Environmental Impact Assessment

McArthur River Mine

Phase 3 Development Project

Report on Archaeology and Historic Heritage

Final report

Prepared for MET Serve

On behalf of Xstrata. Zinc

Begnaze Pty Ltd
ABN 16 050 796 13
Phone: 08 89275091

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EXECUTIVE SUMMARY

The objective of this cultural heritage assessment was to document the known cultural heritage sites, both Indigenous and non-indigenous sites or objects that will be impacted by the MRM Phase 3 Development Project (the Project) and to describe any possible constraints and legal requirements that may arise from their disturbance or destruction.

The table below summarises the recommendations for the protection of cultural values for the identified archaeological sites and objects. No protected historic sites were identified in the footprint of the proposed Project.

Summary of recommendations for archaeological sites and objects.

<table>
<thead>
<tr>
<th>Site</th>
<th>Potential impact</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRM3</td>
<td>None</td>
<td>Site protected by star pickets and signage</td>
</tr>
<tr>
<td>MRM4</td>
<td>Partially impacted</td>
<td>Site protected by star pickets and signage</td>
</tr>
<tr>
<td>MRM5</td>
<td>Will be destroyed</td>
<td>Seek permission for site to be destroyed, with provisos</td>
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<td>MRM6</td>
<td>Will be destroyed</td>
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</tr>
<tr>
<td>BS30</td>
<td>Will be disturbed</td>
<td>Seek permission for artefacts to be disturbed</td>
</tr>
<tr>
<td>BS35-36</td>
<td>Will be disturbed</td>
<td>Seek permission for artefacts to be disturbed</td>
</tr>
<tr>
<td>BS38-39</td>
<td>Will be disturbed</td>
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<td>BS41-55</td>
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<td>BS58-59</td>
<td>Will be disturbed</td>
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</tr>
<tr>
<td>BS64</td>
<td>Will be disturbed</td>
<td>Seek permission for artefacts to be disturbed</td>
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<tr>
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<td>Seek permission for artefacts to be disturbed</td>
</tr>
<tr>
<td>BS66</td>
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</tr>
<tr>
<td>BS67</td>
<td>Will be disturbed</td>
<td>Seek permission for artefacts to be disturbed</td>
</tr>
</tbody>
</table>

Recommendations.

- Pre-Construction phase

Before works commence permission should be sought from the Minister for Natural Resources, Environment and Heritage to disturb / destroy the archaeological sites and objects that will be impacted by the Project.

Those archaeological sites which will not be impacted and all the sacred sites, should be fenced and their boundaries recorded on a GIS data base.

The cultural heritage awareness programme should be continued and should include an awareness of the presence of both archaeological and sacred sites in and around the Project area and the legal obligations on individuals for their continued protection.

The decision for the storage or not, of any Indigenous archaeological material from sites that may be disturbed by the project is made by the traditional owners.
• **Construction phase**

A process should be in place to mitigate the loss of any cultural heritage values in the event of disturbance to any unidentified archaeological sites or objects.

All personnel workers involved in this phase should attend the cultural heritage awareness programme where they are made aware of the areas where no access is allowed.

All archaeological sites and sacred sites are monitored regularly.

• **Operational phase**

All new workers should undergo the cultural heritage awareness programme.

A cultural heritage management plan should be developed to ensure the longer-term protection of sites.

Archaeological sites and sacred sites are monitored yearly.
TABLE OF CONTENTS

1.0. INTRODUCTION .......................................................... 6
2.0. HERITAGE LEGISLATIVE FRAMEWORK .............................. 7
  2.1. Commonwealth legislation ............................................ 7
  2.2. Northern Territory legislation ...................................... 8
       2.1.1. Declared heritage places and objects ...................... 8
       2.1.2. Prescribed archaeological places and objects ............ 8
3.0. ENVIRONMENTAL SETTING ............................................ 9
  3.1. Environmental factors affecting the archaeological visibility. ... 9
4.0. CULTURAL SETTING .................................................. 10
  4.1. Introduction .......................................................... 10
  4.2. Historic background ................................................. 10
  4.3. Previous historical heritage surveys on the McArthur River Mine lease ... 11
  4.4. Ethnographic background .......................................... 11
  4.5. Aboriginal archaeology ............................................. 12
  4.6. Previous archaeological surveys on the MRM Mine lease .......... 13
5.0. METHODOLOGY ......................................................... 16
  5.1. Survey procedures .................................................. 16
  5.2. Types of archaeological sites ..................................... 16
  5.3. Site definition ..................................................... 17
  5.4. Artefact identification ............................................. 17
6.0. RESULTS .............................................................. 19
  6.1. McArthur River Village Complex .................................. 19
       5.1.1. MRM6 ......................................................... 19
       5.1.2. Clay pigeon shooting range ................................ 21
  6.2. Tailings Dam ......................................................... 21
  6.3. North OEF .......................................................... 21
  6.4. East of bund wall .................................................. 22
  6.5. Background scatters of isolated stone artefacts ................. 23
6.6. Discussion .................................................................................................................. 23
6.7. Assessment of archaeological and heritage significance ............................................. 24
7.0. POTENTIAL IMPACTS AND RECOMMENDATIONS .............................................. 26
7.1. Recommendations for archaeological sites and objects ............................................ 26
7.2. Pre-construction phase ............................................................................................... 28
  7.2.1. Appropriate storage and conservation ................................................................. 28
7.3. Construction phase ...................................................................................................... 28
  7.3.1. Unrecorded archaeological material ................................................................... 29
7.4. Operational phase ........................................................................................................ 29
  7.5. Cultural heritage awareness programme .................................................................. 29
  7.6. Decommissioning and rehabilitation stages .............................................................. 29

REFERENCES ................................................................................................................. 31

FIGURES
Figure 1. Map of North OEF and Outer Bund OEF ......................................................... 33
Figure 2. Map of Tailings Dam and Village expansion ..................................................... 34

TABLES
Table 1. Frequency of archaeological sites / material recorded within the subject land ......... 12
Table 2. Previously recorded sites within the subject land ................................................. 15
Table 3. Details of the background scatters of isolated stone artefacts .............................. 23
Table 4. Summary of archaeological sites ........................................................................ 23
Table 5. Summary of the significance of sites and background scatters ........................... 25
Table 6. Summary of potential impacts on sites ................................................................. 26

APPENDICES
Appendix One ....................................................... Detailed descriptions of MRM3, MRM4 and MRM5
Appendix Two .......................................................... Detailed descriptions of BS30, and BS35-BS59
Appendix Three .................................................... Photos
1.0. INTRODUCTION

This report was prepared for MET Serve Pty Ltd on behalf of Xstrata Zinc to describe the cultural heritage component of the environmental impact statement for the proposed Phase 3 Development Project at the McArthur River Mine. The mine is located in the Gulf Region of the Northern Territory of Australia and approximately 60 kilometres southwest of Borroloola, 120 kilometres south of the Bing Bong loading facility on the Gulf of Carpentaria and 900 kilometres southeast of Darwin. Begnaze was contracted to carry out the cultural heritage component by MetServe.

The work consisted of:

- A review of previously recorded archaeological and historic sites, which are located within the vicinity of the proposed Project. The review includes those sites listed on any Commonwealth and Northern Territory heritage registers.

- A field survey to identify any previously unrecorded archaeological and historic sites and objects and to determine which previously recorded sites will be impacted by the proposed works. The proposed expansions are to occur at the McArthur River Mine village complex, the North Overburden Emplacement Facility (OEF) and the Tailings Dam (see Figures 1 and 2). Begnaze was also asked to survey sections of the surface between the outer bund wall and McArthur River Diversion which had not been previously examined (see Figure 1).

The survey was carried out over three days by two archaeologists Christine Crassweller and Dr Silvano Jung accompanied by Kirsty Hogarth from MRM. A senior traditional owner, Ronnie Raggett assisted with the survey for one day and was shown all the identified archaeological sites on the Project’s footprint.

- Assessments of significance for the identified archaeological site and objects located during the survey.

- Determination of the impacts on the sites and recommendations to either protect or mitigate the loss of any cultural values of any identified historic or archaeological places during the construction and operational phases of the project.
2.0. HERITAGE LEGISLATIVE FRAMEWORK

The protection of heritage places and objects is legislated under both Commonwealth and Northern Territory laws. In 1997 an agreement was made by the Council of Australian Governments that each level of government should be responsible for protecting heritage at the appropriate level. Consequently Commonwealth legislation protects places of world and national heritage significance and ensures Commonwealth compliance with state heritage and planning laws. Each state and territory government, and local government, has a similar responsibility for its own heritage.

2.1. Commonwealth legislation

The Commonwealth Government protects heritage sites under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and the Environment and Heritage Legislation Amendment Act (No 1) 2003 and places legal constraints on archaeological and historic sites. There are two lists of protected heritage sites that may be relevant to this study. The lists are available on the internet at [http://www.environment.gov.au](http://www.environment.gov.au) and the relevant lists for this project are:

- **The National Heritage List** that protects places of exceptional natural and cultural significance with penalties for any breaches. Approval from the Minister of Sustainability, Environment, Water, Population and Communities is needed before any sites are disturbed. This list commenced on 1st January 2004, and as at July 2011, no existing or currently proposed sites will be impacted by the project.

- **The Register of the National Estate represents** a national data base of places with significant Aboriginal, historic or environmental values. It originally contained not only places that were registered but also places that had been nominated to the register and had been assessed, nominated, rejected or removed. From 2007 this register has been frozen, meaning that no places can be added or removed and it will continue as a statutory register until February 2012.

  A five year transition period has been provided to allow state and territory governments to consider whether there are any places on the register that should receive heritage protection. The entry of a place on the Register of the National Estate does not place any direct legal constraints or control over the actions of state or local government or private owners.

  No historic or archaeological sites on either of the lists will be impacted by the project. However there are thirty four indigenous sites recorded on the Register of the National Estate for the Borroloola region. No details or locations for these sites are described and it is possible that some may be located in the areas to be disturbed by the Project. These sites have most likely been recorded because of their significance to the Indigenous people and based on their traditional beliefs, rather than being archaeological sites. As traditional owners and custodians have been consulted through the Aboriginal Areas Protection Authority or the Northern Land Council, any archaeological sites that may be a part of a sacred site and located in the area, will be protected by either the Northern Territory Aboriginal Sacred Sites Act 1989 or the Aboriginal Land Rights Act (Northern Territory Act) 1976.
2.2. Northern Territory legislation

There are two kinds of heritage sites protected under the *NT Heritage Conservation Act (1991)*, declared and prescribed places and objects. This Act places legal constraints on owners of private property, local government and the Crown:

- places or objects listed on the Northern Territory Heritage Register are declared heritage places and objects that are protected under section 33 of the *Heritage Conservation Act (1991)*, and
- prescribed archaeological places and objects, which may or may not be declared, are protected under sections 29 and 39 of the *Heritage Conservation Act (1991)*.

It is an offence under the Act to damage, destroy, alter or carry out work of any sort on declared or prescribed sites without the written consent of the Minister for Natural Resources, Environment and Heritage or the Minister’s delegate.

It should be noted that a new Heritage Act was tabled in the Northern Territory Legislative Assembly on the 10th August 2011. This new Act does not include any major changes that would affect the legislative responsibilities by the proponent.

2.1.1. Declared heritage places and objects.

The Northern Territory Heritage Register contains places that possess special significance for the Northern Territory and have been recognized for a wide range of natural and cultural values. As a result it includes places that have been deemed significant because of their environmental and / or cultural characteristics. There are no declared heritage places or objects in the project area.

2.1.2. Prescribed archaeological places and objects.

Most archaeological places and objects are listed in the Heritage Conservation Regulations (1999) as prescribed places and objects. The NT Heritage Conservation Services, Department of Natural Resources Environment and the Arts and Sport (NRETA) holds the Archaeological Sites Register. Included in this register are the protected prescribed sites that consist of all archaeological sites and objects pertaining to the past occupation by Aboriginal or Macassan people. There are currently six archaeological sites and 63 archaeological objects listed on the register that are located within the project area. Three of the archaeological sites have been disturbed / destroyed after permission was given from the Minister.

The historic sites listed on Archaeological Sites Register are not protected under the *NT Heritage Conservation Act 1991*.
3.0. ENVIRONMENTAL SETTING

The McArthur River is an entrenched single channel in the area around the mine site (Scott and Speight 1996). Flooding is infrequent but of high velocity with a rapid runoff leaving a levee bank, behind which is an undulating flood plain. The levee consists of sand and silt with no outcrop or stone and the floodplain is made up of deep alluvial soils of grey and brown clays, cracking clays and siliceous sands formed during recent and Holocene floods. The edge of the river supports mid-high open woodland and tall fringing riparian vegetation (Hughes 2002, Aldrich and Wilson 1992, Guse and Collis 1998).

Along the banks of Barney Creek and the McArthur River, deep gullies have formed in the alluvium by wet season run-off. The flood plains consist of gently undulating plains on mainly unconsolidated Pleistocene transported material with yellow and brown earths, cracking clay soils and mid high open woodland. There are areas where gravel and cobbles have floated to the surface from the underlying bedrock. The higher ground of gently undulating terrain behind the floodplain supports low open eucalypt woodlands of *E. tectifica* (Northern Box) and *E. Terminalias* (Bloodwood) with an understorey of either Golden Beard and White Grass (Wilson et al. 1991).

The geology in the area around the mine site could have provided a source for the raw materials used in the manufacture of stone tools in the past. To the north east, approximately two kilometres from the mine site is a ridge along a fault line, which is made up of the Masterton Sandstone geological group which contains fine grained sandstone and siltstone, the Mainoru Formation which contains siltstone and purple mudstone and the Yalco group, which contains abundant chert nodules. Barney Hill is made up of Teena Dolomite which contains siltstones and quartz nodules. To the north, approximately three kilometres from the mine site is a ridge of Reward Dolulite which contains sandstone.

3.1. Environmental factors affecting the archaeological visibility.

The archaeological visibility will be low on the McArthur River and Barney Creek floodplains as any stone artefacts discarded in the past in this area would be quickly covered by sediments when the areas are flooded. Any sites on the banks of creeks and rivers will more likely be identified in creek gullies where the floodplain deposits have been washed away disclosing bedrock. There will be a higher potential for locating artefacts on higher ground and the low hills and ridges away from the river and creeks where erosion may be occurring. This archaeological pattern was identified during previous archaeological surveys on the mine lease area (Crassweller 2005a, b and c).

This area contains a reliable source of water and a wide variety of raw material which could be used in the manufacture of stone artefacts. Consequently there is a high possibility that the area was used regularly in the past, resulting in a high potential for Aboriginal archaeological material in the area.
4.0. CULTURAL SETTING

4.1. Introduction.

The data sources used for this section have been compiled from four principle sources:

1. The archaeological sites register held by the Heritage Branch, (NRETA).
2. The Northern Territory Heritage Register held by the Heritage Branch (NRETA).

In addition to these sources, published and unpublished documents and reports describing Northern Territory historic places were used. These documents are held by the State Library of the Northern Territory, the Darwin office of the National Trust, the Heritage Branch (NRETA) and the Northern Territory Museum.

4.2. Historic background

The first European to visit the area was the explorer Leichhardt and his party in 1845 when he crossed and named the McArthur River near the present Borroloola town. He found the local population friendly and well acquainted with metal knives and fire arms (Leichhardt 1847:414). After visiting some of their deserted camps he noted that they ate emus (Ibid p:410), cycads and pandanus nuts and used coolomons for water storage (Ibid p:407) and stored ochre in packages (Ibid p:409). In the region he also noted that the Aboriginal people used stone fish traps (Ibid p: 409), burnt the grasses along ridges and flats (Ibid p:418), made wells (Ibid p:405) and ate freshwater mussels (Ibid p:410).

Regular visits to the area commenced around 1869 when people began travelling from Queensland to the gold fields of Pine Creek and then the Kimberley region. Wentworth Darcy was the first to bring cattle overland from western Queensland to the goldfields via the Queensland track and the Borroloola area in 1870. In the 1880s the area was examined for future pastoral leases. Alexandria Downs was the first in the region to be stocked in 1882 and in 1884 the McArthur River Station was established by Broad and Amos. Borroloola town site was surveyed in 1885 and by 1889 the local Aboriginal people started to live in the town (Cotton nd).

The presence of minerals was first identified on the McArthur River Station in 1887 by the station manager Tom Lynott, who identified copper, lead and silver (Jones 1987:170). In 1907 a government exploration team travelled to the McArthur River Station where they found large surface outcrops of copper, lead and zinc ores (Jones 1987:133). In 1911 the McArthur River Syndicate was floated to take up claims in the district, however after successful drilling occurred they wound up the company when it was decided that mining was not viable given the remote location of the ore bodies. Other small mining ventures occurred in the district intermittently and they found that most deposits were in the Barney Hill area (Pietsch et al. 1991). However all were abandoned as freight costs were prohibitive (Radmuller 2004).

In 1951 Mount Isa Mines became interested and commenced exploratory drilling and found the HYC (Here’s Your Chance) deposit in 1955. This exploratory stage ended in 1959. However it was not until 1995 that mining commenced after MIM metallurgists had developed a financially viable method of extracting metals by using fine grinding techniques and by selective mining (Radmuller 2004).

There is only one historic site in the region of the mine that is listed on the Archaeological Site Register held by the Heritage Branch, NT. This site is the Old McArthur River Station is located approximately 3 kilometres south-west of the area to be disturbed.
4.3. Previous historical heritage surveys on the McArthur River Mine lease

Previous surveys by Crassweller (1995a, b and c) identified articles left by mining exploration and pastoral activities. These objects included small bore holes, bottles, soft drink cans, 44-gallon drums, galvanised iron sheets, and numerous star pickets and wire. The majority of this material was located on the eastern side the McArthur River. Other items included three old Australian survey markers on the eastern side of the river with bronze labels screwed onto a concrete block.

Two areas that appeared to be semi-permanent mining camps from the 1950 through to the 1980s were located on the eastern side of the river and are located within the outer bund wall around the existing open cut pit. Both of these sites were assessed as having low historic significance as the remains are disturbed and were of a recent age.

4.4. Ethnographic background

The traditional owners of the land on the McArthur River Mine lease are the Gudanji people. As mentioned above the earliest observations of the Indigenous people in the region were recorded by Leichhardt as he travelled through the country. Spencer and Gillen (1912) were the first anthropologists to record Aboriginal life around Borroloola and they recorded that various food resources were used such as lily roots, sugar bag and damper made from lily seeds. Burials consisted of the bones wrapped in paperbark. A year after the death, the bones were placed in a hollow, decorated tree trunk that was sealed at both ends and then finally placed in a rock shelter or sometimes near a waterhole. The people used two types of spear throwers and during that time stone tipped spears were being replaced by iron tips.

Stretton (1893) who was a magistrate at Borroloola observed that the main way of catching fish was to construct a small dam of stakes and grass near the bars or junctions of fresh and saltwater creeks and rivers. Other foods consumed were kangaroo, fruits and flying foxes.

Baker (1999:145) found that scatters of stone artefacts are located in places where the people used to congregate seasonally at favoured camping spots near reliable water supplies, often lagoons, and near terrestrial food resources with easy access by river to marine resources. Baker also says that it is difficult to estimate the pre-European population in the Borroloola district due to the effects of disease and violence associated with the arrival of Europeans.

The earliest research in northern Australia investigating Aboriginal subsistence strategies and material culture was carried out by Basedow (1907), Foelsche (1882), Thomson (1983) and Spencer (1914). Their observations describe general information regarding Aboriginal life including the various weapons and other implements used during the contact period in the Top End. Basedow (1907) and Foelsche (1882) give early accounts of subsistence activities in the Top End of Australia. They describe swamps and lagoons as being focal points of subsistence activities providing sources of fish, geese, ducks, turtles, crocodiles and their eggs, shellfish and the roots of water lilies and rushes. Away from the lagoons, wallabies, snakes, goannas and other small game were hunted. Seasonal factors were a key determinant on camp locations, types of residential grouping, the degree of mobility and the nature of subsistence activities. During the wet season groups of people would have been able to access resources over a wider area, as water was readily available and higher uplands used to avoid the rivers and tributaries. In the dry season as water receded, the location of camps would have contracted to more permanent sources of water.
4.5. Aboriginal archaeology

Past archaeological research in the McArthur River area was generated in the 1970s and onwards by the development of the McArthur River Mine and other projects (Haglund 1975, Stokes 1992, Thorley 1992, Thorley & Blackwood 1993, Guse and Bowen 1993, Heritage Surveys 1999). Little analytical research or detailed descriptions have been carried out in this region as the majority of the sites were recorded for environmental impact studies where the site recordings were used for management purposes (Guse and Collis 1998).

The only other archaeological research to have been documented in the region was by McLaughlin (1976), Mathew (1964) and Reay (1965) who recorded either rock art or anthropological sites in the area.

There are presently 120 Aboriginal archaeological sites listed on the Archaeological Site Register for the Borroloola 6165, 1:100,000 map sheet held by the Heritage Branch, Darwin. Table 1 lists the frequency of site types and archaeological material on the register. It should be noted that more than one site type may be represented at a single site. For example there are 30 sites that contain both a stone artefact scatter and paintings.

<table>
<thead>
<tr>
<th>Stone artefact scatter</th>
<th>Rock Painting</th>
<th>Rock Engraving</th>
<th>Grinding Stone / place</th>
<th>Quarry</th>
<th>Hearth</th>
<th>Shell Midden</th>
<th>Skeletal Remains</th>
<th>Scarred tree</th>
<th>Stone arrangement</th>
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<td>7</td>
<td>3</td>
<td>1</td>
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</table>

The most common site type is stone artefact scatters, followed by rock art sites. Given the lack of a suitable surface on which the rock art can be produced on the survey areas, the potential for rock art is very low. There is a relatively low proportion of identified quarry sites in the region especially when three of the quarry sites were used to extract pigments that may have been used for either rock paintings or ceremonial purposes. The low number of quarries is most likely related to the areas which have been surveyed rather than a lack of this site type. The other quarries were used to extract raw material such as chert and quartzite used in the manufacture of the stone artefacts (Haglund 1975, Guse and Bowen 1993). Flaked glass was also identified by Haglund (1975) in the area around the Old McArthur River Station. This illustrates how the Indigenous people were able to incorporate new materials into their traditional life.

Thorley and Blackwood (n.d.) located two small artefact scatters 350 metres apart and adjacent to Barney Creek when carrying out a survey for the proposed gas pipeline from Daly Waters to the mine site. These two sites are located approximately five kilometres south west of the proposed area of disturbance. The sites were located on an old gravel terrace and on the creek’s floodplain.

Guse and Collis (1998) attempted to provide an overview of archaeological site types and occurrence in relation to the environment in the wider McArthur River region. They found that the majority of sites were located in rugged rock plateaus, steep hills or alluvial plains adjacent to major drainage lines. Stone artefact scatters are the dominant site type on the alluvial plains, the terrain where the proposed development is to occur.

The archaeological material identified from these studies include flakes, cores, retouched flakes and unifacial and bifacial points predominately made of chert with smaller numbers of quartzite, mudstone
and sandstone. Backed blades and tulas have also been identified in the region (Pickering 1990, Guse and Bowen 1993, Sim 2001, Hughes 2002).

Guse and Bowen (1993) located five areas of background scatters north of Borroloola and they were associated with either raw material source, sources of freshwater or with alluvial floodplains. Pickering (1990) located an artefact scatter on the banks of the McArthur River near Borroloola and described the site as consisting of a light scatter of artefacts exposed through the denudation of sandy soils though human traffic. It contained mainly small flakes and cores of chert and silcrete. Other artefacts identified were two backed blades, one broken bifacial point and a small fragment of a grindstone.

4.6. Previous archaeological surveys on the MRM Mine lease

The first cultural surveys were carried out by Haglund (1977) to survey areas which would be impacted by the planned mine site at that time. No archaeological sites and several anthropological sites (McLaughlin 1976) were identified in the area around the existing mine site. Clusters of archaeological sites were identified along Emu Creek and the Glyde River and were either rock shelters or open sites. These sites contained rock art, burials, stone artefact scatters, quarries with cores, flakes, some with retouch and grindstone slabs. Fifteen sites have been recorded within approximately six kilometres of the MRM Mine site and outside the subject land.

On Barney Hill an artefact scatter was recorded by Stokes (1992) and the fieldwork for this survey consisted of an intensive survey over the then proposed tailings dam, accommodation camp, concentrator facility and the pipeline linking the dam to the concentrator. Hughes and Hiscock (1993) carried out a detailed recording of this site which was located on the northern side of Barney Hill. While this report has not been sighted, Hughes (2002:4) noted that this site had a high diversity of artefacts types and raw material and a relatively high proportion of retouched artefacts which included tulas and points and also grindstones and other retouched artefacts. It is thought that this site was used as a base camp where people processed and consumed food and repaired their tool kits.

Stokes (1992:7) also recorded one small artefact scatter along Surprise Creek and noted that there was a continuous background scatter of stone artefacts along the creek in areas of erosion. However as the site was in an area of sheet wash she considered that the stone artefact concentration may be due to post depositional processes.

No archaeological sites were located during the 2002 survey carried out by Hughes (2002) over the proposed McArthur River mine expansion for the open cut mine. The survey included areas that will be disturbed by the current proposal. The survey however found nineteen areas that contained “find spots” or background scatters of isolated stone artefacts. Unfortunately there is no record of the co-ordinates for these archaeological objects. Twelve of these ‘find spots’ were located adjacent to Barney Creek on cracking clays, four adjacent to Surprise Creek on either silty sands or cracking clays, two on cracking soils in the proposed plant area near rock ‘float’ and one near the Old McArthur River Station.

The archaeological surveys carried out by Crassweller (2005a, b and c) for the Open Cut Project located five archaeological sites and identified eighty one areas containing isolated stone artefacts. The stone artefact scatters of MRM1 and MRM2 were approximately 20 metres apart and located at the top of a gully that becomes quite steep as it nears Barney Creek. MRM1 was located on undulating terrain of cracking clays while MRM2 appears to be eroding out of the side of the gully. The sites were approximately 400 metres from where Barney Creek flows into the McArthur River.

Bourke (1997) carried out a detailed survey and excavation on both sites before they were destroyed for the Open Cut Project. As there was a low average density of artefacts, a high proportion of
cores, mostly of locally available chert and quartzite, Bourke (1997:24) suggested that there was a short term, seasonal occupation of the sites when water was present and other resources were available in the the riparian zones along the creek and river. The presence of a large exotic grindstone which also infers there was exchange of goods with other groups and the fragments of quartzite stone grinding stone fragments indicate that processing of food may also have occurred at the sites.

Supplementary surveys carried out by Crassweller (2005c) located a further three archaeological sites MRM3, MRM4 and MRM5. MRM3 is a stone artefact scatter (32 x 10m) located on the top of a gentle rise that runs along the side of a floodplain which is approximately 100 metres to the east. The site consists of two concentrations of artefacts which included several discrete knapping floors. The artefacts were manufactured from dark grey siltstone consisting of 70% flakes and 30% cores. No retouched artefacts were found. This site was assessed as having moderate archaeological significance.

MRM4 is a large quarry site (240 x 110m) located on a gentle rise on the back plain where the artefacts are made from a light brown siltstone. The size and the high density of artefacts indicate that this site was an important location for the procurement of the raw material used in the manufacture of stone artefacts and was consequently assessed with moderate to high archaeological significance. Consequently, the footprint of the 2005 expansion project was altered to avoid this site.

MRM5 is a small quarry located over a low stone siltstone outcrop on a gravely rise 300 metres from a relatively large billabong, that dries up during the dry season. The main concentration of artefacts is located in a 5 x 5 metre area in a density of approximately 5 artefacts per square metres. The raw material, a dark grey siltstone extracted at this site was similar in colour and texture to the raw material quarried at MRM3. This site was assessed as having low to moderate archaeological significance.

The majority of these were subsurface as they were identified after the surface was being cleared by a bull dozer. The majority of the isolated artefacts were located in areas of minor drainage lines and particularly in the area adjacent to MRM1 and MRM2.

The majority of the isolated stone artefacts identified during the 2005 surveys (Crassweller 2005b) were subsurface as they were identified after the surface was being cleared by a bull dozer. Most were located in areas of minor drainage lines and particularly in the area adjacent to MRM1 and MRM2. A brief examination of these isolated artefacts indicated that north of the river there was less chert and more siltstone artefacts manufactured from the locally available siltstone. There was also a trend towards a higher proportion of retouched artefacts and cores, the majority of which were. One unusual finding was the low proportion of formal types of knapped stone tools, such as points, in the background scatters whereas they were more prevalent in MRM2 and the Barney Hill site. There was also a relatively high proportion of grindstones and grinding slabs in the background scatters both north and south of Barney Creek.

4.7. Discussion

Previous archaeological and anthropological research in the McArthur River region indicates that there will be a higher likelihood of archaeological sites around freshwater sources. In the survey area these sites will consist of open artefacts scatters containing a wide range of stone artefact types. The previous research also indicates that there will be background scatters of isolated artefacts around creeks and billabongs.

The findings from the archaeological survey indicate that the McArthur River and the back plains were a focal point in past Aboriginal use of the landscape. This interpretation is based on the high
frequency of backgrounds scatters rather than a high number of archaeological sites identified in this environmental zone. Previous surveys (Crassweller 2005a, b and c, Hughes 2002) have identified 104 areas which contained a background scatter of isolated stone artefacts that include the sub-surface artefacts located during the clearing operations for the Test Pit Project. This suggests that there is a high potential for the presence of isolated stone artefacts in the areas to be disturbed by the expansion of the OEF.

Most isolated artefacts were identified in eroded areas dissected by gullies and creek lines or on small gravelly rises near small flood plains, ephemeral creeks or billabongs. However the distribution and frequency of artefacts in the area may be a sign of changes to the surface by flooding, erosion and the cracking clay plains which are also prone to local changes over relatively short periods through the swelling of the clays in the wet season and the cracking of the clays in the dry season, rather than an indication of past Aboriginal settlement patterns and resource use.

The lack of artefacts along the river corridor and sandy levees which can extend for 100 metres from the river suggests that the high velocity floods have removed any artefacts that may have been present. In fact previous surveys found that there is a scarcity of any stone in this environmental zone.

The three previously identified archaeological sites (MRM3, 4 and 5) were located either on gravelly or stony low rises on the plains where there was either an outcrop of a raw material suitable for knapping and /or near a source of fresh water and associated resources. The two archaeological sites (MRM1 and MRM2) identified during the surveys carried out for the Test Pit Project (Crassweller 2005b) were located on the boundary between the levee bank and the cracking clay plains on the upper limits of a stony deep gully that flows into Barney Creek. This suggests that if any intact sites are still present along the river they would be located away from the main flow of the flooded river on the cracking clays adjacent to the levee banks.

Table 2 lists all the recorded sites near or on the areas that will be disturbed by the project. Three of these sites, Barney Hill, MRM 1 and MRM2 have been destroyed after a detailed survey and / or an excavation had been carried out (Hughes and Hiscock 1993, Bourke 2007). The Surprise Creek site is outside the area that will be impacted by the current project.

**Table 2. Previously recorded sites within the subject land**

<table>
<thead>
<tr>
<th>Site</th>
<th>Easting</th>
<th>Northing</th>
<th>Type</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surprise Creek</td>
<td>612800</td>
<td>8185500</td>
<td>Stone artefact scatter</td>
<td>Outside area of expansion</td>
</tr>
<tr>
<td>Barney Hill</td>
<td>616300</td>
<td>8182700</td>
<td>Stone artefact scatter</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MRM1</td>
<td>617553</td>
<td>8183239</td>
<td>Stone artefact scatter</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MRM2</td>
<td>617621</td>
<td>8183247</td>
<td>Stone artefact scatter</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MRM3</td>
<td>617571</td>
<td>8187081</td>
<td>Quarry, stone artefact scatter</td>
<td></td>
</tr>
<tr>
<td>MRM4</td>
<td>618364</td>
<td>8184969</td>
<td>Quarry</td>
<td></td>
</tr>
<tr>
<td>MRM5</td>
<td>615922</td>
<td>8185597</td>
<td>Quarry, stone artefact scatter</td>
<td></td>
</tr>
</tbody>
</table>
5.0. METHODOLOGY

5.1. Survey procedures

The aims of the fieldwork were to locate and record any archaeological or historic objects or places in the vicinity of the proposed Project to ensure that the provisions of the Northern Territory Heritage Conservation Act 1991 are not contravened. The archaeological survey was carried out as follows:

- The archaeological and heritage study identified archaeological material within the designated area by means of a survey carried out in a manner that ensured the highest possible coverage. Pedestrian transects were made over the subject land for the McArthur River Mine Village complex, the Tailings Dam and the area between the bund wall and the McArthur River Diversion. The transects were on average between 50 and 100 metres apart, which meant that any features such as higher ground or eroded areas where there is a higher potential for the presence of archaeological material, would be sighted and then examined. As the North OEF had been surveyed previously this area was examined by vehicular transects. The three previously recorded sites were revisited to verify their location and content.

- Any archaeological or heritage places, objects or classes of objects located during the survey were recorded in such detail as to permit independent assessment of their significance. The location of any archaeological places and objects included coordinates obtained by a hand-held Global Positioning System (GDA84). This datum is requested by the Heritage Branch, Department of Natural Resources, Environment, the Arts and Sport (NRETAS). All sites were named in order to identify the sites on the ground.

- After assessing the significance of the archaeological place or object, recommendations were made regarding compliance with the provisions of the Northern Territory Heritage Conservation Act 1991.

5.2. Types of archaeological sites.

There are six types of sites previously recorded in the region around the subject land and can broadly be defined as follows:

- **Artefact scatters** may contain flaked or ground artefacts and hearthstones. They occur as surface scatters of materials or as stratified deposits when there have been repeated occupations.

- **Stone quarries** are generally sites where stone for flaked or edge ground artefacts have been extracted from an outcropping source of rock.

- **Knapping floors** are discrete scatters of artefacts consisting of the remains of a single reduction event associated with the fabrication of implements.

- **Stone arrangements** can range from simple cairns to more elaborate arrangements. These stone arrangements were used in ceremonial activities and represent sacred or totemic sites. Other stone arrangements were constructed for route or territory markers, the walls of huts, fish traps or small walls to stop water from entering a rock shelter or to retain the floor.

- **Scarred trees** may have formed by the extraction of honey (sugar bag), removal of bark for containers and wood for spear throwers or shields.
Burial sites and skeletal remains are often found in rock shelters. In more recent times there has been the adoption of Christian style of graves. They are commonly marked with heaped stone, sheets of metal or situated under prominent trees.

5.3. Site definition

An archaeological site is defined for this survey as a concentration of artefactual material with an average density that is 5 times greater than the average density of the background scatter and there are more than ten artefacts that cover an area of at least 2m². A site will have an identifiable boundary where either artefact densities decrease to the extent as to be classified as background scatter or environmental features determine the boundary.

Background scatter is generally a very low density, more or less continuous distribution of isolated artefacts over the landscape. Although these artefacts do not constitute a site they will be given location details for research purposes.

5.4. Artefact identification

A requirement for a successful archaeological project involves the accurate identification of archaeological materials. For a stone piece to be identified as artefactual it needs to possess one or more of the following:

- a positive or negative ring crack.
- a distinct positive or negative bulb of percussion.
- a distinct eraillure scar in an appropriate position below the platform.
- definite remnants of flake scars on the dorsal surface or dorsal ridges.

Stone artefacts are divided into 4 main types (Hiscock 1984:128-129). They are defined as follows:

- **Cores** are pieces of stone that have one or more negative scars and the absence of positive flake scars.
- **Unretouched flakes** are pieces of stone that have been struck off another piece of stone and ideally possess platforms, positive bulbs of percussion, concentric ripples, ring cracks and/or eraillure scars on the ventral surface.
- **Retouched flakes** are flaked flakes. They are identified by the presence of negative scars that must have been created after the ventral surface of the flake had been created. There will be either negative scars on the ventral surface or negative scars on the dorsal surface, which have been formed by the flake being hit on the ventral surface.
- **Flaked pieces** are stone artefacts that have been formed by knapping but cannot be identified as either a core or a flake.

Other artefact and implement types that have been identified in the region are listed below. They are based on characteristics outlined by McCarthy (1976) and Holdaway and Stern (2004).

- **Unifacial points** are flakes that have been retouched along the margins from one surface, either ventral or dorsal, to give or enhance its pointed shape. They are sometimes symmetrical or leaf shaped.
- **Bifacial points** are retouched along both ventral and dorsal surfaces of a flake to enhance or give the artefact its pointed shape. They may have the platform removed and the proximal end rounded.
• *Edge ground axes* have been shaped by the process of flaking, pecking and polishing. They generally have only one working edge that has been ground to a sharp margin although occasionally they may have two leading edges.

• *Grindstones* are characterized by a worn and abraded surface or surfaces. There also may be a concave surface.

• *Backed blades* are flakes or blades that have been retouched partially or completely along the thick margin of the flake or blade.

• *Hammerstones* display use wear on the surface in the form of abrasion, pitting, edge fracturing with some negative scarring.

• *Manuports* are stone material that are not found naturally in an area and must have been carried in by humans.
6.0. RESULTS

In general the visibility over the areas was very poor as the surface was still covered in dense grass cover and leaf litter and there had been no fires through the area. It is estimated that average ground surface visibility was less than 10% and there were large areas where visibility was zero. Fortunately the surface had dried up and so all areas could be accessed, although some areas around the billabongs were still submerged. Cattle / donkey damage was evident in all survey areas.

The survey located one stone artefact scatter, MRM6 in the proposed village extension and three areas containing a background scatter of isolated stone artefacts. Two of these were located east of the bund wall and one was in the Tailings Dam survey area. The remains of a 40 year old mobile cattle yard and the old Borroloola Road were identified by Ronnie Raggett in the North OEF. Ronnie also identified a concrete floor structure in the proposed village extension as the remains of a clay pigeon shooting range, which was probably constructed in the 1990s.

The results for the four survey areas are described separately in detail in the sections below.


As the map provided for the survey was in the mine grid, the area surveyed was difficult to determine accurately and so a larger than that calculated from the map was surveyed to ensure that all of the area to be disturbed was surveyed.

The survey area was bounded by:
- 614960E 8182490N
- 614990E 8182490N
- 614990E 8182660N
- 614630E 8182660N
- 614630E 8182500N

The subject land consisted of a low hill surrounded by Barney Creek in the west and a small ephemeral tributary which joined the creek 250 metres to the north of the hill (see Figure 2). The top of the hill was level and there was a gentle slope on three sides. Sections of the level area appeared to have been cleared in the past. A power line and several vehicle tracks crossed the hill. There were several stony outcrops and eroded stony slopes, however the majority of the surface was covered in silty soils. The vegetation consisted of dense low grass and open woodlands and surface visibility ranged from 0 to 20%.

The survey consisted of pedestrian transect 25 metres apart.

A stone artefact scatter MRM6 was located on the northeast slope of the hill and the remains of the clay pigeon shooting range was located adjacent to the fence constructed around the existing village complex. One isolated stone artefact was identified and it consisted of a white dolostone flake BS66. Only three other artefacts manufactured from the same material have been identified in the region (Crassweller 2005a, BS1). The details of this artefact are listed in Table 3 below.

5.1.1 MRM6
Stone artefact scatter
Location: 53 614986E 8182627N 1:100,000 map sheet Borroloola 6165
Ground visibility: 70% in eroded area and less than 5% in grass covered areas.
Dimensions: 20 metres NE-SE, 14 metres E-W
This site is located on the northeast slope of a gentle stony rise leading to level ground on top of the rise from an ephemeral creek located 20 metres north of the base of the slope. The surface between the creek and the hill slope and the top of the hill consisted of silty soils. All the artefacts were located on the slope and none were identified on the top of the hill.

The majority of artefacts were manufactured from cherts of several colours and siltstone. There was one small quartz flake. The chert artefacts consisted of several large grey flakes and cores (80mm in length) with cortex and of a poor quality for knapping. The smaller chert flakes and cores were either red, pink or white. Several of these chert cores had been intensely reduced and several of the flakes had been retouched. There was also evidence that some of the chert had been heat treated. The maximum density of artefacts was 5/m$^2$ and average density was 0.25/m$^2$.

The siltstone artefacts consisted of large cores, up to 90mm in length, large flakes and a unifacial point. They majority of the siltstone artefacts were manufactured from siltstone similar in appearance to raw material quarried at MRM4. There was also a large purple siltstone core, which is not known to be available locally, a core of metamorphic raw material and highly weathered dolomite.

*Site’s relationship to the development.*
This site is within the boundary of the proposed village complex.

*Archaeological significance:* This site contains a wide variety of raw material and a diversity of artefact types which indicates that various activities were carried out at the site in the past. The majority of the raw material was sourced locally and minor numbers must have been sourced from further afield. This diversity was also identified at the Barney Hill MRM1 and MRM2 sites which have been excavated and investigated in detail. The contents and density of the artefacts in the site result in a moderate potential for useful research in understanding settlement patterns and resource use in areas around the back plains of the McArthur River. Consequently this site has been assessed as having moderate archaeological significance.

Sketch map of MRM6
5.1.2. Clay pigeon shooting range

*Location: 53 614787E 8182589N 1:100,000 map sheet Borroloola 6165*

The shooting range consisted of five concrete paths 90cm wide that radiate from a central point. The path was marked by painted numbers from 12 -26 which were placed approximately 100cm apart. A concrete slab floor approximately 5 x 5m was located in the southwest corner of the feature. As this feature would have been constructed within the last twenty years it has no cultural heritage significance.

6.2. Tailings Dam

The map provided for this survey area was a draft drawing only so the boundary of the survey area was estimated. In the northern section the existing fence line was used as the boundary line and the existing track around the tailings dam was used as the eastern and southern boundary. The western boundary was on the easting of 612000E (AGD84) / 612149E (GDA94).

This area consisted of an undulating back plain with silty soils and cracking clays (see Figure 1). The vegetation consisted of open and closed low woodlands and dense low grass cover. There is a large billabong in the centre and southern sections of the survey area and a flood plain that links the billabong with Surprise Creek. Surface visibility was the lowest of all the survey areas, with an average of less than 5% visibility. Consequently the pedestrian transects targeted areas of higher surface visibility and these consisted mostly of small areas on the gentle slope around the billabong where the soils had been washed away. Twelve kilometres of pedestrian transects were made over the survey area.

Only one artefact, BS67 was identified. The details of this artefact are described in Table 3 below.

6.3. North OEF

The majority of this area consists of an undulating cracking clay plain with the occasional gentle stony rises in the west and east (see Figure 1). As no fires had burnt the vegetation surface, visibility was very low, less than 5% on the grass covered plain and low open woodlands. When this area was surveyed in 2005 (Crassweller 2005c:8) the majority of the plain had been recently burnt resulting in a high average surface visibility of between 70-90% and the survey concentrated on higher ground around the plain and along creek beds and gullied areas on the plain.

Consequently it was thought that carrying out further pedestrian surveys over the area would be unproductive. The survey for this area was carried out by vehicular transects along the numerous tracks that criss-cross the area. This approach was supported when much time was spent in trying to relocate the artefacts in the known sites where surface visibility was less than 5%.

No new archaeological or historic sites or objects were identified during the survey. Sites MRM3, MRM4 and MRM5 were revisited. While their locations were verified, the previous descriptions of their content could only be partially verified as surface visibility was so low. Consequently the detailed descriptions of these sites and their significance assessments recorded in Crassweller’s 2005c report have been reused for this report. Their details are reproduced in Appendix 1.

In 2005 MRM4 was assessed with moderate to high archaeological significance and the footprint for the 2005 development was altered to avoid this site. As MRM4 is adjacent to the current proposed expansion area it was decided to record the boundary of the restricted area around the site to ensure the site is protected. A buffer zone around the site was included in the restricted area. It is recommended that the western boundary use the existing track and the rest of the site is bounded by:
26 background scatters of isolated stone artefacts that were recorded during the 2005 surveys (Crassweller 2005c) and have been identified as being in the footprint of the proposed North OEF. Their details are reproduced in Appendix Two. No isolated stone artefacts were identified during this survey. In summary the background scatters consist of one to three artefacts, made up of dark grey siltstone (5), chert (5), silcrete (9) and orange /brown siltstone (5), sandstone (2) and one each of mudstone and quartzite. The artefact types were nine cores, nine unretouched flakes, six retouched flakes including an adze and bifacial point, a grinding slab, a ground slab fragment and two flaked pieces. The majority were located on the cracking clay plain.

During the survey Ronnie Raggett pointed out that one of the tracks we were on was the old Borroloola Road which went from the town to the old McArthur River Station and further west. The existing sealed road from Borroloola to the Stuart Highway, which was completed in 1968 (Cotton 2005) diverts from the track approximately three kilometre north of the proposed North OEF. It is estimated that two kilometres of the track will run through the proposed North OEF. The road runs north to south near the easting of 617320E GDA94 (617100E AGD84). This section of the track has low historic significance as it has been used and maintained recently as one of the access roads around the mine lease.

Ronnie also explained that six wooden poles that were observed north of one of the tracks were the remains of a mobile cattle yard. Hessian cloth was strung up between the poles which formed a ‘V’ shape and then a helicopter drove the cattle into the yard. A gate was situated at the apex of the enclosure so that the cattle could be loaded onto trucks. This site is located at 617361E 8186488N and approximately 40 metres east of the old Borroloola Road. As this site is relatively recent it has no heritage value.

6.4. East of bund wall

As this area had not been previously surveyed MRM requested that the area was also examined to identify any cultural heritage material to ensure their protection from accidental disturbance. The survey area was located between the existing bund wall and the McArthur River Diversion (see Figure 1). The small section in the north that is on the western side of the old McArthur River corridor was covered in dense grasses and weeds which resulted in a surface visibility of less than 5%. The surface consisted of sandy river banks where there is a very low potential for the presence of archaeological material. No stone at all was found.

The rest of the survey area consisted of a cracking clay back plain with a low stony rise in the centre. The area was surveyed by pedestrian transects approximately 100 metres apart. The surface along the diversion had been disturbed for up to 30 metres and there were numerous tracks criss-crossing the area. Surface visibility decreased to zero the closer the survey came to the old river corridor because of dense weed cover. Average surface visibility for the remainder of the survey area was between 0 - 20%.

Two background scatters of isolated stone artefacts were located. BS64 was located at the base of the stony rise and BS65 was located on the top of the rise where there was a low stony outcrop. No archaeological or historic sites were identified.
6.5. **Background scatters of isolated stone artefacts**

Unlike the previous surveys carried out on the MRM leases there was only a low number of isolated stone artefacts identified during this survey. BS64 and BS65 are located in the area west of the bund wall and will be impacted by the development of the East OEF. BS66 will be disturbed by the expansion of the MRM village and BS67 will be disturbed by the expansion at the Tailings Dam.

**Table 3. Details of the background scatters of isolated stone artefacts.**

<table>
<thead>
<tr>
<th>Easting</th>
<th>Northing</th>
<th>Type</th>
<th>Dimensions</th>
<th>Dominant raw material</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS64 619259</td>
<td>8182874</td>
<td>Unretouched flake</td>
<td>25 x 18 x 12</td>
<td>mudstone</td>
<td></td>
</tr>
<tr>
<td>BS65 619266</td>
<td>8182722</td>
<td>Unretouched flake</td>
<td>39 x 15 x 42</td>
<td>chert</td>
<td>-ve flake scars on dorsal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unretouched flake</td>
<td>12 x 20 x 4</td>
<td>chert</td>
<td>Broken</td>
</tr>
<tr>
<td>BS66 614962</td>
<td>8182592</td>
<td>Unretouched flake</td>
<td>28 x 18 x 9</td>
<td>white dolostone</td>
<td>Very weathered</td>
</tr>
<tr>
<td>BS67 612409</td>
<td>8184708</td>
<td>Unretouched flake</td>
<td>69 x 50 x 12</td>
<td>siltstone</td>
<td>Platform preparation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unretouched flake</td>
<td>20 x 12 x 7</td>
<td>quartzite</td>
<td>Broken</td>
</tr>
</tbody>
</table>

6.6. **Discussion**

The findings from surveys carried out six years ago (Crassweller 2005a, b, and c) found that while there is a relatively low number of archaeological sites, there is a high frequency of isolated stone artefacts located in eroded areas on the back plain. Unfortunately at the time of this survey surface visibility was very poor and there was difficulty in even relocating artefacts at known sites.

All sites in the Project area were located on either low hills surrounding the back plains or on low rises on the plain. MRM6 located during this survey is similar in content to other stone artefact scatters in the area of Barney Creek and Barney Hill. This site appears to contain more artefacts than MRM1 and MRM2 which were near the creek and where the area was less stable which may have resulted in loss of artefacts through erosion and floods.

It was decided to use the descriptions of the three previously recorded sites MRM3, MRM4 and MRM5. When the sites were revisited there did not appear to be any disturbance to the sites and surface visibility was much higher when originally described than when viewed for this survey. Table 4 lists the details of the sites located in the areas of impact.

Given the intensity of this survey and the 2005 survey over the North OEF, it is thought that there is only a low potential for the presence of any unidentified significant archaeological material in the areas to be impacted by the proposed Project.

**Table 4. Summary of archaeological sites,**

<table>
<thead>
<tr>
<th>Site</th>
<th>Type</th>
<th>Dimensions (m)</th>
<th>Average artefact density</th>
<th>Dominant raw material</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRM3</td>
<td>Stone artefact scatter</td>
<td>32 x 10</td>
<td>0.5</td>
<td>Dark grey siltstone</td>
<td>Low stony rise</td>
</tr>
<tr>
<td>MRM4</td>
<td>Quarry</td>
<td>240 x 110</td>
<td>10 to 0.5</td>
<td>Orange / brown siltstone</td>
<td>Gently undulating hill</td>
</tr>
<tr>
<td>MRM5</td>
<td>Quarry, stone artefact scatter</td>
<td>10 x 10</td>
<td>1</td>
<td>Dark grey siltstone</td>
<td>Low gravelly and stony rise</td>
</tr>
<tr>
<td>MRM6</td>
<td>Stone artefact scatter</td>
<td>20 x 14</td>
<td>0.5</td>
<td>Siltstone / chert</td>
<td>Stony slope of low hill</td>
</tr>
</tbody>
</table>
6.7. Assessment of archaeological and heritage significance

According to Sullivan and Bowdler (1984) archaeological significance means that a site or object has scientific, archaeological or research value, that is, it has the potential to assist current or future research into problems of human history or other areas of enquiry. The Australian International Council on Sites and Monuments (ICOMOS) Charter for the Conservation of Places of Cultural Significance, otherwise known as the Burra Charter (Maquis-Kyle and Walker 1992:73) states that the scientific value or research potential of a place depends upon the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place or object may contribute to further substantial information.

Therefore the significance of a site is firstly related to the intactness or integrity of a site, and the state of preservation of the archaeological material. Secondly, if the site has stratigraphic reliability then it may be possible to use the cultural material for dating which will provide a chronology, extending back into the past. Thirdly, the representativeness of a site is important either because a site is unusual or because the site has research potential when taken in conjunction with other sites.

In order to effectively manage archaeological resources, sites recorded during the survey have been ranked according to their perceived significance.

There are further criteria that can be considered when assessing the significance of historic sites and these are:

- A site is associated with events, developments or cultural phases in human occupation.
- A site demonstrates a way of life no longer practiced or in danger of being lost or of exceptional interest, and
- A site provides information contributing to a broader understanding of the history of human occupation.

It should be noted that historical significance would not necessarily be equated with archaeological significance, as some events may leave nothing in the archaeological record.

Sites that are likely to be particularly valuable in answering archaeological research questions are given moderate archaeological significance. These sites contain a higher density and diversity of archaeological material and are either particularly well preserved or represent a type of archaeological site that is uncommon in the general area. The small artefact scatters with a low density and diversity of artefacts were assessed as having low archaeological significance as their research potential would be minimal, and most of the information that can be recorded from these sites was collected during the survey. Larger sites with a higher density of artefacts were given a moderate significance as these sites have the potential for answering questions regarding settlement patterns, stone artefact manufacture and subsistence strategies in regions where there has been very little previous archaeological research.

The detailed justification for the significance assessments for MRM6 is in Section 5.1.1. above, and the assessments for MRM3, MRM4 and MRM5 are in Appendix 1. The deemed significance for each site is summarised in Table 5. As all the background scatters of isolated stone artefacts have been recorded in detail, they have very little research potential and consequently have been assessed as having low archaeological significance.
Table 5. Summary of the significance of sites and background scatters.

<table>
<thead>
<tr>
<th>Site No.</th>
<th>Significance</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRM3</td>
<td>Moderate</td>
<td>Knapping floors present, increases research potential</td>
</tr>
<tr>
<td>MRM4</td>
<td>Moderate to high</td>
<td>Large site with high density of artefacts</td>
</tr>
<tr>
<td>MRM5</td>
<td>Low to moderate</td>
<td>Research of this site could be used as a comparison with MRM4</td>
</tr>
<tr>
<td>MRM6</td>
<td>Moderate</td>
<td>Variety of raw material and moderate density of artefacts</td>
</tr>
<tr>
<td>Section of the Old Borroloola Rd</td>
<td>none</td>
<td>Is maintained now as a mine track.</td>
</tr>
<tr>
<td>Mobile cattle yard</td>
<td>none</td>
<td>Used in the 1970s</td>
</tr>
<tr>
<td>Clay Pigeon shooting range</td>
<td>none</td>
<td>Used in the 1990s</td>
</tr>
<tr>
<td>All BSs</td>
<td>Low</td>
<td>All artefacts have been recorded in detail</td>
</tr>
</tbody>
</table>
7.0. POTENTIAL IMPACTS AND RECOMMENDATIONS

This section describes the potential impacts on the identified archaeological and historic sites that may occur during the construction and operational stages of the project. Recommendations are made to protect or to mitigate the loss of any archaeological or historic values to the sites located on the project area and to ensure that no offences are committed under the NT Heritage Conservation Act 1991.

The proposed expansion of the North OEF will destroy / disturb the archaeological site MRM5 and the twenty two background scatters of isolated artefacts BS30 and BS35-36, 38-39, BS41-55, and BS58-59 which were identified previously. As the archaeological site MRM4 is located next to the boundary of the southeast boundary of the North OEF, the coordinates of a recommended boundary for the site were recorded. The northeast corner of the site is within the proposed North OEF footprint. MRM3 is located approximately 100 metres north west of the proposed North Dam in the North OEF and should not be disturbed by the expansion. The mobile cattle yard and a section of the old Borroloola Road are located within the North OEF footprint and will be destroyed.

The proposed expansion of the McArthur River Village will impact upon the archaeological site MRM6 and the isolated stone artefact BS66.

The proposed expansion of the Tailings Dam will impact upon BS67.

BS64 and 65 are located east of the bund wall and will be impacted by the proposed East OEF.

<table>
<thead>
<tr>
<th>Site No.</th>
<th>Location</th>
<th>Potential impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRM3</td>
<td>Outside area of North OEF</td>
<td>Should not be impacted</td>
</tr>
<tr>
<td>MRM4</td>
<td>Adjacent to area of impact</td>
<td>Edge of site may be impacted</td>
</tr>
<tr>
<td>MRM5</td>
<td>Within North OEF</td>
<td>Will be destroyed</td>
</tr>
<tr>
<td>MRM6</td>
<td>Within village expansion</td>
<td>Will be destroyed</td>
</tr>
<tr>
<td>Section of the Old Borroloola Rd</td>
<td>Within North OEF</td>
<td>Will be destroyed</td>
</tr>
<tr>
<td>Mobile cattle yard</td>
<td>Within North OEF</td>
<td>Will be destroyed</td>
</tr>
<tr>
<td>Clay Pigeon shooting range</td>
<td>Within village expansion</td>
<td>Will be destroyed</td>
</tr>
</tbody>
</table>

7.1. Recommendations for archaeological sites and objects

Under Sections 29 and 39 of the Northern Territory Heritage Conservation Act 1991 the Minister for Natural Resources, Environment and Heritage, after taking into account the recommendations of the Heritage Council, may permit work to be carried out on a site or object and for any objects to be removed. This permission usually comes with conditions for further work to be carried out in order to mitigate the loss of any heritage values of a site or object which may be destroyed by the Project.

While it is recommended that where possible, all archaeological sites are avoided, the following recommendations are made to ensure there is a minimal loss to heritage values.

- **MRM 3.**
  
  *Location: 53 617571E 8187081N GDA94 1:100,000 map sheet Borroloola 6165*
  
  This site has been assessed as having moderate archaeological significance and will not be destroyed by the proposed expansion of the North OEF. As the site is adjacent to areas that will
be disturbed, it is recommended that before works commence the site is fenced with painted star pickets placed at regular intervals along the boundary. There should also be conspicuous signage indicating that entry is prohibited to the area bounded by the star pickets.

- **MRM4**
  
  *Location:* 53 618364E 8184969N GDA94 1:100,000 map sheet Borroloola 6165
  
  The site has been assessed as having moderate to high archaeological significance. This site was avoided during previous works in the area and should be avoided for the current Project. (The boundaries of the site are given in section 6.3). To ensure its long term protection it is recommended that the site is fenced with painted star pickets placed at regular intervals along the boundary. There should also be conspicuous signage indicating that entry is prohibited to the area bounded by the star pickets.

- **MRM5**
  
  *Location:* 53 615922E 8185597N GDA94 1:100,000 map sheet Borroloola 6165
  
  This site has been assessed as having low to moderate archaeological significance and will be destroyed by the proposed expansion of the North OEF. Therefore it is recommended that before works commence, permission be sought to destroy the site from the Minister for Natural Resources, Environment and Heritage, with the proviso that a detailed surface recording is made by a qualified archaeologist before the site is destroyed.

- **MRM6**
  
  *Location:* 53 614986E 8182627N 1:100,000 map sheet Borroloola 6165
  
  This site has been assessed as having moderate archaeological significance and will be destroyed by the proposed expansion of the McArthur River Village. Therefore it is recommended that before works commence, permission should be sought from the Minister for Natural Resources, Environment and Heritage, with the proviso that there is a detailed surface recording including a sample collection of artefacts.

- **BS30, BS35-36, BS38-39, BS41-55, and BS58-59**
  
  These background scatters of isolated stone artefacts have been assessed as having low archaeological significance and will be disturbed by the proposed expansion of the North OEF. Therefore it is recommended that before works commence, permission should be sought from the Heritage Branch NRETAS for BS30, BS35-BS59 to be disturbed.

- **BS64 and BS65**
  
  These background scatters of isolated stone artefacts have been assessed as having low archaeological significance and will be disturbed by the proposed expansion of the East OEF. Therefore it is recommended that before works commence, permission should be sought from the Heritage Branch NRETAS for BS64 and BS65 to be disturbed.

- **BS66**
  
  This isolated stone artefact has been assessed as having low archaeological significance and will be disturbed by the proposed expansion of the McArthur River Village. Therefore it is recommended that before works commence, permission should be sought from the Heritage Branch NRETAS for BS66 to be disturbed.

- **BS67**
  
  This isolated stone artefact has been assessed as having low archaeological significance and will be disturbed by the proposed expansion of the proposed expansion of the Tailings Dam.
Therefore it is recommended that before works commence, permission should be sought from the Heritage Branch NRETAS for BS67 to be disturbed.

- Other sites
  As the remains of mobile cattle yard and the section of the old Borroloola Road in the proposed north OEF, and the clay pigeon shooting range in the proposed expansion of the MRM Village have no archaeological or historic significance, no further action is required before they are disturbed.

7.2. Pre-construction phase

To ensure that there is compliance with the provision of the Northern Territory Heritage Conservation Act 1991 permission should be sought from the Minister for Natural Resources, Environment and Heritage to disturb the sites and objects listed above.

Archaeological sites MRM3 and MRM4 should be fenced.

To meet their legal obligations Xstrata should ensure that all workers are made aware, through a cultural awareness programme, of the presence of both archaeological and sacred sites in and around the Project area.

To ensure that all sites are protected during the construction phase a GIS data base should be developed which shows accurately the location and boundaries of each site. This will alert workers before any work is carried out that there are ‘no go’ areas. Each site should be fenced by using painted star pickets placed at regular intervals along the boundary which should also have conspicuous signage indicating that entry is prohibited in the area bounded by the star pickets.

7.2.1. Appropriate storage and conservation

Archaeological material can only be removed or collected with compliance of the Northern Territory Heritage Conservation Act 1991 under Section 29 of the Act. The Heritage Branch NT takes into account the wishes of the traditional owners. Consequently all relevant traditional owners should be consulted and offered the opportunity to visit the site to assess the material. Traditional owners should be made aware of why the material is to be disturbed and then decide whether the material should be removed or remain on country. The decision where the material is to be stored should be made by the traditional owners. This process has already started as it has been discussed with Ronnie Raggett, who will consult with the other relevant traditional owners. The consultations with all traditional owners need to be continued until a final decision is made by the traditional owners.

7.3. Construction phase

All new workers should undergo a cultural heritage awareness programme. It is understood that MRM already incorporates cultural awareness into its induction program.

All archaeological sites and sacred site areas should be monitored regularly during the construction phase to determine whether any site boundaries have been breached and, if this has occurred, a review should be carried out to determine the cause of the breach so that processes can be developed to ensure it does not re-occur. The monitoring should occur weekly when ground disturbance activities are occurring within 100 metres of a site. Monitoring should also occur after work has occurred in the vicinity of a site to verify the usefulness of the management plans.
7.3.1. **Unrecorded archaeological material**

There is a potential for disturbance to unidentified surface and subsurface cultural material during this phase of the Project. Therefore it is recommended that a rapid response mechanism is set up to ensure there is minimal loss of archaeological or cultural values and to ensure that the conditions of the *Northern Territory Heritage Conservation Act 1991* are not contravened. The response should include the immediate cessation of work around the cultural material and the area identified by flagging tape and its position recorded by GPS. The find should be reported to the relevant Xstrata personnel, who should then contact the Heritage Branch, NRETAS who provide an emergency service in the event of the discovery of protected heritage items during construction projects in the Northern Territory. The relevant Xstrata personnel should familiarise themselves with the process and identify the role they may play in its implementation. This process should also be explained to all workers involved in the construction phase.

7.4. **Operational phase**

All new workers should undergo a cultural heritage awareness programme that they understand their legal obligations regarding Indigenous culture and the importance these sites to the Gudanji people.

To ensure the longer term protection of sites there should be a process carried out before any new ground disturbance occurs so that there is no unauthorised damage and the sites are managed in a way approved by the traditional owners and in compliance with Northern Territory regulatory requirements. This cultural heritage management plan should consist of a clearance system, where the locations of the sites are mapped onto a GIS data base. When it is planned to disturb an area, its location should be recorded on the GIS data base and if the disturbance is in the vicinity of a site, then there should be a physical examination of the proposed works area to verify that the site will not be disturbed.

The archaeological and sacred sites should be monitored at least yearly to ensure that the signage and fencing are still effective in alerting people to the restricted areas and to identify any damage that may have occurred to the sites.

7.5. **Cultural heritage awareness programme**

The cultural heritage awareness programme which already exists for all new workers at the mine site (pers.com. Kirsty Hogarth) should be continued. The programme should result in all personnel being aware of the importance of both sacred sites and archaeological sites to the traditional owners, the Gudanji people. They should also be made aware of their legal obligations regarding the protection of archaeological and sacred sites and that there are penalties given to any breaches of the *NT Heritage Conservation Act 1991* and the *NT Aboriginal Sacred Sites Act 1989*.

There should be input from the traditional owners into the content of the cultural heritage programme and they confirm that all information given in the programme is culturally appropriate.

During the construction phase all personnel should be made aware of a rapid response process that occurs if any unrecorded archaeological sites or objects are located. During the operational phase the relevant workers should be made aware of where the restricted areas are located.

7.6. **Decommissioning and rehabilitation stages**

All archaeological and sacred sites that were protected during the earlier stages should remain protected during this stage and all fences and signage should remain around the sites until rehabilitation has been completed. There should be consultations with the traditional owners as there might be
provisions to return the artefacts from sites where artefacts were salvaged before the sites were damaged or destroyed by the Project.
REFERENCES


Guse, D and G. Bowen, 1993. An archaeological investigation of the proposed Bing Bong and Borroloola Bypass road alignments. An unpublished report to the Department of Transport and Works, NT.

Haglund, L. 1975. Survey of sites of significance to the Aborigines, McArthur River region, Northern Territory. An unpublished report to Dames and Moore


Stretton, WG 1893. Customs, rites and superstitions of the Aboriginal tribes of the Gulf of Carpentaria, with a vocabulary. Transactions of the Royal Society of South Australia. Vol.1 7:227-253


Thorley, P. 1992. An archaeological survey of a proposed barge loading facility Bing Bong Station, Northern Territory. An unpublished report to Dames and Moore

Appendix One

Details of MRM3, MRM4 and MRM5
MRM3
Stone artefact scatter, quarry

Location: 53 617571E 8187081N WGS84 1:100,000 Map Sheet Borroloola 6185

Ground visibility: 65-80%

Dimensions: 32m N-S and 10m E-W

The site is located on the top of a gentle rise that runs along the side of a floodplain that is approximately 100 metres east of the site. It is in an area of red termite mounds and low woodlands and the site itself is situated over a low and stony outcrop of very dark grey siltstone and a laminate sandstone with a sandy, silty soil.

There are two main concentrations of artefacts. The northern concentration has a density of 8 artefacts per square metre in an area of 2 x 2 metres. The southern concentration measures 3 x 3 metres and has a density estimated to be 6 artefacts per square metre. The density of artefacts between the two is approximately 0.5 artefacts per square metre. There are several discrete knapping floors in both areas. The density of the non-artefactual stone on the surface is approximately 15 per square metre.

All artefacts identified were manufactured from the dark grey siltstone and consisted of 70% flakes and 30% cores. No retouched artefacts were found.

Archaeological significance: This site appears to be undisturbed and has the remains of discrete knapping events. As the site has the potential to generate information regarding stone tool technologies used in the region, the site has been assessed as having medium archaeological significance.

Sketch map of MRM3
MRM facing NE

MRM3, example of siltstone artefacts
MRM4
Quarry
*Location:* 53 618364E 8184969N WGS84 1:100,000 Map Sheet Borroloola 6185
*Ground visibility:* 90-95%
*Dimensions:* 240m N-S and 110m E-W

This site is situated on the eastern side of the road that goes to Emu Bore North on a gently undulating hill covered in a fine grained sandstone and siltstone cobbles that are floating in cracking clay soils. No areas of bedrock were observed. The density of the non-artefactual stone is approximately 30 per square metre. The area is covered by clumping grasses and isolated scrub that has been disturbed by cattle. The southern section of the site has been disturbed by shallow gully erosion.

The quarried material consisted of a pale orange/brown siltstone. The greatest concentration of artefacts is located on the top of the rise in an area of 35 x 35 metres. Where the stone used as the raw material becomes less suitable for knapping the density of artefacts decreased. The average density in the main section is 10 artefacts per square metre and decrease to less than 0.5 near the northern boundaries of the site.

The fracture planes on the majority of the artefacts manufactured from the local siltstone appeared quite fresh. This appearance is probably related more to the nature of the rock rather than any evidence that the artefacts were manufactured recently. There was evidence of a small proportion of the artefacts and non-artefactual stone being damaged by cattle trampling. The artefacts consisted of cores, that ranged in length from 40-170mm in length, with an average length of 70mm, and flakes that ranged from less than 10mm to 90mm in length with an average length of 60mm. There were very few small flakes, which was possibly caused by these artefacts falling between the cracks in the clays during the annual dry seasons. Only two artefacts were located from non-local rock. They were two unretouched dark grey siltstone flakes that appeared to be manufactured from a similar raw material to that identified in the quarries MRM3 and MRM4.

*Archaeological significance:* The size and concentration of artefacts identified at MRM4 suggest that this site was an important location for the procurement of the raw material used in the manufacture of stone artefacts. While cattle and the possible movement of smaller stone artefacts through the clay deposit have disturbed the site, it does have the potential to answer questions regarding stone reduction sequences and procurement methods for the region and has been assessed as having medium to high archaeological significance.
MRM5
Stone artefact scatter and quarry
Location: 53 615922E 8185597 N WGS84 1:100,000 Map Sheet Borroloola 6185
Ground visibility: 30-60%
Dimensions: 10m N-S and 10m E-W

This small site is situated on a low gravelly and stony rise located on a cracking clay plain covered in open scrub and clumping grasses. There are termite mounds in the vicinity. It is adjacent to the northern side of a track that goes to a water bore used by cattle and is 460 metre from the Carpentaria Highway. The main concentration of artefacts has not been disturbed by any road construction or maintenance. A relatively large billabong, that was dry at the time of the survey, is located 300 metres to the north.

The quarry is located over a low stone outcrop on a gravelly rise that has an average of 80 non-artefactual stones per square metre that range in size from gravel to cobbles. The outcrop consists of sandstone through to siltstone and quartzite. The artefacts are manufactured from a very dark grey siltstone that weathers to a light grey colour and is similar in appearance to artefacts found in the quarry MRM3.

The main concentration of artefacts are located in a 5 x 5 metre area in a density of approximately 5 artefacts per square metres and consist of cores to flakes in a ratio of 1:6. Outside this area the density of artefacts is less than one artefact per metre. Average length of the flakes is 50-60mm and the average core is 100mm long.

Archaeological significance: This small site has been assessed as having low to medium archaeological significance. The main research potential for this site is that the contents of this site can be used as a comparison with MRM3 where a similar raw material has been quarried.

Sketch map of MRM5
Appendix Two

Details of all previously recorded isolated artefacts within the proposed North OEF
<table>
<thead>
<tr>
<th>B/S No.</th>
<th>Easting WGS84</th>
<th>Northing WGS 84</th>
<th>Environment</th>
<th>Visibility %</th>
<th>Artefact type</th>
<th>Raw material</th>
<th>Dimensions</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>618375</td>
<td>8183846</td>
<td>undulating cracking clay</td>
<td>15</td>
<td>unretouched flake</td>
<td>chert</td>
<td>34 x 35 x 10</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>618260</td>
<td>8186207</td>
<td>undulating cracking clay</td>
<td>65 x 45 x 22</td>
<td>unretouched flake</td>
<td>mudstone</td>
<td>&gt;50% cortex</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>618107</td>
<td>8186535</td>
<td>undulating cracking clay</td>
<td>60</td>
<td>unretouched flake</td>
<td>chert</td>
<td>22 x 28 x 6</td>
<td>OHR, transverse distal break</td>
</tr>
<tr>
<td>37</td>
<td>617697</td>
<td>8187107</td>
<td>gentle rise (red soil), areas of gravel</td>
<td></td>
<td>core</td>
<td>silcrete</td>
<td>71 x 76 x 64</td>
<td>Multi-platform, 5% cortex</td>
</tr>
<tr>
<td>38</td>
<td>617289</td>
<td>8186349</td>
<td>gentle rise (red soil) with areas of gravel</td>
<td>50</td>
<td>retouched flake</td>
<td>light brown siltstone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>617039</td>
<td>8186836</td>
<td>near small dry waterhole</td>
<td>80</td>
<td>unretouched flake</td>
<td>red silcrete</td>
<td>45 x 31 x 15</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>616356</td>
<td>8186769</td>
<td>undulating with red soil and gravels</td>
<td>85-90</td>
<td>retouched flake</td>
<td>light brown siltstone</td>
<td>50 x 25 x 8</td>
<td>Use wear both laterals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>unretouched flake</td>
<td>silcrete</td>
<td>26 x 18 x 5</td>
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<tr>
<td>41</td>
<td>617048</td>
<td>8186477</td>
<td>on plain, burnt</td>
<td>95</td>
<td>retouched flake</td>
<td>dark grey siltstone</td>
<td>45 x 48 x 18</td>
<td></td>
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<tr>
<td>42</td>
<td>616819</td>
<td>8155330</td>
<td>gravely rise, burnt</td>
<td>85</td>
<td>bifacial point</td>
<td>orange silcrete</td>
<td>50 x 29 x 9</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>616808</td>
<td>8184799</td>
<td>near small creek in sandy stony surface</td>
<td>85</td>
<td>grinding slab fragment</td>
<td>sandstone</td>
<td>108 x 100 x 32</td>
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<tr>
<td>44</td>
<td>616638</td>
<td>8184809</td>
<td>cracking clay plain, burnt</td>
<td>90</td>
<td>core</td>
<td>silcrete</td>
<td>68 x 66 x 3</td>
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<td>45</td>
<td>616435</td>
<td>8185006</td>
<td>undulating cracking clays</td>
<td>80</td>
<td>core</td>
<td>pale brown silcrete</td>
<td>98 x 81 x 30</td>
<td>cortex, multi-platform</td>
</tr>
<tr>
<td>46</td>
<td>618314</td>
<td>8185583</td>
<td>undulating cracking clays</td>
<td>70</td>
<td>core</td>
<td>sandstone</td>
<td>200 x 78 x 17</td>
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<td>618565</td>
<td>8185407</td>
<td>undulating cracking clays</td>
<td>70</td>
<td>core</td>
<td>silcrete</td>
<td>100 x 81 x 42</td>
<td>Multi-platform, very weathered</td>
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<tr>
<td>48</td>
<td>618507</td>
<td>8185294</td>
<td>undulating cratering clays</td>
<td>70</td>
<td>core</td>
<td>silcrete</td>
<td>86 x 98 x 36</td>
<td>River cobble, single platform</td>
</tr>
<tr>
<td>49</td>
<td>618245</td>
<td>8184898</td>
<td>undulating hills with occasional stony surface</td>
<td>70</td>
<td>unretouched flake</td>
<td>silcrete</td>
<td>82 x 41 x 22</td>
<td></td>
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<tr>
<td>50</td>
<td>618063</td>
<td>8184915</td>
<td>low stony rise near flood plain and dry billabong</td>
<td>&lt;15</td>
<td>unretouched flake</td>
<td>dark grey siltstone</td>
<td>30 x 22 x 8</td>
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<td>51</td>
<td>616120</td>
<td>8185587</td>
<td>low stony rise near flood plain and dry billabong</td>
<td>80</td>
<td>retouched flake</td>
<td>dark grey siltstone</td>
<td>70 x 55 x 24</td>
<td>Hinge termination</td>
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<td>flake piece</td>
<td>dark grey siltstone</td>
<td>10 x 18 x 3</td>
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<td></td>
<td>flake piece</td>
<td>dark grey siltstone</td>
<td>21 x 9 x 2</td>
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<td></td>
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<td></td>
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<td></td>
<td>adze</td>
<td>white chert</td>
<td>28 x 34 x 8</td>
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<td></td>
</tr>
<tr>
<td>52</td>
<td>616092</td>
<td>low stony rise near flood plain and dry billabong</td>
<td>30-50</td>
<td>unretouched flake</td>
<td>sandstone</td>
<td>51 x 44 x 14</td>
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<td></td>
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<td>53</td>
<td>616076</td>
<td>8185630</td>
<td></td>
<td>untouched flake</td>
<td>dark grey siltstone</td>
<td>32 x 14 x 4</td>
<td>Cortex 20%</td>
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<td>616076</td>
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<td>untouched flake</td>
<td>dark grey siltstone</td>
<td>28 x 16 x 4</td>
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<tr>
<td>55</td>
<td>615929</td>
<td>8185590</td>
<td></td>
<td>retouched flake</td>
<td>dark grey siltstone</td>
<td>16 x 15 x 3</td>
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<tr>
<td>56</td>
<td>618429</td>
<td>8184989</td>
<td>30-50</td>
<td>untreated flake</td>
<td>dark grey siltstone</td>
<td>19 x 14 x 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>618428</td>
<td>8184992</td>
<td>30-50</td>
<td>grinding stone</td>
<td>dark grey siltstone</td>
<td>142 x 122 x 40</td>
<td>Percussion marks on both sides of one end</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>615840</td>
<td>8185636</td>
<td>30</td>
<td>untreated flake</td>
<td>dark grey siltstone</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>59</td>
<td>615890</td>
<td>8185590</td>
<td>60</td>
<td>core</td>
<td>orange silcrete</td>
<td>122 x 99 x 55</td>
<td>Single platform, with 8 small –ve flake scars</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX THREE

Photos
Facing south

Chert and siltstone flakes

Siltstone core

Chert core

Chert flakes
Isolated stone artefacts

BS65

BS67

Stony hill, location of BS65, facing west
Old Borroloola Road

Facing north

Section of mobile cattle yard

Ronnie Raggett
MRM4

Northern section of site (2011)

Southern section of site (2011)

MRM4 A retouched implement, made from unaltered stone (neither a flake nor core)
Various

Dense vegetation near the McArthur River

Dense vegetation on Tailings Dam survey area