Appendix 13

Aboriginal Archaeology Assessment

Bulga Coal Management Pty Limited

Bulga Coal Continued Underground Operations: Aboriginal Heritage Assessment

July 2003

Umwelt
Environmental Consultants

EXECUTIVE SUMMARY

This report presents the findings of an archaeological study to assess the potential impacts of proposed Bulga Coal Continued Underground Operations (the project) on the Aboriginal heritage values of the project area. The project is located at Bulga Complex, in the Central Lowlands of the Hunter Valley, approximately 12 kilometres southwest of Singleton. The Bulga Complex currently includes both underground and open cut operations, and is operated by Bulga Coal Management.

The report has been prepared by Umwelt and has been subject to extensive consultation with Lower Wonnarua Tribal Consultancy Pty Ltd, Upper Hunter Wonnarua Council, Wanaruah Local Aboriginal Land Council, Ungooroo Aboriginal Corporation and Wonnarua Nation Aboriginal Corporation, National Parks and Wildlife Service and Bulga Coal Management. A strong focus of this consultation process has been the priority of management outcomes that enhance conservation of Aboriginal cultural heritage values wherever practical, to compensate for those sites impacted by the project.

The Aboriginal cultural heritage values and management options that are described for the project area draw on:

- input from five local Aboriginal community groups;
- reconstruction of the landscape context of the project area to derive cultural landscape values;
- existing and new records of Aboriginal archaeological sites;
- an assessment of the current condition of sites in the landscape; and
- an assessment of the opportunities presented by the project to protect and enhance Aboriginal cultural values in the local and regional context.

The project is situated on land that has been subject to and considered for coal mining operations for many years and a number of Aboriginal archaeological surveys and assessments have been conducted since 1980. Each of these assessments has drawn conclusions and made recommendations about Aboriginal cultural heritage management in discrete areas. This new assessment has provided an opportunity to review and integrate the results of different surveys, to fill gaps in the survey areas for previous projects, to consult broadly with the local Aboriginal community and to assess the archaeological and cultural landscape values of the project area.

There are 94 Aboriginal cultural heritage sites within the area proposed for underground mining and surface infrastructure. Five of these sites and a section of another site will be destroyed under Section 90 Consent prior to the commencement of underground mining for the project. The remaining sites include two sets of grinding grooves, one scarred tree, 59 scatters and a partial scatter of flaked and ground artefacts and 29 isolated artefact finds. The project is likely to impact on 25 of these sites through subsidence, subsidence remediation works and construction works. These works include cultivation/ripping, reshaping and alignment of creek banks, road works and conveyor construction.

The assessment has resulted in five key recommendations:

- An area of 58 hectares, west of Charlton Road and adjacent to Wollombi Brook, which will be managed as a formal Voluntary Conservation Area under the *National Parks and Wildlife Act* 1974. This area includes diverse archaeological material and the interface of two landscape types that would have provided attractive resources for Aboriginal activities in the past. The proposed Voluntary Conservation Area will protect Aboriginal cultural heritage values that are assessed as significant at the local and regional scale. A detailed conservation management plan will be prepared and the Voluntary Conservation Area process will provide for ongoing Aboriginal community participation in the long term conservation of the cultural heritage values of this area.
- Four small existing conservation zones along Loders Creek will not be impacted by the project. Bulga Coal Management will take a proactive interest in the management of these zones to protect their cultural heritage values throughout the life of mining operations. These zones include 38 artefact scatters and a total of 50 grinding grooves in four sets on Loders Creek.
- A scarred tree near Charlton Road will be protected throughout the life of the mine.
- The BMU1 grinding groove site will be managed in accordance with the Beltana Aboriginal Cultural Heritage Management Plan for the life of the existing Beltana operation. After cessation of mining under Beltana development consent, it will no longer be classified as a conservation area, but will otherwise be managed to minimize disturbance and maintain access for the Aboriginal community until undermining of the area precludes access from a safety

perspective. As mining proceeds, the site will be allowed to subside as subsequent coal seams are removed. This option will maintain the relationship between the grinding grooves, the creek and the adjacent slopes where flaked and ground artefacts are located. The Aboriginal community and National Parks and Wildlife Service have agreed that undermining of this area is an appropriate option, on the basis of establishment of the proposed Voluntary Conservation Area as an offset for such impact.

- An Aboriginal cultural heritage management plan will be prepared to guide the management of artefact distributed across the project area, outside the Voluntary Conservation Area. The management plan will include processes to ensure ongoing Aboriginal involvement in management of cultural heritage values, through site protection measures, access, and input on rehabilitation processes. It will also include a schedule of applications for Section 90 Heritage Impact Permits for sites that will be impacted by subsidence remediation works. Collection and/or excavation is recommended for selected sites so that more information can be gained before they are damaged by mining activities. The sites that have been identified as requiring a Section 90 Permit are listed in **Table 1**.

Table 1 – Section 90 Requirements for the Project

Section 90 Requirements	**Sites Affected**
Without salvage	BMU1, GIF-IF1, GIF-IF2, GIF-IF3, GIF-IF4, BCO21 and IF1 South Bulga
With Surface Collection	BCO2, BMU2 (section “o”), Saxonvale B, B71, BP2, G2, G3, G4, G9 and G11, BCO21 and sections of sites BCO1, BCO3 and BCO10
With Sub-surface Investigation	BCO1 (incorporating Saxonvale A), BCO3 and BCO10 (incorporating Bulga 7 and G6, G7 and G8)

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1.0 INTRODUCTION

This report presents the results of an archaeological survey and assessment of proposed continued underground coal mining operations at the Bulga Complex in the Upper Hunter Valley of New South Wales. Bulga Coal Management (BCM) commissioned Umwelt (Australia) Pty Limited (Umwelt) to prepare an Environmental Impact Statement (EIS) to accompany a development application for the project.

Bulga Complex is located approximately 12 kilometres southwest of Singleton, 1 kilometre north of Broke and 1.5 kilometres east of Bulga in the Upper Hunter Valley (**Figure 1.1**).

Bulga Complex is managed by BCM on behalf of the Bulga Joint Venture (BJV) and comprises three existing coal mining operations (**Figure 1.2**): the South Bulga Colliery (SBC); Bulga Open Cut Mine (BOC); and Beltana No.1 Underground Mine (Beltana). The Complex also includes associated coal preparation and rail transportation facilities.

BCM seeks approval to extract up to 198 million tonnes (Mt) of coal from the Whybrow, Blakefield, Glen Munro and Woodlands Hill seams, by underground mining methods. The project, known as Bulga Coal Continued Underground Operations, covers approximately 6,026 hectares, of which approximately 5,128 hectares are located within the existing Bulga Complex mining lease boundary. If approved, Bulga Complex underground mining operations will extend to the west over an area of approximately 340 hectares, and to the southeast over an area of approximately 160 hectares (**Figure 1.3**).

1.1 LOCATION OF PROJECT AREA

The project area incorporates land generally between the eastern complex boundary and land to the west of Charlton Road, to the base of the footslopes above Wollombi Brook, not extending as far as the floodplain of Wollombi Brook (see **Figure 1.3**). The area proposed for underground mining includes privately held land to the west of Charlton Road and the east of Wollombi Brook and Commonwealth owned land to the southeast of Broke Road and north of Cessnock Road (**Figures 1.3** and **1.4**).

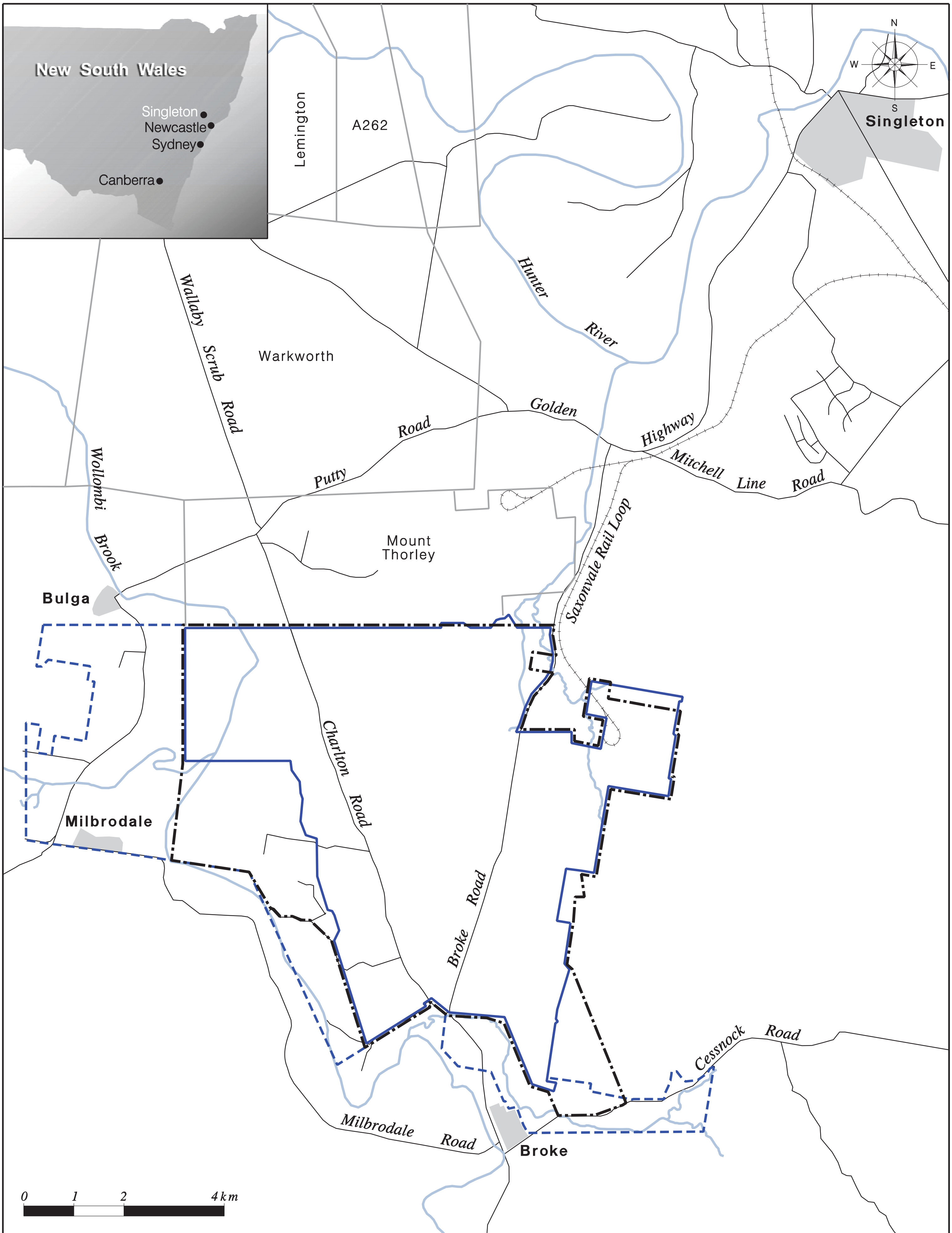
A coal conveyor and access roads are proposed for construction in the northeast of the project area (**Figures 1.3** and **1.4**). Personnel and materials facilities for the underground operations in the northern and central areas will be located in and adjacent to the Bulga Pit (refer to **Figures 1.3** and **1.4**). No new out of pit infrastructure will be required to service mining of the Whybrow seam in the northern and central areas, as the existing SBC and Beltana infrastructure will be utilised.

1.2 AIMS AND OBJECTIVES OF THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT

The aim of this assessment is to provide clear advice on the Aboriginal cultural heritage values of the project area, underpinning the preparation of cultural heritage management strategies for the project that are consistent with local Aboriginal community values, protect significant Aboriginal cultural heritage evidence and facilitate efficient operation of the mining activities.

The brief and scope of work for the Aboriginal cultural heritage assessment was developed by BCM and Umwelt in consultation with National Parks and Wildlife Service (NPWS) and representatives of the local Aboriginal community (refer to **Section 1.5**).

To achieve its aim, the assessment has several key objectives. These are noted in **Table 1.1**, together with brief information about the processes and/or tasks that have been completed to address each objective.



Legend
- Project Area
- Bulga Complex Mining Lease Area
- Bulga Coal Exploration Licence Area
- Other Coal Lease Boundary
- Road
- Railway
- Watercourse

Umwelt (Australia) Pty Limited
Base Map Source: 1:100 000 Cessnock Topographic Map

FIGURE 1.1
Locality Plan

A4 Scale 1:100 000

Ref No.:R03_V2/1468_197.dgn

Legend

Project Area

Bulga Complex Mining Lease Area

Existing and Approved Major Mining and Coal Processing Areas

Umwelt (Australia) Pty Limited

Base Source: Bulga Coal Management & Hatch Aerial Photo (2002)

FIGURE 1.2

Aerial View of Existing Operations

A4 Scale 1:55 000

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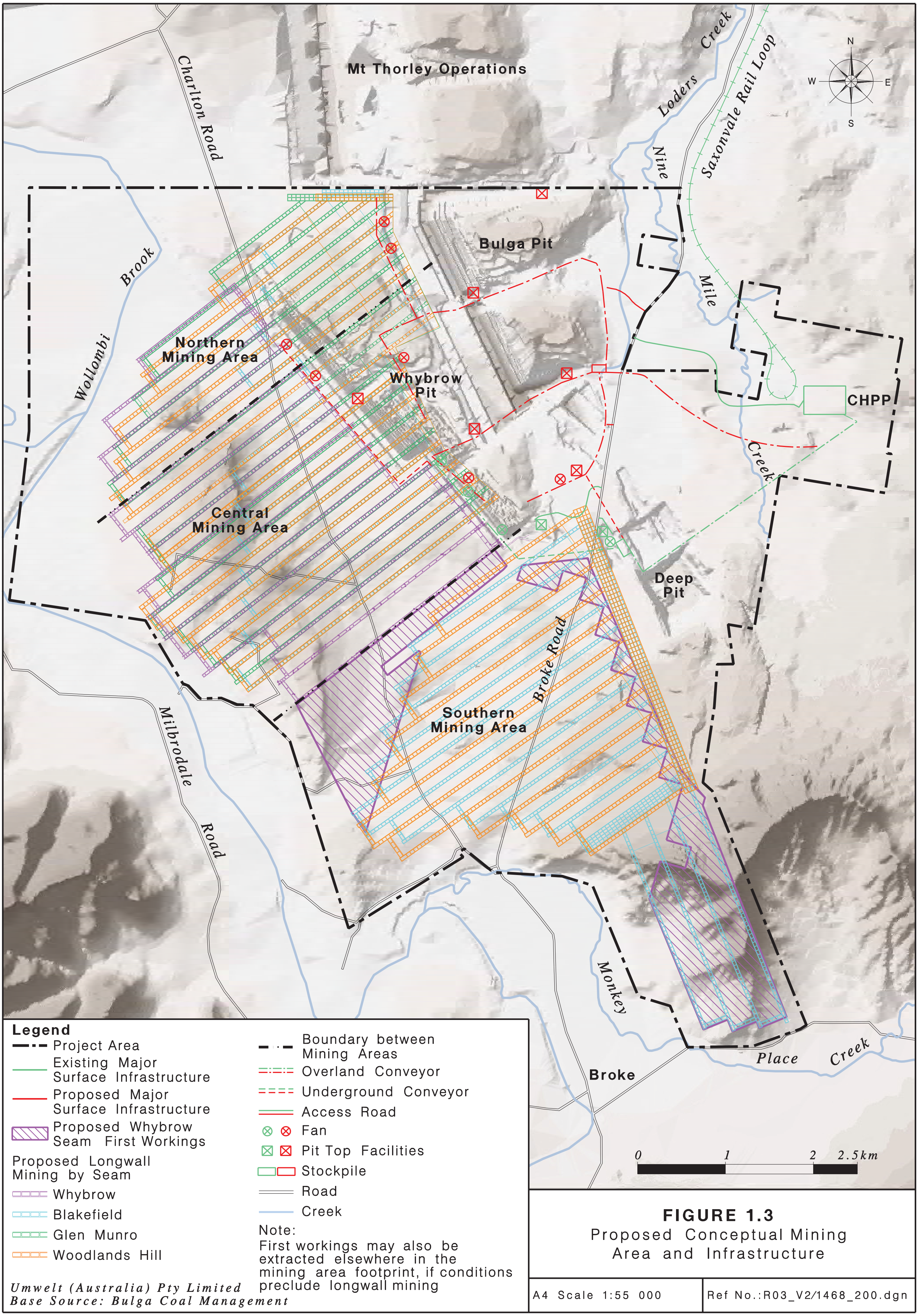
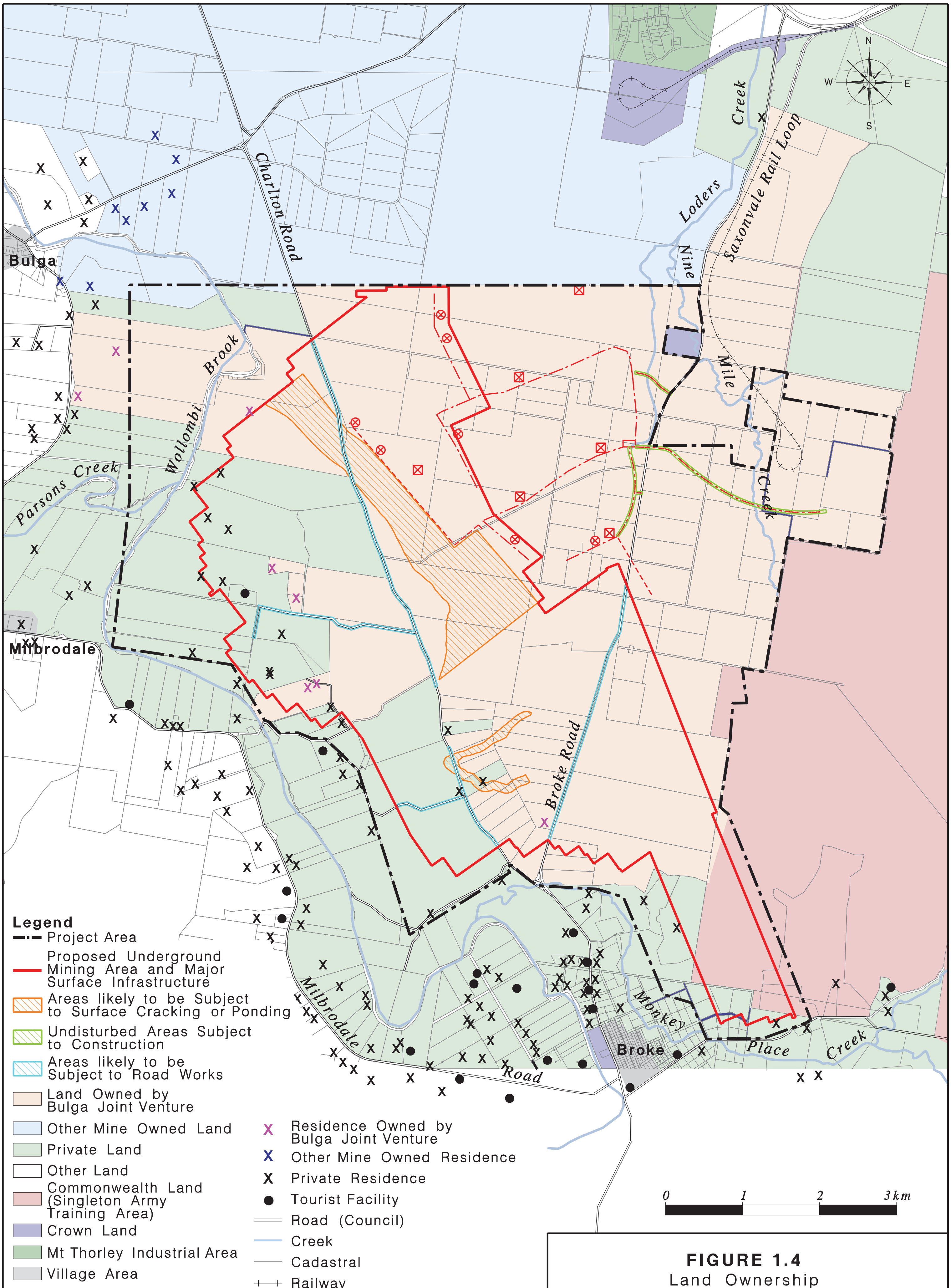


FIGURE 1.3
Proposed Conceptual Mining Area and Infrastructure



Note:
Refer to Figure 1.3 for legend of infrastructure

Umwelt (Australia) Pty Limited
Base Source: Bulga Coal Management

FIGURE 1.4
Land Ownership
in the Project Area

A4 Scale 1:65 000

Ref No.:R03_V2/1468_203.dgn

Table 1.1 - Project Objectives and Tasks

Objective	Assessment Strategy/Task
Comply with NPWS Aboriginal heritage assessment guidelines	• Brief BCM project team on requirements, maintain liaison with NPWS cultural heritage personnel throughout the assessment and management process
Integrate Aboriginal cultural heritage information across all parts of the project area	• Review environmental context for the project area that defines potential cultural heritage values of the landscape • Review previous survey results and interpretation for the project area and summarise current understanding of the distribution and nature of Aboriginal archaeological evidence • Prepare a model/hypotheses to be tested by further survey and analysis of archaeological information – to provide information that informs management decisions • Identify any differences in definition of landscape classification, site boundaries, artefact description etc that will affect integration of data • Prepare a clearly justified survey strategy to address the relevant hypotheses and management issues. Conduct field surveys with the Aboriginal community and document results • Assess cultural heritage values across the entire project area • Assess cultural and archaeological significance across the entire project area
Involve representatives of the local Aboriginal community in the assessment process	• Invite all local Aboriginal groups to participate in all aspects of the assessment process, and provide ongoing feedback about issues and possible management options • Discuss Aboriginal values of the landscape eg traditional food plants, water supply, places of cultural value etc
Maximise opportunities for conservation of Aboriginal heritage values (cultural, social and archaeological)	• Review cultural heritage interpretations of the project area on the basis of integrated information from this assessment • Clearly define potential mining impacts on the Aboriginal cultural heritage values and significant cultural heritage sites in the project area • Document conservation management criteria for the project and note locations which do not require a conservation approach to maintain the cultural heritage values of the project area • Discuss potential conservation management options with the Aboriginal community and NPWS. • Wherever possible, manage surface lands in the mining lease to protect and restore cultural heritage elements of the landscape
Provide clear and practical guidance on measures to minimise potential impacts on Aboriginal cultural heritage values during mining operations	• Fully describe and evaluate the range of management options that are appropriate for all Aboriginal sites and other cultural heritage values across the project area. Evaluation should be against clear criteria. • Provide the basis of a structured Aboriginal cultural heritage management plan for the project area in consultation with the local Aboriginal community

1.2.1 Statutory and Policy Framework

This assessment has been prepared to comply with the requirements of the following legislation, policy and guidelines:

- Part IV of the *Environmental Planning and Assessment Act* 1979
- *National Parks and Wildlife Act* 1974
- NPWS Standards and Guidelines for Archaeological Report Writing 1997
- Australian Heritage Commission “Ask first; A Guide to Respecting Indigenous Heritage Places and Values” (2002).

The assessment also recognises the significant evolution that has occurred in NPWS policy and project specific guidance that has been provided on Aboriginal cultural heritage assessment and management processes in recent years.

A key feature of current best practice, as described by the Heritage Commission (2002) and NPWS (2003) is the full and active participation in the assessment and management process of all Aboriginal people having relevant interests in indigenous heritage matters. A second key feature is the focus on diverse cultural heritage values as well as the archaeological evidence of past Aboriginal occupation of the landscape, recognising ongoing local community attachment to the land and continuance of cultural values and practices.

In accordance with the principles of ecologically sustainable development, these recent guidelines also stress the importance of a precautionary approach to the management of Aboriginal cultural heritage values and objects. They note that uncertainty about indigenous heritage values at a place should not be used to justify activities that might damage this heritage.

1.3 THE PROPOSAL AND THE NATURE OF ITS IMPACT

1.3.1 Underground Mine Plan

The proposed underground mine plan covers approximately 3,010 hectares, of which 340 hectares are within exploration licence areas and 2,510 hectares are within the existing Bulga Complex. The remaining 160 hectares are within Commonwealth land.

The project will target coal in the Whybrow, Blakefield, Glen Munro and Woodlands Hill seams (**Figure 1.3**). The depth of the target seams varies from 35 metres adjacent to the Whybrow Pit to 400 metres in the deeper areas on the western side of Charlton Road. Coal will be extracted from the multiple target seams using retreat longwall methods in three areas:

- the southern area, where two seams will be extracted below existing SBC workings and one seam to the southeast of SBC workings;
- the central area, which will extend the Beltana workings in four seams, including the presently mined Whybrow seam; and
- an area north of the Beltana workings, which will be mined in four seams.

Bord and pillar continuous mining operations will be employed to construct development headings. Mining will be undertaken in all four seams in the northern and central areas, whilst only the Blakefield and Woodlands Hill seams will be extracted in the southern area. With concurrent operations in some seams, the life of the mine is expected to be approximately 27 years. This proposal seeks consent for a 27 year mining approval.

Initially, each longwall panel will be approximately 265 metres in width, with a length of between 1,000 and 4,000 metres, although there is potential for widths of 350-400 metres in the next 7-10 years, due to improvements in mining technology. The orientation of longwall panels is northeast to southwest in the northern and central sections. The southern area has longwall panels oriented in a north-northwest to south-southeast direction. The mine plan has been staggered, so that each seam is offset from the previous one by half a longwall panel (**Figure 1.3**). This staggered mine plan will minimise cumulative surface impacts, as progressive extraction in lower seams will tend to ‘even out’ the subsidence troughs created by mining in the previous seam.

There will be no longwall mining in the Whybrow seam in the southern area, as all available longwall reserves have been extracted by SBC. There will be areas of coal in the Whybrow seam that will be extracted by continuous mining methods (refer to **Figure 1.3**) which will not have any significant surface impacts. Areas elsewhere in the mine footprint may also be extracted by bord and pillar first workings rather than longwall methods, if conditions preclude longwall mining.

The maximum annual production from the project will be up to 14 Mt. Two longwall units will each operate at up to 8 Mtpa, but with a combined capacity of not more than 14 Mtpa. The underground operations will be undertaken concurrently with BOC for approximately 14 years. During the initial period only one longwall unit will be utilised. As the open cut production declines from approximately Year 12 (2015), two longwall units will be operated. The peak production from the Complex during this period will be 15 Mtpa.

1.3.2 Surface Facilities

During mining in the Whybrow seam in the northern and central areas, coal will be extracted using existing facilities (refer to **Figure 1.3**). These include the existing in-pit conveyor and use of SBC stockpile and overland conveyor.

During mining in the Blakefield seam in the northern and central areas, a new in-pit conveyor and approximately 150,000 tonne run-of-mine ROM coal stockpile will be required, as well as an overland conveyor from the ROM stockpile to the coal handling and preparation plant (CHPP) (refer to **Figure 1.3**). This infrastructure will be located predominantly in areas disturbed by open cut mining activity. There will be no new coal clearance infrastructure required for mining in the Glen Munro and Woodlands Hill seams in the northern and central areas, other than minor extensions to the Blakefield in-pit conveyor in order to transport coal from the new adits to the Blakefield conveyor. There will be no major new out of pit surface infrastructure required to extract coal from the Woodlands Hill seam in the southern area. All coal will be washed at the existing CHPP and sent to market via the existing rail loop.

It is proposed to establish personnel and materials facilities for the underground operations in the northern and central areas in and adjacent to the Bulga Pit (refer to **Figure 1.3**). No major new out of pit infrastructure will be required to access the Whybrow seam in the northern area, as the existing Beltana infrastructure will be utilised.

Two new access roads and up to five office and amenity buildings will also be required (**Figure 1.3**). All of the buildings will be located in areas disturbed by existing open cut operations. The roads are generally located in areas not previously disturbed.

1.3.3 Other Surface Works

Drainage works will be required to mitigate the impact of subsidence on a number of unnamed ephemeral creeks located in the northern, central and southern underground mining area. Works to repair dam walls may also be required.

Dewatering bores will be required to extract mine water from the underground workings. These bores will be located on private properties at the western extent of the mining area, on land owned by BJV or by agreement with the relevant landholders. Gas drainage boreholes will be required to extract gas from the coal bed pre and post mining in the deeper seams. These boreholes will also be located on BJV land or private property at the western extent of the mining area. Gas drainage plants will be located on land owned by BJV.

1.4 POTENTIAL IMPACT ON ABORIGINAL SITES/SENSITIVE AREAS

In summary, the project will involve the following impacts at the ground surface:

- predicted maximum subsidence of the ground surface by about 1.2-3.0 metres in each seam corresponding to removal of coal panels;
- potential longitudinal and transverse surface cracking of soils and rock platforms parallel to chain pillars and at margins of the mining area;
- mitigation of surface cracking, where required, by cultivation or ripping affected soils;
- mitigation of surface drainage effects in drainage lines of low relief by in-channel earthworks including cutting, infilling, bank stabilisation and shaping;
- mitigation of subsidence effects along Charlton Road, Broke Road, Fordwich Road and Cobcroft Road involving removal of low rises and resurfacing;
- erosion control works in areas of sheet erosion within subsidence remediation zones; and
- construction of surface infrastructure.

There are three ways in which Aboriginal sites may be affected by the project. These are:

- disturbance, damage and/or destruction of sites/artefacts during the construction of any additional surface infrastructure and any potential additional drainage works;
- damage to sites located on massive sandstone blocks caused during the subsidence process; and
- disturbance, damage or destruction of sites/artefacts caused by subsidence remediation works.

1.4.1 Surface Infrastructure

The majority of surface facilities required for the project will be located in areas previously disturbed by open cut mining activity. Exceptions include the overland conveyor between the ROM stockpile and the CHPP (refer to **Figure 1.3**) and those areas required for dewatering bores, gas drainage bores and the gas drainage plants. Any cultural heritage sites/artefacts within the areas affected by these facilities will be destroyed or at least disturbed/damaged during their construction. The exact location of gas drainage plants, gas drainage bores and dewatering bores is not able to be determined at this stage, and as discussed in **Section 7.3.2** these will need to be subject to ongoing assessment.

1.4.2 Subsidence

As the longwall panel is removed the void left behind collapses, resulting in general subsidence of the overburden as the longwall panel progresses. This results in ground surface subsidence in areas immediately above the mined longwall panels, interspersed by areas that do not subside above the service tunnels, or chain pillars, that are left beside each longwall panel.

The subsidence of the ground surface occurs in a wave-like manner as mining progresses, which may result in cracks at the surface at shallow depths of cover. These cracks generally open and then close again as the wave passes. The majority of subsidence occurs within three weeks of the longwall panel being removed in any location. Additional cracking of the ground surface may occur parallel to the longwall between the longwall panel and the chain pillar, known as the rib-line fracture zone.

Underground mining generally has limited impact on cultural heritage resources at the ground surface. Subsidence of the ground surface alone does not necessarily disturb cultural heritage sites such as stone artefact scatters but simply lowers their elevation. The degree of environmental impact of subsidence is generally related to the depth of cover, that is, the depth of strata between the surface and the underground operations. Greater subsidence impacts will occur in areas of shallow depth of cover. Surface cracking will be most extensive where the depth of cover is less than 80 metres and in these areas, mitigation through cultivation or ripping may be required.

Where low gradient drainage lines are subsided, bed gradients may reverse and water flow may be blocked so that intermittent ponding can occur. Surface engineering work is sometimes required to maintain uninterrupted water flow within affected drainage lines. If required, these works will involve cut, fill and reshaping in drainage lines.

Figure 1.5 shows the variation in the depth of cover across the project area to the uppermost seam, that being the Whybrow seam in the northern and central areas and Blakefield seam in the southern area. As depth of cover increases significantly from east to west in the northern and central mining areas and from north to south in the southern mining area, it can be expected that the effects of subsidence and subsequent requirements for mitigation works will similarly decrease away from the existing open cut pits.

However, sites located on rock exposures/outcrops may be affected adversely by subsidence due to the cracking of the rock.

1.4.3 Mitigation Works

Although subsidence itself is unlikely to cause further damage to artefact scatters and isolated finds, if remediation works are necessary in sites, artefacts would be considerably disturbed/damaged or destroyed in the process.

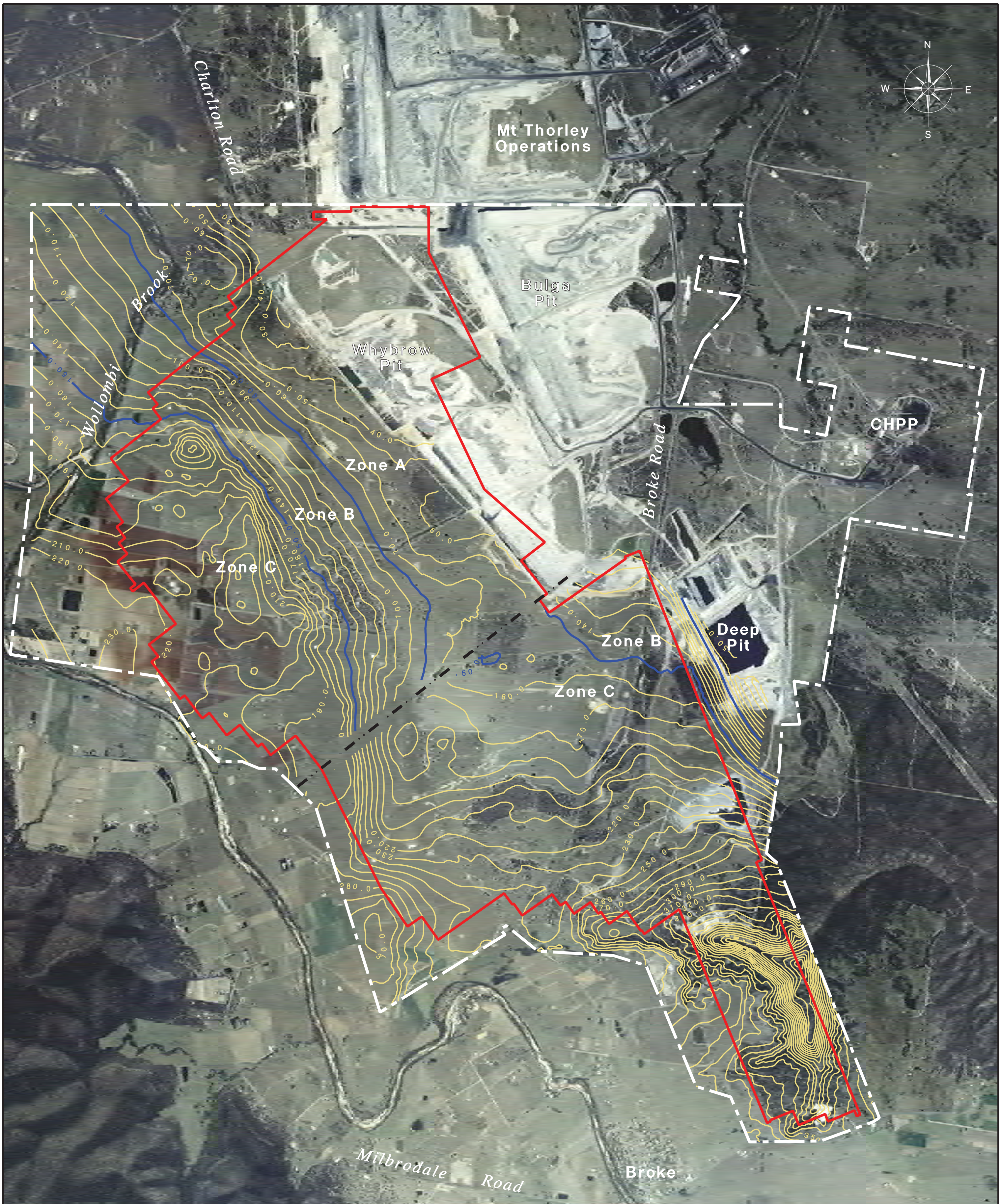
1.5 ABORIGINAL COMMUNITY PARTICIPATION

1.5.1 Aboriginal Cultural Associations with the Project Area

The New South Wales NPWS Aboriginal Cultural Heritage Guidelines outline three principles behind the collaborative approach to Aboriginal heritage survey and site management required by the Service. These principles are that Aboriginal culture is a living culture, that the Aboriginal community are the rightful owners of cultural heritage information, and that NPWS decision making on Aboriginal heritage issues is transparent. Umwelt supports the principles underlying the NPWS approach and aims to involve the relevant Aboriginal community/communities in all its heritage assessments.

The Central Lowlands of the Hunter Valley is recorded as the country of the Wonnarua people. Early European observers recorded their lives as intensely religious and constrained by strictly enforced laws (Ridley 1864 in Brayshaw 1986). The traditional lives of the ancestral Wonnarua focused on the Hunter Valley and were structured around a schedule of social interactions designed to take advantage of seasonal availability of resources. People travelled freely within the broad area of responsibility of their own group. Social responsibilities and obligations meant that people also travelled beyond their own territories to attend ceremonies with neighbours, to trade and to develop social networks that linked people across extensive areas. The Wonnarua had social links from the coast to the western plains of NSW (Brayshaw 1986a: 38-41). People moved often, but not at random.

Most of the evidence for Aboriginal occupation in the Hunter Valley comes from stone artefacts. Unfortunately, there is little ethnography concerning the production and use of stone artefacts. In fact, there are limited published ethnographic accounts of aspects of the lifestyle of Aboriginal people who lived in the Hunter Valley or how people used the land and its resources. The only mention of stone artefacts in the area is in regard to the use of quartz as a barb on spears and a mention of ground edge stone hatchets (Brayshaw 1986a: 66, 68).



Legend

- Project Area
- Proposed Underground Mining Area
- Depth of Cover to Uppermost Seam
- Boundary between Central and Southern Mining Area
- Zone Boundary

Zone A has a >10% probability of Subsidence Remediation Works

Zone B & C are only likely to require Subsidence Remediation Works on Roads, Dams and the Southern Drainage Line

Note:
Whybrow is uppermost seam in northern and central mining area, Blakefield is uppermost seam in southern mining area

Umwelt (Australia) Pty Limited
Base Source: Bulga Coal Management & Hatch Aerial Photo (2002)

FIGURE 1.5
Depth of Cover to Uppermost Seam Proposed for Longwall Mining

A4 Scale 1:55 000

Ref No.:R03_V1/1468_199.dgn

Most of the time, people lived in small groups moving regularly from campsite to campsite, living on local resources. There is little ethnographic evidence about where Aboriginal people camped, however, there is mention of the importance of fresh water. For instance, Fawcett wrote about the “Wonaruah”:

> *In choosing the site, proximity to fresh water was one essential, some food supply a second, whilst a vantage ground in case of attack from an enemy was the third (1898:152).*

The Hunter Valley was subject to drought and permanent water was a valuable commodity. Creeks and rivers also supported a range of vegetable foods and attracted game.

There are several reports that describe the country of the Hunter as having extensive grasslands with few trees and extensive floodplains (Breton 1833). These grasslands are thought to have occurred because Aboriginal people were continually burning the countryside as part of their responsibility to look after the land and as a hunting strategy. Burning cleared the undergrowth and fresh growth produced green shoots which attracted kangaroos to these areas making them easier to hunt. There are early references to this use of fire by the Wonnarua (for example Mitchell quoted in ERM 1999).

While camping at a particular site, people would travel each day throughout the surrounding country to collect food or other required resources (stone, bark for containers, shields etc, gum, fibre plants for weaving and string manufacture) from preferred locations within a day’s walk of camp (usually within about 5 kilometres). If sandstone outcropped in the watercourses they may also grind the cutting edges of their stone axes/hatchets or grind their fire hardened wooden spear points. Some areas which provided abundant resources (even if for only a short period of time on an annual or even occasional basis) and a sheltered location (from view) may have been used for ceremonial gatherings of large groups of people (Satterthwait and Heather 1987).

The abundance of resources in the Hunter Valley is recorded. Kangaroos, emus, possums and fish were plentiful (Breton 1831, Dawson 1830). There was an abundance of food on the flattened ridges and plains for kangaroos (Cunningham 1827: 157) and trees were available for shelters and wooden implements such as shields (Breton 1833, Eyre 1859).

The lifestyle of the Aborigines of the Hunter Valley was shattered with the arrival of Europeans. The rapid settlement in the area disrupted the Aboriginal economy and, in a very short time, the Aboriginal population was decimated by a combination of starvation, introduced diseases and massacres.

1.5.2 Aboriginal Participation in the Project

The project is within the area of interest of Lower Wonnarua Tribal Consultancy Pty Ltd (LWTC), Ungooroo Aboriginal Corporation (UAC), Upper Hunter Wonnarua Council Inc. (UHWC), Wanaruah Local Aboriginal Land Council (WLALC) and the Wonnarua Nation Aboriginal Corporation (WNAC). All five Aboriginal community groups were consulted prior to the field work and were provided with maps detailing the suggested survey strategy for their comment. Two representatives of each group participated in the survey (WNAC was represented by UHWC during the field work phase) and discussions were held in the field in relation to the Aboriginal landscape values and Aboriginal significance of the sites located and recommendations for the management of these sites.

Consultation with the community groups was ongoing throughout the period of report preparation. In addition, five meetings were held with the groups on 28 October 2002, 12 December 2002, 20 March 2003, 2 April 2003, 30 May 2003 and 13 June 2003 (two on site, three at the Bulga Complex offices and one at the offices of Aboriginal groups) to discuss the impacts of the project and preferred management outcomes. Margrit Koettig (Archaeologist NPWS) attended three of these meetings (12 December 2002, 20 March 2003 and 2 April 2003) and Shaun Hooper (Aboriginal Cultural Heritage Unit NPWS) attended one (12 December 2002).

All five groups listed above were provided with a draft copy of this report for comment prior to finalisation. A sixth group (Combined Council Hunter Valley Aboriginal Corporation [CCHVAC]) that formed towards the end of the project was also sent a copy of the draft report for comment. Members of the CCHVAC were present during the field work component and the first three meetings as representatives of WLALC. The comments of the Aboriginal community groups are included within **Appendix A** (refer to **Section 6** for a summary of these comments).

Participants in the surveys were Maree Waugh, Glenn Miller and Dave Swan (LWTC); Tracey Skene, Georgina Berry and Martin Feeney (UHWC) (who also acted as spokespeople for WNAC); Rhonda Ward, Allen Paget, Lisa Clydsdale, Dahlene Hall and Rebecca Faulder (UAC); and John Mathews and Trevor Griffiths (WLALC). Archaeologists involved in the surveys were Jan Wilson and Leila McAdam (Umwelt). Various sections of this report were prepared by Jan Wilson, Katie Sachs, Leila McAdam and Alex Mackay (Archaeologists, Umwelt).

1.6 STRUCTURE OF THE REPORT

The structure of this report follows the “NPWS Aboriginal Cultural Heritage Guidelines for Archaeological Survey Reporting” (1997).

Section 1 of the report provides a background to the proposed development and the archaeological assessment.

Section 2 of the report details the environmental and landscape context of the project area including information related to the topography, drainage, geology, geomorphology, soils and vegetation and past and present land use. This information is used to highlight the Aboriginal resources of the area, and the potential Aboriginal cultural heritage values of the area compared to other parts of the Central Lowlands.

Section 3 of the report summarises the previous archaeological research undertaken within the project area and its immediate surrounds. The discussion considers both the distribution of sites and their content. It also reviews previous interpretations of the archaeological evidence.

Section 4 of the report draws together the information about landscape context, archaeology and interpreted cultural heritage values to provide a series of predictive statements about the likely Aboriginal cultural heritage evidence in previously unsurveyed areas. This section also highlights the particular opportunity provided by this assessment to integrate and re-evaluate interpretations of past Aboriginal occupation activities.

Section 5 of the report discusses the strategy for surveys undertaken in October and December 2002, presents the results of those surveys, and provides information in relation to the sites located and the artefacts located within those sites.

Section 6 of the report reviews and evaluates the cultural heritage values of the project area and includes the Aboriginal and archaeological significance assessment of the known sites and their landscape context within the project area.

Section 7 of the report discusses the likely impacts of the project on Aboriginal cultural heritage values.

Section 8 discusses the management strategies for the sites located in the project area. The focus of management is to achieve long term conservation of a significant cultural landscape, as well as providing clearly justified management measures for other Aboriginal sites in the project area.

Section 9 provides a full list of references cited.

2.0 ENVIRONMENTAL CONTEXT

Dean-Jones and Mitchell (1993: 52) state that there are three sets of questions that need to be addressed when formulating a predictive model for the distribution of Aboriginal sites (ie loci with evidence of past Aboriginal occupation) in the landscape. These are:

i. What environmental factors influenced Aboriginal site selection at the time of occupation?

ii. What environmental factors influence the chance of site preservation over time?

iii. What environmental conditions have produced site exposure and visibility today?

A further set of influences on the pattern of occupation evidence derive from the cultural beliefs and interpretations of individuals and communities in the past.

Section 2 of this report describes and interprets the influences of the physical landscape on past cultural activities and on the conservation of evidence of past activities. It also provides a regional and local environmental context for comparing the patterns of cultural values and occupation evidence in the landscape. This information is an important contributor to the assessment of significance.

The descriptions presented below have been drawn from the literature and from observations during field work.

2.1 LANDSCAPE STRUCTURE

Kovac and Lawrie (1991) identify seven principal topographic zones in the Hunter region. Two of these, the Southern Mountains and the Central Lowlands, occur in parts of the project area.

Five soil landscapes (two within the Southern Mountains and three in the Central Lowlands) occur within the project area (Kovac and Lawrie 1991) and this diversity of soil landscapes is indicative of the range of natural resources that would have been available for traditional Aboriginal inhabitants. The five soil landscapes are briefly described in **Table 2.1**, with information provided about potential cultural value implications wherever possible. The boundaries of these broad soil landscapes are shown in **Figure 2.1** with the local terrain units of the project area.

A small area of the Warkworth soil landscape is mapped in the north of the project area. The Warkworth unit comprises moderately coarse aeolian sand that is derived from alluvial deposits along the Wollombi Brook. The aeolian sands are often situated on old river terraces and have a distinctive native vegetation comprising black wattle and bracken. They are generally linear features that are aligned north west to south east. In the project area, a small area of unconsolidated sand extending south east from the Wollombi Brook was initially considered to be another example of this soil landscape. Further investigations of local geomorphic history and soil profiles suggest that the deposit is alluvial and has only a minimum aeolian component (refer to **Section 2.3.4.1**).

2.1.1 Local Terrain Character

To facilitate discussion of local associations of Aboriginal cultural heritage features and their landscape context, the local terrain units within the project area have been identified (following the method of Speight 1988). These are shown in **Table 2.2** and **Figure 2.2**. An important characteristic of the project area is that some 1697 hectares or 28 per cent are classified as modified. In general, this refers to existing open cut mining operations and principally affects the Rothbury and Branxton soil landscape units (catchments and low order drainage lines of Loders Creek and Nine Mile Creek – see **Figure 1.2**). The units shown in **Figure 2.1** continue the local terrain unit classification presented in Umwelt (2001) for the Beltana project.

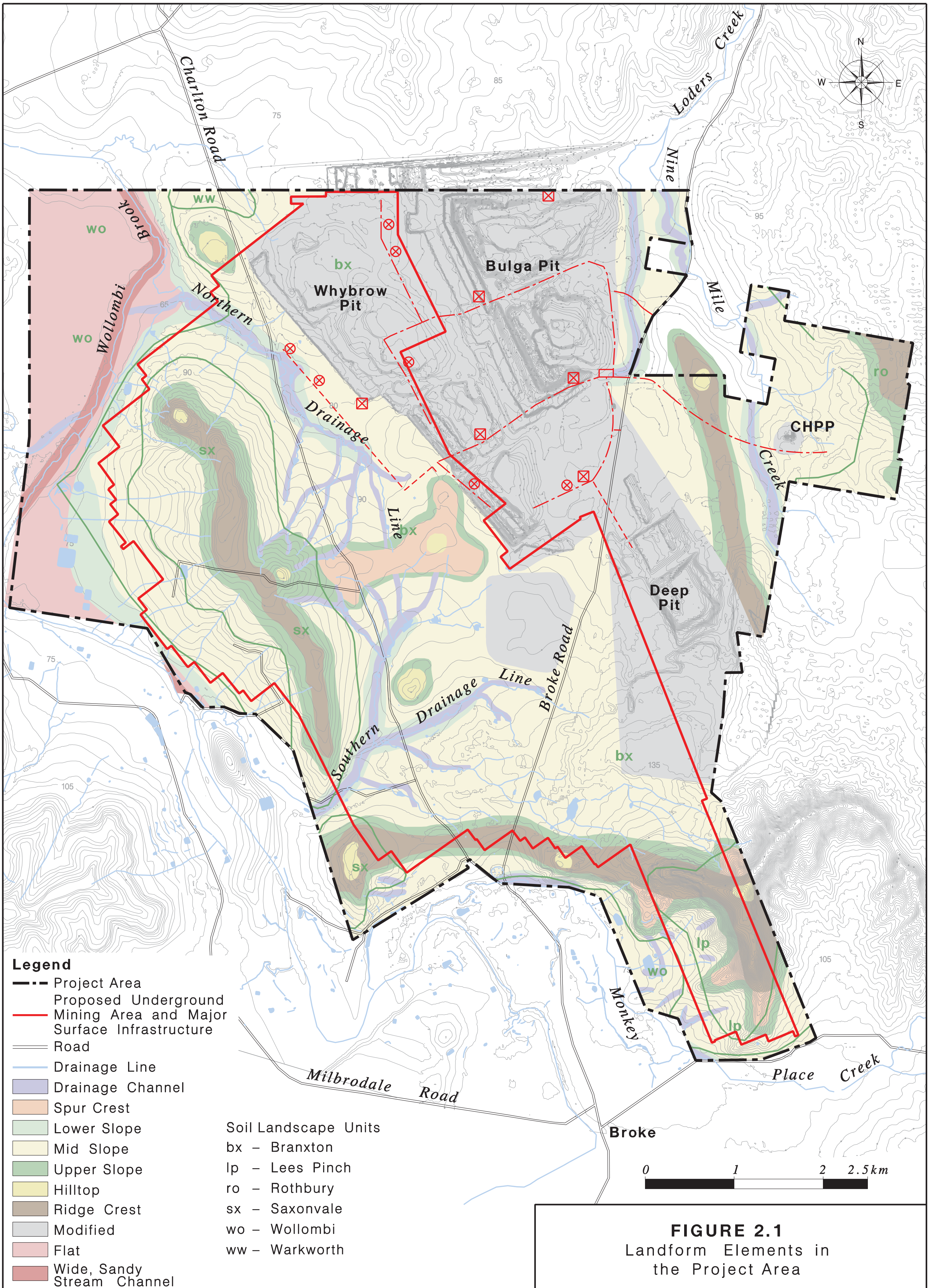


FIGURE 2.1
Landform Elements in the Project Area

Umwelt (Australia) Pty Limited
Base Source: Bulga Coal Management & Kovac & Lawrie (1991)

A4 Scale 1:55 000 | Ref No.:R03_V2/1468_213.dgn

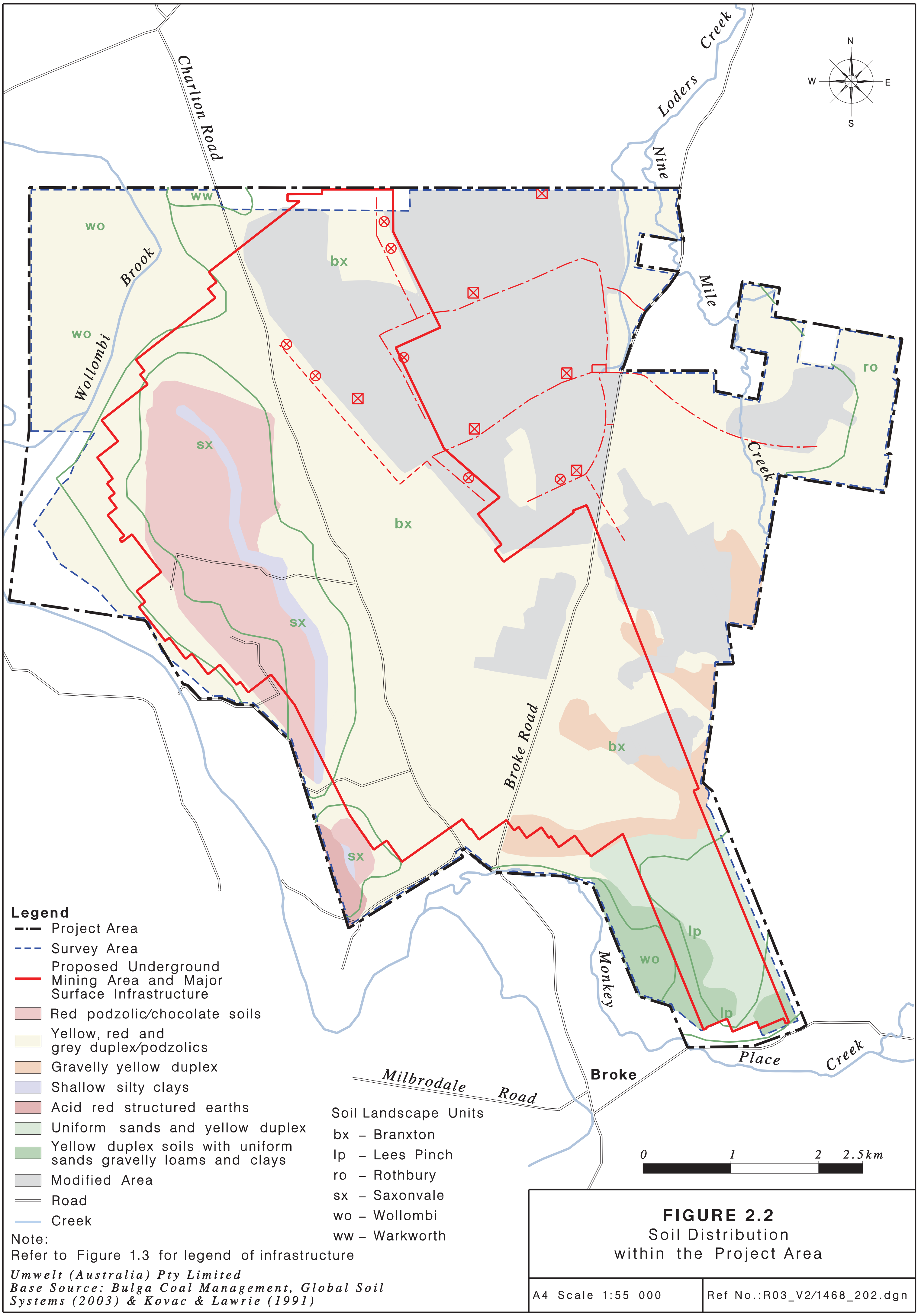


FIGURE 2.2
Soil Distribution within the Project Area

Table 2.1 - Soil Landscape Attributes and Potential Broad Cultural Values in the Project Area

Soil Landscape	Attributes[1]	Cultural Value Implications
Southern Mountains - Lees Pinch	Rolling to steep hills and mountains with escarpments, benches, sandstone and conglomerate outcrop. Talus on lower slopes. Deep, narrow structurally controlled valleys. Mixed shrub and woodland communities, often with black Cyprus pine, broad leaved red ironbark, brown bloodwood, wattles, caleys ironbark etc.	This soil landscape occurs in the Vere. Very sheltered valleys, with possible rock shelters, diverse plant resources likely to vary over short distances. Potential outcrop for grinding, engraving and other art work. Access may be poor at times (local flooding), plus steep slopes and escarpments.
Southern Mountains - Wollombi	Valley flats and undulating rises of Wollombi Brook and its tributaries, with low relief. Valley width increases from about 600 to 2000 metres or more at Broke and Bulga. Vegetation is Forest Oak and River Oak	Limited terrestrial plant resources, but potentially diverse aquatic resources. River flows likely to be variable (and rapidly changing), with extended periods of no flow. May be brackish. Sand bed stream – no gravel resources, but occasional sandstone outcrop where the channel impinges on the bedrock valley margin.
Central Lowlands-Saxonvale	Undulating low hills, often forming distinct ridge lines, elevations of 100-160m, with drainage lines radiating. Slope lengths 300 to 800m. Native vegetation is grey box, red box and blakelys red gum	Ridge crest and upper slopes have good views across the lowlands to the east and west. Little water and poor stone resources. Mixed, low concentrations of plant and animal resources
Central Lowlands - Rothbury	Undulating and rolling low hills, with local relief 60-80 metres, slope lengths of up to 1000 metres and low order drainage lines spaced at intervals of 200 to 1000 metres. Spotted gum, forest red gum, stringybark and ironbark woodland with melaleuca in drainage lines. Related to Branxton soil landscape	This landscape is similar to the Branxton landscape, and is restricted to the eastern part of the project area. Creeks unlikely to have permanent flows, frequently dry. Mixed habitats for plant and animal resources, occasional stone (sandstone and conglomerate) outcrop and potentially gravel in soils and creek bedload.
Central Lowlands - Branxton	Undulating hills and low rises with many small creek flats. Elevations 50-80 m, slope lengths up to 600m, local relief 10-40 m, drainage lines spaced 400-1500m intervals. Uncleared native vegetation includes spotted gum, red ironbark, narrow leaved iron bark with swamp oak in the drainage lines.	Similar to the Rothbury soil landscape, other than dominant riparian species. Similar water constraints and diversity of plant, animal and stone resources.
Central Lowlands – Warkworth	Linear sand dunes of 1-3 metres on old river terraces, generally aligned northwest to southwest. Native vegetation is black wattle and bracken.	Bracken and acacia may provide starch and resin resources. There is little potential for stone resources. Creeks unlikely to have permanent water, but reliable water is available in the nearby Wollombi Brook. Variable animal resources.

1 Source: Kovac and Lawrie 1991

Table 2.2 - Landform Elements

Landform Element	Area (ha)
Modified	1697
Ridge crest	411
Hill top	33
Wide sandy creek bed	61
Flat	413
Spur crest	120
Lower slope	289
Drainage	254
Upper slope	429
Mid slope	2319
Total	**6026**

The project area straddles the low drainage divide that separates subcatchments flowing directly to the Hunter River (Loders Creek and Nine Mile Creek) from subcatchments that are tributaries of the Wollombi Brook. Loders Creek, and Nine Mile Creek in the east of the project area are direct tributaries of the Hunter, whilst several small subcatchments in the western part of the project area are associated with the Wollombi. The drainage divide itself does not appear to have a particular cultural significance, as it is low and not clearly defined. The upper reaches of drainage lines on both sides of the drainage divide are within the same soil landscape (Branxton). However, the catchment context of these drainage lines changes considerably downstream, with proximity to the distinctive Wollombi resources (for west flowing subcatchments) and to the Hunter River for northeast flowing catchments (Loders Creek and Nine Mile Creek).

The lower order tributaries of the Loders Creek and Nine Mile Creek catchments are ephemeral in nature and in general are broad, sometimes imperceptible, grassy waterways on the upper slopes, becoming narrower, more entrenched and with more eroded banks downstream in higher order tributaries. Erosion of the tributary banks includes scouring, slumping and bank collapse. Ongoing entrenchment of the tributary channels is a feature of the majority of the tributaries as they pass from the upper to the mid and lower slopes.

Similarly, tributaries of the Wollombi, also within the Branxton soil landscape, have sections where sandstone outcrops in the bed. In most areas the sandstone is now only exposed due to recent erosion, however, there are some areas where it would have been exposed in pre-European times (eg the Loders Creek grinding groove site).

The western section of the project area is dominated by a low broad ridgeline (the Fordwich Sill) that runs roughly north-south on the western side of the project area (in the Saxonvale soil landscape). The maximum elevation of this feature is 169 mAHD. The moderate upper slopes and gentle lower slopes of this ridgeline are dissected by several minor drainage lines (first to third order). A low east-west oriented spur (100 mAHD) runs off the central eastern part of this ridgeline, separating drainage of the ridgeline into north and south flowing sub-catchments. The tributaries that drain all falls of the ridgeline eventually flow into Wollombi Brook after meandering through its often broad flood plain.

Just within the northwestern boundary of the project area is a sand deposit several metres thick which appears to consist of siliceous alluvial sands that once formed a point bar projecting from the western bank of Wollombi Brook. The sand deposit is approximately 450 metres (east to west) by 500 metres (north to south). The sand is now located on the eastern bank and terrace of the Wollombi Brook and the local tributary that once drained into the Brook opposite the point bar, now flows around the sand deposit to enter the Brook. The period of time over which the alluvial sand deposit has accumulated is unknown. Further detail about the geomorphic processes and history of this part of the project area is presented in **Section 2.3.4.1**.

The southern-most portion of the project area encompasses a narrow ridgeline and steep rugged slopes (in the Lees Pinch soil landscape of the Southern Mountains topographic zone) of the Broken Back Range known as the “Vere”. Numerous conglomerate outcrops, cliffs and overhangs occur in the “Vere” area. The majority of the overhangs are not suitable for human occupation as they are very shallow, have steeply sloping floors (to the outside) and can only be accessed by climbing very steep cliff faces or slopes. Occasionally boulders have come to rest partway down the slope and these can have overhangs suitable for human use where weathering has caused cavernous erosion to occur.

The section of the “Vere” within the project area generally trends north-south and has many east-west trending spurs of lower gradient. The valleys formed between the spurs are wide and grassy on the lower slopes with indistinct tributary channels until they reach areas of low gradient where tree clearance, and to the west, cultivation, has led to erosion and entrenchment of the channels. On the mid and upper slopes the tributaries are scree-lined and often indistinct.

Occasionally deep, rock-lined waterholes have formed at the very abrupt midslope/lower slope boundary. The upper and mid reaches of the tributaries are ephemeral, while the lower reaches probably retain pools of semi-permanent water. The section of ridgeline within the project area drains into four different tributary systems. To the south it drains to Monkey Place Creek (also called Yellow Rock Creek on some topographic maps), to the west it drains to Wollombi Brook and to the north it drains to Loders Creek and Nine Mile Creek. The lower reaches of these tributary systems are presently semi-permanent retaining water in pools (generally on meander bends) for a number of weeks after rain.

Loders Creek, Nine Mile Creek and Monkey Place Creek and their larger tributaries have been subject to recent gully erosion and have deeply incised channels. This channel incision is probably the result of European land use practices. Prior to European settlement it is likely that these creeks had a chain of ponds morphology and provided semi-permanent water to Aboriginal people. It can also be suggested that billabongs formed in meander cut-offs within the flood plains of these tributaries would have provided water for an extended period after heavy rain and/or overflow events.

2.2 GEOLOGY AND SOILS

The undulating hills and valleys of the Branxton and Rothbury soil landscapes overlie Permian sandstone, shale, mudstone, siltstone, tuff and coal seams. Yellow red and grey duplex/podzolic soils cover the midslopes (refer to **Figure 2.2**).

The elongated ridge in the south west of the project area is formed on Tertiary dolerite and a teschenite (basalt) sill (Fordwich Sill). The ridge crest and upper slopes are characterised by weathered, rocky outcrops with shallow silty clay soils. Red podzolic and chocolate soils occur on the lower slopes (**Figure 2.2**) and inconspicuous linear gilgai occur parallel to the slope in some undisturbed areas.

The rugged slopes of the southern portion of the project area are covered by conglomerate scree (Wilson pers. obs. 2002), shallow siliceous uniform sands and shallow loams (of the Lees Pinch soil landscape). Yellow duplex soils with uniform sands, gravelly loams and clays and occur on footslopes to the south and east of the “Vere”, while gravely yellow duplex soils occur along spur lines running to the west (Global Soil Systems 2003). This area is underlain by lithic and quartz sandstone, conglomerate, claystone, shale and siltstone.

Throughout the survey it was noted that pebbles of quartz, quartzite and other potentially flakeable lithologies from weathered conglomerates were common on the ground surface and throughout the soil profile.

The texture contrast (or duplex soils) referred to above characterise the Central Lowlands of the Hunter Valley. The implications of soil forming processes in these soil types for the preservation of cultural heritage discard patterns, and the mixing of cultural evidence of different ages, have been widely reported over the last ten years. Key soil processes include:

- bioturbation (this also applies to other soil types);
- rainsplash, more effective on light textured soils that are do not have a hard setting surface;
- heat effects from bushfire and more recently from land clearing (stump burning);
- differential erosion of light textured and poorly structured A horizons, compared to other soil materials and to the heavier textured B horizon;
- highly localised patterns of soil accretion and erosion on steeper slopes;
- a tendency for artefacts to behave in the soil in the same way as other inclusions, migrating towards the base of the A horizon; and
- on long gentle slopes, an overall tendency for accretion of sheet washed materials on the lower slope, with the potential for burial of former occupation surfaces.

The relevance of these processes to individual Aboriginal sites in the project area is discussed in **Section 5**.

The alluvial and colluvial sequences along Loders Creek and the northern drainage line within the project area (a tributary of Wollombi Brook) have previously been described by Navin and Officer (1995) and Umwelt (2001). This low relief landscape is dominated by slowly accreting colluvial units, with accretion patterns disrupted by recent sheet erosion. The area to the northwest of Charlton Road includes a well developed alluvial and colluvial sequence associated with a tributary of Wollombi Brook and also includes sandy terrain, unique in this project area, bordering Wollombi Brook.

Previous archaeological reports (eg Heffernan and Klaver 1997, Navin and Officer 1995) have raised the possibility of buried soil surfaces within these sequences, that could be archaeologically significant. Stratified soil units that preserve temporarily discrete occupation events are of outstanding archaeological and cultural value in the Hunter Valley. The presence of such units would be a major influence on significance assessment and the preparation of appropriate management strategies for the project area.

The stratigraphy and soil development in the northwestern part of the project area has therefore been studied carefully to ensure that all locations with real potential to include buried soil surfaces of late Holocene or earlier age (ie pre-European surface deposits) are identified. **Section 2.3.4** describes and interprets the results of soil and stratigraphy investigations in the northwestern part of the project area.

2.3 GEOMORPHOLOGY

2.3.1 The Project Area in its Regional Context

As noted in **Section 2.1**, the central part of the Hunter catchment can readily be divided into seven major landscape types.

This section briefly describes patterns of geomorphic processes across these seven landscape types that are relevant to the short and longer term conservation of evidence of cultural landscape values. The discussion focuses on the differential scope and rate of surface processes in different landscape areas and the former presence of landforms and processes that may not now be well represented. It considers the extent to which the landscapes of the project area are broadly representative of other parts of the region, or contain landscape elements that are relatively rare.

The project area lies at the southern margin of the gently undulating terrain of the central Hunter, and the rugged sandstone plateau to the south. A similar juxtaposition of major topographic units occurs in a zone southeast from Denman to Mulbring, although there are clearly differences in local topographic detail.

Some broad regional landform and process distinctions to be considered include:

- The catchment of the Wollombi Brook is entirely within sandstone terrain and virtually the entire Wollombi depositional sequence in the vicinity of the project area is sand. Depositional units cannot be readily differentiated on the basis of sedimentology (grain size), contrasting with the upper and middle reaches of the Hunter River where the coarse gravel bedload is clearly differentiated from sandy and finer grained overbank deposits. Upstream from the confluence of the Wollombi and Hunter, the Hunter River carries a high volume, diverse lithology, gravel bedload. Further downstream, the gravels are part of a wider bedload grain size range, but continue to be present almost to the tidal limit of the catchment, near Maitland. Although cobble size may be smaller and lithologies perhaps less culturally valuable, a similar distinction between bedload and overbank deposits applies to the tributary catchments to the north of the Hunter River. All these gravel deposits offer high potential for the sourcing of abundant raw materials for the manufacture of flaked and ground stone artefacts. In the Wollombi catchment, these raw materials are available only from outcrop of conglomerate on hillslopes, or similarly, from restricted outcrop of Tertiary silcretes.

- The Hunter River flows within a broad riparian corridor, including high alluvial terrace units of considerable antiquity. A variety of circumstances contribute to the presence of these terraces, including catchment size, climatic change, channel migration and stability patterns. Pleistocene terrace units are also present in most of the subcatchments of the Hunter River (eg Bowmans Creek, Glennies Creek), but the details of their stratigraphy and age relationships are not well established. There is some evidence that remnants of alluvial deposits of late Pleistocene age (ie within the last 100,000 years) are also present within the Wollombi catchment, but the narrow valleys, frequent high level flooding and uniform grain size lessen the potential for the preservation of stratigraphic evidence of past land surfaces and catchment processes in this catchment.

- Although the entire Central Lowlands of the Hunter valley are dominated by texture contrast soils, the susceptibility of these soils to sheet and rill erosion, destructive of occupation evidence such as artefact scatters, varies considerably. As examples, Kovac and Lawrie (1991) report the existing erosion status and hazard for the soil landscape types that are represented in the project area. These examples are intended to illustrate the general pattern and not to imply specific differential conservation at specific locations – this clearly requires detailed local information. The Liddell soil landscape, which is representative of the larger part of the Central Lowlands, is included for comparison.

  - Branxton soil landscape: moderate gully and tunnel erosion, low erosion hazard associated with flooding
  - Lees Pinch soil landscape: moderate sheet and rill erosion, extreme hazard due to slope and rock outcrop
  - Liddell soil landscape: Minor rilling, moderate gullying and severe sheet erosion, low flood hazard
  - Rothbury soil landscape: Moderate sheet and gully erosion, extreme erosion hazard associated with flooding

- Saxonvale soil landscape: minor sheet and rill erosion, minimal hazard
- Wollombi soil Landscape: Moderate bank erosion, extreme erosion hazard associated with flooding.

This small sample from the Hunter catchment shows the variable dominance and severity of erosion types, influencing the risks to conservation of intact cultural heritage evidence in different locations. For instance, artefact scatters close to creek banks are at high risk in the Branxton and Wollombi soil landscapes, whereas in the Rothbury and Lees Pinch soil landscapes, sheet erosion on slopes appears to pose a relatively greater threat to the conservation of archaeological evidence. The general information about the Liddell soil landscape suggests a much greater risk to cultural heritage evidence (both on slopes from sheet erosion and along drainage lines from gullying) than the soil landscapes in the current project area.

The implication of these observations are that the project area includes some soil landscapes that are relatively rare in the Hunter context (eg the Wollombi soil landscape), and which have a relatively rare local suite of landscape associations (sandstone to undulating valley). At a very broad level of analysis, the lowland parts of the project area are less influenced by destructive surface processes than much of the remainder of the Central Lowlands. These factors are important considerations when assessing conservation value.

2.3.2 Cultural Significance of Terrace and Aeolian Deposits in the Hunter

The general information about regional landscape structure indicates that the project area is likely to contain limited late Pleistocene alluvial sequences of the type that are preserved along the Hunter River or in the lower reaches of the Wollombi (eg at Lemington). The tributary catchments within the project area do, however, contain small alluvial deposits that are not related to current catchment hydrology. The following discussion provides a review of the geomorphic literature pertaining to late Pleistocene alluvial and aeolian units in NSW. It leads to some tentative conclusions about the likely age of alluvial units in the subcatchments within the project area, and reinforces differences between the project area and some other (spatially restricted) parts of the Hunter Valley.

The stratigraphy of the Hunter River and catchment terrace deposits has been described from limited areas on several occasions (Fahey 1994, Hughes and Shawcross 2001, Dean-Jones and Mitchell 1993, Umwelt 2003 in prep). An unusual characteristic of the Pleistocene sequences from the Hunter is the association of alluvial terraces along the main valley and in the Wollombi catchment with aeolian units. Aeolian units are rare in other coastal catchments.

Fahey (1994) described a sequence from Warkworth West in which a 3 metre deposit of white free flowing quartz sand overlaid iron stained clayey sand. These materials were superimposed on a gravel deposit several metres thick (note that there are no gravels in the Wollombi near the project area). Fahey interpreted this change in sediment grain size to increasing aridity, with the sand transported out of Wollombi Brook by aeolian processes, subsequent to major fluvial activity. Fahey suggested that over the last 12,000 years, the aeolian sands had been partially reworked by fluvial processes.

Hughes and Shawcross (2001) studied the Cheshunt dune deposit, which is adjacent to the Hunter River, 15 kilometres northwest of the Warkworth site and about 30 kilometres from the current project area. They provide little detail about the spatial relationship of the dune to the river, but note that the aeolian deposit is approximately 3.6 metres thick. It overlies a clay rich alluvial deposit. The upper 600 mm of the deposit had been heavily disturbed by destructive rabbit bioturbation and cultivation. The B horizon of the deposit (clayey sand) has been dated (Optically Stimulated Luminescence) at 83,000 years (at 1.25 metres below the surface) to 88,000 years (at 2.5 metres below the surface).

As Hughes and Shawcross note, this age places deposition of the dune and the underlying alluvial terrace well before human occupation in the Hunter valley. No evidence of occupation can be expected to be sealed under the dune, and any artefacts below the dune surface are assumed to have been relocated by bioturbation. The dune surface would appear to have been stable throughout the period of Aboriginal occupation, and it is therefore possible that the large assemblage of artefacts that are present in the dune may include material of Pleistocene age. This material would not, however, be stratigraphically segregated from later occupation evidence.

In the broader region, the fluvial terrace sequences that are documented from the Nepean, Bellinger, Nambucca (Nanson *et al* 2003 in prep), Namoi (Young 2001) and Gwydir (Pietch in prep) catchments, as well as the Riverine Plain provides evidence of significant changes in fluvial activity, including terrace deposition, over the period from 80,000 to approximately 15,000 years ago. There is evidence for accelerated fluvial activity at around 50,000 years ago in both coastal and inland systems as well as at around 20,000 years ago.

Nanson *et al* (2003, in prep) present a sequence of dates (all obtained by thermoluminescence), from the narrow valleys of the Bellinger and Nambucca catchments. These dates provide context for the alluvial chronology from the Hunter. Nanson *et al* also review the chronology available for the Nepean terraces to the west of Sydney and several other river systems in New South Wales, and dates from these deposits are noted below.

- 78,000 years on a terrace 12 metres above the bed of Worrel Creek (Nambucca catchment).

- The fluvial deposits that have been recorded from the eastern part of the Cranebrook terrace on the Nepean River (Nanson *et al* 2003 in prep), and the Coleambally paleochannels in the Riverine Plan (Page et al 1991, Page and Nanson 1996) have also been dated to around 80,000 years. Nanson et al (in prep.) describe the deposition of the Cranebrook terrace as associated with a high sediment load, braided channel. A similar date is also available from a high terrace on the Snowy River at Orbost (Wray et al 2001).

- 50,900 years, 52,900 years and 54,600 years on 10 metre high terraces in Taylors Arm.

- 53,200 years at Deep Creek. Dates of 36,000, 31,000 and 25,000 have also been obtained from other terrace units at Deep Creek.

- 48,000 years on a 10 metre terrace on the Bellinger River.

- 34,000 years on the Kalang River (Warner 1970, 1972).

- 20,900 years, 19,500 years and 16,200 years on a substantial terrace unit at North Arm (Nambucca).

- 19,500 years on the South Arm (Nambucca).

- 16,600 years and 15,400 years at Taylors Arm.

- 13,400 years and 12,600 years at Worrel Creek.

- Approximately 12,000 years from a terrace in the upper Bellinger.

- Approximately 17,000 years from an 11 metre terrace in the lower Bellinger.

Several dates are available for the most recent floodplain deposits from the Bellinger and Nambucca catchments. These are principally carbon dates and fall within the range 1500 years BP to 2600 years BP. In the Bellinger and Nambucca, these most recent floodplain units have a fine gravel base with "vertically accreting silty overburden" (Nanson et al in prep, 2003). The channels are considered to be laterally stable, confined within the earlier terrace units.

Other evidence for variations in fluvial activity comes from high lake levels. Coventry and Walker (1976) report that the last protracted high stand of Lake George was at 21,000 to 27,000 years ago, and was associated with extensive aeolian movement of fine sands. Smaller aeolian deposits are associated with periodically higher lake levels from 21,000 to 4,000 years ago, within an overall trend of water level recession.

The available chronostratigraphy from various coastal catchments suggests an overall decrease in stream discharge and sediment transport capacity from 80,000 years ago to the present. Within this period, there are several clusters of dates for terrace and floodplain deposits, occurring across multiple catchments. The age correlation, together with the details that are known about deposition processes in the Nepean Valley, implies that the high terrace deposits bordering the Hunter River are likely to be associated with an extended period of high river discharges and stream power, that has not been repeated in the last 80,000 years or so.

All of these dated sequences are from much larger catchment areas than that currently being considered in the present project area and the extent to which the alluvial sequences of the larger catchments are representative of the alluvial record in minor subcatchments is not known.

Hughes and Sullivan (1997) provide some evidence of the processes operating in smaller tributary catchments of the Hunter, and further evidence is provided by Dean-Jones and Mitchell 1993, Mitchell 2002 and Umwelt 2003 (in prep). All the described sequences come from the northern margins of the Central Lowlands.

Hughes and Sullivan (1997) describe a four stage alluvial history at Bettys Creek that culminated in swampy lagoons on the terrace surface, adjacent to incised non-permanent streams. The sequence comprises:

- Deposition of a small late Pleistocene terrace (floodplain) that subsequently underwent deep weathering.

- Bettys Creek meandered across and within this terrace through several cycles of erosion and deposition (channels infilled and eroded), and channel fill deposits are probably of Holocene age.

- Fluvial sediments along the channel margins at Bettys Creek were slowly mantled with colluvial clays from the footslopes. Subsequent to European occupation of the Hunter Valley, both soils on valley side slopes and alluvial valley fills have been destabilised. There is widespread (but not uniform) evidence in the Hunter Valley for the reworking of low angle colluvial deposits (footslopes and alluvial fans) and the deposition of recent sediment over the old chain of ponds valley floor. More recently, these valleys have incised to the base of the alluvial fill.

- The shallow meandering channel was infilled for the last time and abandoned, probably in the last Holocene. This left a swampy lagoon on the terrace surface. This swampy terrain, which is repeated in multiple tributary catchments of the Hunter at the time of European contact, would have provided much more diverse resources for Aboriginal people than many of the preceding alluvial landform assemblages and than the current eroded assemblage.

- Similar fining up sequences of alluvium, with no evidence of buried soil surfaces have been noted at Bowmans Creek and along Swamp Creek

Mitchell (2002, in Umwelt 2003 in prep) concludes that "*the modern pattern of abandoned channels/swampy lagoons is likely to date only to the later Holocene and many abandoned channels are even more recent, dating to the period since European occupation. Only occasionally have any buried soil materials been identified (in tributary catchments) and most of these appear to have been in low wet environments that were probably not attractive as sites for human occupation (although adjacent non alluvial surfaces may have been). Third terraces are certainly the oldest alluvial landscapes in the valleys but no absolute dates have been obtained from them and it is possible that any buried units they may contain could be older than the period of Aboriginal occupation in the Hunter Valley or even in Australia*."

The high terrace deposits along the Hunter River are certainly in this category. The extent of weathering in soils included within many of the terrace sequences (with strong concretionary differentiation) suggests considerable antiquity.

2.3.3 Local Geomorphic Processes at the Footslope and Terrace Interface

Observations from the subcatchments within the project area indicate some features in common with the sequences described from larger catchments and from the subcatchments along the northern margin of the Hunter Valley. The geomorphic and stratigraphic information available for the project area does not include any absolute dates on alluvial deposits. Extrapolation from other areas suggests as a working hypothesis:

- Terrace deposits are late Pleistocene in age (of the order of 16,000 to 20,000 years), but possible much older (based on the extent of soil profile differentiation) occur along some tributary creeks (in the Branxton soil landscape), and together with steeper bedrock slopes, confine more recent alluvial deposits. These terraces include resistant clay stratigraphy and some gravel;

- A chain of ponds valley fill of late Holocene age (of the order of 2,000 years) was widespread in third and fourth order tributary creeks. The margins of this morphological unit have been partially mantled with colluvial units that date to the very late Holocene and recent periods;

- The chain of ponds morphology has been significantly reduced or destroyed by recent incision.

Available qualitative evidence prior to this study includes:

- Heffernan and Klaver (1997) report a possible buried soil surface in the alluvial/colluvial stratigraphy of the northernmost drainage line (Wollombi tributary) in the project area. Subsequent detailed observations made for this project are described in **Section 2.3.4.2**. On the basis of these studies, it appears unlikely that any buried soil surface along this tributary predates recent destabilisation of footslopes and valley fills.

- Navin and Officer (1995) describe two distinct sequences along Loders Creek. These appear to relate to the overlap of alluvial terrace deposits and footslope colluvial deposits, affecting the depth and continuity of the A horizon of soil profiles.

2.3.4 Detailed Analysis of Soil and Stratigraphic Sequences from the Northwest of the Project Area

Previous studies have not provided detail about the landform assemblages and the relationships between different types of surface in the part of the project area that is northwest of Charlton Road. The general discussion presented in **Sections 2.1**, **2.2.1** and **2.3.2** shows that this area has some features that are potentially of considerable cultural heritage value. Representatives of local Aboriginal community groups have shown interest in the resources and values of this area and early in the project it was identified as an area where conservation management could be possible. This section explores the character of this area in some detail, to provide information on which to base an assessment of cultural heritage value and significance.

2.3.4.1 The Wollombi Sand Deposits

Observations in the field, from aerial photographs and nineteenth century parish maps indicate that the channel of Wollombi Brook was within historical times slightly east of its current position. It followed the eastern margin of its valley, along the interface between the bedrock valley slopes and the sandy valley fill (Parish Maps from January 1891 and January 1950 show the Brook in its former position). Since 1950 the channel of Wollombi Brook has moved to the west, shortening and straightening its plan form slightly. It is not currently known how long Wollombi Brook occupied the more easterly channel position. The high eastern bank of Wollombi Brook, immediately outside the project area, is associated with abundant Aboriginal archaeological material (see **Section 3** for previously known sites and **Section 5** for sites located during this assessment).

At least part of the triangular area of sandy alluvium between the current Wollombi channel and the former (historic) channel (shown as 5b on **Figure 2.3**) is probably the remains of the point bar deposit associated with the inside of the former bend in the channel.

The eastern bank of this former channel of Wollombi Brook is an elevated sandy ridge that follows the bedrock interface and almost completely encloses the mouth of the northern tributary drainage line valley.

Prior to circa 1950, the junction between the northern tributary drainage line and the Wollombi channel was at the eastern extremity of the Wollombi alluvial sand deposits (see **Figure 2.3**). The junction between the drainage line and Wollombi Brook is now at the location shown in **Figure 2.3**, the drainage line having incised a channel across the sandy Wollombi alluvium.

The Wollombi sand deposit forms two ridges that cross the mouth of the tributary drainage line valley and are at least 2 to 3 metres higher than the adjoining "terrace" or accreting footslope deposits associated with the drainage line. To the northwest (closer to Wollombi Brook) the sand ridges tend to align parallel to the valley sides and are at a lower elevation (**Figure 2.4** and **Plate 5** in **Appendix B**). The sand and fine sand deposit has a very weakly developed soil profile, with slight organic accumulation observed in the upper 30 cm in an auger hole in the ridge furthest from Wollombi Brook. In this ridge there is also some evidence of slight bleaching at approximately 1 metre depth. In general, the sand has little coherence, unless moderately moist.

The Wollombi sands appear to be recent, and have no occupation evidence. They may overlap older surfaces at the margins but only over small areas.

The sandy Wollombi alluvial deposit is estimated to be some 3 to 4 metres higher in elevation than the main valley floor of the northern tributary drainage line, and some 6 to 7 metres above the current bed of this drainage line.

The bedload and overbank deposits associated with Wollombi Brook contrast very clearly with the sedimentology of alluvial deposits associated with its northern tributary stream in the Branxton soil landscape. The alluvial material that has accumulated along the northern tributary stream appears to be up to 4 metres thick and comprises interbedded thin lenses of gravel (up to 30 cm thick) with sandy clay and fine sandy loam units. Predominantly sandy deposits, such as those along Wollombi Brook, are absent from the tributary alluvium.

The surface of the sandy Wollombi deposits is not stable, being subject to widespread burrowing by rabbits and wombats. During the drought of 2002-2003, ground cover was poor, exposing areas of bare sand. It is possible that during such conditions, there is limited aeolian reworking of the sand surface, but the form of the landscape is primarily alluvial.

2.3.4.2 Tributary Alluvial Stratigraphy

Upstream of the Wollombi sands, the northern drainage line is currently deeply incised, to the floor of the valley fill alluvium. It carries a bedload of fine to medium gravel, mixed with finer material. There is no active overbank deposition, with contemporary flows entirely confined within the pre European channel. In dry conditions, the drainage line ceases to flow and dries up altogether.

The lower slopes along the drainage line show evidence of active sheet erosion, with rilling also active on the lower slopes. It appears that a high proportion of the topsoil on the lower slopes has been reworked in European times. This is demonstrated by shallow and uneven A1 and 2 horizon depths, and by the accretion of a layer of fine sandy alluvium across the surface of the former floodplain level of the valley. This unit mantles the former valley floor and is up to 80 cm thick.

Legend

Underground Mining Area
Contour (5m Interval)
(Unit) 1 – in situ footslope / hillslope profile
(Unit) 2 – terrace / flat
(Unit) 3 – alluvial channel fill
(Unit) 4 – Current channels in tributaries
(Unit) 5 –
a – abandoned floodplain – levee of Wollombi Brook
b – abandoned channel of Wollombi Brook
c – current channel / floodplain of Wollombi Brook
d – low level unconsolidated sand
e – interface with footslope

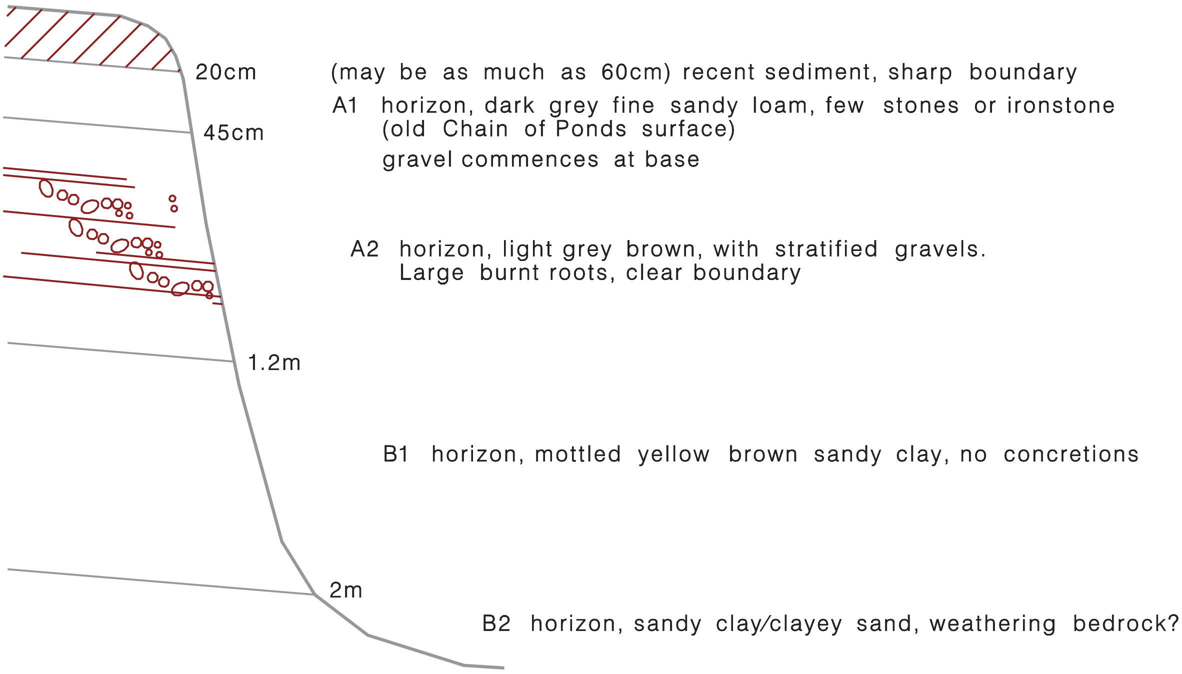
Umwelt (Australia) Pty Limited
Base Source: Hatch Aerial Photograph (2003)

FIGURE 2.3
Geomorphic Units in the Northwest of the Project Area

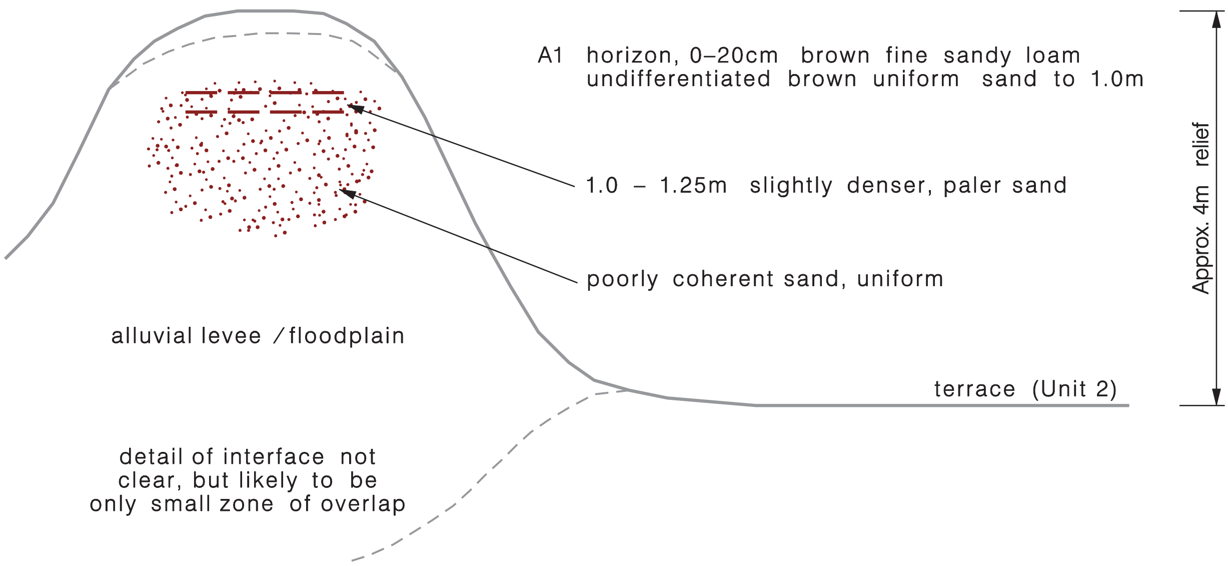
A4 Scale 1:10 000

Ref No.:R03_V1/1468_206.dgn

Unit 3 **Inset valley fill alluvium.**
No artefacts definitely associated with this material



Unit 5 **Wollombi sand unit, no artefacts visible on surface**



Note:
Refer to Figure 2.2 for location of soil units

Umwelt (Australia) Pty Limited

FIGURE 2.4
Typical Unit 3 & 5 Soil Sections
in the Northwest of the Project Area

A4 Not to Scale

Ref No.:R03_V1/1468_205.dgn

The local alluvial terrain in this area also suggests some longer term changes in stream hydrology and alluvial morphology which are relevant to the potential cultural landscape values of the area. This section reviews the field evidence for landscape change in the north western tributary in the project area over the longer term.

Observations were made of exposed soil and stratigraphic sections along the valley of the northern drainage line of Wollombi Brook in the north west of the project area. Four principal profile types were identified. This sequence is very similar to that described by Hughes and Sullivan (1997) at Bettys Creek.

Unit 1: footslope soil profile developed on bedrock;

Unit 2: colluvial bench or terrace deposit – areas of flat, slightly elevated land along the valley floor;

Unit 3: valley fill alluvium with clear evidence of alluvial stratigraphy;

Unit 4: current channels in tributary.

The general distribution of these units is shown in **Figure 2.3** and typical sections are illustrated in **Figure 2.4** and **Figure 2.5**

Units 2 and 3 are frequently mantled by up to 80 cm of recent sediment, which is considered to derive from post European stripping of the A horizon across the landscape, together with incision of drainage lines (see also Whites Creek descriptions in Dean-Jones and Mitchell 1993). In some lower slope locations, Unit 1 was also mantled with this recent sheet wash/overbank alluvial material.

Further detail about units 1, 2 and 3 is provided below.

Unit 1

This unit is exposed in a creek section immediately northwest of Charlton Road and in a section set back from the creek bank (on the lower slope) about half way between Charlton Road and the former Wollombi Brook channel. The profile has the following characteristics:

0-20 cm Recent light brown colluvium, may be slightly bleached at base. Sharp boundary to;

20-40 cm A1 horizon, dark grey fine sandy loam, slightly pedal;

40-70 cm A2 horizon, light grey brown fine sandy loam, with occasional dispersed ironstone gravel. Sharp boundary to;

70-120 cm B1 horizon, mottled sandy clay, yellow brown, scattered ironstone gravel. Clear boundary (see **Figure 2.5** and **Plate 1** in **Appendix B**).

120-140 cm B2 horizon, mottled sandy clay – blocky peds.

140-250 cm Weathering sandstone bedrock.

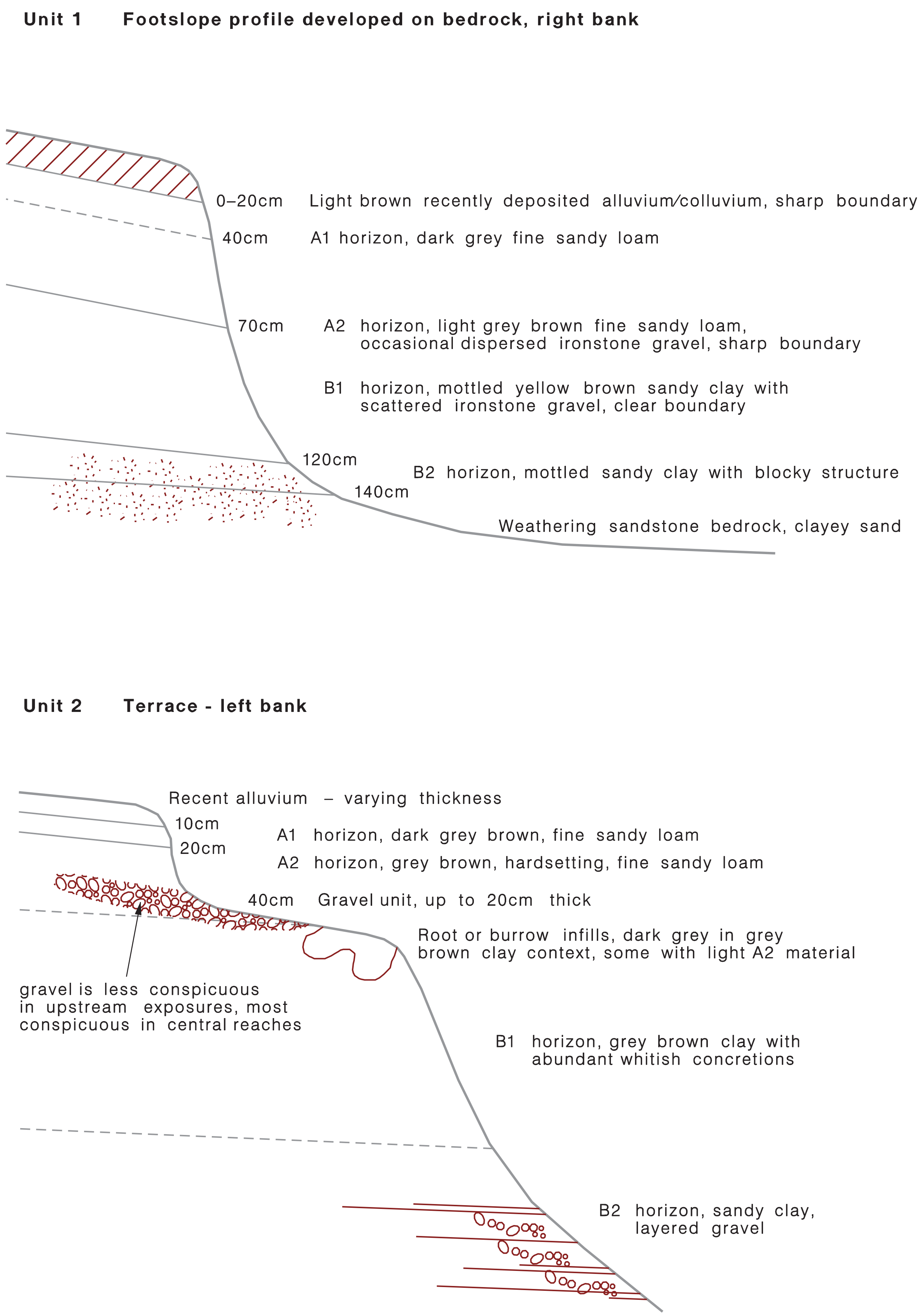
Unit 2

This unit appears to be associated with flats developed in the valley floor, but up to 2-3 metres above the level of the main valley fill alluvial deposit. The geomorphic unit is visible mostly on the left (southwestern) side of the valley, where longer footslopes have developed than on the right hand (northeastern) side. The asymmetry of the valley is presumably associated with geological structure/lithology.

Unit 2 is differentiated from footslope deposits that have developed entirely on bedrock by the presence of white concretions in the lower B horizon. However, the profile (depth approximately 2-3 metres) appears to be deposited over weathering bedrock. The profile is intermittently exposed in the current bank of the creek. Unit 3 is inset into Unit 2 material. In the upstream reaches of the project area, exposures of both Unit 2 and Unit 3 overlie mottled weathered sandy clay, which is interpreted as weathering bedrock (see **Figure 2.5**).

Unit 2, where it is exposed in the current creek bank is overlain/mantled by up to 50 cm of recent alluvium.

The typical characteristics of Unit 2 are as follows:



Note:
Refer to Figure 2.2 for location of soil units

FIGURE 2.5
Typical Unit 1 & 2 Soil Sections in the Northwest of the Project Area

A4 Not to Scale | Ref No.:R03_V1/1468_204.dgn

0-60 cm Recent light brown alluvium, may be slightly bleached at base. Sharp boundary to;

60-70 cm A1 horizon, dark grey fine sandy loam, slightly pedal;

70-100 cm A2 Horizon, light grey brown fine sandy loam, with occasional dispersed ironstone gravel. Large burnt roots are common. Well defined stone line at base. Sharp boundary to;

100-170 cm B1 horizon, mottled sandy clay, yellow brown, with common large whitish concretions, most often from 130 to 170 cm depth. Concretions may be concentrated above hard set gravel unit. Scattered ironstone concretions. Clear boundary. In the lower reaches of the creek, where this concretionary unit is exposed, it may underlie a gravelly unit that forms a distinct break of slope in the section. At a number of locations (see **Figure 2.5**), the impacts of biological processes are clear in the upper B horizon, in the form of infilled root channels/burrows. The root channels may also include abundant charcoal (**Plate 3** in **Appendix B**);

170-220 cm B2 horizon, mottled sandy clay – possible weathering bedrock. May contain gravel, no concretions;

220-250 cm Weathering bedrock – clayey sand.

The large white concretions have previously been observed in alluvial deposits associated with tributaries of the Hunter River (eg see Umwelt in prep, for descriptions of alluvial sequences along Bowmans Creek). The concretions occur in strongly differentiated soil profiles (where soil development overrides alluvial stratigraphy). The concretions are confined to the B horizon of these profiles that are associated with alluvial deposits in elevated terrace positions and are considered to indicate deposits of considerable antiquity. The most likely age is considered to be around 20,000 years.

Unit 3

This unit is interpreted as the main valley fill, predating European occupation of the landscape. It is inset into Unit 2, but does not appear to overlie a full section of Unit 2 at any of the exposed sections along the drainage line (at the level of inspection conducted so far). There is no evidence of buried A1 horizons (other than the widespread mantling of the entire valley floor by recent alluvium) in the sections visible in the creek banks. Both Unit 2 and Unit 3 are underlain by weathering bedrock. Unit 3 does sometimes overlie a portion of the Unit 2 profile (with concretions exposed in the bank section below stratified sand and gravel deposits).

The deposits in Unit 3 represent a series of in-channel deposits (stratified sands and gravels), culminating in fine sand/organic deposits that are either overbank or reflect quiet depositional conditions. The typical section in Unit 3 (**Figure 2.4**, **Plate 4** in **Appendix B**) has the following characteristics:

0-40 cm Recent light brown alluvium, no stones, clear boundary to;

40-50 cm A1 horizon, dark grey brown fine sandy loam, rough peds;

50-80 cm A2 horizon, grey brown, hardsetting fine sandy loam, with abundant ironstone gravel, stone line may be well defined at base;

80-120 cm Light grey brown gravelly stratified sandy loam, multiple thin gravel units. Clear boundary. No concretions;

120-180 cm Clayey sand/sandy clay, weathering bedrock.

The soil stratigraphic units that provide the longest occupation surfaces are the footslopes developed on bedrock (mostly on the northeastern side of the valley) and the old terrace (mostly along the south western side of the valley). Both surfaces are likely to have been available for occupation for tens of thousands of years. In both cases, occupation evidence will be an amalgam of material discarded over this period, and not stratigraphically segregated.

The main valley alluvium is inset into this old terrace surface, and has removed much of it, particularly along the steeper northeastern side of the valley. The penultimate period of deposition of this unit predates European occupation, but the time frame cannot be confirmed from the currently available information. The soil units are well developed with a clear A2 horizon. No evidence was observed anywhere of former A1 or A2 soil units exposed beneath pre-European deposits. Long periods of landscape stability are suggested by the presence of organic material in the upper B horizon of the terrace unit (along root lines and burrows), providing a polygonal pattern of darker soil material at several locations.

2.4 FLORA AND FAUNA

2.4.1 Pre-European and Historic Period Vegetation

In pre-European times the majority of the project area was most likely dominated by open woodlands with a grassy understorey prior to land clearance, cultivation and grazing pressure. The exception is the “Vere” area to the south where, it is suggested, the vegetation would have been forested with a higher species diversity, as it is today.

Mathew (1830 in Brayshaw 1986:26) described the landscape and vegetation around the project area in the early 19th century:

> *Assisted Mr MacLeod in measuring the government reserve of Broke, on the Wollombi – country picturesque, but great part of the land very poor and though flat abounding in Iron Bark – and in some parts with Apple and Gum.*

An examination of the Portion Plans from the late 19th and early 20th centuries indicate that the central part of the project area was covered by ironbark (48 per cent), box (36 per cent), gum (8 per cent), oak (4 per cent), tea tree (2 per cent) and apple (2 per cent) (Dean-Jones & Mitchell 1993:26). The aeolian sand dune on the northwestern boundary of the project area can be distinguished on these plans by the presence of a relatively high number of apple gums (Dean-Jones & Mitchell 1993:26) - these are no longer present.

2.4.2 Remnant Vegetation Communities in the Project Area

Disturbance by agricultural practices and mining activities has resulted in the clearance of the majority of the trees and understorey on the slopes and floodplains. This has resulted in the domination of pastoral grasslands (composed of both native and introduced grass and weed species) interspersed with occasional remnant mature trees along watercourses and occasional patches of woodland dominated by regrowth *Eucalypts*, *Casuarinas* and less commonly *Acacias.* These patches are most common on the steeper slopes. In the “Vere” area the major impact on the steeper slopes has been the past selective logging of Ironbarks. The vegetation communities in this area have greater species diversity and retain an intact understorey. Introduced species appear to have only penetrated onto the cleared lower slopes and along those drainage lines that have been subject to disturbance.

The flora survey undertaken for this project (Umwelt 2003) identified eight vegetation communities in the project area. These have been summarised as follows:

- Mixed Eucalypt Woodland distributed in relatively small pockets throughout the project area dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*) and Grey Box (*Eucalyptus moluccana*). Forest Red Gum (*Eucalyptus tereticornis*), Broad-leaved Ironbark (*Eucalyptus fibrosa*), Spotted Gum (*Corymbia maculata*) and Kurrajong (*Brachychiton populneus* subsp. *populneus*) may also be present.

- Ironbark/Spotted Gum Woodland mainly restricted to the southeastern portion of the project area. The woodland is dominated by Spotted Gum (*Corymbia maculata*), Narrow-leaved Ironbark (*Eucalyptus crebra*) and Broad-leaved Ironbark (*Eucalyptus fibrosa*).

- Grey Box/Grey Gum/Spotted Gum Woodland. A small area in the southeastern portion of the project area is dominated by Grey Box (*Eucalyptus moluccana*), Spotted Gum (*Corymbia maculata*), and Grey Gum (*Eucalyptus punctata*).

- Woodland (Dry Rainforest Elements) located in the southeastern portion of the project area. Dominant species are the Spotted Gum (*Corymbia maculata*) and Rough-Barked Apple (*Angophora floribunda*). Sub-canopy dominated by Kurrajong (*Brachychiton populneus* subsp. *populneus*) and Native Willow (*Acacia salicina*).

- Casuarina Woodland found along creeks and ephemeral drainage lines dominated by Swamp Oak (*Casuarina glauca*) or Bull Oak (*Allocasuarina luehmannii*). A limited number of Rough-barked Apple (*Angophora floribunda*), Forest Red Gum (*Eucalyptus tereticornis*) and Narrow-leaved Ironbark (*Eucalyptus crebra*) are also present in some areas.

- Pastoral Grassland which dominates the project area. Species include Threeawn Speargrass (*Aristida ramosa*), Red Grass (*Bothriochloa macra*), Tall Windmill Grass (*Chloris ventricosa*), Windmill Grass (*Chloris truncata*), Slender Rats Tail Grass (*Sporobolus creber*), Browns Lovegrass (*Eragrostis brownii*) and Purple Lovegrass (*Eragrostis lacunaria*). Introduced species include Plantain (*Plantago lanceolata*), Common Sowthistle (*Sonchus oleraceus*), Rhodes Grass (*Chloris gayana*), Fireweed (*Seneco madagascariensis*), White Clover (*Trifolium repens*), Yellow Burr Daisy (*Calotis lappulacea*) and Bindii (*Soliva sessilis*).

- Aquatic Vegetation was noted in both natural and constructed watercourses. In shallow watercourses species included *Juncus acutus*, Common Rush (*Juncus usitatus*) and Spike Rush (*Eleocharis acuta*). In deeper watercourses Common Reed (*Phragmites australis*) and Cumbungi (*Typha orientalis*) were dominant. Water Ribbons (*Triglochin rheophilum*) and Watermilfoil (*Myriophyllum sp*.) are also sometimes present. Shallow dams are dominated by sedges and rushes such as *Juncus usitatus, Cyperus difformis, C. gracilis* and *Eleocharis acuta*. Deeper dams may have Water Ribbons (*Triglochin rheophilum*), Large-leaved Nardoo (*Marsilea mutica*), Ferny Azolla (*Azolla pinnata*) and Swamp Lily (*Ottelia ovalifolia*).

- Croplands are located in the western portion of the project area within private land. They are generally comprised of vineyards and olive groves.

2.4.3 Aboriginal Economic Plants

Of importance to gaining a greater understanding of the Aboriginal use of an area is the availability of useful plant resources. The recordings were undertaken in October and December 2002. These are generally excellent months for observing plant species especially many of the carbohydrate producing plants like lilies and orchids. Unfortunately the recordings were undertaken during a prolonged drought and the usual spring and summer emergent species were not present. In addition, the degree of land clearance, cultivation and grazing pressure plays a major role in present day species diversity and distribution patterns. Therefore, it was not surprising that the least disturbed section of the project area, the southern section (the "Vere"), contained a far more diverse array of economic plant species and plant species in general. It is recognised that the present economic plant species diversity is depauperate in relation to pre-European times.

Table 2.3 lists the economic plant species identified during the surveys. Full descriptions of the Aboriginal economic plants observed during the archaeological surveys and their locations are provided in **Appendix C** of this report. Further details are provided in the Flora and Fauna Assessment of the project area (Umwelt 2003).

The table identifies the recorded uses of the plants, their topographic location and their location within the project area (ie. northern, northeastern, central or southern section). **Table 2.3** indicates that a total of 23 economic plant species were recorded during the surveys. In terms of their location within the project area, the majority of the (staple) starch producing plants (Bulrush, reeds, rushes, sedges, water ribbons, nardoo) were located in association with drainage lines and dams on drainage lines. Furthermore, they were located on the mid and lower slopes where water may be retained for longer periods of time rather than on the steeper upper slopes. Fruit bearing plants and the majority of the recognised medicinal plants were restricted to the southern section of the project area (the "Vere"). Though species type sometimes differed, fibre and bark producing plants were universal.

Overall the breakdown of economic plant species per section is as follows:

- Northern: 11 economic plant species
- Northeastern: 7 economic plant species
- Central: 10 economic plant species
- Southern: 14 economic plant species.

It should be noted that the areal extent of surveys and the number of watercourses crossed/followed, differed between the areas and that the species diversity would have increased (with the inclusion of aquatic species) dramatically in the southern section if the project area extended to cover the lower reaches of the drainage lines in the area.

In general it can be concluded that the slopes of lower gradient and floodplain areas would have provided the majority of the staple carbohydrates sourced mainly from aquatic vegetation in tributaries and billabongs and from grasses. In normal years it could be expected that additional carbohydrates would have been supplied in spring and summer by orchids and lilies (normally located on the slopes). Fruits and medicines would have been more abundant in the "Vere" area where the stony sandy soils produced from the conglomerate were more suited to their growth.

Table 2.3 - Aboriginal Economic Plants Observed in the Project Area

Common and *Scientific* Name	**Use**	**Reference**	**Topographic Location**	**Section of Project Area**
Blady Grass *Imperata cylindrica*	Leaves used for weaving, basket making	Pers. obs.	On south facing lower slope on tributary bank	Northern
Bracken Fern *Pteridium esculentum*	underground fibrous stem roasted and beaten with a stone to remove starch which can be eaten, new green fronds can be roasted in ashes and eaten, crushed leaves can be used to treat stings of nettle and bull ant	Zola and Gott 1992: 37 Stewart and Percival 1997:44	Lower east facing slopes	Southern (the "Vere")
Bulrush *Typha orientalis*	new shoots can be eaten raw, flowering head can be steamed and eaten when young, rhizomes roasted and pounded or chewed to remove starch, fibre from rhizome used for string	Low 1989: 109; Zola & Gott 1992:8 Stewart and Percival 1997:48	In deeper pools in tributaries and in dams	Northern and Central
Common Reed *Phragmites australis*	roots eaten, sections of reed strung into necklaces, stems used for spear shafts	Zola & Gott 1992: 12, 61	In deeper pools in tributaries and in dams	Northern and Northeastern
Fig *Ficus sp.*	fruit eaten raw, could be dried and later rehydrated	Low 1989: 22	At base of cliffs on western facing slope	Southern (the "Vere")
Five Corners *Styphelia triflora*	Fruit eaten raw, flowers a source of nectar	Low 1989: 43, 176	On eastern and western facing slopes on conglomerate ridge	Southern (the "Vere")
Geebung *Persoonia sp.*	fruit eaten, sore eyes treated by mixing bark scrapings from *Persoonia falcata* with breast milk, bark twine used for fishing lines strengthened by soaking in water to which bark of *Persoonia laurina* added	Zola & Gott 1992: 35 Stewart and Percival 1997:42	On west facing slopes	Southern (the "Vere")
Grey Box *Eucalyptus moluccana*	Bark and underwood used for shields, bowls, shelters	Pers. obs.	slopes	All areas
Headache Vine *Clematis glycinoides*	crushed leaves inhaled for headache	Low 1990: 226	Lower east facing slopes	Southern (the "Vere")
Kangaroo Grass *Themeda sp.*	seeds ground for flour leaves and stem used for fibre, Aboriginal women from the Kimberley visiting MLALC made baskets from this grass May 2001	Greenway 1910:16 Zola & Gott 1992:58 pers. obs. 2001	In all areas except heavily vegetated parts of the Vere and on the central north-south trending ridge	Northern, Northeastern Central, Southern

Table 2.3 - Aboriginal Economic Plants Observed in the Project Area (cont)

Common and *Scientific* Name	**Use**	**Reference**	**Topographic Location**	**Section of Project Area**
Kurrajong *Brachychiton populneus*	Kurrajong has edible seeds. The seeds have irritating hairs that must be removed by roasting. The underbark was used for manufacture of string (used for making strong nets, hair bands and fishing lines), the roots of young saplings are edible and the roots of older trees are a good source of water when cut.	Zola & Gott 1992: 36 Stewart and Percival 1997:14	On slopes	Northeastern and Southern (the "Vere")
Mat Rush *Lomandra sp.*	long pliable leaves used for weaving baskets, leaf bases and flowers edible	Low 1989: 131, 174; Zola & Gott 1992:59 Stewart and Percival 1997:35	Lower west facing slope	Central
Mistletoe *Amyema sp.*	berries eaten, skin and seeds discarded	Low 1989:14; Zola & Gott 1992:54	On *Eucalypts, Casuarinas and Acacias*	All areas
Native Cherry *Exocarpus cupressiformis*	enlarged succulent stalklet (pedicel) eaten, wood used for producing walking sticks*	Low 1989: 46 Stewart and Percival 1997:11 *Victor Perry UHWC pers. comm. 2001	On western slopes that had not been cleared	Southern (the "Vere")
Large-leaved Nardoo *Marsiliea mutica*	Leaves can be eaten fresh, sporocarps can be eaten fresh, dry sporocarps can be collected and ground for flour	Stewart and Percival 1997:38	In shallow dam	Central
Rats Tail Grass *Sporobulus creber*	stems used for weaving, Aboriginal women from the Kimberley visiting MLALC made baskets from this grass May 2001	Cribb and Cribb 1986 pers. obs. 2001	In all grasslands	All areas
Rushes *Juncus sp.*	under ground stem, corm or tuber can be eaten in some species, leaves used for weaving	Low 1989:105; Zola & Gott 1992:60	In shallow areas in tributaries	Northern, northeastern, central
Sedge *Cyperus sp.*	Sedges have strong fibres that can be used for weaving, some sedges produce a meagre supply of starch in corms	Low 1989:109; Zola & Gott 1992:60	In shallow areas in tributaries	Northern
Sour Bush *Choretrum sp.*	Berries eaten	Robinson 1994	On slopes on eastern and western side of conglomerate ridge	Southern (the "Vere")
Spike Rush *Eleocharis acuta*	Onion shaped tubers of some species of *Eleocharis* can be eaten raw when young, and roasted and eaten when older.	Stewart and Percival 1997:21		Northern and central

Table 2.3 - Aboriginal Economic Plants Observed in the Project Area (cont)

Common and *Scientific* Name	**Use**	**Reference**	**Topographic Location**	**Section of Project Area**
Tea Tree *Melaleuca sp.*	some species of tea tree were used by Aboriginal people for medicinal purposes. Leaves could be crushed and inhaled for coughs and colds, leaves could be soaked to make an infusion. Sores and burns were washed with the leaf infusion. The bark was used for bedding and for bandages	Low 1990: 95	On slopes	Central and Southern (the "Vere")
Water Ribbon *Triglochin procera*	bullet-shaped tubers roasted and eaten	Zola & Gott 1992: 12	In dams	Northern and central
Wonga Vine *Pandorea pandorana*	canes used for spear shafts	Cunningham et al 1992:602	Western facing slopes	Southern (the "Vere")

In terms of site distribution this would seem to indicate that whole family camp sites would preferably be located in areas of lower gradient on the slopes and floodplains where the women could gather the staple carbohydrate needs for their families. Trips up onto the steeper slopes of the Vere may have been for special purpose and related to the gathering of fruits and medicines and the hunting of the local fauna (see **Section 2.6**). Sites in this area should be small and representative of single episode occupation (not family camp sites). Differences should be exhibited in the types of artefacts discarded in the sites and the number of artefacts discarded in the sites. In the camp sites stone implements used for the preparation of plant foods should be present along with a wide variety of other implement types and knapping debris derived from people carrying out processing, maintenance and production activities. In the steeper country of the "Vere" artefact numbers should be low and related to lost artefacts and single knapping events.

Due to the degree of land clearance it is unlikely that scarred or carved trees could remain in the northern, northeastern or central sections of the project area. It is possible that these site types may exist in the uncleared section of the "Vere", however, the thickness of the vegetation reduces the probability that they will be observed.

2.4.4 Animal Resources

Faunal records compiled from current surveys undertaken for this EIS (Umwelt 2003) and previous flora and fauna surveys (ERM Mitchell McCotter 1999, ERM 2000, Umwelt 2001 and HLA-Envirosciences 2002) provide details of known and expected species within the project area. For a composite list of these species refer to Appendix 2 of Umwelt (2003). This section of this report will discuss only the distribution and occurrence of species thought to have been important resources for Aboriginal people hunting and gathering in the area.

Due to the impact of European land-use practices mammal numbers and diversity are extremely low within the project area. A decrease in the original number of mammals was noted as early as 1831 by Breton (1833:93 in Brayshaw 1986:19):

> *went out after kangaroos, and to my surprise saw only sixteen, at a place where formerly a hundred might have been seen together; but within the last two or three years they have almost disappeared.*

Since that time the introduction of farm dams and a decrease in hunting has seen a substantial increase in the number of Eastern Grey Kangaroos (*Macropus giganteus*) to a point where it is possible they outnumber their pre-European population. Eastern Greys dominate the ground dwelling fauna to be observed across the project area. Another relatively common mammal species that would have been of economic importance to Aboriginal hunter-gatherers for which evidence was observed throughout the project area was the Common Brushtail Possum (*Trichosurus vulpecula*). Less common than the Eastern Grey but still to be found across the project area is the Red-necked Wallaby (*Macropus rufogriseus*). Within the intact woodland of the "Vere" the Common Wallaroo (*Macropus robustus*), Swamp Wallaby (*Wallabia bicolor*) and Common Wombat (*Vombatus ursinus*) are still to be found.

Ninety-nine bird species have been recorded in the project area, of these the Galah (*Eolophus roseicapillus*), Eastern Rosella (*Platycerus adscitus eximius*), Crested Pigeon (*Ocyphaps lophotes*), Grey Teal (*Anas gracilis*), Pacific Black Duck (*Anas superciliosa*), Australian Wood Duck (*Chenonetta jubata*), Black Swan (*Cygnus atratus*), Little Pied Cormorant (*Phalacrocorax melanoleucos*) and Dusky Moorhen (*Gallinula tenebrosa*) were probably food resources for Aboriginal hunter-gatherers. The eggs of these and other species would also have provided a good source of protein.

Fourteen reptile species have been recorded in the project area, of these the Eastern Snake-necked Turtle (*Chelodina longicollis*), Eastern Water Dragon (*Physignathus lesueurii*), Lace Monitor (*Varanus varius*) and Red-bellied Black Snake (*Pseudechis porphryiacus*). Of these only the Lace Monitor will be found at a distance from water.

The species discussed above cannot be seen to be representative of the fauna available for Aboriginal exploitation in pre-European times. Rather, they provide a general indication that the area would have provided a range of mammals, birds and reptiles known to have been hunted by Aboriginal people. The distribution of the fauna suggests that species suitable for hunting were most common in and around watercourses, however, the largest prey species (and thus the greatest suppliers of protein) kangaroo, wallaroo, wallaby and wombat could be hunted away from the watercourses.

In relation to implications for site location/site type it can be suggested that the permanent to semi-permanent watercourses would have provided a focus for hunting and camping due to their faunal resources. Whilst hunting was also likely away from the watercourses sites in these areas are more likely to represent kill sites and perhaps butchery sites (early stage of butchery) and not camp sites. The artefactual evidence in this case would be similar to that for floral resources with evidence of processing, maintenance and production activities. Away from the watercourses artefact numbers should be low and related to lost artefacts, butchery events and single knapping events.

2.5 PAST AND PRESENT LAND USE

The Hunter Valley was opened for rural settlement by Governor Macquarie in 1819. He thought it 'judicious to establish settlers on the plains along the River Hunter where they would have the combined advantages of a fertile soil of comparatively easy cultivation, and the benefit of water conveyance for their produce to Newcastle and thence by sea to the principal mart of Sydney' (Campbell 1926:74). European settlement began in the 1820s and was focused on the rich floodplain areas.

Karskens (1984:17) records that the Great North Road that extended from Sydney through Broke and Warkworth was surveyed and constructed by convicts over the period 1825-1836.

European settlement and farming practices led to extensive clearing in the Hunter Valley, including the project area. Cultivation was undertaken on floodplain areas and areas of low gradient, and steeper areas were subject to extensive clearing followed by intensive grazing by sheep and cattle. The rapid clearance and intensive grazing by hard hoofed animals led to severe erosion of the soil A horizon on slopes and crests; the deposition of colluvium from the slopes onto the footslopes and margin of the floodplains; and the entrenchment of most streams and ephemeral tributaries.

Other disturbance related to grazing, viticulture and olive production, includes the construction of dams, fencing, the construction of houses and sheds, the grading of firebreaks, cultivation of land and the development of formed and unformed internal roads.

Apart from agricultural activities, the project area has also been disturbed more recently and at specific locations by the construction and sealing of the Broke, Charlton, Fordwich and Cobcroft Roads and the installation of both major and minor powerlines and underground phone cables and other subsurface infrastructure.

Contemporary mining operations are located in the centre, southeast and northeast of the project area and are related to the Bulga Open Cut Mine and the Beltana and South Bulga underground mines and their associated surface infrastructure. Areas of disturbance include pits, visual bunds, dump sites, roads, dams and drainage works and revegetation areas. The area proposed for the construction of the majority of the surface infrastructure associated with this project (**Figure 1.3**) has been subject to varying degrees of disturbance from the construction of the current haul road, minor roads, dams, water diversion channels, an explosives magazine dump etc (refer to **Appendix C** for details of prior disturbance recorded during the surveys).

A large area of the local topography within the north and northeast of the project area has been completely destroyed by open cut mining or has been damaged and/or modified by related infrastructure.

Some of the areas to be impacted by subsidence if the currently proposed project proceeds, have already been subject to subsidence from earlier mining activity related to the SBC. This subsidence resulted in ponding in the lower reaches of some drainage lines, which has been repaired. Works have also been undertaken along some drainage lines to remediate erosion (refer to **Appendix C** for details of prior disturbance recorded during the surveys). Additional works have also been undertaken along Charlton Road to repair the effects of subsidence.

Within the Commonwealth owned land to the south (the Vere), areas of gentle gradient (lower slope, footslope and valley floors between the ridges and between the spurs that run from the ridges) are heavily cleared. Various areas around the base of the slopes on the western arm (on its eastern side) of the Vere have also been subject to uses such as an asbestos dump (now rehabilitated) and rubbish dump. The steeper slopes of the ridges and spurs are still relatively heavily timbered and though intersected by several graded roads, represent an area far less disturbed by European land-use practices. The "Vere" area is currently used by the Army for light military training.

There are 20 properties within the area proposed for underground mining that are not owned by BJV. These are to the west, southwest, south and east of the existing open cut operations (refer to **Figure 1.4**). The majority of these properties are utilised for cattle grazing, with vineyards and an olive grove located in the western portion of the project area.

The pattern of land use and groundsurface disturbance across the project area is shown in **Figures 1.2** and **2.6**. The available evidence indicates the following impacts of land use on the potential for Aboriginal cultural heritage values to be retained in the project area:

- the removal of the majority of old growth trees making it unlikely that scarred and/or carved trees would still be located in any area, except on the "Vere";
- the removal of plant species that were valued resources for Aboriginal hunter-gatherers;
- the introduction of alien flora and fauna that out-competed native flora and fauna making it difficult to reconstruct the pre-European resource base;

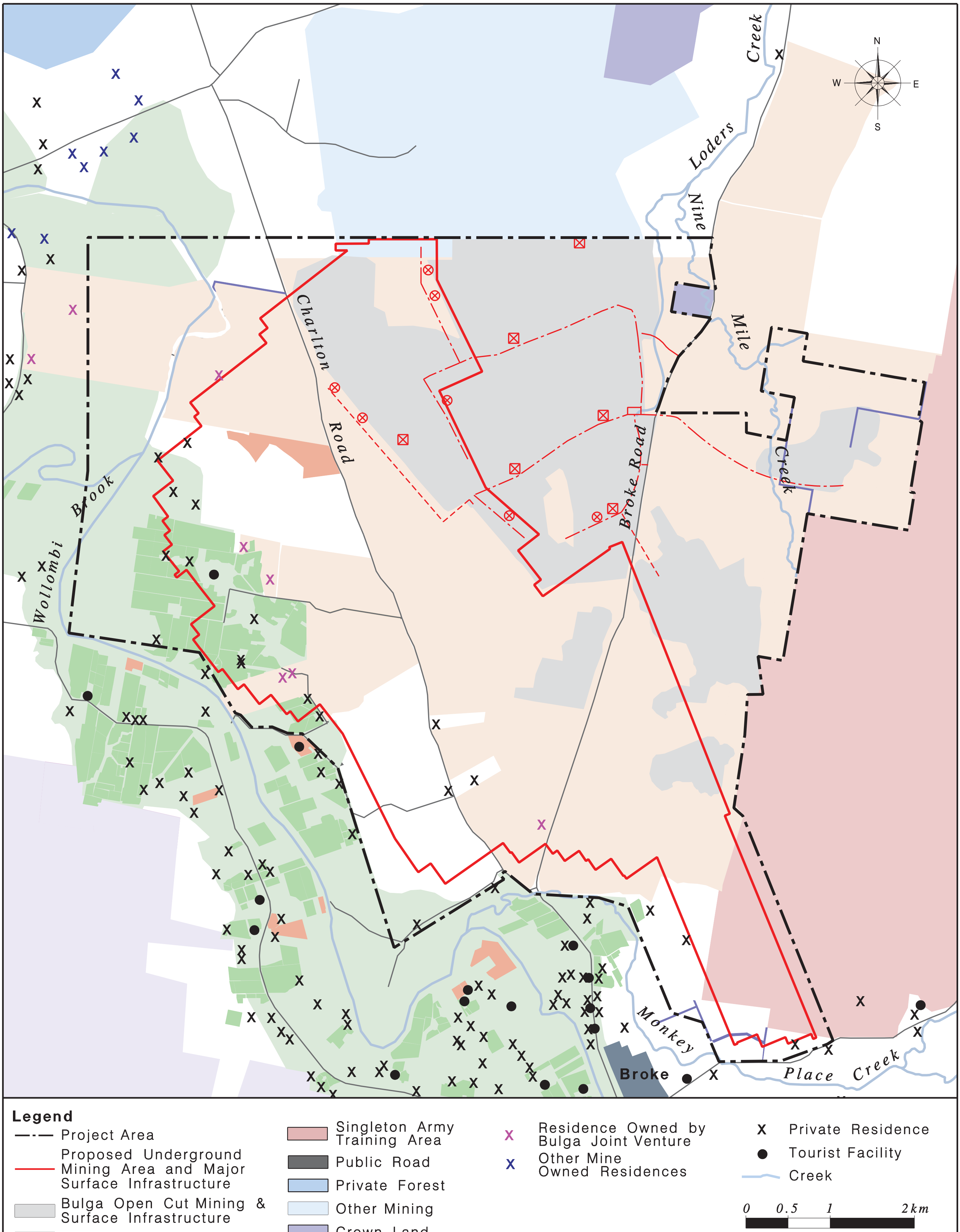


FIGURE 2.6
Land Use

Umwelt (Australia) Pty Limited
Base Source: Bulga Coal Management

A4 Scale 1:60 000

Ref No.:R03_V2/1468_268.dgn

- a change in the hydrology of the creeks and thus in their morphology and endemic flora and fauna;
- an increase in the downslope movement of soil (by sheet erosion) and any artefacts contained within that profile;
- the mixing and reburial of artefacts from different sites and of different ages in areas where colluvium has aggraded;
- in areas of cultivation both vertical and horizontal movement and mixing of artefacts of different ages within the soil profile; and
- destruction by cultivation and stock trampling of sites such as bora rings, stone arrangements and stone cairns, if present (see **Section 3.1** for definitions of site types).

2.5.1 Key Aboriginal Cultural Heritage Values and Constraints Associated with Landscape Attributes

Section 2 has explored the aspects of the project area environmental context that are recognised as having an influence on the patterns of past Aboriginal land use, the evidence that would have been discarded and the potential for that evidence to be retained and observed. General conclusions and hypotheses that can be drawn from the collated evidence are noted below. These conclusions, together with the archaeological information presented in **Section 3** have been used in **Section 4** to develop existing interpretative cultural heritage models for the project area in its regional context. The field work and analysis that has been conducted for this project is directed at further testing and refining these models of Aboriginal occupation and cultural heritage distribution, providing a clear basis for assessment of values, significance and appropriate management options.

General Conclusions

- That the areas of lower gradient (mid and lower slopes and floodplains) would have been suitable for Aboriginal occupation. In the early and mid Holocene, it is possible that some floodplains along tributary streams of the main drainage network would have been too swampy for persistent occupation. They would, however, have provided resources to attract occupation activity on adjacent footslope units.
- Only small areas of former floodplain surface – terraces dating to the late Pleistocene, appear to be retained in the project area, and the modern drainage lines are confined by a mixture of terrace remnant and low angle footslope (bedrock). There is limited opportunity for former surface to have been buried by subsequent deposits of any antiquity (ie if this overlay of units did occur, the evidence has been eroded).
- The steep slopes of the “Vere” would have made camping difficult for all but very small numbers of people that may have found shelter in the overhangs of conglomerate boulders or in rockshelters on the steep slopes.
- Fruits and medicines would have been more abundant in the “Vere” area where the stony sandy soils produced from the conglomerate were more suited to their growth. In terms of site distribution this would seem to indicate trips up onto the steeper slopes of the Vere may have been special purpose and related to the gathering of fruits and medicines and the hunting of the local fauna. Sites in these steeper areas should be small and representative of single episode occupation (not family camp sites). In the steeper country of the “Vere” artefact numbers should be low and related to lost artefacts and single knapping events.
- Loders Creek, Nine Mile Creek and the larger unnamed tributaries of Wollombi Brook would have supplied a semi-permanent supply of water (of variable quality) in their lower reaches, supporting camp sites for small groups of Aboriginal people for short stays.
- The slopes of lower gradient and floodplain areas would have provided the majority of the staple carbohydrates sourced mainly from aquatic vegetation in tributaries and billabongs and from grasses. In non-drought years it could be expected that additional carbohydrates would be supplied in spring and summer by orchids and lilies located on the slopes. In terms of site distribution this would seem to indicate that whole family camp sites would preferably be located in these areas of lower gradient on the slopes and floodplains where the women could gather the staple carbohydrate needs for their families. Sites in these areas should contain stone implements used for the preparation of plants foods along with a wide variety of other implement types and knapping debris derived from people carrying out processing, maintenance and production activities.
- Longer-term occupation was more likely to be focused on Wollombi Brook on the western boundary and just outside the project area, especially during extended dry periods and/or when larger groups of people gathered. However,

the Wollombi Brook also has highly variable flow and is subject to regular flooding that affects all of its banks, so evidence of past occupation on the floodplain is likely to be very poorly preserved.

- Within the project area, stone suitable for knapping is only provided by pebbles sourced from the conglomerates (quartz and quartzite). These pebbles are also of a size and shape useful as a hammerstone or muller. These pebbles can commonly be located on the ground surface across the entire project area. The size of the pebbles is much smaller than cobbles that are available as artefact raw material from the Hunter River and from most of the northern tributaries of the Hunter River. This suggests a significant local level constraint to artefact type and size, with considerably more effort required to obtain large raw material units than elsewhere in the region.

- Creek lines with sandstone outcrops exposed in pre-European times would have provided surfaces suitable for the grinding of stone implements such as axes and chisels and the sharpening of fire hardened spear points. Sandstone may also have been sourced from these areas for use as grindstones and anvils for the preparation of plant foods. This sandstone outcrop is possible in all creeks in the Branxton soil landscape, the Rothbury soil landscape and the Lees Pinch soil landscape. The geomorphic history, however, suggests that many of the tributary creeks across all soil landscapes would have been infilled by valley alluvium for long periods, restricting access to outcrop. There is some evidence to suggest that creek bed outcrop in the higher order tributaries would not have been accessible through the late Holocene. Thus, for instance, sandstone outcrop that has grinding grooves within it, east of Charlton road (eg at BMU1) and in the upper catchment of Loders Creek, occurs in areas where the channel is confined by bedrock footslopes. There is less potential for (and no evidence of) grinding grooves in sandstone that is currently exposed in the bed of the northern tributary drainage line west of Charlton Road.

- The relationship of factors influencing high value for Aboriginal occupation and those that affect potential for surface processes to protect or destroy occupation evidence varies considerably across the project area. For instance, the Vere had and retains diverse plant resources, stone resources and potential rock/boulder shelters. It also has steep and highly erodible slopes and a potential for flooding to destroy occupation evidence along drainage lines. The Branxton soil landscape, in which the tributaries through the centre of the project area are located, had a range of resources that might have attracted Aboriginal activities close to drainage lines. The lower slopes and creek banks are also susceptible to sheet and gully erosion, threatening the preservation of (but exposing for observation) occupation evidence. However, in some higher order tributaries, colluvial accretion on the lower footslope may have preserved occupation evidence until post European destablisation of the landscape.

- The assemblage of landscape and resources represented in the project area is different to other parts of the Central Lowlands of the Hunter valley but is broadly replicated in a corridor extending from Denman to Cessnock. Some elements of the landscape association are relatively rare (eg the juxtaposition of sand bed creeks such as the Wollombi with the Branxton soil landscape).

- The footslopes developed on bedrock and old creek terraces have the potential to provide evidence related to the longest Aboriginal occupation within the project area. Both surfaces are likely to have been available for occupation for tens of thousands of years, however, in both cases, occupation evidence will be an amalgam of material discarded over this period, and will not be stratigraphically segregated.

- No absolute dates are available for the known occupation evidence or landscape features of the project area. The only means of dating open sites would be to employ relative dating using artefact cultural sequences developed from stratified sites; or by the absolute dating of intact features such as hearths and/or heat treatment pits, assuming that sound criteria for the recognition of these features has been established (including a means of assessing post establishment disturbance).

- Due to the degree of land clearance it is unlikely that scarred or carved trees will be located in the northern, northeastern or central sections of the project area. It is possible that these site types may exist in the uncleared section of the “Vere”, however, due to the thickness of the vegetation it is unlikely that they will be observed. The extent of land surface disturbance also suggests that any form of stone arrangement would have been severely impacted.

3.0 ABORIGINAL ARCHAEOLOGICAL CONTEXT

This section of the report presents the known Aboriginal archaeological context of the project area based on a review of previous archaeological investigations. As requested in the NPWS Guidelines (1997) it begins with site definitions and then provides information in relation to the archaeology of the Central Lowlands region in general. This includes the antiquity of Aboriginal occupation of the area and the various models for Aboriginal occupation formulated by researchers to date. Information related to sites located within 5,000 metres of the project area is then presented before focusing on the previous archaeological research undertaken within the project area. This information will be used to formulate a predictive model for site location within the project area. Given the low level of detail and reliability of other types of information on cultural values, site information and interpretation strongly underpins the formulation of a predictive model for Aboriginal resource use, site location, site type and site contents for the project area.

3.1 DEFINITIONS OF SITE TYPES

The most common site types located by archaeologists during survey in the Hunter, are sites that contain scatters of stone artefacts. Stone artefacts are pieces of stone modified for, or by, human use. Stone artefacts are robust and preserve well in the archaeological record when other forms of evidence of Aboriginal exploitation are lost due to preservation biases (wooden implements, food remains), however their associations are rapidly modified. Aboriginal archaeological sites can be divided roughly into secular (concerned with worldly things) and non-secular (concerned with secret, sacred, ceremonial and ritual things) site types. This division is not made by archaeologists, it is strictly drawn from Aboriginal ideologies (manners of thinking, systems of belief). The division is not always clear cut as some site types may be secular in some circumstances and non-secular in others. The secular or non-secular nature of each of the site types is indicated below. Sites that are non-secular in nature generally have much higher Aboriginal cultural heritage significance than sites of a secular nature.

In accordance with the NPWS Guidelines for archaeological report writing (1997), this section provides definitions of the various types of Aboriginal sites known from the archaeological record of the broader Hunter region. It should be noted that many of these site types are not relevant to this project.

Isolated Find/Artefact

The site type described as an “isolated find” or “isolated artefact” consists of a single stone artefact. The vast majority of stone artefacts were tools used in day to day activities and therefore, were secular in nature. There are some stone artefacts, however, that were used in special rituals/ceremonies that were non-secular in nature (i.e. ceremonial axes, tjuringa [engraved or decorated stones], stones knives used in cicatrisation). Isolated finds may represent lost or discarded artefacts, but may also be the surface expression of a larger scatter of artefacts in a subsurface context.

Artefact Scatter or Open Campsite

An artefact scatter or open campsite refers to areas (in the open landscape, not in a rockshelter or cave), that contain two or more stone artefacts, generally located within 100 metres of each other. In general, artefact scatters are secular in nature. Artefact scatters may result from the activities of a single person or a group of people. They may reflect a single occupation episode, or multiple episodes of occupation of a single place.

Rock Art Site

The term rock art site generally refers to Aboriginal ochre paintings or ochre or charcoal drawings located on a rock slab (generally in a sheltered place like the floor of a cave or rockshelter), boulder, cliff-face, cave or rockshelter wall or roof, or wall of a rock overhang. The majority of rock art sites are found in positions that are sheltered from the elements. This observation, however, is probably biased to some extent, as rock art would not preserve well in open positions. Rock art sites are generally believed to be non-secular in nature.

Engraving Site

The term engraving site refers to places where Aboriginal people have incised (using techniques such as pecking or abrasion) some form of motif into rock. The engravings may be on a rock outcrop, rock slab, boulder, cliff-face, rock overhang, or in a cave or rockshelter. Engraving sites are not necessarily located in sheltered positions, but are most often located on softer rock types (like sandstone). Engraving sites are generally believed to be non-secular in nature.

Rockshelter Sites

The term rockshelter site refers to rockshelters/rock overhangs that contain evidence such as stone artefacts and/or bones and/or plant remains (from meals eaten at the site) and/or hearths (fireplaces). Most rockshelter sites are secular in nature, however, those that also contain rock art or engravings are often believed to be non-secular in nature.

Precontact Burial Sites

The term precontact burial site refers to Aboriginal skeletal material dating to a time before white settlement. The skeletal material may be buried, interred in a cave/rockshelter/under a ledge, in a tree hollow etc. or exposed on a platform in a tree. Burial sites are generally believed to be non-secular in nature by contemporary Aboriginal people.

Stone Arrangements

Stone arrangements may take the form of single or multiple cairns, upright standing stones, lines or rings of stones or even stones arranged into figurative designs such as snakes or turtles. The location of many of the recorded stone arrangements suggests that they were related to ceremonial grounds and in particular initiation grounds (McBryde 1974:31-42), while others appear to mark tribal boundaries (Leney 1907:72-77). Stone arrangements it would appear can be either secular or non-secular depending on their purpose.

Shell Middens

Middens are accumulations of shells that have been discarded after human (Aboriginal) meals. Midden sites are commonly located along the coast and estuaries and less often located in inland areas in association with waterways and lakes. Middens sometimes contain burials, but are most often simply domestic waste and as such are generally secular in nature.

Grinding Grooves

Grinding grooves are grooves on rock surfaces that have been manufactured by the sharpening of stone axe heads, stone chisels or fire hardened wooden spear points. Grinding grooves are commonly located on sandstone ledges that outcrop in creek and river beds, as the availability of water enhances the speed with which grinding proceeds. Less commonly, grinding grooves are located on rock surfaces away from water and on stone types other than sandstone. Grinding grooves appear to be secular in nature.

Stone Quarries

Stone quarries are places where Aboriginal people have sourced raw material for the manufacture of tools. Quarries may be cobble beds in rivers or on beaches, or they may be rock outcrops. When outcrops are exploited the quarrying activity may take the form of the flaking of rock from the outcrop itself, or scree from below the outcrop may be used instead. In some areas the stone may be dug from beneath the earth as Aboriginal stone knappers often preferred rock which had not been dried out by exposure to the elements (Tindale 1965: 140; Jones and White 1988:61-62). Stone quarries can be either secular or non-secular in nature depending on the Dreaming with which they are associated (Jones and White 1988).

Ochre Quarries

Ochre quarries are places where Aboriginal people sourced ochre (hydrated iron oxides and iron hydroxides - Whitten and Brooks 1972:269) which they used for body decoration, implement decoration and rock art. Ochre quarries can be either secular or non-secular in nature depending on local belief systems.

Ceremonial Grounds

In the Hunter region the main type of ceremonial ground recorded was the Bora. Bora grounds generally consisted of two earthen rings or two rings outlined with stones. The Bora ground was used during male initiation ceremonies (Fife 1995). Bora grounds are believed by many contemporary Aboriginal people to be non-secular in nature, however, the literature suggests that generally only the viewing of the smaller of the two rings was restricted to initiated males (for a summary of the data recorded about Bora grounds see Fife 1995).

Scarred and Carved Trees

Aboriginal people often removed the bark from the trunks of trees to make toe holds (to aid in climbing to extract honey or possums from tree hollows), bowls, shields, spearthrowers, coolamons, canoes and/or for roofing material for shelters. The bark removal leaves scars on the tree trunk which indicate the Aboriginal use of an area. Other trees were carved with designs. These carved trees were used to mark ceremonial grounds and burials (Etheridge 1918:84; McBryde 1974:126). Scarred trees are generally secular in nature while carved trees are always non-secular.

Post-contact Burial Sites

This term refers to burials/interments that have taken place since European settlement and that are not located in a recognised cemetery and are not documented. If they are documented then they are considered Aboriginal historic sites and not Aboriginal archaeological sites. May be secular or non-secular depending on the status/position of the deceased.

Aboriginal Fringe Camps/Missions/Reserves

These terms refer to those places where Aboriginal people lived in post-contact times. To be archaeological sites they will not be documented in the historic literature, if they are, then they will be called Aboriginal historic sites. These site types are generally secular in nature.

Waterholes/Wells

These are generally natural rock waterholes that contain water used for drinking or for special ritual purposes. Sometimes these holes are made larger by grinding out the sides and base and sometimes they are protected by placing large stones over the hole to keep out animals and to prevent the water from evaporating. These may be either secular or non-secular in nature.

3.2 ABORIGINAL HERITAGE STUDIES IN THE HUNTER

For the last 20 years, archaeological research into Aboriginal sites in the Hunter Valley has been driven by the impact assessment of mining, industrial and residential development proposals. More than 2,200 Aboriginal sites have been recorded, almost all of these have been scatters of stone artefacts. This degree of investigation provides a good basis for developing predictions of regional site distribution in the Central Lowlands.

Two regional overviews, by Hughes (1984) and Koettig (1990), have been produced to integrate the results of the many cultural heritage management reports from the Hunter, to guide the ongoing, development related archaeological work in the area. The Central Lowlands has attracted the greatest intensity of archaeological investigation because of the focus on mining development in that landscape. These studies have demonstrated that the Hunter Valley is a rich source of cultural heritage evidence. Koettig (1990) confirmed Hughes' (1984) predictive statements that large open sites are likely to be located along all large creeks. Smaller open sites are likely to be located along both small and large creek lines and on slopes and crests away from creek lines. Although a large body of physical evidence of open campsites is now available, progress in developing detailed interpretative models that draw together different types of occupation evidence has been relatively limited.

Few studies have been able to contribute detail on the chronological sequence of Aboriginal occupation. The predominance of open artefact scatters identified in the Central Lowlands, in eroding soils, severely limits the potential for dating sites. Open sites were generally created from repeated visits, possibly over thousands of years. Natural processes such as bioturbation, and more recently soil erosion, tend to result in the loss of any stratigraphic distinction between visits and also result in differential exposure of evidence in particular landscape contexts (eg. those with high erodibility).

Pleistocene occupation evidence has been reported at only three locations in the Central Lowlands (see **Section 3.3**), other Carbon 14 dates from the Hunter do not exceed 5,000 years and open sites generally are dominated by artefactual material associated with the backed blade technology that is believed to have developed after 7,000 years BP (McCarthy 1976).

Dean-Jones and Mitchell (1993) have shown that there have been extensive changes to the landscape since European occupation of the Hunter Valley. The extent of soil erosion associated with landscape changes is partly responsible for the visibility of open sites in the Central Lowlands and has influenced the prediction of open site location that heavily emphasises creek lines and lower footslopes where sheet erosion strips the topsoil to expose artefacts (see also Koettig 1991:19). However, they note "there are two environments in the Central Lowlands where open Aboriginal sites are more common than elsewhere. These are as a linear distribution of multiple sites along most tributary streams and along the high terrace above the Hunter River" (1993: 67).

3.2.1 Antiquity of Aboriginal Occupation

Few studies in the Hunter region have been able to contribute detail on the chronological sequence of Aboriginal occupation. The predominant site type recorded is the open artefact scatter. These sites are visible on the surface due to the exposure of the artefacts by erosion processes. These sites may have originally been created by discarded implements from a single visit or from discard events from repeated visits, which could span time periods of 10s, 100s or even 1000s of years. Even when assemblages are located in a subsurface context disturbance to the soil profile (through both human agency and bioturbation) means these assemblages lack any stratigraphic integrity. These problems have led researchers to endeavour to use various artefact types, such as backed blades, Bondi points and eloueras as temporal markers to date elements of surface scatters, or in the case of subsurface assemblages to use the geomorphic history of the soil profile to provide a maximum date for the artefacts it contains.

For example the presence of backed artefacts in a site may be used as a temporal marker, given that these artefacts are often considered to date to the last 4,000 years (Kuskie and Kamminga, 2000: 526). This approach is problematic for two reasons. The first is that the appearance of this technology is likely to be older than the commonly used date (see Hiscock and Attenbrow 1998) and the second is that in the context of a conflated surface site these artefacts provide neither a minimum nor maximum age for the rest of the assemblage. Even taking into account the percentage of the assemblage that can be recognised as being a product of blade production (approximately 3 to 8 per cent of most assemblages) this still generally leaves more than 90 per cent of the assemblage without any chronological control. In these cases it is generally assumed that the upper or ‘A’ horizon of the texture-contrast soils located throughout the Hunter valley date to the last 5,000 – 6,000 years. Thus the artefacts they contain should also date from this time period.

Where older dates have been recorded it has been where geomorphic processes have acted to bury and protect soil surfaces from subsequent disturbance. For example, Pleistocene occupation evidence was located by Koettig (1986, 1987) at Glennies Creek (Fal Brook) north of Singleton. The dated material came from a hearth feature located on an alluvial terrace, approximately 20 kilometres to the northeast of the current project area. Most of the Late Pleistocene sites at Fal Brook were located within the Unit B of a solodized solonetz soil. This soil is characterised by ‘a pronounced texture contrast between the A and B horizons, a bleached A2 horizon, and massive columnar development in the upper part of the B horizon’ (Koettig 1986:11). In the excavations, a buried soil horizon was identified within Unit B at a depth of approximately one metre. Dates from Glennies Creek range between 13020±360 and 34580 ±650 BP (with regard to the 34580 ±650 BP date, Koettig (1987: 34) suggests that dates from such contexts are best used to provide “an order of magnitude general age” as opposed to a direct date for occupation).

A second Pleistocene date has been reported by Kuskie (in prep. reported in Kuskie and Kamminga 2000:215) has also identified artefacts in a clay horizon at Wollombi Brook that were confirmed by a geomorphologist to be late Pleistocene in age (between 18,000 and 30,000 years ago). These terrace dates area generally consistent with the ages quoted for terrace deposits in Nanson *et al* (2003 in prep.) and Hughes and Sullivan (1997). A third Pleistocene date of 14,750 BP (uncal) was taken from a fragment of charcoal in the base of a dune at Moffats Swamp near Medowie (close to Port Stephens).

The oldest rock shelter date presently known for the Hunter is 7750±120BP from Bobadeen (Moore 1970) near Cassilis, approximately 120 kilometres northwest of the project area.

3.3 KNOWN ABORIGINAL SITES WITHIN 5 KILOMETRES OF THE PROJECT AREA

The NPWS Register of Aboriginal Sites was consulted for information in relation to sites located within 5,000 metres of the boundaries of the project area. A total of 167 sites are listed on the data base for this area. It should be noted that NPWS advises that the database of Aboriginal sites cannot be guaranteed to be free from error and currently has a programme of site verification underway to address some of its inaccuracies. Information was also obtained for another 29 sites from Heffernan and Klaver (1997) to bring the total to 196 sites.

Appendix D provides a copy of the site register read-out (please note that Bulga 6 is listed as a scatter on the site register, whilst the site card and report indicate it to be a scarred tree and a scarred tree was identified at this location during the recent survey). In summary there are (including the 29 sites not listed on the register) 42 isolated finds, 146 artefact scatters, four scarred trees, three axe grinding groove sites and two rockshelters with archaeological deposit within 5,000 metres of the project area. Clearly artefact scatter sites and isolated finds dominate the site types.

Figure 3.1 indicates the location of all sites previously recorded within the project area. **Figure 3.2** shows the areas previously surveyed within the project area. The figures show that the majority of the area has been surveyed. The distribution of the sites clearly reflects the intensity and nature of the archaeological survey in the Bulga Complex and adjacent lease areas, rather than site patterning on a regional scale. The number of artefact scatter sites and isolated finds along drainage lines provide an indication of the intensity of Aboriginal exploitation of these areas. The scarred trees and axe grinding groove sites are also located along drainage lines. Whilst this would be an accurate reflection of axe grinding groove sites, as they are generally located on sandstone outcrops in or near creeks, the distribution of scarred trees probably has far more to do with European tree clearing practices (where trees were often left along creeklines while the adjacent flats and slopes were heavily cleared) than the precontact distribution of this site type. The much lower number of sites in areas away from the drainages, has probably been biased to an unknown extent by the

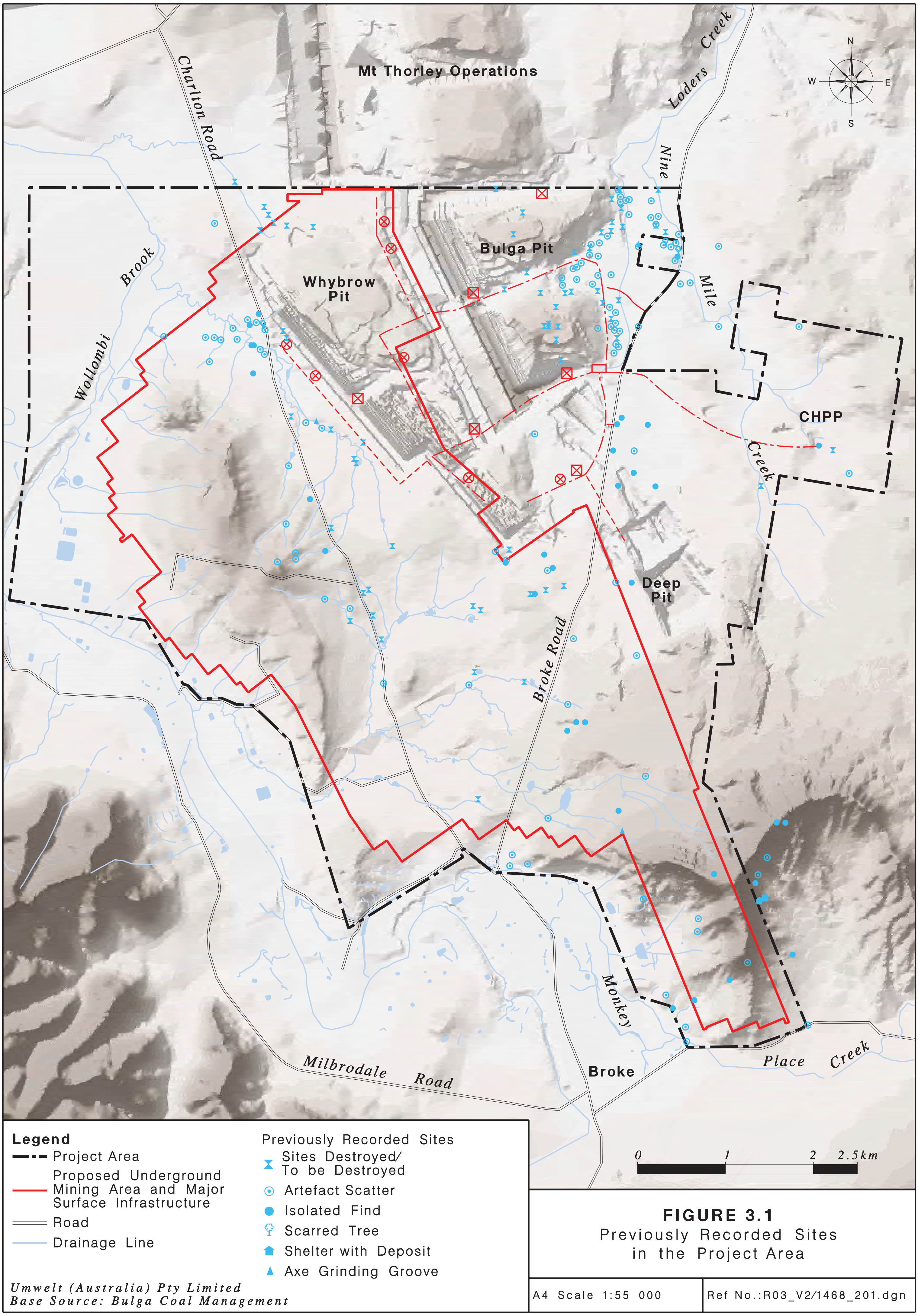


FIGURE 3.1
Previously Recorded Sites
in the Project Area

A4 Scale 1:55 000	Ref No.:R03_V2/1468_201.dgn

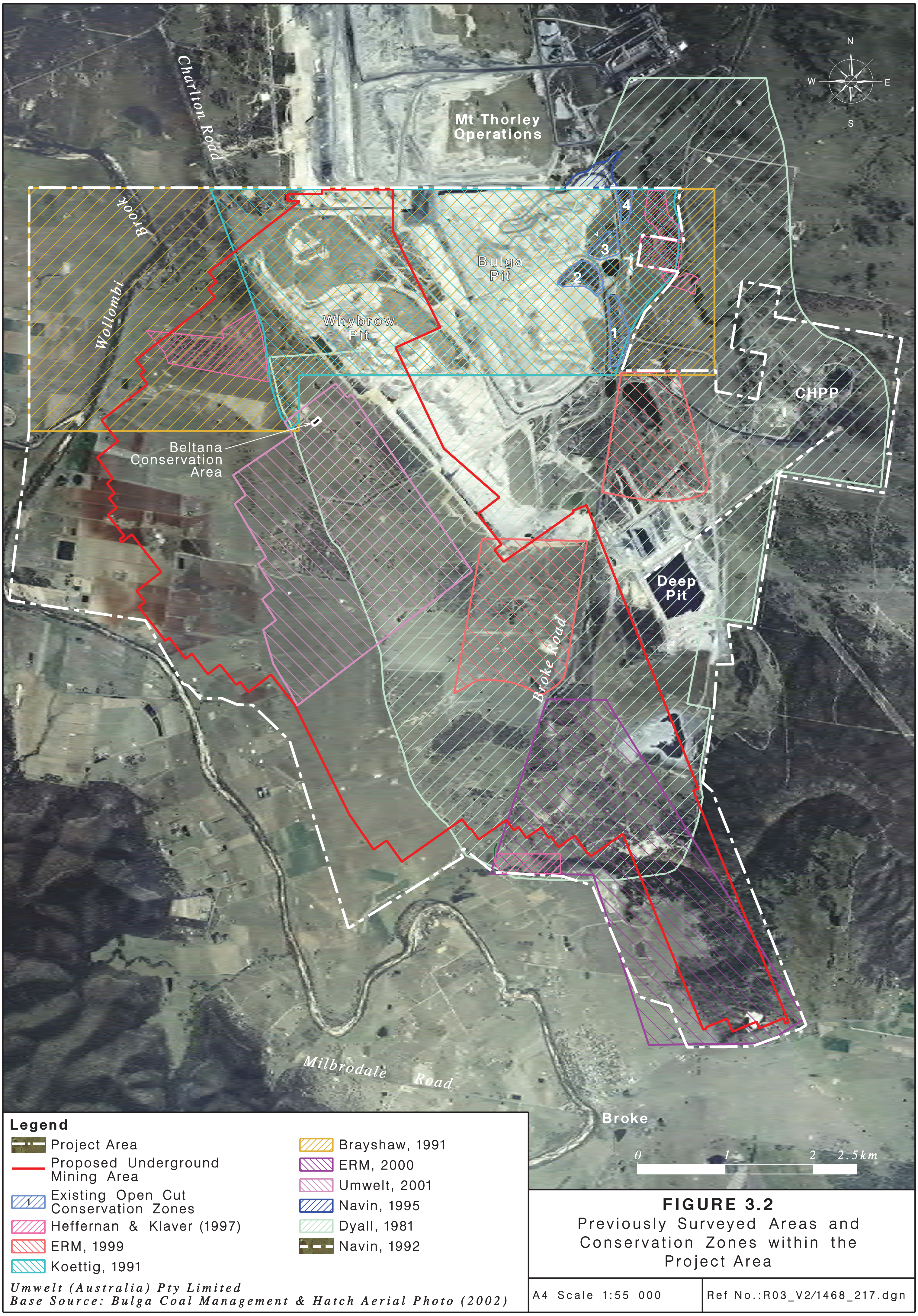


FIGURE 3.2
Previously Surveyed Areas and Conservation Zones within the Project Area

A4 Scale 1:55 000 | Ref No.:R03_V2/1468_217.dgn

general lack of ground surface visibility away from the eroded watercourses and footslopes and earlier survey strategies which tended to concentrate their investigations along creeks (however, see **Section 3.4** where prior researchers argue for this being an accurate reflection of site distribution).

3.4 PREVIOUS STUDIES WITHIN THE PROJECT AREA

Aboriginal archaeological survey and assessment has been undertaken at all stages of the development of the Bulga Complex mining operations with the first project undertaken by Dyall (1981) in the early 1980s. Details of previously recorded sites are provided in **Appendix E**.

3.4.1 Dyall (1981)

In 1981, Dyall undertook a survey of what was then the proposed Saxonvale Coal Mine. The survey was conducted over five days within the area shown in **Figure 3.2**. The survey took in all watercourses and a selection of hillslopes and ridges that had evidence of erosion that might aid in the identification of artefact scatter sites (Dyall 1981:3). The focus of the survey was on areas of improved visibility, such as those subject to active erosion. The southern escarpment of the project area was inspected for art sites and rock shelters and the open country was inspected for evidence of bora rings and stone arrangements, large trees were inspected for evidence of Aboriginal scarring or carving.

The area examined by Dyall amounted to approximately 35 km², and resulted in the location of eight stone artefact scatters, three isolated finds and a set of two grinding grooves (known as the Saxonvale Grinding Grooves). Three of the scatters located contained more than 100 artefacts and whole or fragmentary ground-edge axes were located in four sites. One site also contained a grinding stone.

Of interest, Dyall (1981:3) also reported that the water in the creeks that drained the area was saline and even after substantial rainfall (resulting in sustained flow in the creeks) the water in Loders Creek was “barely drinkable”.

There is some confusion about the listing of the sites identified by Dyall. He is credited (Brayshaw 1988, 5.3) with the identification of a second complex of grinding grooves (37-6-0148a - known as the Loders Creek Grinding Grooves) consisting of 49 grooves (in a later report, Brayshaw (1991:13) updates the number of grooves to 55). However, this set of grinding grooves are not mentioned in Dyall’s 1981 report, site 37-6-0148 being registered by Brayshaw in 1990. Another four sites in the NPWS database are credited to Dyall although the AMG references do not correspond to Dyall’s map in his appendix. For instance, the AMG on the NPWS site register for site 37-6-0142 places this site on the edge of Charlton Road. The description and grid reference (190,822) provided for the site within the information on the site card suggest that this site is actually located on the unnamed creek to the east of Charlton Road. Likewise the AMG on the NPWS site register for the Saxonvale Grinding Grooves (37-6-0149) located by Dyall, places them on a low spur between two drainage lines, whilst Dyall’s map clearly indicates they are on the southernmost of the two drainages. On **Figure 3.1** Dyall’s sites have been marked where he indicates on his map that they were located rather than being plotted by the AMGs supplied by the NPWS Site Register search.

In summarising the archaeology of the Saxonvale Lease, Dyall (1981:4) noted that some of the tributaries of Loders Creek had no artefactual material at all. He suggested that “there are more signs of occupation in the creeks which drain to Wollombi Brook than in the valley of Loders Creek”. In conclusion he stated (1981:6):

> *The general picture to emerge is that the Aborigines hunted over this area and made minor camps along some of the creeks. There are no large camps, possibly because the creeks do not flow often and the standing pools in them are very salty*.

3.4.2 Stern (1981)

In 1981 Stern undertook the subsurface salvage and assessment of a site on a tributary of Nine Mile Creek (to the northeast of the project area). This site had been located by Dyall (1981) during his 1980 survey and was to be partially impacted by the construction of a rail loop planned to service the Saxonvale Mine. Two 1 metre by 1 metre test pits were excavated (Stern 1981:5). The rationale for the pits was to (a) establish the sedimentary context of the material exposed on the surface, (b) determine the extent and density of artefacts, and (c) to provide an assemblage for comparison with the surface collection. One of the excavations was continued into the clay horizon, however, no cultural material was located beneath the interface between the clay and the A horizon. In both excavations the bulk of the excavated material was located at the base of the A1.

Stern (1981:30-32) concluded:

> *The artefact assemblage from Test Pit 1 comprises predominantly retouched/use-wear pieces with no diagnostic tool types … the remainder of the assemblage contains flakes and chipped debris and one split pebble. … Test Pit 2 contains a geometric microlith and a small component of retouched/use-wear pieces, but is predominated by non-utilized flakes and chipped stone debris. Chert [mudstone] is the predominant raw material in Test Pit 1 whereas quartzite is the predominant raw material in Test Pit 2. All the raw materials present can be readily obtained from local gravel sources in the Hunter River or Wollombi Brook. … most of the retouched/use wear pieces are made on chert [mudstone], whereas most of the non-utilized flakes and chipped stone debris are of quartzite.*

3.4.3 Brayshaw (1988, 1991)

In 1988 Brayshaw undertook a reconnaissance survey for the Bulga Coal Project EIS (**Figure 3.2**) during which she recorded seven sites (Bulga 1 to Bulga 7, NPWS#37-6-423 to 37-6-429). These sites comprised three artefact scatters along Loders Creek, one artefact scatter on Nine Mile Creek, one artefact scatter on a tributary of Wollombi Brook, five isolated finds away from the creeks and one scarred tree near Charlton Road (**Figure 3.1**). In 1991 Brayshaw returned for further investigation in the Loders Creek area. During this survey she recorded a further six artefact scatters associated with Loders Creek and its tributaries (Brayshaw 1991:2).

In summary Brayshaw (1991:1) stated:

> *Within the area to be affected by mining, east of Charlton Road, sites were found to be concentrated on Loders Creek and Nine Mile Creek. Elsewhere only isolated artefacts were identified. Although ground cover was generally dense on the slopes and ridge west of the creeks, towards Charlton Road, most exposures on tracks and eroded areas were culturally sterile. … evidence of occupation was particularly dense along Loders Creek… .*

In contrast with Dyall's previous assessment, Brayshaw found the heaviest concentration of artefacts along Loders Creek and its tributaries, with Nine Mile Creek containing relatively fewer artefacts.

The three sites located by Brayshaw on Nine Mile Creek all contained less than 50 artefacts, with a roughly even use of silcrete and mudstone. In contrast, six of the sites located on Loders Creek contained more than 100 artefacts, with mudstone by far the dominant raw material in those sites for which raw material information was recorded. Three of the sites were estimated to contain more than 500 artefacts.

Brayshaw (1991:18) summarised the results by suggesting that evidence of occupation was particularly dense along Loders Creek, and that knapping floors could be identified within site concentrations. She recommended (1991:2-3) that Consent to Destroy without further investigation be sought for sites B1-B3 and all isolated finds. She also recommended that Consent to Destroy with subsurface salvage be sought for sites B8 and B9 and that a conservation area be set up to protect the Loders Creek Grinding Groove site and its associated artefact scatter (B5). At the time of writing Brayshaw was not sure of the extent of impact on sites B10, B12 and B13 but recommended subsurface salvage if they were to be impacted.

3.4.4 Koettig (1991)

In 1991, Koettig reported additional archaeological work undertaken in the area surveyed by Brayshaw (1988, 1991), compliant with requirements made by NPWS. The survey resulted in the recording of an additional 59 archaeological sites (**Figure 3.1**).

The largest of the sites identified by Koettig (1991:19) contained between 200 and 500 artefacts (B5, B9, B11, B44, B46, B54). However, based on her analysis of visible surface artefact numbers (compared to areal extent of erosion), Koettig (1991:19) cautioned that the sites with the large numbers of surface artefacts were directly related to a high degree of surface visibility and to the type and extent of erosion.

Only 11 of the 74 sites within Koettig's survey area (including previously recorded sites) were more than 50 metres from creeks. Of these, only three contained more than ten artefacts, suggesting a rapid decrease in site frequency and site size with increasing distance from water. Koettig's (1991) work reaffirmed the observation made by Brayshaw that sites were more concentrated on Loders Creek than on Nine Mile Creek.

Test excavations were then carried out at a total of 11 locations (B4, B5, B11/B34, B18, B27, B46, B51, B58, 37-6-141 in relation to the proposed Loders Creek diversion channel). The aim of the excavations was to establish if (a) archaeological material was distributed beyond the area of exposure along the creek banks, (b) if this material extended onto the flats (Koettig 1991:26) and (c) whether previously undetected artefacts could be located away from creek banks and flats in other landform elements.

From the results of the surface survey and subsurface testing programme Koettig (1991:27-30, 37), concluded that:

- Artefact scatters are concentrated along the banks and flats of the major and minor creeks, whilst the smaller and more diffuse drainage channels appeared to have little archaeological evidence.
- The larger creeks in the area appear to have archaeological evidence distributed along their entire length. There may at times be breaks of several metres between evidence such as artefact scatters or hearths, but in general the extent of the areas without evidence is not likely to be large.
- Archaeological evidence can extend up to 120 metres from the creek banks.
- When artefacts are found on slopes and/or ridge crests artefact numbers are low and artefacts are generally not found on ridge crests more than 200 metres from a creekline.
- The subsurface artefacts are located in discrete clusters, of single raw materials and most likely represent knapping floors.
- Hearths occurred at many sites, but no evidence of heat treatment pits was detected.
- Mudstone and silcrete are the dominant raw materials.
- Backed blades (symmetric and asymmetric forms) were located in 14 sites, however, some sites with large numbers of artefacts did not have backed blades and other technologies are present.
- "Loders Creek is the area of greatest archaeological sensitivity within the [then] lease area (p.37)".

Koettig (1991:42-48) recommended more salvage excavation for the majority of the sites prior to their destruction and provided several options for a conservation area to be set up along Loders Creek. This recommendation eventually led to the formation of four conservation areas along Loders Creek (see **Figure 3.2**), as part of development consent conditions (File No 88/1276). These conditions require that the Loders Creek grinding grooves be preserved in accordance with the 1990 EIS and requirements of NPWS. No other formal conservation status was placed on these areas.

3.4.5 Koettig (1994)

In 1994, Koettig reported the results of salvage excavation of three sites in slightly different environmental contexts previously identified at the Bulga Complex (B8, B46 and B58) (p.20). The initial testing involved digging a series of small (25 cm x 25 cm) shovel pits in a 100 metre by 100 metre grid and sieving all excavated material through a 5 mm mesh to assess variable density across the site. The result was the excavation of 1575 test pits (328 pits at B8, 702 at B46 and 545 at B58) – a total area of 98 square metres.

Manual excavations were placed at areas within the grid where:

(a) Raw material variability was unusually high or low;

(b) Artefact density was unusual within the broader site context;

(c) Heat shattered rock may have indicated the presence of subsurface heating (hearths "or other heat retaining feature");

(d) Presence of heat shattered artefacts indicated heat treatment; and/or

(e) Unusual assemblages occurred (based on artefact assemblage contents).

Manual excavations were undertaken in 35 locations, with the largest number at B46. Spit depth in the excavations varied between 5 cm and 10 cm "depending on the number of artefacts present". The basic excavation unit was 50 cm x 50 cm, reduced to 25 cm x 25 cm in areas of greater density. A total of 261.5 m² were excavated by this method, with more than 13,000 artefacts recovered.

At B8, on the banks of Loders Creek, Koettig excavated archaeological hearths associated with knapping floors where she obtained Carbon 14 dates of 1,730 and 3,120 years BP. The results were compared with those from similar sites excavated at Camberwell, about 25 kilometres north. Koettig suggested that the traditional Aboriginal occupants at the Bulga Complex had made regular, though relatively infrequent and brief visits to that part of the Loders Creek flat (1994:81-2).

Koettig's results indicated (1994):

- The evidence from the Bulga Complex of the location of small and large artefact scatters sometimes associated with hearths distributed across the creek flats is consistent with other areas of the Central Lowlands region.
- While hearths were evident, heat treatment pits and ovens were not located.
- Nearly all artefact scatters contained backed blades.
- At the Bulga Complex all the assemblages (both large and small) included the reduction of cores and all assemblages had evidence of use-wear (albeit very light).
- Three reduction sequences were identified:
    - Single reduction sequence of a block or cobble down to a discard core;
    - Single reduction of a flake brought to the location where it was knapped;
    - Multiple reduction sequence when the reduction of the block or cobble results in a core, then flakes from that reduction sequence are used as cores.
- The reduction strategies were limited, with the alternating platform strategy predominant.
- Flakes for backing were selected from all stages of reduction and from all reduction sequences that provided stone for a number of purposes.
- There was little patterning within knapping floors with knapping debris mixed with backed and used artefacts.
- Almost all the assemblages and individual reductions were characterised by facetted platforms.
- The predominant raw materials present in the reduction sequences were mudstone and silcrete with some chert.

Koettig (1994:66-67) concluded:

> *The range of evidence from the Bulga sites includes similar types of archaeological features as recorded elsewhere in the Lowlands region: small and large artefact scatters and a small number of hearths, distributed across the creek flats. The range of archaeological evidence at Bulga was much more limited than at Camberwell, where definite heat treatment features, an "oven" were found at several sites. The frequency of these various features at Camberwell appears to be much higher than at Bulga or other study areas in the Central Lowlands. … The sampling of archaeological evidence at both Camberwell and Bulga, as well as in other parts of the Central Lowlands has been extremely limited in terms of the actual amount of evidence present, both within each study area and the wider region. Any observed differences in the range of archaeological evidence within any one area could therefore be seriously misleading.*

Following Koettig's (1994) study four conservation zones were set up to protect Aboriginal cultural heritage values along Loders Creek and one of its tributaries (**Figure 3.2**).

3.4.6 Navin 1992, 1994, 1995

In 1992, Navin reported on surveys undertaken for the proposed South Bulga Underground Mine. This survey included an extension to the existing coal washery, a proposed storage area, a service road, a ventilation shaft, and the proposed route for a coal conveyor. The surveys resulted in the location of two artefact scatters and three isolated finds on the upper reaches of Nine Mile Creek. Only three of these sites are listed on the NPWS Site Register (37-6-0757, 37-6-0584, 37-6-0585). Navin (1992:20) concluded that these sites were typical of other sites located further downstream on Nine Mile Creek, except that they were in far poorer condition and had fewer artefacts.

In 1994, Navin undertook a second survey of a revised route for the coal conveyor. One artefact scatter site (Nine Mile Creek 1 37-6-650) containing seven artefacts was located in an area disturbed by dam construction (1994:5). Navin (1994:8) assessed the site as having low significance and recommended (1994:9) that an application be made for Consent to Destroy.

In 1995, Navin surveyed a 12 hectare area directly to the north of the project area within the Mt Thorley Mine Lease (**Figure 3.2**). This area was a triangular piece of land between Loders Creek and one of its tributaries. Four sites were already known for this area (MT32 and MT33 (Hughes and Silcox 1983) and B53 and B54 (Koettig 1991)). All four of these sites were artefact scatters located on the tributary of Loders Creek. Navin (1995:13) reports that during the survey artefacts were located in all major exposures. These assemblages were separated into four sites (B73-76). Navin (1995:18) concluded that as all the scatters were located along the creek and its tributary that a 50 metre buffer zone along the creeklines would protect the archaeological resource. Navin (1995:19), however, recommended subsurface testing to define the subsurface extent of the artefactual material prior to making management recommendations (see Navin and Officer 1995 below).

3.4.7 Navin and Officer 1995

Navin and Officer (1995) undertook 12 grader scrapes (between 60 and 150 metres in length) perpendicular to Loders Creek in an attempt to define the artefact distribution away from the creek. They found that artefact distribution could be seen to differentiate across two broad zones away from the creek bank. Navin and Officer (1995:31) found that along creek margins with a deep and distinct A horizon there was a relatively dense and continuous occurrence of stone artefacts. Assemblages in this area contained a greater diversity of artefact types and soil horizons were substantially deeper allowing for artefactual material below the plough zone. Zone B had a shallower soil profile (~10 cm) and was found to have a lower density and discontinuous distribution of stone artefacts in a more disturbed context. Along the major creekline Zone B deposits occurred adjacent to Zone A deposits and thus artefact numbers declined away from the creek bank once the A horizon became shallower in nature. Along the tributary of Loders Creek where there was less alluvial build up, Zone B patterning occurred adjacent to the creekline. The spatial patterning of artefacts was interpreted by Navin and Officer (1995:33) as reflecting differential Aboriginal occupation relating to frequency and type of use rather than the result of taphonomic processes. In relation to significance, Heffernan and Klaver (1995:30-31) found that areas with Zone A characteristics had high archaeological significance whilst those with Zone B characteristics had low to moderate archaeological significance.

3.4.8 Heffernan and Klaver (1997)

Heffernan and Klaver (1997) were commissioned to provide a comparative assessment of the four existing conservation zones along Loders Creek (**Figure 3.2**) within the Bulga Complex and five potential alternative conservation zones (totalling 136 hectares). The rationale for their survey was to demonstrate if the other areas surveyed had similar conservation values to the existing conservation zones. If this could be demonstrated then some of the existing conservation zones could be replaced and the areas utilised for the emplacement of mine overburden. The main criterion used by Heffernan and Klaver (1997:36) to determine conservation value of an area was “the extent to which the conserved area is protected (or protectable) and likely to survive in the medium to long term”.

Heffernan and Klaver (1997) argued that they had demonstrated that the heritage values represented in the existing conservation zones (reflected by the nature and condition of the suites of sites and the landscape settings of the sites) could be shown to occur in an alternative arrangement of conservation zones.

Heffernan and Klaver’s surveys for their study resulted in the location of four new sites in the existing Conservation Zones and 29 artefact scatters, four isolated finds and three scarred trees within the proposed conservation zones. Unfortunately, these sites did not appear in the results of the NPWS data base query completed for this project in October 2002. These site details have been included, however, in discussions above and the locations are included on **Figure 3.1**.

The Heffernan and Klaver survey and project reaffirmed Koettig’s earlier observation for Loders Creek that a strong correlation exists between site size and frequency and distance to water. Heffernan and Klaver reported only one isolated find (IF1) more than 50 metres from a drainage line. In addition, they recorded artefacts along at least 60 per cent of the banks of the section of the unnamed northern drainage of Wollombi Brook within their survey area, that flows through the area known as “The Groves” (**Figure 3.2**). Two hearths and a buried soil surface containing artefactual material were also reported within sites in this area (which forms part of the survey area for this project).

Based on the findings of Navin and Officer (1995) Heffernan and Klaver (1997:11) suggested that conservation zones need to incorporate broader landscape context than narrow corridors along creeklines.

From Heffernan and Klaver’s (1997:40-44) site comparisons it can be seen that

- Mudstone was the dominant raw material followed by silcrete and minor amounts of quartz, quartzite, chert, chalcedony, volcanic and petrified wood.

- Flakes were the dominant artefact type (it is assumed that broken flakes are included in this category), followed by cores, flakes pieces, backed blades and blades, manuports, split pebbles and hatchets.

- That the majority of the sites were located on major creek banks and their associated flats and footslopes and that sites on the more diffuse drainage lines and on spurs were rare.

Heffernan and Klaver (1997) did not attempt to interpret the occupational pattern represented by the archaeological evidence, but rather suggested that the behaviours represented in the existing conservation areas (and by extension those behaviours identified by Koettig 1994) were also represented in the parts of the newly surveyed areas. In particular, it was felt that parts of the Travelling Stock Route and northern Nine Mile Creek areas in combination with existing Conservation Zone 4, provided a suitable reflection of the archaeology of the Bulga Complex.

3.4.9 ERM Mitchell McCotter (1999, 2000)

ERM Mitchell McCotter (1999) reported the survey of two areas on either side of Broke Road as part of a proposed extension of BOC operations. These areas are both within the project area (**Figure 3.2**). ERM's survey identified five isolated finds and five small scatters of artefacts to the southeast of the Whybrow Pit and four isolated finds and three artefact scatters to the north of Deep Pit and south of the open cut haul road. ERM note that the general distribution of archaeological resources in those areas conformed to the patterns recorded elsewhere in the Bulga Complex. One of the sites (Site 4), was located in association with a dam that is now located just to the south of the existing haul road. ERM (1999 Appendix C) record "many hundreds of artefacts in this area" including backed artefacts, flakes, flaked pieces, broken flakes and cores. ERM (1999:2.9) assessed the area southeast of the Whybrow Pit as having low scientific significance, whilst the vicinity of Site 4 was assessed as having high scientific significance. ERM (1999: 2.11) recommended Consent to Destroy be sought for those sites in Area 1 to be impacted by overburden emplacement (all but IF1 and IF2). This consent has subsequently been issued and the sites destroyed. Sites in the vicinity of Site 4 were not to be impacted without further investigation.

In 2000, ERM considered the likely impact of the proposed Southeastern Extension to SBC on Aboriginal sites (**Figure 3.2**). Their study area included areas southeast of Broke Road and the "Vere" location within the Singleton Army Training Area and included parts of the current project area. A total of 31 Aboriginal sites including two rockshelters, 14 stone artefact scatters and 13 isolated stone artefacts were recorded during the survey. The rock shelters reflect the different terrain included in the Vere, an eastern outlier of the rugged Broken Back Range west of Wollombi Brook. The remainder of the ERM (2000) study area was composed of gentle slopes and low rolling hills typical of the Central Lowlands. In the northern part of the study area the tributaries drained to Wollombi Brook whilst those in the far south drained to Monkey Place Creek. The nature of the stone artefact sites was assessed as similar to other sites in the Central Lowlands in that:

- mudstone and silcrete dominated the assemblages with small amounts of chert, igneous, quartz and quartzite;

- microliths and retouched artefacts were present in small numbers; and

- the most extensive open sites were associated with drainage lines.

The study concluded that surface cracking associated with subsidence would be unlikely to displace stone artefacts in the low-density sites identified in the area of impact. Subsidence would result in the general lowering of sites without affecting their context.

3.4.10 Umwelt (Australia) Pty Limited (2001)

Umwelt prepared an EIS for the Beltana No. 1 Underground Mine. This EIS related to the removal of coal in the Whybrow seam by longwall mining methods. As part of the EIS an archaeological survey and assessment of an area of approximately 600 hectares was undertaken (**Figure 3.2**). All of this area is within the current project area as it will be further impacted by ongoing mining operations which will entail the removal of further coal seams below the Whybrow seam and thus, further subsidence. The survey method included 12 transects that crossed the study area basically from northeast to southwest following the line of the proposed longwalls. These transects crossed all landform elements present in the study area and also traversed the major drainage lines (Umwelt 2001:15). A high intensity of survey was undertaken for this project, due to the shallow depth of cover east of Charlton Road, which was considered likely to be subject to extensive subsidence remediation works.

The survey resulted in the location of 21 previously unrecorded sites. These consisted of thirteen artefact scatters, seven isolated finds and one grinding groove complex (known as the Beltana Grinding Grooves or BMU1). The most extensive sites occurred along an unnamed tributary of Wollombi Brook that drained the northern section of the survey area (the northern drainage of the project area). One artefact scatter site in this area contained >2000 artefacts (BMU2). The artefacts were located in erosion scours along both sides of the tributary and several knapping floors were observed. Associated with the artefact scatter was a set of 39 grinding grooves (BMU1) on a sandstone platform within the bed of the drainage line.

A second site containing a total of 631 artefacts was recorded on a spur crest overlooking a minor tributary of Wollombi Brook. This site (BMU20) whilst typical in that it is located within 30 metres of a drainage line, is atypical in its landform context and artefact density and complexity (Umwelt 2001:29). BMU20 contained a broad variety of raw material and artefact types. Most other sites recorded on spur crests and reported by previous studies had very few artefacts even when visibility was good and/or subsurface investigations were undertaken.

In the larger assemblages (BMU2, BMU19 and BMU20):

- mudstone dominated the assemblage, followed by silcrete then by minor amounts of quartz, quartzite, porcellanite, basalt and chert; and

- artefact types included flakes, flaked pieces, cores, retouched flakes (including backed artefacts such as backed blades and eloueras) and two ground edge axes (in BMU2).

Of interest is the presence of porcellanite not previously reported from assemblages along Loders or Nine Mile Creeks and their tributaries. The porcellanite recorded was a knapping floor in site BMU19. This site was located on an unnamed tributary of Wollombi Brook (**Figure 3.1**).

Umwelt (2001:21) concluded:

> *Eleven of the 21 sites (52.4%) were identified on the main stream channel or drainage depressions in the study area. Two sites on modified landforms and one on the lower slopes were all within 100 metres of the main stream channel in the north. In addition BMU20 was recorded on a spur crest within 30 metres of a drainage depression. Including the latter sites, 71% of the sites were recorded within 100 metres of the main stream channel or drainage lines within the study area. This included more than 99% of the stone artefacts recorded in the study area during the survey. Three sites were recorded on simple slopes and two on a hilltop or ridge crest away from drainage lines. These sites contained a total of fifteen stone artefacts, about 0.5% of the total recorded.*

In consultation with the Aboriginal community, Umwelt and BCM, the Beltana mine plan was modified so that the grinding groove site (BMU1) and a section of site BMU2 recommended for conservation would be left on top of a chain pillar where they would not be adversely affected by subsidence (Umwelt 2001:40). An Aboriginal Heritage Management Plan (AHMP) (Umwelt 2003) has been formulated for the sites within the Beltana area in consultation with the Aboriginal community, NPWS and Department of Mineral Resources (DMR). Management recommendations include the fencing of the Beltana grinding groove site and a section of the adjacent BMU2 artefact scatter site, with allowance for minor subsidence remediation works. This management plan covers the provision of access to this area for the Aboriginal community, ongoing monitoring of the sites and the collection of those artefacts to be affected by drainage works and/or with the remediation of creek lines and roads, the subsurface investigation of the sections of the BMU2 site that will be impacted by remediation works and the ongoing monitoring and conservation of those sites not directly impacted by works. The management plan also identified the potential for future mining within the Beltana area. Section 90 applications will be staged throughout the life of the development. NPWS has issued general terms of approval relating to Section 90 applications for 11 sites within this area.

3.5 SUMMARY

Over the last 20 years, archaeological survey, assessment and subsurface investigations have been carried out in a number of areas within the Bulga Complex (**Figure 3.2**), resulting in the identification of 196 sites including 42 isolated finds, 146 artefact scatters, four scarred trees, three axe grinding groove sites and two rockshelters with archaeological deposit all within 5,000 metres of the project area. The previous archaeological research indicates:

- the largest and most complex artefact scatter sites are clustered along watercourses, in particular, dense concentrations of sites occur along Loders Creek and its tributaries and along the unnamed northern tributary of Wollombi Brook in the northwest of the current project area;

- lower numbers of artefacts and sites have been associated with Nine Mile Creek and its tributaries;

- artefact numbers and numbers of sites generally decrease substantially in the upper order tributaries of all three major drainage lines of the project area;

- artefact scatters are generally located within 50 metres of creeklines, however, this result is biased by the degree of ground surface visibility in this area provided by sheet erosion;

- hearths are concentrated on the creek terraces, however, this result may also be biased by the degree of ground surface visibility in these areas provided by sheet erosion;

- slopes and spur crests more than 50 metres from drainages are associated with smaller numbers of sites which have less artefacts and far less assemblage complexity;

- slopes and spur crests within 50 metres of drainages also have relatively large numbers of sites, the majority of which have few artefacts and lack complexity. There are, however, exceptions to this as observed in site BMU20 which had a large number of artefacts and artefact types;

- assemblages contain a mix of knapping technologies;

- the affects of heat on the artefacts is common but it is unclear if this reflects heat treatment or simply exposure to natural heat from bushfire, stump burning etc;

- grinding groove complexes are located where sandstone platforms were present in Loders Creek and on two unnamed tributaries of Wollombi Brook (**Figure 3.1**);

- Scarred trees are located where mature trees survived in Loders Creek catchment (3) and the Wollombi Brook catchment (1).

Information derived from excavated assemblages indicates that:

- sites along Loders Creek contain discrete areas of artefact concentration, these concentrations are rarely more than several metres apart;

- all artefacts are in the A horizon, but the different types of “A” (recent deposition following European land clearance or “A” in existence prior to this time) are not differentiated;

- grader scrapes taken perpendicular to Loders Creek indicate that this concentration of artefacts is zoned and that as depth of the A-horizon decreases (generally with distance from the main creekline) artefact numbers decline and the overall density of material across the creek flat declines;

- comparisons between excavated sites from Bulga and Camberwell indicate the range of archaeological evidence at Bulga is more limited than at Camberwell, where definite heat treatment features were found at several sites; and

- the sampling of archaeological evidence in the Central Lowlands has been extremely limited and any observed differences in the range of archaeological evidence between and within areas could be seriously misleading.

Previous conclusions in relation to Loders Creek having the highest archaeological sensitivity in the Bulga Complex (Brayshaw 1991, Koettig 1991) have begun to be challenged by further work on tributaries of Wollombi Brook undertaken by Heffernan and Klaver (1997) and Umwelt (2001). This latter work is beginning to provide evidence to support Dyall’s (1981) earlier conclusion that the Wollombi Brook tributaries had the highest archaeological significance. The surveys for this project concentrate on areas draining to Wollombi Brook, addressing in part the previous imbalance in degree of archaeological survey in the two areas, so that these earlier conclusions can be re-evaluated.

4.0 THE PREDICTIVE MODEL FOR THE PROJECT AREA

4.1 ROLE OF INTERPRETIVE MODELS

Models of the relationship of Aboriginal *sites* to their landscape context have been in widespread use for some time as a tool for focusing attention on rare or different patterns of archaeological occupation evidence. In general, these models generate predictive statements about the likely archaeological evidence in an unsurveyed area, based on the results that are known from nearby or similar areas. Each statement in the model is, in fact, an hypothesis about the location and content of sites, and these specific hypotheses are often then amalgamated into more interpretative statements of past Aboriginal behaviour. These broader interpretative models are strongly affected by the prevailing archaeological theoretical models. The local predictive models can be adapted as new surveys test the predicted archaeological patterns and as new interpretative paradigms emerge.

In the project area, the development of a predictive model has a slightly different function. One of the main objectives of this assessment process was to integrate the results of diverse previous investigations of the project area, undertaken over more than 20 years, and to augment these results with selective additional survey of areas for which little information was available. Because most of the project area has been previously surveyed, much of the input to both the predictive process and to the testing of hypotheses is the same basic assemblage of known sites. However, these sites have been recorded using different methods, different boundary definitions, with different levels of surface visibility and at different levels of detail. The model and testing process therefore provides an opportunity to review the cultural heritage values and significance of the project area by better defining site boundaries and by extending the sample of stone artefacts that have been described.

Predictive models can also be used in other ways. For instance, as the scope and distribution of other Aboriginal cultural heritage values in the landscape becomes more widely appreciated, it is possible to make predictive statements not only about archaeological sites but about broader values of cultural landscapes. These values may include the presence of specific landscape (terrain) features that have cultural value but no tangible or physical occupation evidence, they may include economic and social plant resources, and they may include historical connections with the land. All of these values are relevant to the assessment of development impacts, because they acknowledge the continuity of Aboriginal community associations with the landscape and provide the conservation context for Aboriginal archaeological sites.

By developing a series of working hypotheses about the patterns of occupation evidence, predictive models also provide the basis for assessing the rarity and representativeness of cultural evidence, key elements of significance assessment. For instance, a predictive model will indicate localities where there is a low probability that archaeological evidence will be found and the types of sites that are not likely to be found in a project area. If such atypical sites/site types are located during subsequent survey they are likely to be attributed greater significance due to their rarity (see **Section 6** for a detailed discussion related to site significance).

For areas where no survey is available, and where there is a known potential for disturbance to occur, a predictive model enables a preliminary assessment of cultural heritage risks and can therefore be used to guide the formulation of field survey strategies. For instance, the model can identify those locations most likely to be sensitive from an Aboriginal cultural heritage and/or archaeological perspective. These areas should be subject to survey and assessment if they are to be impacted or have the potential to be impacted by the development. A representative sample of the locations/landform elements not predicted to have sites must also be surveyed and assessed so that predictive models are not self fulfilling and are constantly being tested and refined. The refined site and landscape information can then be used to assist in formulating an occupation model for newly surveyed areas and their context.

The predictions that are developed in this section of the report are presented for the following specific purposes:

- to summarise what is currently known about site location and internal character;
- to understand consistencies and inconsistencies in previous site definition and recording practices and the ways in which these have affected interpretation;
- to integrate Aboriginal cultural heritage values of the landscape with archaeological information;
- to identify particular pieces of information that need to be obtained from further field survey or analysis to improve the management framework for the project area;
- to provide an indication of Aboriginal cultural heritage risks in the project area;
- to underpin the survey strategy for the project;

- to place the cultural values of the project area in its regional context; and
- to facilitate assessment of the values and significance of the project area.

4.2 GENERAL MODELS OF ABORIGINAL OCCUPATION IN THE CENTRAL LOWLANDS REGION

There are a number of theories regarding how Aboriginal people used and affected the landscape in which they lived. These theories attempt to explain or interpret the location and nature of the archaeological record in any region. It is generally assumed that the environment, and implicitly resource distribution, was a major factor influencing Aboriginal movement and camp site location. Socio-cultural and demographic factors probably also influenced patterns of occupation.

Kuskie (2000:33-34) summarised five models of occupation for the Central Lowlands of the Hunter Valley. These models are introduced below:

- Koettig (1994) argues that the location of camps and the patterning within them was determined by rules based on the location of water sources, the demographics of the group, and length of stay. The number of occupational episodes may therefore be interpreted through the spacing and distribution of features within a camp. The frequency of these episodes was probably influenced by the availability of resources.
- Witter (NPWS Workshop 1995) argues that the long-term base camps were located on the Hunter River and its major tributaries, and other open campsites in the region were peripheral to these.
- Haglund (1992) postulates that sites on Doctors Creek and Sandy Hollow Creek are the result of small groups of people visiting the area many times to utilise the rich resources located there.
- Dean-Jones and Mitchell (1993) suggest that various landforms were used to avoid climatic extremes and associated problems, to take advantage of resource-rich areas, and for ease of travel through the landscape. They also suggest that the saline groundwater associated with Permian Coal Measures may have influenced the seasonality of occupation in some areas and so the pattern of archaeological evidence.
    - Rich (1995) argues that technological strategies enabled people to manage resources in the landscape and social strategies enabled management of the uncertainty and risk involved in hunting and gathering. Within the Bayswater catchment, to the north of the present project area, Rich (1992) established a model of archaeological site location which states that the major evidence of Aboriginal occupation of the area is stone artefact scatters which are the most dense along major stream valleys. Site densities decrease uphill away from the streams, in minor tributaries, and other terrain units including slopes, crests, and hilltops. Additionally, sites close to major watercourses contain a greater number of functionally specific features such as knapping floors and heat treatment areas compared to other terrain units.

4.3 SPECIFIC OCCUPATION INTERPRETATIONS FOR THE PROJECT AREA

The previous surveys of the project area (see **Section 3**) have resulted in a number of statements about broader occupation strategies. These are noted below:

- Dyall (1981) distinguished between the occupation strategies along major and minor creeks, noting that major camps were not associated with low order streams (note that Dyall's definition of major camps may not be consistent with subsequent surveyors). Dyall also suggested differential occupation practices between the Wollombi Brook subcatchments (with more evidence) and the Loders Creek/Nine Mile Creek subcatchments (with relatively less evidence).
- Brayshaw (1988 and 1991) contested Dyall's model and suggested that Loders Creek was associated with more complex archaeological evidence (sites with more than 500 artefacts), although she also found that relatively small sites (less than 50 artefacts) were associated with Nine Mile Creek.
- Although Koettig (1991) supported Brayshaw's assessment of Loders Creek, she also cautioned that site complexity was largely controlled by surface visibility (ie sheet erosion of an extent to expose all the A horizon material, but not remove it altogether). Koettig considered that Loders Creek was the area of greatest archaeological sensitivity in the then Bulga lease area.

- Koettig (1994) suggested that the occupation evidence at Loders Creek derived from regular, through relatively infrequent visits. The sites were very late Holocene in age. It is of interest that this finding and interpretation is consistent with subsequent geomorphic interpretations from Bettys Creek which suggest that the very late Holocene was likely to be the period when tributary drainage systems provided good resources to attract at least intermittent occupation.

- Navin 1992, 1994 and 1995 suggested that archaeological evidence would be concentrated within 50 metres of drainage lines, separating occupation strategies for these riparian areas from the remainder of the catchments. Navin and Officer (1997) refined this suggestion by noting the relative preservation of occupation evidence in two topsoil units adjacent to creeks. They suggested that more intensive evidence of occupation was associated with deeper alluvial (terrace) deposits adjacent to creeks, rather than shallower footslope based A horizons. Heffernan and Klaver (1997) also modified the suggested width of the riparian corridor to more than 50 metres.

A review of the existing environmental and archaeological information also indicates a number of specific statements about Aboriginal site content in the project area. The information presented below integrates environmental opportunities and constraints with the known patterns of resource usage, leading to a range of specific issues that needed to be clarified (see **Section 4.3**).

In relation to Aboriginal resources the following general hypotheses are suggested. The broad occupation patterns predicted here are strongly associated with the broad soil landscape types that are represented in the project area.

- Within or immediately adjacent to the project area, the Wollombi Brook (Wollombi soil landscape) provides the most reliable water supply for both humans and animals. Even though the Wollombi clearly ceases flowing and may dry up altogether in extended drought, it is more likely to retain pools of water during dry periods. Its banks would also have been well shaded in pre European times. In theory, this more reliable water supply would suggest more intensive occupation evidence along the Wollombi than in the Loders Creek and Nine Mile Creek catchments. The more intensive pattern could extend up the immediate tributaries of the Wollombi (eg the northern tributary). A high risk to the conservation of evidence on the Wollombi floodplain (due to flooding) suggests that the best evidence of the Wollombi occupation strategy is likely to be found on the footslopes above flood level and in the lower reaches of the northern tributary (interface of the Branxton soil landscape with the Wollombi soil landscape). This prediction disputes the conclusions that have previously been drawn by archaeologists working in the Loders Creek catchment, but was inferred by Dyall in 1981.

- Loders Creek and Nine Mile Creek (Branxton soil landscape, but Hunter subcatchments) would have provided a semi-permanent supply of potable water in their lower reaches and would have provided useful camp sites for small groups of Aboriginal people for short stays. However, the water in these tributaries may only have been potable after heavy rain due to high salinity (note the extent of salinity in these catchments prior to European land clearing is not well established).

- Slopes of lower gradient and floodplain areas (Branxton and Rothbury soil landscapes) would have provided the majority of the staple carbohydrates sourced mainly from aquatic vegetation in tributaries and billabongs and from grasses. In terms of site distribution this would seem to indicate that family camp sites would preferably be located in these areas of lower gradient on the footslopes and floodplains where the women could gather the staple carbohydrate needs for their families. The geomorphic evidence suggests that these gathering strategies would have been more successful in the very late Holocene than in the early or mid Holocene. Clearly, however, the value of the resource varies within drought and wet cycles as well as over longer time frames.

- Fruits and medicines would have been more abundant in the “Vere” area (Lees Pinch soil landscape) where the stony, sandy soils produced from the conglomerate were more suited to their growth. Therefore, sites in the steeper areas of the “Vere” should be small and representative of single episode occupation (not family camp sites). Artefact numbers should be low and related to lost artefacts, tool repair, resharpening and single knapping events. Occupation evidence in the Vere will be diffuse and strongly affected by active slope processes, unless protected by rock shelters. Similarly, artefact scatters and isolated finds on slopes, spurs, spur crests and ridge crests elsewhere in the project area will be rare even when visibility is good. Artefact scatters will have only small numbers of artefacts unless the area is within close proximity to a relatively reliable watercourse. Once again these sites will generally only be visible due to erosion or disturbance.

- The project area provides habitats for a range of mammals, birds and reptiles, the largest number of which will be commonly located in and around watercourses, focussing resource exploitation in these areas. However, the largest prey species (and thus the greatest suppliers of protein) and most mobile of prey species, kangaroo, wallaroo, wallaby and wombat, could also be hunted away from the watercourses. In relation to site location/site type it is probable that the permanent to semi-permanent watercourses would have provided a focus for hunting and camping due to their resources. Whilst hunting and gathering was also likely away from the watercourses, sites in these areas are more likely to be single episode events such as plant food/medicine exploitation (probably invisible in an archaeological sense), kill sites and perhaps butchery sites (early stage of butchery) and not camp sites. Although all these internal site patterns can be predicted, it is highly unlikely that the actual archaeological evidence is sufficiently preserved to enable the detailed differential analysis of artefact attributes to be meaningful. Almost all of the visible and (now) subsurface artefact assemblages on lower footslopes and remnant creek terraces (in the Branxton and Rothbury soil landscapes) have been reworked by sheet erosion, and it is not reasonable to assume that spatial association implies functional association.

- The carbon 14 dates of 1730 and 3120 years BP obtained by Koettig (1994) on hearths along Loders Creek suggest a late Holocene focus of occupation. Similarly the nature of the stone assemblages (generally described as Bondaian to post Bondaian in nature) has led many researchers to associate Aboriginal use of the area with mid-Holocene to recent periods. Thus on knowledge obtained from the previous archaeological research it must be predicted that antiquity of occupation will be mid-Holocene and period of occupation will span from the mid-Holocene to the non-indigenous settlement period and probably for a short period beyond. It is unlikely, however, that the assemblages will yield reliable dating material. The geomorphic evidence suggests that even though there is some potential for occupation extending into the early Holocene and late Pleistocene, the potential for this evidence to be preserved as a separate and intact unit is very low when compared with the high terraces of the Hunter.

4.3.1 Intrasite Characteristics

The following predictions can be made about variations between sites within the project area.

- Sites related to hunting and gathering (rather than camping) may be located anywhere within the project area. These sites should reflect single episodes of use (rather than accumulated evidence from multiple occupation episodes that is expected to occur close to creeks) and should contain isolated finds or only small numbers of artefacts. It is likely that the artefacts will include discarded used/retouched artefacts or small knapping floors. They should not contain cores or implements such as axes, grindstones or mullers. These are much more likely to be transported and/or located at camp sites where food is processed and in close proximity (<100 metres) of a watercourse.

- Scarred trees may be present where mature trees are still in existence. These trees are most likely to be located along the watercourses where the majority of the remaining mature trees exist. Scarred trees may also be in existence within the “Vere” area, however, the density of the vegetation suggests they will be difficult to locate during the survey.

- Creeklines with sandstone outcrops exposed in pre-European times would have provided surfaces suitable for the grinding of stone implements such as axes and chisels and the sharpening of fire hardened spear points. Sandstone may also have been sourced from these areas for use as grindstones and anvils for the preparation of plant foods. Past valley fill alluvial patterns mean that the long term exposures are less likely to be present in the higher order tributary streams where there are alluvial rather than footslope banks.

- Hearths may be located distributed across the creek flats. Heat treatment pits and ovens are unlikely.

- Camp sites used by family groups should contain stone implements used for the preparation of plant foods along with a wide variety of other implement types and knapping debris derived from people carrying out processing, maintenance and production activities.

4.3.1.1 Assemblage Composition

In relation to the artefact assemblages, the following characteristics are anticipated following re-evaluation of the full known assemblage:

- Mudstone should be the dominant raw material followed by silcrete which will be subdominant. Minor sections of the assemblage will be composed of quartz, quartzite, chert, porcellanite, chalcedony, volcanic (most likely basalt) and petrified wood. These are locally and widely available raw materials (but generally only as smaller cobbles), whereas the mudstone and silcrete materials are sourced as large cobbles either from the Hunter (and Goulburn) River or from isolated outcrop. The local variant of basalt (teschenite) is not suitable for implement manufacture. The source of the porcellanite is unknown. Porcellanite will only be found as a minor component of assemblages.

- The pebbles from the conglomerates are of a size and shape that would have made them useful as a hammerstone or muller. If these artefact types are present they should also have been sourced locally.

- Flakes and broken flakes will be the dominant artefact type, followed by flaked pieces, cores and retouched flakes (including backed blades and eloueras). Manuports, split pebbles grindstones (basal) and hatchets/axes may also be found in small numbers in the larger assemblages located near the major creeks.

- Backed blades (symmetric and asymmetric forms) can be expected in the majority, but not all of the sites. The presence of backed blades is *not* dependent on assemblage size, some sites with large numbers of artefacts may not have backed blades.

- Heat impacts on artefacts will be widely present, but specific evidence of heat treatment is much less likely.

- Knapping floors should be present in the larger assemblages. There should be little patterning within knapping floors with knapping debris mixed with backed and used artefacts.

- Three reduction sequences should be represented:
  - Single reduction sequence of a block or cobble down to a discard core;
  - Single reduction of a flake brought to the location where it was knapped;
  - Multiple reduction sequence when the reduction of the block or cobble results in a core, then flakes from that reduction sequence are used as cores.

- The alternating platform strategy should be predominant. Flakes for backing should be selected from all stages of reduction and from all reduction sequences. Almost all the assemblages and individual reductions should be characterised by faceted platforms.

4.4 SPECIFIC ISSUES TO BE CLARIFIED IN THE DESIGN OF THE SURVEY AND INTEGRATED ANALYSIS

The issues that are noted below derive from the predictive statements that have been made previously about the nature of Aboriginal occupation in the Central Lowlands of the Hunter Valley and particularly to potentially different patterns and resources and archaeological evidence of cultural responses across the major landscape types that are represented in the project area. By investigating these issues, this study aims to provide information that will clarify the Aboriginal cultural heritage values of the project area and the archaeological significance of the physical evidence. This information underpins the discussion of appropriate management of Aboriginal cultural heritage within the project area that is presented in **Sections 6.4** and **8**.

Occupation strategies at the interface of the Southern Mountains and Central Lowlands

1. Is there evidence of differences in artefact raw material, artefact size, artefact types or reduction strategies between the sites that are close to the Wollombi Brook (ie within the Wollombi soil landscape or at the lower reaches of tributaries that flow to the Wollombi through the western extremity of the Branxton soil landscape), and the parts of the project area that are clearly within the broader Central Lowlands region such as sites along Loders Creek and Nine Mile Creek?

2. Is there evidence that the sites close to the Wollombi have greater internal complexity than the sites along the intermittent tributaries in the Branxton soil landscape such as Loders Creek, Nine Mile creek and the upper reaches of the Wollombi tributaries?

3. What is the real potential for archaeological evidence that is clearly associated with prior environmental conditions to be preserved within any of the landscape types in the project area? Does any landscape type provide a greater potential for dateable and stratigraphically segregated material?

4. At creek margins (ie within 100 metres of current drainage lines), what differences are there in artefact density, artefact diversity or intrasite complexity between archaeological assemblages that are associated with footslope (colluvial accretion) deposits and alluvial (terrace) deposits?

5. To what extent does the distribution and extent of sheet and creek bank erosion affect the conservation (presence and intactness) of archaeological evidence?

6. Is there field evidence that site distribution in the “Vere” reflects the distinctive landscape processes that occur there, such as cavernous weathering, or the distinctive Aboriginal plant resources that occur there?

The survey and analytical strategy that is presented in **Section 5** has been developed to explore these issues, as well as to meet specific project requirements relating to fixed mining activities (ie elements of the mine plan that cannot be relocated to accommodate cultural heritage values at the surface).

5.0 SURVEYS AND RESULTS

5.1 SURVEY RATIONALE AND DESIGN

As discussed in **Section 4.4** there are several specific issues related to cultural responses to different patterns of availability of resources across the major landscape types in the project area which require clarification. These issues were taken into account when the survey strategy was formulated. The transects undertaken for the survey were targeted to:

- investigate areas of Wollombi soil landscape and Branxton soil landscape to obtain information that can be used to identify if there are differences in artefact assemblages from these areas;
- investigate areas in close proximity to Wollombi Brook to obtain information about the complexity of assemblages from this area for comparison with those from the intermittent tributaries of Loders Creek, Nine Mile Creek and the upper reaches of Wollombi Brook tributaries in the Branxton soil landscape;
- include a sample of the majority landform elements present across the project area;
- locate some of the previously recorded sites to assess their current condition and confirm their extent;
- investigate the nature of the teschenite ridge (Fordwich Sill) to see if it was suitable as a stone source for axe manufacture;
- assist the Aboriginal community to integrate known cultural heritage values consistently across the whole study area; and
- provide a sound basis for identifying any areas with a high value for conservation management.

The survey strategy also had to incorporate areas that had not been surveyed previously, and specifically those areas that are;

- targeted for specific mine works (coal conveyors, access roads);
- likely to require remediation works after subsidence; or
- that have the potential for site types that may be directly affected by subsidence (grinding groove sites, rockshelters).

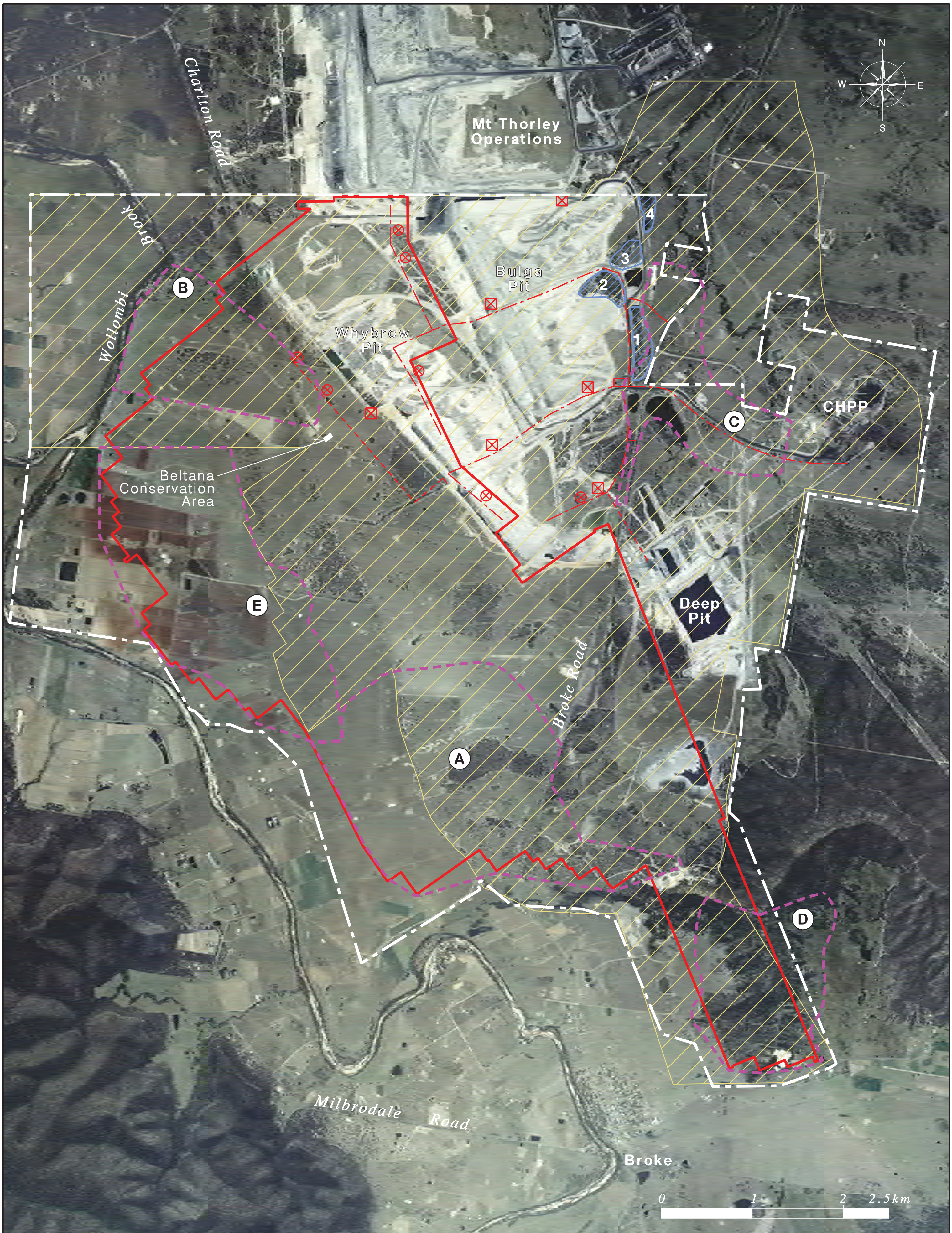
In some areas a restriction was placed on the area available for survey by a few local landholders who did not wish surveys to be undertaken on their properties. It was, however, possible in these cases to survey a similar tract of land within land owned by BJV so that predictions could be made in relation to the likelihood of areas of cultural heritage value within the privately owned land. Should future remediation works be required along any of the watercourses within these areas of private land that could not be surveyed for this project, BCM will be required to undertake survey and assessment prior to any works commencing. The majority of the privately owned land has been heavily cleared and subject to high degrees of disturbance from agricultural practices and are located in the areas with the greatest depth of cover.

Figure 5.1 indicates the areas previously surveyed, the existing conservation zones and those areas surveyed for this project (Areas A through E). **Figures 5.2** to **5.6** indicate the locations of the transects and the general width of the transects undertaken within each of the survey areas.

5.2 SITE BOUNDARY DEFINITIONS

Defining the areal extent of artefact scatter/open camp sites is difficult as surface visibility and degrees of erosion limit the visible surface evidence and the remaining subsurface extent of the site can only be assumed based on the geomorphic context of the particular area. In the past it was common practice to limit the area of a site to the extent of the visible artefact scatter. Although the site boundary definition is rarely explicitly stated, this appears to be the approach used in most previous surveys in the project area. In recent times, however, some archaeologists have begun to argue that it is more appropriate to define the area of the site by the landform element in which it occurs (eg Kuskie 2000).

A site is defined within this report as an area where traditional Aboriginal occupation is located in the landscape. Umwelt (2001) used this terrain unit based approach to site definition in the Beltana project area.



Legend

Project Area

Proposed Underground Mining Area and Major Surface Infrastructure

Existing Open Cut Conservation Zones

Previously Surveyed Area

(A) Area Surveyed for this Project

Umwelt (Australia) Pty Limited

Base Source: Bulga Coal Management & Hatch Aerial Photo (2002)

FIGURE 5.1

Previously Surveyed Areas, Conservation Zones and Areas Surveyed for this Project

A4 Scale 1:55 000

Ref No.:R03_V2/1468_218.dgn

Legend

Project Area

Proposed Underground Mining Area

Area A

Transect Area

Previously Recorded Sites

Isolated Find

Artefact Scatter

Sites Destroyed/To be Destroyed

Axe Grinding Groove

Umwelt (2002) Sites

Isolated Find

Artefact Scatter Exposure

Area with Continuous Artefact Scatter

Area of Deposition/PAD

Umwelt (Australia) Pty Limited

Base Source: Bulga Coal Management & Hatch Aerial Photo (2003)

FIGURE 5.2

Transects and Sites in Survey Area A

A4 Scale 1:20 000

Ref No.:R03_V1/1468_208.dgn

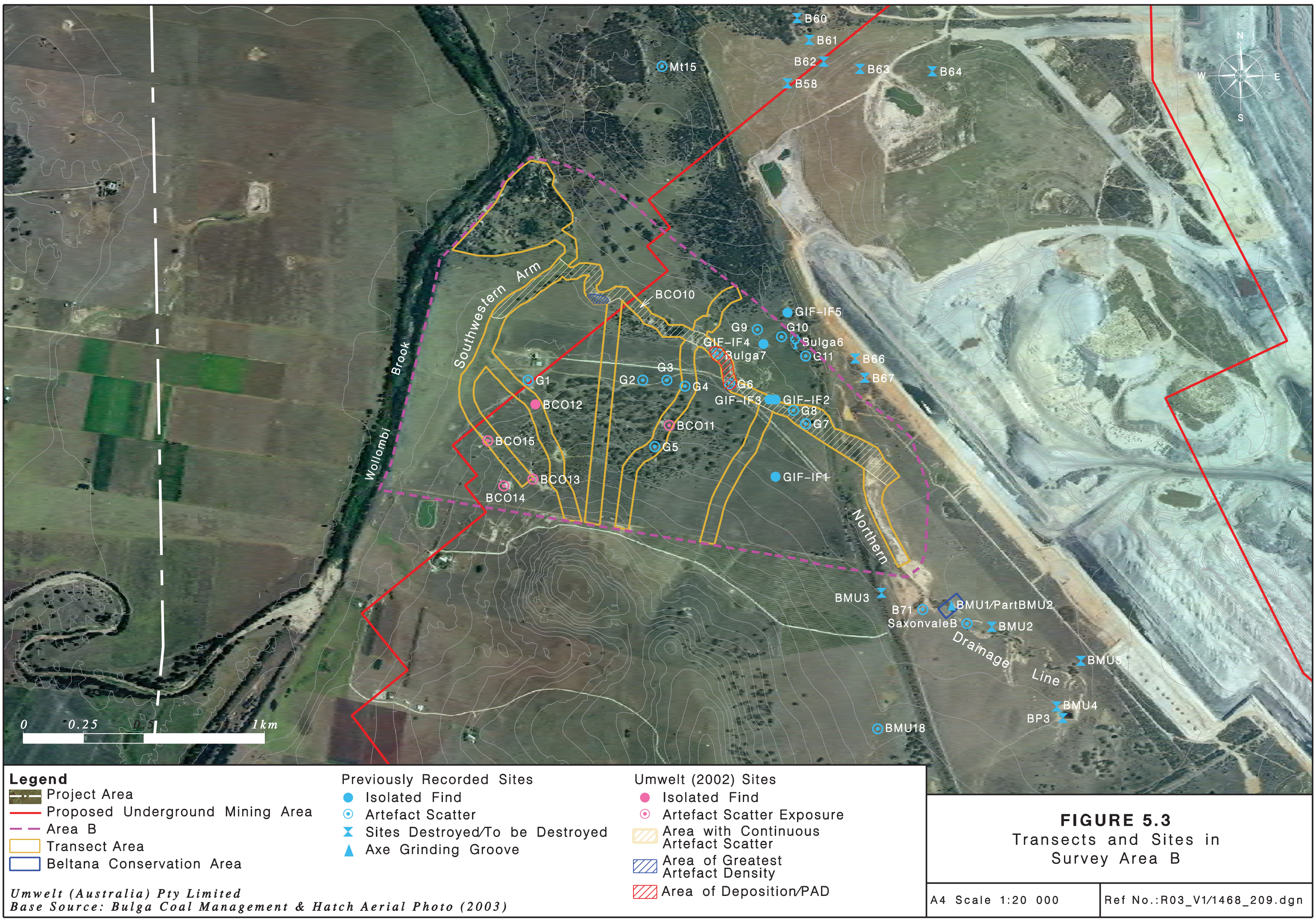


FIGURE 5.3
Transects and Sites in Survey Area B

A4 Scale 1:20 000

Ref No.:R03_V1/1468_209.dgn

Legend

Project Area
Proposed Underground Mining Area
Area C
Transect Area

Previously Recorded Sites
Isolated Find
Artefact Scatter
Sites Destroyed/To be Destroyed
Axe Grinding Groove

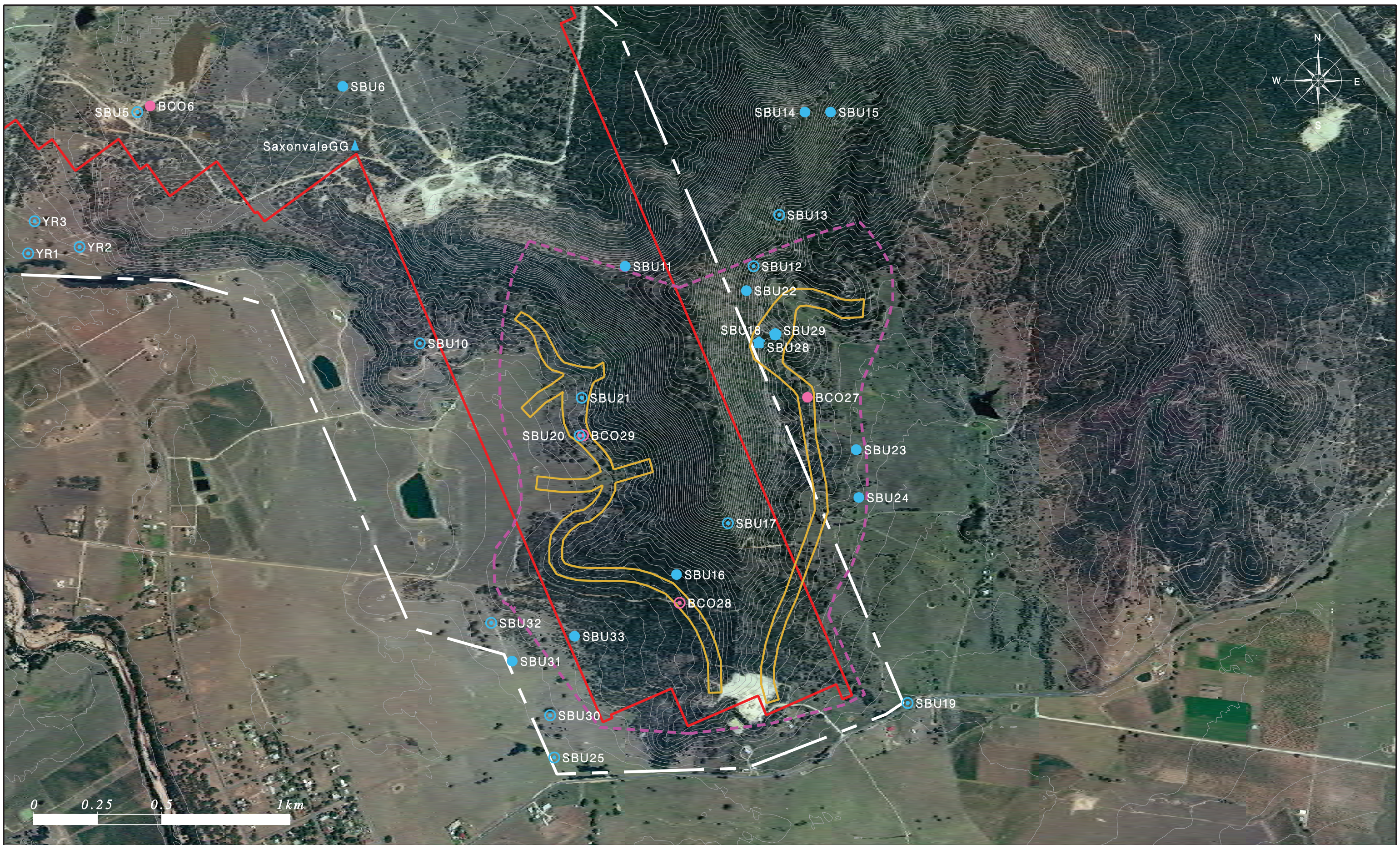
Umwelt (2002) Sites
Isolated Find
Artefact Scatter Exposure
Existing Open Cut Conservation Zones

Umwelt (Australia) Pty Limited
Base Source: Bulga Coal Management &Hatch Aerial Photo (2003)

FIGURE 5.4
Transects and Sites in Survey Area C

A4 Scale 1:20 000

Ref No.:R03_V1/1468_210.dgn



Legend
Project Area
Proposed Underground Mining Area
Area D
Transect Area

Umwelt (Australia) Pty Limited
Base Source: Bulga Coal Management & Hatch Aerial Photo (2002)

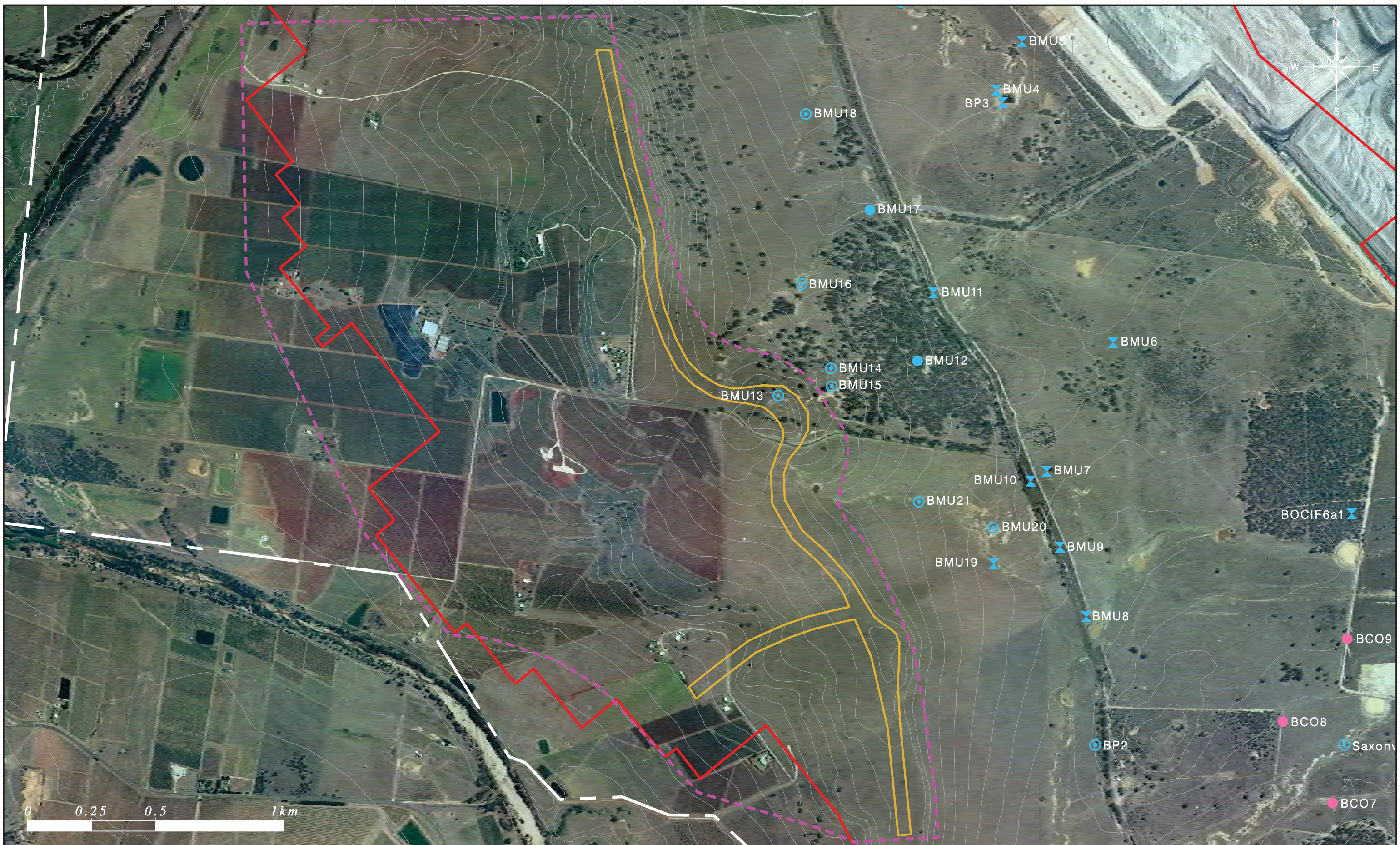
Previously Recorded Sites
- Isolated Find
- Artefact Scatter
- Sites Destroyed/To be Destroyed
- Axe Grinding Groove
- Shelter with Deposit

Umwelt (2002) Sites
- Isolated Find
- Artefact Scatter Exposure

FIGURE 5.5
Transects and Sites in Survey Area D

A4 Scale 1:20 000

Ref No.:R03_V1/1468_211.dgn



Legend
- Project Area
- Proposed Underground Mining Area
- Area E
- Transect Area

Previously Recorded Sites
- Isolated Find
- Artefact Scatter
- Sites Destroyed/To be Destroyed
- Axe Grinding Groove

Umwelt (2002) Sites
- Isolated Find
- Artefact Scatter Exposure

Umwelt (Australia) Pty Limited
Base Source: Bulga Coal Management & Hatch Aerial Photo (2003)

FIGURE 5.6
Transects and Sites in Survey Area E

A4 Scale 1:20 000

Ref No.:R03_V1/1468_212.dgn

Both the exposure based and terrain unit based approaches to site definition have introduced some difficulties for comparison of evidence, and for the preparation of practical management programs. In relation to terrain based site definitions, issues may arise in relation to the management of isolated artefacts or sparse low density artefact scatters within extensive areas of uniform terrain. Site definition inconsistencies can also arise when the exposed evidence clearly traverses more than one terrain unit (eg lower footslope and creek terrace).

To address these concerns, the definition of site boundaries draws on a combination of the visible extent of the site and local terrain units to provide as much clarity as possible about the spatial extent of loci of occupation evidence. For instance, where ground surface exposure and erosion status provide clear evidence of the boundaries of an artefact scatter, this information is used in preference to a less certain local terrain unit boundary. This practical definition of site boundary has resulted in a re-evaluation of the extent of some previously recorded sites. For instance, some individual loci of evidence, previously recorded as separate sites, have been amalgamated within a single site boundary, where inspection clearly indicated continuity.

The changes to site boundaries have a significant influence on the integration of descriptive statistics about other site features (such as complexity). This is discussed further in **Section 5.6**.

5.3 SURVEY IMPLEMENTATION

5.3.1 Participants in the Survey

The following people participated in the surveys.

Lower Wonnarua Tribal Consultancy Pty Ltd: Maree Waugh, Glenn Miller and Dave Swan.

Upper Hunter Wonnarua Council Inc: Tracey Skene, Georgina Berry and Martin Feeney (UHWC representatives also acted as spokespeople for WNAC).

Ungooroo Aboriginal Corporation: Rhonda Ward, Allen Paget, Lisa Clydsdale, Dahlene Hall and Rebecca Faulder.

Wanaruah Local Aboriginal Land Council: John Mathews, Trevor Griffiths and Barry French.

Umwelt (Australia) Pty Limited: Jan Wilson and Leila McAdam.

During October 2002, ten people were involved in the surveys each day as each group requested two survey participants. In December 2002, nine people were involved each day (UHWC had one representative). On 20 March 2003, nine people were involved in the survey to locate the Saxonvale grinding groove site (Umwelt had only one representative).

5.3.2 Survey Strategy for Each Area

The surveys for this project were undertaken over a period of nine days (24-25, 28-31 October, 3-4 December 2002 and 20 March 2003).

Each of the survey areas was investigated by a series of transects. All of the transects were walked. As 10 people generally participated in each transect it was possible to cover an area approximately 100 metres wide. In addition, all areas of ground surface visibility within another 50 metres of the transect were also inspected. The following details were recorded for each landscape element crossed by the transect, or each time they were observed to change within a landscape element.

- aspect;
- gradient;
- topographic unit;
- vegetation;
- geology and soils;
- disturbance;
- ground surface visibility and extent of visibility;

- sites located; and
- Aboriginal resources (animal, plant, stone, water, outlook).

A hand-held GPS was used to record site locations and points in the landscape where the topography varied. Photographs of the sites are contained in **Appendix B**.

5.3.2.1 Area A

Area A will be affected by subsidence following the removal of the various longwall panels. It will be necessary within Area A to undertake remediation works along two of the local drainages in order to alleviate ponding and to ensure that the drainages continue to flow into Wollombi Brook (refer to **Section 7.2**). This area has already been subject to subsidence from the removal of the Whybrow seam at South Bulga Colliery, which has resulted in ponding. Extensive erosion control works have already been undertaken in some drainage channel sections and ongoing works will be required whether or not mining proceeds. A small percentage of Area A was private land for which permission to survey was not forthcoming (**Figure 1.4**), however, this did not lessen the overall effectiveness of the survey.

Within Area A all the drainage channels and their adjacent flats/footslopes were inspected. Transects were also walked on slopes and along a spur crest. The area of the Saxonvale grinding groove site, previously recorded by Dyall (1981), was also surveyed, as was the area of Saxonvale A. These surveys were undertaken to confirm the location and condition of the sites.

Area A partly overlapped with the area surveyed by ERM in 2000. The previously surveyed areas were resurveyed in order to obtain information related to Aboriginal resources in this drainage area, information that was not available in the ERM report.

5.3.2.2 Area B

The majority of Area B will be affected by subsidence following the removal of the various longwall panels. It will be necessary within Area B to undertake remediation works along the local drainage lines in order to alleviate ponding and to ensure that the drainage lines continue to flow into Wollombi Brook (refer to **Section 7.2**). The drainage lines in this area have already been subject to extensive erosion and future works will be required whether or not mining proceeds.

Even though underground longwall mining will not proceed past the footslope/floodplain boundary of Wollombi Brook, at the time of the survey there was potential for flood mitigation works to be undertaken downstream of the mining area. Thus, additional survey was undertaken along drainage lines that cross the floodplain of Wollombi Brook. These surveys are those shown outside the proposed mining area on **Figure 5.3**.

The transects undertaken in Area B included a tributary system of Wollombi Brook and a sample of the floodplains, flats, footslopes, lower slopes, midslopes, upper slopes and spur crests associated with this system and with Wollombi Brook. They also included an elevated area of alluvial sand (interpreted as a former point bar) at the confluence of the northern-most drainage in the project area (**Figure 5.3**) and a backswamp formed between the alluvial sands and Wollombi Brook (see **Section 2.3.4** for details of the geomorphology of this area).

The area between the arms of the northern drainage line and the intervening floodplain on the eastern side of Charlton Road was also inspected (see **Figure 5.3**). The ridge crest in this area could not be surveyed as it was private land and access was not granted. A large proportion of this ridge crest was, however, surveyed in Survey Area E (see **Section 5.1.5**).

Parts of Area B were previously surveyed by Dyall (1981), Brayshaw (1988, 1991) and Heffernan and Klaver (1997) (refer to **Figure 5.1**). Several of the sites they previously recorded (B71, Saxonvale B, Bulga 7, G3, G4, G5, G6, G7, G8, G9, G10 and G11) were located and their present extent and condition recorded. The survey area commenced to the west of the area previously surveyed by Umwelt (2001) as part of the Beltana project.

5.3.2.3 Area C

The transects in Area C were targeted in the locations specified for coal conveyors, access roads and haul roads associated with transporting coal from the underground mine to the Bulga CHPP. The coal conveyor routes and road routes were chosen by BCM so that they would not impact the four archaeological conservation zones along Loders Creek, or the known sites along Loders Creek. In general, the routes traversed areas that were already highly disturbed by the construction of the Loders Creek diversion, the construction of the current haul road from the open cut to the CHPP, the construction of bunds and various dams, water diversion channels, roads, powerline easements etc (**Figure 5.4**).

In general the transects crossed undulating hilly country. One transect began in close proximity to Loders Creek in an area where sites were not previously recorded. Two transects crossed a tributary of Loders Creek and a tributary of Nine Mile Creek in areas where sites were not previously recorded. These latter transects were alternative routes for the same coal conveyor and followed the heavily disturbed route of the current haul road (one to the north and one to the south). One transect intersected the Loders Creek diversion.

Various sections of Area C had been subject to survey by Brayshaw 1988 and 1991, Koettig 1991 and ERM 1999 (**Figure 5.1**).

5.3.2.4 Area D

Area D was located in Commonwealth land (the “Vere”) (**Figure 5.5**). Parts of the survey area will be affected by minor subsidence (up to approximately 2 metres) from the removal of the Blakefield seam. Although subsidence impacts will be minimal, surveys were undertaken to enable the Aboriginal community to assess the cultural heritage significance of the area to be undermined, whilst also assessing the possible effects of subsidence on the known sites and any newly located sites, especially rockshelters. Rockshelters were targeted as these may be adversely impacted by subsidence. The survey area was extended outside the area to be undermined to provide the Aboriginal community with the opportunity to assess the cultural heritage value, as requested by Environment Australia, and to visit the previously recorded rockshelter sites (ERM 2000).

In general, the transects surveyed followed around the midslope/lower slope boundary which was often demarcated by the border between the cleared and grazed land and the steeper uncleared midslopes. Wherever possible roads were followed as these provided higher ground surface visibility than the heavily vegetated slopes. As there were ten people present for all of the surveys in Area D, the group was split into people walking below the road, on the road and in the bush above the road. Those people walking above the road informed those walking below of any rockshelters they observed and these were inspected for their suitability for occupation and any evidence of occupation. It should be noted, however, that the vegetation on the mid and upper slopes is very thick and it is possible that rockshelters went unobserved. The rockshelters in this area previously recorded by ERM (2000) were located and their current state of conservation noted.

Parts of this area had previously been surveyed by ERM (2000) and Dyall (1981) (see **Figure 5.1**) and attempts were made to locate and record the condition and extent of some of these sites.

5.3.2.5 Area E

Area E encompasses the ridge crest and associated upper slopes on the western fall (down to Wollombi Brook) of the Fordwich Sill (**Figure 5.6**). This area will be affected by subsidence following the removal of the various long wall panels. Due to the steepness of this area it is unlikely that it will be necessary to undertake remediation works along the local drainages. The majority of the western fall of Area E was private land for which permission to survey was not granted. Therefore, the survey encompassed the ridge crest within those areas owned by BJV and where permission had been obtained for survey. It also encompassed a transect from the ridge crest to the midslope within land owned by BJV. This transect provided coverage of an area typical of the western fall of the ridge.

Part of this area had been subject to earlier survey by Umwelt (2001) and the ridgeline is mentioned in most reports as a possible source of basalt for axe manufacture. Therefore, another aim of this survey was to locate a previously recorded site (BMU13) and to investigate the nature of the rock outcropping along the ridge to gauge its suitability for the manufacture of axes (see **Figure 5.1**).

5.3.3 Effective Coverage

Table 5.1 indicates the effective coverage for the landform units surveyed for this project. Details of the effective coverage per transect is provided in Table 23 in **Appendix C**.

Table 5.1 - Effective Coverage of Landform Units

Landform Unit	Area Surveyed (m^2)	Total Area of exposure for each landform unit (m^2)	Total % of exposure for each landform unit	Area for detection on the exposure (exposed area x % of visibility)	% of effective coverage for each landform unit (area of detection/total landform unit)
Ridge Crest	307,000	214,250	70%	12,099.9	4%
Spur Crest	429,250	23,020	5%	5,663	1%
Slopes (lower, mid and upper)	1,923,500	1,214,030.5	63%	333,533.8	17%
Drainage lines and associated flats	529,250	361,385	68%	58,111	11%
Total	**3,189,000**	**1,812,686**	**57%**	**409,408**	**13%**

Table 5.1 indicates an overall effective coverage of 13 per cent for the areas surveyed, which was significantly greater than the effective coverage usually achieved for surveys in the Hunter Valley due to the drought conditions at the time of the survey. From the table it can be seen that the flats associated with the drainage lines and slopes had relatively good visibility due in most part to the prolonged drought at the time of the survey. The spur and ridge crests had poorer visibility due to a greater cover of pastoral grasses.

5.4 RESULTS OF THE SURVEY

This section of the report presents the results of the survey. The full survey recording forms have been included in **Appendix C** along with summaries of the important aspects of the various landform elements surveyed and the sites located along each transect. Full details of the sites recorded are included in **Appendix F**.

5.4.1 Area A

5.4.1.1 Aboriginal Cultural Heritage Values of the Landscape

Aboriginal resources recorded in the survey area were common rush and Typha in the drainage lines, nardoo and water ribbons in still pools in the drainage lines and in dams and grey box on the slopes (see **Table 2.3** for a list of economic plant species and their uses). Quartzite, silicified sandstone and quartz conglomerate pebbles suitable for use as hammerstones, mullers and for knapping, were common on the ground surface. Despite a prolonged drought water was still present in deep pools in the drainage lines.

5.4.1.2 Aboriginal Sites

A total of nine sites were located in Area A (BCO1 – BCO9 on **Figure 5.2**). These consisted of three artefact scatters and six isolated finds. The three artefact scatters and two isolated finds were located on drainage lines of Wollombi Brook (BCO1 – BCO5), one isolated find was located on the midslope (BCO6), two on the lower slope (BCO7 – BCO8) and one on the upper slope (BCO9).

Site BCO1 is a large artefact scatter located approximately 1000 metres upstream of Site BCO3. This site contained the largest artefact scatter recorded on the middle reaches of the Wollombi Brook tributary system within the project area. It was of interest to note that although there was severe and extensive erosion (scouring, rilling, gullying, bank collapse) and disturbance (ripping of tops of banks for tree planting) in the intervening area between BCO1 and BCO3 only three artefacts (BCO2) were located between the two sites. Thus it can be stated with some certainty that the two areas represent two separate Aboriginal camp sites, though it cannot at present be known how these are related chronologically.

An area of alluvial/colluvial deposition was observed at the confluence of two drainage lines in BCO3 (**Figure 5.2**). Large numbers of artefacts were recorded in exposures along the banks of the two drainage lines and along an unformed road that runs between the two drainages in this area. The distribution of artefacts along the road suggests that artefacts will be found in a subsurface context in this area up to 100 metres back from the present banks of both drainages.

The distribution of artefacts within BCO3 tended towards the major concentrations being located on the higher side of the tributary rather than the regularly inundated side. This result may be related to degrees of exposure, as generally the high side of the tributaries (where the footslope came down to the watercourse) exhibited scouring over broad areas while on the lower floodplain areas bank collapse resulted in vertical faces with limited horizontal visibility.

5.4.1.3 Saxonvale Grinding Groove Survey

On 20 March 2003 an attempt was made to locate the Saxonvale grinding groove site in the southeast of Area A. The site was initially recorded by Dyall (1981) as two grooves on a sandstone outcrop in the base of an ephemeral tributary of Wollombi Brook. Using the map supplied by Dyall in his report, an area of creekline extending 250 metres upstream and downstream of the site location indicated by Dyall was surveyed. An area of up to 50 metres back from the channel of the drainage was also inspected. It was observed that the sandstone only outcropped in the creekline over a very limited area (approximately 300 metres). Upstream and downstream of this area, the outcrops were of a very coarse conglomerate unsuitable for grinding. Thus, the area in which the site could be located was defined as within the boundaries of the outcropping sandstone.

During the survey, all sandstone outcrops were inspected within the drainage channel and 50 metres back from the channel. The channel of the tributary had undergone substantial erosion since the time of Dyall's (1981) survey and was entrenched for over a metre in several areas. The channel was noted to have carried a substantial bedload of conglomerate cobbles and coarse sediment derived from a quarry located several hundred metres upstream. In an effort to control erosion and sediment, a dam was constructed approximately 100 metres upstream of where the grinding groove site was indicated on Dyall's map.

The grinding groove site was not located during the survey. It is concluded that the grooves have either been worn away by the increased sediment load in the drainage channel, or that they are within the area now covered by the dam. During the survey for the grinding grooves it was noted that subsidence in this area, from the removal of the Whybrow seam, had caused minor cracking in the sandstone bedrock. The removal of the lower Blakefield seam is unlikely to crack the grinding groove site, if it is still located in this area.

5.4.2 Area B

5.4.2.1 Aboriginal Cultural Heritage Values of the Landscape

Aboriginal resources recorded in the survey area were common reed, common rush, sedges and Typha in the drainage lines. Kangaroo grass, mistletoe and grey box were present on the slopes. Quartzite, silicified sandstone and quartz conglomerate pebbles suitable for use as hammerstones, mullers and for knapping, were common on the ground surface. Despite a prolonged drought water was still present in deep pools in the drainage lines.

5.4.2.2 Aboriginal Sites

A total of six sites were located in Area B (BCO10 – BCO15 on **Figure 5.3**). These consisted of five artefact scatters and one isolated find. The two artefact scatters and one isolated find were located on drainage lines of Wollombi Brook (BCO10 – BCO12), one artefact scatter was located on the upper slope (BCO13), one on a spur crest (BCO14) and one on the lower slope (BCO15).

The BCO10 artefact scatter was extensive (in terms of surface artefact distribution and PAD) and encompassed four previously recorded smaller artefact scatters of limited extent (G6, G7 and G8 recorded by Heffernan and Klaver in 1997 and Bulga 7 recorded by Brayshaw in 1991) and included them into a large scatter encompassing three drainage lines of Wollombi Brook and areas of between 20 and 200 metres in width back from the channels of the three drainages (**Figure 5.3**). The drought conditions during the survey provided improved ground surface visibility over that available during previous surveys, allowing for observations of the continuity of the artefact scatters. Three areas of PAD deposit were recorded in BCO10 (see **Appendix F** for full details). An area of extremely high artefact density was located at the western end of the northern drainage line (see **Figure 5.3**). This section of the site contained edge ground axes, mullers in addition to more than 500 flakes, broken flakes, retouched flakes and cores. It was noted that the artefact assemblage from the northern drainage line differed in content to that recorded on a drainage line that flowed into it from the southwest (see **Appendix F** and **Section 5.7.2** for details).

Similarly to BCO3, the distribution of artefacts within BCO10 tended towards the major concentrations being located on the higher side of the drainage line rather than the regularly inundated side. This result was thought to be related to degrees of exposure, as generally the high side of the drainage lines (where the footslope came down to the watercourse) exhibited scouring over broad areas while on the lower floodplain areas bank collapse resulted in vertical faces with limited horizontal visibility.

BCO13, BCO14 and BCO15 were located on the western fall of a ridge that runs sub parallel to Wollombi Brook. The location of artefacts in this area of relatively steep gradient is unusual and supports the proposed model that highlights the importance of Wollombi Brook to the Aboriginal people that utilised this area.

5.4.3 Area C

5.4.3.1 Aboriginal Cultural Heritage Values of the Landscape

Aboriginal resources recorded in the survey area were common rush in the drainage lines and tea-tree, mat rush, kurrajongs, grey box and kangaroo grass on the slopes. Quartzite, silicified sandstone and quartz conglomerate pebbles suitable for use as hammerstones, mullers and for knapping, were common on the ground surface. Despite a prolonged drought water was still present in deep pools in the Nine Mile Creek and its tributary.

5.4.3.2 Aboriginal Sites

A total of 11 sites were located in Area C (BCO16 – BCO26 on **Figure 5.4**). These consisted of nine small artefact scatters and two isolated finds. Two artefact scatters (BCO16 and BCO22) were located on the minor tributary of Loders Creek, one artefact scatter was located on the southern bank of Nine Mile Creek (BCO23) and one artefact scatter was located on the tributary of Nine Mile Creek (BCO19). The remaining sites were located on the lower slope (BCO20 and BCO21), midslope (BCO17, BCO18, BCO24) and the upper slope (BCO25, BCO26). All of the sites were located in extremely disturbed areas associated with the current haul road and other infrastructure related to open cut mining activities.

5.4.4 Area D

5.4.4.1 Aboriginal Cultural Heritage Values of the Landscape

The area proved extremely rich in edible and medicinal plant resources including kurrajong, clematis, fig, mat rush, mistletoe, bracken fern, tea-tree, wombat berry vine, sour bush, five corners, geebung, native cherry, kangaroo grass and wonga vine on the slopes. Typha was recorded in one dam. Quartzite, silicified sandstone and quartz conglomerate pebbles suitable for use as hammerstones, mullers and for knapping, were common on the ground surface. There was no water observed in any of the drainages.

5.4.4.2 Aboriginal Sites

Three new sites and three previously recorded sites were located during the survey. The new sites (BCO27 – BCO29 on **Figure 5.5**) consisted of an isolated find (BCO27) and two small artefact scatters (BCO28, BCO29). Two rockshelters (SBU28, SBU29) and one artefact scatter (SBU5) previously recorded by ERM (2000) were also located. Several other rockshelters were inspected for evidence of Aboriginal occupation. These rockshelters were located at the top of steep slopes, were very narrow, had floors that sloped to the outside and only very shallow deposits. No evidence of occupation was observed in these rockshelters. The rockshelters located by ERM (2001) were very different in their nature. They were large boulders that had rolled down the slope and come to rest. Subsequently an overhang has formed by cavernous weathering of the conglomerate boulder. This weathering has probably been advanced by use of the shelter by animals and humans (evidence of stored firewood in the rockshelter sites show that they are probably still in use). Throughout the surveys these were the only shelters of this nature observed and they appear to be rare. The majority of the rockshelters in the area are formed within the clifflines and are unsuitable for habitation.

Due to the thickness of the vegetation on the steeper slopes it is possible that further rockshelters are present in the area that were not observed, however, if they do exist, it seems unlikely that the majority would be suitable for habitation. The rockshelters that are suitable for habitation seem to be those formed by boulders coming to rest lower down the slope. This type of rockshelter is not likely to be cracked by subsidence, as it is not part of the bedrock; however, there is potential for loose boulders to move when undermined.

5.4.5 Area E

5.4.5.1 Aboriginal Cultural Heritage Values of the Landscape

The area had been heavily cleared leaving a few isolated grey box as the only Aboriginal plant resource located. The teschenite that outcrops along the ridge crest is unsuitable for knapping or grinding. The ridge does, however, provide expansive views of the Wollombi Brook valley and would have been a valuable outlook. It is unlikely that the ridge has ever been heavily covered with trees due the skeletal soil and rocky nature of the area.

5.4.5.2 Aboriginal Sites

No sites were located during this survey.

5.5 SUMMARY OF THE RESULTS OF THE SURVEY

Table 5.2 presents a summary of the results of the survey. It can be observed that artefact scatter sites were most commonly located along the major drainages within all the survey areas, whilst isolated finds were more often located on the slopes. In relation to Aboriginal resources, the relatively uncleared area of the “Vere” (Area D) was found to be the most abundant in Aboriginal resources (plant and stone), followed by the lower reaches of the northern drainage of Wollombi Brook (Area B), where billabongs in meander cut-offs and reliable water holes would have provided aquatic plant foods. In terms of calorific intake the floodplain areas with their billabongs and standing pools of water in the channel of the northern drainage would have provided staple carbohydrates, whilst the “Vere” area would have provided seasonal fruits and berries more valuable for their vitamins than as a staple part of the diet. The “Vere” would also have provided medicinal plants not available in the lower lying country of differing geology. Thus both areas would have been regularly exploited by Aboriginal people in the area, however, the archaeological signature is quite different, as hypothesised in the predictive model presented in **Section 4** and as will be shown by the artefact analysis (**Section 5.6**). These results support the interpretation of landscape use presented in **Section 4**.

The surveys located 29 previously unrecorded (or partially unrecorded) sites including 10 isolated artefacts and 19 artefact scatters. In general, visibility was excellent along all of the watercourses surveyed and variable on the slopes, ranging from 5 to 60 per cent. The majority of the larger and more complex sites were located along the drainage lines within the areas surveyed whilst isolated finds were more common on the slopes and spurs and on the upper reaches of diffuse drainage lines. Artefact scatters on tributaries of Wollombi Brook tended to become denser downstream and closer to Wollombi Brook (**Figures 5.2** and **5.3**). The distribution of artefacts along these drainages also tended towards the major concentrations being located on the higher side of the drainage rather than the regularly inundated side. This result is thought to be related to degrees of exposure, as generally the high side of the tributaries (where the footslope comes down to the watercourse) exhibited scouring over broad areas while on the lower floodplain areas bank collapse resulted in vertical faces with limited horizontal visibility.

In terms of site complexity, the sites located on the tributaries of Wollombi Brook (BCO1, BCO3 and BCO10) contained the largest number of artefacts, artefact types and raw material types (see **Section 5.6** and **Appendices F** and **G** for details). BCO10, the site closest to Wollombi Brook had the greatest complexity overall, in particular the assemblage from the area of greatest artefact density at the northwestern extent of the site (**Figure 5.3**). Whilst it could be argued that this complexity is directly the result of assemblage size, the survey results indicate that the assemblage size in the majority of cases was not affected by ground surface visibility or erosion, as these factors were fairly constant along most stretches of the major and minor drainage lines surveyed. Thus, in the project area, assemblage size appears to be a realistic reflection of the archaeological evidence.

In Area A, large assemblages were restricted to the Wollombi Brook tributary system that drains the area. These assemblages became more complex in terms of raw material and artefact type closer to Wollombi Brook. Area A had several species of Aboriginal food and useful plants, but they were not as abundant as in Areas B and D.

The sites located in Area C, associated with Nine Mile Creek, a tributary of Nine Mile Creek, and a tributary of Loders Creek, were consistently smaller in assemblage size and areal extent than those located in the Wollombi Brook catchment area. The assemblages also lacked the complexity of those located in Areas A and B. Area C also had many useful plant species, but their abundance was limited in relation to Areas B and D. The saline nature of the standing water in pools in the upper reaches of the drainage lines in Area C may have restricted use of this area to periods after heavy rainfall.

Area E supplies an excellent outlook over the landscape towards Loders Creek, and also the Wollombi Brook valley. No food or medicinal plants were recorded in this area. It is likely, however, that prior to European land clearance, and the incursion of exotic grass species, this area with its different soil type (derived from the weathering of the Fordwich Sill) could have provided useful plant species not available elsewhere in the area.

Table 5.2 - Summary of Results for each Survey Area

Survey Area	Landform Elements	Aboriginal Resources	Sites Located
A	Tributaries of Wollombi Brook and associated flats, lower slopes, midslopes, spur crest	Common rush and Typha in tributaries, nardoo and water ribbons in still pools and dams, grey box on slopes. Water in drainages Conglomerate pebbles	Possibly located Saxonvale A artefact scatter. Due to confusion between NPWS AMG coordinates and Dyall's site map (**see Section 3.4.1**) site was recorded as BCO1 BCO 1, 2 and 3 - artefact scatters on tributaries. BCO 4 and 5 - isolated finds on tributaries BCO 6 - isolated find on midslope BCO7 and 8 - isolated finds lower slope BCO9 - isolated find on upper slope (**Figure 5.2**)
B	Swamp on Wollombi Brook, area of sand dunes, tributaries of Wollombi Brook, floodplain Wollombi Brook and tributaries, footslope, lower slope, midslope, upper slope, spur crests	Common rush, Typha, common reed and sedges in drainages. Kangaroo grass, mistletoe and grey box on slopes. Water in drainages Conglomerate pebbles	G6, G7, G8 and Bulga 7 artefact scatters previously recorded sites now incorporated into larger BCO10 site. BCO10 - artefact scatter stretching along both sides of 3 converging drainages. BCO 11 - artefact scatter on tributary of Wollombi Brook BCO 12 - isolated find on tributary of Wollombi Brook BCO13 - artefact scatter upper slope BCO14 - artefact scatter on spur crest BCO15 - artefact scatter on lower slope (**Figure 5.3**)
C	Southern bank of Nine Mile Creek, lower, mid and upper slopes. Lower slope on northern side of tributary of Loders Creek, midslope and upper slope. Tributaries and floodplains of Nine Mile Creek and adjacent lower mid and upper slopes.	Common rush in drainages, tea tree, mat rush, kurrajong, grey box, kangaroo grass on slopes Water in drainages Conglomerate pebbles	BCO 16 - artefact scatter on northern bank of Loders Ck tributary BCO 17 - artefact scatter on midslope BCO18 - artefact scatter upper midslope BCO19 - artefact scatter on tributary of Nine Mile Creek BCO20 - artefact scatter between haul road and ancillary road—not in-situ BCO21 - isolated find on lower slope BCO22 - artefact scatter around dam on tributary of Loders Creek. BCO23 - artefact scatter on southern bank of Nine Mile Creek BCO24 - artefact scatter on midslope BCO25 - artefact scatter on upper slope BCO26 - isolated find on upper slope (**Figure 5.4**)
D	Spurs and their associated slopes on eastern and western fall of the "Vere". Lower and midslopes of the "Vere" and associated tributaries flowing to Monkey Place Creek and Wollombi Brook.	Kurrajong, clematis, fig, mat rush mistletoe, bracken fern, tea trees, wombat berry vine, sour bush, five corners, geebung, native cherry, kangaroo grass, and Wonga vine on the slopes. Typha in dam. Water in drainages Conglomerate pebbles	BCO27 - isolated find on lower slope BCO28 - artefact scatter on road on either side of tributary of Wollombi Brook. SBU5 - previously recorded artefact scatter (ERM 2000) in erosion scours below a dam SBU28 and 29 - previously recorded rockshelters (ERM 2000) BCO29 - artefact scatter on spur crest (**Figure 5.5**)
E	Ridge crest, saddles, upper and midslopes, diffuse upper drainage lines of Wollombi Brook	Grey box	no sites (**Figure 5.6**)

5.6 ARTEFACT ANALYSIS

The analysis focuses on issues arising from the models and hypotheses about past Aboriginal land use as discussed in **Section 4**. An artefact summary has been provided along with a description of each of the sites in **Appendix F** and the full artefact recording forms have been included in **Appendix G**. Comparisons are made between the results of this analysis and artefact characteristics reported in previous analyses.

5.6.1 Raw Material Type

Table 5.3 indicates that of the 461 artefacts recorded during the surveys, 297 or 64.6 per cent were manufactured from mudstone and 114 or 24.8 per cent were manufactured from silcrete with all other raw materials comprising a minor component of the assemblages. From the details provided in **Appendix F** and **Appendix G** it can be seen that the minor raw materials were generally only present in the larger assemblages. These results are consistent with findings of earlier researchers in the general Bulga area. Of interest is the observation of only one porcellanite artefact. While this is not unexpected, as most researchers have failed to locate porcellanite in sites within the project area, it was predicted on the basis of the porcellanite knapping floor located in BMU19 (Umwelt 2001) (**Figure 5.2**), that further porcellanite artefacts may be located in assemblages along tributaries of Wollombi Brook, however, this was not the case.

Table 5.3 - Raw Material Type

Silcrete	Mudstone	Chert	Volcanic	Petrified Wood	Hornfels	Quartz	Quartzite	Silicified Sandstone	Porcellanite	Indeter-minate	Total
114	297	7	8	2	2	17	10	2	1	1	461
24.8%	**64.6%**	**1.5%**	**1.7%**	**0.4%**	**0.4%**	**3.7%**	**2.2%**	**0.4%**	**0.2%**	**0.2%**	**100%**

Local use of raw materials was noted for quartz, quartzite and silicified sandstone. All of these materials appeared (from their retained cortex) to have been derived from the pebbles available from the local conglomerates. Quartz and quartzite were flaked whilst the silicified sandstone was used for mullers. Quartzite was also used for mullers. One of the axes was manufactured from basalt and the other axe was so highly weathered, patinated and heat affected that its raw material could not be identified. Artefacts from all potentially local raw materials make up 10.7 per cent of the total assemblage.

The vast majority of the flaked material appears to have been sourced as cobbles from the Hunter River. In general the mudstone appears to have been transported to the site as smallish cobbles, often tabular, whilst the silcrete was brought to the site as large flakes taken from cobbles or as chunks of material (still with pebble cortex) for further reduction. This clearly reflects the way in which the raw material is available in the cobble beds of the Hunter River. Mudstone can be collected as small cobbles, however, the silcrete is generally found as small boulders which require reduction at the source. The easiest method of reduction is to either remove large flakes when this is possible, or to smash the small boulder against other boulders in the cobble beds (Wilson 1995-2003: pers. obs.) to provide smaller chunks for transport away from the river.

There was no evidence that the basalt (teschenite) that outcrops along the western ridge (Fordwich Sill) was used for artefact manufacture (**Figure 2.1**). There was no evidence of quarrying along the ridge and no artefacts manufactured from material that resembled the material outcropping on the ridge located in the sites; however, visibility was low during the survey.

5.6.2 Artefact Type

Table 5.4 indicates that of the 461 artefacts recorded, flakes and broken flakes were the most common types, followed by retouched flakes and cores, then flaked pieces. Total artefact type distributions from previous surveys found a smaller proportion of broken flakes, this result is most likely due in large part to differences in recording techniques between archaeologists rather than any reflection of Aboriginal behaviour. Of interest are the lack of quartzite split cobbles and manuports recorded in relatively large numbers by Heffernan and Klaver (1997). Once again this is probably due to recording techniques. As quartzite cobbles were naturally occurring in most areas surveyed they were only recorded as artefacts during this assessment when there was absolutely no doubt that they had been reduced for flake production, in which case they were recorded as cores. Alternatively if they had been used as top grindstones, they were recorded as mullers.

Table 5.4 - Artefact Type All BCO Sites

Flake	Broken Flake	Retouched Flake	Flaked Piece	Core	Axe	Muller	Anvil	Total
178	163	58	23	29	5	3	2	461
38.6%	**35.4%**	**12.6%**	**5.0%**	**6.3%**	**1.1%**	**0.6%**	**0.4%**	**100%**

More informative in relation to human behaviour is the information presented in **Table 5.5** which indicates the percentage of artefact types in those sites with 10 or less artefacts and those sites with more than 20 artefacts (there were no sites with between 11 and 20 artefacts).

Table 5.5 - Artefact Type All BCO Sites/Assemblage Size %

Site Size	Flake	Broken Flake	Retouched Flake	Flaked Piece	Core	Axe	Muller	Anvil
10 artefacts or less	38.8%	23.8%	21.3%	8.8%	7.5%	0%	0%	0%
> 20 artefacts	38.4%	37.6%	10.7%	4.2%	6.5%	1.3%	0.8%	0.5%

It can be noted that those sites with small assemblages (10 or less), while having similar numbers of whole flakes, differed significantly in the percentages of the other artefact types. The rarer artefact types such as axes, anvils and mullers were not present in the smaller assemblages (**Section 4**). As predicted, the smaller assemblages do have a substantial percentage of retouched flakes (double the percentage in larger assemblages) consistent with activities undertaken away from whole family camp sites, such as butchery events or repair/replacement of broken implements. Cores were never located as isolated finds, however, they were more abundant as a percentage of the smaller assemblages than previous studies have indicated.

The cores located in the smaller sites were on the slopes directly adjacent to Wollombi Brook (BCO11, BCO13 and BCO14). One of these sites (BCO11) was on a minor tributary of Wollombi Brook, the other two were in areas of relatively steep gradient (3-5°) and not related to ephemeral watercourses (**Figure 5.3**). Sites BCO13 and BCO14 were only located due to severe erosion and prior earthworks respectively. Otherwise the surrounding area was heavily grassed. It is suggested that these two assemblages are only a small sample of the subsurface assemblage (ie. they are loci within a larger site) and that unlike the slopes and especially the steeper midslopes and upper slopes in other parts of the project area, this particular area in close proximity to Wollombi Brook appears to have an artefact distribution stretching up to 600 metres back from the watercourse. It is not thought that artefact numbers would be high in this area, only that they would be higher than in areas of similar gradient further from such a reliable water source and area of high food resource availability.

The resource richness of the landscape close to the Wollombi meant that Aboriginal people could stay in the area for longer periods of time (relative to other smaller tributaries and diffuse drainage lines), longer periods of residence require strategies for hygiene such as moving around within small areas of the landscape. Thus people may have camped further back from the Brook on occasions and the artefacts they discarded would be expected to be similar to those found adjacent to the Brook.

In relation to retouched artefacts, previous studies along Loders Creek have found that backed blades were located in most, but not all, assemblages, independent of assemblage size. Of the 29 sites recorded during this survey, which covered mostly Wollombi Brook tributaries and Wollombi Brook, only five contained backed artefacts (located as both isolated finds and within large artefact scatters) and there were only nine backed artefacts overall. These consisted of three eloueras (two silcrete and one mudstone all in site BCO10) and six backed points (one silcrete and five mudstone, located in various sites across the area). As anticipated, the location of backed artefacts in assemblages was found to be independent of assemblage size. However, as only five of 29 sites contained backed artefacts, the evidence is not consistent with previous survey results for the Loders Creek area. In the current survey, backed blades are not common to all sites. This may suggest some differences in landscape use between the two areas. However, due to the small number of artefacts analysed, apparent differences may be due to small sample bias.

5.6.3 Retouch Type

Of the 461 artefacts recorded in detail 12.6 per cent (58) were retouched flakes. **Table 5.6** indicates the various types of retouch present in the assemblages and shows how this is related to raw material type. It is noted that as some artefacts exhibit more than one type of retouch, the total does not add up to 58.

Table 5.6 - Retouch Type/Raw Material

Raw Material	Acute Retouch (resharpening)	Steep Retouch (blunting)	Notch	Unifacially Backed Point	Bifacially Backed Point	Elouera	Tranchet Retouch	Used as Core	Total
Silcrete	3	1	1	2	0	2	0	4	**13**
Mudstone	14	10	2	7	1	1	2	8	**45**
Chert	1	0	0	0	0	0	2	0	**3**
Quartz	0	0	0	0	0	0	1	0	**1**
Quartzite	0	0	0	0	0	0	0	1	**1**
Total	**18**	**11**	**3**	**9**	**1**	**3**	**5**	**13**	**63**

These results indicate that mudstone was the raw material most often retouched, that acute retouch of the lateral margin of the flake was the most common form of retouch, that flakes were used as cores, that tranchet retouch was not present for silcrete but present for mudstone, chert and quartz and that unifacial backing (always from the ventral onto the dorsal) was far more common than bifacial backing. Mudstone was preferred for the production of points but silcrete was preferred for the production of eloueras. The largest number of retouched flakes were located in the larger assemblages. Backed artefacts were recorded in BCO1, BCO3, BCO10, BCO15 and BCO27. BCO1, BCO3 and BCO10 were the three largest assemblages and all were located on tributaries of Wollombi Brook. BCO15 was located on the slope directly above Wollombi Brook and contained the fourth largest assemblage (21 artefacts) recorded. BCO27 was an isolated find on the lower slope of the eastern fall of the “Vere” and was not associated with a drainage line. The evidence for retouch provided for the sites recorded during the present survey is consistent with the results from previous surveys.

5.6.4 Knapping Floors, Knapping Methods and Reduction Sequences

5.6.4.1 Knapping Floors

Based mainly on the findings of Koettig (1994) in relation to the Loders Creek sites, where many knapping floors were identified, it was anticipated that knapping floors would be located in the larger assemblages. This was not the case. It is suggested that the evidence of intact knapping floors in the larger sites recorded in this survey has been destroyed by recent disturbance of the eroded and scoured areas of the Wollombi Brook tributary sites (eg. from the impact of cattle). Scuffage by cattle along the creek banks acts to disperse artefactual material once it is on the surface. The dust churned up by the cattle could also be obscuring many of the smaller artefacts. Thus although the survey results show no knapping floors were present during the field survey, it may be possible that a conjoin analysis after collection of the artefacts could demonstrate the former presence of knapping floors no longer evident in the field.

Previous study results also suggested that little patterning would be observed within knapping floors with debris from backed artefact manufacture, used artefacts and knapping debris mixed. As no knapping floors were identified, support for this observation could not be tested.

5.6.4.2 Knapping Methods

The vast majority of the artefacts were produced by freehand percussion. Bipolar reduction was only noted for three artefacts. These were a silcrete flake in BCO1 and two quartz flakes in BCO10. In all three instances bipolar reduction was used to reduce a pebble. The quartz pebbles are available locally, whilst the closest known source of the silcrete pebbles is the Hunter River. Pressure flaking was only in evidence for the backing of artefacts. Only one of the backed points showed clear evidence of having been knapped on site (this point clearly broke during the manufacturing process), however, it should be noted that the artefacts recorded were only samples (all the artefacts that fell along a randomly placed line through the site) and that this may be biasing the results. In addition, the dusty conditions at the time of recording would have prevented the location of the small flakes produced during backing and possibly even the small, broken, partially backed pieces often found in areas where backing has taken place (the smallest artefact recorded was 7 mm in maximum dimension).

5.6.4.3 Reduction Sequences

Koettig’s (1994) analysis of sites at Loders Creek indicated the presence of three sequences of reduction:

- single reduction of a block or a cobble down to a discard core;
- single reduction of a flake brought to the location where it was knapped; and

- multiple reduction sequences when the reduction of the block or cobble results in a core, then flakes from that reduction sequence are used as a core.

As no knapping floors were located and no conjoin analysis was undertaken during the field survey, insufficient data exist to test these findings. Field observations suggest, however, that the most common reduction sequence for mudstone was the reduction of relatively small tabular pebbles by amorphous freehand percussion. Primary, secondary and tertiary reduction was common in the sites. For silcrete it appears that the raw material was transported to the area as relatively large primary flakes or chunks of material. These were then reduced by amorphous freehand percussion and once again, primary, secondary and tertiary reduction was present in the sites. Primary reduction was, however, less evident than for mudstone. Many of the larger flakes of both mudstone and silcrete exhibited further reduction indicating their use as cores, as predicted.

There was little evidence in the sites of a specialised microblade technology. Of the 29 cores recorded (this number excludes the anvil and the muller that were subsequently used as cores as they may bias the sample) a total of five were noted to have been set up for blade production (shown as blade cores on **Figure 5.7**). These cores reflected both the alternating platform method (2) and single platform reduction (3). The remaining 25 cores (shown as cores on **Figure 5.7**) exhibited amorphous flake scars and from one to four rotations.

Figure 5.7 indicates that blade cores fall at the lower end of the range of core volumes, whilst amorphously flaked cores are highly variable in their volume, overlapping at the smaller end with blade cores. This evidence suggests that the majority of cores transported into the sites are subject to amorphous reduction. A small percentage of these (in this case 17 per cent) may start out their life as amorphous cores and eventually when reduced to a small size (the blade cores averaged 35 mm maximum dimension, amorphous cores averaged 50 mm maximum dimension) some will be set up as blade cores. As a general rule, these are the cores of higher quality knapping material. All of the blade cores came from the two largest sites, BCO3 and BC010, both on unnamed tributaries of Wollombi Brook.

Further evidence that the majority of knapping in the sites was related to amorphous reduction is reflected by the shape and size of the flakes and the flake scars on the dorsal surface of the flakes. **Figure 5.8** indicates flake length plotted against flake width (ie. a measure of flake elongation for all whole flakes) with flakes that are more than twice as long as they are wide having the possibility of falling into the blade category.

The figure indicates that of the 158 whole flakes measured, only 17 (10.75 per cent) were elongated and could possibly fall into the blade category. Of these 17, only one artefact was actually recorded as a blade (ie. twice as long as wide, with parallel sides and two parallel arises) the remainder were simply flakes of amorphous shape. There were also four partial blades recorded. Once again these were in BCO3 and BCO10.

The data were also examined to see how many of the flakes exhibited blade scars on their dorsal surface. A total of six flakes (two silcrete and four mudstone) and two broken flakes (one silcrete, one mudstone) were found to have blade scars on their dorsal surface. Three of the whole flakes were core rejuvenation flakes, which clearly indicated the removal of aberrant blade scars (hinged). All three of these were in BCO1. The remainder of the flakes/broken flakes were in BCO3 and BCO10.

These data suggest that in the larger sites some blade reduction was taking place but that this was only a minor component of a knapping technology that focused on the production of amorphous flakes for multiple uses. The evidence from previous surveys (**Section 3**) that the alternating platform strategy would be the predominant reduction strategy was not supported by the sample of artefacts recorded during the survey.

From her analysis of the assemblages from Loders Creek, Koettig also predicted that flakes for backing would be selected from all stages of reduction and from all reduction sequences. Too few backed artefacts were located in the current assessment to test this hypothesis.

5.6.5 Platform Faceting

Based on the results of Koettig's (1994) analysis of excavated assemblages from Loders Creek it was predicted that almost all the assemblages and individual reductions would be characterised by faceted platforms. The sample of artefacts recorded did not support this prediction. Only 11 flakes and proximal portions of flakes exhibited platform faceting. Ten of these were mudstone and one was silcrete. Only two of the flakes with faceted platforms were retouched (one to form a notch and one unifacially backed). The length of the flakes was highly variable from 41 mm maximum percussion length to 9 mm maximum percussion length. On the basis of the evidence from the recorded assemblages, it can be suggested that faceted platforms are more likely to be associated with mudstone than silcrete and that they do not (at least in the Wollombi Brook area) appear to characterise the reduction sequences taking place in the sites. This may indicate a differential use of the landscape in the Loders Creek and Wollombi Brook areas, however, due to the small sample size recorded during the present survey, such a conclusion must await the analysis of a larger assemblage from the Wollombi Brook area.

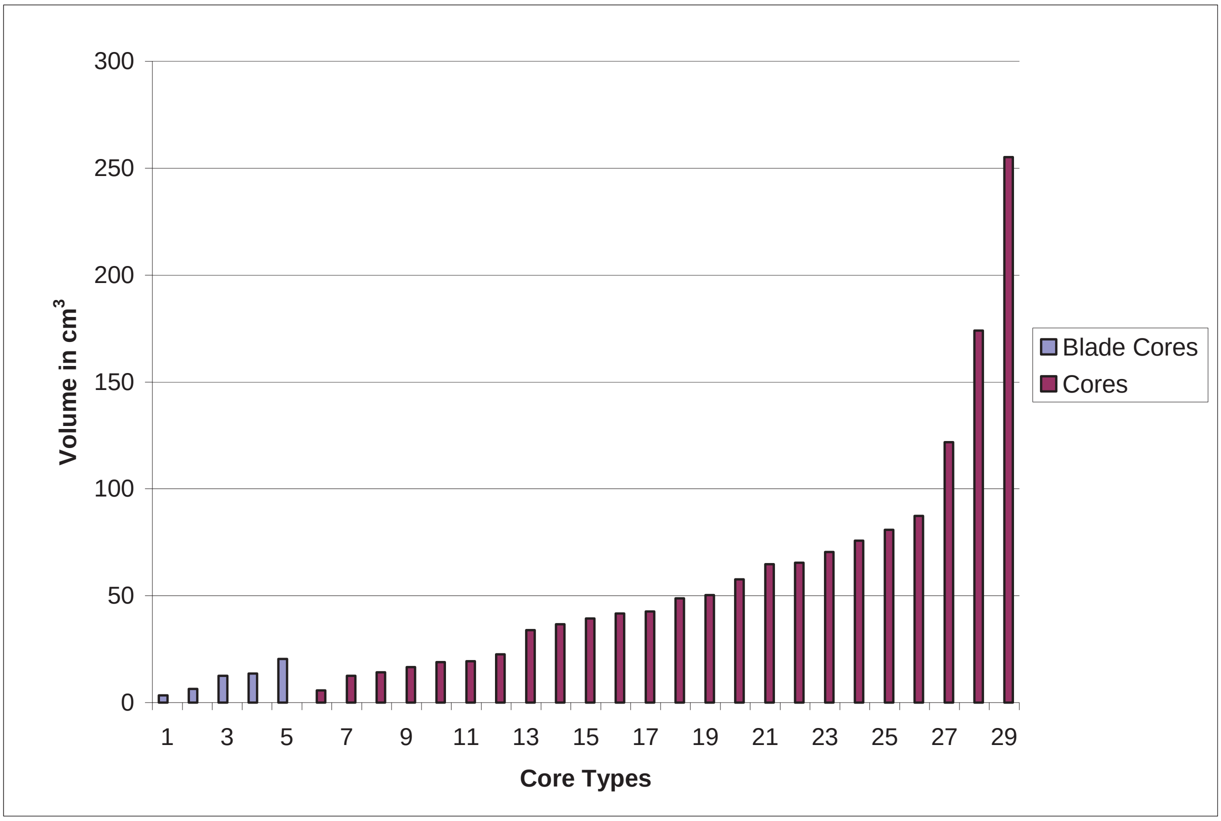


FIGURE 5.7
Core Volumes All BCO Sites

Not to Scale | Ref No.:R03_V1/1468_266.doc

Umwelt (Australia) Pty Limited

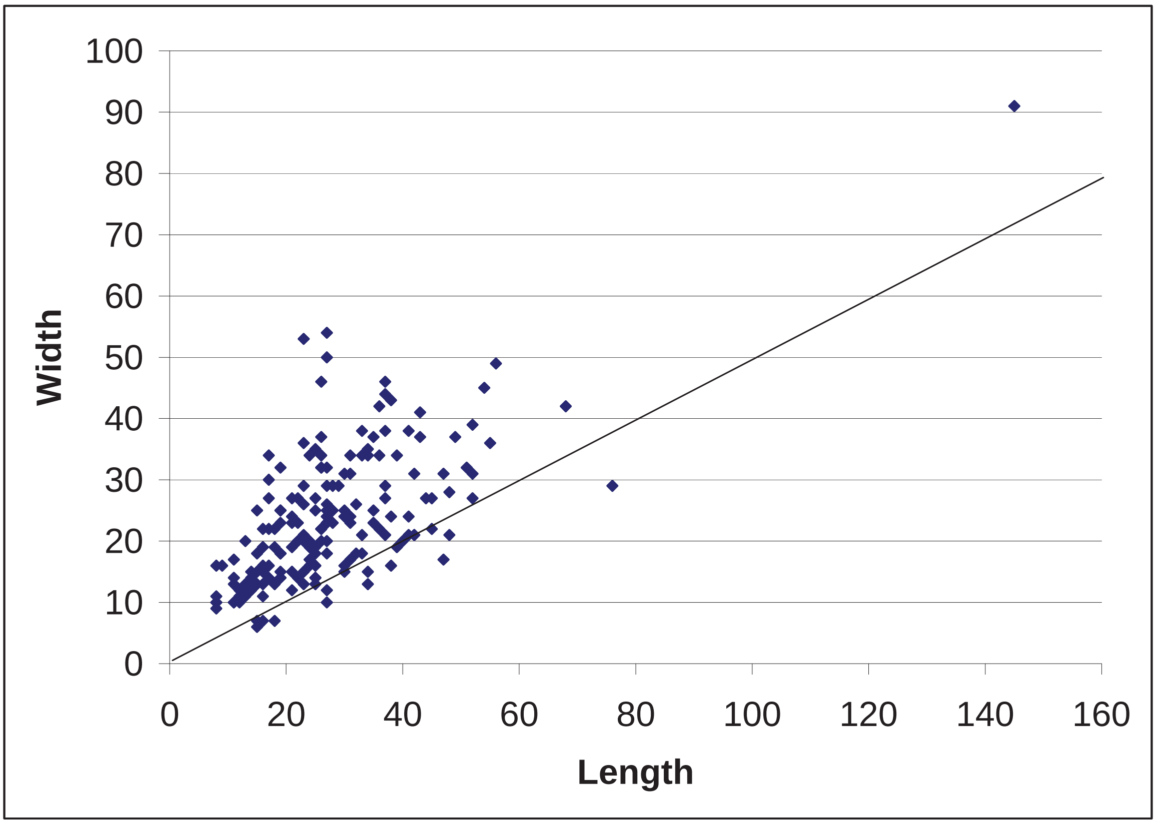


FIGURE 5.8
Flake length/width (elongation)

Not to Scale | Ref No.:R03_V1/1468_267.doc

Umwelt (Australia) Pty Limited

5.6.6 Artefact Size

Table 5.7 presents statistics related to artefact size. The table provides information related to whole flakes and cores for silcrete and mudstone. The other raw material types had too few artefacts for comparisons to be statistically meaningful. For this exercise the volume of the artefacts in centimetres cubed (cm^3) is used to equate size ([length x width x thickness]/1000).

Table 5.7 - Artefact Size

	Silcrete Flake Volume (cm^3)	Mudstone Flake Volume (cm^3)	Silcrete Core Volume (cm^3)	Mudstone Core Volume (cm^3)
Mean	21	6.2	106	23.6
Standard Deviation	69.9	7.8	102.3	15.5
Range	488	39.6	377.7	47.2
Minimum	0.1	0.1	3.4	9.9
Maximum	488	39.7	381.0	57.1
Count	48	109	15	10

Table 5.7 indicates that silcrete is generally subject to less reduction than mudstone when it is discarded in the sites, however, and that silcrete is represented by artefacts that vary more widely in their size than mudstone. As both raw materials had been sourced from cobbles (evident by cobble cortex on the majority of the artefacts) and as the Hunter River is the most likely source of both of these raw material types, raw material availability should be a constant, indicating that the greater reduction of the mudstone is the direct result of human behaviour. This suggests that as core size decreases mudstone is preferentially targeted over silcrete. This result most likely relates to the nature of the mudstone which requires less force for the removal of flakes (Wilson 2002: pers. obs.) and is therefore, better suited for ongoing reduction as size decreases.

5.7 VARIATIONS WITHIN AND BETWEEN BCO SITES

Three extensive sites with large artefact assemblages (BCO1, BCO3 and BCO10) were recorded during the survey. During the recording it was noted that the artefact assemblages of BCO1 and BCO3 differed even though they were located on the same drainage channel and were within sight of each other. The two sites were recorded as individual sites as they were separated by 800 metres where visibility was excellent and erosion advanced, yet no artefacts were visible. Likewise, the BCO10 site was found to extend along three contiguous drainage lines. Similarly it appears from field observations that, even though the artefact distribution appeared continuous, there were some differences between assemblage compositions within areas of the site. Assemblages were recorded in three areas for comparison, once again to indicate if differential use of the landscape by Aboriginal people could be ascertained. This section considers the results of the inter and intra-site comparisons for these three sites.

5.7.1 BCO1 and BCO3

Tables 5.8 and **5.9** detail the raw material and artefact type of each of the artefacts from the random samples recorded in BCO1 and BCO3 (**Figure 5.3**). Although the number of artefacts recorded is similar, BCO3 contained a more complex assemblage in terms of artefact type and raw material type. Both assemblages were dominated by mudstone, however, that dominance was far more pronounced in BCO3. The minor raw material classes were different between the two sites. Within the retouched flake category tranchet retouch was present in BCO1 and absent in BCO3. Platform faceting was more common in BCO3, while cortical platforms were far more common in BCO1.

Table 5.8 - BCO1 Artefact Type/Raw Material Type

Raw Material	Flake	Broken Flake	Retouched Flake	Flaked Piece	Core	Total
Silcrete	9	12	2	0	1	**24**
Mudstone	19	34	3	1	2	**59**
Chert	1	0	2	0	0	**3**
Quartz	2	0	0	0	0	**2**
Basalt	2	1	0	0	0	**3**
Total	**33**	**47**	**7**	**1**	**3**	**91**

A total of 8.8 per cent of this sample comprised raw materials that could be sourced locally.

Table 5.9 - BCO3 Artefact Type/Raw Material Type

Raw Material	Flake	Broken Flake	Retouched Flake	Flaked Piece	Core	Axe	Total
Silcrete	6	4	3	1	4	0	**18**
Mudstone	35	27	6	2	2	0	**72**
Volcanic	0	0	0	0	0	3	**3**
Quartz	1	1	0	0	0	0	**2**
Quartzite	1	0	0	0	0	0	**1**
Porcellanite	0	1	0	0	0	0	**1**
Total	**43**	**33**	**9**	**3**	**6**	**3**	**97**

A total of 7.2 per cent of this assemblage comprised raw materials that could be sourced locally.

Table 5.10 indicates the mean flake and core volumes for the mudstone and silcrete flakes and cores in the two sites. The table indicates that the artefacts discarded in BCO1 are on average more than twice the size of the artefacts discarded in BCO3. This result has not been biased by outliers (a few large artefacts).

Table 5.10 - Artefact Volume

Site	Silcrete Mean Flake Volume (cm^3)	Mudstone Mean Flake Volume (cm^3)	Silcrete Mean Core Volume (cm^3)	Mudstone Mean Core Volume (cm^3)
BCO1	14.09	8.41	102.26	40.32
BCO3	6.09	4.23	47.37	16.48

5.7.2 BCO10

During the survey (Area B) a random sample of artefacts was recorded in three areas within the BCO10 site. The areas where the artefacts were recorded are shown in **Figure 5.3**. **Tables 5.11, 5.12** and **5.13** present the details of the artefact type and raw material type for each of the three assemblages. It is recognised that the small number of artefacts recorded in the sites may be biasing the results, however, the information is presented to indicate that that there are possibly differences that should be investigated further should the sites be considered for destruction.

Table 5.11 - BCO10 Northern Drainage Channel/Area of Highest Artefact Concentration West of Charlton Road

Raw Material	Flake	Broken Flake	Retouched Flake	Flaked Piece	Core	Axe	Muller	Total
Silcrete	18	12	2	2	2	0	0	**36**
Mudstone	13	21	8	4	1	0	0	**47**
Chert	1	1	0	0	0	0	0	**2**
Volcanic	0	0	0	0	0	1	0	**1**
Quartz	3	2	0	1	2	0	0	**8**
Quartzite	2	2	0	0	0	0	0	**4**
Silicified Sandstone	0	0	0	0	0	0	2	**2**
Total	**37**	**38**	**10**	**7**	**5**	**1**	**2**	**100**

Seventeen per cent of this sample comprised raw materials that could be locally sourced.

Table 5.12 - BCO10 Northern Drainage Channel and Floodplain East of Charlton Road

Raw Material	Flake	Broken Flake	Retouched Flake	Flaked Piece	Core	Axe	Muller	Anvil	Total
Silcrete	4	0	0	0	3	0	0	0	**7**
Mudstone	9	3	4	1	2	0	0	0	**19**
Volcanic	0	0	0	0	0	1	0	1	**2**
Hornfels	0	0	0	0	1	0	0	1	**2**
Petrified Wood	1	0	0	0	0	0	0	0	**1**

Table 5.12 - BCO10 Northern Drainage Channel and Floodplain East of Charlton Road (cont)

Raw Material	Flake	Broken Flake	Retouched Flake	Flaked Piece	Core	Axe	Muller	Anvil	Total
Quartz	1	0	0	0	0	0	0	0	**1**
Silicified Sandstone	0	0	0	0	1	0	1	0	**2**
Total	**15**	**3**	**4**	**1**	**7**	**1**	**1**	**2**	**34**

Twenty three per cent of this sample comprised raw materials that could be locally sourced, but this result may be biased by the use of these materials as muller and anvils.

Table 5.13 - Southwestern Arm of Northern Drainage Channel West of Charlton Road

Raw Material	Flake	Broken Flake	Retouched Flake	Flaked Piece	Core	Total
Silcrete	0	2	2	1	1	**6**
Mudstone	11	11	5	0	1	**28**
Chert	1	2	0	1	0	**4**
Petrified Wood	1	0	0	0	0	**1**
Quartz	0	0	0	0	1	**1**
Total	**13**	**15**	**7**	**2**	**3**	**40**

Fifteen per cent of this sample comprises raw materials that can be locally sourced.

Comparison of the three assemblages indicates that the assemblage from the northern channel east of Charlton Road and the assemblage from the densest concentration of artefacts from the northern drainage channel west of Charlton Road are far more complex in terms of artefact type and raw material type than the assemblage recorded from the southwestern arm of the northern drainage channel (**Figure 5.3**). The inclusion in the first two assemblages of mullers, axes and anvils suggests that these areas were longer term camps sites and that Aboriginal people left implements like axes and mullers at the site for future use. This was not evident in the assemblage on the southwestern arm of the drainage (either from the recorded assemblage or from artefacts observed but not recorded).

The tables also indicate that mudstone is the dominant raw material discarded in the southwestern arm and the drainage to the east of Charlton Road, however, it is almost co-dominant with silcrete in the assemblage from the western end of the northern drainage channel. Field observations suggest that this result is not biased by the size of the assemblages recorded and that silcrete is really a much larger component of the northern channel assemblage to the west of Charlton Road in the area of greatest artefact density. In all three samples, the proportion of artefacts using locally sourced raw materials is higher than the results of surveys across the whole project area had indicated. In relation to the retouched flake category, the western drainage assemblage contained several eloueras (three were recorded) and evidence for tranchet retouch, neither of which was recorded in the other assemblages.

Table 5.14 - Artefact Volume

Section of Site	Silcrete Mean Flake Volume (cm^3)	Mudstone Mean Flake Volume (cm^3)	Silcrete Mean Core Volume (cm^3)	Mudstone Mean Core Volume (cm^3)
Northern drainage west of Charlton Road	10.1	7.5	129.3	9.9
Northern drainage east of Charlton Road	137.8	9.9	114.6	39.5
Southwestern arm of northern drainage	0	4.5	30.4	13.6

Table 5.14 indicates the mean size of the whole mudstone and silcrete flakes and cores within the three assemblages. The assemblage from the southwestern arm of the northern drainage line is generally further reduced than the other two assemblages. It was noted during the survey that there were many very large silcrete flakes and cores in the assemblages from the northern drainage, but not in the assemblage from the southwestern drainage line. It can be suggested that these large silcrete flakes and cores reflect raw material provisioning within often used camp sites. This observation will, of course, require further testing by analysis of much larger assemblages from the area.

The comparison of the three assemblages leads to the preliminary suggestion that activities along the southwestern drainage may have been different to those along the northern drainage to the west of Charlton Road and the northern drainage and associated floodplain to the east of Charlton Road (the latter two being more similar to each other in nature). This difference should be investigated further if relevant sections of the BCO10 site are to be damaged or destroyed by remediation works/drainage works etc. associated with the project.

6.0 EVALUATION AND REVIEW OF ABORIGINAL CULTURAL HERITAGE VALUES AND INTERPRETED OCCUPATION STRATEGIES

6.1 REVIEW OF PREDICTIVE STATEMENTS

6.1.1 Assemblage Composition

Sections 3.5 and **4.3** presented predictive statements in relation to the likely composition of assemblages located (or relocated) during the survey. The results of artefact analysis support revision of qualification of seven of these predictive statements.

In **Section 4.3** it was suggested that cores would not be expected in assemblages located in areas that were not in close proximity (>100 metres) to a watercourse. Based on the findings of this project this should be revised to:

- cores may occur in assemblages located more than 100 metres from a watercourse where the area of the site is near a permanent water source (like Wollombi Brook) in which case cores can be expected up to 600 metres from the watercourse.

In **Section 4.3** it was suggested that porcellanite would be restricted to tributaries of Wollombi Brook and that it would only ever form a minor component of the assemblages. As only one porcellanite artefact was located during the survey (albeit on a tributary of Wollombi Brook) it suggests a more appropriate description of the assemblages is that:

- porcellanite is a rare raw material in the project area and can only be expected in extremely low numbers in sites located along tributaries of Wollombi Brook.

In **Section 4.3** it was suggested from that flakes and flaked pieces would be the dominant artefact types located in the assemblages. Based on the findings of this project this should be revised to:

- flakes and broken flakes are the dominant artefact types located in assemblages from the Wollombi Brook catchment within the project area.

In **Section 4.3** it was suggested that backed blades could be expected in the majority of the sites irrespective of assemblage size. This was not supported by the assemblages from the present survey. No backed blades were located, only backed points, and a more appropriate description for assemblages within the project area would be:

- in the Wollombi Brook catchment area the backed artefact category is dominated by backed points. These will be predominantly manufactured from mudstone and most often located in the larger assemblages, though occasionally they may be found as isolated finds; and

- eloueras are predominantly be manufactured from silcrete and will be found in larger assemblages.

In **Section 4.3** it was suggested that knapping floors could be expected in the larger activity loci. This was not supported by the assemblages and should be revised as follows:

- knapping floors can be expected in larger activity loci, however, in heavily disturbed areas these may not be apparent during surface survey and may only become apparent when artefacts are collected and conjoin analysis can be undertaken.

In **Section 4.3** it was predicted that the alternating platform strategy would be dominant. This was not supported by the assemblages and a more accurate description is:

- in assemblages from sites along Loders Creek the alternating platform strategy is dominant, whilst assemblages from sites along tributaries of Wollombi Brook are dominated by multi-directional platform core reduction strategies.

In **Section 4.3** it was noted that platform faceting would characterise almost all assemblages and individual reductions. This was not supported by the assemblages and the revised description is:

- in assemblages from sites along Loders Creek platform faceting characterises almost all assemblages and individual reductions, whilst assemblages from sites along tributaries of Wollombi Brook are characterised by multi-directional platform core reduction strategies with rare platform faceting.

6.1.2 Comparisons with Previously Recorded Assemblages from Loders and Nine Mile Creeks

The nature of the assemblages recorded during the survey undertaken for this project (which concentrated most of its effort on the Wollombi Brook catchment area) is similar to those recorded earlier (Dyall 1981; Brayshaw 1988, 1991; Koettig 1991, 1994; Navin 1992, 1994, 1995; Heffernan and Klaver 1997; ERM 1999, 2000; Umwelt 2001) in the Loders Creek and Nine Mile Creek drainage areas in terms of artefact type and raw material type. The assemblages fitted relatively comfortably within the general expectations of the predictive model presented in **Section 4**. The differences in some technological aspects of the assemblages and the lack of knapping floors suggests some differences between Aboriginal behaviour in the Loders Creek area, areas associated with tributaries of Wollombi Brook and Wollombi Brook. However, the small samples recorded and the disturbance factors noted within the sites may have biased these results and further analysis of larger samples from the Wollombi Brook assemblages (especially BCO1, BCO3 and BCO10) would be required to confirm this view.

6.1.3 Implications of Technological Findings

It was suggested in **Section 4** that Aboriginal people inhabiting the project area would have been tied during drier times to the major watercourses, such as Wollombi Brook, Monkey Place Creek and the Hunter River and the lower reaches of the tributaries that drain into these watercourses that would have retained pools of standing water (eg. the larger unnamed tributaries of Wollombi Brook and Loders Creek). The location of extensive artefact scatters along the lower reaches of tributaries of Wollombi Brook supports this earlier prediction. In addition, the location of axes, anvils and mullers and the overall greater complexity of the BCO10 assemblage (which is closest to Wollombi Brook) supports an argument for longer term Aboriginal occupation and return visits to this particular area. Preliminary comparisons of the assemblages from the Wollombi Brook catchment and the assemblages from the Loders Creek catchment suggest that different patterns of behaviour relating to raw material sourcing and reduction techniques may be present, suggesting more complex use of the landscape than previously identified.

It was further suggested that the floodplains in the project area would have provided rich plant and animal resources especially along the watercourses and in billabongs in meander cut-offs and that the availability of these resources would have enabled larger groups of people to gather together in these areas for relatively longer periods of time. It is tentatively suggested that BCO10 provides evidence of this sort of Aboriginal resource exploitation, particularly at the western end of the site adjacent to Wollombi Brook and at the eastern end of the site and its associated floodplain.

It was also hypothesised that during wetter periods when the tributaries were flowing (and thus less likely to be saline) it would have been possible for smaller groups of people to move out along the minor drainages to exploit the animal and plant resources across the broader area. It seems plausible to suggest that the many smaller sites along the mid to upper reaches of the drainage systems support this argument.

Finally it was postulated that the “Vere” area may have provided many food and medicinal plants that would have formed the focus of short-term seasonal exploitation (fruits, berries, bulbs) and also short-term special purpose visits targeted towards obtaining medicinal plants. Visits such as these would not result in camp sites with large and complex assemblages and the small assemblages from this area lend support to this type of visitation.

6.2 SIGNIFICANCE ASSESSMENT

6.2.1 Interpretation of Significance

Aboriginal sites are a non-renewable resource and large numbers of Aboriginal sites in the project area have already been destroyed by natural erosion processes and European land-use practices, including agriculture and open cut mining operations. Those that remain, even if damaged to some extent, provide the only material evidence of the pre-contact (pre-European settlement) way of life of the Aboriginal people that inhabited this particular area. Therefore it is preferable that some of these sites are conserved and that some of those that are to be destroyed are subject to some form of salvage prior to their destruction so that at least the information they contain can be preserved for future generations. The preferred management options proposed for sites located within an area to be developed are determined after the site is assessed for its significance.

In total there are 117 recorded sites within the area proposed for underground mining and surface infrastructure. Of these 117 sites, 88 are sites recorded prior to this study and 29 are newly recorded sites that resulted from this study (**Figure 5.1**). Of the 88 previously known sites, 23 have been subject to successful Section 90 consent applications and have subsequently been destroyed. A further five sites are targeted for destruction under Section 90 consent during the Beltana operations and prior to the commencement of works related to the present project. A further site within the Beltana area (BMU2) will also be partially destroyed. A portion of this site (approximately 1 hectare) adjacent to the BMU1 grinding groove site will be conserved throughout the Beltana operations (see **Table 6.1**). Therefore, there will be a total of 89 sites and one partial site that have the potential for impact by subsidence or infrastructure construction if ongoing underground mining is approved, and the significance of all these sites has been assessed for this project. The majority of the previously recorded sites have already been subject to significance assessment and these assessments remain unchanged, unless that significance has been altered in light of the newly recorded sites or the information recorded during this survey.

Table 1 in **Appendix E** presents details of the sites and their current status (destroyed/to be destroyed during Beltana operations/extant). **Table 6.1** presents a summary of these sites. There are also some sites that have been recorded at the same AMG coordinates but have been recorded more than once on the NPWS site register and sites that had the same name but two different AMG coordinates. These sites are also listed in **Table 6.1**.

Table 6.1 - Status of Previously Recorded Sites

Site Status	Site Name
Destroyed under Section 90 Consent for Open cut and Beltana No. 1 Operations	B58, B60, B61, B62, B63, B64, B66, B67, BMU6, BMU7, BMU8, BMU9, BMU10, BMU19, BOC IF6 (A1), BOC IF1 (A1), BOC IF2 (A1), BOC IF2 (A1), BOC IF6 (A1), BOC IF7 (A1), BOC 7 (A1), BOC ISF4 (A1), South Bulga 1
To be destroyed Under Section 90 Consent during Beltana No. 1 Operations	sections of BMU2, BMU3, BMU4, BMU5, BMU11, Saxonvale B
Extant in project area	B51, B71, BMU1 (Beltana grinding grooves), BMU12, BMU13, BMU14, BMU15, BMU16, BMU17, BMU18, BMU20, BMU21, BP2, BP3, BOC 1 (A1), BOC 10 (A1), BOC 5 (A1), BOC6 (A1), BOC 8 (A1), BOC9 (A1), BOC ISF8 (A1), Broke Road 1, Bulga 6, Bulga 7, G1, G2, G3, G4, G5, G6, G7, G8, G9, G10 G11, GIF-IF1, GIF-IF2, GIF-IF3, GIF-IF4, GIF-IF5, IF1 Bulga South, Saxonvale A, Saxonvale grinding grooves, SBU3, SBU4, SBU5, SBU6, SBU7, SBU8, SBU9, SBU10, SBU11, SBU16, SBU17, SBU20, SBU21, SBU33, South Bulga 2
Sites that have been recorded more than once and represent a single site	(Saxonvale B, B71 and BMU2), (Broke Road 1 and BOC 1 (A1)), (Bulga 7 and G6)
Sites that have same name but are recorded in two different locations	BOC IF2 (A1), both of these sites have been destroyed.

The significance assessment of the sites located within the area proposed for underground mining and surface infrastructure provides the basis for developing and assessing appropriate management options.

Significance is assessed from two perspectives; Aboriginal significance and archaeological/ scientific significance. For this project, in addition to site assessment, Environment Australia has requested that the “Vere” area also be subject to significance assessment as an “area” from an Aboriginal perspective. **Section 6.2.2.2** presents the Aboriginal significance of the sites within the “Vere” and project area as a whole.

6.2.2 Aboriginal Significance

The Aboriginal significance of a site or an area draws on the Aboriginal cultural heritage value of that site/area and can only be determined by Aboriginal people. The following comments have been summarised from discussions with Aboriginal group representatives that participated in the field work, from subsequent meetings with the groups and from written comments received from WLALC, UAC and UHWC following their receipt of the draft report. These letters are included in **Appendix A**.

Copies of the draft report were also forwarded to WNAC and CCHVAC. WNAC chose to have UHWC act as their spokespeople. CCHVAC chose to have WLALC act as their spokespeople (committee members of CCHVAC were members of WLALC and represented WLALC during the field work for this project).

6.2.2.1 Aboriginal Site Significance and Significance of the Project Area

The Aboriginal groups concurred that all of the sites located within the project area were important to Aboriginal people and held high cultural and spiritual significance. The groups also stressed that the sites cannot be viewed in isolation, they are part of a “living culture” that includes the broader landscape and the resources it provided, both for people’s day to day nourishment and subsistence (food, water, shelter), but also for their spiritual nourishment (areas of mythological and ceremonial importance). The following are extracts from the written comments (refer **Appendix A**).

> *All sites designated in this draft plan are of high Cultural and Spiritual significance to the Aboriginal community, the sites in question hold the link between the Wanaruah people of today, and there ancestors who actually made and used the artefacts that are present. The land, on which they sit, has special meaning as mother earth was the giver of life to the Wanaruah people that occupied the land prior to European settlement on Wanaruah*

Land. The area in question was a natural gathering point because of the accessibility of BUSH TUCKER – BUSH MEDICINES – AND THE WILD LIFE THAT WAS A MAJOR PART OF THE MENU THAT SUSTAIN THE WANARUAH PEOPLE FOR THOUSANDS OF YEARS. The area that Bulga Coal now sits is part of the Wanaruah dreaming trail that lead to the SPRITUAL AND LEARNING AREAS ON THAT Trail. (UAC 2003:1).

The Field Assistants employed by Upper Hunter Wonnarua Council reported that the general landscape is perceived as a well used area, visited by Generations of Wonnarua People up until Europeans invasion of Aboriginal Australia. The High Density of Recorded Wonnarua Sites is not surprising to the Local Koori people, because these Sites are within the vicinity of a Major Wonnarua Mythological area and Keepara Grounds. The Significance to the Descendants of the Wonnarua are Very High (UHWC 2003: 1).

Wanaruah Local Aboriginal Land Council considers all Aboriginal sites within its constituted boundaries important to the local Aboriginal community. Aboriginal Cultural Heritage is not limited to the relics and art that survived the impact of European settlement. It is a living culture and includes landforms, water holes, vegetation zones, habitats and people. … This part of the Hunter Valley is part of the "Song Line" linking New England and Western Plains to the Sydney Basin. It traces past the Wingen Maid and Mount Dangar through to Mount Arthur and continues past Mount Yengo. This area is also in close proximity to the junction of several tribal countries, and in the near vicinity to several sacred sites, two of which are the Bora Ground at Bulga and Biamie at Milbrodale. To say this area is "VERY Significant" is to understate its importance. In recent months as more cultural mapping work is being done we are finding out just how important this area has been to our ancestors and is to us, our children and future generations. … No amount of written language can adequately describe or replace the value or meaning of being in touch with the living remanets (sic) of our dreamtime. On a social level these remanets (sic) and markers give hope to a displaced people. (WLALC 2003:1-2).

This area of Broke Bulga and Milbrodale of the Hunter Valley is of High Significance to the Wonnarua People and the other Aboriginal Tribes that used this area for Camping, Hunting, Fishing, Ceremonies and as a Trading route to the south, pre:1800's ***before settlement****, there are a number of High Significance Sites around Broke, Bulga and Milbrodale area's, and we the Aboriginal Community continue the connection from pre: 18800's in the Hunter Valley and there are still Aboriginal families with that connection living in the Broke, Bulga, Milbrodale, Singleton and throughout the Hunter Valley (LWTC 2003: 1).*

During the field work and in subsequent discussions at meetings held on 28 October 2002, 12 December 2002, 20 March 2003, 2 April 2003, 30 May 2003 and 13 June 2003, four sites were afforded the highest significance by all groups. These were the BCO1, BCO3 and BCO10 artefact scatters and the Beltana grinding groove site (BMU1). The Aboriginal representatives present during the recording of the artefact scatter sites afforded them high significance due to the large number of artefacts in the sites, the potential for some sections of each of the sites to have further subsurface artefacts and because each site was in an area that was perceived as an excellent camp site with good views across the Wollombi Brook valley. The Beltana grinding groove site was also afforded extremely high significance as it represents a rarer site type in the Upper Hunter Valley and retains a link with the past for the "Wanaruah people" (UAC 2003:2).

6.2.2.2 Significance of the "Vere" Area

The "Vere" area was also assessed for Aboriginal cultural significance by the Aboriginal groups involved in the project. While it was assessed separately it was stressed that it is seen as forming part of the broader pattern of landscape use by Aboriginal people in pre-European times.

The Vere – being one of the major areas used for education due to the diversity and availability of medicine plants used for the well being of tribal members. (A large amount of the vegetation was only available on this site and would have been used as a final stage of the learning process) (UAC 2003:1)

We feel that the "Vere" area is an Important Landscape which ties in with Mythological Areas because Bush Tucker would be needed in time's of High land use because of the Local Kinship groups Camping in the area during Ceremonial Business (UHWC 2003:1).

The "Vere" area is also very great importance for two reasons. The first because of its near natural state, because Aboriginal Cultural Heritage is not limited to the relics and the art that have survived the impact of European settlement. It is a living culture and includes landforms, water holes, vegetation zones, habitats and peoples. This allows us to see and hear first hand what our ancestors did. The other reason (more importantly) is that in the near vicinity there are many sacred formations and areas, some we cannot reveal, many we know only as "do not go near that area" (WLALC 2003:2).

The VERE AREA is of High Significance as to the amount of Bush Tucker Food's and other Medicine Plants that are a natural recourse (sic) for this area, and with the Conglomerate and Sandstone overhangs and caves *providing shelter it would have been used by Aboriginal people in the past, and that the Cultural Heritage Sites that were located during the surveys show this. (LWTC 2003: 1).*

6.2.3 Archaeological/Scientific Significance

NPWS Guidelines for Archaeological Survey reporting (1997) state that archaeological significance should be based on the research potential of a site and the representativeness and rarity of a site. Archaeological significance should be discussed in terms of local and regional significance. The project area and the broader Hunter Valley have been the subject of extensive archaeological enquiry and assessment. The Hunter Valley has over 2000 known Aboriginal sites including artefact scatters ranging from one to several thousand pieces, grinding grooves, scarred and carved trees, ceremonial sites, wells and fish traps. As noted in **Section 3**, a broad subset of the sites occurring in the Hunter Valley have been recorded in the project area. Elements of the significance assessment consider how the sites in the project area relate to the local and broader pattern of Aboriginal use of the area, and what they can contribute that is not better represented elsewhere.

6.2.3.1 Archaeological Research Potential

The archaeological research potential of a site depends on factors such as:

- the state of preservation of the site or artefacts it contains relative to other sites of the same type previously known from an area (its archaeological integrity and intactness);
- the inclusion of the site in a complex of other sites or site types which may give it greater potential for answering research questions than an isolated site (connectedness);
- the complexity of a site (ie. the nature and diversity of the site contents);
- the potential for there to be intact subsurface archaeological deposits (PAD);
- the potential of a site or artefacts it contains to provide information to answer questions of relevance to the contemporary archaeological/Aboriginal community.

6.2.3.2 Integrity and Intactness

Each archaeological site represents a number of pieces of evidence spatially organised by human behaviour and by subsequent environmental effects. When a site has been subject to relatively few environmental and/or cultural post-depositional processes it will represent more directly the original human activities that created it. Such undisturbed sites are considered to have greater archaeological integrity because of their intactness.

In sites which have been heavily disturbed by post-depositional processes such as erosion, agriculture and mining, aspects of the original activities which formed the sites will be damaged or even destroyed. This destruction of site integrity has a severe constraining effect on the ability of the site to provide useful information about the Aboriginal past, it is, however, a dominant characteristic of the open camp sites in the Hunter Valley.

Information presented in Table 1 in **Appendix E** and in **Appendix F** in relation to the integrity of the known sites indicates that they have all been disturbed to varying degrees by erosion, erosion control works, agricultural practices, dam construction, road construction, haul road construction, construction of power lines, drainage works, bund construction, open cut mining and other mining activities. However, a small number of artefact scatter sites have been recorded as having the potential to provide assemblages in a subsurface context that are likely to have retained some degree of archaeological integrity. It should be noted that in all cases it is only a section of these extensive sites that is being assessed as having integrity and intactness. This section focuses on the sites with potential for integrity and intactness.

Artefact Scatters

<u>BMU2 Artefact Scatter (Area “o”)</u>

The BMU2 site (**Figure 5.3**) incorporates two previously recorded sites, B71 and Saxonvale B. B71 was recorded by Koettig in 1991, at that time the site was outside the area of impact and Koettig (1991) recommended that it would require further investigation if it was to be destroyed by future development. Saxonvale B was recorded by Dyall in 1981, as it was not to be impacted at that time no recommendations were made for the site. Both B71 and Saxonvale B are part of the BMU2 site recorded by Umwelt (2001). BMU2 is an extensive artefact scatter that stretches for 1500 metres along the northern-most Wollombi Brook tributary in the project area (upstream of BCO10). Umwelt (2001:43-48) divided this extensive site into smaller areas, named “a” through “s”. Of these areas, Area “o” was assessed as having high significance for integrity and intactness on both a local and regional scale. Area “o” was located adjacent to the BMU1 grinding grooves. Part of this area is presently partially incorporated into the BMU1 conservation zone, in accordance with the Beltana AHMP (Umwelt 2003). The remainder of the site will be salvaged under consent during the Beltana operations. This will include the artefacts in the area previously recorded as Saxonvale B.

BCO1 Artefact Scatter Site

BCO1 (**Figure 5.2**) is an extensive artefact scatter site exposed along an extremely eroded tributary channel of Wollombi Brook and in the intervening area between the tributary and an associated meander cut-off. BCO1 incorporates the smaller artefact scatter site Saxonvale A previously recorded by Dyall in 1981. The majority of the area of the BCO1 site is eroded to the A2 horizon. It was assessed that the area between the channel and the meander cut-off retained the potential to have intact features such as hearths or heat treatment pits and that it should be subject to subsurface investigation if it was to be damaged by subsidence remediation works.

BCO3 Artefact Scatter Site

BCO3 (**Figure 5.2**) is an extensive site that contained large numbers of surface artefacts along three contiguous tributaries of Wollombi Brook. Where two of these drainages converge west of Charlton Road there is an area of alluvial/colluvial aggradation. This area is assessed as having a high likelihood of retaining intact deposits and features. Large numbers of surface artefacts were observed along the banks in this area as well as along an unformed road that ran 100 metres back and parallel to one of these drainages indicating a large area of artefact distribution both along and back from its drainages.

BCO10 Artefact Scatter Site

BCO10 (**Figure 5.3**) contained large numbers of surface artefacts along three contiguous drainage lines. Three artefact scatter sites recorded earlier in this area have now been incorporated into the BCO10 site. These are Bulga 7 (recorded by Brayshaw 1988) and G6, G7 and G8 (recorded by Heffernan and Klaver 1997). G6 was reported by Heffernan and Klaver (1997:111) to contain stone artefacts and bone eroding from a buried soil profile. Geomorphic investigations undertaken as part of this project, indicate that there are buried soils in this area, however, they are buried beneath recent material deposited in the area following European land clearance and are recent in nature. There is no evidence to suggest that the buried soils are of any great antiquity. The particular buried soil profile described by Heffernan and Klaver as containing stone artefacts and bone (1997:111) was not observed during the geomorphic investigations even though the area they recorded as having the soil profile was investigated (see BCO10 site description in **Appendix F** for details). Artefacts were observed on the surface in this area where the A2 horizon was exposed on the channel banks. Stone artefacts were also observed eroding from the base of the A2-horizon where it was exposed by bank collapse. It was concluded that this area and two other areas indicated on **Figure 5.3** retain sufficient integrity and intactness to warrant subsurface investigation if they are to be impacted by remediation or drainage works associated with the project.

Grinding Groove Sites

Two other sites that require assessment for integrity and intactness are the Saxonvale grinding groove site (**Figures 3.1** and **5.2**) recorded by Dyall (1981) and the Beltana grinding groove site (BMU1, **Figure 5.3 -** recorded by Umwelt 2001). The Saxonvale grinding groove site has already undergone subsidence from the removal of the Whybrow seam during mining operations at SBC. An attempt was made to relocate this site on 20 March 2003. All relevant Aboriginal interest groups took part in the location process. A search was made of the sandstone outcrops in the creek bed and alongside the creek in this area. It was noted that the sandstone in the area had been subject to a large amount of abrasion from sand and gravel being transported downstream from a gravel quarry a few hundred metres upstream. A dam had subsequently been constructed below the quarry in an effort to restrict the sediment load and following this the gravel quarry was abandoned. Despite a thorough search of the area, the grinding grooves could not be relocated. It is thought that they are either in the area now covered by the dam, or that they have been worn away by the heavy sediment load that washed down the creek prior to the construction of the dam. It was concluded that the Saxonvale grinding groove site no longer retained integrity or intactness.

The Beltana grinding groove site (BMU1) will be situated on top of a chain pillar during mining in the Whybrow seam for the Beltana operation and thus will retain the high significance assessment for integrity and intactness afforded it following the Beltana survey and assessment (Umwelt 2001:36).

Scarred Trees

There is only one scarred tree within the area proposed for underground mining and surface infrastructure. This is the Bulga 6 scarred tree recorded by Brayshaw in 1988. The scarred tree is located on a ridge crest approximately 20 metres west of Charlton Road. The scar is located on the northern side of a mature Grey Box (*Eucalyptus moluccana*). Both the tree and the scar (shield or coolamon in shape) are in good condition and thus their integrity and intactness is assessed as high at both the local and regional level.

Summary

In summary, section “o” of BMU2 and sections of BCO1, BCO3 and BCO10 are assessed as having moderate to high significance for integrity and intactness on a local level and moderate to low significance on a regional level. The Saxonvale grinding grooves are assessed as having low significance and the BMU1 grinding grooves are assessed as having high significance for integrity and intactness on both a local and regional level. The Bulga 6 scarred tree is assessed as having high significance for integrity and intactness on both a local and regional level. The remaining sites within the area to be impacted by subsidence or surface infrastructure are assessed as having low significance for integrity and intactness due to their highly disturbed natures (see **Table 6.2** and **Table 6.3**).

6.2.3.3 Connectedness

Connectedness refers to the relationship between sites within an area. Connectedness can be considered in a number of ways, at a number of scales.

In its broadest sense, ‘connectedness’ refers to patterns linking sites within an area. Connectedness is often difficult to ascertain as the chronological sequence of use of surface sites is unknown at this stage of their assessment. Thus connectedness must be related to other features of sites and/or their assemblages. Sites may appear connected due to their location within the landscape (eg. a series of sites along a drainage system) or because of the nature of their assemblages (eg. the use of similar raw materials and reduction sequences aimed at producing similar implement types) or the nature of features within the sites (eg. heat treatment pits, hearths, knapping floors). In some cases, it may be that a series of sites within an area relates to a number of different activities which are in fact all components of a single land use system (eg. a stone quarry, a camp site at which reduction of that stone takes place, a sandstone outcrop on which that stone is ground). As mentioned above the difficulty with assessing such an aspect of connectedness arises in demonstrating that all of the sites relate to the same period of time. While it is broadly possible to assign some artefacts to limited time periods (backed blades, Bondi points, eloueras, edge ground axes), these time periods still span thousands of years and the artefacts in question generally only represent a minor component of most assemblages and thus their presence cannot be used to make statements about the majority of the artefacts within any assemblage. Thus, the use of “artefact types” to date surface assemblages remains too broad (eg. 4000 years) to be useful in discussing the operation of a pattern of land use at any given time and to make judgements related to connectedness.

The sites identified during the present survey and in prior surveys indicate that the entire project area was utilised by Aboriginal people and that the size and complexity of the sites (ie. areal extent, assemblage size and nature, associated features) was related primarily to the availability of reliable water and plant resources. However, the remaining areas of exploitation were also of importance for survival and thus all of the sites have a degree of connectedness through time and space. In all sites, mudstone is the dominant raw material, despite the fact that sources of silcrete appear to be equally available (from the Hunter River). In this case, the pattern is inconsistent with expectations based on environmental factors alone, and must reflect the organisation of technology (raw material preference) of the Aboriginal people exploiting the project area. Thus it could be argued that all the sites reflect a low to moderate significance for connectedness.

A more convincing argument for connectedness can be put forward for the Beltana grinding groove site (BMU1), the adjacent section “o” of BMU2 (incorporating B71 and Saxonvale B), and the BCO10 artefact scatter site. These sites are clearly connected both geographically and technologically, as they are adjacent in the landscape, there are edge ground axes in the artefact scatters, and the artefact scatters contain similar artefact and raw material types, reduced by the same techniques. Artefact scatter sites BCO1 (incorporating Saxonvale A) and BCO3 are located on the same drainage system but are located approximately 800 metres apart. The intervening area has almost 100 per cent visibility from 2 to 20 metres back from the drainage channel indicating that these are clearly two separate areas used as camp sites by Aboriginal people. These two sites have similar assemblages in terms of raw material use, reduction techniques and large numbers of artefacts, however, BCO3 (closer to Wollombi Brook) has a far more complex assemblage (in terms of artefact types) than BCO1. In terms of connectedness these two sites appear to reflect different patterns of use by Aboriginal people exploiting a single drainage of Wollombi Brook and as such have research potential for exploring “connectedness”.

Summary

In summary, the Beltana grinding groove site (BMU1) and section “o” of BMU2 (incorporating B71 and Saxonvale B) and BCO10 (incorporating G6, G7, G8 and Bulga 7) are assessed as having high significance for connectedness on a local scale and moderate significance for connectedness on a regional scale. BCO1 (incorporating Saxonvale A) and BCO3 have also been assessed as having high significance for connectedness (to each other) on a local scale and low significance on a regional scale. The remainder of the sites are assessed as having low significance for connectedness (see **Table 6.2** and **Table 6.3**).

Table 6.2 - Assessment of Scientific Significance for Sites Recorded During the Study

Site	Integrity and Intactness		Connectedness		Complexity		PAD		Rarity		Representativeness		Score	Significance
	Local	Regional	Local	Regional	Local	Regional	Local	Regional	Local	Regional	Local	Regional		
BCO1 (Saxonvale A)	2	1	3	1	2	1	3	2	2	1	3	1	20	Moderate
BCO2	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO3	3	2	3	1	3	1	3	2	2	2	2	1	24	Moderate
BCO4	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO5	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO6	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO7	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO8	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO9	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO10 (Bulga 7, G6, G7, G8)	3	2	3	2	3	2	3	2	3	3	3	3	32	High
BCO11	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO12	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO13	1	1	2	1	1	1	1	1	2	1	2	1	15	Low
BCO14	1	1	2	1	1	1	2	1	2	1	2	1	16	Low to Moderate
BCO15	1	1	2	1	1	1	1	1	2	1	2	1	15	Low
BCO16	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO17	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO18	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO19	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO20	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO21	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO22	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO23	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO24	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO25	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO26	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO27	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO28	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BCO29	1	1	1	1	1	1	1	1	1	1	1	1	12	Low

Overall Significance score: Low 12-15, Low to Moderate 16-20, Moderate 21-25, Moderate to High 25-28, High 29+

Table 6.3 - Assessment of Scientific Significance for the Previously Recorded Sites in the Area Proposed for Underground Mining and Surface Infrastructure

Site	Integrity and Intactness		Connectedness		Complexity		PAD		Rarity		Representativeness		Score	Significance
	Local	Regional	Local	Regional	Local	Regional	Local	Regional	Local	Regional	Local	Regional		
BMU1	3	3	3	2	3	2	3 (in BMU2)	2	3	3	3	3	33	High
BMU2 (including B71 and Saxonvale B), area "o"	3	2	3	2	3	2	3	2	3	2	3	3	31	High
BMU20	2	1	1	1	3	2	1	1	3	2	3	2	22	Moderate
Saxonvale Grinding Grooves	1	1	1	1	1	1	1	1	2	1	2	1	14	Low
Bulga 6 scarred tree	3	3	1	1	1	1	1	1	3	3	3	3	24	Moderate
Isolated Finds BOC 1(a1), BOCISF8(A1), BMU5, BMU11, BMU12, BMU17, GIF-IF1 to GIF-IF5 IF1 Bulga South, SBU4, SBU6, SBU8, SBU9, SBU11, SBU16, SBU33	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
Artefact scatters B51, BMU13 to BMU16, BMU18, BMU20, BMU21 BOC8(A1), BOC9(A1), BOC10(A1), BP2&3, Broke Road 1, Bulga 7, G1-G11, Saxonvale A, SBU3, SBU5, SBU7, SBU10, SBU17, SBU20, SBU21, South Bulga 2	1	1	1	1	1	1	1	1	1	1	1	1	12	Low

Overall Significance score: Low 12-15, Low to Moderate 16-20, Moderate 21-25, Moderate to High 25-28, High 29+

6.2.3.4 Complexity

The complexity of a site or group of sites is assessed on the basis of their ability to contribute to our understanding of the Aboriginal past. The more complex a site, the more potential it has to be interpreted in an informative way. Complexity can be related to the artefact assemblage and/or the nature of the sites (features) and intra and inter-site spatial patterning.

In regard to artefact assemblages, the highest complexity was generally observed in those sites with the largest numbers of artefacts (BMU2 [area "o"], BCO3 and BCO10 (incorporating G6, G7, G8 and Bulga 7)). This result is not thought to have been biased by visibility factors. The sites exhibiting the highest artefact numbers are also the sites that have been associated with features such as hearths, knapping floors and associations (connectedness) with other site types.

Summary

In summary, area "o" of BMU2 (incorporating B71 and Saxonvale B), BCO3 and BCO10 (incorporating G6, G7, G8 and Bulga 7) are assessed as having high significance for complexity on a local scale and moderate significance for complexity on a regional scale. The remainder of the sites are assessed as having low significance for complexity (see **Table 6.2** and **Table 6.3**).

6.2.3.5 Potential Archaeological Deposits

Potential archaeological deposits (PADs) are places where the sub-surface profile is assessed as having a high probability of containing cultural heritage materials in a relatively undisturbed context, or where disruption factors can readily be accounted for in interpreting the patterns and characteristics of archaeological objects. Factors that need to be considered when assessing PADs include:

- the depth of the 'A' horizon profile relative to the natural profile in that location;
- any potential disturbances to the sub-surface environment (eg. ploughing, bioturbation, burning);
- the probability of cultural materials being present as assessed through the environmental setting and/or a surface artefact assemblage; and
- any geomorphic agencies likely to have affected the area (eg. creek channel migration, colluvial or alluvial depositional processes resulting in buried or other isolation from destructive slope processes).

During the current survey several areas with PADs were recorded in association with surface artefact scatters. These were in sections of the sites BCO1 (incorporating Saxonvale A), BCO3, BCO10 (incorporating Bulga 7, G6, G7 and G8) and BCO14. The previous studies also suggested section "o" of BMU2 (incorporating B71 and Saxonvale B) has PAD (**Figures 5.2** and **5.3**).

Summary

In summary, section "o" of BMU2 (incorporating B71 and Saxonvale B), and one section of BCO1 (incorporating Saxonvale A) and BCO3 and three sections of BCO10 (incorporating G6 and Bulga 7) are assessed as having high significance for PAD on a local scale and moderate significance for PAD on a regional scale (**Figure 5.2** and **Figure 5.3**). The remainder of the sites are assessed as having low significance for PAD (see **Table 6.2** and **Table 6.3**).

6.2.3.6 Rarity and Representativeness

One of the objectives of cultural heritage management is to ensure that a representative sample of all site types is preserved in the variety of landscapes in which they occur. Unlike many other natural resources and some related aspects of cultural landscapes, archaeological sites are non-renewable. Once they are destroyed they cannot be replaced or replicated. As a result, one of the aims of a scientific value assessment is to examine the potential for newly discovered sites to provide representative examples of a particular site type.

All sites can be described as representative of a particular site type, however, certain aspects of sites increase both their rarity and representativeness value. Some sites contain elements that are uncommon to the area in which they are located. Examples would be hearths or axe grinding grooves. Such sites have high rarity value. Other sites may be composed of common elements, but may be preserved in such a way, or may be arranged with such complexity that they will have great value in representing the site type, but in an unusually informative way. Sites of a similar type which are heavily disturbed or lack complexity have less ability to provide information about the kind of activities that took place in the sites. Sites that have integrity and intactness and/or PADs of high value for research also have a high rarity value.

As discussed in **Section 4**, artefact scatters and isolated finds are not rare in the broader project area. Artefact scatters and isolated finds are already being conserved along Loders Creek in four conservation areas to the east of the area proposed for underground mining (**Figure 3.2**). These conservation areas were set aside as they contained large numbers of sites and the largest recorded set of axe grinding grooves in the area. In general, the sites in the conservation zones contain similar artefact types and raw material types to those located within the project area and similar associations exist between axe grinding grooves and artefact scatters. Descriptions and photographs of these sites in earlier reports (Koettig 1994; Heffernan and Klaver 1997) indicate that they have been subject to similar forms of disturbance.

In regard to the sites within the area proposed for underground mining and surface infrastructure the majority do not exhibit attributes that would place them in the "rare" category. There are however, four sites (BCO10, BMU20, BMU1, Bulga 6) that have characteristics that indicate they are rare in light of our present level of knowledge about what to expect in the local area. Part of BCO10 is located outside the proposed underground mining area.

Artefact Scatters

The area of highest artefact density at the western end of the BCO10 site (**Figure 5.3**) is located in an area that is unique within the project area (because of its association with Wollombi Brook and the geomorphic history of this particular area (see **Section 2.3.4.1**), possible Pleistocene antiquity of the creek terrace and possible association with a backswamp formed at the mouth of the tributary when it used to empty into Wollombi Brook much closer to this area (up until around 50 years ago). This particular area of the BCO10 site has the capacity to provide information about Aboriginal use of the landscape not known to be available elsewhere within the project area and the broader region and is assessed as having high significance for rarity and representativeness at both the local and regional level.

Site BMU20 is rare because of its geographic location and large assemblage and assemblage complexity. BMU20 is located on a spur crest and at the time of recording contained 631 artefacts including backed artefacts, blades, microblades and microblade cores (Umwelt 2001 Appendix E: 8-21). In regard to site location and assemblage size and content BMU20 has high significance for rarity and representativeness on a local scale and low significance for rarity and representativeness when viewed in the regional context.

Grinding Grooves

The Beltana grinding groove site (BMU1) is one of 18 sets of axe grinding grooves recorded in the Singleton and Muswellbrook local government areas (see NPWS Site Register Search in **Appendix D**). Of these, there are seven sets of axe grinding grooves associated with artefact scatters, one of which is already protected within a conservation zone in the Bulga Complex (Conservation Zone 2 on **Figure 5.1**). Thus the Beltana grinding groove site is not rare in a regional context. The location of the site on a tributary of Wollombi Brook, does, however, make it rare and representative on a local scale as it is the only grinding groove site presently recorded in this catchment. As the location of grinding groove sites is specifically related to the presence of sandstone in outcrop in or near the tributary, the likelihood of further grinding groove sites on tributaries (in the Branxton soil landscape) of Wollombi Brook is considered low. The number and integrity of the Beltana grinding grooves also adds to this significance.

Scarred Trees

The Bulga 6 scarred tree is one of four scarred trees recorded in the project area. The other three scarred trees (TSR4, TSR7 and TSR10) were recorded by Heffernan and Klaver (1997: 91-95) within the Travelling Stock Reserve associated with Nine Mile Creek in the northeast of the project area (**Figure 5.1**). Bulga 6 is the only scarred tree recorded in the project area that is associated with the Wollombi Brook catchment and thus, has high rarity and representativeness value on a local level. As scarred trees make up only a minor percentage of the sites recorded (due in large part to European tree clearance) Bulga 6 retains this high value for rarity and representativeness on a regional level.

Summary

In summary, the area of highest artefact density at the western end of the BCO10 site and the BMU20 artefact scatter have been assessed as having high significance for rarity and representativeness on a local scale but low significance for rarity and representativeness on a regional scale. The Beltana grinding groove site has been assessed as having high significance for rarity and representativeness on a local scale but only moderate significance on a regional scale. The Bulga 6 scarred tree has high significance for rarity and representativeness on both a local and regional scale (see **Table 6.2** and **Table 6.3**).

6.3 SUMMARY OF SIGNIFICANCE

All the groups expressed a desire for a conservation outcome from the project. It was recognised that underground mining was far less destructive of Aboriginal cultural heritage values than open cut mining and that it was possible for sites/areas to be conserved by appropriate management throughout the life of the underground mining project. Appropriate management of sites/areas was only thought possible through an Aboriginal Cultural Heritage Management Plan, prepared in consultation with all the relevant Aboriginal groups and NPWS. It was accepted that some sites/areas may be adversely impacted by subsidence, remediation works or infrastructure construction. This loss was only acceptable if an appropriate conservation outcome was possible elsewhere that would act to conserve sites/areas of similar Aboriginal cultural heritage value to those sites/areas being affected. It would also be necessary for appropriate surface or subsurface salvage to be undertaken in any of the artefact scatter sites to be impacted. The methodology for the salvage operations to be subject to further consultation with all relevant Aboriginal groups during the NPWS Section 90 application process.

Four sites were assessed by the Aboriginal community as being of very high Aboriginal significance. These sites are the BCO1, BCO3 and BCO10 artefact scatter sites and the Beltana grinding groove site (BMU1). All of these sites are on tributaries of Wollombi Brook. Management options for these sites were discussed at length during the field work and subsequent meetings and the views expressed by the Aboriginal community groups have been included in the discussions related to management options provided in **Section 8** (for endorsement refer to **Appendix A**).

Archaeological significance has been assessed relative to six criteria and at both a local and regional level. The scientific values ascribed on the basis of these assessments for the 29 newly recorded sites are presented in **Table 6.2**. **Table 6.3** provides significance assessment of the previously recorded individual sites discussed above and a summary of the previously recorded sites assessed as having low significance for all of the criteria.

From the tables and the discussions above it can be seen that the following sites have been assessed as having moderate to high overall scientific significance when both local and regional significance are taken into account:

- Saxonvale A artefact scatter (Dyall 1981), which is part of BCO1 (associated with the southern drainage line, a tributary of the Wollombi Brook);
- Saxonvale B artefact scatter (Dyall 1981), which is part of BMU2 (on the same tributary as BCO10, but further upstream and clearly within the Branxton soil landscape);
- B71 artefact scatter (Koettig 1991), which is part of BMU2 (on the same tributary as BCO10, but further upstream and clearly within the Branxton soil landscape);
- Bulga 6 (scarred tree) and Bulga 7 artefact scatter (Brayshaw 1988), which is part of BCO10 (associated with the northern drainage line, also a tributary of the Wollombi Brook);
- G6, G7 and G8 artefact scatters (Heffernan and Klaver 1997), which are part of BCO10 (Wollombi tributary);
- Beltana grinding grooves (BMU1) and section "o" of the BMU2 artefact scatter site and the BMU20 artefact scatter site (Umwelt 2001) (see B71 and Saxonvale B); and
- BCO1, BCO3, BCO10 and BCO14 artefact scatter sites (recorded during the survey for this project).

These significance results highlight the value of the direct tributaries of Wollombi Brook and the interface of the Wollombi and Branxton soil landscapes.

The remainder of the sites within the project area were assessed as having low overall scientific significance. **Section 8** takes into account both the Aboriginal and archaeological significance of the sites within the project area when discussing management options for the sites.

7.0 IMPACTS

There are three ways in which Aboriginal sites and values of the project area could be affected by the continued underground mining operations proposed by BCM. These are:

- damage to sites caused by subsidence;
- disturbance, damage or destruction of sites/artefacts caused by remediation works along stream channels and remediation of subsidence effects along Broke, Charlton, Cobcroft and Fordwich Roads; and
- disturbance, damage and/or destruction of sites/artefacts during the construction of additional surface infrastructure, gas drainage bores, dewatering bores and any additional drainage works.

This section of the report will discuss the possible impacts of proposed underground mining and surface infrastructure on the sites within the project area. Areas likely to be subject to surface disturbance are shown in **Figure 7.1**.

7.1 IMPACTS DUE TO SUBSIDENCE

As discussed in **Section 1.3** the proposed development will target coal in the Lower Whybrow, Blakefield, Glen Munro and Woodlands Hill seams (**Figure 1.3**). The depth of the target seams varies from less than 50 metres adjacent to the Whybrow Pit (**Figure 1.5**) to approximately 400 metres in the deeper areas to the west. The coal will be extracted using retreat longwall methods resulting in a total surface subsidence of varying depths, dependent on the number of seams to be removed. In the southern area only two seams (Blakefield and Woodlands Hill) will be extracted by longwall methods. In the central and northern area all four seams will be extracted. As the depth of cover and topographic relief both generally increase from north to south and from east to west of the Whybrow Pit, it can be predicted that subsidence impacts at the surface will also decrease. In addition, as only two seams will be extracted from the southern area by longwall mining and only one in the “Vere” area, the overall level of subsidence in this area will be less.

As discussed in **Section 1.4**, subsidence of the ground surface alone does not necessarily disturb sites such as stone artefact scatters but simply lowers their elevation. The degree of environmental impact of subsidence at the surface is generally related to the depth of cover and surface topography. In areas of shallow depth of cover, subsidence remediation works are more likely along drainage lines in flatter terrain. Surface cracking will occur parallel to and transverse to the chain pillars and will be most extensive where the depth of cover is less than 80 metres. **Figure 1.4** shows the variation in depth of cover across the project area to the shallowest seam to be extracted by longwall mining and the likelihood of surface disturbance within various depth of cover zones.

There are only two site types that are likely to be affected by subsidence alone. These are rockshelter sites and grinding groove sites. There are no known rockshelter sites within the area to be impacted by subsidence, and as discussed in **Section 4**, the rockshelters suitable for human habitation are those formed beneath large boulders that are not part of the bedrock in areas subject to relatively low levels of subsidence and thus, should not be adversely affected by subsidence. Therefore, rockshelters will not be considered further.

There are two sets of grinding grooves within the area to be affected by subsidence, the Saxonvale grinding groove site and the Beltana grinding groove site (**Figures 7.1**, **7.2** and **7.3**). The possibility of cracking is high for the Beltana grinding groove site, but very low for the Saxonvale site.

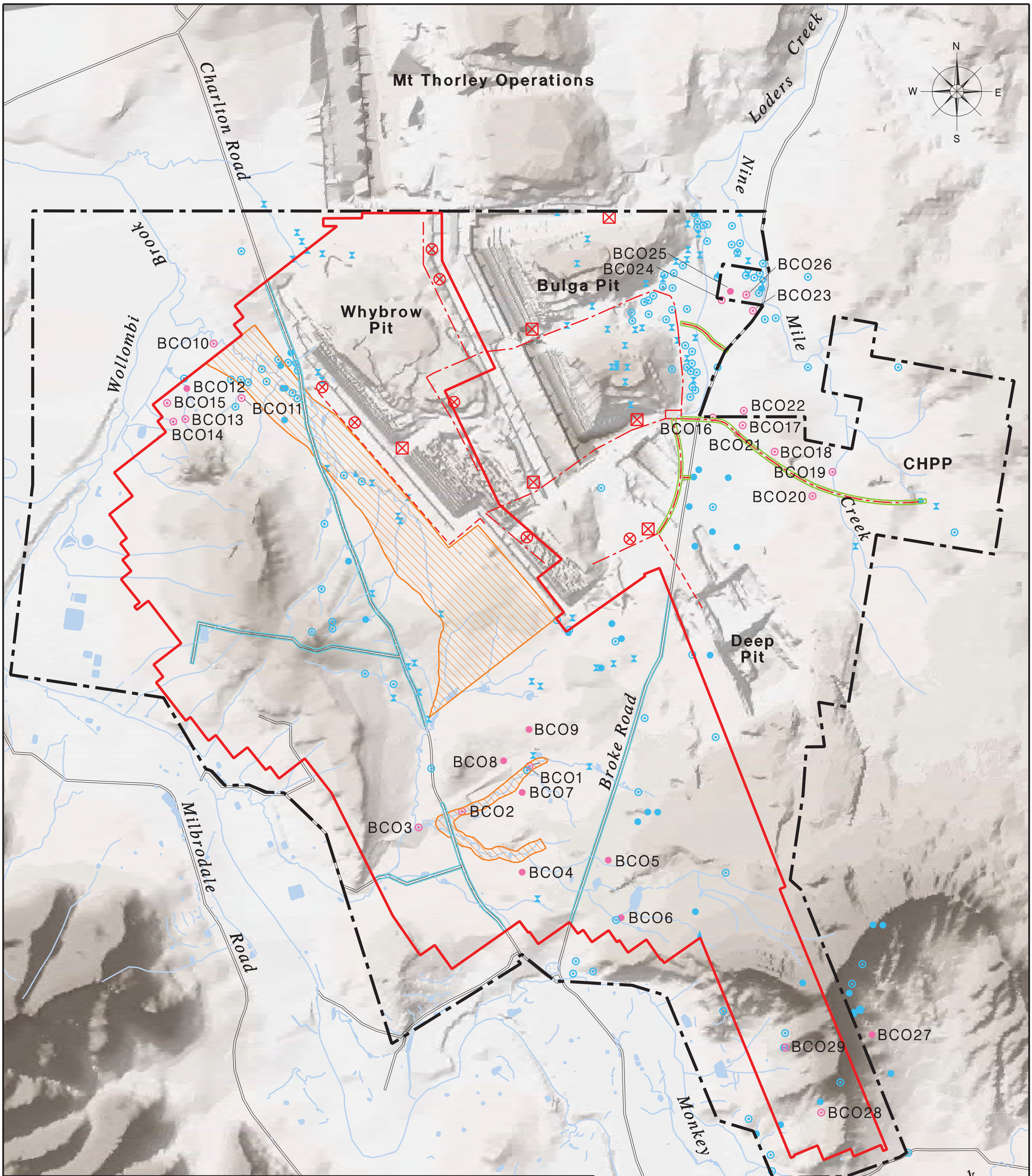
Table 7.1 - Sites Possibly Impacted by Subsidence

Site Type	Site Name	Total
Grinding Grooves	Beltana grinding grooves (BMU1) Saxonvale grinding grooves	2

The Beltana grinding groove site was assessed as having high significance on both a local and regional level. The Saxonvale grinding grooves were assessed as having low significance on both a local and regional level.

7.1.1 Beltana Grinding Groove Site (BMU1)

The Beltana grinding groove site (BMU1) is presently managed in a conservation zone with a section of the adjacent BMU2 artefact scatter, in accordance with the Beltana AHMP (Umwelt 2003). This AHMP will remain active until the conclusion of the Beltana operations. Under the Beltana AHMP, access to the BMU1 site is provided for members of the



Legend

- Project Area
- Proposed Underground Mining Area and Major Surface Infrastructure
- Road
- Drainage line
- Areas likely to be Subject to Surface Cracking or Ponding
- Undisturbed Areas Subject to Construction
- Areas likely to be Subject to Road Works

Umwelt (2003) Sites
- Artefact Scatter
- Isolated Find

Previously Recorded Sites
- Sites Destroyed/ To be Destroyed
- Artefact Scatter
- Isolated Find
- Scarred Tree
- Shelter with Deposit
- Axe Grinding Groove

Umwelt (Australia) Pty Limited
Base Source: Bulga Coal Management

FIGURE 7.1
Areas affected by the Project

A4 Scale 1:55 000 | Ref No.:R03_V2/1468_223.dgn

Legend

Project Area
Proposed Underground Mining Area
Areas likely to be Subject to Surface Cracking or Ponding
Areas Subject to Road Works

Previously Recorded Sites
Isolated Find
Artefact Scatter
Sites Destroyed/To be Destroyed
Axe Grinding Groove

Umwelt (2002) Sites
Isolated Find
Artefact Scatter Exposure
Area with Continuous Artefact Scatter
Surface Collection
Subsurface Salvage

Umwelt (Australia) Pty Limited
Base Source: Bulga Coal Management & Hatch Aerial Photo (2003)

FIGURE 7.2
Section 90 Heritage Permits recommended for Area B

A4 Scale 1:20 000

Ref No.:R03_V2/1468_225.dgn

Legend

Project Area
Proposed Underground Mining Area
Areas likely to be Suject to Surface Cracking or Ponding
Areas Subject to Road Works

Previously Recorded Sites
- Isolated Find
- Artefact Scatter
- Sites Destroyed/To be Destroyed
- Axe Grinding Groove

Umwelt (2002) Sites
- Isolated Find
- Artefact Scatter Exposure
- Area of Continuous Artefact Scatter
- Surface Collection
- Subsurface Salvage

Umwelt (Australia) Pty Limited
Base Source: Bulga Coal Management & Hatch Aerial Photo (2003)

FIGURE 7.3
Section 90 Heritage Impact Permits recommended for Area A

A4 Scale 1:20 000

Ref No.:R03_V2/1468_224.dgn

relevant Aboriginal community groups so that they may visit and monitor the site. During longwall mining of the Whybrow seam at Beltana, the potential for cracking in BMU1 will be minimal as the mine plan was modified to situate the grinding grooves in the middle of a chain pillar so that they will not be subject to significant tensile or compressive forces. During mining at Beltana, the site will be located at the northern extremity of the longwall mining operations and thus will only have a longwall panel removed to its south. The longwall panel to the north will only be removed if this project is approved. The probability of the site cracking will increase with the removal of this northern panel.

As the plan for the ongoing mining operation is to stagger the removal of the longwalls, so that overall the subsidence troughs and peaks will be lessened, the site will be located on top of a chain pillar for the removal of the Glen Munro seam and in mid-panel for the removal of the Blakefield and Woodlands Hill seams. Due to the site's location on a large and very thick block of sandstone (approximately 35 metres) it is highly likely that cracking of the sandstone will occur during the mining of the second (Blakefield) and subsequent seams and that cracking has the capacity to damage the area of the grinding grooves. At this stage, it is anticipated that the site will be undermined in the Blakefield seam approximately 15 years after underground mining commences for this project. There is a high probability that the site will crack during extraction of this seam.

7.1.2 Saxonvale Grinding Groove Site

As previously discussed (**Section 5.4.1.3**) the Saxonvale grinding groove site has already been subject to subsidence from the removal of the Whybrow seam during mining operations at SBC. Recent attempts to assess the impact of this subsidence on the site failed as it was not possible to locate the site. It was concluded that the site is either covered by a dam constructed in the area or that the two grinding grooves recorded in the area have been worn away by the coarse sediment load of the local watercourse. Even though the site could not be located it is possible to predict that the removal of the deeper seam proposed for this project is unlikely to have any substantial effect upon the integrity of the site beyond that already incurred from the removal of the shallower Whybrow seam. Thus, it would seem appropriate in the circumstances to suggest that no intervention is necessary in the case of this site, and that it should be allowed to simply subside.

7.2 IMPACTS ASSOCIATED WITH REMEDIATION OF SUBSIDENCE EFFECTS

In all areas mined there will generally be a period of between five and seven years between the extraction of each seam and each episode of subsidence. BCM will be required throughout the life of the mine to (a) monitor drainage channels and undertake remediation works required to prevent ponding; (b) monitor slopes and undertake remediation works required to minimise surface erosion; and (c) monitor public roads to remediate cracking and remove dips in the roadway caused by subsidence.

7.2.1 Remediation of Drainage Channels

Channelisation works may be necessary in creeks of low gradient if ponding occurs following subsidence. Channelisation works have the capacity to damage/destroy sites located along the banks of the drainage channels by impacting upon the horizontal and vertical distribution of the stone artefacts and by breakage of stone artefacts in the sites. Channelisation works may also impact on grinding groove sites in the base of the channel of the drainage line if care is not taken to avoid impact. Table 1 in **Appendix E** lists all of the previously known sites, their geographic location and an assessment of whether they will be disturbed by the project. Table 13 in **Appendix F** presents the same information for the newly recorded sites.

The tables indicate that there is one grinding groove site, four isolated finds and 16 artefact scatters that, based on the conceptual mine plan, will be impacted by subsidence remediation works along drainage lines. In relation to the number of sites, several have now been incorporated into larger sites reducing the number of artefact scatters to nine. The previously recorded sites incorporated into larger sites include B71, Saxonvale A, Saxonvale B, Bulga 7, G6, G7 and G8. All of the sites listed in **Table 7.2** are located along low gradient drainage channels that will require channel and bank reshaping works. **Table 7.2** lists the sites by site type (site locations are shown on **Figures 7.1**, **7.2** and **7.3**).

Table 7.2 - Sites Possibly Impacted by Subsidence Remediation Works Associated with Drainage Channels

Site Type	Site Name	Total
Grinding Grooves	Beltana Grinding Grooves (BMU1)	1
Isolated Find	GIF-IF1, GIF-IF2, GIF-IF3, GIF-IF4	4
Artefact Scatter	BCO1, BCO2, part BCO3, part BCO10, B71, BMU2, Bulga 7, G2, G3, G4, G6, G7, G8, G9, Saxonvale A, Saxonvale B	16 recorded sites (9 actual sites)

Of the sites listed above the Beltana grinding grooves (BMU1), BCO1 (incorporating Saxonvale A), BCO3, BCO10 (incorporating Bulga 7, G6, G7 and G8) and BMU2 (incorporating B71 and Saxonvale B) have been assessed as having moderate to high overall scientific significance and high Aboriginal significance. The remainder of the sites have been afforded low overall scientific significance.

7.2.2 Remediation of Slopes

Surface cracking during subsidence may require mitigation through cultivation or ripping on slopes where depth of cover is less than 80 metres. Cultivation and ripping will disturb the horizontal and vertical distribution of stone artefacts in sites and may also break stone artefacts. Due to the depth of cover on the slopes within the project area (Table 1 in **Appendix E**), the likelihood of remediation works to alleviate erosion has been assessed as low. Therefore, on present knowledge, there are no sites on the slopes that should require remediation works.

7.2.3 Remediation of Subsidence Effects along Charlton, Broke, Cobcroft and Fordwich Roads

BCM will also be required to undertake works along Broke, Charlton, Cobcroft and Fordwich Roads to maintain the road surface. Works such as pavement stabilisation and maintenance of appropriate line of sight will be required.

There are only three known sites along roads that will be affected by subsidence (**Figures 7.2** and **7.3**). All three sites are located on Charlton Road. The sites are the Bulga 6 scarred tree and the BP2 and G11 artefact scatter sites. The Bulga 6 scarred tree was assessed as having moderate overall scientific significance and the BP2 and G11 sites as having low overall scientific significance. The Aboriginal significance of all sites is considered to be high, as discussed in **Section 6.2.2** and **Appendix A**.

Table 7.3 - Sites Possibly Impacted by Subsidence Remediation Works associated with Charlton, Broke, Cobcroft and Fordwich Roads

Site Type	Site Name	Total
Scarred Tree	Bulga 6	1
Artefact Scatter	BP2, G11	2

7.3 SURFACE INFRASTRUCTURE

7.3.1 Major Infrastructure

The majority of surface facilities required for the continued underground operations will be located in areas previously disturbed by open cut mining activity (**Figure 7.4**). Exceptions include sections of the overland coal conveyor, access roads and haul roads (refer to **Figure 1.3**). Any cultural heritage sites/artefacts within the areas affected by these facilities will be destroyed or at least disturbed/damaged during their construction. The areas selected for the overland coal conveyor, access roads and haul road are all within Area C (**Figure 7.4**). This infrastructure has been carefully planned to avoid as many sites as possible and will only disturb one of the previously known sites. It has been designed to pass between the existing conservation zones and only impact upon Loders Creek in the area of the existing Loders Creek diversion channel. Therefore, the sites for which management options will be discussed are the 11 sites located during the surveys undertaken for this project (BCO16 through to BCO26) and the one previously known site to be impacted (IF1 Bulga South). These sites were all assessed as having low overall scientific significance and high Aboriginal significance (refer to **Section 6.2.2** and **Appendix A** for Aboriginal significance assessment.

Sites BCO16 through BCO22 and IF1 Bulga South are in areas already highly disturbed by haul road construction, construction of minor roads, an explosives dump, 33kV powerline construction, dam construction and drainage works associated with this infrastructure on the eastern side of Broke Road. Two optional routes for the coal conveyor were surveyed in this area, one to the north and one to the south of the existing haul road (**Figure 7.4**). Only one of these route options will be utilised by BCM. As the sites located were so badly disturbed there appeared no reason on archaeological grounds to select one route over the other, however, in an attempt to impact as few sites as possible, BCM have chosen the southern route, which will impact only site IF1 Bulga South and BCO21 (**Figure 1.3**). Both of these sites are assessed as having low overall scientific significance and high Aboriginal significance.

The remaining sites, BCO23 through BCO26 are in areas that may be impacted by access road construction on the western side of Broke Road. In this area there has been prior disturbance from bund construction, existing access roads to the open cut and the Loders Creek diversion. Two alternate routes were surveyed for the access roads. Following the survey BCM chose to implement the most southern route as this avoided all newly recorded sites.

Legend

Project Area

Proposed Underground Mining Area and Major Surface Infrastructure

Undisturbed Area Subject to Construction

Previously Recorded Sites

- Isolated Find
- Artefact Scatter
- Sites Destroyed/To be Destroyed
- Axe Grinding Groove

Umwelt (2002) Sites

- Isolated Find
- Artefact Scatter Exposure
- 1 Existing Open Cut Conservation Zones

Umwelt (Australia) Pty Limited
Base Source: Bulga Coal Management & Hatch Aerial Photo (2003)

FIGURE 7.4
Section 90 Heritage Permits recommended in Area C

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The survey for the haul road route failed to locate any sites in what was a very disturbed area.

There are only two sites that will be impacted by the construction of surface infrastructure. Both are associated with the proposed coal conveyor. The sites are IF1 Bulga South and BCO21 (**Table 7.4** and **Figure 7.4**). Both of these sites were assessed as having low archaeological significance on a local and regional level.

Table 7.4 - Sites Possibly Impacted by Coal Conveyor Construction

Site Type	Site Name	Total
Isolated Find	IF1 Bulga South	1
Artefact Scatter	BCO21	1

7.3.2 Minor Infrastructure

Minor infrastructure includes dewatering bores, gas drainage boreholes and gas drainage plants. The construction of minor infrastructure can act to vertically and horizontally displace artefacts and possibly break artefacts. The precise location of this infrastructure is not presently known. Minor infrastructure, however, impacts on a limited area and can generally be placed in the landscape so that it does not impact upon known sites.

8.0 MANAGEMENT STRATEGIES

8.1 MANAGEMENT OBJECTIVES

The management options that are outlined in this section have been prepared in the context of the following objectives:

- where practicable, to retain artefacts/sites in their current state to retain and enhance the cultural landscape context within the constraints of the mining proposal;
- to comply with the requirements of Section 90 of the *National Parks and Wildlife Act* 1974. Under this act all known Aboriginal sites are protected from destruction or disturbance without the written consent of the Director General of NPWS. The known sites are shown on **Figure 7.1** and are listed in Table 1 of **Appendix E** (previously recorded sites) and Table 1 of **Appendix F** (sites located during the surveys undertaken for this project);
- to develop a management strategy that recognises the Aboriginal cultural heritage value and archaeological (scientific) significance of individual sites and groups of sites in the landscape. The management options presented below take into account the assessed significance of the known sites in the project area (see **Section 6**). The Aboriginal significance of the sites and areas has been detailed in the correspondence received from each of the groups (**Appendix A**) and summarised in **Section 6.2.2**. The archaeological/scientific significance of the sites was established in **Section 6.2.3** and summarised in **Section 6.3**, and was based on their research potential.
- to prepare a management strategy that addresses the range and severity of impacts on Aboriginal sites within the proposed mining area. NPWS has advised (Umwelt 2001:38), that a Section 90 Heritage Impact Permit is required for all sites in areas of underground mining where there is more than a 10 per cent chance that the site will be affected by subsidence impacts (such as cracking and drainage remediation works);
- to respect the views of the local Aboriginal community about which sites are important from a cultural heritage perspective;
- to obtain the views of the local Aboriginal community about the questions they would like answered by further research in the project area related to sites for which a Section 90 Heritage Impact Permit application is proposed;
- to obtain the opinions of the local Aboriginal community in relation to appropriate salvage strategies for any sites for which a Section 90 Heritage Impact Permit is proposed.
- to promote a shared understanding between the local Aboriginal community, BCM and NPWS about sustainable management of Aboriginal sites throughout the mining process;
- to provide clear guidance to land managers in BCM about the management process, and protocols that should be observed during the life of the proposed mining operations to protect cultural heritage values; and
- to facilitate timely and effective management options.

The management options explored in this section of the report have been developed in consultation with LWTC, WLALC, UHWC, UAC, WNAC and NPWS.

8.2 OVERVIEW OF MANAGEMENT STRATEGY

A number of options to address the management of aspects of the Aboriginal cultural heritage evidence known within the project area are discussed in **Sections 8.3** to **8.4**. In combination, these options present a strategy for effective and sustainable management of Aboriginal cultural heritage values in the context of the underground mining activity within the project area. Three principle types of management outcomes are included in the strategy.

- conservation of areas/sites of Aboriginal cultural heritage significance. This outcome is recommended where there are diverse Aboriginal cultural heritage values, the heritage significance is assessed as high and salvage is considered inappropriate. Conservation is also appropriate for those sites that will not be impacted by the proposed development, whatever their significance;
- destruction of sites with further investigation. Further investigation may include detailed recording of the site, salvage of surface artefacts or salvage including subsurface investigation. Subsurface investigation can include manual or mechanical excavation and will be of an area/depth thought appropriate to retrieve a sample of the cultural heritage

material (cultural heritage salvage) or to retrieve the kinds of information required to answer questions of importance to the Aboriginal community and the scientific community (archaeological salvage). For the latter, further investigation will also include detailed analysis of the artefacts retrieved;

- destruction of sites without further investigation. This option will only be recommended when the site has been assessed as having low Aboriginal and archaeological (scientific) significance and where it can be demonstrated that similar sites are being conserved elsewhere.

In summary, the proposed Aboriginal cultural heritage management strategy for the project area includes:

- conservation of a section of site BCO10 within a Voluntary Conservation Area (VCA) jointly managed by BCM and NPWS (see **Section 8.3**);
- preparation of a VCA Management Plan (see **Section 8.3.1**);
- preparation of an AHMP to guide all ongoing cultural heritage management decisions and activities within the project area (see **Section 8.6**);
- management of existing conservation areas (refer to **Section 8.4**);
- conservation of the Bulga 6 scarred tree;
- Section 90 Heritage Impact Permit for the Beltana grinding groove site (BMU1);
- Section 90 Heritage Impact Permit with Salvage for artefact scatter sites BCO2, BCO21, BMU2 (section "o", incorporating B71 and Saxonvale B), BP2, G2, G3, G4, G9 and G11 and sections of sites BCO1 (incorporating Saxonvale A), BCO3 and BCO10 (incorporating G6, G7 G8 and Bulga 7) as shown in **Figures 7.2** and **7.3**, to be impacted by subsidence remediation works, drainage works or the construction of surface infrastructure;
- Section 90 Heritage Impact Permit without salvage for isolated find sites BMU12, BMU17, IF1 Bulga South, GIF-IF1, GIF-IF2, GIF-IF3 and GIF-IF4 (**Figures 7.2** and **7.4**) to be impacted by subsidence remediation works, drainage works or the construction of surface infrastructure.

8.3 PROPOSED CONSERVATION OFFSET

In order to provide long term conservation of a valued cultural heritage landscape and to offset the loss of Aboriginal cultural heritage values within the project area, it is proposed to establish a 580 hectare VCA under the *National Parks and Wildlife Act* 1974 in the northwest of the project area (**Figure 8.1**). This particular area was chosen as it was assessed as incorporating:

- sections of a site of high Aboriginal and archaeological significance on both a local and regional scale;
- a wide variety of landscape types that provide numerous resources of value to traditional Aboriginal hunter-gatherers and contemporary Aboriginal communities;
- rare landscape types of archaeological and geomorphic interest;
- areas of remnant woodland vegetation; and
- items of historic heritage value.

All of these values were seen to be available in an area that could be fenced and managed to conserve these values into the future. Each of these values is discussed in more detail in **Sections 8.3.1** to **8.3.4**.

8.3.1 Site Significance

The area proposed for the VCA incorporates a section of the BCO10 site. The area of the BCO10 site to be conserved within the VCA was assessed as having high significance from an Aboriginal and archaeological perspective on both a local and a regional scale. This significance was based on:

- the importance of this section of the site to the Aboriginal community groups as indicated during extensive discussions and field investigations (refer to **Appendix A**). This importance is related to:

FIGURE 8.1
Proposed Voluntary Conservation Area

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  - *the high density artefact scatter in this area;*

  - *the wide variety of artefact types and raw material types in the artefact scatter (which differ across the proposed VCA);*

  - *the location of the artefact scatter in close proximity to a permanent water supply provided by Wollombi Brook (which was much closer in the past);*

  - the likelihood that a backswamp once existed in proximity to this part of the site (as it does where the local tributary meets with Wollombi Brook at present) that would have provided a rich resource for Aboriginal people camped in the area;

  - the outlook back to the mountains where many known art sites exist;

  - the possibility of the area conserving evidence of Aboriginal occupation of late Pleistocene/early Holocene antiquity; and

  - the inclusion of almost 1000 metres of Wollombi Brook frontage within the VCA. This is seen as important as Wollombi Brook would have provided many useful resources including fish, shellfish, crayfish, eels, tortoise and a wide variety of aquatic bird and plant species.

- its rarity and representativeness (both in terms of the site contents and site location in the landscape):

  - the scatter with the densest concentration of artefacts and the most complex assemblage of artefacts is associated with a terrace of possible Pleistocene age. Such associations are rare in the broader Hunter Valley;

  - the terrace of possible Pleistocene age would have been associated with the confluence of the tributary channel with Wollombi Brook. This area would have provided a rich resource area (water and food) for Aboriginal people and a focus for occupation during the more arid Pleistocene and early Holocene period; and

  - the section of site to be conserved is representative of two sections of the site further upstream on similar terraces (of much smaller dimensions) that will require remediation and drainage works.

- the complexity of its artefact assemblage:

  - the largest (in terms of artefact numbers) and most complex surface artefact scatter (in terms of artefact types) recorded to date within the project area is within the proposed VCA. This scatter forms part of the BCO10 site;

  - the area within the proposed VCA contains burnt clay features that may represent hearths in association with stone artefacts; and

  - differences in the nature of the assemblages that make up the BCO10 site within the proposed VCA area indicate differential use of the landscape between the main tributary channel and a tributary channel that flows into this channel from the south.

- the possible capacity of the site to provide Aboriginal cultural heritage material from an extended chronological period:

  - geomorphic studies of the landscape context of the BCO10 site indicated that there are several areas that have the potential to contain artefactual material of possible late Pleistocene/early Holocene antiquity on terraces and an alluvial fill associated with the tributary channel downstream of Charlton Road. The largest and least disturbed of these areas is within the proposed VCA.

- the relative integrity and intactness of its deposits:

  - as noted above the area of the BCO10 site within the proposed VCA has been assessed as having greater relative integrity and intactness than those areas further upstream that have been disturbed to various degrees by dam construction and earlier drainage works associated with agricultural pursuits. These areas have generally been subject to extreme erosion and will require remediation and drainage works irrespective of ongoing mining to ameliorate this problem. Subsurface investigation of these areas prior to works will allow information to be gathered that will help with the interpretation of that section of the site to be conserved within the VCA.

- as it is in an area that would have been resource rich in terms of food resources and reliable water for Aboriginal hunter-gatherers in the past:
  - The section of the BCO10 site within the proposed VCA is associated with two arms of a tributary of Wollombi Brook. Prior to the 1955 flood it appears that both of these areas would have been much closer to the main channel of Wollombi Brook and in an area that would have provided reliable water and rich floral and faunal resources.

8.3.2 Aboriginal Resources

Resources that would have been important to Aboriginal people living a hunter-gatherer lifestyle and/or to the contemporary Aboriginal community within the proposed VCA include:

- frontage to Wollombi Brook (approximately 1000 metres) which for traditional hunter-gatherers would have supplied:
  - permanent water;
  - a resource rich backswamp environment at the confluence of the local tributary and Wollombi Brook;
  - faunal resources associated with the Brook and the backswamp that included species such as fish, shellfish, crayfish, eels, tortoise and aquatic birds and plants; and
  - a focus for occupation during dry periods.
- a diverse range of landform elements including alluvial sand dunes, possible Pleistocene terraces, floodplain of Wollombi Brook and local drainage lines, footslopes, lower, mid and upper slopes and a section of ridge crest which still provides habitat for a range of terrestrial prey species (grey kangaroo, wombat, goanna, black and brown snake) and economic plants (see **Table 2.3**); and
- a useful teaching area that contains a site set within a landscape that provides a variety of Aboriginal resources that can be easily accessed from Charlton Road (even during mining operations).

8.3.3 Other Values of the Proposed VCA

As well as preserving Aboriginal cultural heritage values the proposed VCA includes:

- areas of remnant vegetation which are becoming rarer in the region;
- areas of geomorphic interest including:
  - a possible Pleistocene terrace and adjacent floodplain deposits that could incorporate material of this antiquity; and
  - an area of rare alluvial sand dunes in association with Wollombi Brook;
- remnants of the early European settlement of the area (sections of post and rail fencing, a shed).

8.3.4 Access and Management of the VCA

The proposed VCA area:

- can be fenced and stock excluded allowing for regeneration of native vegetation and erosion control in the area of the site;
- is outside the area where extreme erosion of the banks and entrenchment of the tributary channel requires remediation works;
- does not have problems with feral animals or with noxious weeds that can make management problematic;
- includes a right of way from Charlton Road to ensure that the area can be easily and safely accessed throughout the mining operations; and

- is marginal to the mining operations and has two boundaries (north and west) that will be unaffected by mining operations. The location of the proposed VCA on the margin of the active mine area makes ongoing management, monitoring and visitation to the area more feasible. Having two sides of the VCA that are not affected by mining or works associated with subsidence remediation reduces the overall problems associated with providing a buffer between the VCA and mine related activities.

In summary, the section of the BCO10 site to be conserved within the proposed VCA has the potential to preserve Aboriginal cultural heritage values of importance to the Aboriginal groups involved in the project. There is also the capacity to preserve evidence of early Aboriginal occupation of the Bulga/Wollombi Brook drainage area in what is a relatively undisturbed (in the context of Bulga/Wollombi Brook drainage sites) context. Geomorphic and archaeological investigation of sections of the site further upstream (to be impacted by remediation and drainage works) also associated with what appear to be Pleistocene terraces gives the rare opportunity of obtaining information that can assist in the interpretation of the conserved sections of the site. In terms of the broader Hunter region, sites located on Pleistocene terraces are still rare, and where possible all attempts should be made to conserve a representative sample of them.

The proposed VCA also incorporates a diverse range of landform elements and their respective Aboriginal resources. Access to the area is provided by an easement from Charlton Road that will remain open throughout the life of the mine. The proposed VCA is not significantly affected by erosion, noxious weeds or feral animals and thus does not require any works other than fencing to exclude stock to make it suitable for conservation.

Mining in the Bulga area and across the Hunter region has resulted in the loss of many areas of Aboriginal cultural heritage value without the requirement for conservation of areas of similar value. The VCA proposed has been chosen as it provides an opportunity to conserve Aboriginal cultural heritage values representative of those areas of Wollombi Brook drainage to be impacted by remediation and drainage works associated with underground mining. The Wollombi Brook drainage will be subject to loss of areas of cultural heritage value during works associated with underground mining over the next three decades. In addition to protecting a representative sample of those values to be lost, the proposed VCA will act to conserve Aboriginal cultural heritage values that are unique within this catchment (alluvial sand dunes, proximity to former course of Wollombi Brook, more complex artefact assemblages). Furthermore, the proposed VCA will compliment the existing Loders Creek conservation zones that provide protection for sites/areas representative of this drainage system (refer to **Section 8.4**).

8.3.5 VCA Management Plan

A conservation management plan will be prepared for the proposed VCA. The plan will be prepared by BCM in consultation with NPWS and Aboriginal community representatives and will:

- define the boundaries and objectives of the VCA;
- identify the parties to the VCA and the structure of the VCA management committee;
- describe the statutory and environmental context;
- describe the cultural and scientific heritage values;
- identify the threats to the values of the VCA;
- discuss land management activities including fire, flora, fauna water and soil management;
- outline protocols for access to the VCA;
- identify potential future uses of the VCA, including permissible mining related activities; and
- discuss monitoring and reporting procedures.

8.4 EXISTING CONSERVATION AREAS

8.4.1 Loders Creek Conservation Zones

As discussed in **Section 3.4.4**, there are currently four areas set aside for the conservation of Aboriginal sites/values along Loders Creek, under the BOC development consent. These conservation zones vary between 8.5 and 11 hectares, with a total area of 39 hectares and each has a frontage to either Loders Creek or a tributary of Loders Creek. The conservation zones contain 40 sites including artefact scatters, isolated finds and an axe grinding groove site (Heffernan and Klaver 1997:15). The grinding groove site consists of four sets of grooves (total of 55 grooves) located in the bed of Loders Creek and extending over an area measuring 43 metres by 12 metres, approximately 100 metres west of a creek confluence (Heffernan and Klaver 1997:74). These grinding grooves will not be affected by the project. The ongoing management of the conservation areas along Loders Creek is viewed as important as they retain evidence of the Aboriginal use of a different drainage system to the VCA to be set up on Wollombi Brook. The conservation of both of these areas enhances the future research and teaching potential of the sites they contain by conserving evidence that can be used for comparative purposes.

8.4.2 Beltana Grinding Groove Conservation Area

A 1 hectare conservation zone was created as part of the consent conditions for the Beltana operations. This area incorporates the Beltana grinding groove site and a section of the adjacent BMU2 site. These are both located on the northern drainage line in the project area (**Figure 7.2**). The conservation area is currently managed in accordance with the AHMP prepared for Beltana (Umwelt 2003). When the current project is approved, the area and the sites it contains, will become subject to the AHMP prepared for this project. **Section 8.6** presents details of the requirements of an AHMP.

8.4.2.1 Management Options for the Beltana Grinding Groove site (BMU1)

As discussed earlier (**Section 7.1.1**) the sandstone outcrop containing the Beltana grinding grooves is likely to crack during the removal of the Blakefield and subsequent seams. The likelihood of cracking in the Whybrow seam is also increased when mining proceeds in the panel north of the grinding groove. During ongoing consultation with the relevant Aboriginal groups throughout this project, it was decided that an independent expert should be brought in to give advice on the likelihood of cracking and to discuss management options for the grinding groove site. Ken Mills, Senior Technical Engineer of SCT Operations Pt Ltd visited the site on 28 October 2002. Two representatives of each of the relevant Aboriginal groups were present during the assessment to question Ken Mills and to discuss their concerns. SCT subsequently provided Umwelt with a report (SCT 2003), a copy of which has been included in **Appendix H**. SCT provided four options for the management of the grinding grooves during the mining operations.

Option 1: Do Nothing

In this option mining is carried out and BMU1 simply allowed to subside. SCT (2003:7) predict that this option would result in the fracturing, uplifting and lateral displacement of the sandstone slab in the area of the site and possibly through the area of the grinding grooves. The majority of the damage will occur during the removal of the Blakefield and Woodlands Hill seams while the removal of the Glen Munro seam is predicted to cause further mobilisation of the existing cracks but no new cracking.

Option 2: Protection of the Grinding Grooves by Isolation (small area)

In this option a slot approximately 3 to 4 metres deep is cut that encircles the grinding grooves and acts to isolate the site from the rest of the slab. The slot would act to prevent tensile strain and compressive forces from cracking the grinding grooves during mining of the Blakefield and subsequent seams. The width of the slot would be in the vicinity of 150 mm. The slot could be covered between the mining of each seam or filled and topped with sandstone cement so that it blends with the natural rock surface.

In order for this option to be successful, the slotted area would have to be isolated horizontally from the bedrock. Thus it would be necessary if no natural bedding planes could be located, to create a horizontal fracture through hydraulic fracturing. This method of protecting the site can be achieved with the use of lightweight drilling machinery and the impact on the surrounding area would be minimal, however, it does not give protection to the site area at large and this will most likely fracture. In addition, it is also possible that the areas on either side of the protected area may end up at slightly different levels. This problem could be fixed by sandstone cement sculpturing (SCT (2003:8).

Option 3: Protection of the Grinding Grooves by Isolation (large area)

In this option a slot is cut 15 to 20 metres out from the area of the grinding grooves. This slot would need to be in the vicinity of 500 mm wide and 10 to 15 metres deep. The size of the machinery required for such an exercise and the area required would necessitate the removal of some trees and impact upon the adjacent BMU2 artefact scatter site. The trench would have to be permanently covered for the safety of humans and animals using the area. It could also result in odour problems from water ponding in the trench and possible explosive danger from the escape of methane gas. There is also the possibility that as the area protected is so large that there may still be some risk of internal fracturing (SCT 2003: 11-12).

Option 4: A combination of Options 2 and 3

In this option the inner slot is maintained and outer slot of narrower (100-200 mm) and shallower (5 to 10 metres) dimensions employed. This option would afford the best protection for the grooves but would still have significant impact on the site and on the adjacent BMU2 artefact scatter site (SCT 2003:12).

Option 5: Leave the Site Permanently on a Chain Pillar

A fifth option not discussed by SCT is to leave an unmined area beneath the BMU1 site and a section of the BMU2 artefact scatter site. It is envisaged that the area left would need to be approximately 100 metres by 100 metres in area. The major disadvantage to this option is that the area left on the chain pillar would be approximately 6 metres higher than the surrounding landscape and the drainage line that presently flows through the site would have to diverted around this area. Therefore, though the grinding groove site would be protected, the context of the site would be lost. Erosion would also be a problem around the extremities of this pedestal and works designed to combat erosion and divert the drainage would adversely affect BMU2.

Option 6: Move the Grinding Grooves

Another option is to cut out the grinding grooves in the manner described by SCT in Option 2 above, and move them to one of the existing conservation zones, or an area approved by the relevant Aboriginal community groups. This option totally removes the axe grinding grooves from their context and destroys their association with BMU2.

8.4.2.2 The Preferred Option

Following ongoing discussions between the relevant Aboriginal community groups, NPWS and BCM it was decided that the least intrusive management option for BMU1 and its context (refer to **Figure 7.2**) was to allow it to subside without intervention, and provide a 58 hectare conservation outcome adjacent to Wollombi Brook, as discussed in **Section 8.3** and shown in **Figure 8.1**. BCM will also maintain the present informal conservation zones along Loders Creek (refer to **Figure 7.4**) and take a more active role in their management and conservation. The conservation zones will be maintained as part of the open cut operations until they cease in approximately 14 years time. BCM will then undertake to continue the protection of these areas as part of the underground mining operations. Conservation Zone 2 contains the Loders Creek grinding groove site and an associated artefact scatter that will be protected from impact by mining activities. Thus, this area will protect a grinding groove site complex similar to the Beltana grinding groove site and associated BMU2 artefact scatter site.

Access to the Loders Creek grinding groove site will not be possible during the life of the open cut operations due to safety concerns as it is located in close proximity to active mining areas. Access to the site will also be restricted during the life of the underground mining operations as a coal conveyor will be in close proximity to the northern boundary of Conservation Area 2. Access will be available to this site at the end of mining operations. Access will be maintained to the Beltana grinding groove site until it is affected by subsidence and site access is no longer appropriate for safety reasons.

As there is a slightly increased probability of the site cracking when the first panel of the Whybrow seam is removed to the north of the Beltana grinding groove site (BMU1), a Section 90 Heritage Impact Permit should be prepared six months prior to the removal of this longwall panel, as a contingency.

While subsidence of BMU1 the grinding groove site was agreeable to all of the Aboriginal groups, UAC and LWTC (Barry Anderson pers. comm. 17 June 2003) wish to reserve the right to monitor cracking of the sandstone in the creekline upstream of the grinding grooves after the removal of the Whybrow seam during the Beltana Operations. If the cracking was thought to be too damaging they would like the opportunity to reassess the option of cutting a slot around the site (refer to **Appendix H**).

8.5 CONSERVATION OF THE BULGA 6 SCARRED TREE

The Bulga 6 scarred tree is located approximately 20 metres west of Charlton Road and in an area where subsidence remediation works associated with Charlton Road may be required. Due to the significance of this tree it is appropriate that it be protected during times when remediation works are required in this area. Therefore permanent fencing will be constructed around the tree to prevent inadvertent disturbance. The fencing will be placed at a distance from the tree extending past the spread of its canopy to protect its root system. Care will also be taken in this area when fire breaks are graded. Grading near the tree will be limited in depth so that it does not interfere with the tree's root system.

8.6 ABORIGINAL HERITAGE MANAGEMENT PLAN FOR AREAS OUTSIDE THE PROPOSED VCA

There are currently many sites within the project area for which Section 90 consent is not likely to be required. These sites, and those sites for which conservation is recommended, or which may not be impacted for a period of more that two years after operations commence, will be considered in an AHMP to ensure their ongoing protection during mining operations or until they are subject to salvage. An AHMP will also address the possibility of new sites that could be located during the mining process, including sites (if any) located when inspections are undertaken of areas for the minor infrastructure. The AHMP in existence for the Beltana project area will over time be superseded by the new plan encompassing the whole of the area affected by the continuing operations including the Loders Creek conservation zones. The AHMP has two principal functions:

- to provide an overview of which sites are subject to Section 90 consents, and the status and conditions associated with each of these consents; and
- to provide guidance to mining personnel about the day to day management of cultural heritage values within the project area, both for known sites and sites that may be encountered during the course of mining operations. It is proposed that this guidance will be in the form of a series of checklists and protocols.

As a minimum, the AHMP will address the following issues:

- *in-situ* management of sites that are not subject to Section 90 consents;
- timing and compliance during the implementation of Section 90 consent conditions;
- general land management issues to protect cultural heritage values;
- protocol for rehabilitation of subsidence cracks and establishment of minor infrastructure in areas not covered by Section 90 Consent;
- participation in decision making by the Aboriginal community;
- access and induction issues for the Aboriginal community; and
- long term rehabilitation of the drainage lines and cultural heritage values.

As discussed in **Section 7.1**, it is highly unlikely that subsidence will adversely affect the sites located in the “Vere” area and subsidence remediation works will therefore be unnecessary. BCM will, however, advise the Department of Defence of the location of the sites in the area and of the high scientific and Aboriginal cultural heritage value of the area, especially in relation to the vast number of economic plant species it contains.

8.6.1 Section 90 Heritage Impact Permits

This section summarises the consent requirements thought appropriate for those sites to be impacted by subsidence remediation works or by the construction of surface infrastructure. The scheduling of the Section 90 applications and any compliance requirements should be detailed in the AHMP.

8.6.1.1 Section 90 Heritage Impact Permit with Salvage (Subsurface Investigation)

This management option is appropriate for sections of BCO1 (incorporating Saxonvale A), BCO3, BCO10 (incorporating Bulga 7 and G6, G7 and G8) as shown in **Figures 7.2** and **7.3**, as these sites will be impacted by subsidence remediation works or drainage works. The research design and methodology for the subsurface investigations and the extent of the subsurface investigations to be decided in consultation with the relevant Aboriginal groups and NPWS.

8.6.1.2 Section 90 Heritage Impact Permit with Salvage (Collection Only)

This management option is appropriate for the artefact scatter sites BCO2, BMU2 (section “o”), Saxonvale B, B71, BP2, BCO21, G2, G3, G4 G9, and G11 and sections of sites BCO1, BCO3 and BCO10 as shown in **Figures 7.2, 7.3** and **7.4**, as the sites will be impacted by subsidence remediation works, drainage works or construction of surface infrastructure.

8.6.1.3 Section 90 Heritage Impact Permit (Without Salvage)

This management option is appropriate for BMU1 and isolated find sites GIF-IF1, GIF-IF2, GIF-IF3 and GIF-IF4 (**Figure 7.2**) and IF1 South Bulga (**Figure 7.4**) if these sites are to be impacted by subsidence remediation works, drainage works or the construction of surface infrastructure.

8.7 SUMMARY OF PROPOSED SITE MANAGEMENT STRATEGIES

A principal outcome of this assessment is the commitment by BCM to conserve Aboriginal cultural heritage values, including landscape context and significant Aboriginal sites, in a VCA. An area west of Charlton Road, including part of BCO10 and relatively rare landscape context, will be included in the VCA. A further assemblage of some 40 sites will continue to be managed for conservation in existing conservation zones in the Loders Creek area, and a locally significant scarred tree near Charlton Road will also be protected.

These conservation management commitments represent significant long term opportunities to maintain and enhance Aboriginal cultural heritage values in this part of the central lowlands.

Table 8.1 presents a summary of the preferred management options for the sites located within the area to be impacted by subsidence, subsidence remediation works or surface infrastructure. If sites identified in **Table 8.1** are not affected by the project, they will be managed *in-situ* in accordance with an AHMP prepared in consultation with the relevant Aboriginal community groups and NPWS.

Should surface disturbance be required in the area of any sites not listed below, BCM will discuss management options with the relevant Aboriginal communities and NPWS. Permit applications, will be prepared six months prior to the commencement of remediation works or infrastructure construction, where possible.

Table 8.1 - Preferred Management Options for the Sites Located within the Area to be Impacted by the Project

NPWS #	Site Name	AMG	Site Type	Management Option
37-6-0966	B71	318760E 6382250N	Artefact scatter	See BMU2. Note a separate Section 90 Heritage Impact Permit will be required by NPWS for each recorded site.
37-6-0967	Beltana Grinding Groove Site (BMU1)	318900E 638225N	Grinding grooves	Maintain access for the relevant Aboriginal community groups to the area prior to undermining in the Blakefield seam unless removal of the Whybrow seam to the north of the site produces safety concerns which would require withdrawal of access. A revised AHMP should be prepared in consultation with the relevant Aboriginal community groups and NPWS that provides for appropriate management of this area until it is undermined. As there is a possibility that the site may crack during the removal of the Whybrow seam to the north of the site, six months prior to the removal of this seam, BCM should start preparation of an application for a NPWS Section 90 Heritage Impact Permit. This permit should be forwarded to the Director General of NPWS at least three months prior to longwall removal. If the site does not crack during removal of the Whybrow seam the Section 90 Heritage Impact Permit will lapse and it will be necessary for BCM to apply for a second Section 90 Heritage Impact Permit. BCM should start preparation of this permit at least six months prior to longwall removal for the Blakefield seam. The permit should be forwarded to the Director General of NPWS at least three months prior to longwall removal.
37-6-0966 (incorporating 37-6-0547)	BMU2 area "o" (incorporating B71 and Saxonvale B)	319000E 6382150N	Artefact scatter	Maintain access for the relevant Aboriginal community groups to the area prior to undermining in the Blakefield seam to provide context for the adjoining BMU1 site until BMU1 is undermined. As there is a possibility that some subsidence remediation may be required after the removal of the Whybrow seam to the north of this site, six months prior to the removal of this seam BCM should start preparation of an application for a NPWS Section 90 Heritage Impact Permit (surface collection) for this site. This permit should be forwarded to the Director General of NPWS at least three months prior to longwall removal. This permit should not be acted upon unless it becomes necessary to undertake subsidence remediation works in the site following removal of the Whybrow seam. If the Section 90 Heritage Impact Permit lapses prior to the collection of the artefacts a second Section 90 Heritage Impact Permit (collection only) will be required if subsidence remediation works become necessary following the removal of the Blakefield or subsequent seams.
37-6-0977	BP2	319700E 6379300N	Artefact scatter	Prior to subsidence remediation works associated with Charlton Road in the area of the site, apply for a Section 90 Heritage Impact Assessment (collection only).
37-6-0428	Bulga 6	318250E 6383370N	Scarred Tree	Prior to subsidence remediation works associated with Charlton Road approaching within 100 metres of the site, protect with fencing. Limit depth of firebreak grading to avoid damage to roots.
37-6-0428	Bulga 7	317910E 6383310N	Scarred Tree	See BCO10: Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment (subsurface investigation). Note a separate Section 90 Heritage Impact Permit will be required by NPWS for each recorded site.

Table 8.1 - Preferred Management Options for the Sites Located within the Area to be Impacted by the Project (cont)

NPWS #	Site Name	AMG	Site Type	Management Option
not listed	G2	317600E 6383200N	Artefact scatter	Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment (collection only).
not listed	G3	317700E 6383200N	Artefact scatter	Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment (collection only).
not listed	G4	317775E 6383175N	Artefact scatter	Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment (collection only).
not listed	G6	317960E 6383185N	Artefact scatter	See BCO10: Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment (subsurface investigation). Note a separate Section 90 Heritage Impact Permit will be required by NPWS for each recorded site.
not listed	G7	318275E 6383020N	Artefact scatter	See BCO10: Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment (subsurface investigation). Note a separate Section 90 Heritage Impact Permit will be required by NPWS for each recorded site.
not listed	G8	318225E 6383075N	Artefact scatter	See BCO10: Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment (subsurface investigation). Note a separate Section 90 Heritage Impact Permit will be required by NPWS for each recorded site.
not listed	G9	318075E 6383410N	Artefact scatter	Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment (collection only).
not listed	G11	318275E 6383300N	Artefact scatter	Prior to subsidence remediation works associated with Charlton Road in the area of the site, apply for a Section 90 Heritage Impact Assessment (collection only).
not listed	GIF-IF1	318150E 6382200N	Isolated find	Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment without Salvage.
not listed	GIF-IF2	318150E 6383120N	Isolated find	Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment without Salvage.
not listed	GIF-IF3	318125E 6383120N	Isolated find	Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment without Salvage.
not listed	GIF-IF4	318100E 6383350N	Isolated find	Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment without Salvage.
37-6-0757	IF1 Bulga South	324600E 6382100N	Isolated find	Prior to coal conveyor construction, apply for a Section 90 Heritage Impact Assessment without Salvage.

Table 8.1 - Preferred Management Options for the Sites Located within the Area to be Impacted by the Project (cont)

NPWS #	Site Name	AMG	Site Type	Management Option
37-6-0139	Saxonvale A	319865E 6378793N	Artefact scatter	see BCO1: Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment (collection only). Note a separate Section 90 Heritage Impact Permit will be required by NPWS for each recorded site.
37-6-0142	Saxonvale B	318899E 6381518N	Artefact Scatter	See BMU2. Note a separate Section 90 Heritage Impact Permit will be required by NPWS for each recorded site.
new site	BCO1 (incorporating Saxonvale A)	320693E 6379343N to 320380E 6379080N	Artefact scatter	Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Permit with Salvage. Dependent on the area of the site to be impacted this will refer to surface collection or subsurface investigation. The areas identified for subsurface investigation or surface collection are shown on **Figure 7.3**.
new site	BCO2	320020E 6378871N to 319946E 6378803N	Artefact scatter	Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Assessment (collection only).
new site	BCO3	319453E 6378682 central point	Artefact scatter	Prior to subsidence remediation works in the area of the site, apply for a Section 90 Heritage Impact Permit with Salvage. Dependent on the area of the site to be impacted this will refer to surface collection or subsurface investigation. The areas identified for subsurface investigation or surface collection are shown on **Figure 7.3**.
new site	BCO10 (incorporating Bulga 7, G6, G7 and G8)	317425E 6383550N densest concentration	Artefact scatter	Provide a conservation zone covering the area of highest artefact density and geomorphic interest as shown in **Figure 7.2**. For the remainder of the site, prior to remediation works apply for a Section 90 Heritage Impact Permit with Salvage. Dependent on the area of the site to be impacted this will refer to surface collection or subsurface investigation. The areas identified for subsurface investigation or surface collection are shown on **Figure 7.2**.
new site	BCO21	322732E 6382746N	Isolated find	Prior to conveyor construction, apply for a Section 90 Heritage Impact Permit without salvage.

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APPENDIX A

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RECEIVED 19 JUN 2003 BY

FAXED

Umwelt (Australia) Pty Ltd
P.O. Box 838
Toronto 2283

Re: Draft Bulga Coal Continued Underground Operations

Dear Jan,

Wanaruah Local Aboriginal Land Council considers all Aboriginal sites within its constituted boundaries important to the local Aboriginal community. Aboriginal Cultural Heritage is not limited to the relics and art that have survived the impact of European settlement. It is a living culture and includes landforms, water holes vegetation zones, habitats, and peoples.

Before considering any consents, Wanaruah Local Aboriginal Land Council has a duty to fully explore and compare all the negative impacts that such action will have against the benefits of the development, to the Land, Aboriginal Culture and the Community.

This part of the Hunter Valley is part of the "Song Line" linking New England and Western Plains to the Sydney Basin. It traces past the Wingen Maid and Mount Dangar through to Mount Arthur and continues through past Mount Yengo. This area is also in close proximity to the junction of several tribal countries, and in the near vicinity to several sacred sites, two of which are the Bora Ground at Bulga and Biamie at Millbrodale. To say this area is "VERY Significant" is to understate its importance. In recent months as more cultural mapping work is being done we are finding out just how important this area has been to our ancestors and is to us, our children and future generations. As quickly as we begin to understand something about our forbearers the evidence and markers are lost and destroyed by development.

In the area Bulga Coal wish to impact on we are starting to see many styles and technologies not seen elsewhere in the Hunter Valley. Yet again we are seeing it only to know it's destruction is coming before we will have time to learn how our people lived, the activities they partook in and the time lines showing when, "history" that was not passed on because of the savage impact of European settlement. Many of the people still living in this area cannot speak the language of their tribe, we cannot sing the songs, we cannot tell our children the stories of all creation. This was lost because these things were considered "Evil" by the missionaries. What little is still known is closely guarded by those entrusted with it who pass it on as "need to know" on those occasions when something vital to the dreamtime is endangered. All that is left is to the majority is the few markers that remain of a once full and harmonious society and culture. These markers along with the snippets allowed to us by those entrusted, is all we have to link us to our mother the earth.

The "Vere" area is also very great importance for two reasons. The first because of its near natural state, because Aboriginal Cultural Heritage is not limited to the relics and art that have survived the impact of European settlement. It is a living culture and includes landforms, water holes vegetation zones, habitats, and peoples. This allows us to see and hear first hand what our ancestors did. The other reason (more importantly) is that in the near vicinity there are many sacred formations and areas, some we cannot reveal, many we know only as "do not go near that area".

As previously stated, culturally, these places give us an insight to our forbearers. The level of occupation and the length of occupation give us insight to what the landscape was like and the activities the conducted. With no culture of writing, history has been passed by word of mouth. To aid the telling, many of the creation stories incorporated the land forms. This included how they came to be. No amount of written language can adequately describe or replace the value and meaning of being in touch with the living remanets of our dreamtime.

On a social level these remanets and markers give hope to a displaced people. No longer is it "Shame" to be Aboriginal. We have for many years been told that our culture was "Bad, Heathen, Satanical, Backward, Uncivilised and generally unacceptable". Employment, education, and health issues can be directly linked to ones vision of ones self and community. We still suffer from stereotyping and bigotry. We need something that is ours to take pride in. All we have is tied to the land in the remanets and markers.

Finally, we concur with the management recommendations in the Draft Bulga Coal Continued Underground Operations Aboriginal Heritage Assessment so long as the infrastructure is situated where it is designated in our copy of the report. We also have the following requirements:

1. That Wanaruah Local Aboriginal Land Council insists on being involved in the development and implementation of a plan of management for all the Aboriginal Sites within the project area.

2. Wanaruah Local Aboriginal Land Council consents to and insists on being involved in the negotiations, salvage and excavation of any sites to be destroyed. We will submit an application for care and control for all artefacts salvaged from these sites.

3. Wanaruah Local Aboriginal Land Council insists that if at anytime, during the project, works a site /or sites are uncovered, all work is to cease and the Wanaruah Local Aboriginal Land Council is to be notified.

4. Wanaruah Local Aboriginal Land Council will make further written comment at any time it deems necessary. We reserve the right to change our position as new information comes to hand

5. We would like to see radio carbon dating conducted where possible.

6. We would like to have ownership of the Wollombi and Loaders Creek VCAs pass to the Aboriginal community either through the LALC or through community trust.

7. Wanaruah Local Aboriginal Land Council would like to be considered for involvement in the development and implementation of a plan of management for the rehabilitation of the project area.

Thank you for this opportunity for input,

Noel Downs 16/6/03
Co-Ordinator

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REC[...] 18 JUN 2003 BY:............

Jan Wilson
Umwelt Australia
PO Box 838
TORONTO NSW 2283

16th June 2003

RE: DRAFT Bulga Continued Underground Operations
Aboriginal Heritage Assessment - CULTURAL SIGNIFICANCE

Dear Jan
Thank you for the Draft Aboriginal Heritage Assessment concerning the above Coal Mining Proposal.

The Upper Hunter Wonnarua Council would like to submit an Aboriginal Significance Review as needed under the National Parks and Wildlife Service New Guidelines.

The Field Assistants employed by the Upper Hunter Wonnarua Council reported that the general landscape is perceived to be a well used area, visited by Generations of Wonnarua People up until the Europeans invasion of Aboriginal Australia.

The High Density of Recorded Wonnarua Sites is not surprising to the Local Koori people, because these Sites are within the vicinity of a Major Wonnarua Mythological Area and Keepara Grounds.

The Significance to the Descendants of the Wonnarua are Very High and there is other information concerning the Mythological Area that must remain guarded because of Protocol Reasons.

The Upper Hunter Wonnarua Council is concerned with the Coal Mining within the Valley, but we do prefer that Underground methods of Coal Extraction be the preferred option to the more Detrimental Open Cut Coal Mining Process.

We feel that the "Vere" area is an Important Landscape which ties in with the Mythological Areas because Bush Tucker would be needed in time's of High land use because of the Local Kinship Groups Camping in the area during Ceremonial Business.

Victor Perry
Upper Hunter Wonnarua Council &
Wonnarua Nation Corporation

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ABORIGINAL CORPORATION

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RE: BULGA COAL CONTINUED UNDERGROUD MINING OPERATIONS: ABORIGINAL HERATAGE ASSESMENT (DRAFT PLAN)

1. All sites designated in this draft plan are of high Cultural and Spiritual significance to the Aboriginal community, the sites in question hold the link between the Wanaruah people of today, and there ancestors who actually made and used the artifacts that are present.

2. The land, on which they sit, has special meaning as mother earth was the giver of life to the Wanaruah people that occupied the land prior to European settlement on Wanaruah Land.

3. The area in question was a natural gathering point because of the accessibility of **BUSH TUCKER – BUSH MEDICINES – AND THE WILD LIFE THAT WAS A MAJOR PART OF THE MENU THAT SUSTAIN THE WANARUAH PEOPLE FOR THOUSANDS OF YEARS.**

4. The area that Bulga Coal now sits is part of the Wanaruah dreaming trail that lead to the **SPIRITUAL AND LEARNING AREAS ON THAT Trail.** (The area is used to educate members of the tribe on what bush medicines are there, and what there uses are for, and how to prepare them. This would only have been done as they moved through the knowledge path as they progressed with there move up through the tribal system.)

5. **THE VERE** – being one of the major areas used for education due to the diversity and availability of medicine plants used in for the well being of tribal members. (A large amount of the vegetation was only available on this site and would have been used as a final stage of the learning process).

6. **GRINDING GROOVES:** the grooves are of MAJOR, MAJOR significance as again for the links to the Wanaruah people of to day. On this site we are hesitant for the fear of damage, We at UAC will agree to the works taking place on the understanding that we are afforded the right to monitor sandstone areas leading towards the grinding grooves, prior to actually undermining them to asses if cracking takes place on similar sandstone area's to be undermined and suffer subsidence. (ON THIS WE WOULD INSIST) and further discussions can take place prior to any work being done under the Grooves so concerns can be raised should any arise regarding subsidence

7. We at UAC feel that grader scrapes should take place on BC01 & relevant sections of BCO10 where both these areas are not listed for subsurface investigations or are not in the designated conservation area.

8. **SITE OF MAJOR SIGNIFEGANCE:** All site are of major significance to our community, (But in saying that to put a European term on it THE SITES OF MOST SIGNIFEGANCE ARE SITES BC01 – BC03 – BC010)

9. **We would like to commend Umwelt Aust & Bulga coal on the foresight to place a VCA for use of the Aboriginal communities for there cultural and heritage use.**

10. **RECOMMENDATIONS:** We at Ungooroo Aboriginal Corporation agree with the Bulga Coal Continued Underground operations, on agreement with the conditions stipulated above.

Graham Ward — Allen Paget

[signature] — [signature]

CEO — Director.

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Grinding Grooves Site BUM1

DRAFT: BULGA COAL CONTINUED UNDERGROUND OPERATIONS

ABORIGINAL HERITAGE ASSESSMENT

Dear Jan,
As to the draft Bulga Coal Aboriginal Heritage Assessment we the LWTC put these recommendations forward for this proposal.

SIGNIFICANCE

1. That all Cultural Heritage Sites are of High Significance to the Aboriginal Community as more and more are being lost to Mining and other Development across the Hunter Valley.

This area of Broke Bulga and Milbrodale of the Hunter Valley is of High Significance to the Wonnarua People and the other Aboriginal Tribes that used this area for Camping, Hunting, Fishing Ceremonies and as a Trading route to the south, *pre:1800's* **before settlement**, there are a number of High Significance Sites around the Broke, Bulga and Milbrodale area's, and we the Aboriginal Community continue the connection from *pre: 1800's* in the Hunter Valley and there are still Aboriginal families with that connection living in the Broke, Bulga, Milbrodale, Singleton and though out the Hunter Valley.

The VERE AREA is of High Significance as to the amount of Bush Tucker Food's and other Medicine Plants that are a natural recourse for this area. and with the Conglomerate and Sandstone overhangs and caves providing shelter it would have being used by the Aboriginal People in the past, and that the Cultural Heritage Sites that where located during the surveys show this.

RECOMMENDATIONS

We the LWTC Pty Ltd Agree with the recommendations on the condition that:

1. That the grade scrapes are undertaken in those areas of BC01 & BCO10 that are not subject to subsurface investigation or in a conservation area.

2. We the LWTC Pty Ltd would like to carry out these as part of a Aboriginal Cultural Heritage Study , Undertake Magnetometer searches in BCO1, BCO3 & BCO10 to locate hearths to excavate for radiocarbon dating. Subsurface Excavation of BCO1 & BCO3 is necessary for these sites are of different context (age) and 100mtr square excavation of each area .

3. All excavation to be carried out by Hand only.

4. Fencing of the VCA area to be done ASAP.

5. That the LWTC Pty Ltd to be given the opportunity to tender for fencing and any mitigation works that needs to be carried out on the Beltana Mining Lease Area.

6. LWTC WOULD LIKE TO SEE THE VCA AREA EXTENDED TO THE WESTERN SIDE OF THE BROOK TO PUTTY ROAD AND TO CARLTON ROAD TO THE EAST THAT COVERS THE LAND CURRENTLY OWNED BY THE MINE AS A OFFSET FOR THE GRINDING GROOVE SITE BMU1.

7. IF THIS IS ONLY A LIFE OF THE MINE VCA THE ABORIGINAL COMMUNITY WOULD LIKE THE OPPORTUNITY TO PURCHASE THIS AREA ONCE MINING HAS FINISHED.

8. The LWTC Pty Ltd would like to point out at this stage that we do agree with the Mining of the lower seams of coal beneath the Grinding Groove Site BMU1. But wish to reserve the right to observe the affect of subsidence from the Beltana Mining lease on the sandstone upstream from the grinding grooves BMU1 and to make a decision about the correct management option for the future preservation of this site.

Regards,

Barry Anderson
Coordinator