COMMONWEALTH DEPARTMENT OF
TRANSPORT AND REGIONAL
DEVELOPMENT

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Visual and Landscape

Proposal for a Second Sydney Airport
at Badgerys Creek or Holsworthy Military Area

Technical Paper

PPK
Environment & Infrastructure

Prepared for:

COMMONWEALTH DEPARTMENT OF
TRANSPORT AND REGIONAL DEVELOPMENT

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December 1997

Report No: 58H233B PR1052
ISBN No: 0642280444

Explanatory Statement

This technical paper is not part of the Draft Environmental Impact Statement (EIS) referred to in paragraph 6 of the Administrative Procedures made under the Environment Protection (Impact of Proposals) Act 1974.

The Commonwealth Government is proposing to construct and operate a second major airport for Sydney at Badgerys Creek. This technical paper contains information relating to the Badgerys Creek airport options which was used to assist the preparation of the Draft EIS.

The technical paper also assesses the impacts of developing a major airport at the Holsworthy Military Area. On 3 September 1997, the Government eliminated the Holsworthy Military Area as a potential site for Sydney's second major airport. As a consequence, information in this technical paper relating to the Holsworthy Military Area is presented for information purposes only.

Limitations Statement

This technical paper has been prepared in accordance with the scope of work set out in the contract between Rust PPK Pty Ltd and the Commonwealth Department of Transport and Regional Development (DoTRD) and completed by PPK Environment and Infrastructure Pty Ltd (PPK). In preparing this technical paper, PPK has relied upon data, surveys, analyses, designs, plans and other information provided by DoTRD and other individuals and organisations, most of which are referenced in this technical paper. Except as otherwise stated in this technical paper, PPK has not verified the accuracy or completeness of such data, surveys, analyses, designs, plans and other information.

This technical paper has been prepared for the exclusive use of DoTRD. PPK will not be liable to any party other than DoTRD and assumes no responsibility for any loss or damage suffered by any other party arising from matters dealt with in this technical paper, including, without limitation, matters arising from any negligent act or omission of PPK or for any loss or damage suffered by any other party in reliance upon the matters dealt with and opinions and conclusions expressed in this technical paper.

Acknowledgments

Data used to develop the figures contained in this document have been obtained and reproduced by permission of the Australian Bureau of Statistics, NSW Department of Land and Water Conservation, NSW National Parks and Wildlife Service (issued 14 January 1997), NSW Department of Urban Affairs and Planning and Sydney Water. The document is predominantly based on 1996 and 1997 data.

To ensure clarity on some of the figures, names of some suburbs have been deleted from inner western, eastern, south-eastern and north-eastern areas of Sydney. On other figures, only 'Primary' and 'Secondary' centres identified by the Department of Urban Affairs and Planning's Metropolitan Strategy, in addition to Camden, Fairfield and Sutherland, have been shown.

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CONTENTS

LIST OF FIGURES

APPENDICES

Part A
Introduction

CHAPTER 1 OVERVIEW OF THE PROPOSAL

1.1 INTRODUCTION

This technical paper addresses the potential visual and landscape impacts identified as part of the previously proposed development of the Second Sydney Airport at either Badgerys Creek or Holsworthy Military Area. It contains information used to prepare the Draft Environmental Impact Statement (EIS) which addresses the overall environmental impacts of the Badgerys Creek airport options.

1.2 A BRIEF HISTORY

The question of where, when and how a second major airport may be developed for Sydney has been the subject of investigation for more than 50 years. The investigations and the associated decisions are closely related to the history of the development of Sydney's existing major airport, located at Mascot.

The site of Sydney Airport was first used for aviation in 1919. It was acquired by the Commonwealth Government in 1921, and was declared an International Aerodrome in 1935. In 1940 the first terminal building and control tower were opened.

In 1945 the airport had three relatively short runways. A major expansion began in 1947, and by 1954 the current east-west runway was opened. The north-south runway was first opened in 1954 and was extended to its current length in 1972. The present international terminal was opened in 1970.

Planning and investigations for a site for a second Sydney airport first started in 1946. A large number of possible sites both within and outside the Sydney Basin have been investigated.

The *Second Sydney Airport Site Selection Program Draft Environmental Impact Statement* (Kinhill Stearns, 1985) re-examined all possible locations for the second airport and chose 10 for preliminary evaluation. Two sites, Badgerys Creek and Wilton, were examined in detail and an EIS was prepared. In February 1986 the then Commonwealth Government announced that Badgerys Creek had been selected as the site for Sydney's second major airport.

The Badgerys Creek site, which is about 46 kilometres west of Sydney's Central Business District and is 1,700 hectares in area, was acquired by the

Commonwealth between 1986 and 1991. A total of $155 million has been spent on property acquisition and preparatory works.

Since 1986, planning for Sydney's second airport has been closely linked to the development of the third runway at Sydney Airport. In 1989 the Government announced its intention to construct a third runway. An EIS was undertaken and the decision to construct the runway was made in December 1991.

At the same time as investigations were being carried out on the third runway, detailed planning proceeded for the staged development of the second airport at Badgerys Creek. In 1991 it was announced that initial development at Badgerys Creek would be as a general aviation airport with an 1,800 metre runway.

The third runway at Sydney Airport was opened in November 1994. In March 1995, in response to public concern over the high levels of aircraft noise, the Commonwealth Senate established a committee in March 1995 to examine the problems of noise generated by aircraft using Sydney Airport and explore possible solutions. The committee's report, *Falling on Deaf Ears?*, containing several recommendations, was tabled in parliament in November 1995 (Senate Select Committee on Aircraft Noise, 1995).

During 1994 and 1995 the Government announced details of its proposed development of Badgerys Creek, and of funding commitments designed to ensure the new airport would be operational in time for the 2000 Olympics. This development included a 2,900 metre runway for use by major aircraft.

The decision to accelerate the development of the new airport triggered the environmental assessment procedures in the *Environment Protection (Impact of Proposals) Act 1974*. In January 1996 it was announced that an EIS would be prepared for the construction and operation of the new airport.

In May 1996, the present Commonwealth Government decided to broaden the environmental assessment process. It put forward a new proposal involving the consideration of 'the construction and operation of a second major international/domestic airport for Sydney at either Badgerys Creek or Holsworthy on a site large enough for future expansion of the airport if required' (Department of Transport and Regional Development, 1996). A major airport was defined as one 'capable of handling up to about 360,000 aircraft movements and 30 million passengers per year' (Department of Transport and Regional Development, 1996).

The Government also indicated that 'Badgerys Creek at this time remains the preferred site for Sydney's second major airport, subject to the favourable outcome of the EIS, while Holsworthy is an option to be considered as an

alternative' (Minister for Transport and Regional Development, 1996). The two sites considered in this technical paper are shown in *Figure 1.1*.

Following the substantial completion of a Draft EIS on the Badgerys Creek and Holsworthy airport options, the Government eliminated the Holsworthy Military Area as a potential site for Sydney's second major airport. The environmental assessment showed that the Badgerys Creek site was significantly superior to the Holsworthy Military Area. As a result a Draft EIS was prepared which examines only the Badgerys Creek site. While this technical paper examines both the Badgerys Creek and Holsworthy airport options, only the parts of the assessment relating to the Badgerys Creek airport options were used to assist the preparation of the Draft EIS.

1.3 THE PROPOSAL

The Commonwealth Government proposes the development of a second major airport for Sydney capable of handling up to 30 million domestic and international passengers a year. By comparison, Sydney Airport will handle about 20 million passengers in 1997. The *Second Sydney Airport Site Selection Program Draft Environmental Impact Statement* anticipated the airport would accommodate about 13 million passengers each year (Kinhill Stearns, 1985).

A stated objective of the Government is the building of a second major airport in the Sydney region to a full international standard, subject to the results of an EIS. In the Government's view, Sydney needs a second major airport to handle the growing demand for air travel and to control the level of noise experienced by Sydney residents (Coalition of Liberal and National Parties, 1996).

Government policy (Coalition of Liberal and National Parties, 1996) indicates:

- that Sydney's second airport will be more than just an overflow airport and will, in time, play a major role in serving Sydney's air transport needs; and

- a goal of reducing the noise and pollution generated by Sydney Airport as much as possible and that the Government would take steps to ensure that the noise burden around Sydney Airport is shared in a safe and equitable way.

The assumptions made on how the Second Sydney Airport would operate and the master plans which set out the broad framework for future physical development of the airport are based on an operational limit of 30 million passengers a year. The main features include parallel runways, a cross wind

runway and the provision of the majority of facilities between the parallel runways.

Consideration has also been given to how the airport may be expanded in the future and the subsequent environmental implications. Such an expansion could not proceed, however, unless a further detailed environmental assessment and decision making process were undertaken by the Government.

Five airport options are considered, as well as the implications of not proceeding with the proposal. Three of the airport options are located at Badgerys Creek and two are located within the Holsworthy Military Area. Generally, the airport options are:

- Badgerys Creek Option A which has been developed to be generally consistent with the planning for this site undertaken since 1986. The airport would be developed within land presently owned by the Commonwealth with two parallel runways constructed on an approximate north-east to south-west alignment;

- Badgerys Creek Option B would adopt an identical runway alignment to Option A, but provides an expanded land area and also a cross wind runway;

- Badgerys Creek Option C would provide two main parallel runways on an approximate north to south alignment in addition to a cross wind runway. Again the land area required would be significantly expanded from that which is presently owned by the Commonwealth;

- Holsworthy Option A would be located centrally within the Holsworthy Military Area and would have two main parallel runways on an approximate north to south alignment and a cross wind runway; and

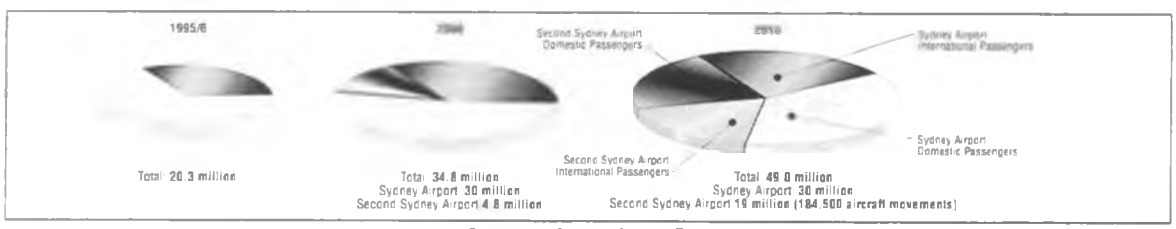
- Holsworthy Option B would be located in the south of the Holsworthy Military Area and would have two main parallel runways on an approximate south-east to north-west alignment and a cross wind runway.

To ensure that the likely range of possible impacts of the airport options are identified a number of different assumptions about how the airport options would be developed and operate have been adopted. These different assumptions relate to the number and types of aircraft that may operate from the airport, the flight paths used and the direction of take offs and landings.

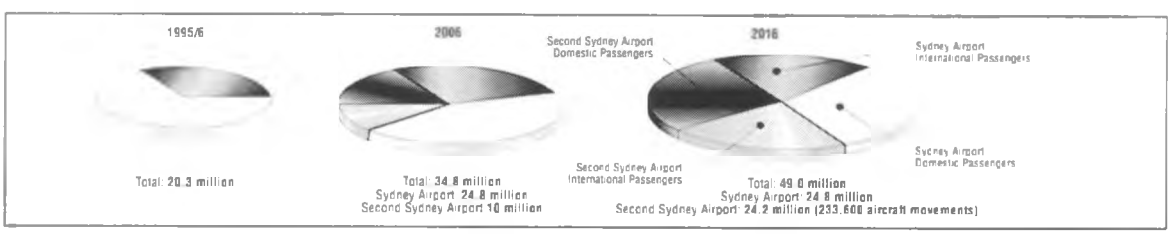
The number of flights into and out of the proposed Second Sydney Airport would depend on a number of factors including the types of aircraft that would use the airport and the associated numbers of passengers in each aircraft. The

Figure 1.1

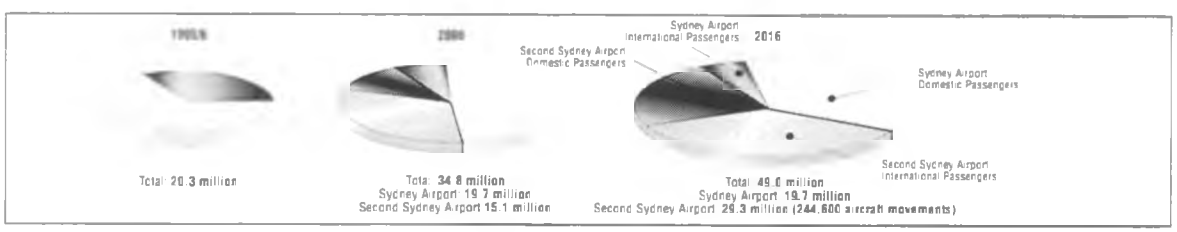
Potential Airport Sites Considered in the Draft EIS



Assumptions about Passenger Movements for Air Traffic Forecast 1



Assumptions about Passenger Movements for Air Traffic Forecast 2



Assumptions about Passenger Movements for Air Traffic Forecast 3

Figure 1.2

Summary of Passenger Movement Forecasts Used for Environmental Assessment

proposal put forward by the Government anticipates a major airport handling 30 million passengers and up to 360,000 aircraft movements per year.

Air traffic forecasts have been developed based on an examination of the number and type of aircraft that would use the airport as it approaches an operating level of 30 million passengers per year. This examination has shown that if the airport accommodated about 245,000 aircraft movements each year, the number of air passengers would approach 30 million. This assumes a relatively high percentage of international flights being directed to the Second Sydney Airport. Therefore it is appropriate for this Draft EIS to assess the airport operating at a level of 245,000 aircraft movements per year, rather than the 360,000 originally anticipated by the Government. It has been assumed that this level of operation could be reached by about 2016.

1.4 AIR TRAFFIC FORECASTS

Cities around the world which have developed second major airports have responded to their particular needs in different ways. For example, the original airport in Dallas, United States, is now used for short range traffic that does not connect with other flights. Second airports in New York and Washington serve as hubs for particular airlines. In Taipei, Taiwan, smaller domestic aircraft use the downtown airport and larger international flights use a newer airport 40 kilometres from the city.

It is clear that each metropolitan area around the world has unique characteristics and the development of multi-airport systems respond to particular local circumstances. The precise role and consequential staging of development of the Second Sydney Airport would be the subject of future Government decisions. To assist in developing a realistic assessment of the potential impacts of the Second Sydney Airport, three sets of air traffic forecasts for the airport were developed. Each forecast assumes a major airport would be developed, however, this may be achieved at different rates of growth.

The three potential air traffic scenarios considered for the Second Sydney Airport are shown in *Figure 1.2*. They are:

- *Air Traffic Forecast 1* where the Second Sydney Airport would provide only for demand which cannot be met by Sydney Airport. This is an overflow forecast, but would nevertheless result in a significant amount of air traffic at the Second Sydney Airport. The proportion of international and domestic air traffic is assumed to be similar at both airports;

- *Air Traffic Forecast 2* where the Second Sydney Airport would be developed to cater for 10 million passengers a year by 2006, with all

further growth after this being directed to the second airport rather than Sydney Airport. The proportion of international and domestic traffic is also assumed to be similar at both airports; and

- *Air Traffic Forecast 3* which is similar to Forecast 2 but with more international flights being directed to the Second Sydney Airport. This would result in the larger and comparatively noisier aircraft being directed to the second airport. It would accommodate about 29.3 million passengers by 2016.

1.5 OPERATION OF THE AIRPORT OPTIONS

At any airport, aircraft operations are allocated to runways (which implies both the physical runway and the direction in which it is used) according to a combination of wind conditions and airport operating policy. The allocation is normally performed by Air Traffic Control personnel.

Standard airport operating procedures indicate that a runway may not be selected for either approach or departure if the wind has a downwind component greater than five knots, or a cross wind component greater than 25 knots. If the runway is wet, it would not normally be selected if there is any downwind component. This applies to all aircraft types, although larger aircraft would be capable of tolerating relatively higher wind speeds. Wind conditions at the airport site therefore limit the times when particular runways may be selected. However, there would be a substantial proportion of the time, under low wind conditions, when the choice of runways would be determined by airport operating policy.

For the environmental assessment, the maximum and minimum likely usage for each runway and runway direction was estimated and the noise impact of each case calculated. The actual impact would then lie between these values and would depend on the operating policy which is applicable at the time.

The three airport operation scenarios were adopted for the environmental assessment, namely:

- *Airport Operation 1* shown in *Figure 1.3*. Aircraft movements would occur on the parallel runways in one specified direction (arbitrarily chosen to be the direction closest to north), unless this is not possible due to meteorological conditions. That is, take offs would occur to the north from the parallel runways and aircraft landing would approach from the south, travelling in a northerly direction. Second priority is given to operations in the other direction on the parallel runways, with operations on the cross wind runway occurring only when required because of meteorological conditions;

- *Airport Operation 2* shown in *Figure 1.4*. As for Operation 1, but with the preferred direction of movements on the parallel runways reversed, that is to the south; and

- *Airport Operation 3*. Deliberate implementation of a *noise sharing* policy under which seven percent of movements are directed to occur on the cross wind runway (equal numbers in each direction) with the remainder distributed equally between the two parallel runway directions.

Since a cross wind runway is not proposed at Badgerys Creek Option A, only Operations 1 and 2 were considered for that option.

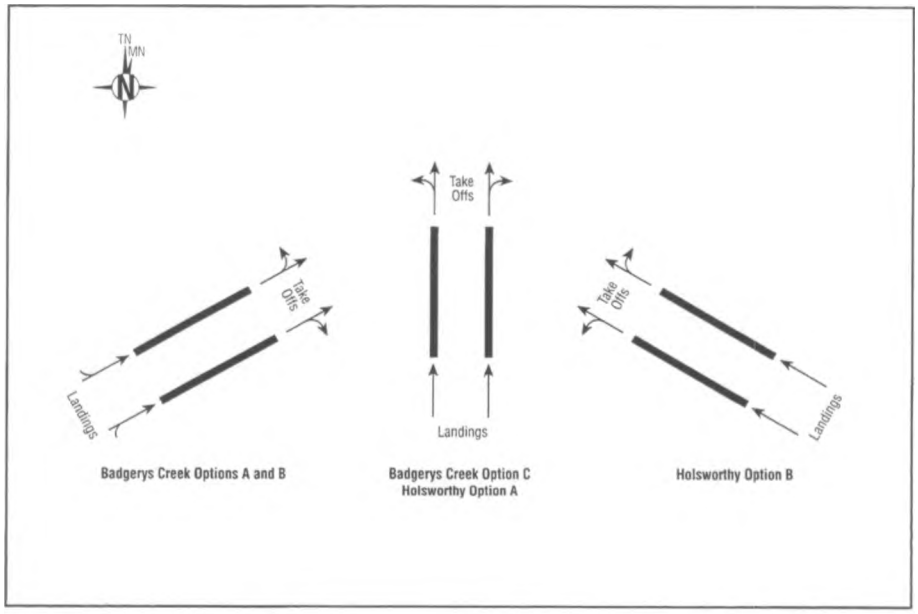


Figure 1.3

Predominant Directions of Movement of Aircraft for Airport Operation 1

Note: Cross wind runway used only when required because of meteorological conditions

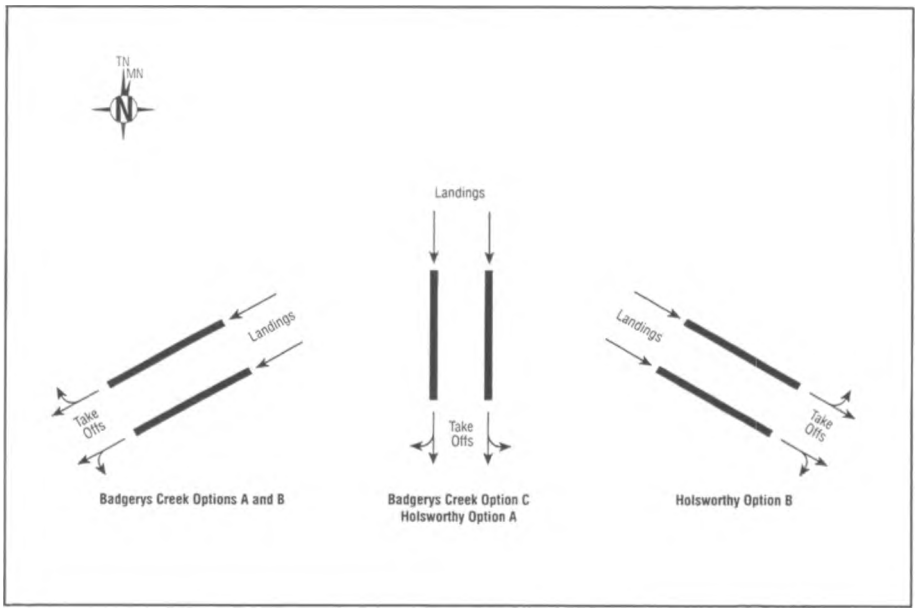


Figure 1.4

Predominant Directions of Movement of Aircraft for Airport Operation 2

Note: Cross wind runway used only when required because of meteorological conditions

CHAPTER 2 CONSULTATION

Preparation of this Draft EIS involved consultation with the community, other stakeholders, Commonwealth, State and local Governments and Government agencies.

2.1 COMMUNITY CONSULTATION

The primary role of the consultation process during the preparation of the Draft EIS was to provide accurate, up to date information on the proposals being considered and the assessment process being undertaken. From October 1996 to May 1997, ten separate information documents were released and over 400,000 copies distributed to the community. Four types of display posters were produced and 700 copies distributed. Over 140 advertisements were placed in metropolitan and local newspapers. Non English language documents were produced in 14 languages and over 20,000 copies distributed. Advertisements in seven languages were placed on ethnic radio.

Opportunities for direct contact and two way exchange of information with the community occurred through meetings, information days, displays at shopping centres, telephone conversations and by responding to written submissions. Through these activities over 20,000 members of the community directly participated in the consultation activities.

Written and telephone submissions received were incorporated into a database which grouped the issues in the same way as the chapters of the Draft EIS. The issues raised were progressively provided to the EIS study team to ensure that community input was an integral part of the assessment process.

Further details of consultation with the community and other stakeholders and its outcomes are contained in *Technical Paper No. 1 Consultation*.

2.2 OTHER CONSULTATION

The following organisations and government agencies were consulted in the process of obtaining background information for this study:

- Australian Heritage Commission;
- National Trust of Australia (NSW);

- Department of Urban Affairs and Planning; and
- Federal Airports Corporation.

The Australian Heritage Commission was consulted regarding the potential listing of items on the National Estate. The National Trust of Australia (NSW) provided details regarding the registration of Holsworthy Military Area as a Landscape Conservation Area. The Department of Urban Affairs and Planning provided advice on visual assessment methodology and local planning issues associated with the airport sites. It also provided previous studies and planning documents relating to the study areas. Previous studies of the visual character of airports were provided by the Federal Airports Corporation.

CHAPTER 3 METHODOLOGY

3.1 AIMS AND SCOPE OF WORK

This technical paper seeks to achieve the following with respect to a landscape and visual assessment for the proposals at Badgerys Creek and Holsworthy Military Area:

- to describe the existing landscape and visual quality of each of the sites;
- to analyse the landscape and visual impacts of the construction of an airport on each of the sites; and
- to propose appropriate mitigation measures to minimise the landscape and visual impacts.

A number of techniques were examined for their applicability to this study. These techniques are generally based on a very early United States Forestry Department methodology. This process analyses the landscape, classifies it into a number of 'landscape units' and then assigns a relative value of visual quality to each landscape unit. A similar technique was used for the *Second Sydney Airport Site Selection Program Draft Environmental Impact Statement* (Kinhill Stearns, 1985).

An assessment methodology based on this approach is not applicable to this study since the majority of 'landscape units' within the sites under consideration will be totally modified by the construction of an airport. Also, this approach does not adequately describe the visual impact of an airport relative to the surrounding landscape and land use.

A more relevant landscape site analysis methodology was adopted for the landscape and visual assessment component of this study. Essentially there are three phases to the procedure as described below.

Description of Existing Landscape and Visual Quality

- the existing landscape of the site and its surroundings/context are described in terms of its topography, vegetation and land use patterns;
- from this information, views into the site that would be affected by the construction of an airport are identified and mapped; and
- the level of visual sensitivity and sensitivity to change of each site are then assessed.

Landscape and visual sensitivity relates to the ability of a landscape or site to absorb change. The degree of sensitivity is a measure of how any change would impact on existing landscape and visual quality. A low level of sensitivity indicates that change could be readily absorbed whereas a high level indicates that change would result in substantial alteration to existing conditions.

Analysis of Potential Impacts

- potential impacts of the various options on each site for the construction phase and the operational phase of the development are identified. Landscape and visual impacts are described separately. Landscape impacts are those that change the general fabric and pattern of the existing landscape and its component parts, such as landform modification, vegetation removal and modification of existing drainage patterns all of which combine to give a 'place' or 'area' its particular landscape quality. Visual impacts relate solely to alterations to views of the site or viewing opportunities directly resulting from the airport development;

- from the available information the likely magnitude of the potential impacts is estimated; and

- the significance of the various impacts is assessed.

Determination of Appropriate Mitigation Measures

- strategies and techniques for reducing the potential landscape and visual impacts are determined; and

- procedures are developed for monitoring landscape and visual impacts and any following mitigation measures throughout the construction and establishment phase of the development. This serves to compare the actual impacts in relation to predicted impacts and the determined effectiveness of any proposed mitigation measures.

3.2 INFORMATION SOURCES

Much of the data relating to the existing site conditions for the sites of the Badgerys Creek Airport options was obtained from the *South Creek Valley Regional Environmental Study*, (Department of Planning, 1991a) and the *Second Sydney Airport Site Selection Program Draft Environmental Impact Statement* (Kinhill Stearns, 1985). The data was checked against topographic maps, 1994 aerial photographs, current land use maps and by site investigation

and updated as required. Additional sources of information included the following:

- 1:25,000 scale topographic maps (Department of Land and Water Conservation); and
- Soil Landscapes of Penrith 1:100,000 Sheet - (Bannerman & Hazelton, 1990).

Similarly for Holsworthy Military Area, information on existing site conditions was obtained from AXIS Environmental/Australian Museum Business Services Consulting (1995). The data was checked against topographic maps, 1994 aerial photographs, current land use maps and by site investigation and updated as required. Additional sources of information included the following:

- Holsworthy Landscape Conservation Area Listing (National Trust, 1996);
- 1:100,000 scale topographic maps (Department of Land and Water Conservation);
- 1:50,000 scale topographic maps (Royal Australian Survey Corps);
- Macarthur Regional Environmental Study (Department of Environment and Planning, 1986); and
- Soil Landscapes of Wollongong 1:100 000 Sheet (Soil Conservation Service of NSW).

3.3 REVIEW OF PREVIOUS WORK

In relation to the sites of the Badgerys Creek Airport Options, a landscape and visual quality assessment was undertaken as part of the *Second Sydney Airport Site Selection Program Draft Environmental Impact Statement* (Kinhill Stearns, 1985). This study described the existing site conditions and gave a description of the landscape character of the site based on existing topographic features. It also provided an assessment of the visual qualities of the site based on views from five selected viewing points within the site. The study concluded that:

> 'From the information in *Table 10.6.1* (Landscape Character of the Proposed Site) and the analysis of the landscape from the selected viewing points, it is apparent that the proposed site does not contain large areas of significant or prominent features that can be seen from public roads in the area. The only relatively

> distinctive feature - the ridge feature extending south-east from the village of Luddenham - would not be classified as distinctive when compared with the adjacent mountain landscape features further to the west.' (Kinhill Stearns, 1985).

In subsequent submissions received regarding that EIS concerns were expressed regarding the detrimental impact the airport construction would have on the existing rural character of the area and also that the visual quality of the Badgerys Creek area had been underestimated.

In 1991 the then Department of Planning prepared the *South Creek Valley Draft Regional Environmental Study* (Department of Planning, 1991a). The Department study offers a general description of the landscape and visual character of the valley. The following is an extract from the study:

> 'Essentially, the South Creek Valley Sector is a rural area. Its present character largely reflects this underlying landscape structure and may be divided into the following four main categories:
>
> - watershed ridgelines;
> - upper catchment hills;
> - undulating valley side slopes; and
> - valley floor and creekbeds.
>
> There are two anomalies within this broad structure:
>
> - the steep-sided linear ridge formed by the basaltic intrusion of the Luddenham Dyke west of Badgerys Creek; and
> - the linear, steep-sided ridge along the west side of the large dam on South Creek near its junction with Badgerys Creek.'

In addition to this general overview the Department study also identifies areas and items of environmental heritage and landscape significance, these are discussed in *Chapter 4*.

In relation to the potential airport sites within the Holsworthy Military Area, the *Holsworthy Training Area Environmental Audit, Main Report*, (AXIS Environmental/Australian Museum Business Services Consulting, 1995)

provides an inventory of the existing physical environment but does not offer any assessment of existing landscape or visual quality.

The Holsworthy Military Area lies within the 'Macarthur Region'. In 1986 the then Department of Environment and Planning prepared a Regional Environmental Study which included an environmental heritage and landscape assessment of the region. In this assessment the Holsworthy Military Area falls within an area considered to be of high scenic value and categorised as being an area with significant natural features within a natural setting.

The National Trust of Australia (NSW) has also studied the site and has listed it as a Landscape Conservation Area. This is discussed in more detail in *Chapter 4*.

The Australian Heritage Commission has also studied the site and has included the Military Camp at the northern end of the site on The Interim List of the Register of the National Estate. On 24 July 1997, the Australian Heritage Commission decided to place the 18,000 hectare Holsworthy Military Area on the Interim List of the Register of the National Estate. It is to be described in the Register as the Cubbitch Barta National Estate Area.

3.4 SITE INVESTIGATIONS

Site investigations for this technical paper involved inspecting each site and the surrounding areas to record existing conditions by way of photographic records with supplementary annotations. Inspections within the site boundaries were undertaken by traversing the site by vehicle on existing roads and tracks and also on foot where possible. Surrounding areas were investigated to establish areas and locations from which each site can be seen. Initially, topographic maps and aerial photographs were examined to determine areas and locations from which the site may be visible, each of these locations was subsequently visited to confirm the degree of site visibility.

Part B

Existing Environment

CHAPTER 4 EXISTING ENVIRONMENT

4.1 BADGERYS CREEK SITES

4.1.1 CONTEXT

The sites of the Badgerys Creek airport options are located in western Sydney and within the local government area of Liverpool City Council. The sites are is part of the larger South Creek valley of which Badgerys Creek is a tributary. The Nepean River is approximately twelve kilometres to the west and the Blue Mountains National Park and Warragamba Dam another six to eight kilometres further west. The town centre of Penrith is approximately twelve kilometres to the north of Badgerys Creek. The site falls within the broad geographical region of the Cumberland Plain. The site and its surroundings are essentially open pasturelands and rural residential areas.

4.1.2 TOPOGRAPHY

The sites of the Badgerys Creek Airport options are located in a transitional landscape zone between the relatively flat Cumberland Plain and the footslopes that rise to the Blue Mountains. There is approximately 40 metres range in elevation within the site; from a high point close to The Northern Road of approximately 107 metres to a low point along Badgerys Creek of approximately 70 metres.

The topography of the site is gently undulating with broad rounded crests and ridges (200-600 metres). The major ridge lines occur along The Northern Road and perpendicular to it, in the western part of the site. These ridges offer views into the site and beyond. Other viewing points into the site exist to the north and east of the site. Long distance views to the site would also exist from the foothills of the Blue Mountains. The lower and flatter parts of the site occur in the eastern portion around Badgerys and Thompsons Creeks (refer to *Figure 4.1*). Slopes are predominately five percent or less with some slopes five to 10 percent and a very small percentage 10 to 20 percent (Bannerman et al 1990).

The existing landscape of the sites and the general environs is typical of the larger South Creek valley area, being essentially rural in character and having parkland qualities. These characteristics result from the combination of gently undulating terrain, creeklines, cleared pastureland and scattered groupings of trees. This landscape type is well represented in the region and therefore is not considered significant in regional terms.

4.1.3 VEGETATION TYPES

Approximately 90 percent of the vegetation cover of the site consists primarily of cleared pastures and grasslands with the balance comprising small clusters of remnant/regrowth woodland and cleared/scattered woodland and shrubland. Much of the land has been cleared for agriculture and rural residential development since the early days of settlement. Existing stands have been greatly modified by fire, clearing, cultivation and weed infestation resulting in the loss of many plant species (Department of Planning, 1991a).

As a consequence of this extensive clearing, views into the site tend to be quite open compared to the Holsworthy site.

The vegetation that does remain can be classified into four main groups (refer to *Figure 4.2*):

- Type 1 - Remnant Grey Box-Red Gum Woodland

  Some remnants of native vegetation on the site occur in woodland form (with a canopy of trees), indicating either that the area has never been cleared or, more usually, that it was cleared at some time in the past and there has been some regrowth. These remnant woodland areas are dominated by *Eucalyptus moluccana* (grey box) and *E. tereticornis* (forest red gum). Other occasionally occurring species include *E. amplifolia* (cabbage gum), *E. eugeniodes* (thin leaved stringy bark), and the ironbarks, *E. crebra and E. fibrosa* (Kinhill Stearns, 1985).

- Type 2 - Cleared areas - shrubland and grasslands

  On most of the site the tree canopy has been removed, although scattered individuals or clusters of the tree species mentioned in Type 1 remain. Generally the cleared areas contain introduced species but occasionally small native plants can be found, especially in ungrazed areas such as along margins of roads. Native species occurring in these areas include *Bursaria spinosa* (native blackthorn), *Dillwynia juniperina*, and one population of the rare pea-flowered shrub, *Pultenaea parviflora* (Kinhill Stearns, 1985).

- Type 3 - Riverine

  This vegetation type generally consists of *Casuarina glauca, Melaleuca stypheloides, M. linarifolia* and *Eucalyptus amplifolia* (Department of Planning, 1991a).

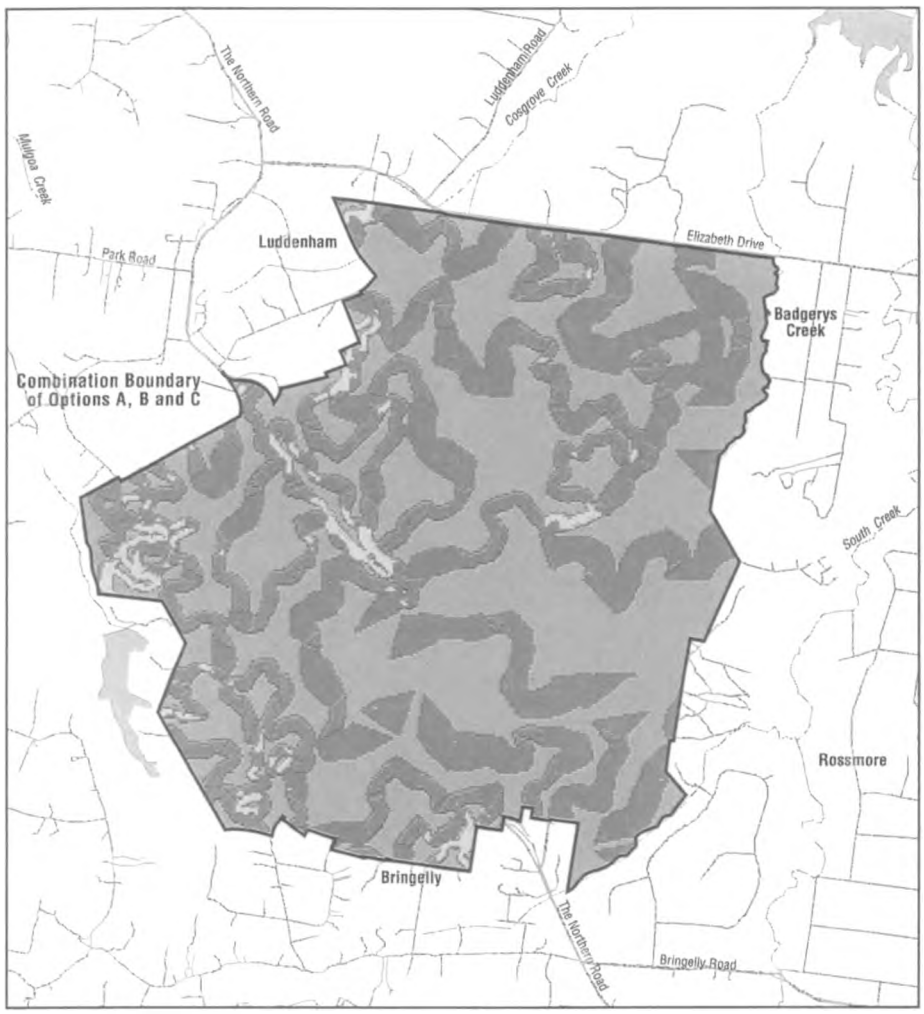
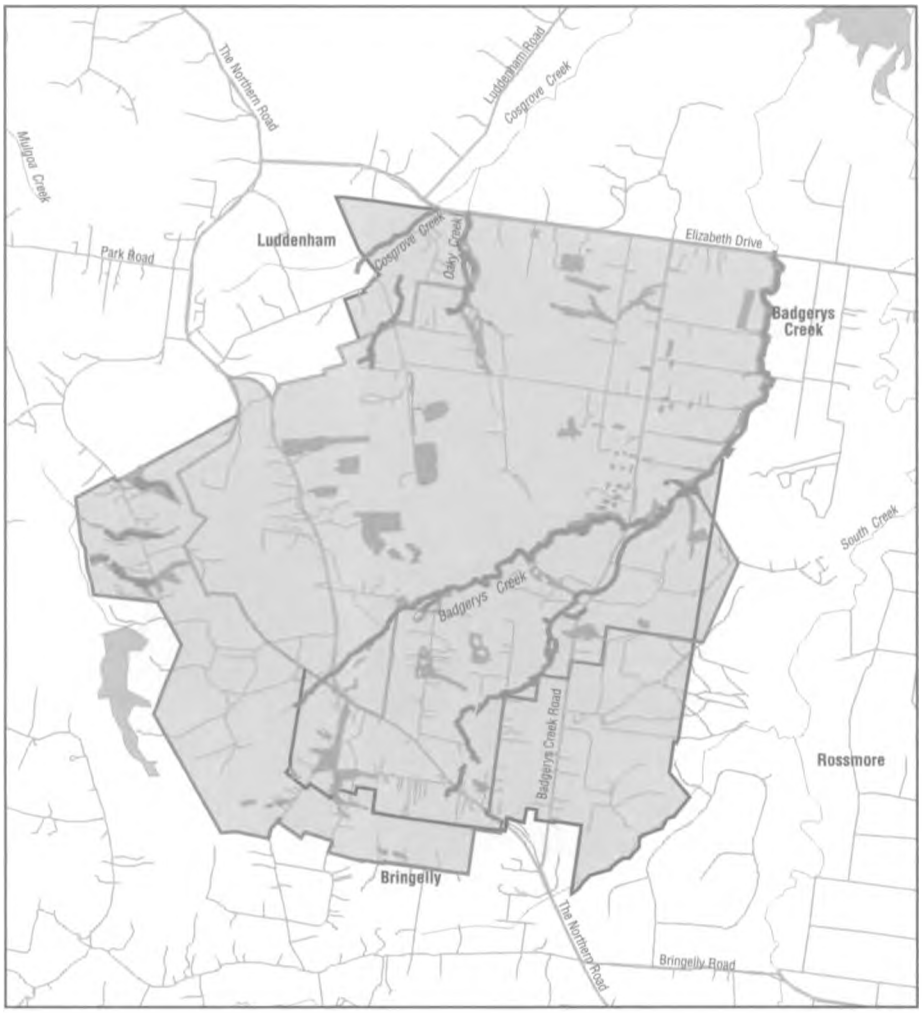


Figure 4.1

Topography of the Badgerys Creek Airport Sites



Boundary of airport option A
Boundary of airport option B
Boundary of airport option C
Grey Box Woodland
River-Flat Forest/Freshwater River Swamps

Figure 4.2

Native Vegetation Within Badgerys Creek Airport Sites

- Type 4 - Pastures

  Pastures consist of mostly introduced grasses, with occasional trees and shrubs, some native and some exotic. Some pasture areas are showing signs of regeneration after the cessation of grazing. (Department of Planning, 1991a).

4.1.4 EXISTING LAND USES

The existing land uses, within and surrounding the site include:

- agricultural - both pastoral and intensive;
- villages;
- rural residential;
- special uses - radio towers and radio telescopes;
- intensive agriculture/rural residential; and
- cemetery.

4.1.5 LANDSCAPE CHARACTER

The existing landscape is typical of the broader region of the Cumberland Plain, that being of gently undulating landform typical of the underlying Wianamatta Shale geology with scattered groupings of trees throughout cleared pastureland and numerous creeks and small farm dams. There are no dramatic features or elements in the landscape, it is essentially open and rural in character with no significant changes in scenery, but still offers a subtle variety of visual experiences ranging from shorter and contained views in the lower valley areas to more open and expansive views from higher ridge areas.

4.1.6 AREAS OF LANDSCAPE SIGNIFICANCE

The *South Creek Valley Regional Environmental Study* (Department of Planning, 1991a) identified and mapped various items of 'Environmental Heritage' and 'Significant Landscapes'. The items of Environmental Heritage are listed in Schedules 1-4 of the *South Creek Valley Draft Regional Environmental Plan* (Department of Planning, 1991b). Areas and items of landscape significance are listed in the Regional Environmental Study.

Items of Environmental Heritage listed in the schedule which lie within the site or nearby are listed below.

Schedule 1 - Items of State Significance

- 'Kelvin Park' group: main building, domestic outbuildings, coach house, farm buildings, setting and garden. Kelvin Park Road, Bringelly; and
- Fleurs Radio Telescope site, Badgerys Creek.

Schedule 2 - Items of Regional Significance

- Overseas Telecommunications Housing group, Badgerys Creek Road, Bringelly; and
- 'Evergreen', Derwent St, Bringelly.

Schedule 3 - Items of Local Significance

- 'St Albans', The Northern Road, Bringelly; and
- Cemetery and trees, St James Church, The Northern Road, Luddenham.

Areas and Items of Landscape Significance listed in the study which lie within the site, or nearby, are listed below.

Creekside Vegetation

- Badgerys Creek.

Roadside Vegetation

- Elizabeth Drive (two locations);
- Badgerys Creek Road (two locations);
- Lawson Road; and
- Sales Park, Luddenham.

Scenic Landscapes

- McMasters Field Station, Elizabeth Drive.

The Australian Heritage Commission has advised that the historic site called 'Kelvin, Outbuildings and Curtilage', Kelvin Park Road, Bringelly is included in the Register of The National Estate. A copy of the *Place Report* (Australian

Heritage Commission, 1996) for the listing is contained in *Appendix A*. The Commission also advised that the Overseas Telecommunications historical site at Badgerys Creek Road, Bringelly, is currently entered as an 'indicative place' on the Register of the National Estate data base and is under assessment for possible inclusion on the Register.

4.2 HOLSWORTHY MILITARY AREA

4.2.1 CONTEXT

The sites for the Holsworthy airport options occur within the Holsworthy Military Area in south-western Sydney. The Holsworthy Military Area is bounded by the Georges River in the west and by Heathcote Road, Woronora River and Heathcote National Park in the east. To the south the Military Area adjoins Lake Woronora and its catchment area and the Dharawal State Recreation Area. The site of Option A occurs roughly in the centre of the Military Area immediately north of Lake Woronora. Lucas Heights, Engadine and Heathcote are approximately four to five kilometres to the east of the site and Kentlyn and Minto Heights are approximately four to five kilometres to the west of the site. The site of Option B is located at the very southern end of the Military Area adjoining the Dharawal State Recreation Area. Wedderburn lies approximately two to three kilometres to the west of the site.

4.2.2 TOPOGRAPHY

The site forms part of the Woronora Plateau and is bounded to the west by the Georges River and to the east by Heathcote National Park. The topography is made up of three terrain types/soil landscapes; the Blacktown grouping, the Lucas Heights grouping and the Hawkesbury grouping (Bannerman and Hazelton, 1990).

The Blacktown grouping covers a relatively small area in the north of the site. The topography in this area is gently undulating with local relief to 30 metres. Slopes are usually less than five percent with broad rounded crests and ridges.

The remainder of the site is characterised by the Lucas Heights and Hawkesbury groupings.

The topography of the Lucas Heights grouping is gently undulating crests and ridges on plateau surfaces of the Mittagong Formation. Local relief is to 30 metres with slopes less than 10 percent.

The topography of the Hawkesbury grouping is in stark contrast to the other site groupings. The topography is rugged, rolling to very steep hills on Hawkesbury sandstone. Local relief is 40 to 200 metres with slopes greater

than 25 percent. It is also characterised by narrow crests and ridges, narrow incised valleys, steep sideslopes with rocky benches, broken scarps and boulders (refer *Figure 4.3*).

As a result of the elevated plateau nature of the site views into it are quite restricted. Views into the northern part of the site can be gained from Engadine/Lucas Heights and occasional views into the south-east corner can be gained from the South Western Freeway. Views from the other residential areas are impeded by topography.

4.2.3 VEGETATION TYPES

The Holsworthy Military Area comprises over 15,000 hectares of bushland, which consists mainly of woodland and heath vegetation on the elevated ridge areas of the site and forest vegetation in the gullies and the lower areas in the north. The woodland is mainly on Hawkesbury sandstone, though there is considerable shale and tertiary alluvium in the north-west (AXIS Environmental/Australian Museum Business Services Consulting, 1995). Part of the site has also been cleared for military uses. Views into the site from most locations are limited by the dense nature of the vegetation and topography.

The dense nature of the vegetation and the topography limits views into the site as previously outlined. The vegetative cover of the site can be classified into three main groups (AXIS Environmental/Australian Museum Business Services Consulting, 1995) (refer to *Figure 4.4*):

- Type 1 - Woodland/Heath and Heath Complex

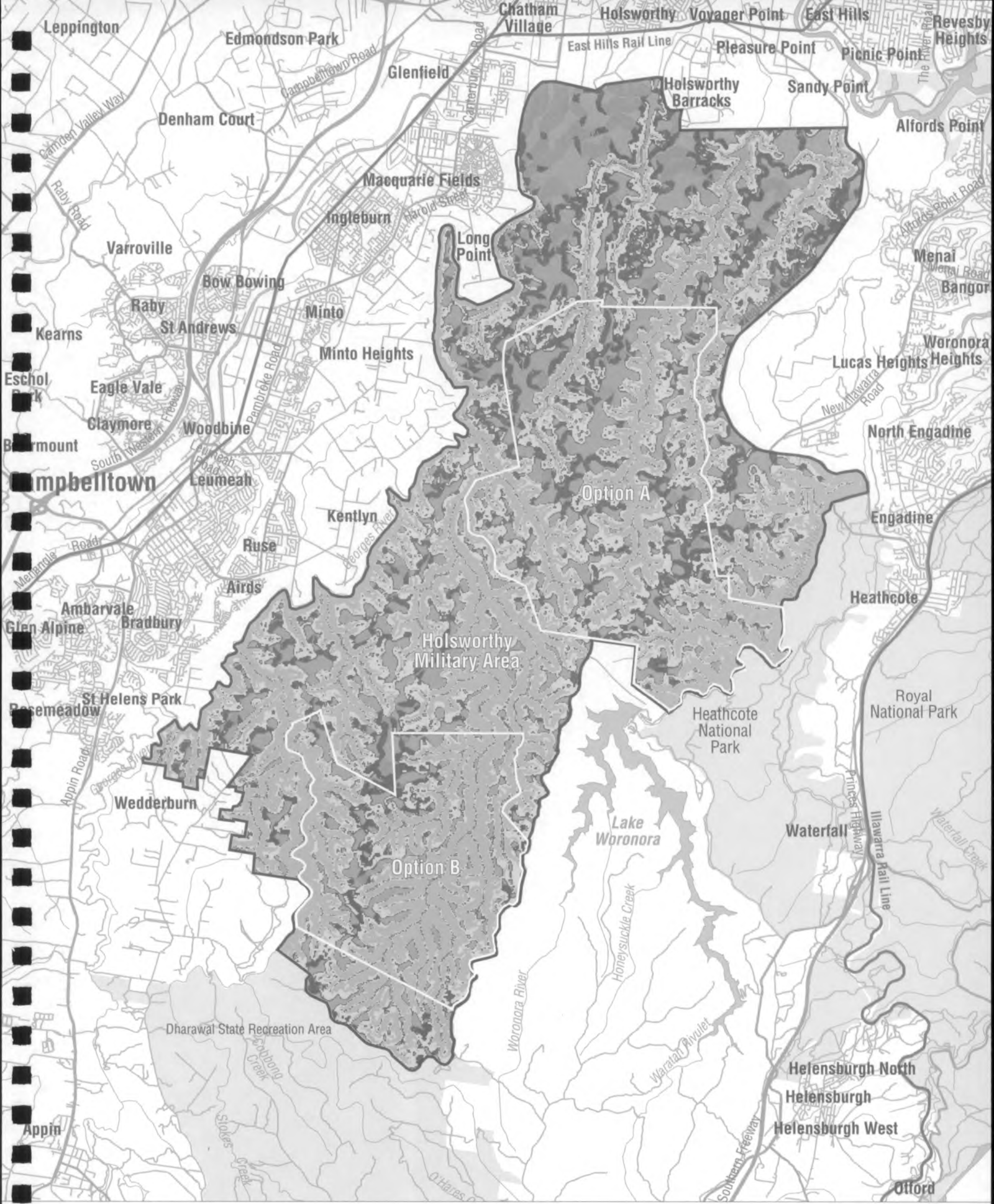
  This vegetation group covers approximately 51 percent of the site and occurs along most of the sandstone ridges in the southern area with some ridges extending into the central and western parts of the site.

- Type 2 - Plateau and Gully Forest

  This vegetation group covers approximately 48 percent of the site and occurs in the north-western corner, along the length of the Georges River, and in most major gullies predominantly in the southern part of the site.

- Type 3 - Cleared/Grassed Areas

  Less than one percent of the site has been cleared, mainly occurring in the north of the site at the firing ranges and airfield.



0-2% Slopes
2-5% Slopes
5-10% Slopes
10-20% Slopes
>20% Slopes

TN
MN

0Km 5Km

Figure 4.3

Slope Classes within Holsworthy Military Area

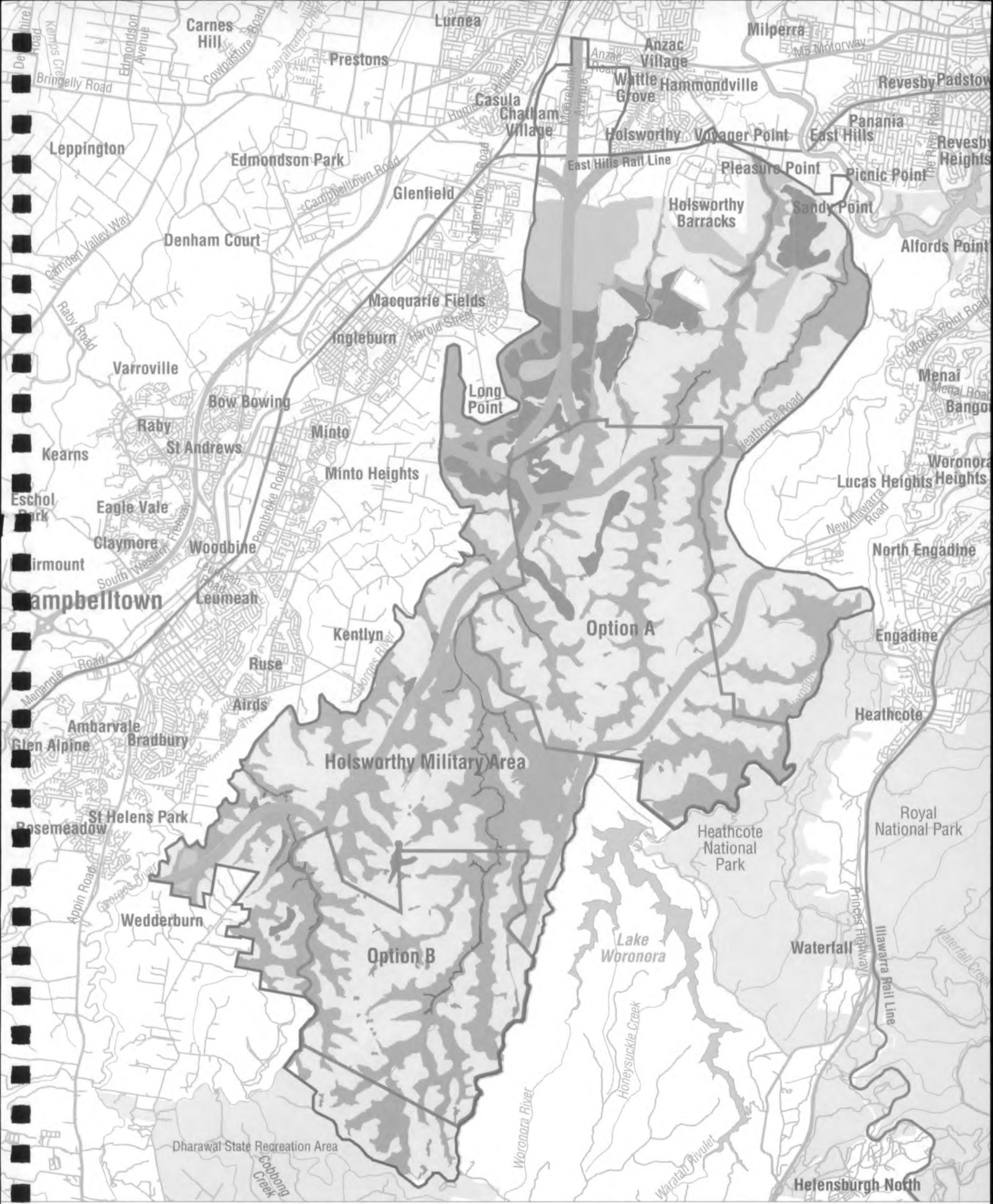


Figure 4.4

Native Vegetation within Holsworthy Military Area

Types 1 and 2 can be broken down further into vegetation communities and species (refer *Technical Paper No. 8 - Flora and Fauna*).

4.2.4 EXISTING LAND USES

In contrast to the sites of the Badgerys Creek Airport options there is only one land use within the Holsworthy Military Area, this being a range for military training purposes. The contextual land uses surrounding the Holsworthy Military Area include residential areas at Engadine, Lucas Heights, Macquarie Fields, Ingleburn, Campbelltown, Wedderburn and Helensburgh, catchment areas of Woronora River and O'Hares Creek, and the Heathcote National Park.

Views from residential areas into the site are possible from Engadine and Lucas Heights, however, views from the remainder of the residential areas are impeded by topography and vegetation.

4.2.5 LANDSCAPE CHARACTER

The Holsworthy Military Area is typical of a Sydney sandstone landscape, being characterised by exposed narrow crests and ridges, deep and narrow incised valleys and steep sideslopes with rocky benches and broken scarps. The vegetation cover of the site directly reflects the underlying geology and terrain, available soil depths and microclimate conditions. Crests and ridges tend to be elevated and exposed and have dry shallow soils supporting predominantly heath vegetation. From these elevated areas expansive views over the site are available. Some areas of deeper soil on ridges and slopes support woodland vegetation and on lower slopes where soils are deeper and moister taller forest vegetation occurs. On sideslopes views tend to be cross valley and essentially become more contained and enclosed on lower slopes and valley floors.

When viewed from outside the site the Holsworthy Military Area appears as essentially a wilderness, extending to the horizon, of heavily vegetated plateaus dissected with steep sideslopes and valleys. The actual airport site areas or boundaries are not discernible from the adjoining expanses of the Woronora Plateau.

4.2.6 AREAS OF LANDSCAPE SIGNIFICANCE

The Holsworthy Military Area has been listed by the National Trust of Australia (NSW) as a 'Landscape Conservation Area'. A copy of the listing is contained in *Appendix B*. In the northern part of the site the Old Army/Internment Camp Group has been included by the Australian Heritage Commission on the Interim List of the Register of the National Estate. A copy of the place report is contained in *Appendix C*.

The entire Holsworthy Military Area has recently been listed on the Interim Register of the National Estate. It is to be described in the Register as the Cubbitch Barta National Estate area. A copy of the Statement of Significance is contained in *Appendix D* for reference.

Landscape of the Holsworthy Military Area has regional significance. Urban bushland is an ever decreasing resource in Sydney. Most of Sydney's bushland occurs in the north on the Hornsby Plateau and in the south on the Woronora Plateau, which includes the Holsworthy Military Area. These areas are significant in terms of their size, coverage, condition and quality, and as records of Sydney's natural and cultural heritage.

In the central and western parts of the region only small remnants of original vegetation remain. Consequently these remaining large tracts of bushland to the south and north of Sydney are of great significance to the entire Sydney region. Much of the remnant bushland in Sydney is of a degraded condition. The areas to the south and the north are significant in terms of their size and coverage, their ecological authenticity and as records of Sydney's natural and cultural heritage.

The landscape significance of the reserve is described at length in the National Trust listing. The key elements of this listing are:

- importance in the evolution of Australia flora and landscape;
- importance in maintaining existing processes or natural systems at the regional or national scale;
- importance in the course, or pattern, of Australia's cultural history;
- importance for association with events, developments or cultural phases which have had a significant role in the human occupation and evolution of the nation, State, Region or community;
- importance for rare, endangered or uncommon flora, fauna, communities, ecosystems, natural landscapes or phenomena, or as wilderness;
- importance in demonstrating a distinctive way of life, custom, process, land use, function or design no longer practiced, in danger of being lost, or of exceptional interest;
- importance for information contributing to a wider understanding of the history of human occupation of Australia;

- importance as a place highly valued by a community for reasons of religious, spiritual, symbolic, cultural, educational or social associations; and

- importance for close associations with individuals whose activities have been significant within the history of the nation, State or region.

CHAPTER 5 RESULTS OF SURVEYS

5.1 BADGERYS CREEK SITES

5.1.1 SITE VISIBILITY

The existing road network through and around the site provides the major opportunities for the general public to view the site. The existing landform and vegetation patterns, which give the site and its surroundings its gently undulating rural character, are the primary controlling factors in determining site visibility. From the existing road network, views into the site have a general viewing range from zero to four kilometres.

There are four primary viewing opportunities offered by the existing road network, these being The Northern Road, Elizabeth Drive, Badgerys Creek Road and Lawson Road.

The Northern Road

The Northern Road in the north-western sector of the site offers the most expansive views over the site, in an easterly direction, where the road runs along the main north-south ridge in the vicinity of Luddenham and the intersection with Elizabeth Drive. The site falls away from this ridge in a north-easterly direction towards Elizabeth Drive in the north and Badgerys Creek in the east. Further to the south along The Northern Road only a small portion of the site is visible from the road, site visibility is generally restricted by landform and vegetation.

Elizabeth Drive

Elizabeth Drive runs in an east-west direction forming the northern boundary to the airport site, approximately three kilometres in length. Site visibility is high along this boundary with expansive views into the site possible for almost the entire length.

The viewing position along this edge is generally lower than the site areas being viewed. Consequently, site areas form virtually the entire view from this edge with the main north-south ridge in the western portion of the site and existing vegetation patterns forming the skyline.

Badgerys Creek Road

Badgerys Creek Road runs in a north-south direction across the eastern portion of the site linking The Northern Road with Elizabeth Drive.

In the southern section site visibility is restricted by the existing landform and vegetation patterns along Badgerys Creek.

On the northern side of Badgerys Creek larger areas of the site become visible.

Lawson Road

Lawson Road runs off Elizabeth Drive to the east of Badgerys Creek in a north-south direction along the shallow crest separating Badgerys Creek from South Creek.

The north-eastern portion of the site is visible from Lawson Road and the properties along it. The view into the site is partly restricted by the vegetation along Badgerys Creek.

5.1.2 LANDSCAPE AND VISUAL SENSITIVITY

The existing landscape of the site and its environs is the result of extensive clearing for agriculture. As such it can be considered a landscape which has already been highly modified from its woodland origins. In relation to the Badgerys Creek options the ability to absorb change, in visual quality terms is dependent upon sufficient peripheral site areas being available around the core development area for the creation of new landscape environments. On this basis, it could be considered that, in visual terms the level of sensitivity is low. This is because there are sufficient land areas around each of the options to develop new landscape environments of a similar scale and character. The existing landscape character of undulating landform and scattered vegetation patterns can be reproduced and, more importantly, enhanced. However, some of its component parts may be considered as sensitive to change.

The most important of these is the existing creek system. For Option A, Badgerys Creek is shown as undisturbed, whereas Options B and C dramatically impact upon Badgerys Creek. Potential changes in water quality and quantity related to the airport development would be likely to impact on the creekline visual environment, not only on the section of the creek that traverses the site, but potentially downstream where it joins South Creek.

Other landscape components are the remaining fragments of Cumberland Plain Woodland vegetation on the site and the areas of landscape significance and environmental heritage as identified in the 1991 *South Creek Valley Draft Regional Environmental Study* (Department of Planning, 1991a). In relation to the remaining vegetation, there are better and more substantial remnants elsewhere in the region, however there is some sensitivity to losing vegetation in a region which has already been substantially cleared and modified. Cumberland Plain Woodland vegetation is now poorly represented in the region (Benson and Howell, 1990).

5.2 HOLSWORTHY MILITARY AREA

5.2.1 SITE VISIBILITY

The Holsworthy Military Area is not publicly accessible due to its current land use as a military reserve. The elevated nature of the site generally restricts views into it, however the western margins of the Holsworthy Military Area are partially visible from the residential areas of Campbelltown adjoining the Georges River. These views do not extend to either of the airport sites within the Military Area as dense vegetation and rising landform restrict the view.

To the east the margins of the Military Area are visible from Heathcote Road where it forms part of the eastern boundary of the site and also from the residential areas of Lucas Heights, Engadine and Heathcote. The site of Option B is not visible from these areas but Option A is visible from these areas, with viewing distances in the order of four to five kilometres. Further to the south occasional glimpses of the south-eastern portion are likely from the Southern Freeway given that segments of the freeway are visible from the site of the southern option, however these would be long distance views in the order of eight to 10 kilometres and would only be momentary.

5.2.2 LANDSCAPE AND VISUAL SENSITIVITY

In terms of landscape sensitivity both airport sites within the Holsworthy Military Area could be considered to be highly sensitive to change. The development of an airport at either of these sites would involve the complete elimination of the existing landscape. Restriction of public access to the Holsworthy Military Area has permitted much of the existing landscape to remain in almost pristine condition, with the exception of access tracks, firing range areas and other areas affected by military activities. The value of the existing landscape at Holsworthy has been assessed by the National Trust of Australia (NSW) and it has been listed as a Landscape Conservation Area. The Statement of Significance associated with this listing describes the various attributes of the site which led to the Trust's nomination as a Landscape Conservation Area. A copy of the Statement of Significance is contained in *Appendix B*. Some of the attributes listed are:

- 'Importance in maintaining existing processes or natural systems at the regional or national scale.

  The Holsworthy area contains populations of Koala, Quoll and Grey Kangaroo which are becoming rare and likely to become extinct in the Sydney Basin with continuing development pressures. The restricted access to the Holsworthy site since 1912 has allowed the area to become a refuge for these species and a wildlife corridor between the adjoining National Parks and Nature Reserves, a source for the

establishment of populations following fire and a valuable area for study of these remnant fauna populations to determine strategies for reintroduction programmes.

- Possession of uncommon, rare or endangered aspects of Australia's natural or cultural history.

  The area contains a large (1,650 hectare) remnant of Cumberland Plain Woodland. This community is being listed under the NSW Endangered species legislation as an endangered community. The area also contains a number of plant species which are rare or endangered on a national basis.

- Potential to yield information that will contribute to an understanding of Australia's natural or cultural history.

  The area is known to contain at least 420 Aboriginal sites, practically all of which are above surface art works or markings. The presence of the firing range since 1912 has restricted public access and urban development and it is to be expected that those portions of the area not previously disturbed by European nineteenth century settlers will yield considerable Aboriginal archaeological evidence contributing to a wider understanding of the occupation of the coastal Aboriginal peoples'.

In terms of visual sensitivity in relation to existing site visibility, the site of Option B is anticipated to be visible only momentarily and from a long distance from the Southern Freeway. Consequently it can be considered to be of low visual sensitivity.

The site of Option A is potentially visible from Lucas Heights, Engadine and Heathcote and from Heathcote Road.

The existing view is of completely vegetated terrain. Given that the airport development involves extensive modification to the existing landscape by way of clearing existing vegetation and terrain alteration it is likely that the view of this part of the site will be affected dramatically.

The magnitude and significance of the potential landscape and visual impacts are discussed in *Chapters 6* and *7*.

Part C

Assessment of Impacts

CHAPTER 6 IMPACTS OF BADGERYS CREEK OPTIONS

6.1 GENERALLY

Potential landscape and visual impacts for each option have been identified following detailed consideration of the various master plan drawings and the construction proposals. The information provided in these documents is of a broadscale conceptual planning nature. Consequently the potential impacts are identified and described in a similar level of detail. More detailed assessments of impacts would be required when detailed development plans are prepared.

The drawings used for this assessment are contained in Second Sydney Airport Planners (1997a) and (1997c):

- Master Plans (1:25,000) for Badgerys Creek Options A, B and C;
- Stage 1 Plans (1:25,000) for Badgerys Creek Options A, B and C;
- Master Plan Fencing and Clearing (1:25,000) Badgerys Creek Options A, B and C Stage 1 Fencing and Clearing (1:25,000) Badgerys Creek Options A, B and C;
- Land Acquisition (Badgerys Creek Options A, B and C and Holsworthy Options A and B;
- Runway Cross Sections;
- Runway Long Sections;
- Obstacle Limitation Surface/Cut Trees Master Plan (1:25,000) Badgerys Creek Options A, B and C; and
- Obstacle Limitation Surface/Cut Trees Stage 1 (1:25,000) Badgerys Creek Options A, B and C.

Potential landscape and visual impacts are described separately. Landscape impacts are those that change the general fabric and pattern of the existing landscape and its component parts. These basically include direct physical alterations such as landform modification, vegetation removal, modification of existing drainage patterns and removal or modification of specific natural or cultural elements, heritage items and the like, all of which combine to give a 'place' or 'area' its particular landscape quality. Visual impacts relate solely

to alterations to views of the site or viewing opportunities directly resulting from the airport development.

Potential impacts are described for both the construction phase and operational phase of the airport development. The estimated construction time for the airport is five years for the 'stage one' development phase and six years to achieve the ultimate master plan configuration.

The construction phase of the various airport development options is the most significant in terms of impact as virtually all of the impacts would occur during this phase.

In addition to the impacts described for each option there will also be a number of additional impacts that are related to the construction process but are not part of the finished development which are common to all options. These aspects are briefly described in the construction description and typically relate to such items as construction compounds, carparking areas, materials stockpile areas, erosion and sediment control procedures and the like.

As there is no information in relation to the location and extent of these various elements an assessment of any impact they may have is not possible. Nevertheless, given the scale and extent of the airport development it could be considered that these various construction related activities would not cause any significant additional impact, as most of the items could be located in areas that form part of the ultimate development, for example construction road access and carparking could be located on the designed entry road alignment and carpark areas.

6.2 BADGERYS CREEK OPTION A

6.2.1 CONSTRUCTION PHASE - LANDSCAPE IMPACTS

Option A comprises two parallel runways running in a north-east to south-west direction approximately 1,600 metres apart. The northern most runway is approximately 3,000 metres long and the southern most runway 4,000 metres long. The terminal, control tower and apron reserve areas are located between the runways. The associated airport support facilities and services such as fuel storage, freight terminals and maintenance areas are located at the north-eastern and south-western ends.

Topography

The first major impact is the modification to the existing undulating landform of broad crests and gentle slopes generally between Badgerys Creek in the

south-east and Cosgrove Creek in the north-west, arising from the formation of the basic airport platform for the runways, taxiways, terminal and apron reserve areas. This formation occupies just under 800 hectares (eight square kilometres) and is basically rectangular in shape with a north-east to south-west orientation being approximately four kilometres in length and 2.2 kilometres in width. It cuts through The Northern Road and the ridgeline in the western portion of the site resulting in cuts up to 16 metres deep and realignment of the road. The majority of the platform occurs on fill resulting in fill embankments in the order of four to seven metres high along the northern and southern margins and up to 12 metres high along the eastern margin.

Associated with this landform modification is the loss of the upper section of Oaky Creek and numerous other swale formations feeding Cosgrove and Badgerys Creeks.

Additional cutting would also be required to accommodate finished ground levels required for aircraft approach paths at the south-western end of each runway.

The Master Plan design drawings do not describe any landform modifications for the associated airport support facilities and services described on the drawings, however it can be expected that the development of these facilities will also require extensive landform modification. This includes the re-alignment of The Northern Road, upgrading of other roads, rail access services installations, stormwater detention ponds, fuel storage areas, airport maintenance facilities, freight terminals, fire training areas, navigational aids and airline support facilities.

Vegetation

The second major impact is the loss of existing vegetation. The site is primarily cleared pasture and grasslands, however there are some areas of remnant and/or regrowth woodland and scattered groupings of trees that are affected. This occurs primarily in the western, elevated portion of the site where virtually all of the existing vegetation would be cleared. In the lower north-eastern corner of the site most of the remaining vegetation would not be affected by the construction of the airport platform with the exception of minor losses associated with the establishment of obstacle limitation surface areas. However, the development of associated airport services, facilities and access roads in this area would impact on the remaining vegetation. The degree of impact cannot be determined from the available information, nevertheless, given that the remaining vegetation occurs in scattered groupings it may be possible to retain most of the vegetation in the subsequent development of facilities in these areas. The existing riverine vegetation along Badgerys Creek would remain intact.

Indirect Impacts

The impacts described above relate to direct and immediate physical impacts on the landscape and its various components. In addition to these direct impacts there are potential indirect impacts that may occur. These impacts relate primarily to the condition and quality of the remaining vegetation and general landscape environment along Badgerys Creek, Cosgrove Creek, Oaky Creek and ultimately South Creek. During the construction phase there would be an increased risk of erosion and sedimentation resulting from potential increases in stormwater run-off and sediments transported in stormwater flows during earthworks operations.

There would also be a potential impact on the vegetation remaining after initial site clearing operations. The quality and condition of this remaining vegetation could be affected by alterations in the stormwater drainage regime and by soil compaction which would result from unrestricted access over the site by earthmoving machinery and general construction traffic. The effects of these types of impacts would not be immediately apparent and may take a number of years to appear.

Areas of Landscape Significance

The development of Option A would not have any direct impact on any of the 'Areas of Landscape Significance' identified in the *South Creek Valley Regional Environmental Study* (Department of Planning, 1991a). However, two areas of listed remnant roadside vegetation along Elizabeth Drive may be impacted upon with any road widening or airport entry road development. Any subsequent development works should seek to preserve this remnant vegetation.

6.2.2 CONSTRUCTION PHASE - VISUAL IMPACTS

Major impacts during construction would result from modification of the existing undulating landform of broad crests and gentle slopes generally between Badgerys Creek in the south-east and Cosgroves Creek in the north-west, as a result of formation of the basic airport platform. Associated with this landform modification would be the loss of the upper section of Oaky Creek and numerous other swale formations feeding Cosgroves and Badgerys Creeks. The area in which the landform would be modified is shown in *Figure 6.1*. Also virtually all of the existing vegetation would be cleared from the western, elevated portion of the site.

The existing rural visual character of undulating cleared pasture land with a scattered vegetation cover over the site would be replaced by a large scale, flat industrial/commercial environment. Restricted views and viewing opportunities of the site are generally experienced from peripheral roads.

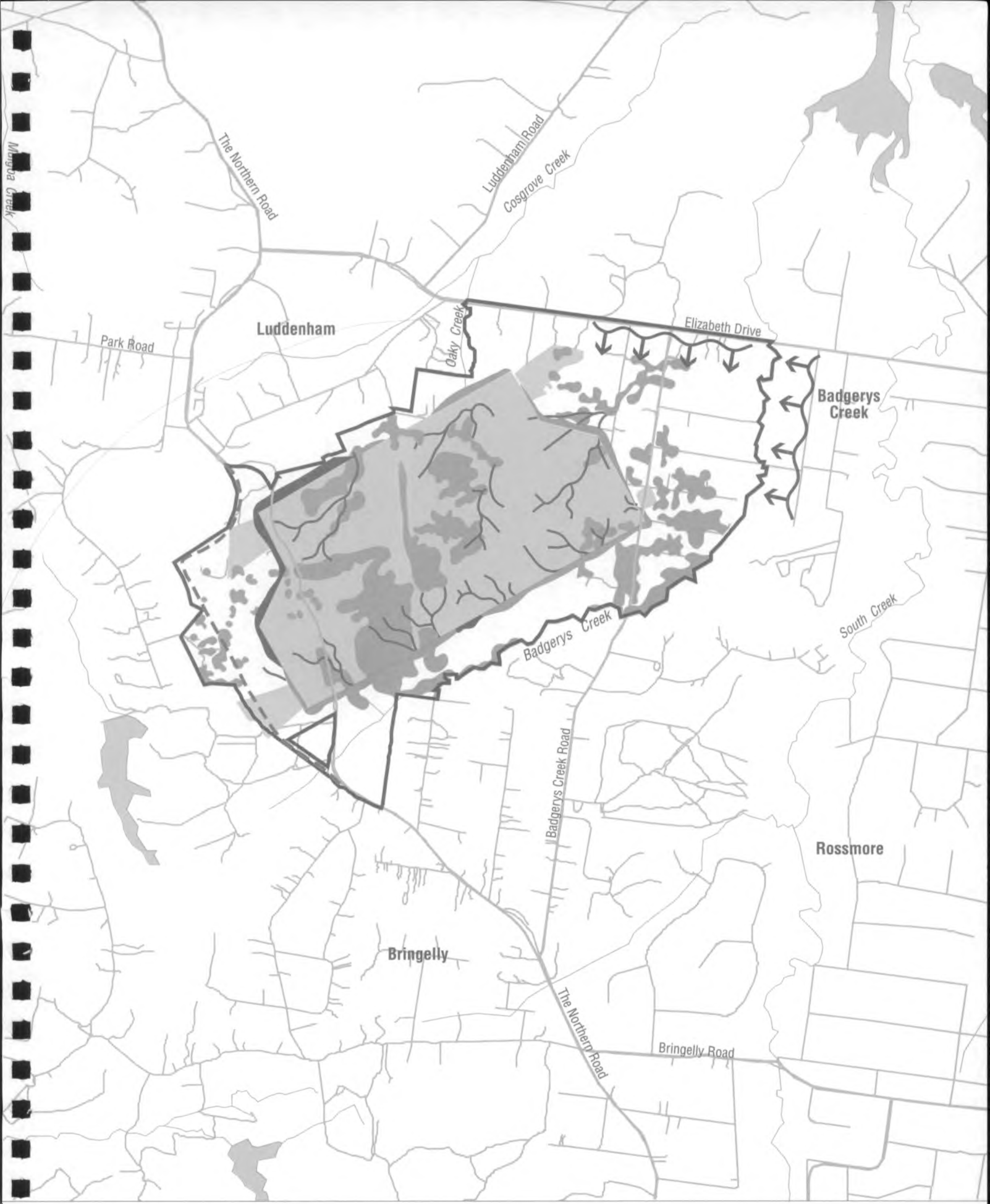


Figure 6.1

Landscape and Visual Impacts of Badgerys Creek Option A

Views of the site from other locations further away, such as Wallgrove Road, are not possible as they are generally obscured by the intervening terrain, vegetation or urban development.

The visual impacts are described in relation to the four main viewing opportunities around the site, these being views from The Northern Road, Elizabeth Drive, Badgerys Creek Road and Lawson Road.

The Northern Road

The realignment of The Northern Road further to the west removes the opportunity for panoramic views to the east over the site and beyond to Cecil Hills, however views to the west towards the Blue Mountains will still be available along the new alignment. Views to the east along the central and northern sections of the new alignment will generally be restricted by the development of the airport support facilities between the airport platform and The Northern Road, however along the southern section some elevated views across the site may be possible depending on the finished elevation of new road alignment (refer *Figure 6.1*).

Elizabeth Drive

Views into the site would be restricted by the fill embankments occurring on the northern and eastern margins of the airport platform and by the development of airport support facilities in the general vicinity of the intersection of Badgerys Creek Road and Elizabeth Drive. The embankments would range in height from two metres to 12 metres and at a distance of 500 metres to 1,500 metres from Elizabeth Drive. The existing ridgeline and woodland vegetation cover in the western portion of the site currently forms the skyline to the views from this area. The airport development would remove this ridge and vegetation and the airport terminal and associated facilities would be likely to create a 'built form' skyline to views from Elizabeth Drive (refer *Figure 6.1*).

Badgerys Creek Road

The northern section of Badgerys Creek Road between Badgerys Creek and Elizabeth Drive is removed in this option, consequently no viewing opportunity would be available. The southern section would not be affected by the proposal, and so views from this portion of the road would be unlikely to change. The topography, remaining scattered woodland vegetation and riverine vegetation along Badgerys Creek would effectively screen the airport development from view (refer *Figure 6.1*).

Lawson Road

From Lawson Road the removal of part of the western ridgeline and vegetation cover would be apparent. It is unlikely that any of the runway, apron areas or other ground plane surfaces would be visible as these would be screened by the riverine vegetation along Badgerys Creek. However, parts of the terminal building may be visible above the vegetation line along Badgerys Creek along with other building elements associated with the airport support facilities and services, nevertheless the majority of these elements would be screened by the existing vegetation (refer *Figure 6.1*).

Lighting

During the construction phase night lighting would generally be restricted to security lighting of construction compounds and site buildings. If work is required to be performed at night portable floodlighting towers would be used. The extent and intensity of this lighting is not anticipated to have any direct impact on areas adjoining the airport site.

6.2.3 OPERATIONAL

Realignment of The Northern Road further to the west would remove the opportunity for panoramic views to the east over the site and beyond to Cecil Hills. Views to the east along the central and northern sections of the new alignment would generally be restricted.

Views into the site from Elizabeth Drive would be restricted by the fill embankments proposed along the northern and eastern margins of the airport platform and by the development of airport support facilities in the general vicinity of the intersection of Badgerys Creek Road and Elizabeth Drive. The airport terminal and associated facilities would most likely create a 'built form' skyline.

As the northern section of Badgerys Creek Road between Badgerys Creek and Elizabeth Drive would be removed, views from this section would not be possible. Views from the southern portion are unlikely to change as the topography, remaining scattered woodland vegetation and riverine vegetation along Badgerys Creek would effectively screen the airport from view.

From Lawson Road the removal of part of the western ridgeline and vegetation cover would be apparent, however, it is unlikely that any of the runway, apron areas or other ground surfaces would be visible. However, parts of the terminal building might be visible above the vegetation line along Badgerys Creek.

Some landscape and visual impacts would result from the subsequent development of areas around the airport, resulting in further landform modification and possible loss of existing vegetation. The potential for these visual impacts resulting from the operational phase could be expected to be much greater than the potential landscape impacts and would arise from the subsequent development of the fringe areas of the airport. Such fringe areas would become key elements in controlling the visual perceptions of the airport and its environs.

Night lighting would also have an impact on the existing visual environment although the level of impact is uncertain. The level of any potential impacts on adjoining properties would depend upon separation distances from the airport boundary.

It could be considered that much of the lighting will be concentrated in the area between the two parallel runways with the terminal and its immediate environs along with carparking and access roads. This central core is approximately 1.5 kilometres from the airport boundary. Given this separation distance significant impacts on surrounding areas from the lighting in this central zone would be unlikely.

6.3 BADGERYS CREEK OPTION B

6.3.1 CONSTRUCTION PHASE - LANDSCAPE IMPACTS

Badgerys Creek Option B comprises two parallel runways running in a north-east to south-west direction approximately 4,000 metres long and 2,200 metres apart with a cross runway, approximately 2,500 metres long running in a north-west to south-east direction across the western portion of the parallel runways. As with Option A the terminal, control tower and apron reserve areas are located between the two parallel runways, the associated airport support facilities and services are also located between the runways at the north-eastern and south-western ends. This layout also makes provision for commercial uses in residual land areas within the runway separation corridor. In the north-east portion the commercial uses flank the airport entry road from Elizabeth Drive and in the south-west they front on to the realigned The Northern Road. The Option B configuration is substantially larger than Option A and would require additional land acquisition to the west and south of the current airport as shown in *Figure 6.2*.

Topography

As with Option A the first major impact is the modification to the undulating landform arising from the establishment of the basic platform for the runways, taxiways, terminal and apron reserve areas. The formation of Option B

occupies approximately 1,200 hectares (12 square kilometres) and is basically rectangular in shape with a north-east to south-west orientation being approximately four kilometres in length and 2.8 kilometres in width. It is the largest of the three Badgerys Creek options. The impacts are similar to but more extensive than Option A with the platform extending further to the south and west. It would be established by cutting through The Northern Road and the ridgeline in the western portion of the site and filling in the swale and valley formations running from the ridgeline to the north-east and south-west. The cut and fill operation results in cuts up to 13 metres deep across the ridge area and fill with embankments up to 10 metres high in the lower north-eastern portion of the site and eight metres high in the south-western portion.

The southern runway would occur virtually on top of the uppermost section of Badgerys Creek, which occurs upstream from where the creek crosses Badgerys Creek Road. As with Option A the upper section of Oaky Creek is lost along with numerous other swale formations feeding Cosgrove Creek to the north and Duncans Creek to the west and additional cutting is also required to accommodate the necessary finished ground levels required for aircraft approach paths at the south-western end of the southernmost runway and the southern end of the cross runway.

Vegetation

The impact on vegetation is somewhat more extensive than that of Option A. As with Option A, Option B involves the loss of all of the remnant and/or regrowth woodland and scattered groupings of trees on the elevated western portion of the site and also the loss of all the riverine vegetation along the upstream section of Badgerys Creek and the scattered woodland to the south of this section of the creek. In the lower north-eastern corner of the site most of the remaining vegetation would not be affected by the construction of the airport platform. Some additional losses would also occur beyond the immediate platform at the south-western ends of the parallel runways and at each end of the cross runway. These losses are associated with the establishment of obstacle limitation surface areas for aircraft approach paths.

As with Option A the development of associated airport services and facilities and additional commercial areas would impact on the vegetation remaining following the construction of the basic airport platform. Similarly, the degree of impact cannot be determined from the available information but it would be possible to limit and control the impact by setting appropriate development controls and standards for these areas.

Indirect Impacts

The potential for indirect impacts is the same as for Option A. These potential impacts relate primarily to the condition and quality of the remaining

Figure 6.2

Landscape and Visual Impacts of Badgerys Creek Option B

vegetation and general landscape environment along Badgerys Creek, Cosgrove Creek, Oaky Creek and ultimately South Creek. During the construction phase there would be an increased risk of erosion and sedimentation resulting from potential increases in stormwater run-off and sediments transported in stormwater flows during earthworks operations.

There would also be a potential impact on the vegetation remaining after initial site clearing operations. The quality and condition of this remaining vegetation could be affected by alterations in the stormwater drainage regime and by soil compaction which would result from unrestricted access over the site by earthmoving machinery and general construction traffic. The effects of these types of impacts would not be immediately apparent and may take a number of years to appear.

Areas of Landscape Significance

Badgerys Creek Option B would result in the loss of 'St. Albans' on The Northern Road at Bringelly, which is listed as an 'Item of Environmental Heritage' in the *South Creek Valley Draft Regional Environmental Plan* (Department of Planning, 1991b). It is listed in 'Schedule 3' as being an Item of Local Significance. As with Option A two areas of remnant roadside vegetation, as identified in the *South Creek Valley Regional Environmental Study* (Department of Planning, 1991a) along Elizabeth Drive may be impacted upon with any road widening or airport entry road development. In addition the vegetation along Badgerys Creek and two areas of remnant roadside vegetation along Badgerys Creek Road may also be impacted upon by associated work. However all of these areas of remnant vegetation may be able to be preserved.

6.3.2 CONSTRUCTION PHASE - VISUAL IMPACTS

The visual impact of Option B during the construction phase is similar to that of Option A, and relates essentially to the modification of landform and clearing of existing vegetation. This is illustrated in *Figure 6.2*.

Modification of the existing undulating landform arising from the development of the basic platform for the runways would be more extensive than Option A with the platform extending further to the south and west. The southern runway would be virtually on top of the uppermost section of Badgerys Creek and the upper section of Oaky Creek would need to be removed along with numerous other swale formations feeding Cosgroves Creek to the north and Duncans Creek to the west.

The impact on vegetation would be more extensive than for Option A. This would involve the loss of all of the remnant/regrowth woodland and scattered groupings of trees on the elevated western portion of the site; the riverine

vegetation along the upstream section of Badgerys Creek; and the scattered woodland to the south of this section of the creek.

The visual impacts are described in relation to the four main viewing opportunities around the site, these being views from The Northern Road, Elizabeth Drive, Badgerys Creek Road and Lawson Road and also from the from the rural residential areas to the south which are affected by land acquisition required by the Option B configuration. In general terms however, the existing rural visual character of undulating cleared pastureland with a scattered vegetation cover over the site will be completely replaced by, essentially, a large scale, flat industrial/commercial environment.

The Northern Road

As with Option A the realignment of The Northern Road further to the west removes the opportunity for panoramic views to the east over the site and beyond to Cecil Hills, however views to the west towards the Blue Mountains would still be available along the new alignment. Views to the east from the roadway along the central and northern sections of the new alignment will generally be restricted by the development of the airport support facilities between the airport platform and The Northern Road. The viewing distance from the road to the airport margins would range from 500 metres to 1,000 metres. Along the southern section the road alignment rises across the elevated lands to the south of the cross runway. From this elevated section of road, expansive views to the north over the airport would be possible. Views over the airport may also be possible from the remaining residential allotments adjoining the proposed southern boundary of the airport in the vicinity of Dwyer Road, Francis Street, Findley Road and Carr Road (refer *Figure* 6.2).

Elizabeth Drive

As for Option A views into the site from the road would be restricted by the fill embankments occurring on the northern and eastern margins of the airport platform and by the development of airport support facilities in the general vicinity of the intersection of Badgerys Creek Road and Elizabeth Drive. The embankments range in height up to 10 metres, however they would be some distance from the road and the airport boundary, the closest being the end section of the northern runway which is approximately 1,000 metres from the roadway. Similarly as with Option A, the most significant alteration to the view would be the loss of the existing ridgeline and woodland vegetation cover in the western portion of the site which currently forms the skyline to the views from this area. The airport terminal and associated facilities would be likely to create a 'built form' skyline to views from Elizabeth Drive, depending on final siting arrangements and design solutions for the terminal and other associated facilities (refer *Figure* 6.2).

Badgerys Creek Road

The northern and central sections of Badgerys Creek Road fall within the airport boundary, consequently no viewing opportunity will be available. A number of properties adjoining Badgerys Creek Road and also Mersey Road, Shannon Road, Severn Road and Derwent Road would need to be acquired for this option. However, along the southern section which remains, views would be unlikely to change as the topography and remaining scattered woodland vegetation will largely screen the airport development from view. Nevertheless some sections of the southern edge of the airport may be visible, given that the existing vegetation along Badgerys Creek is removed (refer *Figure 6.2*).

Lawson Road

As for Option A, much of the airport development is unlikely to be seen, as the existing riverine vegetation along Badgerys Creek will screen it from view. It is unlikely that any of the runway, apron areas or other ground plane surfaces will be visible however, parts of the terminal building may be visible above the vegetation line along Badgerys Creek along with other building elements associated with the airport support facilities and services in the north-eastern portion of the site, nevertheless the majority of these elements would be screened by the existing vegetation (refer *Figure 6.2*).

6.3.3 OPERATIONAL

Realignment of The Northern Road to the west removes the opportunity for panoramic views to the east over the site and beyond to Cecil Hills. Along the southern section the road alignment rises across the elevated lands to the south of the cross runway and from this elevated section expansive views to the north over the airport site may be possible.

Views into the site from Elizabeth Drive would be restricted by the fill embankments proposed along the northern and eastern margins of the airport platform. As for Option A the airport terminal and associated facilities would most likely create a 'built form' skyline.

The northern and central sections of Badgerys Creek Road would be removed. Along the southern section, views would be unlikely to change as the topography and remaining scattered woodland vegetation would largely screen the airport from view. Nevertheless some sections of the southern edge of the airport might be visible, as existing vegetation along Badgerys Creek would be removed.

From Lawson Road, much of the airport would be unlikely to be seen, however parts of the terminal building might be visible above the vegetation

line along Badgerys Creek along with other building elements associated with the airport support facilities and services in the north-eastern portion of the site.

Operation impacts due to subsequent development of adjoining areas, and night lighting would be similar to Option A.

6.4 BADGERYS CREEK OPTION C

6.4.1 CONSTRUCTION PHASE - LANDSCAPE IMPACTS

Badgerys Creek Option C comprises two parallel runways running in a north to south direction approximately 4,000 metres long and 2,200 metres apart with a cross runway, approximately 2,500 metres long running in an east to west direction across the western portion of the parallel runways. As with Options A and B the terminal, control tower and apron reserve areas are located between the two parallel runways, the associated airport support facilities and services are also located between the runways at the northern and southern ends. This layout also makes provision for commercial uses in residual land areas within the runway separation corridor. In the northern portion the commercial areas flank the airport entry road from Elizabeth Drive and in the southern they front on to the realigned The Northern Road. The Option C configuration is similar in size to Option B (being substantially larger than Option A) requiring additional land acquisition to the south-east and north-east of the current airport site as shown in *Figure 6.3*.

Topography

As with Options A and B the first major impact is the modification to the undulating landform arising from the establishment of the basic platform for the runways, taxiways, terminal and apron reserve areas. The formation of Option C occupies approximately 1,100 hectares (11 square kilometres) and is rectangular in shape with a north to south orientation being approximately four kilometres in length and 2.7 kilometres in width. The extent of impact is similar to Option B. The platform would be established essentially by filling the upstream section of Badgerys Creek and cutting the elevated areas south and north of the creek and filling the northern the lower northern areas of the site. Unlike Options A and B most of the western ridgeline remains with only a small section being cut, in the order of five metres deep, to accommodate the western end of the east-west cross runway. The cut and fill requirements would result in cuts up to nine metres deep in the south-eastern section in the vicinity of the OTC Radio Centre and fills with embankments up to 13 metres high in the lower northern portion of the site running parallel to Elizabeth Drive, with a setback distance in the order of 1,000 metres.

Figure 6.3

Landscape and Visual Impacts of Badgerys Creek Option C

The filling of Badgerys Creek would extend to just below the point where it crosses Badgerys Creek Road. Similarly, as with Options A and B the upper section of Oaky Creek would be lost.

As with Options A and B additional cutting would also be required to accommodate the necessary finished ground levels required for aircraft approach paths at the western end of the east-west cross runway and at the northern and southern ends of the eastern north-south runway.

Vegetation

As with Option B this option would involve the loss of remnant and/or regrowth woodland and scattered groupings of trees on the elevated western portion of the site but to a lesser extent with a significant proportion remaining. The riverine vegetation along the upstream section of Badgerys Creek would be lost along with the majority of the scattered woodland to the south of this section of the creek. In the lower, northern portion of the site most of the remaining vegetation would not be affected by the construction of the airport platform. Some additional losses would also occur beyond the immediate platform at the ends of the parallel north-south runways and at each end of the cross runway. These losses are associated with the establishment of obstacle limitation surface areas for aircraft approach paths.

As with Options A and B the development of associated airport services and facilities and additional commercial areas would impact on the vegetation remaining following the construction of the basic airport platform. Similarly, the degree of impact cannot be determined from the available information but it would be possible to limit and control the impact by setting appropriate development controls and standards for these areas.

Indirect Impacts

The potential for indirect impacts is the same as for Options A and B. These potential impacts relate primarily to the condition and quality of the remaining vegetation and general landscape environment along Badgerys Creek, Cosgrove Creek, Oaky Creek and ultimately South Creek. During the construction phase there would be an increased risk of erosion and sedimentation resulting from potential increases in stormwater run-off and sediments transported in stormwater flows during earthworks operations.

There would also be a potential impact on the vegetation remaining after initial site clearing operations. The quality and condition of this remaining vegetation could be affected by alterations in the stormwater drainage regime and by soil compaction which would result from unrestricted access over the site by earthmoving machinery and general construction traffic. The effects of

these types of impacts would not be immediately apparent and may take a number of years to appear

Areas of Landscape Significance

In Option C the 'OTC Housing Group, Badgerys Creek Road, Bringelly', listed as an 'Item of Regional Significance' in the *South Creek Valley Draft Regional Environmental Plan* (Department of Planning, 1991b) would be lost as would two areas of remnant roadside vegetation as listed in the *South Creek Valley Regional Environmental Study* (Department of Planning, 1991a). The OTC Housing Group is currently entered as an 'indicative place' on the Register of the National Estate Data Base and is under assessment for possible inclusion on the Register. As with Options A and B two additional areas of remnant roadside vegetation, along Elizabeth Drive may be impacted upon with any road widening or airport entry road development, however these two areas of remnant vegetation may be able to be preserved.

6.4.2 CONSTRUCTION PHASE - VISUAL IMPACTS

The visual impact of Option C during the construction phase is similar to that of Options A and B, and relates essentially to the modification of landform and clearing of existing vegetation. This is illustrated on *Figure 6.3*.

Construction impacts for Option C would be similar to Options A and B in terms of the modification to the undulating landform from the basic platform for the runways, taxiways, terminal and apron reserve areas. The platform would be established essentially by filling the upstream section of Badgerys Creek, cutting the elevated areas south and north of the creek and filling the lower northern areas of the site. Unlike Options A and B most of the western ridgeline would remain. Only a small section would be cut. Impacts on vegetation would be similar in extent to those for Option B.

The visual impacts are described in relation to the four main existing viewing opportunities around the site, these being views from The Northern Road, Elizabeth Drive, Badgerys Creek Road and Lawson Road and also from the from the rural residential areas to the south which are affected by land acquisition required by the Option C configuration. As with Options A and B the existing rural visual character of undulating cleared pastureland with a scattered vegetation cover over the site would be completely replaced by, essentially, a large scale, flat industrial or commercial environment.

The Northern Road

As with Options A and B the realignment of The Northern Road further to the west removes the opportunity for panoramic views to the east over the site and beyond to Cecil Hills, however views to the west towards the Blue Mountains

would still be available along the new alignment. Views to the east from the roadway along the northern sections of the new alignment would likely be of the existing pastureland and scattered trees, it is unlikely that the airway platform would be visible. However, from the central section of the new alignment the southern end of the western north-south runway would likely be visible from a viewing distance in the order of 600 metres. Along the southern section of the alignment the road rises across the elevated lands to the south of the parallel runways. From this elevated section of road views to the north over the airport may be possible, however, it is anticipated that views would be restricted by the development of the airport support facilities and commercial areas between the airport platform and The Northern Road. Views over the airport may also be possible from the remaining residential allotments adjoining the proposed southern boundary of the airport in the vicinity of Dwyer Road, Francis Street, and Car Road (refer *Figure 6.3*).

Elizabeth Drive

As for Options A and B, views into the site would be restricted by the fill embankments occurring on the northern and eastern margins of the airport platform and by the development of airport support facilities in the general vicinity of the intersection of Badgerys Creek Road and Elizabeth Drive. The embankments would range in height up to 10 metres, however they are some distance from the road and the airport boundary, the closest being the end section of the northernmost runway which is approximately 1,000 metres from the roadway. Similarly as with Option A, the most significant alteration to the view would be the loss of the existing ridgeline and woodland vegetation cover in the western portion of the site which currently forms the skyline to the views from this area. The airport terminal and associated facilities would be likely to create a "built form" skyline to views from Elizabeth Drive, depending on final siting arrangements and design solutions for the terminal and other associated facilities (refer *Figure 6.3*).

Badgerys Creek Road

Option C removes virtually all of Badgerys Creek Road except for a short section running off The Northern Road providing access to the few remaining properties (refer *Figure 6.3*).

Lawson Road

As for Options A and B much of the airport development is unlikely to be seen, as the existing riverine vegetation along Badgerys Creek would screen it from view. It is unlikely that any of the runway, apron areas or other ground plane surfaces will be visible however, parts of the terminal building may be visible above the vegetation line along Badgerys Creek along with other building elements associated with the airport support facilities and services in the north-

eastern portion of the site. Nevertheless, the majority of these elements would be screened by the existing vegetation (refer *Figure 6.3*).

6.4.3 OPERATIONAL

Realignment of The Northern Road further to the west would remove the opportunity for panoramic views to the east over the site and beyond to Cecil Hills. Views to the east from the roadway along the northern sections of the new alignment would likely be of the existing pastureland and scattered trees.

Views into the site from Elizabeth Drive would be restricted by the fill embankments proposed at the northern and eastern margins of the airport platform and by the development of airport support facilities. As for Options A and B the airport terminal and associated facilities would most likely create a 'built form' skyline to views from Elizabeth Drive.

Virtually all of Badgerys Creek Road would be removed and consequently it would not provide any viewing opportunities.

From Lawson Road the existing riverine vegetation along Badgerys Creek would screen much of the airport from view. Parts of the terminal building and other building elements associated with the airport support facilities and services in the north-eastern portion of the site might be visible above the vegetation line along Badgerys Creek.

Operation impacts due to subsequent development of adjoining areas, and night lighting would be similar to Options A and B.

CHAPTER 7 IMPACTS OF HOLSWORTHY OPTIONS

7.1 GENERALLY

The potential landscape and visual impacts for each option have been identified following detailed consideration of the various development plan drawings and the Construction Plan. The information provided in these documents is of a broadscale conceptual planning nature and consequently the potential impacts are identified and described in a similar level of detail. More detailed assessments of impacts would be required when detailed development plans are prepared.

The drawings used for this assessment are contained in Second Sydney Airport Planners (1997a) and (1997c):

- Master Plans (1:25,000) for Holsworthy Options A and B;
- Stage 1 Plans (1:25,000) for Holsworthy Options A and B;
- Master Plan Fencing and Clearing (1:25,000) Holsworthy Options A and B;
- Stage 1 Fencing and Clearing (1:25,000) Holsworthy Options A and B;
- Runway Cross Sections;
- Runway Long Sections;
- Borrow Areas (plans and sections);
- Obstacle Limitation Surfaces/Cut Trees and Borrow Areas Master Plan (1:25,000) Holsworthy Options A and B;
- Obstacle Limitation Surfaces/Cut Trees and Borrow Areas Stage 1 (1:25,000) Holsworthy Options A and B;
- Access Road Routes Holsworthy Options A and B; and
- Access Rail Routes Holsworthy Options A and B.

The potential landscape and visual impacts are described separately. Landscape impacts are those that change the general fabric and pattern of the existing landscape and its component parts. These basically include direct physical alterations such as landform modification, vegetation removal,

modification of existing drainage patterns and removal or modification of specific natural or cultural elements, heritage items and the like, all of which combine to give a 'place' or 'area' its particular landscape quality. Visual impacts relate solely to alterations to views of the site or viewing opportunities directly resulting from the airport development.

Potential impacts are described for both the construction phase and operational phase of the airport development. The estimated construction time for the airport is five years for the 'stage one' development phase and six years to achieve the ultimate masterplan configuration.

The construction phase of the various airport development options is the most significant in terms of impact as virtually all of the impacts would occur during this phase.

7.2 HOLSWORTHY OPTION A

7.2.1 CONSTRUCTION PHASE - LANDSCAPE IMPACTS

Option A is located in the northern portion of the Holsworthy Military Area immediately to the north of Lake Woronora and comprises two parallel runways running in a north to south direction and a cross runway at the southern end of the parallel runways. Of the two parallel runways the westernmost runway is 3,800 metres long and the easternmost is 4,000 metres long. They are approximately 2,200 metres apart. The cross runway is 2,500 metres long. The terminal, control tower, apron reserve areas are located between the parallel runways. The associated airport support facilities and services occur at the northern and southern ends of the runway separation corridor. Areas for commercial uses are provided at the northern end.

Rail access would potentially be provided from the north. There are three options for road access, one from the west between Minto and Ingleburn connecting with the South Western Freeway, a second from the north connecting with the South Western Freeway at Moorebank and a third from the east connecting with Old Illawarra Road at Menai as shown on *Figure 7.1*.

Topography

The construction of the airport would have a large impact on the existing topography. The Holsworthy plateau is incised with steep and deep valleys. The proposal involves cutting of ridgetops and filling of creek valleys to establish the basic airport platform. The extent of earthworks is estimated to include 93 million cubic metres of cut and 170 million cubic metres of fill and requiring approximately six and a half years to complete. The basic airport platform formation occupies approximately 1,200 hectares (12 square

kilometres). In addition to this approximately 180 hectares would be cut to establish obstacle limitation surface on runway approach paths and approximately 360 hectares would be quarried to provide the required quantity of fill material.

The earthworks would result in cuts up to 36 metres deep and fills up to 60 metres deep.

This would result in the loss of approximately four kilometres of the southern section of Harris Creek and approximately seven kilometres of the southern section of Williams Creek. Lyretail Gully, Kalibucca Creek and Deadmans Creek would also be impacted upon, but to a lesser degree, through loss or disturbance to upper catchment areas and their tributaries.

The ridgeline between Williams and Harris Creek would be lost as would the ridgeline between Williams and Deadmans Creek. In addition to this and beyond the basic airport platform, there would be two borrow areas established. The borrow area for the Stage 1 phase of the development removes the ridge between Deadmans and Williams Creek below Porcupine Creek. A second borrow area removes the ridge formation between Dingo Creek and Punchbowl Creek. Further cutting of ridge areas for establishing the required obstacle limitation surfaces occurs at the southern ends of the parallel runways and at each end of the cross runways. The earthworks and clearing operations for the obstacle limitation areas on the southern approach to the western runway extend beyond the current Military Area boundary and occur partly within the Lake Woronora catchment area.

The master plan design drawings do not describe any landform modifications for the associated airport support facilities and services described on the drawings, however it can be expected that the development of these facilities would also require extensive landform modification of a comparative scale with the airport platform earthworks. This includes elements such as road and rail access, services installations, stormwater detention ponds, fuel storage areas, airport maintenance facilities, freight terminals, fire training areas, navigational aids and airline support facilities.

Vegetation

The potential impact on existing vegetation is severe. Excluding road and rail access corridors and services corridors, the development of this option would require clearing approximately 2,700 hectares of existing bushland. This represents approximately 18 percent of the 15,000 hectares of existing bushland coverage over the Military Area. The vegetation types which would be lost include woodland, heath and gully forest.

The loss of this vegetation is significant as:

- it contributes to the continual reduction of Sydney's remaining bushland, an irreplaceable resource;
- it would fragment existing bushland, reducing viability of adjoining margins by increasing edge exposure;
- it would reduce wildlife habitat and movement corridors; and
- it would contribute to the loss of rare and/or endangered plant species.

Indirect Impacts

The impacts described above relate to direct and immediate physical impacts on the landscape. In addition to these direct impacts there are potential indirect impacts that relate primarily to the condition and quality of the remaining vegetation and general landscape environment along the downstream sections to the north of the airport development of Harris Creek, Williams Creek and Deadmans Creek. In addition, to the south and east the gullies feeding the northern end of Lake Woronora, Wappa Creek and Lyretail Gully are also likely to be affected, but to a lesser degree. During the construction phase there would be a dramatically increased risk of erosion and sedimentation resulting from potential increases in stormwater run-off and sediments transported in stormwater flows during earthworks operations. In addition to erosion and sedimentation risks there would be a risk of increased nutrient levels and pollutants in the stormwater carried along these creeks leading to an increased risk of weed infestation and degradation of existing bushland. The risk of weed infestation is also increased by the simple matter of people, vehicles and construction materials being brought onto the site. The current circumstances of restricted access to the military reserve area has allowed the existing bushland environment to be conserved in almost pristine condition, relatively free of weed infestations.

7.2.2 CONSTRUCTION PHASE - VISUAL IMPACTS

Construction impacts on the existing topography of the site of Holsworthy Option A would be massive, involving the cutting of ridgetops and filling of creek valleys to establish the basic airport platform. The extent of earthworks would involve cuts up to 36 metres deep and fill up to 60 metres deep and would result in the loss of the southern section of Harris Creek and the southern section of Williams Creek. This is illustrated on *Figure 7.1*. Lyretail Gully, Kalibucca Creek and Deadmans Creek would also be severely impacted.

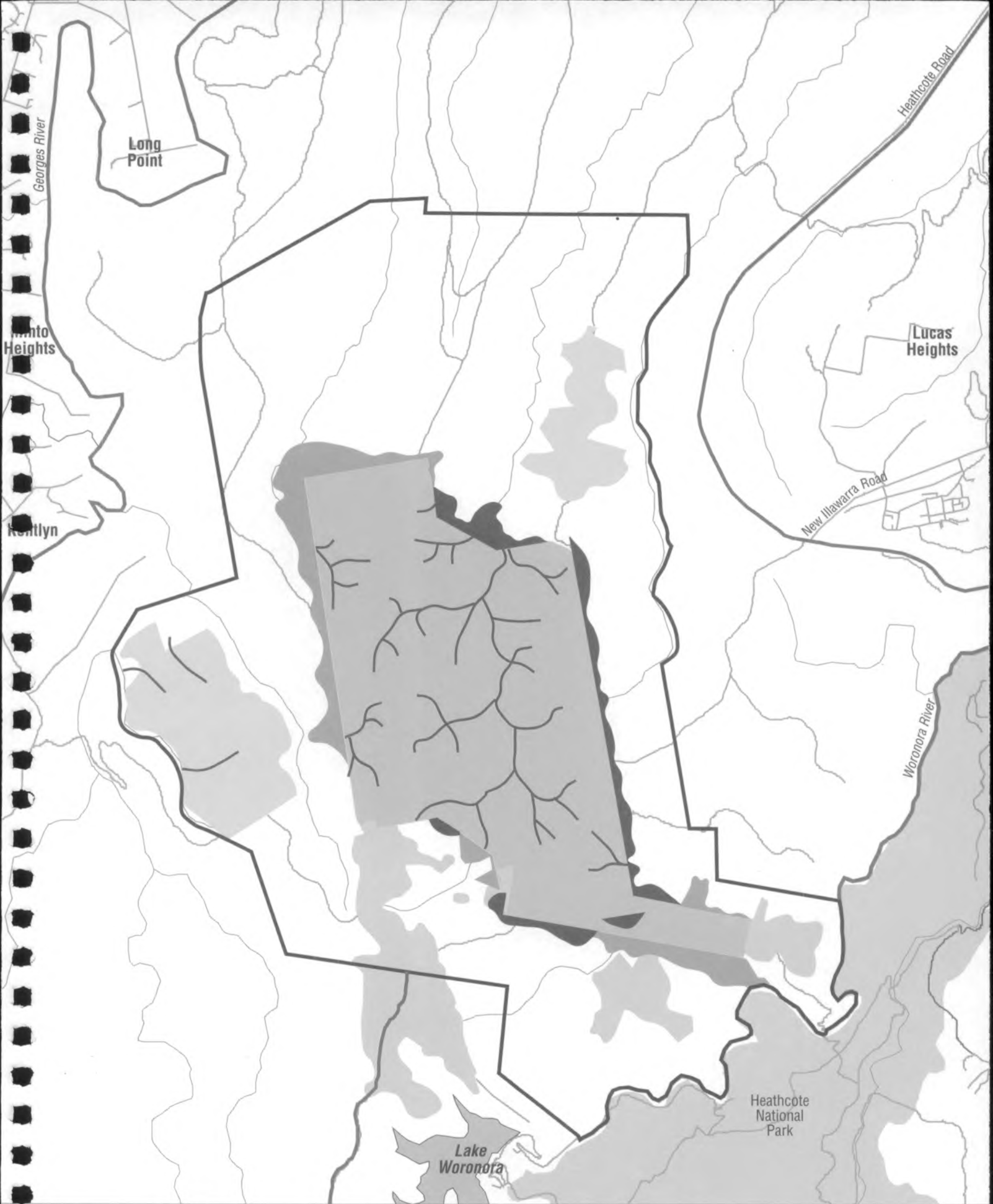


Figure 7.1

Landscape and Visual Impacts of Holsworthy Option A

Note: refer to Second Sydney Airport Planners (1997a) for details of vegetation to be removed

The ridgeline between Williams and Harris Creek and between Williams and Deadmans Creek would be removed. The ridge between Deadmans and Williams Creek below Porcupine Creek would be removed by the borrow area for Stage 1. A second borrow area would remove the ridge formation between Dingo Creek and Punchbowl Creek.

Impacts on existing native vegetation would also be severe. Approximately 4,200 hectares of existing bushland would be removed including woodland/ heath and gully forest. Impacts on native vegetation are discussed in more detail in *Technical Paper No. 8 - Flora and Fauna*.

It is unlikely that the airport would be visible from any of the areas outside the Military Area boundary. For Option A the areas most likely to be in view of the airport are Lucas Heights, Engadine and Heathcote to the east (approximately four to five kilometres away) and Long Point, Minto Heights and Kentlyn to the west (approximately two to three kilometres away).

When viewing Option A from the west only the immediate western margin of the Military Area is visible. The ridgeline on the eastern side of the Georges River and the existing bushland cover would prevent views of Option A.

When viewing from the east the airport formation would be effectively screened from view as it is located behind a cutting of variable depth ranging from eight metres to 26 metres. The view from these elevated areas are extensive panoramic views across the Military Area and are of high scenic quality.

The areas which are likely to generate the most visual impact are road and rail access corridors and services corridors which connect to existing roads, rail lines and services. There are various options for these facilities and the assessment of these impacts is beyond the scope of this study.

Lighting

As with the Badgerys Creek options, night lighting during the construction phase would generally be restricted to security lighting of construction compounds and site buildings. If work is required to be performed at night portable floodlighting towers would be used. Given the separation distance between the airport and the residential areas to the west and east, the extent and intensity of this lighting is not anticipated to have any direct impacts.

7.2.3 OPERATIONAL

As for the Badgerys Creek options, the majority of impacts for the Holsworthy options would occur as part of construction. Operational impacts would be primarily of a visual nature.

It is unlikely that the site of Option A would be visible from any area outside of the Holsworthy Military Area. The site of Option A could potentially be viewed from areas such as Lucas Heights, Engadine and Heathcote to the east (approximately four to five kilometres away) and Long Point, Minto Heights and Kentlyn to the west (approximately two to three kilometres away). When viewing from the west only the immediate western margin of the Military Area would be visible, as the ridgeline on the eastern side of the Georges River would obstruct views. The airport site would effectively be screened from view from the east, as it is located behind a cutting of variable depth ranging from eight metres to 26 metres.

Approaching and departing aircraft and night lighting would have some visual impacts, although the level of impact is uncertain. As the airport would be well separated from any developed and lit areas, a glow of light emanating from the airport may be visible from the elevated areas of Lucas Heights, Engadine and Heathcote to the east. As these areas are approximately four to five kilometres away significant impact are unlikely.

Landscape impacts from operation of the airport would relate primarily to further bushland deterioration, potential weed infestation and loss of surrounding bushland adjoining the airport development area and the downstream sections of the creek systems which receive stormwater run-off from the airport. The operational phase would dramatically increase this risk of further deterioration through potential increased levels of nutrients and pollutants in stormwater run off from the airport areas. These impacts are discussed in *Technical Paper No. 8 - Flora and Fauna*.

7.3 HOLSWORTHY OPTION B

7.3.1 CONSTRUCTION PHASE - LANDSCAPE IMPACTS

Option B is located in the southern portion of the Military Area close to the southern boundary and west of Lake Woronora and Old Illawarra Road. This option comprises two parallel runways running in a south-east to north-west direction and a cross runway running in a north-south direction. The northern parallel runway would be 4,000 metres long and the southern would be 3,600 metres long. They would be approximately 2,200 metres apart. The cross runway 2,500 metres long. As with Holsworthy Option A, the terminal, control tower and apron reserve areas are located between the parallel runways as are the associated airport support facilities and services. Areas for commercial uses are provided at the western end of the northern parallel runway on both sides of the runway.

There are two potential options for rail access, one from the north and one from the west. There are three options for road access, one from the west

connecting with the South Western Freeway near Menangle, one from the north connecting with the South Western Freeway at Moorebank and a third from the north east connecting with New Illawarra Road at the intersection of Heathcote Road as shown in *Figure 7.2*.

Topography

As with Holsworthy Option A construction of the airport at this location would have a large impact on the existing topography. The establishment of the basic airport platform would involve the cutting of ridgetops and filling of creek valleys estimated to involve 156 million cubic metres of cut and 173 million cubic metres of fill and would require six and a half years to complete. The basic airport platform formation occupies approximately 1,400 hectares (14 square kilometres). In addition to this approximately 100 hectares would be cut to establish obstacle limitation surfaces on runway approach paths and approximately 110 hectares would be quarried to provide the required quantity of fill material.

The earthworks would result in cuts up to 50 metres deep and fills up to 80 metres deep.

This would result in the loss of approximately 4.5 kilometres of the upper catchment of Punchbowl Creek and the loss of all ridgeline and gully areas between O'Hares Creek at the western edge of the airport and Old Illawarra Road to the east. Beyond the basic airport platform a borrow area located to the north of the airport platform would remove approximately three kilometres of the ridge between Punchbowl Creek and Gunyah Creek. Further cutting of ridge areas for establishment of obstacle limitation surfaces occurs at the approaches of all three runways with the most extensive cutting occurring on the southern approach to the north-south cross runway. This obstacle limitation surface cutting and similar cuttings at the eastern approaches to the parallel runways and on the western approach to the southernmost runway all extend beyond the current military reserve boundary. The cuttings to the south and east also extend into the Lake Woronora catchment area.

As with Holsworthy Option A the master plan design drawings do not describe any landform modifications for the associated airport support facilities and services that are located beyond the basic airport platform, however it can be expected that the development of these facilities would also require extensive landform modification of a comparative scale with the airport platform earthworks. This includes elements such as road and rail access, services installations, stormwater detention ponds, fuel storage areas, airport maintenance facilities, fire training areas, navigational aids and airline support facilities.

Vegetation

As with Holsworthy Option A the impact on existing vegetation is severe. Excluding road and rail access corridors and services corridors, the development of the airport in this location would require clearing approximately 2,300 hectares of existing bushland. This represents approximately 15.5 percent of the 15,000 hectares of existing bushland coverage over the Military Area. As with Holsworthy Option A the vegetation types lost would be woodland, heath and gully forest.

Indirect Impacts

The impacts described above relate to direct and immediate physical impacts on the landscape. In addition to these direct impacts there are potential indirect impacts that relate primarily to the condition and quality of the remaining vegetation and general landscape environment along the downstream section of Punchbowl Creek to the north of the airport development. In addition, O'Hares Creek to the south and west of the site to the south and Woronora River to the east are also likely to be affected, but to a lesser degree. As described for Option A, during the construction phase there would be a dramatically increased risk of erosion and sedimentation resulting from potential increases in stormwater run-off and sediments transported in stormwater flows during earthworks operations. In addition to erosion and sedimentation risks would be a risk of increased nutrient levels and pollutants in the stormwater carried along these creeks leading to an increased risk of weed infestation and degradation of existing bushland. The risk of weed infestation is also increased by the simple matter of people, vehicles and construction materials being brought onto the site. The current circumstances of restricted access to the Holsworthy Military Area has allowed the existing bushland environment to be conserved in almost pristine condition, relatively free of weed infestations.

7.3.2 CONSTRUCTION PHASE - VISUAL IMPACTS

Option B would have a significant impact on the existing topography. Establishing a basic airport platform would involve the cutting of ridgetops and filling of creek valleys on a massive scale. Earthwork cuts up to 50 metres deep and fill up to 80 metres deep would result in the removal of the upper catchment of Punchbowl Creek and all ridgeline and gully areas between O'Hares Creek at the western edge of the airport and Old Illawarra Road to the east. A proposed borrow area to the north of the airport platform would remove approximately three kilometres of the ridge between Punchbowl Creek and Gunyah Creek. This is illustrated on *Figure 7.2*. Cutting of ridge areas to establish Obstacle Limitation Surfaces would occur at the runway approaches.

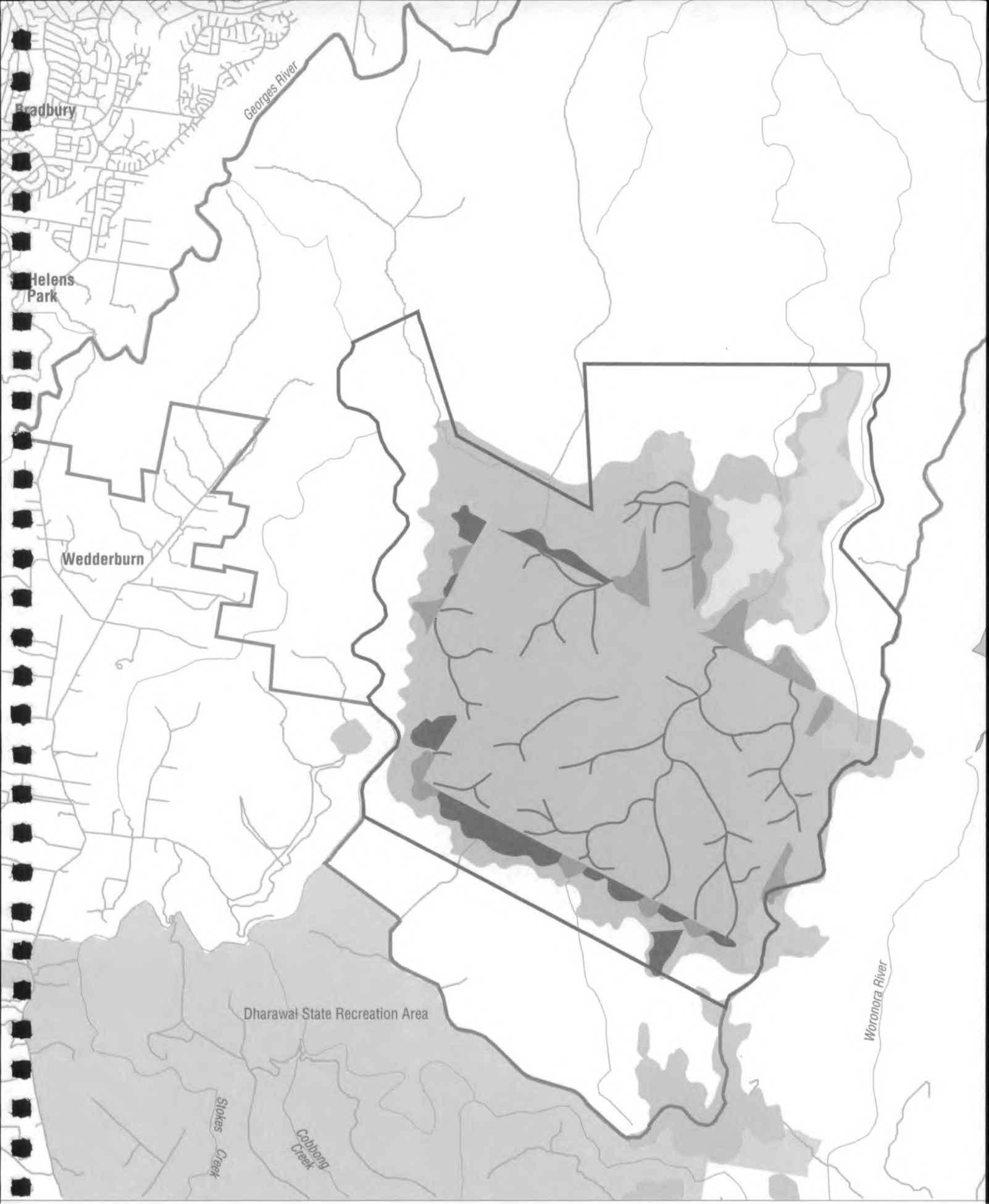


Figure 7.2

Landscape and Visual Impacts
Holsworthy Option B

Note. Refer to Second Sydney Airport Planners (1997a) for details of vegetation to be removed

Potential impacts on existing vegetation would be severe. Approximately 2,800 hectares of existing bushland would be removed including woodland/ heath and gully forest. Impacts on native vegetation are discussed in more detail in *Technical Paper No. 8 - Flora and Fauna*.

As with Holsworthy Option A it is unlikely that the airport development would be visible from any of the areas outside the Military Area boundary. The area most likely to be in view of the airport is Wedderburn, two to three kilometres to the west of the airport site. However, views to the site are restricted by the ridgeline between Pheasants Creek and O'Hares Creek. The areas which are likely to generate the most visual impact are road and rail access corridors and services corridors which connect to existing roads, rail lines and services. There are various options for these facilities and the detailed assessment of these impacts is beyond the scope of this study.

Lighting

As described for Holsworthy Option A, night lighting during the construction phase would generally be restricted to security lighting of construction compounds and site buildings. If work is required to be performed at night portable floodlighting towers would be used. Given the separation distance between the airport and the residential areas to the west, the extent and intensity of this lighting is not anticipated to have any direct impacts.

7.3.3 OPERATIONAL

It is unlikely that the site of Option B would be visible from many areas outside the Holsworthy Military Area. Views of the airport may be possible from Wedderburn, two to three kilometres to the west. However, views would generally be restricted by the ridgeline between Pheasants Creek and O'Hares Creek. Operation impacts due to aircraft and night lighting, bushland deterioration and potential weed infestation would be similar to Option A.

The level of impact that night lighting would have cannot be predicted from the available information, however, it could be considered that as the airport would be separated from any developed and lit areas, the general glow of light emanating from the airport would be likely to be visible from Wedderburn, the closest residential area, and possibly from the Campbelltown area to the north-west. Given the separation distances from these areas, significant impacts are unlikely.

The potential for landscape impacts resulting from the operational phase is much greater than the potential for visual impacts. This relates primarily to further deterioration, weed infestation and loss of surrounding bushland adjoining the airport development area and the downstream sections of the creek systems which receive stormwater run-off from the airport. The

operational phase would dramatically increase this risk of further deterioration through increased levels of nutrients and pollutants in stormwater run-off from the airport and also by the volume of vehicles and people that would be using the airport.

Part D

Environmental Management

CHAPTER 8 ENVIRONMENTAL MANAGEMENT

8.1 BADGERYS CREEK OPTIONS

8.1.1 MITIGATION OF CONSTRUCTION IMPACTS

The key to minimising impacts arising from the airport development is to carefully plan and control the site management and development sequence and the staging of construction operations. Through careful planning and design of the construction sequence, it would be possible to conceal a large proportion of the development from general public view. In ideal circumstances, all peripheral landscape development works would be put in place prior to commencing site clearing and earthworks operations. Essentially this involves the creation of enhanced landscape environments to the perimeter of the site prior to commencing the airport works.

The development of an airport would completely modify the existing landscape. Consequently the perimeter zones would be the only areas in which the visual characteristics and landscape perceptions of the locality could be maintained and enhanced using landform modification and vegetation. Effective mitigation measures would require provision of substantial portions of peripheral land to permit retention of as much existing vegetation as possible and to permit the reprofiling of existing topography for the purpose of controlling views into and out of the site. Part of this landscape development could be provided by establishing, in strategic locations, setbacks from site boundaries and road margins of at least 200 metres.

The scale and configuration of peripheral areas could permit the creation of landscape environments as opposed to more conventional methods of screening along boundaries. This would allow the visual characteristics and landscape perceptions of the area to be maintained and enhanced.

Revegetation of peripheral areas would be essential. An opportunity exists for all options to revegetate the site with the woodland plant communities that would have once covered the area. This could be implemented in conjunction with peripheral earthworks at the earliest possible time in the construction process. Variations on theme or other landscape treatments would be possible at specific locations or areas such as the airport entry road and arrival zone.

Existing drainage patterns and proliferation of farm dams across the sites of the Badgerys Creek options are also important elements. New drainage patterns should wherever practical reflect the scale and character of the existing site drainage patterns.

Fencing also has a significant impact on the way a place is perceived. Where the airport boundary occurs adjacent to a public road the location of a security fence should be set back substantially from the boundary so that it is not visible from any point along the road edge.

Specific recommendations for mitigation of construction impacts are focused on how the airport environs and in particular the margins are treated. These recommendations deal both with the minimisation of landscape impacts (changes to the general fabric and pattern of the existing landscape) and potential visual impacts alterations of views or visible subject).

Landscape Character

The existing landscape on the sites of the Badgerys Creek airport options is broken into a series of view fields by the existing topography and more pronounced vegetation. The development of an airport dictates the complete modification of the existing landscape through the establishment of a vast flat landscape completely out of context with its immediate surroundings in terms of scale and character. Consequently the perimeter zones are the only areas in which the visual characteristics and landscape perceptions of the locality can be maintained and enhanced.

The two primary determinants of existing landscape character, and thus the mitigation of impacts, are topography and vegetation. For these to be effective would require the allocation of substantial portions of the peripheral lands to permit retention of existing vegetation, reprofiling of existing topography and revegetation. Part of this allocation of space for landscape development would include development setbacks from boundaries and road margins of at least 200 metres.

Earthworks

Existing slopes across the site and adjoining land areas are predominantly five percent or less with some slopes falling within the range of five to 10 percent. Where possible all cut and fill embankments that occur at the edges of the airport platform should be established using profiles capable of merging with the existing terrain without an abrupt and obvious change in grade. In the case of the site of the Badgerys Creek airport options this would mean using variable slope profiles in the range of 10 to 25 percent. The plan arrangement of these edge profiles should also be variable where other constraints permit. The plan arrangement should avoid rectilinear shapes which are derived from the shape of the airport platform and should respond to the curvilinear formations of the existing topography. These slope profiles and plan arrangements need only be implemented where space permits, which would be determined largely by the location of existing vegetation which should be preserved wherever practical.

Beyond the immediate airport platform in the peripheral areas running out to the airport boundaries earthworks should also be undertaken to control views into the site to screen various aspects of the airport development. The same principles apply in these areas as for the basic airport platform in relation to slope profiles and plan configurations. Essentially this would involve the creation of profiles compatible with the scale and character of the existing topography. The extent and coverage of reprofiling and shaping in these areas would need to be determined in parallel to the overall airport planning and design process and, importantly, needs to be implemented at the beginning of the construction process. If planned and designed correctly the entire core area of the site and construction operation could be screened from view.

Vegetation

The site of the Badgerys Creek airport options has little vegetation cover at present, and would have even less following the initial clearing operations for the airport. Essentially all of the remaining vegetation beyond the immediate footprint of the airport platform should be retained and protected. Measures include locating, identifying and fencing all of the vegetation to be protected prior to any site preparation or establishment work commencing on the site. Other site development requirements such as erosion and sedimentation control, stormwater retention, construction facilities, services and infrastructure should be planned and designed to maximise the retention of existing vegetation. Equally critical will be the on-going monitoring and assessment of the condition of remaining vegetation throughout the construction phase of the airport facility.

In conjunction with reshaping and profiling, revegetation of the peripheral areas would be essential. An opportunity exists in all Badgerys Creek options to revegetate and substantially increase the amount of vegetation cover over the site provided revegetation does not impede airport operations or aircraft safety. Revegetation work should be implemented in conjunction with peripheral earthworks at the earliest possible time in the construction process. Revegetation should seek to achieve a re-establishment, as far as practical, of the woodland plant communities that would have once covered the site. This should be the overall theme of any revegetation work, but variations on theme or other landscape treatments would be possible at specific locations or areas such as the airport entry road and arrival zone.

Drainage

The existing drainage pattern and proliferation of farm dams across the site are also important elements in the perception of the airport site. New drainage patterns that would be required should, wherever practical reflect the scale and character of the site drainage patterns. New drainage formations should be responsive to the existing undulating terrain and existing vegetation.

Fencing

Fencing has a significant impact on the way a place is perceived. Present plans for the three airport options at Badgerys Creek illustrate security fencing, two metre high chainwire fence topped with barbed wire, along the boundary of the site. Where the airport boundary occurs adjacent to a public road the location of a security fence along the boundary would be visually undesirable. In these locations the security fencing should be setback substantially from the boundary so that it is not visible from any point along the road edge. This would allow the security function to be met but removes the visual intrusion on the boundary.

8.1.2 MITIGATION OF OPERATIONAL IMPACTS

The majority of impacts would occur as a result of the construction phase. Impacts during the operational phase would result from the subsequent development of commercial areas around and adjoining the airport. Development control plans would be required for these areas and they would need to be developed with the objective of maintaining and enhancing the existing rural character. In simple terms in the future land use planning of these areas, open space and landscape development areas should predominate. Essentially in any view of these development areas, the impression of landscape should be clear and unambiguous. Development should appear within a total landscape environment as opposed to landscape being applied as decoration to the edges of development.

Equally critical would be the ongoing monitoring and assessment of the condition of remaining vegetation. Regular inspection and recording of the surrounding landscape environment should be undertaken to determine the extent and magnitude of impacts resulting from airport operations and enable appropriate landscape management systems to be implemented.

Management of the landscape should include the monitoring and maintenance of revegetation works, monitoring of water quality and the control of weed development along drainage lines; the harvesting of macrophytes from nutrient ponds and stormwater detention ponds.

8.2 HOLSWORTHY OPTIONS

8.2.1 MITIGATION OF CONSTRUCTION IMPACTS

Mitigation measures for the airport options at Holsworthy would need to focus on the margins of the airport and the treatment of the direct landscape impacts such as cut and fill batters, borrow areas, Obstacle Limitation Surfaces clearing

and stormwater management. The two options have similar issues which are discussed as general mitigation measures for both sites.

Cut batters would be largely inward facing and would therefore be viewed as part of the airport environs. As treatment of these batters is expected to be near vertical faces, where geology permits, revegetation would not be possible. Fill embankments are outward facing and should therefore merge with the surrounding terrain. The use of vertical toe walls to retain and control the filling operation should be investigated for fill batters. This would allow the construction area to be controlled and prevent unnecessary and uncontrolled destruction of bushland margins.

Revegetation of fill batters would be limited by the operational requirements of the airport. Plant material used for revegetation should attempt to match the indigenous plant communities of the immediate site. Plant material used in any revegetation work could potentially be propagated from seed or cuttings of existing site vegetation. Collection of seeds would therefore be vital to avoid introducing new genotypes to the region. Use of local landscape materials from the site including mulches and soils as well as plants should be maximised.

Borrow areas should be planned so that on completion the configuration of the borrow area is compatible with the existing adjoining terrain. If possible, proposed borrow areas could be relocated to areas that would be destroyed by the establishment of Obstacle Limitation Surfaces. This might allow site disturbances to be concentrated in fewer areas.

Modification of the existing drainage regime in terms of water quality, sediment transport and increased nutrients and pollutant levels poses a threat to the long term condition and viability of the bushland and downstream creek environments. The implementation of a monitoring system that facilitates regular inspection and recording of the surrounding landscape environment to determine the extent and magnitude of impacts should be a priority management measure. From this, appropriate landscape management systems could be implemented to maintain and preserve the existing bushland environment.

Minimising the number of access points to service corridors and combining service corridors into one easement would minimise the impacts of fragmentation and edge exposure of existing bushland.

The landscape impact at both sites is extreme, involving the complete destruction of the existing landscape as it now exists at each site. Mitigation measures described below relate essentially to the margins of the airport on the basis that the primary requirement of mitigation in circumstances like these is

to restrict the damage to the immediate footprint of the development and to prevent continuing degradation and loss at the edges of the development.

Treatment of Cut and Fill Batters

Cut batters are largely inward facing and are therefore viewed as part of the airport environs than the adjoining bush setting. The treatment of these batters is expected to be near vertical faces where geology permits. Revegetation is consequently not an option.

Treatment of fill embankments on the other hand are outward facing and should therefore try to link with the surrounding the terrain. The most difficult areas to address are where the edges of the airport platform adjoin steep incised valleys. In these situations, it is imperative to restrict the filling at the top of the slope to preserve the existing valley wall formations. The treatment of fill batters should therefore investigate the use of vertical toe walls to retain and control the filling operation. This allows the construction area to be controlled and prevents unnecessary and uncontrolled destruction of the bushland margins.

The revegetation of fill batters is limited by the operation requirements of the airport. Consequently tree planting is restricted particularly in areas identified as obstacle limitation surfaces. These zones would be restricted to a cover of low heath. Immediate edges would have similar limitations with mainly lower portions of batters capable of supporting woodland or gully forest. Selection of plant material should match as far as possible the indigenous plant communities of the immediate site. Plant material used in any revegetation work must be propagated from seed or cuttings of existing site vegetation. Collection of seed would be vital to avoid introducing new genotypes to the region.

Further to this, only landscape materials from the site should be used in any subsequent works, this includes mulches and soils as well as plants. Imported materials should be avoided.

Borrow Areas

These are essentially quarry areas. The restoration of these zones should adopt best practice methods of revegetation. The possibility of locating the borrow areas in locations that will destroyed by the establishment of obstacle limitation surfaces should be investigated, where they occur within the site boundary and catchment areas. This would allow site disturbances to be concentrated in fewer areas and reduce the fragmentation of remaining bushland.

The profiling of borrow areas should be undertaken in a manner which enables its integration with the existing topography. Present plans show a pitched profile which may potentially pose problems in the control of sediment movement from the site. The management of these borrow areas should aim to minimise sedimentation impacts. Where a vertical face is to be achieved this should be stepped to enable the borrow to be integrated into the natural surrounds.

Sediment control of the borrow areas is not covered in the construction report. This needs to be addressed to minimise impacts to adjoining creeklines. The preferred approach would be to have control ponds located within the borrow footprint and to minimise changes to the creek system. However, this may not be possible in the terrain nominated and creekline modifications may be necessary.

Stormwater Retention Ponds

These should aim to be as close to disturbed areas and collection points as possible. The removal of nutrients should be undertaken as part of the water treatment processes. This may require the use of macrophyte beds or other alternative technologies. These beds should form part of the detention/ retention pond system to minimise landscape impacts.

Access and Service Corridors

The mitigation of impacts along access and service corridors is addressed individually for each airport option. The general principles which apply are however universal. Combining service corridors into one easement is essential to minimise the detrimental effects of fragmentation of existing bushland. Minimisation of the number of access points to service corridors is another factor. The overall objective is to limit the length of service corridors cutting through existing bushland in order to limit edge exposure and fragmentation of the existing bushland.

Option A

Three road access corridors and one rail access corridor are identified for Holsworthy Option A, two are road options and one a combined road and rail corridor. Of the three alternatives the northern option involves the least impact as it allows road and rail access to be combined and it is the only alternative offered for rail access.

The first of these is the western road option between South Western Freeway and the site. This option utilises the existing high voltage cable alignment for much of its length and therefore reduces its impacts by being located in an area of some disturbance. It does, however, create a physical barrier between

southern and northern sections of the Georges River valley. To further reduce these impacts the use of a bridge across the valley is recommended. Control of stormwater is also of importance, careful siting of detention and pollution control devices should be undertaken to limit fragmentation of the adjoining bushland margins.

The second of these options is the road and rail corridor to the north connecting with the South Western Freeway at Moorebank. This option creates a linear corridor along a similar alignment to the Old Coach Road which impinges on the viability of the adjoining areas of the Georges River valley. This corridor runs adjacent to an existing high voltage line offset by some 100 to 500 metres.

The third option is the eastern road access connecting with Old Illawarra Road at Menai. Existing bushland has already been partly degraded by present army operations including an airfield. Crossings of Woronora River and Deadmans Creek should be by bridge to limit impacts on each valley.

Option B

There are three road and two rail access corridors identified for Holsworthy Option B, two of the options combine road and rail with the third splitting them.

The first is the road and rail corridor to the west connecting with the South Western Freeway at Appin. This alternative offers the shortest route, with good linkages to existing transport modes. Being the shortest route means that fewer areas are affected and that impacts on existing bushland as a whole is reduced. However, it does fragment the bushland along the western boundary with the possibility that movement of fauna is restricted between southern and northern portions of the site. Bridges should be used at all valley crossings. This option results in the least amount of bushland fragmentation.

The second is the road and rail corridor to the north connecting with the South Western Freeway at Moorebank. The alignment of this corridor generally corresponds with that of the existing Old Coach Road with its northern section following the same alignment as the corridor nominated for the northern airport site. This lengthy corridor fragments the western edge of site to produce a lengthy isolated strip of proportionally narrow land which is likely to result in a decline in bushland quality due to weed/pest invasion.

The third is the road corridor to the north-east connecting with New Illawarra Road at the intersection of Heathcote. This corridor follows the basic alignment of the existing Old Illawarra Road to link eventually with Heathcote Road. The corridor is lengthy and would separate the adjoining Heathcote National Park and Lake Woronora catchment area along the military reserve

boundary. As this is a road option only, another corridor would be required for rail access from the north or the west.

Of the three road and rail access corridor options the western link would have the least landscape impact.

8.2.2 MITIGATION OF OPERATIONAL IMPACTS

As with Badgerys Creek the majority of impacts would occur as a result of the construction phase. The main area of landscape impact during the operational phase of the airport is the potential for continuing deterioration of the adjoining areas of bushland and downstream sections of the creek systems below the airport. The modification of the existing drainage regime in terms of quantity of water, sediment transport and increased nutrients levels and pollutants are the greatest threat to the long term condition and viability of the bushland and downstream creek environments. Stormwater detention ponds are proposed as part of the works for erosion and sediment control. In addition to these, nutrient control devices need to be incorporated upstream from these ponds as close to the source as possible.

The main factor involved in the mitigation of operational impacts on the landscape is the implementation of an on-going monitoring system that facilitates regular inspection and recording of the surrounding landscape environment to determine the extent and magnitude of impacts resulting from airport operations. The objective would be to establish appropriate management systems that can be implemented to maintain and preserve the existing bushland environment. Management of the landscape should include the monitoring and maintenance of revegetation works, monitoring of water quality and the control of weed development along drainage lines; the harvesting of macrophytes from nutrient ponds and stormwater detention ponds, the maintenance of obstacle limitation surfaces clearance zones with a low heath cover which will involve the periodic removal of larger plants.

Part E

Summary of Visual and Landscape Impacts

CHAPTER 9 SUMMARY OF VISUAL AND LANDSCAPE IMPACTS

The three Badgerys Creek options all have similar impacts. All options involve complete modification of the existing landscape and visual environment. The only difference between the three options, in terms of landscape and visual impact, is the extent of impact.

Of the three Badgerys Creek Options, Option A would have the least impact due primarily to it requiring the smallest land area owing to the fact that it involves the development of only two parallel runways. Options B and C would involve the development of three runways, two parallel runways both 4,000 metres long with a 2,200 metre separation and a cross runway of 2,500 metres in length.

The land area required for the development of the basic airport platform for runways, taxiways, terminal, control tower and apron reserve areas in Option A is approximately 800 hectares. Options B and C are approximately 50 percent larger with Option B requiring approximately 1,200 hectares and Option C requiring approximately 1,100 hectares.

Option A also retains Badgerys Creek in its entirety. Options B and C would involve filling that section of the creek occurring upstream of Badgerys Creek Road. This represents approximately 50 percent of the creek as it occurs between The Northern Road and Elizabeth Drive.

The loss of vegetation is also significant, even though the three sites have already been extensively cleared and modified for agricultural purposes, as the development of an airport would add to the on-going incremental loss of vegetation cover in western Sydney.

The landscape and visual impacts of all three options on their respective sites would be severe and extensive. However, as the sites have already been extensively modified and consist largely of cleared pasture/grasslands, significant opportunities exist in all three options for landscape development of the remaining peripheral areas in each option. The existing topography and vegetation of the site are the primary elements which control existing site visibility. As much of the site is cleared there is significant potential for modifying existing topography for the purpose of screening the site and controlling viewing opportunities. The scale and configuration of these peripheral areas would also permit the creation of landscape environments as opposed to more conventional methods of screening that utilise linear elements along boundaries. This would allow the visual characteristics and landscape perceptions of the area to be maintained and enhanced.

The two primary determinants of existing landscape character in each of the Badgerys Creek options are topography and vegetation. Consequently, they would be critical elements in mitigation of impacts. For them to be effective would require the provision of substantial portions of the peripheral lands to permit retention of existing vegetation, reprofiling of existing topography and revegetation. Part of this allocation of space for landscape development would include development setbacks from boundaries and road margins of at least 200 metres. Such an allocation of space for the sole purpose of landscape development would be essential to each of the options.

For the Holsworthy Options the landscape impacts would be extremely large. Each option involves the complete alteration of the existing landscape. The existing landscape of the Holsworthy Military Area is part of the larger Woronora Plateau landscape, which together with the Hornsby Plateau in the north are the areas that contain most of Sydney's bushland coverage. The bushland of Sydney is in short supply and under constant development pressure, it is an ever decreasing resource.

In the central and western parts of the region only small remnants of original vegetation remain. Consequently these remaining large tracts of bushland to the south and north of Sydney are of great importance and significance to the entire Sydney region. Much of the remnant bushland in Sydney is of a degraded condition. The areas to the south and the north are significant in terms of their size and coverage, their ecological authenticity and as records of Sydney's natural and cultural heritage.

In addition to the immediate devastation arising from the construction phase, there is likely to be on-going further decline in quality and condition of the remaining bushland areas adjoining the edge of the airport development and also in the existing creeklines downstream from the airport development.

Although it is unlikely that either Holsworthy Option A or B would be visible from areas outside the Military Area the development of an airport at either site at Holsworthy would be undesirable in terms of landscape impacts.

TABLE 9.1 SUMMARY OF POTENTIAL VISUAL AND LANDSCAPE IMPACTS - BADGERYS CREEK OPTIONS

Option	Landscape Impact	Visual Impact
Badgerys Creek - Option A	▪ Terrain modification approximately 800 hectares. ▪ Cut embankments up to 16 metres, fill embankments up to 13 metres. ▪ Loss of upper section of Oaky Creek, approximately 1 kilometre. ▪ Loss of existing vegetation from area of terrain modification.	▪ Existing rural visual character completely modified. ▪ Loss of views from The Northern Road (realigned) to the east. ▪ Views south from Elizabeth Drive restricted. ▪ Viewing opportunity from northern section of Badgerys Creek Road lost (road removed).
Badgerys Creek - Option B	▪ Terrain modification approximately 1200 hectares. ▪ Cut embankments up to 13 metres, fill embankments up to 10 metres. ▪ Loss of upper section of Badgerys Creek, approximately 5 kilometres. ▪ Loss of upper section of Oaky Creek, approximately 1 kilometre. ▪ Loss of existing vegetation from area of terrain modification.	▪ Existing rural visual character completely modified. ▪ Loss of views from The Northern Road (realigned) to the east. ▪ Views south from Elizabeth Drive restricted; ▪ Viewing opportunity from northern and southern sections of Badgerys Creek Road lost (road removed). ▪ Views over airport possible from southern section of the realigned The Northern Road and residential areas adjoining southern airport boundary.
Badgerys Creek - Option C	▪ Terrain modification approximately 1,100 hectares. ▪ Cut embankments up to 9 metres, fill embankments up to 13 metres. ▪ Loss of upper section of Badgerys Creek, approximately 4 kilometres. ▪ Loss of upper section of Oaky Creek, approximately 1 kilometre. ▪ Loss of existing vegetation from area of terrain modification.	▪ Existing rural visual character completely modified. ▪ Loss of views from The Northern Road (realigned) to the east. ▪ Views from Elizabeth Drive restricted to the south. ▪ Viewing opportunity from northern and southern sections of Badgerys Creek Road lost (road removed). ▪ Views over airport possible from residential areas adjoining southern airport boundary.

TABLE 9.2 SUMMARY OF POTENTIAL VISUAL AND LANDSCAPE IMPACTS - HOLSWORTHY OPTIONS

Option	Landscape Impact	Visual Impact
Holsworthy - Option A	▪ Terrain modification approximately 1,800 hectares. ▪ Cut embankments up to 36 metres, fill embankments up to 60 metres. ▪ Loss of Harris Creek, approximately 4 kilometres. ▪ Loss of Williams Creek, approximately 7 kilometres. ▪ Loss of approximately 4,200 hectares of bushland. ▪ Potential continuing degradation of remaining bushland margins and downstream sections of creeklines. ▪ Clearing of bushland and cutting of ridgetops to establish obstacle limitation surfaces outside Military Area boundary in Lake Woronora catchment.	▪ Airport unlikely to be visible from areas outside the Military Area.
Holsworthy - Option B	▪ Terrain modification approximately 1,600 hectares. ▪ Cut embankments up to 50 metres, fill embankments up to 80 metres. ▪ Loss of Punchbowl Creek, approximately 4 kilometres. ▪ Potential continuing degradation of remaining bushland margins and downstream sections of creeklines. ▪ Loss of approximately 2,800 hectares of bushland. ▪ Clearing of bushland and cutting of ridgetops to establish obstacle limitation surfaces outside Military Area boundary in Lake Woronora catchment and O'Hares Creek catchment.	▪ Airport unlikely to be visible from areas outside the Military Area.

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Appendices

Appendix A

Register of the National Estate Database - Place Report 'Kelvin Park' Outbuildings and Curtilage

Identification

Name of Place: Kelvin, Outbuildings & Curtilage

Other Names: The Retreat

Database No: 003298

File No: 1/15/023/0012

Principal Group: Farming and Grazing

Status

Legal Status: 21/03/1978 — Registered

Admin Status: 21/03/1978 — Registered

Location

Nearest Town: Bringelly

Distance (km): 3.00

Direction from town: NE

Area (ha):

Address: Bringelly Rd, Bringelly NSW 2171

Local authorities: Liverpool City

Property Information
Part portion 22 and part of land in d.P. 90287

Location/Boundaries
Approx. 3Km.Northeast of Bringelly.

AHC Official Statement of Significance
Built by Thomas laycock jnr.,1820, Having received the Bringelly grant in 1818. He returned to Australia in 1817 after fighting for England in the American war of 1812.An early house of quality and rich historical associations being one of the charming country houses of the 1820
(The Commission is in the process of developing and/or upgrading official statements for places listed prior to 1991. The above data was mainly provided by the nominator and has not yet been revised by the Commission.)

Description
a stuccoed single Storey Georgian farmhouse.Hipped iron roof,'cranked'in vernacular fashion over wide high verandah on three sides.This is paved with sandstone.The roof supported on heavily chamfered timber posts and with an exceptionally finely scalloped timber valance board.Shuttered windows.Front door has beautiful elliptical fanlight over it.Exceptional cedar joinery inside.At rear is sandstock brick kitchen,dairy,offices,small carriage house at Rear.

Condition

Bibliographic references

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Appendix B

National Trust of Australia (NSW)
Listing - 'Holsworthy Landscape
Conservation Area'

HOLSWORTHY	National Trust of Australia (New South Wales) HOLSWORTHY LANDSCAPE CONSERVATION AREA		SYDNEY
Town, District, Location	Name or Identification of listing		Region
Proposer(s) of Classification Graham Quint	Title CROWN LAND	Owner/s DEPARTMENT OF DEFENCE/ VARIOUS	Map references APPIN 9029-I-S CAMPBELLTOWN 9029-I-N LIVERPOOL 9030-II-S BOTANY BAY 9130-III-S PORT HACKING 9129-IV-N
Date of Proposal July, 1996	Local Government Authority/s LIVERPOOL CITY COUNCIL CAMPBELLTOWN CITY COUNCIL SUTHERLAND SHIRE COUNCIL BANKSTOWN CITY COUNCIL		
Committee (Trust use) LCC			
Board Approval (Trust use)			

Statement of Significance

Importance in the Course, or Pattern, of Australia's Natural or Cultural History

Importance in the evolution of Australian flora and landscape

The small native tree species Heart-leaved Apple *(Angophora hispida)* and the shrub Gymea Lily *(Doryanthes excelsa)* are nearing their most southerly limit of geographic distribution within the Conservation Area (O'Hare's Creek).

The Holsworthy area is the site of one of a small number of disjunct populations of the rare shrub *Allocasuarina diminuta ssp. mimica* which occurs in isolated populations in the Sydney Region (Kingsford to Little Bay, NW of Heathcote, Blackheath to Taralga and Bundanoon. This plant is one of three sub-species, making up three disjunct populations, the others on the New South Wales South Coast and the Pilliga Scrub.

Importance in maintaining existing processes or natural systems at the regional or national scale.

The Holsworthy Area contains populations of Koala, Quoll and Grey Kangaroo which are becoming rare and likely to become extinct in the Sydney Basin with continuing development pressures. The restricted access to the Holsworthy site since 1912 has allowed the area to become a refuge for these species and a wildlife corridor between the adjoining National Parks and Nature Reserves, a source for the establishment of populations following fire and a valuable study area for study of these remant fauna populations to determine strategies for reintroduction programs.

Importance in the course, or pattern, of Australia's cultural history

The Holsworthy Area demonstrates a remarkable variety of cultural developments, phases and events in the one locality and is a place sequentially occupied over a very long period of time. For thousands of years it was the meeting place for the Tharawal and Darug Aboriginal peoples and a migration route for the Tharawal. European settlement occurred in the mid 1790s with small farms and from 1797 to 1802 there were increasing hostilities between the original inhabitants and the new settlers. Governor Macquarie visited the district in 1810 and established the adjoining Town of Liverpool. Holsworthy appears to have been named after the town in Devon, England where Macquarie married his second wife Elizabeth in 1807. The Area contains some of the colony's important early land grants from 1798 including grants to Thomas Laycock, Thomas Moore and Captain Thomas Rowley. The Area was crucial to the early food production of the colony and then demonstrated the early industry of the colony including an 1822 mill, boatbuilding in the 1830s and major river trade with vessels up to 100

tons till the late 1880s. The Area then saw the introduction of important vineyards and development of the town of Eckersley with its inhabitants ranging from the grand vignerons to settlers supplementing their incomes through illicit rum production. The Area was a crucial site during the Ist World War with the training of the Light Horse Divisions and the preparation and despatch of 47,000 horses for use in supporting combat overseas. The establishment of the German Concentration Camp was a key event in Australia's early nationhood and reflected the then deep suspicions of some migrant communities. The Area also served as a major military site during the Second World War and maintains this status to the current day.

Importance for association with events, developments or cultural phases which have had a significant role in the human occupation and evolution of the nation, State, Region or community.

The Holsworthy Landscape Conservation Area demonstrates the history of settlement with relatively intact relics such as the 1822 sandstone weirs of the Brisbane Water Mill, the Old Illawarra Road and Old Coach Road and various quarry sites dating from the days of early settlement.

It demonstrates cross cultural contacts with the rock carving of a four-masted sailing ship thought to date from the earliest days of contact between the Aboriginal peoples and European settlers and the site of one of the first reserves established under the Aboriginal Protection Board in 1883 and the site of the Heathcote Road Migrants' Hostel evidencing an important phase in Australia's history of immigration.

The Area demonstrates the development of early industries including ship building, milling, wine-growing, quarrying and some of the earliest crop cultivation and animal farming in the colony of New South Wales.

The Area demonstrates the use of convict labour including the construction of the Illawarra Road and the involvement of its key landholder Thomas Moore as the Liverpool Magistrate and Superintendent of Convicts for a period of thirty years from 1810.

Possession of Uncommon, Rare or Endangered Aspects of Australia's Natural or Cultural History

Importance for rare, endangered or uncommon flora, fauna, communities, ecosystems, natural landscapes or phenomena, or as wilderness

The Area contains populations of Quoll, Koala and Grey Kangaroo which are rare in the Sydney Region. The Area contains a large (1,650 ha) remnant of Cumberland Plain Woodland (*Eucalyptus tereticornis/Eucalyptus moluccana/Eucalyptus crebra* with understorey dominated by *Themeda australis*). This community is being listed under the NSW endangered species legislation as an endangered community. The Area also contains a number of plant species which are rare or endangered on a national basis - *Melaleuca deanei, Tetratheca neglecta, Eucalyptus luehmanniana, Allocasuarina diminuta, Allocasuarina glareicola, Grevillea longifolia, Lomandra fluviatilis, Darwinia grandiflora, Blechnum ambiguum, Eucalyptus baueriana, Eucalyptus multicaulis, Eucalyptus squamosa, Grevillea diffusa, Lasiopetalum parvifolium, Leucopogon amplexicaulis, Pultenaea hispidula, Zornia dyctiocarpa* and *Bossiaea buxifolia, Acacia pubescens, Persoonia nutans.*

Importance in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practised, in danger of being lost, or of exceptional interest.

The presence in the Area of an Aboriginal carving of a sailing ship is a rare record of exceptional interest relating to the earliest contact between the new arrivals and the indigenous Australians. Also the early evidence of the 1820s/1830s mills, quarrying and shipbuilding is a now rare

example of the first industrial endeavours of the first forty years of European settlement.

The survival of the 1880s illicit rum stills is an example of an activity of the Victorian period now no longer practised in the manner of those times.

Potential to yield information that will contribute to an understanding of Australia's natural or cultural history.

Importance for information contributing to a wider understanding of the history of human occupation of Australia

The Area is known to contain at least 420 Aboriginal sites, practically all of which are above surface art works or markings. The presence of the firing range since 1912 has restricted public access and urban development and it is to be expected that those portions of the Area not previously disturbed by European nineteenth century settlers will yield considerable aboriginal archaeological evidence contributing to a wider understanding of the occupation of the coastal Aboriginal peoples.

There are a number of industrial heritage sites , e.g. the Brisbane Water Mill and the Grodno Vineyard at Eckersley etc. which have not been investigated and have the potential to yield information which would contribute to a better understanding of the history of this region of Sydney which has been only scantily recorded in the historical literature.

Strong or Special Associations with a Particular Community or Cultural Group for Social, Cultural or Spiritual Reasons

Importance as a place highly valued by a community for reasons of religious, spiritual, symbolic, cultural, educational or social associations

The name "Holsworthy" is synonymous with the Army Camp for the thousands of Australians who trained there during World War II and who undertook National Service Training or Permanent Army service there in more recent years as it would have been for the members of the Light Horse Regiments, their families and descendants in terms of the First World War. It is a community history landmark site of National significance.

Special Association with the Life or Works of a Person, or Group of Persons, of Importance in Australia's Natural or Cultural History

Importance for close associations with individuals whose activities have been significant within the history of the nation, State or region

Holsworthy is intimately associated with New South Wales Governor Lachlan Macquarie who visited the Area in 1810, established the neighbouring town of Liverpool in that year and after whose wedding town in Devon, England the Area was named. Early land grantee Thomas Moore after whom the suburb of Moorebank was named and who was a pivotal figure in the first forty years development of the local region was the key early resident of the Area.

Aboriginal Peoples:

The Holsworthy Cultural Landscape Conservation Area falls within the Tharawal Local Aboriginal Land Council area. The Tharawal tribal homeland is bounded by Botany Bay to the north and the George's River to the west and extends to the south coast.

The adjoining area (present day Liverpool) was the home of the Cabrogal clan of the Darug Tribe which was centred on the Cumberland Plain.

The Cultural Landscape would have been a key travel route for trade purposes between the two tribes and the first european ridge-top bridle tracks to the Illawarra which later developed into the early connecting roads would have followed these trade routes developed over thousands of years.

The explorer George Caley noted such a 'native pathway' in the Leppington area west of Liverpool in the early 1800's. In "On the Frontier - A Social History of Liverpool", Christopher Keating noted "Seasonal shortages dictated movement which brought contact with other clans and tribes. This reinforced the complex social system and the trade networks, along which travelled material as well as spiritual goods.

Items of religious significance...were passed between tribes as far away as Wollongong and Newcastle. At large *kuringal* (initiation) ceremonies the three local tribes (Darug, Tharawal and Gandangara (Blue Mountains) were often joined by their northern neighbours the Darkinjung and Kurringgai and even the Awabakal from the Newcastle region."

Keating records that "by 1810 the pattern of domination and dispossession of the Aboriginal peoples around Sydney had been well and truly established..."Troops were posted at the George's River in 1797 to guard crops. In 1801 Governor King ordered that all the Aborigines in the Prospect, Parramatta and George's River areas 'be driven back from the settlers' habitations by firing at them'. A state of open warfare lasted for the next year."

In 1883 the Aboriginal Protection Board was established in New South Wales and one of the first reserves in Sydney was set up at Holsworthy. It is understood that this reserve was established on Portion 53 in the Parish of Holsworthy, an area of 100 acres first granted to John Thomas Williams in August, 1809. Williams was a First Fleeter and his name is perpetuated in Williams Creek which adjoins Portion 53. This land is situated at the confluence of Williams Creek and the Georges River on the eastern side of Williams Creek.

At the time of the transfer of Portion 53 to the Commonwealth in 1950 for a Migrant Hostel it was still understood to be an Aboriginal Reserve and occupied by people of Aboriginal descent.

Keating's *A Social History of Liverpool* notes that "Within the restricted-access areas of the Australian Army firing range at Holsworthy there remain over 400 significant Aboriginal sites, including rock shelters, ochred stencils and carvings of animals and spirit figures...and the recent discovery of Aboriginal artwork -dated from the time of Captain James Cook and depicting a four-masted sailing ship."

The Holsworthy Training Area Environmental Audit prepared in 1995 by Axis Environmental and AMBS Consulting for the Department of Defence recorded 295 sites comprised of 219 shelters with art and/or deposit, one shelter deposit, 58 grinding grooves, five engravings, eleven grooves and engravings and one open site. The Audit noted that "open sites were not easily detected as the artefacts are usually buried within the deposit and only revealed during disturbance of the ground. Additionally, recognition of such sites depends on experience with stone artefacts and they are

usually only detected by trained archaeologists." It is thus very likely that further investigations would increase the number of sites, particularly open sites.

European Settlement:

In 1788, Governor Arthur Phillip explored Botany Bay and sailed up the George's River for a short distance before arriving at Port Jackson and establishing the first European settlement.

Captain John Hunter (to become the second governor of the colony in 1795) surveyed Botany Bay in September, 1788 and entered Georges River, then known as 'West River' travelling upstream tp present day Alford's Point.

In *An Historical Journal of Events at Sydney and at Sea 1787-1792*, Hunter writes

> "The river in some parts has good depth and that near and within its entrance; but higher up it is all shoal water, and full of knowls of sand; in short, it is only to be navigated by boats; it has two branches, in which there are several coves, or bays containing shoal water."

Matthew Flinders and George Bass were the first to undertake a major exploration of the George's River. They sailed up the River in 1795 for approximately 40 kilometres and to beyond present day Liverpool.
In November 1795 Governor Hunter made a journey to the Cow Pastures district to inspect the colony's herd of cattle which had escaped in 1788 and were lost for years until found by a convict. On his visit Hunter passed through the area later to become the town of Liverpool.

In the late 1790s there were the first accounts of the George's River Settlement which was one of the earliest farming settlements in the Colony with farms and dwellings scattered along the George's River. Troops were posted to guard crops in 1797. In April 1798 the area's first land grants in "Bank's Town" went to Bass and Flinders and to captains George Johnson and Thomas Rowley on the River near the present suburb of Georges Hall.

The first land grants in the Liverpool area from 1798 to 1805 were in the present Moorebank and Chipping Norton areas on the southern bank of the George's River opposite the grants at present day George's Hall.

These first small land grantsof 40 acre allotments for cropping were to Captain Thomas Rowley, Richard Clinch, James Angle, Thomas Bramwell and others. Clinch's 260 acres granted in March 1800 were taken up by his family following his death by drowning before the deeds were completed. He is commemorated at Clinches Pond, a component of the Holsworthy Cultural Landscape Conservation Area.

Thomas Moore was the first major grantee of land receiving land at present day Moorebank in 1805 and additional grants in 1809. His grants totalled 6,000 acres on the east bank of the river and covered most of the lands from the George's River east to Harris Creek and south to the east-west bend of Harris Creek. Moore had arrived in the colony in 1792 on the Britannia as the ship's carpenter and in 1796 was appointed Government Boat Builder.

In the George's River floods of 1800, settler John Hopkins had five acres of corn and eight acres of cut wheat 'entirely carried away with five Pigs and almost a hundred fowls.' In 1809 the George's River again rose in a flood to 34 feet and brought food shortages of famine status to the colony. Christopher Keating in *A Social History of Liverpool* concludes that "It was these circumstances that led Macquarie to begin opening up the forest land to the west of the Cumberland Plain."

On 7 November, 1810 Governor Lachlan Macquarie, his wife Elizabeth, the Surveyor James Meehan and Captain Antill crossed the George's River and visited Thomas Moore at his house "Moore Bank". Macquarie founded the town of Liverpool on 15th December, 1810 and built a gaol, commissariat store, convict barracks, military barracks, a church, parsonage and hospital.

Moore was appointed a magistrate in 1810, was responsible for allocating the town blocks in Liverpool and was Superintendent of Convicts. He received no payment for this work. Moore co-ordinated fundraising for the building of a school and five bridges along the road between Sydney and Liverpool.

Moore was the overseer for the building of the Liverpool Gaol in 1819. Moore continued as magistrate for thirty years until his death on Christmas Eve, 1840.

In his will, Thomas Moore gave his entire estate to the Church of England which administered it for the next sixty years. Under the bequest, Moore Theological College was established in Elizabeth Street, Liverpool in 1857. Both the old Moore Theological College and the adjoining Thomas Moore's house were demolished in 1930. Moore is commemorated in the naming of the suburb Moorebank.

Christopher Keating records that in 1814 there were very few people living in the town of Liverpool with most of the population living on the farms. "3,229 acres of land were under cultivation in the Liverpool district, nearly one-third of which was growing wheat, with maize, barley and oats being the other major crops. Just under 20,600 acres were in use as grazing land supporting 4,743 cattle and 8,554 sheep and 1,090 pigs. By 1817 the area under wheat had almost trebled to 2,989 acres...and... the number of cattle grazed in the district doubled to 7,291 head and sheep numbers rose by about 50% to 12,667."

Keating records that by 1821, the Liverpool district was second only to Windsor in the production of wheat. The historian Brian Fletcher calculated that the Liverpool district contained 28.1% of the land owned in New South Wales, 28% of the area cropped, 27% of the horses, 26.9% of the cattle and 27.5% of the sheep. By 1826 the great majority of this wool was exported to England.

The 1821 Liverpool district covered included areas such as present day Campbelltown, Camden, Cobbity, Menangle and Bringelly. However, the area's agricultural industry and its vital contribution to the early growth of the colony of New South Wales began with the small farms on the Georges River.

The exploratory expeditions of the naval officers Phillip, Hunter, Flinders and Bass and the posting of troops to the George's River in 1797 to guard crops were portents of the area's increasing involvement with the military over a two hundred year period.

Keating reports that "By 1821 the town (Liverpool) housed a large military presence. In July 1819 a troop of 41 blue-jacketed, yellow-caped Cavalry (including thirty privates, a farrier and a trumpeter) and a company of 53 red-jacketed infantry (complete with 42 privates and no less than three drummers) were stationed in Liverpool."

Industry was also developing in the Liverpool area and within the Holsworthy Landscape Conservation Area. An 1827 map of part of the Parish of Holsworthy prepared by surveyor Robert Dixon noted a "mill" on the western bank of Williams Creek on land granted to Thomas Rowley and adjacent to the land grant to miller John Lucas. This mill is thought to have been the 'Brisbane Water Mill' built in 1822 and operated by John Lucas and named after Governor Brisbane.

In the March 1824 edition of the Sydney Gazette there appeared the following advertisement:-

> *"BRISBANE WATER MILL - The first Grant of his Excellency the present GOVERNOR, of one hundred and fifty acres of land, for the purpose of erecting a Water Mill, at Liverpool, has been completed by Mr John Lucas, a Native of the Colony. This mechanic has finished the Machinery with the greatest accuracy; and now the Dam is completed, the Public are assured, that Flour will be Sold at as low Prices as in Sydney; and I can confidently say; this Mill will not stand still for the want of Water, when once the Dam is full. A hitherto the Mill was worked undershot, this waste, added to the uncommon drought, has caused the Mill to stand still. In the mean time, Mr. John Lucas will receive Wheat, free from smut, at the Liverpool Warehouse, and pay for the same as fair as Settler can sell in Sydney..".*

On the farms of John Campbell and John Gowen at Holsworthy, F.E. Forbes operated sawpits with convict labour from 1832. Both the sawpits and the adjoining quarry shipped their products by boat along the George's River.

The Liverpool Bench Books (Archives Office of NSW) dated 3rd and 18th September, 1832 report on the operation of a shipyard by a Mr Coutts at the confluence of Williams Creek and the George's River and the building of the vessel *Lady Leith* there in about 1832.

David Lennox designed the Lansdowne Bridge over Prospect Creek and using convict labour built the bridge between 1834 and 1836 with sandstone quarried from a site near present day Voyager Point on the Georges River east of Holsworthy. The stone was quarried by a "gang of 50 ironed convicts under military guard" who all lived in "caravans" near the site (Christopher Keating's "On the Frontier - A Social History of Liverpool".

Industry continued in the Holsworthy area with George Onslow operating his quarry from 1841 and ships continued to be built near the junction of Williams Creek and the Georges River till the 1840s. Schooners with a berth of 100 tons loaded sandstone from the quarry and plied the George's River.

The establishment of the Liverpool Paper Mills in 1868 required the importation of coal by rail from Lithgow but this was supplemented by shipping along the George's River up to the 1880s when the 40-ton ketch *Ino* and the schooner *Advance* brought coal from Wollongong and Newcastle.
In the 1860s Joseph Pemmell set up a cardboard mill at Holsworthy on William's or Harris Creek. This mill was later converted to a flour mill and then Thomas Woodward utilised the mill as a woolwash until it was destroyed by fire in the 1880s.

The New Century Brings Changes

The late nineteenth century saw a major shift in agricultural emphasis and a growing awareness that environmental pollution from industry in the Liverpool/Holsworthy area could no longer be tolerated.

The onset of rust disease and poor seasons in the 1860s saw the decline of wheat growing on the Cumberland Plain and its transfer west of the Great Dividing Range.

Floods, siltation of the George's River, bushfires, the comparatively small size of allotments and agricultural competition from other areas saw the general decline of cereal and livestock production.

As indicated earlier, the local economy initially diversified into various industrial undertakings which provided much needed employment and income for the settlers facing destitution.

However, these industries proved to be very environmentally degrading with severe impacts on the George's River. Tanneries, saw mill, wool scours, paper mills, abattoirs, flour mill and fellmongering (animal skin production, tanning of quality pelts and glue production as a by-product) all discharged their untreated by products to the River.

A report in 1885 by the chief government medical officer, Dr Ashburton Thompson noted that both the Collingwood Paper Mill and Haigh's wool scour were each pumping 6,000 gallons of sewage per hour via ponds to the River. The effluent contained caustic soda, pulp fibre, soap, dirt, fatty matter and other industrial waste.

The fellmongery soaked the skins of 4,000 slaughtered sheep per week in pits from which the drainage flowed to the River. This effluent was joined by discharges from the town drains, bath house, laundries, lavatories and kitchens of the Old Men's Asylum and produced 'visible deposits' on the banks of the River with the caustic soda killing the River's fish.

The move from noxious industry to a diversified agricultural base began in the 1880s when the small acreage farmers began fruit and grape growing. Christopher Keating noted "On Franklin's farm the experimental vines 'throve so well in the sandy loam of the river flats that a vineyard was planted'. "

A report in the September, 1889 edition of the Cumberland Argus noted a new community had established at Eckersley south of Holsworthy -

> *"a novel settlement [of] thirteen Russian Poles, under a Russian nobleman named De Liski, who finds the money [and each has] selected 640 acres of land, and are planting it out with grapes, almonds, figs and olives. The foreigners reckon they have struck the best land in the world for vine growing and intend to show the world the best champagne yet uncorked."*

A few kilometres further south Charles Kelso and the Frere Family also established a vineyard in 1889 known as "Beausejour." Australian vines were being attacked by phylloxera and Leonce Frere was aware that vines grown on sandy soils in France were less susceptible to attack. He determined that the sandy soils of Eckersley would be ideal for vine growing.

George Frere operated a Sydney wine cellar with wines from the Eckersley vineyard and his family's St. Hilaire Vineyard at Thurgoona Near Albury. By early 1895 it was clear that the poor soils on this site were unsuitable and the project failed. Georges Frere returned to the St. Hilaire Vineyard and later became Mayor of Albury.

However the richer soils further north proved very suitable for vine growing and the Grodno Vineyard of Isaac Himmelhoch was very successful.

An article in the Sydney Mail of May 4, 1901 reported on an inspection of the Grodno Vineyard by the Hon. J. Kidd (Minister for Mines & Agriculture), Professor Blunno (the Government Wine Expert), Isaac Himmelhoch and the Mayor and some Liverpool Municipal Council aldermen.

The winery premises were described as including "a new and commodious wine cellar with pressing and fermenting room attached, constructed of stone, with tiled roof, the temperature of which rarely exceeds 60 degrees."

In 1901, the Grodno Vineyard contained an area of about 17 acres under Hermitage and "Maalbec" grapes, and about 15 acres were to be planted with fully established cuttings planted in the previous season.

The 1902 and 1903 NSW Post Office Directory listings for Eckersley recorded ten farmers. an apiarist, a selector and five vignerons.

Following petitions from the local community the Eckersley Post Office was established at the junction of Old and New Illawarra Roads.

Old Illawarra Road linked Liverpool to Darkes Forest. A more easterley Old Illawarra Road linking Cooks River via a punt at Lugarno and a crossing of the Woronora River at the Pass of Sabugal was built by Surveyor-General Mitchell in the 1850s. When this was replaced by the Princes Highway in the 1870s the more easterley Old Illawarra Road fell into disuse and was replaced by New Illawarra Road linking to the Liverpool Old Illawarra Road at Eckersley (Heathcote Road was not built until the Second World War).

It is difficult to determine the age of the Old Illawarra Road from Liverpool to Darkes Forest and the Illawarra. The road appears on the 1886 title documents for various allotments when the town of Eckersley was established. A coach station (probably Cobb & Co) was established on the Old Illawarra Road at Giles Junction. It is understood that the wells, cobbled roads and horse yards for this station still survive on this site (pers. comm. Peter Coghlan, Sept, 1996). The former Denmark Hotel at 202 Princes Highway, Bulli (1878) which was entered on the National Trust Register on 21st February, 1977 has a watch tower which was used as a lookout on coach days when a member of the household would "scan the mountain track for the coming of the Cobb and Co Coach." This was the likely next staging post on the route after the Giles Junction Station.

A card index in Liverpool City Council's Local History Library contains references to early road building in the Liverpool area and the following entry:-

"Illawarra Road from Liverpool to Hammondville and beyond, built by convicts in 1850, in 1930 called the 'Army' Road."

But there are indications that this road may be considerably earlier than this date. An 1810 map indicates Macquarie's district of Airds, the eastern boundary of which coincides with the route of the Illawarra Road or more correctly Greenhills Road from Liverpool to its connection with Illawarra Road and then Illawarra Road southwards. This same map indicates a road progressing onwards from the Airds boundary line which is marked "The Road to Five Islands" - the earlier name for the Illawarra District.

It is therefore likely that this route may have been used by the earliest settlers on the Georges River (pre 1810) to travel to the then Five Islands and that they may have been following an original aboriginal migration route. If this can be established then this road may prove to be one of the earliest Australian roads surviving in a relatively original setting. And, given its use by the Eckersley and earlier settlers and now the army, this road would be one of Australia's oldest road routes in continual use (approaching two centuries).

Similarly The Old Coach Road, Greenhills Road and the National Park Road appear to have been used as early transport routes for the settlers in the Liverpoool/Holsworthy/Campbelltown area. Photographic documentation of stone culverts indicates a quality of work which is associated with two periods - either relief unemployment work of the 1880's or much earlier convict stone work. Investigation by archaeologists will be required to establish definitive dates for these works and the roads.

The Journal of the Campbelltown and Airds Historical Society Inc. (Grist Mills) details the town of Eckersley where a number of families selected land in the late 1880s and early 1890s.

Besides the Frere and Kelso families the settlers included the Etchells and Longhursts. Grist Mills notes that "Frank (and sometimes Harry) produced rum from illegal stills concealed under rock ledges near waterfalls at Eckersley. Swamps filtered the water, maintaining a constant flow. The site of each still always included a creek with a flow of water, a rock bar undercut to provide room for the boiler and a condenser and shelter for the people feeding the fire. Usually the water flowing over the bar was directed into the condenser by a chisel-cut groove, if nature had not already provided a suitable cascade. There were at least three stills, including one on Garden Creek. As well as supplying cattle to the Illawarra, distilled rum was taken overland by the Etchells on pack horse to Bulli where it was sold to miners. It was carried in 4-gallon kerosene tins, two either side of the horse, and sold at £4 a tin, so all up they made £16 a trip. The rum was known as '3Ps' - 'Profitable, Private and Pure.' "

Grist Mills notes that a detective named J.P. Rochaix moved onto fifty acres immediately north of the Kelso property allegedly to try and catch the Etchells brothers red-handed with their illegal rum. "My father reckoned they sent a detective to live there to catch him out", said Oke Etchells. "My father used to go by his place and pretend he was going to make a drop, and the detective would follow him and then Dad would lose him in the bush."

The activities of the Etchells with their illegal rum and subsistence lifestyle contrasted dramatically with the nearby Grodno Vineyard and its major financial investments by the Sydney financier Isaac Immelhoch.

The Re-Emergence of a Military Presence

In "A History of 'A' Battery" Richmond Cubis documents the re-emergence of Holsworthy as a key military area. In 1886, following the Soudan expedition, the NSW Government allowed the use of the then National Park (Royal National Park) for annual training.

On Flagstaff Hill (above Gray's Point) a signalling station was established providing communication by heliograph to Victoria Barracks at Paddington.

Cubis writes "The first camp was held at the National Park at Easter 1886 and, whatever its military virtues, it proved to be a sensational attraction to the citizens of Sydney who flocked there in a multitude. The Railways had planned one special train but the crush was so great that they had to provide three others, running out of carriages and turning to cattle trucks."

The Royal National Park spur line was, Cubis notes "constructed by the NSW Railways as a "military railway" and matched the military road, which in due course constituted the southern part of Lady Rawson Avenue."

"The culminating events of this camp, and subsequent ones, were a field day in which the troops divided into attacking and defending forces and went through appropriate manoeuvres, and a ceremonial day, when the Governor inspected the troops. National Park was to be used annually until 1890. It was used again until the Holsworthy-Eckersley range was acquired shortly before the Great War...The site for the 1897 camp and subsequent ones was across the Port Hacking River from Audley in an area, still known on the maps as Artillery Hill."

"In September 1903, a staff ride (a tactical exercise for the theoretical training of officers, not attended by troops) took place in the Holsworthy Liverpool Area which the Cadre Commander, Sweetland, attended with the other commanding officers and adjutants of the Light Horse Brigade.

In the course of this staff ride the officers of the Australian Light Horse brigade, being exercised, actually rode up the impossible track from Darkes Forest to Eckersley, approaching Porcupine from the south and ending on the present Heathcote Road near the present reactor site," wrote Cubis.

"In early 1911, 1 RAFA (Royal Australian Field Artillery) (the Sydney battery) had attended and assisted at the annual militia camps at Liverpool with shooting at Heathcote. Shooting in the National Park was becoming unpopular and it was now the practice to fire from an elevated position about 1 miles south of Heathcote Station. From this position, the guns fired west across the Woronora River on to Eckersley Ridge in (what is now) the Holsworthy Range Area and on to Battery Knob"

Christopher Keating records that "since the early 1890s military encampments and manoeuvres had been conducted at Easter time each year in the Liverpool area. In May 1894 the 'A' Battery of the New South Wales Artillery practised 'Boer formations' at Liverpool...and annual manoeuvres and artillery training took place annually up until World War I."

"Lord Kichener spent the two days of 6 and 7 January 1910 at Liverpool watching manoeuvres by 6000 infantry and light horse soldiers and a vineyard homestead, now known as 'Kitchener Cottage' was converted into his temporary headquarters," writes Keating.

Based on a Report by Kitchener, in 1912, 883 acres of land were acquired for the establishment of a Remount Depot and Veterinary Hospital and a further 16,868 acres were resumed in 1913 at the site now known as the 'Old Holsworthy Camp'. A total of approximately 80,000 acres of land were finally set aside for the barracks, training area and artillery range.

On the second site the Anzac Rifle Range was completed in August, 1916.

The Liverpool Camp was the site for training of the Light Horse Regiments' new recruits who were housed in tents on the banks of the Georges River. The Remount Depot was used for the despatch of 47,000 horses for artillery purposes to the troops serving overseas.

After the declaration of World War I in August 1914, the 3rd Light Horse Brigade, 4th and 5th Infantry Brigades and the 6th, 7th and 12th Light Horse regiments were moved to the Liverpool Camp.

Internment

In 1914, the Holsworthy German Concentration Camp was established under the provisions of the War Precautions Act. Essentially any person with a German or Austrian link was liable under ths Ac t to be termed "the enemy".

6,890 people were interned under this Act in Australia. Seven hundred of these people were Natualised British Subjects (Australian Citizens) and seventy were Australian born.

The internees included Serbian, Croatian, Dalmatian, Swiss, Bulgarians, Americans, Belgians, Russians, Dutch and a Scot.

The internees at Holsworthy included captured ship crews (including the crew of the German Raider S.M.S. Emden sunk by H.M.A.S. Sydney in a naval action off the Cocos Islands on 9th November, 1914) and residents from other British territories in South East Asia and the Pacific Region.

In its 1914 connotation "Concentration Camp" meant simply to concentrate people in one place and was an approach which had been used by the British against the Boers in South Africa.

The internees of the German Concentration Camp constructed a railway during their internment period. From February 1917 to 21st January, 1918 they constructed all but the first 2.2km of the line which was constructed by the New South Wales Railway at the Liverpool end.

In *History and Significance of the Site of the Remount Depot, Holsworthy* (a July 1993 Report to the Defence Housing Authority, Consulting Historians Christa Ludlow and Catherine Snowden describe the railway line -

"During World War I the Commonwealth Government decided it needed a branch railway to service the army camp near Liverpool, the Artillery Range, Ordnance (mounted guns and cannon) and Ammunition Stores (2 miles from Liverpool), the Remount Depot (3 miles) and the Veterinary Depot (4 miles) and the enemy aliens' and prisoner of war camp at Holsworthy (5 miles)."

"The crossing of the Georges River, with eight 66 foot approach spans, four on each side came from the old single undercrossings of the Wollondilly River near Carrick and Solitary Creek near Tarana; while the main span was an eight foot truss from the old single-line over Argyle Street, Moss Vale."

"The single line joined the main Southern line on the Sydney side of Liverpool Station and crossed the Georges River on a descending grade of 1 in 68 and then crossed the Heathcote Road to reach the Camp Siding. Curving to the right, the line continued on a descending grade of 1 in 100 crossing the Heathcote Road to its left side. At Swain Street, the line left the Heathcote Road and swung to the right, passing the length of Clinche's Park (probably between it and Swain Street before it bends southeast) until it reached Greenhills Avenue. After continuing along the roadway for about a quarter mile, it curved off towards the newly constructed Anzac Rifle Range and below Anzac Road. It crossed this at the right of its junction with Centenary Avenue and then turned right again on a 15 chain curve and diverged from the road and still on its right side. It continued on, swinging south east and rising, reaching Heathcote Road again at approximately today's Bardia Parade exit. As it ran along the road, the grade suddenly increased to 1 in 40."

"At three miles from Liverpool, it reached the short loop siding of Remount Depot, possibly in the vicinity of today's school. There were catchpoints at both ends of the loop and it was capable of holding seven 4-wheel waggons. The line then crossed a road, possibly about the position of today's Artillery Parade (suggested by its older trees) and travelled over a Bailey (?) Bridge on Harris Creek. It rose steadily on grades of 1 in 50 and 1 in 40, passing the site of the proposed Veterinary Depot Siding until, at the top of a half-mile long grade of 1 in 40, it reached the Holsworthy camp. Its turning point was 4 miles, 73 chains from the junction at Liverpool."

"After the line was opened, several additional sidings were constructed. The first was the Ordnance Stores Siding, opened 29 April 1919, with standing room for 75 four-wheel vehicles on three loop sidings. The Ammunition Stores Siding on Anzac Parade was opened in October 1920."

On 3rd February 1930, the Commonwealth suspended services on the line beyond the Rifle Range and from that date only carried out repairs on the section of line between Liverpool and the Range.

The service to the Rifle Range was discontinued on 29th June, 1940 but was resumed again after the war. Due to declining patronage the last train ran on the line on 25th June, 1960. All the sidings closed on 21st June, 1977.

The camp jail, recreation centre and sergeants mess were constructed by the internees. Other internees grew vegetables in a twenty five acre area fronting the Georges River or worked in the

saw mill and sandstone quarry from which stone was cut for the construction of the jail, recreation centre and sergeants mess.

By mid 1915 the camp had three theatres, a picture show, tennis courts, football ground, band pavilion, and an orchestra.

The Deutsches Theater Liverpool produced its own theatre program brochures and opened on 26th June 1915 with performances by theatrical, singing and orchestra clubs. It sat three hundrd and fifty people. The orchestra gradually swelled to 20 members as new professional musicians came to the camp.

An open air cinema commenced in July 1916 and this developed into a large canvas-covered building seating several hundred people and called the Austro-Hungarian Theatre.

By late 1918 the camp compound boasted butchers' and fruit shops, nine cafes and restaurants, a post office and a bakery.

While to the outside observer the camp life of cafes, theatre and sport seemed too idyllic for an internee, the crowded conditions, poor camp drainage, dust, boredom and ethnic differences between the internees all took their toll. There were riots at the camp and extortion gangs operated preying on the other internees.

The camp amusements had largely developed to counter the deprivations. At Christmas the internees made toys for the children interned at the Bourke camp.

One of the internees, was a noted book illustrator Kurt Wiese who drew various cartoons depicting camp life and in his later years became the illustrator for the Walt Disney animation feature *Bambi*.

A number of prisoners escaped from the camp through a 120 metre tunnel and one stowed away on a ship to Java and was never apprehended.

The internees began leaving the camp from mid 1919 and the last man left on 5 May 1920. Most were deported.

Holsworthy to the Present

A new ordnance depot was built after the end of the First World War and the former Concentration Camp was the site for militia camps and the stone buildings erected by the internees were used for permanent army units.

The Darwin Mobile Force was established at Holsworthy before it was relocated to the north.

In July 1938 an additional 33,860 acres were added to the Holsworthy Training Area. In 1942 an Armoured Fighting Vehicle School replaced the old Remount Depot.

From 1939 the Anzac Rifle Range at Holsworthy was converted to become a prisoner of war camp. 6,780 Australians mostly of Italian origin were interned at the camp.

The army's association with the local community had its low points. Christopher Keating in A Social History of Liverpool writes - "On 24 April 1944 Lieutenants Rablings and Farleigh and eight men from the Royal Australian Engineers ran out of time in their attempts to dispose of three and a half tons of old explosives, so they detonated the remaining stock of grenades and gelignite. The surrounding vegetation was stripped bare and the shock waves travelled down the valley of

Deadman's Creek and smashed the windows of Marguerite Cox's General Store at Picnic Point. The force lifted the roof, cracked some concrete and broke the chandelier in the lounge room."

In 1958 Holsworthy became the home of 1st Infantry Brigade Group, a field force which could be despatched overseas at short notice if required. Richmond Cubis reported that "the headquarters of the Brigade was at Gallipoli Lines, Holsworthy, in barracks formerly occupied by a national service battalion and later to be shared with 2nd Royal Australian Regiment, when the latter returned from Malya". By 1990 the Liverpool Military Area contained 35 army units and 5,000 personnel.

Chronology of Early Land Grants and Land Purchases for the Holsworthy Landscape Conservation Area

Grant No	Date	Name	Details
778	14/8/1798	Rowley, Cpt Thomas	85 acres, banks of Georges R, Bankstown
793	1/8/1799	(K)Nowlan(d), Michael	30 acres, district of Bankstown
817	6/4/1798	Healey, James	160 acres, banks of Georges R, Bankstown
818	6/4/1798	Murphy, Michael	60 acres, banks of Georges R, Bankstown
808	28/5/1799	Baxter, William	60 acres, district of Bankstown
875	3/8/1799	Gilbert, Ann	110 acres, district of Bankstown
891	12/11/1799	Mitchell, William	50 acres, banks of Georges R, Bankstown
943	12/3/1800	Clinch, Richard	260 acres, district of Bankstown
1145	1/10/1803	Moore, Thomas	700 acres, district of Bulanaming
1531	8/8/1809	Williams, Johnathon Thomas	100 acres, district of Bankstown
1642	1/11/1809	Moore, Thomas	160 acres at Holsworthy "Clarke Farm"
1643	1/11/1809	Moore, Thomas	160 acres at Holsworthy "Hudson Farm"
1644	1/11/1809	Moore, Thomas	160 acres at Holsworthy "Turner Farm"
1645	1/11/1809	Moore, Thomas	160 acres at Holsworthy "Turnbull Farm"
1646	1/11/1809	Moore, Thomas	160 acres at Holsworthy "Nathaniel Farm"
1647	1/11/1809	Moore, Thomas	160 acres at Holsworthy "Boits Farm"
	19/10/1831	Lucas, John	150 acres at Holsworthy
	1831	Alford, John	60 acres at Holsworthy
	1831	Ikin, William	200 acres at Holsworthy
	1832	Lawrence, Thomas Jnr	120 acres at Holsworthy
		Cowan, James	50 acres at Holsworthy

	Cuthill, James	127 acres at Holsworthy
	{Eaton John James {Thompson, James {Francis Kirkpatrick	164 acres at Holsworthy
	Evans, George William	140 acres at Holsworthy
	Gordon, Lewis	50 acres at Holsworthy
	Greaves, W.A.B	33 acres at Holsworthy
	Hamilton, J	120 acres at Holsworthy
	Lackey, Mary	34 acres at Holsworthy
1802?	Laycock, Thomas	100 acres at Holsworthy
10/5/1871	Leane, William	126 acres at Holsworthy
11/1853	MacPherson, Dugald	24 acres at Holsworthy (portion 73)
	McCallum, Daniel	60 acres at Holsworthy
	Mayne, J.T.C.	30 acres at Holsworthy
	Newton, J	47 acres at Holsworthy
1841 or pre 1841	Onslow, G	52 acres at Holsworthy
	Richardson, Thomas L.	181 acres at Holsworthy
	Spencer, John Lewis	315 acres at Holsworthy
18/2/1891	Tome, Giralamo	43 acres at Holsworthy
	Weame, John Caldwell	280 acres at Holsworthy
	Weame, Joseph (Jnr)	77 acres at Holsworthy
	Weame, Thomas	30 acres at Holsworthy
	Wilkinson, Charles	90 acres at Holsworthy
1810 or pre 1810	Williams, John Thomas	100 acres at Holsworthy

Description

The Holsworthy Cultural Landscape Conservation Area is a 20,310 ha area of land on the Woronora plateau at the southern edge of the Cumberland Plain which includes the 1880's - 1912 locality of Eckersley and portions of the locality of Holsworthy.

Boundaries of the Conservation Area:

Western Boundary

It is bounded on the west by the western bank of the Georges River (the Conservation Area includes this section of the Georges River) which also forms part of the boundary to the north.

Southern Boundary

The southern boundary follows the boundary of the Holsworthy Firing Range.

The boundary departs from the Georges River at a point level with the westerly extension of the northern boundary of portion 38, Parish of Eckersley. It then extends eastwards along the northern boundary of portion 38 to the north-eastern corner of that portion. From that point it extends in a southerly direction along the eastern edge of portion 38 to the south-eastern corner of that portion. From that point it extendsin an easterly direction along portion 22 to the north eastern corner of that portion. From that point it extends in a southerly direction along the eastern boundary of portion 22 to its intersection with the northern boundary of portion 29. From that point the boundary extends eastwards along the northern portion of portion 29 to the south-western corner of portion 31. From that point the boundary extends northwards along the western boundaries of portions 31 and 36 to the north-western corner of portion 36. From that point the boundary extends eastwards along the northern edge of portion 36 to its north-eastern corner. From that point the boundary extends in a north-westerly direction along the western boundary of portion 35 to the north-western corner of that portion. From that point the boundary extends in an easterly direction along the northern edge of portion 35 to that portions north-easterly boundary. From that point the boundary extends in a south-westerly direction along the eastern boundary of portion 35 to the southern corner of the triangular portion. From this point the boundary extends eastwards along the northern boundary of portion 34 to the north-eastern corner of that portion. From this point the boundary extends southwards along the eastern boundary of portion 34 to the south eastern corner of that portion. From that point the boundary extends westwards along the southern boundary of portion 34 to the south-western corner of that portion. From this point the boundary extends south-westwards to the north-western corner of portion 18. From that point the boundary extends eastwards along the northern boundaries of portions 18, 27 and 30 to the north-eastern corner of portion 30. From that point the boundary extends southwards along the eastern boundary of portion 30 to the south-eastern corner of that portion. From that point the boundary extends westwards along the southern boundary of portion 30 to the south-western boundary of portion 30. From this point the boundary extends southwards along the eastern boundary of portion 37 to the south-eastern corner of portion 37. From this point the boundary extends eastwards along the northern boundary of portion 8 to the north-eastern corner of that portion. From that point the boundary extends southwards along the eastern boundary of portion 8 to the north-western corner of portion 9. From that point the boundary extends eastwards along the northern boundary of portion 9 to its intersection with the western bank of O'Hares Creek.

From that point the boundary extends southwards along the western bank of O'Hares Creek to its intersection with the boundary of the County of Cumberland. The boundary then extends in a south-easterly direction following the boundary of the County of Cumberland to its intersection with the Old Coach Road. The boundary then follows the southern edge of the Old Coach Road (and the County of Cumberland boundary in a south-easterly direction till its intersection with the Old Illawarra Road.

Eastern Boundary

From that point the boundary follows and includes the Old Illawarra Road in an a northerly direction till its intersection with the southern edge of portion 42 (County Eckersley). The boundary extends eastwards from the Old Illawarra Road along the southern edge of portion 42 till the eastern corner of that portion and then follows the edge of the Woronora Catchment in a south-easterly direction until it crosses to the eastern bank of the Woronora River.

From this section of the boundary description onwards all portion number references refer to the Parish of Holsworthy

The boundary then follows the eastern bank of the Woronora River northwards to Heathcote Road at which point the boundary follows the northern and western edge of Heathcote Road (including Heathcote Road) northwards to its intersection with the southern boundary of portion 16 (Parish of Holsworthy.

From this point it extends eastwards along the southern boundary of portion 16 to the north eastern corner of Portion 268 at which point it extends southwards along the western bank of Mill Creek to the south-western corner of portion 268. From this point it extends eastwards along the southern boundary of portion 268 to that portions south eastern corner. From that point it extends southwards along the western boundary of portion 272 to that portion's south-western corner. From that point it extends eastwards along the southern boundary of portion 277 to the south eastern corner of that portion. It then extends northwards along the boundary between portions 272 and 273 to the north-western corner of portion 273. It then extends eastwards along the northern edge of portion 273 to its north-eastern corner, then extends along the eastern edge of portion 273 to its south-eastern corner. From that point it extends eastwards along the southern edge of portion 274 to its south-eastern corner. From this point it extends northerly along the eastern boundaries of portions 274, 253 and 252 till the south-western corner of portion 254. From this point the boundary extends eastwards along the southern boundary of portion 254 to that portion's south-eastern corner. It then extends northwards to the north-eastern corner of portion 254, then westwards along the northern boundary of portion 254 to its intersection with the southern boundary of portion 120. From that point the boundary extends south-westwards along the southern boundaries of portions 120 and 250 to the south-western corner of portion 250. From this point the boundary extends northwards along the western edge of portion 250 to the north-western corner of portion 250. From this point the boundary extends westwards along the northern edge of portion 249 and then along the northern boundary of portion 16 until it meets the eastern bank of Mill Creek.

The boundary then extends north-eastwards along the eastern bank of Mill Creek to its confluence with the Georges River.

Northern Boundary

From this point the boundary extens across the river and then extends westwards along the northern bank of the River (including the River but not its northern bank) to a point level with an easterly extension of the southern boundary of Sandy Point Reserve.

From this point the boundary crosses the Georges River, extends along the southern boundary of Sandy Point Reserve and continues in a straight line to a point where it intersects with the eastern edge of St George Crescent. The boundary then extends southwards from this point along the eastern edge of St. George Crescent until it intersects with the eastern edge of Heathcote Road.

From this point the boundary extends north along the eastern edge of Heathcote Road until it intersects with the eastern bank of Deadman's Creek, it then extends along the eastern bank of Deadman's Creek to its confuence with the Georges River then crosses the river and extends to the northern bank of the River. From this point it extends westwards along the northern bank of the River (including the River but not its bank) until it reaches a point level with a northerly extension of the eastern edge of Pleasure Point Road.

The boundary then crosses the Georges River and proceeds in a southerly direction along the western boundary of Pleasure Point Reserve to the south western corner of that Reserve. From that point the boundary extends along the southern and south-western boundary of Pleasure Point Reserve to a point level with a line joining the south-eastern ends of Riverview and River Heights Roads. The boundary then extends in a south-westerly direction along that line till it meets the eastern edge of Green Street. The boundary then extends in a southerly direction along the eastern edge of the southerly extension of Green Street till it meets the western edge of a private road from Heathcote Road to the Georges River. The Boundary then extends westwards from that point to the eastern edge of Pleasure Point Road and from there extends southwards along the eastern edge of Pleasure Point Road to its intersection with Heathcote Road. The boundary crosses at this point to the southern side of Heathcote Road and then extends along the southern edge of Heathcote Road to the intersection with the southern edge of portion 91. It then extends

westwards along the southern boundaries of portions 91 and 79 to the south western corner of portion 79.

From this point the boundary extends northwards along the western boundaries of portions 79 and 74 to the north western corner of portion 74. From this point the boundary extends eastwards along the southern boundary of portion 73 and crosses the George's River to its eastern bank. From this point the boundary extends northwards along the eastern bank of the River to the northern edge of the footbridge over the River. From this point the boundary extends westwards along the northern edge of the footbridge (including the footbridge) and then extends westwards along the southern edge of portion 72 to that portion's south western corner.

From that point the boundary extends northwards along the western edges of portions 72, 75 and 68 to the Georges River anad crosses the River at this point to the northern bank of the River.

From that point the boundary extends in a north-westerly direction along the northern bank of the Georges River (including the River but not its bank) to the southern edge of the M5 Motorway. The boundary then follows the southern edge of the motorway in a westerly direction crossing the Georges River and extending to the north-western corner of Lt. Cantello Reserve. From this point the boundary extends in a south-westerly direction along the boundary of Lt. Cantello Reserve to the south-western corner of the Reserve. From this point the boundary extends along the south-western edge of the Reserve to the northern bank of Williams Creek.

The boundary then extends southwards along the western bank of Williams Creek till it reaches the boundary of the Sewage Treatment works. From this point the boundary follows the boundary of the Sewage Treatment Works south-westwards, south-eastwards and then north-westwards to its intersection with Harris Creek. The boundary then follows the north-western bank of Harris Creek south westwards to Heathcote Road crossing Heathcote Road and then extending north-westwards along the edge of Heathcote Road to the southern boundary of residential development fronting Sabre Crescent, Holsworthy. The Conservation Area boundary then proceeds south-westwards from this point along the residential boundary to Sabre Crescent and then south-eastwards along the north-western edge of Sabre Crescent to the cul-de-sac of Sabre Crescent. From this point the boundary extends south-westwards along the rear of properties at the ends of the cul-de-sacs of Kitchener Circuit and Provost Mews to the boundary of Remount Park. The boundary then extends along the boundary of Remount Park (to include Remount Park) to the north-eastern edge of the residential development fronting Troopers Mews. From this point the boundary proceeds south-westwards and then in a southerly direction along the rear of the residential allotments fronting Gunners Mews and then continues southwards crossing the East Hills Railway line and then follows the southern boundary of this railway line in a westerly direction to the south-western corner of the Wattle Grove Estate. From this point the boundary crosses the East Hills Railway Line and then proceeds northwards along the western boundary of the Wattle Grove Estate till it intersects with the southern edge of Anzac Road. The boundary then extends westwards along the southern edge of Anzac Road to its intersection with Greenhills Avenue. The boundary then extends northwards along the western boundary of Greenhills Avenue to its intersection with the South Western Freeway and then extends westwards along the southern edge of the Expressway to the intersection with Moorebank Avenue. It then extends southwards along the eastern edge of Moorebank Avenue to the intersection with Anzac Parade and then extends westwards along the southern edge of Bapaume Road to the north-western corner of Titalka Park. From this point the boundary extends southwards along the western boundary of Titalka Park to its south-western corner. From this point the boundary extends westwards in line with an extension of Anzac Road to the western bank of the Georges River.

The Listing also includes two disjunct features which formed part of the railway from Liverpool to Holsworthy and which still survive. They are the old railway bridge over the Georges River at Liverpool (north of the present road bridge and the intersection of Greenhills Avenue and Church Road, Moorebank where the only known remnant of the railway line survives and can be seen embedded in the bitumen road surface.

Physical Description:

The 1995 Environmental Audit of the Holsworthy Training Area prepared for the Department of Defence records that the area has soils derived from the interbedded shale and fine to medium grained quartz sandstone of the Mittagong Formation.

The Mittagong Geological Formation produces an "undulating landscape of crests, ridges and plateau surfaces."

Since its formation the Mittagong Formation has been eroded to form deeply dissected steep and narrow valleys in which the underlying Hawkesbury Sandstone formation has been revealed.

On the northern part of the Area, four valleys lie in a generally north-south direction, parallel with the Georges River's southerly flow from its source to Liverpool. In order from the west, the creeks in these valleys are Harris Creek, Williams Creek, Deadman's Creek (Tudera Creek) and Mill Creek which all flow northwards to discharge into the Georges River as it flows eastwards from Liverpool to Botany Bay.

On the southern portion of the Conservation Area two major creeks flow northwards to join the Georges River east of Campbelltown. The most northerly is Punchbowl Creek which rises in the most southerly portion of the Conservation Area and O'Hare's Creek the source of which is near Darkes Forest south of the Conservation Area.

Portion of the western boundary is Woronora River which has been dammed to form Lake Woronora and is the source of water supply for the Sutherland and St. George regions.

An analysis of the Terrain Units in the Environmental Audit indicates that the area is divided almost equally between relatively level areas (crests and shallow slopes) of 46.5% and steep slopes and cliffs of 49.1%, the remaining 4.4% being drainage plains and channels.

Benson & Howell in "Taken for Granted - The Bushland of Sydney and Its Suburbs" list four main vegetation types for the Conservation Area.

Predominantly the Area has Hawkesbury Sandstone woodland comprised mainly of Woodland/Heath Complex dominated by Sydney Red Gum *(Angophora costata)*, Scribbly Gum *(Eucalyptus haemastoma - Eucalyptus racemosa)*, Grey Gum *(Eucalyptus punctata)* and Narrow-leaved Apple *(Angophora bakeri)* and Gully Forest dominated by Sydney Red Gum *(Angophora costata)*, Red Bloodwood *(Eucalyptus gummifera)* and SydneyPeppermint *(Eucalyptus piperita ssp. piperita)*.

In the north eastern corner of the Conservation Area four other vegetation types occur. They are:-

Cumberland Plain Woodland of Grey Box *(Eucalyptus moluccana)* and Forest Red Gum *(Eucalyptus tereticornis)* between Harris Creek and the Georges River around the Artillery Road area

Castlereagh Woodland of Scribbly Gum *(Eucalyptus sclerophylla* Broad-leaved Ironbark *(Eucalyptus fibrosa)*, Narrow-leaved Ironbark *(Eucalyptus crebra)* and Narrow-leaved Apple *(Angophora bakeri)*, adjoining the East Hills Railway line between Harris Creek and the Georges River,

Estuarine Swamp at Voyager Point, and

River-flat forest of Blue Box *(Eucalyptus bauerana)* on Lt. Cantello Reserve.

Other tree species found to occur in the Hawkesbury Sandstone Woodland Complex were Yertchuk *(Eucalyptus considenlana)* and Narrow-leaved Stringybark *(Eucalyptus oblonga)*.

An understorey species of note is the small she-oak *(Allocasuarina diminuta)*.

Benson and Howell record that only 6.0% of the original area of Cumberland Plain Woodland now survives and only 3.0% of the River-flat forests survive.

On the Holsworthy Firing Range a total area of 1,650 ha of the *Eucalyptus tereticornis/Eucalyptus moluccana/Eucalyptus crebra* woodland comes under the categories 10c and 10d of the vegetation types of the Cumberland Plain (D. Benson, Royal Botanic Gardens). These communities are currently being listed as endangered communities under New South Wales endangered species legislation.

Other plant communities which occur in the area are Riparian Forest (approximately 0.2% of the Conservation Area) dominated by Coachwood *(Ceratopetalum apetalum)* and River Gum *(Tristaniopsis laurina)* and Sedgeland (approximately 0.8% of the Conservation Area) of *Leptocarpus tenax* and *Schoenus brevifolius* and *Sprengelia incarnata* with some shrubs of Fern-leaved Banksia *(Banksia oblongifolia)* and *Symphionema paludosa.*

The sedgelands occurred in the south of the Conservation Area.

In the north of the Conservation Area there were very small areas (approximately only 0.2% of the Conservation Area) of Melaleuca Thicket dominated by Snow-in-Summer *(Melaleuca linearifolia)* with an intergrading form of Bangalay *(Eucalyptus botryoides)* and Sydney Blue Gum *(Eucalyptus saligna).*

The final community to be recorded by the Environmental Audit was Heath/Swamp Complex dominated by the shrubs Fern-leaved Banksia *(Banksia oblongifolia),* Dagger Bush *(Hakea teretifolia)* and Heath-leaved Banksia *(Banksia ericifolia).* This community also contained the rare herb *Dawwinia diminuta* recorded at three sites.

Rare species found on the sandstone ridges were *Melaleuca deanei,* Black-eyed Susan *(Tetratheca neglecta), Eucalyptus luehmanniana, Allocasuarina diminuta, Darwinia diminuta. Angophora hispida* also occurs in this community and is nearing its southern limit of geographic distribution (O'Hare's Creek).

Gully Forest contains the ROTAP species *Grevillea longifolia* and Gymea Lily *(Doryanthes excelsa)* is nearing its southern limit (O'Hare's Creek catchment).

The Riparian Forest community contain the rare herb *Lomandra fluviatilis.*

Two other species with ROTAP listings also occur in the Conservation Area - *Darwinia grandiflora* (Old Illawarra Road) and *Leucopogon exolasius.*

Other species of conservation significance because they are uncommon at a regional or national level were the fern *Blechnum ambiguum,* Blue Box *(Eucalyptus baueriana),* the mallee *Eucalyptus multicaulis,* Scaly Bark *(Eucalyptus squamosa), Grevillea diffusa, Lasiopetalum parvifolium, Leuciopogon amplexicaulis, Pultenaea hispidula, Zornia dyctiocarpa* and *Bossiaea buxifolia.*

Transport Links:

The Old Illawarra Road, Greenhills Road, the Old Coach Road and the National Park Road are all early transport links and the National Park Road has culverts which were constructed by either unemployement relief works in the 1880s or by convicts at an earlier period.

The stonework on these culverts is particularly fine and requires detailed investigation.

Ludlow and Snowden report that there are significant relics remaining of the military railway built by the German Concentration Camp internees - "Traces of it remain: the solid bridge on Harris Creek (now modified as a foot bridge), substantial ruins of the platform at Holsworthy, and a few ridge lines suggesting the original tracks (eg at Clinche's Park). Traces also show up on aerial maps, especially of the branches and sidings to the Moorebank Depot." And there is also the original railway bridge across the Georges River which still survives.

At the intersection of Greenhills Avenue and Church Road, the rail lines still survive imbedded in the bitumen roadway. The impression of the two lines can be clearly seen and part of the track and a metal pin have been revealed by flaking of the bitumen cover.

At the Harris Creek bridge there is a carved plaque with the words "Erected 1917" with kangaroo and emu carvings on each side and surmounted by a crown and the interleaved initials GCC (German Concentration Camp).

Industrial Relics

There are remains of two sandstone walls which are believed to be the convict built weir associated with the former mill built by John Lucas in the early 1820s ("The Brisbane Water Mill"). (Voyager Point Assessment of Historical Archaeological Significance - Clive Lucas, Stapleton and Partners Pty Ltd - 28 February, 1996).

The weirs are located about 2 metres south of the C.1950s elevated sewer main which is approximately 400 metres north of Heathcote Road. Access is via a track leading west of Sirius Road adjacent to the boundary of the Army establishment, about 400 metres west to Williams Creek.

Old Holsworthy Camp

Liverpool City Council's State Heritage Inventory Public Presentation Report on the Old Holsworthy Camp details the present appearance and condition of this site.

"The *Old Holsworthy Camp* group comprises a collection of early 20th century structures (and building remains) scattered round the edge of a former parade ground. The former parade ground is a flat, largely grassed area encircled by a macadam paved road. Tree planting is informally arranged and generally located adjacent to the main buildings and on the edge of the precinct. In some areas native trees (generally Eucalyptus species) have been retained in straight rows while elsewhere small areas of bushland have been retained. Mature tree plantings of various exotics - most notably various Pine species - are also to be found on and adjacent to the site."

"*The Old Holsworthy Camp* group includes

i) the remains of the former Officers' Mess, a large sandstone building on the western edge of the parade ground,

ii) the (former) Corporal's Club, a smaller stone and timber building to the north of the parade ground, and

iii) the Powder Magazine - formerly the Detention Block or Lock-up, a small rendered masonry structure on the southern edge of the parade ground.

The remains of a former railway bridge (which once served the line linking Holsworthy Camp with Liverpool) located some distance away from the main precinct is also included in the group. This structure, which crosses Harris Creek, now serves as a pedestrian footbridge."

The powder magazine (former Lock-up) has been little modified over the years apart from the fitting of some signs and possibly non-original steel plate doors.

It is a single storey concrete block building with the blocks textured and coloured to resemble snadstone. It has a gabled roof of terracotta tiles. There is a small "exercise yard" in front of the building's north and west facades which is enclosed by a block wall matching the external walls of the building. Along the front of the building is a tall, iron palisade fence between rendered masonry piers which have raised, textured panels and the inscriptions "1914", 1916" and "GCC". In the end gables there are small window openings with curved heads. The main door on the northern side of the building has decorated surrounds with chamfered edges and raised, textured renderwork panels.

The former Corporals' Club is a single storey "L" shaped building of rock-faced sandstone with a hipped roof. At the rear of the building is an externally mounted stone chimney. The building has been recently renovated with the erection of a new colour-bonded steel roof and various renewals of external building material.

The Historical Notes for this Inventory Item state that this building "reputedly was once used as terminus - 'railway station' - for rail line between Liverpool and Holsworthy.

The (former) Officers' Mess was substantially damaged by fire in 1990. It served as a canteen and recreational facility for officers during World War I and until 1990 was the officers' mess for the 2nd Cavalry regiment. The building is sited on the eastern edge of the ring road around the central parade ground. Although some piers are charred, the stonework is in generally good condition. Piers of rock-faced sandstone with fluted decorative bands, stonework walls, a pair of brick chimneys, remnants of stone internal walls survive. A lower storey still remains with stone walls and timber framed windows and doors substantially intact.

German Concentration Camp

Although more than 210 buildings were erected to form the German Concentration Camp on the south side of Artillery Road, their ephemeral nature and thorough clearing of the site have resulted in almost no on site physical evidence remainingto the present day. However the buildings on the northern side of Artillery Road where the guards were housed (the Sergeants' Mess, jail and recreation hall) and relics of the railway do survive as evidence of the Camp. However, there is a wealth of photographic evidence, personal relics and documentation on the Camp which, although scattered through various collections at present would form the basis for establishing an interpretive centre possibly in conjunction with the buldings on the north of Artillery Road.

Other relics of the German Concentration Camp are the quarry from which stone was extracted for construction of the guard's buildings and the site of the camp timber mill. The site of these two items needs to be located and investigated.

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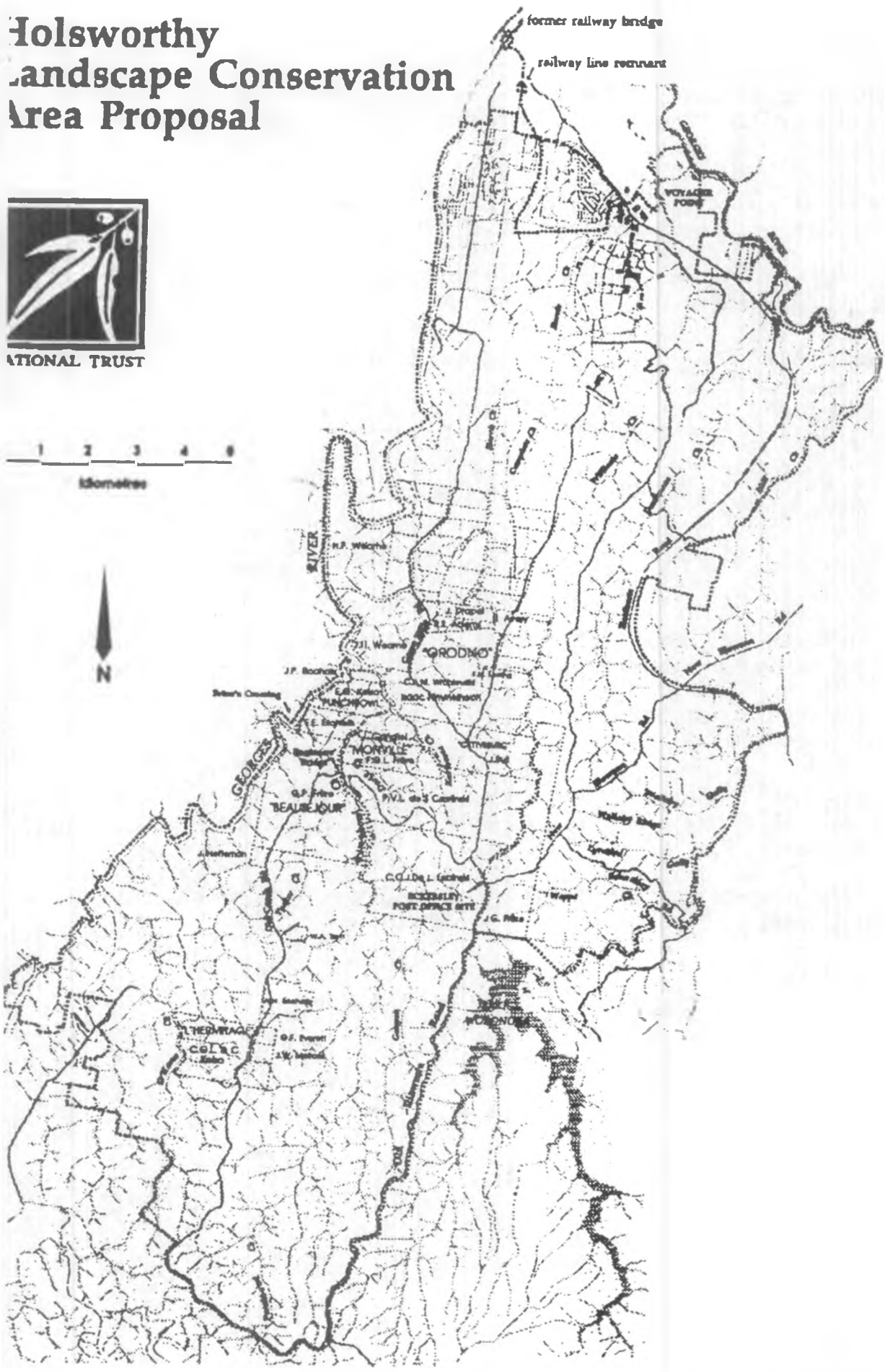
SYDNEY MAIL, May 4, 1901

Holsworthy Landscape Conservation Area Proposal



Appendix C

Register of the National Estate
Database - Place Report Old Army/
Internment Camp Group,
Holsworthy

Identification

Name of Place: Old Army / Internment Camp Group, Holsworthy

Other Names: Holsworthy Military Camp

Database No: 014223

File No: 1/15/023/0009

Principal Group: Military

Status

Legal Status: 06/02/1986 — Indicative Place

Admin Status: 25/11/1996 — Decision to list

Location

Nearest Town: Holsworthy

Distance (km):

Direction from town:

Area (ha):

Address: Artillery Rd, Holsworthy NSW 2173

Local authorities: Liverpool City

Property Information
Military Reserve.

Location/Boundaries
Artillery Raod, Holsworthy, comprising: former Sergeants Mess (Corporals Club), Powder Magazine (Gaol), Recreation Hall ruins, Parade Ground, former Railway Siding, former Railway Bridge, Brush Box plantings along the road to, and around, the former stables complex, and the grove of Crab Apples near the Parade Ground.

AHC Official Statement of Significance
The Old Army / Internment Camp Group, Holsworthy, comprises surviving guard buildings and structures that were elements of an internment camp for Germans and other Europeans, from 1914 to 1919. The internment of migrants in Australia followed Britain's foreign nationals policy during World War One and the Army / Internment Camp Group reflects Australia's strong defence links with Britain. The Old Army / Internment Camp Group demonstrates Australia's fear of European immigrants during World War One, and concerns that Australia's war effort and national security were threatened by spies and invasion. The Old Army / Internment Camp Group also reflects the impact of World War One on Australia's home front when men were interned and their families left to fend for themselves.(Criterion A.4)
The Old Army / Internment Camp Group is associated with Federation and the acquistion of its remaining buildings in 1913 was part of the Commonwealth Government's major program of defence construction for Australia. (Criterion A.4)
(Historic Themes 7.3 Federating Australia, 7.5.2 Providing for the common defence, 7.5.8 Enforcing discriminatory legislation)
The Old Army / Internment Camp Group survives as evidence of the largest internment camp in Australia during World War One. The guard buildings and structures are rare in demonstrating the

AHC Official Statement of Significance (continued)

guards' section of a World War One internment camp in Australia and are also significant because they were constructed by the German and other European internees.
(Criterion B.2.)
The Old Army / Internment Camp Group has important associations for those who trained there during World War Two and who undertook National Service Training or Permanent Army service there more recently, during its use as military camp. It has similar associations for members of the World War One Light Horse Regiments and their families and descendants. It has strong but unpleasant associations for former internees. It has important associations for Australians as a reminder of a period of conflict and troubled national identity, involving a deep suspicion of non-British elements of the population. (Criterion G.1)
It is possible that Indigenous cultural values of national estate significance may exist in this place. As yet, the Australian Heritage Commission has not identified, documented or assessed these values.

Description

PHYSICAL DESCRIPTION

The Old Army/Internment Camp Group, Holsworthy, is within the Holsworthy Training Area, 25 kilometres south of Sydney. The zone known as the Holsworthy Field Firing Range comprises its southern area and is an extensive tract of open countryside, in parts very undulating and not fully accessible to the public, dominated by a thickly wooded eroded plateau. Due to the area being used as a firing range by the army, settlement is restricted to the Holsworthy Army Camp, on the north edge of this zone.
The remaining elements of the Old Army Camp Group which were used as part of the internment camp are guards' camp buildings, all built by internees after its establishment in 1914. There are two stone buildings north of Artillery Road : the former Sergeants' Mess (or Corporal's Club), and a Powder Magazine (used as a lock-up jail), both circa 1916. The former Sergeants' Mess is a Federation Bungalow, L-shaped building of rock-faced sandstone with a hipped roof clad in colour-bonded corrugated steel, north of the parade ground. The Powder Magazine is a single storey Federation Bungalow building of concrete textured and coloured to resemble sandstone, with a gabled, terracotta tiled roof, and an exercise yard fenced by a block wall, fronted by an iron palisade fence with a gate incorporating rendered piers inscribed '1914', '1916', and 'GCC'; it bears graffiti dating to the World War One internment period. There is a burned out ruin of a Recreation Hall, on the western edge of the ring road around the central parade ground. There is also a federation Bungalow, comprising rock-faced remnants of external walls, rendered internal walls, two chimneys and a substantially intact portion of the lower storey behind the main front wing. There are ruins of the Railway Terminus, the Railway Siding and part of Military Road, east of the former jail, with kerbing. It is possible that archaeological remains relating to these elements survive, with potential national estate significance; in the event of future development proposals, this aspect of the place should be investigated.
The Parade Ground area in the centre of the guards' camp remains, as do tree plantings from the internment period. As indicated by a photographic panorama taken between 1914 and 1918 from the south eastern corner of the site, newly-planted avenues of Brush Box (Lophostemon confertus) formed avenues along a section of Old Illawarra Road, through the camp along Artillery Road and around the stables to the east of the guards' camp. Of more than 300 trees, only 41 trees remain, all to the east of the guards' camp, flanking Artillery Road. Of the large vegetable gardens and ornamental garden beds of the internment period, a small grove of crab apple trees near the railway siding remains. (Mature Pine tree species were planted in the 1950s and 1960s.)
There is a pedestrian bridge used formerly as a Railway Bridge, comprising a painted steel framed walkway built over the remains of the earlier structure, consisting of concrete piers in the bed of the

Description (continued)

creek with the remains of iron fixings for the previous rail line (built 1917-1918). There are no remains of the structures of the main compound south of Artillery Road due to extensive clearance.

EUROPEAN SETTLEMENT

In 1794, six years after the arrival of the Europeans, the colonial government issued land grants for the region southwest of Sydney and for the more fertile lands west of the area along the Nepean and Hawkesbury Rivers. In 1809, the first land grants associated with European settlement west of the Holsworthy Training Area were made in the District of Minto. In 1810, Governor Macquarie visited the district and established the adjoining town of Liverpool. Holsworthy was named after the town in Devon, England, where Macquarie married his second wife Elizabeth in 1807. By 1813, the districts of Airds and Appin were created south of Minto which collectively now represent the region of Campbelltown. In 1835 the rugged sandstone gorges of the Holsworthy Training Area were surveyed and proclaimed as the parish of Eckersley. Under the Crown Lands Act (1884), the parish was opened for permanent settlement. The first settlers to take up an 'official' selection with the parish were Frank and Harry Etchells in 1889, building a stone cottage. The Etchells grew fruit and vegetables, raised poultry and bees, and distilled rum inside the rock ledges at waterfalls along the river. They were followed by other settlers including Nathaniel George Bull who also built a stone dwelling, with 'inground' sandstone water tanks. The Freres brothers established a vineyard in the area in association with Charles Kelso. By 1890, the area supported nearly a dozen early settlers with orchards and vineyards including Isaac Himmelhoch's substantial 'Grodno' vineyard. Sixteen years later, most of the selections were abandoned in preparation for the proposed military reserve and selections like the 'Grodno' vineyard were destroyed once the Army arrived. According to Longhurst, there exist many buildings and structures relating to European settlement within the Holsworthy Training Area and today much of this evidence is considered integral to the heritage landscape of the Macarthur region.

MILITARY ACQUISITION

Liverpool has long been associated with the military. As early as 1811, soldiers' barracks were provided in the township, and from 1886, following the Sudan expedition, Artillery Hill, across the Port Hacking River from Audley in the then-National Park was used for annual training. In 1906, 1907 and 1910, the army held manoeuvres in the Holsworthy area. (More recently, military establishments have been concentrated in this precinct.) As part of the new Commonwealth government's major program of defence construction, two areas were acquired: 833 acres for the establishment of a Remount Depot and Veterinary Hospital and a further 16,868 acres at the site now known as Old Holsworthy Camp. The Commonwealth Government Gazette formally proclaimed the Holsworthy Training Area as a military reserve on 7 March 1913. Eighty thousand acres of land were finally acquired for a military barracks, a training area and an artillery range. At the time the land consisted of both large and small holdings, many of which were still undeveloped. Some of the land was planted with fruit trees and there were market gardens in the area. Within this, the site chosen for the barracks had been a large orchard, completely surrounded by thick bush and scrub. The transfer was made on 25 October 1914. By April 1915 permanent barracks had been constructed there. The Anzac Rifle Range was completed in August, 1916.

The small holdings which eventually became the area known as the German Concentration Camp were owned variously by James and Andrew Cowan, William Leane, E A McNeil and Giratamo Tome and varied in size from 41-43 acres. However, the area occupied by the camp and associated activities was never clearly defined. The camp itself, including the main barracks areas, the armed forces barracks, the playing fields, guard barracks and facilities and the hospital occupied an area which measures about one and a half kilometres by one kilometre. Wooden barracks were erected, each housing sixty men with a company commander of their own nationality who was responsible for administration. About a quarter of this total area was enclosed to form some five compounds which existed for the period of the camp:-

Description (continued)

Compound 1, main barracks, south of Artillery Road and including playing fields, along its south and west sides,
Compound 2, of unknown purpose, located some 200 m north of Artillery Road,
Compound 3, recalcitrants compound (Sing Sing), south-east of the complex,
Compound 4, military barracks for Prisoners of War, north-east of the complex, north of Artillery Road, and the Hospital compound, north-east of the complex.
Other elements included a stables complex, eastern guard post, guards' camp, (north of Artillery Road and including the recreation centre, jail, guard barracks), bakery, kitchen and cloth store.
Accommodation for internees consisted of tents. As a result of the increase in numbers, work began to prepare an area which would later become the permanent camp. The camp also had a saw mill and a sandstone quarry where stone for the jail, the recreation area and the sergeants' mess was extracted.
The principal part of the Main Compound was constructed on gently sloping land south of the newly constructed Artillery Road, which ran almost due east from Illawarra Road, now the Old Illawarra Road. Over 100 individual barracks were located there, each holding fifty men. As well there were cafes, a post office, stores, a theatre, latrines, laundries, a bakery, kitchen and mess halls.
The guards' barracks and the associated infrastructure were located on the north side of Artillery Road and eventually nine barrack buildings were constructed, by the internees, along with the railway station, goods store, a headquarters building, the recreation hall, sergeants' mess, jail, guardhouse and a number of ancillary buildings.
A branch railway was built during World War One by internees to service the army camp near Liverpool, the Artillery Range, Ordnance (mounted guns and cannon) and Ammunition Stores (two miles from Liverpool), the Remount Depot (three miles) and the Veterinary Depot (four miles), and the Holsworthy Internment Camp (five miles). Traces of the railway include the terminus in the guards' camp and a bridge across Harris Creek which has been modified and is now known as the Holsworthy Pedestrian Bridge.
Holsworthy Barracks was used as an Internment Camp during World War One and World War Two. During World War One, German, Austrian, Hungarian, Croatian, Czech, Bulgarian, and Turkish people were interned as well as Australian internees from Australia, South Pacific and Asia. German people were regarded as enemy aliens and were interned. Other groups regarded as being of less threat to security were also watched by Australian guards. The main compound was where German and Australian civilians were interned. However, there were some prisoners of war, including many of the survivors of the German cruiser Emden which was beached at Cocos on 9 November, 1914. There were a further three compounds holding other prisoners near by. It was the largest internment camp in Australia in World War One holding over 6,000 internees. There were in excess of 210 buildings on site at the height of the camp.
One of the survivors of the Emden, George Boysen, wrote to his wife that it was 'a dreadful place' housing 'sailors, merchants, bushrangers, doctors, mine labourers, farmers, beachcombers'. There were riots at the camp and extortion gangs preyed on other internees. However, apart from the overcrowding, the living conditions at the concentration camp were not much worse than those of the soldiers in AIF camps that surrounded it. Escape attempts were common, for example a number of prisoners escaped through a 120 metre tunnel and one stowed away on a ship bound for Java and was never caught. The camp held cabarets and theatre, movie nights, choirs, lectures and sporting competitions. Along the Kaiserwilhelmstrasse there was a bath house, cigar stands, bakery, sausage factory, pawn shop, barber and two cafes. The German Concentration Camp was closed in mid-1919 with the last man leaving on 5 May, 1920.
It would appear that almost all of the buildings associated with the internees were ephemeral in nature and when hostilities ceased the camp was razed. None of the former Concentration Camp structures in the area of the internees (Main) compound south of Artillery Road remains. The only

Description (continued)

evidence of the camp exists in the three stone buildings (Sergeants' Mess/Corporals' Club, burnt-out Recreation Hall and jail/Powder Magazine) in the former guards' camp, north of Artillery Road, the railway siding and its associated permanent way and some of the road and kerbing surrounding the former parade ground, a flat grassed area. It is understood that a quarry exists in the area. The powder magazine has been little modified with the exception of signs and possibly its steel plate doors being fitted. Planting comprises areas of informally arranged trees adjacent to the main buildings, native trees planted in straight rows, and small areas where bushland has been retained. Mature exotic trees, mostly pines, are scattered around the site. Of the four identified periods where buildings were constructed on site, practically nothing remains as the site remediation which followed each phase removed practically all evidence of the previous occupation. The main north-south camp road has been covered by successive periods of occupation. All other existing fabric on the site dates from the period after 1930. A new ordnance depot was built after World War One, and the former internment camp was used for militia camps; the stone buildings erected by the internees were used for permanent army units. The Darwin Mobile Force was established at Holsworthy before being relocated to the north.
In 1938 a further 33,860 acres were added to the Holsworthy Training Area, the development of which was directly related to the earlier Army Camp. From 1939 the Anzac Rifle Range was converted to a prisoner of war camp, and 6,780 Australians, mostly of Italian origin, were interned in the camp. In 1942 an Armoured Fighting Vehicle School replaced the Remount Depot. In 1958 Holsworthy became the home of the 1st Infantry Brigade Group. By 1990 the Liverpool Military Area contained 35 army units and 5,000 personnel. The training area has also been used as a firing range for small firearms and artillery. With the exception of the Holsworthy Barracks, the airfield and small weapons ranges, other developments in the Holsworthy Training Area have been limited to small networks of roads, culverts, bridges and fences. Other military establishments which have been developed in close proximity to the training area include the Liverpool Military Area of Moorebank and Ingleburn which both represent important historical connections going back to Federation. Although the Holsworthy Training Area was used extensively in the past for artillery practice, it remains a relatively undisturbed natural landscape with a limited number of roads, firing ranges and vehicle harbour or staging areas. Today the training area remains of considerable value to the Army.
After World War Two, the consolidation of military bases continued to exert pressure for housing to accommodate its personnel, and Holsworthy Village, established in 1952, examplifies this process. Holsworthy Village was characterised by rows of modest cottages of similar architectural form set in wide, tree lined streets. Originally of fibro with timber sash windows, the houses have recently been comprehensively refurbished with modern cladding and aluminium windows, effectively destroying their significance as a post-war housing group.

Condition

The former Powder Magazine/jail is generally in good condition and is still being used. The mess (former Corporal's Club) is externally in good condition having recently been renovated by the Army, but the interior is somewhat dilapidated. The Recreation Hall comprises burnt out remains of wall footings but with a small portion of the lower storey of the main wing substantially intact. Much of the pedestrian bridge's original fabric has been removed, but concrete piers and iron fixings remain. The former parade ground and some tree plantings survive from the internment period.

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• • • End Of Report • • •

Appendix D

Statement of Significance for
Australian Heritage Commission
Interim Listing of Holsworthy
Military Area

AUSTRALIAN HERITAGE COMMISSION

Cubbitch Barta National Estate Area

Statement of Significance

Cubbitch Barta National Estate Area is a large area with outstanding cultural and natural values. It is very significant as a cultural and natural landscape which demonstrates relationships between the environment and human occupation through time. Its significance is emphasised by its proximity to Sydney, the nation's largest metropolitan centre.

Cubbitch Barta National Estate Area is an integral component of the Woronora Ramp area, stretching south-west from Sydney, together with Royal National Park, Heathcote National Park, the Woronora catchment and O'Hares Creek Catchment. Major parts of the Woronora Ramp region are included in the Register of the National Estate. This region, together with the other tracts of undeveloped areas to the west and north of the metropolitan area, are essential in defining the character of the broader Sydney region.

In the network of gullies which criss-cross the area, many of the natural values remain undisturbed, and the indigenous heritage is impressively retained. Over 500 Aboriginal sites provide a glimpse of the relationship between people and the land prior to 1788. The sites, and the area's long-term and more recent connections with Aboriginal people, combine to form a landscape of great significance for its indigenous heritage. The landscape also provides important illustrations of European settlement, agriculture and Australia's military history.

It is unusual to find landscapes in this region so intact. This provides a rare opportunity to understand both the natural and cultural history of the region. It is remarkable that this landscape has survived on the margins of the nation's earliest and largest urban centre.

INDIGENOUS VALUES

The Cubbitch Barta National Estate Area is highly valued by members of the Tharawal Local Aboriginal Land Council and the Dharawal people for its symbolic, cultural, educational and social associations. (Criterion G.1) The Aboriginal cultural landscape of the area reflects the past lifestyle of Aboriginal people in this region, and its preservation enables Aboriginal people to maintain cultural links to the area. These connections with the past are particularly important, because Aboriginal people in this part of Australia were among the earliest impacted by European settlement of this continent, and their culture has since been disrupted by war, disease and urban development. Throughout the environments of the area, the Dharawal see evidence of the relationship between their people and the land. The Tharawal Local Aboriginal Land Council is also concerned about maintaining the area's natural environment.

The area contains a large and diverse collection of Aboriginal sites, which represent a complex Aboriginal cultural landscape. (Criterion A.3) Over 530 sites are known from the area, and a further 509 potential archaeological sites have been documented. It is highly likely that the area contains many hundreds more sites. Sites include rock

paintings and drawings, engravings, open scatters of artefacts, grinding grooves and scarred trees. The survival of a significant number of scarred trees within the area is important as this is a rare type of site within the Sydney Basin. (Criterion B.2) While rock art sites are well-represented in the Sydney Basin, other types of sites are less so. The preservation within the area of scarred trees, open artefact scatters and archaeological sites in particular, offer considerable potential for further developing a picture of day-to-day activities of Aboriginal people in the Sydney Basin prior to 1788. (Criterion C.2)

This large number of sites, and the stories they may tell, form a landscape in which Aboriginal life prior to 1788 is recorded without the large-scale impact of European settlement. There is also a high density of sites in the area. This is particularly important because sites are found in groups or clusters with their relationship to one another largely intact. By examining where they are located in the landscape and their relationship to other types of sites, a more complete picture of the lifestyle of Aboriginal people could be established. (Criterion C.2)

The Georges River, which bounds the national estate area on the west, and is close to the north, has been identified as an important north-south Aboriginal cultural boundary within the Sydney Basin. The cultural landscape of the national estate area is representative of the southern social unit of the Sydney Basin. (Criterion D.2) This unit has been characterised by the presence of a number of distinctive traits within the art and by complex analyses which show that the art sites of this region are significantly different from those north of the Georges River. The large number of sites, the relatively high site density, the condition of sites and the preservation of the landscape as a whole makes the area important in terms of the further definition of this southern unit.

The area also offers considerable research potential in terms of the analysis and interpretation of small-scale groups. (Criterion C.2) There is evidence to suggest that this area formed the cultural landscape of a single residence group whose territory extended over the Georges River and Williams/Mill Creek drainage basins. In this region, it is uncommon to have such a landscape preserved in this way, and particularly important, as knowledge of local groups from enthnohistory is often incomplete and problematic.

The rich collection of more than 300 rock art sites within the area is regionally significant as a group in the Sydney Basin and representative of rock art south of the Georges River. (Criterion D.2) The rock art sites are diverse in terms of technique (paintings, drawings and engravings) and motifs depicted. (Criterion A.3) The art in the area contains a number of motifs which are rare within the Sydney region, such as the engraving of a pregnant woman. The site where this occurs is considered important, as female motifs and gender-specific evidence of this kind are relatively rare. (Criterion B.2) The long history of recording the rock art sites by voluntary groups and individuals indicates that they are aesthetically important to groups within the broader community. (Criteria E.1) The aesthetic value of these sites is enhanced by their excellent condition and lack of graffiti.

The Cubbitch Barta National Estate Area is important as an illustration of a landscape in which changes in the relationship between Aboriginal people and early settlers took place (Criterion A.4). This is a phase in the cultural history of Australia for which traditional documentation is often poor. The area is associated with Governor Macquarie's war against the Aboriginal people of the Liverpool, Campbelltown and Appin areas from April to November 1816. Despite efforts to mov_ indigenous people away from this country, documentation indicates Aboriginal people were still visiting sites within the area in the 1830s. Within the area, it is the evidence of the strong

Aboriginal presence combined with the nineteenth century history and landuse without much twentieth century development, which makes this area unusual for the way it can illustrate this period of history. Potential exists for further research to shed light on this era through research relating to exploration, settlements within the area and information about the adjacent Aboriginal reserve. (Criterion C.2)

NATURAL VALUES

This area contains a diversity of natural landscapes and vegetation types in a relatively unmodified condition, in an area otherwise greatly altered by urban development. Vegetation communities include plateau forest (covering forest and woodland on both tertiary alluvium soils and on shale), gully forest, woodland/heath complex, riparian forest, sedgeland, heath/swamp complex and melaleuca thickets. The laterite ridgetops are almost entirely intact and are significant reference sites which demonstrate the formation of laterite caps and the occupying vegetation communities. (Criterion A.2)

Diversity of plant species is high, with more than 400 species recorded in the area. At least seven different plant communities have been distinguished in the area, indicating high community diversity. (Criterion A.3)

At least eight plant species considered rare nationally occur here: DARWINIA DIMINUTA, D. GRANDIFLORA, EUCALYPTUS LUEHMANNIANA, GREVILLEA LONGIFOLIA, HIBBERTIA NITIDA, LOMANDRA FLUVIATILIS, MELALEUCA DEANEI and TETRATHECA NEGLECTA. A rare and undescribed species of greenhood orchid PTEROSTYLIS sp. E has also been recorded here. The area contains a substantial remnant of Cumberland Plain woodlands, a vegetation type growing mainly on Wianamatta shale. Only 6% of the original area of Cumberland Plain woodlands remains. This community has been listed as an endangered ecological community under the NSW Threatened Species Conservation Act 1995. LEUCOPOGON EXOLASIUS, found here, is listed as vulnerable under the Commonwealth Endangered Species Protection Act 1992. Regionally significant plants include E. SQUAMOSA, GREVILLEA DIFFUSA and ZORNIA DYCTIOCARPA. (Criterion B.1)

The broad-headed snake HOPLOCEPHALUS BUNGAROIDES, found in this area, is listed under the Commonwealth Endangered Species Protection Act 1992. The koala PHASCOLARCTOS CINEREUS population found locally is considered one of the few remaining viable populations in southern NSW. The area also contains a significant population of the spotted-tailed quoll DASYURUS MACULATUS. Both the koala and quoll are listed as vulnerable under the NSW Threatened Species Conservation Act, together with the giant burrowing frog HELEIOPORUS AUSTRALIACUS, red-crowned toadlet PSEUDOPHRYNE AUSTRALIS, powerful owl NINOX STRENUA, and greater broad-nosed bat SCOTEANAX RUEPPELLII, all of which are recorded in the area. The New Holland mouse PSEUDOMYS NOVAEHOLLANDIAE, considered to be regionally rare, is also found here together with a number of other fauna species of regional or state conservation significance. (Criterion B.1)

The area has areas of significant aesthetic values, particularly the forested creek gorges. (Criterion E.1)

HISTORIC VALUES

The settlement sites and transport routes in the area are associated with the history of nineteenth century European settlement and the development of agriculture in the Liverpool region, including the wine industry and subsistence farming in a bushland

setting. The Grodno settlement site is associated with the activities of migrants in the Liverpool region. The Cubbitch Barta National Estate Area also provides evidence of transport routes for settlers in the Liverpool, Holsworthy and Campbelltown areas. These demonstrate the transport linkages that connected the nineteenth century settlements, industry and farms to more established regions of Sydney. Holsworthy is also significant for its military associations. It was a training site for Australian troops and horses engaged in World War I battles, including Gallipoli. The Holsworthy Military Training Area is also significant for the training activities of the Australian Army after the Second World War. (Criterion A.4)

The Old Army Internment Camp Group was used to inter Germans and other Europeans, from 1914 to 1919. The internment of migrants in Australia followed Britain's foreign nationals policy during World War I and this site reflects Australia's strong defence links with Britain. It also demonstrates Australia's fear of European immigrants during World War I, and reflects concerns that Australia's war effort and national security were threatened by spies and invasion. The Old Army Internment Camp Group also indicates the impact of World War I on Australia's home front when men were interned and their families left to fend for themselves. (Criterion A.4)

The Old Army Internment Camp Group is associated with the history of Federation. The acquisition of its remaining buildings in 1913 was part of the Commonwealth Government's major program of defence construction for Australia. (Criterion A.4)

The Old Army Internment Camp Group survives as evidence of the largest internment camp in Australia during World War I. The guard buildings and structures are rare in demonstrating the guards' section of a World War I internment camp in Australia, and are also significant because they were constructed by German and other European internees. (Criterion B.2.)

This Group has important associations for those who trained there during World War II and who more recently undertook National Service Training or Permanent Army service there during its use as a military camp. It has similar associations for members of the World War I Light Horse Regiments and their families and descendants. It has strong associations for former internees. It also has important associations for Australians as a reminder of a period of conflict and troubled national identity, involving a deep suspicion of non-British immigrants at that time. (Criterion G.1)