Appendix 4

Aboriginal Cultural Heritage and Archaeological Assessment

Aboriginal Cultural Heritage
& Archaeological Assessment

for

Moolarben Coal Project
Stage 1 Infrastructure Area & Proposed Water Sharing Pipe-line Modification Project
In support of a Section 75w (2) Approval

A Report to Moolarben Coal Operations Pty Ltd

by

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1. INTRODUCTION & BACKGROUND

Archaeological Risk Assessment Services Pty Ltd has been engaged by Moolarben Coal Operations Pty Ltd to conduct an Aboriginal Cultural Heritage assessment as part of a Section 75W (2) approval for a project modification of Moolarben Coal Project Stage 1 Infrastructure Area and proposed watersharing pipe-line.

The modification involves relocating the approved Stage 1 ROM coal facilities to the proposed location for the Stage 2 ROM dump hopper facility (as described in the Stage 2 Environmental Assessment), located to the North-East of Open Cut 1 and south of the Stage 1 Main Infrastructure Area. This modification requires the Stage 2 ROM dump hopper site to be included as part of Stage 1 Infrastructure Areas.

The proposed water sharing pipe-line is to provide Moolarben Coal Project with excess water from Ulan Coal Mine via a pipe-line route. The route is approximately 2.5 km long and consists of a 250mm poly pipe buried to a depth of 1 metre (*see* Appendix 1: Figure 1).

1.1 Project Description

The land to be developed is rural in character and has been previously developed for by the Mid Western Regional Council as a road base borrow pit and waste transfer station, and road reserve. The area to be impacted by relocating the Stage 1 ROM dump hopper covers a construction area of approximately 400m x 500m. Vegetation will be stripped using a mulcher and a grader followed by heavier earth moving equipment.

Within the proposed water pipe-line construction area a corridor of less than 5 metres will be disturbed and a trench dug for installation of poly pipe to be laid at a depth of 1 metre (*see* Appendix 1: Figure 1 and Figure 3).

1.2 Aims of the Assessment

The purpose of undertaking an Aboriginal Cultural Heritage and Archaeological Assessment is to carry out an assessment of the project, with the involvement of the Aboriginal community, to confirm the Aboriginal heritage values of the study area and define any constraints and opportunities in carrying out a project modification.

It is necessary for the current project to identify matters which are relevant in assessing whether a project, to which Part 3A of the Environmental Planning and Assessment Act 1979 applies, is likely to have an impact on Aboriginal cultural heritage. In order to comply with the above requirement, a proponent should consider the following when making an assessment:

- Justification for any likely impact(s), including any alternatives considered for the proposal;
- Any measures which will be implemented to avoid, mitigate or offset the likely impact(s); and
- Demonstration that the input by affected Aboriginal communities has been considered when determining and assessing impacts, developing options, and making final recommendations to ensure that Aboriginal cultural heritage outcomes can be met by the proposed development.

The aims of the study were to:

- Review any relevant existing Aboriginal Cultural Heritage information and relevant databases;
- Carry out an archaeological assessment to identify likely Aboriginal heritage issues on the ground and make an assessment of likely Aboriginal heritage potential;
- Advise on the appropriate level of Aboriginal consultation that may be required;
- Determine whether the proposed activity is likely to cause any additional damage to Aboriginal Objects other than any that may have occurred already;
- Provide advice as to the likely land use restrictions posed by Aboriginal Heritage Objects or potential Aboriginal Heritage Objects; and
- Provide recommendations for any further Aboriginal Cultural Heritage work at the development.

2. ABORIGINAL CULTURAL HERITAGE ISSUES & BACKGROUND RESEARCH

A review of the NSW Department of Environment and Climate Change (DECC) Aboriginal Heritage Information Management System to determine if any known Aboriginal Sites were registered for the land proposed for development was undertaken. The results of the register search show there are registered Aboriginal Sites or Objects located near the land proposed for development (see Appendix 1: Figure 2). These sites have been previously recorded by Hamm (2006 & 2008) as part of the Moolarben Coal Project Stage 1 & 2 Assessments.

Table 1 Known Aboriginal sites located within or near the study area within a 3–5km radius

*= located within the Stage 2 MCP study area

Ulan ID#	Site Name	DECC Site #	Site Type	Eastings	Northings	Landform
62	Identifier 62 or S4	36-3-040	artefact scatter	756000	6428000	Simple slope
65	Identifier 65 or S3	36-3-041	artefact scatter and grinding grooves	756510	6428030	Creek flat
66	Identifier 66		isolated find	756550	6428338	Simple slope
67	Identifier 67		isolated find	756552	6428448	Simple slope
68	Identifier 68 or F3		isolated find	756464	6428520	Simple slope
69	Identifier 69 or F1		isolated find	756545	6428599	Simple slope
70	Identifier 70 or S5	36-3-038	isolated find	756000	6428000	Simple slope
71	Identifier 71 or F4	36-3-038	artefact scatter	756660	6428867	Simple slope
72	Identifier 72		artefact scatter	756701	6428906	Simple slope
	Cook Gap	36-3-0015	axe grinding groove	760387	6415931	
	Ulan; Murragamba	36-3-0016	shelter with art	760796	6421957	
	Wollar	36-3-0020	shelter with art	777958	6415823	
	Cooks Gap	36-3-0027	axe grinding groove	7603873	6415931	
	Ulan	36-3-0039	scarred tree	760828	6427722	
	Ulan Creek; Site 2	36-3-0042	axe grinding groove, shelter with art, shelter with deposit	762944	6428010	
	Ulan; Wilpinjong Creek	36-3-0044	Bora/ceremonial, carved trees	771442	6420278	
	Ulan Creek; Site 18	36-3-0060	open campsite	760215	6426006	
	Ulan Creek; Site 19	36-3-0061	open campsite	760878	6426622	
	Ulan Creek; Site 21	36-3-0063	open campsite	761207	6428074	
	Bobadeen	36-3-0068	shelter with art	761661	6427966	
	Wollar; Gulgong	36-3-0074	open campsite	781478	6414502	
	Wattle Creek No.2	36-3-0098	shelter with art	769880	6422760	
	Yawanna No.2	36-3-0101	shelter with art	774740	6421270	
	Wilpinjong	36-3-0103	scarred tree	767950	6422190	
	Yawanna No.1	36-3-0106	shelter with art	774780	6421260	

Ulan ID#	Site Name	DECC Site #	Site Type	Eastings	Northings	Landform
	Yawanna No.3	36-3-0115	axe grinding groove	774800	6420900	
	Yawanna No.4	36-3-0116	open campsite	775200	6420600	
	Deridgeree No.3	36-3-0124	axe grinding groove	777480	6427480	
	Wattle Creek No.1	36-3-0133	shelter with art	769500	6422630	
	*Murragamba No.1	36-3-0134	shelter with art	761300	6421170	
	Moolarben Creek MC1	36-3-0222	open campsite	760420	6420820	Alluvial flat
	MC2	36-3-0223	open campsite	760420	6420880	Alluvial flat
	MC4	36-3-0241	artefact	763161	6421650	Alluvial flat
	MC11	36-3-0237	artefact	763384	6421070	Alluvial flat
	MC10	36-3-0238	artefact	763226	6422860	Alluvial flat
	MC8	36-3-0239	artefact	763193	6422680	Alluvial flat
	MC6	36-3-0240	artefact	763113	6421940	Alluvial flat
	WC/1	36-3-0287	art (pigment or engraved)	765680	6425480	Alluvial flat
	*MC7	36-3-0337	open campsite	763136	6422480	Alluvial flat
	N/A	36-3-0690	N/A	N/A	N/A	N/A
	N/A	36-3-0691	N/A	N/A	N/A	N/A
	N/A	36-3-0692	N/A	N/A	N/A	N/A
	N/A	36-3-0693	N/A	N/A	N/A	N/A
	N/A	36-3-0694	N/A	N/A	N/A	N/A
	N/A	36-3-0695	N/A	N/A	N/A	N/A
	N/A	36-3-0696	N/A	N/A	N/A	N/A
	N/A	36-3-0697	N/A	N/A	N/A	N/A
	N/A	36-3-0698	N/A	N/A	N/A	N/A
	N/A	36-3-0699	N/A	N/A	N/A	N/A

2.1 Known Registered DECC Aboriginal Sites within MCP Stage 1 & 2 areas

The 18 registered DECC Aboriginal sites located near the study area are: 36-3-0016, 36-3-0134, 36-3-0237, 36-3-0238, 36-3-0239, 36-3-0240, 36-3-0241, 36-3-0287, 36-3-0337, 36-3-0690, 36-3-0691, 36-3-0692, 36-3-0693, 36-3-0694, 36-3-0695, 36-3-0696, 36-3-0697, 36-3-0698, 36-3-0699 (*see* Table 1 above). These sites are described below:

2.2 Site Descriptions

36-3-0016 – This rock-shelter site with art was originally reported to Fred McCarthy by a Mr J Milliken Resident Engineer in the mid 1940's. McCarthy reports the site in his journal article for Mankind Vol. 3 No. 6 1944 (McCarthy 1944). It is described as Site Number 152, Murragamba, Gulgong Parish, Cave at Murragamba via Ulan. Known as 'Hands in the Rock Cave'; it contains hands, iguana and emu tracks in red. Its condition then was described as faded and vandalised. The site was later re-recorded by Bluff in 1987 and given a new NPWS site number 36-3-0134.

36-3-0134 – This is the same site as was reported by McCarthy in 1944. Warren Bluff recorded it in November 1987 calling it 'Murragamba 1'. The site was described as a large shelter in cliff-line with good deposit at northern end measuring 23m in length x 2.5m in height and 7m in depth with pencil charcoal paint over art names scratched in rock lying on flour. The owner was identified as Mr MJ Carlisle.

The site became known to local Aboriginal people in the mid 1980s and in 1999 the DECC investigated the site as part of a Ulan rock art conservation project (*see* Lambert 1999). Lambert reported that: *"Being a remote site on private property, visitation levels are low and there is no recent visitor damage. The site is in need of management to control illegal practice of writing on the shelter walls"*. The site is described as Wollar 1 but there was some confusion whether it had been previously recorded and registered. Lambert also comments that: *"The cave provides adequate protection from surface water and no intervention in the form of artificial drip-lines are proposed. The art appears stable and in good condition"* (Lambert 1999:4). There was a discussion on how the site should be fully recorded given the amount of graffiti and its history. The local landowners expressed a view that the graffiti should not be removed without consultation with the local farming community families who might have an historical connection to the site.

36-3-0237 – This site was recorded in 2001 by David Maynard as part of a Telstra cable survey and is described as an open artefact scatter/campsite located at the edge of a spur near Murragamba Road, approximately 170m from Murragamba Creek. It contains a scatter of 14 artefacts all made up of quartz material except one piece of green volcanic material. The assemblage is described as flakes, broken flakes and one retouched item (backed artefact).

36-3-0238 – This site was recorded in 2001 by David Maynard as part of a Telstra cable survey and is described as an open artefact scatter/campsite located the edge of a spur near Murragamba Road, approximately 70m from Murragamba Creek. It contains a scatter of six artefacts all made up of quartz material. The assemblage is described as flakes, flaked pebble and broken flakes.

36-3-0239 – This site was recorded in 2001 by David Maynard as part of a Telstra cable survey and is described as an open artefact scatter/campsite located the edge of a spur near Murragamba road, approximately 60m from Murragamba Creek. It contains a scatter of three artefacts made up of quartz material and tuff. The assemblage is described as core, flakes, and broken blade.

36-3-0240 – This site was recorded in 2001 by David Maynard as part of a Telstra cable survey and is described as an isolated find located the edge of a spur near Murragamba road, approximately 15m from Murragamba Creek. It contains a single complete flake of white chert.

36-3-0241 – This site was recorded in 2001 by David Maynard as part of a Telstra cable survey and is described as an open artefact scatter/campsite located on the edge of a spur near Murragamba Road, approximately 70m from Murragamba Creek. It contains a scatter of 19 artefacts principally made up of quartz and tuff material. The assemblage is described as flakes and broken flakes.

36-3-0337 – MC 7 – This site was recorded in 2001 by David Maynard as part of a Telstra cable survey and is described as an open artefact scatter/campsite located the edge of a spur near Murragamba road, approximately 50m from Murragamba Creek. It contains a scatter of 32 artefacts principally made up of quartz and tuff material. The assemblage is described as flakes and broken flakes with a flake tool.

36-3-0690 to **36-3-0699** – There is no information currently available from DECC about these sites or their site cards.

2.3 Registered Sites of Cultural Significance

A search of the DECC AHIMS show there are no known places or sites of cultural significance located near the study area. According to Glen Morris Senior Aboriginal Sites Officer with DECC, records from the NSW National Parks and Wildlife Service Sacred Sites Survey show that there were no living Aboriginal people interviewed in the 1980s who knew of places or sites of sacred value located near the study area (Glen Morris pers comm. 2005).

Site types that have been typically recorded in the general region include (*see* Appendix 1: Figure 2):

- Open campsites made up of stone artefacts dominated by tuff, silcrete and quartz assemblages and sometimes containing hearth material in the form of burnt or cracked sandstone heat retainers. These sites vary in complexity and density depending on their physical condition in the modern landscape and their proximity to major resource zones.
- Scarred Trees representing Aboriginal removal of bark material to make shelters, dishes, canoes, string, shields, boomerangs and carved trees. Within the study area most Aboriginal scars are found on River Red Gum (*Eucalyptus camaldensis*) or Blakely's Red Gum (*Eucalyptus blakelyi*), White Box (*Eucalyptus albens*) and Grey Box (*Eucalyptus largiflorens*). There is a strong correlation between large canoe type scars and more permanent river watercourses (i.e. associated with the use of the Goulburn, Cudgegong and Macquarie River flood plains).

- Carved Trees represent important Aboriginal ceremonial or burial marker locations. They are usually carved on high quality timber such as Red Gum. A slab of bark is removed and then the inner wood tissue is carved using a stone axe or heavy duty cutting tool. Common designs found on carved trees are diamond or linear cross hatching motifs.
- Burial sites are sites that show evidence of Aboriginal burial in discrete locations. Burials in the study region are usually associated with major areas of occupation found next to rivers, lagoons, lakes, waterholes and some creeks. Skeletal material is normally discovered eroding out of sandy deposits, where interment is easiest. Burials may occur in an isolated context or they may be part of a larger cemetery.
- Bora rings are sites containing an arrangement of natural stone to represent ceremonial or ritual practice. They are often found near traditional ceremonial grounds in areas of abundant surface rock. Rocks may be arranged in a circular fashion or oval shapes signifying important ritual meaning for a ceremony. Often bora rings are found isolated on ridge tops or flat hilltops overlooking a significant stretch of country.
- Art sites. These types of sites reflect Aboriginal use of sandstone outcrops for the purpose of painting, engraving or drawing traditional designs. Art sites are often found in areas where people are using country that has good sources of sandstone in the form of rock-shelters, which offer cover from the elements or may be located next to a stream or river.
- Common symbols found in art sites are hand stencils, figurative art representing animal or human forms, tracks of animals and patterns of lines or circles that may represent landscape elements to a traditional story.
- Axe grinding grooves. These types of sites are associated with Aboriginal people using sandstone outcrops to sharpen stone implements and in particular stone axes. Grinding grooves are usually 5-20cm in length and 2-3cm in depth depending on how often the person is using the groove section. Grooves may be found in clusters and are usually concentrated around a surface rock pool where people use water to assist them in sharpening an edge.
- Contact sites. A contact site is site where there is evidence of Aboriginal people living traditionally in close proximity to European settlement. Aboriginal people may be using European items in traditional hunting and gathering practices, for instance bottle glass as a substitute for stone, or metal as a substitute for bone or stone.
- Sites may be associated with Aboriginal people working for European settlers, such as gathering bark sheeting for bark slab huts. Often historic items associated with that contact would be found in certain traditional campsites.

- Waterhole/well. These types of sites, as well as being important places for obtaining water, may also be sacred places and of religious significance to living Aboriginal people.

2.4 Chronology of Aboriginal Occupation in the Central Western and North-West Slopes

Chronology of Aboriginal occupation within the broader region is known to be at least 29,000–34,000 years Before Present (BP) (Kamminga & Mulvaney 1999). The Pleistocene sites of Cuddie Springs and Tambar Springs provide some evidence of early human exploitation of open plain landforms which also contain megafaunal species (i.e. Diprotodonts). Attenbrow (2003) reports a date of 11,050 +/- 135 years BP for a rock-shelter site occupation (Loggers Rock-shelter Site) within the Upper Mangrove catchment.

In 1994, Patrick Gaynor obtained a date of 20,000 years BP from Crazy Man Rock-shelter in the Warrumbungle's National Park. In 1970 David Moore completed excavation of a small rock-shelter at Bobadeen. This excavation site adjoins but is not within the Moolarben Coal Mine exploration license (EL). The Bobadeen shelter excavation produced a basal occupation date of 5500 years BP (Moore 1970, 1981).

In 1961, Tindale completed an excavation at Noola Rock-shelter in the Rylstone area and suggested a date of approximately 12,000 years BP for basal occupation. Another site, Botobolar 5 has been dated to 5770 +/- 100 years BP. Excavations within the Ulan Mine Lease are limited to a salvage excavation and several test excavations. The age of occupation of the sites has been assessed as less than 5000 years old. Technological attributes of stone artefacts present at sites in Ulan have not been the subject of comparison with other sites in the Central Tablelands or Hunter Valley regions, with the exception of Moore's (1970) excavation at Bobadeen.

Moore's (1970) investigations also provide a date of 7000-8000 years BP for the Ulan region, while Pearson (1981) recovered an occupation date of 5500 BP at a shelter site at Botobolar (Kuskie & Clarke 2005).

Haglund's archaeological surveys, test excavations of rock-shelters and open sites and surface collection of stone artefacts were all completed within the Ulan mine lease area in the early 80s. A salvage of shelter site 36-3-177 was the first major sub-surface investigation within Ulan Coal Mine Lease areas.

2.5 Local Archaeological Studies

A majority of Aboriginal sites recorded in or near the MCP Stage 2 study area have been recorded by several different types of Aboriginal heritage assessment. These can generally be described as:

- Telecommunication and power-line environmental surveys such as those undertaken by David Maynard and Siobhan Lavelle for Telstra and Country Energy;
- Volunteer heritage site recordings such as those undertaken by Fred McCarthy of the Australian Museum and Mr Warren Bluff;
- Academic archaeological research undertaken by Dr Mike Pearson in 1981; and
- Environmental assessment of coal mining leases such as those undertaken by Haglund and Associates for Ulan Mine, Hamm for Moolarben Coal Project Stage 1 & 2, Navin/Officer for Wilpinjong Mine and Kuskie and Clarke for Ulan Coal Mine.

2.6 Ulan Coal Mine Lease Archaeological Assessment: Overview

Prior to 1980, three sites were listed by AHIMS in the immediate vicinity of the Ulan Coal Mine Lease (UCML). Since 1980, there have been a number of Aboriginal heritage assessments of the existing Ulan mining lease as part of EIA and other studies, resulting in the recording and registration of over 440 Aboriginal sites. Aboriginal Heritage investigations of the Ulan Mine Lease (i.e. Ulan Colliery and No. 2 Underground mine have been carried out (*see* Haglund 1980, 1981b, 1992 and Corkill 1991).

These archaeological assessments also reported archaeological site descriptions, as well as oral history, and describe test excavations carried out on rock-shelter sites and surface collections. Archaeological surveys of Ulan Coal's ML1468 by Haglund (1999a, 1999b) for the EIS have been reported. A salvage excavation was also undertaken within one rock-shelter site (Haglund 1996a). Archaeological surveys have also been carried out on the northward extension of underground mining, including Longwall Panels 11 and 12 (Haglund 1996b) and Longwall Panels 13-17 (Edgar 1997).

Archaeological salvage excavations have been carried out on SG5 rock-shelter site within Longwall Panel 13 (Haglund 2001a, 2001b, White 2001). Archaeological surveys have also been undertaken for areas west of the existing open cut mine, an irrigation area and other infrastructure facilities (Haglund 1999c, 1999d; Kuskie 2004; Kuskie & Clarke 2005a). Detailed archaeological surveys of portions of the ML1468 area in advance of underground mining, including Panels 18–22 (Kuskie & Webster 2001), Panels 23-26 and W1 (Kuskie & Clarke 2005b) and Panels W2 and W3 (Kuskie & Clarke 2007).

2.7 Haglund's Assessment Studies: 1980–99

Haglund and Associates completed a series of archaeological assessments at Ulan Coal Mine covering a period of almost 20 years. Parts of the Ulan mine were previously surveyed by Haglund (1980, 1981a, 1981b, 1992 and 1999d). Haglund's initial assessment (1980) involved a preliminary archaeological survey of the Ulan Colliery and No. 2 Underground Mine areas. Six Aboriginal sites and numerous isolated finds were identified, largely within the area proposed for open cut mining.

Between 1980-1981 and 1991-1992 Haglund carried out a series of archaeological surveys of mine leases covering parts of the Ulan Mine Exploration area. She identified at least 60 Aboriginal archaeological sites within UCML mining leases.

Corkill (1991) undertook an archaeological survey along a 4km route of a proposed coal conveyor belt and an area to be impacted by mine infrastructure development. Two artefact scatters and one isolated find were located during the survey. One artefact scatter (UC1), located on *'a level bench on the west bank of Ulan Creek in the vicinity of the confluence with an unnamed tributary'*, comprised 50-100 artefacts, predominantly of quartz and chert (Corkill 1991). The other artefact scatter site (UC2) comprised four artefacts on a long exposure adjacent to a road junction and was not to be impacted by the proposed works (Corkill 1991). Chert and quartz were also present at this site which had a high level of disturbance due to earlier road works.

An isolated find (distal end of a quartz flake) was located on a track. Corkill recommended that the full recording of site UC1 be completed and arrangements made to ensure the protection of the site during construction (Corkill 1991) of the Ulan lease area Haglund commented that large portions of existing lease area had yet to be inspected. Table 2 below summarises her findings.

Table 2 Sites recorded as a result of Haglund's 1990s assessments

Report Code	Field Code	Land Form	Size	Boundary Criteria	Deposit Type	Visible Artefacts	Materials represented	Condition	Comments
WV/8	Kwk4	Hill crest; low hill in valley	N/A		Sandy with leaf litter, vis<10%				
MC6	Kbd2	Valley floor and foot slopes			Pale sand with grass	1C, 5F	2 quartz, 1 chert, 2 quartzite, 1 petrified wood	Many wombat holes	Patchy visibility
MC7	Kbd4	Valley floor			Sand with grass	Not recorded		Many wombat holes	Not recorded due to failing light
MC8	Bt2	Hill slope	c.30m	Fence and edge of track	Decaying rock and red sand	c.20 fragments	Quartz and chert	Trampled, eroded, disturbed	Visible artefacts damaged, site may continue beyond fence (woodland)
MC10	Mc13	Valley floor and foot slopes	10m x10m	Track and erosion scar	Eroding B horizon	1C, 3F	3 chert, 1 quartz	Graded, wash, eroding	Site may continue both sides of track, poor visibility
MC12	Mc12	Hill slope	c.10m x10m		Sandy, rocky	2F, >3FF	Chert	Wash, ploughing	Probable remains of minor knapping event
MC13	Kht1	Creek banks, hill slope	C30m dlam.	Edge of clearing	Coarse sand and rock frags = lag	>50 C, F, Ff	Quartz	Severe erosion, disturbed	Severely affected by logging erosion. <10 artefacts/m square
MC14	Kht2	Hillside	c.60m (?)	Track	Eroding colluvium	F, Ff	Quartz	Track, severe erosion and wash	Appears to relate to MC13 nearby; 1 artefact? 5-10m of track
MC15	Mc14	Ridge crest	x.20m dlam	Tracks (intersecting)	Sandy, silty soil, A2-B horizon	C, F, Ff and traffic prod.	Quartz	Traffic, graded, eroded	Some artefacts crushed, many traffic products
BO1	Kl1	Hill slope	50m x20m	Exposures	Topsoil, degrading	C and F (sample recording)	Quartz	Parts much disturbed, road, ploughing	Low lying areas may retain good deposit
BO2	Krm3	Hill slope	c.5m x2m	Exposure on track	Topsoil, degrading	2C, 4F and 1Fp	Quartz	Track worn, slope cleared	Single knapping event. Small area, extends beyond track
BO3	Krm2	Hill slope	c.6m x2m	Patchy exposure	Topsoil, degrading	2F	Quartz	Disturbed by post clearing	Minor knapping/ discard event?

Report Code	Field Code	Land Form	Size	Boundary Criteria	Deposit Type	Visible Artefacts	Materials represented	Condition	Comments
BO4	Krm1	Hill slope	c.30m x2m	Exposure along track	Topsoil, degrading	Core, 3F	Quartz, chert	Soil profile disturbed by road ploughing	Remains of minor, disturbed scatters of background scatter?
BO8	Bc/11	Creek bank and footslopes	c.100 m x50m	Exposure along track and near dam	Topsoil, degrading	1C, 2F, 7FF	Quartz, chert	Surface graded, possibly ripped	Areas between track and creek may retain some less disturbed deposit
BO9	Area 1	Flat crest of low ridge	Crest c.350 m x50m	Patchy exposure	Degrading surface	1C, 1F	Quartz	Severely eroded	Very sparse, little or no potential for research
DU3	Area 2	Rock platform above deep gullies and minor creeks	c.300 m x20m	Exposed rock platform	Bare rock	Sample of c.40 artefacts recorded: C, F, FF backed pieces, hammer and anvil stones	Quartz, chert, basalt, quartzite, petrified wood	Exposed to wash	Represents repeated activities? Probably linked to shelter site just below western end

Note: C=Core, F=Flake, Ff=Flake fragment, Fp=Flaked piece.

Haglund's studies aimed to collect available background information, including oral history, and to get at least 50% survey coverage of surfaces affected by the proposed open-cut mining and associated works. She explains that:

> *A less intensive sampling of other areas aimed to define the types of sites likely to be present, patterns of distribution and, if possible, probable frequencies. Three levels of intensity of survey coverage were aimed for: 100% survey of open sites and some selected areas and, in some areas, 25% survey or single traverse to assess topography, visibility and similarity to areas of more detailed survey.*
>
> *Samples of stone artefacts were collected from sites which would be destroyed by the proposed mining activities, and selected rock-shelters adjacent to the proposed open-cut mine were tested for the presence of stone artefacts, but no extensive excavation had been carried out within the mine area prior to the 1996 salvage excavation; ...*(Haglund 1997:34)

In these two years, Haglund reported on the results of two surveys conducted in the existing mine and proposed open and underground operations at Ulan. The areas examined are located north-west of the Goulburn River, encompassing land units featuring a limited alluvial plain cut by minor tributaries of that river and prominent high ridge structures of sandstone outcrops.

As a data set, these results apply to past habitation in relatively close proximity (800–2500m) of a major waterway and accordingly have potential for setting up comparative insights for the Moolarben Coal Project. To the south of the mine is a subset of habitation phenomena in the ephemeral catchment that makes up the head waters of this major river system.

In 1992, Haglund also surveyed a proposed access route, an area proposed for surface facilities for an extension of the underground mine as well as carrying out sample surveys of three areas of different topography, concentrating on valleys bordered by cliff faces. One of the sample areas overlapped somewhat with the present study area.

She explains that:

> *As survey conditions were different during the 1996 season, a portion of the overlap was re-surveyed (= the east part of the Brokenback Unit).The surface scatters of stone artefacts identified within CCL 741 during previous surveys were found mainly within cleared, often cultivated, areas.*
>
> *The scatters were seen on and in yellow podsolic soils and yellow earth soils which both form firm and well drained surfaces which may be affected by sheet-flooding and severe erosion, but are unlikely to become unpleasantly boggy. In these cleared areas the surface often seemed lowered by deflation of surface wash. The artefacts were mostly exposed on the surface or covered by a thin layer of accumulated debris and turf, except on alluvial flats close to the creek bank or in minor sandy patches where the cover could be deeper and exposure occurred mainly in the sides of small gullies or erosion scars.*
>
> *Some of the erosion was possibly recent, and due to prolonged droughts. However, some artefacts with a heavy growth of lichen must have been exposed for considerable amounts of time. Given the soil characteristics, there was and is little chance of finding organic archaeological material in these open sites; ...* (Haglund 1997:25)

Haglund (1996b) conducted the salvage excavation of DECC site #36-3-177, a rock-shelter site situated in the vicinity of longwall panels 10 and 11 which was considered necessary because longwall mining of these panels was scheduled to take place and the potential for the site to be detrimentally affected by subsidence could not be discounted. Salvage excavation was conducted over three days and a total area of $10m^2$ was excavated (Haglund 1996b). A total of 391 lithic artefacts and 374 flaking debris items were recovered from this excavation; predominantly quartz (68%) then with chert (28%) and igneous rock and petrified wood which were also present. The bulk of the excavated assemblage comprised flakes (52%) and flake fragments (26). Other artefact types recovered included cores, core fragments, flaked pieces and modified flakes (Haglund 1996b).

Haglund's investigation of reduction sequences at site #36-3-177 largely followed Witter's (1992) technological analysis methodology, and using this occupation model analysed the stone tool assemblage in terms of the profiles forwarded by Witter (1994). The assemblage recovered from the excavation most resembled that described for a '*vantage point / crafts station'*. Haglund concluded, however, that the assemblage did not fit any one suggested model in particular (Haglund 1996b).

Haglund's interpretation of the Aboriginal heritage evidence recovered from site #36-3-177 was one of sporadic occupation associated with artefact manufacture and/or repair and that the shelter may represent a vantage point site at which casual manufacture took place (Haglund 1996b). The age of the site was assessed as being within the last 5000 years, although there was no datable material such as charcoal (Haglund 1996b).

Haglund (1996a), during another survey, located an isolated find northwest of site #36-3-177. This was a quartz flake with retouch and use-wear and was interpreted by Haglund (1996a) as representing an item lost or discarded in transit.

Haglund (1996c) also recorded eight rock-shelters and three artefact scatters which had the potential to be affected by longwall mining subsidence and the construction of a pumping station, access track and power line associated with Longwall Panels 11 and 12; and recommended sub-surface testing for the open camp sites to be impacted and altering the route of the access track with an application for section 90 Consent for sites to be disturbed. Further investigation and consultation was recommended.

2.8 Site Location Modelling

Based on her three main Ulan survey assessments, Haglund (1997) argues that Ulan site location modelling can be explained in the following way:

> *…it is likely that at least some water-holes, springs and soaks could be found to be closely associated with archaeological material. It is also possible that more extensive and intensive investigation will reveal examples of additional site types; ...* (Haglund 1997: 26)

She further explains that:

> *It should be noted that previous investigations have concentrated on two landforms, ridge slopes and/or valley floors, depending on what type of topography was most likely to be affected by particular proposed developments. These landforms are also, according to present models, those most likely to contain Aboriginal sites. However, judging from sample surveys in adjoining areas, open sites are likely to occur also on ridge crests, and quarry sites where there are outcrops of suitable rock, e.g. basalt; ...* (Haglund 1997: 26)

Both Edgar (1997) and Haglund (1999a) presented a complementary Aboriginal occupation model for the Ulan region involving:

- Regular seasonal occupation by a local Aboriginal group, resulting in evidence of a range of economic activities associated with repeated long-term occupation, including hearths, stone tool manufacture and curation;
- Intensive but short-term occupation by Aboriginal people from the surrounding regions for special ceremonies. Stone tool assemblages would reflect intensive food gathering and preparation, extensive art and other special activities; and
- Ephemeral occupation resulting from travel through the area between the coast and further inland regions.

Edgar (1997) considered that the results of his survey support aspects of each of these occupations models and recommended that further work be conducted. A later survey by Haglund (1999a) provides evidence which primarily supports the first model of regular occupation.

2.9 Limitation of Sampling Methods and Previous Archaeological Assessment

Several factors from previous archaeological work are likely to affect the assessment of archaeological landscape values within the study area:

- The absence of any form of analysis of data sets to elicit discard patterning in the study area or indeed illuminate any of the primary characteristics of the archaeological record itself or the behavioural systems behind it.
- Site areas, density values, industrial attributes, tabulations of material types, landscape delineation, and similar elements in archaeological investigation that are designed to underscore the significance of cultural materials that may be lost if in fact the mine proposal proceeds as proposed are not adequately described.
- Haglund's overall assessment of significance is not comparable because she has too many lines of evidence which are fragmented and not discussed in any holistic way.
- Sites are discussed but not at an intersite level where comparability can be analysed.

2.10 Ulan Coal Mine Extensions Archaeological Assessment after 2000 Kuskie and Associates

Following on from the work of Haglund, Ulan Coal Mine engaged Peter Kuskie through his company South-East Archaeology Pty Ltd to undertake a series of archaeological assessments within parts of the Ulan Coal Mine that were being expanded for future development.

Kuskie and Webster (2001) comprehensively surveyed Longwall Panels 18-22 in ML1468, a 498ha area, over 12 days in June and July 2001, involving direct coverage of 57.8ha (12% of the study area), resulting in an effective survey sample of about 4.7ha (1% of the study area). This area was subdivided into 205 survey areas, with all different environmental contexts sampled. Vegetation was noted as being the primary detection-limiting factor (Kuskie & Webster 2001).

Some 58 Aboriginal heritage sites were identified; 56 artefact scatters, one rock-shelter with archaeological deposit and one ochre quarry. Three sites (BO10, #36-3-205 and #36-3-207) previously reported within the area were included in this total. Another three previously recorded sites (Haglund 1999a) within the area (BO2, BO3, BO4) could not be relocated. In addition, six potential archaeological deposits were also identified. Artefacts were identified at a very low mean density of 0.0025 artefacts per square metre of effective survey coverage across the entire study area sample (Kuskie & Webster 2001).

Kuskie and Webster (2001) identified and recorded in detail a total of 117 stone artefacts during the investigation. The lithic item assemblage was dominated by quartz (79%), with six other stone materials occurring in much lower frequencies. Sandstone outcrops, alluvial and colluvial gravels, quartz, quartzite, volcanics and ochre were noted within the study area. A total of 14 lithic item types were recorded, comprising thirteen categories of artefacts and lithic fragments, items that could not be positively identified as artefacts.

The lithic item assemblage was dominated by flakes and portions of flakes (51% of combined artefact total) and cores (26%). This evidence represented the dominance of non-specific stone flaking activities within the study area. Evidence of microblade manufacturing was very low, comprising 6% of the total assemblage. A very low frequency of utilised and/or retouched flaked artefacts was present (2% of the combined assemblage). Very low frequencies of tools indicative of other activities were identified. The flaked artefacts tend to be small in size (often less than 30mm in maximum dimension (Kuskie & Webster 2001).

This evidence indicates that Aboriginal utilisation of the Longwall Panels 18–22 study area was of a very low intensity and was probably infrequent and involved low numbers of people. Occupation was more likely focussed in surrounding areas where major watercourses and/or rock-shelters suitable for habitation are located (Kuskie & Webster 2001). Scientific significance of evidence within the Longwall Panels 18–22 study area was assessed as ranging from low to high within a local and regional context. Some 55 of the artefact scatter sites were assessed by Kuskie and Webster (2001) as being of low scientific significance in a local context.

Following minor archaeological surveys in 2003 and 2004, in 2005, Kuskie and Clarke completed an assessment of an area of the Western Open Cut for Ulan. During the initial surveys the then proposed western open cut extension area was subdivided into a total of 54 archaeological survey areas.

The total survey coverage of these survey areas equated to approximately 33,420m^2 or 3.3ha of ground. The total effective survey coverage of this sample area equated to about 3582m^2.

Surface visibility ranged between means of 10 and 20% in the survey areas. Archaeological visibility also ranged between means of 10 and 20%. Vegetation was the factor that typically limited surface visibility (Kuskie & Clarke 2005).

Following reinspection of the physically marked boundaries of the proposed new works, it was concluded that:

- No identified Aboriginal heritage sites are located directly within the *clean water diversionary dam study area*, west of the open cut, although site/locus OCE1/A and Haglund's Site S4 (Ulan ID #62, DECC #36-3-40) are situated within close proximity.
- One identified Aboriginal heritage site/locus, OCE1/A, extends marginally within the current *western open cut extension study area*, and another site/locus, OCE2/A, is situated within close proximity (Kuskie & Clarke 2005).

The sites west of the open cut are dominated by tuff, with quartz, chert and quartzite stone materials also present. However, the small size of the sample is noted.

Tuff is particularly notable west of the open cut in survey area OCE1 and west of the present study area in survey areas OCE34, 38, 39, 40 and 51 (South East Archaeology 2004), which include broad simple slopes, spur crests descending from the adjacent elevated terrain, and the main drainage depression. It occurs as tabular surface outcrops and has become incorporated into the gravels of the main watercourse (OCE40). In the lower portions of the simple slope (OCE34) tabular tuff is eroding from 0.15–0.20m below the present surface, and represents another source of the material. Many samples of the tuff examined were of sufficient quality for stone knapping (Kuskie & Clarke 2005).

In the then proposed western open-cut area examined by South East Archaeology in 2002 and 2003, a high frequency of tuff artefacts exhibited cortex, including 39% (of the tuff artefact total) with the tabular variety and 8% with a rougher, terrestrial cortex. A relatively high frequency of tuff cores were identified (26% of tuff artefacts), including many larger cores. The cores exhibiting cortex (80% of tuff cores) are particularly large, ranging from a maximum dimension of 60-200mm.

Many of the tuff flakes exhibiting cortex (39% of tuff flakes) are also large in size (size classes 6-10). All of these factors are strongly indicative that the tuff used for artefact manufacturing was procured from a local source. The evidence is also indicative of procurement and at least initial reduction of tuff at several sites, particularly at the loci OCE1/A and OCE34/B. At the later locus, it could even be speculated that Aboriginal digging for the high quality tuff that is in abundance 15-20cm below the surface has occurred, possibly causing the formation of the erosion scour (Kuskie & Clarke 2005).

Quartz pebbles were noted in several localities within the study area and it is common in the pebbly sandstone of the adjacent elevated terrain. It can be inferred that this material was procured from colluvial gravels available within or in the immediate vicinity of the study area. Chert was a favoured material for manufacturing artefacts, as it breaks by the process of conchoidal fracture (breakage through force being applied stone on stone) and provides flakes that have sharp, durable edges. Chert is present in the local Illawarra Coal Measures. Several artefacts were comprised of quartzite, and boulders of this material occur throughout the Ulan area and these may represent Permian era glacial erratics (Kuskie & Clarke 2005).

The small sample of lithic items recorded in or immediately adjacent to the western open-cut extension area predominantly includes flakes, cores and flake portions. These items represent general or non-specific knapping activities. However the presence of cores at site OCE1/A may relate to lithic procurement and reduction. The remainder of the items from the western open cut area include a chert utilised flake and a tuff utilised microblade – proximal portion. The utilised microblade portion and utilised flake are indicators of activities other than knapping, such as processing plant food or maintaining wooden implements (Kuskie & Clarke 2005).

The identified sites loci west of the open cut occur on all three of the landform units present (simple slope, spur crest and drainage depression). This result is consistent with the nature of the area, but does not indicate a particular focus of occupation within a particular environmental context. Evidence is distributed widely across the locality in typically very low numbers and densities (Kuskie & Clarke 2005).

Given the virtual absence of clear activity areas – locations where focused human activity has occurred – it can be argued that the evidence within the western open cut study area is predominantly indicative of low density background discard (Kuskie & Clarke 2005).

Kuskie & Clarke (2005) inferred on a preliminary basis from the evidence at the Aboriginal sites recorded within the present study and from other sources that:

- Members of the Wiradjuri people predominantly occupied the study area, within the past 5000 years. Members of neighbouring cultural groups (particularly the Kamilaroi) may also have sporadically occupied the area and occupation may have extended as far back as 30,000-40,000 years (although it is uncertain that any evidence for this may remain).
- Aboriginal people used the entire study area, but at a very low intensity.
- Focused occupation was more likely to have occurred in rock-shelters or overhangs on the scarps and on the major creek flats, but even this may have been relatively sporadic or of low intensity.

- Sandstone bedrock within the main ephemeral tributary of Ulan Creek close to the western open-cut study area was used for the shaping and/or maintenance of ground-edge hatchets.
- The stone materials tuff and quartz were favoured for stone-working activities.
- The manufacturing of stone tools, particularly flaked implements for use in making or maintaining wooden tools or butchering or processing foods, was generally a casual or opportunistic activity. Non-specific stone flaking was a common activity (Kuskie & Clarke 2005).

2.11 Regional Context

The nature of the evidence from the study area can be compared with other studies and sites in the region, although such a comparison is constrained by the limited sample sizes. Some of the notable similarities, particularly within the Longwall Panels 18–22 assessment of Kuskie and Webster (2001) and surveys of Haglund (1999a, 1999b), include:

- Stone artefacts being the dominant form of Aboriginal heritage evidence;
- Quartz being one of the dominant stone materials;
- A generally low mean density of artefacts;
- Dominance of non-specific stone flaking in the overall assemblage;
- Similar range of artefact types; and
- Estimated antiquity of the evidence.

Some of the notable differences, particularly with the studies in the elevated sandstone terrain but also the open lowland terrain investigated by Kuskie and Webster (2001), include:

- The dominance of tuff and presence of tuff sources and potential tuff lithic quarries;
- Absence of rock-shelter art and/or occupation sites; and
- Lower numbers and densities of artefacts than in several areas.

The majority of the items or context located within the study area do not appear to be unique in the region, with the possible exception of the evidence of tuff procurement and initial reduction (Kuskie & Clarke 2005).

2.12 Reassessment of Predictive Model of Site Location

In view of the survey results, the predictive model of site location can be reassessed. The results provide no evidence to contradict the assessments that burial, carved tree, scarred tree, stone arrangement, mythological and rock-shelter with art and/or occupation deposit sites have a low to very low potential to occur within the study area (Kuskie & Clarke 2005).

No grinding groove sites were identified; hence the potential for grinding groove sites within the study area can be revised downward to very low. The potential for lithic quarry sites was initially assessed as low. However, during the course of the investigation, sources of the stone material tuff were identified in widespread locations west of the open cut, including survey area OCE1 within the present study area. In at least one location, Aboriginal site OCE1/A, the evidence is indicative of procurement and possibly at least initial reduction of tuff.

This is consistent with Hiscock and Mitchell's (1993:32) general definition of a lithic quarry site as a '*location of an exploited stone source'*. However, within the revised study area boundaries, the potential for further evidence of lithic procurement to occur is considered to be low, although elsewhere west of the open cut where tuff of sufficient quality for knapping occurs this potential may be higher (Kuskie & Clarke 2005).

The prediction that artefact scatters have a moderate to high potential to occur across the level to gently inclined portions of landform elements (e.g. spur crests and simple slopes), particular adjacent to watercourses has been confirmed during this survey. Evidence was located in these contexts (Kuskie & Clarke 2005).

There remains potential for further stone artefact evidence to occur across virtually the entire study area, albeit typically in low density consistent with background discard, interspersed by occasional areas of higher density in which localised activity areas have occurred. At site OCE1/A, positioned largely between the western open-cut extension and diversionary dam study areas, there remains potential for deposits of sufficient integrity to be of research value (cf. Koettig 1989; Kuskie & Kamminga 2000).

However, in virtually all of the western open-cut extension and diversionary dam study areas, the potential for sub-surface deposits that are *in situ* or of possible research value appears to be low, considering the levels of ground disturbance, shallow upper soil unit and predictive model (Kuskie & Clarke 2005).

In 2007, Kuskie and Clarke, carried out an archaeological assessment of an area defined as SMP (*Subsidence Management Plan*) Area Longwall Panels: W2-W3 measuring approximately 478ha within the Ulan Coal Mine Lease. This development approval was part of an underground coal mine assessment. 21% of the study area was effectively sampled.

Twenty eight Aboriginal heritage sites were identified within the Longwall Panels W2-W3 SMP area, comprising a total of 22 artefact scatters (including 'isolated artefacts'), two rock-shelters with grinding grooves and artefacts, two rock-shelters with grinding grooves, and two rock-shelters with artefacts. Thirteen rock-shelters with Potential Archaeological Deposits (PADs) were also recorded (Kuskie & Clarke 2007).

Only 80 stone artefacts were recorded and Kuskie and Clarke concluded that:

> *Artefacts occur at a very low mean density of 0.0022 artefacts per square metre of effective survey coverage (accounting for visibility), across the sampled area. This evidence indicates that Aboriginal utilisation of the study area was of a very low intensity. It was probably infrequent and involved low numbers of people. Occupation is more likely to have been focused in surrounding areas where major watercourses and/or rock-shelters suitable for habitation are located; ...* (Kuskie & Clarke 2007:3)

Three of the six rock-shelter sites were assessed as having low to moderate scientific significance within a local context, with one site (BB14/F) being assessed to be of moderate scientific significance within a local context, one site (MC1) as being of moderate to high significance within a local context, and one (MC2) as being of high significance within a local context and low to potentially moderate scientific significance within a regional context (Kuskie & Clarke 2007).

2.13 Site Descriptions and Significance Ratings

Kuskie and Clarke (2007) describe each of the sites, which are reproduced below in Table 3 along with their original scientific descriptions.

Table 3 Sites recorded by Kuskie and Clarke in 2007 for UCML SMP Study (after Kuskie & Clarke 2007)

Site Name	DECC #	Ulan ID#	Site Type[1]	MGA Eastings	MGA Northings	Scientific Significance[2]
BB14/A PAD^			Rock-shelter with PAD	755121	6436503	-
BB14/B^			Artefact Scatter	755333	6436458	Low
BB14/F^			Rock-shelter with Artefacts	755125	6436393	Moderate
BO33/B^			Artefact Scatter	757870	6436419	Low
BO36/A^			Rock-shelter with Artefacts	757579	6436530	Low to Moderate
BO37/A			Artefact Scatter	758617	6436885	Low
BO38/A			Artefact Scatter	758465	6436824	Low
BO39/A			Artefact Scatter	758085	6437602	Low
BO40/A			Artefact Scatter	757917	6436956	Low
BQ3	36-3-292		Artefact Scatter	756425	6437144	Low
MC1		163	Rock-shelter with Artefacts and Grinding Grooves	756157	6437582	Moderate to High
MC2		164	Rock-shelter with Artefacts and Grinding Grooves	756191	6437687	High
MC32/C	36-3-376		Artefact Scatter	756541	6436881	Low
MC33/A PAD^			Rock-shelter with PAD	755299	6436592	-
MC34/A			Artefact Scatter	756458	6437087	Low
MC34/B			Artefact Scatter	756207	6437247	Low
MC34/C			Artefact Scatter	756033	6437212	Low
MC35/A			Artefact Scatter	755030	6437043	Low
MC36/A			Artefact Scatter	755524	6437155	Low
MC37/A			Artefact Scatter	755200	6436999	Low
MC38/A			Artefact Scatter	755443	6436931	Low
MC39/A			Rock-shelter with Grinding Grooves	755269	6437104	Low to Moderate
MC40/A PAD			Rock-shelter with PAD	755026	6437199	-

[1] Artefact scatter refers to both scatters (multiple identified artefacts) and isolated finds (single identified artefact). Four rock-shelters (MC46A-D) and an artefact scatter (MC41/C) recorded during the present survey but outside of the SMP area are excluded. Potential Archaeological Deposits (PADs) in rock-shelters are listed but their significance is not assessed due to the absence of identified evidence.

[2] Preliminary assessment of scientific significance within a local context based on the criteria outlined in Kuskie and Clarke (2007).

Site Name	DECC #	Ulan ID#	Site Type[1]	MGA Eastings	MGA Northings	Scientific Significance[2]
MC40/B PAD			Rock-shelter with PAD	755068	6437177	-
MC40/C PAD			Rock-shelter with PAD	755072	6437188	-
MC40/D PAD			Rock-shelter with PAD	755012	6437162	-
MC41/A			Artefact Scatter	756063	6437732	Low
MC41/B			Artefact Scatter	756102	6437830	Low
MC41/D			Rock-shelter with Grinding Grooves	756106	6437785	Low to Moderate
MC41/E			Artefact Scatter	756387	6437713	Low
MC41/F PAD			Rock-shelter with PAD	756156	6437710	-
MC41/G PAD			Rock-shelter with PAD	756119	6437744	-
MC41/H PAD			Rock-shelter with PAD	756102	6437753	-
MC42/A			Artefact Scatter	756358	6437617	Low
MC43/A PAD			Rock-shelter with PAD	755868	6437774	-
MC44/A			Artefact Scatter	757155	6437367	Low
MC44/B			Artefact Scatter	756788	6436906	Low
MC45/A PAD			Rock-shelter with PAD	755518	6437429	-
MC45/B PAD			Rock-shelter with PAD	755492	6437462	-
MC45/C PAD			Rock-shelter with PAD	755417	6437443	-
MC45/D			Artefact Scatter	755037	6437856	Low

^ Site occurs in previously approved SMP Area (W1) area of overlap with SMP Area (W2-W3).

2.14 Rock-shelter Sites

Site MC1 (Mona Creek 1)

Site MC1 is a large cavernous north-east facing rock-shelter with two openings at either end. It had previously been recorded by Haglund (1999b). A potential archaeological deposit was recorded during the Kuskie & Clarke 2007 survey and is considered to have high research potential. The sandstone surfaces of the shelter are subject to some exfoliation and disturbance to the deposit is potentially moderate, with animal burrows and a silty and sandy floor. Twenty-four artefacts were located within and around the shelter during the Kuskie & Clarke 2007 survey. Site MC1 also hosts a floating sandstone slab in the northern portion of the shelter, approximately 700mm in length, with three clearly defined grinding grooves. The grooves measure

between 40–50mm wide and 300–400mm long. The grooves are shallow and clear, but slightly weathered.

Site MC2 (Mona Creek 2)

Site MC2 is a large cavernous south facing outcropping rock-shelter in a massive boulder. Site MC2 had previously been recorded by Edgar (Haglund 1999b). A potential archaeological deposit was recorded during the Kuskie & Clarke 2007 survey and is considered to have a moderate to high research potential. The sandstone surfaces of the shelter are stable, while disturbance to the deposit and surrounds is potentially moderate and primarily arises from animal burrowing and erosion. No visible artefacts were noted during the Kuskie & Clarke 2007 investigation. However, Haglund (1999b) noted three small quartz flakes. Haglund (1999b) also briefly reported the subsequent identification of a rare wooden implement, a boomerang, within the shelter. This item was not relocated during the present investigation and its precise provenance is uncertain.

Site MC2 also hosts a large floating sandstone slab in the central portion of the shelter, approximately 2m in length, with three clearly defined grinding grooves. The grooves identified measure between 60-90mm wide and 350-480mm long. The grooves are shallow and clear, but slightly weathered.

Site MC39/A

Site MC39/A is a south-westerly facing overhang, with substantial rubble overlying largely sandy and silty soils. Two grinding grooves occur on a freestanding/floating sandstone slab in the centre of the shelter. There is potential for further grooves which may be presently covered with silt. The grooves identified measure between 45–50mm wide and 240–260mm long. The grooves are shallow and clear, but slightly weathered. There is only potential for a shallow sub-surface deposit in a relatively small area, which may not be of research potential. No visible flaked stone artefacts are associated with site MC39/A.

Site MC41/D

Site MC41/D is a small westerly facing low shelter with a rocky and sandy floor. Two grinding grooves occur on a small, potentially portable freestanding/floating sandstone slab in the centre of the back of the shelter. The grooves identified measure between 35mm wide and 200-280mm long. The grooves are shallow and clear, but slightly weathered. There is low potential for a sub-surface deposit, particularly one that may be of research value. No visible flaked stone artefacts are associated with site MC41/D.

Site BB14/F

Site BB14/F is an exfoliating rock-shelter in a high sandstone rock formation, previously recorded by Kuskie and Clarke (2005b). A relatively shallow (c. 0.15m) potential archaeological deposit was recorded and is considered to have moderate to high research potential. The sandstone surfaces of the shelter are exfoliating, exposed and weathered, while disturbance to the deposit and surrounds is apparently moderate and primarily arises from animal burrowing and erosion. A single quartz flake portion was located approximately 3m west of the shelter opening.

Site BO36/A

Site BO36/A is a pair of moderately sized cavernous rock-shelters in a low-lying sandstone rock formation, previously recorded by Kuskie and Clarke (2005b). A relatively deep (c. 0.6m) potential deposit was recorded of the western shelter and is considered to have low to moderate research potential. The research potential of the smaller eastern shelter is assessed as limited. The sandstone surfaces of the shelter are predominantly stable, while disturbance to the deposit and surrounds is apparently moderate and primarily arises from animal burrowing and vegetation. Eighteen artefacts were located within and around the western shelter.

Lithic Artefact Scatter Sites

A total of 22 artefact scatter sites (incorporating '*isolated artefacts*') (BB14/B, BO33/B, BO37/A, BO/38/A, BO39/A, BO40/A, BQ3, MC32/C, MC34/A-C, MC35/A, MC36/A, MC37/A, MC38/A, MC41/A-B, MC41/E, MC42/A, MC44/A-B and MC45/D) occur in or within 50m of the Ulan Coal SMP area (W2-W3).

Nineteen of these sites were located and recorded during the Kuskie and Clarke 2007 survey. One site (MC32/C) was recorded by Kuskie and Clarke (2005b) on the margin of the current study area but could not be relocated during the present survey. Another two sites are situated in the portion of the Ulan Coal SMP area that overlaps with the previously approved Ulan Coal SMP area (W1).

The sites recorded by Kuskie & Clarke range up to 2000m^2 in area (visible extent of evidence). Approximately two-thirds of the 'artefact scatter' sites comprise a single lithic artefact, which have been referred to in previous studies as 'isolated finds'. The remaining sites comprise two or more lithic items. Typically 'isolated artefacts' represent the only visible evidence of larger artefact scatters, in which low conditions of visibility have prevented the detection of further items.

A total of 80 lithic items were identified during the Kuskie and Clarke 2007 survey, including 40 artefacts in open artefact scatters and 24 artefacts associated with rock-shelters. This total includes 16 artefacts within the four rock-shelter sites (MC46/A-D) which lie marginally outside of the Ulan Coal SMP area. Artefact numbers range from 1 to 10 within each artefact scatter site recorded.

In general terms, the artefact densities identified within the study area are low by south-east Australian standards and indicate a generally low-intensity utilisation of the locality. The overall spatial distribution and nature of evidence is largely consistent with background discard, manuport and artefactual material which is insufficient either in number of in association with other material to suggest focused activity in a particular location (cf. Rich 1993; Kuskie & Kamminga 2000). This is interspersed by occasional focalised areas of slightly higher artefact density where activities or repeated activities have occurred.

2.15 Wilpinjong Coal Mine Assessment: Navin/ Officer 2005

In 2003, Excel Coal through its subsidiary Wilpinjong Coal Pty Limited, undertook to develop the Wilpinjong Coal Mine Operation. This new coal mine was located approximately 2km to the east of the current Stage 2 Moolarben Coal Project. Part of this assessment included an assessment of Aboriginal cultural heritage and likely open cut mine and associated infrastructure impacts (i.e. Coal Handling and Preparation Plant).

The mine development covered approximately 2800ha or 28km^2 in area and is generally described as the 'project disturbance area'. An Aboriginal cultural heritage survey was conducted by Navin Officer and members of the local Aboriginal community (i.e. Mudgee Local Aboriginal Land Council, Murong Gialinga Aboriginal and Torres Strait Islander Corporation and Warrabinga Native Title Claimants Aboriginal Corporation. Approximately 2510ha (25km^2) of the Wilpinjong Coal Exploration Licence area were surveyed, including comprehensive survey of the Project Disturbance Area and sample survey or other areas adjacent to the Project Disturbance Area.

A total of 235 Aboriginal sites and objects were recorded as a result of the assessment. These Aboriginal sites and objects are described as:

- Isolated finds and artefact scatters in open contexts;
- Rock-shelters with surface artefacts (may also contain potential or confirmed archaeological deposits);
- Rock-shelters with potential or confirmed archaeological deposits;
- Rock-shelters with rock art;

- Possible and probable Aboriginal scar trees;
- Potential archaeological deposits in an open context; and
- Reported places of Aboriginal cultural significance (reported by some Aboriginal people but disputed by others).

In addition, three non-Aboriginal scarred trees were recorded.

Table 4 Aboriginal Sites and Objects Identified in the Wilpinjong Project Area (after Navin Officer 2005)

No. of objects & sites recorded	Site Type Recorded
70	Open artefact scatters
1	Open artefact scatter and procurement site
64	Isolated finds
19	Rock-shelters with surface artefacts (may also contain potential or confirmed archaeological deposit)
21	Rock-shelters with potential archaeological deposit (only)
3	Rock-shelters with rock art (may also contain surface artefacts and confirmed or potential archaeological deposit
24	Possible Aboriginal scarred trees
15	Probably Aboriginal scarred trees
3	Surveyor's scarred trees (undebated European origin)
3	Probably surveyor scarred trees (debated origin)
1	Indeterminate tree feature (debated origin)
3	Other (debated origin) scarred trees
2	Potential archaeological deposits (PAD) (open context)
2	Reported places of Aboriginal cultural significance (disputed by some other Aboriginal representatives)
3	Springs/natural pothole ('waterhole' recorded at the request of an Aboriginal representative)
4	Other (debated origin) isolated finds, lithic scatters or stone arrangements

Navin Officer summarise the main archaeological findings of their investigations in the following way:

> *There are three sites with artefact densities of between 51 to 100, and 101 to 500 estimated on the surface. These sites are located near the banks of* ***Cumbo*** *and* ***Wilpinjong Creeks****, as well as some basal slope contexts. Two sites were recorded with more than an estimated* ***500 artefacts****. Both occur along the banks of* ***Wilpinjong Creek*** *and outside of the Project open cut mine and contained infrastructure area. The margin of one of these sites would potentially be disturbed by realignment of an electricity transmission line.*

Three rock-shelter sites with rock art were identified during the field program. All occur outside of the Project disturbance area and within sandstone and conglomerate rocks. Identifiable motifs include upward pointing tridents or arrows shapes, and red hand stencils.

*Approximately **half** of the **recordings** identified during the survey are located within the Project Disturbance Area and would be subject to direct disturbance during the life of the Project. Approximately 10% of recordings are located within the Project Disturbance Area on the boundaries of the Project open cut pits and are also likely to be disturbed, subject to the detailed mine design.*

One site of high archaeological significance (within a local context) occurs within the Project Disturbance Area. This is a large open artefact scatter with more than 500 artefacts that may be impacted on its margin by the realignment of an electricity transmission line. No other recordings of high archaeological significance occur within the Project disturbance area. Eight stone material categories were recorded during the survey. The dominant categories were quartz (noted in 75% of all artefact occurrences), and tuff (36%).

Just under half of the recorded Aboriginal sites occur within valley floor contexts, a third within basal valley slope contexts, 19% occur on mid valley slope contexts and 4% in upper valley contexts; ... (Navin Officer: Fii-iii 2005)

2.16 Moolarben Coal Project Assessment of Stage 1: Hamm

In 2005 and 2006 Hamm (2006) undertook an assessment of Aboriginal cultural heritage values for the proposed Moolarben Coal Project Stage 1, located in the western coal fields of NSW, 40km north-east of Mudgee and 25km east of Gulgong. The study covered an area of approximately 35km^2 of low undulating hills and hill slopes from 400-680m above sea level on sandstone plateaus with extensive rock outcrop. Narrabeen Sandstone is the dominant parent rock. Parts have lower colluvial slopes of sandstone plateaus escarpments with low undulating rises and creek flats. Moolarben Creek flows through part of the study area. The landscape is heavily vegetated with some clearing for pastoral activity around the village of Ulan, and the locality of Moolarben along the Moolarben Creek. Approximately 4.2km^2 of land was foot surveyed from approximately 6.8km^2 of land available to be surveyed due to available surface visibility.

The assessment located and recorded a total of 1598 Aboriginal objects (302 sites). This cultural record was made up of: 63 open stone artefact scatter sites of varying densities, 219 individual stone artefact isolated finds, 18 rock-shelter sites, a grinding groove site and a scarred tree site. A majority of this record (87%) is made up of exposed stone artefactual material eroding from areas of bare soil exposure with less than five artefacts in density.

The most concentrated occupation areas located within the Stage 1 study area were:

- Central Moolarben Creek Alluvial Flats: Mayberry Property at Open Cut 3
- Southern Moolarben Creek Alluvial Creek Flats and Ridges: Stokes Property Open Cut 3 Extended
- Underground No. 4 Northern Ridge Lines: Westwood Property
- Bora Creek Alluvial Flats: Ulan Coal Mines Property.

The principal Aboriginal objects recorded in the assessment were stone artefacts. A total of 1597 stone artefacts were recorded. Quartz raw material dominated all assemblage components for MCP Stage 1 sites, accounting for 81.6% of the total raw material count. The next most commonly used raw material was Tuff, accounting for 10.6% of the total assemblage count. Silcrete was also used, but in much lower proportions.

A majority of surface assemblages recorded were made up of Broken Flakes, followed by Flaked Pieces and Complete Flakes. Retouched or used items only accounted for 2.2% of the total assemblage contents. Cores made up approximately 8.5% of the total assemblage content. A majority of cores were multi-platform type made from quartz and tuff materials. A total of four backed pieces (i.e. geometrics) were identified with three being recorded, within Transect 4 Underground No. 4. All three backed pieces are made from Tuff material.

A majority of flakes (Complete and Broken Proximal) contained approximately 75% broad platforms with 18% containing focal platforms. Cortex is found on approximately 12% of all stone artefact items. A comparison was made of the size of Complete Flakes. Graphing shows that a majority of quartz Complete Flakes recorded were between 10-40mm in length and 10-25mm wide. Whilst the Complete Flake size distribution for Tuff was much broader, showing a more diverse flake selection process operating.

Of a total of 302 sites recorded for the Stage 1 project area, eight sites (i.e. S1MC: 103, 230, 264, 280 (36-3-0042), 282, 283, 286, 287 are considered to be of high archaeological significance. However, given some of these sites are located within a disturbed context, further archaeological investigation may not be warranted. The remaining 294 sites were considered to be of medium or low archaeological

significance. From an Aboriginal cultural assessment point of view, the most sensitive Aboriginal cultural landscape is located within the northern area of Underground No. 4 (i.e. near 'The Drip'). However, general Aboriginal community consultation advice has stated that all sites (archaeological or cultural) are of value, but none of the community members interviewed objected to the mining proposal going ahead.

A significant percentage of open alluvial plains and flats assessed in MCP Stage 1 have been disturbed due to historic farming practices, especially broad acre clearing for ploughing and pasture improvement. As a result of this activity, approximately 80% of Moolarben Creek's modern day channel has been heavily affected by sheet erosion as a result of agriculture. It is argued that this long-term impact may also be responsible for a lack of intact rich open sites which are more common along Murragamba and Wilpinjong Creeks. The presence of natural springs and soaks is likely to have heavily influenced the location of major open space Aboriginal sites occupation for the Moolarben Creek catchment and surrounding ridgelines. Although rock-shelters were used by Aboriginal people in the MCP Stage 1 study area they were more specific in their purpose (i.e. to carry out rock art and ceremony) and less likely to contain significant long term occupation evidence.

2.17 Moolarben Coal Project Assessment of Stage 2: Hamm

In 2006, Archaeological Risk Assessment Services Pty Ltd (ARAS) was engaged to undertake an assessment of the Aboriginal cultural heritage values of the proposed Stage 2 Moolarben Coal Project (MCP) area (Hamm 2008), located in the western coal fields of NSW, 40km north-east of Mudgee and 25km east of Gulgong. The Stage 2 study area is approximately 37km^2 in size, being located to the immediate east of the approved Stage 1 MCP site.

Stage 2 MCP investigation area consists of two proposed Underground Mines (UG 1 and UG 2) and a large Open Cut Mine (Open Cut No. 4). The total area of potential mine impact is approximately 2260ha or 22.6km^2.

The most dominant environmental feature of the Stage 2 investigation area is the Murragamba Creek Valley and the surrounding sandstone ridgelines which run in a north-south direction creating a series of elongated valleys. Approximately 7.65km^2 (20.6%) of the study area was assessed on foot by a team of qualified archaeologists and local Aboriginal community members over a 30 day period in 2006. A total of 49 survey foot transects were completed.

This assessment located and recorded a total of 4836 Aboriginal objects. This cultural record is made up of: 150 open stone artefact scatter sites of varying densities, 103 individual stone artefact isolated finds, four rock-shelter sites, a grinding groove site and 33 Potential Archaeological Deposits (PADS). A total of 258 Aboriginal sites have been identified in the investigation area. There are 18 existing Department of Environment and Climate Change (DECC) sites which have been re-recorded in light of this assessment and assigned their own S2MC site number.

A majority of this record (90%) is made up of exposed stone artefactual material eroding from areas of bare soil exposure with less than 50 artefacts in density. However, 33 of these open sites also contain PADs which are principally concentrated within the Murragamba Creek catchment. There are 10 sites that contain over 100 artefacts within their surface assemblage. Eleven sites were recorded as being of High Scientific Significance with one registered DECC site (37-3-0134) containing painted rock art that is assessed to be of regional significance. Twenty nine sites were assessed to be of Medium Scientific Significance and 218 were assessed to be of Low Scientific Significance. The Murragamba Creek Valley and adjacent Moolarben Ridge (Carr's Gap Ridge) are considered to be significant cultural landscape features.

The assessment of Aboriginal cultural values was by expression of interest through letters and community meetings. Several people were interviewed about places of cultural significance near the proposed Stage 2 MCP development area. Parts of the Munghorn Nature Reserve located to the south-east of Stage 2 MCP development area are considered to be significant from a contemporary Aboriginal cultural perspective.

No one was identified within the existing four Aboriginal groups as having cultural knowledge about the proposed Stage 2 MCP development area. Whilst local Aboriginal people generally expressed an interest in archaeological sites and their protection, there were no objections to the proposed coal mine project going ahead on cultural assessment grounds.

2.18 Site Definition and Problems of Site Recording

A significant issue in recording hunter-gatherer open space occupation is how to define an occupation location or 'site'. The NSW Department of Environment & Climate Change (DECC) advise developers and Consultants that the term 'site' is used to group objects or define a location where a relic or cultural item occurs. The general criterion used to define sites is set out below. Sites may be:

- Exposures where archaeological evidence is revealed;

- Topographic or land form units where occupation evidence has been recorded. This may be an entire landform unit (ridge, creek, valley) or part of a landform unit (saddle on ridge, creek bank);
- Locations having physical boundaries defined by rocks (stone arrangement), or earthworks (mounds) or cleared land (ceremonial ground);
- Locations having cultural significance to Aboriginal community groups;
- Locations having an arbitrary boundary or the assignation of a boundary for the convenience of recording (in cases where the site would probably be much larger if based on the criteria above). Arbitrary criteria include the use of a fence-line, dirt track or gully as a boundary. In some cases the area may simply be designated as 50m x 50m, or as a smaller sample plot, on the basis of convenience; and
- Locations having a specific artefact density. In some cases a site boundary may be defined by the average number of flakes per square metre. This is a specialised type of arbitrary criterion and justification of the rules used must be made explicit.

The chosen definition of a site or isolated find needs to be specified for the study. It is the Consultant's responsibility to decide on an appropriate definition, suited to the particular project, the research goals and comparability with other regional studies. DECC requires site forms to be completed for isolated finds.

In addition to the above, the NPW Act 1974 (amended) also defines an Aboriginal object as:

> *any deposit, object, or material evidence (not being a handicraft for sale) relating to indigenous and non European habitation of the area that comprises New South Wales being habitation both prior to and concurrent with the occupation of that area by persons of European extraction and includes Aboriginal remains; ...* (NPW Act 1974, section 5: Part 1 pp: 8–9)

Other issues concerning site integrity, site formation and factors of disturbance have been argued by a number of authors. The work of Schiffer (1987) helped describe the patterns of transformational processes, both cultural and non-cultural that create the archaeological record. Following on from this Hurst Thomas (1991) argues four distinct cultural processes that affect the final condition of the archaeological record (i.e. especially for open space occupation).

These processes are defined as 'deposition, reclamation, disturbance and re-use' (Hurst Thomas 1991:132). These processes are briefly described below:

Deposition – These are actions, usually cultural in origin, that cause the accumulation of the archaeological record. This can be simple discard of cultural material at a site, burying the dead or the construction of a hearth. Size of cultural objects is one major influence on the way cultural objects are incorporated into the cultural deposit. This is called the 'size-sorting effect'.

Reclamation – This is the process whereby archaeological material is reincorporated back into a systemic context. Examples of this would be people re-using occupation areas or new people settling on an old campsite location that has been abandoned by another family group.

Disturbance – This process mainly refers to human or natural actions, which transform the archaeological record from its origin depositional context. Human actions would refer to prehistoric land-use patterns where materials are swept away or moved from a campsite to clear the ground. Modern human actions would be: Vegetation clearing on hill-slopes increasing sheet erosion and removing small artefacts that are redeposited on lower slopes and flats. Removal of old trees containing scars or carvings on them. Dam building and road building causing an increase in surface erosion and possible destruction of buried deposits. Cattle walking across sites causing artefacts to be scuffed, broken or working edges damaged. Trees falling over causing displacement of sub surface artefacts. Bushfire causing a heat distortion effect with surface artefacts and the collection of charcoal. Natural processes can refer to down slope slippage, gully and sheet erosion, and bioturbation by tree roots and insects.

Re-use – This process usually refers to how people may re-use cultural objects in a different way for a different purpose. An example could be stone tools used for another purpose or hearth stones used as anvils etc.

Given the above site disturbance factors, any comparison of open sites and their content can only be used as an indication of land-use in land unit context. The comparison will be limited in determining the true extent of occupation, unless ground exposure is uniform across several land units and measured at a consistent scale.

2.19 Stone Technology and its Variability

Hunter gatherer occupation sites or campsites (i.e. rock-shelter or open space) are likely to have a broad range of tool types due to the variety of activities undertaken at a site over a certain period of time. These types of sites are contrasted to the more specialised sites where food gathering or hunting requires a more restricted range of tool kit. Tools that are broken or exhausted are often found at these types of sites as well as resharpening flakes from a tool user carrying out tool maintenance (Kooyman 2000).

Lithic analysis can also lead to information about where a tool may have been manufactured and why it was discarded. The analysis of lithic debitage can also provide information on whether the tool was manufactured close to a quarry site or transported from a distance. Evidence such as the amount of decortification flakes, unmodified or broken flakes or flakes with specific types of platform can all lead to an understanding of the stages of tool manufacture.

Modelling of prehistoric hunter gather behaviours using lithic analysis has led some researchers to speculate on the level of sedentism or mobility. The assumption that mobility of a group limits the type of the toolkit has been put forward by a number of researchers (Walker 1978, Bleed 1986, Bamforth 1986). Conversely, greater sedentism usually means groups will have a greater range of resources to choose from at one site and thus their toolkits will contain more variety (Odell 1994). The more mobile a group is the more likely it is to standardise its core technology (Odell 1994).

Curation of tools is another important consideration in assessing lithic variability. Odell (1996) argues that curation will usually reduce the need for raw material supply. This leads on to the concept of gearing up or preparing tools in advance of use. This further raises the question of the functionality and versatility of tool types that may or may not tell us something about how prehistoric hunters maximised opportunity when using a range of landscape in the past.

2.20 Sample Size Considerations and Inter-Site Comparisons

An article by Hiscock (2001) on the effects of sample size on the interpretation of archaeological patterning of Holocene stone artefact assemblages requires some consideration in comparing sites across landscapes. The central issue for most consulting reports is the recording of rarer types of artefacts (i.e. backed artefacts) in relation to the entire site assemblage. Comparing the variation of assemblages between sites and using this to define site function may be refuted on the grounds that the sample sizes of site assemblages are too small to provide statistically valid comparisons.

Hiscock explains his proposition by using a hypothetical example:

> *Even in sites where only one specific kind of knapping activity takes place, such as the manufacture of backed artefacts, the various objects employed and created will be probably discarded at different rates. For instance, many flakes will be rapidly discarded, cores are likely to be discarded less frequently, backed artefacts less frequently still, and hammerstones may be rarely thrown away.*
>
> *These differences in the likelihood of discard relate to a number of factors, including the length of 'use-life' of each kind of object. When only a few of these objects have been discarded it is likely that the assemblages will be dominated by only those classes of object that are discarded frequently such as flakes and cores in this example. As occupation of the site continues and the size of the assemblage grows with further discard of material, it is likely that objects such as backed artefacts and hammerstones may be eventually discarded;* ... (Hiscock 2001:50)

Hiscock further argues that a sample required to contain all possible categories of artefacts in a particular locality is proportional to the relative abundance of the rarest artefact type. Thus while some sites or regions with sample sizes of between 50-100 may be adequate, sites in other regions with 1000-10,000 may be too small to provide a more complete assemblage composition. As Orton (1992) has put it, there is no absolute sample size in which all sites or regions are likely to contain an adequate sample of the total variation in assemblage composition.

3. ENVIRONMENT & LAND-USE HISTORY

The study area falls within the Sydney Basin physiographic land system (Murphy & Laurie 1998). Generally the land is described as having low undulating hills and hillslopes from 400-680m above sea level on sandstone plateaus with extensive rock outcrop. Narrabeen Sandstone is the dominant parent rock. Parts have lower colluvial slopes of sandstone plateaus escarpments with low undulating rises and creek flats. The Ulan soil landscape is the dominant soil landscape found within the study area and is describe in Table 5 below.

Table 5 Ulan Soil landscape of the study area After Jammell Environmental Planning Services (2005)

Landscape	Landform	Lithology	Typical soils	Limitations
Ulan	Low undulating rises and creek flats. Elevations between 360-570 m. Slopes between 2-10%. Local relief varies between 10-40 m.	*Undifferentiated and Illawarra Coal Measures* Shale, sandstone, conglomerate, chert, coal and torbanite.	Yellow podzolic, yellow solodic/ solonetz, yellow and brown earths, and earthy sands.	Mod to high erosion hazard and susceptible to soil structure degradation. Imperfectly drained on the lower slopes and depressions. High soil salinity levels and low soil fertility.

Source: Adopted from DLWC (1998) & Jammell (2005).

There is no significant natural watercourse found within the study area, although some areas do contain run-off points in lower parts of the landscape. Prior to European settlement, the vegetation community in the study area would have been defined as woodland. The existing vegetation community has been classified by Aitkens (2006) as cleared remnant woodland. Many of these remnant woodlands and forests are floristically variable, with some being characterised by White Box (*E. albens*), Yellow Box (*E. melliodora*) and Blakely's Redgum (*E. Blakelyi*).

The community characterised by these species is listed as endangered under the TSC Act and EPBC Act (Grassy White Box Woodland). Woodlands dominated by Rough-barked Apple (*Angophora floribunda*) are commonly found along the creek lines, often in association with Yellow Box (*E. melliodora*) and Blakely's Redgum (*E. Blakelyi*). The adjoining sandy terraces of the Permian geological period also host monotypic communities dominated by Rough-barked Apple (*A. floribunda*). More clayey soils support Grey Box (*E. moluccana*) dominated communities.

A majority of the study area has been cleared of mature eucalypt trees for pasture improvement and this has seen the growth of Sifton Bush(*Cassinia arcuata*) across midslopes. Regrowth of mainly Ironbark species such as Narrow-leaved Ironbark (*E. crebra*) and Broad-leaved Ironbark (*E. fibrosa*) has also occurred in places. A number of small farm dams lie within the rail loop extension area as do some fence-lines which run in a north-south direction.

4. ABORIGINAL CONSULTATION

As part of the Aboriginal community stakeholder consultation process, the following MCP Stage 1 & 2 Aboriginal stakeholder groups were notified about the proposed assessment and invited to participate in the archaeological work:

- Mudgee Local Aboriginal Land Council based in Mudgee;
- North-East Wiradjuri Pty Ltd based in Ulan;
- Murong Gialinga Aboriginal & Torres Strait Islander Corporation based in Mudgee; and
- Warrabinga Native Title Claimants Aboriginal Corporation based in Kandos.

A total of two Aboriginal Community Stakeholder representatives per group were invited to participate in the survey assessment (*see* Appendix 4).

5. SURVEY ASSESSMENT METHODS

I was provided with a basic site plan showing the locations of the proposed relocated Stage 1 ROM dump hopper site and the proposed water pipe-line route (*see* Appendix 1: Figure 1). I conducted the survey assessment of both sites with six Aboriginal people on 1st and 2nd of June 2009.

The most likely sites to occur within the land proposed for development area are isolated finds, open campsites and scarred trees. Rarer sites may include grinding grooves, carved trees, bora grounds (stone arrangements) and burials.

6. ASSESSMENT COVERAGE & SURVEY RESULTS

The most significant constraint in carrying out the survey assessment was lack of ground surface visibility. Some land units did contain vehicle tracks and small patches of erosion due to waste dump modification and land-fill clearing. The Ulan-Cassils road reserve has been subjected to clearing and earthworks. In addition to this several utility services have also been install along section of the road reserve (i.e. water pipe-line and Telstra cable route *see* Plate 1-5: Appendix 2). Average visibility across the study area would have been between 0% and 25%. Foot coverage across the study area was 100%. Orange & Pink flags were used to mark potential cultural features for detailed recording (i.e. Aboriginal Objects).

Field conditions were good. The main method of survey assessment was foot transect. The survey team consisted of six people walking slowly across the study area spaced 20m apart. A total of two foot transects were investigated, one for the proposed relocated Stage 1 ROM dump hopper site and the other for the proposed pipe-line easement.

Areas which contained evidence of ground surface exposure were investigated thoroughly. The original vegetation community can be described as open forest/woodland with ironbarks dominant. In the road reserve, over 95% of the easement has been cleared for road infrastructure purposes. The pipe-line easement was investigated using a 10 metre wide corridor.

Table 6 explains which areas were sampled and what physical evidence were located during the survey assessment.

Table 6 Archaeological assessment sample unit and results June 2009 *(*see Appendix 1: Figure 2 and Figure 3)

Land Form Units	Transect No.	Area investigated	Results
Broad Ridge crests Spur-lines Simple-Mid Slopes Erosion gullies	1	400m x 500m ROM Hopper Area Vehicle access track Boundary fence Dams Cleared Land fill	No sites identified 0–25% ground visibility Ironbark re-growth, pasture grasses Sifton Bush, Small shrubs, trees
Spur-lines Simple –Mid Slopes Erosion gullies	2	2.5kms Water pipe-line Start: E: 0761010 N:6429034 Finish: E:0761503 N:6426822	3 Isolated Finds identified 0-25% visibility. Cleared easement Road Reserve

7. RESULTS & DISCUSSION

A total of three Aboriginal Sites (making up a total of three Aboriginal Objects) were located as a result of Aboriginal cultural heritage assessment along the proposed water pipe-line route. This cultural record is made up of three Isolated Finds. The archaeological evidence represents stone artefact material being exposed by surface erosion processes and road work activities. No Aboriginal sites or objects were identified for the proposed relocated Stage 1 ROM dump hopper site area.

The Aboriginal Objects located on the surface are principally concentrated on a broad spur/ridge crest features which lie above minor ephemeral drainage associated with the Goulburn River catchment (*see* Appendix 1: Figure 4). The three sites (Sites S1MC 310-S1MC 312) are described in Table 7 below.

Table 7 MCP Stage1 Proposed Water Pipe-line Route Aboriginal Site Descriptions

Site Name	Site Features	Comments
S1MC 310 (T2) Site 1	Isolated find. Spur slope. Bare soil patch: 1m^2. No cultural deposits present. There is no hearth or visible bone material associated with the site's contents. The site is located on a mid-slope feature. The site is in poor condition.	A single isolated flake. Quartz . Unmodified. Broken Flake. L:17mm W:15mm T:7mm. Medial fragment. No cortex. E:0761014 N:6428930
S1MC 311 (T2) Site 2	Isolated find. Spur slope. Bare soil patch: 1m^2. No cultural deposits present. There is no hearth or visible bone material associated with the site's contents. The site is located on a vehicle track mid-slope feature. The site is in poor condition.	A single isolated flake. Silcrete . Unmodified. Complete Flake. L:20mm W:17mm T:4mm. Focal platform. No cortex. E:0761232 N:6428099
S1MC 312 (T2) Site 3	Isolated find. Spur slope. Bare soil patch: 1m^2. No cultural deposits present. There is no hearth or visible bone material associated with the site's contents. The site is located on a vehicle track mid-slope feature. The site is in poor condition.	A single isolated flake. Quartz . Unmodified. Broken Flake. L:25mm W:17mm T:7mm. Proximal fragment. No cortex. E:0761279 N:6427873

7.1 Site Age & Subsurface Potential

Without evidence of buried hearths (i.e. ancient fireplaces), rock-shelter deposits containing dateable carbon material are the only evidence that could be dated directly. None of the open sites recorded in the study area can be directly dated. This obviously means that true age cannot be known. Another technique of indirect dating is seriation. Hiscock (1986) has set out the main stone tool reduction sequence for the Hunter Region and is further refining this through research looking (Eastern Sequence Project) to identify the nature and directionality of technological changes in stone artefact assemblages in Aboriginal sites within the Sydney Basin. The study is also looking to compare temporal trends between and within sub-regions of the Hunter Region and the Sydney Basin.

Surface artefactual assemblage data recorded in proposed water pipe-line route study area and overall for MCP Stage 1 & 2 Aboriginal sites show stone tool manufacture being associated with a backed technology sequence principally designed for geometric and bondi point production. It is likely that the surface assemblages recorded in the water pipe-line study area can be generally described as being part of the Eastern Regional Sequence of backed technology, first proposed by Fred McCarthy in the 1940s (Hiscock & Attenbrow 2002).

In terms of direct dating, the surface evidence is likely to be only a few hundred or thousand years old. One can only speculate, given the extent of erosion and likely disturbance along Goulburn River and surrounding landforms that most sites are probably not more than 500-2000 years old.

Although a majority of the soils are shallow over much of the study area and likely to have been heavily bioturbated, there is some alluvial soil development within the immediate Bora and Wilpinjong Creek catchments. This, coupled with the fact that human occupation is likely to have been concentrated within a certain distance from creek margins, show there may be some potential for buried open deposits.

7.2 Limitations of the Data

The most significant limitation of the survey data is the lack of ground visibility on the tops of spur-lines and ridge crests. Due to the above, more archaeological evidence was expected in areas within 100m along most of Goulburn's River's catchment. Although road works has no doubt removed potential sub-surface deposits in some alluvial land units, more buried evidence would be expected to be found where occupation material has accumulated over a long period of time.

7.3 Landscape Setting

The three sites recorded are as expected in their current topographical setting. Archaeological material is especially concentrated on elevated spur land units east-west of Bora and Wilpinjong Creek. The highest concentration of occupation evidence is located between the spurs, terraces and creek flats. As cultural features, they represent low level Aboriginal occupation of the Bora and Wilpinjong Creek valleys. Artefacts found in isolation are likely to have represented discard events associated with short-term fringing occupation. This may have been associated with a small ridge-crest campsite or site-specific activity events (i.e. stone tool manufacturing and discard events). Due to the level of soil disturbance across the study area, the possibility of dating individual artefacts has been lost.

Adjacent to the proposed relocated Stage 1 ROM dump hopper site are a series of spur-lines running in a north-south direction which may contain low level Aboriginal occupational evidence. Due to a severe lack of ground visibility on these spurs no cultural evidence could be detected.

Within a broader context, the sites in their landscape setting are not identified as being rare or significant when compared with other geomorphic or archaeological landscape features in the Moolarben and Ulan region.

8. SIGNIFICANCE ASSESSMENT

The consultant has based his Significance Assessment of the MCP Stage 1 Rail Loop cultural resource on the following criteria:

- *NSW National Parks and Wildlife Service Guidelines*
- Australian Heritage Commission National Estate criteria
- Archaeological significance assessment
- Aboriginal social significance
- Educational value

It is important to state that not all cultural heritage sites or places are equally significant or important and consequently worthy of long-term preservation. A detailed discussion of significance criteria and how it has changed over time has recently been undertaken by Byrne et al (2001). The most important criteria for the assessment of the MCP Stage 1 water pipe-line route study area Aboriginal cultural resources are:

- Aboriginal social significance
- Scientific archaeological significance
- Educational significance

Excluding Aboriginal social significance, these specific criteria are defined below.

8.1 Aboriginal Social Significance

Moolarben Coal Operation Pty Ltd has undertaken to consult directly with all Aboriginal community stakeholder groups affected by this development proposal. As such, the relevant groups will be providing their own statement of Aboriginal significance to accompany this report (*see* Appendix 4).

'Scientific significance' is defined as: *The scientific or research value of a place. This will depend upon the importance of the data involved, on its rarity, quality or representativeness and on the degree to which the place may contribute further substantive information*. (Byrne et al 146:2002).

In the Sydney Basin context, I have used following archaeological assessment criteria concerning Aboriginal history and past land-use, which are represented by the following headings:

- Information and Research Potential
- Regional Research Priorities
- Representativeness

- Rarity
- Educational Potential
- Cultural Landscape Value

8.2 Information & Research Potential

This criterion is relevant to assessing an area's research potential in understanding Australia's cultural history or human occupation of Australia. An area's cultural resource may have the potential to provide information that will contribute to understanding past human behaviour. Three factors are considered important in assessing a site, suite of sites or cultural object as having research potential:

- A place or site's intactness or integrity (this may include the state of preservation of a site or cultural remains). An intact site or place may reveal a greater amount of cultural evidence for past human behaviour. Sites in poor condition may be limited in what they can contribute to further research.
- Whether a site or Aboriginal Object may demonstrate connectedness to other sites within a landscape or within a regional context.
- The chronological potential of a site or suite of sites to provide dates of human history for that particular evidence of occupation. This includes whether the site or place has potential for dateable deposits or strata.

8.3 Regional Research Priorities

This research criterion is important for assessing the significance of when information will contribute on a regional level and will assist other researchers in the understanding of past human behaviour. It is usually understood in the context of regional research priorities. Some priorities may be focused on chronology, others on technological variability, while others may be looking at site function.

8.4 Representativeness

This archaeological assessment criterion is based on a conservation objective. It is particularly relevant when assessing what a site or place may contribute if it were to be preserved for future generations. The concept has to be assessed in a regional and local context. If very little of this type of site or suite of sites has been conserved, then it becomes a conservation priority. The aim for cultural resource managers is to conserve a representative sample of sites or places for future generations and research.

The main problem of this criterion is that much of the comparative data for site conservation, especially on a regional scale, has not been systematically gathered by many conservation agencies. Defining 'variability' may be an aim for cultural resource managers, but if nothing is known about what has been destroyed or lost due to natural or human development processes then comparisons concerning representativeness are meaningless.

Without the above information, archaeologists are encouraged to assess representativeness based on their field experience and on their reading of the representative literature.

8.5 Rarity

This concept of significance criteria concerns the issue of how distinct a site or cultural object may be compared to other similar sites or objects. 'Rare' implies that sites or objects of this nature have not been readily reported or assessed in a local or regional context before. The criterion of rarity may be assessed at a range of levels including local, regional, national, state or international.

8.6 Educational Potential

Sites or places that help educate the broader public about Wiradjuri Aboriginal history are a valuable resource. It is usually the level of information retrieved from sites or objects that can really assist in enlightening the public about what happened at a particular place in the past. This educational potential comes from the work of the archaeologist in translating their findings or research results into everyday language that people can understand.

The educational outcomes may be presented in newspaper articles, books, video presentations, lectures, radio broadcasts and information brochures. The information may be displayed as part of a local or regional museum. A mining company may use the research results to inform their employees about Aboriginal cultural history and occupation of a local area. The Aboriginal community may take the information and use it in local schools to teach and educate children about Wiradjuri Aboriginal history and culture.

8.7 Cultural Landscape Value

This value combines the concept of aesthetic and social significance in the broader context of how living Wiradjuri Aboriginal people perceive the local landscape and their sites or cultural objects within it. This Aboriginal concept may be connected to the understanding of religious and scenic values where places and natural features may contain inherent Wiradjuri cultural landscape values.

Sites or Aboriginal Objects found within a landscape which is 'untouched' or has natural scenic beauty may be important when assessing cumulative impact or broader landscape disturbance. Aboriginal people will place a value on an entire landscape (with all its natural features) and how that may be affected by development impact.

9. SIGNIFICANCE RESULTS

9.1 Information & Research Potential

There are no sites or Aboriginal objects considered to have any research potential based on their local contents and condition.

9.2 Regional Research Values & Representativeness

There are no sites or Aboriginal objects considered to have any regional research value.

9.3 Rarity

There are no sites considered rare based on their content, landscape aspect and research potential.

9.4 Educational Potential

There are no sites or Aboriginal Objects considered to have any educational potential.

9.5 Cultural Landscape Values

Neither the proposed relocated Stage 1 ROM dump hopper site or water pipe-line route contain Aboriginal cultural landscape values.

9.6 Scientific Significance Rating

Based on the above significance criteria, Table 8 below summarises the main significance rating for each site. It shows level of scientific significance assessed for Aboriginal sites/objects located within the project area.

Table 8 Level of scientific significance assessed for Aboriginal sites/ objects located within MCP Stage 1 Water Pipe-line area

Low	Medium	High
S1MC 310-312	None	None

10. DEVELOPMENT IMPACTS & CONSERVATION OUTCOMES

Following a meeting with Moolarben Coal Operations Pty Ltd on 1st of June 2009 to determine likely impacts from the development proposal on existing Aboriginal heritage, none of the sites identified in the assessment can be conserved as a result of the development.

A total of three sites will be impacted by the development proposal, all are of low scientific significance. All will be impacted by the current water pipe-line development proposal (*see* Appendix 1: Figure 4).

The area containing the proposed relocated Stage 1 ROM dump hopper site cannot be conserved and will be totally disturbed due to construction activity.

11. MANAGEMENT RECOMMENDATIONS

The following recommendations are made based on the existing and proposed legal requirements of the *NSW National Parks and Wildlife Act 1974* and Part 3A of the *Environment Planning & Assessment Act 1979* and the type of archaeological evidence found within the study area:

- The study area is considered to have low potential for Aboriginal heritage.
- The above conclusion is reached based on Aboriginal consultation advice, background archaeological/historical research, field assessment and land-use history.
- Sites S1MC 310-312 be subject to surface collection in keeping with the methodology being currently applied under MCP Stage 1 Aboriginal Heritage Plan (*see* Section 2.5.3 of the AHP) approved by the NSW Department of Planning on 29 August 2008.
- The water pipe-line route within the Moolarben mine lease needs to be fenced off and kept within a strict narrow construction easement to avoid any disturbance to existing Aboriginal Sites and Objects.
- The area immediately to the west of the proposed relocated Stage 1 ROM dump hopper site be subject to cultural heritage monitoring prior to construction taking place.
- The cultural heritage monitoring is to be undertaken by a qualified archaeologist and members of the four Aboriginal Stakeholder community groups: : Mudgee Local Aboriginal Land Council based in Mudgee; North-East Wiradjuri Pty Ltd, based in Ulan, Murong Gialinga Aboriginal & Torres Strait Islander Corporation based in Mudgee and Warrabinga Native Title Claimants Aboriginal Corporation based in Kandos.
- This salvage work be undertaken with the participation of the four existing Aboriginal Stakeholder community groups: North-East Wiradjuri Pty Ltd, based in Ulan, Murong Gialinga Aboriginal & Torres Strait Islander Corporation based in Mudgee and Warrabinga Native Title Claimants Aboriginal Corporation based in Kandos.
- If additional Aboriginal Sites or Objects are identified as result of the cultural heritage monitoring and cannot be permanently avoided by the development proposal, further archaeological assessment may be warranted.

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Appendix 1 FIGURES

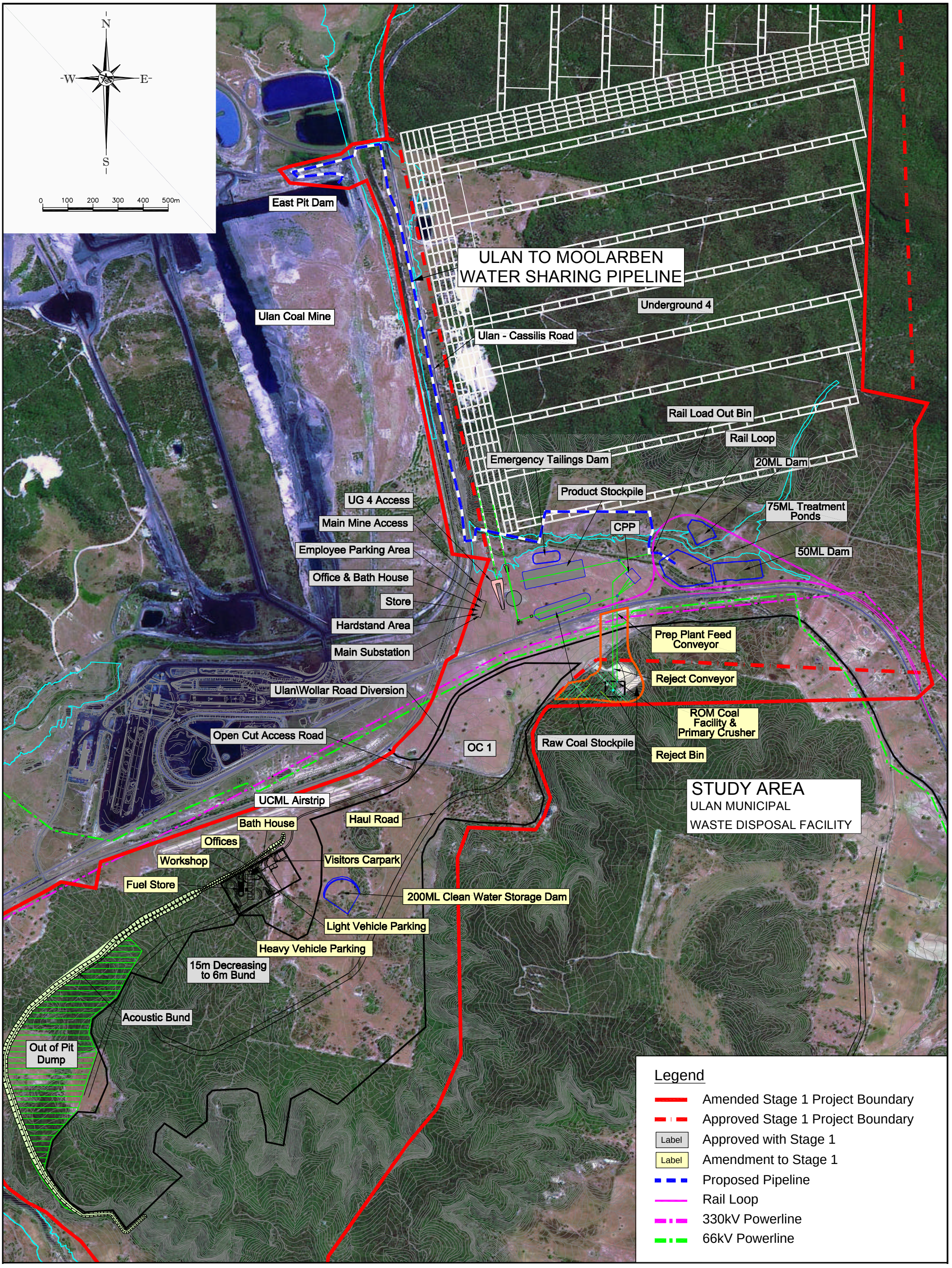
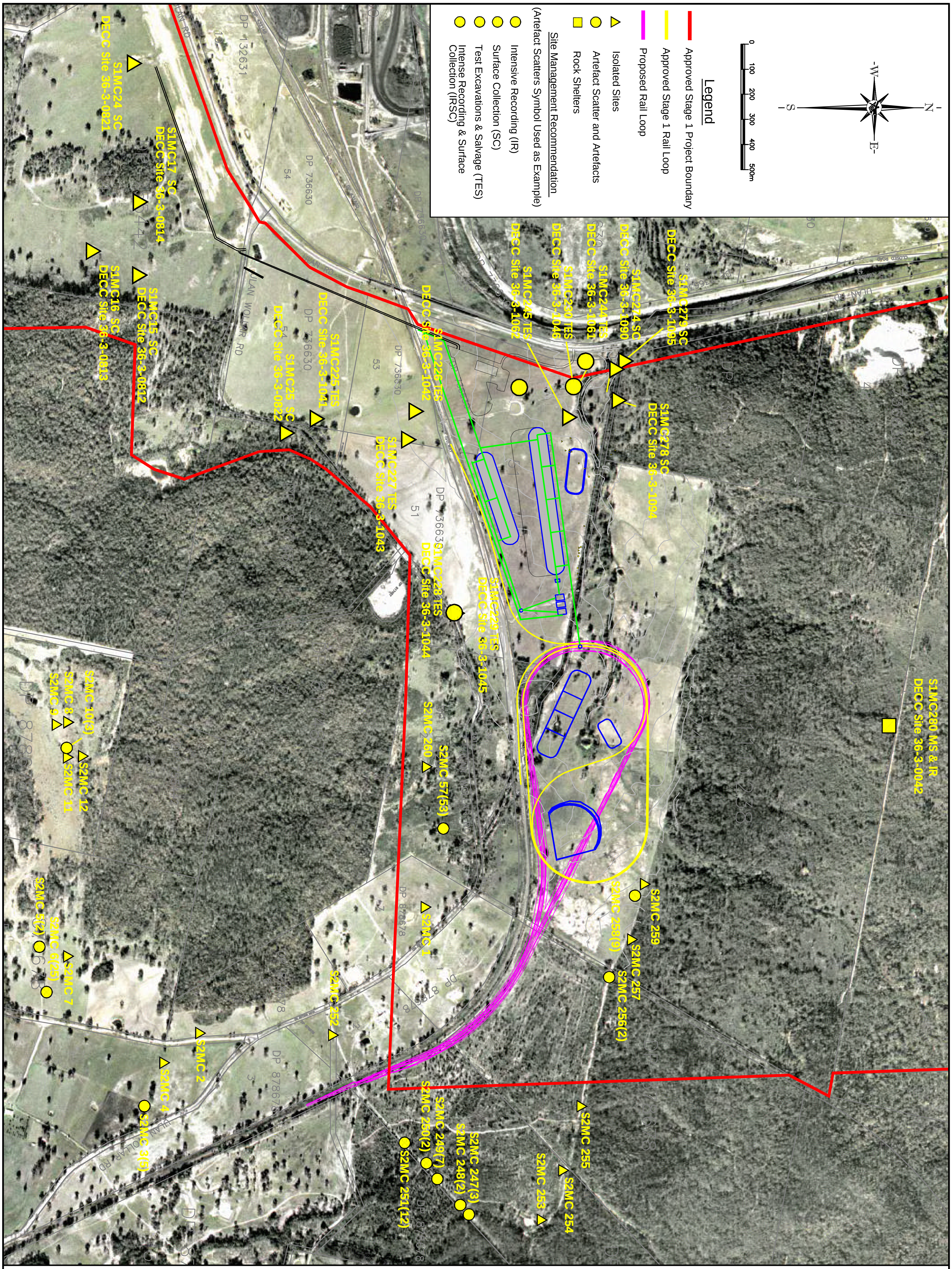


FIGURE 1
MOOLARBEN COAL - STAGE 2
INFRASTRUCTURE AREA & WATER PIPELINE
A.R.A.S. MAY 2008 N.T.S.



Pegasus Technical

Moolarben Coal Project

Known Recorded Sites Located Near the Study Area

Figure 2

CAD FILE: 03814A.dwg

FIGURE 3
MOOLARBEN COAL - STAGE 2
PROPOSED WATER PIPELINE
A.R.A.S. MAY 2008

Appendix 2 PLATES

Plate 1 Looking at Survey Transect 1 ROM Hopper Site

Plate 2 Looking at Survey Transect 1 ROM Hopper Site

Appendix 2 PLATES

Plate 3 Looking at Survey Transect 1 ROM Hopper Site

Plate 4 Waste Management Facility looking East with survey crew

Appendix 2 PLATES

Plate 5 Pipe-line easement looking south with field crew

Plate 6 Pipe-line easement with survey crew

Appendix 2 PLATES

Plate 7 Site S1MC 311 Isolated Find. Pink flag=artefact location

Plate 8 Site S1MC 310 Isolated Find. Orange flag=artefact location