. locally dominant ridge 2. subsidiary ridge 3. dominant spur 4. absence of dominant ridges/spurs

7. Toposequence
1. crest
2. ridge
3. saddle
4. ridge hillock
5. low spur
6. simple slope
7. upper slope waxing
8. upper slope maximal
9. mid-slope maximal
10. mid-slope waning
11. lower slope maximal
12. lower slope waning
13. mid-slope minimal (bench)
14. flat
15. plain
16. stream /swamp bank

8. Geomorphology
A= aggrading E= eroding 0= aggrading or eroding

9. Soil
1. sand with stone/gravel
2. sand without stone/gravel
3. loam with stone/gravel
4. loam without stone/gravel
5. clay with stone gravel
7. clay without stone/gravel
8. bedrock/lithsol
9. peat/swamp

10. Native vegetation
1. rain forest
2. dry rain forest
3. wet sclerophyll
4. dry sclerophyll forest
5. dry sclerophyll woodland
6. swamp sclerophyll/dry sclerophyll/swamp
7. heath/swamp
8. grassland
9. dry rain forest/wet sclerophyll
10. dry sclerophyll/wet sclerophyll
11. dry sclerophyll/rain forest

11. Slope
1. 0-2 degrees level/v. gently inclined
2. >2-5 degrees gently inclined
3. >5-10 degrees moderately inclined
4. >10-20 degrees inclined
5. 20-30 degrees steep
6. >30-45 degrees v. steep
7. >45-70 precipitous
8. >70 degrees cliffed

12. Landuse
1. native vegetation
2. selectively logged
3. fully logged
4. recently burnt
5. pasture
6. plantation
7. forestry/recreation camp.

13. Component form
1. bulldozer push
2. unformed track
3. formed track
4. cutting/batter
5. quarry
6. logging coupe
7. regenerating coupe
8. log dump
9. regenerating log dump
10. animal track/camp
11. natural

14. Detection limiting factors
1. quartz gravels
3. deep sediments
4. redeposited sediments
5. deep excavation/erosion
6. heaved up
7. vegetation
8. litter and/or gravels

15. Component length (m) __________ **16. Component width (m)** __________

17. Surface visibility % __________ **18. Archaeological visibility %** __________

19. Effective coverage (m2) **20. Artifact occurrence** __________

21. Artifact No. __________

22. Distance to water
1. 0-200m
2. 201-400m
3. 401-600m
4. 601-800m
5. 801-100m
6. 1000-2000m
7. 2000+m

23. Water source
1. 1st order stream
2. 2nd order stream
3. 3rd order stream
4. 4th order stream
5. intermittent swamp
6. perennial swamp

24. Altitude (MABSL) __________

NORTHEAST FORESTS ARCHAEOLOGICAL SURVEY
SITE RECORDING FORM

1:250 000 map sheet:____________________ 1:25 000 map sheet:____________________

AMG Grid Ref. 250 K

						E

25K

250 K

							N

25K

Site Name/Code [ ]

Sample Trajectory Code [ ] Component Code [ ]

Site Type

1. artifact scatter
2. isolated artifact
3. scarred tree
4. quarry
5. shelter/cave with deposit
6. midden
7. stone arrangement
8. art/engraving
9. skeletal material/burial

Land Status

1. State Forest/Reserve
2. National Park/Reserve
3. Proposed National park
4. Vacant Crown land
5. Leasehold
6. Freehold
7. Other:____________

Access Instructions:

Landform Element [ ] Slope [ ] Aspect [ ] Altitude [ ]

(for codes see Component Recording Form)

Exposure Type

1. bulldozer push
2. unformed track
3. formed track
4. cutting/batter
5. quarry
6. logging coupe
7. regenerating coupe
8. log dump
9. regenerating coupe
10. animal track/camp
11. natural

Distance from drinking water: Source:

Resource Zone:

Site Dimensions: Length:__________m Width:__________m Area:__________m2

Surface visibility:__________%

Site description:

APPENDIX 6

Artifact Recording Code

NORTH EAST FORESTS ARCHAEOLOGICAL SURVEY
RECORDING FORM

Sketch Map(general location of site)

Site Plan (show maximum dimensions, north etc. for open sites show areas of different artifact density).

Artifact Code

1. Artifact blank
Sixteen categories of artifact blank are defined:

1= flake
2= broken flake
3= bipolar (1)
4= bipolar (2)
5= blocky
6= flake like
7= flake like fragment.
8= core
9= core fragment
10= anvil
11= hammerstone
12= manuport
13= flaked pebble
14= grindstone
15= hatchet
<1= artifact less than 1cm.

1. A flake is defined as any piece of stone struck from a core with one or more of the following diagnostic characteristics, a bulb of percussion and positive percussion scarring, a striking platform and/or ring crack.

2. A broken flake is defined as any piece having the diagnostic features of a flake but showing evidence of a longitudinal or lateral snap. It must still be possible to recognise the orientation of the original flake.

3. Bipolar (1) is defined as elongated, usually banana shaped pieces with crushing and/or incipient fracture lines at one or two ends.

4. Bipolar (2) can be differentiated from bipolar (1) as these pieces do not display an obvious point of impact or crushing. The pieces are banana or crescent shaped. Crescent shaped pieces often have an outer margin of cortex not unlike an orange segment.

5. A blocky piece is any piece other than a core or core fragment that has no single surface that could have been an interior surface.

6. A flake like piece is any piece that lacks the diagnostic features of a flake but has a discernible single interior surface.

7. A flake like fragment is any piece which has two surfaces which may have been interior surfaces.

8. A core is any piece which has one or more whole negative flake scars with no positive flake scars being present. An exception to this definition is some micro

blade cores which are made on a single large flake.

9. A core fragment is any piece which has one or more negative flake scars and no positive flake scars. All or some of the flake scars may be abruptly terminated by breakage.

10. An anvil is defined as a whole or fragmentary flat pebble which has evidence of pitting caused by repetitive flaking episodes.

11. A hammerstone is defined as a rounded river pebble with evidence of pitting from numerous flaking events.

12. A manuport is defined as any piece of stone which is exotic to its immediate surrounds and which has not been flaked or modified.

13. A flaked pebble is defined as a whole or broken pebble that has been modified by flaking but has no clear platform preparation or regular retouch indicative of cores or retouched tools.

14. A grindstone is defined as a whole or broken flat pebble with one or more depressions resulting from abrasion.

15. A hatchet is defined as unifacially or bifacially flaked or ground pebble or quarry blank.

<1cm. Any piece less than 1cm in its maximum dimensions.

2. Type

Flakes, blades, retouched pieces and cores were classified into 16 different categories.

1= blade
2= backed blade
3= geometric microlith
4= concave scraper
5= convex scraper
6= nosed scraper
8= straight scraper
9= pebble tool
10= prismatic blade core
11= bifacial alternating platform core
12= tranchet blade core
13= bipolar core
14= freehand core
15= multiplatform core
16= thumbnail scraper

1. A blade is defined as a flake with sub parallel to parallel margins and a dorsal

ridge (Flenniken & White 1985:136).

2. Backed blades are blades that have been systematically trimmed on one margin to produce a "back" as opposed to the sharp edge of the opposite margin.

3. A geometric microlith is defined as a blade that has been trimmed on one or two margins to produce a symmetrical backed piece which is roughly triangular in plan.

4-8. Concave, convex, nosed and straight edged scrapers refers to four different scraper shapes defined on the basis of descriptive edge morphology. A scraper is defined as any piece with unifacial and systematic retouch (Lampert 1971:16)

9. A pebble tool is defined as a whole pebble or broken pebble that has been modified by flaking and has retouch present on one or more margins.

10. A prismatic blade core is a conventional fluted type of blade core.

11. A bifacial alternating platform core is a bifacial core that is used to produce thin flakes or blades. The core may have multiple platforms and is often disk shaped in cross section.

12. A tranchet blade core is a core made on a flake. The core platform is set up by retouch.

13. Cores are classified as bipolar if they contain the following attributes: opposing platforms of some form and/or a platform opposed to an area of crushing and signs that the force was directed into the core at or near a 90 degree angle as indicated by the flake scars (Hiscock 1979:59-60).

14. A freehand core is defined as a piece of stone held in one hand and struck with a hammerstone held in the other to remove flakes. Cores must have at least one negative flake scar and platform.

15. A multiplatform core is defined as a micro core with more than two platforms

16. A thumbnail scraper is a microlithic flake with regular unifacial retouch

3. Breakage Type

1= proximal
2= mid
3= distal
4= proximal blade
5= mid blade
6= distal blade
7= longitudinal

Complete flakes have all the characteristics of flakes, namely, ring crack, bulbar and termination characteristics.

1. A proximal flake is defined as a flake with ring crack and bulbar features intact but with no distal end.

2. A mid flake fragment is defined as a flake that has both proximal and distal portions missing.

3. A distal flake is defined as a flake with an intact termination but with no proximal features intact.

4. A proximal blade is defined as a blade with ring crack and bulbar features intact but with no distal end.

5. A mid blade fragment is defined as a blade that has both proximal and distal portions missing.

6. A distal blade is defined as a blade with an intact termination but with no proximal features intact.

7. A longitudinal fragment is a flake or blade broken along the percussion axis from the ring crack to the distal end.

4. Cortex

The amount of cortex was recorded as a percentage of total dorsal surface on all pieces with a discernible interior surface. On pieces with no discernible interior surface such as cores and blocky pieces cortex was recorded as a percentage of the total surface area.

0= 100%
2= 100-75%
2= 75-50%
3= <50%
4= 0%

5. Cortex type

Cortex type was recorded as one of two types of cortex, pebble or terrestrial.

1= pebble
2= terrestrial

6. Length

Percussion length was measured along the percussion axis from the ring crack to the distal margin. The measurements were taken with callipers to the nearest millimetre. On pieces that could not be orientated maximum length was taken, this is the measurement along the widest margin of an artifact.

7. Width

Percussion width was measured at right angles to the percussion axis midway between the ring crack and the distal end. The measurement was taken with callipers to the nearest millimetre. On pieces that could not be orientated block width was taken at 90 degrees of maximum length measurement.

8. Thickness

Percussion thickness was taken at the intersection of the percussion length and width. On pieces that could not be orientated block thickness was taken at the intersection of maximum length and block width.

9. Lithology

Artifact raw materials are defined into thirteen categories

1= quartz
2= acid volcanics
3= metasediments
4= chalcedonic chert
5= chert
6= conglomerite
7= unknown fine grained
8= sandstone
9= quartz rich sandstone
10= fine grained silcrete
11= coarse grained silcrete
12= coarse grained unknown
13= quartzite

1. Quartz is a crystalline rock with irregular fracture pattern. Quartz used in artifact manufacture is generally semi-translucent, although it grades from milky white to clear (extremely rare).

2. Acid volcanics are siliceous volcanic rocks such as rhyolite and ignimbrite. Most have a fine grained matrix (often similar to fine grained silcrete).

3. Metasediments are sedimentary rocks which have been subject to metamorphism. Inclusive in this category are argillites, compact rocks derived either from mudstone (claystone or siltstone) or shale that has undergone a some-what higher degree of induration than is present in mudstone or shale but that is less clearly laminated than, and without the fissility (either parallel bedding or other wise) of shale, or that lacks the cleavage distinctive of shale (Gary et al 1974:37). Also Included in this category is greywacke. Greywacke is a very hard, tough and

firmly indurated coarse grained sandstone and has poor flaking qualities (Gary et al 1974:312).

4. Chalcedonic chert is a transparent, translucent, vitreous, waxy variety of smooth chert of any colour. It is highly siliceous and flakes with smooth conchoidal surfaces (Gary et al 1974:117).

5. Chert is composed of amorphous silica and is an extremely dense, compact dull to semi vitreous, cryptocrystalline sedimentary rock. It may be an original organic or inorganic precipitate or replacement product (Gary et al 1974:122). It has variable flaking properties due to its hackly structure. It comes in a variety of colours, although it is generally dark green, grey or brown.

6. Conglomerite is a term used to describe conglomerate that has reached the same stage of induration as quartzite, characterised by the welding together of matrix and clasts as evidenced by fractures passing through both (Gary et al 1974:149). Conglomerite can be located in western and eastern boundaries of the Clarence Moreton basin in areas where basal conglomerates outcrop.

7. Unknown fine grained rocks are mainly comprised of acid volcanic and contact metamorphic rock. Many of these rocks are highly siliceous and fracture conchoidally.

8. Sandstone is coarsely layered quartz grains, cemented with silica. Sandstone is distinguishable from quartz rich sandstone by its coarser structure, less compact and highly visible grain. This rock type is generally not suitable for flaking but has useful abrasive qualities.

9. Quartz rich sandstone is silicified sandstone. It has larger grains than coarse grained silcrete, and is distinguished from it by the following criteria: if it fractures cleanly through individual grains in the matrix, it is coarse grained silcrete. If it fractures around the grains, it is quartz rich sandstone.

10-11. Soil, clay or sand sediments that have silicified under basalt through ground water percolation. It ranges in texture from very fine grained to coarse grained (Sullivan and Simmons 1979:56). At one extreme it is cryptocrystalline with very few class. It generally has characteristic yellow streaks of titanium oxide that occur within a grey and less commonly reddish background. Coarse grained silcrete which is more common in the study area than the former has larger inclusions and many more of them than fine grained silcrete. It has a sugary texture and glitter.

12. Coarse grained unknown are coarse grained rocks of indeterminate origin.

13. Quartzite is a very hard sometimes almost glassy metamorphic rock formed from quartz sandstone. It has a similar appearance to sandstone but can be distinguished by its crystalline structure as opposed to the granular structure of sandstone. It is generally coarse grained in texture.

APPENDIX 7

Coverage Data

The survey coverage database is set out as follows:

Column 1 -	Trajectory (name)
Column 2 -	Component number (within Trajectory)
Column 3 -	Geol. = Geological group (see code list in Appendix 5)
Column 4 -	L/system = Land system (see code list in Appendix 5)
Column 5 -	L/pattern = Landform pattern (see code list in Appendix 5)
Column 6 -	Topo.= Toposequence (see code list in Appendix 5 and explanatory diagram Appendix 4)
Column 7 -	Geom. = Geomorphological regime - predominate landsurface condition (see code list in Appendix 5)
Column 8 -	Soil - soil texture and type/absence of soil inclusions that a survey Component passes through (see code list in Appendix 5)
Column 9 -	Veg. = Vegetation - forest type/s present within 100m of the survey Component (see code list in Appendix 5)
Column 10 -	Slope - the predominant slope of an area through which a component passes (see code list in Appendix 5)
Column 11-	Landuse - post-contact landuse of an area (see code list in Appendix 5)
Column 12 -	Comp. frm.= Component form - type and surface characteristics of Component surveyed (see code list in Appendix 5)
Column 13 -	DLF = Detection limiting factors - variables which determine the extent to which archaeological materials will be located if present (see code list in Appendix 5)
Column 14 -	Length - length of Component surveyed
Column 15 -	Width - width of Component surveyed
Column 16 -	Surf. vis.= Surface visibility - percentage of a Component where ground surface soil is exposed
Column 17 -	Arch. vis.= Archaeological visibility - percentage of a Component where conditions permit the observation of archaeological material
Column 18 -	Eff. cover. m2 = Effective coverage(m2) - total area of effective survey coverage of a Component (see page in text for explanation of effective coverage)
Column 19 -	Site occ. = Site Occurrence - number of Artifact Occurrences in a Component (see text for explanation of Artifact Occurrence)
Column 20 -	Art. no.= Artifact Number - number of artifacts recorded in an Artifact Occurrence
Column 21 -	Dis. water = Distance to Water - distance of an Artifact Occurrence to the nearest third order stream or greater (measured in metres)
Column 22 -	Source- stream order of water source 3 = 3rd order, 4= 4th order
Column 23 -	ASL(m) - meters above sea level

Casino/Mur Coverage

Rows	Trajectory	Component	Geol.	L/system	L/pattern	Topo.	Geom.	Soil	Veg.	Slope	Landuse	Comp.frm.	DLF	Length	Width	Surf.vis.	Arch.vis.	Eff. cover. m2	Site occ.	Art.no.	Dis.water	Source	ASL(m)
1	Pyrocarpa	1	7	3	4	8	O	4	4	1	3	2	3	100	3	50	20	60	0	0	6	3	130
2	Pyrocarpa	2	7	3	4	13	O	4	4	1	3	2	3	300	3	50	20	180	0	0	6	3	130
3	Pyrocarpa	3	7	3	4	2	O	4	4	1	3	2	3	100	3	50	20	60	0	0	6	3	140
4	Pyrocarpa	4	7	3	4	2	O	2	4	1	3	2	3	1000	4	80	10	400	0	0	5	3	150
5	JackybulbinCk	1	7	3	7	12	O	2	10	1	3	2	3	750	2	20	20	300	0	0	2	3	20
6	JackybulbinCk	2	7	3	7	14	O	2	10	1	3	2	3	500	2	80	80	800	1	1	1	3	10
7	JackybulbinCk	3	1	3	7	14	A	2	10	1	3	2	3	300	2	10	10	60	0	0	1	3	10
8	JackybulbinCk	4	1	3	7	14	A	2	10	1	3	2	3	50	2	10	0	0	0	0	1	3	10
9	JackybulbinCk	5	1	3	7	14	A	2	4	1	3	2	3	100	2	10	0	0	0	0	1	3	10
10	JackybulbinCk	6	1	3	7	14	A	2	4	1	3	2	3	1000	2	5	0	0	0	0	1	3	10
11	JackybulbinCk	7	1	3	7	12	A	2	6	1	3	2	3	550	2	50	20	220	0	0	3	3	10
12	JackybulbinCk	8	1	3	7	12	A	2	6	1	3	2	3	75	2	70	70	105	0	0	4	3	10
13	IslandRd	1	7	3	4	12	O	3	10	2	3	2	3	60	3	80	50	90	1	7	3	3	30
14	IslandRd	2	7	3	4	2	O	3	10	2	3	2	3	50	5	50	10	25	1	5	3	3	40
15	IslandRd	3	7	3	4	2	O	3	10	3	3	4	3	50	0.5	80	0	0	1	1	3	3	40
16	IslandRd	4	7	3	3	2	E	5	5	2	3	2	3	150	3	80	20	90	1	2	6	3	200
17	IslandRd	5	7	3	3	2	E	5	5	3	3	2	3	100	3	80	20	60	0	0	6	3	210
18	IslandRd	6	7	3	3	2	E	5	5	3	3	2	3	100	3	80	20	60	1	1	6	3	220
19	IslandRd	7	7	3	3	2	E	5	5	1	3	2	3	300	3	5	5	45	0	0	6	3	240
20	IslandRd	8	7	3	3	2	E	5	5	1	3	2	3	500	3	10	10	150	0	0	6	3	220
21	Lookout	1	7	3	3	2	E	1	5	1	2	3	5	100	3	100	80	240	1	3	6	3	180
22	Lookout	2	7	3	3	2	E	1	5	1	2	3	5	100	2	10	10	20	0	0	6	3	180
23	Lookout	3	7	3	3	2	E	1	5	1	2	3	5	500	2	5	5	50	0	0	6	3	180
24	PineRd	1	1	3	4	12	O	7	3	1	2	2	4	50	3	80	80	120	0	0	7	3	30
25	PineRd	2	1	3	4	13	E	1	6	1	2	4	0	100	1	100	100	100	1	2	7	3	30
26	PineRd	3	1	3	4	14	A	4	3	1	2	2	8	80	3	20	20	48	0	0	7	3	30
27	PineRd	4	1	3	4	16	A	4	3	1	2	2	5	50	3	5	5	7	0	0	7	3	30
28	PineRd	5	1	3	4	12	A	4	6	2	2	1	7	200	3	80	80	480	0	0	7	3	30
29	McFaydenRd	1	5	3	7	6	O	2	10	1	2	2	8	500	2.5	30	30	225	0	0	6	3	30
30	McFaydenRd	2	5	3	7	6	O	2	10	1	2	2	8	600	2.5	20	20	300	1	1	7	3	30
31	McFaydenRd	3	5	3	7	6	O	2	10	2	2	2	8	150	2.5	20	20	75	0	0	7	3	40
32	TullymorganRd	1	5	3	4	6	E	4	10	1	2	1	6	100	2.5	20	20	50	0	0	2	3	60
33	TullymorganRd	2	5	3	4	6	E	4	10	1	2	1	6	100	2.5	40	0	0	0	0	2	3	60
34	TullymorganRd	3	5	3	4	2	O	4	10	1	2	8	6	100	4	100	0	0	0	0	1	3	60
35	TullymorganRd	4	5	3	4	2	E	4	10	1	2	2	6	100	4	50	50	200	0	0	2	3	60
36	TullymorganRd	5	5	3	4	2	E	4	10	1	2	2	6	50	4	50	50	100	0	0	2	3	60
37	TullymorganRd	6	5	3	4	2	E	4	10	1	2	2	6	50	4	50	50	100	1	1	2	3	70
38	TullymorganRd	7	5	3	4	2	E	4	10	1	2	2	6	200	4	100	80	640	1	1	3	3	70
39	TullymorganRd	8	5	3	4	2	E	4	10	3	2	2	6	150	4	100	80	480	0	0	3	3	80
40	TullymorganRd	9	5	3	4	4	E	4	10	1	2	8	6	50	4	80	80	160	0	0	4	3	90
41	MangroveCk	1	5	3	4	15	E	4	10	1	2	2	0	10	4	100	100	40	0	0	5	3	90
42	MangroveCk	2	5	3	4	2	E	7	10	1	2	4	8	30	1	80	80	24	0	0	3	3	60
43	MangroveCk	3	5	3	4	2	E	7	10	1	2	8	8	100	2	80	80	160	0	0	3	3	60
44	MangroveCk	4	5	3	4	2	E	7	10	2	2	1	6	100	4	100	20	8	0	0	3	3	60
45	MangroveCk	5	5	3	4	2	E	7	10	2	2	1	6	100	4	100	20	80	0	0	3	3	60
46	MangroveCk	6	5	3	4	2	E	7	10	2	2	1	6	100	4	100	20	80	0	0	3	3	60
47	MangroveCk	7	5	3	4	2	E	7	10	1	2	1	6	50	4	100	20	40	1	1	3	3	60
48	MangroveCk	8	5	3	7	12	E	7	10	1	3	3	8	100	3	80	80	240	0	0	2	3	30
49	MangroveCk	9	5	3	7	12	O	4	10	1	3	4	8	100	4	50	20	80	0	0	2	3	30
50	MangroveCk	10	5	3	7	5	A	4	10	1	3	1	3	200	4	80	0	0	0	0	2	3	30
51	MangroveCk	11	5	3	7	5	A	4	10	1	3	1	3	70	4	80	0	0	1	2	1	3	30
52	MangroveCk	12	5	3	7	16/1	A	4	10	1	3	1	0	20	4	100	100	80	0	0	1	3	30
53	MangroveCk	13	5	3	7	14	A	4	10	1	3	1	0	100	4	100	100	400	0	0	1	3	30

Casino/Mur Coverage

Rows	Trajectory	Component	Geol.	L/system	L/pattern	Topo.	Geom.	Soil	Veg.	Slope	Landuse	Comp.frm.	DLF	Length	Width	Surf.vis.	Arch.vis.	Eff. cover. m2	Site occ.	Art.no.	Dis.water	Source	ASL(m)
54	MangroveCk	14	1	3	7	2	O	2	10	1	3	2	8	200	2	15	15	60	0	0	1	3	30
55	MangroveCk	15	1	3	7	2	O	2	10	1	3	2	8	100	4	50	50	200	0	0	1	3	30
56	MangroveCk	16	5	3	7	15	O	2	4	1	3	2	8	400	4	50	50	800	2	19	3	3	40
57	OilRig	1	5	3	4	2	E	2	5	1	1	2	8	150	3	80	80	360	0	0	6	4	100
58	OilRig	2	5	3	4	2	E	2	5	1	1	2	4	50	3	80	30	45	0	0	6	4	100
59	OilRig	3	5	3	4	2	E	1	5	2	1	2	8	100	3	80	80	240	1	1	6	4	100
60	OilRig	4	5	3	4	2	E	3	5	1	2	2	8	400	4	80	50	800	0	0	6	4	100
61	OilRig	5	5	3	4	2	E	1	5	3	2	2	8	100	4	80	80	320	0	0	6	4	120
62	OilRig	6	5	3	4	2	E	7	5	1	2	2	0	100	4	100	100	400	0	0	6	4	120
63	OilRig	7	7	3	4	2	E	1	5	1	2	2	8	1100	3	50	50	1650	0	0	6	3	230
64	OilRig	8	7	3	4	2	E	1	5	1	2	2	8	200	3	50	50	300	0	0	6	3	230
65	BroadwaterCkRd	1	7	3	4	5	E	5	5	1	3	2	6	200	4	50	50	400	1	1	1	4	40
66	BroadwaterCkRd	2	7	3	4	5	E	5	5	1	3	2	6	150	3	50	50	225	0	0	1	4	40
67	BroadwaterCkRd	3	7	3	4	12	E	1	10	1	2	2	8	100	3	30	10	30	1	1	1	4	30
68	BroadwaterCkRd	4	7	3	4	5	E	8	10	1	2	2	8	100	3	30	30	90	0	0	1	4	30
69	BroadwaterCkRd	5	7	3	4	5	E	8	10	1	2	2	8	100	3	30	30	90	0	0	1	4	30
70	BroadwaterCkRd	6	7	3	4	5	E	8	10	2	2	2	8	100	3	30	30	90	0	0	1	4	30
71	BroadwaterCkRd	7	7	3	4	5	E	8	10	1	2	2	8	80	3	30	30	72	0	0	1	4	30
72	BroadwaterCkRd	8	7	3	4	5	E	8	10	1	2	2	8	80	3	30	30	72	0	0	1	4	30
73	BroadwaterCkRd	9	7	3	4	5	E	8	10	1	2	2	8	80	3	30	30	72	0	0	1	4	30
74	BroadwaterCkRd	10	7	3	4	5	E	8	10	2	2	2	8	200	3	20	20	120	0	0	1	4	30
75	BroadwaterCkRd	11	7	3	4	5	E	1	10	1	2	2	8	50	3	20	20	30	0	0	1	4	30
76	BroadwaterCkRd	12	7	3	4	14	A	9	10	1	2	2	3	30	3	30	30	27	1	1	1	4	30
77	BroadwaterCkRd	13	7	3	4	5	E	8	10	1	2	2	8	50	3	30	30	45	0	0	1	4	30
78	BroadwaterCkRd	14	7	3	4	5	E	8	10	1	2	2	8	100	3	30	30	90	1	1	1	4	30
79	BroadwaterCkRd	15	7	3	4	5	E	8	6	2	2	2	8	100	3	30	30	90	0	0	1	4	30
80	BroadwaterCkRd	16	7	3	4	5	E	8	6	1	2	2	8	100	3	30	30	90	0	0	1	4	30
81	MtMarsh1	1	1	2	4	14	O	2	5	1	1	2	3	100	0.5	50	50	25	0	0	1	4	110
82	MtMarsh1	2	1	2	4	14	O	2	5	1	1	2	3	70	2	5	5	7	0	0	1	4	110
83	MtMarsh1	3	7	2	4	6	E	8	5	3	1	2	8	250	2	80	0	0	0	0	2	4	120
84	MtMarsh1	4	7	2	4	2	E	1	5	1	1	2	5	600	2	30	30	360	0	0	2	4	150
85	MtMarsh1	5	7	2	4	2	E	1	5	3	1	2	8	200	2	30	30	120	0	0	2	3	180
86	MtMarsh1	6	7	2	4	4	E	1	5	1	1	2	5	100	2	30	30	60	1	1	2	3	200
87	MtMarsh1	7	7	2	4	4	E	2	5	1	1	11	8	500	2	5	5	50	0	0	2	3	220
88	MtMarsh2	1	7	2	4	12	E	2	6	1	1	2	8	400	2	30	30	240	0	0	1	4	120
89	MtMarsh2	2	7	2	4	8	E	1	4	3	1	2	5	250	2	80	10	50	0	0	3	4	150
90	MtMarsh2	3	7	2	4	2	E	2	4	1	1	2	8	350	2	50	10	70	0	0	4	4	200
91	MtMarsh2	4	7	2	4	8	E	8	4	4	1	2	5	100	2	50	0	0	0	0	6	4	200
92	MtMarsh2	5	7	2	4	2	E	8	4	3	1	2	5	450	2	10	10	90	0	0	6	4	210
93	MtMarsh2	6	7	2	4	2	E	1	4	1	1	2	8	100	4	20	20	80	0	0	6	4	210
94	MtMarsh2	7	7	2	4	2	E	1	4	2	1	2	8	100	4	20	20	80	1	1	6	4	220
95	MtMarsh2	8	7	2	4	4	E	1	4	1	1	2	8	200	4	10	10	80	0	0	6	4	220
96	MtMarsh2	9	7	2	4	2	E	1	4	1	1	2	8	150	4	20	20	120	0	0	5	3	200
97	MtMarsh2	10	7	2	4	2	E	1	4	2	1	2	8	150	4	20	20	120	0	0	5	3	190
98	MtMarsh2	11	7	2	4	2	E	1	4	1	1	2	8	50	4	50	50	100	0	0	4	3	180
99	MtMarsh3	1	7	2	4	2	O	2	4	1	1	2	4	20	4	20	20	16	1	1	1	4	120
100	MtMarsh3	2	7	2	4	2	O	2	4	1	1	2	8	500	4	0	0	0	0	0	1	4	120
101	MtMarsh3	3	7	2	4	5	E	2	6	1	1	2	8	50	4	20	5	10	0	0	1	4	120
102	MtMarsh3	4	7	2	4	5	E	2	6	2	1	11	8	50	4	20	20	40	0	0	1	4	120
103	MtMarsh3	5	7	2	4	5	E	1	6	2	1	2	8	50	2.5	20	20	25	0	0	1	4	120
104	MtMarsh3	6	7	2	4	11	E	4	6	1	1	10	0	100	0.5	100	100	50	0	0	1	4	110
105	MtMarsh3	7	1	2	4	14	A	4	6	1	5	4	3	40	1	100	100	40	0	0	1	4	100
106	MtMarsh3	8	7	2	4	5	E	3	4	2	1	11	8	60	4	5	5	12	1	1	1	4	120

Casino/Mur, Coverage

Rows	Trajectory	Component	Geol.	L/system	L/pattern	Topo.	Geom.	Soil	Veg.	Slope	Landuse	Comp.frm.	DLF	Length	Width	Surf.vis.	Arch.vis.	Eff. cover. m2	Site occ.	Art.no.	Dis.water	Source	ASL(m)
107	MtMarsh3	9	7	2	4	16	O	4	6	1	1	10	3	80	0.5	100	100	40	0	0	1	4	100
108	MtMarsh3	10	7	2	4	5	E	3	4	1	1	11	8	100	4	10	10	40	1	1	1	4	120
109	MtMarsh3	11	7	2	4	5	E	3	6	1	1	11	8	200	4	5	5	40	1	2	1	4	120
110	MtMarsh3	12	1	2	4	14	A	4	6	1	5	4	3	100	1	100	100	100	0	0	1	4	100
111	MtMarsh3	13	1	2	4	11	O	4	6	3	5	4	3	10	3	100	100	30	0	0	1	4	110
112	MtMarsh3	14	7	2	4	5	E	3	6	3	1	11	8	100	2	5	5	10	1	1	1	4	120
113	MtMarsh4	1	7	2	3	4	E	3	4	1	1	11	8	100	4	5	5	20	1	2	6	3	280
114	MtMarsh4	2	7	2	3	4	E	3	4	1	1	2	8	60	2.5	80	80	120	0	0	6	3	280
115	MtMarsh4	3	7	2	3	3	E	3	4	3	1	2	8	80	3	50	50	120	0	0	6	3	280
116	MtMarsh4	4	7	2	3	3	E	3	4	3	1	11	8	80	4	5	5	16	1	5	6	3	280
117	MtMarsh4	5	7	2	3	3	E	3	4	1	1	11	8	120	4	5	5	24	1	6	6	3	280
118	MtMarsh4	6	7	2	3	3	E	3	4	1	1	2	8	120	2.5	40	40	120	0	0	6	3	280
119	MtMarsh4	7	7	2	3	3	E	3	4	1	1	2	8	150	2.5	40	40	150	0	0	6	3	280
120	MtMarsh5	1	7	2	4	2	E	4	4	1	1	2	8	500	2.5	10	10	125	1	1	3	3	140
121	MtMarsh5	2	7	2	4	6	E	7	4	3	1	2	8	100	2.5	10	10	25	0	0	5	3	140
122	MtMarsh5	3	7	2	4	16	E	4	4	1	1	2	8	20	2.5	80	80	40	0	0	6	3	140
123	MtMarsh5	4	7	2	4	12	E	4	4	1	1	2	8	20	2.5	80	80	40	0	0	6	3	140
124	MtMarsh5	5	7	2	4	12	E	4	4	1	1	2	8	150	2.5	10	10	37	1	1	6	3	160
125	MtMarsh5	6	7	2	4	12	E	5	4	2	1	2	8	150	2.5	10	10	37	0	0	6	3	160
126	MtMarsh5	7	7	2	4	12	E	5	4	2	1	2	8	150	3	40	40	180	0	0	4	3	140
127	MtMarsh5	8	7	2	4	12	E	5	4	3	1	2	8	100	3	40	40	120	1	1	4	3	140
128	MtMarsh5	9	7	2	4	3	E	5	4	1	1	2	8	40	3	30	30	36	0	0	4	3	140
129	MtMarsh5	10	7	2	4	2	E	4	4	1	1	2	8	150	4	5	5	30	1	3	4	3	140
130	LollbackCk	1	5	2	3	2	E	3	4	1	2	9	6	20	20	50	0	0	0	0	6	3	210
131	LollbackCk	2	5	2	3	2	E	3	4	2	2	4	5	100	0.5	80	80	40	1	2	6	3	210
132	LollbackCk	3	5	2	3	2	E	3	4	1	2	2	5	100	3	50	50	150	0	0	6	3	220
133	PeacockCkRd	1	5	2	3	2	E	7	3	1	2	8	6	40	5	100	0	0	0	0	6	3	290
134	PeacockCkRd	2	5	2	3	2	E	7	3	1	2	2	5	70	2.5	30	30	175	0	0	6	3	290
135	PeacockCkRd	3	5	2	3	2	E	4	3	1	2	2	8	15	3	30	30	13	0	0	6	3	290
136	PeacockCkRd	4	5	2	3	2	E	7	3	1	2	2	8	250	2.5	25	25	156	1	1	6	3	280
137	PeacockCkRd	5	5	2	3	2	E	4	3	2	2	11	8	50	2	50	50	50	0	0	5	3	270
138	PeacockCkRd	6	5	2	3	2	E	4	3	3	2	2	5	50	4	50	50	100	0	0	5	3	250
139	PeacockCkRd	7	5	2	3	8	E	4	3	2	2	11	8	100	2	50	50	100	1	1	5	3	250
140	PeacockCkRd	8	5	2	3	2	E	4	3	4	2	11	8	15	2	100	80	24	1	1	5	3	220
141	PeacockCkRd	9	5	2	3	2	E	7	3	2	2	2	5	400	3	30	30	360	0	0	4	3	210
142	PeacockCkRd	10	5	2	3	2	E	4	3	1	2	4	0	20	0.5	100	100	10	1	2	4	3	210
143	PeacockCkRd	11	5	2	3	2	E	4	3	2	2	4	8	40	1	50	50	40	1	1	4	3	210
144	PeacockCkRd	12	5	2	3	5	E	4	3	2	2	1	0	10	1	100	100	10	1	1	2	3	170
145	PeacockCkRd	13	5	2	3	5	E	7	3	3	2	2	5	100	2	20	20	40	0	0	2	3	170
146	BabylCkRd	1	5	2	3	2	E	7	3	3	3	2	8	100	4	50	50	200	0	0	4	3	240
147	BabylCkRd	2	5	2	3	2	E	7	3	3	3	4	5	50	0.5	80	80	20	0	0	4	3	260
148	BabylCkRd	3	5	2	3	2	E	7	3	1	3	2	6	500	3	10	10	150	1	1	5	3	250
149	BabylCkRd	4	5	2	3	2	E	7	3	1	3	4	8	40	2	10	10	8	1	6	5	3	250
150	BabylCkRd	5	5	2	3	2	E	7	3	1	3	7	8	100	2	80	0	0	1	1	5	3	250
151	MtBelmore	1	7	2	5	2	E	7	4	3	3	2	8	150	2.5	80	80	300	0	0	6	3	280
152	MtBelmore	2	7	2	5	2	E	7	4	2	3	2	8	50	2.5	80	80	100	0	0	6	3	290
153	MtBelmore	3	7	2	5	4	E	4	4	1	3	2	8	70	3	80	80	168	1	27	6	3	310
154	MtBelmore	4	7	2	5	13	E	7	4	1	3	2	5	70	3	80	0	0	1	5	6	3	310
155	MtBelmore	5	7	2	5	13	E	7	4	3	3	2	5	70	3	50	50	105	1	1	6	3	310
156	FortyAcreRd	1	5	2	3	5	E	4	1	2	3	2	5	50	4	80	80	160	0	0	1	3	180
157	FortyAcreRd	2	5	2	3	5	E	7	1	2	3	2	5	50	4	100	0	0	1	1	1	3	180
158	FortyAcreRd	3	5	2	3	14	O	7	1	1	3	2	3	200	4	80	80	640	1	2	1	3	180
159	RoyalCamp	1	7	6	4	2	E	4	4	2	3	2	6	200	4	100	10	80	1	1	4	3	200

Casino/Mur Coverage

Rows	Trajectory	Component	Geol.	L/system	L/pattern	Topo.	Geom.	Soil	Veg.	Slope	Landuse	Comp.frm.	DLF	Length	Width	Surf.vis.	Arch.vis.	Eff. cover. m2	Site occ.	Art.no.	Dis.water	Source	ASL(m)
160	RoyalCamp	2	7	6	4	2	E	4	4	1	3	2	6	800	4	100	10	320	0	0	3	3	180
161	BulldogRock	1	8	1	3	2	E	4	4	1	2	10	0	100	10	100	100	44	1	26	6	3	630
162	BulldogRock	2	8	1	3	2	E	4	4	1	2	2	0	20	3	100	100	20	1	20	6	3	630
163	ElkhornRd	1	8	1	4	15	A	4	9	1	3	1	3	600	2	100	50	600	0	0	1	3	680
164	B[illegible]mbraRd	1	8	1	3	2	A	4	1	1	7	2	3	5	4	50	50	20	0	0	3	3	770
165	NogrigarRd	1	9	1	3	2	E	7	10	1	3	9	0	0.5	0.5	100	100	0.5	1	1	1	3	430
166	NogrigarRd	2	9	1	3	2	E	7	4	1	3	7	0	1	1	100	100	1	1	1	2	3	540
167	NogrigarRd	3	9	1	3	2	E	7	4	1	3	9	0	10	10	100	100	200	1	1	3	3	540
168	NogrigarRd	4	9	1	3	2	E	7	11	1	3	9	0	10	10	100	100	100	1	30	4	3	540
169	MalaraCkR	1	8	1	3	2	E	3	4	1	1	2	8	300	2	50	50	300	1	2	3	3	570
170	MalaraCkR	2	8	1	3	2	E	3	4	1	1	11	8	200	4	5	5	40	1	11	3	3	570
171	DomeMtn	1	5	6	7	2	E	5	4	1	1	11	8	600	2	15	15	180	0	0	6	3	170
172	DomeMtn	2	5	6	7	12	E	7	4	1	1	2	8	30	3	60	60	54	0	0	6	3	160
173	DomeMtn	3	5	6	7	12	E	5	4	1	1	11	8	500	2	10	10	100	1	1	6	3	160
174	DomeMtn	4	5	6	7	15	E	5	4	1	1	11	8	500	2	10	10	100	1	1	5	3	160
175	DomeMtn	5	5	6	7	2	E	4	4	1	1	2	8	30	2	40	40	24	0	0	5	3	140
176	DomeMtn	6	5	6	7	2	E	7	4	2	1	2	8	30	2	40	40	24	0	0	5	3	130
177	DomeMtn	7	5	6	7	16	E	7	4	2	1	11	0	100	1	100	100	100	0	0	4	3	130
178	DomeMtn	8	5	6	7	5	E	7	4	1	1	2	8	20	2	50	50	20	0	0	4	3	120
179	DomeMtn	9	5	6	7	12	E	7	4	1	1	2	8	10	2	50	50	10	0	0	4	3	120
180	DomeMtn	10	5	6	7	14	E	7	4	1	1	2	8	100	2	80	80	160	0	0	1	3	110
181	CambridgeRes	1	10	2	6	4	A	4	1	0	2	11	3	100	4	20	0	0	0	0	6	3	590
182	CambridgeRes	2	10	2	6	2	A	4	1	2	2	11	3	150	4	10	0	0	0	0	6	3	590
183	CambridgeRes	3	10	2	6	3	A	4	1	1	2	11	3	60	4	5	0	0	0	0	6	3	590
184	CambridgeRes	4	10	2	6	2	A	4	1	2	2	2	3	200	4	20	0	0	0	0	6	3	590
185	CambridgeRes	5	10	2	6	2	A	4	1	1	2	2	3	200	4	10	0	0	0	0	6	3	590
186	CambridgeRes	6	10	2	6	2	A	4	1	1	2	2	3	200	4	10	0	0	0	0	6	3	590
187	CambridgeRes	7	10	2	6	2	A	4	11	1	2	2	3	150	4	20	0	0	0	0	6	3	590
188	CampForest	1	5	2	4	12	E	4	6	1	3	2	8	100	3	80	80	240	1	4	1	3	310
189	CampForest	2	5	2	4	14	O	4	6	1	3	2	8	300	3	80	80	720	0	0	1	3	310
190	CampForest	3	5	2	4	13	E	4	6	1	3	2	8	100	3	10	10	30	0	0	2	3	340
191	CampForest	4	5	2	4	2	E	4	3	1	3	2	8	300	3	30	30	270	0	0	4	3	370
192	CampForest	5	5	2	4	16	O	2	3	3	3	11	3	100	3	100	10	0	0	0	4	3	370
193	CampForest	6	5	2	4	12	E	7	6	1	3	4	0	80	3	100	100	240	0	0	1	3	310
194	PawPawRd	1	7	2	4	2	E	2	4	1	2	2	4	100	2	80	30	60	1	4	2	4	340
195	PawPawRd	2	7	2	4	2	E	7	4	1	2	2	4	100	2.5	80	50	125	0	0	2	4	340
196	PawPawRd	3	7	2	4	2	E	7	4	1	2	2	8	100	2	80	80	160	0	0	4	4	360
197	GorgeCreek	1	7	2	4	12	E	4	6	2	2	2	5	50	4	100	20	40	1	4	1	4	270
198	GorgeCreek	2	7	2	4	10	E	4	6	3	2	2	5	50	4	100	20	40	1	2	1	4	280
199	GorgeCreek	3	7	2	4	8	E	4	6	3	2	2	5	50	4	100	20	40	0	0	1	4	290
200	GorgeCreek	4	7	2	4	14	O	4	6	1	2	2	5	50	4	80	20	40	0	0	1	4	270
201	GorgeCreek	5	7	2	4	2	E	4	4	1	2	2	3	50	4	100	20	40	1	1	2	4	320
202	SugarloafR	1	5	2	3	2	E	4	4	1	3	1	0	30	2	100	100	60	1	1	5	3	210
203	SugarloafR	2	5	2	3	2	E	4	4	1	3	1	0	100	2	100	100	200	1	1	5	3	210
204	SugarloafR	3	5	2	3	16	E	5	4	1	2	2	5	40	2	100	50	40	1	4	5	3	160
205	SugarloafR	4	5	2	3	16	O	4	4	1	2	1	3	40	2	100	20	16	0	0	6	3	160
206	SugarloafR	5	5	2	3	14	O	4	4	1	2	11	8	50	2	5	0	0	0	0	6	3	170
207	SugarloafR	6	5	2	3	12	E	4	4	2	2	11	8	80	2	80	0	0	0	0	6	3	200
208	SugarloafR	7	5	2	3	8	E	4	4	4	2	11	8	80	2	80	0	0	0	0	6	3	230
209	SugarloafR	8	5	2	3	2	E	7	4	2	2	2	4	600	2.5	100	50	450	0	0	6	3	260
210	BranchCk	1	5	2	4	14	O	4	6	1	3	9	6	50	4	80	20	40	1	13	1	3	150
211	MackellarRange	1	10	4	3	2	E	4	4	1	1	2	8	100	2.5	80	80	200	0	0	4	3	220
212	MackellarRange	2	10	4	3	2	E	4	4	4	1	2	8	120	2.5	80	80	240	0	0	4	3	220

Casino/Mur Coverage

Rows	Trajectory	Component	Geol.	L/system	L/pattern	Topo.	Geom.	Soil	Veg.	Slope	Landuse	Comp.frm.	DLF	Length	Width	Surf.vis.	Arch.vis.	Eff. cover. m2	Site occ.	Art.no.	Dis.water	Source	ASL(m)
213	MackellarRange	3	10	4	3	2	E	4	4	1	1	2	8	150	2.5	80	80	300	0	0	4	4	220
214	MackellarRange	4	10	4	3	2	E	4	4	3	1	2	8	150	2.5	80	80	300	0	0	4	4	220
215	MackellarRange	5	10	4	3	2	E	4	4	1	1	2	8	200	2.5	80	80	400	1	1	4	4	220
216	MackellarRange	6	10	4	3	2	E	4	4	4	1	2	8	100	2.5	80	80	200	0	0	4	4	220
217	MackellarRange	7	10	4	3	2	E	4	4	2	1	2	8	100	2.5	80	80	200	0	0	4	4	220
218	MackellarRange	8	10	4	3	3	E	4	4	1	1	2	8	60	2.5	80	80	120	0	0	4	4	200
219	MackellarRange	9	10	4	3	2	E	4	4	1	1	2	8	200	2.5	80	80	400	0	0	4	4	180
220	MackellarRange	10	10	4	3	2	E	4	4	3	1	2	8	100	2.5	80	80	200	0	0	4	4	180
221	MackellarRange	11	10	4	3	2	E	4	4	1	1	2	8	200	2.5	80	80	400	0	0	5	4	180
222	MackellarRange	12	10	4	3	2	E	4	10	1	1	2	8	200	2.5	80	80	400	1	1	5	4	180
223	MackellarRange	13	10	4	3	2	E	2	10	1	1	2	8	50	2.5	80	80	100	1	1	5	4	180
224	MackellarRange	14	10	4	3	2	E	1	10	2	1	2	8	200	2.5	80	80	400	0	0	6	4	180
225	MackellarRange	15	10	4	3	2	E	2	10	1	1	2	8	100	2.5	80	80	200	0	0	6	4	180
226	MackellarRange	16	10	4	3	2	E	2	10	2	1	2	8	100	2.5	80	80	200	1	1	6	4	180
227	MackellarRange	17	10	4	3	3	E	2	10	1	1	2	8	50	2.5	80	80	100	1	2	6	4	180
228	MackellarRange	18	10	4	3	2	A	4	10	1	1	2	7	200	2.5	50	50	250	1	3	2	4	120
229	OakyCk	1	10	4	3	14	O	3	10	1	1	2	6	50	2.5	50	50	62	0	0	1	4	60
230	OakyCk	2	10	4	3	5	E	4	10	1	1	2	8	50	2.5	80	80	100	0	0	1	4	60
231	OakyCk	3	10	4	3	14	A	4	10	1	1	2	3	200	2.5	50	0	0	0	0	1	4	60
232	OakyCk	4	10	4	3	2	E	5	10	1	1	2	8	200	3	80	80	480	1	34	2	4	100
233	ChristiesCkRd	1	2	4	3	3	E	5	3	1	3	9	6	30	10	80	20	0	0	0	1	3	120
234	ChristiesCkRd	2	2	4	3	2	E	5	3	2	3	2	5	50	2.5	40	15	11	1	1	1	3	120
235	Burringbar	1	2	4	3	2	E	5	10	1	3	9	6	10	10	50	0	0	0	0	4	3	240
236	Burringbar	2	2	4	3	2	E	5	10	1	3	2	8	150	3	50	50	225	0	0	4	3	240
237	BaranbaliRd	1	2	4	3	2	E	7	3	3	3	2	5	100	3	40	20	60	0	0	5	3	240
238	BaranbaliRd	2	2	4	3	3	E	7	3	1	3	2	8	50	3	20	20	30	0	0	5	3	240
239	BaranbaliRd	3	2	4	3	2	E	3	3	3	3	2	8	60	3	40	40	72	0	0	5	3	240
240	BaranbaliRd	4	2	4	3	2	E	3	3	2	3	2	8	200	3	20	20	120	0	0	5	3	240
241	WabbaRd	1	2	4	3	3	E	3	3	1	3	2	8	60	3	60	60	108	0	0	5	3	240
242	CooradillaRd	1	2	4	3	4	E	5	3	1	3	2	8	50	3	20	20	30	0	0	5	3	190
243	PalmvaleSpurRd	1	2	4	3	2	E	5	3	2	3	2	8	200	3	40	40	240	0	0	3	3	160
244	MiddleRidgeRd	1	9	4	3	2	E	7	9	1	3	9	6	20	10	100	0	0	0	0	4	3	250
245	MiddleRidgeRd	2	9	4	3	2	E	5	9	1	3	9	8	10	1	80	80	8	1	7	4	3	250
246	MiddleRidgeRd	3	9	4	3	13	E	3	9	1	3	2	8	100	2	20	20	40	1	1	4	3	250
247	MiddleRidgeRd	4	9	4	3	2	E	5	9	1	3	2	8	80	0.5	50	50	20	1	4	4	3	220
248	ScrubRidgeRd	1	9	4	3	3	E	5	3	1	3	2	8	30	3	10	10	9	0	0	1	3	160
249	ClaypotRd	1	9	4	3	2	E	7	9	3	3	2	5	50	4	10	10	20	0	0	1	4	100
250	ClaypotRd	2	9	4	3	16	O	7	9	1	3	4	6	10	0.5	80	80	4	0	0	1	4	100
251	ClaypotRd	3	9	4	3	14	O	5	9	1	3	2	6	20	3.5	50	50	35	0	0	1	4	100
252	ClaypotRd	4	9	4	3	12	E	7	9	2	3	2	8	20	3.5	80	80	56	0	0	1	4	140
253	ClaypotRd	5	9	4	3	13	O	7	3	1	3	9	6	10	5	10	0	0	1	1	2	4	200
254	ClaypotRd	6	9	4	3	13	O	7	3	1	3	2	5	100	3	80	80	240	0	0	3	4	210
255	KoonyumRd	1	10	4	6	2	E	7	5	1	1	4	0	100	1	100	100	100	0	0	6	3	440
256	KoonyumRd	2	10	4	6	2	E	7	5	1	1	2	8	100	2	80	80	160	0	0	6	3	450
257	KoonyumRd	3	10	4	6	2	E	7	5	1	1	2	0	20	10	100	100	200	0	0	6	3	460
258	RaynersTrack	1	9	4	6	8	E	7	5	4	3	1	8	50	4	20	20	40	0	0	6	3	380
259	RaynersTrack	2	9	4	6	2	E	7	5	1	3	9	6	200	2	80	20	80	0	0	6	3	380
260	RaynersTrack	3	9	4	6	2	E	7	5	1	3	2	8	200	4	80	80	640	0	0	6	3	380
261	RaynersTrack	4	9	4	6	6	E	4	5	3	3	2	8	50	4	80	80	160	0	0	6	3	390
262	RaynersTrack	5	9	4	6	14	E	7	5	1	3	2	0	30	4	100	100	120	0	0	6	3	390
263	RaynersTrack	6	9	4	6	6	E	7	5	4	3	4	0	100	0.5	100	100	50	0	0	6	3	390
264	RaynersTrack	7	9	4	6	2	E	4	5	1	3	2	8	80	4	20	20	64	0	0	6	3	390
265	RahertysR	1	9	4	6	15	O	4	3	1	6	4	0	40	0.5	100	100	20	0	0	4	3	400

Casino/Mur Coverage

Rows	Trajectory	Component	Geol.	L/system	L/pattern	Topo.	Geom.	Soil	Veg.	Slope	Landuse	Comp.frm.	DLF	Length	Width	Surf.vis.	Arch.vis.	Eff. cover. m2	Site occ.	Art.no.	Dia.water	Source	ASL(m)
266	FlahertysFt	2	9	4	6	15	O	4	3	1	6	2	8	150	4	20	20	120	0	0	4	3	400
267	FlahertysFt	3	9	4	6	15	O	4	3	1	6	4	0	20	0.5	100	100	10	0	0	4	3	400
268	FlahertysFt	4	9	4	6	15	O	7	3	1	6	2	4	1000	4	80	10	400	0	0	4	3	400
269	EasternBoundary	1	9	4	6	3	E	7	10	1	2	2	4	100	2.5	40	40	100	0	0	1	3	380
270	EasternBoundary	2	9	4	6	2	E	7	10	2	2	2	4	70	2.5	40	40	70	1	1	1	3	380
271	EasternBoundary	3	9	4	6	2	E	7	10	4	2	2	4	60	2.5	40	40	60	0	0	1	3	380
272	EasternBoundary	4	9	4	6	2	E	7	10	1	2	2	4	80	2.5	40	40	80	0	0	1	3	380
273	EasternBoundary	5	9	4	6	2	E	7	10	3	2	2	4	80	2.5	40	40	80	0	0	1	3	380
274	EasternBoundary	6	9	4	6	4	E	7	10	1	2	2	4	100	2.5	40	40	80	0	0	2	3	380
275	FostersSpur	1	9	4	4	2	E	7	9	1	3	2	4	50	2.5	40	20	25	1	1	3	3	270
276	FostersSpur	2	9	4	4	2	E	7	9	1	3	2	4	400	2.5	40	20	200	0	0	4	3	300
277	FostersSpur	3	9	4	1	2	E	7	9	1	3	2	4	500	4	80	10	200	0	0	5	3	320
278	DuffysBreak	1	9	4	6	2	E	7	3	2	3	2	8	100	4	20	20	80	0	0	6	3	320
279	DuffysBreak	2	9	4	6	2	E	7	3	1	3	2	8	30	4	80	80	96	0	0	6	3	370
280	DuffysBreak	3	9	4	6	2	E	7	3	2	3	2	8	300	4	20	20	240	0	0	6	3	380
281	DuffysBreak	4	9	4	6	2	E	7	3	3	3	2	8	100	4	20	20	80	0	0	6	3	380
282	DuffysBreak	5	9	4	6	2	E	7	3	2	3	2	8	200	4	20	20	160	0	0	6	3	380
283	FortySpurRd	1	9	4	4	2	E	5	2	1	3	4	8	40	2	80	80	32	0	0	2	3	260
284	FortySpurRd	2	9	4	4	2	E	5	2	1	3	2	5	40	3	100	20	24	1	2	5	3	290
285	FortySpurRd	3	9	4	4	2	E	5	2	1	3	7	8	30	2	80	80	48	1	1	5	3	290
286	FortySpurRd	4	9	4	4	3	E	5	2	1	3	2	4	30	2.5	100	20	15	0	0	5	3	290
287	FortySpurRd	5	9	4	4	3	E	5	2	1	3	4	8	30	2	80	80	48	0	0	5	3	290
288	JerusalemMtnRd	1	10	4	6	2	E	7	3	1	3	2	8	30	2	80	80	48	0	0	6	3	670
289	JerusalemMtnRd	2	10	4	6	2	E	5	3	1	3	9	0	10	10	100	100	100	0	0	6	3	670
290	JerusalemMtnRd	3	10	4	6	2	E	7	3	1	3	9	6	100	2	100	2	4	0	0	6	3	680
291	JerusalemMtnRd	4	10	4	6	2	E	7	3	1	3	4	0	30	1	100	100	30	0	0	6	3	680
292	JerusalemMtnRd	5	10	4	6	2	E	7	9	1	3	2	0	100	2.5	100	100	250	0	0	6	3	600
293	JerusalemMtnRd	6	10	4	6	3	E	7	9	1	3	2	0	50	2.5	100	100	125	0	0	6	3	550
294	WildDogRd	1	10	4	6	2	E	3	10	2	3	10	8	300	0.5	10	10	15	0	0	6	3	770
295	WildDogRd	2	10	4	6	4	E	7	10	1	3	2	0	10	10	100	100	100	0	0	6	3	770
296	WildDogRd	3	10	4	6	4	E	7	10	1	3	2	8	50	2.5	0	0	0	0	0	6	3	770
297	WildDogRd	4	10	4	6	2	E	4	3	1	3	2	3	300	2.5	80	0	0	0	0	6	3	770
298	WildDogRd	5	10	4	6	2	E	7	3	1	3	9	6	100	2	80	80	160	0	0	6	3	770

APPENDIX 8

Site Data

CanMore site db

Rows	Site Name	SP/Tenure	Geol.	L/system	L/form	Top.	Veg.	Slope	Landuse	Comp.fen.	Sample length	Sample width	Sample area	Art.no.	Art.den.	site length	site width	site area	Dis.water	Source	ASL(m)	Spur/ridge	Site class
1	JackybulbinCk1-1	Doubleduke	7	3	7	14	10	1	3	2	•	•	•	1	•	•	•	•	30	3	10	4	1
2	IslandRd1-1	Doubleduke	7	3	4	12	10	2	3	2	60	3	90	7	7.8	60	3	180	550	3	30	2	2
3	IslandRd2-1	DevilsPulpit	7	3	4	2	10	2/3	3	2/4	100	5	100	6	6	100	5	500	300	3	40	2	2
4	IslandRd4-1	DevilsPulpit	7	3	3	2	5	2	3	2	50	3	30	2	6.7	50	3	150	1175	3	200	2	1
5	IslandRd6-1	DevilsPulpit	7	3	3	2	5	3	3	2	•	•	•	1	•	•	•	•	1375	3	220	2	1
6	Lookout1-1	Doubleduke	7	3	3	2	5	1	2	2	2	2	4	3	75	2	2	4	1350	3	180	1	1
7	Pine2-1	Tabbimoble	1	3	4	10	6	1	2	4	100	1	100	2	2	100	1	100	2750	3	30	4	1
8	McFaydenRd2-1	Tabbimoble	5	3	7	6	10	1	2	2	•	•	•	1	•	•	•	•	2125	3	30	4	1
9	TullymorganRd6-1	Gibberagee	5	3	4	2	10	1	3	2	•	•	•	1	•	•	•	•	375	3	70	2	1
10	TullymorganRd7-1	Gibberagee	5	3	4	2	10	1	3	2	•	•	•	1	•	•	•	•	500	3	70	2	1
11	MangroveCk7-1	Gibberagee	5	3	4	2	10	1	2	1	•	•	•	1	•	•	•	•	425	3	60	2	1
12	MangroveCk11-1	Gibberagee	5	3	7	5	10	1	3	1	70	4	0	2	•	70	4	280	200	3	30	4	1
13	MangroveCk16-1	Gibberagee	5	3	7	15	4	1	3	2	100	4	200	7	3.5	100	4	400	350	3	30	4	2
14	MangroveCk16-2	Gibberagee	5	3	7	15	4	1	3	2	30	8	120	12	10	30	8	240	575	3	30	4	2
15	OilRig3-1	Gibberagee	5	3	4	2	5	1	2	2	•	•	•	1	•	•	•	•	1250	3	100	2	1
16	BroadwaterCkRd1-1	Gibberagee	7	3	4	5	5	1	2	2	•	•	•	1	•	•	•	•	160	4	40	2	1
17	BroadwaterCkRd3-1	Gibberagee	7	3	4	12	10	1	2	2	•	•	•	1	•	•	•	•	125	4	30	2	1
18	BroadwaterCkRd12-1	Gibberagee	7	3	4	14	10	1	2	2	•	•	•	1	•	•	•	•	125	4	30	2	1
19	BroadwaterCkRd14-1	Gibberagee	7	3	4	5	6	1	2	2	•	•	•	1	•	•	•	•	125	3	30	2	1
20	MtMarsh1,6-1	MtMarsh	7	2	4	4	5	1	1	2	•	•	•	1	•	•	•	•	200	3	200	2	1
21	MtMarsh2,7-1	MtMarsh	7	2	4	2	4	2	1	2	•	•	•	1	•	•	•	•	1150	4	220	1	1
22	MtMarsh3,1-1	MtMarsh	7	2	4	2	4	1	1	2	•	•	•	1	•	•	•	•	175	4	120	2	1
23	MtMarsh3,8-1	MtMarsh	7	2	4	5	4	2	1	11	•	•	•	1	•	•	•	•	125	4	120	2	1
24	MtMarsh3,10-1	MtMarsh	7	2	4	5	4	1	1	11	•	•	•	1	•	•	•	•	125	4	120	2	1
25	MtMarsh3,11-1	MtMarsh	7	2	4	5	6	1	1	11	100	4	20	2	10	100	4	400	120	4	120	2	1
26	MtMarsh3,14-1	MtMarsh	7	2	4	5	6	3	1	11	•	•	•	1	•	•	•	•	75	4	120	2	1
27	MtMarsh4,1-1	MtMarsh/N. Res	7	2	3	3/4	4	1/3	1	11	200	4	60	13	21.7	200	35	7000	1075	3	280	1	2
28	MtMarsh5,1-1	MtMarsh	7	2	4	2	4	1	1	2	•	•	•	1	•	•	•	•	700	3	140	2	1
29	MtMarsh5,5-1	MtMarsh	7	2	4	12	4	1	1	2	•	•	•	1	•	•	•	•	1100	3	160	2	1
30	MtMarsh5,8-1	MtMarsh	7	2	4	12	4	3	1	2	•	•	•	1	•	•	•	•	1200	3	140	2	1
31	MtMarsh5,10-1	MtMarsh	7	2	4	2	4	1	1	2	100	4	20	3	15	100	4	400	650	3	140	2	1
32	LollbackCk2-1	CherryTree	5	2	3	2	4	2	2	3	100	3	30	2	5	100	3	300	1075	3	210	2	1
33	PeacockCkRd4-1	RichmondRange	5	2	3	2	3	1	2	2	•	•	•	1	•	•	•	•	1250	3	280	2	1
34	PeacockCkRd7-1	RichmondRange	5	2	3	2	3	2	2	11	•	•	•	1	•	•	•	•	750	3	250	2	1
35	PeacockCkRd8-1	RichmondRange	5	2	3	8	3	4	2	11	•	•	•	1	•	•	•	•	750	3	220	2	1
36	PeacockCkRd10-1	RichmondRange	5	2	3	2	3	1	2	4	20	0.5	10	2	20	20	0.5	10	600	3	210	2	1
37	PeacockCkRd11-1	RichmondRange	5	2	3	2	3	2	2	4	•	•	•	1	•	•	•	•	300	3	210	2	1
38	PeacockCkRd12-1	RichmondRange	5	2	3	5	3	2	2	1	•	•	•	1	•	•	•	•	250	3	170	2	1
39	BabylCkRd3-1	RichmondRange	5	2	3	2	3	1	3	2	•	•	•	1	•	•	•	•	700	3	250	1	1
40	BabylCkRd4-1	RichmondRange	5	2	3	2	3	1	3	4/7	80	2	8	7	87.5	80	25	2000	850	3	250	1	2
41	MtBelmore3-1	MtBelmore	7	2	5	4/13	4	1/3	3	2	90	3	275	33	12	90	60	5400	1000	3	310	2	3
42	FortyAcreRd2-1	MtBelmore	5	2	3	5	10	2	3	2	•	•	•	1	•	•	•	•	50	3	180	2	1
43	FortyAcreRd3-1	MtBelmore	5	2	3	14	10	1	3	2	20	4	64	2	3.1	20	4	80	50	3	180	2	1
44	RoyalCamp1-1	RoyalCamp	7	6	4	2	4	2	3	2	•	•	•	1	•	•	•	•	600	3	200	2	1
45	BulldogRock1-1	Ewingar	7	1	3	2	4	1	1	10/2	100	10	64	46	71.9	100	30	3000	1350	3	630	1	3
46	NogrigarRd1-1	Ewingar	8	1	3	2	10	1	3	9	•	•	•	1	•	•	•	•	125	3	430	2	1
47	NogrigarRd2-1	Ewingar	9	1	3	2	4	1	3	7	•	•	•	1	•	•	•	•	350	3	540	2	1
48	NogrigarRd3-1	Ewingar	9	1	3	2	4	1	3	9	•	•	•	1	•	•	•	•	500	3	540	2	1
49	NogrigarRd4-1	Ewingar	9	1	3	2	11	1	3	9	10	10	100	30	30	60	25	1500	600	3	530	2	3
50	MalaraCk31-1	Leasehold	8	1	3	2	4	1	1	2/11	200	4	40	13	32.5	200	20	4000	450	3	570	2	2
51	DomeMtn3-1	MtMarsh	5	6	7	12	4	1	1	11	•	•	•	1	•	•	•	•	1100	3	160	4	1
52	DomeMtn4-1	MtMarsh	5	6	7	15	4	1	1	11	•	•	•	1	•	•	•	•	625	3	370	4	1
53	CampForestRd1-1	RichmondRange	5	2	2	12	6	1	3	2	100	3	240	4	1.7	100	3	300	50	3	310	2	1
54	PawPawRd1-1	RichmondRange	7	2	4	2	4	1	2	2	60	2	36	4	11	60	2	120	270	4	340	2	1
55	GorgeCreek1-1	RichmondRange	7	2	4	12/10	6	2/3	2	2	100	4	80	6	7.5	100	25	2500	50	4	270	2	2
56	GorgeCreek5-2	RichmondRange	7	2	4	2	4	1	2	2	•	•	•	1	•	•	•	•	375	4	320	2	1
57	SugarloafR1-1	Sugarloaf	5	2	3	2	4	1	3	3	70	2	140	2	1.4	70	2	140	1250	3	210	2	1
58	SugarloafR1-3	Sugarloaf	5	2	3	16	4	1	3	2	40	2	40	4	8	40	2	80	1250	3	160	2	1
59	BranchCk1-1	Sugarloaf	5	2	4	14	6	1	3	9	50	4	40	13	32.5	250	75	18750	50	3	150	2	2
60	MackellarRange5-1	Bungabee	10	4	3	2	4	1	1	2	•	•	•	1	•	•	•	•	725	4	220	1	1
61	MackellarRange12-1	Bungabee	10	4	3	2	10	1	1	2	•	•	•	1	•	•	•	•	925	4	180	1	1
62	MackellarRange13-1	Bungabee	10	4	3	2	10	1	1	2	•	•	•	1	•	•	•	•	950	4	180	1	1
63	MackellarRange16-1	Bungabee	10	4	3	2	10	2	1	2	•	•	•	1	•	•	•	•	1000	4	180	1	1
64	MackellarRange17-1	Bungabee	10	4	3	3	10	1	1	2	25	2.5	50	2	4	25	2.5	62	1075	4	180	1	1
65	MackellarRange18-1	Bungabee	10	4	3	2	10	1	1	2	70	2.5	87	3	3.4	75	2.5	175	375	4	120	2	1
66	OakyCk4-1	Bungabee	10	4	3	2	10	1	1	2	70	3	168	34	20.2	200	3	600	280	4	100	2	3
67	MiddleRidge2-1	Nullum	9	4	3	2	9	1	3	9	10	1	8	7	87.5	10	1	10	800	3	250	1	2
68	MiddleRidge3-1	Nullum	9	4	3	13	9	1	3	2	•	•	•	1	•	•	•	•	675	3	250	2	1
69	MiddleRidge4-1	Nullum	9	4	3	2	9	1	3	2	80	0.5	20	4	20	80	4	320	725	3	220	1	1
70	ClaypotRd5-1	Nullum	9	4	3	13	3	1	3	9	•	•	•	1	•	•	•	•	375	4	200	2	1
71	ChristiesCkRd2-1	Mooball	2	4	3	2	3	2	3	2	•	•	•	1	•	•	•	•	175	3	120	2	1
72	EasternBoundaryTrail2-1	WhianWhian	9	4	6	2	10	2	2	2	•	•	•	1	•	•	•	•	150	3	380	1	1
73	Fosters Spur1-1	WhianWhian	9	4	4	2	9	1	3	2	•	•	•	1	•	•	•	•	450	3	270	3	1
74	FernySpurRd2-1	Mebbin	9	4	4	2	2	1	3	2/7	40	3	24	3	12.5	40	30	1200	775	3	290	4	1

The site data base is set out as follows:

Column 1 -	Site Name - site names are derived from Trajectory name and followed by two digits. The first digit refers to the number of the component within the Trajectory and the second refers to the number of the Artifact Occurrence within that Component, ie Sugarloaf 1-1.
Column 2-	SF/Tenure = name of State Forest in which Artifact Occurrence is located; other land tenure
Column 3-	Geol.= Geological group (see code list in Appendix 5)
Column 4-	L/system = Landsystem -(see code list in Appendix 5
Column 5-	L/form = Landform pattern -(see code list in Appendix 5)
Column 6-	Top.= Toposequence - (see code list in Appendix 5 & and explanatory diagram Appendix 4)
Column 7-	Veg.= Vegetation - forest type/s present within 100m of the survey Component (see code list in Appendix 5)
Column 8-	Slope - the predominant slope of an area through which a component passes (see code list in Appendix 5)
Column 9 -	Landuse - post-contact landuse of an area (see code list in Appendix 5)
Column 10-	Comp. frm.= Component form - type and surface characteristics of Component surveyed (see code list in Appendix 5)
Column 11 -	Sample length - maximum linear dimension of an Artifact Occurrence within a Component (measured in metres).
Column 12 -	Sample width - width of an Artifact Occurrence within a Component (measured in metres)
Column 13 -	Sample area = Effective sample area - sample length x sample width (metres squared) x % of archaeological visibility. Archaeological visibility refers to the percentage of a Component where conditions permit the observation of archaeological material.
Column 14-	Art. no.= Artifact Number - number of artifacts recorded in an Artifact Occurrence
Column 15-	Art. den. = Artifact density - calculated on the basis of number of artifacts per 100 square metres of sample area
Column 16 -	site length - maximum linear dimension of an Artifact Occurrence.Site length differs from sample length in that it is the actual length of an Artifact Occurrence regardless of Component boundaries.
Column 17 -	site width - width of an Artifact Occurrence.Site width differs from sample width in that it is the actual length of an Artifact Occurrence regardless of Component boundaries.
Column 18 -	site area - site length x site width (metres squared)
Column 19 -	Dis. water = Distance to Water - distance of an Artifact Occurrence to the nearest third order stream or greater (measured in metres)
Column 20 -	Source - stream order of water source 3 = 3rd order, 4= 4th order
Column 21 -	ASL(m) - meters above sea level
Column 22 -	Spur/ridge- refers to the local ridge system category through which the survey Component passes 1=locally dominant ridge, 2=subsidiary ridge, 3=dominant spur, 4=absence of dominant ridges/spur (see Appendix 4 for explanatory diagram).
Column 23 -	Site class - Artifact Occurrence size class based on number of artifacts present 1=0-4 artifacts, 2=5-20 artifacts, 3=21-50 artifacts, 4=51-100 artifacts, 5= 100+ artifacts

other sites db

Rows	Site Name	SF/Tenure	Geol.	L/system	L/form	Top.	Veg.	Slope	Landuse	Comp.frm.	Dis.water	Source	ASL(m)	Spur/ridge	Site Type
1	MtBelmore	MtBelmore	7	2	5	8	10	7	1	11	1800	3	610	1	Rock shelter/Artifact Occurrence
2	CampForestRd Shelter	RichmondRange	5	2	4	16	3	3	3	11	625	3	370	2	Rock shelter/occupation deposit
3	DuffyBreak Scarred Tree	WhianWhian	9	4	4	2	3	1	3	9	450	3	270	2	Scarred Tree 125X49cm

APPENDIX 9

Artifact Data

(see Appendix 6 for artifact recording codes)

Cas/Mur Artifact db

Rows	Site name	morphology	formal type	break type	cortex	cortex type	length	width	thickness	raw material	MA
1	JackybulbinCk1-1	1	•		4	•	17	12	4.0	9	Casino/Mur.
2	IslandRd1-1	2	•	3	2	1	34	45	9.0	2	Casino/Mur.
3	IslandRd1-1	5	•		4	•	46	40	23	12	Casino/Mur.
4	IslandRd1-1	6	•		4	•	45	19	14	1	Casino/Mur.
5	IslandRd1-1	6	•		4	•	35	39	10	7	Casino/Mur.
6	IslandRd1-1	5	•		4	•	15	12	7.0	7	Casino/Mur.
7	IslandRd1-1	9	14		3	2	55	45	29	11	Casino/Mur.
8	IslandRd1-1	13	9		1	1	70	69	33	9	Casino/Mur.
9	IslandRd2-1	1	•		4	•	12	25	4.0	11	Casino/Mur.
10	IslandRd2-1	1	•		4	•	25	24	6.0	12	Casino/Mur.
11	IslandRd2-1	1	•		3	1	49	43	9.0	8	Casino/Mur.
12	IslandRd2-1	6	•		4	•	21	16	7.0	11	Casino/Mur.
13	IslandRd2-1	8	15		4	•	19	26	25	1	Casino/Mur.
14	IslandRd2-1	13	9		1	1	130	90	35	8	Casino/Mur.
15	IslandRd4-1	1	•		4	•	19	20	9.0	9	Casino/Mur.
16	IslandRd4-1	6	•		4	•	25	27	10	7	Casino/Mur.
17	IslandRd6-1	1	•		3	1	19	13	4.0	1	Casino/Mur.
18	Lookout1-1	5	•		2	2	•	•	•	4	Casino/Mur.
19	Lookout1-1	5	•		2	2	•	•	•	6	Casino/Mur.
20	Lookout1-1	6	•		4	•	•	•	•	6	Casino/Mur.
21	Lookout1-1	9	14		4	•	•	•	•	6	Casino/Mur.
22	Pine2-1	1	•		4	•	30	9.0	20	3	Casino/Mur.
23	Pine2-1	6	•		4	•	15	11	5.0	4	Casino/Mur.
24	McFaydenRd2-1	1	•		4	•	30	20	11	9	Casino/Mur.
25	TullymorganRd6-1	1	1		4	•	12	11	3.0	1	Casino/Mur.
26	TullymorganRd7-1	<1	•		4	•	•	•	•	1	Casino/Mur.
27	MangroveCk7-1	1	•		4	•	56	34	16	9	Casino/Mur.
28	MangroveCk11-1	1	•		4	•	13	20	7.0	9	Casino/Mur.
29	MangroveCk11-1	8	14		4	•	22	47	36	9	Casino/Mur.
30	MangroveCk16-1	2	•		4	•	22	30	10	9	Casino/Mur.
31	MangroveCk16-1	5	•		4	•	22	25	16	9	Casino/Mur.
32	MangroveCk16-1	5	•		4	•	29	23	16	9	Casino/Mur.
33	MangroveCk16-1	5	•		2	1	20	11	8.0	1	Casino/Mur.
34	MangroveCk16-1	2	•		4	•	8.0	12	2.0	7	Casino/Mur.
35	MangroveCk16-1	7	•		3	2	11	10	2.0	7	Casino/Mur.
36	MangroveCk16-1	5	•		4	•	11	20	7.0	7	Casino/Mur.
37	MangroveCk16-2	1	•		4	•	28	17	9.0	11	Casino/Mur.
38	MangroveCk16-2	2	•		0	1	14	15	5.0	11	Casino/Mur.
39	MangroveCk16-2	6	8		3	1	16	10	3.0	7	Casino/Mur.
40	MangroveCk16-2	7	•		4	•	34	34	10	11	Casino/Mur.
41	MangroveCk16-2	7	•		4	•	24	16	5.0	9	Casino/Mur.
42	MangroveCk16-2	13	•		0	1	25	13	4.0	11	Casino/Mur.
43	MangroveCk16-2	5	•		4	•	12	11	8.0	1	Casino/Mur.
44	MangroveCk16-2	13	•		0	1	57	44	23	11	Casino/Mur.
45	MangroveCk16-2	13	•		2	1	35	43	29	1	Casino/Mur.
46	OilRig3-1	1	•		4	•	18	4.0	5.0	1	Casino/Mur.
47	BroadwaterCkRd1-1	7	•		4	•	16	12	3.0	9	Casino/Mur.
48	BroadwaterCkRd3-1	7	•		0	1	20	17	4.0	9	Casino/Mur.
49	BroadwaterCkRd12-1	<1	•		4	•	•	•	•	7	Casino/Mur.
50	BroadwaterCkRd14-1	13	•		0	1	45	71	30	9	Casino/Mur.
51	MtMarsh1,6-1	1	•		2	1	36	22	12	13	Casino/Mur.
52	MtMarsh2,7-1	1	•		2	1	28	34	28	9	Casino/Mur.
53	MtMarsh3,1-1	1	•		4	•	43	12	17	9	Casino/Mur.

Cas/Mur Artifact db

Rows	Site name	morphology	formal type	break type	cortex	cortex type	length	width	thickness	raw material	MA
54	MtMarsh3,8-1	5	8		2	2	86	68	60	.9	Casino/Mur.
55	MtMarsh3,10-1	8	13		4	·	39	27	23	1	Casino/Mur.
56	MtMarsh3,11-1	2	·	1	3	1	40	30	13	9	Casino/Mur.
57	MtMarsh3,11-1	1	·		4	·	50	33	10	12	Casino/Mur.
58	MtMarsh3,11-1	13	9		2	1	106	72	56	8	Casino/Mur.
59	MtMarsh3,14-1	5	8		2	2	88	76	55	8	Casino/Mur.
60	MtMarsh4,1-1	1	·		4	·	27	11	8.0	9	Casino/Mur.
61	MtMarsh4,1-1	1	·		0	1	53	39	14	13	Casino/Mur.
62	MtMarsh4,1-1	1	·		4	·	14	30	6.0	8	Casino/Mur.
63	MtMarsh4,1-1	6	·		4	·	16	11	7.0	1	Casino/Mur.
64	MtMarsh4,1-1	6	·		4	·	20	15	4.0	9	Casino/Mur.
65	MtMarsh4,1-1	5	·		4	·	34	32	17	9	Casino/Mur.
66	MtMarsh4,1-1	7	·		4	·	23	16	4.0	13	Casino/Mur.
67	MtMarsh4,1-1	6	·		4	·	21	13	5.0	1	Casino/Mur.
68	MtMarsh4,1-1	6	·		4	·	33	18	17	1	Casino/Mur.
69	MtMarsh4,1-1	6	·		3	1	19	10	4.0	1	Casino/Mur.
70	MtMarsh4,1-1	8	13		4	·	14	15	8.0	1	Casino/Mur.
71	MtMarsh4,1-1	8	14		2	1	40	38	32	8	Casino/Mur.
72	MtMarsh4,1-1	13	9		2	1	106	72	56	8	Casino/Mur.
73	MtMarsh5,1-1	5	·		4	·	24	10	6.0	1	Casino/Mur.
74	MtMarsh5,5-1	8	13		4	·	25	19	10	1	Casino/Mur.
75	MtMarsh5,8-1	2	·	1	3	2	15	26	8.0	7	Casino/Mur.
76	MtMarsh5,10-1	2	·	1	4	·	15	15	5.0	1	Casino/Mur.
77	MtMarsh5,10-1	7	·		4	·	14	8.0	4.0	1	Casino/Mur.
78	MtMarsh5,10-1	5	8		4	·	92	64	56	7	Casino/Mur.
79	LollbackCk2-1	1	·		4	·	30	31	12	7	Casino/Mur.
80	LollbackCk2-1	1	·		4	·	22	17	6.0	7	Casino/Mur.
81	PeacockCkRd4-1	13	9		2	1	90	60	25	12	Casino/Mur.
82	PeacockCkRd4-1	1	·		2	1	85	58	48	7	Casino/Mur.
83	PeacockCkRd6-1	1	·		4	·	28	18	3.0	7	Casino/Mur.
84	PeacockCkRd7-1	12	·	7	0	1	70	52	35	8	Casino/Mur.
85	PeacockCkRd8-1	6	·		4	·	22	14	5.0	11	Casino/Mur.
86	PeacockCkRd10-1	<1	·		4	·	·	·	·	1	Casino/Mur.
87	PeacockCkRd10-1	8	15		4	·	41	48	40	11	Casino/Mur.
88	PeacockCkRd11-1	6	·		4	·	42	32	13	11	Casino/Mur.
89	PeacockCkRd12-1	4	·		4	·	18	18	4.0	1	Casino/Mur.
90	BabylCkRd3-1	5	·		4	·	11	11	7.0	1	Casino/Mur.
91	BabylCkRd4-1	1	8		4	·	134	70	43	11	Casino/Mur.
92	BabylCkRd4-1	6	·		4	·	16	4.0	6.0	1	Casino/Mur.
93	BabylCkRd4-1	8	10		4	·	32	26	11	11	Casino/Mur.
94	BabylCkRd4-1	8	13		3	1	36	23	12	4	Casino/Mur.
95	BabylCkRd4-1	2	·	1	3	·	26	20	6.0	4	Casino/Mur.
96	BabylCkRd4-1	1	·		4	·	18	25	5.0	11	Casino/Mur.
97	BabylCkRd4-1	1	·		3	1	27	47	8.0	3	Casino/Mur.
98	MtBelmore3-1	2	·	7	4	·	21	14	5.0	7	Casino/Mur.
99	MtBelmore3-1	2	1	4	4	·	7.0	7.0	3.0	4	Casino/Mur.
100	MtBelmore3-1	2	·	7	4	·	19	20	6.0	12	Casino/Mur.
101	MtBelmore3-1	1	·		1	1	45	37	13	2	Casino/Mur.
102	MtBelmore3-1	5	·		4	·	21	10	6.0	1	Casino/Mur.
103	MtBelmore3-1	7	·		4	·	14	9.0	3.0	4	Casino/Mur.
104	MtBelmore3-1	<1	·		4	·	·	·	·	10	Casino/Mur.
105	MtBelmore3-1	<1	·		4	·	·	·	·	1	Casino/Mur.
106	MtBelmore3-1	<1	·		4	·	·	·	·	1	Casino/Mur.

Cas/Mur Artifact db

Rows	Site name	morphology	formal type	break type	cortex	cortex type	length	width	thickness	raw material	MA
107	MtBelmore3-1	<1	•		4	•	•	•	•	1	Casino/Mur.
108	MtBelmore3-1	<1	•		4	•	•	•	•	1	Casino/Mur.
109	MtBelmore3-1	<1	•		4	•	•	•	•	1	Casino/Mur.
110	MtBelmore3-1	<1	•		4	•	•	•	•	1	Casino/Mur.
111	MtBelmore3-1	<1	•		4	•	•	•	•	1	Casino/Mur.
112	MtBelmore3-1	<1	•		4	•	•	•	•	1	Casino/Mur.
113	MtBelmore3-1	<1	•		4	•	•	•	•	1	Casino/Mur.
114	MtBelmore3-1	<1	•		4	•	•	•	•	1	Casino/Mur.
115	MtBelmore3-1	5	•		4	•	11	4.0	2.0	1	Casino/Mur.
116	MtBelmore3-1	2	2	6	4	•	8.0	12	3.0	4	Casino/Mur.
117	MtBelmore3-1	7	•		4	•	6.0	8.0	1.0	4	Casino/Mur.
118	MtBelmore3-1	6	•		4	•	11	10	4.0	1	Casino/Mur.
119	MtBelmore3-1	6	•		4	•	14	11	3.0	7	Casino/Mur.
120	MtBelmore3-1	6	16		4	•	11	6.0	2.0	4	Casino/Mur.
121	MtBelmore3-1	5	•		4	•	36	17	9.0	1	Casino/Mur.
122	MtBelmore3-1	3	•		4	•	17	7.0	7.0	1	Casino/Mur.
123	MtBelmore3-1	13	•		2	1	37	30	29	1	Casino/Mur.
124	MtBelmore3-1	13	•		3	1	36	22	8.0	9	Casino/Mur.
125	MtBelmore3-1	5	•		4	•	22	14	8.0	1	Casino/Mur.
126	MtBelmore3-1	8	13		2	1	45	33	22	1	Casino/Mur.
127	MtBelmore3-1	8	13		3	1	19	13	11	1	Casino/Mur.
128	MtBelmore3-1	8	13		4	•	26	18	14	1	Casino/Mur.
129	MtBelmore3-1	12	•		0	1	113	80	76	12	Casino/Mur.
130	MtBelmore3-1	10	•		1	1	58	38	23	7	Casino/Mur.
131	MtBelmore3-1	6	8		2	2	54	46	37	2	Casino/Mur.
132	FortyAcreRd2-1	15	•		2	1	81	72	27	3	Casino/Mur.
133	FortyAcreRd3-1	6	•		4	•	59	24	25	3	Casino/Mur.
134	RoyalCamp1-1	12	•		2	1	120	75	37	9	Casino/Mur.
135	MalaraCkFt1-1	5	•		4	•	22	12	9.0	1	Casino/Mur.
136	MalaraCkFt1-1	1	•		4	•	48	19	11	1	Casino/Mur.
137	MalaraCkFt1-1	5	•		4	•	38	20	15	1	Casino/Mur.
138	MalaraCkFt1-1	3	•		4	•	18	11	7.0	1	Casino/Mur.
139	MalaraCkFt1-1	5	•		4	•	28	22	10	1	Casino/Mur.
140	MalaraCkFt1-1	5	•		4	•	18	15	10	1	Casino/Mur.
141	MalaraCkFt1-1	5	•		4	•	18	8.0	5.0	1	Casino/Mur.
142	MalaraCkFt1-1	9	10		4	•	25	13	7.0	1	Casino/Mur.
143	MalaraCkFt1-1	1	•		4	•	16	11	6.0	1	Casino/Mur.
144	MalaraCkFt1-1	2	•	1	4	•	8.0	14	4.0	1	Casino/Mur.
145	MalaraCkFt1-1	<1	•		4	•	•	•	•	1	Casino/Mur.
146	MalaraCkFt1-1	<1	•		4	•	•	•	•	1	Casino/Mur.
147	MalaraCkFt1-1	1	•		4	•	32	20	6.0	2	Casino/Mur.
148	DomeMtn3-1	1	•		4	•	33	25	7.0	9	Casino/Mur.
149	DomeMtn4-1	6	•		4	•	16	15	3.0	4	Casino/Mur.
150	CampForestRd1-1	7	•		4	•	32	18	9.0	2	Casino/Mur.
151	CampForestRd1-1	5	•		4	•	31	18	13	7	Casino/Mur.
152	CampForestRd1-1	6	•		4	•	21	12	7.0	7	Casino/Mur.
153	CampForestRd1-1	5	•		4	•	15	13	12	1	Casino/Mur.
154	PawPawRd1-1	1	•		4	•	39	24	13	11	Casino/Mur.
155	PawPawRd1-1	1	•		4	•	50	56	13	11	Casino/Mur.
156	PawPawRd1-1	2	•	1	4	•	23	35	13	11	Casino/Mur.
157	PawPawRd1-1	5	•		4	•	21	15	7.0	11	Casino/Mur.
158	GorgeCreek1-1	5	4	1	3	2	26	44	19	4	Casino/Mur.
159	GorgeCreek1-1	5	5	1	4	•	82	78	33	11	Casino/Mur.

Cas/Mur Artifact db

Rows	Site name	morphology	formal type	break type	cortex	cortex type	length	width	thickness	raw material	MA
160	GorgeCreek1-1	5	•		4	•	58	43	25	11	Casino/Mur.
161	GorgeCreek1-1	6	•		0	1	34	20	9.0	13	Casino/Mur.
162	GorgeCreek1-1	6	•		4	•	30	16	9.0	2	Casino/Mur.
163	GorgeCreek1-1	6	•		4	•	70	47	20	11	Casino/Mur.
164	GorgeCreek5-2	1	•		4	•	20	15	3.0	11	Casino/Mur.
165	SugarloafFt1-1	1	•		4	•	33	40	6.0	11	Casino/Mur.
166	SugarloafFt1-1	1	•		0	2	19	33	15	10	Casino/Mur.
167	SugarloafFt3-1	5	•		4	•	25	25	15	1	Casino/Mur.
168	BranchCk1-1	3	•		3	1	25	17	8.0	1	Casino/Mur.
169	BranchCk1-1	1	•		4	•	80	83	20	12	Casino/Mur.
170	BranchCk1-1	1	•		4	•	44	44	15	7	Casino/Mur.
171	BranchCk1-1	1	•		4	•	17	43	9.0	7	Casino/Mur.
172	BranchCk1-1	1	•		4	•	19	12	4.0	7	Casino/Mur.
173	BranchCk1-1	2	•	1	4	•	22	25	7.0	7	Casino/Mur.
174	BranchCk1-1	1	•		4	•	27	24	4.0	8	Casino/Mur.
175	BranchCk1-1	1	•		4	•	14	18	2.0	8	Casino/Mur.
176	BranchCk1-1	2	•	3	4	•	17	21	3.0	8	Casino/Mur.
177	BranchCk1-1	2	•	3	4	•	11	10	1.0	1	Casino/Mur.
178	BranchCk1-1	7	•		4	•	18	15	5.0	1	Casino/Mur.
179	BranchCk1-1	<1	•		4	•	•	•	•	1	Casino/Mur.
180	BranchCk1-1	<1	•		4	•	•	•	•	1	Casino/Mur.
181	MackellarRange5-1	1	•		4	•	13	42	8.0	11	Casino/Mur.
182	MackellarRange12-1	8	12		4	•	26	28	19	7	Casino/Mur.
183	MackellarRange13-1	2	•	1	4	•	11	14	5.0	9	Casino/Mur.
184	MackellarRange13-1	5	•		4	•	21	16	3.0	2	Casino/Mur.
185	MackellarRange16-1	5	•		4	•	21	15	11	1	Casino/Mur.
186	MackellarRange17-1	1	•		4	•	55	75	17	11	Casino/Mur.
187	MackellarRange17-1	1	•		4	•	21	16	9.0	11	Casino/Mur.
188	MackellarRange18-1	2	•	1	4	•	24	30	10	11	Casino/Mur.
189	MackellarRange18-1	5	•		4	•	17	15	10	2	Casino/Mur.
190	MackellarRange18-1	5	•		4	•	19	13	6.0	11	Casino/Mur.
191	OakyCk4-1	2	•	1	4	•	37	40	15	11	Casino/Mur.
192	OakyCk4-1	2	•	7	4	•	9.0	11	2.0	11	Casino/Mur.
193	OakyCk4-1	3	•		0	1	19	10	3.0	1	Casino/Mur.
194	OakyCk4-1	1	•		4	•	18	28	10	11	Casino/Mur.
195	OakyCk4-1	2	•	1	4	•	17	15	5.0	4	Casino/Mur.
196	OakyCk4-1	1	•		4	•	25	4.0	4.0	4	Casino/Mur.
197	OakyCk4-1	1	•		4	•	10	15	2.0	7	Casino/Mur.
198	OakyCk4-1	1	•	3	4	•	12	12	3.0	2	Casino/Mur.
199	OakyCk4-1	5	•		4	•	13	8.0	5.0	11	Casino/Mur.
200	OakyCk4-1	5	•		4	•	33	33	21	8	Casino/Mur.
201	OakyCk4-1	6	•		4	•	21	18	4.0	8	Casino/Mur.
202	OakyCk4-1	5	•		4	•	12	8.0	6.0	4	Casino/Mur.
203	OakyCk4-1	6	•		4	•	24	13	7.0	11	Casino/Mur.
204	OakyCk4-1	6	•		4	•	12	11	5.0	11	Casino/Mur.
205	OakyCk4-1	6	•		4	•	27	17	6.0	11	Casino/Mur.
206	OakyCk4-1	6	•		4	•	20	20	12	11	Casino/Mur.
207	OakyCk4-1	6	•		4	•	27	18	5.0	11	Casino/Mur.
208	OakyCk4-1	6	•		4	•	11	9.0	3.0	7	Casino/Mur.
209	OakyCk4-1	6	•		4	•	16	7.0	4.0	1	Casino/Mur.
210	OakyCk4-1	5	•		4	•	15	9.0	6.0	11	Casino/Mur.
211	OakyCk4-1	5	•		4	•	12	11	4.0	2	Casino/Mur.
212	OakyCk4-1	8	14		1	1	115	85	73	11	Casino/Mur.

Caa/Mur Artifact db

Rows	Site name	morphology	formal type	break type	cortex	cortex type	length	width	thickness	raw material	MA
213	OakyCk4-1	13	9		3	1	110	85	20	11	Casino/Mur.
214	OakyCk4-1	10	•		4	•	180	70	25	8	Casino/Mur.
215	OakyCk4-1	2	•	7,3	4	•	21	14	4.0	13	Casino/Mur.
216	OakyCk4-1	1	1		4	•	20	9.0	3.0	4	Casino/Mur.
217	OakyCk4-1	2	•	7	4	•	17	13	5.0	7	Casino/Mur.
218	OakyCk4-1	1	•		4	•	20	17	7.0	7	Casino/Mur.
219	OakyCk4-1	6	•		4	•	13	11	3.0	7	Casino/Mur.
220	OakyCk4-1	1	•	7	4	•	30	26	9.0	9	Casino/Mur.
221	OakyCk4-1	2	•	2	4	•	26	19	11	2	Casino/Mur.
222	OakyCk4-1	1	•		4	•	23	11	6.0	2	Casino/Mur.
223	OakyCk4-1	2	•	7	4	•	18	12	7.0	2	Casino/Mur.
224	OakyCk4-1	2	•	7	4	•	13	12	5.0	2	Casino/Mur.
225	MiddleRidge2-1	1	•		4	•	20	27	6.0	7	Casino/Mur.
226	MiddleRidge2-1	2	•	7	4	•	20	25	6.0	13	Casino/Mur.
227	MiddleRidge2-1	2	•	1	4	•	12	22	8.0	2	Casino/Mur.
228	MiddleRidge2-1	5	•		4	•	11	9.0	6.0	7	Casino/Mur.
229	MiddleRidge2-1	6	•		4	•	14	12	6.0	7	Casino/Mur.
230	MiddleRidge2-1	6	•		4	•	50	27	13	7	Casino/Mur.
231	MiddleRidge2-1	6	•		4	•	19	18	5.0	7	Casino/Mur.
232	MiddleRidge3-1	7	•		4	•	13	6.0	2.0	4	Casino/Mur.
233	MiddleRidge4-1	2	•	7	4	•	13	20	5.0	4	Casino/Mur.
234	MiddleRidge4-1	7	•		4	•	25	19	7.0	7	Casino/Mur.
235	MiddleRidge4-1	6	•		4	•	13	7.0	3.0	7	Casino/Mur.
236	MiddleRidge4-1	8	15		4	•	41	35	20	7	Casino/Mur.
237	ClaypotRd5-1	1	1		4	•	38	25	4.0	7	Casino/Mur.
238	ChristiesCkRd2-1	8	11		4	•	27	17	9.0	7	Casino/Mur.
239	EasternBoundaryTrail2-1	5	•		4	•	15	11	8.0	7	Casino/Mur.
240	Fosters Spur1-1	5	8		4	•	66	40	28	3	Casino/Mur.
241	FortySpurRd2-1	14	•		1	1	190	110	90	8	Casino/Mur.
242	FortySpurRd2-1	6	•		4	•	21	17	6.0	2	Casino/Mur.
243	FortySpurRd2-1	7	•		4	•	18	10	4.0	2	Casino/Mur.
244	NPWS(13-1-84)	2	•	7	4	•	18	16	5.0	4	Casino/Mur.
245	NPWS(13-1-84)	7	•		4	•	35	15	10	2	Casino/Mur.
246	NPWS(13-1-84)	1	•	1	4	•	24	32	9.0	2	Casino/Mur.
247	NPWS(13-1-84)	1	8		4	•	30	17	6.0	7	Casino/Mur.
248	NPWS(13-1-84)	2	•	7,1	4	•	14	14	3.0	7	Casino/Mur.
249	NPWS(13-1-84)	5	•		4	•	33	14	12	7	Casino/Mur.
250	NPWS(13-1-84)	7	•		4	•	36	23	22	7	Casino/Mur.
251	NPWS(13-1-84)	7	•		4	•	26	16	9.0	7	Casino/Mur.
252	NPWS(13-1-84)	1	•	1	4	•	21	14	6.0	7	Casino/Mur.
253	NPWS(13-1-84)	1	•		3	1	27	22	8.0	7	Casino/Mur.
254	NPWS(13-1-84)	7	•		4	•	20	12	10	4	Casino/Mur.
255	NPWS(13-1-84)	2	•	1	4	•	10	14	4.0	7	Casino/Mur.
256	NPWS(13-1-84)	2	5	3	4	•	19	10	4.0	7	Casino/Mur.
257	NPWS(13-1-84)	5	•		4	•	17	16	11	7	Casino/Mur.
258	NPWS(13-1-84)	7	•		4	•	32	14	9.0	4	Casino/Mur.
259	NPWS(13-1-84)	6	•		4	•	23	12	6.0	4	Casino/Mur.
260	NPWS(13-1-84)	2	•	7	4	•	30	13	5.0	7	Casino/Mur.
261	NPWS(13-1-84)	2	•	7	4	•	12	7.0	3.0	7	Casino/Mur.
262	NPWS(13-1-84)	1	•		4	•	30	19	8.0	2	Casino/Mur.
263	NPWS(13-1-84)	2	•	7	4	•	25	18	8.0	2	Casino/Mur.
264	NPWS(13-1-84)	1	•	7	4	•	16	11	4.0	2	Casino/Mur.
265	NPWS(13-1-84)	2	•	1	4	•	14	14	6.0	7	Casino/Mur.

Cas/Mur Artifact db

Rows	Site name	morphology	formal type	break type	cortex	cortex type	length	width	thickness	raw material	MA
266	NPWS(13-1-84)	2	•	1	4	•	9.0	10	2.0	4	Casino/Mur.
267	NPWS(13-1-84)	7	•		4	•	15	5.0	3.0	7	Casino/Mur.
268	NPWS(13-1-84)	5	•		4	•	25	16	15	7	Casino/Mur.
269	NPWS(13-1-84)	2	•	1	4	•	14	15	2.0	7	Casino/Mur.
270	NPWS(13-1-84)	2	•	3	4	•	25	15	4.0	7	Casino/Mur.
271	NPWS(13-1-84)	5	•		4	•	28	21	13	7	Casino/Mur.
272	NPWS(13-1-84)	1	•		4	•	18	21	4.0	2	Casino/Mur.
273	NPWS(13-1-84)	<1	•		4	•	•	•	•	4	Casino/Mur.
274	NPWS(13-1-84)	<1	•		4	•	•	•	•	7	Casino/Mur.
275	NPWS(13-1-84)	<1	•		4	•	•	•	•	7	Casino/Mur.
276	NPWS(13-1-84)	<1	•		4	•	•	•	•	7	Casino/Mur.
277	NPWS(13-1-84)	<1	•		4	•	•	•	•	7	Casino/Mur.
278	NPWS(13-1-84)	<1	•		4	•	•	•	•	7	Casino/Mur.
279	NPWS(13-1-84)	1	•		4	•	38	21	7.0	2	Casino/Mur.
280	NPWS(13-1-84)	2	•	1	4	•	11	11	3.0	2	Casino/Mur.
281	NPWS(13-1-84)	7	•		4	•	11	15	4.0	7	Casino/Mur.
282	NPWS(13-1-84)	1	•		4	•	17	16	8.0	2	Casino/Mur.
283	NPWS(13-1-84)	5	•		4	•	15	12	8.0	7	Casino/Mur.
284	NPWS(13-1-84)	5	•		4	•	17	10	6.0	7	Casino/Mur.

APPENDIX 10

Site Complexity Scores

Artifact Categories Present

Site size class and complexity scores

Site name	Site class	tech. category	site furniture	raw mat. category	total score
JackybulbinCk1-1	1	0		1	1
IslandRd1-1	2	2		6	8
IslandRd2-1	2	2		4	6
IslandRd4-1	1	0		2	2
IslandRd6-1	1	0		1	1
Lookout1-1	1	1		2	3
Pine2-1	1	0		2	2
McFaydenRd2-1	1	0		1	1
TullymorganRd6-1	1	1		1	2
TullymorganRd7-1	1	1		1	2
MangroveCk7-1	1	0		1	1
MangroveCk11-1	1	1		1	2
MangroveCk16-1	2	0		3	3
MangroveCk16-2	2	1		4	5
OilRig3-1	1	0		1	1
BroadwaterCkRd1-1	1	0		1	1
BroadwaterCkRd3-1	1	0		1	1
BroadwaterCkRd12-1	1	1		1	2
BroadwaterCkRd14-1	1	1		1	2
MtMarsh1,6-1	1	0		1	1
MtMarsh2,7-1	1	0		1	1
MtMarsh3,1-1	1	0		1	1
MtMarsh3,8-1	1	1		1	2
MtMarsh3,10-1	1	1		1	2
MtMarsh3,11-1	1	1		3	4
MtMarsh3,14-1	1	0		1	1
MtMarsh4,1-1	2	2		4	6
MtMarsh5,1-1	1	1		1	2
MtMarsh5,5-1	1	0		1	1
MtMarsh5,8-1	1	0		1	1
MtMarsh5,10-1	1	1		2	3
LollbackCk2-1	1	0		1	1
PeacockCkRd4-1	1	1		2	3
PeacockCkRd7-1	1	1	Y	1	2
PeacockCkRd8-1	1	0		1	1
PeacockCkRd10-1	1	2		2	4
PeacockCkRd11-1	1	0		1	1
PeacockCkRd12-1	1	0		1	1
BabylCkRd3-1	1	0		1	1
BabylCkRd4-1	2	2		1	3
MtBelmore3-1	3	6	Y	7	13
FortyAcreRd2-1	1	1		1	2

Key to Site Complexity table:

Column 1	Site name
Column 2	Site size class - Artifact Occurrence size class based on number of artifacts present 1= 0-4 artifacts, 2= 5-20 artifacts, 3= 21-50 artifacts, 4=51-100 artifacts, 5=100+ artifacts
Column 3	tech. category = number of types of technological category present
Column 4	Site furniture - defined as large stone artifacts such as anvils and grindstones brought to a site as potential permanent or semi permanent site features. Recorded as Y if present.
Column 5	raw mat. category = number of types of raw material category present
Column 6	total score - total score of Columns 3 & 5

Site size class and complexity scores (continued)

Site name	Site class	no. of tech. category	site furniture	no. of raw mat. category	total score
FortyAcreRd3-1	1	0		1	1
RoyalCamp1-1	1	1	Y	1	2
BulldogRock1-1	3	6	Y	3	9
NogrigarRd1-1	1	0		1	1
NogrigarRd2-1	1	0		1	1
NogrigarRd3-1	1	0		1	1
NogrigarRd4-1	3	?	Y	?	?
MalaraCkFt1-1	2	2		2	4
DomeMtn3-1	1	0		1	1
DomeMtn4-1	1	0		1	1
CampForestRd1-1	1	0		3	3
PawPawRd1-1	1	0		1	1
GorgeCreek1-1	2	1		4	5
GorgeCreek5-2	1	0		1	1
SugarloafFt1-1	1	0		2	2
SugarloafFt1-3	1	0		1	1
BranchCk1-1	2	1		4	5
MackellarRange5-1	1	0		1	1
MackellarRange12-1	1	1		1	2
MackellarRange13-1	1	0		2	2
MackellarRange16-1	1	0		1	1
MackellarRange17-1	1	0		1	1
MackellarRange18-1	1	0		2	2
OakyCk4-1	3	4	Y	8	12
MiddleRidge2-1	2	0		5	5
MiddleRidge3-1	1	0		1	1
MiddleRidge4-1	1	1		2	3
ClaypotRd5-1	1	1		1	2
ChristiesCkRd2-1	1	1		1	2
EasternBoundaryTrail2-1	1	0		1	1
Fosters Spur1-1	1	1		1	2
FortySpurRd2-1	1	1	Y	2	3
NPWS(13-1-84)	3	2		3	5

? = data not available

Key to Artifact Categories table:

Artifact types listed for table are defined in Appendix 6 (Artifact Recording Code)
Y=artifact type present

Artifact categories present

Site name	anvil	<1cm	hatchet	flaked pebble	manuport	core	microlith	retouched piece	grindstone
JackybulbinCk1-1									
IslandRd1-1				Y		Y			
IslandRd2-1				Y		Y			
IslandRd4-1									
IslandRd6-1									
Lookout1-1						Y			
Pine2-1									
McFaydenRd2-1									
TullymorganRd6-1							Y		
TullymorganRd7-1		Y							
MangroveCk7-1									
MangroveCk11-1						Y			
MangroveCk16-1									
MangroveCk16-2				Y					
OilRig3-1									
BroadwaterCkRd1-1									
BroadwaterCkRd3-1									
BroadwaterCkRd12-1		Y							
BroadwaterCkRd14-1				Y					
MtMarsh1,6-1									
MtMarsh2,7-1									
MtMarsh3,1-1									
MtMarsh3,8-1								Y	
MtMarsh3,10-1						Y			
MtMarsh3,11-1				Y					
MtMarsh3,14-1									
MtMarsh4,1-1				Y		Y			
MtMarsh5,1-1									
MtMarsh5,5-1									
MtMarsh5,8-1									
MtMarsh5,10-1								Y	
LollbackCk2-1									
PeacockCkRd4-1				Y					
PeacockCkRd7-1					Y				
PeacockCkRd8-1									
PeacockCkRd10-1		Y				Y			
PeacockCkRd11-1									
PeacockCkRd12-1									
BabylCkRd3-1									
BabylCkRd4-1						Y		Y	
MtBelmore3-1	Y	Y			Y	Y	Y	Y	

Artifact categories present (continued)

Site name	anvil	<1cm	hatchet	flaked pebble	manuport	core	microlith	retouched piece	grindstone
FortyAcreRd2-1			Y						
FortyAcreRd3-1									
RoyalCamp1-1					Y				
BulldogRock1-1	Y	Y		Y	Y	Y		Y	
NogrigarRd1-1									
NogrigarRd2-1									
NogrigarRd3-1									
NogrigarRd4-1	?	?		?	?	?			
MataraCkFt1-1		Y				Y			
DomeMtn3-1									
DomeMtn4-1									
CampForestRd1-1									
PawPawRd1-1									
GorgeCreek1-1								Y	
GorgeCreek5-2									
SugarloafFt1-1									
SugarloafFt1-3									
BranchCk1-1		Y							
MackellarRange5-1									
MackellarRange12-1						Y			
MackellarRange13-1									
MackellarRange16-1									
MackellarRange17-1									
MackellarRange18-1									
OakyCk4-1	Y			Y		Y	Y		
MiddleRidge2-1									
MiddleRidge3-1									
MiddleRidge4-1						Y			
ClaypotRd5-1							Y		
ChristiesCkRd2-1						Y			
EasternBoundaryTrail2-1									
Fosters Spur1-1								Y	
FortySpurRd2-1									Y
NPWS(13-1-84)		Y						Y	

? data not available

APPENDIX 11

Value of forests and sites to Bundjalung people, statement by John Roberts (Chairman of the Far North Coast Regional Aboriginal Land Council).

FORMAL STATEMENT TO BE GIVEN TO CONSULTANT AND ESSENTIAL TO BE INCLUDED IN LIST OF VALUES:

To the Bunjulung people the forest areas have the value of:

protecting and maintaining sites.

The functions of sites are:

personal identity for all Bunjulung people

cultural continuity of Bunjulung culture

accessibility of spiritual power to all Bunjulung people.

METHODOLOGICAL POINTS

The putting together of sacred sites of importance to Bunjulung with archeological sites of importance to western academics and western science is outrageous. It in no way gives the mandate to represent the Bunjulung people's interest in this debate.

While western science is unable to demonstrate the existence or non existence of sites of either kind the word of the Bunjulung people will have to be taken as definitive. The onus of proof must be on those who wish to destroy - arguments such as lack of time, lack of technique etc. are totally inadequate.

APPENDIX 12

Report by Aboriginal consultant William Follent (Tweed-Byron Land Council) on survey work undertaken in the Murwillumbah forests.

VALUE OF FORESTS AND SITES TO BUNJULUNG PEOPLE

The relationship between forests and sites:

Forests are not only the geographical location of many sites they are the energetic protectors of the sites. Sites have been placed in the forest position for reasons intrinsic to the sites meaning and power. The particular area and environment has been chosen and is essential to the sites effectiveness.

The relation between sites and Aboriginal culture:

Sites are places of sacred power and they encapsulate cultural traditions at their area of location. This enables both rites of passage to take place maintaining the development into adulthood of each generation, and it also facilitates the survival of culture from one generation to the next. They also are the only source of continued relationship between Aboriginal people and their Spiritual Guidance.

The current use of sites:

In the last 10 years there has been steadily increasing cultural revival among Bunjulung. This revival has reached the point where now there will be Bunjulung teaching to all Aboriginal children in the area formalised in all schools. This teaching is cultural teaching not just language teaching and introduction to sites is an integral part of it. This use of sites involves both the elder and new generation of Bunjulung.

After a history of genocide, protection and assimilation, the Australian Government policy of conciliation recognises the cultural independence and identity of Aboriginal people. This is the official policy of the Australian Government and is supported by the people of Australia. The protection of those sites that have not been destroyed is a mandatory corollary of the new policy.

The value of sites to Bunjulung:

essential for Bunjulung individuals to attain adulthood and full identity.

essential for continuity of Bunjulung culture.

essential for Spiritual dimension of Bunjulung culture to exist.

REPORT BY WILLIAM FOLLENT

DAY 1

Moobal State Forest, 10 kms S/E of Murwillumbah. Travelled to outer ridge of the mountain and did some fossicking. Found a small piece of shale that looked as if it had work done on it by Aboriginals. Roger took its measurements, weighed it, drew a diagram of it, then put it back where he found it.

Not much here because too much has been touched by man by means of logging, The forest has been cut down and we are looking through a 20-30 year secondary growth.

Found a quartz rock, maybe of some significance, for it showed no stress fractures.

Roger showed me what to look for when searching for Aboriginal arrifacts.

The places we looked at today in Moobal State Forest were

- Corkadilla Rd
- Baranbali Rd
- Wabba Rd
- Condong Ridge

Roger is a very pleasant person to work with, he also knows his job very well and I felt I will learn quite a lot.

DAY 2

Nullum Forest, West of Mullumbimby

Found 5 pieces of rock which may be of some significance. One of these pieces is a positive find. The flake is about 10-15 mm long with minor flake marks on the underside. There is also evidence of where the stone was struck. (striking platform).

These stones were situated 5km from Main Arm on Middle Ridge Rd. which is an old timber dump.

I took some photos to establish the terrain in which we found the stones. Roger will take the photos back for further research.

We drove down the same road about 2-3km North, down a gully. We stopped on a piece of ground Roger called a "Saddle". We must have looked for about an hour and we found a large "core" which small tools were made from eg. flinting small pieces off a large piece to make barbs, spear points etc.

We then drove deep into the Nullum Forest, very deep. We did not find much here as there was too much leaf litter on the ground.

We stopped at an old log dump, had a look around and Roger found a tool of some kind, we were lucky to find it. You could see the distinct cutting edge, the chips taken off the edge to make a scraper of some kind, but it was positive find.

This day was most exciting to me, because I found a quite large core stone that had been worked on.

WE set camp about S/W of Mullumbimby in Nullum State Forest

DAY 3

Coonyum Range Ridge Rd. Stopped 10km up the road, were a sort of glass rock was found. Walked around for a while and did not find anything, because this glass rock is too brittle and soft for working on. The rock is Obsidian (volcanic rock).

Walked about another 200-300 m. Didn't find anything. So we set off to Whain Whain State Forest. We arrived at 12.30. We then headed up Eastern Boundary trail. Wain Wain State Forest is located 20-3-km south of Byron Bay.

Roger found a small fragment, but was not sure of it.

It has a considerable amount of fire damage and human damage on it. Roger took the information and put it back where he found it.

WE are deep in Whain Whain State Forest. Still a lot of damage from early timber getters and also tourists.

There is a picnic area and camping ground about 10km away. We also passed a Hooping Pine plantation, planted by early timber getters or Forestry Commission.

Tjis area is mostly Blackbutt.

We looked for a few hours and didn't find much, so we set camp on the edge of Rocky Dam, Lismore's water supply.

DAY 4

Roger and myself started walking 5km's from our campsite, WE walked about 100-200m and Roger found quite a large artifact. It weas a tool of some sort. It had all the distinct markings to be a tool. One side was flaked away (retouched, resharpened) and the edge of the tool had small flake marks that were well distinguished.

The bush we are now studying is moist blackbutt with booyung gullies. It has been heavily forested in the oast and we are actually looking through a 20-30 year regrowth. Very hard looking because of the initial damage done by timber getters. You can see some of the old stumps with board holes in them.

WE came across an old stump where there has been a large piece taken out of it, until further studies we will not know what made this hole. What interested Roger was the regrowth the hole had before the tree had been cut down. I will show you with a sketch of it.

The hole in tn emiddle seems to be older than the board holes.

It could be a natural thing we don't know, so we took its photo and recorded location details for further research.

Arrived in Mebbin state forest, went down 40 Spur Rd. Walked for about 3hrs, didn't find anything. On our way back to the car Roger found 3 positive pieces. One is a large grinding stoneof some kind. We took photos and the particulars, and then put the rocks back where we found them.

Dark caught up on us, so we set camp in Mebbin State Forest.

Day 5

Began day at Nullum State Forest.

Didn't have much time here, time was short, It was too bad we had to leave for we had found a good sorce of rock which the Aboriginals may have used as it was the correct variety.

We have found about 15 pieces of rock which look to have had some work done on them by Aboriginals. Roger will take particulars and was to come back later on this afternoon.

We are now travelling back into Mebbin State Forest, to have a look at Jeruselum Mt. We did not find anything here, there has been too much damage done by timber getters. We walked for about 3-4 hours around Jeruselum Mt. After Roger took down some notes on this region, we moved on.

Roger dropped me back home at about 4-30 Fridy afternoon.

My experience over the last week has been nothing but learning. Roger summed things up very well with the equipment he had.

I feel there should be further studies on these Forests, for these are many things still to be found inn our state forests. We did not have properly enough time to study these regions. If there are things there to study where our Ancestors travelled through our mountains we must know so we can stop the damage being done by timber getters as they destroy our people's walkway to the sea.

APPENDIX 13

Letter from the Far North Coastal Regional Aboriginal Land Council

NEW SOUTH WALES
ABORIGINAL LAND COUNCIL
FAR NORTH COAST BRANCH

P.O.Box 494
Lismore NSW 2480
Telephone (066) 22 1010
Facsimile (066) 22 1931

25 Orion Street
Lismore NSW 2480

6th April, 1993

Mr Roger Hall
Forestry Commission
of New South Wales
P.O. Box J19
Coffs Harbour NSW 2451

Re: Draft Archaeological Assessment of the Casino District Forests

Dear Roger,

Firstly, let me apologize for taking so long to respond to your requests for comments on the above document.

After reading the document and especially the recommendations I would like to add these comments, which I will leave to you to put into appropriate recommendation form.

"That before any management work is undertaken the Forestry Commission should engage an appropiate person to undertake a complete anthropological survey of the relevant State forests, and to remunerate the Aboriginal consultants."

I hope this is of assistance to you and look forward to continued co-operation with you.

Yours sincerely

Donnelly
....
Dallas Donnelly
Branch Co-ordinator

John Roberts
....
John Roberts
Chairperson FNCRALC