Silverton Wind Farm NSW Stage 1
Aboriginal Heritage and Non Indigenous Heritage Assessment
Volume 1

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A report to nghenvironmental on behalf of
Silverton Wind Farm Developments

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1. SUMMARY

1.1 Introduction

New South Wales Archaeology Pty Ltd was commissioned in September 2007 by nghenvironmental on behalf of Silverton Wind Farm Developments to undertake an Indigenous and Non Indigenous heritage assessment of the proposed Silverton Wind Farm Stage 1 project area.

Silverton Wind Farm Developments propose to develop a wind farm for electricity generation, near Silverton, northwest of Broken Hill. The proposed wind farm will be assessed as a Major Project under Part 3A of the Environmental Planning and Assessment Act 1979.

nghenvironmental has been commissioned by Silverton Wind Farm Developments to conduct a number of studies in relation to the proposal. This report is provided to nghenvironmental for inclusion within an Environmental Assessment Report.

1.2 Partnership with the Aboriginal Community

The field survey and assessment has been undertaken in partnership with the Broken Hill Local Aboriginal Land Council (BHLALC).

This assessment has been conducted in accordance with the consultation process as outlined in the Interim Guidelines for Aboriginal Community Consultation - Requirements for Applicants (NSW DEC 2004).

1.3 Description of Impact

The proposed impact area is situated in the Barrier Ranges and is located north of Silverton.

The Stage 1 proposal will involve the construction, operation and eventual decommissioning of a wind farm with capacity of up to 400MW (all stages would be 1000MW). The Stage 1 proposal includes the following components:

- Up to 150 wind turbines;
- Electrical connections between wind turbines using a combination of underground cable and overhead power lines;
- An onsite substation and control room;
- 25 km transmission 220kV power line linking the wind farm to the Transgrid sub station at Broken Hill;
- Access roads around the site, and upgrades of the Silverton and Daydream Mine roads, for installation and maintenance of wind turbines.

Additional temporary construction infrastructure will be required during the construction and decommissioning phases such as concrete batching plant, storage of construction machinery, equipment and materials and site offices.

Impacts will be located on land currently utilised for sheep grazing and a goat management program. Previous land uses in the region have resulted in significant environmental impacts and a generally highly degraded landscape. European activated geomorphological processes and other actions have caused significant prior impacts to Aboriginal objects within the region.

However irrespective of prior impacts the proposed works entail ground disturbance and accordingly the project has the potential to cause additional impacts to any Aboriginal objects or historical items which may be present within the individual components of the proposal. Impact areas can be considered as being small and discrete in area.

The Stage 1 development envelope measures approximately 4,900 hectares however the total area encompassed by the impacts associated with the individual components of the project will measure approximately 50 hectares or 1% of that envelope. Accordingly more that 98% of the ground surfaces in the proposal area will not sustain impacts with the concomitant result that the majority of the archaeological and heritage resource in the area will be exempt from development impacts.

1.4 Objectives and Methods

The study has sought to identify and record the presence of Aboriginal objects and Non Indigenous heritage items in the proposed impact areas, to assess the archaeological potential of the landform elements present and to formulate management recommendations based on the results of background research, a field survey and site significance assessment. Field work was undertaken in November 2007.

The field inspection has entailed a survey which has encompassed the majority but not all of the proposed impact areas associated with the Stage 1 project. Not all areas of proposed impact had been finalized at the time the field inspection was undertaken and accordingly this has been addressed in the recommendations.

Indigenous

The proposal area falls within the Barrier Ranges archaeological region as defined by Witter (2004). This region has been subject to very few previous archaeological investigations and accordingly is not well understood. Given that the environmental context is semi-arid, and the proposal area is far from rivers or lakes, the region would seem to be unfavourable for Aboriginal occupation. Nevertheless Witter (2004) indicates that open camp sites are abundant and present on all landscapes. Witter (2004), and others (Holdaway *et al*. 2002; Shiner 2006) suggest that occupation of the region may have been highly dynamic with occupation fluctuating in accordance with seasonal variability, and perhaps longer term climate changes.

The site types found in the Barrier Ranges include camp sites comprised of stone artefacts and heat retaining hearths commonly located along streams and around clay pans, and at water holes in the ranges, and stone quarries and rock art. Artefact types found in the region include ground stone artefacts, including milling slabs, often made of the local schist, flaked stone mostly of quartz, and occasional retouched artefacts including Pirri points, geometric backed blades, Bondi points and Tulas. Currently the archaeology of the Barrier Ranges Region is dated to no earlier than the mid Holocene (Witter 2004).

A landscape based approach and methodology has been implemented for the survey and assessment conducted during this study. The proposal area has been divided into a number of Survey Units each of which has been defined on the basis of a combination of environmental variables. These areas have been defined according to landform element, gradient and aspect; Survey Units are utilised as a framework for artefact recording and analysis.

The New South Wales National Parks and Wildlife Service has prepared a draft document which provides a series of guidelines regarding the assessment, reporting and management of Aboriginal cultural heritage in New South Wales. This report has been prepared in accordance with these draft guidelines (NSW NPWS 1997).

Additionally the study has been conducted in accordance with the Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (NSW DEC July 2005). The Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation have been prepared specifically for development applications assessed under Part 3A of the Environmental Planning and Assessment Act 1979.

Non-Indigenous

The Non Indigenous component of this assessment has been conducted with reference to historical literature and mapping relating to the area and a field inspection aimed at locating historical items, features or potential archaeological sites. Hope (2006) has recently completed a heritage study of the Unincorporated Area of New South Wales, in which the Stage 1 area is situated. Hope (2006) has outlined a number of historical themes relevant to the Unincorporated Area, several of which are directly applicable to the study area. These include exploration, pastoralism, mining, towns and transport and communication.

The NSW Department of Urban Affairs and Planning and the NSW Heritage Office have produced guidelines for preparing archaeological and heritage assessments as set out in Archaeological Assessment Guidelines 1996 and Heritage Assessments 1996. Where relevant this report has been prepared in accordance with these guidelines and those defined as a result of the 1998 amendments to the NSW Heritage Act 1977.

In addition the NSW Heritage Council has produced a policy paper on *Wind Farms and Heritage - Heritage Council Advice* (Coleman 2003b) and a related document entitled *Cultural Landscapes Charette* (Coleman 2003a). Both of these documents have been consulted during this assessment.

1.5 Previous Heritage Listings

A review of previous archaeological investigations in the region has been undertaken in order to provide an analytical context to the assessment. A search of the New South Wales Department of Environment and Climate Change (the NSW DECC) Aboriginal Heritage Information Management System (AHIMS) has indicated that there are a number previously recorded sites located within the Silverton Wind Farm Stage 1 project area (AHIMS #20121 and AHIMS #20122: 26th September 2007). The nature and location of these previously recorded sites is discussed in Section 7.2.

Searches have also been undertaken of historic heritage data bases including the NSW Heritage Inventory and the Australian Heritage Database. The results of the historic heritage database searches are listed in Section 8 and Appendix 6. There is no heritage items present in the Silverton Wind Farm Stage 1 project area listed on historic databases.

1.6 Results

Indigenous

The study area has been divided into 232 Survey Units. The area surveyed during this assessment measured approximately 822.4 hectares in area. Ground exposures visually inspected are estimated to have measured 342.4 hectares in area. Of that ground exposure area archaeological visibility (the potential artefact bearing soil profile) is conservatively estimated to have been 267.8 hectares. Effective Survey Coverage is therefore calculated to have been 32.6% percent of the total survey area. Effective Survey Coverage achieved during the site inspection is assessed to have been reasonably high and adequate for the purposes of establishing the archaeological status of the proposed impact areas.

The Stage 1 - Silverton Wind Farm site has been found to contain an extensive distribution of Aboriginal objects. Stone artefacts have been recorded in most of the landforms subject to survey and assessment. Additional features recorded include quartz outcrops which have been utilised as stone procurement areas, stone heat retainer ovens/hearths and a possible stone arrangement.

A total of 262 Aboriginal object locales were recorded within the Stage 1 area. The majority of locales are predominantly quartz stone artefacts distributed across individual survey units (N=166; 63.4%). A total of 78 (approximately 30%) quartz outcrops with evidence of exploitation – Stone Procurement Areas were recorded. Fourteen locales are stone artefacts with heat retaining hearths (5.34%). In addition several isolated artefact recording have been made. One locale is a complex of two small circular stone arrangements. The origin of the mounds could not be determined during the field survey on the basis of a visual inspection alone. However the arrangement is similar to others found in the regions which have been assessed to be of Aboriginal origin. Accordingly, it is prudent to consider this locale as a possible Aboriginal stone arrangement.

Given the comprehensive nature of the archaeological survey it has been possible to establish a basic pattern in artefact type and distribution across the landscape; - the results indicate a variable use by Aboriginal people of the different landforms in the Barrier Ranges. The ridge crests and slopes in the hills possess primarily quartz artefacts in a widespread but generally low density distribution. The majority of stone artefacts present are unretouched flakes and cores however a number of retouched tools and several mortar dishes were also recorded. The artefact types recorded indicates that the ridges were utilised by both men and women for hunting, gathering and perhaps some food processing activities.

Drainage depression landforms and flats associated with creek lines possess a relatively higher artefact density and greater abundance of rarer artefacts types; a higher percentage of foreign stone is present in the artefact assemblages and stone heat retaining ovens are common in these lower landforms. The higher artefact density and greater abundance and range of artefact types (including ovens) indicate that the lower landforms sustained higher levels of landuse associated with camping.

The majority of quartz outcrops located in all landforms, including very small and insignificant exposures, possess evidence of their use as stone procurement sites.

Non-Indigenous

Searches have been undertaken of historical heritage databases including the NSW Heritage Inventory, the Australian Heritage Database and the National Trust of Australia (NSW) Register; these databases include items of

local through to world significance. There are no heritage items present in the Silverton Wind Farm Stage 1 project area that are listed on any of these databases.

In the course of the field survey 24 historical features were recorded. These recordings largely include sites that relate to mining activities, although there are also a small number of recordings that relate to pastoral and transport activities. A total of 22 of the recordings are located in or immediately adjacent proposed impact zones. Lakes' Grave, an important local landmark, and the remains of a nearby camp or settlement were also recorded; these items are outside proposed impact zones.

Of those recordings that correspond to impact zones there are two small twentieth century sites that relate to farming activities (SU141/HS1: Farm equipment/stockpile; SU141/HS2: Stockyards), two recordings of old road alignments that appear to be associated with nearby mines (SU93/HS1, SU191/HS3), nine recordings of building remains (SU62/L1, SU90/HS2, SU90/HS3, SU90/HS4, SU94/HS1, SU94/HS2, SU143/HS1, SU191/HS1 & SU191/HS2), three recordings of prospecting pits and other small mining explorations (SU32/HS1, SU54/HS1 & SU226/HS1), one recording of a stone cairn that appears to be a mine lease marker (SU191/HS1), one recording of infrastructure associated with the Umberumberka Reservoir (SU53/HS1) and two recordings of more substantial mine workings that appear to be associated with the Iron Duke mine (SU90/HS1, SU92/HS1). There are also basic site details provided for the Corruga zinc sintering works and a nearby section of the Silverton Tramway; these locations were not however visited during the surveys.

1.7 Conclusions

Indigenous

As previously noted the majority of the Aboriginal object locales recorded in the proposal area are low or very low density stone artefact distributions; these are assessed to be of low archaeological significance. In addition a number of Aboriginal object locales have been identified which are assessed to be of low/moderate, moderate or high archaeological significance.

The construction of the Silverton Wind Farm will result in substantial physical impacts to any Aboriginal objects which may be located within direct impact areas - *irrespective of their archaeological significance*. That is, any Aboriginal object situated within an area of direct impact will be comprehensively disturbed, and/or destroyed during construction.

As with any development the chances of impacting Aboriginal objects, particularly stone artefacts, is high given that they are present in a continuum across the landscape and located on or within ground surfaces. Silverton Wind Farm is no exception in this regard and it would be impossible to have a development of this nature without causing direct physical impact.

However in regard to the majority of Aboriginal object locales such as artefact scatters assessed to be of low significance, the impacts can be viewed as being of correspondingly low significance. On the other hand, impacts to any object locales which are assessed to be of higher archaeological significance can be viewed as being of correspondingly higher significance. This assessment forms the basis for the formulation of management strategies which aim to mitigate impacts.

Non-Indigenous

A variety of items have been recorded in the course of fieldwork and research for this project. It should be noted however that there are no previously recorded heritage items within the proposal area that are on any statutory lists. The vast majority of identified items are assessed to be of local significance and eight of the recordings are assessed to be of insufficient heritage value to warrant any sort of formal listing. One of the recorded heritage items is assessed to be of potential state significance (Corruga zinc sintering works) while the Silverton Tramway is assessed to be of state significance and potentially national significance. Neither of these sites is formally listed on any current heritage register. Impacts to these sites can be minimised, and effectively avoided, through adoption of the visual impacts minimised route for the proposed transmission line. This would mean that the transmission line structures would not physically coincide with the curtilage of these heritage items and as such the overall heritage impact would be negligible.

Direct impacts can be avoided to all heritage items within the proposal area. Given that none of the identified heritage items have been assessed to have a significant aesthetic component to their heritage value and, given that the development could effectively avoid all physical impacts to heritage items within the proposal area, the overall impact on items of Non-Indigenous heritage would be minimal.

Statements of Heritage Impact, which detail the nature of these impacts to individual heritage items are provided in Appendix 7.

Impacts to the broader cultural landscape are unavoidable; a full Statement of Heritage Impact is included in Appendix 7. Nonetheless, the visual impacts assessment indicates that the cumulative impact on landscape character would be low to moderate only (Green Bean Designs 2008). Furthermore, the proposed development fits within a theme of previous landuse, i.e. exploitation of natural resources and could usefully contribute to an adaptive reuse of the landscape. A result such as this could be ensured if the development was accompanied by a more comprehensive research project on the history and heritage of the area. Primary objectives of such a study would be to fill in the gaps in the existing history of mining for the region and compilation of a more complete record of heritage items in the Barrier Ranges. This would in turn aid in conservation of heritage values across the landscape, which would serve as a considerable mitigation of the abovementioned impacts to that landscape.

1.8 Management Recommendations

Indigenous

- Management and mitigation recommendations are listed in respect of each Survey Unit and Aboriginal object locale in Table 22 in Section 12 of this report.

- No Survey Units have been identified in the proposal area to warrant further archaeological investigation such as subsurface test excavation; the Effective Survey Coverage achieved during the field survey was relatively high and can be considered to have been generally adequate for the purposes of determining the archaeological status of the proposed impact areas.

- None of the Survey Units in the proposal area have been assessed to surpass archaeological significance thresholds which would act to entirely preclude proposed impacts. However two discrete Aboriginal object locales have been identified to warrant total exclusion of impacts.

  It is recommended that an active conservation strategy is implemented in regard to these locales to ensure that they are not inadvertently impacted during the construction, operation and decommissioning of the wind farm. It is noted that these locales are either situated outside areas in which impacts are proposed or within areas in which a strategy of conservation, and hence impact avoidance, is expected to be highly feasible (see Section 12).

- The majority of the Aboriginal object locales recorded are very low (<1 artefact per square metre) or low density (between 1 per square metre and 10 per square metre) distributions of quartz stone artefacts. The archaeological significance of these locales is assessed to be low. Accordingly a management strategy of unmitigated impact is considered to be appropriate.

- Many of the Aboriginal object locales and/or discrete areas within wider stone artefact distribution locales (including those which are predicted to contain subsurface archaeological deposit), stone procurement areas and locales with heat retainer hearths, are assessed to be of low/moderate or moderate archaeological significance. Accordingly, in regard to these areas it is generally recommended that avoidance of impacts, or limiting the extent of impacts to these locales, if at all feasible, should be given consideration. In respect of some locales suggestions are outlined (in Section 12) as to how a strategy of impact avoidance may be achieved.

  In regard to these locales further recommendations are made in the event that avoidance of impacts is not feasible. In some cases especially those relating to small stone procurement area locales it is recommended that if avoidance is not feasible unmitigated impacts are appropriate. However, in other cases such as locales containing deep soils and hence potential subsurface archaeological deposit with predicted moderate density artefact distribution, locales containing heat retaining hearths and larger and more complex stone procurement areas, it is recommended that if impact avoidance is not feasible a strategy of impact mitigation is appropriate. Impact mitigation will entail surface collection and sub-surface excavation of Aboriginal objects and subsequent analysis and research. Ideally such a program would entail an adequately designed research program which would aim to address research questions similar to those currently being pursued in the region.

- It is recommended that additional archaeological assessment is conducted in any areas which are proposed for impacts that have not been surveyed during the current assessment. It is predicted that significant

Aboriginal objects can occur anywhere in the landscape and accordingly if present they need to be identified and impact mitigation strategies implemented prior to impacts.

- The proponent should, in consultation with an archaeologist, develop a Cultural Heritage Management Protocol, which documents the procedures to be followed for impact avoidance or mitigation.

- Personnel involved in the construction and management phases of the project should be trained in procedures to recognise and avoid disturbance to any recorded (if necessary) and/or unrecorded cultural heritage places and items.

Non-Indigenous

- Management and mitigation recommendations are listed in respect of each historical item in Table 23 in Section 13.

- There are no constraints with regard to those items that are assessed not to meet the criteria for heritage listing (SU32/HS1, SU54/HS1, SU141/HS1, SU141/HS2, SU143/HS1, SU190/HS1, SU191/HS3 & SU226/HS1). Nonetheless, in most cases it has been recommended that impacts be avoided if possible.

- For the majority of recordings (SU62/L1, SU90/L1, SU90/L2, SU90/L3, SU90/L4, SU92/HS1, SU93/HS1, SU94/HS2, SU191/L1, SU191/L2 and the Stone Ruins) it is recommended that impacts be avoided if feasible and that where such a course of action is not feasible mitigation in the form of archival recording and/or salvage excavation be undertaken.

- In the case of Survey Unit 94, which contains a recording assessed to be of local significance and high research potential, two options have been outlined. On one hand there is the same course of action that is outlined above; that is, avoidance or mitigated impacts to the individual recordings. Alternatively, there is an option to avoid all impacts to the southeast of grid reference 526696e 6480400n. This is noted as the preferred option as it would also ensure conservation of a section of the road that extends down the spur (SU93/HS1) and conservation of the recordings SU94/HS1 and SU94/HS2. In this way a parcel of the larger site complex would be conserved, thus ensuring that future possibilities remain open for research, such as exploring the interrelationship between these sites, the Iron Duke mine and the recording of the Stone Ruins on the valley floor to the southeast.

- With regard to SU53/HS1, which also extends into SU57 and SU58, this item is associated with a larger site complex that it arguably of state significance and that is listed as an indicative place on the Register of the National Estate. While the water tank and pipeline themselves may not be of the same heritage value they do contribute to the overall significance of the Umberumberka Reservoir. Accordingly, it is recommended that these items be conserved and be the subject of more detailed recording prior to commencement of construction.

- In the case of the zinc sintering works it is noted that there are two options for the alignment of the transmission line: *initial route* and *visual impacts minimised route*. Given the extent of the site, the level of its heritage significance (local and/or state) and the fact that the initial route runs directly across the site it would be preferable to adopt the visual impacts minimised route, which runs approximately 1 km to the east of the sintering works. If impacts were unavoidable at the sintering works then mitigation in the form of archival recording and/or salvage excavation would need to be undertaken.

- The Silverton Tramway is a heritage item that is of state if not national significance (Hope 2006); it extends for approximately 50 km and is potentially subject to direct physical impacts at one of two locations. As discussed above the initial route of the transmission line is not preferable in terms of heritage management. This applies as much to the sintering works as an individual heritage item as it does to the tramway as the structure that linked the sintering works with Broken Hill and South Australia. Thus, for similar reasons the visual impacts minimised route is preferable. In either case, given the importance of the tramway at local through to state and potentially national levels it is an example of a heritage item that should be conserved. As such, regardless of which transmission route is chosen, all direct impacts associated with the transmission line should be kept at least 30 m off the permanent way of the tramway.

- Lake's Grave is assessed to be of high local significance. It is a site that has a history of importance as a local landmark and a place that has significantly impacted on how people relate to and name features in this part of the landscape. Accordingly it is recommended that the site be conserved and that any future development proposals should respect the heritage significance of this site.

- It is recommended that the *visual impact minimised route* for the transmission line be adopted so that direct impacts are avoided at the Zinc Sintering Works, Corruga and so that visual impacts to the cultural landscape as a whole are minimised.
- It is recommended that additional heritage assessment is conducted in any areas which are proposed for impacts that have not been surveyed during the current assessment. It is predicted that significant Non Indigenous heritage items can occur anywhere in the landscape and accordingly if present they need to be identified and impact mitigation strategies implemented prior to impacts.
- It is recommended that the proponent give consideration to commissioning a comprehensive research project on both the Aboriginal and Non Indigenous history and heritage of the area. Primary objectives of such a study would be to fill in the gaps in the existing history of mining for the region and compilation of a more complete record of heritage items in the Barrier Ranges. This would in turn aid in conservation of heritage values across the landscape, which would serve as a considerable mitigation of the abovementioned impacts to that landscape.
- The proponent should, in consultation with an archaeologist, develop a Cultural Heritage Management Protocol, which documents the procedures to be followed for impact avoidance or mitigation.
- Personnel involved in the construction and management phases of the project should be trained in procedures to recognise and avoid disturbance to any recorded (if necessary) and/or unrecorded cultural Non Indigenous heritage places and items.

Acknowledgements

Gratitude is extended to the following people for their assistance in this project:

Dulcie O'Donnell, Raymond O'Donnell, Raymond jnr O'Donnell and Bernie O'Donnell, Sites Officers, Broken Hill Local Aboriginal Land Council
Jo-Anne O'Donnell, Co-ordinator Broken Hill Local Aboriginal Land Council
Maureen O'Donnell, Chairperson, Broken Hill Local Aboriginal Land Council
Harvey Johnston, NSW DECC
Siobhan Lavelle, NSW Heritage Office
Tim Browne, Steve Sass, Brooke Marshall and Nick Graham-Higgs, nghenvironmental
Philip and Judy Blore, landholders
Greg Lawrence, landholder
Madeline Cowley, Donna Bolton and Chris Loty, Epuron Pty Ltd
Dr Johan Kamminga, National Heritage Consultants
Dr Rebecca Parkes, Non Indigenous Heritage Specialist
Dr Sarah Martin, Broken Hill and Environs Archaeology Specialist
Robert Barnes, NSW Department of Primary Industry
Kingsley Mills, NSW Department of Primary Industry

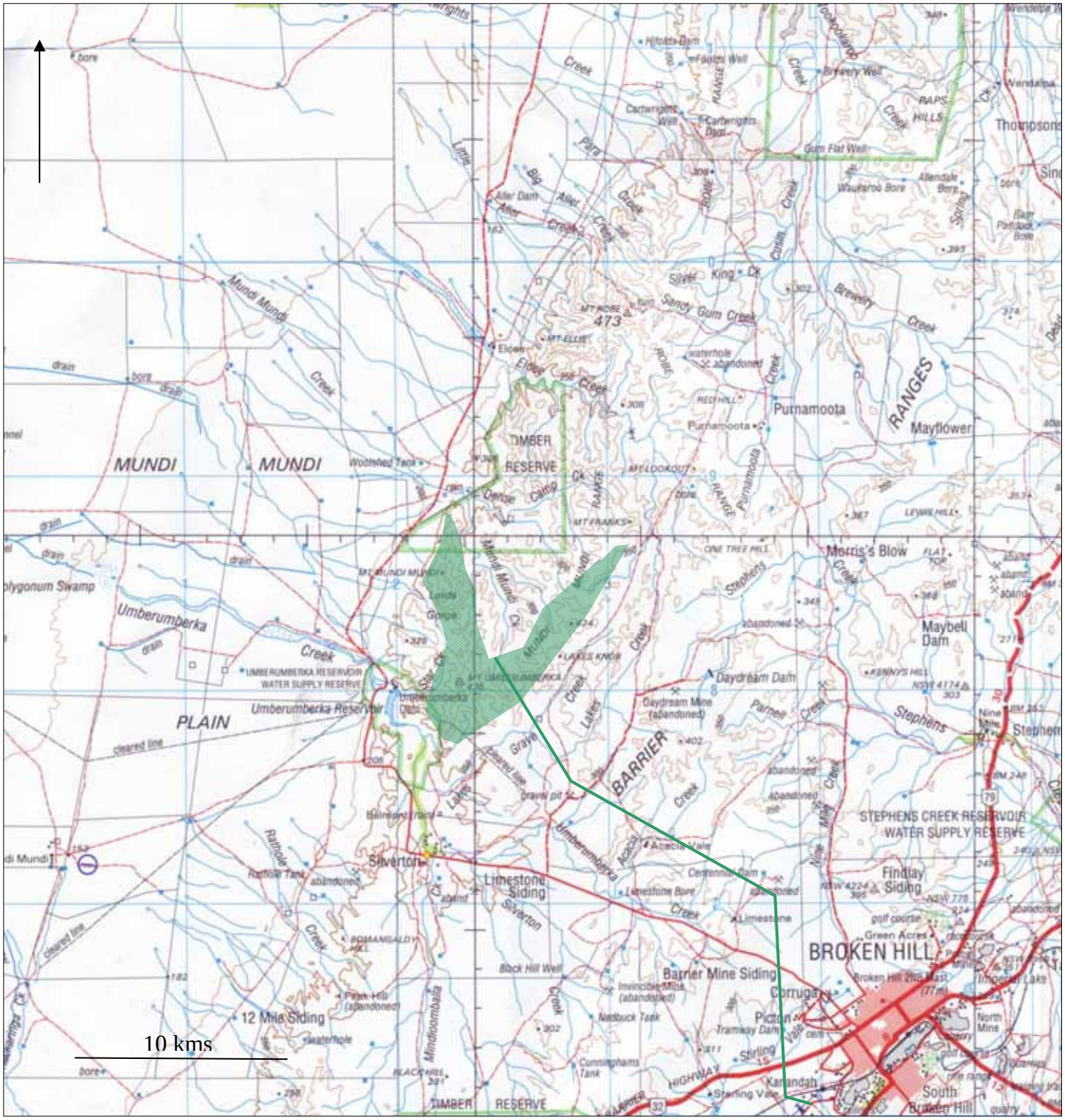

Figure 1. Indicative location of impact areas including the Silverton Wind Farm Stage 1 turbine envelope and transmission line (Broken Hill SH54-15 ed. 2 1:250,000 topographic map).

2. INTRODUCTION

2.1 Introduction

New South Wales Archaeology Pty Ltd was commissioned in September 2007 by nghenvironmental on behalf of Silverton Wind Farm Developments to undertake an assessment of Indigenous and Non Indigenous heritage values of the proposed Stage 1 Silverton Wind Farm.

Silverton Wind Farm Developments propose to develop a wind farm for electricity generation, near Silverton, northwest of Broken Hill. The proposed wind farm will be assessed as a Major Project under Part 3A of the Environmental Planning and Assessment Act 1979.

This report aims to address the NSW Department of Planning Director-General's Environmental Assessment Requirements in respect of potential impacts and proposed mitigation measures relating to Indigenous and Non Indigenous Heritage.

The proposal has been separated into three distinct stages of proposed development. Silverton Wind Farm Developments is seeking project approval for Stage 1 works and concept approval for the broader proposal area including Stages 2 and 3 of the wind farm site and an overhead transmission line between Broken Hill and Red Cliffs in Victoria. The assessment documented in this report relates to the Stage 1 works only (Figure 1).

The turbine site of the wind farm is located within the Unincorporated Area of the Western Lands Division, administered by the Department of Lands. Components of the proposal including the construction of transmission lines would be located within the Broken Hill Local Government Area (LGA), the Wentworth LGA and the Mildura LGA, Victoria.

The tenure of land at the subject site is leasehold under the authority of the *Western Lands Act 1901*. The Stage 1 area and part of the powerline is located in the Unincorporated Area. Where the powerline is located near Broken Hill it is within the Broken Hill LGA. The land is currently used for pastoral activities (sheep grazing and a goat management program). The Stage 1 wind farm would directly involve two properties, with the powerline traversing an additional five properties closer to Broken Hill.

In accordance with the NSW NPWS guidelines for archaeological reporting (NSW NPWS 1997), the NSW DECC Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (NSW DEC 2005) and the NSW Heritage Manual this report aims to document:

- The Aboriginal consultation process undertaken for the project and the involvement in the project of the Aboriginal community;
- A description of the proposal and whether or not it has the potential to result in impacts to Indigenous and Non Indigenous cultural heritage;
- A description of the impact history of the proposal area;
- The methodology implemented during the study;
- The landscape and natural resources of the study area in order to establish background parameters;
- A review of archaeological and relevant literature and heritage listings on the NSW DECC Aboriginal Heritage Information Management System;
- A synthesis of local and regional archaeology;
- A predictive model of Aboriginal object type and location relevant to the proposal area;
- A review of the historical context of the proposal area and the results of relevant heritage data base searches;
- An outline of historical themes applicable to the proposal area;
- The cultural and archaeological sensitivity of the landforms subject to proposed impacts;
- The field survey results;
- The cultural and archaeological significance of Aboriginal objects and Non Indigenous items;
- An assessment of the impact of the proposal on Aboriginal objects, places and Non Indigenous items;
- A description and justification of the proposed outcomes and alternatives; and
- A series of recommendations based on the results of the investigation.

This project has been undertaken in consultation with NSW DECC and the NSW Heritage Office staff in order to adequately address local and relevant assessment issues.

Consultation with Harvey Johnston, NSW DECC archaeologist, has been undertaken in order to clarify aspects of the Indigenous heritage context and management considerations. The assistance of NSW DECC in this project is gratefully acknowledged.

Consultation has also been undertaken with Siobhan Lavelle, NSW Heritage Office with regards to management of heritage items that might potentially be impacted by the proposed development. The assistance of NSW Heritage Office in this project is gratefully acknowledged.

The Heritage Council of New South Wales has issued a draft policy document entitled *Wind Farms and Heritage: Heritage Council Advice* (Coleman 2003b). This policy document outlines the Heritage Council of NSW's objectives, policy and directives for wind farm development and heritage in NSW. The policy is intended to be used as a tool to assist the Heritage Office, local government, planning and developers in their decision making processes, with the aim being to keep any potential negative affects of wind farms on heritage items at an absolute minimum and ideally avoid such impacts.

A key theme within the policy is awareness of potential impacts on cultural landscapes. The NSW Heritage Office issued a background paper entitled *Cultural Landscapes Charette* (2003a), which discusses the definition, identification and management of cultural landscapes in NSW. This document also contains a list of cultural landscapes that were listed on State and local government registers in 2003. Ten of the cultural landscapes listed on local environmental plans were in Broken Hill.

2.2 Project personnel

NSW Archaeology is a consultancy specialising in both Indigenous and Non Indigenous Cultural Heritage Management. NSW Archaeology has conducted assessments of five wind farm projects and numerous other major infrastructure projects in New South Wales.

The field work component of this project has been conducted by Julie Dibden, Andrew Pearce, Rebecca Parkes, (NSW Archaeology Pty Ltd), Johan Kamminga and Sarah Martin, and Dulcie O'Donnell, Raymond O'Donnell, Raymond jnr O'Donnell and Bernie O'Donnell, (Broken Hill Local Aboriginal Land Council). This report has been complied and written by Julie Dibden with certain sections completed by Dr Sarah Martin, Dr Johan Kamminga and Dr Rebecca Parkes.

The Stage 1 - Silverton Wind farm archaeological project has been conducted in partnership with the Broken Hill Local Aboriginal Land Council. The Broken Hill LALC Sites Officers have extensive experience working in the local area and their assistance in the project has been invaluable.

This archaeological assessment has been conducted and managed by Julie Dibden, Director and principal consultant of NSW Archaeology Pty Ltd. The archaeologists working on this project include:

Dr Johan Kamminga - has more than 30 years experience in consulting archaeology. His field areas in Australia have included Central Australia, Arnhem Land, Cape York Peninsula, the Victorian Mallee and many areas of NSW. Overseas he has worked in New Guinea, Thailand, India, Sri Lanka and Canada. Dr Kamminga is recognised internationally for his research on Australian archaeology, Aboriginal prehistory and ancient technology and has published more than 40 books and papers including the co-authored books '*Prehistory of Australia'* (Mulvaney and Kamminga 1999) and '*Mechanics of pre-industrial technology'* (Cotterell and Kamminga 1992). One of his areas of specialisation is the identification and analysis of Aboriginal stone artefacts and lithic scatter sites.

Dr Sarah Martin – resides in Broken Hill and has more than 30 years experience in consulting archaeology. Dr Martin's local knowledge and breadth of experience has been invaluable in this study.

Dr Rebecca Parkes – has more than 10 years experience in consulting archaeology and specialises in Non Indigenous archaeology. Dr Parkes' research areas include Afghan cameleer sites in Central Australia and the archaeology of mining in Australia. Over the past seven years she has been employed in teaching roles within the Australian National University, which has largely involved training students in historical archaeology field methods and interpretation of cultural landscapes. The archaeology of landscape is a central component of Dr Parkes' research; it formed the focus of her doctoral studies in Spain and is an ongoing area of research into identity, environment and archaeological signatures.

3. PARTNERSHIP WITH THE ABORIGINAL COMMUNITY

The NSW DECC requires proponents to undertake consultation with the Aboriginal community "…as an integral part of the impact assessment" process (NSW DEC 2004). The NSW DECC has formalised the process of Aboriginal consultation with the introduction in late 2004 of the Interim Guidelines for Aboriginal Community Consultation - Requirements for Applicants (IGACC) (NSW DEC 2004).

The proposed wind farm will be assessed as a Major Project under Part 3A of the Environmental Planning and Assessment Act 1979. While it is recognised that under Part 3A of the Environmental Planning and Assessment Act 1979 approvals and legislation under the National Parks and Wildlife Act do not apply to the current project fulfilment of the consultation requirements as outlined in the IGACC document has nevertheless been undertaken as follows:

Notification and Registration of Interests

NSW Archaeology Pty Ltd on behalf of the proponent has actively sought to identify stakeholder groups or people wishing to be consulted about the project and has invited them to register their interest as follows:

Written notification about the project dated 4th October 2007 was supplied to the Broken Hill Local Aboriginal Land Council.

Additionally, written notification seeking to identify stakeholder groups or people wishing to be consulted about the project, dated 4th October 2007, was supplied to following bodies:

- Native Title Services
- Broken Hill City Council
- The NSW Department of Environment and Climate Change

In addition an advertisement has been placed in the 5th October 2007 edition of the Barrier Daily Truth.

The Registrar of Aboriginal Owners was not notified of the project given that the proposal area is not situated within a National Park which possesses a register of Aboriginal owners.

Maureen O'Donnell, representing the Broken Hill Local Aboriginal Land Council and Wilyakali Traditional Owners registered an interest in this project in writing. A study methodology was outlined to the Broken Hill Local Aboriginal Land Council.

Rachel Merton, Executive Assistant to the General Manager, Broken Hill City Council also responded, advising that the letter of notification had been forwarded to Donna Kennedy, the Chairperson of the Broken Hill Aboriginal Working Party. No response to this letter has been received and accordingly a telephone call was made to Ms Kennedy and message left on her answering service prior to the commencement of fieldwork.

The proposal area is situated within the Broken Hill Local Aboriginal Land Council boundaries, and representatives of this Land Council assisted in the field assessment.

A copy of the draft report will be provided to both the Broken Hill Local Aboriginal Land Council and the Broken Hill Aboriginal Working Party for review and comment.

4. DESCRIPTION OF IMPACT

The information contained in this section of the report is provided in accordance with the NSW NPWS (1997) guidelines for archaeological survey reporting.

4.1 Impact justification

In Australia wind farms have become viable propositions because of renewable energy policies of the Federal and respective State Governments requiring electricity retailers to source a certain percentage of electricity from renewable sources. The NSW State Government has recently introduced new legislation to parliament called the Renewable Energy (NSW) Bill as part of the Government's Greenhouse Policy to encourage additional generation of renewable energy. The NSW renewable energy target, referred to as NRET, requires NSW electricity retail companies to purchase a percentage of their power from renewable energy sources.

The NRET is a market based mechanism designed to encourage investment in renewable energy technologies that will provide the lowest cost generation of renewable electricity in the National Electricity Market. The proposed Silverton Wind Farm would provide renewable energy which is eligible for Renewable Energy Certificates under the NSW Government scheme. Projects such as the Silverton Wind Farm will encourage renewable energy investment in NSW and will reduce the costs of production by reducing transmission losses to the NSW load centres (nghenvironmental 2008).

The Silverton Wind Farm will offer the following benefits to the environment and local community (nghenvironmental 2008):

- This project will directly inject funds into the local economy (both during construction and during the operational phase);
- The project will provide an opportunity for regional investment in the Broken Hill area as the renewable energy sector and the businesses that supply and service it, grow;
- The wind farm will provide electricity into the NSW and Victorian grid that would assist in meeting ongoing load growth in NSW and Victoria;
- The project will reduce greenhouse gas emissions, helping to reduce the impact of climate change;
- The project will supply renewable energy that would assist NSW electricity retailers fulfill their obligations under the NSW Greenhouse Plan and the NSW renewable energy target;
- The proposal will include an annual funding allocation for community projects including environmental measures both on and offsite. Silverton Wind Farm Developments would make an annual funding commitment which would be set aside into a community fund to be managed for community benefits.

State (NSW and Victoria) and Federal governments have been shown to support wind farms for their ability to produce renewable energy while reducing greenhouse gas emissions. The Silverton Wind Farm proposal is fully self-funding, producing no drain on the public purse. The project maximises use of existing resources while being remote from high population centres, thereby reducing social impacts. The wind farm would have a minimal impact on capital investment in other forms of power generation.

4.2 Proposed impacts

The project involves the construction, operation, and decommissioning of the Silverton Wind Farm Stage 1. The layout of the proposal is shown in Volume 2 - Appendix 1 of this report. A description of the proposed impacts is listed below.

- Up to 150 wind turbines will be constructed in the Stage 1 area.
- The electrical connections between wind turbines will be a combination of underground cable and overhead power lines.
- An onsite substation will be constructed in the Stage 1 area.
- Approximately 25 kilometres of transmission power line will link the wind farm to the Transgrid substation at Broken Hill. This will entail the installation of up to three 220kV powerlines. The initial powerline proposed for construction would be double pole, strung on one side which would be completed during stage one works. The powerline proposed to be completed during stage two works would involve the 'stringing' of the other side of the double pole powerline originally constructed during stage one works.

- There will be an onsite control room and equipment storage facility.
- Access roads will be constructed around the site in addition to minor upgrades of the Silverton Road and the Daydream Mine Road, for installation and maintenance of wind turbines.

Detailed descriptions of impacts are listed below:

Wind turbines

Each wind turbine would be a three bladed type of the "up-wind" design, which is, facing up into the wind and in front of the tower.

Installation of the wind turbines would require establishment of a level (<1% gradient) and stable hardstand area at the base of each wind turbine. This hardstand area could measure up to 30 x 30 metres in area. It is also necessary to have a delivery area for the various components adjacent to the hardstand area; in most cases it is expected that the access road could be used as this delivery area.

The wind turbines would be anchored using large concrete gravity footings or smaller concrete footings bolted to rock, as determined by geological parameters. Some blasting of rock may be required to excavate footings, dependent on the geological properties of the rock and design of the footing.

Rock crusher

Materials excavated during the construction of wind turbine footings may be able to be reused as road base for the road surface upgrades, and construction of the 30 x 30 metre hard stand area required at each turbine. For this purpose, it is possible that a mobile rock crusher would be used onsite.

Concrete batch plant

It is expected that a portable concrete batch plant would be required to supply concrete onsite. The batch plant would be located on an existing clear and level area of the site, situated in the central area of the wind farm site.

Site substation

A substation is required on site to convert power from on-site reticulation voltage of 22kV or 33kV to a transmission voltage of 220kV suitable to connect into Trangrid's transmission system. It would also include all necessary ancillary equipment such as control cubicles, voltage and current transformers, and circuit breakers for control and protection of the substation.

The substation area would be surrounded by a security fence and the ground would be covered partly by crushed rock and partly by concrete pads for equipment, walkways and cable covers, and would have an earth grid extending outside of the boundary of the security fence.

The substation would be located on-site in the inner lowland area of the Stage 1 envelope and will measure approximately one hectare in area. The location of the substation has been selected to minimise environmental disturbance of the site.

During the archaeological assessment a location for the substation has been identified which would minimise impacts to the archaeological resource in the lower valley area.

Onsite electrical reticulation

Each wind turbine will be connected together at reticulation voltage, and then connected to the Site Substation. These connections would be made using either underground or overhead cabling. Cable trenches would, where possible, be installed within the onsite roads to minimise ground disturbance. Short spur connections would come off a main cable run which would approximately follow the main road access route on site. Underground cables would require a trench of approximately 1–1.5 metres deep and 0.5–1 metre wide.

Control cabling

In addition to the power reticulation cabling, control and communications cabling is required from the control building to each wind turbine, and to the Site Substation. Control cabling would be installed using the same method

and route as the power cabling described above, that is, strung from the same poles as overhead lines, or installed in the same cable trench as underground cables.

Control building

A control building would be built onsite to house instrumentation, control equipment and communications equipment. This building would also house routine maintenance stores, a small work area, and amenities for staff. The control building will measure 50 m x 40 m in area. It will be constructed on a concrete slab and would include rainwater collection and storage for domestic use. A composting or septic toilet system would be installed for staff use. The control building would be located adjacent to the site substation, and is expected to be a joint facility for control of the substation as well as the wind farm.

Access route

Access routes to the site are expected to include the Silverton Road from Broken Hill and the Daydream Mine Road. The proposed route is via the Silverton Road, to the Daydream Mine Road, and onto the existing track across Nine Mile Station across Lakes Creek and to the south of Lakes Knob.

Access tracks

Approximately 50 kilometres of onsite access tracks for construction and operation would be unsealed formations measuring up to five metres in width, and are required to the base of each wind turbine location and the location of the site substation and control building.

Summary

The construction phase of the Stage 1 wind farm would occur over a 12 – 18 month period and would include such activities as:

- Transport of people, materials and equipment to site;
- Civil works for access track construction, footings and trenching for cables;
- Establishment, operation and subsequent removal of concrete batching plant;
- Potential use of rock crushing equipment onsite, if required;
- Installation of wind turbines using large mobile cranes;
- Construction of substation and onsite power reticulation lines and cables;
- Temporary site offices and facilities; and
- Restoration and revegetation of site on completion.

Construction would commence with the upgrading and construction of new roads and all other site civil works, including preparation of hardstand areas, and laying of cables. This would be followed by preparation of concrete footings, which must be cured prior to construction of wind turbines.

Wind turbines are likely to be installed at a rate of approximately 4 per week. The towers are erected in sections, the nacelles lifted to the top of the towers, and finally blades lifted and bolted to the hub. The necessary substation construction and grid connection works would be carried out in parallel.

The commissioning phase would include pre-commissioning checks on all high-voltage equipment prior to connection to the Transgrid transmission system. Once the wind farm electrical connections have been commissioned and energised, each wind turbine is then separately commissioned and connected and put into service. On completion of construction, the site would be revegetated and all waste materials removed from the site. Any temporary road realignments would be restored and revegetated.

During construction every effort would be made to:

- Minimise the number and length of necessary access tracks;
- Locate access tracks along the route of existing farm tracks;
- Locate access tracks where clearing of existing native vegetation would be minimised;
- Locate access tracks where impact on sensitive biodiversity or heritage areas would be minimised; and

- Construct access tracks with due regard to erosion, sediment control and drainage.

In this report recommendations are made in respect of an appropriate level of management and mitigation of impacts to the heritage recourse which takes into consideration heritage significance and the nature of proposed impacts.

In summary impacts relating to construction of the Silverton Wind Farm will occur in small, localised and discrete areas of the broader Stage 1 envelope. It is estimated that impacts will occur over a total area measuring approximately 50 hectares itemised as follows:

- 120 turbine towers and footings: 10.8 hectares;
- Access tracks to and between turbines: 25 hectares;
- Site office: 0.2 hectares;
- Substation: 1 hectare;
- Construction facilities: 0.75 hectares;
- Powerline (to Broken Hill) and Access track: 12.5 hectares.

The nature of the proposal is such that any Indigenous and/or Non Indigenous heritage items which maybe located directly within any of the areas in which various components are proposed will be significantly, physically impacted. The Stage 1 development envelope measures approximately 4,900 hectares however the total area encompassed by the impacts associated with the individual components of the project will measure approximately 50 hectares or 1% of that envelope. Accordingly more that 98% of the ground surfaces in the proposal area will not sustain impacts with the concomitant result that the majority of the archaeological and heritage resource in the area will be exempt from development impacts.

4.3 History of landuse and prior impacts

The primary landuse in the proposal area is sheep and cattle grazing on native vegetation, predominantly chenopod shrublands (Fanning 1999). Within the proposed turbine envelope extensive mining has also occurred in the past. Most recent landuse to which the ranges are subject is goat management programs. These prior and existing land uses have caused significant changes to geomorphological processes in the area, with an associated effect on the archaeological resource. This is discussed below and elaborated further in Section 6.2.

The European settlement of the Barrier Ranges has caused significant environmental changes to the landscape. The area was originally covered with woody mulga scrub and when the first explorers arrived they reported such thick vegetation that men had to walk their horses as it was too closely wooded for them to ride (Barrier Miner 2007). However the arrival of Europeans with sheep and later with their requirements for timber for use in the mining and pastoral industries, as well as the construction and operation of townships they built, resulted in the denudation of the vegetation (Murray/Darling Study Group 2004).

The wool industry between 1840 through to 1900 was the dominant export commodity in Australia. In the Western Division, pastoralism, in particular the grazing of sheep on native vegetation, became the dominant landuse practice. The development of riverine transport along the Darling, Murray and Murrumbidgee Rivers in the 1850s and 1860s facilitated this spread of pastoralism.

The area west of the Darling River was taken up by sheep farmers between 1859 and 1876 as new settlers were required to move out from the already occupied margins of the Darling in search of new grazing land (Lunney 2001). When Gow and Thornton explored the Barrier Ranges in 1861 looking for land suitable for pastoral use, they observed the tracks of horses and cattle, indicting that domestic stock had already found their way into that country beforehand. As wool exports increased, sheep numbers in the region dramatically surged in the late 1800s.

Opportunities which arose as a result of legislative changes to land tenure from the 1860s through to the 1880s patterned land occupation in the Western Division; these changes were accompanied by unforseen implications in relation to landscape and ultimately the history of land use. The Western Division was created as an entity as a result of the introduction of the Crown Lands Act 1884 (Lunney 2001). In addition, leasehold lands were divided into two equal parts with one part, the resumed area, made available to new settlers. As a result of this the original settlers were forced into the position of having to graze all their sheep on half the original land area they had previously utilised; the new settlers then grazed their sheep on the residual or resumed land (Lunney 2001). This resulted in more intensive grazing and higher levels of impacts to native vegetation.

Pastoralism in the western district during the late 1800s became fraught as vulnerability to droughts increased due to over stocking and the deterioration of the landscape. At this time wool production and the corresponding incomes of pastoralists became unreliable (Lunney 2001). Nevertheless before the end of the 1880s a large part of the country's overall increase in wool production occurred in this region, in part assisted by the widespread introduction of bores. Also around this time paddock fencing and vermin proof fences were constructed over most of the grazing land in New South Wales. Sheep numbers were still increasing at this time and as well, by the 1880s, rabbit populations. At the end of the century the Western District experienced a severe drought causing the death of huge numbers of sheep. In addition the economic depression saw wool prices fall.

By the turn of the century the negative effects off pastoralism on the landscape were beginning to be appreciated and this was recognised in the 1901 Royal Commission of the Western Lands when it acknowledged that the carrying capacity of the Western lands had been greatly over estimated. The Commission recognised that overstocking and the impacts of rabbits had resulted in the destruction of almost all vegetation.

Mulga was the principal tree species to be affected by pastoral management. It is documented to have been cut for drought feed early in the 1890s and regeneration was prevented in most areas by continued drought feeding and grazing by both sheep and rabbits (Oxley 1987).

In addition to the use of mulga as feed for sheep, especially in drought, this species was also widely exploited for fencing. The earliest fences were made of mulga bushes piled up in lines to about 1 metre in height. One such brush fence, 1.16 kilometres long, was the first fence installed around a selection on Purnawilla Station near Wilcannia in December 1882 (Pickard 1992). Wire strung fences had begun to be used from the 1870s. Fencers were paid per mile of erected fencing and where possible they cut the fence posts locally from living trees. Mulga was the favoured species for posts and this style of fence construction was still in wide use up until about World War II when steel posts started to be more commonly used. While the first steel posts were advertised in 1908, in western New South Wales they were not used extensively for another forty or so years for reasons of cost (Pickard 1992).

The discovery of ore bodies in the region in 1883 led to the establishment of the local mining industry which had a voracious appetite for wood to fire steam machinery and make pit props (Murray/Darling Study Group 2004). Compounding on this was the need for wood to build townships, for use in domestic fires and thereafter to power locomotive steam engines; following the mineral discoveries at Thackaringa and Umberumberka in 1883 local business people formed the Silverton Tramway Company in 1885 to build a railway line from Silverton to the South Australian border. Then with the silver-lead-zinc discovery at Broken Hill the railway line was extended from Silverton to Broken Hill in 1887 (Cockburn 2007). The result was that almost all the trees were cut down within a few days travel of Broken Hill (Murray/Darling Study Group 2004). When most of the local timber was removed builders and miners brought timber in from Adelaide (NSW NPWS 1991).

While at one time the vegetation was so thick there were stories of people losing their way in the scrub, the cumulative impacts of European settlement created a landscape heavily denuded of trees for hundreds of kilometres in every direction (Pritchard 2004). The resultant effect was the exposure of bare soils which were susceptible to aeolian erosion and dust storms became common phenomena. When strong winds blew the layers of soil were stripped from the bedrock and huge amounts of sand and dust became airborne. When this occurred the township of Broken Hill became inundated with sand drifts which piled up on its outskirts and covered its streets.

Archer Russell has recalled the road from Broken Hill to Menindee at this time: 'It was a hot track' wrote Russell, 'hot and long and abominably dusty. The sand upon it lay two feet thick. The plains through which it led marched away in great red wastes. Sometimes they ran up into rippled sand ridges and fell away into great scored hollows—the product of incessant wind-storms. As often as not there was no track at all—the wind had buried it in drift-sand' (Cited in Freeman 2002). When surveyor Randolph Bedford was appraising the Broken Hill township at about that time he wrote that "Argent Street was a huge dust heap…a two chain wide road knee deep in dust".

In 1908 Albert Morris, who is now remembered as a conservationist for starting the first revegetation program at Broken Hill, wrote of the degraded surrounding landscape: "The extending country stretched for miles without a vestige of any green thing and each stone or old tin had a streamer of sand tailing out from it. The fences were piled high with sand, inside and out and it looked as if the intended railway lines would just be buried every dusty day, which was every windy day" (Morris 1908, in Mining Hall of Fame Pty Ltd 2004).

Wind and dust storms continued to be a problem through the drought years in the 1930s and 1940s. Botanist Barbara Briggs indicates that her first recollection of Broken Hill as a child in the 1930s was a dust-storm she experienced while walking home from kindergarten with her older sister: "We clung to a wire fence while wind-blown sand stung our faces and we tried to keep grit and dust out of our eyes". Such storms and widespread sand-drift were frequent in

the 1930s in Broken Hill, when the city was surrounded by treeless wasteland, the result of overgrazing and cutting timber" (Briggs 2001). Others recall dust storms so heavy that the sun was obscured and the day seemed like night.

Botanist Noel Beadle was of the opinion that the dust storms of the 1940s were more frequent and more severe than those experienced during the 'Federation Drought". One such storm had buried roads near Menindee, blown down a town store and caused a train derailment after the railway line was buried by deep sand drifts. Across the district these dust storms had ripped away or buried all remaining feed. The Soil Conservation Service feared a 'moving sand desert' of reactivated dunes would put an end to grazing in the western district (Freeman 2002).

While many earlier accounts tended to attribute much of the cause of land degradation, the ensuing soil losses and dust storms to rabbit infestation, more recent assessments recognise that the initial introduction of sheep and their subsequent overstocking were the primary reasons. The introduction of rabbits and then goats served only to compound the problems initiated by pastoral enterprise, as the grazing habits of these animals curtailed regrowth.

Rabbits were introduced to Australia in 1859 by a wealthy Victorian grazier keen on the sport of hunting. They first arrived in the Broken Hill region 1883, well after the introduction of sheep and the earliest occurrence of severe dust storms. Reports by pastoral inspectors during the early 1890s indicated the seriousness of the rabbit problem. In one report the inspector stated that: ". . . the years 1890 and 1891, though splendid season as far as rainfall was concerned, were in reality, so far as feed for stock was considered, droughts. Rabbits had swarmed over the whole country, and the ground appeared incapable of growing anything. Many persons thought that the rabbits had poisoned the ground as nothing grew after such a good rainfall".

Rabbits competed directly with the domestic herbivores for palatable herbage and shrubs and so exacerbated the already high stocking rates. It is indicated that virtually no regeneration of Mulga occurred between 1899 and the 1950s, when rabbit numbers began to decline (Oxley 1987). David Lord, the owner of Thackaringa Station, has indicated that because each rabbit consumes about 250 grams of dry matter per day, just one or two rabbits per square kilometre can cause very significant environmental damage by completely suppressing the regeneration of plants. With regard to *Acacia carnei* trees there has been an increase in regeneration of *1700* percent since rabbits were excluded from areas within that station. Similarly, caging experiments at Kinchega National Park indicated that the rabbit was primarily responsible for the observed lack of regeneration of a range of *Acacia carnie* and that the control of rabbits was essential to initiate regeneration.

Goats were originally brought to Australia by European settlers in 1788 in the first of many introductions. They were introduced to inland areas by early settlers, miners and railway construction workers for use as a source of meat and milk, and in 1861 angora and cashmere goats were introduced for a specialty wool trade. Feral goats bred from escapees and deliberate releases from these flocks. Historically, feral goat numbers have increased on several occasions because of the collapse of the goat fibre industry. When this industry failed in the late 1800s, goats were abandoned leading to an increased feral population. The goat fibre industry experienced resurgence in the early 1900s only to decline around the same time as the wool crash in the 1960s (Southwell *et al.* 1993). Australia now supports the biggest feral goat population in the world.

The grazing of goats on many semi arid zone plant species has been found to have a deleterious effect with regard to both established trees and plant regeneration. However goats are selective grazers so that their impact on different plant species is varied. During times of drought or under conditions of heavy stocking, goats have been found to severely impact established trees and to eliminate new sprouts. Stocking at moderate rates however does not preclude regeneration. Nevertheless, given the plant selectivity of goats, it has been found that the overall effect of their continued grazing in a given area is the replacement of palatable shrubs by unpalatable ones (Harrington 1989). When both rabbit and goat populations occupy the same area the combined effect of the grazing habits of both species has been found to inhibit plant regeneration on a broad scale (Auld 1993).

Condon (1983) and Wasson and Galloway (1986) have noted that the cover of vegetation in the area around Broken Hill has undoubtedly increased during the last 30 years, and that as a result the rates of erosion have fallen. Much of the reason for this moderate recovery has been attributed to a drop in the rabbit population.

The implications of these prior impacts in regard to geomorphological processes and impacts on archaeological sites is set out in Section 6.2. In summary previous landuse in the region has resulted in a highly eroded and degraded landscape. These prior impacts will have caused significant changes to the archaeological resource in the proposal area.

4.4 Potential Impacts

It is estimated that impacts will occur within a total area measuring approximately 50 hectares. It is noted that impacts will be confined to cleared areas currently utilised for grazing; where possible existing access roads will be used. Electrical connections will generally be installed within access roads. Impacts can be summarised as small and discrete in area. However, given that the proposed works entail ground disturbance the project has the potential to cause impacts to any Aboriginal objects or historic items which may be present within the zones of direct impact.

5. STUDY METHODOLOGY

This Indigenous and Non Indigenous heritage study has included the following components:

- Consultation with Harvey Johnston, NSW DECC archaeologist, in order to clarify aspects relating to the Indigenous heritage context of the proposal area, legislative requirements and management and mitigation.
- A NSW DECC Aboriginal Heritage Information Management System site search to determine whether or not previously recorded sites are present on the proposal area and to give consideration to the type of sites known to be present within the local area.
- A review of Non Indigenous heritage registers to determine whether or not historic items present in the proposal area are listed.
- A review of local and regional archaeological reports and other relevant documents in order to provide a contextual framework to the study and heritage management process.
- A review of impacts relating to the construction of the Silverton Wind Farm aimed at determining the potential nature and extent of impacts to any Indigenous objects and heritage items which may be present.
- A field survey of the proposal area aimed at locating Aboriginal objects and Non Indigenous heritage items, recording survey coverage data, assessing the archaeological potential of the landforms present and formulating a model of site location relevant to the area.
- Documentation of survey results.
- An assessment of survey results.
- A site significance assessment.
- The formulation of management and mitigation recommendations ensuing from the above.

5.1 Literature Review

Background research has been conducted to determine if known Aboriginal objects and Non Indigenous heritage items are located in the proposal area and to assist in the construction of a relevant model of site type and location.

The following information sources were accessed for this study:

- NSW DECC Aboriginal Heritage Information Management System;
- Relevant archaeological reports held in the NSW DECC Cultural Heritage Unit;
- Historical sources including the Unincorporated Area of NSW Heritage Study (Hope 2006) and the Silverton Heritage Management Plan (McDougal & Vines 2005);
- Historical heritage inventories including the NSW State Heritage Register and Inventory, the National Trust Register, the Register of the National Estate, the National Heritage Register and the Broken Hill Local Environment Plan 1996 (as amended);
- Pearson, M. and B. McGowan 2000 Mining Heritage Places Assessment Manual. Australian Council of National Trusts and Australian Heritage Commission.
- Broken Hill 1:100,000 topographic map;
- Umberumberka 1:25,000 geological map;
- Broken Hill 1:250,000 Land Systems Series Sheet.

5.2 Field Survey and Methodology

The approach to recording stone artefacts in the current study has been a ‘nonsite’ methodology (*cf* Dunnell 1993; Shott 1995). The rationale behind this approach is that the identification of discrete ‘sites’ and their boundaries are a construction within an interpretative process and is often found to be flawed. Given that full archaeological visibility is generally not encountered during survey conditions the process of identifying site boundaries (if they exist at all) is usually not possible.

However, it can be expected that artefacts will be distributed across the proposal area in a virtual continuum. Therefore in respect of stone artefact distribution the notion of site is itself a meaningless concept and cannot encompass or reflect the actual distribution of artefacts across the landscape. Given that artefacts are generally continuous in distribution and not discrete 'site' occurrences artefact distribution is better conceptualised in continuous terms.

While stone artefacts will generally be found to be continuous in distribution, the density and nature of that artefact distribution, will vary across the landscape in accordance with a number of behavioural factors which resulted in artefact discard. While cultural factors will have informed the nature of Aboriginal land use, and the resultant artefact discard across the landscape, environmental variables are those which can be utilised archaeologically in order to analyse the variability in artefact density across the landscape. Accordingly in this study the landscape has been divided into a number of Survey Units which are utilised as the framework of recording and analysis (*cf* Wandsnider and Camilli 1992).

Survey Units have been defined on the basis of a combination of environmental variables which are assumed to relate to Aboriginal usage of the area. These areas are conceptualised as *archaeological terrain units* and in this study have been defined on the basis of a combination of landform element, gradient and aspect (*cf* Kuskie 2000: 67). The Survey Unit is defined as discrete area that is bounded on all sides by different archaeological terrain units.

The rationale for employing this approach relates also to its utility in regard to predicting the archaeological potential of landforms; archaeological terrain units are "…discrete, recurring areas of land for which it is assumed that the Aboriginal land use and resultant heritage evidence in one location may be extrapolated to other similar locations" (Kuskie 2000: 67).

Field work was undertaken over a nine day period in November 2007. The survey was conducted on foot by two survey teams each consisting of four people. The field assessment sought to inspect as much of the proposed impact area as practicable and was reasonably comprehensive. The survey methodology entailed walking parallel transects across individual Survey Units with each surveyor situated ca. 10 m apart. This methodology enabled an optimal level of direct visual inspection of each Survey Unit. The field survey was aimed at locating Aboriginal objects and historical heritage items. An assessment was also made of prior land disturbance and the effects of this on the archaeological resource, survey coverage variables (ground exposure and archaeological visibility) and the potential archaeological sensitivity of the land.

Quartz artefacts were expected to be the predominant Aboriginal object type encountered in the proposal area. A characteristic feature of quartz is that it is not always homogeneous and possesses flaws and incipient fracture planes which influence the manner in which it fractures; therefore quartz artefacts do not always possess readily identifiable artefactual features. On the other hand naturally fractured quartz may appear to be artefactual to the untrained eye. Given the problems in distinguishing between artefactual and non-artefactual quartz in the field, measures were adopted in order to provide certainty in regard to quartz artefact identification: Dr Kamminga was engaged to assist during the survey, specifically for the purposes of distinguishing, with a high level of certainty, between artefactual and non-artefact quartz. In addition a stereoscopic microscope and hand lens's (magnification x 10) were utilised in the field.

In order to ensure consistency in data collection all field records was entered onto recording forms generated specifically for the Silverton Wind Farm project. Three separate forms were used for recording Survey Unit data, Aboriginal Object data and Historical features data. The data collected forms the basis for the documentation of survey results outlined in Section 9. The variables recorded are defined below:

Survey Unit Variables

Landscape variables utilised are conventional categories taken from the *Australian Soil and Land Survey Field Handbook* (McDonald *et al*. 1998):

Landform pattern: (measuring more than 600 m across) Relief and stream occurrence define landform pattern – the following landform patterns were recorded:

- Low hills (low relief 30 – 90 m).
- Hills (high relief 90 - 300 m).
- Rises (very low relief 9 – 30 m).
- Plain.

Landform elements: (measuring 40 m or more across): slope and position in a toposequence are key attributes – Landform element recording, in combination with Aspect and Slope Class form the basis for defining Survey Unit boundaries. The following landform elements were recorded:

Morphological type:

- Crest – element that stands above all or almost all points in the adjacent terrain – smoothly convex upwards in downslope profile. The margin is at the limit of observed curvature.
- Hillock – *a compound morphological type*: narrow crest and short adjoining slopes with the crest length being less than the width of the landform.
- Ridge - *a compound morphological type*: narrow crest and short adjoining slopes with the crest length being greater than the width of the landform.
- Simple slope: - element adjacent below crest or flat and adjacent above a flat or depression.
- Flat: - planar element, neither crest or depression and is level or very gently inclined.
- Open depression: - extends at same elevation or lower beyond locality where it is observed.
- Closed depression: - stands below all points in adjacent terrain.

Slope class and value:

- Level 0 - 1%.
- Very gentle 1 - 3%.
- Gentle 3 – 10%.
- Moderate 10 – 32%.
- Steep 32 – 56%.

Element:

- summit
- bench
- saddle
- gully
- gorge
- stream bank
- stream bed
- stream channel

Geology

The type of geology was recorded and as well the nature of its occurrence such outcrops, shatter or gravels if present. All quartz outcrops whether bedrock or scree was recorded and in addition the level of visual interference from background quartz shatter was noted.

Soil

Soil type and depth was recorded. The potential for soil to contain subsurface archaeological deposit (based on depth) was recorded as Low, Moderate or High.

Geomorphological processes

The following gradational categories were recorded:

- eroded
- eroded or aggraded
- aggraded

Geomorphological agents

The following geomorphological agents were recorded:

- gravity: *collapse or particle fall*
- precipitation: *creep; landslide; sheet flow*
- stream flow: *channelled or unchannelled*
- wind

- biological: *human; nonhuman*

Vegetation
The following vegetation communities were recorded:

- Mulga - Dead Finish Shrubland
- Prickly Wattle open shrubland
- Mallee - Bluebush open woodland
- River Red Gum Open Woodland
- River Red Gum Woodland
- Sandplain Mulga Tall open Shrubland
- Chenopod shrublands

Survey coverage variables were also recorded; these are described further below in Section 5.3.

The archaeological sensitivity of each Survey Unit was defined according to assessed artefact density as either very low, low, low/moderate or moderate.

Aboriginal Object Recording

The proposal area was found to contain continuous, albeit usually very low to low density, distributions of quartz stone artefacts. Accordingly in the majority of Survey Units where this was the case the artefact distribution was recorded in terms of its estimated density. For the purposes of defining the artefact distribution in space it has been labeled as a locale (eg. Survey Unit 1/Locale 1) and the grid reference is given as the centre of the Survey Unit. It is noted that artefact density estimates made for Survey Units are based on an average density calculation across the entire Survey Unit. Where apparently genuine 'isolated finds' or discrete artefacts clusters were encountered in the absence of a continuous distribution across Survey Units these were recorded as such.

Artefact density has been defined in arbitrary categories as follows;

- Very low: <1 artefact per square metre;
- Low: between 1 and 10 artefacts per square metre;
- Low/moderate: between 11 and 30 artefacts per square metre;
- Moderate: between 31 and 50 artefacts per square metre.

In addition to recording artefact density a general description of the artefact types observed is noted. Clusters of artefacts were recorded. Any artefacts made of material other that quartz were recorded individually, measured and often photographed. Rare artefact types such as mortars, adzes etc have been recorded individually.

If additional features were recorded in a Survey Unit these were defined as a Locale separate to that of the stone artefact distribution (eg. Survey Unit 1/Locale 2). Additional features recorded included Stone Procurement Areas (SPAs), occasional discrete areas in a Survey Unit containing stone heat retainer ovens, and a single possible stone arrangement.

Historical Feature Recording

The following variables were recorded:

- Site type or feature such as building, mine etc;
- A general description made including the number of features, overall dimensions, materials etc.;
- Architectural features such as materials, orientation, function etc.;
- Artefacts present including types, density and location;
- An estimate of age and/or period of use/occupation;
- Site condition including integrity, previous impacts, geomorphic processes etc.;
- Subsurface potential including an estimate of potential nature, depth and integrity of deposit within individual features an in surrounding areas.

5.3 Survey Coverage Variables

Survey Coverage Variables are a measure of ground surveyed during the study and the type of archaeological visibility present within that surveyed area. Survey coverage variables provide a measure with which to assess the effectiveness of the survey so as to provide an informed basis for the analysis of artefact density, site significance and the formulation of management strategies.

Specifically, an analysis of survey coverage is necessary in order to determine whether or not the opportunity to observe stone artefacts in or on the ground was achieved during the survey. In the event that it is determined that ground exposures provided a minimal opportunity to record stone artefacts it may be necessary to undertake archaeological excavation for determining whether or not stone artefacts are present. Conversely, if ground exposures encountered provided an ideal opportunity to record the presence of stone artefacts, the survey results may be considered to be adequate and accordingly no further archaeological investigation may be required.

Two main variables were used to measure ground surface visibility during the study; the area of ground exposure encountered and the quality and type of ground visibility (archaeological visibility) within those exposures.

The two survey coverage variables estimated during the survey are defined as follows:

- Ground Exposure – a percentage estimate of the total area inspected which contained exposures of bare ground; and

- Archaeological Visibility – a percentage estimate of the average levels of potential archaeological surface visibility within those exposures of bare ground.

Based on the two visibility variables as defined above, a net estimate (Net Effective Exposure) of the archaeological potential of exposure area within a survey unit or set of units has been calculated. The Effective Survey Coverage (ESC) is a percentage calculation of the archaeological visibility encountered and is defined and required by the NSW DECC.

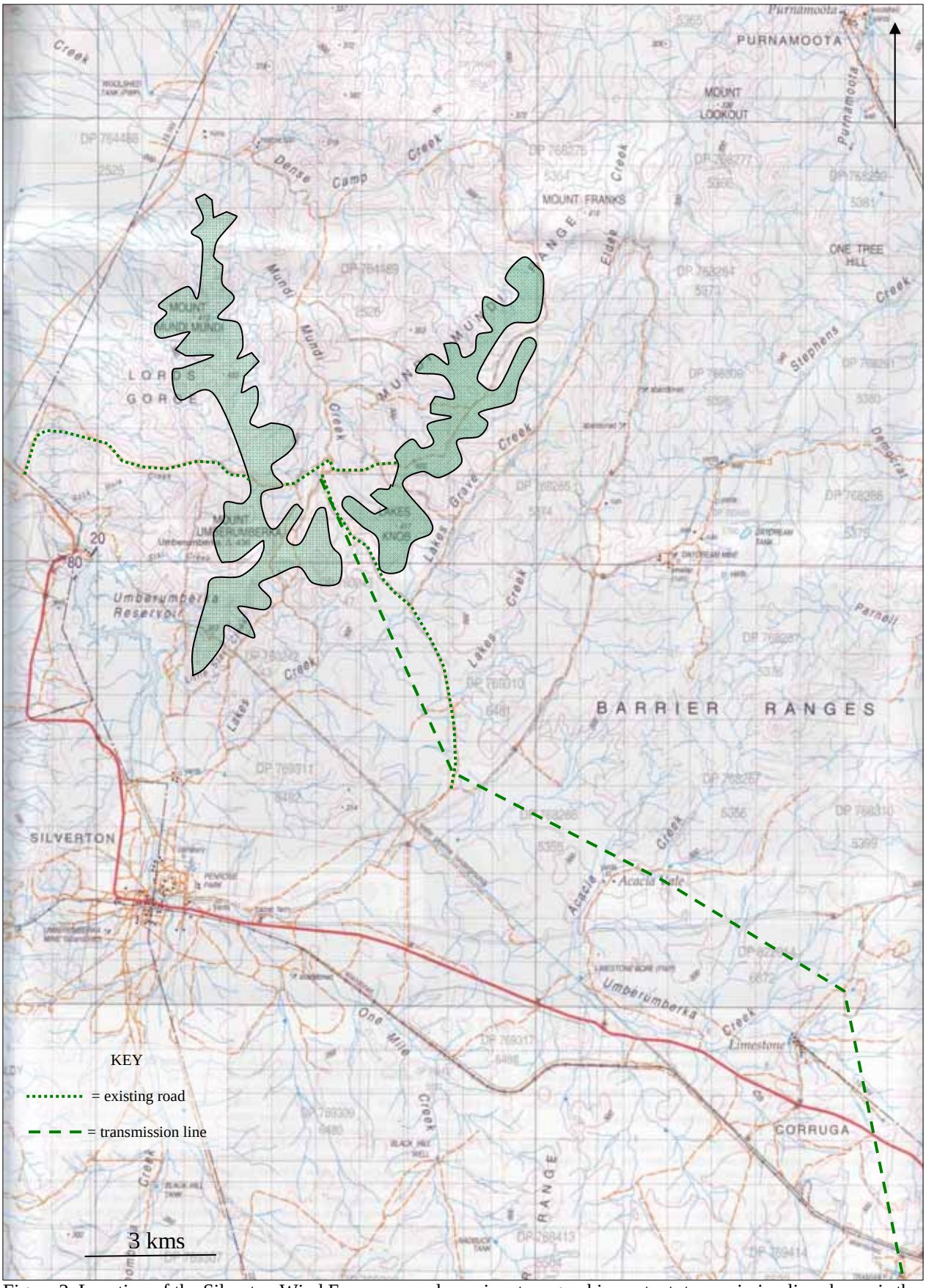

Figure 2. Location of the Silverton Wind Farm proposal area in a topographic context; transmission line shown is the visual impacts minimised route (Broken Hill 7134 2nd ed. 1:100,000 topographic map).

6. LANDSCAPE CONTEXT

A consideration of the landscape is necessary in archaeological work in order to characterise and predict the nature of Aboriginal occupation across the land (NPWS 1997). In Aboriginal society landscape could be both the embodiment of Ancestral Beings and the basis of a social geography and economic and technological endeavour. The various features and elements of the landscape are/were physical places that are known and understood within the context of social and cultural practice.

Given that the natural resources that Aboriginal people harvested and utilised were not evenly distributed across landscapes Aboriginal occupation and the archaeological manifestations of that occupation will not be uniform across space. Therefore, the examination of the environmental context of a study area is valuable for predicting the type and nature of archaeological sites which might be expected to occur. Factors which typically inform the archaeological potential of a landform include the presence or absence of water, animal and plant foods, stone and other resources, the nature of the terrain and the cultural meaning associated with a place.

Additionally, geomorphological processes and agents need to be defined as these will influence the degree to which archaeological sites may be visible and/or conserved. Land which is heavily grassed will prevent the detection of archaeological material while land which has suffered disturbance may no longer retain artefacts or stratified deposits. A consideration of such factors is necessary in formulating site significance and mitigation and management recommendations.

The following sections provide information in regard to the landscape context of the study area.

6.1 Topography and geology

The proposed Silverton Wind Farm is situated in the Barrier Ranges north of Silverton. The topographic context of the proposal area is shown on Figure 2.

The proposal area is situated on the eastern margin of the Australian the arid zone; average annual rainfall is below 250 mm with pan evaporation exceeding 2000 mm in most areas (Fanning 1999). Precipitation variability is high and seasonality of rainfall is weak.

The Barrier Ranges form a series of north-east and north-west trending ridges rising up to 300 m above the surrounding plain. The proposed turbines are situated on ridges within two land systems; the Barrier land system (Br on Figure 3) which is defined as ranges with narrow incised drainage and relief to 80 metres and the Umberumberka land system (Ub on Figure 3) which is defined as rugged ranges with narrow incised drainage and relief to 200 metres (Broken Hill Land Systems Series Sheet SH 54 -15). The Barrier land system conforms to a low hills landform pattern; that is with a typical relief of between 30 – 90 m (*cf.* McDonald *et al.* 1998). The Umberumberka land system conforms to a hills landform pattern; that is with a typical relief of between 90 - 300 m (*cf.* McDonald *et al.* 1998).

A portion of a proposed access road from Eldee Road into the turbine envelope crosses the Mundi Mundi land system (Mg on Figure 3). This land system is defined as extensive alluvial and colluvial plain with aeolian deposition, westward trending narrow drainage lines and floodouts with relief to 2 metres. Further to the east the proposed transmission line is located in part, in the Nine Mile land system (Nm on Figure 3). The Nine Mile system is defined as lower ridges, slopes and major drainage plains of the Barrier Range with relief to 30 metres. The Mundi Mundi land system conforms to a plain landform pattern; that is with a typical relief of <9 metres while the Nine Mile land system conforms to a Rises landform pattern; that is with a typical relief between 9 and 30 metres (*cf.* McDonald *et al.* 1998).

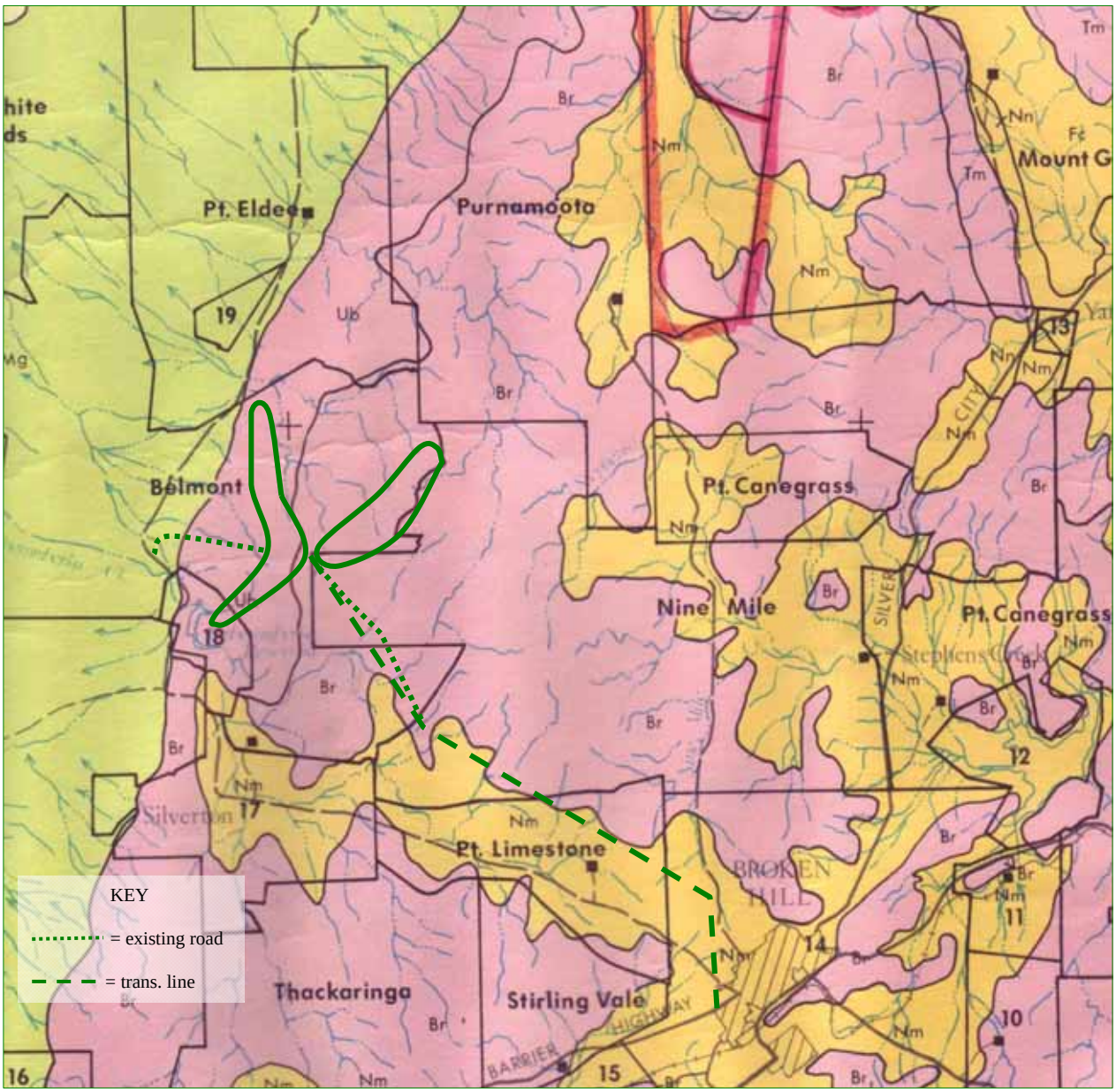

Figure 3. Location of the Silverton Wind Farm in relation to defined land systems (Broken Hill Land Systems Series Sheet SH 54 – 15): *red line not relevant*.

The rocks of the Broken Hill region are a part of the Adelaide Fold Belt province and include two main sequences, the Willyama Supergroup and the Toorowangee Group (Branagan & Packham 2000). The Willyama Supergroup rocks are the oldest. These rocks were mainly sandy and shaly sedimentary and silicic volcanic rocks which have since been subjected to large earth movements resulting in their transformation into a variety of metamorphics including schists and gneisses (Branagan & Packham 2000).

Soils in the Umberumberka land system are lithosols with some texture-contrast soils while soils in the Barrier land system are lithosols and red texture-contrast soils (Broken Hill Land Systems Series Sheet SH 54 -15). Generally soils in all turbine impacts areas are skeletal; land surfaces are rocky with extensive, low outcrops and generally high levels of rock shatter. Extensive milky quartz outcrops are present across the wind farm area. These are generally small and isolated pockets, often less than 10 square metres in area but are in some instances large both in area and height. Quartz quality varies from poor to very high.

There are no major watercourses present; however, several ephemeral watercourses exist. These include Umberumberka Creek, Lakes Grave Creek, Lakes Creek, Eldee Creek and Mundi Mundi Creek. The first three creeks drain into Umberumberka Dam, which provides part of the water requirements for Broken Hill and Silverton.

In some areas, the creeks have formed steep-sided gorges, such as Lords Gorge, where sheltered waterholes exist when water is present. Beyond the Barrier Ranges, the creeks expand as alluvial fans, distributing sediment onto the Mundi Mundi Plain (nghenvironmental 2008).

While these streams flow for a short time after rain bedrock and other features within channels are likely to have held water for longer periods of time; Holdaway *et al*. 2002 have argued that these waterholes may have held water for considerable periods of time. These features generally however, no longer exist because they have been buried with Post Settlement Alluvium or completely destroyed by channel incision and knickpoint retreat (Fanning 1999). Holdaway *et al*. (2002) have argued that concentrations of curated artefacts in the Stud Creek catchment in Sturt National Park are located adjacent to features that are interpreted to be infilled waterholes in the Stud Creek channel. Accordingly the archaeology in the region may well point to the presence and location of previous water holes.

6.2 Geomorphology

The sequence of geomorphic change that has occurred in the Barrier Ranges has been viewed in terms of pre-European and post-European phases. Generally, pre-European events are seen as being driven by climatic shifts, while post-European changes are attributed in large part to humanly activated processes (Cupper 2005; Fanning 1999; Holdaway *et al*. 2002; Wasson and Galloway 1986).

Geomorphic evidence for recent, widespread landscape change in the region comes from a number of sources ranging from the measurement of processes responsible for topsoil loss, descriptions and dating of regolith sequences in valley fills, monitoring of channel enlargement and knickpoint retreat and observations of the burial of land surfaces and the erosion of cultural heritage features and infrastructure (Fanning 1999). These processes and changes need to be considered in the context of archaeological analysis as they have the potential to cause significant impacts to archaeological features.

Wasson (1979) examined the Mundi Mundi Alluvial Fans. The catchment for these fans falls entirely within the Barrier Ranges, and reflects the geomorphological history of those ranges. Wasson (1979) found the fans to consist of five well-defined and easily recognised stratigraphic units. The earliest stratigraphic unit recognised is the Umberumberka unit believed to have been deposited as the result of a period of increased moisture during the last glaciation of southeastern Australia, and which ceased to accumulate as a result of increasing aridity.

The Belmont Palaeosol, deposited over the Umberumberka unit, represents a period when the fan surfaces were inactive between 16,000 and 13,000 years B.P. Over this the Korkora unit is a thin and discontinuous unit. The streams which deposited this latter unit were often less than 50 cm deep. It is suggested that the Korkora unit was deposited during a short period of increased moisture (Wasson 1979).

The final period of major deposition on the fans is represented by the Mundi Mundi unit. The sediments of this unit are indistinguishable from those of the Umberumberka unit, except that the mud content of the Mundi Mundi unit is lower than in the older unit. The Mundi Mundi unit began to accumulate about 6000 years B.P. as a result of an increase in rainfall. Pollen evidence from the unit suggests that vegetation about 4500 years ago was little different from that of today showing that the increase in rainfall of the time was not substantial at Broken Hill. Into this, the Thackaringa unit was deposited between ca 1000 and 500 BP as an inset fill within trenches cut into the fans. The deposition of this unit appears to have been the result of a slight increase in moisture recorded in lakes in southern Australia. Wasson's overall findings were that climatic changes were the dominant 'secondary control' in the evolution of the Mundi Mundi Alluvial Fans (Wasson 1979).

A marked acceleration in pre-European sediment yield from the Barrier Ranges between 6000 BP and 3000 BP was later documented by Wasson and Galloway (1986), which they argue resulted in the formation of the Mundi Mundi unit. This increase in the depositioning of sediment has chiefly been attributed to a period of higher temperature and rainfall.

Wasson and Galloway (1986) in their comparative study of the sediment yield in the Barrier Ranges before and after European settlement, suggest that "…it is generally agreed that European settlement of Australia's rangelands altered the biota and increased rates of soil erosion". Their investigation found that a dramatic change in the catchment occurred when Europeans and domestic stock arrived, with a rate of sedimentation between 1915 and 1982 many times higher than the pre-European period. The average post-settlement sediment yield was found to be 50 times greater than the average yield for the 3000 years preceding settlement. They indicate that although at present the rate of erosion has fallen, it is still continuing at a pace far above the pre-1850 rate.

Fanning's (1999) research, conducted across a number of upland catchments between Broken Hill and Tibooburra, likewise found that modern rates of soil erosion are approximately 145 times the 'natural' rates occurring before

European occupation. This reflects the acceleration of geomorphic processes such as sheetwash, rilling, gullying and wind drift set in play as the result of European land use. Channel enlargement and knickpoint retreat were found to be active in many catchments, resulting in destabilisation of riparian areas and causing impacts to infrastructure such as roads and fences and cultural heritage.

Fanning (1999) describes two broad geomorphological processes causing impacts in the area. Erosion: - which entails widespread stripping of surface alluvium causing extremely high rates of soil loss; and aggradation: - resulting in channel infilling which generally occurs in localised areas, in downstream locations.

The source of the material deposited on the floodplains has derived from the erosion of the hillslopes of the Barrier Range regolith. With the introduction of domestic grazing, and feral animals, and other vegetation impacts, the hydrologic balance has shifted towards surface runoff, an increase in the erosiveness of flows on hillslopes and the subsequent loss of topsoil; topsoil loss has been found to exceed soil formation (Fanning 1999). On hillslopes evidence such as presence of lichen lines on rocks and the widespread exposure of tree roots points to an average lowering of the land surface of at least 10 cm.

The aggradation of Post Settlement Alluvium in valley floors has been found to vary in depth between 10 cm and one metre in catchments across the region (Fanning 1999). These sediments either overlie the original land surfaces (sometimes containing charcoal, ash, bone, stone artefacts and heat retaining hearths: for example at Giles Creek at Mutawintji) or eroded surfaces (Fanning 1999).

Radiocarbon dating of charcoal retrieved from Aboriginal fireplaces buried beneath sediment indicates that many were in use immediately prior to European settlement of the area about 140 years ago. Fanning (1999) concludes that the red sandy alluvium had been deposited over the floodplain surface very close to the time of European settlement, and most likely as a result of the initial disturbance of the catchment when sheep grazing was introduced.

The loss of topsoil on valley floors is also observed by examination of Aboriginal heat retaining hearths. The stones of these hearths, which originally lined sunken cooking pits, are often found exposed as a high point of the land surface, having protected the soil beneath from the impact of rain-splash erosion. At the same time the surrounding unprotected land surface has been eroded away, clearly demonstrating that surface lowering had occurred since the fireplaces were in use (Fanning 1999).

Prior to European induced geomorphic change the upland creek systems comprised shallow, sinuous channels. However when the hillslope source of sediment was depleted, the stream flows became more erosive within the valley floors; this led to a triggering of channel incision into the valley fills buried under the highly erodible sandy Post Settlement Alluvium. The commencement of this entrenchment began at about 140 years ago (Fanning 1999). Gullying is causing streams to widen, and to become straight sided with flat floored gullies. The process continues as banks become undercut and collapse. In addition to gullying enlargement, knickpoint retreat is widespread across the region. These processes cause significant erosion and loss of valley fill with the associated loss of the archaeological resource which may be present within it.

While the studies outlined above have been conducted outside the proposal area it is believed that they can be extrapolated across the region. During field survey of the Stage 1 proposal area evidence of these processes was assessed across the various landforms and documented as either erosion, aggradation or a combination of both processes. Given that the sediments deposited in the valleys in a post settlement context have derived from the hills as topsoil loss, in the proposal area, these processes are highly likely to have caused impacts to the archaeological resource in the turbine envelope. Hillslopes have been denuded of topsoil via erosion with an associated impact of archaeological objects. Fanning and Holdaway (2001) have attempted to quantify the effects of these processes on artefact distribution. They have argued that at even low gradients artefact size and slope angle are significantly related; smaller artefacts are moved at greater distances than larger artefacts and as slope angle increases this phenomena is enhanced. In valleys both erosion and aggradation has occurred resulting in disturbance and removal or the burying of archaeological objects; gullying enlargement and knickpoint retreat of the valley fills will have entirely removed archaeological material from the former stream margins.

The upside of some of these processes is that the loss of soil has resulted in the exposure of archaeological material which would otherwise be located within a subsurface context; it can be expected that the turbine envelope within the proposal area is likely to possess high levels of archaeological visibility.

6.3 Vegetation

Diverse vegetation communities occur across the Broken Hill Complex Bioregion, varying according to topography, soils and micro-climate. Mulga (*Acacia aneura*) communities and chenopod shrubland communities dominate the

vegetation of the bioregion (nghenvironmental 2008). The composition and structure of vegetation communities within the bioregion has been modified as a result of grazing by stock and feral animals such as goats, and altered fire regimes (nghenvironmental 2008).

Ten vegetation communities occur across the Silverton Wind Farm proposal area. These communities are listed and described briefly below:

Mulga - Dead Finish Shrubland – This community is the most common type on the ridges of the turbine envelope. This tall open shrubland is dominated by Mulga (*Acacia aneura*) and Dead Finish (*Acacia tetrogonophylla*) with Belah (*Casuarina pauper*) also present. In the study area this community occurs on skeletal or shallow, stony soils which occur on the steep slopes, hillcrests, midslopes and terraced flats of elevated landscapes. Over much of the study area there is evidence of dieback and a general absence of regeneration and in most areas this community is highly degraded. Overgrazing by feral goats is the main reason for this phenomenon. The understorey is typically sparse. However, scattered shrubs present included Silver senna (*Senna artemisiodes*), Bastard mulga (*Acacia sibrica*) and Umbrella mulga (*Acacia brachystachya*). The ground vegetation consists of numerous chenopod shrubs such as Black bluebush (*Maireana pyamidata*) and copperburs (*Sclerolaena* spp.). The dieback of Mulga and lack of regeneration of these key species suggests a long-period of degradation likely to be caused by timber cutting and grazing by feral goats and rabbits. The sparse cover of ground vegetation is also likely to be impacted by feral animal grazing and is expected to have eliminated many floral species from this community.

Porcupine Grass – Red Mallee – Gum Coolibah Hummock Grassland/Low Sparse Woodland - This community is dominated by Red Mallee (*Eucalyptus socialis*) and Gum Coolibah (*Eucalyptus intertexta*). Some areas on the ranges are devoid of trees and are hummock grasslands, while other areas contain scattered trees.

River Red Gum Open Woodland – This community is present on sandy or loamy soils in sandy creeks and is dominated by River red gum (*Eucalyptus camaldulensis* subsp. *obtusa*). Within the study area it occurs along major drainage lines such as Umberumberka Creek and Lakes Creek. Typically, the understorey is sparse in this community; typical understorey species included Silver senna, Prickly wattle (*Acacia victoriae*) and Emubush (*Eremophilia longifolia).* Other species common throughout include Black bluebush and the grasses *Aristida echinata* and *Aristida contorta*. Many areas appear to be heavily grazed either by domestic stock and/or feral animals.

River Red Gum Woodland - This community occurs in stony creeks, mainly on the flats and lower areas. While this vegetation community is also dominated by River red gum, the presence of species such as Mulga and Dead finish typically associated with rocky hills, indicate the landscape position of this community which is confined to gravelly creeks on hillsides or rocky gorges. Sticky hopbush (*Dodonea viscosa* subsp. *angustissima)* and Cough bush (*Cassinia laevis*) occur as a very sparse shrub layer in places. Grasses such as Kangaroo grass (*Themeda australis*) and *Digitaria brownii* contribute to a very sparse ground layer of vegetation.

Prickly Wattle Open Shrubland – This community is found in ephemeral drainage lines in both stony hills and ranges and the low hills of the Barrier Range. The dominant shrub in this community is Prickly wattle while the understorey of chenopod shrubs includes Black bluebush and Thorny saltbush (*Rhagodia spinescens*). Lemon grass (*Cymbopogon ambiguous*) is present, mainly within the stony hills. On the stony ranges, this community grades into Mulga-Dead finish and elsewhere, into chenopod shrublands.

Chenopod shrublands – These communities are found on the lower areas on the Mundi Mundi Plain and between the turbine area and Broken Hill; they include the following communities:

Bluebush Shrublands on Stony Rises and Downs - This chenopod shrubland community comprises of numerous bluebush species. Throughout the study area this community is dominant along the proposed powerline route towards Broken Hill and in the vicinity of the proposed substation where red or brown clays or red loams occur. The shrubs Black bluebush (*Maireana pyramidata*), Pearl bluebush (*M. sedifolia*), copperburrs (*Sclerolaena* spp) and Ruby saltbush (*Enchylaena tomentosa*) form a major component of this community.

Bladder Saltbush Shrubland on Stony Plains - Bladder saltbush occurs primarily along the powerline route close to Broken Hill. This vegetation community is dominated by Bladder saltbush (*Atriplex versicaria*) with many other chenopod species also present such as copperburs and bluebush.

Black Bluebush Low Open Shrubland of the Alluvial Plains and Sand Plains - this vegetation community is found on the Mundi Mundi Plain on the Barrier Range Alluvial Fans and is generally dominated by Black bluebush and other chenopods such as copperburrs and occurs primarily on deep, sandy-loam soils of drainage depressions.

Sand Plain Mulga – This community is found in areas along the powerline route near Broken Hill. This tall open shrubland is dominated by Mulga (*Acacia aneura*) with other shrub species such as Belah (*Casuarina pauper*), Turpentine bush (*Eremophilia sturtii*) and Punty Bush (*Senna* form taxon '*filifolia*'). In the study area this

community occurs in the small patches near ephemeral drainage lines and on sandy areas in the eastern portion of the study area.

Black Oak Woodland - this low, open woodland is dominated by Black Oak (Casuarina pauper) and Western Rosewood (*Alectryon oleifolius*). In this study area this community was recorded in a small area of the north-western section on rocky hills. The trees in this community in the study area are extremely sparse.

While these vegetation communities are highly degraded a number of plants are still present in the proposal area which are known to be been utilised and/or eaten by Aboriginal people. Table 1 below lists the plants observed during the November 2007 field trip known to have been utilised by Aboriginal people.

Scientific name	**Common name**	**Parts used or eaten**
Disphyma crassifolium	pig face	fruit, leaves (Badger Bates pers. comm.; Bonney c.1881)
Marsdenia australis	wild banana	fruit, flowers, leaves, tubers (Badger Bates pers. comm; Bonney c.1881)
Enchylaena tomentosa	ruby saltbush	fruit (Badger Bates pers. comm.; Cleland & Johnson 1939)
Rhagodia spinescans	rhagodia	fruit (Badger Bates pers. comm)
Convolvulus erubescens	morning glory	taproot
Acacia aneura	mulga	seeds, mulga apples, gum (Badger Bates pers. comm.; Bonney c.1881; Cleland & Johnson 1939; Institute for Aboriginal Development 1985)
Acacia victorieae	prickly wattle	seeds, gum (Badger Bates pers. comm.; Institute for Aboriginal Development 1985) Badger Bates pers. comm
Erodium crinatum	crowfoot	root, shoots (Badger Bates pers. comm.; Barker 1972; Newland 1887-8)
Amyema sps	mistletoe	fruit (Badger Bates pers. comm.)
Lysiana exocarpi	mistletoe	fruit (Badger Bates pers. comm.; Institute for Aboriginal Development 1985)
Myoporum montanum	water bush	fruit, resin (Badger Bates pers. comm)
Eucalyptus camaldulensis	river red gum	nectar, manna, grubs, seeds (Bonney c.1881)
Portulacca oleracea	pigweed	seeds, leaves, stems, roots (Badger Bates pers. comm.; Bonney c.1881; Cleland & Johnson 1939)
Santalum acuminatum	quandong	fruit, seeds, (Badger Bates pers. comm.; Bonney c. 1881)
Santalum lanceolatum	plumbush	fruit (Badger Bates pers. comm.; Institute for Aboriginal Development 1985)
Alectron oleifolius	rosewood	red tissue between seed & capsule eaten (Cleland & Johnson 1939)
Solanum spps	bush tomato	fruit (Institute for Aboriginal Development 1985; Mitchell 1848)
Pimelea microcephala	rice flower	fruit (Cleland & Johnson 1939)
Grevillea striata	beefwood	nectar, resin
Triodia irritans	spinifex	resin, ?seeds
Eremophila duttonii	emu bush	medicine
Eremophila alternifolia	emu bush	medicine
Cymbopogon ambigous	lemon grass	medicine
Pittosporum phylliraeoides	butterbush	medicine, resin

Table 1. Plants observed in the proposal area during the November 2007 field trip.

Summary

The impact areas relating to the proposed Silverton Wind Farm are situated in the hills of the Barrier Range and adjoining plains.

The hills in the area are very rocky and generally possess moderately inclined or steep slopes. Prior to historic impacts which have caused significant degradation to the vegetation communities the hills are likely to have been utilised by Aboriginal people for hunting numerous animal species including mammals and reptiles. Plant species would also have been harvested for fruit, seeds (including staples such as mulga) and medicine. Quartz outcrops are ubiquitous throughout the hills and proved an abundant and readily accessible supply of stone for tool manufacture. Fresh water is however present in the hills as an ephemeral source only. The hilly areas are predicted to have been utilised for low levels of Aboriginal occupation associated with hunting and gathering forays conducted away from base camp locations. It is predicted that in the hills artefact discard would have been correspondingly low and commensurate with low levels of utilisation. In summary the hills are predicted to contain stone artefacts distributed in low density. Any quartz outcrops present in the hills are likely to have been exploited as a source of raw material for implement manufacture.

Numerous creeks are present within the ranges and these areas contrast to the environmental context of the hills. The open depression landforms through which these creeks flow (such as Umberumberka Creek, Lakes Grave Creek, Lakes Creek, Eldee Creek and Mundi Mundi Creek) are relatively flat and are significantly less rocky than the adjoining hillslopes. The biodiversity within the open depressions is greater than that which is found on the adjoining hills, however the significant environmental difference is that the creeks are likely to have held water for longer periods of time than the drainage lines flowing through the hills. The creek environments are therefore likely to have been favoured by Aboriginal people as camping places when occupying the Barrier Ranges. It is predicted that in the open depression landforms and associated relatively flat slopes, artefact discard would have been relatively high as a result of greater levels of utilisation. In addition it can be expected that these locations will contain a greater variety of artefact types reflecting longer periods of habitation and a greater diversity of activities undertaken. In summary the open depressions and plains are predicted to contain higher artefact densities and a wider range of artefact types.

7. ARCHAEOLOGICAL CONTEXT - INDIGENOUS

7.1 Regional occupation

On the basis of archaeological research it is known that Aboriginal people have occupied Australia for at least 40,000 years and possibly as long as 60,000 years (Mulvaney and Kamminga 1999: 2). By 35,000 years before present (BP) all major environmental zones in Australia, including the arid environments of Central Australia, were occupied (Mulvaney and Kamminga 1999:114).

At the time of early occupation Australia experienced moderate temperatures. However, between 25,000 and 12,000 years BP (a period called the Last Glacial Maximum) dry and either intensely hot or cold temperatures prevailed over the continent (Mulvaney and Kamminga 1999: 114). At this time the mean monthly temperatures on land were 6-10ºC lower; in southern Australia coldness, drought and winds acted to change the vegetation structure from forests to grass and shrublands (Mulvaney and Kamminga 1999: 115-116).

During the Last Glacial Maximum at about 24-22,000 years ago, sea levels fell to about 130 m below present levels and accordingly, the continent was correspondingly larger. With the cessation of glacial conditions, temperatures rose with a concomitant rise in sea levels. By ca. 6000 BP sea levels had more or less stabilised to their current position. With the changes in climate during the Holocene Aboriginal occupants had to deal not only with reduced landmass, but changing hydrological systems and vegetation; forests again inhabited the grass and shrublands of the Late Glacial Maximum. As Mulvaney and Kamminga (1999: 120) have remarked:

> *When humans arrived on Sahul's (*the Australian continental landmass*) shores and dispersed across the continent, they faced a continual series of environmental challenges that persisted throughout the Pleistocene. The adaptability and endurance in colonising Sahul is one of humankinds' inspiring epics.*

Within the Western New South Wales region the very nature of the river systems, and consequently the surrounding vegetation and fauna, have all undergone considerable changes in the past 40,000 to 60,000 years. From approximately 50,000 to 25,000 years ago the region enjoyed wetter conditions with increased runoff, during which time lakes filled and contained a wide array of fish and other fauna. Then with the subsequent dryer climate from around 25,000 years ago the lakes shrank and their deposits were reworked to form the lunettes found now along their eastern margins. It was also during this period that the sand dunes became active again with their final major phase of building around 15,000 BP (Bonhomme Craib & Associates 1999: 6; Eastburn 1990: 6). By time of European contact this region was one of the most highly populated parts of Aboriginal Australia, with semi sedentary communities focused along the major waterways of the Darling and Murray (Mulvaney and Kamminga 1999: 302-303).

Some of the earliest evidence of human occupation of Australia comes from western New South Wales (Bowler *et al*. 1970, 2003, Thorne *et al*. 1999). Stone artefacts found at Lake Mungo, about 100 km to the east of the Darling Anabranch, have been dated to around 47,000 years ago. The burials of a male and female at Lake Mungo are 40,000 years old (Bowler *et al*. 2003). People were also at nearby Lake Menindee from 40,000 years ago (Cupper 2003a) and at Lake Victoria on the Murray River by around 21,000 years ago (Gill 1973). The oldest site on the Darling Anabranch is a freshwater mussel shell midden in the lunette at Lake Nitchie dating to almost 26,000 years ago (Balme and Hope 1990).

Western New South Wales, and more specifically the central section of the Murray Darling Basin, has been the subject of archaeological research since the early twentieth century. The first archaeological study in the region was undertaken by Tindale as part of a mapping project done with Birdsell in 1939 at the then dry Lake Menindee. Fossils of extinct animals, Aboriginal artefacts and human burials were recorded and further investigated by Tindale, Tedford and Stirton in 1953. Work continued at Lake Menindee into the 1960s providing information regarding the antiquity of human occupation in Australia as well as the possible links between humans and the extinction of megafauna (Hope 1981: 2). Work in the 1960s concentrated on Lake Tandou, the southernmost of the Menindee Lakes (Hope 1981: 4), however, an extensive program of archaeological work along the Murray between Mildura and Renmark was also initiated during the late 1960s by the National Museum of Victoria (Buchan 1984: 33).

The proposal area falls within the Barrier Ranges archaeological region as defined by Witter (2004). This region has been subject to very few previous archaeological investigations and accordingly is not well understood. Given that the environmental context is semi-arid, and far from rivers or lakes, the region would seem to be unfavourable for Aboriginal occupation. Nevertheless Witter (2004) indicates that open camp sites are abundant and present on all landscapes. Witter (2004), and others (Holdaway *et al*. 2002; Shiner 2006) suggest that occupation of the region may

have been highly dynamic with occupation fluctuating in accordance with seasonal variability, and perhaps longer term climate changes.

The site types found in the Barrier Ranges include camp sites comprised of stone artefacts and heat retaining hearths commonly located along streams and around clay pans, and at water holes in the ranges, and stone quarries and rock art. Artefact types found in the region include ground stone artefacts, including milling slabs, often made of the local schist, flaked stone mostly of quartz, and occasional retouched artefacts including Pirri points, geometric backed blades, Bondi points and Tulas. Currently the archaeology of the Barrier Ranges Region is dated to no earlier than the mid Holocene (Witter 2004).

Occupation of the Australian arid zone during the Holocene is believed to have entailed a pattern of movement involving periodic aggregation around semi-permanent or permanent water sources, with dispersal and use of other country, during periods following rain. A number or recent studies, many of which have focused on the interpretation of patterns in dates obtained from heat retainer hearths (and also a consideration of the nature of stone artefacts encountered – see below), and a consideration of geomorphic processes effecting preservation of archaeological material, have sought to clarify the antiquity and nature of occupation of the region.

In attempting to resolve questions relating to the chronology of Aboriginal occupation in the arid margins of southeastern Australia Holdaway *et al.* (2002) dated charcoal deposits found in 28 heat retainer hearths in the Sturt National Park, north of the study area. The soil profiles into which the hearths were dug were found to be no older than 4-5000 years, and perhaps as recent as 2000 years, due to prior erosion. The findings of the investigation demonstrated hearth construction in the area for at least the last 1700 years, but with a gap of 200 - 400 years between 820 ± 50 and 1170 ± 130 years BP. This finding was interpreted as demonstrating a hiatus in occupation of the area. However, while Holdaway *et al.* (2002) suggest the possibility that paleoenvironmental fluctuations resulted in this discontinuity of occupation, they nevertheless advised caution in postulating causes until further research had been conducted.

Radiocarbon dates from 53 heat retainer hearths from the semi-arid ranges near Fowlers Gap about 100 km north of Broken Hill gave a record from about 6,000 BP to modern, with variability in the length of the record at different places linked to geomorphic landscape change (Holdaway and Fanning 2003a). At Peery National Park nine heat retainer hearths were dated ranging from about 1,800 BP to about 350 BP (Holdaway and Fanning 2003b).

Holdaway *et al*. (2005:47) interpret increasing frequency of younger hearths as the result of more well-preserved recent surfaces and relative lack of older surfaces. The gaps in hearth dates from the three areas are analysed and interpreted as indicating that the region was periodically 'abandoned' during the Late Holocene. Recently more dates from Peery have been obtained and range from modern to just under 2,000 cal. BP, and they are interpreted as reflecting the age of the land surface on which sediment is episodically deposited and then eroded in response to flood flows (Holdaway *et al*. 2007).

Shiner (2006) has also established discontinuity in landscape occupation over the last 2000 years when dating 16 hearths in conjunction with analysing the surface stone artefact assemblages from Pine Point and Langwell Stations, located just to the south of the foothills of the Barrier Range. Shiner (2006) found that the different artefact assemblages he examined represented unique occupational histories, but that these were punctuated by long periods with scant evidence of Aboriginal presence or activity.

In conclusion the nature of occupation of Barrier Ranges is likely to have undergone considerable variability and change from the Pleistocene through to the present. Occupation is likely to have been dynamic as a result of annual and seasonal climatic variability and environmental change, and possibly, as many of the recent studies suggest, over much longer time periods.

7.2 Previously Recorded Sites

A search of the NSW DECC Aboriginal Heritage Management Information System has been conducted for the area encompassed by the Stage 1 turbine area (AHIMS # 20121 – 26th September 2007) and an area encompassed by the proposed transmission line from the turbine envelope to Broken Hill (AHIMS # 20122 – 26th September 2007). Nine Aboriginal objects are listed on the AHIMS #20121 search (Table 2), and 19 are listed on the AHIMS #20122 search (Table 3). A review of the AHIMS site searches indicates that the most commonly recorded Aboriginal objects recorded in the Broken Hill area are stone artefacts and quartz stone quarries.

The AHIMS register only includes sites which have been reported to NSW DECC. Accordingly this search cannot be considered to be an actual or exhaustive inventory of Aboriginal objects situated within the local area. Generally, Aboriginal objects are only recorded during targeted surveys undertaken in either development or research contexts.

It can be expected that additional sites will be present within the local area but that to date they have not been recorded and/or reported to NSW DECC.

Site ID	Site name	Easting AGD	Northing AGD	Type	Recorder	Location in respect of impacts
23-4-0047	BH1-10 "Nine Mile"	530395	6481890	Isolated find	Appleton	Outside turbine envelope and other impacts
23-4-0048	BH1-7 "Belmont"	528018	6480938	Open camp site	Appleton	Outside turbine envelope and other impacts
23-4-0049	BH1-8 "Belmont"	528474	6481907	Open camp site	Appleton	Outside turbine envelope and other impacts
23-4-0050	BH1-5 "Belmont"	524498	6482025	Open camp site	Appleton	Outside turbine envelope and other impacts
23-4-0051	BH1-6 "Belmont"	526519	6481970	Open camp site	Appleton	Outside turbine envelope and other impacts
23-4-0052	BH1-4 "Belmont"	522599	6482258	Open camp site	Appleton	Outside turbine envelope and other impacts
23-4-0053	BH1-2 "Belmont"	520586	6482055	Isolated find	Appleton	Outside turbine envelope; adjacent to access road
23-4-0054	BH1-3 "Belmont"	520587	6482057	Open camp site	Appleton	Outside turbine envelope; adjacent to access road
23-4-0055	BH1-1 "Belmont"	524400	6482000	Open camp site	Appleton	Outside turbine envelope and other impacts

Table 2. Results of AHIMS site search # 20121 for the area encompassed by the Stage 1 turbine area.

The previously recorded sites located in the proposed turbine envelope have all been recorded by Appleton (1996) during a survey conducted in relation to a proposed seismic survey line. The majority of these site recordings are situated outside the proposed impact areas. Sites #23-4-0053 and #23-4-0054 plot to a location adjacent to the existing access road which extends from the Mundi Mundi Plains eastward into the turbine envelope. Their location corresponds to Survey Unit 219 recorded during the current assessment.

Site ID	Site name	Easting AGD	Northing AGD	Type	Recorder	Location in respect of impacts
23-4-0001	Nine Mile Creek	539302	6473657	Open camp site, rock engraving, stone arrangement	Blinksell	Outside proposed impact area
23-4-0006	Limestone Campsite	534150	6469500	Open camp site	Bates	Outside proposed impact area
23-4-0072	PML2	539690	6465790	Open camp site	Appleton	Outside proposed impact area
23-4-0081	AS1	539110	6460112	Stone quarry	Gay	Close to existing transmission line SW of Broken Hill
23-4-0082	AS3	539012	6460300	Stone quarry	Gay	Close to existing transmission line SW of Broken Hill
23-4-0083	AS4	539106	6460350	Stone quarry	Gay	Close to existing transmission line SW of Broken Hill
23-4-0084	AS5	538860	6460460	Stone quarry	Gay	Close to existing transmission line: *s90 previously issued*
23-4-0085	AS6	538930	6460150	Open camp site	Gay	Close to existing transmission line SW of Broken Hill
23-4-0086	AS7	538650	6460280	Open camp site	Gay	Close to existing transmission line SW of Broken Hill: *s90 previously issued*

Site ID	Site name	Easting AGD	Northing AGD	Type	Recorder	Location in respect of impacts
23-4-0087	AS8	538610	6460140	Open camp site	Gay	Close to existing transmission line SW of Broken Hill: *s90 previously issued*
23-4-0088	AS9	538341	6460729	Open camp site	Gay	Close to existing transmission line SW of Broken Hill: *s90 previously issued*
23-4-0089	AS10	538433	6460600	Open camp site	Gay	Close to existing transmission line SW of Broken Hill: *s90 previously issued*
23-4-0090	AS12	538540	6460660	Quarry	Gay	Close to existing transmission line SW of Broken Hill: *s90 previously issued*
23-4-0091	AS16	538220	6460730	Quarry	Gay	Close to existing transmission line SW of Broken Hill
23-4-0092	AS15	538325	6460180	Open camp site	Gay	Close to existing transmission line SW of Broken Hill: *s90 previously issued*
23-4-0093	AS14	538213	6460566	Quarry	Gay	Close to existing transmission line SW of Broken Hill: *s90 previously issued*
23-4-0107	AS13	538240	6460510	Quarry	Gay	Close to existing transmission line SW of Broken Hill: *s90 previously issued*
23-4-0111	AS11	538500	6460630	Open camp site	Gay	Close to existing transmission line SW of Broken Hill: *s90 previously issued*
23-4-0112	AS2	539100	6460160	Quarry	Gay	Close to existing transmission line SW of Broken Hill

Table 3. Results of AHIMS site search # 20122 for the area encompassed by the proposed transmission line.

Of the previously recorded sites listed on AHIMS site search #20122 the 16 sites recorded by Gay (2001) are all located in close proximity to *possible* proposed impacts relating to the proposed transmission line from the Stage 1 turbine envelope to the Broken Hill substation; the remainder of the sites on the list are well outside any proposed impact areas. The sites recorded by Gay are located southwest of Broken Hill in the area of the Bemax Mineral Separation Plant. The existing transmission line which extends south from the Broken Hill substation to Mildura passes through the Bemax site.

The following discussion in Section 7.3 will present a review of previous archaeological work in the region for the purposes of producing a predictive model of site type and location relevant to the study area.

7.3 Archaeology – The local area

Development driven heritage assessments began to take place in the region during the late 1970s. One of the first of these was a survey for assessment of impacts to sites by the Mildura-Broken Hill electricity line in 1977 (McIntyre 1977; 1981). This survey located 132 sites comprising 106 open camp sites, five shell middens, ten PADs, seven burial sites and four isolated finds (McIntyre 1981: 9). The survey corridor measured 285 kilometres long and three to seven kilometres wide however the actual survey was concentrated within a few hundred metres of the central pegged line (McIntyre 1981: 10). The survey was thus targeted, and the coverage could not be considered comprehensive within the defined corridor. Information regarding ground surface visibility is unavailable except for a general comment that it was poor in the Murray River sections. It is thus unlikely that the results of this survey are

a complete and accurate reflection of the patterning of archaeological sites. Nonetheless this survey provides a significant contribution to our understanding of site location within the region.

Since the late 1970s and early 1980s there has been a variety of work undertaken including both academic research and heritage management studies. One of the most significant of these was the study undertaken by Johnston and Witter (1996) to compile a cultural resource database for western NSW. The project was aimed at aiding predictive modeling for the region through the identification of the principles that affect location and internal spatial organisation of sites.

There have been one previous archaeological study conducted within the Stage 1 turbine envelope itself and several studies have been undertaken within the immediate local area. Appleton (1996) conducted an assessed of a proposed seismic survey which followed an east west alignment through the middle of the stage 1 area. Martin (2000) conducted an assessment of a small and discrete impact area at the Terrible Dick Mine located north of the Stage 1 area and within the Stage 2 and 3 wind farm area. The only previous assessment conducted within the vicinity of the proposed transmission line is that conducted by Gay (2001) at the Bemax mineral separation plant located south west of the Broken Hill substation. The following discussion includes a review of archaeological work and its results conducted within the regional area.

Appleton (1996) recorded a series of stone artefact sites (these are listed on the AHIMS #20121 search) on Belmont Station and Nine Mile Station in the vicinity of the proposed wind farm, including six open campsites and two isolated finds on Belmont, and one isolated find on Nine Mile Station.

Martin (2000) undertook a very small survey (100 m x 125 m) on a diamond drill site at the location of the historic Terrible Dick mine and smelter ruins on Purnamoota Station. The drill site was at a base of the large hill named Mt Lookout which is part of the Mt Robe range, north of the stage 1 wind farm area. The landscape consists of undulating hilly country with small creeks. The drill site was on a small flat on the edge of a rocky creek with mallee and *Acacia victoriae* joining a larger creek with River Red Gum. The low hills surrounding the location have a sparse cover of mulga, with understorey plants of Sida, Solanum and Bassia dominating. Historic material included the smelter chimney built into the hill, slag heaps, and the remains of several stone buildings and stone chimneys, and a mine shaft full of water which was being pumped by windmill for stock water. Heavy ceramic pots used to set silver ingots lay scattered over the area, as well as glass, ceramic and metal artefacts. A mulga post and wire stockyard is still partially standing in the middle of the flat area. Five isolated silcrete flakes were recorded and a very low density of possible unretouched quartz flakes. However, long term heavy machinery use in the area and the high degree of disturbance made it difficult to determine whether the quartz flakes were Aboriginal artefacts or made more recently by the impact of machinery on quartz. The successive use of this small area with evidence of Aboriginal use, mine, smelter, domestic buildings, stockyard and watering point for stock makes it a significant feature for the interpretation of the history of the Mt Robe Ranges.

Gay (2001) conducted an assessment of the then proposed Bemax mineral separation plant located southwest of the Broken Hill substation. The existing Broken Hill to Mildura transmission line traverses the property. Gay (2001) recorded 16 sites including open camp sites and quartz quarries. Camp sites appeared to be associated with ephemeral water courses and occasionally were found to contain heat retainer ovens. Quarry sites comprised low density artefact scatters associated with bedrock quartz outcrops.

The Living Desert Area, situated immediately to the north of the Broken Hill township, is similar to the proposed wind farm in geology, landform and vegetation patterns, except that the hills and ridges are lower and less steep. It is close to the proposed powerline corridor. The pattern of sites recorded during the 4WD archaeological survey (Martin 1995) and Wildlife Sanctuary Survey (Martin 1998b) indicates that:

i. there was intensive exploitation of quartz reefs throughout the Hills with Rock Outcrop landform;

ii. there are large complex campsites in the Upper Creeks with Terraces and Valleys with Wide Alluvial Flats with heat retainer ovens, seed grinding material, flaking areas, and a range of flaked artefacts dominated by quartz but including on average <5% silcrete/chert;

iii. there is less abundant, less varied archaeological material on Low Ridges and the Undulating Uplands landforms; and

iv. there are rare but well-delineated quartz blade workshops and artefact scatters on some ridges, perhaps indicating areas that were used as day camps and ‘lookouts’ overlooking valleys or waterholes.

Martin (1995) recorded 5 quartz reef stone procurement areas (SPAs *see below*) on the rocky hills; two quartz artefact scatters on low rocky ridges; one artefact scatter on a low undulating upland; one large site with artefacts, flaking areas and ovens on an alluvial/colluvial terrace, and two very large sites on wide valley floors with artefacts, flaking

areas and heat retainer ovens. Martin (1998b) recorded 8 quartz reefs with evidence of stone procurement including bedrock anvils with Hertzian cones and battering marks as well as trimming debris and evidence of flaking activities. An extensive flaking area on a ridgetop was interpreted as a daytime camp for flaking, wood-working and a 'looking out' to watch for game etc. The upper valleys had three open sites with quartz artefacts and heat retainer ovens, and the large lower valleys had three extensive sites with heat retainer ovens, seed grinding material, and dominated by quartz artefacts but with 0%, 1%, and 6% silcrete artefacts in three random sample areas.

In addition some more unusual sites were recorded in the Living Desert Area. A rock engraving site is located adjacent to Ngatji Nguku Mingka (Rainbow Serpent Waterhole) semi-permanent rockhole. The rock engraving site has been recorded in detail by Dr Dan Witter and the Broken Hill Aboriginal Land Council and principally consists of engraved circles and animal tracks, and also a panel of small cupules. Local Aboriginal elder Alice Bugmy (now deceased) has described how her family camped some distance away from this site and only her father was able to approach the site and take water indicating the significance of the waterhole and the rock engravings (Martin 1998b). This is the only known engraving site in the area immediately surrounding Broken Hill, although engravings are known further to the west and north.

Gnamma holes (rockholes) with stone lids were located on sloping rock platforms on the edges of hills in the Living Desert Area (Martin 1998b). One rockhole is 1.52 metres long, 0.4 metres wide and 0.96 metres deep. This rockhole has 4 large flat rocks beside it and one fallen into one end of the hole, obviously used in the past to cover the hole over to prevent evaporation of water and use by animals. This site is situated on a gently sloping outcrop of granite-like gneiss that acts as a catchment for the rockhole. The edges of the rockhole are polished with use.

Appleton (1999) surveyed a section of the Living Desert Area that overlapped with Martin (1998b). He recorded 20 sites including 7 artefact scatters, 2 heat retainer ovens and 1 oven complex, 3 isolated artefacts, and 7 quartz reef quarries and associated artefacts. Appleton found that some of the quartz reefs in the hills had been extensively exploited for suitable material for flaking, and that flaked material in the area was dominated by quartz, with some quartzite and silcrete artefacts.

Witter (1994a) has proposed a method of distinguishing between transient camps, dispersion/satellite camps, aggregation camps and base camps based on the type and abundance of stone artefacts and the presence or absence of ovens, grinding gear etc. Aggregation camps and base camps tend to have a higher density and variety of artefacts and material types including more exotic materials and specialised tools such as backed blades, as well as features such as ovens and seed grinding equipment. Dispersion/satellite camps will have a lower density and lower variety of tool types and materials. The Main Picnic Area in the Living Desert has been described by Witter (1994a) as a base camp, which presumably has a series of satellite camps around it. Other major base camps have been recorded at Stephen's Creek/The Gorge (Martin 1990).

However, the sites recorded at the Living Desert by Martin (1995 and 1998b) do not easily fit into Witter's 1994a scheme of settlement patterns. It is apparent that some of the larger valley sites were more than satellite camps, but do not fit well as a base camps either (lack of exotic stone material, backed blades, specialised tools and grinding equipment). The archaeological pattern seems to fit the aggregation - dispersal pattern better, with sites resulting from family groups dispersing to these areas whenever conditions are appropriate and then retiring periodically to larger camps near more permanent water or seasonally abundant resources.

The Western NSW Archaeology Program research headed by Simon Holdaway and Trish Fanning, has conducted some artefact analysis at Poolamacca, to the north of the proposed wind farm. Parts of Poolamacca have similar geology, vegetation and landform to the Stage 1 area, although the central area of Poolamacca consists of younger Adelaidean geology that includes conglomerates with quartz and quartzite pebbles and cobbles. This different geology may affect the technology and materials used for flaking on parts of Poolamacca. Holdaway *et al*. (2005) reports that 3 types of quartz were identified on the basis of the degree to which it transmits natural light; namely crystal quartz, milky quartz and opaque quartz. Angular fragments without conchoidal fracture are common, but complete flakes with a full suite of attributes relating to conchoidal fracture outnumber them. A large sample recorded gives frequencies for flakes, flake fragments and tools recorded at Poolamacca. Crystal quartz includes 6 angular fragments, 9 complete flakes, 1 core and 1 distal flake. Milky quartz includes 476 angular fragments, 20 angular fragment tools, 2 complete bipolar flakes, 532 complete flakes, 24 complete split flakes, 3 spilt flake tools, 12 complete flake tools, 118 cores, 116 distal flakes, 1 distal flake tool, 34 medial flakes, 45 proximal flakes, 1 proximal flake tool. Opaque quartz includes 163 angular fragments, 2 angular fragment tools, 2 complete bipolar flakes, 266 complete flakes, 9 spilt flakes, 7 complete flake tools, 24 cores, 60 distal flakes, 2 distal flake tools, 13 medial flakes, and 12 proximal flakes. Another table gives frequencies of quartz tool types, including 1 backed blade, 7 denticulates, 4 notched tools, 1 pirri point, 11 angular fragment scrapers, 12 complete flake scrapers, and 9 utilised flakes. It is concluded that quartz artefacts are abundant at Poolamacca and occur in a range of forms (he does not give the numbers on other materials as this note was specifically about quartz) (Holdaway *et al*. 2005).

Detailed recording of a terrace on a valley floor next to Campbell's Creek, Poolamacca Station, resulted in the recording of 223 hearths and a sample of 2129 stone artefacts. Of the 2129 recorded artefacts, the majority were

made from quartz, plus 110 silcrete artefacts, 55 quartzite artefacts, and 2 pieces of ochre. Only artefacts with a maximum dimension greater than 20mm were recorded. Calculated by Minimum Flake Number, the percentages of the different raw materials of artefacts at Poolamacca is; amorphous silcrete 1.2%, clast silcrete 4%, coarse silcrete 0.3%, matrix dominated silcrete 0.3%, milky quartz 61%, opaque quartz 29%, crystal quartz 0.9%, quartzite 3.1%.

Quartz outcrops are located close to the study area and at least one outcrop has been quarried and it is surrounded by worked flakes and cores. No systematic survey for quarries was undertaken but it is considered likely that many quartz outcrops at Poolamacca were quarried.

Of the 223 hearths, 15 were classified as partially exposed, 38 as intact, 3 as disturbed, 116 as scattered, and 20 as remnant. Twenty of the more intact hearths were excavated and 18 contained enough charcoal for dating. Most date to within the last 1000 years, but two older dates of 1500 BP and 6000 BP were obtained. The use of OSL dating was trialed by comparing OSL dates from hearth stones with the charcoal dates, results indicated that for 68% of the stones dated the OSL dates agreed closely with the charcoal dates. Charcoal in hearths was analysed and found contain either a single species or a mixture of species including Acacia type A (including mulga and dead finish), Acacia type B (prickly wattle), river red gum. One hearth had Buddha or *Eremophila* mitchelli, and one had water bush (*Myoporum montanum*). There were 2 undetermined species present (Holdaway *et al.* 2005).

'The Pinnacles' are three distinctive pointy hills to the south-west of Broken Hill, an area of similar geology and vegetation to the wind farm, but lower topography. In 1992 Lance undertook an archaeological survey of the Hungary Hill area adjacent to the Middle Pinnacle where he surveyed a proposed amphibolite quarry in detail. The area surveyed was 900 x 550 metres and Lance recorded one artefact scatter on the top of Hungary Hill and a very low background density over the slopes of Hungary Hill and the bottom of the Middle Pinnacle. The artefact scatter on top of Hungary Hill consists of 31 quartz artefacts including 1 backed blade, 12 flakes, 1 core, 16 flaked pieces and 1 retouched piece. Lance noted that the quartz found in this site was similar to that found in the large quartz quarry to the north (recorded as Site 36 in Martin 1998a), and that precision flaking techniques were being used. He suggested that fine wood-working tasks were being carried out at this site as well as the maintenance of spears with quartz barbs (Lance 1992).

The anthropologist Dr Lindy Warrell (1995) was employed in August 1994 by NSW NPWS to undertake an anthropological assessment of the Pinnacles. A process was set in place for all the stakeholders to comment on the Warrell report and its recommendations and The Pinnacles were finally declared an Aboriginal Place on the 5th July 1996. The boundaries of the Aboriginal place were however markedly smaller than the boundaries recommended in the Warrell report and recommended by the Aboriginal elders at a 1995 workshop. The boundary declaration process did not address the questions of adequate buffer zones or whether there was additional cultural material that should also be protected.

As a result of the small area declared around the Pinnacles it was decided by NPWS (now NSW DECC) that an archaeological survey was needed to document the range and distribution of archaeological material in the wider area and to determine whether other significant areas occur that need to be protected. A series of sample areas along Stirling Vale Creek, Pine Creek, and around the three Pinnacles was surveyed in 1997 (Martin 1998a). The results of this sample survey are summarised below:

Distribution of archaeological material at The Pinnacles

The survey showed a distinctive patterning of archaeological material around the Pinnacles. Campsite material is concentrated in two areas along Pine Creek and in one area on Stirling Vale Creek. By far the most concentrated area is the area near the South Pinnacle on both sides of Pine Creek (Sites 8, 9, 10, 11, 12, 13, 14, 15) and in particular on the north side of the creek (Sites 11, 8, 9). The second biggest concentration of material is on Stirling Vale Creek around Site 30. Site 37 on the northern branch of Pine Creek also has a relatively high concentration of artefacts. These three areas all have a density of ovens and food processing equipment including grinding dishes and mortar/pestle type proportional to the artefact density.

Apart from these three areas there is a consistent low to medium density scatter of material along both creeks with only occasional ovens and rare grinding equipment. It was found that the lower the density of material the lower the range of artefact types.

The Rolling Lowlands Zone contains significant campsite material where it is adjacent to the main creeks and low and smooth enough to be utilised in the same way as the alluvial flats along the creeks (Sites 10, 17, 18, 23 and 33). Small artefact scatters were also found on top of the Knob between Sites 11 and 12, and along a small tributary gully draining from the North Pinnacle. Quarries 15, 20, 21, 22, 35 and 36 were also located in the Rolling Downs Zone.

The actual conical peaks of the South, Middle and North Pinnacles had no archaeological material except a very low density background scatter on the lower colluvial slope units. However other archaeological material was found to be associated with these Zones. Hummock Hill has a small artefact scatter on top recorded by Lance 1992. Quarry 14 is

located on the gibber surface unit at the base of the South Pinnacle and Quarry 40 and 41 located on the slopes of a ridge adjacent to the North Pinnacle. Artefact scatters were also found on the gibber surface below the North Pinnacle and beside a tributary gully on the western side of the North Pinnacle zone.

Quarrying and Associated Activities

The quartz quarries recorded during the survey are typical of the Broken Hill area and represent intensive exploitation of the good quality quartz and less intensive exploitation of poorer quality quartz material. The quartz reefs represented an invaluable material to the Aboriginal people of the area who otherwise did not have any suitable material for making artefacts. The reefs with the better quality milky and translucent quartz have been heavily utilised, sometimes leaving only rounded bedrock from which it was impossible to detach any more suitable pieces. The bedrock displays Hertzian cones or ring cracks from the impact of rocks being thrown against the bedrock anvils in order to smash rocks up into suitable size for further working. The bedrock also displays areas of pounding and negative flake scars where rocks have been hit against the bedrock to dislodge large flakes or blocks. The quarries are surrounded by a ring of quartz trimming debris and in places workshops can be delineated where artefacts were manufactured.

Quartz Technology

Quartz is worked in a number of ways in the Broken Hill area (Martin & Witter 1997, Martin & Witter in prep);

1. fracture line or fracture plane propagation for core preparation and production of block tools;

2. production of flakes detached from a hand-held core by a hammerstone;

3. blade technology manufacture of microblades by a wooden baton;

4. bipolar or semi-bipolar manufacture of microblades; and

5. nuclear tools including naturally weathered or fractured blocks and quartz crystals.

The quartz blade workshops found at The Pinnacles are typical of the Broken Hill area. The Broken Hill type blades (blades defined as thin flakes with parallel or symmetrically tapering margins and straight dorsal scars) have been experimentally replicated by Dr Dan Witter using a hard Acacia (Gitji or Mulga) baton to detach blades from a quartz core (Martin & Witter 1997). The baton detached blades with precision and offered a much more controlled situation than a hammerstone. Bending type fractures were common but it was possible to make long straight-sided blades like the ones seen in the Broken Hill sites. Witter has also used a smaller wooden baton for retouching quartz artefacts with success, although finer retouch such as the backing and invasive flaking on the backed blades, pirri points and small notched blade tools probably resulted from pressure flaking with a bone point. However, many of the blades may have been used without retouch, as Witter has suggested that many of the thin quartz blades found in abundance on most of the sites recorded during this survey were used for the manufacture of "jagged" spears which are normally associated with group hunting of larger animals. The blades would be snapped to the right size and shape for hafting in spears rather than backed (Martin & Witter 1997). The use of wooden batons for manufacture of the blades is also suggested by the scarcity or absence of hammerstones or fragments of hammerstones in many of the sites, including quartz workshop areas (Martin 1995, 1998a).

Retouched Artefacts

The majority of retouched tools on the sites are small to medium sized general purpose wood working tools with single or multiple working edges. Edges showing only usewear are more common than retouch, but retouched tools may have scalar, step or cuspate retouched edges, or notched or snapped edges. A number of sites including Site 8 and 37 contain a number of larger tools including core tools and tools made on large blocks and flakes which would have been used for heavy duty woodworking. Specialised tools include crescentic backed blades, pirri points and micro round edged tools (thumbnails).

Stone Material Type

The stone material found in the sites is predominantly local quartz from the quarried quartz outcrops. Quarrying of good quality and medium quality quartz is the dominant stone used in all the sites, the best quality being the translucent reef quartz such as that found at Site 36. The exact source of the crystal quartz also found in sites is not known, but is probably the local pegmatite. Crystals are difficult to work because of small size, and may have been used for ceremonial purposes. Silcrete and chert is found in sites, but only makes up between 1% - 5% of artefacts and has been brought in from probably over 100 km. Coarse brown silcrete that outcrops 30-50 km south of the Pinnacles is not found at the Pinnacles, but is found in sites close to the outcrops.

Local gneiss has been used for grinding dishes, but the extent of this is difficult to judge as many of the flat gneiss rocks found in sites (manuports) have been weathered and it not possible to say if they have been used as grinding dishes. However, there are enough examples with non-weathered ground surfaces to indicate that the use of local

gneiss was common. A range of different non-local quartzites has been used for grinding dishes and in rare cases for hammerstones.

Heat Retainer Oven Use

Evidence of heat retainer ovens was noted in the larger campsites along Pine Creek and Stirling Vale Creek. The ovens range in diameter from 50 to 180 cm and are composed of local stone (mainly gneiss with some quartz) heat retainer with rare pieces of burnt termite mound heat retainer. Some ovens are still *in situ* and just exposed while others have been affected by erosion and are either on pedestals or are left "floating" on the eroded surface. Charcoal and charcoal staining can be seen in some ovens.

Water Resources

The larger campsites are located in specific areas along the main creeks and this patterning may relate to the presence of springs. Both the mythology and oral history describe the presence of water at the Pinnacles, and the oral history describes this water as a “spring” in Pine Creek.

More recently a number of studies have been carried out at the Pinnacles in response to the NSW DECC bringing court action against the Pinnacles Mine owners for damaging the Pinnacles Aboriginal Place and recorded archaeological material in adjacent areas. Macintyre-Tamwoy, employed by the defendant, looked at partially overlapping areas to Martin (1998a) and agreed with some of her conclusions, but strongly disagreed with others. Macintyre-Tamwoy (2006) re-recorded the large open sites on both sides of Pine Creek near the South Pinnacle and found another area with a high density of artefacts to the west of the Middle Pinnacle in an area not surveyed by Martin (1998a). However, Macintyre-Tamwoy concludes that none of the quartz outcrops at the Pinnacles have been exploited for raw material and that the quarries recorded by Martin (1998a) do not show any evidence of exploitation by Aboriginal people. In an appendix to her report Wright (2006) supports this conclusion after examining several quartz outcrops both at the Pinnacles and at the Railway Siding also damaged by the defendant and near the Pinnacles. However, it must be stated here that Wright examined at the Railway siding a different feature to that photographed and recorded by Martin and NSW DECC investigators, and the area at the Pinnacles where he purportedly examined two other quarries recorded by Martin (1998a) was so badly damaged by large costeans that Martin and the NSW DECC investigators were unable to relocate the original features and concluded that they had been destroyed. Martin’s (1998a) Quarry 14 at the South Pinnacle was determined by Macintyre-Tamwoy not to be a site, despite the exceptionally good bedrock anvil features such as Hertzian cones, ringcracks, battering marks, and surrounding flaked material recorded by Martin. Macintyre-Tamwoy (2006) did not examine the very large and exceptionally good quality reef of distinctive banded milky/translucent quartz recorded by Lance (1992) and as Quarry 36 by Martin (1998a), despite the fact that it is visible from, and very close to areas she surveyed. Wright (2006) also examined Martin’s (1998a) Site 38 and found that it had a very low density of artefacts, so low that he calculates it was being of background density found all over Australia, and that most of the quartz material was naturally occurring ‘lag’ quartz. Martin (1998a) however, specifically mentions in addition to a consistent density of between 0.6/m2 to 2.2/m2 of flakes, blades and blocks or angular fragments (estimated by flipping a rigid metre square across exposures and tallying density in each square), a large unifacial core, 3 bipolar split cores, a crystal micro block tool, a flake tool with scalar retouch, a grey crystal flake tool with scalar retouch, a block tool with scalar retouch, a crystal blade core and a nosed flake tool, as well as one *in situ* heat retainer oven. The disparate findings of Martin (1998a), Martin & Witter (1997) and Lance (1992) compared to Macintyre-Tamwoy (2006) and Wright (2006) clearly need explanation.

At the junction of the Barrier Range foothills and the sand plain, approximately 60 km to the south of Broken Hill Shiner found that quartz, silcrete and minor quartzite were the main raw materials (2004:182). In this detailed study he found that quartz gibber nodules varied from milky to partially translucent, and included significantly smaller amounts of quartz crystal gibber. He found that both the milky and partially translucent quartz could occur in the same small fist sized nodule, and that it is the internal flaws in the structure of the material that affected knapping quality rather than the degree of translucency. Reef quartz is extremely rare in this area and the two minor occurrences noted exhibited numerous internal flaws reducing its utility for knapping. Quartzite occurs rarely as isolated nodules within the quartz gibber pavements (Shiner 2004:184-185). Silcrete occurs in this area as two small areas of outcrop on Tertiary deposits and as a remnant of Tertiary outcrop now eroded to gibber pavement covering low rises. This silcrete is defined as clast silcrete with light brown ‘abrasive’ cortex on the outcrop and smooth rounded cortex on the gibber nodules. Shiner shows that the non-clast silcrete found in small quantities in the artefact samples in his study area is not from the study area (Shiner 2004:188,192, 259). He defines clast silcrete as that having fine to coarse clasts or grains, and non-clast silcrete as dominated by microcrystalline matrix with no clasts or scattered angular clasts (Shiner 2004:187-189). The assemblage samples displayed different proportions of raw material but all were heavily dominated by quartz. The minimum number of flakes and total number of pieces counts are more dominated by quartz than the volume, where the proportion of other materials increased relative to quartz. In the 2 CN assemblages quart accounts for about 80% of the number of pieces, with silcrete accounting for about 20%, of that between 3-4% is non-clast, ie. non-local silcrete. At the KZ assemblages quartz accounts for 60% of pieces, and silcrete accounts for about 38%, with non-clast silcrete comprising between 4-7%. Quartz crystal and

quartzite comprise a tiny proportion of pieces, which together with chert, hornfels, ironstone, sandstone, and schist, comprise only between 0-2% (Shiner 2004:193-200). Shiner shows that silcrete has a much higher tendency than quartz to have been partially decortified before reaching the dominant occupation assemblages, and that silcrete is mainly obtained from the outcrops rather than the gibber, while quartz is mainly obtained from the gibber and creek gravels. Assemblages closer to the silcrete out crops have a higher proportion of silcrete, and silcrete nodules coming from the quarries were larger than both quartz and non-clast silcrete original pre-flaking pieces (Shiner 2004:200-206). Thus the assemblages are dominated by the most easily obtained material, gibber and gravel quartz, and then by the local clast silcrete which was mainly obtained from outcrops between 3-7 kilometres away. The proportion of silcrete increases in the assemblages closest to the silcrete outcrops. Shiner demonstrates that larger proportions of non-clast flakes are retouched into tools than either quartz or clast silcrete flakes, and these tools tend to be more formal tool forms. The quartz section of the assemblages has a low proportion of tools, except at one assemblage where it has the highest proportion, which is consistent with non-intensive utilisation of a local raw material source (Shiner 2004:258). Specialised core forms are rare and core rotation is uncommon, unifacial cores making up the largest proportion. Non-clast cores tend to be the most reduced, followed by clast silcrete, then quartz. Core platform preparation is rare and largely confined to non-clast silcrete. Non-clast silcrete is most intensively worked and selected for certain tool forms, showing conservation of this material that was brought for a greater distance (Shiner 2004:258-260). Shiner compared areas at Fowlers Gap and Burkes Cave in different landforms and at a distance and found that some of the patterns found at Pine Point were consistent. This includes that trend for quartz, despite the fact that it is contributes the highest numbers of artefacts to all assemblages except Burkes Cave, to be the least intensively worked raw material as measured by core reduction, proportion of tools and degree tool resharpening. Another trend is that raw material availability was an important factor in influencing assemblages (Shiner 2004:283).

Based on the above review the following section outlines a model of site type and location applicable to the Stage 1 proposal area.

5.6 Predictive Model of Site Type and Location

Stone Artefacts

Stone artefacts are found either on the ground surface and/or in subsurface contexts. The raw materials used for artefact manufacture in the local area will be quartz with smaller proportions of silcrete, chert and quartzite.

Stone artefacts will be widely distributed across the landscape in a virtual continuum, with significant variations in density in relation to different environmental factors. Artefact density and site complexity is expected to be greater near water courses and the confluence of a number of different resource zones.

The detection of artefact scatters depends on ground surface factors and whether or not the potential archaeological bearing soil profile is visible. Lack of erosion, vegetation cover and sediment/gravel deposition can act to obscure artefact scatter presence.

Generally, lithic scatters represent a range of stages in what is termed a 'reduction sequence' – the reduction of stone by stages of flaking and/or grinding to make stone tools. The debitage (or debris) from tool making, including partly fashioned implements, and finished implements were discarded or lost on the ground, and subsequently incorporated into the archaeological record.

On the basis of general ethnographic analogy from the Australian desert region it is inferred that both men and women knapped stone to fashion and resharpen a range of both general tools and gender-specific tools. The flaking methods are freehand percussion, bipolar flaking, and ‘chimbling’ (application of direct pressure with a small stone presser) to make microblades and microliths. Given the known predominance of quartz in local assemblages evidence of bipolar flaking is likely to be abundant; this will reflect the local reliance upon quartz, which is the predominant stone type in the region. Whilst not all stone-working areas will have bipolar flaking debris the basic method of bipolar flaking, of quartz in particular, would have prevailed in the region from the beginning of its occupation. Hatchet heads and other ground stone tools were ground as well as flaked, and some were finished by pecking or lightly pounding the surface of the stone (such as ‘Wiradjuri-style’ hatchet heads).

The types of flaked stone and cobble tools which might be expected to be found in the study area are listed as follows:

Flake
A flake is a piece of stone detached from a stone nucleus such as a core or from a stone implement being made. The most common type of flake is a 'conchoidal flake', which is a flake created by Hertzian initiation (a cone crack). The flake's primary fracture surface (the ventral or inside surface) exhibits features such as a partial Hertzian cone, bulb

of force, érraillure scar, undulations and lances, which indicate the direction of the fracture front (Cotterell and Kamminga 1979, 1987, 1992). Bipolar flakes are created when a stone core is placed on an anvil and struck from above with a hammerstone. A proportion of the pieces broken from the core in this manner are 'compression flakes' which are formed by substantial dynamic compressive force causing the core to break into two or three pieces of roughly equal size.

Flakes are the most common group of stone artefacts found throughout Australia. Flakes are the predominant artefacts in debitage from on-site flaking of all kinds – freehand, bipolar and microblade flaking. Specific flaking tasks included 'backing retouch' of microliths. There are a number of identifiable subtypes of flake debitage from making microliths, and often they are so small that microscopic examination is required for reliable identification. While very few microlith backing flakes are likely to be identified during field survey they occur wherever microliths were made and therefore must be a common component of microlithic debitage.

In certain circumstances flakes may be the result of natural fracture of stone. For instance, thermal fracture creates potlid flakes which are generally dome-shaped and has a fracture initiation within the ventral surface rather than on an edge of the flake.

Core
A core is a chunky piece of stone, often a pebble or cobble, but also quarried stone, from which flakes have been struck to make stone tools. Flakes removed from a core are called 'primary flakes' and may be further shaped by finer flaking, called 'retouch'.

Cores are especially evident on eroded land surfaces because of their relatively large size. Cores in subsurface sediments comprise only a small percentage of lithic assemblages, usually ranging up to about 10% of the total (Kuskie and Kamminga 2000). The categories of cores include polyhedral or amorphous (with flakes struck opportunistically from different surfaces), microblade, bipolar, pebble core (retaining cortex over most of the surface, and single platform cores (sometimes forming a classic horsehoof shape).

Bipolar cores are not often identified during field survey as identification of this type often requires very close inspection. Bipolar cores were supported on a stone anvil and struck repeatedly with a hammerstone from above. Diagnostic attributes of bipolar fracture damage on this type or core are point or sinuous-ridge type initiation platforms, crushing, cracks, and concentrated overlapping step fractures emanating from areas of hammer impact (Cotterell and Kamminga 1979, 1987, 1992).

Flaked piece
This is a general category of artefacts with flaking on its surfaces that has no specific attributes to identify it as a particular type of debitage.

Microblade
A small elongated stone flake with at least one longitudinal ridge along the length of its outside (dorsal) surface. This type of specialised flake is detached from a microblade core. Technically, they are at least twice as long as they are wide. It is believed that they were fashioned into spear barbs in recent prehistoric times, within the last few thousand years In south-eastern Australia, microblades can comprise 25% or more of microlithic flaking debitage at a site (Kuskie and Kamminga 2000).

Microlith backing flake
A flakelet pressed off a microlith preform during the creation of an abruptly angled thick margin (a mode of flaking called 'backing retouch'). This type of flake usually has a slight to pronounced outrépassé (or plunging) termination (Cotterell and Kamminga 1979, 1987, 1992). This termination on such small flakes reveals that the nucleus (preform) was only a few millimetres thick.

Microblade core
A small core from which regularly shaped bladelets have been struck (see 'microblade'). Some microblade cores have only one or two microblade facets; others have numerous facets emanating from more than one initiation surface (striking platform).

Microlith
Microliths are small finely shaped stone barbs with a thick back and delicate cutting edge (chord). The flaking of microblades and microliths (spear barbs) is a consistent pattern for south-eastern Australia. The process begins with the selection of stone, in particular better-quality quartz sourced locally, and chert and silcrete. Flaking was done in stages to prepare the core with regular ridges. Some of microblades (and probably other flake types, perhaps including bipolar flakes) were delicately shaped into microliths. A large quantity of non-biodegradable stone flaking

debitage was created when people made microliths. In replicative experiments it has been shown that 188 microblades and 14 Bondi points produces a total of 1,155 flaking discard artefacts of a size recoverable by wet-sieving sediment through fine mesh (Akerman and Kamminga 2000). Microlithic flaking debris and finished microliths are commonplace in the surface sediments of south-eastern Australia, especially in areas near to water sources.

Microliths apparently disappear from the archaeological record as recently as only a few hundred years ago, however there is some evidence suggesting that microblades and microliths they were still being made along the Darling River in the early nineteenth century (Kamminga 1980).

While debate about the function of microliths continues, there is considerable evidence that they served as barbs on hunting and fighting spears, and were elements of men's subsistence equipment (Mulvaney and Kamminga 1999:235-36). Possible different microlith types were designed to serve very specific function in the armature, such as barbs that make it difficult to extract the spear head and lacerators that cause massive bleeding. While Fullagar and his colleagues (1994) have inferred from residues on a small sample of bondi points from the Hunter Valley that these delicate implements were multi-functional and used for a number of different tasks, in general the evidence that microliths were spear armatures is persuasive. This evidence can be summarised in the following six points:

- They are small and have very delicate shapes unsuitable for most tool-use activities.

- A use-wear study (Kamminga 1980) has suggested that most specimens in museum collections had not been used but were lost during and after manufacture of batches, and that the occasional use-wear observed was consistent with spear armature use and inconsistent with a number of other tool-use activities.

- Traces of resin have been identified on excavated bondi points from the New England region, the Pilbara regions and the Hunter Valley (cf. Fullagar in Koettig 1994:48; McBryde 1985, Mulvaney and Kamminga 1999:236), suggesting that normally they were embedded in cement on a wooden point or handle.

- Function analysis of microliths (dating to 3,677 cal BP) indicates that some were used as hafted armatures on one or more weapons, inferred to have been a spear and/or knife (McDonald *et al.*, in prep.).

- Microlith specimens and associated manufacturing debris are commonly found in large quantities at archaeological sites (and in landscape units) across south-eastern Australia, indicating that very large numbers were required, more so than any other formally shaped implement type, and indicating that probably they were replaced during use of the composite implement.

- Australian microliths are directly comparable to microliths fixed on spears and arrows preserved in Stone Age and Metal Age sites in Europe and Africa.

The closest ethnographic analogue for microliths is the barbing of ‘death spear’ widely used along the southern coasts of Australia for hunting and for fighting (Mulvaney and Kamminga 1999:292-93). There are a number of descriptions of the death spear, the earliest dating from first settlement at Sydney Cove. During historic times the death spear was seen in the region around the Murray River. For instance, the explorer Hovell recorded in his journal that this type was ‘made of strong knotted reeds, about 6 foot long to which was affixed a piece of hardwood about 2 foot in length with a rounded point, barbed in some instances with numerous small pieces of flint or agate’ (Bland in Carnegie 1973:18).

Small jagged fragments of stone (usually quartz) were embedded in series into a layer of resin (sometimes referred to as gum) smeared on the head of a single piece wooden shaft. In some cases, grooves were carved into the wooden shaft to accommodate the stone barbs, but this was not a universal practice. It is not known if the sharp flakes cemented onto these spears were retouched by careful knapping to form an abruptly angled ‘back’, as were microliths, which would allow fixture in a groove cut into the spear shaft, or to maximise adhesion in a resin cement.

In the lower Hunter Valley, the death spear was referred to as a 'battle spear' as it was specifically used for fighting (Threlkeld in Gunson 1974:67; Browne c.1813). The barbed point of death spears was about 15 cm to 30 cm long, with up to about seven to 14 sharp stone flakes or fragments for one-sided armature and about 14 to 28 fragments for two-sided armature. For a spear armed with microliths the range may have varied from these figures. An authority on Aboriginal stone technology, Kim Akerman, has estimated that it may have taken only 20 minutes to procure resin from grass tree plant, and from 20 minutes to an hour to make seven or eight microliths for spear repair (Kuskie and Kamminga 2000).

Segment microlith
The segment microlith is a type often found in artefact scatters dating to the mid to late Holocene. This type has an orange-segment plan shape and is the most common type of microlith west of the Great Dividing Range. It is thought to have been a variety of spear barb. While segment-shaped microliths will comprise a very low percentage of artefacts recorded during field survey, like bondi points, their numbers are usually underestimated; microscopic examination is the only method of reliably identifying them. In any event, consistent with the regional pattern, segment-shaped microliths are likely to be more common than bondi points at sites in the study area, which is consistent with the regional pattern.

Bondi point
The bondi point is a type of microlith often found in artefact scatters dating to the mid to late Holocene. It is thought to have been a variety of spear barb. It has abruptly angled backing retouch along one lateral margin (and often the butt end as well) so that it has an asymmetrical plan shape similar to a pen knife blade, but more triangular in cross-section because of the retouched back surface opposite the cutting edge. Often the tips are broken because they are so delicate. This microlith type is commonly found east of the Great Dividing Range as far north as Great Keppel Island.

Obliquely retouched microlith
This microlith type has a patchy distribution in south-eastern Australia (McCarthy 1967; McCarthy *et al.* 1948; Kamminga 1980). There is stylistic variation within the type (such as the ‘woakwine point’ and ‘pejar point’, and generally a number of technically obliquely retouched microliths are simply bondi points that were only partially backed and simply variations of the theme. It is thought to have been a variety of spear barb.

Thumbnail scraper
Thumbnail scrapers are very small retouched flake implements about the size and shape of a person's thumbnail. One end of the implement is retouched to have a convex (semicircular) plan shape. They are usually made from a flake larger than a microblade but are invariably found in low numbers in association with microliths and microlithic flaking debitage. While their function has never been determined they are notably small in size and are delicately shaped, suggesting that they were probably hafted onto a wooden handle or shaft. It is unlikely that they were used to scraping wood or other resistant materials since they seldom have abrasive smoothing and use-rounding wear on their retouched edges, and none have been repeatedly resharpened to an exhausted 'slug' form which is a normal feature of hafted flake scrapers and adzes. Mulvaney and Kamminga (1999:236-37) argue that at least a proportion of those identified in microlithic assemblages may have been components of a spear armature ensemble, hence their common occurrence in sites that also have bondi points and segment microliths.

Utilised flake
Utilised flakes have use-wear along at least one cutting edge, but not retouch to shape the tool or rejuvenate a blunt cutting edge. The use-wear exhibited by these implements follows closely that described for flake scrapers. The fundamental difference between these two categories of implements is the absence of retouch on one or more edges. The use-wear forms comprised use-fracturing, edge-rounding and moderate abrasive smoothing.

Flake scraper
The general category ‘flake scraper’ refers to flake tools that have retouched edges. In most cases, this retouch is for the purpose of rejuvenating a cutting or scraping edge worn from use. However, in some instances the retouch has acted to shape an implement or remove or blunt an inconvenient sharp edge (c.f., Mulvaney and Kamminga 1999:218). Scrapers can have a wide range of variation in plan-shape. Some of the specimens are more specifically classified as end-scraper or convex scraper. However, most are relatively nondescript and could only be described as retouched flakes. The retouch on scrapers usually was abruptly angled, but there will also be dentated retouch.

Cobble tools
While tools made from waterworn stones are commonly called ‘pebble tools’ the term ‘cobble tools’ is used in this report. A pebble has a maximum length of 6.5 or 7.5 cm (depending on the geological classification used). However, in Australia the waterworn stones fashioned into tools are nearly always within the size range of cobbles. Water-worn cobbles selected from gravels along watercourses and sea coasts were convenient sources of flakable stone, because their shapes were convenient for hammerstones and pounders, and with minimal flaking they could be fashioned into hand-held choppers and hatchet heads. Depending on local geology, gravel beds provided a choice of stone types useful for a wide range of tasks, and the quality of the stone had already been tested by the forces of nature for its mechanical strength and durability.

Other stone artefacts found across Australia include stones used for the preparation of plants for consumption such as mortars and pestles. The types of processing known to have been undertaken with these implement types include:

- *Roots.* A number of plant species had roots which were soft and after cooking these would probably be eaten without further processing. Twenty three known species had roots which were fibrous to varying degrees, and even after cooking these may have been processed to break up the fibre or to separate it from the more edible tissues.
- *Seeds.* Ethnographic evidence indicates the use of seeds which would have been pounded or ground before eating.
- *Fruits.* Various species could have been processed so that the hard stones were cracked to get the edible seed.
- *Medicinal leaves and whole plants.* Medicines would have been bruised to make poultices and decoctions.

Stone materials which may be present in the stone artefact assemblages in the study area include the following types:

Chert
Chert is one of the finest material used for flaking stone implements in Australia. Most types of chert are comprised of randomly orientated interlocking grains of microcrystalline quartz. Often, the groundmass comprises various proportions of quartz, chalcedony and amorphous silica arranged in a very finely granular mosaic. Impurities such as dolomite, calcite, pyrite and glauconite can occur.

Exposures of bedrock chert and chert pebbles in gravel beds are found in many areas of Australia. Flint is a type of chert that occurs in Australia but is better known in Western Europe where it is the predominant stone type in Stone Age assemblages. Detailed review of prehistoric chert sources in Australia, and particularly along the east coast, is problematical because rhyolitic tuff, indurated siltstone and metamorphosed sediments often have been misidentified as cherts even though their microscopic characteristics and mechanical properties are different (Kamminga 1978).

Chert does not outcrop in the proposal area and accordingly chert artefacts area unlikely to be present in large numbers.

Silcrete
Silcrete was one of the most important stone materials used to make flaked stone tools in Australia. Silcrete flakes usually have sharp, durable edges, and the stone was used for a variety of tasks, including heavy-duty woodworking and spear armatures. Silcrete is often grey in natural colour, but other colours include white, red and brown; often a single piece will be made up of a number of colours. Heating, either by natural or cultural agency, may cause colour change, most notably to red, purple or pink. The rock is composed mainly of cryptocrystalline or microcrystalline quartz, and/or chalcedony and amorphous (opaline) silica. Crystals within the matrix range in size up to about 0.5 mm. The matrix is usually seeded with larger detrital grains or crystals, most often quartz but also chert and chalcedony, or heavy mineral particle such as tourmaline or feldspar. A small proportion of silcretes has opal-CT, which may occur as both a general matrix component and as a late-stage void-fill. Under low magnification, silcrete is often easily identifiable by the sheared quartz grains reflecting brightly in a groundmass of finely textured coloured matter (Hutton *et al.* 1978; Langford-Smith 1978:3).

Mineral composition is highly variable, and silcrete cannot be precisely characterised by its bulk chemical composition, other than that its minimum silica content of 85% weight, which provides an arbitrary lower limit. In addition to silicon only aluminium, iron, and titanium are generally present in significant amounts. Iron may occur in microscopic voids and both within the matrix and as a late-stage precipitate within weathering surfaces. While a process of titanium concentration is closely associated with silcrete formation, not all silcrete is titanium-rich. Trace element abundance tends to be related to the composition of the host material.

Silcrete forms as a sedimentary layer from the massive accumulation of silica precipitated from aqueous solution under low temperature. This silica is derived from chemical weathering of a near-surface sedimentary bedrock layer, weathering deposits, unconsolidated sediments, soil or other material. The formation of silcrete requires the removal of most elements other than silicon in the host material.

Exposures of silcrete bedrock are commonly layers between one and three metres thick. Erosion products occur as waterworn boulders, cobbles and pebbles in ancient and modern watercourses. Bedrock outcrops occur along the eastern and south-eastern coasts. The component of silcrete in Aboriginal artefact assemblages in sites in NSW is sometimes higher than 50%. However, in inland regions of NSW the silcrete component is often minor. Normally, silcrete artefacts at sites in south-eastern Australia are prominently microlithic and derive from manufacture of microblades and microliths (spear barbs).

Silcrete does not outcrop in the proposal area and accordingly silcrete artefacts area unlikely to be present in large numbers. The closest outcropping silcretes are located at c. 50 kilometres to the north in Tertiary deposits.

Quartzite

Quartzite occurs in many Australian stone industries, at times constituting up to 95% or more of an excavated assemblage. In south-eastern Australia this stone type is commonly used for hammers, pestles and pounders and is a common find at prehistoric habitation sites such as base camps. Geologically this stone type is closely related to sandstone, the essential difference being that a fracture in quartzite passes through the constituent grains, whereas in sandstone it passes mostly around the grains and through the cement material. There are two major types of quartzite: sandstone recrystallised by intense geological heat (such as volcanic activity), in which the original quartz constituents are transformed to interlocking crystals; and sandstone that has been completely indurated by silica solution percolating into intergranular pore space. With the latter type, the cementing material may be quartz, opaline or chalcedonic silica, or any combination of these. The critical factor for overall strength and resistance to abrasive wear is the bond strength between the crystals or grains constituting the stone matrix. While mechanical variation of quartzite in general is considerable, the range of variation is much less with the quartzite selected for making stone artefacts.

In the region quartzite is found at:

- The western margin of the Bancannia Trough in Cretaceous conglomerate;
- The eastern side of the Bancannia Trough (Byngnano Range) in Devonian conglomerates and sandstones.

Quartz

Since quartz is readily available throughout most of the continent it was probably the most common type of stone used for flake tools. In some regions it is virtually the only suitable stone for flaking. Quartz is composed of extremely small hexagonal crystals of silicon oxide, which give it a glossy texture. It is translucent when composed purely of silicon oxide, but with the addition of minute traces of other elements it exhibits colour. Most quartz has microscopic gas or liquid filled vacuoles which makes it milky in appearance. While trace elements or vacuoles do not affect the rock's strength, clay minerals (particularly iron compounds) in groundwater that seeps into flaws in the stone may weaken it, or even cause it to break into pieces.

There are three major forms of massive (as opposed to microscopic) quartz: veins, geodes and macro crystals. Because it exhibits a small degree of cleavage and tends to have internal flaws of various kinds, quartz ranges in knapping quality from very poor to acceptable. Vein (or reef) quartz is more likely to contain major pre-existing flaws. Internal cracking of quartz often occurs during flaking and the fractures usually are much less predictable than with stone that breaks with distinct conchoidal fracture. For these reasons, quartz tends to be a poor-quality knapping material compared with chert and silcrete. However, quartz was often used because it was readily available, and in some areas of Australia it was the predominant knapping material. The other advantage offered by quartz is that it provides small flakes with sharp edges suitable for light-duty work such as skinning, light-duty butchering and cutting plant material.

Given that quartz outcrops extensively across the proposal area quartz is predicted to be the common material in the artefacts assemblages.

Summary

Given the different environmental contexts present in the proposal area stone artefacts are predicted to be present in variable densities ranging from very low to moderate. The soils in the majority of the proposed turbine impact areas are skeletal and rocky; accordingly stone artefacts are unlikely to be present on ridges in deep or stratified subsurface contexts. Soils on the plains and along drainage depressions are considerable deeper and therefore have the potential to contain subsurface archaeological deposits.

Quartz is the most common stone type found in artefact assemblages in the region (Witter 2004). It is ubiquitous in the landscape as vein exposures, cobbles and gibber deposits flanking foothills, and isolated pockets of macrocrystals in pegmatite bedrock and accordingly is likely to dominate artefact assemblages.

Grinding Grooves

Grinding grooves are found in rock surfaces and result from the manufacture and maintenance of ground edge tools. Grinding grooves are only found on sedimentary rocks such as sandstone. Given the absence of suitable rock exposures in the study area grinding groove sites are unlikely to be present.

Burials sites

Burial sites have been recorded within the wider region and are commonly found in riverine or lacustrine contexts.

Although it is not of the question this site type is not expected to be present within the proposed impact areas given the geological and geomorphic context.

Rock Shelter Sites

Rock shelters sites are unlikely to be present in the study area given the absence of large vertical stone outcrops.

Scarred and Carved Trees

Scarred and Carved trees result from either domestic or ceremonial bark removal. Carved trees associated with burial grounds and other ceremonial places have been recorded in the wider region. In an Aboriginal land use context this site type would most likely have been situated on flat or low gradient landform units in areas suitable for either habitation and/or ceremonial purposes.

Bark removal through the entire historic period and by natural processes such as fire blistering and branch fall make the identification of scarring from a causal point of view very difficult. Accordingly, given the propensity for trees to bear scarring from natural causes their positive identification is impossible unless culturally specific variables such as stone hatchet cut marks or incised designs are evident and rigorous criteria in regard to tree species/age/size and it specific characteristics in regard to regrowth is adopted.

Nevertheless, the likelihood of trees bearing cultural scarring remaining extant and *in situ* is low given events such as land clearance and bushfires. Generally scarred trees will only survive if they have been carefully protected (such as the trees associated with Yuranigh's grave at Molong where successive generations of European landholders have actively cared for them).

The study area has been extensively cleared. While not impossible this site type is unlikely to have survived and therefore be extant in the study area.

Stone Procurement Areas (SPAs)

Throughout Australia various stone and mineral substances were collected and sometimes quarried to make stone implements and pigments of various kinds (Hiscock and Mitchell 1993; Mulvaney and Kamminga 1999:27-31). Sandstone also was quarried in large slabs for use as grindstones in milling seeds for flour. Pebble beds in watercourses were often ideal places to collect suitable stone, because there was usually a choice of different stone types, pebbles and cobbles were often a convenient size and shape, and water transport had tested the stones for toughness. In areas where pebbles were collected there often occur rejected pieces of flaked stone and other flaking debris from roughly shaping pieces of stone before these were taken away for final knapping. Where particularly desirable stone was available, the discarded knapping debris may be thousand of items per square metre. Some larger stone collecting localities in the arid zone were extensive rock formations, where knapping debris is scattered over the ground for kilometres. Some collecting sites have quarry pits and shafts following a seam of high quality stone or ochre. Around these pits are knapping floors or 'stone reduction sites', where the early stages of tool manufacture occurred. Often at probable stone procurement places such as small pebble beds in creeks, there is little or no archaeological evidence, in the form of extraction pits or concentrations of preliminary knapping debris, that stone had been selected and knapped in the past.

Certain Aboriginal quarries and mines possessed significance that transcended material needs. People did not always prefer the closest source, but exchanged valuable goods or travelled through arid country to a more distant source for stone they believed was imbued with spiritual power.

Quartz quarries are often recorded during surveys in the Broken Hill area and represent intensive exploitation of the good quality quartz and less intensive exploitation of poorer quality quartz material. The quartz reefs represented an invaluable material to the Aboriginal people of the area who otherwise did not have any suitable material for making artefacts. The reefs with the better quality milky and translucent quartz have often been heavily utilised, sometimes leaving only rounded bedrock from which it was impossible to detach any more suitable pieces. The bedrock displays Hertzian cones or ring cracks from the impact of rocks being thrown against the bedrock anvils in order to smash rocks up into suitable size for further working. The bedrock also displays areas of pounding and negative flake

scars where rocks have been hit against the bedrock to dislodge large flakes or blocks. These stone procurement areas are often surrounded by a ring of quartz trimming debris. Providing quartz stone outcrops in the proposal area this site type is likely to be recorded during the study.

Heat Retainer Hearths/Ovens

Heat retainer ovens range in diameter from 50 to 180 cm and are composed of local stone (mainly gneiss with some quartz) heat retainer and occasionally with rare pieces of burnt termite mound heat retainer. This type of fireplace is described in the diary of the explorer Daniel George Brock (Peake-Jones 1988). The feature consists of a shallow pit excavated into the ground surface in which a fire was lit on top of a layer of stones. It is believed that when the stones were hot, food was placed on the stones, and then covered by the excavated dirt (and also possibly vegetation: Martin 2007 pers comm.).

Holdaway *et al*. (2002) report that excavation of hearths reveals a layer of heat cracked stone mixed with soil and in some cases flecks of charcoal. Some hearths have a dense layer of charcoal underneath the stones. Generally however hearths are so eroded that all traces of charcoal have been removed. Excavation of hearths has also shown that most were excavated a few centimetres into the top of the massive, bleached A^2 horizon, which provided a firm base for the arrangement (Reaves 1997).

Some ovens are found *in situ* and just exposed while others have been affected by erosion and are either on pedestals or are left "floating" on the eroded surface. Charcoal and charcoal staining can be seen in some ovens. Ovens are commonly recorded along valley floors (Holdaway *et al*. 2002) and in upper valley/basin contexts. There is high potential for this site type to be recorded in the lower landforms of the proposal area.

Holdaway *et al*. (2002) point out that in their study some concentrations of heat fractured stone, identified to be hearths, possibly did not function as hearths, indicating that caution is required in their identification. Holdaway *et al*. (2002) defined hearths during their field work as concentration of 10 or more stones separated by less than 10 cm, however suggest that a more conservation approach may have been preferable.

Rock Art

Rock art is found across the continent as paintings, drawings, and pecked or abraded imagery and mechanically produced motifs such as stencils. In the Australian semi-arid zone art is found both within rock shelters on walls, ceilings and other stone features and also in open contexts as pecked or abraded art. In Australia rock art has been produced since the Pleistocene through to the present.

Much of the rock art in the semi-arid zone belongs to the so called Panaramitee style or track and circle style. This imagery typically includes animal track motifs. Classic Panaramitee rock art sites are present at Sturts Meadow and Mt Poole both of which are located north of the Barrier Ranges. In the region this site type is often found on large expanses of rock close to water holes and springs.

Providing suitable rock surfaces are present in the proposal area there is potential for this site type to be present.

8. ARCHAEOLOGICAL AND HERITAGE CONTEXT – NON-INDIGENOUS

8.1 Historical Context

Exploration and early settlement

The northern section of the Darling was discovered by Europeans in 1829 during exploration undertaken by Charles Sturt, who named the river after the Governor of New South Wales, Sir Ralph Darling. Following this Major Thomas Livingston Mitchell explored further to the south in 1835 and discovered a series of lakes he named *Laidley's Ponds*, which are now known as Menindee Lakes. During that expedition Mitchell noted a range of mountains to the west of the river; this same range was also later noted from the western side by Captain Frome, Surveyor General of South Australia, who described them as 'a succession of apparently barren ranges running north and south' (Kearns 1973: 7). The first Europeans to explore these mountains were the members of Captain Charles Sturt's 1844 Central Australian Expedition. Sturt undertook the expedition in an attempt to settle the debate as to whether there was an inland sea in central Australia. In August 1844 he and a party of 15 men, 200 sheep, six drays and a boat set out to explore north-western New South Wales and then to advance into central Australia.

In their travels from the Darling to the north-west they moved through the site of present day Broken Hill, with Sturt making mention of this "broken hill" in his diary (NSW DECC 2007). At the time Sturt collected mineral specimens, which later, upon his return, were not properly examined or assayed (AUCTA 2007). Sturt and his party then made several scouting expeditions into and beyond the Barrier Range. Sturt named this feature Stanley's Barrier Range due to the difficulties it presented to his progress. He described the land in this area as some of the most barren and desolate he had seen.

To negotiate the range "the party found a route by following Stephen Creek to the junction of Nine-Mile Creek, then along its northward course into the hills, passing Parnell Creek, the seven-mile well, past Lewis Hill (which they climbed) on to the watershed between Stephen, Yancowinna and Purnamoota Creeks. Crossing this watershed they reached the headwaters of Purnamoota Creek and followed this down till they found a pool. Below this pool the bed of the Purnamoota Creek became impassable owing to large boulders, so they turned up a spur which led them westerly on to the plains of Mundi Mundi close to the present Soapstone Creek. From here they travelled northwards along the base of the scarp till they found good water at the "Gorge of the Glen," where Campbell Creek issues from the ranges on the plains" (Cumpston 1951).

Thereafter, as the party progressed further into the arid regions they became stranded for months by the extreme summer conditions near the present site of Milparinka. The men and their equipment suffered terribly from the heat and Sturt's second-in-command, James Poole, died of scurvy. When rains eventually came Sturt pressed on into central Australia until they discovered the Simpson Desert, at which point they were unable to go further and turned back to Adelaide (Cumpston 1951).

Following in Sturt's wake pastoralists began to move west in the 1850s in order to take up land along the Darling River. Between 1847 and 1857 sheep runs such as Tapio, Para, Cawndilla, Weinteriga, Netallie, Moorabin, Culpaulin, Toorale, Pamamaroo, Tintinallogy, Cuthero, Willotia, Annalara, Nelia Gaari, Netley and Mount Murchison were taken up along the river frontage (Kearns 1973). However, when the lands along the river were fully occupied pastoralists were then forced to look further to the west. This situation was exacerbated in 1864 following a severe drought in the district (Fairfax 2007).

In 1859 the Darling River was navigated from Wentworth to Brewarrina. Captain Cadell, who had made the journey up to Mount Murchison sheep station in the paddle steamer *Albury*, established a stores depot on the west bank of the river at the site of what is now Menindee. As riverboats became more common along the Darling, thus providing new transport routes for supplies, pastoralism also grew. During the 1860s a series of properties further to the west in the Barrier Ranges were taken up, including Corona, Alberta, Poolamacca, Mundi Mundi, Mount Arrowsmith, Tarella and Torowoto (Kearns 1973).

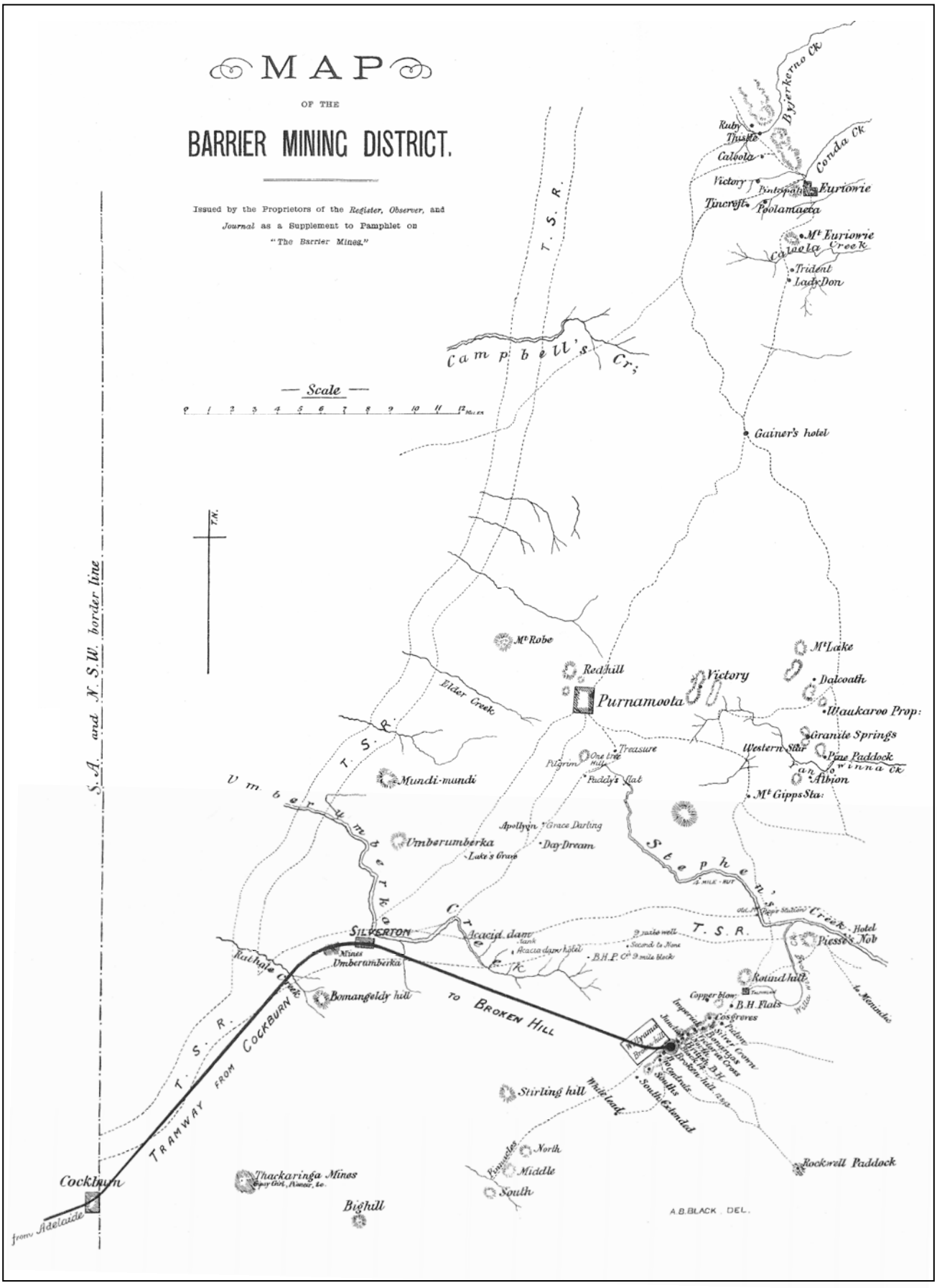

Figure 4. Map of the Barrier Mining District (*Barrier Silver and Tin Fields in 1888* 1970).

Henry Lake, together with his sons William Henry, James and George took up the Alberta sheep run about forty miles north-east of Thackaringa. They are thought to be the first to drive a bullock team through the Barrier Ranges to Menindee. Henry, James and George returned to South Australia while William Henry stayed at Alberta. Together with Charles Carl, *aka* German Charley, he made a living from sly grog deals and cattle duffing. He died in 1875 after being thrown from his horse; he was buried at the site of the accident. This grave was a well known landmark on the road to Purnamoota and it gave its name to the small settlement of Lake's Camp (Kearns 1980).

Mining and other developments

The search for minerals in Australia began soon after the arrival of the First Fleet. Initial reports of gold were however suppressed due to fears of effects the news might have on the convicts (Kearns 1980). The first official report of gold in New South Wales was at Fish River between Rydal and Bathurst in 1823 by James McBrien, a Land Department Surveyor. At that time mining was still not a priority for the colony, however following the emigration of settlers to the gold rush in California in 1849 the government realised the need to identify substantial gold deposits at home to reverse the migration. A reward was offered for the discovery of payable gold and in April 1851, John Lister and William Tom made the first report of payable gold at the junction of Lewis Ponds and Summer Hill Creeks, Ophir near Bathurst. Thus began the Australian gold rush which provided the first impetus for substantial growth in the country. Within the next ten years population grew in New South Wales from 197,265 to 350,860. The gold rush also affected demography with a substantial increase in non-Anglo immigrants such as those from Germany, France, America, and China. Initial finds were alluvial deposits, although with time reef gold was also identified and mined. From 1851 to 1948 New South Wales contributed 8.5% of Australia's gold production (Department of Mineral Resources 1994: 3-4).

Although Sturt had collected mineral samples from the Barrier Ranges during his Central Australian Expedition the specimens had not been adequately examined. It was not until December 1858 that a serious prospecting party set out from Adelaide to search for gold in the Barrier Ranges; nonetheless, even this exploration did not result in gold or other mineral finds. Soon after pastoralists settled in the Barrier Ranges reports went back to South Australia of quartz outcrops similar to those in the Bendigo goldfields. In 1867 there was a so-called gold rush at Poolamacca Station that turned out to be a hoax. A station employee had borrowed a horse to allegedly ride to Wilcannia to register a claim, however he was never seen again. While some reports suggest that gold was discovered in the Barrier Ranges in the 1860s, it was not until after 1875 that major exploration for gold, silver and tin took place. (HO & DUAP 1996). The impetus for this renewed exploration was the news of silver-lead ore discovered at Thackaringa.

Thackaringa (20 km southwest of Silverton) was originally a stop over point for those travelling through the region; it was located at the junction of tracks that linked South Australia with Menindee, Milparinka and Wilcannia (Kearns 1980). In 1875 silver-lead ore was discovered by Julius Charles Nickel and his companion McLean while sinking a well on Thackaringa Station. The ore was then identified by local hotel keeper John Stockie, who showed the ore to Patrick Green, a storekeeper from Menindee, Green in turn pegged out a claim in 1876 known as the Pioneer Mine, which was the first in the Barrier Ranges (Kearns 1973, 1980). The Pioneer Mine was worked on and off by Patrick and his brother Richard. Following Patrick's death in 1877 his brother Richard continued work at the mine with partner A. L. Garot. It was not until 1878 however that a shipment of ore successfully reached England and was assayed to contain 65% lead and an assayed 35 ounces of silver per ton. Previous shipments had been lost *en-route*, thought to have most likely been dumped overboard into the Darling when a paddle steamer ran aground (Kearns 1973).

The discovery of a rich silver-lead ore started a flurry of prospecting in the district with miners arriving in numbers, especially from the declining copper fields of South Australia and the early 1880s saw many encouraging finds of silver in the district. In 1881 John Stokie founded the Umberumberka Mine to the west of the modern settlement of Silverton (DLWC 1995). The following years saw numerous other mines established, including the Day Dream and Apollyon mines 15 km to the northeast of Silverton. A settlement of 400 to 500 people soon grew around that location and the first smelters in the district were established there in 1885. At the same time the mine at Purnamoota was flourishing, to the extent that in 1884 the township was considered to have such prospects as to warrant the installation of an electric power station and tram services (AUCTA 2007).

Silverton and surrounds

As mining increased in the region so did the population. In 1879 a hotel and store were established adjacent the workings of Stockie's Umberumberka Mine (DLWC 1995), about two kilometres south-west of the present township of Silverton. In addition to the hotel and store there were two boarding houses that helped cater for a population of 150. However, many settlers preferred to establish themselves closer to the water supply and so set up camp by Umberumberka Creek. This offshoot of Umberumberka gradually became the centre of settlement and following a meeting at John Stokie's hotel in 1883 a request was made to the Postmaster General for a post office at this settlement, which was to be known as Silverton (Kearns 1980). Rough huts of iron and canvas began to proliferate.

> On foot or in the saddle, by coach or by team, the diggers reached Silverton at last… Silverton lay before us as a mass of canvas stretching in all directions. Iron shanties, looking like big sardine tins, dotted the whole valley (*Barrier Silver and Tin Fields in 1888* 1970: 23).

The town itself was essentially ill equipped for the ensuing population increase, prices were inflated and housing was at a premium. Most lived in tents, with some unable to even secure this level of comfort. Shops were largely built of weatherboard with stone chimneys, while a few of the public buildings such as the Bank of Australasia were constructed of bluestone (Cox & Stacey 1973).

> This was Silverton, the capital of the Barrier in those days. Afterwards men settled down a little. The prospectors spread out over the country, and the business people built themselves habitations, and hotels sprang up like magic, Chapels followed (*Barrier Silver and Tin Fields in 1888* 1970: 23)

The population increased from 250 in September 1883 to 500 by December and peaked at 2,000-3,000 in 1885-86. In 1884 alone 1222 mineral leases, 937 business permits and 114 miners' rights were issued. That same year 6000 tonnes of ore were extracted, three-quarters of which was sent to South Australia for processing (Fairfax 2007). 1884 saw the formation of the Barrier Ranges Miners' Association in Silverton, which was a forerunner to the trade union movement in Broken Hill (Kearns 1973). In the same year the first hospital and school opened, while 1885 saw the opening of a customs house, Bank of Australasia, "Lion" brewery (Emil Resch) and commencement of the Silverton Tramway that linked the district with Cockburn in South Australia (Camilleri 1997; DLWC 1995) Further developments included establishment of telegraph communications with Adelaide in 1885, proclamation as a municipality in 1886, construction of a Masonic temple in the same year followed by a police station and gaol in 1888 and 1889 respectively; 1888 also saw the opening of the Silverton Tramway (Alpin *et al*. 1987; Camilleri 1997; DLWC 1995). The end result of this tramway was that the region was linked with Adelaide as opposed to Sydney and Melbourne, and a bulk transport system was already in place when Broken Hill developed (HO & DUAP 1996).

The early to mid 1880s were the heyday of Silverton, located as it was central to the surrounding mines and on reasonably flat ground with a form of water supply nearby, Silverton naturally became a district centre that served mines such as The Day Dream, Umberumberka, Purnamoota, Pinnacles and Pilgrim Mine (Cox & Stacey 1973). Burke Street developed as the main thoroughfare of the town leading off the road to Broken Hill and through to the Umberumberka Mine (McDougall & Vines 2005). Prior to 1880 all mining in the Barrier Ranges was under the jurisdiction of the Albert District. This meant that all mining applications had to be made through Milparinka or Wilcannia. This was then locally centralised through the appointment of Richard O'Conell as Police Officer, Acting Clerk of Petty Sessions, Mining Registrar, and Wardens Clerk. O'Connell was initially based just north of Mount Gipps Station homestead and then later based himself at Silverton in 1883 (Kearns 1980). Other significant changes during the 1880s included the diversification of the transport network with goods now carried by tram, steamboat, bullock wagon and camel train; coaching services were established and Afghan and Indian hawkers began trading throughout the region (Kearns 1973).

However by the late 1880s Silverton's better ore had been exhausted and with the opening up of the far richer lodes at Broken Hill, Silverton started to decline. The Day Dream Mine smelter had already closed down in 1886, one year after it commenced operation, and the mine was abandoned in the 1890s. The Umberumberka mine closed in 1892, the Thackaringa mine closed in 1897 and by 1890 Purnamoota had ceased to exist as a township. In 1888 Broken Hill boasted a population of some 11,000 (Drew 1991) while the population of Silverton was 1,700 and by 1901 it had dropped to 286. By this time many of Silverton's houses had been carted off to Broken Hill by their owners and the area was becoming a recreation centre for Broken Hill residents. Silverton ceased to be a municipality on 25 September 1907. Today about 50 people remain in Silverton and most of those cater to tourism. (Australian Heritage Database 2007).

Broken Hill

Mt Gipps Station was taken up in 1863 by the Barrier Range Co. The richest silver, lead and zinc deposit yet discovered in the world was found on the station by a German born boundary rider, Charles Rasp, in 1883. Rasp pegged out 40 acres on Mt Gipps Station that he thought to be rich in tin (Block 10). Together with the Station Manager, George McCulloch, and five other workers they pegged out another 6 blocks (Blocks 11-16). In January 1885 a young jackaroo by the name of Philip Charley discovered silver chlorides in the ore from Rasp's shaft; it was assayed to contain thousands of ounces per ton (Kearns 1973). Broken Hill Proprietary Company Ltd (BHP) was formed in August 1885 comprising Blocks 10-16. The first dividend was returned in 1886; it was also in this year that Broken Hill took off as a settlement. Rasp and company initially smelted their ore at Day Dream, they then built their own Nevada furnaces in 1886, which continued in operation until 1898 when smelting operations were moved to Port Pirie. Local vegetation was harvested across the region to fuel the furnaces; this resulted in a denuding of the landscape that led to enormous dust storms as a common occurrence (Drew 1991). The year 1886 also saw the Barrier Ranges Miners' Association move from Silverton to Broken Hill (Alpin *et al*. 1987). Over the years zinc residues from the Broken Hill mines were stockpiled awaiting suitable extraction methods. Herbert Hoover (later to

become the US President) bought the tailings and formed Zinc Corporation in 1905 and started his own mine (Alpin *et al*. 1987).

Broken Hill township reserve was proclaimed in 1885 and the town of "Willyama" was laid out in 1886 on the saltbush plain to the northwest of the ore body with the streets aligned parallel to the mining leases. The name Willyama however proved unpopular and so the settlement continued to be known as Broken Hill. Its population was in the hundreds in 1885, and by 1886 there were some 3000 people living largely in tents in a shantytown. By 1891 there were over 21,000 and by 1901, 31,000. Population then fluctuated during the two World Wars and peaked again in the 1950s/60s before declining to around 20,000-24,000 (Drew 1991).

Broken Hill South opened in 1885. The Silverton Tramway was then extended to Broken Hill in 1888 (HO & DUAP 1996), securing an ongoing connection between the old and new centres of the Barrier Ranges. Another rail link was established a few years later with the opening of the Broken Hill railway to Tarrawingee. This line operated from 1891 to 1932 and was initially established to transport limestone flux to the smelters in Broken Hill. The Broken Hill railway station was built in 1895, the courthouse in 1889, post office and mosque in 1889 and the town hall in 1890 (Alpin *et al*. 1987). The first miners' strikes were in 1889, 1890 and 1892 (Alpin *et al.* 1987); these events helped shape the union movement in Australia. Furthermore, the *Barrier Truth* newspaper that was founded in 1898 became the first union owned paper in Australia in 1908 (Alpin *et al*. 1987). Essentially, Broken Hill has played an important role in Australian history both in terms of mining and industrial relations.

Broken Hill also has an important place in the history of Australia's cameleers. As a railhead and major mining centre there were numerous camel trains and hawkers that used the town as a base. There were two "Ghantown" camps at Broken Hill and while the modern settlement has engulfed these sites the Muslim section of the cemetery and the Mosques on William Street provide a tangible physical link with this often overlooked aspect of the region's past; the mosques themselves being among the oldest examples still standing in the country (Cigler 1986; Hardy 1969; Parkes 1997). Another facet of the relationship between Broken Hill and Australia's Muslim community was displayed in the infamous Turkish attack on the railway during World War I. This incident, which has been depicted in varying ways over the years, led to the Attorney General's decision to inter all enemy nationals in Australia (Alpin *et al*. 1987).

Over the years Broken Hill has seen numerous changes, although many of the early buildings are still standing. There is an echo of the 1880s town that mainly comprised timber and corrugated iron structures and included 35 hotels and numerous churches. Although, it is more than the architecture that has lived on, anyone who has spent much time in Broken Hill would see the similarities between the modern settlement and the early descriptions of life and atmosphere.

> The visitor to Broken Hill should not, if he can help it, miss Saturday night in the streets… The principal street of the town, Argent-street, is the centre of traffic, and it is crowded with energetic good-humoured people, mostly men and boys, moving up and down where the numerous tradesmen display their wares in shops large and small… (*Barrier Silver and Tin Fields in 1888* 1970: 7)

Broken Hill is Australia's longest living mining city and the world's largest silver-lead-zinc mineral deposit (Drew 1991). BHP's expansion and success has meant that Broken Hill and the mines there have a special place in Australian history (HO & DUAP 1996), which in turn has resulted in the history of mining and the union movement having a continued importance within the local community today.

The Study Area

The study area for Stage 1 of the Silverton Wind Farm encompasses parts of the Parishes of Umberumberka, Mundi Mundi, Stephen and Naradin, although it largely corresponds to the Parish of Umberumberka. The proposed powerline to Broken Hill also traverses the Parishes of Nadbuck and Picton.

Available maps for this area indicate that there were numerous mines both within and in areas adjacent the study area (Wisehart & Co. 1885; County of Yancowinna Map 1964; 1:25,000 Geological Map; 1:50,000 Geological Map). The majority of these mines were relatively small scale and details of their names and owners are not listed on the abovementioned maps. Exceptions to this include the Iron Duke and Tower Hill mines. The first of these was an iron oxide mine located on a ridge to the north of Lake's Grave Creek that corresponds to part of the Stage 1 turbine envelope, while the latter was mined by a Sydney Company who drove a tunnel through Tower Hill (*aka* Lake's Knob) to explore the copper, silver and lead carbonates that were identified there (*Barrier Silver and Tin Fields in 1888*). The Tower Hill mine is located outside areas of proposed impacts associated with Stage 1.

There are at least a further 55 mines and smaller prospecting pits within the Stage 1 impact areas. These sites correspond to mining activities that span both the 19th and 20th centuries. The majority of these mines appear to have been exploratory in nature; none had returns that totaled more than $10,000 AUD. A list of known mine leases from within Stage 1and their grid reference is provided in Table 4. Not all of these mine leases correspond to areas of direct impacts such as access roads and turbine locations. Accordingly not all of these mining features correspond to areas surveyed during this project.

Lease	GDA East	GDA North	Notes
U0045	522072	6477679	No mineralisation
U0044	522122	6477494	
U0068	522172	6478394	
U0067	522172	6487654	No mineralisation
U0027	522237	6479354	
U0066	522237	6486754	
U0006	522322	6483494	
U0062	522322	6487179	
U0024	522337	6479744	
U0028	522347	6479294	
U0026	522347	6479779	No mineralisation
U0065	522347	6487379	
U0033	522372	6478029	
U0007	522372	6480229	
U0019	522397	6480154	
U0063	522397	6487154	No mineralisation
U0015	522422	6480629	
U0032	522472	6478679	
PW051	522472	6487654	
U0031	522497	6478529	No mineralisation
U0030	522522	6478394	
U0064	522522	6486704	
U0013	522572	6480999	
PU156	522572	6488579	
U0020	522597	6480079	
U0061	522597	6486729	
U0021	522647	6480144	
U0038	522672	6477729	
U0127	522772	6485354	
U0010	522797	6482304	
U0011	522822	6481544	No mineralisation
U0036	522922	6478594	
U0034	522997	6478819	
U0035	523222	6478594	No mineralisation
U0012	523322	6481079	
U0037	523597	6478629	
LC195	523772	6481314	
LC309	523947	6481679	
LC194	524162	6481954	
LC192	524972	6481342	
LC193	525047	6481304	
LC187	525272	6481054	
LC188	525297	6481504	
LC180	525722	6481729	
LC268	525897	6480279	
LC269	526022	6479642	
LC226	526272	6482279	
LC220	526672	6480329	
LC218	526722	6480279	Part of Iron Duke complex
LC219	526772	6480379	Part of Iron Duke complex
LC221	526812	6480779	Part of Iron Duke complex
LC272	526957	6483829	
LC177	527252	6480979	IRON DUKE MINE
LC225	527622	6481104	Part of Iron Duke complex
LC227	527772	6481229	
LC203	528922	6485142	

Table 4. List of known mine leases within impact areas associated with Stage 1.

Traces of these mines are likely to be still evidenced in the form of costeans, prospecting pits, mine shafts, adits, drives, quarries, mullock and tailing mounds, and pieces of machinery. There is also the potential for a range of other historical features to exist that are associated with mining. Examples include old roadways, miners' camps, and graves.

Pastoral history and heritage is a fundamental component of the heritage of far western NSW (Hope 2006). The Stage 1 study area encompasses a series of modern pastoral stations that correspond to parts of the earlier Mount

Gipps and Mundi Mundi Stations. The modern day stations include Acacia Vale, Belmont, Limestone and Nine Mile. These stations are the result of a series of subdivisions that have taken place since the late nineteenth century when populations increased as a result of mining developments across the Barrier Ranges.

The turbine envelope for Stage 1 corresponds to part of Belmont and Nine Mile Stations, while the proposed transmission line also crosses parts of Acacia Vale and Limestone Stations. Originally much of the area that comprises the study area was part of the Mount Gipps Station, the history of which is outlined in *The Unincorporated Area of New South Wales: A Heritage Study* (Hope 2006). Acacia Vale, Limestone and Nine Mile Stations all correspond in part to sections of the original Mount Gipps Station.

> Mount Gipps Station at its largest covered much of the Barrier Ranges, including the land where the city of Broken Hill now stands. It was well-watered by soaks along Stephens, Yancowinna and other creeks draining the ranges to both the east and west. The station took its name from Mount Gipps, named by Charles Sturt in 1844 after the Governor of NSW, Sir George Gipps. It was established around 1863, by the Barrier Ranges Company', which included George Urquhart of Kinchega Station; in 1865 the Mount Gipps run was transferred to George Urquhart and Mount Gipps South was taken over by James McCulloch and R. Sellars.
>
> …The original Mount Gipps Homestead was on Stephens Creek, upstream from the Stephens Creek Reservoir. A new homestead was built further north in 1871. …
>
> Some of the earliest mineral discoveries in the Barrier Ranges occurred on Mount Gipps Station (or holdings that were amalgamated into it such as Alberta), in the Apollyon Valley, at Purnamoota and Round Hill (Hope 2006: 66-68).

Acacia Vale, Belmont and Limestone Stations correspond at least in part to sections of the original Mundi Mundi Station. There is not the same level of information readily available for this pastoral holding as there is for Mount Gipps. Nonetheless, it is known that the Mundi Mundi Ruins are located approximately one and a half kilometres north of the Stage 1 study area. These ruins are a site complex that date to the nineteenth century and include homestead remains, a water tank and well and a series of burials; they are located on Eldee Station, which will be incorporated into future surveys as part of the Stage 2 fieldwork for the Silverton Wind Farm. While the Mundi Mundi Ruins do not correspond to proposed turbine envelopes there is the potential that futures stages of the development project will impact on this item at which stage it will be necessary to document the site and assess the heritage significance and potential impacts. At this stage it can be stated that the Mundi Mundi Ruins are almost definitely of local significance and have the potential to be of state significanc. This item will not be materially affected by the Stage 1 development and as such was not included in the field work for this report.

8.2 Historical Register searches

Searches have been conducted for previous heritage listings in and around the Stage 1 study area; these searches have included all of the relevant heritage registers for items of local through to world significance. Details of these searches are provided below.

Australian Heritage Database

This database contains information about more than 20 000 natural, historic and Indigenous places.

The database includes places in:

- the World Heritage List
- the National Heritage List
- the Commonwealth Heritage list
- the Register of the National Estate

and places under consideration for any one of these lists. A search of this database revealed that there are four items located near to the Stage 1 proposal area; all four items are listed on the Register of the National Estate. A summary of the search results is provided below in Table 5. Details of individual heritage listings are provided in Appendix 6. It should be noted that there are no items listed as being present within areas of direct impacts for Stage 1.

Heritage Item	Location	Register and Status
Former Municipal Chambers Bourke St	Silverton, NSW, Australia	(Registered) Register of the National Estate
Mundi Mundi and Umberumberka Reservoir	Silverton, NSW, Australia	(Indicative Place) Register of the National Estate
Public School - Burke Ward Rakow St	Broken Hill West, NSW, Australia	(Registered) Register of the National Estate
Silverton Adelaide St	Silverton, NSW, Australia	(Registered) Register of the National Estate

Table 5. Australian Heritage Database search results.

The following is taken from the Department of Environment, Heritage, Water and the Arts website (DEHWA 2007).

Status of the Register of the National Estate - February 2007

The Australian Heritage Council can no longer add places to or remove places or a part of a place from the Register of the National Estate (Register).

In 2006, the Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act), and the Australian Heritage Council 2003 were amended to, among other things, stop changes to the Register.

Places may be protected under appropriate States, Territories and Local Governments heritage legislation. Under an agreement between the Commonwealth and States and Territories it is intended that Registered places will be considered for inclusion in appropriate Commonwealth, State/Territory heritage lists.

Registered places can be protected under the EPBC Act if they are also included in another Commonwealth statutory heritage list. For example, Registered places owned or leased by the Commonwealth are protected from any action likely to have a significant impact on the environment.

There is no provision in the EPBC Act for Register of the National Estate places to be transferred to the National Heritage List or the Commonwealth Heritage List.

Indicative

Data provided to or obtained by the Australian Heritage Council or the former Australian Heritage Commission has been entered into the database.

Identified

The former Australian Heritage Commission has assessed the values of this place and decided that it should be entered in the Register. The place had not reached the Interim List stage by 1 January 2004 when the Commission was abolished.

Interim list

The place was in the Interim List at 1 January 2004 when the Australian Heritage Commission was abolished. The place had been publicly proposed for entry in the Register.

Registered

The place is in the Register of the National Estate. Although some places may be legally registered because they are within a larger registered area they may not necessarily possess intrinsic significance.

Removed from Register

The place has been removed from the Register

Destroyed

The place has been destroyed before being assessed or listed.

Rejected

The Australian Heritage Council or the former Australian Heritage Commission has assessed the place and found that it does not warrant entry in the Register in its own right.

Duplicate record

The place has another record in the database.

Identified through state processes

The place is entered in a state/territory heritage register. The Australian Heritage Commission had formally recognised the standards of historic assessment of the relevant state or territory heritage body and acknowledged that the place has National Estate historic values.

Of itself listing on the Register of the National Estate does not afford legal protection for a heritage item. None of the abovementioned identified items listed on the Register of the National Estate are included in another Commonwealth statutory heritage list and as such are not afforded protection under the EPBC Act.

State Heritage Inventory

The *NSW heritage databases* contain over 20,000 statutorily-listed heritage items in New South Wales. This includes items protected by heritage schedules to local environmental plans (LEPs), regional environmental plans (REPs) or by the State Heritage Register.

The information is supplied by local councils and State agencies and includes basic identification details and listing information. Consequently listings should be confirmed with the responsible agency.

A search of this database revealed that there are six items that are nearby the Stage 1 proposal area (Table 6). There are considerably more heritage items listed within Broken Hill City as a whole; this search has however focused on those around the western outskirts in areas adjacent the proposed transmission line. Only one of these heritage items, Day Dream Smelter, is listed under the Heritage Act as an item of state significance. The other five items are listed on the Broken Hill LEP; one of these, Burke Ward Public School, is also listed on the Register of the National Estate. Details of individual heritage listings are provided in Appendix 6. It should be noted that there are no items listed as being present within areas of direct impacts for Stage 1.

Item Name	Address	Suburb	LGA	Significance
Broken Hill Veterinary Clinic	127-129 Rakov (sic) Street	Broken Hill	Broken Hill	Local
Brookfield's Grave and Monument	Rakow Street	Broken Hill	Broken Hill	Local
Burke Ward Public School	Rakow Street	Broken Hill	Broken Hill	Local
Cemetery	Rakow Street	Broken Hill	Broken Hill	Local
Day Dream Smelter	Por. PML 2	Broken Hill	Unincorporated	State
White Rocks Reserve	Schlapp Street	Broken Hill	Broken Hill	Local

Table 6. State Heritage Inventory search results.

The NSW Heritage Act (1977)

The purpose of the NSW Heritage Act 1977 is to ensure that the heritage of New South Wales is adequately identified and conserved. In practice the Act has focused on items and places of non-indigenous heritage to avoid overlap with the NSW National Parks & Wildlife Act, 1974, which has primary responsibilities for nature conservation and the protection of Aboriginal objects and places in NSW. In recent years, however, the Heritage Council has targeted these other areas, working with relevant state agencies such as NPWS to identify gaps in the protection of Aboriginal and natural heritage places (for example the Cyprus Hellene Club was protected under the Heritage Act as a place of historic significance to Aboriginal people amongst other values).

Section 4 of the Act considers a heritage item to include *any place, building, work, relic, movable object, which may be of historic, scientific, cultural, social, archaeological, natural or aesthetic value.*

The Heritage Amendment Act 1998 came into effect in April 1999. This Act instigated changes to the NSW heritage system, which were the result of a substantial review begun in 1992. A central feature of the amendments was the clarification and strengthening of shared responsibility for heritage management between local government authorities, responsible for items of local significance, and the NSW Heritage Council. The Council retained its consent powers for alterations to heritage items of state significance.

The Heritage Act is concerned with all aspects of conservation ranging from the most basic protection against damage and demolition, to restoration and enhancement. It recognises two levels of heritage significance, State significance and Local significance across a broad range of values.

Generally this Act provides protection to items that have been identified, assessed and listed on various registers including State government section 170 registers, local government LEPs and the State Heritage Register. The Interim Heritage Order provisions allow the minister or his/her delegates (local government may have delegated authority) to provide emergency protection to threatened places that have not been previously identified. The only 'blanket' protection provisions in the Act relate to the protection of archaeological deposits and relics greater than 50 years old.

The Heritage Council of NSW

The role of the Heritage Council is to provide the Minister with advice on a broad range of matters relating to the conservation of the heritage of NSW. It also has a role in promoting heritage conservation through research, seminars and publications. The membership of the Heritage Council is designed to reflect a broad range of interests and areas of expertise.

Interim Heritage Orders

Under the provisions of Part 3 of the Act, the Minister can make an interim heritage order (IHO). A recommendation with respect to an order can come from the Heritage Council, either based on a request for the Minister, or the Council's own considerations. The Minister can also authorise Local Councils to make IHOs within their area. An interim conservation order may remain in force for up to 12 months, until such time as it is revoked or the item is listed on the State Heritage Register. A heritage order may control activities such as demolition of structures, damage to relics, places or land, development and alteration of buildings, works or relics.

The State Heritage Register

Changes to the Heritage Act in the 1998 amendments established the State Heritage Register which includes all places previously protected by permanent conservation orders (PCOs) and items identified as being of state significance in heritage and conservation registers prepared by State Government instrumentalities. Sites or places which are found to have a state level of heritage significance should be formally identified to the Heritage Council and considered for inclusion on the State Heritage Register.

National Trust of Australia (NSW) Register

The National Trust of Australia (NSW) is a non-government Community Organisation which promotes the conservation of both the built and natural heritage (for example, buildings, bushland, cemeteries, scenic landscapes, rare and endangered flora and fauna, and steam engines may all have heritage value). The Trust has approximately 30,000 members in New South Wales.

Following its survey and assessment of the natural and cultural environment, the Trust maintains a Register of landscapes, townscapes, buildings, industrial sites, cemeteries and other items or places which the Trust determines to have heritage significance and are worthy of conservation. Currently there are some 11,000 items listed on the Trust's Register. They are said to be 'Classified'.

The Trust's Register is intended to perform an advisory and educational role. The listing in the Register has no legal force. However, it is widely recognised as an authoritative statement of the heritage significance of a place. The Trust does not have any control over the development or demolition of the Classified Places or Items in its Register.

While the National Trust Register does not provide any statutory obligations for protection of a site as such, the acknowledgment of a place being listed on the Register as a significant site lends weight to its heritage value. Also, the fact that the actual data for sites may be minimal does not diminish the significance of a place. In fact, many sites were listed with only basic data added, especially in the early developmental stages of the Register.

The Trust, over the last few years has been upgrading the information for places listed, with criteria for assessment for listing based on the Australian Heritage Commission Criteria of assessment for entry to the Register of the National Estate.

A search of the National Trust of Australia (NSW) Register revealed that there are 13 items that are nearby the Stage 1 proposal area, three of these (DayDream Smelter, Burke Ward Public School & Municipal Chambers Former) correspond to items listed on the Australian Heritage Database and the State Heritage Inventory (Table 7). It should be noted that there are no items listed as being present within areas of direct impacts for Stage 1.

Item name	**Address**
DayDream Smelter Ruins	DayDream Road, 15km north-west (sic) of Silverton, 13km due east of the Umberumberka Reservoir, 19km north-west of Broken Hill
Burke Ward Public School	Rakow Street (Broken Hill West)
Museum formerly Gaol	Bourke Street (Silverton)
Methodist Church	Sturt Street (Silverton)
School	Loftus Street (Silverton)
Masonic Temple Former	Canopus Street (Silverton)
War Memorial Youth Camp formerly Police Station/Courthouse/Gaol	Bourke Street (Silverton)
Municipal Chambers Former	Bourke Street (Silverton)
Three Stone Houses	Sterling Street (Silverton)
Silverton Urban Conservation	Silverton Urban Conservation Area: Comprises the whole of the

Area	original town area
Silverton Hotel	Layard Street (Silverton)
Railway Station Former	(Silverton)
Roman Catholic Church Former	Canopus Street corner Loftus Street (Silverton)

Table 7. National Trust of Australia (NSW) Register search results.

Other Identified Heritage Items

In addition to those items discussed above that are listed on formal heritage databases, there are a number of other recognised heritage items that appear in the *Unincorporated Area of NSW Heritage Study* (Hope 2006). Below are details of heritage items discussed in that report that are located in or adjacent areas of direct impacts associated with Stage 1.

Day Dream Mine and Settlement

Located at the Day Dream Mine tourist site and in association with the State Heritage listed Day Dream Smelter are remains of the underlay mine and the settlement that developed alongside the mine. There are many mining feature visible at this site including openings to underlay declines, vertical shafts, building ruins, mining equipment and mullock heaps. This site is unusual in that it is accessible to tourists and has a considerable amount of original fabric. In addition to this there are remains of the substantial settlement that developed at this site, which extends across the plain from the Day Dream Road. Features present include chimney mounds, building footings, earth works and artefact scatters. As a site complex including the smelter and mine this has been identified as one of the most complete and accessible early mining landscapes in the Barrier Ranges (Hope 2006).

Day Dream Mine and associated smelter and settlement is outside areas of direct impact associated with Stage 1 and was not visited during this study.

Zinc Sintering Works, Corruga

Located in the Parish of Nadbuck on Limestone Station, immediately to the north of the Silverton Tramway near Corruga, there are the remains of zinc sintering works. Slimes from the Broken Hill ore tailings were brought here on the Silverton Tramway for sintering prior to transport to Port Pirie. The site encompasses an area of approximately 2.4 hectares and comprises remains of Silverton Tramway permanent way embankment, underground Umberumberka pipeline, siding embankments with lines of slag and reject bricks running parallel, fire boxes, roasting mounds, various wooden and metal artefacts and remains of stone and brick houses. These remains have been assessed by Hope (2006) to be historically significant as a site type that is relatively rare, well preserved and representative of pre-industrial technological processes; it is also a site that displays excellent archaeological research potential.

The Zinc sintering works are in an area of potential direct impacts associated with the initial route proposed for the transmission line, they are outside areas of direct impact for the minimised visual impacts route.

Silverton

Silverton has been the subject of various heritage studies including *Silverton Heritage Study* (Latona Masterman and Associates 1987) and *Silverton, New South Wales Heritage Management Plan* (McDougall & Vines Conservation and Heritage Consultants 2005). While elements of the town are listed on the Register of the National Estate and the National Trust of Australia (NSW) Register, a more comprehensive listing is provided in Hope's (2006) heritage study of the Unincorporated Area. The table below lists heritage items previously recorded in the (Latona Masterman and Associates 1987) and (McDougall & Vines Conservation and Heritage Consultants 2005) is adapted from that study.

Heritage Item	**Location**	**Latona Masterman 1987**	**McDougall & Vines 2005**	**Other Listings**
Silverton Gaol	Burke St	OB 1.1	10. Silverton Gaol	NT
Court House Complex	Burke St	OB 1.2	7. Silverton Courthouse	NT
Municipal Chambers	Burke St	OB 1.3	6. Silverton Municipal Chamber	NT, RNE
Silverton Public School	Loftus St	OB 1.4	18. Silverton Public School	
Mining Surveyor's Hut	Sturt St	OB 1.5	5. Stone building constructed on site of surveyors hut	NT
Silverton Hotel	Layard St	OB 1.6	17. Silverton Hotel. Layard St	NT
Two houses	Adelaide St west of Layard St	OB 1.7	1. Cottage Adelaide St 2. Cottage, Adelaide St	
Two houses	Gipps St, east and west of Layard St	OB 1.8	14. Cottage, Layard St (second not listed)	

Heritage Item	Location	Latona Masterman 1987	McDougall & Vines 2005	Other Listings
Two houses	Burke St, between Adams & Abbott Sts	OB 1.9	3, 4. Stone and brick cottages, Burke St.	
Private Museum	Burke St, corner of Layard St	OB 1.10	8. House Burke St	
House	Burke St	OB 1.11	9. Cottage, Burke St	
House	Burke St, corner of Loftus St	OB 1.12	11. House, Burke St (near corner of Loftus St)	
House	Layard St, Corner of Sturt St	OB 1.13		
House	Stirling St, between Layard & Loftus Sts	OB 1.14	19. House (Peter Brown Gallery), Stirling St	NT?
Two houses	Stirling St, west of Layard St	OB 1.15	20. House, Stirling St 21. House, Stirling St 22. House, Stirling St 23. House, Stirling St (between Thackaringa & Abbot Sts)	NT?
Methodist Church	Sturt St, between Layard & Loftus Sts	VB 2.1	24. Methodist Church, Sturt St	NT
Masonic Temple	Canopus St, between Layard & Loftus Sts	VB 2.2	12. Masonic Lodge, Canopus St	
Catholic Church	Canopus St, corner of Loftus St	VB 2.3	13. Catholic Church, Canopus St	NT
Two shops	Layard St, north of Burke St	VB 2.4	15. Shop. Layard St 16. Horizon Gallery, Layard St	
Ruins and remains in town area	Scattered throughout the town	RR 3.1	R1. Ruins of DeBraun's Silverton Hotel R2. Former House, Canopus St R3. Salvation Army Ruin, Gipps St R4. Former House, Gipps St R6. Former St Stephens Church of England & Rectory, Stirling St R7. Former Houses, Stirling St	
Remains of building immediately north of town	Adjoining the town, north of Umberumberka Creek	RR 3.2		
Brewery	North end of Loftus St	RR 3.3	R5. The Lion Brewery, Loftus St	
Silverton Cemetery	Northeast of Penrose Park	C 4.1	27. Silverton Cemetery	
Vacant land in town	Throughout the town	VL 5.1		
Street pattern	Throughout the town	VL 5.2		
Land around approach from west	The view of the town from west on the road from the Umberumberka Reservoir	VL 5.3		
Peppercorn trees	On approach from Broken Hill, extending into Burke St at east end of town	V6.1		
River red gums	Beds and banks of Umberumberka and Black Hill (Mindioomballa) Creeks	V 6.2		
Penrose park	North of Umberumberka Creek, adjacent town	R7.1		
Racecourse	South of the main town area	R 7.2		
Tramway route	Through town, along alignment of Sturt St	ST 8.1		
Level crossing sign	Layard St, south of Sturt St	ST 8.2		

Heritage Item	Location	Latona Masterman 1987	McDougall & Vines 2005	Other Listings
Silverton station	Junction of Purnamoota & Broken Hill Roads	ST 8.4	25. Silverton Ticket Office Complex, off Silverton Road	
Embankments and water works	East and west of town	ST 8.4	28. Silverton Railway Cutting	
Blue Anchor Tank	Mount Umberumberka, north of Silverton	WS 9.1		
Wood Stave pipeline	Runs from Umberumberka Reservoir via Blue Anchor Tank towards Broken Hill	WS 9.2		
Umberumberka Reservoir, with equipment and gardens	Northwest of Silverton	WS 9.3		
Police Dam	Adjacent to Penrose Park Northeast of town	WS 9.4		
Day Dream Mine and Smelter	ca. 9km northeast of Silverton	MA 10.1		RNE
Umberumberka Silver Mining Centre	Southwest of Silverton on line of tramway	MA 10.2		

Table 8. Heritage Items previously recorded in and around Silverton.

As a whole Silverton is outside areas of direct impact associated with Stage 1, there are however elements of its heritage that may be directly impacted (see below).

Tramway

The Silverton Tramway was a historically significant development within the context of the development of mining at Silverton and Broken Hill. Although not formally listed on any heritage register it was discussed in some detail in Hope's (2006) heritage study. The following extract is from that report:

> The permanent way formation of the Silverton Tramway is well preserved along its route. The steel rails were removed for scrap, but rails were also recycled locally, and used to build station fences, gates and other structures. Most sleepers were also taken up, but traces remain in some localities. Concrete pylons of bridges over creeks survive, although some are badly broken. Culverts through the embankment were lined with stone; there is a good example at Umberumberka Mine. At Silverton, the ticket office survives, as well as an underground stone tank, and the foundations of the goods shed. It is possible today to drive along the permanent way between Silverton and Umberumberka Mine through a spectacular cutting (Hope 2006: 341).

Hope (2006) goes on to point out that, tramways should be dealt with in terms of heritage corridors that comprise a suite of contributory items such as the rail alignment, remains of bridges and culverts, water tanks, telegraph poles, buildings and other associated features. She notes that of themselves many of these items may not be of high significance but as a complex they all contribute to the overall significance of the transport corridor. In conclusion she states:

> The Silverton Tramway is of exceptionally high state and national significance. As a private railway of approximately 50km length, its strategic role in the interstate railway network may be unique. For 80 years it was critical to the economic functioning of Broken Hill, by providing the key transport of ore to the smelters at the Port Pirie sea-port. It played a significant role in the politics and recreation of Broken Hill, and a crucial role at times of water shortage (Hope 2006: 342).

Only a very small portion of the Silverton Tramway is within an area of potential direct impacts associated with Stage 1; this is the area where the proposed transmission line would cross the tramway.

Umberumberka Reservoir and Infrastructure

> The dam at Umberumberka is of concrete with a crest of 680 feet long, 85 feet above the creek bed and 135 feet above the rock foundation, with a spillway 263 feet wide. There is a rising main (1.9miles) to a service reservoir on top of Blue Anchor Hill, then 16.8 miles of gravitation line to Broken Hill. Originally 18 inch woodstave piping was used on the sections of the gravitation main where the

> pressure was lower, with steel pipes for the lower part of the gravitation main and the rising main (Hope 2006: 324).

There are a wide variety of extant heritage items associated with the Umberumberka Reservoir. These include the dam itself, pumphouses and engines, steam boilers and bins, concrete mixers, barrel hoops, wooden pipes, Blue Anchor Tank, and remains of the settlement that developed as a result of the reservoir construction. The complex as a whole has been assessed by Hope (2006) to be of state significance.

While the reservoir and settlement ruins are outside areas of direct impact associated with Stage 1, Blue Anchor Tank and part of the pipeline to Broken Hill are within the proposal area.

Lakes Camp - Nevada

Lakes Camp, also known as Apollyon, was a mining settlement on Lakes Creek northeast of Silverton. The location of this settlement is also marked on the Yancowinna County Map as the village of Nevada. The history of this item is briefly covered by Hope (2006), although no description of the site is provided.

This item is outside areas of direct impact associated with Stage 1 and was not visited during this study.

Picnic Train Attack

Another potential heritage item that is worthy of note is the location of the Picnic Train Attack, on the railway reserve immediately northwest of the cemetery in Broken Hill. This location is part of a wider cultural landscape that encompasses Silverton Tramway and White Rocks, where the final shoot out took place. Of itself the site has no direct archaeological evidence of the attack, although a monument marks the location. Given the importance of the event and repercussions across the nation the importance of the locale cannot be denied. Nonetheless, the site only really has meaning in association with the other abovementioned elements of the landscape and the historical context of Broken Hill as a whole.

This item is outside areas of direct impact associated with Stage 1.

8.3 Historical Themes

A historical theme is a way of describing a major historical event or process that has contributed to the history of NSW. Historical themes provide the background context within which the heritage significance of an item can be understood. Themes have been developed at National and State levels, but corresponding regional and local themes can also be developed to reflect a more relevant historical context for particular areas or items.

In the table below is a summary of themes that are applicable to the areas in and around Stage 1 of the proposed Silverton Wind Farm.

Australian Theme	**NSW Theme**	**Local Theme**
Tracing the natural evolution of Australia	Environment – naturally evolved	Barrier Ranges
		Mundi Mundi Plain
		Stone and mineral resources
		Wind resources
Peopling Australia	Aboriginal cultures and interactions with other cultures	Day-to-day life
		Mythological and ceremonial
		Natural resources
		Contact period
	Ethnic influences	‘Afghans’/cameleers
		Chinese
Developing local, regional and national economies	Agriculture	Fencing
		Sheds
		Pasture
		Water provision
		Farmsteads
		Machinery
		Mulga cutting
	Commerce	Banking
		Trade routes
		Shops
		Inns
	Communication	Postal services
		Telephone and telegraph services
		Newspapers

Australian Theme	NSW Theme	Local Theme
		Transport networks
	Events	Picnic Train Attack
		Lake's Grave
		Miners' strikes
	Exploration	Camp sites
		Exploration routes
		Water sources
	Health	Hospitals
		Pharmacies
	Industry	Blacksmithing
		Kilns
		Smelters
		Workshops
		Breweries
		Private rail lines
	Mining	Prospecting
		Mine claims
		Extraction of ores
		Processing plants
		Transport of supplies and ore
		Mining settlements
		Mining equipment/machinery
		Mining landscapes
		Aboriginal stone procurement
	Pastoralism	Pastoral stations
		Sheds and yards
		Travelling stock reserves
		Fencing
		Pastoral workers' camps
		Water sources
	Technology	Communication networks
		Processing of ores
		Aboriginal technologies
	Transport	Stock routes
		Highways
		Railways
		Coaches
		Camel trains
Building settlements, towns and cities	Towns, suburbs and villages	Existing towns
		Abandoned settlements
		Relocated centres
		Streetscapes
		Neighbourhoods
		Ethnic quarters
	Land tenure	Fencing and other boundary markers
		Mining lease markers
		Trig stations
	Utilities	Water distribution
		Garbage disposal
		Sewage/septic systems
		Provision of electricity
		Bridges
		Culverts
	Accommodation	Inns and hostels
		Domestic residences
		Temporary encampments
		Homesteads

Australian Theme	NSW Theme	Local Theme
		Humpies
Working	Labour	Trade unions
		Miners' strikes
		Workers' quarters
		Work kitchens
		Brothels
Education	Education	Technical institutes
		Schools
		Playgrounds
Governing	Defence	Training grounds
		National security – Picnic Train Attack
	Government and administration	Municipal chambers
		Mining registrar
	Law and order	Judicial system
		Policing
		Detainment of suspects and criminals
	Welfare	Trade training institutions
Developing Australia's cultural life	Domestic life	Domestic artefact scatters
		Residences
		Food preparation
		Gardens
		Domesticated animals
	Creative endeavour	Sculptures
		Rock art
		Film industry
	Leisure	Picnic/camping areas
		Showgrounds
		Scenic lookouts
		Dance halls
		Tourism
	Religion	Churches
		Mosques
		Graveyards
		Religious schools
		Religious residences
	Social institutions	Masonic hall
		Public hall
		Public library
		Social groups/associations
		Museums
	Sport	Sports grounds
		Sports teams
Marking the phases of life	Birth and death	Hospitals and other places of birth
		Mortuary practices
		Cemeteries
	Persons	Individual monuments
		Significant individuals/families
		Place names

Table 9. National, state and local historical themes that are applicable to the study area and surrounds.

8.4 Predictive Statements

As the above table indicates there is an enormous array of themes and hence potential site types that might occur in and around the study area. Nonetheless, many of these correspond to heritage items in urban contexts. Given that there are no known historical villages or towns within the proposal area it is unlikely that most of these themes will be represented within the proposed turbine envelopes and other areas of direct impacts. It is however likely that there

will be an array of features associated with mining and pastoral activities and potentially exploration, transport and communication. Similarly, there is the potential for features associated with particular individuals; examples might include place names and burials. Accordingly, in terms of potential heritage items within areas of direct impacts there is a high potential for traces of mines to be still evidenced in the form of costeans, prospecting pits, mine shafts, adits, drives, quarries, mullock and tailing mounds, and pieces of machinery. There is also the potential for a range of other historical features to exist that are associated with mining. Examples include old roadways, miners' camps, and graves. In addition there is a high potential for sites associated with pastoral and transport activities, which would in most cases leave archaeological signatures similar to those associated with mining settlements, such as roads and traces of hut and tent sites.

While Hope (1996) has identified a number of heritage items in or adjacent the study area there is no documentary evidence to suggest that there are any further significant historical sites, with perhaps the exception of the Iron Duke mine. Nonetheless, there remains the possibility that an array of features such as those described above may occur. In addition it is known that the grave of William Henry Lake is adjacent one of the existing access roads to the study area. A late 19th century description of this site and its history is provided below.

> The road from Silverton to Tower Hill has several interesting features. It passes through picturesque and undulating country in sight of rugged ranges. Its name has a tragic association – Lake's Grave-road, and about 5 miles out, the grave is found on the road enclosed by a picket fence, while close by, at the turn of a deep gorge to the right, is the unfinished stone house of the deceased, fast falling to ruins. Mr. Lake, a station owner, some years ago was returning from Umberumberka, and fell off his horse. Twice he was assisted into the saddle again, but his third fall found him dead on the ground, and there he was buried. A little further on to the left is a conical shaped peak, slightly bent at the summit, standing severely isolated in the cloudless sky as if it were some Titanic fortress. It was called Lake's Knob, but now more appropriately Tower Hill. (*Barrier Silver and Tin Fields in 1888* 1970: 54).

With regard to potential heritage items that might occur in areas adjacent the proposal area, that is, within view of the wind farm, there is a potential for a much wider array of themes to be evidenced. This is particularly true at areas in and around Silverton, Lakes Camp, Day Dream Mine and Broken Hill West. These items have not been targeted within the course of fieldwork for this project as such a task is beyond the scope of this study. Nonetheless, they are encompassed briefly in a consideration of a cultural landscape across the Barrier Ranges in Section 13.

9. SURVEY RESULTS

9.1 Effective Survey Coverage

The study area has been divided into 232 Survey Units. Survey Units are described in Table 10 below and their location is shown on maps in Volume 2 - Appendix 2.

A summary of Effective Survey Coverage is listed in Table 11. The area surveyed during this assessment measured approximately 822.4 hectares in area (Table 11). Ground exposures inspected are estimated to have been 342.4197 hectares in area. Of that ground exposure area archaeological visibility (the potential artefact bearing soil profile) is conservatively estimated to have been 267.7945 hectares. Effective Survey Coverage is therefore calculated to have been 32.6% percent of the total survey area.

Generally ground exposure encountered during the survey was high as a result of low levels of vegetation cover. In the majority of Survey Units ground exposure was estimated to be between 80 and 85 percent. Ground cover was obscured by sparse vegetation and generally high levels of bedrock shatter.

Archaeological visibility was also found to be generally high, especially on the hills. On the hills archaeological visibility was estimated to generally range from 80 to 90 percent of ground exposure. That is, it has been estimated that ground exposures were not sufficiently breached so as to provide a view of the full range of artefacts present in the ground. This result is considered to have been a conservative estimate but took into consideration the fact that soil while often skeletal, was present and therefore likely to act so as to obscure some artefacts, especially small items. In lower landforms archaeological visibility was found to be much less than that estimated on the hills (ranging from 15 to as much as 60%). Generally in these landforms it was estimated that while ground exposure was high, it was insufficiently breached by erosional processes to provide high visibility of the potential artefact bearing soil profile. In addition these landforms are subject to aggrading geomorphological processes and so archaeological items and features are likely to be covered with soils deposits, especially Post Settlement Alluvium. The Effective Survey Coverage calculations made in respect of each Survey Unit therefore vary significantly between the hills and the lower landforms reflecting the differences in estimates of archaeological visibility.

During the survey estimates of stone artefact density in individual Survey Units was made and these are listed in the Effective Survey Coverage table (Table 11). These estimates have been made based both on artefact density calculations made during the survey (taking into consideration effective survey coverage), and also, a consideration of the environmental context and the predicted nature of Aboriginal land use. Predictions relating to Aboriginal land use and the levels of resulting artefact discard in the different environments of the proposal area have previously been outlined in Section 6.

Based on a consideration of a number of environmental factors including steep gradients and absence of water the hilly areas were predicted to have been utilised for low levels of Aboriginal occupation associated with hunting and gathering forays conducted away from base camp locations. Therefore it was predicted that in the hills artefact discard would have been correspondingly low, commensurate with low levels of utilisation. The hills were predicted to contain stone artefacts distributed in low density. By contrast the lower landforms were considered likely to have been utilised by Aboriginal people as camping places given the presence of more reliable water and a greater range of resources etc. It was predicted that in the open depression landforms and associated relatively flat slopes, artefact discard would have been relatively high as a result of greater levels of utilisation. In addition it was suggested that these locations would contain a greater variety of artefact types reflecting longer periods of habitation and a greater diversity of activities undertaken. While discussed further below, it is noted here that these predictions, especially those relating to variable artefact density across the range of landforms in the proposal area, have been found to correspond with the survey results.

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
1	hills	crest	very gentle	bench	open	Mulga - Dead Finish shrubland	schist	high levels of shatter and outcrops	low	skeletal	low	eroded	gravity; wind; biological: human	low
2	hills	crest	very gentle	saddle	south but open	Mulga - Dead Finish shrubland	schist	high levels of shatter	low	skeletal	low	eroded	gravity; wind; precipitation: creep; biological: human	low
3	hills	crest	moderate		north	Mulga - Dead Finish shrubland	schist	high levels of shatter	low	skeletal	low	eroded	gravity; wind; precipitation: creep; biological: human	low
4	hills	crest	gentle	summit	open	Mulga - Dead Finish shrubland with scattered Mallee	schist	outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
5	hills	crest	gentle		west	Mulga - Dead Finish shrubland	schist; amphib-olite	high levels of shatter	low/ moderate	skeletal	low	eroded	gravity; wind; precipitation; biological: human, fence line; graded track	low
6	hills	crest	very gentle	bench	open	Mallee - Bluebush open woodland	schist	high levels of shatter	low	skeletal	low	eroded	gravity; wind; biological: human	low
7	hills	crest	moderate	saddle	west	Mulga - Dead Finish shrubland	schist	high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
8	hills	crest	steep	summit	open	Mulga - Dead Finish shrubland	schist	outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
9	hills	crest	gentle		southeast	Mulga - Dead Finish shrubland with occasional Mallee	schist	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
10	hills	crest	very gentle	saddle	open	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; wind; biological: human, graded track	low
11	hills	crest	moderate		northeast	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
12	hills	crest	very gentle		open	Mulga - Dead Finish shrubland	schist	high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
13	hills	crest	very gentle	bench	open	Mulga - Dead Finish shrubland	schist	low levels of shatter	low	skeletal	low	eroded	wind; biological: human	low
14	hills	simple slope	moderate		east	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
15	hills	crest	very gentle	bench	east	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
16	hills	crest	gentle	bench	east	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
17	hills	simple slope	moderate		east	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
18	hills	crest	very gentle	saddle	open	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
19	hills	crest	very gentle	bench	open	Mulga - Dead Finish shrubland; sparse Mallee	schist	occasional outcrops; high levels of shatter	very low; increased to north but low quality	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
20	hills	crest	moderate		southwest	Mallee - Bluebush open woodland	schist	isolated outcrops; high levels of shatter	very low; isolated small pieces and small cobbles	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
21	hills	crest	very gentle		open	Mallee - Bluebush open woodland	schist	occasional outcrops; high levels of shatter	very low; occasional small cobbles and shatter	skeletal	low	eroded	gravity; wind; biological: human	low
22	hills	crest	moderate		east	Mallee - Bluebush open woodland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
23	hills	crest	very gentle	bench	northeast	Mallee - Bluebush open woodland	schist	occasional outcrops; high levels of shatter	moderate cobbles; very small low exposures	skeletal	low	eroded	wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
24	hills	crest	very gentle		northeast	Mallee - Bluebush open woodland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
25	hills	crest	moderate		east	Mallee - Bluebush open woodland	schist	occasional outcrops; high levels of shatter	low/ moderate; poor quality	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
26	hills	crest	very gentle		east; open	Mallee - Bluebush open woodland	schist	occasional outcrops; high levels of shatter	very sparse cobbles and shatter	skeletal	low	eroded	wind; biological: human	low
27	hills	simple slope	steep		southeast	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
28	hills	crest	gentle		northeast	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	very low; sparse levels of shatter	skeletal	low	eroded	gravity; precipitation; wind; biological: human; graded road	low
29	hills	crest	very gentle	bench	north	Mulga - Dead Finish shrubland	pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
30	hills	crest	moderate		northeast	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low to moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
31	hills	crest	very gentle		north but open	Mulga - Dead Finish shrubland	pegmatite and schist	high levels of outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
32	hills	crest	gentle	summit	open	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
33	hills	simple slope	moderate		west	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
34	hills	simple slope	moderate		east	Mulga - Dead Finish shrubland	pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
35	hills	crest	gentle		east	Mulga - Dead Finish shrubland	schist	high levels of outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
36	hills	crest	very gentle	bench	open	Mulga - Dead Finish shrubland	pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
37	hills	crest	moderate		east	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
38	hills	crest	very gentle		southeast	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; wind; biological: human	low
39	hills	crest	moderate		east	Mulga - Dead Finish shrubland	pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
40	hills	crest	moderate	saddle	open	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
41	hills	crest	very gentle		open	Mulga - Dead Finish shrubland	schist; pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; wind; biological: human	low
42	hills	crest	gentle	saddle	open	Mulga - Dead Finish shrubland	schist; pegmatite	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	wind; biological: human	low
43	hills	crest	gentle		northeast	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; wind; biological: human	low
44	hills	crest	very gentle		open	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	moderate to high	skeletal	low	eroded	wind; biological: human	low
45	hills	crest	moderate		southwest	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
46	hills	crest	level	saddle	open	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	wind; biological: human	low
47	hills	crest	moderate		east	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
48	hills	crest	gentle		open	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
49	hills	simple slope	steep		west	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
50	hills	crest	very gentle	bench	northwest	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; wind; biological: human	low
51	hills	crest	very gentle	bench	west but open	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; wind; biological: human	low
52	hills	crest	moderate	saddle	south	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	wind; biological: human	low
53	hills	crest	gentle	summit	open	Mulga - Dead Finish shrubland	schist; quartzite	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	wind; biological: human, road water tank and electricity lines	low
54	hills	crest	moderate	summit	open	Mulga - Dead Finish shrubland	schist; quartzite	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
55	hills	crest	moderate		northwest	Mulga - Dead Finish shrubland	schist; quartzite	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
56	hills	crest	gentle		south	Mulga - Dead Finish shrubland	schist; quartzite	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
57	hills	simple slope	moderate		east	Mulga - Dead Finish shrubland	schist; quartzite	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
58	hills	crest	very gentle		open	Mulga - Dead Finish shrubland	schist; quartzite	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; wind; biological: human	low
59	hills	crest	very gentle		east	Mulga - Dead Finish shrubland	schist; quartzite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	wind; biological: human	low
60	rises	simple slope	gentle		southwest	Mulga - Dead Finish shrubland; with Prickly Wattle in minor drainage lines; River Red Gum in creekline	pegmatite gneiss	high levels of shatter	low to moderate; patchy	sandy; silty	moderate	eroded or aggraded	precipitation; wind; biological: human; vehicle track	moderate
61	rises	crest	very gentle		northwest but open	Mulga - Dead Finish shrubland; with Prickly Wattle in minor drainage lines; River Red Gum in creekline	schist; gneiss	low levels of shatter	low to moderate	sandy; silty; sediment accumulate-ing down slope adj. to creek	moderate/ high adj. to creek	eroded or aggraded	precipitation; wind; biological: human; road and fencing	moderate

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
62	rises	crest	very gentle		northwest but open	Mulga - Dead Finish shrubland; with Prickly Wattle in minor drainage lines; River Red Gum in creekline	gneiss; amphib-olite	low levels of outcrops	moderate	silty; sandy	moderate/ high adj. to creek	eroded or aggraded	precipitation; wind; biological: human; road and fence line	moderate
63	rises	crest	gentle		northwest but open	Mulga - Dead Finish shrubland; with Prickly Wattle in minor drainage lines; River Red Gum in creekline	gneiss; amphib-olite	low levels of isolated outcrops	low	skeletal	low	eroded or aggraded	precipitation; wind; biological: human; water tanks at northwest end	moderate
64	rises	simple slope	very gentle		west	Mulga - Dead Finish shrubland; with Prickly Wattle in minor drainage lines; River Red Gum in creekline	gneiss	moderate levels of outcrops and shatter at east end	low	desert loam in west end; deep gravelly silt: colluvial/alluvial	high	eroded or aggraded	precipitation: sheet flow; wind; biological: human (track across western end)	moderate
65	rises	simple slope	very gentle	foot slope	east	Mulga - Dead Finish shrubland; with Prickly Wattle in minor drainage lines; River Red Gum in creekline	gneiss	nil outcrops; very sparse shatter	low	desert loam; deep gravelly silt: colluvial/ alluvial	high but disturbed	eroded or aggraded	precipitation: sheet flow; stream flow: unchannelled (rill erosion); High human impacts: cattle yards and fencing; vehicle track	moderate

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
66	hills	crest	moderate		east	Mulga - Dead Finish shrubland	schist	high levels of outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
67	hills	crest	gentle	saddle	open	Mulga - Dead Finish shrubland	schist	high levels of outcrops; high levels of shatter	low to moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
68	hills	crest	moderate		west	Mulga - Dead Finish shrubland	schist	isolated outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
69	hills	crest	gentle	summit	open	Mulga - Dead Finish shrubland	schist	moderate level of outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
70	hills	crest	moderate		southeast	Mulga - Dead Finish shrubland	schist	occasional outcrops; moderate levels of shatter	low to moderate	skeletal	very low	eroded	gravity; precipitation; wind; biological: human	low
71	hills	crest	moderate	summit	open	Mulga - Dead Finish shrubland	schist	high levels of outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
72	hills	crest	steep		north	Mulga - Dead Finish shrubland	schist	high levels of outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
73	hills	crest	gentle	saddle	open	Mulga - Dead Finish shrubland	schist	high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
74	hills	crest	moderate	summit	open	Mulga - Dead Finish shrubland	schist; some gneiss present	high levels of rocky outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
75	hills	crest	gentle		north	Mulga - Dead Finish shrubland	schist; pegmatite present in lower slope	high levels of outcrops; high levels of shatter	high	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
76	low hills	crest	very gentle	bench	open	Mulga - Dead Finish shrubland	schist; pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
77	low hills	crest	moderate		northwest	Mulga - Dead Finish shrubland	schist	high levels of outcrops; high levels of shatter	low to high	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
78	low hills	crest	moderate	summit	open	Mulga - Dead Finish shrubland	pegmatite	high levels of outcrops; high levels of shatter	high	skeletal	very low	eroded	gravity; precipitation; wind; biological: human	low
79	low hills	crest	gentle		north	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	moderate to high	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
80	low hills	crest	moderate		southwest	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human; track construction	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
81	low hills	crest	moderate		west	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human; track construction	low
82	low hills	simple slope	gentle	foot slope	southwest	Mulga - Dead Finish shrubland	pegmatite	occasional outcrops; moderate levels of shatter	moderate	desert loam; moderate depth	moderate	eroded or aggraded	gravity; precipitation; stream flow; wind; biological: human	low
83	low hills	simple slope	gentle		south	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
84	low hills	crest	very gentle		open	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; wind; biological: human	low
85	low hills	crest	very gentle	saddle	open	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; wind; biological: human	low
86	low hills	crest	gentle		northeast	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	low to moderate	skeletal	low	eroded	gravity; wind; biological: human	low
87	low hills	crest	gentle		open	Mulga - Dead Finish shrubland	gneiss; schist; pegmatite	occasional outcrops; high levels of shatter	low to moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
88	low hills	crest	very gentle	saddle	open	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
89	low hills	crest	moderate		northwest	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
90	hills	crest	very gentle		open	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; wind; biological: human, mining, road and building ruins	low
91	hills	crest	moderate		northeast	Mulga - Dead Finish shrubland; Single River Red Gum	schist; gneiss; quartzite	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
92	hills	crest	very gentle		east but open	Mulga - Dead Finish shrubland	schist; gneiss; pegmatite	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; wind; biological: human; mining	low
93	hills	crest	moderate		southwest	Mulga - Dead Finish shrubland; occasional rosewood	schist; gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human; old road	low
94	low hills	crest	gentle		southeast but open	Mulga - Dead Finish shrubland	schist; gneiss; pegmatite	occasional outcrops; high levels of shatter	low to moderate levels	skeletal	low	eroded	gravity; precipitation; wind; biological: human; old road, mining, building ruins	low
95	hills	crest	moderate		west	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
96	hills	crest	moderate		east	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
97	hills	crest	gentle		open	Mulga - Dead Finish shrubland	schist; gneiss; amphib-olite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; wind; biological: human	low
98	hills	crest	moderate	summit	open	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
99	hills	crest	gentle		northwest	Mulga - Dead Finish shrubland	schist; gneiss; pegmatite	occasional outcrops; high levels of shatter	low to moderate	skeletal	low	eroded	gravity; wind; biological: human	low
100	low hills	crest	moderate		east	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
101	low hills	crest	gentle		open	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	low to moderate	skeletal	low	eroded	gravity; wind; biological: human	low
102	low hills	crest	gentle	saddle	open	Mulga - Dead Finish shrubland with sparse Mallee	schist	low levels of outcrops; low levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
103	low hills	crest	gentle	summit	open	Mallee - Bluebush open woodland	schist	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
104	low hills	crest	very gentle		north but open	Mulga - Dead Finish shrubland; occasional Mallee	schist; pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
105	low hills	crest	very gentle		open	Mulga - Dead Finish shrubland	schist; pegmatite	occasional outcrops; high levels of shatter	low to moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
106	low hills	crest	gentle		north	Mulga - Dead Finish shrubland	schist	outcrops at eastern edge; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
107	low hills	crest	gentle		west	Mulga - Dead Finish shrubland	pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
108	low hills	crest	gentle		open	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
109	low hills	crest	gentle	saddle	open	Mulga - Dead Finish shrubland	schist; pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
110	low hills	crest	gentle	saddle	open	Mulga - Dead Finish shrubland	schist; gneiss; pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
111	low hills	crest	very gentle		open	Mulga - Dead Finish shrubland	schist; gneiss; pegmatite	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
112	low hills	crest	very gentle		west but open	Mulga - Dead Finish shrubland	schist; pegmatite	occasional outcrops; high levels of shatter	moderate to high	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
113	low hills	crest	gentle		open	Mulga - Dead Finish shrubland with occasional Mallee	schist; gneiss; pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
114	low hills	crest	moderate		northeast	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded or aggraded	gravity; precipitation; wind; biological: human	low
115	low hills	crest	gentle	summit	open	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	low to moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
116	low hills	crest	very gentle	saddle	open	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
117	low hills	crest	gentle	summit	open	Mulga - Dead Finish shrubland with occasional Mallee	schist; gneiss	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
118	low hills	crest	moderate		south west	Mulga - Dead Finish shrubland; occasional Mallee - Bluebush	schist; gneiss	occasional outcrops; high levels of shatter	moderate to high	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
119	low hills	crest	very gentle		open	Mulga - Dead Finish shrubland; occasional Mallee - Bluebush	schist	occasional outcrops; high levels of shatter	moderate to high	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
120	low hills	crest	gentle	saddle	open	Mulga - Dead Finish shrubland; occasional Mallee	schist; gneiss; pegmatite amphib-olite	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
121	low hills	crest	gentle		north	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
122	low hills	crest	gentle	saddle	open	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	moderate to high	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
123	low hills	crest	very gentle	summit	open	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
124	low hills	crest	gentle		south east	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
125	low hills	crest	moderate		north east	Mulga - Dead Finish shrubland; occasional Mallee	gneiss; pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
126	low hills	crest	gentle	saddle	open	Mulga - Dead Finish shrubland	schist; amphibolite	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
127	low hills	simple slope	moderate		north	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
128	low hills	crest	very gentle		open	Mulga - Dead Finish shrubland	schist	high levels of outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
129	low hills	crest	gentle	bench	east	Mulga - Dead Finish shrubland with occasional Mallee	schist	occasional outcrops; high levels of shatter	low to moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
130	low hills	crest	moderate		southeast	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
131	low hills	crest	moderate		south	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
132	low hills	open depress-ion	gentle	foot slope	west	Prickly Wattle open shrubland with mulga	schist; pegmatite	occasional outcrops; moderate levels of shatter	low	skeletal higher up; moderate depth along creek	moderate	eroded or aggraded	gravity; precipitation; stream flow: channelled; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
133	low hills	simple slope	moderate	gully	west	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; stream flow: channelled; unchannelled; wind; biological: human	low
134	low hills	crest	moderate	saddle	open	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
135	low hills	simple slope	moderate		east	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
136	rises	simple slope	very gentle		south but open	Mulga - Dead Finish shrubland with River red gum in creek	schist; gneiss	moderate levels of shatter and gravels	low	desert loam; deep gravelly silt: colluvial/ alluvial	high	eroded or aggraded	gravity; precipitation; stream flow: unchannelled; wind; biological: human	moderate
137	rises	crest	very gentle		open	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; low levels of shatter	low	desert loam	moderate	eroded	gravity; precipitation; wind; biological: human: vehicle track	low
138	rises	simple slope	gentle		north	Mulga - Dead Finish shrubland	gneiss	low levels of shatter	low	desert loam; moderate depth, gravelly silt: colluvial/ alluvial	moderate	eroded or aggraded	gravity; precipitation; wind; biological: human: vehicle track	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
139	rises	open depress-ion	very gentle		northwest	Mulga - Dead Finish shrubland	gneiss	low levels of shatter	low	desert loam; moderate depth, gravelly silt: colluvial/ alluvial	moderate	eroded or aggraded	gravity; precipitation; stream flow: channelled; unchannelled; wind; biological: human, vehicle track	low
140	rises	simple slope	very gentle		northwest	Mulga - Dead Finish shrubland	gneiss	low levels of outcrops; moderate levels of shatter	low	desert loam; moderate depth, gravelly silt: colluvial/ alluvial	moderate	eroded or aggraded	gravity; precipitation; wind; biological: human: vehicle track	low
141	rises	flat	very gentle		open	Mulga - Dead Finish shrubland with river red gum in creek	schist; gneiss	occasional outcrops; moderate levels of shatter	low to moderate	desert loam; moderate depth, gravelly silt: colluvial/ alluvial	moderate	eroded or aggraded	gravity; precipitation; stream flow: channelled; unchannelled; wind; biological: vehicle track, stock yards	moderate
142	rises	open depress-ion	very gentle		southwest	Mulga - Dead Finish shrubland with river red gum in creek	schist; gneiss	occasional outcrops; moderate levels of shatter	low	desert loam; moderate depth, gravelly silt: colluvial/ alluvial	high	eroded or aggraded	gravity; precipitation; stream flow: channelled; unchannelled; wind; biological: human, vehicle track	moderate

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
143	rises	open depress-ion	very gentle		southeast	Mulga - Dead Finish shrubland with river red gum in creek	schist; gneiss	occasional outcrops; moderate levels of shatter	moderate	desert loam	moderate	eroded or aggraded	gravity; precipitation; stream flow: channelled; unchannelled; wind; biological: human, vehicle track	moderate
144	low hills	crest	moderate		northeast	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; wind; biological: human	low
145	rises	simple slope	very gentle		north	Prickly Wattle open shrubland	schist	moderate amounts of gibber	low	desert loam	low	eroded or aggraded	gravity; precipitation; stream flow; wind; biological: human	low
146	rises	crest	gentle		open	Mulga - Dead Finish shrubland	schist; pegmatite	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; stream flow: unchannelled; wind; biological: human	low
147	rises	simple slope	very gentle		southeast	Prickly Wattle open shrubland with mulga	schist; gneiss	occasional low outcrops; moderate levels of gibber	moderate	desert loam; gravelly silt: colluvial/ alluvial. depth increases adjacent creek	low, generally higher adjacent creek	eroded or aggraded	precipitation; stream flow: channelled, unchannelled; wind; biological: human	moderate

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
148	rises	crest	very gentle		open	Mulga - Dead Finish shrubland	gneiss	occasional low outcrops; moderate levels of shatter and gibber	moderate	skeletal	low	eroded	wind; biological: human	low
149	rises	open depress-ion	very gentle		west	Chenopod shrublands	gneiss; amphib-olite	sparse shatter, high levels of gibber	moderate	desert loam; gravelly silt: colluvial/ alluvial	low	eroded or aggraded	gravity; precipitation; stream flow: unchannelled; wind; biological: human	low
150	rises	crest	very gentle		open	Chenopod shrublands	gneiss; amphib-olite; schist	occasional outcrops; sparse shatter; moderate levels of gibber	low	desert loam; gravelly silt: colluvial/ alluvial	low	eroded	gravity; precipitation; wind; biological: human	low
151a	rises	simple slope	very gentle		open	Chenopod shrublands	pegmatite amphib-olite	occasional outcrops; very sparse shatter; very sparse gravels	low	desert loam; gravelly silt: colluvial/ alluvial	low	eroded or aggraded	gravity; precipitation; stream flow; wind; biological: human - small recent quarry	low
151b	rises	simple slope	very gentle		open	Chenopod shrublands	pegmatite amphib-olite	occasional outcrops; very sparse shatter; very sparse gravels	low	desert loam; gravelly silt: colluvial/allu vial	low	eroded or aggraded	gravity; precipitation; stream flow; wind; biological: human	low
152	rises	crest	moderate		open	Chenopod shrublands	gneiss	high levels of outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
153	rises	crest	gentle		open	Chenopod shrublands	pegmatite	high levels of outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
154	rises	simple slope	very gentle		northeast	Chenopod shrublands; river red gum on creek; occasional prickly wattle in drainage lines	gneiss; schist; pegmatite	low levels of outcrops; low levels of shatter	low to moderate	desert loam; gravelly silt: colluvial/ alluvial	moderate	eroded or aggraded	gravity; precipitation; stream flow: channelled; wind; biological: humans - vehicle track	low
155	rises	crest	very gentle		open	Chenopod shrublands with mulga and dead finish	gneiss; pegmatite	moderate levels of outcrops and shatter	low	desert loam; gravelly silt: colluvial/ alluvial	low/ moderate	eroded	gravity; precipitation; wind; biological: human	low
156	rises	simple slope	very gentle		southwest	Chenopod shrublands with prickly wattle	gneiss; pegmatite	sparse shatter, moderate levels of gibber	low	desert loam; gravelly silt: colluvial/ alluvial	moderate	eroded or aggraded	gravity; precipitation; stream flow: channelled; unchannelled; wind; biological: human	low
157	rises	crest	gentle		open	Chenopod shrublands with mulga and dead finish	gneiss; pegmatite	moderate levels of outcrops and shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
158	rises	simple slope	gentle		southeast	Chenopod shrublands with mulga and dead finish; river red gum on creek	gneiss; pegmatite	low levels of outcrops; low levels of shatter	low	desert loam; gravelly silt: colluvial/ alluvial, increasing depth to south	high	eroded or aggraded	gravity; precipitation; stream flow: channelled; unchannelled; wind; biological: human - sheds, obstacle course	moderate
159	rises	simple slope	very gentle		northwest	Chenopod shrublands with prickly wattle	gneiss; schist; pegmatite	low levels of outcrops; moderate levels of shatter	low	desert loam; gravelly silt: colluvial/ alluvial depth increases adjacent creek	high	eroded or aggraded	gravity; precipitation; stream flow : channelled; unchannelled; wind; biological: humans	moderate
160	rises	crest	gentle		open	Chenopod shrublands with prickly wattle	gneiss; schist; pegmatite	low levels of outcrops; low levels of shatter	moderate	desert loam; moderate depth, gravelly silt: colluvial/ alluvial	high	eroded	gravity; precipitation; wind; biological: human	low
161	rises	simple slope	gentle		west	Chenopod shrublands with mulga and dead finish	schist; gneiss	low levels of outcrops; moderate levels of shatter	low	desert loam; moderate depth, gravelly silt: colluvial/alluvial	high	eroded or aggraded	gravity; precipitation; stream flow: unchannelled; wind; biological: human	low/ moderate
162	hills	crest	gentle	bench	open	Mallee - Bluebush open woodland	gneiss	occasional outcrops; high levels of cobbles	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human - vehicle track	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
163	hills	crest	moderate		southwest	Mallee - Bluebush open woodland, spinifex	schist; gneiss	high levels of outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
164	hills	crest	moderate	summit	open	Mallee - Bluebush open woodland, spinifex	schist	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
165	hills	simple slope	steep		east	Mallee - Bluebush open woodland	schist	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
166	hills	simple slope	steep		west	Mallee - Bluebush open woodland	schist	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
167	hills	crest	gentle	summit	open	Mallee - Bluebush open woodland, spinifex	schist	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
168	hills	crest	gentle		open	Mallee - Bluebush open woodland, spinifex	schist; gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
169	hills	crest	steep		southeast	Mallee - Bluebush open woodland, spinifex	gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
170	hills	crest	steep		southwest	Mallee - Bluebush open woodland, spinifex	gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
171	hills	crest	steep		south	Mallee - Bluebush open woodland, spinifex, sparse mulga	schist; gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
172	hills	crest	steep		northwest	Mallee - Bluebush open woodland, spinifex, sparse mulga	schist; gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
173	hills	crest	moderate	summit	open	Mallee - Bluebush open woodland, spinifex	gneiss	occasional outcrops; high levels of shatter	low to moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
174	hills	crest	gentle	saddle	open	Mallee - Bluebush open woodland, spinifex	schist; gneiss; shale	occasional outcrops; moderate levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
175	hills	crest	gentle	summit	open	Mallee - Bluebush open woodland, spinifex	gneiss	occasional outcrops; high levels of shatter	low to moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
176	hills	crest	moderate		west	Mallee - Bluebush open woodland, spinifex	schist; gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
177	hills	crest	very gentle	bench	west	Mallee - Bluebush open woodland, spinifex	schist; gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
178	hills	crest	gentle	summit	open	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
179	hills	crest	moderate		southwest	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
180	hills	crest	moderate		west	Mulga - Dead Finish shrubland	schist; gneiss; pegmatite	occasional outcrops; high levels of shatter and gravels	moderate	skeletal	low	eroded or aggraded	gravity; precipitation: creep, sheet flow; wind; biological: human	low
181	hills	crest	steep		west	Mulga - Dead Finish shrubland	schist	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
182	hills	crest	gentle	bench	west	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	low to moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
183	hills	crest	steep		west	Mulga - Dead Finish shrubland with occasional casuarinas	gneiss	occasional outcrops; high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
184	hills	ridge	gentle		open	Mulga - Dead Finish shrubland	schist	extensive outcrops and shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
185	hills	crest	gentle	saddle	open	Mulga - Dead Finish shrubland	schist; gneiss	high levels of outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
186	hills	crest	gentle	summit	open	Mulga - Dead Finish shrubland	schist	extensive outcrops and high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
187	hills	crest	moderate		southeast	Mulga - Dead Finish shrubland	gneiss	high levels of outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
188	hills	crest	steep		southeast	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
189	hills	crest	moderate		northeast	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
190	hills	crest	very gentle	summit	open	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human - mining	low
191	hills	crest	moderate		west	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human - mining, road, hut sites	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
192	hills	crest	gentle		west	Mulga - Dead Finish shrubland	schist	low levels of outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
193	hills	crest	gentle	saddle	open	Mulga - Dead Finish shrubland	schist; pegmatite	occasional outcrops; moderate levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
194	hills	crest	very gentle	summit	open	Mulga - Dead Finish shrubland	schist	moderate levels of shatter and gravels	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
195	hills	crest	gentle		west	Mulga - Dead Finish shrubland	schist	high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
196	hills	crest	steep		north	Mulga - Dead Finish shrubland	schist	high levels of outcrops; high levels of shatter; high levels of gravel	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
197	hills	crest	gentle		open	Mulga - Dead Finish shrubland	schist; gneiss	low levels of outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
198	hills	crest	moderate		east	Mallee - Bluebush open woodland, spinifex	schist; gneiss	low levels of outcrops; moderate levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
199	hills	crest	moderate		northeast	Mallee - Bluebush open woodland, spinifex	schist	moderate levels of shatter and gravels	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
200	hills	crest	gentle	summit	northeast	Mallee - Bluebush open woodland, spinifex	schist; gneiss	moderate levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
201	hills	crest	steep		north	Mallee - Bluebush open woodland, spinifex	schist; gneiss	moderate levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
202	hills	crest	very gentle	saddle	open	Mallee - Bluebush open woodland, spinifex	schist; gneiss; pegmatite	low levels of outcrops; moderate levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
203	hills	crest	moderate		south	Mallee - Bluebush open woodland, spinifex	schist; gneiss	high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
204	hills	crest	very gentle	summit	open	Mallee - Bluebush open woodland, spinifex	schist	moderate levels of outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
205	hills	crest	gentle	saddle	open	Mallee - Bluebush open woodland, spinifex	schist; gneiss	low levels of outcrops; high levels of shatter and gravels	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
206	hills	crest	moderate	summit	open	Mallee - Bluebush open woodland, spinifex	schist; gneiss	high levels of outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
207	hills	crest	steep		west	Mallee - Bluebush open woodland, spinifex	schist	moderate levels of shatter and gravels	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
208	hills	crest	steep		east	Mallee - Bluebush open woodland, spinifex	schist	low levels of outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
209	hills	crest	gentle	summit	open	Mallee - Bluebush open woodland, spinifex	schist	low levels of outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
210	hills	crest	moderate		northwest	Mallee - Bluebush open woodland, spinifex	schist	high levels of outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
211	hills	crest	moderate		southeast	Mallee - Bluebush open woodland, spinifex	schist; pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
212	hills	crest	gentle	summit	southwest but open	Mallee - Bluebush open woodland, spinifex, sparse mulga	schist	high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
213	hills	crest	moderate	saddle	open	Mallee - Bluebush open woodland, spinifex	schist	moderate levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
214	hills	simple slope	steep		south	Mallee - Bluebush open woodland, spinifex	schist	moderate levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
215	hills	crest	gentle		southwest	Mallee - Bluebush open woodland, spinifex	schist; gneiss; pegmatite	moderate levels of outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
216	hills	crest	very gentle		open	Mallee - Bluebush open woodland, spinifex	schist; gneiss; pegmatite	low levels of outcrops; moderate levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human	low
217	hills	open depress-ion	gentle	gorge	northwest	Mulga - Dead Finish shrubland	schist; gneiss	high levels of outcrops; high levels of shatter; high levels of gravel	low	desert loam; moderate depth, gravelly silt: colluvial/ alluvial	low	eroded or aggraded	wind; precipitation; stream flow: channelled; biological: human	low
218	hills	crest	moderate		west	Mulga - Dead Finish shrubland	schist; gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human - vehicle track	low
219	hills	crest	moderate		east	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; moderate levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human - vehicle track	low
220	hills	crest	gentle		open	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human - vehicle track	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
221	hills	crest	moderate		southwest	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	low to moderate	skeletal	low	eroded	gravity; precipitation; wind; biological: human - vehicle track	low
222	hills	crest	gentle	saddle	open	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human - vehicle track	low
223	hills	crest	moderate		southeast	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human - vehicle track	low
224	hills	crest	very gentle	summit	open	Mulga - Dead Finish shrubland	gneiss; pegmatite	occasional outcrops; moderate levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human - vehicle track	low
225	hills	crest	moderate		west	Mulga - Dead Finish shrubland	gneiss	low levels of outcrops; high levels of shatter	very low	skeletal	low	eroded	gravity; precipitation; wind; biological: human - vehicle track	low
226	hills	crest	gentle		north	Mulga - Dead Finish shrubland	gneiss; pegmatite	low levels of outcrops; moderate levels of shatter	low	skeletal	low	eroded	gravity; precipitation; stream flow: channelled; wind; biological: human - vehicle track	low

SU	Landform pattern	Landform element	Slope class	Element	Aspect	Vegetation	Geology	Rock exposures	Quartz	Soil	Potential for subsurface deposit	Geomorphological processes	Geo agents	Bio-diversity
227	low hills	simple slope	very gentle		north	Mulga - Dead Finish shrubland	gneiss; pegmatite	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; biological: human - vehicle track	low
228	hills	crest	moderate		east	Mulga - Dead Finish shrubland	gneiss	occasional outcrops; high levels of shatter	low	skeletal	low	eroded	gravity; precipitation; wind; biological: human - vehicle track	low
229	hills	open depress-ion	very gentle	foot slope	west	Mulga - Dead Finish shrubland	schist	high levels of shatter	moderate	colluvial	moderate	eroded	gravity; precipitation; wind; biological: human - vehicle track	low/ moderate
230	hills	simple slope	very gentle		north	Mulga - Dead Finish shrubland	schist	high levels of shatter	moderate	skeletal	low	eroded	gravity; precipitation; stream flow wind; biological: human - vehicle track	low
231	plain	simple slope	very gentle	foot slope	west	Chenopod shrublands	schist	high levels of shatter; high levels of gravel and gibber	high	desert loam; gravelly silt: colluvial/ alluvial	low	eroded or aggraded	streamflow: unchannelled; wind; biological: human - vehicle track	low
232	plain	flat	level		open	Chenopod shrublands	schist	high levels of gravels	low	desert loam; gravelly silt: colluvial/ alluvial	low	eroded or aggraded	precipitation: sheet flow; stream flow: channelled and unchannelled wind; biological: human - vehicle track	low

Table 10. Summary description of Survey Units.

A summary of Effective Survey Coverage is listed in Table 11 below. It is noted that both Indigenous and historical items are listed in the Recordings column.

SU	Area (m2)	Area inspected	Exposure %	Exposure Area	Visibility %	Net Effective Exposure	ESC	Recordings	Stone artefact density
1	25000	20000	85	17000	80	13600	54.4	SU1/L1	very low
2	25000	20000	85	17000	80	13600	54.4	SU2/L1; SU2/L2; SU2/L3	low
3	24000	14400	85	12240	85	10404	43.35	SU3/L1	very low
4	14400	11520	85	9792	80	7833.6	54.4	SU4/L1; SU4/L2	very low
5	100000	90000	85	76500	80	61200	61.2	SU5/L1; SU5/L2; SU5/L3	very low
6	14000	12600	85	10710	80	8568	61.2	SU6/L1	very low
7	7000	6300	85	5355	80	4284	61.2	nil	very low to negligible
8	22500	2250	85	1912.5	80	1530	6.8	nil	very low to negligible
9	24000	19200	85	16320	80	13056	54.4	SU9/L1; SU9/L2	very low
10	37500	30000	85	25500	80	20400	54.4	SU10/L1	very low
11	12000	7200	85	6120	95	5814	48.45	nil	very low to negligible
12	30000	24000	80	19200	85	16320	54.4	SU12/L1	very low
13	25000	15000	80	12000	80	9600	38.4	SU13/L1	very low
14	140000	98000	85	83300	80	66640	47.6	nil	very low to negligible
15	30000	25500	85	21675	85	18423.75	61.4125	SU15/L1	very low
16	27500	19250	85	16362.5	80	13090	47.6	SU16/L1	very low
17	40000	4000	85	3400	80	2720	6.8	nil	very low to negligible
18	30000	21000	85	17850	80	14280	47.6	SU18/L1	very low
19	33750	27000	90	24300	85	20655	61.2	SU19/L1	very low
20	6500	4550	85	3867.5	80	3094	47.6	SU20/L1	very low to negligible
21	17500	12250	85	10412.5	80	8330	47.6	nil	very low to negligible
22	25000	12500	85	10625	80	8500	34	SU22/L1	very low
23	14000	11200	85	9520	80	7616	54.4	SU23/L1	very low
24	25000	17500	85	14875	80	11900	47.6	SU24/L1	very low
25	45000	36000	85	30600	80	24480	54.4	SU25/L1	very low
26	40000	32000	85	27200	80	21760	54.4	SU26/L1	very low
27	10000	500	85	425	80	340	3.4	nil	very low to negligible
28	80000	40000	85	34000	80	27200	34	SU28/L1	very low
29	25000	20000	85	17000	80	13600	54.4	SU29/L1	very low
30	45000	22500	85	19125	80	15300	34	SU30/L1	very low
31	22500	18000	85	15300	80	12240	54.4	SU31/L1	very low to negligible
32	10000	8000	85	6800	80	5440	54.4	SU32/HS1	very low to negligible
33	8000	4000	85	3400	80	2720	34	nil	very low to negligible
34	8000	4000	85	3400	80	2720	34	nil	very low to negligible
35	26250	21000	85	17850	80	14280	54.4	nil	very low to negligible
36	9000	7200	85	6120	80	4896	54.4	nil	very low to negligible
37	27500	22000	85	18700	80	14960	54.4	nil	very low to negligible
38	32500	26000	85	22100	80	17680	54.4	SU38/L1	very low
39	18000	9000	85	7650	80	6120	34	nil	very low to negligible

SU	Area (m2)	Area inspected	Exposure %	Exposure Area	Visibility %	Net Effective Exposure	ESC	Recordings	Stone artefact density
40	40000	24000	85	20400	80	16320	40.8	nil	very low to negligible
41	18000	10800	80	8640	90	7776	43.2	SU41/L1; SU41/L2	very low
42	10500	7350	90	6615	85	5622.75	53.55	SU42/L1	very low
43	37500	24375	85	20718.75	90	18646.875	49.725	SU43/L1; SU43/L2; SU43/L3; SU43/L4	very low
44	30000	21000	80	16800	90	15120	50.4	SU44/L1	very low
45	7500	6000	70	4200	85	3570	47.6	SU45/L1	very low
46	4000	3200	70	2240	85	1904	47.6	SU46/L1	very low
47	11250	9000	80	7200	90	6480	57.6	SU47/L1	very low
48	90000	67500	85	57375	95	54506.25	60.5625	SU48/L1	very low
49	60000	18000	80	14400	90	12960	21.6	SU49/L1	very low to negligible
50	10000	8000	90	7200	95	6840	68.4	SU50/L1	very low
51	6000	3000	80	2400	90	2160	36	SU51/L1	very low
52	22500	15750	85	13387.5	95	12718.125	56.525	SU52/L1	very low
53	52500	36750	85	31237.5	90	28113.75	53.55	SU53/L1	very low
54	30000	22500	85	19125	95	18168.75	60.5625	SU54/L1; SU54/HS1	very low
55	24000	7200	85	6120	90	5508	22.95	SU55/L1	very low
56	25000	20000	85	17000	95	16150	64.6	SU56/L1; SU56/L2	very low
57	140000	28000	75	21000	80	16800	12	nil	very low to negligible
58	22000	13200	80	10560	90	9504	43.2	SU58/L1	very low
59	39375	29531.25	80	23625	95	22443.75	57	SU59/L1; SU59/L2; SU59/L3	very low
60	20000	16000	70	11200	70	7840	39.2	SU60/L1	very low
61	60000	45000	80	36000	50	18000	30	SU61/L1	low
62	60000	45000	80	36000	40	14400	24	SU62/L1; SU62/HS1	very low
63	20000	15000	70	10500	70	7350	36.75	SU63/L1; SU63/L2	very low
64	40000	32000	60	19200	20	3840	9.6	SU64/L1; SU64/L2	moderate
65	24000	21600	95	20520	20	4104	17.1	SU65/L1	moderate
66	20000	6000	85	5100	80	4080	20.4	nil	very low to negligible
67	20000	16000	85	13600	80	10880	54.4	SU67/L1	very low
68	48000	9600	85	8160	80	6528	13.6	nil	very low to negligible
69	50000	25000	85	21250	80	17000	34	SU69/L1	very low
70	20000	1000	85	850	80	680	3.4	SU70/L1	very low to negligible
71	26250	7875	85	6693.75	80	5355	20.4	SU71/L1	very low to negligible
72	15000	1500	85	1275	80	1020	6.8	nil	very low to negligible
73	9900	5940	85	5049	80	4039.2	40.8	nil	very low to negligible
74	32500	26000	85	22100	80	17680	54.4	SU74/L1	very low to negligible
75	66000	52800	85	44880	80	35904	54.4	SU75/L1	very low
76	30000	18000	70	12600	80	10080	33.6	SU76/L1; SU76/L2	very low
77	70000	28000	85	23800	80	19040	27.2	SU77/L1	very low
78	52500	5250	85	4462.5	80	3570	6.8	SU78/L1	very low
79	100000	60000	85	51000	80	40800	40.8	SU79/L1	very low
80	43750	17500	85	14875	80	11900	27.2	nil	very low to negligible

SU	Area (m2)	Area inspected	Exposure %	Exposure Area	Visibility %	Net Effective Exposure	ESC	Recordings	Stone artefact density
81	60000	18000	85	15300	80	12240	20.4	SU81/L1	very low
82	30000	12000	75	9000	40	3600	12	SU82/L1	very low
83	54000	8100	95	7695	90	6925.5	12.825	nil	very low to negligible
84	6000	2700	95	2565	90	2308.5	38.475	nil	very low to negligible
85	15000	12000	80	9600	90	8640	57.6	SU85/L1	very low
86	20000	16000	70	11200	90	10080	50.4	SU86/L1; SU86/L2; SU86/L3	very low
87	50000	37500	70	26250	95	24937.5	49.875	SU87/L1; SU87/L2; SU87/L3	low
88	2400	2160	80	1728	95	1641.6	68.4	SU88/L1	very low
89	10000	6000	80	4800	90	4320	43.2	SU89/L1	very low to negligible
90	176000	132000	85	112200	95	106590	60.5625	SU90/L1; SU90/HS1; SU90/HS2; SU90/HS3; SU90/HS4	very low
91	20000	10000	80	8000	90	7200	36	SU91/L1	very low to negligible
92	14000	11200	90	10080	95	9576	68.4	SU92/L1; SU92/HS1	very low
93	12500	8750	80	7000	90	6300	50.4	SU93/L1; SU93/HS1	very low
94	40000	30000	70	21000	85	17850	44.625	SU94/L1; SU94/L2; SU94/L3 SU94/HS1; SU94/HS2	low
95	7000	4900	70	3430	85	2915.5	41.65	SU95/L1; SU95/L2	very low
96	4200	2940	70	2058	80	1646.4	39.2	SU96/L1	very low
97	30000	22500	80	18000	90	16200	54	SU97/L1 SU97/L2; SU97/L3	very low
98	8750	7000	80	5600	95	5320	60.8	SU98/L1; SU98/L2	very low
99	45000	36000	85	30600	95	29070	64.6	SU99/L1	very low
100	10400	7280	85	6188	95	5878.6	56.525	SU100/L1	very low
101	140000	91000	80	72800	90	65520	46.8	SU101/L1; SU101/L2; SU101/L3	very low
102	10000	7000	85	5950	80	4760	47.6	SU102/L1; SU102/L2	very low
103	120000	72000	85	61200	80	48960	40.8	SU103/L1	very low
104	240000	168000	85	142800	80	114240	47.6	SU104/L1; SU104/L2; SU104/L3; SU104/L4; SU104/L5	very low
105	140000	98000	85	83300	80	66640	47.6	SU105/L1	very low
106	24000	16800	85	14280	80	11424	47.6	SU106/L1; SU106/L2	low
107	140000	98000	85	83300	80	66640	47.6	SU107/L1	very low
108	60000	36000	85	30600	80	24480	40.8	SU108/L1	low
109	33750	30375	85	25818.75	80	20655	61.2	SU109/L1	very low
110	15000	12000	85	10200	95	9690	64.6	SU110/L1	very low
111	27000	21600	90	19440	95	18468	68.4	SU111/L1 SU111/L2; SU111/L3; SU111/L4;	low

SU	Area (m2)	Area inspected	Exposure %	Exposure Area	Visibility %	Net Effective Exposure	ESC	Recordings	Stone artefact density
112	15000	11250	80	9000	95	8550	57	SU112/L1; SU112/L2	low
113	22000	18700	85	15895	95	15100.25	68.6375	SU113/L1; SU113/L2; SU113/L3	very low
114	6000	5100	90	4590	95	4360.5	72.675	SU114/L1	low
115	33000	28050	90	25245	90	22720.5	68.85	SU115/L1; SU115/L2	very low
116	5500	4675	90	4207.5	95	3997.125	72.675	SU116/L1	very low
117	17250	13800	85	11730	95	11143.5	64.6	SU117/L1	very low
118	6000	4800	80	3840	90	3456	57.6	SU118/L1	very low
119	35000	26250	85	22312.5	95	21196.875	60.5625	SU119/L1; SU119/L2; SU119/L3; SU119/L4	very low
120	48000	36000	85	30600	95	29070	60.5625	SU120/L1	very low
121	22000	17600	90	15840	95	15048	68.4	SU121/L1	very low
122	16000	12000	85	10200	90	9180	57.375	SU122/L1	low
123	30000	22500	85	19125	90	17212.5	57.375	SU123/L1; SU123/L2	low
124	5000	4000	85	3400	95	3230	64.6	SU124/L1	very low
125	17600	12320	80	9856	80	7884.8	44.8	SU125/L1	very low
126	37500	30000	85	25500	80	20400	54.4	SU126/L1; SU126/L2	low
127	31250	12500	85	10625	80	8500	27.2	SU127/L1	very low
128	105000	73500	85	62475	80	49980	47.6	SU128/L1	very low
129	60000	42000	85	35700	80	28560	47.6	SU129/L1; SU129/L2	very low
130	70000	42000	85	35700	80	28560	40.8	SU130/L1	very low
131	20000	1000	85	850	80	680	3.4	nil	very low to negligible
132	100000	70000	85	59500	80	47600	47.6	SU132/L1	low
133	50000	20000	85	17000	80	13600	27.2	SU133/L1; SU133/L2	very low
134	25000	10000	85	8500	80	6800	27.2	nil	very low to negligible
135	62500	6250	85	5312.5	80	4250	6.8	nil	very low to negligible
136	50000	12500	40	5000	15	750	1.5	SU136/L1	moderate
137	14000	3500	60	2100	20	420	3	SU137/L1	low
138	65000	16250	70	11375	15	1706.25	2.625	SU138/L1	low
139	17500	3500	60	2100	10	210	1.2	SU139/L1	low
140	40000	8000	60	4800	30	1440	3.6	SU140/L1	low
141	150000	30000	70	21000	15	3150	2.1	SU141/L1; SU141/HS1; SU141/HS2	moderate
142	12000	3000	80	2400	15	360	3	SU142/L1	low/moderate
143	100000	20000	70	14000	15	2100	2.1	SU143/L1; SU143/HS1	low/moderate
144	80000	24000	85	20400	80	16320	20.4	SU144/L1; SU144/L2	very low
145	90000	18000	85	15300	50	7650	8.5	SU145/L1; SU145/L2	very low
146	130000	26000	85	22100	80	17680	13.6	SU146/L1	very low
147	80000	16000	85	13600	60	8160	10.2	SU147/L1	low, except for area adjacent creek
148	80000	8000	85	6800	80	5440	6.8	SU148/L1; SU148/L2; SU148/L3	very low
149	60000	6000	85	5100	80	4080	6.8	nil	very low
150	60000	6000	85	5100	80	4080	6.8	SU150/L1	very low
151a	200000	20000	90	18000	60	10800	5.4	SU151a/L1	very low
151b	180000	18000	90	16200	60	9720	5.4	SU151b/L1	very low

SU	Area (m2)	Area inspected	Exposure %	Exposure Area	Visibility %	Net Effective Exposure	ESC	Recordings	Stone artefact density
152	80000	64000	85	54400	80	43520	54.4	SU152/L1; SU152/L2	very low, with the exception of the scree adjacent SU152/L2
153	45000	22500	85	19125	80	15300	34	SU153/L1	very low
154	140000	42000	75	31500	40	12600	9	SU154/L1	moderate
155	30000	24000	75	18000	50	9000	30	SU155/L1; SU155/L2; SU155/L3; SU155/L4	very low
156	75000	18750	75	14062.5	30	4218.75	5.625	SU156/L1	low
157	90000	18000	80	14400	60	8640	9.6	SU157/L1; SU157/L2; SU157/L3	very low
158	70000	14000	75	10500	15	1575	2.25	SU158/L1; SU158/L2	moderate
159	30000	12000	70	8400	15	1260	4.2	SU159/L1; SU159/L2	moderate
160	150000	30000	75	22500	15	3375	2.25	SU160/L1; SU160/L2; SU160/L3; SU160/L4	low
161	80000	24000	85	20400	25	5100	6.375	SU161/L1; SU161/L2; SU161/L3; SU161/L4	moderate
162	37500	30000	85	25500	80	20400	54.4	SU162/L1; SU162/L2	very low
163	36000	28800	35	10080	80	8064	22.4	SU163/L1; SU163/L2	very low
164	10000	8000	35	2800	80	2240	22.4	nil	very low to negligible
165	15000	1500	85	1275	80	1020	6.8	SU165/L1	very low to negligible
166	10000	1000	85	850	80	680	6.8	nil	very low to negligible
167	20000	16000	85	13600	80	10880	54.4	SU167/L1	very low
168	24000	19200	20	3840	80	3072	12.8	SU168/L1	very low
169	5000	1000	85	850	80	680	13.6	nil	very low to negligible
170	3000	600	85	510	80	408	13.6	nil	very low to negligible
171	35000	3500	60	2100	80	1680	4.8	nil	very low to negligible
172	30000	3000	60	1800	80	1440	4.8	nil	very low to negligible
173	33750	27000	85	22950	80	18360	54.4	SU173/L1; SU173/L2	very low
174	8750	7000	65	4550	85	3867.5	44.2	SU174/L1	very low
175	45000	36000	35	12600	80	10080	22.4	SU175/L1	very low
176	17500	7000	60	4200	85	3570	20.4	nil	very low to negligible
177	15000	12000	60	7200	80	5760	38.4	SU177/L1	very low
178	22500	18000	85	15300	80	12240	54.4	SU178/L1	very low
179	45000	9000	85	7650	80	6120	13.6	nil	very low to negligible
180	4000	1200	95	1140	80	912	22.8	nil	very low to negligible
181	6000	1800	90	1620	80	1296	21.6	nil	very low to negligible
182	9000	7200	85	6120	80	4896	54.4	SU182/L1	very low
183	9000	5400	85	4590	80	3672	40.8	SU183/L1	very low to negligible

SU	Area (m2)	Area inspected	Exposure %	Exposure Area	Visibility %	Net Effective Exposure	ESC	Recordings	Stone artefact density
184	1250	750	85	637.5	80	510	40.8	SU184/L1	very low
185	1000	800	85	680	80	544	54.4	SU185/L1	very low
186	12000	7200	85	6120	80	4896	40.8	SU186/L1	very low
187	5500	4400	85	3740	80	2992	54.4	SU187/L1	very low
188	10000	4000	85	3400	80	2720	27.2	nil	very low to negligible
189	21250	17000	85	14450	80	11560	54.4	SU189/L1	very low
190	22500	18000	85	15300	80	12240	54.4	SU190/L1; SU190/HS1	very low
191	21000	16800	85	14280	80	11424	54.4	SU191/HS1; SU191/HS2; SU191/HS3	very low to negligible
192	12800	6400	80	5120	95	4864	38	SU192/L1; SU192/L2	very low
193	4500	3600	80	2880	95	2736	60.8	SU193/L1	very low
194	25000	15000	80	12000	95	11400	45.6	SU194/L1	very low
195	8000	4800	80	3840	90	3456	43.2	SU195/L1	very low to negligible
196	10000	3000	80	2400	90	2160	21.6	nil	very low to negligible
197	6250	3125	85	2656.25	80	2125	34	SU197/L1	very low
198	8400	5880	70	4116	90	3704.4	44.1	SU198/L1	very low
199	10000	7000	75	5250	90	4725	47.25	SU199/L1	very low
200	5000	3750	80	3000	95	2850	57	SU200/L1	very low
201	4000	2400	85	2040	90	1836	45.9	SU201/L1	very low to negligible
202	2000	1600	80	1280	95	1216	60.8	SU202/L1	very low
203	6000	4500	65	2925	85	2486.25	41.4375	SU203/L1	very low
204	15000	12000	50	6000	90	5400	36	nil	very low to negligible
205	2700	2160	70	1512	90	1360.8	50.4	SU205/L1	very low
206	5000	2000	80	1600	85	1360	27.2	nil	very low to negligible
207	3000	900	80	720	90	648	21.6	nil	very low to negligible
208	4000	1200	80	960	90	864	21.6	nil	very low to negligible
209	40000	12000	70	8400	90	7560	18.9	SU209/L1; SU209/L2	very low
210	3200	1600	75	1200	90	1080	33.75	SU210/L1	very low
211	4000	1200	70	840	90	756	18.9	SU211/L1	very low
212	20000	6000	70	4200	90	3780	18.9	SU212/L1	very low
213	8000	2400	60	1440	80	1152	14.4	SU213/L1	very low
214	9000	900	50	450	80	360	4	nil	very low to negligible
215	17000	3400	70	2380	90	2142	12.6	SU215/L1; SU215/L2; SU215/L3	very low
216	11000	4400	85	3740	85	3179	28.9	SU216/L1	very low
217	12000	6000	80	4800	50	2400	20	nil	very low to negligible
218	6000	3000	85	2550	80	2040	34	SU218/L1	low
219	5000	2500	85	2125	80	1700	34	SU219/L1	very low
220	5000	2500	85	2125	80	1700	34	SU220/L1	very low
221	5000	2500	85	2125	80	1700	34	SU221/L1	very low
222	5000	1000	85	850	80	680	13.6	SU222/L1	very low
223	2000	1200	85	1020	90	918	45.9	SU223/L1	very low
224	5000	3500	80	2800	90	2520	50.4	SU224/L1; SU224/L2	very low
225	19500	11700	85	9945	90	8950.5	45.9	SU225/L1; SU225/L2	very low
226	16000	8000	85	6800	80	5440	34	SU226/L1; SU226/HS1	very low
227	3000	1800	80	1440	85	1224	40.8	SU227/L1	very low

SU	Area (m2)	Area inspected	Exposure %	Exposure Area	Visibility %	Net Effective Exposure	ESC	Recordings	Stone artefact density
228	8000	1600	80	1280	85	1088	13.6	nil	very low to negligible
229	28125	14062.5	85	11953.125	80	9562.5	34	SU229/L1; SU229/L2	low/moderate
230	7500	3750	85	3187.5	80	2550	34	SU230/L1	very low
231	15000	7500	65	4875	50	2437.5	16.25	SU231/L1; SU232/L2	very low
232	35000	17500	75	13125	50	6562.5	18.75	nil	very low to negligible
Total	**822.4 ha**	**420.8219 ha**		**340.8219 ha**		**267.7945 ha**	**32.563 %**		

Table 11. Effective Survey Coverage.

9.2 Survey Results - Indigenous

A total of 262 Aboriginal object locales were recorded within the proposal area. Each locale is listed in summary form in Table 17 and described in further detail in Volume 2 - Appendix 3.

Five different Aboriginal object type categories were recorded (Table 12). The majority of locales are continuous distributions of predominantly quartz stone artefacts across individual survey units (N=166; 63.4%). Quartz outcrops with evidence of exploitation – Stone Procurement Areas (SPA's) account for 78 locales (approximately 30 %). Fourteen locales are stone artefacts with heat retaining ovens/hearths (5.34%). In addition several isolated artefact recording have been made. One locale is a complex of two small circular stone arrangements. The origin of the mounds could not be determined during the field survey on the basis of a visual inspection alone. However the arrangement is similar to others found in the regions which have been assessed to be of Aboriginal origin (Sarah Martin pers. comm. 16th Nov 2007). Accordingly, while it cannot be confirmed, it is prudent to consider this locale as a possible Aboriginal stone arrangement.

Feature	Crest	Flat	Open depression	Ridge	Simple slope	Total
SPA	68		1		9	78 (29.77%)
Stone arrangement					1	1 (0.38%)
Stone artefact	3					3 (1.15%)
Stone artefacts	148		3	1	14	166 (63.36%)
Stone artefacts; hearths	2	1	2		9	14 (5.34%)
Total	221	1	6	1	33	262 (100%)

Table 12. Cross tabulation of Aboriginal object locales and landform element.

The majority of locales have been found on crest landform elements. This result is not surprising given that the majority of the survey was conducted within the proposed turbine envelope. Stone Procurement Areas are situated predominantly on crests and this result also is a factor, at least in part, of survey bias. Locales containing both stone artefacts and heat retaining oven/hearths are located mostly in open depressions and simple slopes. These locales are all located in the lower areas of the proposal area and this site locational pattern is significant however not unexpected.

The majority of stone artefact locales consist of very low to low density quartz artefact distributions situated on hill crests. This result conforms generally to the predictions made in regard to artefact density in relation to the environmental context of the proposal area as outlined in Section 6. The Effective Survey Coverage achieved during the field inspection is relatively high and can be considered to be adequate for the purposes of calculating artefact density. Accordingly the low artefact densities encountered is considered to be reasonably accurate; it is however recognised that very small artefacts (such as those measuring <1 cm in overall size) may have been located in subsurface contexts and hence invisible. While the hill crests were expected to contain low artefact densities the extremely low densities generally encountered was however somewhat surprising. It is believed that this result is possibly related, in part, to land degradation and the high levels of erosion that have taken place over the last 150 years or so (see Fanning 1999).

The table below lists stone artefacts recorded that are made from materials other than quartz. These materials are all foreign to the immediate locale area and include chert, silcrete, quartzite and volcanics. Foreign stone materials were

found across all landforms in the study area however some patterning in distribution did seem to be apparent. While it has not been quantified a greater proportion of foreign materials did seem to be present in artefact assemblages located in the lower landform contexts compared to the hills.

ID #	Survey Unit	Locale	GDA East	GDA North	Description
1	SU5	SU5/L1	522995	6481311	grey silcrete flake: 37 x 25 x 10mm
2	SU5	SU5/L1	523105	6481310	white silcrete longitudinal flake fragment: 38 x 17 x 7mm
3	SU5	SU5/L1	523297	6481134	grey silcrete flake (microblade rotation): 15 x 20 x 9mm
4	SU16	SU16/L1			fine grained sedimentary flake: 95 x 50 x 18mm
5	SU19	SU19/L1	523592	6482297	brown silcrete flake: 32 x 36 x 7mm
6	SU41	SU41/L1			Red quartzite kulki: 92 x 79 x 32mm. Highly weathered, 1 shallow indentation in centre of one face (2cm diameter, 2mm deep). Flat worn surface on both faces. 5 lateral margins with flat wear facets.
7	SU54	SU54/L1			silcrete flake, bifacial platform, feather termination, invasive retouch on one margin, notch on opposite margin
8	SU55	SU55/L1			Silcrete flake, very heavy usewear and retouch on one margin
9	SU61	SU61/L1	525175	6482023	silcrete retouched artefact; retouch and usewear along 1 edge: 26 x 12 x 4.7mm
10	SU61	SU61/L1	525002	6482067	red chert flake fragment: 17 x 11 x 3mm
11	SU61	SU61/L1	525070	6482127	grey quartzite manuport fragment, pebble cortex: 83 x 48 x 35mm
12	SU61	SU61/L1	525072	6482134	grey quartzite manuport fragment, pebble cortex; probably piece of a kulki: 72 x 50 x 25mm
13	SU62	SU62/L1	525238	6482288	retouched silcrete flake
14	SU62	SU62/L1			cream silcrete flake with fine scalar retouch along distal margin
15	SU62	SU62/L1			thick silcrete flake with steep retouch along one margin
16	SU62	SU62/L1	525258	6482355	pink quartzite core, 1 platform, 4 scars: 24 x 64 x 25mm
17	SU62	SU62/L1	525252	6482352	red quartzite cobble fragment (manuport): 90 x 37 x 30mm
18	SU63	SU63/L1	525351	6482280	Large silcrete flake, coarse grained, some usewear
19	SU64	SU64/L1	525413	6482402	very fine grained white silcrete scraper (convex/thumbnail), 90% of margins retouched: 29 x 30 x 10mm
20	SU64	SU64/L1	525398	6482400	brown chert flake: 15 x 15 x 2.5mm
21	SU64	SU64/L1	525374	6482403	very fine grey chert blade with outrepassé termination: 43 x 17 x 6mm
22	SU64	SU64/L1			grey silcrete flake with steep retouch on distal margin
23	SU64	SU64/L1	525374	6482473	yellow chert flake fragment
24	SU64	SU64/L1	525386	6482484	coarse grained grey silcrete blade
25	SU64	SU64/L1	525325	6482476	yellow silcrete backing flake: 13 x 22 x 5mm
26	SU64	SU64/L1	525279	6482475	grey silcrete flake
27	SU64	SU64/L1	525259	6482475	grey silcrete flake
28	SU64	SU64/L1	525265	6482480	very fine grained grey silcrete adze (burren) with moderate use rounding, 1 longitudinal side useworn and retouched to form slug, other side retouched for hafting: 34 x 16 x 11mm
29	SU65	SU65/L1	525161	6482511	black chert flake: 18 x 20 x 3mm
30	SU65	SU65/L1	525156	6482506	grey quartzite proximal flake fragment: 25 x 37 x 14
31	SU65	SU65/L1	525174	6482490	white silcrete proximal microblade portion, backing retouch on one side: 25 x 26 x 10mm
32	SU65	SU65/L1	525148	6482375	grey silcrete microblade core, 3 initiation surfaces: 23 x 33 37mm
33	SU65	SU65/L1	525149	6482380	grey silcrete microblade core fragment, with white inclusions
34	SU76	SU76/L1	527174	6482378	grey quartzite manuport fragment, pebble cortex: 93 x 55 x 45mm
35	SU82	SU82/L1	526466	6482195	white silcrete flake: 24 x 18 x 10mm
36	SU104	SU104/L1	529304	6484379	silcrete flake, proximal portion: 22 x 22 x 9mm; usewear on one margin
37	SU104	SU104/L1	529251	6484117	grey quartzite flake

ID #	Survey Unit	Locale	GDA East	GDA North	Description
38	SU108	SU108/L1	528261	6483557	quartzite cobble - mortar: 160 x 146 x 47mm. 1 face with slight depression and peck marks: 53 x 50 x 2mm, possibly indicative of use as anvil; other face is concave and has pitted surface: 97 x 91 x 6mm. Edges show some evidence of pounding as a pestle
39	SU108	SU108/L1	528222	6483491	brown silcrete adze slug (not tula): (12) x 25 x 7mm. Focal platform, distal end used as working edge, heavy usewear and step fracturing
40	SU108	SU108/L1	528266	6483562	grey chert adze slug (not tula): (20) x 34 x 11mm. Invasive retouch on one side; distal end used as working edge, heavy usewear and step fracturing
41	SU120	SU120/L1	528973	6484948	grey quartzite flake: 70 x 62 x 10mm. Missing flake initiation features, possibly a 'retoucher' for pressure flaking and chimbling, hence wear at edges
42	SU136	SU136/1	527992	6477138	grey silcrete flake: 25 x 16 x 12mm
43	SU136	SU136/1	527992	6477138	red chert flake fragment: 12 x 8 x 2mm
44	SU136	SU136/1	527992	6477138	grey silcrete flake: 11 x 4 x 3mm
45	SU136	SU136/1	527973	6477110	extremely fine grained white silcrete microblade portion, proximal: (21) x 13 x 5mm
46	SU136	SU136/1	527976	6477045	grey volcanic pebble, kulki, with one facet smoothed: 58 x 47 x 49mm
47	SU136	SU136/1	528002	6477138	grey silcrete flake: 18 x 12 x 4mm
48	SU136	SU136/1	528019	6477185	grey silcrete flake: 23 x 15 x 5mm
49	SU136	SU136/1	527909	6477262	red quartzite cobble (manuport): 70 x 60 x 45mm
50	SU136	SU136/1	527913	6477266	white silcrete flake: 31 x 26 x 4mm
51	SU136	SU136/1	527906	6477352	grey silcrete core fragment: 32 x 27 x 13mm
52	SU136	SU136/1	527906	6477352	very fine grained grey silcrete microblade portion, proximal: (17) x 14 x 5mm
53	SU136	SU136/1	527893	6477394	grey quartzite microblade core, single platform: 60 x 65 x 35mm
54	SU136	SU136/1	527885	6477397	grey silcrete flake: 19 x 20 x 10mm
55	SU136	SU136/1	527907	6477347	dark brown silcrete flake with 10mm of retouch along part of distal margin: 20 x 27 x 12mm
56	SU136	SU136/1	527909	6477345	yellow/cream chert scraper portion with 15mm of retouch along part of the distal margin: (22) x 26 x 9mm
57	SU136	SU136/1	527907	6477343	grey silcrete flake: 20 x 10 x 2mm
58	SU136	SU136/1	527895	6477398	grey silcrete microblade: 42 x 17 x 7mm
59	SU136	SU136/1	527895	6477398	fine grained grey silcrete microblade portion, proximal: (23) x 15 x 4mm
60	SU136	SU136/1	527909	6477375	grey silcrete flake: 41 x 26 x 10mm
61	SU136	SU136/1	527909	6477375	white chert flake: 33 x 16 x 9mm
62	SU136	SU136/1	527909	6477375	yellow silcrete flake: 15 x 10 x 4mm
63	SU136	SU136/1	527909	6477375	grey silcrete flake: 31 x 18 x 8mm
64	SU138	SU138/L1	527710	6478044	grey silcrete flake (convex scraper) with retouch on both lateral margins: 54 x 39 x 18mm
65	SU138	SU138/L1	527693	6478129	white silcrete flake portion, proximal: (12) x 25 x 9mm
66	SU138	SU138/L1	527716	6478073	grey silcrete microblade: 27 x 13 x 8mm
67	SU141	SU141/L1	526755	6478654	brown silcrete flake: 28 x 23 x 6mm
68	SU141	SU141/L1	526764	6478637	brown silcrete flake portion, proximal
69	SU141	SU141/L1	526749	6478036	very fine grained chert flake, proximal
70	SU141	SU141/L1	526780	6478075	yellow silcrete flake portion, proximal
71	SU146	SU146/L1	526176	6479533	yellow silcrete blade portion, proximal; micro scarring from ventral surface on both margins - usewear: (24) x 18 x 5mm
72	SU147	SU147/L2	526653	6478832	brown silcrete flake, probably from microblade core: 9 x 12 x 4mm
73	SU147	SU147/L2	526654	6478825	brown silcrete flake: 12 x 15 x 3mm
74	SU147	SU147/L2	526642	6478780	very fine grained, white silcrete microblade core, 3 platforms

ID #	Survey Unit	Locale	GDA East	GDA North	Description
75	SU157	SU157/L1	527465	6477412	chert pebble hammerstone (backing hammer) with pitting on one end: 43 x 38 x 34mm
76	SU158	SU158/L1	527757	6476957	grey silcrete flake: 25 x 30 x 10mm
77	SU160	SU160/L1	530719	6473877	Green chert flake portion, proximal: (13) x 13 x 6mm
78	SU160	SU160/L1	530750	6473848	grey silcrete flake portion, distal: (26) x 20 x 12mm
79	SU187	SU187/L1	522799	6487403	fine brown silcrete flake fragment: 40 x 33 x 13mm
80	SU189	SU189/L1	522637	6486976	fine grey silcrete flake: 24 x 22 x 4mm
81	SU225	SU225/L1	519579	6482624	grey silcrete flake, utilised as a multidirectional core: 28 x 29 x 24mm
82	SU226	SU226/L1	526184	6482137	fine brown silcrete flake with terrestrial cortex on distal end: 26 x 16 x 7mm
83	SU231	SU231/L2	519168	6482902	brown silcrete flake, cortex (pebble?) on platform: 25 x 18 x 8mm
84	SU231	SU231/L2	519147	6482903	brown silcrete microblade: 40 x 25 x 8mm
85	SU231	SU231/L2	519143	6482910	grey silcrete flaked piece: 15 x 13 x 7mm

Table 13. List of artefacts made from foreign material recorded in the proposal area.

The majority of artefact types in the proposal area are flakes, cores, flaked pieces and flake portions, however a range of other artefact types were observed and recorded. Technological processes evident included both free hand percussion and bipolar flaking. Abundant evidence of blade and microlith production was recorded across all landforms indicating a technology geared towards the manufacture of spear barbs for hunting. Rarer artefact types included retouched artefacts including scrapers, bondi points and adzes. Non-flaked artefacts recorded included mortars (SU108/L1 see plate 1 below), kulkis, and hammerstones. Several slabs of schist were recorded as possible grinding slabs. These items did not contain obvious grinding depressions and this is possibly a result of high levels of erosion of their surfaces; schist is known to have been utilised as grinding slabs in the region.

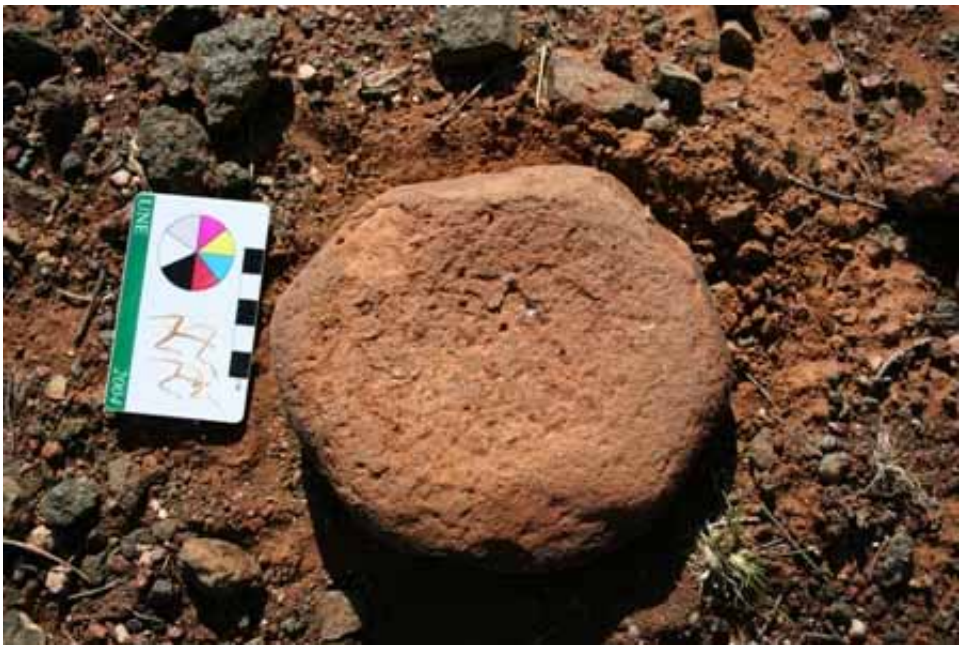

Plate 1. Stone mortar (SU108/L1).

Similarly to the pattern of foreign stone distribution, a greater abundance of retouched artefacts and tools was observed in lower landforms compared to the hills. Nevertheless the full range of stone artefact types encountered were observed across all landforms. This result indicates that the hills were utilised for a broader range of activities than might be expected. For example adzes and other retouched tools were commonly recorded in hill landforms. The recording of mortars such as that shown in Plate 1 above suggests the hills were utilised for activities such as food processing, additional to hunting and gathering.

The significant difference in artefact type pattering is that stone heat retainer hearths/ovens were recorded exclusively in the lower areas; no heat retaining hearths were recording on the hill landforms. Drainage depression landforms and flats associated with creek lines possess a relatively higher artefact density and greater abundance of

rarer artefacts types; a higher percentage of foreign stone is present in the artefact assemblages and stone oven features are common in these lower landforms. The higher artefact density and greater range of artefact types (including ovens) indicate that the lower landforms sustained higher levels of landuse associated with camping. Recorded heat retainer hearths are listed in the table below.

Name	Feature	GDA East	GDA North	Notes
SU62/L1	Hearth	525293	6482332	Very low schist and quartz hearth mound (85 x 75cm) with ashy deposit
SU62/L1	Hearth	525324	6482325	Very low schist and quartz hearth mound (60 x 65cm) with ashy deposit
SU64/L1	Hearth	525267	6482493	Very low schist and quartz hearth mound (60 x 65cm)
SU64/L1	Hearths	525378	6482411	At least 5 hearth mounds in situ, another 3 possible hearth remnants in an area of c. 50m^2
SU64/L1	Hearth	525368	6482421	Very low schist and gneiss hearth mound (70 x 60cm)
SU64/L1	Hearth	525351	6482428	Very low schist and quartz hearth mound (60 x 60cm), mostly *in situ*
SU64/L1	Hearth	525323	6482439	Very low schist and quartz hearth mound (60 x 40cm), mostly *in situ*; partially visible, probably extends to south
SU64/L1	Hearth	525314	6482499	c. 7 hearth mounds located in an area of c. 150m^2; hearths are in varying states of preservation
SU64/L1	Hearth	525311	6482461	2 hearths, largely intact, about 10m apart.
SU64/L1	Hearth	525402	6482482	Very low gneiss hearth mound (80cm x 80cm), very well preserved example
SU64/L1	Hearth	525292	6482473	ephemeral remains of a hearth
SU64/L1	Hearth	525255	6482486	Very low schist and gneiss hearth mound (100 x 60 x 10cm), mostly *in situ*
SU65/L1	Hearth	525180	6482339	Very low schist and gneiss hearth mound (50cm x 50cm), very well preserved example, covered with sediment
SU65/L1	Hearth	525174	6482432	Remains of a very low schist and gneiss hearth mound (50cm x 40cm), largely *in situ*, covered with sediment
SU65/L1	Hearth	525184	6482513	Very low schist and gneiss hearth mound remnants (30cm x 30cm)
SU132/L1	Hearth	525514	6481038	Low circular gneiss hearth mound (50cm x 50cm)
SU132/L1	Hearth	525512	6481013	Low schist and gneiss hearth mound (84cm x 85cm), well preserved example
SU136/L1	Hearth	527995	6477135	Scattered remains of a gneiss and schist hearth, very disturbed
SU136/L1	Hearth	c.527970	6477110	Very low schist and gneiss hearth mound (80 x 60cm), partially *in situ*
SU138/L1	Hearth	527805	6477906	Low gneiss hearth mound (60cm x 60cm), erosion on southern side has revealed soil profile with dark charcoal staining below the stones.
SU138/L1	Hearth	527823	6477876	Remnants of low gneiss hearth mound (60cm x 40cm).
SU138/L1	Hearth	527734	6478058	Low gneiss hearth mound (45cm across), very well preserved example.
SU140/L1	Hearth	527502	6478373	Low gneiss and amphibolite hearth mound (80cm x 60cm) relatively intact example.
SU141/L1	Hearth	526686	6478580	Low gneiss and quartz hearth mound (60cm x 60cm), largely *in situ*.
SU141/L1	Hearth	526689	6478623	Low gneiss hearth mound (75cm x 70cm), well preserved example only partially exposed.
SU141/L1	Hearth	526710	6478582	Low schist and gneiss hearth mound (80cm x 60cm), well preserved example only partially exposed
SU141/L1	Hearth	526770	6478642	Low schist and gneiss hearth mound (150cm x 90cm), partially *in situ*
SU142/L1	Hearth	527075	6479130	Pair of low schist and gneiss hearth mounds (c. 80-100cm across), partially *in situ*, one with charcoal deposit eroding out from stones
SU142/L1	Hearth	527078	6479141	Group of 6 hearths in an area of 15m x 5m. Varying states of preservation, most c.50cm across
SU142/L1	Hearth	527066	6479148	Low schist and gneiss hearth mound (80cm x 70cm), well

Name	Feature	GDA East	GDA North	Notes
				preserved example
SU147/L1	Hearth	526631	6478825	Very low hearth mound of gneiss and quartz (75cm x 60cm), well preserved example, no charcoal visible
SU147/L1	Hearth	526635	6478832	Very low hearth mound of gneiss and quartz (60cm x 45cm), well preserved example, no charcoal visible
SU147/L1	Hearth	526650	6478838	Very low hearth mound of gneiss and quartz , no charcoal visible
SU147/L1	Hearth	526627	6478800	Very low schist, quartz and granite hearth mound (60 x 70cm)
SU147/L1	Hearth	526642	6478780	Very low hearth mound of gneiss and quartz (60cm x 45cm), well preserved example, no charcoal visible
SU147/L1	Hearth	526648	6478771	Very low schist, gneiss and quartz hearth mound (100 x 80cm), mostly *in situ*
SU158/L1	Hearth	527792	6477000	Disturbed hearth mound (80cm across), no obvious signs of charcoal
SU158/L1	Hearth	527893	6477004	Group of 3 hearth mounds (each c. 70cm across), 2 relatively intact
SU158/L1	Hearth	527739	6476983	Indistinct remains of disturbed hearth mounds
SU160/L1	Hearth	527880	6476468	Partially intact hearth mound (70 x 90cm) exposed in an erosion scour
SU160/L1	Hearth	527878	6476407	Disperse remnants of low hearth mound
SU160/L1	Hearth	527936	6476243	Very low hearth mound of gneiss and schist (50 x 55cm) , clear charcoal staining
SU160/L1	Hearth	527919	6476257	Partially visible, largely intact hearth mound (50 x 55cm)
SU161/L1	Hearth	530710	6473876	Group of 10 hearths in an area of c.100m^2. Varying states of preservation, at least one very well preserved (100 x 88cm) with lots of charcoal visible
SU161/L1	Hearth	530718	6473883	Partially collapsed hearth
SU161/L1	Hearth	530723	6473913	Partially intact hearth mound (70 x 60cm)
SU161/L1	Hearth	530734	6473917	Partially intact hearth mound (55 x 55cm)
SU161/L1	Hearth	530725	6473875	Partially collapsed hearth (100 x 80cm)
SU161/L1	Hearth	530750	6473876	Indistinct remains of disturbed hearth mound (60 x 50cm)
SU161/L1	Hearth	530719	6473877	Indistinct remains of disturbed hearth mound (50 x 50cm)
SU161/L1	Hearth	530726	6473861	Partially visible, largely intact hearth mound (80 x40cm)
SU161/L1	Hearth	530721	6473843	Pair of hearth mounds (80 x 60cm; 70 x 75cm)
SU161/L1	Hearth	530728	6473840	Small hearth mound (50 x 60cm)
SU161/L1	Hearth	530704	6473817	Partially intact hearth mound (65 x 55cm)
SU161/L1	Hearth	530686	6473775	Partially collapsed hearth (110 x 90cm)
SU161/L1	Hearth	530675	6473766	Partially intact hearth mound (70 x 65cm)
SU161/L1	Hearth	530626	6473825	Largely intact hearth mound (80 x 75cm)
SU161/L1	Hearth	530590	6473833	Pair of hearth mounds (85 x 70cm; 60 x 65cm)
SU161/L1	Hearth	530568	6473845	Partially visible, largely intact hearth mound (50 x 55cm)
SU161/L1	Hearth	530562	6473866	Partially visible, largely intact hearth mound (55 x 45cm)
SU161/L1	Hearth	530564	6473899	Indistinct remains of disturbed hearth mounds
SU161/L1	Hearth	530575	6473939	Well preserved, largely intact hearth mound (80 x 80cm) with charcoal clearly visible
SU164/L1	Hearth	525378	6482411	At least 5 hearths *in situ*; another 3 possible hearths in areas measuring 50 sq m.

Table 14. Summary descriptions of individual heat retaining hearths recorded in the proposal area.

Quartz outcrops are ubiquitous in the Barrier Ranges. A total 152 quartz outcrops were recorded in the study area (Table 15 below). The majority of these outcrops/scree possessed evidence of Aboriginal exploitation.

Outcrop/Scree	SPA	Total
73	79	152
48%	52%	100%

Table 15. Frequency of quartz outcrops/scree and SPA recordings in the study area.

Quartz Stone Procurement Areas (SPA's) have been recorded across all landforms in the study area. The Table below lists SPA's recorded.

Name	Feature	GDA East	GDA North	Notes
SU2/L2	SPA	523501	6481429	Small quartz cobble (2m x 2m x 0.3m) with associated flakes and cores
SU2/L3	SPA	523515	6481582	Low quartz outcrop (2m x 2m x 0.3m) with flakes associated
SU4/L2	SPA	523386	6481115	Low quartz outcrop (3m x 2m x 0.3m)with batter marks and associated flakes
SU5/L2	SPA	523355	6481107	Small quartz outcrop (5m x 2m x 0.2m) with associated flakes and cores
SU5/L3	SPA	523334	6481079	Extensive quartz scree (60m x 40m)with small percentage of artefacts
SU9/L2	SPA	523553	6480934	Medium quartz outcrop (25m x 4m x 0.3m) with associated quartz artefacts
SU30/L1	SPA	524184	6480550	Very low quartz outcrop (3m x 2m x 0.2m) with one large Hertzian flake associated
SU41/L2	SPA	523965	6480112	Low quartz outcrop (3m x 2m x 0.3m)with batter marks and associated microblade core
SU43/L2	SPA	523601	6479808	Low quartz outcrop (30m x 10m x 0.3m), no artefacts evident
SU43/L3	SPA	523551	6479746	Low quartz outcrop (30m x 10m x 0.3m) with batter marks and associated flakes
SU43/L4	SPA	523505	6479692	Low quartz outcrop (10m x 5m x 0.2m) with batter marks
SU56/L2	SPA	522281	6477626	Low quartz outcrop (40m x 8m x 0.2m) with flakes associated
SU59/L2	SPA	523130	6478638	Low quartz outcrop (20m x 5m x 0.15m) with flakes associated
SU59/L3	SPA	523097	6478749	Low quartz outcrop (5m x 3m x 0.3m) with flakes associated
SU63/L2	SPA	525362	6482103	Low quartz outcrop (40 x 15 x 0.3m) with 1 Hertzian cone, scree contains flakes and cores
SU64/L2	SPA	525414	6482449	Small quartz cobble (0.4m x 0.4m x 0.15m) with batter marks and associated artefacts
SU76/L2	SPA	527205	6482366	Poor quality low quartz outcrop (5m x 4m x 0.8m), 1 Hertzian cone, no artefacts evident
SU86/L2	SPA	526942	6481492	Medium quartz outcrop (60m x 10m x 0.3m) with associated quartz artefacts
SU86/L3	SPA	526896	6481426	Low quartz outcrop (6m x 2m x 0.5m) with flakes associated
SU87/L2	SPA	526697	6481449	Large quartz outcrop (70m x 2m x 0.5m), 2 areas with Hertzian cones, 5% of scree (60m x 20m) is artefactual
SU87/L3	SPA	526699	6481423	Medium quartz outcrop (40m x 2m x 0.2m) with batter marks and associated cores
SU94/L2	SPA	526651	6480533	Low quartz outcrop ($3m^2$ x 0.3m)with batter marks and associated flakes; scree (15m x 2m) extends downslope and includes blades and flakes
SU94/L3	SPA	526850	6480333	Low quartz outcrop (10m x 3m x 0.5m), variable quality milky quartz, with batter marks Hertzian cones, associated flakes in scree that extends 20m downslope
SU95/L2	SPA	526502	6480864	Low quartz outcrop (10m x 3m x 0.3m) with c. $40m^2$ of scree, 1% artefactual
SU97/L2	SPA	526012	6480973	Low quartz outcrop (10m x 3m x 0.15m) with 1 Hertzian cone, associated scree contains flakes
SU97/L3	SPA	526003	6481009	Low blocky quartz outcrop ($15m^2$ x 0.15m) with batter marks and associated flakes; scree extends c. 20m downslope and includes debris from flaking and core preparation
SU98/L2	SPA	525986	6481031	Medium quartz outcrop (30m x 4m x 0.2m) with battering and associated quartz artefacts
SU101/L2	SPA	527842	6482485	Extensive quartz outcrop/vein (100m x 10m x 0.5m) with Hertzian cones and associated artefacts in scree (100m x 50m)
SU101/L3	SPA	527952	6482595	Small quartz outcrop (3m x 1m) with associated flakes and cores
SU102/L2	SPA	528802	6483705	Medium quartz outcrop (50m x 15m x 0.4m) with Hertzian cones and associated quartz artefacts in scree

Name	Feature	GDA East	GDA North	Notes
SU104/L2	SPA	529430	6484379	Small quartz outcrop (3m x 3m) with 1 Hertzian cone and associated artefacts
SU104/L3	SPA	529368	6484229	Low quartz outcrop (8m x 5m x 0.4m), good quality, with 2 Hertzian cones, batter marks and associated flakes
SU104/L4	SPA	529192	6483936	Small quartz outcrop (4m x 3m x 0.2m) with batter marks and associated artefacts
SU104/L5	SPA	529225	6484160	Low quartz outcrop (60 x 10 x 0.3m), associated blocky scree contains artefacts
SU106/L2	SPA	528724	6483971	Low quartz outcrop with batter marks and associated flakes
SU111/L2	SPA	529885	6486491	Quartz scree (30m x 5m), c. 1% artefactual
SU111/L3	SPA	529899	6486527	Quartz scree (30m x 20m), c. 5% artefactual
SU111/L4	SPA	529945	6486734	Small quartz outcrops (3m x 10m x 1m; 15m x 3m x 0.5m) with associated flakes and cores in scree (c. 40m)
SU112/L2	SPA	529630	6486404	Medium quartz outcrop (30m x 4m x 0.2m) with associated quartz artefacts; c. 2% artefactual
SU113/L2	SPA	529913	6485937	Medium quartz outcrop (8m x 20m x 0.4m) with battering and associated scree (40m x 10m) including 1% quartz artefacts
SU113/L3	SPA	529913	6485898	Small quartz outcrop (8m x 5m x 0.3m) with scree (30m x 10m) and associated artefacts
SU115/L2	SPA	529626	6485622	Small quartz outcrop (5m x 2m x 0.2m) with scree (c. 20m) and associated artefacts
SU119/L2	SPA	529253	6485469	Small quartz outcrop (c.1m^2) with scree (30m x 10m) and associated artefacts
SU119/L3	SPA	529215	6485445	Quartz scree (40m x 10m), c. 2% artefactual
SU119/L4	SPA	529120	6485376	Small quartz outcrop (5m x 5m x 0.2m) with scree (c. 20m x 30m) and associated artefacts
SU123/L2	SPA	528414	6484601	Good quality quartz outcrop (30m x 2m x 0.5m), milky grey; numerous boulders with hertzian cones, flakes and cores in associated scree.
SU126/L2	SPA	528263	6483471	Scattered small quartz outcrops, sparse artefacts associated
SU129/L2	SPA	528423	6483146	Small quartz outcrop (3m x 2m) with batter marks and associated artefacts
SU133/L2	SPA	525681	6480954	Small quartz outcrops (10m x 4m) with batter marks and associated artefacts in scree (20m x 10m)
SU144/L2	SPA	525969	6480341	Low quartz outcrop (10m x 4m) with batter marks, negative scar and associated flakes in scree (20m x 20m)
SU145/L2	SPA	526020	6479743	Low quartz outcrop (15m x 4m) with batter marks and associated flakes in scree (25m x 20m)
SU148/L2	SPA	527945	6475904	Low quartz outcrop (5m x 3m x 0.4m), with 1 hertzian cone, batter marks and sparse shatter
SU148	SPA	527965	6475882	Low quartz outcrop (3m x 3m x 0.3m), one area of batter marks and sparse shatter
SU152/L2	SPA	530444	6474207	Medium sized, excellent quality quartz outcrop (20m x 5m) with batter marks, hertzian cones and associated quartz artefacts in scree (100m x 50m).
SU155/L2	SPA	527137	6477931	Low quartz outcrop (2m x 1m x 0.15m) in pegmatite with flakes and blades associated
SU155/L3	SPA	527113	6477906	Very small quartz outcrop (0.5m^2) in pegmatite with flakes and microblades associated
SU155/L4	SPA	527111	6477861	Very small quartz outcrop (0.5m^2) in pegmatite with flakes and blades associated
SU157/L2	SPA	527455	6477423	Low quartz outcrops (c. 2m^2 each) in pegmatite outcrop (c. 20m) with flakes and cores associated.
SU157/L3	SPA	527484	6477369	Small area of quartz scree (10m^2)with blades and flakes associated within
SU158/L2	SPA	527608	6477198	Low quartz outcrop and scree (40m x 15m); very good quality material; c.30artefacts/m^2
SU159/L2	SPA	527784	6476793	Low quartz outcrop (8m x 2m x 0.4m), poor quality grey, opaque, fractured material with batter marks

Name	Feature	GDA East	GDA North	Notes
SU159	SPA	527905	6476769	Very small poor quality quartz outcrop ($1m^2$ x 0.2m), no artefacts evident
SU160/L2	SPA	527926	6476687	Two small quartz outcrops ($2m^2$ x 0.5m) in pegmatite with flakes and blades associated
SU160/L3	SPA	527870	6476686	Low quartz outcrop with batter marks, hertzian cones, hammer stone and flaking debris
SU160/L4	SPA	527935	6476676	Low quartz outcrop (5m x 2m x 0.2m) with core and flakes associated
SU161/L2	SPA	530678	6473958	Low grey quartz outcrop (5m x 0.5m x 0.1m) with flakes associated in sparse scree
SU161/L3	SPA	530687	6473901	Low quartz outcrop (15m x 2m x 0.4m), variable quality, with 2 areas of hertzian cones and associated flakes in scree
SU161/L4	SPA	530637	6474035	Small, low quartz outcrop (3m x 1m x 0.8m), reasonably homogenous white/pink quartz; hertzian cones, numerous batter marks and assorted artefacts associated
SU162/L2	SPA	522004	6484096	Low quartz outcrop (3m x 0.5m x 0.4m) with batter marks and associated flakes in scree
SU163/L2	SPA	522324	6483964	Very low dispersed quartz outcrop (15m x 1m x 0.2m) with batter marks, negative scars and associated artefacts
SU173/L2	SPA	523197	6483334	Low quartz outcrop (3m x 1m x 0.2m) with flakes associated
SU192/L2	SPA	522111	6487962	Low quartz outcrop (5m x 0.5m x 0.1m) with core and flakes associated
SU209	SPA	522651	6484868	Disperse, highly fractured quartz outcrop (15m), no artefacts evident
SU215/L2	SPA	521986	6485248	Low, highly fractured quartz outcrop (10m x 5m x 0.3m) with flakes associated in scree
SU215/L3	SPA	521758	6485242	Small quartz outcrop (10m x 8m x 0.7m) with scree and associated artefacts
SU223/L2	SPA	519848	6482333	Small quartz outcrop (2m x 1m x 0.1m) with scree (20m) and associated artefacts
SU225/L2	SPA	519497	6482600	Medium quartz outcrop (20m x 5m x 1.5m), milky opaque and fractured, with batter marks, hertzian cones and artefacts in associated scree (50m)
SU227/L1	SPA	525526	6482028	Low quartz outcrop (15m x 5m x 0.1m) with batter marks and associated flakes
SU229/L2	SPA	522932	6482229	Small, good quality quartz outcrop (12m x 5m x 0.2m) with battering marks, negative scars and extensive scree (100m x 80m) and artefacts associated

Table 16. SPA's recorded in the proposal area.

All Aboriginal object locales recorded during the survey are summarised below in Table 17 below and described more fully in Appendix 3.

Name	Feature	GDA Easting	GDA Northing	Landform	Description	Impacts
SU1/L1	Stone artefacts	523550	6481800	Crest	Quartz stone artefacts; $<1/20m^2$	Turbine envelope
SU2/L1	Stone artefacts	523490	6481500	Crest	Quartz stone artefacts; $1/m^2$	Turbine envelope
SU2/L2	SPA	523501	6481429	Crest	Small quartz outcrop with associated flakes and cores	Turbine envelope
SU2/L3	SPA	523515	6481582	Crest	Low quartz vein with flakes and blades	Turbine envelope
SU3/L1	Stone artefacts	523500	6481230	Crest	Quartz stone artefacts; $<1/20m^2$	Turbine envelope
SU4/L1	Stone artefacts	523440	6481070	Crest	Quartz stone artefacts; $<1/10m^2$	Turbine envelope
SU4/L2	SPA	523386	6481115	Crest	Quartz outcrop with batter marks and associated flakes	Turbine envelope
SU5/L1	Stone artefacts	523220	6481150	Crest	Quartz stone artefacts; $<1/10m^2$. 3 silcrete artefacts	Turbine envelope
SU5/L2	SPA	523355	6481107	Crest	Small quartz outcrop with associated flakes and cores	Turbine envelope
SU5/L3	SPA	523334	6481079	Crest	Extensive quartz scree with small percentage of artefacts	Turbine envelope

Name	Feature	GDA Easting	GDA Northing	Landform	Description	Impacts
SU6/L1	Stone artefacts	522930	6481400	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU9/L1	Stone artefacts	523530	6480950	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU9/L2	SPA	523553	6480934	Crest	Quartz outcrop with associated quartz artefacts	Turbine envelope
SU10/L1	Stone artefacts	523420	6480730	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU12/L1	Stone artefacts	522900	6480320	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU13/L1	Stone artefacts	523690	6480840	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU15/L1	Stone artefacts	523800	6481240	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU16/L1	Stone artefacts	523920	6481750	Crest	Quartz stone artefacts; <1/20m^2. 1 sedimentary flake	Turbine envelope
SU18/L1	Stone artefacts	523540	6482120	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU19/L1	Stone artefacts	523650	6482330	Crest	Quartz stone artefacts; <1/20m^2. 1 silcrete flake	Turbine envelope
SU20/L1	Stone artefacts	523750	6482491	Crest	Discrete occurrence of quartz stone artefacts	Turbine envelope
SU22/L1	Stone artefacts	524130	6482680	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU23/L1	Stone artefacts	524300	6482810	Crest	Quartz stone artefacts; <1/20m²	Turbine envelope
SU24/L1	Stone artefacts	524430	6482980	Crest	Quartz stone artefacts; <1/20m²	Turbine envelope
SU25/L1	Stone artefacts	524070	6483180	Crest	Quartz stone artefacts; <1/50m^2	Turbine envelope
SU26/L1	Stone artefacts	523820	6482970	Crest	Quartz stone artefacts; <1/50m^2	Turbine envelope
SU28/L1	Stone artefacts	524410	6481170	Crest	Quartz stone artefacts; <1/50m^2	Turbine envelope
SU29/L1	Stone artefacts	524290	6480830	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU30/L1	SPA	524184	6480550	Crest	Quartz outcrop with one associated flake	Turbine envelope
SU31/L1	Stone artefact	524221	6480212	Crest	Isolated quartz artefact	Turbine envelope
SU38/L1	Stone artefacts	523620	6479200	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU41/L1	Stone artefacts	523930	6480050	Crest	Quartz stone artefacts; <1/10m^2. 1 Quartzite kulki	Turbine envelope
SU41/L2	SPA	523965	6480112	Crest	Quartz outcrop with batter marks and associated artefact	Turbine envelope
SU42/L1	Stone artefacts	523780	6479930	Crest	Quartz stone artefacts; <1/10m^2	Turbine envelope
SU43/L1	Stone artefacts	523530	6479780	Crest	Quartz stone artefacts; <1/5m^2	Turbine envelope
SU43/L2	SPA	523601	6479808	Crest	Quartz outcrop with associated flakes	Turbine envelope
SU43/L3	SPA	523551	6479746	Crest	Quartz outcrop with Hertzian cone fractures and associated flakes	Turbine envelope
SU43/L4	SPA	523505	6479692	Crest	Quartz outcrop with batter marks	Turbine envelope
SU44/L1	Stone artefacts	523380	6479410	Crest	Quartz stone artefacts; <1/5m^2	Turbine envelope
SU45/L1	Stone artefacts	523220	6479370	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU46/L1	Stone artefacts	523120	6479330	Crest	Quartz stone artefacts; <1/5m^2	Turbine envelope
SU47/L1	Stone artefacts	522900	6479390	Crest	Quartz stone artefacts; <1/10m^2	Turbine envelope
SU48/L1	Stone artefacts	522690	6479100	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU49/L1	Stone artefacts	522500	6479040	Simple slope	Quartz stone artefacts; <1/50m^2	Turbine envelope
SU50/L1	Stone artefacts	522320	6479230	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU51/L1	Stone artefacts	522370	6478870	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU52/L1	Stone artefacts	522700	6478700	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU53/L1	Stone artefacts	522630	6478420	Crest	Quartz stone artefacts; <1/5m^2	Turbine envelope
SU54/L1	Stone artefacts	522500	6478100	Crest	Quartz stone artefacts; <1/10m^2. 1 silcrete flake	Turbine envelope
SU55/L1	Stone artefacts	522300	6478220	Crest	Quartz stone artefacts; <1/10m^2. 1 silcrete flake	Turbine envelope
SU56/L1	Stone artefacts	522320	6477800	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU56/L2	SPA	522281	6477626	Crest	Quartz outcrop with associated flakes	Turbine envelope
SU58/L1	Stone artefacts	522900	6478220	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU59/L1	Stone artefacts	523110	6478750	Crest	Quartz stone artefacts; <1/10m^2	Turbine envelope
SU59/L2	SPA	523130	6478638	Crest	Quartz outcrop with associated flakes	Turbine envelope
SU59/L3	SPA	523097	6478749	Crest	Quartz outcrop with associated flakes	Turbine envelope
SU60/L1	Stone artefacts	525100	6481930	Simple slope	Quartz stone artefacts; <1/10m^2	Substation envelope
SU61/L1	Stone artefacts	525140	6482120	Crest	Quartz stone artefacts; c.1/20m^2 -	Substation

Name	Feature	GDA Easting	GDA Northing	Landform	Description	Impacts
					20/m^2 (increasing towards creek). 1 silcrete retouched artefact, 1 chert flake fragment, 2 quartzite manuport fragments	envelope
SU62/L1	Stone artefacts; hearths	525280	6482180	Crest	Quartz stone artefacts, some with retouch; <1/20m^2 at east end, increasing to 1/m^2 towards creek. 3 silcrete flakes, 1 quartzite core, 1 quartzite manuport, 2 hearths	Substation envelope
SU63/L1	Stone artefacts	525430	6482230	Crest	Quartz stone artefacts, some with retouch and usewear; <1/20m^2. 1 silcrete flake	Substation envelope
SU63/L2	SPA	525362	6482103	Crest	Quartz outcrop with 1 Hertzian cone fracture; associated scree contains flakes and cores	Substation envelope
SU64/L1	Stone artefacts; hearths	525330	6482400	Simple slope	Quartz stone artefacts, some with retouch and usewear; c.1/m^2. Some areas may have densities approaching 50/m^2. 7 silcrete artefacts, 3 chert artefacts, 24 hearths, 1 possible gneiss grinding piece	Substation envelope
SU64/L2	SPA	525414	6482449	Simple slope	Very small, low quartz outcrop with multiple signs of battering; associated quartz shatter and artefacts	Substation envelope
SU65/L1	Stone artefacts; hearths	525140	6482370	Simple slope	Quartz stone artefacts, some with retouch and usewear; c.1/20m^2; predicted to be 30-50/m^2. 3 silcrete artefacts, 1 chert artefacts, 1 quartzite artefact, 3 hearths	Substation envelope
SU67/L1	Stone artefacts	524600	6480000	Crest	Quartz stone artefacts; <1/10m^2	Turbine envelope
SU69/L1	Stone artefacts	525070	6480000	Crest	Quartz stone artefacts, one with retouch; <1/10m²	Turbine envelope
SU70/L1	Stone artefacts	525160	6479800	Crest	Quartz stone artefacts; <1/50m². 2 quartz microblade cores	Turbine envelope
SU71/L1	Stone artefact	525310	6479630	Crest	Isolated quartz artefact	Turbine envelope
SU74/L1	Stone artefacts	524993	6480580	Crest	Discrete occurrence of 5 quartz flakes and flaked pieces	Turbine envelope
SU75/L1	Stone artefacts	525133	6481494	Crest	Discrete occurrence of 3 quartz flakes	Turbine envelope
SU76/L1	Stone artefact	527174	6482378	Crest	Isolated quartzite manuport fragment	Turbine envelope
SU76/L2	SPA	527205	6482366	Crest	Quartz outcrop with 1 Hertzian cone fracture	Turbine envelope
SU77/L1	Stone artefacts	526950	6482600	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU78/L1	Stone artefacts	526580	6482800	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU79/L1	Stone artefacts	527200	6482700	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU81/L1	Stone artefacts	526780	6482220	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope; road
SU82/L1	Stone artefacts	526470	6482220	Simple slope	Quartz stone artefacts; <1/5m^2. 1 silcrete flake	Road
SU85/L1	Stone artefacts	526980	6481670	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU86/L1	Stone artefacts	526920	6481490	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU86/L2	SPA	526942	6481491	Crest	Quartz outcrop with associated quartz artefacts	Turbine envelope
SU86/L3	SPA	526896	6481426	Crest	Quartz outcrop with associated flakes	Turbine envelope
SU87/L1	Stone artefacts	526750	6481410	Crest	Quartz stone artefacts; 1/m²	Turbine envelope
SU87/L2	SPA	526697	6481449	Crest	Large quartz outcrop with Hertzian cone fractures and associated quartz artefacts	Turbine envelope
SU87/L3	SPA	526699	6481423	Crest	Quartz outcrop with batter marks and associated quartz artefacts	Turbine envelope
SU88/L1	Stone artefacts	526900	6481290	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU89/L1	Stone artefacts	526920	6481210	Crest	Quartz stone artefacts; <1/100m^2	Turbine envelope

Name	Feature	GDA Easting	GDA Northing	Landform	Description	Impacts
SU90/L1	Stone artefacts	526950	6480930	Crest	Quartz stone artefacts, one with retouch; <1/10m^2	Turbine envelope
SU91/L1	Stone artefacts	527190	6481280	Crest	Quartz stone artefacts; <1/200m^2	Turbine envelope
SU92/L1	Stone artefacts	527180	6481000	Crest	Quartz stone artefacts, one with retouch; <1/100m^2	Turbine envelope
SU93/L1	Stone artefacts	526650	6480580	Crest	Quartz stone artefacts, one with retouch; <1/20m^2	Turbine envelope
SU94/L1	Stone artefacts	526750	6480350	Crest	Quartz stone artefacts, average density c.1/m². Some areas have densities approaching 20/m^2.	Turbine envelope
SU94/L2	SPA	526651	6480533	Crest	Quartz outcrop with batter marks and associated flakes; scree extends downslope and includes blades and flakes	Turbine envelope
SU94/L3	SPA	526850	6480333	Crest	Quartz outcrop, variable quality milky quartz, with batter marks Hertzian cone fractures, associated flakes in scree that extends 20m downslope	Turbine envelope
SU95/L1	Stone artefacts	526430	6480900	Crest	Quartz stone artefacts; <1/5m^2	Turbine envelope
SU95/L2	SPA	526502	6480864	Crest	Quartz outcrop with flakes associated	Turbine envelope
SU96/L1	Stone artefacts	526350	6480930	Crest	Quartz stone artefacts; <1/20m^2, increasing to 1/5m^2 in east	Turbine envelope
SU97/L1	Stone artefacts	526150	6480970	Crest	Quartz stone artefacts; <1/10m^2	Turbine envelope
SU97/L2	SPA	526012	6480973	Crest	Quartz outcrop with 1 Hertzian cone fracture and associated scree contains flakes	Turbine envelope
SU97/L3	SPA	526003	6481009	Crest	Blocky quartz outcrop with batter marks and associated flakes; scree extends downslope and includes debris from flaking and core preparation	Turbine envelope
SU98/L1	Stone artefacts	525950	6481060	Crest	Quartz stone artefacts; <1/10m^2	Turbine envelope
SU98/L2	SPA	525986	6481031	Crest	Quartz outcrop with battering and associated quartz artefacts	Turbine envelope
SU99/L1	Stone artefacts	525700	6481270	Crest	Quartz stone artefacts; <1/10m^2	Turbine envelope
SU100/L1	Stone artefacts	527320	6482350	Crest	Quartz stone artefacts, one with usewear; <1/20m^2	Turbine envelope
SU101/L1	Stone artefacts	527680	6482400	Crest	Quartz stone artefacts, one with usewear; <1/50m^2	Turbine envelope
SU101/L2	SPA	527842	6482485	Crest	Extensive quartz outcrop with Hertzian cone fractures and associated artefacts in scree	Turbine envelope
SU101/L3	SPA	527952	6482595	Crest	Quartz outcrop with associated flakes and cores	Turbine envelope
SU102/L1	Stone artefacts	528780	6483750	Crest	Quartz stone artefacts; 1/50m^2	Turbine envelope
SU102/L2	SPA	528802	6483705	Crest	Quartz outcrop with Hertzian cone fractures and associated quartz artefacts in scree	Turbine envelope
SU103/L1	Stone artefacts	528950	6483680	Crest	Quartz stone artefacts; <1/10m^2	Turbine envelope
SU104/L1	Stone artefacts	529430	6484290	Crest	Quartz stone artefacts; <1/20m^2. 1 silcrete flake, 1 quartzite flake, 1 possible schist grinding slab	Turbine envelope
SU104/L2	SPA	529430	6484379	Crest	Quartz outcrop with 1 Hertzian cone fracture and associated artefacts	Turbine envelope
SU104/L3	SPA	529368	6484229	Crest	Quartz outcrop, good quality, with 2 Hertzian cone fractures, batter marks and associated flakes	Turbine envelope
SU104/L4	SPA	529192	6483936	Crest	Quartz outcrop with batter marks and associated artefacts	Turbine envelope
SU104/L5	SPA	529225	6484160	Crest	Quartz outcrop, associated blocky scree contains artefacts	Turbine envelope
SU105/L1	Stone artefacts	528420	6483990	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU106/L1	Stone artefacts	528730	6483950	Crest	Quartz stone artefacts; 1/m^2	Turbine envelope

Name	Feature	GDA Easting	GDA Northing	Landform	Description	Impacts
SU106/L2	SPA	528724	6483971	Crest	Quartz outcrop with batter marks and associated flakes	Turbine envelope
SU107/L1	Stone artefacts	527820	6484250	Crest	Quartz stone artefacts, one with retouch; <1/20m^2	Turbine envelope
SU108/L1	Stone artefacts	528050	6483550	Crest	Quartz stone artefacts; <1/20m^2. 1 quartzite mortar, 1 silcrete adze slug, 1 chert adze; potential subsurface deposit at east end	Turbine envelope
SU109/L1	Stone artefacts	528320	6483800	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU110/L1	Stone artefacts	529810	6486320	Crest	Quartz stone artefacts; <1/5m^2	Turbine envelope
SU111/L1	Stone artefacts	529890	6486560	Crest	Quartz stone artefacts; <1/m^2	Turbine envelope
SU111/L2	SPA	529885	6486491	Crest	Quartz scree, c. 1% artefactual	Turbine envelope
SU111/L3	SPA	529899	6486527	Crest	Quartz scree, c. 5% artefactual	Turbine envelope
SU111/L4	SPA	529945	6486734	Crest	Two small quartz outcrops with associated flakes and cores in scree	Turbine envelope
SU112/L1	Stone artefacts	529530	6486400	Crest	Quartz stone artefacts; 1/m^2	Turbine envelope
SU112/L2	SPA	529630	6486404	Crest	Quartz outcrop with associated quartz artefacts; c. 2% artefactual	Turbine envelope
SU113/L1	Stone artefacts	529950	6486030	Crest	Quartz stone artefacts; <1/5m^2	Turbine envelope
SU113/L2	SPA	529913	6485937	Crest	Quartz outcrop with battering and associated quartz artefacts	Turbine envelope
SU113/L3	SPA	529913	6485898	Crest	Quartz outcrop with scree and associated artefacts	Turbine envelope
SU114/L1	Stone artefacts	529860	6485770	Crest	Quartz stone artefacts; 1/m^2	Turbine envelope
SU115/L1	Stone artefacts	529710	6485700	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU115/L2	SPA	529626	6485622	Crest	Quartz outcrop with scree and associated artefacts	Turbine envelope
SU116/L1	Stone artefacts	529560	6485600	Crest	Quartz stone artefacts; <1/50m^2	Turbine envelope
SU117/L1	Stone artefacts	529420	6485560	Crest	Quartz stone artefacts; <1/100m^2	Turbine envelope
SU118/L1	Stone artefacts	529300	6485500	Crest	Quartz stone artefacts; <1/100m^2	Turbine envelope
SU119/L1	Stone artefacts	529170	6485450	Crest	Quartz stone artefacts; <1/5m^2	Turbine envelope
SU119/L2	SPA	529253	6485469	Crest	Quartz outcrop with scree and associated artefacts	Turbine envelope
SU119/L3	SPA	529215	6485445	Crest	Quartz scree, c. 2% artefactual	Turbine envelope
SU119/L4	SPA	529120	6485376	Crest	Quartz outcrop with scree and associated artefacts	Turbine envelope
SU120/L1	Stone artefacts	529120	6485050	Crest	Quartz stone artefacts; 1/2m^2. 1 Quartzite flake	Turbine envelope
SU121/L1	Stone artefacts	528780	6484780	Crest	Quartz stone artefacts; <1/5m^2	Turbine envelope
SU122/L1	Stone artefacts	528630	6484620	Crest	Quartz stone artefacts, average density c.1/m^2. Increasing to c. 4/m^2 in some areas	Turbine envelope
SU123/L1	Stone artefacts	528420	6484700	Crest	Quartz stone artefacts, average density c.2/m^2. Varies from1/5m^2 to 20/m^2.	Turbine envelope
SU123/L2	SPA	528414	6484601	Crest	Good quality quartz outcrop, milky grey; numerous boulders with Hertzian cone fractures, flakes and cores in associated scree.	Turbine envelope
SU124/L1	Stone artefacts	528430	6484480	Crest	Quartz stone artefacts; <1/5m^2	Turbine envelope
SU125/L1	Stone artefacts	528410	6484300	Crest	Quartz stone artefacts; 1/2m^2	Turbine envelope
SU126/L1	Stone artefacts	528280	6483450	Crest	Quartz stone artefacts; <1/m^2, increasing to 5/m^2 on flatter areas	Turbine envelope
SU126/L2	SPA	528263	6483471	Crest	Scattered small quartz outcrops, sparse artefacts associated	Turbine envelope
SU127/L1	Stone artefacts	528240	6483260	Simple slope	Quartz stone artefacts; <1/10m^2	Turbine envelope
SU128/L1	Stone artefacts	528150	6483100	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU129/L1	Stone artefacts	528550	6483100	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU129/L2	SPA	528423	6483146	Crest	Quartz outcrop with batter marks and associated artefacts	Turbine envelope
SU130/L1	Stone artefacts	528500	6482900	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU132/L1	Stone artefacts;	525450	6481090	Open	Quartz stone artefacts; <1/10m^2. 2	Transmission line;

Name	Feature	GDA Easting	GDA Northing	Landform	Description	Impacts
	hearths			depression	hearths	access road
SU133/L1	Stone artefacts	525660	6480890	Simple slope	Quartz stone artefacts; <1/20m^2	Transmission line; access road
SU133/L2	SPA	525681	6480954	Simple slope	Quartz outcrop with batter marks and associated artefacts	Transmission line; access road
SU136/L1	Stone artefacts; hearths	527970	6477290	Simple slope	Quartz stone artefacts, some with retouch; <1/m^2. Some areas may have densities approaching 50/m^2. 2 hearths. 16 silcrete artefacts, 3 chert artefacts, 2 quartzite artefacts and 1 volcanic item potential subsurface deposit	Access road
SU137/L1	Stone artefacts	527900	6477600	Crest	Quartz stone artefacts; <1/10m^2	Access road
SU138/L1	Stone artefacts; hearths	527770	6477950	Simple slope	Quartz stone artefacts; <1/20m^2, increasing to north. 3 silcrete artefacts, 3 hearths potential subsurface deposit	Access road
SU139/L1	Stone artefacts	527580	6478290	Open depression	Quartz stone artefacts, one with retouch; <1/20m^2 potential subsurface deposit	Access road
SU140/L1	Stone artefacts; hearths	527360	6478510	Simple slope	Quartz stone artefacts; <1/20m^2. 1 hearth; potential subsurface deposit	Access road
SU141/L1	Stone artefacts; hearths	526980	6478800	Flat	Quartz stone artefacts; <1/10m^2. 4 hearths; potential subsurface deposit	Transmission line
SU142/L1	Stone artefacts; hearths	527090	6479060	Open depression	Quartz stone artefacts; <1/20m^2. Subsurface density may approach 20-30/m^2. 9 hearths; potential subsurface deposit	Access road
SU143/L1	Stone artefacts	526630	6479520	Open depression	Quartz stone artefacts, one with retouch; <1/20m^2	Access road
SU144/L1	Stone artefacts	525880	6480150	Crest	Quartz stone artefacts; <1/10m^2	Transmission line
SU144/L2	SPA	525969	6480341	Crest	Quartz outcrop with batter marks and associated flakes in scree	Transmission line
SU145/L1	Stone artefacts	526080	6479850	Simple slope	Quartz stone artefacts; <1/100m^2	Transmission line
SU145/L2	SPA	526020	6479743	Simple slope	Quartz outcrop with batter marks and associated flakes in scree	Transmission line
SU146/L1	Stone artefacts	526310	6479360	Crest	Quartz stone artefacts; <1/50m^2	Transmission line
SU147/L1	Stone artefacts; hearths	526580	6478880	Simple slope	Quartz stone artefacts; <1/50m^2 - <1/5m^2. Subsurface density adjacent to creek may approach 50/m^2. 3 silcrete artefacts, 6 hearths	Transmission line
SU148/L1	Stone artefacts	527900	6476020	Crest	Quartz stone artefacts; <1/100m^2	Transmission line
SU148/L2	SPA	527945	6475904	Crest	Quartz outcrop with 1 Hertzian cone fracture	Transmission line
SU148/L3	SPA	527965	6475882	Crest	Quartz outcrop, one area of batter marks	Transmission line; access road
SU150/L1	Stone artefacts	528150	6475500	Crest	Quartz stone artefacts; <1/100m^2	Transmission line; access road
SU151a/L1	Stone artefacts	528700	6475100	Simple slope	Quartz stone artefacts; <1/100m^2	Transmission line; access road
SU151b/L1	Stone artefacts	529780	6474500	Simple slope	Quartz stone artefacts; <1/100m^2	Transmission line
SU152/L1	Stone artefacts	530420	6474220	Simple slope	Quartz stone artefacts; <1/5m^2	Transmission line
SU152/L2	SPA	530444	6474207	Crest	Excellent quality quartz outcrop with batter marks, Hertzian cone fractures and associated quartz artefacts in scree.	Transmission line
SU153/L1	Stone artefacts	529210	6474750	Crest	Quartz stone artefacts; <1/50m^2	Transmission line
SU154/L1	Stone artefacts	527000	6478275	Simple slope	Quartz stone artefacts; <1/20m^2	Transmission line
SU155/L1	Stone artefacts	527210	6478970	Crest	Quartz stone artefacts; <1/20m^2	Transmission line

Name	Feature	GDA Easting	GDA Northing	Landform	Description	Impacts
SU155/L2	SPA	527137	6477931	Crest	Quartz outcrop in pegmatite with flakes and blades associated	Transmission line
SU155/L3	SPA	527113	6477906	Crest	Very small quartz outcrop in pegmatite with flakes and microblades associated	Transmission line
SU155/L4	SPA	527111	6477861	Crest	Very small quartz outcrop in pegmatite with flakes and blades associated	Transmission line
SU156/L1	Stone artefacts	527325	6477800	Simple slope	Quartz stone artefacts; <1/20m^2	Transmission line; access road
SU157/L1	Stone artefacts	527515	6477450	Crest	Quartz stone artefacts; <1/10m^2, increasing to 5/m^2 in some areas. 1 chert hammerstone	Transmission line
SU157/L2	SPA	527455	6477423	Crest	Quartz outcrops in pegmatite with flakes and cores associated.	Transmission line
SU157/L3	SPA	527484	6477369	Crest	Small area of quartz scree with blades and flakes associated within	Transmission line
SU158/L1	Stone artefacts; hearths	527730	6477080	Simple slope	Quartz stone artefacts, some with retouch and usewear; <1/5m^2. 1 silcrete flake, at least 4 hearths, 2 possible gneiss mortars subsurface potential	Transmission line
SU158/L2	SPA	527608	6477198	Simple slope	Quartz outcrop and scree; very good quality material; c.30 artefacts/m^2	Transmission line; access road
SU159/L1	Stone artefacts; hearths	527876	6476860	Simple slope	Quartz stone artefacts, some with retouch and usewear; <1/5m^2 subsurface potential	Transmission line; access road
SU159/L2	SPA	527784	6476793	Simple slope	Quartz outcrop, poor quality grey, opaque, fractured material with batter marks	Transmission line
SU160/L1	Stone artefacts; hearths	528100	6476460	Crest	Quartz stone artefacts, some with retouch and usewear; <1/20m^2, predicted to be up to 2/m^2 subsurface. 4 hearths	Transmission line; access road
SU160/L2	SPA	527926	6476687	Crest	Two small quartz outcrops in pegmatite with flakes and blades associated	Transmission line; access road
SU160/L3	SPA	527935	6476676	Crest	Quartz outcrop with core and flakes associated	Transmission line; access road
SU160/L4	SPA	527870	6476686	Crest	Quartz outcrop with batter marks, Hertzian cone fractures, hammer stone and flaking debris	Transmission line; access road
SU161/L1	Stone artefacts; hearths	530650	6473850	Simple slope	Complex of 50 or more hearths with predicted artefact density approaching 20-50/m^2. Sections of intact cultural deposit	Transmission line
SU161/L2	SPA	530678	6473958	Simple slope	Quartz outcrop; grey quartz; with flakes associated in sparse scree	Transmission line
SU161/L3	SPA	530687	6473901	Simple slope	Quartz outcrop, variable quality, with 2 areas of Hertzian cones and associated flakes in scree	Transmission line
SU161/L4	SPA	530637	6474035	Simple slope	Quartz outcrop, reasonably homogenous white/pink quartz; Hertzian cone fractures, numerous batter marks and associated artefacts	Transmission line; access road
SU162/L1	Stone artefacts	522060	6484050	Crest	Quartz stone artefacts; <1/50m^2	Turbine envelope
SU162/L2	SPA	522004	6484096	Crest	Quartz outcrop with batter marks and associated flakes in scree	Turbine envelope
SU163/L1	Stone artefacts	522360	6483950	Crest	Quartz stone artefacts; <1/100m^2	Turbine envelope
SU163/L2	SPA	522324	6483964	Crest	Very low dispersed quartz outcrop with batter marks, 1 Hertzian cone and associated artefacts	Turbine envelope

Name	Feature	GDA Easting	GDA Northing	Landform	Description	Impacts
SU165/L1	Stone artefacts	522700	6484210	Simple slope	Discrete small occurrence of quartz stone artefacts in small saddle; <1/5m^2	Turbine envelope
SU167/L1	Stone artefacts	522900	6484250	Crest	Quartz stone artefacts; <1/100m^2	Turbine envelope
SU168/L1	Stone artefacts	522910	6483780	Crest	Quartz stone artefacts; <1/50m^2	Turbine envelope
SU173/L1	Stone artefacts	523180	6483350	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU173/L2	SPA	523197	6483334	Crest	Quartz outcrop with flakes associated	Turbine envelope
SU174/L1	Stone artefacts	523220	6483660	Crest	Quartz stone artefacts, 1 with retouch; <1/50m^2	Turbine envelope
SU175/L1	Stone artefacts	523300	6483750	Crest	Quartz stone artefacts; <1/100m^2	Turbine envelope
SU177/L1	Stone artefacts	522240	6484320	Crest	Quartz stone artefacts; <1/5m^2	Turbine envelope
SU178/L1	Stone artefacts	521220	6484970	Crest	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU182/L1	Stone artefacts	522100	6487320	Crest	Quartz stone artefacts; <1/50m^2	Turbine envelope
SU183/L1	Stone artefacts	522280	6487430	Crest	Quartz stone artefacts; <1/200m^2	Turbine envelope
SU184/L1	Stone artefacts	522610	6487570	Ridge	Quartz stone artefacts; <1/20m^2	Turbine envelope
SU185/L1	Stone artefacts	522820	6487650	Crest	Quartz stone artefacts, including hammerstone; <1/5m^2	Turbine envelope
SU186/L1	Stone artefacts	522940	6487790	Crest	Quartz stone artefacts; <1/10m^2	Turbine envelope
SU187/L1	Stone artefacts	522800	6487410	Crest	Quartz stone artefacts; <1/10m^2. 1 silcrete flake fragment	Turbine envelope
SU189/L1	Stone artefacts	522760	6487000	Crest	Quartz stone artefacts; <1/50m^2. 1 silcrete flake	Turbine envelope
SU190/L1	Stone artefacts	522480	6486950	Crest	Quartz stone artefacts; <1/50m^2.	Turbine envelope
SU192/L1	Stone artefacts	522260	6487925	Crest	Quartz stone artefacts; <1/20m^2.	Turbine envelope
SU192/L2	SPA	522111	6487962	Crest	Quartz outcrop with core and flakes associated	Turbine envelope
SU193/L1	Stone artefacts	522500	6487950	Crest	Quartz stone artefacts; <1/20m^2.	Turbine envelope
SU194/L1	Stone artefacts	522510	6488100	Crest	Quartz stone artefacts; <1/50m^2.	Turbine envelope
SU195/L1	Stone artefacts	522325	6488075	Crest	Quartz stone artefacts; <1/100m^2.	Turbine envelope
SU197/L1	Stone artefacts	521230	6482180	Crest	Quartz stone artefacts; <1/20m^2.	Access road
SU198/L1	Stone artefacts	523125	6484350	Crest	Quartz stone artefacts; <1/50m^2.	Turbine envelope
SU199/L1	Stone artefacts	523375	6484500	Crest	Quartz stone artefacts; <1/20m^2.	Turbine envelope
SU200/L1	Stone artefacts	523500	6484625	Crest	Quartz stone artefacts; <1/50m^2.	Turbine envelope
SU201/L1	Stone artefacts	522900	6484425	Crest	Quartz stone artefacts; <1/100m^2.	Turbine envelope
SU202/L1	Stone artefacts	522900	6484600	Crest	Quartz stone artefacts; <1/5m^2.	Turbine envelope
SU203/L1	Stone artefacts	522900	6484725	Crest	Quartz stone artefacts; <1/20m^2.	Turbine envelope
SU205/L1	Stone artefacts	522980	6484930	Crest	Quartz stone artefacts; <1/5m^2.	Turbine envelope
SU209/L1	Stone artefacts	522625	6484840	Crest	Quartz stone artefacts; <1/5m^2.	Turbine envelope
SU209/L2	SPA	522651	6484868	Crest	Dispersed quartz vein with scree and associated artefacts	Turbine envelope
SU210/L1	Stone artefacts	522600	6485025	Crest	Quartz stone artefacts, including cores and a portable quartz block anvil; <1/5m^2.	Turbine envelope
SU211/L1	Stone artefacts	522500	6485100	Crest	Quartz stone artefacts; <1/50m^2.	Turbine envelope
SU212/L1	Stone artefacts	522400	6485190	Crest	Quartz stone artefacts; <1/50m^2.	Turbine envelope
SU213/L1	Stone artefacts	522275	6485250	Crest	Quartz stone artefacts; <1/50m^2.	Turbine envelope
SU215/L1	Stone artefacts	521920	6485260	Crest	Quartz stone artefacts; <1/50m^2, mainly at northwest end.	Turbine envelope
SU215/L2	SPA	521986	6485248	Crest	Quartz outcrop; highly fractured; with flakes associated in scree	Turbine envelope
SU215/L3	SPA	521758	6485242	Crest	Quartz outcrop with scree and associated artefacts	Turbine envelope
SU216/L1	Stone artefacts	521575	6485200	Crest	Quartz stone artefacts; <1/5m^2, increasing in east to 1/m^2.	Turbine envelope
SU218/L1	Stone artefacts	520950	6482190	Crest	Quartz stone artefacts; <1/m^2.	Access road
SU219/L1	Stone artefacts	520530	6482310	Crest	Quartz stone artefacts; <1/20m^2.	Access road
SU220/L1	Stone artefacts	520380	6482300	Crest	Quartz stone artefacts; <1/50m^2.	Access road
SU221/L1	Stone artefacts	520320	6482220	Crest	Quartz stone artefacts; <1/50m^2.	Access road
SU222/L1	Stone artefacts	520290	6482125	Crest	Quartz stone artefacts; <1/20m^2.	Access road
SU223/L1	Stone artefacts	519950	6482250	Crest	Quartz stone artefacts; <1/5m^2.	Access road
SU224/L1	Stone artefacts	519850	6482350	Crest	Quartz stone artefacts; <1/5m^2.	Access road
SU224/L2	SPA	519848	6482333	Crest	Quartz outcrop with scree and associated artefacts	Access road
SU225/L1	Stone artefacts	519500	6482600	Crest	Quartz stone artefacts; <1/5m^2. 1	Access road

Name	Feature	GDA Easting	GDA Northing	Landform	Description	Impacts
					silcrete flake	
SU225/L2	SPA	519497	6482600	Crest	Quartz outcrop, milky opaque and fractured, with batter marks, Hertzian cone fractures and artefacts in associated scree	Access road
SU226/L1	Stone artefacts	526100	6482150	Crest	Quartz stone artefacts; <1/100m^2. 1 silcrete flake	Access road
SU227/L1	SPA	525526	6482028	Simple slope	Quartz outcrop with batter marks and associated flakes	Access road
SU229/L1	Stone artefacts	522820	6482230	Open depression	Quartz stone artefacts, varying density, average 10/m^2.	Access road
SU229/L2	SPA	522932	6482229	Open depression	Good quality quartz outcrop with battering marks, negative scars and extensive scree and artefacts associated; potential subsurface deposit	Access road
SU230/L1	Stone artefacts	522430	6482260	Simple slope	Quartz stone artefacts; <1/20m^2.	Access road
SU231/L1	Stone artefacts	519000	6482810	Simple slope	Quartz stone artefacts; <1/50m^2.	Access road
SU231/L2	Stone arrangement	519173	6482885	Simple slope	Possible stone arrangement consisting of 2 low stone mounds (3.4m across, 0.35m high; 1m x 0.8m x 0.2m), both features partially covered by wind blown dirt. 3 silcrete artefacts adjacent	Access road

Table 17. Summary description of Aboriginal Object locales recorded in the proposal area.

9.3 Survey Results – Non Indigenous

There are no previously recorded historical sites within the proposal area that are listed on any of the local or State heritage registers. However, in the course of surveys and research 24 historical features were recorded. These recordings largely include sites that relate to mining activities, although there are also a small number of recordings that relate to pastoral and transport activities. A total of 22 of the recordings are located in or immediately adjacent potential impact zones. Lakes' Grave, an important local landmark, and the remains of a nearby camp or settlement were also recorded; these items are outside proposed impact zones for Stage 1.

Of those recordings that correspond to impact zones there are two small twentieth century sites that relate to farming activities (SU141/HS1: Farm equipment/stockpile, SU141/HS2: Stockyards), two recordings of old road alignments that appear to be associated with nearby mines (SU93/HS1, SU191/HS3), nine recordings of building remains (SU62/L1, SU90/HS2, SU90/HS3, SU90/HS4, SU94/HS1, SU94/HS2, SU143/HS1, SU191/HS1 & SU191/HS2), there are three recordings of prospecting pits and other small mining explorations (SU32/HS1, SU54/HS1 & SU226/HS1), one recording of a stone cairn that appears to be a mine lease marker (SU191/HS1), one recording of infrastructure associated with the Umberumberka Reservoir (SU53/HS1) and two recordings of more substantial mine workings that appear to be associated with the Iron Duke mine (SU90/HS1, SU92/HS1). There are also basic site details provided for the Corruga zinc sintering works and a nearby section of the Silverton Tramway; these locations were not however visited during the surveys. A summary of the historical recordings and their grid references is provided below in Table 18. More complete site descriptions and photographs are provided in the Historical Site Gazetteer in Volume 2 - Appendix 4.

Name	GDA Easting	GDA Northing	Description	Impacts
SU32/HS1	524500	6478350	Prospecting pits, probably associated with LC 280	Turbine envelope
SU53/HS1	522560	6478388	Blue Anchor Tank and pipeline, part of the Umberumberka Reservoir infrastructure	Turbine envelope
SU54/HS1	522437	6478017	Prospecting pits, probably associated with U 0033	Turbine envelope
SU62/HS1	525234	6482292	Building platform with intact deposit, probably dates to 19th century	Substation envelope
SU90/HS1	526822	6480842	Mine workings, part of the Iron Duke complex	Turbine envelope
SU90/HS2	526901	6480842	Building platform and costeans, part of the Iron Duke complex. Moderate/high potential for subsurface archaeological material	Turbine envelope
SU90/HS3	526722	6480822	Forge. Well preserved forge hearth with slag and other metal artefacts associated. High excavation/research potential	Turbine envelope
SU90/HS4	526718	6480788	Building platform	Turbine envelope
SU92/HS1	527273	6480984	Mine workings, part of the Iron Duke complex	Turbine envelope
SU93/HS1	526660	6480590	Old road cutting that links Iron Duke workings with roads along Lake's Grave Creek	Turbine envelope
SU94/HS1	526731	6480379	Forge. Well preserved forge hearth, wooden stump and intact building platform. High potential for *in situ* subsurface remains	Turbine envelope
SU94/HS2	526767	6480349	Large building platform, probably associated with Iron Duke workings	Turbine envelope
SU141/HS1	526678	6478571	Farming equipment/stockpile. Assorted pieces of machinery parts and building material remains	Transmission line
SU141/HS2	526751	6478690	Stock yards. Mid 20th century yards built from mulga and steel, various phases of modification evidenced	Transmission line
SU143/HS1	525924	6480599	Artefact scatter and building platform/hearth, probably dates to 19th century. Moderate potential for subsurface artefacts and other structural evidence	Access road
SU190/HS1	522495	6486969	Stone cairn. Probably a mine lease marker associated with adjacent mines	Turbine envelope
SU191/HS1	522296	6487120	Building platform with associated artefact scatter and intact deposit, probably dates to early 20th century	Turbine envelope
SU191/HS2	522268	6487130	Building platform with intact deposit, probably dates to early 20th century	Turbine envelope
SU191/HS3	522132	6487128	Road associated with SU191/HS1 and SU191/HS2	Turbine envelope
SU226/HS1	525845	6482125	Costean	Access road
Lake's Grave	527862	6480066	Grave site of William Henry Lake	None proposed
Stone ruins	527575	6479935	Stone ruins, probable remains of a series of hearths and associated building platforms. Possibly associated with the Iron Duke mine. High potential for subsurface archaeological material	None proposed
Zinc sintering works	536100	6465800	Remains of Silverton Tramway permanent way embankment, with lines of slag and reject bricks running parallel, fire boxes, roasting mounds and remains of stone and brick houses	Transmission line
Silverton Tramway	536500-537500	6465300-6464800	Section of the Silverton Tramway to the southeast of the zinc sintering works	Transmission line

Table 18. Historical features recorded in the project area.

10. STATUTORY CONTEXT

The Environmental Planning and Assessment Act 1979

The Environmental Planning and Assessment Act 1979 (EP&A Act), its regulations, schedules and guidelines provides the context for the requirement for environmental impact assessments to be undertaken during land use planning (NPWS 1997).

Part 3A of the Environmental Planning and Assessment Act 1979

On 9 June 2005 the NSW Parliament passed the Environmental Planning and Assessment Amendment (Infrastructure and Other Planning Reform) Bill. The Act was assented to on 16 June 2005 and commenced on 1 August 2005. This amendment contains key elements of the NSW Government's planning system reforms and makes major changes to both plan-making and major development assessment.

Fully operational in August 2005, the major projects assessment system includes:

- a new part of the *Environmental Planning and Assessment Act 1979* (EP&A Act) — known as Part 3A — which defines the way a project should be assessed.
- State Environmental Planning Policy (Major Projects) 2005 — which defines what projects are subject to Part 3A and require ministerial approval.

The Silverton Wind Farm has been declared a major project under Part 3A of the Act and furthermore has been declared to be 'critical infrastructure'. The environmental assessment process for critical infrastructure is the same as for any other major project, that is, the Director-General of the Department of Planning establishes requirements which outline the key issues that a proponent must address in its environmental assessment of the project. Relevant government agencies such as the Department of Environment and Climate Change and the Heritage Council of NSW are consulted in developing these requirements.

The Director-General's Environmental Assessment Requirements, pursuant to section 75F(2) of the *Environmental Planning and Assessment Act 1979*, for the Silverton Wind Farm were prepared following a Planning Focus Meeting held in consultation with relevant government agencies on 14 and 15 November 2007. With regard to Non Indigenous heritage the Director-General's requirements state that:

> The EA must include an assessment of the potential impact on Non Indigenous heritage values/items and proposed mitigation measures. The assessment should be undertaken in accordance with the updated guidelines in the NSW Heritage Manual and a Statement of Heritage Impact prepared.

With regard to Indigenous heritage the Director-General's requirements state that:

> The EA must include an assessment of the potential impact on Aboriginal heritage values/items and proposed mitigation measures in accordance with the Draft Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation.

Under the terms of Part 3A of the Environmental Planning and Assessment Act 1979 the following authorizations are not required for an approved project (and accordingly the provisions of an Act that prohibit an activity without such an authority do not apply):

- a permit under section 87 or a consent under section 90 of the National Parks and Wildlife Act 1974; and
- an approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977*.

11. SIGNIFICANCE ASSESSMENT

The information provided in this report and the assessment of significance of Aboriginal objects provides the basis for the proponent to make informed decisions regarding the management and degree of protection which should be undertaken in regard to the Aboriginal objects and Non Indigenous items located within the study area.

11.1 Significance Assessment Criteria - Indigenous

The NPWS (1997) defines significance as relating to the meaning of sites: "meaning is to do with the values people put on things, places, sites, land". The following significance assessment criteria is derived from the relevant aspects of ICOMOS Burra Charter and NSW Department of Urban Affairs and Planning's 'State Heritage Inventory Evaluation Criteria and Management Guidelines'.

Aboriginal archaeological sites are assessed under the following categories of significance:

- cultural value to contemporary Aboriginal people,
- archaeological value,
- aesthetic value,
- representativeness, and
- educational value.

Aboriginal cultural significance

The Aboriginal community will value a place in accordance with a variety of factors including contemporary associations and beliefs and historical relationships. Most heritage evidence is valued by Aboriginal people given its symbolic embodiment and physical relationship with their ancestral past.

Archaeological value

The assessment of archaeological value involves determining the potential of a place to provide information which is of value in scientific analysis and the resolution of potential archaeological research questions. Relevant research topics may be defined and addressed within the academy, the context of cultural heritage management or Aboriginal communities. Increasingly, research issues are being constructed with reference to the broader landscape rather than focusing specifically on individual site locales. In order to assess scientific value sites are evaluated in terms of nature of the evidence, whether or not they contain undisturbed artefactual material, occur within a context which enables the testing of certain propositions, are very old or contain significant time depth, contain large artefactual assemblages or material diversity, have unusual characteristics, are of good preservation, or are a part of a larger site complex. Increasingly, a range of site types, including low density artefact distributions, are regarded to be just as important as high density sites for providing research opportunities.

Representativeness

Representative value is the degree to which a "class of sites are conserved and whether the particular site being assessed should be conserved in order to ensure that we retain a representative sample of the archaeological record as a whole" (NPWS 1997). Factors defined by NPWS (1997) for assessing sites in terms of representativeness include defining variability, knowing what is already conserved and considering the connectivity of sites.

Educational value

The educational value of cultural heritage is dependent on the potential for interpretation to a general visitor audience, compatible Aboriginal values, a resistant site fabric, and feasible site access and management resources.

Aesthetic value

Aesthetic value relates to aspects of sensory perception. This value is culturally contingent.

11.2 Significance Value of the Aboriginal Objects in the Study Area

The predominant Aboriginal object found in the proposal area is distributions of stone artefacts. Stone artefact scatters are a common site type in the local area and wider region. In the proposal area stone artefacts have been found to be distributed in a virtual continuum and occur in all environmental contexts.

However the density of stone artefact distributions varies significantly from very low (<1 per square metre) to moderate (30 - 50 per square metre). The density of the stone artefact distribution is assumed to be related, at least in part, to environmental factors such as the nature of the terrain (landform element, gradient and slope), proximity to water and other resources.

The stone artefact distributions have also be found to be variable in terms of the types of raw materials present and the nature of the artefacts. These differences are likely to reflect differences in site function ie different activities undertaken in different places. Therefore, stone artefact distributions, while common, will each have the potential to provide unique archaeological data and hence interpretive value within a research context.

Furthermore if each stone artefact locale is considered to be a component of a broader network of site types and distribution in the wider landscape they can then be considered to be of a higher research value.

Quartz stone procurement areas are common sites in the proposal area. Similarly to stone artefact distributions these sites vary greatly in the flaking quality of quartz, their size, the nature of procurement evidence and their relationship to associated stone artefacts. The majority of these sites in the proposal area possess very low levels of obvious use and extraction while some have extensive evidence of use. This site type has the potential for research projects looking at reduction analysis, technology and patterns of landuse.

Heat retainer hearths possess relatively high research potential both individually and as clustered suites. A number of recent studies relating to heat retainer hearths have been conducted in the region. These studies have been focused on dating of charcoal fragments in the hearths for the purposes of analyzing occupational patterns in the region. Accordingly those hearths situated within the proposal area have high potential for use within comparative research programs.

It is noted that Aboriginal heritage sites often have high cultural value to the local Aboriginal community given that they provide direct physical and symbolic linkages to their ancestral past and to the landscape. The cultural values of the identified sites may possibly differ to the archaeological significance values.

Table 19 below sets out the archaeological values of each of the recorded Aboriginal object locales recorded during the study. It is emphasized that the majority of the locales are assessed to be of low archaeological significance. However many locales are assessed to be of low/moderate and moderate significance; several locales are assessed to be of high significance.

While the archaeological significance of each locale has necessarily been assessed on individual merits it is emphasized that when considered as a suite of sites reflecting the occupation of a larger landscape context, the overall archaeological potential of the archaeological resource in the project area in increased.

Name	Significance	Criteria
SU1/L1: Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU2/L1 Low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU2/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at this locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU2/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU3/L1: Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU4/L1: Very low density stone	Low local archaeological	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil:

Name	Significance	Criteria
artefacts	significance	limited excavation potential
SU4/L2 SPA and associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU5/L1: Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU5/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU5/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU6/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU9/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU9/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU10/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU12/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU13/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU15/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU16/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU18/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU19/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU20/L1 Discrete cluster of stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU22/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU23/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU24/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU25/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU26/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU28/L1 Very low density stone	Low local archaeological	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil:

Name	Significance	Criteria
artefacts	significance	limited excavation potential
SU29/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU30/L1 SPA with one flake	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: very low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU31/L1 Isolated quartz artefact	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low/negligible artefact density in survey unit; site not predicted to be larger than recorded; skeletal/deflated soil: limited excavation potential
SU38/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU41/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU41/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU42/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU43/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU43/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU43/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU43/L4 SPA	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU44/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU45/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU46/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU47/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU48/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU49/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low/negligible artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU50/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU51/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU52/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU53/L1	Low local	Common Aboriginal object and site type, low educational value, low aesthetic value,

Name	Significance	Criteria
Very low density stone artefacts	archaeological significance	low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU54/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU55/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU56/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU56/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU58/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU59/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU59/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU59/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU60/L1 Very low density stone artefacts with subsurface archaeological potential adjacent to creek	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited subsurface potential generally however moderate excavation potential adjacent to creek
SU61/L1 Low density stone artefacts with subsurface archaeological potential adjacent to creek	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in survey unit; skeletal/deflated soil: limited subsurface potential generally however moderate/high excavation potential adjacent to creek and minor drainage lines
SU62/L1 Very low density stone artefacts with 2 hearths	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: very low artefact density in survey unit; skeletal/deflated soil: limited subsurface potential generally however moderate/high excavation potential adjacent to creek and minor drainage lines
SU63/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU63/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU64/L1 Moderate density stone artefacts with 24 hearths; subsurface potential	Moderate/high local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, moderate/high research potential: predicted moderate artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU64/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low artefact density in locale; low/moderate research potential: excavation potential
SU65/L1 Moderate density stone artefacts with 3 hearths	Moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, moderate research potential: predicted moderate artefact density in survey unit; high disturbance: a certain excavation potential
SU67/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU69/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential

Name	Significance	Criteria
SU70/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low/negligible artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU71/L1 Isolated artefact	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low/negligible artefact density in survey unit; site not predicted to be larger than recorded skeletal/deflated soil: limited excavation potential
SU74/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU75/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU76/L1 Isolated artefact	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; site not predicted to be larger than recorded skeletal/deflated soil: limited excavation potential
SU76/L2 SPA	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU77/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU78/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU79/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU81/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU82/L1 Low/moderate density stone artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low/moderate artefact density in survey unit; excavation potential across survey unit
SU85/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU86/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU86/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU86/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU87/L1 Low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU87/L2 SPA with associated artefacts	Moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU87/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU88/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU89/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low/negligible artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU90/L1 Very low density stone	Low local archaeological	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil:

Name	Significance	Criteria
artefacts	significance	limited excavation potential
SU91/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low/negligible artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU92/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU93/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU94/L1 Low density stone artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU94/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU94/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU95/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU95/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU96/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU97/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU97/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU97/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU98/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU98/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU99/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU100/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU101/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU101/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU101/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential

Name	Significance	Criteria
SU102/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU102/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU103/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU104/L1 Very low density stone artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU104/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU104/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU104/L4 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU104/L5 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU105/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU106/L1 Low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU106/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU107/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU108/L1 Low density stone artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type (however some rare artefacts and foreign stone materials), low educational value, low aesthetic value, low/moderate research potential: low artefact density in survey unit; skeletal/deflated soil: limited excavation potential generally except for east end
SU109/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU110/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU111/L1 Low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU111/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU111/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU111/L4 SPA with associated artefacts	Low/moderate local archaeological	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential

Name	Significance	Criteria
	significance	
SU112/L1 Low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU112/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU113/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU113/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU113/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU114/L1 Low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU115/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU115/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU116/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU117/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU118/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU119/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU119/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU119/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU119/L4 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU120/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU121/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU122/L1 Low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU123/L1 Low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU123/L2 SPA with associated	Low/moderate local	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil:

Name	Significance	Criteria
artefacts	archaeological significance	limited excavation potential however a certain analytical potential
SU124/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU125/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU126/L1 Low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU126/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU127/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU128/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU129/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU129/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU130/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU132/L1 Low density stone artefacts with 2 hearths	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in survey unit; skeletal/deflated soil: excavation potential
SU133/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU133/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU136/L1 Predicted moderate density stone artefacts with 3 hearths; predicted subsurface deposit	Moderate/high local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, moderate/high research potential: predicted moderate artefact density in survey unit; excavation potential across survey unit
SU137/L1 Low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU138/L1 Low density stone artefacts with 3 hearths with predicted subsurface deposit	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in survey unit; excavation potential across survey unit
SU139/L1 Low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; a certain excavation potential
SU140/L1 Low density stone artefacts with 1 hearth	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; a certain excavation potential
SU141/L1 Moderate density stone artefacts with 4 hearths with predicted subsurface deposit	Moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, moderate research potential: predicted moderate artefact density in survey unit
SU142/L1	Low/moderate	Common Aboriginal object and site type, low educational value, low aesthetic value,

Name	Significance	Criteria
Low/moderate density stone artefacts with 9 hearths	local archaeological significance	low/moderate research potential: predicted low/moderate artefact density in survey unit however high geomorphological and human disturbance
SU143/L1 Low/moderate density stone artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: excavation potential across survey unit
SU144/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU144/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU145/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU145/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU146/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU147/L1 Moderate density stone artefacts with 6 hearths	Moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, moderate research potential: predicted moderate artefact density in south end of survey unit; excavation potential at south end of survey unit in area measuring c. 70 x 70 m adjacent to creek
SU148/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU148/L2 SPA	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU148/L3 SPA	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU150/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; limited excavation potential
SU151a/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; limited excavation potential due to geomorphological processes
SU151b/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; limited excavation potential due to geomorphological processes
SU152/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: generally limited excavation potential
SU152/L2 SPA with associated artefacts	High archaeological significance	Common Aboriginal object and site type, excellent example of high quality quartz resource; moderate educational value, moderate/high aesthetic value, high research potential: predicted moderate/high artefact density at this locale
SU153/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU154/L1 Moderate density stone artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, moderate research potential: potential moderate artefact density in survey unit; moderate excavation potential
SU155/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low/moderate excavation potential
SU155/L2 SPA with associated artefacts	Low/moderate local archaeological	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential

Name	Significance	Criteria
	significance	
SU155/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU155/L4 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU156/L1 Low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; moderate excavation potential however low artefact density predicted
SU157/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU157/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU157/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU158/L1 Moderate density stone artefacts with 6 hearths	Moderate/high local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, moderate/high research potential: predicted moderate artefact density within 100m of creek; excavation potential adjacent creek
SU158/L2 SPA with associated artefacts	Moderate/high local archaeological significance	Common Aboriginal object and site type, good example of high quality quartz resource, moderate educational value, low aesthetic value, moderate/high research potential: predicted moderate artefact density at this locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU159/L1 Moderate density stone artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: predicted moderate artefact density in survey unit; excavation potential
SU159/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU160/L1 Low/moderate density stone artefacts with 4 hearths	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density in survey unit; moderate excavation potential
SU160/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU160/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU160/L4 SPA with associated artefacts	Moderate local archaeological significance	Common Aboriginal object and site type, moderate/high educational value, low aesthetic value, moderate research potential: good example of stone procurement area complete with hammerstone and flaking debris, low artefact density at this locale; a certain excavation potential
SU161/L1 Extensive complex of hearths with moderate density artefacts	High local archaeological significance	Common Aboriginal object and site type, however it is a relatively rare example of such a large complex with intact deposit, moderate/high educational value, low aesthetic value, high research potential: predicted moderate artefact density at this locale; excellent excavation potential at this locale
SU161/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU161/L3 SPA with associated artefacts	Low/moderate local archaeological	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential

Name	Significance	Criteria
	significance	
SU161/L4 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU162/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU162/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU163/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU163/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU165/L1 Discrete occurrence of very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low/negligible artefact density in survey unit; locale not predicted to be larger than recorded; skeletal/deflated soil: limited excavation potential
SU167/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU168/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU173/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU173/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU174/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU175/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU177/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU178/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU182/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU183/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU184/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU185/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU186/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU187/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU189/L1	Low local	Common Aboriginal object and site type, low educational value, low aesthetic value,

Name	Significance	Criteria
Very low density stone artefacts	archaeological significance	low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU190/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU192/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU192/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU193/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU194/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU195/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU197/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU198/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU199/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU200/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU201/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU202/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU203/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU205/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU209/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU209/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU210/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU211/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU212/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU213/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU215/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential

Name	Significance	Criteria
SU215/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU215/L3 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU216/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU218/L1 Low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU219/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU220/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU221/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU222/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU223/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU224/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU224/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU225/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU225/L2 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU226/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU227/L1 SPA with associated artefacts	Low/moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low/moderate research potential: low artefact density at locale; skeletal/deflated soil: limited excavation potential however a certain analytical potential
SU229/L1 Low/moderate density stone artefacts	Moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, moderate research potential: low/moderate artefact density in survey unit; colluvial soil with excavation potential
SU229/L2 SPA with associated artefacts	Moderate local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, moderate research potential: low/moderate artefact density at locale; excavation potential
SU230/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU231/L1 Very low density stone artefacts	Low local archaeological significance	Common Aboriginal object and site type, low educational value, low aesthetic value, low research potential: very low artefact density in survey unit; skeletal/deflated soil: limited excavation potential
SU232/L1 Possible stone arrangement	Potentially high local archaeological significance	Rare Aboriginal object and site type, moderate education value, moderate aesthetic value, moderate research potential: both features have excavation potential

Table 19. Archaeological significance assessment of Aboriginal object locales.

11.3 Significance Assessment Criteria – Non Indigenous

The NSW Heritage Office and Planning NSW have defined a set of criteria and methodology for the assessment of cultural heritage significance for items and places, where these do not include Aboriginal heritage from the pre-contact period (NSW Heritage Office & DUAP 1996, NSW Heritage Office 2000).

The following heritage assessment criteria are those set out for Listing on the State Heritage Register. In many cases items will be significant under only one or two criteria. The State Heritage Register was established under Part 3A of the Heritage Act (as amended in 1999) for listing of items of environmental heritage which are of state heritage significance. Environmental heritage means those places, buildings, works, relics, moveable objects, and precincts, of state or local heritage significance (section 4, Heritage Act 1977).

An item will be considered to be of State (or local) heritage significance if, in the opinion of the Heritage Council of NSW, it meets one or more of the following criteria:

Criterion (a) an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area);

Criterion (b) an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area);

Criterion (c) an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area);

Criterion (d) an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;

Criterion (e) an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);

Criterion (f) an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area);

Criterion (g) an item is important in demonstrating the principal characteristics of a class of NSW's
cultural or natural places; or
cultural or natural environments (or a class of the local areas).

An item is not to be excluded from the Register on the ground that items with similar characteristics have already been listed on the Register. Only particularly complex items or places will be significant under all criteria.

In using these criteria it is important to assess the values first, then the local or State context in which they may be significant. Different components of a place may make a different relative contribution to its heritage value. For example, loss of integrity or condition may diminish significance. In some cases it is constructive to note the relative contribution of an item or its components. Table 20 below provides a guide to ascribing relative values.

Grading	Justification	Status
Exceptional	Rare or outstanding item of local or State significance. High degree of intactness Item can be interpreted relatively easily.	Fulfils criteria for local or State listing.
High	High degree of original fabric. Demonstrates a key element of the item's	Fulfils criteria for local or State listing.

Grading	Justification	Status
	significance. Alterations do not detract from significance.	
Moderate	Altered or modified elements. Elements with little heritage value, but which contribute to the overall significance of the item.	Fulfils criteria for local or State listing.
Little	Alterations detract from significance. Difficult to interpret.	Does not fulfil criteria for local or State listing.
Intrusive	Damaging to the item's heritage significance.	Does not fulfil criteria for local or State listing.

Table 20. Significance grading.

In instances where a heritage site is complex and/or comprises numerous elements a hierarchy of significance may be useful in assigning significance to individual elements or areas of a site. A commonly used four level hierarchy is: considerable, some, little, and intrusive (NSW Heritage Management Guidelines – Heritage terms and Abbreviations).

11.4 Significance – Non Indigenous

The sites recorded during this survey have been assessed against the State Heritage Register criteria and have been guided by the NSW Heritage Office update *Assessing Heritage Significance* (2001) and the Heritage Council of NSW update *Levels of Heritage Significance* (2008); Pearson and McGowans (2000) *Mining Heritage Places Assessment Manual* has also guided the significance assessment. A statement of significance for each site is provided below in Table 21; a brief description of the reasoning behind the significance assessment is included in the table. Further details regarding the heritage assessment are also discussed below in terms of the thresholds for each significance category and individual site details where appropriate.

Eight of the historical recordings (SU32/HS1, SU54/HS1, SU141/HS1, SU141/HS2, SU143/HS1, SU190/HS1, SU191/HS3& SU226/HS1) have been assessed as being of insufficient heritage value to warrant listing at local or state level. Essentially these are all common site types that cannot be linked to people, places or events of local importance and they are recordings with very limited research potential. For example, the prospecting pits, costeans and stone cairn recorded at sites SU32/HS1, SU54/HS1, SU190/HS1 and SU226/HS1 are all discrete recordings that fit within a theme that is locally important but do not have the potential to contribute a great deal to what is know about mining in the local district. Similarly, the building platform and artefact scatter recorded at SU143/HS1 was not as well preserved as those recoded in other areas, nor was it associated with other sites of higher heritage value, as such it was determined that there were insufficient grounds for heritage listing.

Historical recordings SU92/HS1 (part of Iron Duke workings), SU93/HS1 (Road associated with Iron Duke) and SU94/HS2 (building platform associated with SU93/HS1 and the Iron Duke) were all assessed to be of *little/moderate* value as components of a larger complex that is of local significance. These recordings are considered to just meet the criteria for heritage listing, although it should be noted that this is based in part on their association with other heritage items. Essentially, none of these recordings display particularly good research potential, however as a part of a larger complex (all those sites that make up the Iron Duke complex) they have the potential to yield information and have significance against criterion e. More generally, they are associated with the course of mining history in the local area (criterion a) and as such have significance within the local community as part of the mining heritage that has shaped Broken Hill and Silverton (criterion d).

There are eleven recordings (SU53/L1, SU62/L1, SU90/L1, SU90/L2, SU90/L3, SU90/L4, SU94/HS1, SU191/L1, SU191/L2, Lake's Grave and the Stone Ruins) that have been assessed to be of local significance. The majority of these items include remains of buildings that have very good potential for subsurface deposits and hence moderate to high research potential; they generally have significance against criterion e. The four recordings in Survey Unit 90 are also part of a site complex that is associated with the Iron Duke mine, which means that there is potential to research a suite of sites that will contribute to understanding of small scale

mining in the Barrier Ranges. All of these recordings also have significance against criterion a as sites that fit into the themes of settlement and mining during the first century of the historical period in this region; their significance against this criterion is increased by the overall integrity of each site and in some cases by the connections that can be established between them. Furthermore, these sites have significance against criterion d because their potential to yield further information elevates their social significance. This is due to the fact that they might help the local community in understanding more about their forebears and how the past has helped shape the modern community. With regard to SU53/L1, Blue Anchor Tank and Pipeline, this item has relatively limited research potential however its importance in the course of the local history of securing a water supply for Broken Hill is undeniable. There is also a degree of technical value to the item with regard to the broader context of transporting water across a section of the Barrier Ranges (criterion c). The heritage value of this item is heightened due to its association with the Umberumberka Reservoir as a whole.

The rationale discussed above is also broadly applicable to the forge at SU94/HS1 and Lake's Grave. Each of these sites however has other qualities that have contributed to their significance assessment. The forge at SU94/HS1 for example is notable for the very good preservation due to its relatively sheltered position. This has resulted in excellent excavation potential in and around the hearth and building platform. Furthermore the preservation of the site as a whole and the presence of remains of a wooden stump *in situ* make this a somewhat unusual site that could be considered to be rare at a local level and hence meet the requirement for listing against criterion g. Due to the apparent connection with the Iron Duke mine and, subject to the results of further historical research and excavation, there remains a possibility that this site might have an association with a person(s) of local importance and may thus have significance against criterion b.

Similarly, Lake's Grave is a relatively well preserved site that is likely to have evidence relating not only to the original interment of William Henry Lake but also the various phases of modification to the monument that marks the locale. As an individual grave it is also a relatively rare site type given that the majority of known graves for that period are in formal cemeteries; accordingly it has significance against criterion f. The significance of this site is due largely to its association with William Henry Lake, who has been assessed to be an individual of local importance (criterion b). There are several reasons for such an assessment, first is the fact that he and his family are reputedly the first to drive a bullock team through the Barrier Ranges (Kearns 1980). Second is the fact that William Lake figures in nearly every local history and, judging by the newspaper extracts of 1888 (*Barrier Silver and Tin Fields in 1888* 1970), over a decade after his death, he and the events surrounding his demise were of sufficient interest to be repeatedly mentioned in articles written for the South Australian papers. Furthermore, he and his grave became important enough that numerous places and local landmarks were named after him, including Lake's Grave Creek, Lake's Creek, Lake's Knob and Lake's Camp. So while Lake might not fit standard interpretations of an *important* individual, as someone who has shaped history for example, his local importance is undoubtedly demonstrated by the legacy of toponyms he has left across the local landscape.

The Zinc Sintering Works and the Silverton Tramway are items that clearly have local significance and have the potential to be of state and/or national significance. The sintering works are representative of their type (criterion g) and rare at both a local and state level (criterion f), especially with regard to the processes employed at the site (criterion c), which involved a pre-industrial technique applied in such a way that it developed new innovations in the sintering process (Hope 2006). As such the Zinc Sintering Works are important in the history of mining within the local area and the treatment of zinc slimes across NSW (criterion a). Furthermore, the site is well preserved and displays excellent research potential (criterion e).

The Silverton Tramway has heritage significance due to its direct association with the Silverton Tramway Company (criterion b) and the role it has played in the development of Broken Hill (criterion a). Given that the Silverton Tramway played a fairly unique role as a private railway linking two states and given the history of state government involvement in decisions surrounding its development it would appear to have state, and possibly national, significance against criterion a. Due to its uniqueness it has significance against criterion f and, as an item that is well preserved and associated with a wide array of other heritage items it also has considerable research potential (criterion e). In summary, it has heritage significance at local and state levels and has the potential to be of national significance.

Statements of heritage impact for those items assessed to be of sufficient significance to warrant listing on an appropriate heritage register are provided in Volume 2 - Appendix 7.

Name	**Significance**	**Rationale**
SU32/HS1 Prospecting pits	Does not meet the criteria for heritage listing	Common site type that has very limited research potential and cannot be directly linked to people or events of importance. Nonetheless the site fits within themes that are of local significance.

Name	Significance	Rationale
SU53/HS1 Blue Anchor Tank and pipeline	Local significance, meets the requirements for listing against criteria a and c	This item is part of a larger complex that was incredibly important in the course of the local area's cultural history (i.e. securing a reliable water supply for Broken Hill). It is also part of a complex that demonstrates considerable technical achievement.
SU54/HS1 Prospecting pits	Does not meet the criteria for heritage listing	Common site type that has very limited research potential and cannot be directly linked to people or events of importance. Nonetheless the site fits within themes that are of local significance.
SU62/HS1 Building platform	Local significance, meets the requirements for local listing against criteria a, d and e	Common site type that displays very good research potential. While the site cannot at this stage be linked with people or events of local importance, it appears to be associated with relatively early phases of settlement in the region and as such has local significance that is increased by the research potential that exists.
SU90/HS1 Mine workings	Local significance, meets the requirements for local listing against criteria a, d and e	Common site type that displays good research potential. The site appears to be associated with the Iron Duke mine and with relatively early phases of historical settlement in the region. As such it has local significance that is increased by the research potential that exists.
SU90/HS2 Building platform and costeans	Local significance, meets the requirements for local listing against criteria a, d and e	Common site type that displays very good research potential. The site appears to be associated with the Iron Duke mine and with relatively early phases of historical settlement in the region. As such it has local significance that is increased by the research potential that exists.
SU90/HS3 Forge	Local significance, meets the requirements for local listing against criteria a, d and e	Common site type that displays very good research potential. The site appears to be associated with the Iron Duke mine and with relatively early phases of historical settlement in the region. As such it has local significance that is increased by the research potential that exists.
SU90/HS4 Building platform and hearths	Local significance, meets the requirements for local listing against criteria a, d and e	Common site type that displays very good research potential. The site appears to be associated with the Iron Duke mine and with relatively early phases of historical settlement in the region. As such it has local significance that is increased by the research potential that exists.
SU92/HS1 Mine workings	Local significance, meets the requirements for local listing against criteria a, d and e	Common site type that displays good research potential. The site appears to be associated with the Iron Duke mine and with relatively early phases of historical settlement in the region. As such it has local significance.
SU93/HS1 Road	Local significance, meets the requirements for local listing against criteria a, d and e	Common site type that displays good research potential. The site appears to be associated with the Iron Duke mine and with relatively early phases of historical settlement in the region. As such it has local significance.
SU94/HS1 Forge	Local significance, meets the requirements for local listing against criteria a, d and e; also possibly meets the requirements against criteria b and f	Common site type with relatively rare characteristics: site preservation, wooden stump. This site displays excellent research potential. This site appears to be associated with mining activities in and around the Iron Duke mine. The social significance of this site is increased by the research potential that exists.
SU94/HS2 Building platform	Local significance, meets the requirements for local listing against criteria a, d and e	Common site type that displays good research potential. The site appears to be associated with the Iron Duke mine and with relatively early phases of historical settlement in the region. As such it has local significance.
SU141/HS1 Farming equipment	Does not meet the criteria for heritage listing	Common site type that has very limited research potential and cannot be directly linked to people or events of importance.
SU141/HS2 Stockyards	Does not meet the criteria for heritage listing	Common site type that has very limited research potential and cannot be directly linked to people or events of importance.
SU143/HS1 Artefact scatter and building platform/ hearth	Does not meet the criteria for heritage listing	Common site type with a certain amount of research potential. While the site cannot definitively be associated with people or events of importance it fits within a broader theme that is of high local significance.

Name	Significance	Rationale
SU190/HS1 Stone cairn	Does not meet the criteria for heritage listing	Common site type that has very limited research potential and cannot be directly linked to people or events of importance. Nonetheless the site fits within themes that are of local significance.
SU191/HS1 Building platform	Local significance, meets the requirements for local listing against criteria a, d and e	Common site type that displays excellent research potential. The site appears to be associated with adjacent mining leases such U0064 and probably dates to the first half of the 20th century. As such it has local significance that is increased by the research potential that exists.
SU191/HS2 Building platform	Local significance, meets the requirements for local listing against criteria a, d and e	Common site type that displays excellent research potential. The site appears to be associated with adjacent mining leases such U0064 and probably dates to the first half of the 20th century. As such it has local significance that is increased by the research potential that exists.
SU191/HS3 Road	Does not meet the criteria for heritage listing	Common site type that has very limited research potential and cannot be directly linked to people or events of importance.
SU226/HS1 Costean	Does not meet the criteria for heritage listing	Common site type that has very limited research potential and cannot be directly linked to people or events of importance. Nonetheless the site fits within themes that are of local significance.
Lake's Grave	Local significance, meets the requirements for heritage listing against criteria a, b, d, e and f	This site is directly associated with an individual of local importance. Moreover, the site marks the location of his death, which is itself an event that has become part of folk legend for the area. This site is a local landmark.
Stone ruins	Local significance, meets the requirements for local listing against criteria a, d and e	Common site type that displays very good research potential. The site appears to be associated with the Iron Duke mine and/or with relatively early phases of historical settlement in the region. As such it has local significance that is increased by the research potential that exists.
Zinc sintering works	Local significance and potential state significance, meets the requirements for listing against criteria a, c, e, f and g	This is a very rare site type that is representative of a labour-intensive sintering process. It is important in the course of the history of mining and given its excellent preservation it has enormous research potential. The sintering works at Corruga are important not only at a local level but within the context of mining across NSW.
Silverton Tramway	Local, state and potentially national significance, meets the requirements for listing against criteria a, b, e, f and g	The Silverton Tramway has strong associations with the Silverton Tramway Company, its construction had ongoing importance for the local region and was critical to the economic functioning of Broken Hill. It has also played a significant role in interstate politics, recreation at Broken Hill, and a crucial role at times of water shortage. Moreover, it is a reasonably well preserved and rare example of such a privately owned section of an interstate railway network. As a whole it displays very good research potential and is representative of its type.

Table 21. Significance assessment of historical features recorded in the proposal area.

12. MITIGATION AND MANAGEMENT STRATEGIES – ABORIGINAL OBJECTS

The aim of this study has been to identify Aboriginal objects within the proposal area, to assess their significance and thereafter, to given consideration to their management within the context of the proposed impacts.

In the following sections a variety of strategies that can be considered for the mitigation and management of development impact to the recorded Aboriginal object locales within the proposal area are listed and discussed. Table 22 lists recommended management and mitigation strategies in regard to all Survey Units surveyed during the assessment.

12.1 Management and Mitigation Strategies

Further Investigation

The current field survey has been focused on recording artefactual material present on visible ground surfaces. Further archaeological investigation entails subsurface excavation which is generally undertaken as test pits for the purposes of identifying the presence of artefact bearing soil deposits and their nature, extent, integrity and significance.

Further archaeological investigation in the form of sub-surface test excavation can be appropriate in certain situations. Such situations generally arise when the proposed development is expected to involve ground disturbance in areas which are assessed to have potential to contain high density artefactual material and when the Effective Survey Coverage achieved during a survey of a project area is low due to ground cover, vegetation etc. In certain situations subsurface investigation provides a level of surety in regard to the archaeological status of a place so that informed management decisions can be duly made.

Test excavation can be undertaken in a variety of ways including hand excavation, shovel pits, auger holes, mechanically excavated trenches or surface scrapes. Such a strategy is pro-active and enables the proponent to properly understand the nature of archaeological sites prior to development activity occurring.

However no Survey Units have been identified in the proposal area to warrant further archaeological investigation. The Effective Survey Coverage achieved during the field survey was relatively high and can be considered to have been generally adequate for the purposes of determining the archaeological status of the proposed impact areas.

The ridges in which the turbines and their associated impacts will be located contain skeletal soil as a result of high levels of erosion and disturbance; accordingly these soils have low potential to contain intact and/or stratified archaeological deposit. Given the skeletal nature of these soils the potential to physically conduct subsurface excavation is limited. Elsewhere in locations which contain deeper soil deposits such as landforms located in the lower landform contexts a number of additional factors have been taken into consideration to determine whether or not further investigation is necessary. Proposed impacts in these landforms are small scale, discrete and generally linear impacts (road access, transmission line construction etc). In addition, it is considered that in regard to the archaeology itself, subsurface testing is unlikely to produce results much different to predictions made in respect of the subsurface potential of these landforms. Accordingly a program of subsurface testing is not considered to be necessary or warranted in regard to the proposal.

Conservation

Conservation is a suitable management option in any situation, however, is not always feasible. Such a strategy is generally adopted in relation to Aboriginal objects which are assessed to be of high cultural and scientific significance, but can be adopted in relation to any object irrespective of its significance.

When conservation is adopted as a management option it may be necessary to implement various strategies to ensure Aboriginal objects are not inadvertently destroyed or disturbed during construction works or within the context *of the life* of the development project. Such procedures are essential when development works are to proceed within close proximity to identified sites.

None of the Survey Units in the proposal area have been identified to surpass scientific significance thresholds which would act to entirely preclude proposed impacts. However a small number of discrete locales and

discrete areas within locales have been identified to warrant total exclusion of impacts and the implementation of a strategy of conservation. These locales are listed individually below.

- SU152/L2
- SU231/L2

It is recommended that an active conservation strategy is implemented in regard to these locales to ensure that they are not inadvertently impacted during the construction, operation and decommissioning of the wind farm. It is noted that these locales are either situated outside areas in which impacts are proposed or within areas in which a strategy of conservation, and hence impact avoidance, is expected to be highly feasible.

Unmitigated Impacts

Unmitigated impacts to an Aboriginal object can be given consideration when it is assessed to be of low or low/moderate archaeological and cultural significance and otherwise in situations where conservation is simply not feasible.

Many of the Aboriginal object locales are very low (<1 per artefact square metre) or low density (between 1 artefacts per square metre and 10 artefacts per square metre) distributions of quartz stone artefacts. The archaeological significance of the locales is assessed to be low. Accordingly unmitigated impact is considered to be appropriate in regard to the majority of locales in the proposal area (see Table 22).

Mitigated Impacts

Mitigated impact usually takes the form of partial impacts only (ie conservation of part of the Survey Unit) and/or salvage in the form of further research and archaeological analysis prior to impacts. Such a management strategy is generally appropriate when Aboriginal objects are assessed to be of moderate or high significance to the scientific and/or Aboriginal community and when avoidance of impacts and hence full conservation is not feasible. Salvage can include the surface collection or sub-surface excavation of Aboriginal objects and subsequent research and analysis.

Many of the Aboriginal object locales and/or discrete areas within wider stone artefact distribution locales (including those which are predicted to contain subsurface archaeological deposit), stone procurement areas and locales with heat retainer ovens, are assessed to be of low/moderate or moderate archaeological significance. Accordingly it is generally recommended that avoidance of impacts, or limiting the extent of impacts to these locales, if at all feasible, should be given consideration. In regard to some locales suggestions are outlined as to how avoidance may be achieved.

In regard to these locales for which it is recommended that avoidance of impacts be considered, further recommendations are made in the event that avoidance of impacts is not feasible. In some cases especially those relating to small stone procurement locales it is recommended that if avoidance is not feasible unmitigated impacts are appropriate. However, in other cases such as locales containing deep soils and hence potential subsurface archaeological deposit with predicted moderate density artefact distribution, locales containing heat retaining hearths and larger and more complex stone procurement areas (and which are assessed to be of low/moderate or moderate archaeological potential), it is recommended that if impact avoidance is not feasible a strategy of impact mitigation is appropriate.

It is proposed that where necessary an appropriate impact mitigation strategy would be a program of archaeological excavation and analysis. Ideally such a program would entail an adequately designed research program which would aim to address research questions similar to those currently being pursued in the region.

12.2 Management options - Summary

The table below summarises the management and mitigation strategies considered to be relevant to proposal area. Management and mitigation strategies are addressed in relation to all Survey Units recorded during the study (noting that not all Survey Units contain Aboriginal object locales) and where relevant individual locales located within each Survey Unit. The assessed archaeological significance of each Aboriginal object locale is listed given that site significance forms the basis for rationalizing the proposed management strategy. The recommended management strategy listed for each Survey Unit and Aboriginal object locale is selected from the various management options as discussed above in Section 12.1. Finally the rationale behind each recommendation is outlined, taking into consideration the nature of the Aboriginal object and its archaeological significance rating.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
SU1	SU1/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU2	SU2/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low.
SU2	SU2/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts if avoidance not possible	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU2	SU2/L3 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts if avoidance not possible *Avoidance may be possible by locating impacts to west of locale*	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU3	SU3/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU4	SU4/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be very low.
SU4	SU4/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts if avoidance not possible *Avoidance likely to be possible by locating impacts to south of locale*	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts unlikely given site location at edge of landform near gully*
SU5	SU5/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU5	SU5/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts if avoidance not possible *Avoidance likely to be possible by locating impacts to south of locale*	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU5	SU5/L3 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts if avoidance not possible *Avoidance likely to be possible by confining impacts to existing track*	Discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU6	SU6/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
SU7	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU8	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU9	SU9/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological potential assessed to be low
SU9	SU9/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts if avoidance not possible *Avoidance likely to be possible by locating impacts to southeast of locale on existing track*	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU10	SU10/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU11	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU12	SU12/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU13	SU13/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU14	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU15	SU15/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU16	SU16/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU17	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU18	SU18/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU19	SU19/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU20	SU20/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation	Discrete occurrence of stone artefacts. Archaeological significance assessed to be low.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
			Unmitigated impacts	
SU21	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU22	SU22/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU23	SU23/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU24	SU24/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU25	SU25/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU26	SU26/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU27	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU28	SU28/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU29	SU29/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU30	SU30/L1 SPA	Low/moderate	**No constraints, however avoid SPA if feasible** No further archaeological investigation Unmitigated impacts if avoidance not possible. *Avoidance likely to be possible by confining impacts to existing road which is situated to the east of the locale.*	Very small, discrete feature with low density artefact distribution; remainder of survey unit assessed to be of very low archaeological potential. Archaeological significance assessed to be low/moderate. *Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU31	SU31/L1 Isolated artefact	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU32	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU33	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU34	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
SU35	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU36	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU37	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU38	SU38/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU39	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU40	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU41	SU41/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU41	SU41/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts if avoidance not possible	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU42	SU42/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU43	SU43/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU43	SU43/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated or mitigated impacts in form of salvage excavation/analysis if avoidance not possible	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU43	SU43/L3 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated or mitigated impacts in form of salvage excavation/analysis if avoidance not possible	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU43	SU43/L4 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated or mitigated impacts in form of salvage excavation/analysis if avoidance not possible	Very small, discrete feature. Archaeological significance assessed to be low/moderate.
SU44	SU44/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU45	SU45/L1	Low	**No constraints**	Very low density artefact distribution.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
	Stone artefacts		No further archaeological investigation Unmitigated impacts	Archaeological significance assessed to be low.
SU46	SU46/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU47	SU47/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU48	SU48/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU49	SU49/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low/negligible density artefact distribution. Archaeological significance assessed to be low.
SU50	SU50/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU51	SU51/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU52	SU52/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU53	SU53/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU54	SU54/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU55	SU55/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU56	SU56/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU56	SU56/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts if avoidance not possible	Discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU57	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU58	SU58/L1	Low	**No constraints**	Very low density artefact distribution.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
	Stone artefacts		No further archaeological investigation Unmitigated impacts	Archaeological significance assessed to be low.
SU59	SU59/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU59	SU59/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis. *Avoidance may be possible by confining impacts to north of the locale.*	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU59	SU59/L3 SPA	Low/moderate	**Avoid impacts if feasible** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis. *Avoidance may be possible by confining impacts to northeast of the locale.*	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU60	SU60/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU61	SU61/L1 Stone artefacts	Low/moderate	**No constraints however avoid impacts within 75m of creek line.** No further archaeological investigation If impacts proposed within 75 m of creek line mitigated impacts: salvage excavation and/or artefact analysis in impact area	Artefact density varies from very low to low/moderate; density increases in areas immediately adjacent creek. Soil depth decreases on upper slopes. Archaeological significance assessed to be low/moderate
SU62	SU62/L1 Stone artefacts; hearths	Low/moderate	**No constraints** No further archaeological investigation	Artefact density varies from very low to low density increasing in areas immediately adjacent creek and minor drainage lines. Soil depth decreases on upper slopes. Archaeological significance assessed to be low/moderate
SU63	SU63/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU63	SU63/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis. *Avoidance may be possible by confining impacts to existing track*	Discrete feature with very low density artefact distribution. Archaeological significance assessed to be low/moderate. *Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU64	SU64/L1 Stone artefacts;	Moderate/high	**Avoid impacts if feasible** No further archaeological investigation	Artefact density varies from low to moderate density. Archaeological significance assessed to be moderate/high

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
	hearths		If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis	
SU64	SU64/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis. *Avoid by confining impacts away from locale.*	Very small, discrete feature with associated artefact distribution. Archaeological significance assessed to be low/moderate. *Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU65	SU65/L1 Stone artefacts; hearths	Moderate/high	**Avoid impacts if possible** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis	Artefact density predicted to be moderate density. Archaeological significance assessed to be moderate/high *Impacts unlikely given that area is used as stock yards*
SU66	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU67	SU67/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU68	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU69	SU69/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU70	SU70/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU71	SU71/L1 isolated artefact	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU72	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological significance assessed to be low.
SU73	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU74	SU74/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Discrete occurrence of stone artefacts. Archaeological significance assessed to be low.
SU75	SU75/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Discrete occurrence of stone artefacts. Archaeological significance assessed to be low.
SU76	SU76/L1 Stone artefact	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Isolated artefact; locale not predicted to be larger than recorded. Archaeological significance assessed to be low.
SU76	SU76/L2	Low/moderate	**No constraints however avoid impacts if feasible**	Very small, discrete feature.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
	SPA		No further archaeological investigation If avoidance not possible unmitigated impacts	Archaeological significance assessed to be low/moderate. *Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU77	SU77/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU78	SU78/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU79	SU79/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU80	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU81	SU81/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU82	SU52/L1 Stone artefacts	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts *Restrict impacts to existing road as much as practicable*	Predicted low/moderate artefact density. Archaeological significance assessed to be low/moderate
SU83	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU84	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU85	SU85/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU86	SU86/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU86	SU86/L2 SPA	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU86	SU86/L3 SPA	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU87	SU87/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low.
SU87	SU87/L2	Moderate	**Avoid impacts if feasible**	Discrete feature with low/moderate density artefact distribution.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
	SPA		No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and/or artefact analysis. *Avoidance may be possible by confining impacts to south/southeast of the locale.*	Archaeological significance assessed to be moderate. *Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU87	SU87/L3 SPA	Low/moderate	**Avoid impacts if feasible** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis. *Avoidance may be possible by confining impacts to southeast of locale.*	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU88	SU88/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU89	SU89/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low/negligible density artefact distribution. Archaeological significance assessed to be low.
SU90	SU90/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU91	SU91/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low/negligible density artefact distribution. Archaeological significance assessed to be low.
SU92	SU92/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU93	SU93/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU94	SU94/L1 Stone artefacts	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis. *NB: This locale is in an area that coincides with SU94/HS1 for which avoidance of impacts is also recommended.*	Variable artefact density from very low to low/moderate. Archaeological significance assessed to be low/moderate.
SU94	SU94/L2 SPA	Low/moderate	**No constraints however avoid impacts if possible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU94	SU94/L3 SPA	Low/moderate	**No constraints however avoid impacts if possible** No further archaeological investigation If impacts are proposed then mitigation in the form of	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Area in survey unit appears to be sufficient to allow alternate*

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
			salvage excavation and artefact analysis. *Avoidance may be possible by confining impacts to southeast of locale.*	*impact locations to be considered.*
SU95	SU95/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU95	SU95/L2 SPA	Low/moderate	**No constraints however avoid impacts if possible** No further archaeological investigation Unmitigated impacts	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU96	SU96/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU97	SU97/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU97	SU97/L2 SPA	Low/moderate	**No constraints however avoid impacts if possible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU97	SU97/L3 SPA	Low/moderate	**No constraints however avoid impacts if possible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU98	SU98/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU98	SU98/L2 SPA	Low/moderate	**No constraints however avoid impacts if possible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU99	SU99/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU100	SU100/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU101	SU101/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU101	SU101/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation If impacts proposed unmitigated impacts	Discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU101	SU101/L3 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
			Unmitigated impacts	
SU102	SU102/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU102	SU102/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation If impacts proposed mitigation in the form of salvage excavation and analysis	Discrete feature with artefact distribution. Archaeological significance assessed to be low/moderate.
SU103	SU103/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU104	SU104/L1 Stone artefacts	Low/moderate	**No constraints generally however if feasible avoid area of crest north of grid ref: 529637e 6484738n** No further archaeological investigation If impacts proposed at north end mitigation in form of salvage Salvage of possible schist mortar for further analysis	Generally very low density artefact distribution however with clusters at north end of survey unit. Archaeological significance assessed to be low/moderate.
SU104	SU104/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU104	SU104/L3 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU104	SU104/L4 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU104	SU104/L5 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU105	SU105/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU106	SU106/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low.
SU106	SU106/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU107	SU107/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
SU108	SU108/L1 Stone artefacts	Low/moderate	**No constraints generally however if feasible avoid area at east end of survey unit** No further archaeological investigation If impacts proposed at east end mitigation in form of salvage	Generally very low density artefact distribution however with higher density, rare materials and artefacts and subsurface potential at east end of survey unit. Archaeological significance assessed to be low/moderate
SU109	SU109/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU110	SU110/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU111	SU111/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low.
SU111	SU111/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU111	SU111/L3 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU111	SU111/L4 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU112	SU112/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low.
SU112	SU112/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU113	SU113/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU113	SU113/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU113	SU113/L3 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU114	SU114/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low.
SU115	SU115/L1	Low	**No constraints**	Very low density artefact distribution. Archaeological

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
	Stone artefacts		No further archaeological investigation Unmitigated impacts	significance assessed to be low.
SU115	SU115/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU116	SU116/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU117	SU117/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU118	SU118/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU119	SU119/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU119	SU119/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU119	SU119/L3 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU119	SU119/L4 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU120	SU120/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU121	SU121/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU122	SU122/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low.
SU123	SU123/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low.
SU123	SU123/L1 SPA	Low/moderate	**Avoid impacts if feasible** No further archaeological investigation If impacts are proposed then mitigation in the form of	Discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Area in survey unit appears to be sufficient to allow alternate*

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
			salvage excavation and artefact analysis. *Avoidance may be possible by confining impacts to southeast of locale.*	*impact locations to be considered.*
SU124	SU124/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU125	SU125/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU126	SU126/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low.
SU126	SU126/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU127	SU127/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU128	SU128/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU129	SU129/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU129	SU129/L2 SPA	Low/moderate	**No constraints however avoid impacts if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU130	SU130/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU131	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU132	SU132/L1 Stone artefacts; hearths	Low/moderate	**No constraints however avoid impacts if possible** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis *Restrict impacts to existing track as much as possible*	Artefact density is low however soils are moderately deep with subsurface potential and contain hearths. Archaeological significance assessed to be low/moderate *Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU133	SU133/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU133	SU133/L2	Low/moderate	**No constraints however avoid impacts if feasible**	Small, discrete feature with low density artefact distribution.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
	SPA		No further archaeological investigation Unmitigated impacts *Restrict impacts to existing track*	Archaeological significance assessed to be low/moderate. *Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU134	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU135	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU136	SU136/L1 Stone artefacts; hearths	Moderate/high	**No constraints however avoid impacts to as much of survey unit as feasible** No further archaeological investigation If road is to be widened or realigned then mitigation in the form of salvage excavation and artefact analysis *Restrict impacts as much as practicable to existing track.*	Artefact density varies from low to moderate/high density, soils are deep with subsurface archaeological potential and there is a high potential for additional hearths. Excavation potential across survey unit. Archaeological significance assessed to be moderate/high *Impacts proposed are relatively discrete in nature*
SU137	SU137/L1 Stone artefacts	Low	**No constraints however confine impacts to existing track as much as practicable** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU138	SU138/L1 Stone artefacts; hearths	Low/moderate	**No constraints however avoid impacts to as much of survey unit as feasible** No further archaeological investigation If road is to be widened or realigned then mitigation in the form of salvage excavation and artefact analysis *Restrict impacts to existing track.*	Artefact density predicted to be low/moderate, soils are deep; excavation potential across survey unit. Archaeological significance assessed to be low/moderate *Impacts proposed are relatively discrete in nature*
SU139	SU139/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU140	SU140/L1 Stone artefacts; hearth	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU141	SU141/L1 Stone artefacts; hearths	Moderate	**No constraints however avoid impacts to as much of survey unit as feasible** No further archaeological investigation If road is to be widened or realigned or if transmission line impacts are proposed then mitigation in the form of salvage excavation and artefact analysis *Restrict impacts to existing track as much as practicable*	Predicted moderate density artefact distribution. Archaeological significance assessed to be moderate. *Impacts proposed are relatively discrete in nature*
SU142	SU142/L1 Stone artefacts; hearths	Low/moderate	**No constraints however avoid impacts to as much of survey unit as feasible** No further archaeological investigation Unmitigated impacts	Predicted low/moderate density artefact distribution however high prior disturbance. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature*
SU143	SU143/L1	Low/moderate	**No constraints however avoid impacts to as much of**	Predicted low/moderate density artefact distribution.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
	Stone artefacts		**survey unit as feasible** No further archaeological investigation If road is to be widened or realigned then mitigation in the form of salvage excavation and artefact analysis *Restrict impacts to existing track as much as practicable*	Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature*
SU144	SU144/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU144	SU144/L2 SPA	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts.	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU145	SU145/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU145	SU145/L2 SPA	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts.	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU146	SU146/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU147	SU147/L1 Stone artefacts; hearths	Moderate	**No constraints however avoid impacts if possible at southern end adjacent to creek** No further archaeological investigation If impacts are proposed at south end then mitigation in the form of salvage excavation and artefact analysis *Avoidance may be possible by excluding impacts over 70m x 70m area adjacent to creek*	Artefact density varies from low to moderate; area at south end has potential to contain subsurface deposit. Archaeological significance assessed to be moderate *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU148	SU148/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU148	SU148/L2 SPA	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts.	Small, discrete feature. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU148	SU148/L3 SPA	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation	Small, discrete feature. Archaeological significance assessed to be low/moderate.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
			Unmitigated impacts.	*Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU149	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low.
SU150	SU150/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU151a	SU151a/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU151b	SU151b/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU152	SU152/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU152	SU152/L2 SPA	High	**Avoidance of impacts recommended** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis *Avoid impacts to outcrop and associated scree by establishing a 50m buffer zone at this locale*	Large discrete feature with associated artefact distribution. Archaeological significance assessed to be high due to exceptional quality of quartz resource *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU153	SU153/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU154	SU154/L1 Stone artefacts	Low/moderate	**No constraints** No further archaeological investigation Unmitigated impacts	Predicted moderate density artefact distribution. Archaeological significance assessed to be low/moderate *Impacts proposed are relatively discrete in nature*
SU155	SU155/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU155	SU155/L2 SPA	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts.	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU155	SU155/L3 SPA	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts.	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
				Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.
SU155	SU155/L4 SPA	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts.	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU156	SU156/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU157	SU157/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU157	SU157/L2 SPA	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU157	SU157/L3 SPA	Low/moderate	**No constraints, however avoid if possible** No further archaeological investigation Unmitigated impacts	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU158	SU158/L1 Stone artefacts; hearths	Moderate/high	**No constraints however avoid impacts if feasible** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis *Avoid impacts within 100 m of creek*	Artefact density is low, however soils are moderately deep with subsurface archaeological potential. Archaeological significance assessed to be moderate/high *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow impact avoidance within 100 m of creek to be considered.*
SU158	SU158/L2 SPA	Moderate/high	**No constraints however, avoid impacts if possible** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis *Avoidance of impacts to outcrop and associated scree is possible by establishing a 50m buffer zone at this locale*	Artefact density is moderate. Archaeological significance assessed to be moderate/high due to good quality of quartz resource and evidence of exploitation *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU159	SU159/L1 Stone artefacts	Low/moderate	**No constraints however mitigation if impacts proposed** No further archaeological investigation	Predicted moderate density artefact distribution. Archaeological significance assessed to be low/moderate.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
			Mitigation in the form of salvage excavation if impacts proposed	*Impacts proposed are relatively discrete in nature*
SU159	SU159/L2 SPA	Low/moderate	**No constraints however mitigation if impacts proposed** No further archaeological investigation Mitigation in the form of salvage excavation if impacts proposed	Discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature*
SU160	SU160/L1 Stone artefacts; hearths	Low/moderate	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature*
SU160	SU160/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU160	SU160/L3 SPA	Low/moderate	**No constraints however avoid impacts if possible** No further archaeological investigation Unmitigated impacts	Discrete feature with low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature*
SU160	SU160/L4 SPA	Moderate	**No constraints however avoid impacts if possible** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis	Discrete feature with low artefact density. Archaeological significance assessed to be moderate: locale is a good example of its type due to good quality of quartz resource and evidence of exploitation. *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU161	SU161/L1 Stone artefacts; hearths	High	**Avoidance of impacts recommended** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis *Avoidance possible by establishing a 200 x 200m 'no go' zone at this locale*	Artefact density predicted to be moderate, soils are relatively deep and appear to contain intact cultural deposits. Archaeological significance assessed to be high *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU161	SU161/L2 SPA	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts.	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU161	SU161/L3 SPA	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts.	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU161	SU161/L4	Low/moderate	**No constraints, however avoid if feasible**	Very small, discrete feature with low density artefact

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
	SPA		No further archaeological investigation Unmitigated impacts.	distribution. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU162	SU162/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU162	SU162/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU163	SU163/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU163	SU163/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU164	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU165	SU165/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Discrete occurrence, very low density artefact distribution. Archaeological significance assessed to be low
SU166	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU167	SU167/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU168	SU168/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU169	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU170	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU171	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU172	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU173	SU173/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
SU173	SU173/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU174	SU174/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU175	SU175/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU176	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU177	SU177/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU178	SU178/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU179	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU180	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU181	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU182	SU182/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU183	SU183/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low/negligible density artefact distribution. Archaeological significance assessed to be low.
SU184	SU184/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts unlikely given the nature of the terrain*
SU185	SU185/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts unlikely given the nature of the terrain*
SU186	SU186/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts unlikely given the nature of the terrain*
SU187	SU187/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts unlikely given the nature of the terrain*

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
SU188	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU189	SU189/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU190	SU190/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU191	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU192	SU192/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU192	SU192/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts	Very small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate.
SU193	SU193/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU194	SU194/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU195	SU195/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low/negligible density artefact distribution. Archaeological significance assessed to be low.
SU196	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU197	SU197/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU198	SU198/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU199	SU199/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU200	SU200/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU201	SU201/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation	Very low density artefact distribution. Archaeological significance assessed to be low.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
			Unmitigated impacts	
SU202	SU202/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts unlikely given the nature of the terrain*
SU203	SU203/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts unlikely given the nature of the terrain*
SU204	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU205	SU205/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts unlikely given the nature of the terrain*
SU206	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU207	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU208	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible
SU209	SU209/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts unlikely given the nature of the terrain*
SU209	SU209/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts	Discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts unlikely given the nature of the terrain*
SU210	SU210/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts unlikely given the nature of the terrain*
SU211	SU211/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts unlikely given the nature of the terrain*
SU212	SU212/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts unlikely given the nature of the terrain*
SU213	SU213/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts unlikely given the nature of the terrain*
SU214	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible *Impacts unlikely given the nature of the terrain*
SU215	SU215/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation	Very low density artefact distribution. Archaeological significance assessed to be low.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
			Unmitigated impacts	*Impacts unlikely given the nature of the terrain*
SU215	SU215/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate
SU215	SU215/L3 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate
SU216	SU216/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU217	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible *Impacts unlikely given the nature of the terrain*
SU218	SU218/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Low density artefact distribution. Archaeological significance assessed to be low.
SU219	SU219/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low.
SU220	SU220/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature.*
SU221	SU221/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature.*
SU222	SU222/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature.*
SU223	SU223/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature.*
SU224	SU224/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature.*
SU224	SU224/L2 SPA	Low/moderate	**No constraints however avoid if feasible** No further archaeological investigation Unmitigated impacts	Small, discrete feature with low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts proposed are relatively discrete in nature.*
SU225	SU225/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature.*
SU225	SU225/L2	Low/moderate	**No constraints, however avoid if feasible**	Small, discrete feature with low density artefact distribution.

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
	SPA		No further archaeological investigation Unmitigated impacts. *Avoid by confining impacts to existing road which is situated to the north of the locale.*	Archaeological significance assessed to be low/moderate. *Impacts unlikely given that locale is 30m south of existing track*
SU226	SU226/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature.*
SU227	SU227/L1 SPA	Low/moderate	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts. *Avoid by confining impacts to existing road .*	Small, discrete feature with very low density artefact distribution. Archaeological significance assessed to be low/moderate. *Impacts unlikely given that locale is southeast of existing track*
SU228	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low/negligible *Impacts proposed are relatively discrete in nature.*
SU229	SU229/L1 Stone artefacts	Moderate	**No constraints, however avoid if feasible** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis *Avoid by confining impacts to existing track*	Artefact density varies from low to moderate, soils are relatively deep. Archaeological significance assessed to be moderate *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU229	SU229/L1 SPA	Moderate	**Avoid impacts if feasible** No further archaeological investigation If impacts are proposed then mitigation in the form of salvage excavation and artefact analysis *Avoid impacts to outcrop and associated scree by confining impacts to existing track*	Small discrete feature; artefact density is low/moderate. Archaeological significance assessed to be moderate: locale is a good example of its type due to good quality of quartz resource and evidence of exploitation *Impacts proposed are relatively discrete in nature. Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.*
SU230	SU230/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature.*
SU231	SU231/L1 Stone artefacts	Low	**No constraints** No further archaeological investigation Unmitigated impacts	Very low density artefact distribution. Archaeological significance assessed to be low. *Impacts proposed are relatively discrete in nature.*
SU231	SU231/L2 Possible stone arrangement	*Potentially* high	**Avoid impacts** No further archaeological investigation Ensure locale is not subject to inadvertent impacts	Small discrete feature, possibly Aboriginal. Archaeological significance assessed to be potentially high. *Impacts proposed are relatively discrete in nature and away from the locale.* *Area in survey unit appears to be sufficient to allow alternate impact locations to be considered.* *Locale is situated c. 60 m north of existing road and 6m to east of smaller track*

Survey Unit	Aboriginal object recording	Archaeological significance	Recommended management strategy	Rationale
SU232	nil	Not applicable	**No constraints** No further archaeological investigation	No Aboriginal objects recorded. Archaeological potential assessed to be low. *Impacts proposed are relatively discrete in nature.*

Table 22. Recommendations for the management and mitigation of impact to the Aboriginal object locales recorded in the proposal area.

13. MITIGATION AND MANAGEMENT STRATEGIES – NON INDIGENOUS

The management recommendations for the historical recordings can be broken down into three basic categories: those for which there are no constraints, those where mitigated impacts could be pursued if it proved unviable to avoid impacts and those where conservation is recommended. A summary of mitigation strategies and management recommendations is provided in Table 23 below.

Essentially there are no constraints to impact with regard to those sites that were assessed not to meet the criteria for heritage listing (SU32/HS1, SU54/HS1, SU141/HS1, SU141/HS2, SU143/HS1, SU190/HS1, SU191/HS3& SU226/HS1). Nonetheless, in most cases it has been recommended that impacts be avoided if possible. The reasoning behind this is that all of the historical recordings contribute to the overall heritage of the region and have varying degrees of importance within the local community. Furthermore, while they have not at this stage been assessed to be of sufficient significance to warrant heritage listing, there remains the possibility that future generations might view these sites differently and so it is prudent to conserve sites where practicable.

For the majority of recordings (SU62/L1, SU90/L1, SU90/L2, SU90/L3, SU90/L4, SU92/HS1, SU93/HS1, SU94/HS2, SU191/L1, SU191/L2 and the Stone Ruins) it is recommended that impacts be avoided if feasible and that where such a course of action is not feasible mitigation in the form of archival recording and/or salvage excavation be undertaken. The rationale for these recommendations is that the sites are assessed to be of sufficient significance for local heritage listing and as such should preferably be conserved. In the event that impacts cannot be avoided, as much information as possible should be salvaged from these sites through archival recordings, archaeological excavation and additional historical research where appropriate.

In the case of Survey Unit 94 two options have been outlined. On one hand there is the same course of action that is outlined above; that is, avoidance or mitigated impacts to the individual recordings. Alternatively, there is an option to avoid all impacts to the southeast of grid reference 526696e 6480400n. This is noted as the preferred option as it would also ensure conservation of a section of the road that extends down the spur (SU93/HS1) and conservation of the recordings SU94/HS1 and SU94/HS2. In this way a parcel of the larger site complex would be conserved, thus ensuring that future possibilities remain open for research, such as exploring the interrelationship between these sites, the Iron Duke mine and the recording of the Stone Ruins on the valley floor to the southeast.

With regard to SU53/HS1, which also extends into SU57 and SU58, this item is associated with a larger site complex that it arguably of state significance and that is listed as an indicative place on the Register of the National Estate. While the water tank and pipeline themselves may not be of the same heritage value they do contribute to the overall significance of the Umberumberka Reservoir. Accordingly, it is recommended that these items be conserved and be the subject of more detailed recording prior to commencement of construction.

In the case of the Zinc Sintering Works it is noted that there are two options for the alignment of the transmission line: *initial route* and *visual impacts minimised route*. Given the extent of the site, the level of its heritage significance (local and/or state) and the fact that the initial route runs directly across the site it would be preferable to adopt the visual impacts minimised route, which runs approximately 1 km to the east of the sintering works. If impacts were unavoidable at the sintering works then mitigation in the form of archival recording and/or salvage excavation would need to be undertaken.

The Silverton Tramway is a heritage item that is of state if not national significance (Hope 2006); it extends for approximately 50 km and is potentially subject to direct physical impacts at one of two locations. As discussed above the initial route of the transmission line is not preferable in terms of heritage management. This applies as much to the sintering works as an individual heritage item as it does to the tramway as the structure that linked the sintering works with Broken Hill and South Australia. Thus, for similar reasons the visual impacts minimised route is preferable. In either case, given the importance of the tramway at local through to state and potentially national levels, it is an example of a heritage item that should be conserved. As such, regardless of which transmission route is chosen, all direct impacts associated with the transmission line should be kept at least 30 m off the permanent way of the tramway.

Finally, with regard to Lake's Grave, it is a site that has a history of importance as a local landmark and a place that has significantly impacted on how people relate to and name features in this part of the landscape. Accordingly it is recommended that the site be conserved and that any future development proposals should respect the heritage significance of this site.

Recommendations in regard to management and mitigation strategies relating to historical features are listed in Table 23 below.

Survey Unit	Historical site recording	Significance level	Recommended management strategy	Rationale
SU32	SU32/HS1 Prospecting pits	NA	**No constraints, however avoid if feasible** No further archaeological investigation. Unmitigated impacts.	Very small, discrete feature with limited archaeological research potential. *Does not meet the criteria for heritage listing*
SU53 (SU57 & SU58)	SU53/HS1 Blue Anchor Tank and pipeline	Local – part of a complex that is potentially of state significance	**Conservation: avoid all impacts.** Detailed recording of the exact location and extent of the pipeline prior to construction. *Avoid impacts within 10m of the tank and pipeline*	Structural evidence of this feature is relatively well preserved. Relatively discrete feature. *Site is assessed to be of local significance and is part of a broader complex that is potentially of state significance*
SU54	SU54/HS1 Prospecting pits	NA	**No constraints, however avoid if feasible** No further archaeological investigation. Unmitigated impacts.	Very small, discrete feature with limited archaeological research potential. *Does not meet the criteria for heritage listing*
SU62	SU62/HS1 Building platform	Local	**Avoid impacts if feasible** No further archaeological investigation. If impacts are proposed then mitigation in the form of salvage excavation/archival recording and artefact analysis. *Avoid impacts within 20m of this recording if feasible*	Structural evidence of this feature is relatively well preserved; associated deposits, while shallow, have potential to contain artefacts and additional structural evidence. Archaeological research potential is assessed to be moderate/high. *Site is assessed to be of local significance*
SU90	SU90/HS1 Mine workings	Local	**Avoid impacts if feasible** No further archaeological investigation. If impacts are proposed then mitigation in the form of salvage excavation/archival recording and artefact analysis. *Avoid impacts within 200m of this recording if feasible*	Structural evidence of this feature is relatively well preserved; while there is limited excavation potential there is good survey/research potential. Archaeological research potential is assessed to be moderate *Site is assessed to be of local significance*
SU90	SU90/HS2 Building platform and costeans	Local	**Avoid impacts if feasible** No further archaeological investigation. If impacts are proposed then mitigation in the form of salvage excavation/archival recording and artefact analysis. *Avoid impacts within 40m of this recording if feasible*	Structural evidence of this feature is relatively well preserved; while there is limited excavation potential there is good survey/research potential. Archaeological research potential is assessed to be moderate/high *Site is assessed to be of local significance*
SU90	SU90/HS3 Forge	Local	**Avoid impacts if feasible** No further archaeological investigation. If impacts are proposed then mitigation in the form of salvage excavation/archival recording and artefact analysis. *Avoid impacts within 20m of this recording if feasible*	Structural evidence of this feature is relatively well preserved; associated deposits, while shallow, have potential to contain artefacts and additional structural evidence. Archaeological research potential is assessed to be moderate/high *Site is assessed to be of local significance*

Survey Unit	Historical site recording	Significance level	Recommended management strategy	Rationale
SU90	SU90/HS4 Building platform and hearths	Local	**Avoid impacts if feasible** No further archaeological investigation. If impacts are proposed then mitigation in the form of salvage excavation/archival recording and artefact analysis. *Avoid impacts within 20m of this recording if feasible*	Structural evidence of this feature is relatively well preserved; associated deposits, while shallow, have potential to contain artefacts and additional structural evidence. Archaeological research potential is assessed to be moderate/high *Site is assessed to be of local significance*
SU92	SU92/HS1 Mine workings	Local	**Avoid impacts if feasible** No further archaeological investigation. If impacts are proposed then mitigation in the form of salvage excavation/archival recording and artefact analysis. *Avoid impacts within 200m of this recording if feasible*	Structural evidence of this feature is relatively well preserved; while there is limited excavation potential there is good survey/research potential. Archaeological research potential is assessed to be moderate *Site is assessed to be of local significance*
SU93	SU93/HS1 Road	Local	**No constraints, however avoid if feasible** No further archaeological investigation. Unmitigated impacts. *Recording extends into SU94 where it is recommended that impacts be restricted in a manner that would effectively conserve a portion of the road (see below)*	Discrete feature with limited archaeological research potential. However the site fits into a broader site complex that is assessed to be of local significance *Site is assessed to be of local significance*
SU94	SU94/HS1 Forge	Local	**Avoid impacts if feasible** No further archaeological investigation. If impacts are proposed then mitigation in the form of salvage excavation/archival recording and artefact analysis *Avoid impacts within 20m of this recording OR Preferably avoid all impacts on ridge crest southeast of 526700 6480500 so as to conserve SU94/HS1, SU94/HS2 and a portion of the associated road (SU93/HS1)*	Structural evidence of this feature is well preserved; associated deposits have potential to contain artefacts and additional structural evidence. Archaeological research potential is assessed to be moderate/high. *Site is assessed to be of local significance*
SU94	SU94/HS2 Building platform	Local	**Avoid impacts if feasible** No further archaeological investigation. If impacts are proposed then mitigation in the form of salvage excavation/archival recording and artefact analysis. *Avoid impacts within 30m of this recording and/or refer to above recommendations for SU94/HS1*	Structural evidence of this feature is relatively well preserved; associated deposits, while shallow, have potential to contain artefacts and additional structural evidence. Archaeological research potential is assessed to be moderate/high *Site is assessed to be of local significance*
SU141	SU141/HS1 Farming equipment	NA	**No constraints** No further archaeological investigation. Unmitigated impacts.	Very small, discrete feature with very limited archaeological research potential. *Does not meet the criteria for heritage listing*

Survey Unit	Historical site recording	Significance level	Recommended management strategy	Rationale
SU141	SU141/HS2 Stockyards	NA	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts. *Avoid impacts within 30m of this recording if feasible*	Very small, discrete feature with limited archaeological research potential. *Does not meet the criteria for heritage listing*
SU143	SU143/HS1 Artefact scatter and building platform/ hearth	NA	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts. *Avoid impacts within 20m of this recording if feasible*	Very small, discrete feature with limited archaeological research potential. *Does not meet the criteria for heritage listing*
SU190	SU190/HS1 Stone cairn	NA	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts. *Avoid impacts within 10m of this recording if feasible*	Very small, discrete feature with limited archaeological research potential. *Does not meet the criteria for heritage listing*
SU191	SU191/HS1 Building platform	Local	**Avoid impacts if feasible** No further archaeological investigation. If impacts are proposed then mitigation in the form of salvage excavation/archival recording and artefact analysis. *Avoid impacts within 20m of this recording if feasible*	Structural evidence of this feature is relatively well preserved; associated deposits have potential to contain artefacts and additional structural evidence. Archaeological research potential is assessed to be high. *Site is assessed to be of local significance*
SU191	SU191/HS2 Building platform	Local	**Avoid impacts if feasible** No further archaeological investigation. If impacts are proposed then mitigation in the form of salvage excavation/archival recording and artefact analysis. *Avoid impacts within 20m of this recording if feasible*	Structural evidence of this feature is relatively well preserved; associated deposits have potential to contain artefacts and additional structural evidence. Archaeological research potential is assessed to be moderate/high. *Site is assessed to be of local significance*
SU191	SU191/HS3 Road	NA	**No constraints, however avoid if feasible** No further archaeological investigation. Unmitigated impacts.	Discrete feature with limited archaeological research potential. *Does not meet the criteria for heritage listing*
SU226	SU226/HS1 Costean	NA	**No constraints, however avoid if feasible** No further archaeological investigation Unmitigated impacts. *Avoid impacts within 10m of this recording if feasible*	Very small, discrete feature with limited archaeological research potential. *Does not meet the criteria for heritage listing*
	Lake's Grave	Local	**Conservation: avoid all impacts.** Avoid impacts within 10m of this recording	This recording is a local landmark directly associated with an individual of local importance. The site has high archaeological research potential. *Site is assessed to be of local significance*

Survey Unit	Historical site recording	Significance level	Recommended management strategy	Rationale
	Stone ruins	Local	**Avoid impacts if feasible** No further archaeological investigation. If impacts are proposed then mitigation in the form of salvage excavation/archival recording and artefact analysis. *Avoid impacts within 50m of this recording*	Structural evidence of this feature is relatively well preserved; associated deposits have potential to contain artefacts and additional structural evidence. Archaeological research potential is assessed to be high. *Site is assessed to be of local significance. Landform is of sufficient size to allow alternate impact locations to be considered*
	Zinc sintering works	Local - potentially of state significance	**Avoid impacts if feasible** No further archaeological investigation. If impacts are proposed then mitigation in the form of salvage excavation/archival recording and artefact analysis *Visual impacts minimised route is preferred alignment for the transmission line*	Structural evidence of this feature is very well preserved; associated deposits, have potential to contain artefacts and additional structural evidence. Archaeological research potential is assessed to be high. *Site is assessed to be of local significance*
	Silverton Tramway	State - potentially of national significance	**Conservation: avoid all impacts.** *Avoid impacts within 30m of permanent way of the tramway*	Structural evidence for this feature extends along a relatively narrow corridor within which direct impacts might easily be avoided. Archaeological research potential is moderate. *Site is assessed to be of state significance and potentially of national significance.*

Table 23. Recommendations in regard to management and mitigation strategies relating to historical features.

While the table above details specific management options with regard to heritage items recorded within the proposal area there remains the consideration of management and mitigation of impacts to the broader cultural landscape of the Barrier Ranges. This includes all those heritage items discussed in Section 8 that are outside areas of direct impact but are within the visual catchment of the wind farm.

Within the Heritage Council's Wind Farm policy document it states that:

> An impact is any effect on heritage items, including cultural landscapes, which would not have occurred in the absence of the development. An adverse impact is one that leads to the loss of heritage value (Coleman 2003b: 12).

It goes on to discuss that the construction of a wind farm will change the landscape in which it sits and if this landscape is of heritage value, it can be said that the wind farm might *Materially Affect* the significance of that heritage landscape.

> *Materially Affect* is defined as: The changes proposed to a heritage item that will have an affect on the heritage significance of the item. This is not restricted to changes to the built fabric.

A wind farm does not automatically have a negative effect on a cultural landscape, but its potential impacts must be considered by consent authorities, and changes in the design of the wind farm to lessen such impacts may be required.

Section 6 of the *Wind Farms and Heritage* policy document deals with assessing potential impacts of proposed wind farms at or near heritage items; that is, it details considerations that are pertinent to developments within the curtilage of a heritage item and impacts that might occur where wind farms are located in the vicinity of heritage items. There is a particular emphasis in this section on the need to consider the historical and geographical context of heritage items and the historical influences that have shaped and continue to shape the area (Coleman 2003b). One component of this is consideration of the *viewshed*:

> *Viewshed:* If the values of a heritage landscape lie in the significant views that it offers, a wind farm development can potentially materially affect the views of a place.

A viewshed can be thought of similarly to a watershed, but in terms of what can be seen from a set point. A viewshed is an area composed of land, water, biotic and cultural elements which may be viewed and mapped from one or more viewpoints and which has scenic qualities and/or aesthetic values.

An assessment of visual impacts of the Silverton Wind Farm has been undertaken independently of this heritage study (Green Bean Design 2008). The visual impacts assessment has dealt with issues surrounding Silverton, its listing on the Register of the National Estate and potential impacts on aesthetic values at the site. The assessment considered the fact that Silverton comprises both extant buildings and empty spaces where structures once stood, all of which contributes to the aesthetic qualities of the site and hence to its listing on the Register of the National Estate.

> Although a number of wind turbines will be visible from areas within Silverton, as well as more extensive views toward the wind farm from areas to the south of Silverton, it is not considered that the wind farm will have a direct impact on the immediate aesthetic qualities contained within the area defined by the Register of the National Estate (Green Bean Design 2008: 14).

The report goes on to detail the visibility ratings from 51 different viewing locations including numerous locations in and around Silverton. The results indicate that the wind farm will have a low to moderate impact on landscape character (Green Bean Design 2008: 76).

Nonetheless, it is undeniable that the wind farm will have an impact on the landscape. Accordingly, it is worthwhile to consider the heritage impacts to what is essentially a cultural landscape of mining, pastoralism and human occupation. The history of that landscape might only extend into the nineteenth century however the landscape also bears testimony to a much lengthier human occupation and indeed an older exploitation of natural resources.

As this report has detailed there are a series of management strategies that will serve to minimise impacts to the heritage of the Barrier Ranges and while the cumulative effects of the wind farm may result in a low to moderate impact on landscape character, there are ways in which impacts might be mitigated and there are ways in which the proposed development could be seen to be complementary to the existing cultural landscape.

One aspect of this relates to the concept of *compatible use* which is defined within the HO&DUAP *Heritage Terms and Abbreviations* (1996) as:

> A use for a heritage item which involves no change to its culturally significant fabric, changes which are substantially reversible or changes which make a minimal impact.

Given that the Silverton Wind Farm proposal entails both construction and decommissioning of wind turbines, it is a change within the landscape that is substantially reversible with regard to visual impacts and that is temporary in terms of major changes in traffic patterns. Furthermore, since there remains the possibility that direct impacts might be avoided with regard to heritage items within the Stage 1 study area and, since any indirect impacts to heritage items in the vicinity of the wind farm would be limited, thus resulting in minimal impacts, the proposed use of the Barrier Ranges as a wind farm is in many ways a compatible use.

It could also be argued that the Silverton Wind Farm proposal contributes to an *adaptive reuse* of the mining landscape of the Barrier Ranges. The stone resources within this landscape have been exploited by Aboriginal peoples for thousands of years, while the historical period has seen a much more intense exploitation of mineral wealth across the region. Both these phases of stone procurement and mining have left considerable physical signatures and together they contribute to the heritage significance of the landscape. Similarly, the proposed Silverton Wind Farm aims to harness a natural resource within that landscape. The construction of the wind farm would add another dimension to the history of resource exploitation in the Barrier Ranges. Furthermore, there is the potential for this development to contribute to tourism by creating a new dimension to the visual identity of the place, as has been the case at other wind farms promoted as tourist attractions both nationally (eg Crookwell, NSW (Pacific Power no date) and internationally (eg Tarifa, Spain). Potential such as this could be embraced at Silverton through public education about the history of land use and the theme of resource exploitation. In this way the Silverton Wind Farm might help raise awareness of the heritage resources in the region and further serve to identify and protect these resources for future generations.

Indeed it is worth noting that the mining history and heritage of the local region has suffered a surprising amount of neglect in terms of historical research, field surveys, significance assessments and formal listing of heritage items. While the recent study by Hope (2006) has added considerably to what is known about the heritage of the region it also highlights areas that are deserving of further attention and, given the broad nature of the study, provides very limited details concerning the myriad of smaller heritage items that are scattered across the Barrier Ranges.

The field results detailed in this report provide an insight into the nature and extent of heritage items present within the landscape and demonstrate the potential information that could be gathered through a research project. A commitment to such a project would ensure that a much more comprehensive picture be compiled of

the history and heritage of the Barrier Ranges. This would in turn serve to raise awareness of and aid protection of the elements that comprise this broader cultural landscape.

14. RECOMMENDATIONS

Indigenous

- Management and mitigation recommendations are listed in respect of each Survey Unit and Aboriginal object locale in Table 22 in Section 12.

- No Survey Units have been identified in the proposal area to warrant further archaeological investigation such as subsurface test excavation; the Effective Survey Coverage achieved during the field survey was relatively high and can be considered to have been generally adequate for the purposes of determining the archaeological status of the proposed impact areas.

- None of the Survey Units in the proposal area have been assessed to surpass scientific significance thresholds which would act to entirely preclude proposed impacts. However two discrete Aboriginal object locales have been identified to warrant total exclusion of impacts: SU152/L2 and SU231/L2.

  It is recommended that an active conservation strategy is implemented in regard to these locales to ensure that they are not inadvertently impacted during the construction, operation and decommissioning of the wind farm. It is noted that these locales are either situated outside areas in which impacts are proposed or within areas in which a strategy of conservation, and hence impact avoidance, is expected to be highly feasible (see Section 12).

- The majority of the Aboriginal object locales recorded are very low (<1 per square metre) or low density (between 1 per square metre and 10 per square metre) distributions of quartz stone artefacts. The archaeological significance of these locales is assessed to be low. Accordingly unmitigated impact is considered to be appropriate.

- Many of the Aboriginal object locales and/or discrete areas within wider stone artefact distribution locales (including those which are predicted to contain subsurface archaeological deposit), stone procurement areas and locales with heat retainer hearths, are assessed to be of low/moderate or moderate archaeological significance. Accordingly, in regard to these sites, it is generally recommended that avoidance of impacts, or limiting the extent of impacts to these locales, if at all feasible, should be given consideration. In respect of some locales suggestions are outlined in Section 12 as to how avoidance may be achieved.

  In regard to these locales further recommendations are made in the event that avoidance of impacts is not feasible. In some cases especially those relating to small stone procurement locales it is recommended that if avoidance is not feasible unmitigated impacts are appropriate. However, in other cases such as locales containing deep soils and hence potential subsurface archaeological deposit with predicted moderate density artefact distribution, locales containing heat retaining hearths and larger and more complex stone procurement areas, it is recommended that if impact avoidance is not feasible a strategy of impact mitigation is appropriate. Impact mitigation will entail surface collection and sub-surface excavation of Aboriginal objects and subsequent analysis and research. Such a program would entail an adequately designed research program which would aim to address research questions compatible to those currently being pursued within the region.

- It is recommended additional archaeological assessment is conducted in any areas which are proposed for impacts that have not been surveyed during the current assessment. It is predicted that significant Aboriginal objects can occur anywhere in the landscape and accordingly if present they need to be identified and impact mitigation strategies implemented prior to impacts.

- The proponent should, in consultation with an archaeologist, develop a Cultural Heritage Management Protocol, which documents the procedures to be followed for impact avoidance or mitigation measures as recommended in this report.

- Personnel involved in the construction and management phases of the project should be trained in procedures to recognise and avoid disturbance to any recorded (if necessary) and/or unrecorded cultural heritage places and items.

Historical

- Management and mitigation recommendations are listed in respect of each historical item in Table 23 in Section 13.

- There are no constraints with regard to those items that are assessed not to meet the criteria for heritage listing (SU32/HS1, SU54/HS1, SU141/HS1, SU141/HS2, SU143/HS1, SU190/HS1, SU191/HS3 & SU226/HS1). Nonetheless, in most cases it has been recommended that impacts be avoided if possible.

- For the majority of recordings (SU62/L1, SU90/L1, SU90/L2, SU90/L3, SU90/L4, SU92/HS1, SU93/HS1, SU94/HS2, SU191/L1, SU191/L2 and the Stone Ruins) it is recommended that impacts be avoided if feasible and that where such a course of action is not feasible mitigation in the form of archival recording and/or salvage excavation be undertaken.

- In the case of Survey Unit 94, which contains a recording assessed to be of local significance and high research potential, two options have been outlined. On one hand there is the same course of action that is outlined above; that is, avoidance or mitigated impacts to the individual recordings. Alternatively, there is an option to avoid all impacts to the southeast of grid reference 526696e 6480400n. This is noted as the preferred option as it would also ensure conservation of a section of the road that extends down the spur (SU93/HS1) and conservation of the recordings SU94/HS1 and SU94/HS2. In this way a parcel of the larger site complex would be conserved, thus ensuring that future possibilities remain open for research, such as exploring the interrelationship between these sites, the Iron Duke mine and the recording of the Stone Ruins on the valley floor to the southeast.

- With regard to SU53/HS1, which also extends into SU57 and SU58, this item is associated with a larger site complex that it arguably of state significance and that is listed as an indicative place on the Register of the National Estate. While the water tank and pipeline themselves may not be of the same heritage value they do contribute to the overall significance of the Umberumberka Reservoir. Accordingly, it is recommended that these items be conserved and be the subject of more detailed recording prior to commencement of construction.

- In the case of the zinc sintering works it is noted that there are two options for the alignment of the transmission line: *initial route* and *visual impacts minimised route*. Given the extent of the site, the level of its heritage significance (local and/or state) and the fact that the initial route runs directly across the site it would be preferable to adopt the visual impacts minimised route, which runs approximately 1 km to the east of the sintering works. If impacts were unavoidable at the sintering works then mitigation in the form of archival recording and/or salvage excavation would need to be undertaken.

- The Silverton Tramway is a heritage item that is of state if not national significance (Hope 2006); it extends for approximately 50 km and is potentially subject to direct physical impacts at one of two locations. As discussed above the initial route of the transmission line is not preferable in terms of heritage management. This applies as much to the sintering works as an individual heritage item as it does to the tramway as the structure that linked the sintering works with Broken Hill and South Australia. Thus, for similar reasons the visual impacts minimised route is preferable. In either case, given the importance of the tramway at local through to state and potentially national levels it is an example of a heritage item that should be conserved. As such, regardless of which transmission route is chosen, all direct impacts associated with the transmission line should be kept at least 30 m off the permanent way of the tramway.

- Lake's Grave is assessed to be of high local significance. It is a site that has a history of importance as a local landmark and a place that has significantly impacted on how people relate to and name features in this part of the landscape. Accordingly it is recommended that the site be conserved and that any future development proposals should respect the heritage significance of this site.

- It is recommended that the *visual impact minimised route* for the transmission line be adopted so that direct impacts are avoided at the Zinc Sintering Works, Corruga and so that visual impacts to the cultural landscape as a whole are minimised.
- It is recommended that additional heritage assessment is conducted in any areas which are proposed for impacts that have not been surveyed during the current assessment. It is predicted that significant

Non Indigenous heritage items can occur anywhere in the landscape and accordingly if present they need to be identified and impact mitigation strategies implemented prior to impacts.

- It is recommended that the proponent give consideration to commissioning a comprehensive research project on both the Aboriginal and Non Indigenous history and heritage of the area. Primary objectives of such a study would be to fill in the gaps in the existing history of mining for the region and compilation of a more complete record of heritage items in the Barrier Ranges. This would in turn aid in conservation of heritage values across the landscape, which would serve as a considerable mitigation of the abovementioned impacts to that landscape.
- The proponent should, in consultation with an archaeologist, develop a Cultural Heritage Management Protocol, which documents the procedures to be followed for impact avoidance or mitigation.
- Personnel involved in the construction and management phases of the project should be trained in procedures to recognise and avoid disturbance to any recorded (if necessary) and/or unrecorded cultural Non Indigenous heritage places and items.

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