Holcim (Australia) Pty Ltd

DRAFT

Aboriginal Cultural and Archaeological Assessment – Proposed Minor Modifications to Lynwood Quarry, Marulan

August 2010

Umwelt
Environmental Consultants

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Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Holcim (Australia) Pty Limited

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Acknowledgement

Holcim and Umwelt would like to acknowledge the Traditional Custodians of the Lynwood Quarry Project Area – the Gundungurra peoples – and pay respect to their cultural heritage, beliefs and continuing relationship with the land.

Holcim and Umwelt would also like to acknowledge the post-contact experiences of Aboriginal peoples who have attachment to the Lynwood Quarry Project Area.

We pay our respect to the Elders – past, present and future – for they hold the memories, traditions, culture and hopes of Aboriginal peoples in the area.

Holcim and Umwelt thank the registered Aboriginal parties for their participation in this project and for their valuable contribution to the assessment report which has been enriched by their willingness to share valuable aspects of their cultural knowledge.

Statement of Aboriginal Cultural Significance

The following statements of Aboriginal cultural significance have been prepared by the Registered Aboriginal Parties participating in this assessment. The statements of Aboriginal cultural significance have been included early in this report to ensure all readers recognise the cultural heritage value and importance of the Lynwood Quarry project area and its environs. Holcim (Australia) Pty Limited and Umwelt (Australia) Pty Limited recognise the primary role of the Registered Aboriginal Parties participating in this assessment to affirm the Aboriginal cultural significance of the Lynwood Quarry Project Area and the Aboriginal archaeological sites it contains.

Gundungurra Aboriginal Heritage Assoc Inc.

> *It's hard to express connection to a place. It's happy and sad for me. Gundungurra people have walked the land here for thousands of years before me. Now I'm here walking, as I know Gundungurra People did. I'm not here at Lynwood Quarry to live in our traditional ways. Instead I'm helping to record our past and work out a way to protect what is very important to Gundungurra families.*
>
> *To my family, it's all about not losing anymore of our past history and looking after what is still out there in our Traditional Lands. The only way to do this is to record all of the Lynwood Quarry area so that we can manage and preserve the sites for future generations (Sharyn Halls, Gundungurra Person and member Gundungurra Aboriginal Heritage Association Inc. - GAHAI)*.

As Gundungurra People the Lynwood Quarry Project area at Marulan, as well as the surrounding District, is of great significance to members of GAHAI. This area is part of our Traditional Country and we have the responsibility to care for it for present and future generations of Gundungurra Peoples. This responsibility comes down to us from our ancestors and through our heritage and connection to our Traditional Country and through our stories from the Dreaming Time of how the water ways and surrounding mountains were created thousands of years ago before our human like form.

GAHAI has been involved in the Lynwood Quarry project for about 4 years now and this has given us an insight to our peoples movements in this area even though the landscape has been changed due to Colonisation, clearing of our land for Old Marulan Town and farming. Gundungurra Aboriginal Heritage has survived and it is our place to keep on protecting and managing our Heritage and Country from impacts from development and use for its minerals and water (GAHAI 16 July 2010).

Gundungurra Tribal Council Aboriginal Corporation

Pejar Local Aboriginal Land Council

Peter Falk Consultancy

Abbreviations

AHIP	Aboriginal Heritage Impact Permit
AHMP	Aboriginal Heritage Management Plan
ATU	Archaeological Terrain Unit
DEC	Department of Environment and Conservation (previously the NSW EPA and the NPWS)
DECC	Department of Environment and Climate Change (previously DEC)
DECCW	Department of Environment Climate Change and Water (previously DECC)
DoP	Department of Planning
EP&A Act	Environmental Planning and Assessment Act 1979
GAHAI	Gundungurra Aboriginal Heritage Association Inc.
GTCAC	Gundungurra Tribal Council Aboriginal Corporation.
Holcim	Holcim (Australia) Pty Limited
NPW Act	National Parks and Wildlife Act (1974)
NPWS	National Parks and Wildlife Service
PAD	Potential Archaeological Deposit
PFC	Peter Falk Consultancy
PLALC	Pejar Local Aboriginal Land Council
s.87/90	Section 87/Section 90
Umwelt	Umwelt (Australia) Pty Limited

Executive Summary

Lynwood Quarry is located west of Marulan, in the Southern Highlands region of NSW, approximately 160 kilometres south-west of Sydney and approximately 27 kilometres north-east of Goulburn, NSW (refer to **Figure 1.1**). Marulan is located within the traditional Country of the Gundungurra[1] Peoples (Tindale 1974, Smith n.d.) and within the Pejar Local Aboriginal Land Council boundary. The Marulan area is of great cultural heritage significance to the Gundungurra Peoples and Aboriginal Peoples that have historic and contemporary association with the Country of the Gundungurra.

Holcim (Australia) Pty Limited (Holcim, formerly Readymix[2]) received Development Consent (DA-128-5-2005) to establish the Lynwood Quarry, on 21 December 2005 (refer to **Figure 1.2**). Schedule 3, Condition 36 (b) of the Development Consent, identifies the requirement for Holcim to undertake a subsurface testing and salvage program for its development impact area prior to the commencement of quarry development. In consultation with the Department of Environment, Climate Change and Water (DECCW) (formerly Department of Environment and Climate Change - DECC) and the relevant Registered Aboriginal Parties (for details refer to **Section 2**), Holcim developed a subsurface testing program incorporating all the known Aboriginal archaeological sites and all of the Archaeological Terrain Units (ATUs – refer to **Section 1.4** and **Section 3**) within its approved disturbance footprint. The subsurface testing program also extended to Aboriginal archaeological sites and ATUs proposed for impact by the Country Energy Marulan Electricity Supply Upgrade. The subsurface testing program was followed by a final salvage program and in June 2009 Country Energy completed all its relevant salvage under Section 87/90 Aboriginal Heritage Impact Permit (s.87/90 AHIP) (#1089392) and in January 2010, Holcim completed all salvage required by DECCW within its approved Section 87/90 (#1100264) Aboriginal Heritage Impact Permit Area.

As part of the detailed design process for Lynwood Quarry, Holcim Australia has identified opportunities to improve the plant set up and optimise the site layout. The proposed minor modification includes the reconfiguration of the rail loop to a rail spur and the realignment of the main access road. As a consequence of the proposed minor modifications, Holcim seeks to impact areas that fall outside the currently approved disturbance footprint (refer to **Figure 1.3**). To gain approval for the proposed minor modifications to the project, Holcim is required to prepare an Environmental Assessment (EA) under section 75W of the *Environmental Planning and Assessment Act* 1979 (EP&A Act) to modify its existing consent. The original consent, classified as a State Significant Development, was granted under Part 4 of the EP&A Act in May 2005, and as such, section 75W of the EP&A Act is available to modify DA 128-5-2005 pursuant to Clause 8J of the Environmental Planning and Assessment Regulation 2000.

As small areas (approximately 10.5 hectares in total) of the modified footprint fall outside the area covered by DECCW s.87/90 AHIP (#1100264), subject to obtaining development consent it will be necessary for Holcim to revise the boundary of the s.87/90 AHIP area to incorporate the modification prior to impact in this area.

Potential Impact of the Proposed Modifications

The overall nature, components and approved production rate of 5 million tonnes per annum (Mtpa) remains unchanged, including the extent of the approved 30 year Quarry pit (refer to **Figure 1.3**). The proposed modification includes the reconfiguration of the rail loop to a rail

[1] This is the preferred spelling of the Registered Gundungurra Aboriginal Parties for this project. Often spelt Gandangara (Tindale 1974).
[2] Readymix (parent company Rinker) then CEMEX, now Holcim.

spur, which has allows for greater flexibility in locating the components of the processing and loading out facilities, including the main access road.

Figure 1.4 indicates the 94 known (through surface survey and subsurface testing) sites within the Lynwood Quarry Project Area (colour-coded to indicate their current management status), the currently approved s.87/90 AHIP (#1100264) area and highlights the areas subject of the proposed modification that fall outside the current s.87/90 AHIP (#1100264) area. Prior investigations (Umwelt 2005, 2007a, 2007b, 2007c, 2007d; 2008a, 2008b, 2008c, 2008d, 2008e, 2008f, 2009) within the broader Lynwood Quarry Project Area (including investigations for Country Energy) have not identified any Aboriginal archaeological sites within the proposed modification areas; however, some impacts are proposed within ATUs that have been previously identified as culturally and archaeologically sensitive (for details refer to **Section 5** and **Section 6**).

Table 1 provides a description of the works proposed for each component of the modification and identifies possible impacts and management options that Holcim incorporated into its planning based on prior knowledge of the sensitivity of the ATUs.

Table 1 – Components of the Modification/Potential Impacts/Management

Component of Modification	Potential Impact	Holcim Management Commitment
Access Road	For the majority of its length the modified access route follows the existing Country Energy access road which moves in and out of the approved s87/90 AHIP area. The existing access road will need to be widened by approximately 5 metres and the overall area of impact including table drains and batters will be approximately 20 metres. The works will typically include stripping topsoil, compacting the sub-base and then laying and compacting fill and road base on top of the sub-base to form the pavement. The creek crossing works will involve laying pipes and culverts in the main channels of the drainage lines/creeks at the crossing locations. This will involve excavation within the channel to prepare the beds for the pipes and culverts. At the creek crossings there will also be oil and sediment basins constructed to manage the quality of rainfall runoff from the road. These are typically small dam type structures involving surface disturbance works. In addition, there are number of areas where the proposed Holcim access road deviates from the existing Country Energy access road. Access road construction/widening has the potential to damage/destroy any Aboriginal archaeological sites that fall within the development impact areas.	Holcim has committed to constructing the access road using geotextile and imported fill where it crosses areas identified during this assessment as sensitive from an Aboriginal and archaeological perspective. Ground disturbance in these areas will be limited to culverts. Oil and sediment basins will not be constructed within ATUs identified as sensitive from an Aboriginal and archaeological perspective.
Rail Siding and Cribroom	The works will typically include stripping topsoil from the area under the proposed embankment and then placement and compaction of fill to form the embankment. There will be culverts for drainage under the siding at two locations. The only protection works specifically related to the rail siding would be scour protection around the inlet and outlet of the culverts. This will typically involve laying rip rap in the drainage channel/creek. There will be a previously approved creek crossing at approximately chainage 600 metres along the siding associated with an internal haul road. This will again involve scour protection of the channel. Ground surface disturbance related to the construction and maintenance of this infrastructure has the potential to damage/destroy any Aboriginal archaeological sites that fall within the construction impact area.	All topsoil stripped will be retained in the locality and used for landscaping of the area.

Table 1 – Components of the Modification/Potential Impacts/Management (cont)

Component of Modification	Potential Impact	Holcim Management Commitment
Train Driver's Cribroom, Double Weighbridge and Office and Tarping Area	The construction of the train driver's crib room will involve localised ground levelling for plinths to support a transportable building and in-ground concrete anchors to hold the building down in the event of high winds. There will also be a water tank for the amenities (potentially on a small concrete slab), some foot paths around the building and to and from the rail siding, a roadway to access the building for maintenance, and a 'packaged' sewage treatment plant to cater for the amenities in this building. The tarping area will involve similar works to the access road to construct a sealed pavement area trucks can stop in to cover their loads. There is an earth bund on the eastern side, either an earth mound or concrete upstand to the west (to separate the area from through traffic), and lighting (with associated foundations and underground power supply). The Double Weighbridge and Office will involve excavation to construct concrete foundations for the weighbridges as well as the roads leading to and from the bridge. The works for the office will be similar to those for the train driver's crib room. Ground surface disturbance related to the construction and maintenance of this infrastructure has the potential to damage/destroy any Aboriginal archaeological sites that fall within the construction impact area.	All topsoil stripped will be retained in the locality and used for landscaping of the facilities.
Underground Electricity Feeder	Ground surface disturbance related to excavation for the trenches has the potential to damage/destroy any Aboriginal archaeological sites that fall within the impact areas. Office, Amenities and Carpark - Topsoil disturbance will be limited to an area 0.6 metres wide and 1.2 metres deep. Infrastructure Area **-** Topsoil disturbance will be limited to an area 0.3 metres wide and 1 metre deep.	Registered Aboriginal Parties and an archaeologist will be provided the opportunity to monitor all topsoil removal for the trenches. Topsoil will be removed from trenches separately and spread back over the infilled trench. No topsoil will be removed from the local area.

Current Aboriginal Cultural Heritage and Archaeological Conservation Strategy

An important aspect of the management of Aboriginal archaeological sites and landscape values within the broader approved Lynwood Quarry Project Area is the conservation of a representative sample of site types (and resources) within the various ATUs identified in the Project Area (refer to **Figure 1.4**). In summary the Lynwood Quarry Project Area conservation management strategy includes:

- 51 sites to be conserved *in-situ* and managed for conservation during the 30 year life of the quarry (including 19 isolated finds, 27 artefact scatters, one *in-situ* boulder that has been used for grinding and four scarred trees) that are within the broader Project Area boundary but which are outside the approved disturbance footprint; and

- 11 sites to be conserved long term within a Cultural Heritage Management Zone (CHMZ- including one stone arrangement, five scarred trees, one isolated find and four artefact scatters).

The remaining 32 sites (seven isolated finds and 25 artefact scatters) will be impacted/partially impacted by the currently approved Lynwood Quarry disturbance footprint (27 sites) or works associated with Country Energy infrastructure related to the Marulan Electricity Supply Upgrade (5 sites).

Consultation with Registered Aboriginal Parties occurred as part of the survey and assessment work conducted on behalf of Country Energy within the Lynwood Quarry project area (Umwelt 2007a, Umwelt 2007b) and in relation to the s.87 and s.87/90 AHIP applications related to Stages 1, 2 and 3 of the investigations (Umwelt 2007c, 2008d, 2008e, 2008f, 2009). As the Registered Aboriginal Party consultation associated with the Lynwood Quarry project has been comprehensively detailed elsewhere, this report will outline only the consultation undertaken for the current assessment and for the proposed s.87/90 AHIP (#1100264) variation application.

Registered Aboriginal Party Consultation and Participation

Gundungurra Aboriginal Heritage Association Inc (GAHAI), Gundungurra Tribal Council Aboriginal Corporation (GTCAC), Pejar Local Aboriginal Land Council (PLALC) and Peter Falk Consultancy (PFC) were advised by Holcim of the proposed modification to the project impact area in June 2010. At this time Holcim provided information in relation to the nature of the modifications and of the proposed intention to invite the Registered Aboriginal Parties to participate in a survey of the areas proposed for modification. The survey methodology proposed by Holcim was to inspect the proposed modification areas in their entirety (i.e. 100% survey coverage).

The survey methodology was acceptable to all Registered Aboriginal Parties and GAHAI, GTCAC and PLALC accepted the invitation to have a representative participate in the survey. PFC declined the invitation to participate in the fieldwork, but was involved in the consultation process.

Fieldwork was undertaken on the morning of 6 July 2010. On the afternoon of 6 July 2010 a meeting was held at Marulan. During this meeting the results of the survey, the Aboriginal cultural heritage and archaeological significance of the ATUs proposed for impact and the various management options available for the ATUs were discussed and draft management recommendations prepared based on Registered Aboriginal Party comments and advice. It was made clear to the Registered Aboriginal Parties and Holcim at this time, however, that draft report would be circulated and further advice sought from the broader membership of each of the Registered Aboriginal Parties.

A draft copy of this Aboriginal Cultural and Archaeological Assessment was provided to the Registered Aboriginal Parties on 20 August 2010 for their review and comment. At the same time as requesting comment on the draft *Aboriginal Cultural and Archaeological Assessment*, the Registered Aboriginal Parties were asked to comment on whether they thought it appropriate from an Aboriginal cultural perspective for Holcim to request a variation to its current DECCW s.87/90 AHIP (#1100264) to modify the area over which it has s.87/90. Comments provided by the Registered Aboriginal Parties are summarised in **Table 2**. The written comments provided have been included in **Appendix A**.

Table 2 – Registered Aboriginal Party Comments

Registered Aboriginal Party	Comments
Gundungurra Aboriginal Heritage Association Inc. (GAHAI)	*To be completed based on comments provided by GAHAI*
Gundungurra Tribal Council Aboriginal Corporation (GTCAC)	*To be completed based on comments provided by GTCAC*
Pejar Local Aboriginal Land Council (PLALC)	*To be completed based on comments provided by PLALC*
Peter Falk Consultancy (PFC)	*To be completed based on comments provided by PFC*

A Native Title search was undertaken on 15 July 2010 for the Goulburn Mulwaree LGA. The Native Title search indicated that there were two Native Title claimant groups for the Goulburn Mulwaree LGA. These are:

- Donald Thomas Bell on behalf of the Ngunawal People (NNTT number: NCOO/1); and
- Gundungurra Tribal Council Aboriginal Corporation #6 (NNT number: NC97/7).

The GTCAC's Native Title claimant area was found to include the Project Area and GTCAC are a Registered Aboriginal Party for this project. The claim by the Ngunawal People was for an area outside the Project Area. The results of the Native Title Search are included in **Appendix B**.

Archaeological Terrain Units

The environmental and cultural context of the broader Lynwood Quarry Project Area was detailed in the *Aboriginal Archaeological Survey and Assessment of the Proposed Lynwood Quarry Marulan, NSW* report (Umwelt 2005). As a result of further consultation with the DECCW and participating Registered Aboriginal Parties the environmental and cultural context of the area has been further investigated and then utilised to divide the Project Area into ATUs.

A total of 34 ATUs have been identified within the Lynwood Quarry Project Area. **Figure 3.5** indicates the location and extent of the ATUs. The ATUs have been derived from a combination of the information gathered in relation to stream order, geology, soils, landform element and cultural context (refer to **Sections 3.1** through **3.4**).

Analysis of the ATUs indicated the following for the 34 identified ATUs:

- 29 have known sites;
- 5 do not have known sites;

- the largest numbers of known sites in the ATUs are within the Bindook Porphyry, in the spur crest landform element (4BP - 26% of total sites) and within the gentle slope landform element (6BP - 23.5% of total sites) respectively;

- three sites (two isolated finds and one artefact scatter) are located in ATUs predicted from the ethnographic/ethnohistoric review to have been associated with ceremony or burial;

- two sites (both scarred trees) are located in the ATU predicted from the landform element analysis to have been used for hunting and gathering rather than camping - due to the steepness of the gradient; and

- 89 sites (isolated finds, artefact scatters, an artefact scatter with an in-situ boulder used for grinding, scarred trees and a stone arrangement) are in ATUs predicted from the ethnographic/ethnohistoric review and the landform element analysis to have been used for camping.

Predictive Model

Three ATUs (6BP, R6BP and 4BP) are proposed for impact by the modification. Based on the analysis of the ATUs it was predicted that:

- ATU 6BP is likely to have:
  - isolated finds and small, low density, low complexity artefact scatters;
  - any subsurface artefactual material associated with sites is unlikely to retain archaeological integrity due to topsoil disturbance and topsoil loss (downslope movement due to gravity and slopewash); and
  - if sites are located they are most likely to contain flakes, broken flakes and flaked pieces manufactured from silcrete, quartz and quartzite.
- ATU R6BP is likely to have:
  - isolated finds and moderate density and low complexity artefact scatters;
  - any subsurface artefactual material associated with sites is unlikely to retain archaeological integrity due to topsoil disturbance and topsoil loss (scouring by overbank flows), except where they are in an aggradational/stable context (e.g. colluvial deposit at the base of the slope) and where they are above the level scoured by high water flows;
  - in these cases they may retain some archaeological integrity; and
  - if sites are located they are most likely to contain flakes, broken flakes, retouched flakes and cores manufactured from silcrete, quartz and quartzite and to a lesser extent, chert and volcanic.
- ATU 4BP is likely to have:
  - isolated finds and low to moderate to high density and low to moderate complexity artefact scatters (density and complexity was found to vary between various testing locations with those sheltered from spring, autumn and winter winds having higher densities and greater complexity);
  - any subsurface artefactual material associated with sites is unlikely to retain archaeological integrity due to topsoil disturbance and topsoil loss (downslope movement due to slopewash); except where they are in a fairly stable context (i.e. on level spur crests where rock outcrops and/or remnant vegetation has acted to stabilise the soil);

- in these cases they may retain some archaeological integrity;
- the sites are most likely to contain flakes, broken flakes, retouched flakes and cores manufactured from silcrete, quartz and quartzite and to a lesser extent, chert and volcanic; and
- scarred trees may be present in areas where remnant vegetation exists.

Survey Methodology

The survey was conducted on 6 July 2010. Prior to commencing the survey all of the survey areas were driven across and plans viewed to ensure that all survey participants understood the nature of the proposed modification and potential impacts that may arise from works associated with the modification.

The proposed modified access road survey was divided into nine transects based on the ATUs traversed. ATUs within the proposed modified access road survey area included 6BP, R6BP and 4BP. The proposed modified access track was clearly pegged to ensure that the correct corridor was surveyed. Holcim will be required to widen the existing Country Energy access road by approximately 5 to 10 metres in this area. It was not known at the time of the survey if this would relate to widening on one or both sides of the existing roadway. Thus a corridor of 20 metres either side of the existing access road was inspected. Participants were spaced at 5 to 10 metre intervals and all exposures were checked for artefacts. At the point where the proposed modified access road diverges from the existing Country Energy access road (refer to **Figure 5.1**), a corridor 25 metres wide was inspected based on the centreline of the proposed access road which was pegged. Once again all exposures were subject to inspection.

The proposed underground electricity feeder was not pegged at the time of the survey. Richard Savage (Holcim) explained that the trench would exit from the NMZS on its northern side following and existing approved easement. It would then extend to the south-east along the alignment of the proposed modified access road to the approved office, amenities and car park area (refer to **Figure 5.2**). The area to be impacted by the proposed trench to the approved office, amenities and car park area that is outside the current s.87/90 AHIP (#1100264) and Project Approval boundary was surveyed as part of Transect 7 for the proposed modified access road (refer to **Figure 5.1**).

A second trench is also proposed to branch from the first to turn north-west to follow the alignment of the proposed modified access road to the infrastructure area (refer to **Figure 5.2**). This area was surveyed as Transects 7, 8 and 9 of the modified access road survey and as part of Transect 1 of the rail siding survey (refer to **Section 5.1.3**) and Transect 1 of the area to the north of the rail siding area (refer to **Section 5.1.4**).

The centreline of the alignment for the proposed rail siding was pegged in the area outside the Project Approval boundary and the current s.87/90 AHIP (#1100264) area (refer to **Figure 5.2**). The survey transect in this area included a corridor of 50 to 80 metres in width to ensure that the area between the proposed railway siding and the tributary of Joarimin Creek was intensively inspected as well as a corridor of 25 metres to the north and west of the proposed railway siding (refer to **Figure 5.1**). All exposures in this area were inspected by the survey participants. Participants were generally spaced between 5 and 10 metres apart. The survey team initially walked the corridor along the proposed rail siding alignment and to its north and west; returning to survey to the south and east of the pegged alignment. The Joarimin Creek channel and both banks were then subject to inspection.

An area of approximately 4 hectares to the north and west of the proposed rail siding also falls outside the current Project Approval and s.87/90 AHIP (#1100294) area (refer to **Figure 5.1**). Only part of this area is currently proposed for impact by construction of a

tarping area facility and double weighbridge and office. However, as the remainder of the area is wedged between this infrastructure, the proposed rail siding and the approved plant to the north it is expected that it will be impacted and it is therefore included in the proposed disturbance area. Thus the area was surveyed. Survey participants inspected the area using a rough grid pattern with transects walked east and west and then north and south. Participants walked at roughly 20 metre intervals and inspected all areas of exposure.

As part of the survey methodology all remnant mature trees, stumps and logs were inspected for evidence of scarring/carving.

Results of the Survey

The survey undertaken for the proposed modification found:

- no artefactual material exposed within the survey areas;
- sections of three ATUs that were identified as being likely to retain potential archaeological deposits (PADs - refer to **Section 5.3**);
- all the survey areas had been heavily cleared;
- much of the length of the modified access road (where it follows the existing Country Energy access road) appears to have been mechanically ripped historically and was highly disturbed and eroded;
- almost all areas surveyed had lost the A1 soil horizon and parts of the A2 soil horizon due to ongoing downslope movement of the coarse, sandy, granitic soils through gravity and slopewash;
- slopewash had resulted in many areas of scouring;
- the soils of the spur crests were generally shallow to skeletal and more sparsely vegetated;
- minor areas of recent soil aggradation were noted in association with relatively broad, shallow grassy waterways (first order streams); and
- only the area of riparian corridor at the start of the modified access road (north of site MRN15) and the area associated with the central section of the Rail Siding survey area) are assessed as likely to have retained semi-permanent water within chains of ponds in their respective creek channels (refer to **Figure 5.1**).

PAD Descriptions

The areas assessed as PADs identified during the survey are indicated on **Figure 5.3**. The PADs have been numbered 1 to 5 in the order they were recorded during the survey. With the exception of PAD5, the PAD areas identified on **Figure 5.3** relate to the area of the PAD within the proposed disturbance boundary and not the broader PAD area.

PAD1 ATU R6BP - incorporates the area of riparian corridor to the north of a tributary of Joarimin Creek. The area has been totally cleared and is heavily grassed. No surface artefacts were exposed in this area. The PAD is identified as extending from 5 metres north of the current creek bank (the area beside the creek bank is recent alluvial deposit) to 50 metres north of the creek bank. It is assessed that the PAD area extends to the east and west along the riparian corridor in this general area, however, only the area to be impacted by the modified access road was assessed. One of the major determinants of this area

being assessed as PAD is its proximity to the MRN15 site which has artefacts in a surface and subsurface context and the likelihood that the creekline in this area retained semi-permanent water in a chain of ponds context (refer to **Figure 5.3** and **Appendix E**).

PAD2 ATU 4BP - incorporates an area of two adjoining spur crests encircled to the south west and north by a tributary of Joarimin Creek. The area to be impacted by the access road and underground trenches for the modification is to the east and north of the known extent of the MRN54 site (i.e. the area currently subject to disturbance by the construction of the NMZS). The area has been totally cleared and is heavily grassed. No surface artefacts were exposed in this area. The PAD is identified as extending along the whole of the survey transect in this area and is assessed as incorporating the extremities of the MRN54 site (the NMZS location) which had few surface artefacts but over 1300 subsurface artefacts (refer to **Appendix E**). It is predicted that subsurface artefact numbers will be relatively low in the eastern and northern extremities of the proposed modified impact areas (access road and underground trenches) and higher in proximity to the known extent of the MRN54 site (refer to **Figure 5.2**).

PAD3 ATU 6BP - incorporates an area of gentle slope to the north of the MRN54 site and PAD2 and to the south and east of a tributary of Joarimin Creek. PAD3 is the northerly extension of PAD2 and has only been identified separately as it is a different ATU. The area has been totally cleared and is heavily grassed. No surface artefacts were exposed in this area. The PAD is identified as extending along the whole of the survey transect in this area and is assessed as incorporating the extremities of the MRN54 site (the NMZS location) which had few surface artefacts but over 1300 subsurface artefacts (refer to **Appendix E**). It is predicted that subsurface artefact numbers will be relatively low in this area compared to the area of MRN54 exposed by the construction of the NMZS (refer to **Figure 5.2**).

PAD4 ATU R6BP - incorporates an area of gentle slope in the riparian corridor to the north of the MRN54 site and PAD2 and PAD3 and to the south and east of a tributary of Joarimin Creek. PAD4 is the northerly extension of PAD2 and PAD3 and has only been identified separately as it is a different ATU. The area has been totally cleared and is heavily grassed. No surface artefacts were exposed in this area. The PAD is identified as extending along the whole of the survey transect in this area and is assessed as incorporating the extremities of the MRN54 site (the NMZS location) which had few surface artefacts but over 1300 subsurface artefacts (refer to **Appendix E**). It is predicted that subsurface artefact numbers will be relatively low in this area compared to the area of MRN54 exposed by the construction of the NMZS (refer to **Figure 5.2**).

PAD4 ends approximately 10 metres before it reaches the tributary of Joarimin Creek. It does not continue to the creek bank as the creek line has multiple mobile channels in this area which migrate across the valley floor. The riparian corridor on the northern side of the creekline is lower lying and of gentler gradient but has been subject to scouring during high water flows and substantial bioturbation due to cattle trampling when wet and boggy. The riparian corridor on the northern side of the creekline was not assessed as PAD in the area crossed by the access road and underground feeder for the modification.

PAD5 ATU R6BP - is a small area of elevated terrace within the riparian corridor on the northern side of tributary of Joarimin Creek and within the area proposed for impact by the construction of the rail siding. PAD5 is at the base of the footslope and between the footslope and the creekline. In this area the creekline has been prevented from migrating by rock outcropping along a small section of the creek bank. Behind and to the north of the outcropping rock there is an area approximately 50 metres by 50 metres that has not been scoured and as it is better drained has not been as badly affected by cattle trampling as the majority of the riparian corridor along the northern bank of the tributary. It is possible that this area has retained a relatively intact soil profile, though it is unlikely that this soil profile will

retain stratigraphic integrity due to land clearance and grazing, it is possible that some spatial integrity may remain.

The tributary of Joarimin Creek currently contains a fairly deeply entrenched chain of ponds in this area. Prior to European land clearance it is assessed that the creekline would have been a fairly broad, grassy waterway and that it is likely that a chain of ponds was present near the elevated terrace. This suggestion is supported by the location of a relatively large number of artefacts in the nearby MRN54 site. PAD5 does not extend throughout the riparian corridor ATU on the northern side of the tributary as this area has been heavily scoured (evidenced by the few remaining stumps and trees standing on pedestals of remnant soil with most of their roots exposed) and subject to cattle trampling when wet and boggy.

Significance Assessment

Aboriginal Cultural Significance

Throughout the history of the Lynwood Quarry Project Area survey, assessment and subsurface investigations it has been made clear by the GAHAI, GTCAC, PLALC and PFC that the entire Project Area and its surrounds are of traditional, historic and contemporary cultural significance to the Gundungurra Peoples and the Aboriginal Peoples that have associations with Gundungurra Country (refer to the **Aboriginal Cultural Significance Statements** in the preface of this report). In relation to the ATUs proposed for impact by the modification the following comments were provided by the Registered Aboriginal Parties.

This section of the report will be completed based on comments provided by the Registered Aboriginal Parties on the draft report.

Archaeological Significance

As no Aboriginal archaeological sites were located during the survey of the areas proposed for impact by the modification the archaeological significance assessment was based on the ATUs and the PADs identified during the survey. The ATUs have been previously assessed for their significance based on the outcomes of the surface survey and subsurface testing of Aboriginal archaeological sites and ATUs (Umwelt 2008f). The significance assessment for ATU 4BP has subsequently been revised based on the outcomes of the monitoring of works in the NMZS area under Country Energy s.87/90 AHIP (#1089392) (Umwelt in prep. – refer to **Appendix E**).

The Umwelt (2008f) ATU significance assessment was based on the archaeological significance of the known sites within each of the ATUs. The archaeological significance was assessed according to the value each site had to contribute to furthering the archaeological/scientific understanding of Aboriginal use of the landscape (their archaeological research potential). Six criteria were assessed for each site to deduce its archaeological research potential from a local and regional perspective. These criteria were rarity, representativeness, integrity, connectedness, complexity and potential for archaeological deposit (refer to **Table 3**).

Table 3 – Significance Assessment and Conservation Status – Archaeological Terrain Units

ATU Description	Aboriginal Significance	Archaeological Significance	Research Potential	Conservation Status
6BP – gentle slope on Bindook Porphyry	low to moderate (variable)	Transect 2 – low Transect 4 – low Transect 6 – low Transect 8 – low to moderate Area North of proposed Rail siding - low	low low low low to moderate low	ATU6BP is the most commonly occurring ATU across the project area. A relatively large area of ATU 6BP will be impacted by the Lynwood Quarry disturbance footprint, however, a larger area outside the disturbance footprint will be managed in-situ throughout the 30 year life of the quarry or conserved long-term within the CHMZ.
R6BP – gentle slope within the riparian corridor in the Bindook Porphyry	very high except where very eroded	Transect 1 – low Transect 8 – low to moderate Railway Siding Scoured/highly disturbed areas - low Elevated terrace - moderate	low low to moderate low moderate	The majority of R6BP will be conserved within the Joarimin Creek Riparian Corridor and the broader Lynwood Quarry project area and also within the CHMZ.
4BP – spur crest in the Bindook Porphyry	low to extremely high (variable)	Transect 3 - low Transect 5 - low Transect 7 - moderate	low low moderate	ATU 4BP is the second most common ATU within the Lynwood Quarry project area. While a relatively large area of the ATU is within the disturbance footprint an even larger area outside the disturbance footprint will be managed in-situ throughout the 30 year life of the quarry or conserved long-term within the CHMZ.

In general the ATUs within the areas proposed for impact by the modifications were assessed as having low archaeological significance and low research potential. The areas of ATUs where this was not the case are within the areas identified as PAD (refer to **Section 7.4**).

Archaeological Significance of PADs

For this assessment archaeological significance of the PADs was ranked according to their potential to have a subsurface artefactual assemblage that through its investigation could contribute to the archaeological/scientific understanding of the Aboriginal use of the landscape (their research potential) using five of the six criterion identified for sites (rarity, representativeness, integrity, connectedness and complexity). The sixth criterion – potential for archaeological deposit – was not relevant as the areas are already assessed as being PAD.

PAD1 was assessed as having low overall archaeological significance, PAD2, 3 and 4 as having low to moderate overall archaeological significance and PAD5 as having moderate overall archaeological significance. PAD5 was assessed as having the highest significance as elevated terraces in the upper tributary system are rare and representative locally and only slightly less rare and representative regionally (based on current knowledge of similar landscapes). PAD2, 3 and 4 owe their slightly higher overall archaeological significance to their proximity to the MRN54 site. None of the PADs were assessed as having overall high archaeological significance due to the levels of disturbance and the nature of size of their predicted assemblages.

Management Options

From an Aboriginal cultural and archaeological perspective, Aboriginal archaeological sites and PADs are a finite and irreplaceable resource that has already been heavily impacted by development in the Southern Highlands. Thus DECCW requires proposals for site/PAD damage/destruction to be accompanied by appropriate mitigation (salvage and/or management) and to be balanced by conservation offset measures. Therefore, the management options considered span ATU/PAD conservation, existing conservation offsets and impact mitigation. The management options were also prepared taking into account the need for the project outcomes to demonstrate Intergenerational Equity.

Three potential management options were considered for the ATUs and the PADs located during the survey of the areas proposed for the modification. The options were:

- Conservation;
- Impact without subsurface investigation; and
- Impact following subsurface investigation and subsequent salvage (where required).

Management Strategy

Specific Recommendations

The management strategy includes specific recommendations relating to each of the proposed modification areas and general recommendations that relate to all ground disturbing works associated with the proposed modifications.

Modified Access Road and Underground Electricity Feeder

It is recommended that Holcim obtains a variation to its existing s.87/90 AHIP (#1100264) to modify its current s.87/90 AHIP boundary to allow the construction of the modified access road and underground electricity feeder as shown on **Figure 9.1**. The variation should be conditional on the following:

- Holcim will construct the modified access road over geotextile using imported fill in those areas of ATU R6BP, 6BP and 4BP indicated by orange hatching on **Figure 9.1**;
- within the orange hatched areas Holcim will keep all machinery associated with road construction in the surveyed corridor;
- Holcim will not undertake any works in the orange hatched areas if the ground is wet and boggy;
- Holcim will restrict ground disturbance within the orange hatched areas to culverts and to works associated with the proposed underground electricity feeder;

- Holcim will ensure that all topsoil disturbed is kept for landscaping/spreading over the backfilled trenches; and

- Holcim will provide the opportunity for the Registered Aboriginal Parties and an archaeologist to monitor all topsoil disturbance related to the underground powerline within the orange hatched areas (refer to **Appendix F** for monitoring methodology).

For the remainder of the modified access road (incorporating areas of ATU 4BP and 6BP) the variation should be conditional on the following:

- Holcim will restrict all ground disturbing works to within the surveyed corridor.

Rail Siding

It is recommended that Holcim obtains a variation to its existing s.87/90 AHIP (#1100264) to modify its current s.87/90 AHIP boundary to allow the construction of the rail siding as shown on **Figure 9.1**. The variation should be conditional on the following:

- prior to any works in this area of ATU R6BP, Holcim will commission a suitably qualified archaeologist and the Registered Aboriginal Parties to undertake subsurface testing within the white hatched area (slightly elevated terrace) indicated on **Figure 9.1**;

- the subsurface testing will be undertaken using the same methodology as all previous subsurface testing of ATUs undertaken during Stages 1 and 2 of the Lynwood Quarry Project subsurface investigations (refer to **Appendix F** for details);

- following subsurface testing discussions will be held with DECCW (Southern Directorate) and the Registered Aboriginal Parties to determine if further subsurface salvage is required (refer to **Appendix F** for details);

- if further salvage is required it will be undertaken using the same methodology as undertaken during Stage 3 of the Lynwood Quarry Project subsurface investigations (refer to **Appendix F** for details); and

- Holcim will ensure that all topsoil disturbed is used for landscaping purposes as close as possible to its area of derivation.

Area North of Rail Siding

It is recommended that Holcim obtains a variation to its existing s.87/90 AHIP (#1100264) to modify its current s.87/90 AHIP boundary to allow impact within this area resulting from the construction of the tarping area and double weighbridge facilities, works associated with the rail siding and other works as required as shown on **Figure 9.1**. The variation should be conditional on the following:

- Holcim will ensure that all topsoil disturbed is used for landscaping purposes as close as possible to its area of derivation.

General Conditions

It is recommended that Holcim obtains a variation to its existing s.87/90 AHIP (#1100264) to modify its current s.87/90 AHIP boundary in compliance with the following general conditions:

- Holcim will incorporate the results of all subsurface testing and monitoring of works within the PADs and any subsequent artefact analysis into the Stage 3 report for the broader Project Area (Umwelt in prep.);

- Holcim must ensure that all its personnel and contractors are aware of the requirements of the Lynwood Quarry Aboriginal Heritage Management Plan (AHMP);

- all Holcim personnel and contractors working on the modification within the Lynwood Quarry Project Area must undertake the Holcim Aboriginal Cultural Heritage Awareness Training package that forms part of the Holcim induction procedure;

- all Holcim personnel and contractors working on the modification within the Lynwood Quarry Project Area must be made aware of the location of known Aboriginal sites, PADS and ATUs that are to be protected from impact;

- in compliance with the Lynwood Quarry AHMP and DECCW AHIP (#1100264), in the event that previously unknown artefactual material is uncovered during quarry development/operations, ground disturbance works should cease and DECCW and the Registered Aboriginal Parties should be contacted so that appropriate management strategies can be identified. Work may recommence at a distance approved by the DECCW and the Registered Aboriginal Parties; and

- in the event that any skeletal material of possible human origin is uncovered during the proposed works, ground disturbance works should cease to allow management in accordance with the *Skeletal Remains – Guidelines for the Management of Human Skeletal Remains under the Heritage Act 1977* (NSW Heritage Office 1998) and the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NPWS 1997). This would first involve notification of local police and, for potential Aboriginal remains, the DECCW and Registered Aboriginal Parties; followed by an inspection by a physical or forensic anthropologist/archaeologist to determine the ancestry and antiquity of the remains, on which basis appropriate management strategies will be identified. Work may recommence at a distance approved by the DECCW and the Registered Aboriginal Parties.

Care and Control

The care and control of all 'Aboriginal objects' (stone artefacts) recovered from the Lynwood Quarry disturbance footprint is detailed within the current 'Care' Permit #2761 and it is proposed that existing 'Care' Permit #2761 is varied to enable the 'Care' of any artefacts salvaged during the subsurface investigation of PAD5 or during the monitoring of the trench excavation for the underground electricity feeder.

On completion of the reporting process and following the construction of the appropriate facilities within the Lynwood Quarry Office complex, the artefacts will be handed over to the Lynwood Quarry Aboriginal Heritage Management Committee to be placed in the appropriate storage facility or on display.

Timeframes for Implementation of the Management Strategy

Table 4 provides a timeframe for the implementation of the management strategy.

Table 4 – Timeframes for Implementation of the Management Strategy

Task	Timeframe
Subsurface testing of ATU R6BP/PAD5 – proposed Rail Siding location	Holcim should commence the subsurface testing as soon as feasible after obtaining approval.
Aboriginal Cultural Heritage Awareness Training	Must be provided to all personnel and contractors prior to any works being carried out within the modified Lynwood Quarry Project Area.
Laying of geotextile in specified areas	Must be undertaken prior to any road construction works in the specified areas.
Monitoring of topsoil removal from trenches required for the underground electricity feeder in areas outside the current Project Approval and s.87/90 AHIP (1100264) boundary.	No ground disturbing works are permitted for the trench unless representatives of the Registered Aboriginal Parties and an archaeologist are present. The monitoring should be undertaken at least 1 month prior to the date when the electricity feeder must be connected. This is to ensure that there is sufficient time to undertake any necessary additional salvage that may arise from the outcomes of the monitoring (i.e. if a feature is located – for details refer to Appendix F).

Intergenerational Equity

It was assessed that the management strategy when added to the existing Lynwood Quarry Project Area conservation strategy as discussed in **Section 6**, met the requirements of Intergenerational Equity.

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APPENDICES

1.0 Introduction

Lynwood Quarry is located west of Marulan, in the Southern Highlands region of NSW, approximately 160 kilometres south-west of Sydney and approximately 27 kilometres north-east of Goulburn, NSW (refer to **Figure 1.1**). Marulan is located within the traditional Country of the Gundungurra[3] Peoples (Tindale 1974, Smith n.d.) and within the Pejar Local Aboriginal Land Council boundary. The Marulan area is of great cultural heritage significance to the Gundungurra Peoples and Aboriginal Peoples that have historic and contemporary association with the Country of the Gundungurra.

Holcim (Australia) Pty Limited (Holcim, formerly Readymix[4]) received Development Consent (DA-128-5-2005) to establish the Lynwood Quarry, on 21 December 2005 (refer to **Figure 1.2**). Schedule 3, Condition 36 (b) of the Development Consent, identifies the requirement for Holcim to undertake a subsurface testing and salvage program for its development impact area prior to the commencement of quarry development. In consultation with the Department of Environment, Climate Change and Water (DECCW) (formerly Department of Environment and Climate Change - DECC) and the relevant Registered Aboriginal Parties (for details refer to **Section 2**), Holcim developed a subsurface testing program incorporating all the known Aboriginal archaeological sites and all of the Archaeological Terrain Units (ATUs – refer to **Section 1.4** and **Section 3**) within its approved disturbance footprint. The subsurface testing program also extended to Aboriginal archaeological sites and ATUs proposed for impact by the Country Energy Marulan Electricity Supply Upgrade. The subsurface testing program was followed by a final salvage program and in June 2009 Country Energy completed all its relevant salvage under Section 87/90 Aboriginal Heritage Impact Permit (s.87/90 AHIP) (#1089392) and in January 2010, Holcim completed all salvage required by DECCW within its approved Section 87/90 (#1100264) Aboriginal Heritage Impact Permit Area.

Holcim now proposes to redesign the conceptual Quarry footprint, which will result in minor changes to site infrastructure layout and changes to the impact footprint. As a consequence of the proposed minor modifications, Holcim seeks to impact areas that fall outside the approved disturbance footprint (refer to **Figure 1.3**). To gain approval for the proposed minor modifications to the project, Holcim is required to prepare an Environmental Assessment (EA) under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to modify its existing consent. The original consent, classified as a State Significant Development, was granted under Part 4 of the EP&A Act in May 2005, and as such, section 75W of the EP&A Act is available to modify DA 128-5-2005 pursuant to Clause 8J of the Environmental Planning and Assessment Regulation 2000.

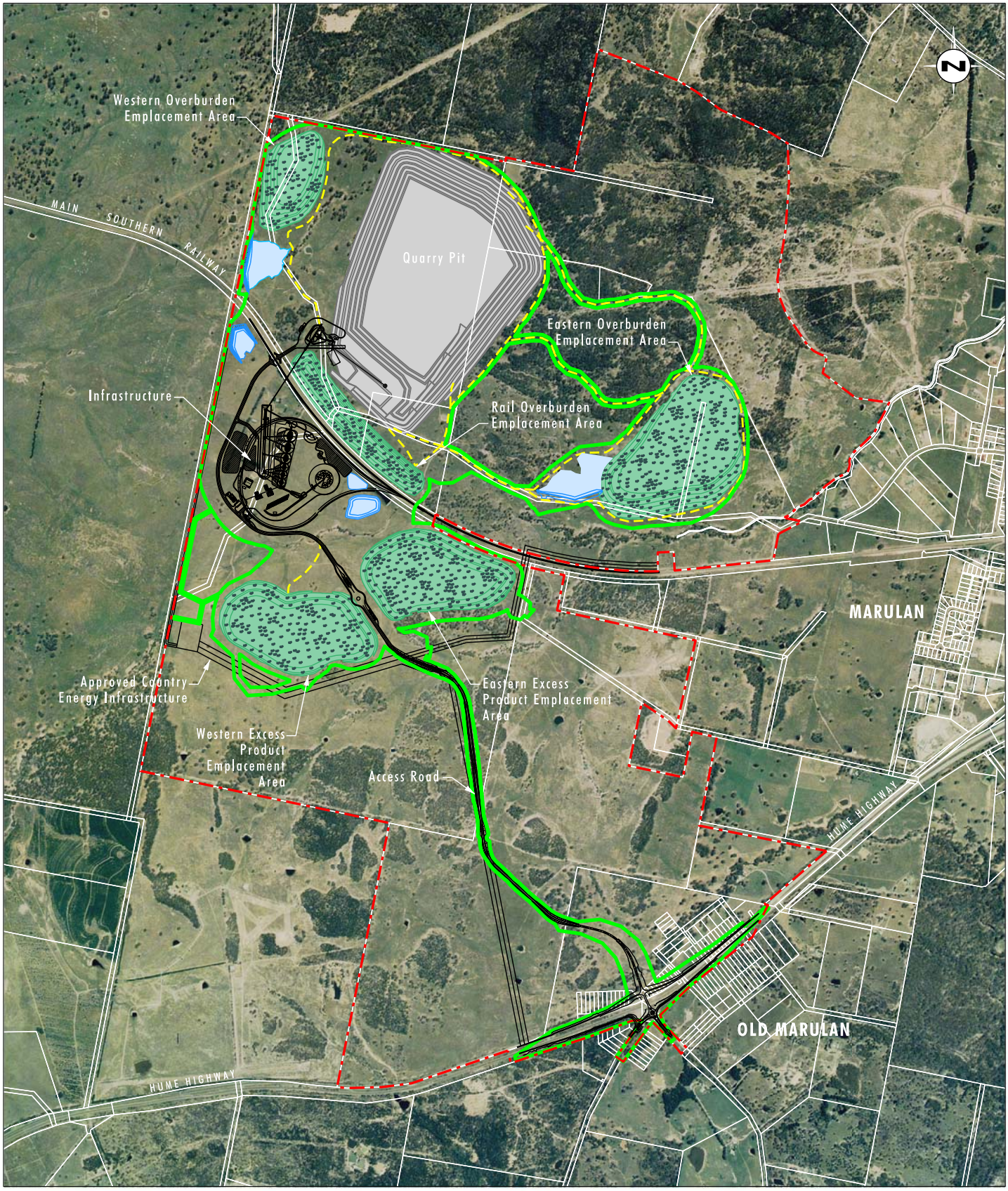
As small areas (approximately 10.5 hectares in total) of the modified footprint fall outside the area covered by DECCW s.87/90 AHIP (#1100264), subject to obtaining development consent it will be necessary for Holcim to revise the boundary of the s.87/90 AHIP area to incorporate the modification prior to impact in this area.

This *Aboriginal Cultural Heritage and Archaeological Assessment* has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Holcim to assess the potential impacts of the proposed minor modifications on Aboriginal archaeological sites and ATUs within the modification areas. The *Aboriginal Cultural Heritage and Archaeological Assessment* will form part of the overall EA for the modification area and will be a supporting document to the Modification Application lodged with the Department of Planning (DoP) and subsequently with a s.87/90 AHIP variation application to DECCW.

[3] This is the preferred spelling of the Registered Gundungurra Aboriginal Parties for this project. Often spelt Gandangara (Tindale 1974).
[4] Readymix (parent company Rinker) then CEMEX, now Holcim.

FIGURE 1.1

Locality Plan



Base Source: LPI 2004, CEMEX Pty Ltd (Aerial Photo March 2005)

0 0.5 1 1.25km
1:25 000

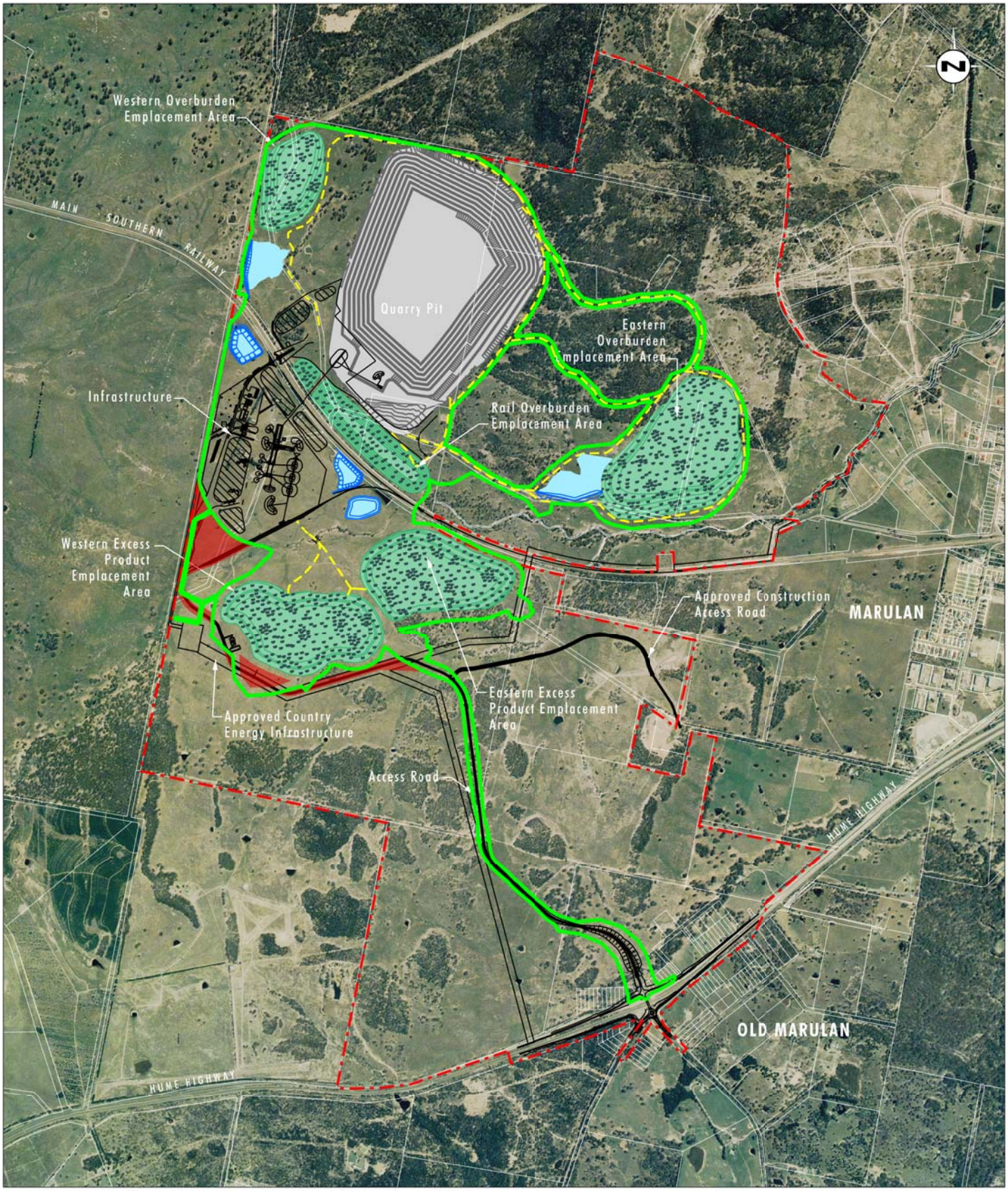
Legend

- Project Area
- Haul Road
- Approved Disturbance Footprint
- Quarry Pit
- Emplacement Area
- Rehabilitated Area
- Dam

FIGURE 1.2

Lynwood Quarry Approved 30 Year Quarry Plan and Disturbance Footprint and Country Energy Infrastructure for Marulan Upgrade

File Name (A4): R21_V1/2238_268.dgn



Base Source: LPI 2010, Holcim Australia (Aerial Photo March 2005)

0 0.5 1 1.25km
1:25 000

Legend

- Project Area
- Haul Road
- Lynwood Quarry 30 Year Development Footprint and Approved s.87/90 AHIP area
- Modified Disturbance Footprint
- Quarry Pit
- Emplacement Area
- Rehabilitated Area
- Dam

FIGURE 1.3

Modified Lynwood Quarry 30 Year Disturbance Footprint and Country Energy Infrastructure for Marulan Upgrade

File Name (A4): R21_V1/2238_269.dgn

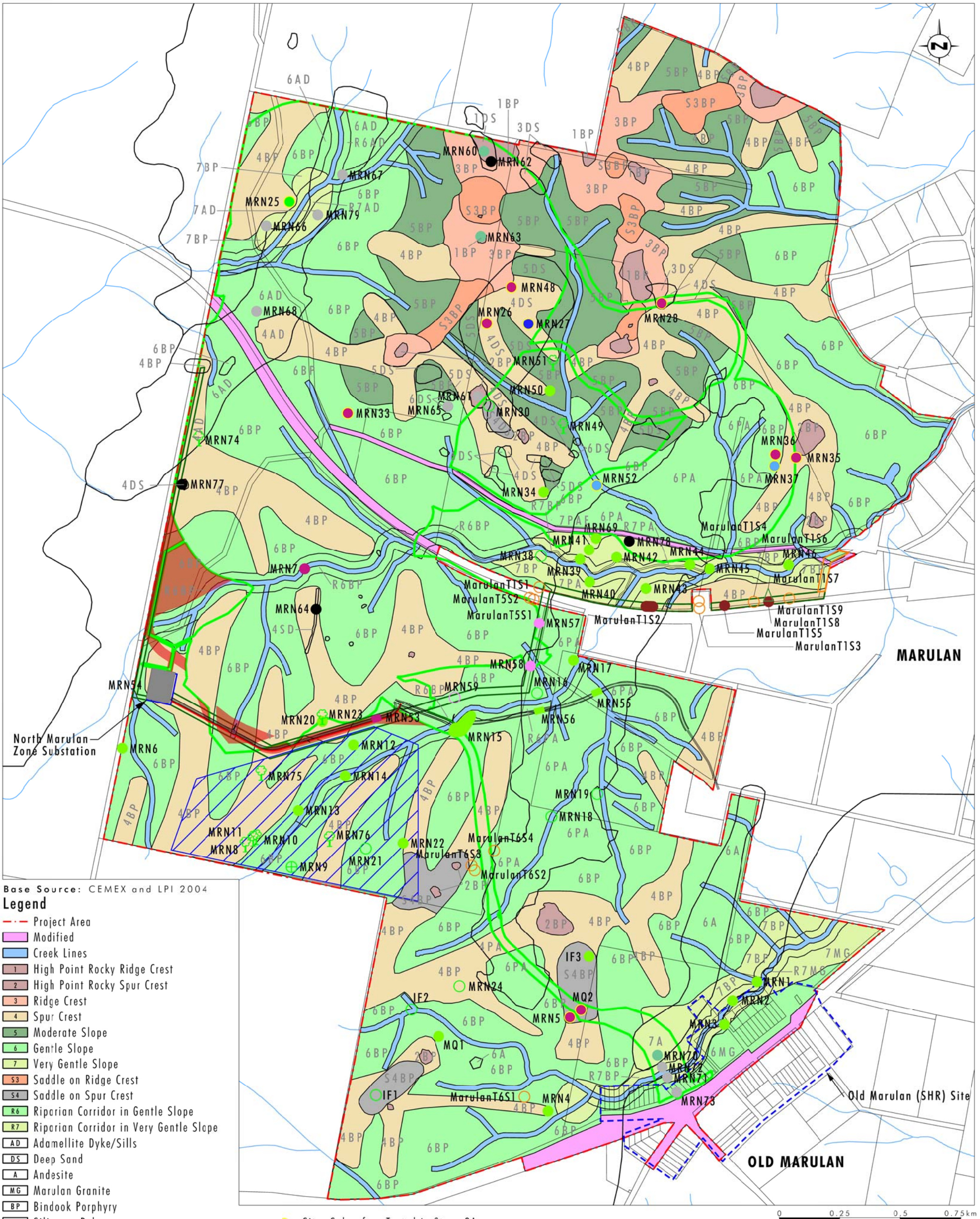
1.1 Potential Impact of the Proposed Minor Modifications

The overall nature, components and approved production rate of 5 million tonnes per annum (Mtpa) remains unchanged, including the extent of the approved 30 year Quarry pit (refer to **Figure 1.3**). The proposed modification includes the reconfiguration of the rail loop to a rail spur, which has allows for greater flexibility in locating the components of the processing and loading out facilities, including the main access road, which is now proposed to be located along the southern boundary of the excess product emplacement areas and along the western boundary of the broader Lynwood Quarry Project Area.

Figure 1.4 indicates the 94 known (through surface survey and subsurface testing) sites within the Lynwood Quarry Project Area (colour-coded to indicate their current management status), the currently approved s.87/90 AHIP (#1100264) area and highlights the areas subject of the proposed modification that fall outside the current s.87/90 AHIP (#1100264) area.

Prior investigations (Umwelt 2005, 2007a, 2007b, 2007c, 2007d; 2008a, 2008b, 2008c, 2008d, 2008e, 2008f, 2009) within the broader Lynwood Quarry Project Area (including investigations for Country Energy) have not identified any Aboriginal archaeological sites within the proposed modification areas; however, some impacts are proposed within ATUs that have been previously identified as culturally and archaeologically sensitive (for details refer to **Section 5** and **Section 6**).

Table 1.1 provides a description of the works proposed for each component of the modification and identifies possible impacts and management options that Holcim incorporated into its planning based on prior knowledge of the sensitivity of the ATUs.



Base Source: CEMEX and LPI 2004

Legend

- Project Area
- Modified
- Creek Lines
- 1 High Point Rocky Ridge Crest
- 2 High Point Rocky Spur Crest
- 3 Ridge Crest
- 4 Spur Crest
- 5 Moderate Slope
- 6 Gentle Slope
- 7 Very Gentle Slope
- S3 Saddle on Ridge Crest
- S4 Saddle on Spur Crest
- R6 Riparian Corridor in Gentle Slope
- R7 Riparian Corridor in Very Gentle Slope
- AD Adamellite Dyke/Sills
- DS Deep Sand
- A Andesite
- MG Marulan Granite
- BP Bindook Porphyry
- SD Siliceous Dyke
- PA Porphyritic Adamellite
- AD Adamellite Dyke
- PAE Elevated Area within Gentle Slope
- Stage 1 Construction Access Road to Substation
- Approved Underground Transmission Line
- Approved Transmission Line Easement
- Stage 1 Post Hole Monitoring Area
- 30 Year Approved Footprint/s.87/90 AHIP area
- Modified Disturbance Footprint
- Cultural Heritage Management Zone

- Sites Subsurface Tested in Stage 2A
- Artefact Scatter s87/90 Collection/Monitoring
- Artefact Scatter salvaged during Stage 1A
- Isolated Find salvaged during Stage 1A
- Artefact Scatter (CE) Conservation
- Artefact Scatter Located During Stage 2B s87/90 No Further Subsurface Salvage
- Isolated Find Located During Stage 2B s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 Further Subsurface Salvage
- Isolated Find s87/90 No Further Subsurface Salvage
- Isolated Find (CE) Conservation
- Artefact Scatter located during Stage 2B Surface Collection only
- Isolated Find (CE) Conservation
- Grinding Stone (CE) Conservation
- Stone Arrangement Conservation
- Scarred Tree Conservation
- Isolated Find s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 No Further Subsurface Salvage

FIGURE 1.4

Archaeological Terrain Units, Aboriginal Archaeological Sites and Modified Infrastructure Area

File Name (A3): R21_V1/2238_270.dgn

Table 1.1 – Components of the Modification/Potential Impacts/Management

Component of Modification	Potential Impact	Holcim Management Commitment
Access Road	For the majority of its length the modified access route follows the existing Country Energy access road which moves in and out of the approved s87/90 AHIP area. The existing access road will need to be widened by approximately 5 metres and the overall area of impact including table drains and batters will be approximately 20 metres. The works will typically include stripping topsoil, compacting the sub-base and then laying and compacting fill and road base on top of the sub-base to form the pavement. The creek crossing works will involve laying pipes and culverts in the main channels of the drainage lines/creeks at the crossing locations. This will involve excavation within the channel to prepare the beds for the pipes and culverts. At the creek crossings there will also be oil and sediment basins constructed to manage the quality of rainfall runoff from the road. These are typically small dam type structures involving surface disturbance works. In addition, there are number of areas where the proposed Holcim access road deviates from the existing Country Energy access road. Access road construction/widening has the potential to damage/destroy any Aboriginal archaeological sites that fall within the development impact areas.	Holcim has committed to constructing the access road using geotextile and imported fill where it crosses areas identified during this assessment as sensitive from an Aboriginal and archaeological perspective. Ground disturbance in these areas will be limited to culverts. Oil and sediment basins will not be constructed within ATUs identified as sensitive from an Aboriginal and archaeological perspective.
Rail Siding and Cribroom	The works will typically include stripping topsoil from the area under the proposed embankment and then placement and compaction of fill to form the embankment. There will be culverts for drainage under the siding at two locations. The only protection works specifically related to the rail siding would be scour protection around the inlet and outlet of the culverts. This will typically involve laying rip rap in the drainage channel/creek. There will be a previously approved creek crossing at approximately chainage 600 metres along the siding associated with an internal haul road. This will again involve scour protection of the channel. Ground surface disturbance related to the construction and maintenance of this infrastructure has the potential to damage/destroy any Aboriginal archaeological sites that fall within the construction impact area.	All topsoil stripped will be retained in the locality and used for landscaping of the area.

Table 1.1 – Components of the Modification/Potential Impacts/Management (cont)

Component of Modification	Potential Impact	Holcim Management Commitment
Train Driver's Cribroom, Double Weighbridge and Office and Tarping Area	The construction of the train driver's crib room will involve localised ground levelling for plinths to support a transportable building and in-ground concrete anchors to hold the building down in the event of high winds. There will also be a water tank for the amenities (potentially on a small concrete slab), some foot paths around the building and to and from the rail siding, a roadway to access the building for maintenance, and a 'packaged' sewage treatment plant to cater for the amenities in this building. The tarping area will involve similar works to the access road to construct a sealed pavement area trucks can stop in to cover their loads. There is an earth bund on the eastern side, either an earth mound or concrete upstand to the west (to separate the area from through traffic), and lighting (with associated foundations and underground power supply). The Double Weighbridge and Office will involve excavation to construct concrete foundations for the weighbridges as well as the roads leading to and from the bridge. The works for the office will be similar to those for the train driver's crib room. Ground surface disturbance related to the construction and maintenance of this infrastructure has the potential to damage/destroy any Aboriginal archaeological sites that fall within the construction impact area.	All topsoil stripped will be retained in the locality and used for landscaping of the facilities.
Underground Electricity Feeder	Ground surface disturbance related to excavation for the trenches has the potential to damage/destroy any Aboriginal archaeological sites that fall within the impact areas. Office, Amenities and Carpark - Topsoil disturbance will be limited to an area 0.6 metres wide and 1.2 metres deep. Infrastructure Area **-** Topsoil disturbance will be limited to an area 0.3 metres wide and 1 metre deep.	Registered Aboriginal Parties and an archaeologist will be provided the opportunity to monitor all topsoil removal for the trenches. Topsoil will be removed from trenches separately and spread back over the infilled trench. No topsoil will be removed from the local area.

1.2 Proposed Variation to Section 87/90 AHIP (#1100264)

As noted in **Section 1.1**, Holcim has a current s.87/90 AHIP (#1100264) for its approved project impact area. Subsequent to discussions with DoP (June 2010) Holcim proposes (following development consent) to provide a request to DECCW for a variation to the existing AHIP to revise the s.87/90 AHIP (#1100264) boundary and to incorporate any further subsurface investigation/salvage required (if any) under the conditions of this AHIP.

1.3 Prior Aboriginal Heritage Impact Permits and Reports

In July 2007, Readymix (now Holcim) provided the DECC (now DECCW) with a s.87/90 AHIP application and an accompanying Research Design and Methodology for the subsurface testing and salvage program for Lynwood Quarry, including the cultural heritage works required within this area by Country Energy (Umwelt 2007c). The s.87/90 investigations were designed as a staged process. The following three stages were approved by the DECC under s.87 AHIP #1077225 and a combined s.87/90 AHIP #1077294.

- Stage 1 – subsurface testing and salvage of power pole locations (Stage 1A) and subsurface testing of the ATUs associated with the Country Energy North Marulan Zone Substation (NMZS) site and construction access road corridor (Stage 1B). This stage also included artefact and data analysis, reporting and the preparation of the accompanying s.87/90 AHIP application to enable works required by Country Energy to proceed (Stage 1C);

- Stage 2 – subsurface testing of known sites (Stage 2A) and the remaining ATUs (Stage 2B) within the Lynwood Quarry development impact area (including those to be impacted by decommissioning of a 132kV feeder), monitoring of Section 60 Heritage investigations within Old Marulan (Stage 2C), artefact and data analysis, reporting, and the preparation of a s.87/90 AHIP application for final site salvage (if required) and to enable works required by Holcim to proceed (Stage 2D); and

- Stage 3 – further subsurface salvage if required (Stage 3A) and preparation of a final report incorporating the results of all previous stages (Stage 3B).

Stage 1 was completed in September 2007 and a report on the results provided to the DECC in January 2008 (Umwelt 2008a). Subsequently a s.87/90 AHIP application for the Country Energy impact area was provided to the DECC in March 2008 (Umwelt 2008d) and approval of this s.87/90 AHIP (#1089392) was provided by the DECC in June 2008. This included monitoring and salvage of the NMZS development impact area. Salvage associated with s.87/90 AHIP (#1089392) was completed in June 2009. The results of the artefact analysis and reporting will be undertaken as part of the broader Stage 3B reporting for the Lynwood Quarry Project Area.

Stage 2 fieldwork was undertaken from February to April 2008 and a report on the results of Stage 2 was provided to the DECC in September 2008 (Umwelt 2008e).

A s.87/90 application for the final Stage 3A investigations was forwarded to the DECC by CEMEX in September 2008 (Umwelt 2008f). As part of ongoing consultation with the DECC it was recognised that the prior subsurface testing of ATU 7PA (very gentle slope in the porphyritic adamellite) was of an area that was not typical of the remainder of the ATU and it was further observed that a very small ATU (7AD – very gentle slope in the adamelite dykes and sills) measuring approximately 400 metres by 200 metres was missed during the earlier subsurface testing program. Therefore, when providing the final s.87/90 AHIP (#1100264) for the Stage 3A salvage on 20 May 2009, the DECC included within General Operational

Condition 13; that CEMEX was to undertake the 'subsurface testing of two further Archaeological Terrain Units (ATUs) (7PA #51-6-0647 & 7AD #51-6-0648) within the Lynwood Quarry development impact footprint'. The subsurface testing was to be undertaken 'using the same methodology as that implemented for the ATUs previously tested under s.87 AHIP #1077225' (Umwelt 2008).

Subsurface testing of ATU 7PA and 7AD was undertaken during the period 23 and 27 June 2009. A subsequent report was provided to DECC in July 2009 (Umwelt 2009), detailing the results of the subsurface testing. Based on the results of the subsurface testing no further salvage was required within these ATUs.

The final Stage 3A subsurface investigation and salvage program was undertaken over the period 28 October 2009 to 22 January 2010. This included broad area manual excavation within site MRN27 and surface collection of MRN62, MRN64 and MRN77. Umwelt (in prep.) is currently undertaking the requisite artefact analysis and reporting required as Part of Stage 3B.

In relation to the current proposed modification it is anticipated that any further subsurface testing and salvage (if required) be undertaken under a variation to s.87/90 AHIP (#1100264) as part of Stage 3A. If subsurface testing is required it is proposed that a brief report will be provided to the DECCW at the completion of the subsurface testing program which will outline the results of the subsurface testing and identify any requirements for further investigation from an Aboriginal cultural heritage or an archaeological perspective prior to impact by the works proposed as part of the modifications (for further details refer to **Appendix E**).

Figure 1.4 indicates all the Aboriginal archaeological sites located during investigations within the Lynwood Quarry Project Area to date including the:

- survey of the Lynwood Quarry project area (Umwelt 2005);
- surveys for the Country Energy infrastructure and modifications (Umwelt 2007a, 2007b, 2008b, 2008c);
- Stage 1 subsurface investigations (Umwelt 2008a);
- Stage 2 subsurface investigations (Umwelt 2008e, 2008f, 2009);
- Stage 3 subsurface and surface salvage (Umwelt in prep.);
- annual site monitoring in compliance with the Lynwood Quarry Aboriginal Heritage Management Plan (AHMP) (Umwelt 2007d); and
- survey prior to 2005 (Navin 1990).

1.4 Current Aboriginal Cultural Heritage and Archaeological Conservation Strategy

An important aspect of the management of Aboriginal archaeological sites and landscape values within the broader approved Lynwood Quarry Project Area is the conservation of a representative sample of site types (and resources) within the various ATUs identified in the Project Area (refer to **Figure 1.4**). In summary the Lynwood Quarry Project Area conservation management strategy includes:

- 51 sites to be conserved *in-situ* and managed for conservation during the 30 year life of the quarry (including 19 isolated finds, 27 artefact scatters, one *in-situ* boulder that has been used for grinding and four scarred trees) that are within the broader Project Area boundary but which are outside the approved disturbance footprint; and

- 11 sites to be conserved long term within a CHMZ (including one stone arrangement, five scarred trees, one isolated find and four artefact scatters).

One of the artefact scatters to be conserved (MRN69), was formerly within the approved development impact footprint. However, based on the outcomes of the subsurface testing program it has been afforded conservation status and Holcim has redesigned its approved footprint to avoid the ATU within which the site is located (Umwelt 2009 - refer to **Figure 1.4**).

The remaining 32 sites (seven isolated finds and 25 artefact scatters) will be impacted/partially impacted by the currently approved Lynwood Quarry disturbance footprint (27 sites) or works associated with Country Energy infrastructure related to the Marulan Electricity Supply Upgrade (5 sites).

Further information in relation to Aboriginal archaeological site and ATU conservation is presented in **Section 6**.

1.5 DECCW Consultation

In June 2010, Holcim provided a letter to the Southern Directorate of the DECCW informing of the proposed:

- nature of the modification;

- Aboriginal consultation process (for details refer to **Section 2**);

- survey methodology (refer to **Sections 2** and **5**); and

- the intention to seek a variation to s.87/90 AHIP (#1100264) to revise the s.87/90 AHIP area and to cover any requisite subsurface testing/salvage.

Following the survey an email (dated 20 July 2010) was provided to Dr Philip Boot (Archaeologist Southern Directorate) informing DECCW of the participants in the survey, the results of the survey and the management outcomes discussed with the Registered Aboriginal Parties (refer to **Section 2**).

1.6 Statutory and Policy Framework

The Project is identified as a Major Project as defined by the State Environmental Planning Policy Major Developments 2005, and requires the approval of the NSW Minister for Planning under the *Environmental Planning and Assessment Act 1979*.

1.6.1 EP&A Act (1979)

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is administered by the Department of Planning (DoP) and by local government at a local level. It is the primary legislation governing environmental planning and assessment for the State of NSW. Holcim Australia is seeking to modify development consent DA 128-5-2005 MOD1 under Part 3A, section 75W of the EP&A Act. The original consent, classified as a State Significant

Development, was granted under Part 4 of the EP&A Act in May 2005, and as such, section 75W of the EP&A Act is available to modify DA 128-5-2005 pursuant to Clause 8J of the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation). Part 3A of the EP&A Act applies to projects that are declared to be a 'Major Project' (in accordance with Section 75B of the EP&A Act). Under Section 75U of the EP&A Act, it is not necessary to obtain a permit under Section 87 or consent under Section 90 of the NPW Act (1974 – refer to **Section 1.6.2**) to impact on Aboriginal archaeological sites/objects in relation to activities approved under Part 3A of the EP&A Act. Projects approved under Part 3A of the EP&A Act are subject to conditions of approval issued by DoP and (where relevant) Aboriginal cultural heritage is addressed by appropriate conditions and usually managed under an Aboriginal Cultural Heritage Management Plan (ACHMP). Furthermore, Section 75J (5) of the EP&A Act states that conditions of approval for the carrying out of a project may require the proponent to comply with obligations made in a Statement of Commitments submitted by the proponent as part of the development approval process. The Statement of Commitments outlined in the EA main text will contain commitments in relation to Aboriginal cultural heritage sites/objects/landscape features and their management/conservation.

1.6.2 NPW Act (1974)

As discussed in **Section 1.6.1**, projects approved under Part 3A of the EP&A Act do not require the proponent to obtain an s.87 or s.90 AHIP to impact on Aboriginal cultural heritage sites/objects. However, as the initial assessment (Umwelt 2005) was undertaken under Part 4 of the EP&A Act, permits were required for subsurface testing and salvage. As noted in **Section 1.1**, as Holcim Australia has a current s.87/90 AHIP (#1100264) it is proposing to seek a variation to that AHIP to have the approved AHIP area revised to cover the modified project impact footprint and to incorporate any further investigation/salvage required (if any).

Under the provisions of the *National Parks and Wildlife Act 1974* (NPW Act), all Aboriginal objects are protected regardless of their significance or land tenure. Aboriginal objects are defined as:

> …any deposit, object or material evidence (not being a handicraft made for sale) relating to Aboriginal habitation of the area that comprises NSW, being habitation before or concurrent with the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.
>
> Aboriginal objects are therefore limited to physical evidence and may also be referred to as 'Aboriginal sites', 'relics' or 'cultural material'. Aboriginal objects can include pre-contact[5] features such as scarred trees, middens and artefact scatters, as well as physical evidence of post-contact use of the area such as Aboriginal built fencing or stockyards, fringe camps.

The NPW Act also protects Aboriginal Places, which are defined as *'a place that is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects'.* Aboriginal Places can only be declared by the Minister administering the NPW Act.

Under Section 91 of the Act, the Department of Environment Climate Change and Water (DECCW[6]) must be informed upon the identification of all Aboriginal Objects. Failure to do this within reasonable time is an offence under the Act.

Under Section 90 of the Act, it is an offence for a person to destroy, deface, damage or desecrate an Aboriginal Object or Aboriginal Place without the prior issue of Section 90 consent. The Act requires a person to take reasonable precautions and due diligence to

[5] Pre-contact refers to the period prior to non-Aboriginal settlement of an area.
[6] DECCW – previously the Department of Environment and Climate Change (DECC) and prior to DECC as the Department of Environment and Conservation (DEC)

avoid impacts on Aboriginal objects. Section 90 Consent may only be obtained from the Environmental Protection and Regulation Division (EPRD) of DECCW. In considering whether to issue Section 90 Consent, DECCW take into account the:

- cultural and archaeological significance of the Aboriginal object(s) or Aboriginal place(s) subject to the proposed impacts;
- effect of the proposed impacts and the mitigation measures proposed;
- alternatives to the proposed impacts;
- conservation outcomes that will be achieved if impact is permitted; and
- outcomes of Aboriginal community consultation regarding cultural values, the proposed impact of the Project on cultural values, Aboriginal cultural significance and proposed conservation measures including offsets.

The Act also provides for stop-work orders under Section 91AA if an action is likely to significantly affect an Aboriginal Object or Aboriginal Place. The order may require that an action is to cease or that no action is carried out in the vicinity of the Aboriginal Object or Aboriginal Place for a period of up to 40 days.

It is also an offence under Section 86 of the NPW Act to disturb or excavate land for the purpose of discovering an Aboriginal object, or to disturb or move an Aboriginal object on any land, without first obtaining a permit under Section 87 of the NPW Act. In issuing a permit under Section 87, DECCW will take into account the:

- views of the Aboriginal community about the proposed activity;
- objectives and justification for the proposed activity;
- appropriateness of the methodology to achieve the objectives of the proposed activity; and
- knowledge, skills and experience of the nominated person(s) to adequately undertake the proposed activity.

1.7 Report Authorship

During the reporting process information relevant to the Aboriginal cultural heritage values of the proposed modification areas was provided by Sharyn Halls and Merle Williams of Gundungurra Aboriginal Heritage Association Inc (GAHAI), Tom Brown and Sharon Brown of the Gundungurra Tribal Council Aboriginal Corporation (GTCAC), Delise Freeman and Justin Boney of the Pejar Local Aboriginal Land Council (PLALC) and Peter Falk of Peter Falk Consultancy (PFC).

The information provided by the Registered Aboriginal Parties has been added directly into the text as quotes and/or is incorporated into **Appendix A**. Comments/advice on the draft report have been taken into account throughout the report and the set out of the report has been developed in consultation with the Registered Aboriginal Parties.

Jan Wilson (Manger Cultural Heritage Umwelt) co-ordinated the archaeological assessment and was the primary author of this report. John Merrell (Project Director/Associate) and Steven Farrar (Project Manager/Environmental Scientist) provided strategic direction for the

project and conducted the quality review of this report. Jan Wilson undertook the Aboriginal and DECCW consultation process and the field survey.

1.8 Structure of this Report

Section 2 of this report summarises consultation conducted with the four Registered Aboriginal Parties. Documentation arising from the consultation program is included in full in **Appendix A** of this document. **Section 2** also provides the results of a Native Title Search.

Section 3 provides background information in relation to the ATUs that have been identified within the broader Lynwood Quarry Project Area. This information is used to prepare a predictive model for Aboriginal archaeological site location, site type, site content and site preservation within the ATUs incorporated into the modification areas. It is also used as the basis for the survey methodology and interpretation of the survey results and the assessment of Aboriginal cultural heritage and archaeological significance.

Section 4 presents the predictive model for Aboriginal archaeological site location, site type, site content and site preservation within the ATUs within the modification areas.

Section 5 presents the survey methodology and details the results of the survey of the proposed modification areas undertaken by the Registered Aboriginal Parties and an archaeologist and provides details of the nature of the ATUs investigated during the survey.

Section 6 discusses the current Lynwood Quarry Project Area conservation management strategy.

Section 7 assesses the Aboriginal cultural heritage and archaeological significance of the ATUs investigated.

Section 8 discusses the management options available to mitigate/manage the impact of the proposed modification to the Lynwood Quarry Project on the ATUs investigated. The appropriateness of the management options are then considered in terms of meeting the requirements of Intergenerational Equity from an Aboriginal cultural and archaeological perspective.

Section 9 outlines the proposed Aboriginal cultural heritage and archaeological management strategy for the ATUs within the proposed modification areas. The management strategy has been prepared taking into account the proposed impacts to Aboriginal cultural heritage and archaeological values within the ATUs and the requirement for the project outcomes to consider Intergenerational Equity.

Section 10 lists the references cited in the text.

2.0 Registered Aboriginal Party Consultation and Participation

Registered Aboriginal Party consultation for the Lynwood Quarry Project has been ongoing since February 2005 (Umwelt 2005). Further consultation with the Registered Aboriginal Parties occurred as part of the survey and assessment work conducted on behalf of Country Energy within the Lynwood Quarry project area (Umwelt 2007a, Umwelt 2007b) and in relation to the s.87 and s.87/90 AHIP applications related to Stages 1, 2 and 3 of the investigations (Umwelt 2007c, 2008d, 2008e, 2008f, 2009). As the Registered Aboriginal Party consultation associated with the Lynwood Quarry Project has been comprehensively detailed elsewhere, this report will outline only the consultation undertaken for the current assessment and for the proposed s.87/90 AHIP (#1100264) variation application.

2.1 DEC Interim Community Consultation Requirements for Applicants (2004)

The Registered Aboriginal Parties were initially identified through the notification process required under the DEC[7] Interim Community Consultation Requirements for Applicants (2004) during Stages 1, 2 and 3 of the subsurface testing and salvage program. As noted in **Section 1.2**, subsequent to discussions with DoP (June 2010), Holcim concluded that the assessment to be undertaken for the Lynwood Quarry modification was part of an ongoing process and that in this regard it was appropriate for Holcim to continue to consult with the Aboriginal Parties already registered for the project. This was also in line with the more recently released DECCW Aboriginal Cultural Heritage Consultation Requirements for Applicants released in March 2010; which allow ongoing consultation to be undertaken with Registered Aboriginal Parties identified under the DEC Interim Community Consultation Requirements for Applicants. Holcim provided correspondence to the DECCW (dated 23 June 2010) to advise that it was Holcim's intention to continue consultation under the DEC Interim Community Consultation Requirements for Applicants.

2.2 Registered Aboriginal Party Consultation and Participation - Current Assessment

Gundungurra Aboriginal Heritage Association Inc (GAHAI), Gundungurra Tribal Council Aboriginal Corporation (GTCAC), Pejar Local Aboriginal Land Council (PLALC) and Peter Falk Consultancy (PFC) were advised by Holcim of the proposed modification to the project impact area in June 2010. At this time Holcim provided information in relation to the nature of the modifications and of the proposed intention to invite the Registered Aboriginal Parties to participate in a survey of the areas proposed for modification. The survey methodology proposed by Holcim was to inspect the proposed modification areas in their entirety (i.e. 100% survey coverage).

The survey methodology was acceptable to all Registered Aboriginal Parties and GAHAI, GTCAC and PLALC accepted the invitation to have a representative participate in the survey. PFC declined the invitation to participate in the fieldwork, but was involved in the consultation process.

Fieldwork was undertaken on the morning of 6 July 2010. On the afternoon of 6 July 2010 a meeting was held at Marulan. During this meeting the results of the survey, the Aboriginal

[7] DEC – Department of Environment and Conservation – now DECCW

cultural heritage and archaeological significance of the ATUs proposed for impact and the various management options available for the ATUs were discussed and draft management recommendations prepared based on Registered Aboriginal Party comments and advice. It was made clear to the Registered Aboriginal Parties and Holcim at this time, however, that the draft report would be circulated and further advice sought from the broader membership of each of the Registered Aboriginal Parties.

Table 2.1 lists the participants in the fieldwork and attendees at the subsequent meeting to discuss the outcomes of the survey.

Table 2.1 – Registered Aboriginal Party Participants/Comments Survey/Management

Survey 6 July 2010	**Participants**	**Comments**
Gundungurra Aboriginal Heritage Association Inc. (GAHAI)	Sharyn Halls	Agreed that the survey coverage was adequate and that where ground surface visibility was poor that sufficient knowledge of what artefacts are likely in a subsurface context could be predicted from GAHAI's knowledge of the way their ancestors used the landscape and the distribution of the known sites and prior subsurface investigations and salvage of sites and ATUs.
Gundungurra Tribal Council Aboriginal Corporation (GTCAC)	Tom Brown	Agreed that the survey coverage was adequate and that informed decisions on management of the ATUs could be based on what was seen when in the field and the results of earlier subsurface testing.
Pejar Local Aboriginal Land Council (PLALC)	Justin Boney	Agreed that the survey coverage was adequate and that he could inform the broader PLALC membership of the results of the survey and assist them to make management recommendations based on what he saw during the survey and what he knows from being involved in nearly all prior investigations of the Lynwood Quarry Project Area.
Meeting 6 July 2010	**Participants**	**Comments**
Gundungurra Aboriginal Heritage Association Inc. (GAHAI)	Sharyn Halls	Agreed that the management commitments put forward by Holcim were appropriate. Advised that suitable management of the ATUs would need to include: • covering the area proposed for the access road with geotextile and constructing road with imported fill when crossing ATU R6BP (both creek crossings) and ATU 4BP in the area of the NMZS; • undertaking subsurface investigations in the area of the rail siding within ATU R6BP; and • monitoring of topsoil disturbance related to the underground electricity feeder.

Table 2.1 – Registered Aboriginal Party Participants/Comments Survey/Management (cont)

Meeting 6 July 2010	Participants	Comments
Gundungurra Tribal Council Aboriginal Corporation (GTCAC)	Tom Brown	Thought that the management commitments put forward by Holcim appeared to be appropriate. Advised that suitable management of the ATUs should include: • covering the area proposed for the access road with geotextile and constructing road with imported fill when crossing ATU R6BP (both creek crossings) and ATU 4BP in the area of the NMZS; • undertaking subsurface investigations in the area of the rail siding within ATU R6BP; and • monitoring of topsoil disturbance related to the underground electricity feeder.
Pejar Local Aboriginal Land Council (PLALC)	Justin Boney	Thought that the management commitments put forward by Holcim seemed appropriate and advised that he would discuss more broadly with PLALC. Advised that he thought that suitable management of the ATUs would need to at least include: • covering the area proposed for the access road with geotextile and constructing road with imported fill when crossing ATU R6BP (both creek crossings) and ATU 4BP in the area of the NMZS; • undertaking subsurface investigations in the area of the rail siding within ATU R6BP; and • monitoring of topsoil disturbance related to the underground electricity feeder.

2.3 Draft Aboriginal Cultural and Archaeological Assessment

A draft copy of this Aboriginal Cultural and Archaeological Assessment was provided to the Registered Aboriginal Parties on 20 August 2010 for their review and comment. Closing date for comments was 15 September 2010 Comments provided by the Registered Aboriginal Parties are summarised in **Table 2.2**. The written comments provided have been included in **Appendix A**.

Table 2.2 – Registered Aboriginal Party Comments on Draft Assessment

Registered Aboriginal Party	Comments
Gundungurra Aboriginal Heritage Association Inc. (GAHAI)	*To be completed based on comments provided by GAHAI*
Gundungurra Tribal Council Aboriginal Corporation (GTCAC)	*To be completed based on comments provided by GTCAC*
Pejar Local Aboriginal Land Council (PLALC)	*To be completed based on comments provided by PLALC*
Peter Falk Consultancy (PFC)	*To be completed based on comments provided by PFC*

2.4 Variation to s.87/90 AHIP #1100264

At the same time as requesting comment on the draft *Aboriginal Cultural and Archaeological Assessment*, the Registered Aboriginal Parties were asked to comment on whether they thought it appropriate from an Aboriginal cultural perspective for Holcim to request a variation to its current DECCW s.87/90 AHIP (#1100264) to modify the area over which it has s.87/90. With the understanding that this variation would include the requirement for Holcim to undertake the management strategy outlined in **Table 2.2** and further detailed in **Sections 8** and **9** of this document. Comments provided by the Registered Aboriginal Parties are summarised in **Table 2.3**. The written comments provided have been included in **Appendix A**.

Table 2.3 – Registered Aboriginal Party Comments on Variation to s.87/90 AHIP #1100264

Registered Aboriginal Party	Comments
Gundungurra Aboriginal Heritage Association Inc. (GAHAI)	*To be completed based on comments provided by GAHAI*
Gundungurra Tribal Council Aboriginal Corporation (GTCAC)	*To be completed based on comments provided by GTCAC*
Pejar Local Aboriginal Land Council (PLALC)	*To be completed based on comments provided by PLALC*
Peter Falk Consultancy (PFC)	*To be completed based on comments provided by PFC*

2.5 Native Title Search

A Native Title search was undertaken on 15 July 2010 for the Goulburn Mulwaree LGA. The Native Title search indicated that there were two Native Title claimant groups for the Goulburn Mulwaree LGA. These are:

- Donald Thomas Bell on behalf of the Ngunawal People (NNTT number: NCOO/1); and
- Gundungurra Tribal Council Aboriginal Corporation #6 (NNT number: NC97/7).

The GTCAC's Native Title claimant area was found to include the Project Area and GTCAC are a Registered Aboriginal Party for this project. The claim by the Ngunawal People was for an area outside the Project Area. The results of the Native Title Search are included in **Appendix B**.

3.0 Environmental and Cultural Context

The environmental and cultural context of the broader Lynwood Quarry Project Area was detailed in the *Aboriginal Archaeological Survey and Assessment of the Proposed Lynwood Quarry Marulan, NSW* report (Umwelt 2005). As a result of further consultation with the DECCW and participating Registered Aboriginal Parties the environmental and cultural context of the area has been further investigated and then utilised to divide the Project Area into ATUs. Rather than reiterate the information provided in relation to the environmental and cultural context presented in the Umwelt 2005 report, it has been included in **Appendix C** (Environmental Context) and **Appendix D** (Cultural Context).

Also appended is a brief summary of the results of all prior subsurface investigations within the broader Lynwood Quarry Project Area (**Appendix E**). The methodology and results of prior survey and Stage 1 and Stage 2 subsurface testing have been detailed in Umwelt (2005, 2007b, 2008a, 2008e, 2008f and 2009) and are currently being incorporated into the final Stage 3[8] report (Umwelt in prep.). The summary of prior subsurface investigations has been used to revise/update (where relevant) information pertaining to the known Aboriginal archaeological sites within the ATUs presented within this section of the report.

Specific information related to the formulation of the ATUs (based on **Appendices C**, **D** and **E**) is provided within **Sections 3.1** to **3.5**. The ATUs identified are then used as the basis for the predictive model (refer to **Section 4**).

Following a request from DECCW (then DECC) the Lynwood Quarry Project Area was divided into ATUs for the purpose of preparing the initial s.87 AHIP and s.87/90 AHIP subsurface testing and salvage program (Umwelt 2007a). The ATUs were identified based on:

- stream order;
- geology and soils;
- landform element and gradient (following McDonald, Isbell, Speight, Walker and Hopkins (1990); and
- cultural context.

Thus the ATUs took into account both the environmental and cultural context of the Lynwood Quarry Project Area as known in 2007. The definition and rationale for use of each of the criterion chosen to determine the ATUs is set out in **Sections 3.1** to **3.4** whilst **Section 3.5** provides information related to the ATUs identified. This information was previously presented in Umwelt (2007a) but has been updated and revised where relevant with information gathered during fieldwork in 2007, 2008 and 2009.

3.1 Stream Order

Stream order was included as a criterion when identifying the ATUs, as the order of the stream broadly indicates whether it would have been an ephemeral, semi-permanent or permanent source of water for Aboriginal hunter-gatherers using the area. The rationale for taking stream order into account when identifying the ATUs is that Aboriginal hunter-gatherers would have been more likely to camp and undertake tasks that would leave behind substantial archaeological material in areas with more reliable water. As the Project Area is

[8] The Stage 3 report will also incorporate the final salvage program.

in the upper catchment of Joarimin, Marulan and Lockyersleigh Creek, all of the streams are low order (first to fourth order) ephemeral to semi permanent tributaries that flow only during, or shortly after, heavy rainfall and which would have retained water for only a short period of time after heavy rainfall (refer to **Figure 3.1**). The deeply entrenched nature of sections of these tributaries means that they currently hold water for several weeks after heavy rain and in some places for a few months after flood rain or when rainfall is fairly continuous.

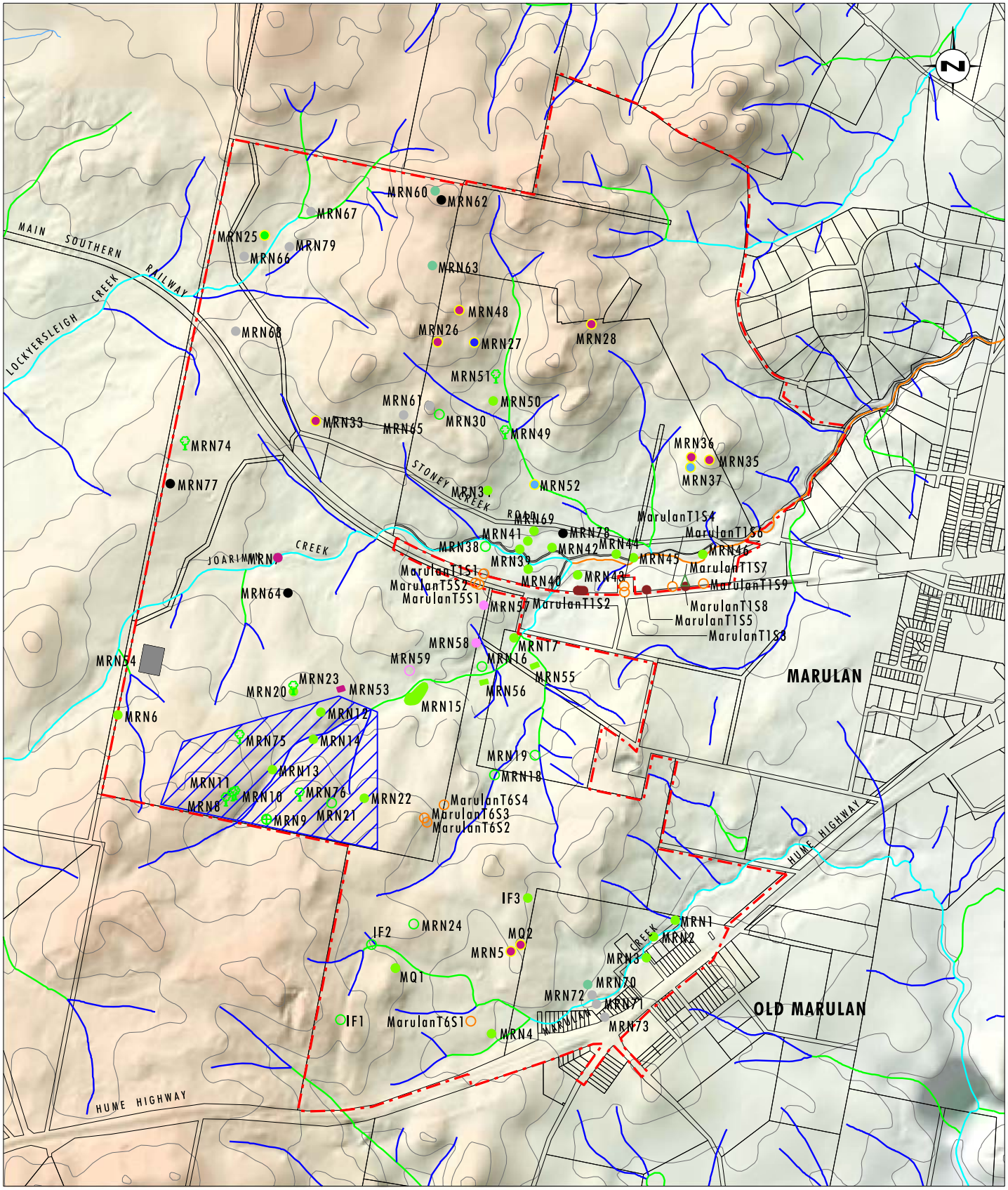
Table 3.1 provides a general description of the various tributaries within the Lynwood Quarry Project Area. In order to be more specific about the reliability of the tributaries they have been inspected following heavy rainfall and after short (one week), medium (two to four weeks) and long-term (more than 3 months) dry periods and following a major flood event (June 2007). **Table 3.1** has been updated since the 2007 flood event and more reliable rainfall pattern since that time.

Table 3.1 – Stream Order/Description

Stream Order	Description	Reliability
1	Shallow grassy waterways often imperceptible in the landscape.	Water typically drains away within 1 to 2 hours of heavy rain.
2	Shallow grassy waterways.	Water typically drains away within 1 day of heavy rain.
3	Many entrenched – a few with chain of ponds (appear to post date European land clearance) – some with banks that are scoured up to 10 metres back from watercourse during high flow events after heavy rain/flood in some areas.	Flows may occur for up to 10 days after heavy rain. Water available in deeper ponds/shaded pools for 7 to 21 days after heavy rain. Pools can persist for several weeks after flood rain.
4	Generally moderately to deeply entrenched – channels widened to more than twice original (predicted) width by erosion (bank collapse/scouring) - banks that are scoured up to 10 to 20 metres back from watercourse during high flow events after heavy rain/flood in some areas.	Flows may occur for 10 to 20 days after heavy rain – water available in deeper shaded, pools for 4 to 12 weeks after heavy rain and several months after flood rain or periods of continuous rain (water is currently available for longer periods in one section of Joarimin Creek where it has been dammed back behind a creek crossing).

The current entrenched state of some of the third, and all of the fourth order tributaries, cannot be seen to reflect their pre-European land clearance morphology. It is suggested that prior to land clearance (which appears to have initiated an ongoing episode of channel entrenchment and widening) that they would have been shallow, grassy waterways interspersed by chains of ponds. The chains of ponds would have been an attractive water source for small groups of Aboriginal hunter-gatherers using the area for a short period after moderate to heavy rain. The capacity of the tributaries to hold water after rain would have been shorter than at present as the current level of entrenchment has created deep pools shaded by steep banks which would not have been present in the past.

Many exposures in the creeklines have been inspected for any geomorphic evidence of chains of ponds that once may have existed along the watercourses. No evidence of a former chain of ponds morphology has been recorded; however, it is possible that this evidence has been destroyed by channel widening and entrenchment. The Stage 3B report currently being prepared by Umwelt (in prep.) is investigating the known occurrence of larger camp sites (in terms of areal extent and artefact density) and one of the criterion being investigated is proximity to a former chain of ponds sequence.



Base Source: LPI 2004, Readymix Holdings Pty Ltd

Legend

- Project Area
- First Order Stream
- Second Order Stream
- Third Order Stream
- Fourth Order Stream
- Cultural Heritage Management Zone
- Sites Subsurface Tested in Stage 2A
- Artefact Scatter s87/90 Collection/Monitoring
- Artefact Scatter salvaged during Stage 1A
- Isolated Find salvaged during Stage 1A
- Artefact Scatter (CE) Conservation
- Artefact Scatter Located During Stage 2B s87/90 No Further Subsurface Salvage
- Isolated Find Located During Stage 2B s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 Further Subsurface Salvage
- Artefact Scatter located during Stage 2B Surface Collection only
- Isolated Find (CE) Conservation
- Isolated Find s87/90 No Further Subsurface Salvage
- Isolated Find (CE) Conservation
- Grinding Stone (CE) Conservation
- Stone Arrangement Conservation
- Scarred Tree Conservation
- Isolated Find s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 No Further Subsurface Salvage

FIGURE 3.1

Stream Order

File Name (A4): R21_V1/2238_274.dgn

Following the major flooding event in 2007, it was noted that the water rose and dissipated very quickly in the Project Area. It was also noted that the flood waters scoured the banks of the creeklines removing some of the previously recorded artefacts for 10 to 20 metres from the banks of the channel.

Based on field observations of the creeklines within the Lynwood Quarry Project Area over the 2005 to 2007 period, reaches of some third and all of the fourth order streams (predicted to have had the capacity to hold water for a week or more) were incorporated into a 'Riparian Corridor' landform element which was combined with other criteria to form the ATUs first presented by Umwelt in 2007. Further observations from 2007 to 2009 have generally confirmed the earlier conclusions (refer to **Section 3.5** for details of the ATUs).

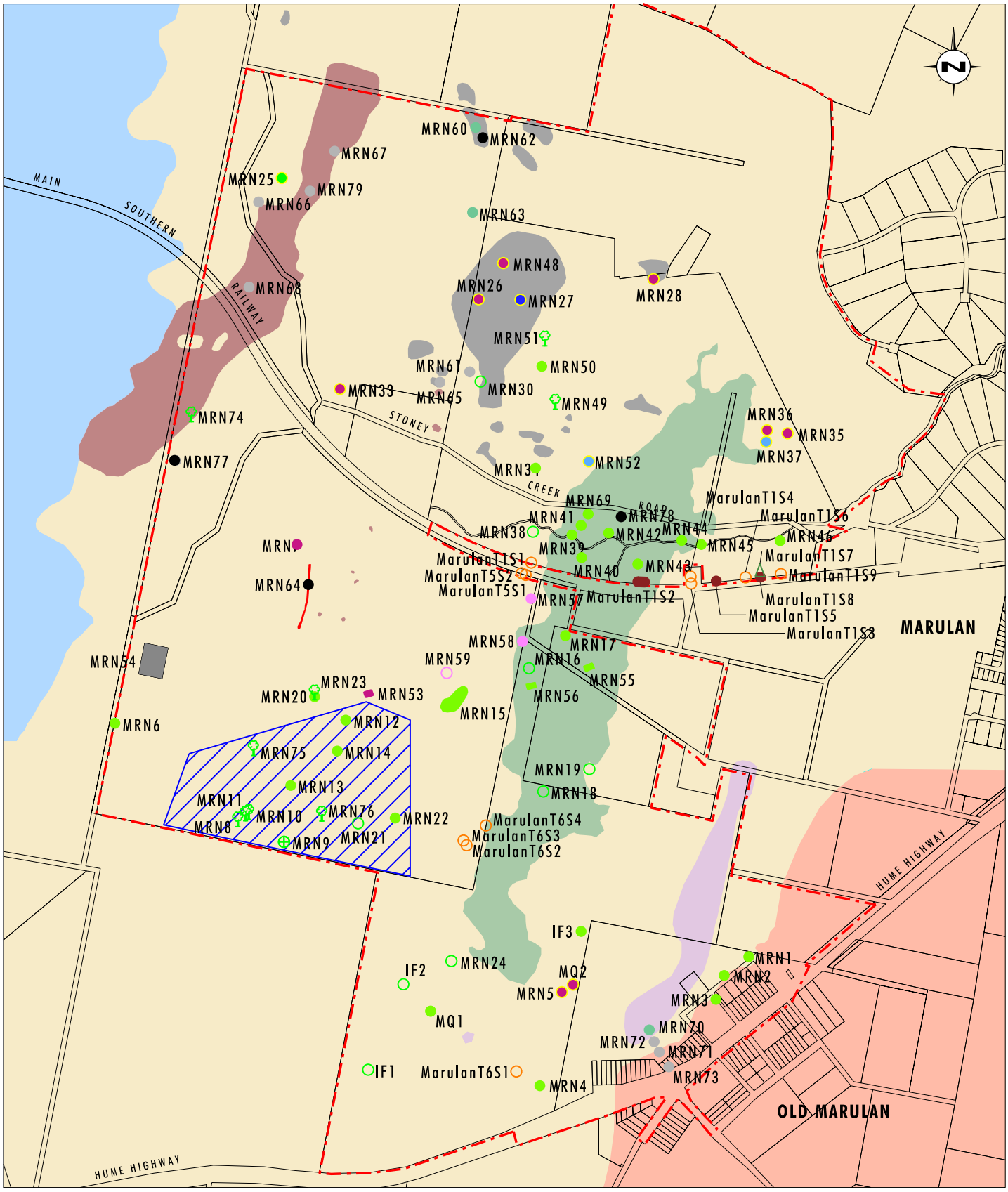
Patterning of the known sites suggests that areas of gentle gradient associated with the larger third and the fourth order tributaries present in the Project Area have been subject to relatively higher rates of Aboriginal occupation than areas associated with the lower order tributaries. Based on the results of subsurface investigations the exceptions to this are the MRN54 and MRN27 site areas. Both of these sites are associated with first and second order tributaries, however, both were found to have relatively large numbers of artefacts (mostly in a subsurface context – refer to **Appendix E**). Therefore, while stream order can be seen to be a determining factor in site location, it is not the only factor. In the case of MRN54, it is probable that the reach of Joarimin Creek directly to its north, did have a chain of ponds morphology. This is unlikely to be the case for the MRN27 site, however, due to the gradient of the surrounding landforms.

3.2 Geology and Soils

The geology of an area determines its morphology (e.g. due to erosion wearing away different rock types at different rates forming valleys and leaving landform elements like ridges and spurs) and its soil types. The morphology of the landscape determines how it is used by hunter-gatherers (e.g. travel routes may occur along ridges and spurs and camping in low gradient, slightly elevated areas along creeklines); whilst the soil types determine the food, medicine and fibre/useful plants that will grow and also the species of prey animals inhabiting an area. The geology also determines whether there are rock types available that would have been suitable for use by Aboriginal people for stone implement manufacture. In addition, ecotones (areas along the boundaries of different geological boundaries/soil types), are relatively richer resource areas as they have the capacity to provide a more diverse resource base within a restricted area. Thus, geology and soils are important criteria that should be taken into account when identifying ATUs.

Figure 3.2 indicates the geological boundaries within the Lynwood Quarry project area. From the figure it can be seen that:

- the majority of the area is composed of Bindook Porphyry;
- the south-eastern corner of the project area is composed of Marulan Granites;
- there is a narrow band of Andesite in the south-east with a small outlier to its west;
- the central area is composed of Porphyritic Adamellite;
- there is a small Siliceous Dyke in the central west;
- the north-eastern corner contains an Adamellite Dyke and there are scattered small intrusive adamellite dykes and sills (including the Lockyersleigh Adamellite) throughout the centre of the Project Area; and



Source: Bell Cochrane & Associates
Base Source: LPI 2004

0 0.25 0.5 1km
1:22 000

Legend

- Project Area
- Deep Sand
- Lockyersleigh Adamellite
- Adamellite Dyke/Sills
- Siliceous Dyke
- Porphyritic Adamellite
- Andesite
- Marulan Granite
- Bindook Porphyry
- Cultural Heritage Management Zone
- Sites Subsurface Tested in Stage 2A
- Artefact Scatter s87/90 Collection/Monitoring
- Artefact Scatter salvaged during Stage 1A
- Isolated Find salvaged during Stage 1A
- Artefact Scatter (CE) Conservation
- Artefact Scatter Located During Stage 2B s87/90 No Further Subsurface Salvage
- Isolated Find Located During Stage 2B s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 Further Subsurface Salvage
- Artefact Scatter located during Stage 2B Surface Collection only
- Isolated Find (CE) Conservation
- Isolated Find s87/90 No Further Subsurface Salvage
- Isolated Find (CE) Conservation
- Grinding Stone (CE) Conservation
- Stone Arrangement Conservation
- Scarred Tree Conservation
- Isolated Find s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 No Further Subsurface Salvage

FIGURE 3.2

Geological Units

File Name (A4): R21_V1/2238_275.dgn

- there are aeolian Deep Sands in the central and central north of the Project Area. These are mainly confined to the low ridge and spur crests.

Within the Lynwood Quarry project area the Bindook Porphyry has been the most resistant to weathering and thus forms the low ridges and spurs that dissect the area. The deep sands that have formed on the ridges and spurs in some areas support populations of wombats and provide for a different vegetation community that includes large stands of *Pteridium esculentum* (bracken fern), a recorded Aboriginal food plant (Low 1989). Deep colluvial sands formed from the Bindook Porphyry are also found in a limited area to the west of Lockyersleigh Creek in the north-western corner of the project area. This area is also targeted by wombats. The remaining areas of the Bindook Porphyry generally have skeletal to shallow soils, with slopewash following clearing and grazing resulting in massive downslope movement of topsoil. In most areas the transported material has been washed away by the streams with generally only 10 to 20 centimetres of topsoil exposed by bank collapse along the creeklines.

During fieldwork undertaken in 2008 a single daisy yam or Murnong (*Microseris lanceolata*) was observed growing beside a tributary of Joarimin Creek in the 5BP (moderate slope in Bindook Porphyry) ATU and directly to the south-west of the MRN27 site. Daisy yams provided one of the staple carbohydrates for Aboriginal people prior to European settlement in parts of NSW and Victoria. Daisy yams were targeted by sheep and horses once livestock was introduced and daisy yams disappeared across much of NSW and Victoria and were replaced by the inedible Flat Weed (*Hypochoeris radicata*) (Gott 1983; Zola and Gott 1992). The presence of this plant indicates that the locality is suitable for its growth and suggests that it may have been far more prevalent in the past in the area near the MRN27 site and possibly across the broader Project Area where growing conditions were suitable.

The remaining geologies within the Project Area form the majority of the areas of lower altitude and lower gradient and the majority of the riparian corridor. In general, these areas do not have deep *in-situ* sands or deep colluvial sand deposits (even though the slopes have been subject to slopewash the regular scouring of the creek banks during periods of high flow appear to have generally removed the majority of the colluvium that reaches the footslope/creek bank area).

Stone artefacts recorded to date within the Lynwood Quarry project area have predominantly been manufactured from imported raw materials including; quartz pebbles, silcrete, quartzite, chert and volcanic (mafic). Some evidence of reef/vein quartz has been identified during subsurface investigations in the Adamellite Dykes and Sills; however, there was no evidence that this had been quarried/used by Aboriginal people (Umwelt 2009). Evidence for use of the local igneous rock outcrops as sources of stone relates to a small number of artefacts recovered during the salvage program that appear to be manufactured from the Bindook Porphyry, pieces of granitic rock that were identified as grindstone fragments and the use of an *in-situ* boulder of Bindook Porphyry as a grinding bowl (refer to **Appendix E** for site/artefact details). Some evidence of reef/vein quartz has also been identified during subsurface investigations in the Adamellite Dykes and Sills; however, there was no evidence that this had been used/quarried by Aboriginal people (Umwelt 2009).

There has been no evidence of quarrying noted on any of the outcrops inspected within the Project Area and it is thought that the advanced state of weathering of the exposed stone made it unsuitable for stone implement manufacture. Thus, the rock outcrops within the Project Area are not likely to have been quarried by Aboriginal hunter-gatherers and the rationale for using geology and soils as criterion when identifying ATUs is related to the differences in plant and animal resources and the differences related to topography and gradient arising from the different geologies/soils (refer to **Section 3.5** for details relating to the ATUs).

Table 3.2 indicates the relationship of the 94[9] known sites within the Lynwood Quarry Project Area to the geology of the project area. In **Table 3.2** the aeolian Deep Sands within the Bindook Porphyry have been listed separately from the remainder of the Bindook Porphyry due their very different derivation. The small Adamellite Dykes and Sills have been combined with the larger Adamellite Dyke in the north-west of the Project Area due to their very similar nature when viewed in outcrop.

Table 3.2 – Geology/Known Sites

Geology	Known Sites	Site Types
Adamellite Dykes and Sills	MRN67, MRN68, MRN74, MRN77, MRN79 **Total 5**	Artefact Scatters, Scarred Tree
Andesite	MRN70 **Total 1**	Isolated Find
Deep Sand/Bindook Porphyry	MRN26, MRN27, MRN28, MRN30, MRN48, MRN60, MRN62, MRN65 **Total 8**	Isolated Find, Artefact Scatters
Bindook Porphyry	Marulan T1 S1, Marulan T1 S3, Marulan T1 S4, Marulan T1 S5, Marulan T1 S6, Marulan T1 S7 Marulan T1 S8, Marulan T1 S9, Marulan T5 S1, Marulan T5 S2, Marulan T6 S1, Marulan T6 S2 Marulan T6 S3, Marulan T6 S4, MRN1, MRN4, MRN5/MQ2, MRN6, MRN7, MRN8, MRN9, MRN10, MRN11, MRN12, MRN13, MRN14, MRN15, MRN19, MRN20, MRN21, MRN22, MRN23, MRN24, MRN25, MRN33, MRN34, MRN35, MRN36, MRN37, MRN38, MRN39, MRN45, MRN46, MRN49, MRN50, MRN51, MRN52, MRN53, MRN54, MRN57, MRN59, MRN61, MRN63, MRN66, MRN72, MRN75, MRN76, IF1, IF3, IF2, MQ1 **Total 61**	Isolated Finds, Artefact Scatters, Scarred Trees, Stone Arrangement, *in-situ* boulder used for grinding
Porphyritic Adamellite	Marulan T1 S2, MRN16, MRN17, MRN18, MRN40 MRN41, MRN42, MRN43, MRN44, MRN55, MRN56, MRN58, MRN69, MRN78 **Total 14**	Isolated Finds and Artefact Scatters
Marulan Granite	MRN2, MRN3, MRN71, MRN73 **Total 4**	Artefact Scatters
Siliceous Dyke	MRN64 **Total 1**	Artefact Scatter

[9] MRN29 and MRN47 are outside of the Project Area. MRN31 and MRN32 have been reassessed as not being cultural sites.

Patterning of the known sites derived from surface survey and subsurface testing indicates that all of the geological units have sites (refer to **Figure 3.2**). The majority of the known sites are located within the Bindook Porphyry, a result to be expected as the majority of the project area is composed of this geological unit. In general, the number of sites roughly equates with the areal extent of each of the geological units; however, it also relates to the extent of the surface survey and the subsurface investigations, which were generally limited to the areas proposed for development impact. For example, survey and subsurface testing in the Andesite geological unit was minimal as the majority of the geological unit is outside the approved Lynwood Quarry development impact footprint. The low number of sites within the Andesite geological unit, therefore, has been biased by the level of archaeological investigation.

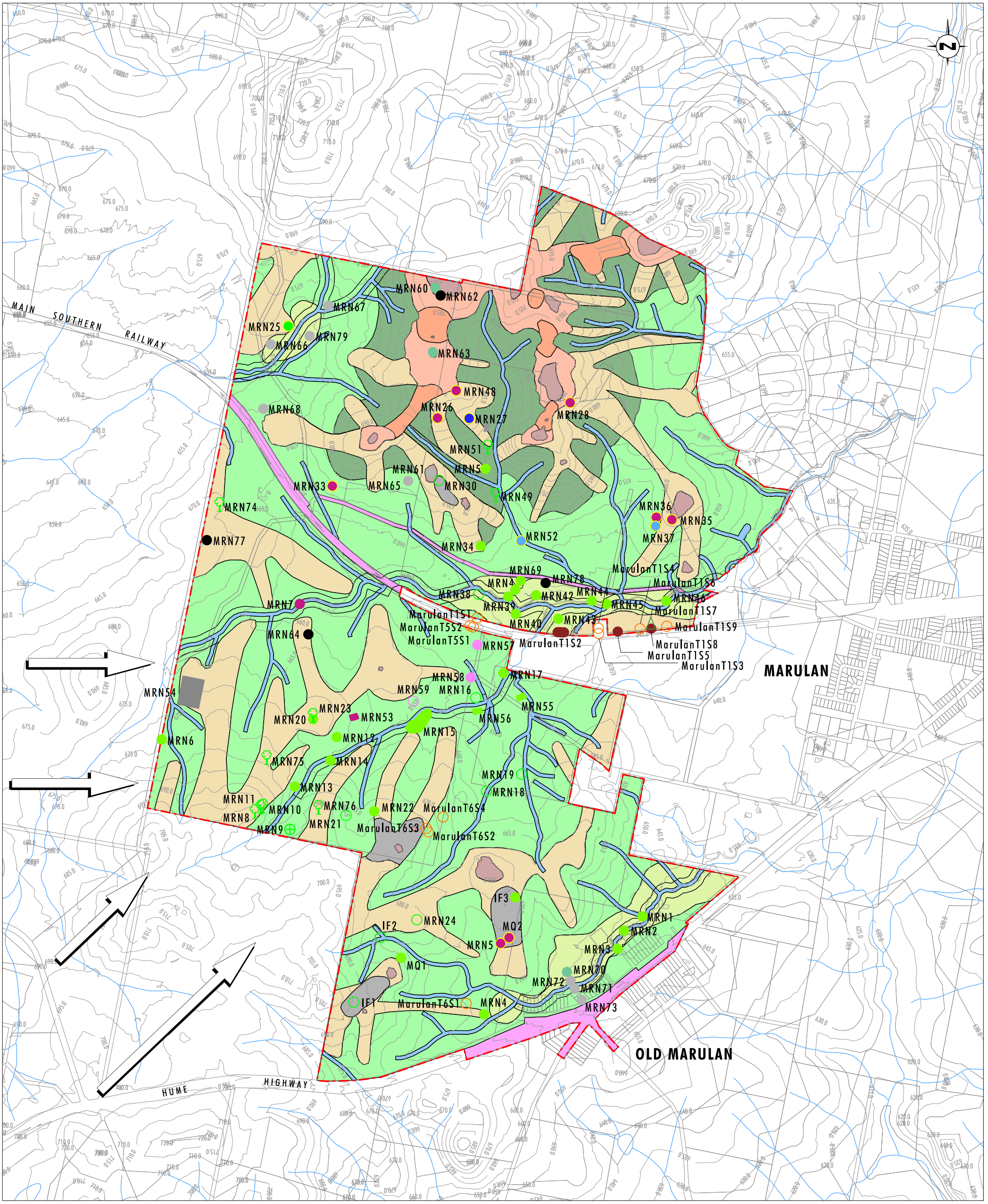
3.3 Landform Element and Gradient

As mentioned in **Section 3.2**, the morphology of the landscape determines how it is used by hunter-gatherers. For example, areas of steep gradient may be used for hunting and gathering but are unlikely to have been used for camping. Ridge crest and spur crests are likely to be used for travel if they provide the easiest route, otherwise creeklines may be preferred. Low gradient, slightly elevated and well drained areas close to the most reliable water are likely to be preferred camp sites.

The Lynwood Quarry Project Area has been divided into 11 landform elements based on McDonald *et al* (1990), field observations including two days of groundtruthing the resultant mapping and subsequent subsurface testing that has suggested an additional micro-landform (refer to **Figure 3.3**). Definitions of the various landform elements are provided in **Table 3.3**. Aboriginal resources observed in each of the landform elements during the period 2005 to 2010 are also described in **Table 3.3**.

Table 3.3 – Landform Element Definitions and Aboriginal Resources

Landform Element	Definition	Key Aboriginal Resources
High Point on Rocky Ridge Crest	Rocky knolls of locally higher elevation than ridge crest on which they occur.	Broad outlook, mat-rush (*Lomandra* sp.), urn heath (*Melichrus urceolatus*).
High Point on Rocky Spur Crest	Rocky knolls of locally higher elevation than spur crest on which they occur.	Broad outlook, mat-rush (*Lomandra* sp.), urn heath (*Melichrus urceolatus*).
Rocky Ridge Crest	Level to gently sloping crest with altitude >700 mAHD.	Broad outlook, kangaroo grass (*Themeda australis*), mat-rush (*Lomandra* sp), peach heath (*Lissanthe strigosa*), urn heath (*Melichrus urceolatus*), stringybark (*Eucalyptus sp.*).
Saddle on Rocky Ridge Crest	Level to gently sloping saddle between two areas of higher elevation on ridge crest.	Broad outlook, kangaroo grass (*Themeda australis*), mat-rush (*Lomandra* sp), peach heath (*Lissanthe strigosa*), urn heath (*Melichrus urceolatus*), stringybark (*Eucalyptus sp.*).



Base Source: Readymix Holding Pty Ltd and LPI 2004

0 0.25 0.5 1km
1:20 000

Legend

- Project Area
- Modified
- Creek Lines
- High Point Rocky Ridge Crest or Rocky Spur Crest
- Ridge Crest
- Spur Crest
- Moderate Slope
- Gentle Slope
- Very Gentle Slope
- Saddle on Ridge Crest
- Saddle on Spur Crest
- Riparian Corridor
- Prevailing Winds
- Sites Subsurface Tested in Stage 2A
- Artefact Scatter s87/90 Collection/Monitoring
- Artefact Scatter salvaged during Stage 1A
- Isolated Find salvaged during Stage 1A
- Artefact Scatter (CE) Conservation
- Artefact Scatter Located During Stage 2B s87/90 No Further Subsurface Salvage
- Isolated Find Located During Stage 2B s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 Further Subsurface Salvage
- Artefact Scatter located during Stage 2B Surface Collection only
- Isolated Find (CE) Conservation
- Grinding Stone (CE) Conservation
- Stone Arrangement Conservation
- Scarred Tree Conservation
- Isolated Find Conservation
- Artefact Scatter Conservation
- Isolated Find s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 No Further Subsurface Salvage

FIGURE 3.3

Landform Elements

File Name (A3): R21_V1/2238_276.dgn

Table 3.3 – Landform Element Definitions and Aboriginal Resources (cont)

Landform Element	Definition	Key Aboriginal Resources
Rocky Spur Crest	Level to gently sloping crest with altitude >700 mAHD which runs from a higher ridge.	Appleberry (*Billardiera scandens*), wombats in areas of deep sands associated with the deepsands, black wattle (*Acacia decurrens*), bracken fern (*Pteridium esculentum*), grass tree (*Xanthorrhoea australis*), Dianella (*Dianella revolute var. revoluta*), grey box (*Eucalyptus moluccana*), kangaroo grass (*Themeda australis*), mat-rush (*Lomandra* sp.), native cherry (*Exocarpus cupressiformis*), Narrow-leafed geebung (*Persoonia linearis*), peach heath(*Lissanthe strigosa*), stringybark (*Eucalyptus sp.*), urn heath (*Melichrus urceolatus*).
Saddle on Rocky Spur Crest	Level to gently sloping saddle between two higher points on a spur crest.	Appleberry (*Billardiera scandens*), wombats in areas of deep sands associated with the weathered porphyry, black wattle (*Acacia decurrens*), bracken fern (*Pteridium esculentum*), grass tree (*Xanthorrhoea australis*), Dianella (*Dianella revolute var. revoluta*), grey box (*Eucalyptus moluccana*), kangaroo grass (*Themeda australis*), mat-rush (*Lomandra* sp.), native cherry (*Exocarpus cupressiformis*), Narrow-leafed geebung (*Persoonia linearis*), peach heath (*Lissanthe strigosa*), stringybark (*Eucalyptus sp.*), urn heath (*Melichrus urceolatus*).
Moderate Slope	Slope below ridge/spur crest with gradient =>4 degrees.	Dianella (*Dianella revolute var. revoluta*), grey box (*Eucalyptus moluccana*), stringybark (*Eucalyptus sp.*), Daisy Yam/Murnong (*Microseris lanceolata*) one plant only associated with tributary bank of Joarimin Creek downslope of MRN27.
Gentle Slope	Slope below ridge/spur crest or moderate slope with gradient <4 degrees and > 1 degree.	Dianella (*Dianella revolute var. revoluta*), grey box (*Eucalyptus moluccana*), kangaroo grass (*Themeda australis*), stringybark (*Eucalyptus sp*.).
Very Gentle Slope	Slope below spur crest or gentle slope with gradient =<1 degree.	Gradient suitable for camping, wombats in areas of colluvial aggradation, Dianella (Dianella revolute var. revoluta), grey box (Eucalyptus moluccana), kangaroo grass (Themeda australis), stringybark (Eucalyptus sp.).
Riparian Corridor	Creek channel, creek banks, low gradient footslope within 30 metres of creekline along some third order and all fourth order streams.	Water, gradient suitable for camping, wombats in areas of deep colluvial aggradation, Dianella (*Dianella revolute var. revoluta*), grey box (*Eucalyptus moluccana*), kangaroo grass (*Themeda australis*), mat-rush (*Lomandra sp.),* rushes and sedges (*Juncus and Cyperus spp*.), water ribbons (*Triglochin procera*), bulrush (*Typha orientalis*).

From **Table 3.3** it can be seen that the riparian corridor, spur crests and saddles currently exhibit the majority of the exploitable resources, while the riparian corridor retains the most essential resources (water and easily gathered and processed staple carbohydrate sources such as water ribbons and bulrush). The identification of daisy yams in the moderate slope

landform element also suggests another easily gathered staple carbohydrate that once should have been plentiful in the area. These resources would have attracted Aboriginal hunter-gatherers and resulted in longer term or more frequent occupation, and thus the likelihood of the discard of more items of material culture (artefacts) to enter the archaeological record. However, areas within 10 metres of the third and fourth order streams are also likely to have been scoured during high flow events and thus artefactual material may have been lost from camp sites close to the stream channels, unless these areas contain (micro-topographic) slightly elevated areas that escape the scouring and may be subject to alluvial aggradation.

Figure 3.3 identifies the location of the 94 known Aboriginal archaeological sites within the Lynwood Quarry Project Area and **Table 3.4** indicates the distribution of the known sites in relation to the 11 landform elements.

Table 3.4 – Landform Element/Known Sites

Landform Element	Known Sites
High Point on Rocky Ridge Crest	MRN60, MRN63 **Total: 2** (isolated find and artefact scatter)
High Point on Rocky Spur Crest	MRN61 **Total: 1** (artefact scatter)
Ridge Crest (level to very gentle gradient)	MRN62 **Total: 1** (isolated find)
Saddle on Ridge Crest	0
Spur Crest (level to very gentle gradient)	Marulan T1 S2, Marulan T1 S3, Marulan T1 S4, Marulan T1 S5, Marulan T1 S6, Marulan T1 S7, Marulan T1 S8, Marulan T1 S9 MRN4, MRN8, MRN10, MRN11, MRN20, MRN22, MRN23, MRN24, MRN25, MRN26, MRN27, MRN28, MRN34, MRN35, MRN48, MRN50, MRN54, MRN64, MRN74, MRN75, MRN76, MRN77 **Total: 30** (isolated finds, artefact scatters, *in-situ* boulder used for grinding, scarred trees)
Saddle on Spur Crest	IF1, IF3, MRN5/MQ2, MRN30 **Total: 4** (isolated finds)
Moderate Slope	MRN49, MRN51 **Total: 2** (scarred trees)
Gentle Slope	IF2 Marulan T1 S1, Marulan T5 S1, Marulan T5 S2, Marulan T6 S1, Marulan T6 S2, Marulan T6 S3, Marulan T6 S4 MQ1, MRN6, MRN9, MRN12, MRN18, MRN19, MRN21, MRN33, MRN36, MRN37, MRN52, MRN53, MRN55, MRN57, MRN58, MRN59, MRN65, MRN68, MRN73 **Total: 27** (isolated finds, artefact scatters and a stone arrangement)

Table 3.4 – Landform Element/Known Sites (cont)

Landform Element	Known Sites
Very Gentle Slope	MRN42, MRN43, MRN44, MRN66, MRN69, MRN70, MRN78, MRN79 **Total: 8** (isolated finds and artefact scatters)
Riparian Corridor	MRN1, MRN2, MRN3, MRN7, MRN13, MRN14, MRN15, MRN16, MRN17, MRN40, MRN45, MRN46, MRN38, MRN39, MRN41, MRN56, MRN67, MRN71, MRN72 **Total: 19** (isolated finds and artefact scatters)

The distribution of known sites indicates that the majority are located within three landform contexts; spur crests, gentle slopes and the riparian corridor. The greatest cluster of sites (often with relatively high numbers of exposed artefacts) are located in close proximity to the fourth order reach of Joarimin Creek and are located within the riparian corridor, very gentle slope and spur crest landform elements. It should be noted that many of the sites located along the southern side of the Joarimin Creek corridor have now be subsumed into a single site (Joarimin Creek South site – refer to **Figure 3.3**), as relatively intensive subsurface investigations (associated with Country Energy infrastructure) have indicated that the area has a continuous artefact scatter of varying densities. Subsurface testing on the northern side of the Joarimin Creek corridor in this same area indicated a patchier artefact distribution with a very dense scatter indicated by subsurface testing in the MRN69 site area. This area is a low gradient, slightly elevated and better drained landform than those surrounding and appears to have been preferentially targeted for camping. MRN69 was not salvaged and is being conserved by quarry plan modifications.

Figure 3.3 indicates that that there is also another cluster of sites in association with the main channel of Marulan Creek. Subsurface investigations (refer to **Appendix E**) have identified three large artefact scatter sites (in terms of areal extent and artefact numbers). These are MRN25 (spur crest), MRN27 (spur crest) and MRN54 (spur crest). While this suggests that spur crests are one of the preferred landform elements for longer term camping, subsurface investigations indicated some spur crests had little or no evidence of occupation.

Figure 3.3 indicates that in addition to the artefact scatters and isolated finds located within the overall Lynwood Quarry Project Area, there are nine scarred trees, one stone arrangement and one small *in-situ* boulder used for grinding. Seven of the scarred trees (MRN8, MRN10, MRN11, MRN23, MRN74, MRN75, MRN76) are on spur crests and two are in areas of moderate slope (MRN49, MRN51 – these are the only sites known within the moderate slope landform element). It should be noted that this result may have been biased by European land clearance practices which have acted to remove nearly all trees from the other landform elements. Thus while the presence of scarred trees in the spur and moderate slopes landform elements can be taken to indicate that scarred trees are likely in these areas, it does not preclude that they may also have once been more widespread across the landform elements.

The stone arrangement (MRN9) is located on a gentle slope in a closed valley context (i.e. a valley that is hidden from view from all compass directions). The *in-situ* boulder used as a grindstone (Marulan T1 S7) is located on a spur in close association with Joarimin Creek (refer to **Figure 3.3**).

Overall, the spur crest landform context has the largest number of known sites (30) and the greatest diversity of site types (4) within the project area. The gentle slope context has nearly as many sites (27) and site types (3). Once again it should be noted that the spur crests and gentle slopes make up the bulk of the project area and those areas targeted for survey. Thus some bias is present in the data.

3.4 Cultural Context

Based on a request from DECC (now DECCW) the ethnographic and ethnohistoric record for Marulan and the broader Southern Tablelands was examined to extract information in relation to observations of Aboriginal people and how they utilised the landscape (Umwelt 2007a). Research included sourcing documents from the Australian Institute of Aboriginal and Torres Strait Islander Studies, the Australian National University, the DECCW library at Hurstville and resources already held by Umwelt. Both primary and secondary sources were reviewed including: Smith n.d.; Throsby 1818; Wild 1820; NSW Calendar and General Post Office Directory 1832; Baylie 1843; McAlister 1907; Wyatt 1941; Tindale 1974; Laws et al 1979; Flood 1980; Eades 1976; Sullivan 1983; Eddie 1985; Packard 1986, Lance and Koettig 1986, Koettig 1988, 1991; Paton 1989; Navin 1990, Sefton 1995.

As noted by Boot (2002: 58):

> *The problems associated with ethnohistoric documents include their tendency to record unusual, rather than everyday events, and their focus on religious behaviour to the exclusion of women and children (Attenbrow 1976:34; Sullivan 1983:12.4).*

Thus whilst there were numerous mentions of the locations of ceremonial activities and burials, secular activities such as camping and hunting and gathering, though often mentioned, were rarely ever placed in a landscape context (i.e. mention is made of camp sites but no information is provided on where the camp site was located). **Table 3.5** presents the small amount of information derived from both primary and secondary references where activities were actually placed in a landscape context. Also included in the table is information provided by Bill Hardie (GTCAC) and Pat Little (PLALC) derived from the oral history of the area and provided during the initial 2005 survey.

Table 3.5 – Landform/Cultural Contexts

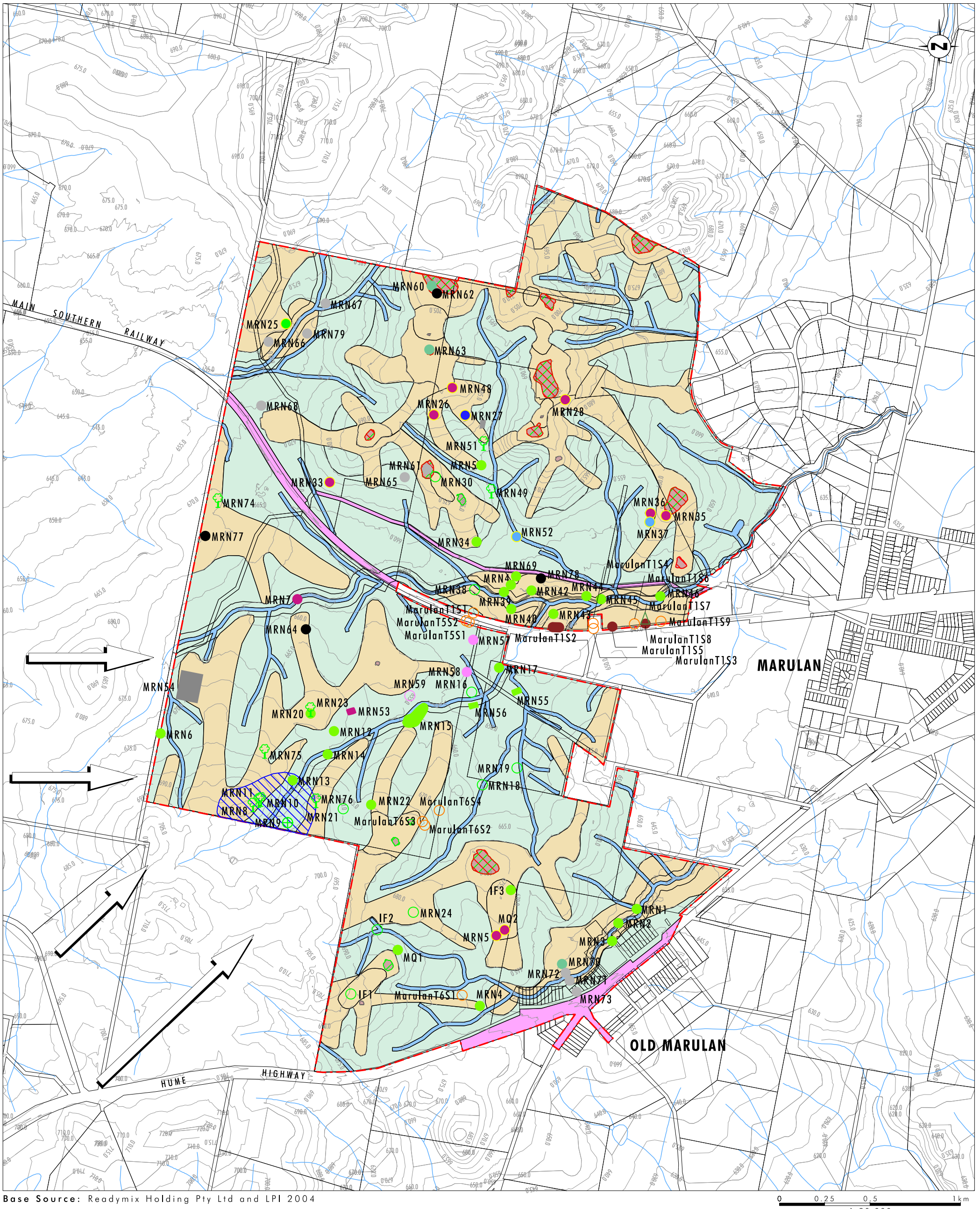
Landform Element	Cultural Context	Reference
High points on rocky ridge and spur crests.	Burials	Areas like these were used for burials. (Bill Hardie GTCAC: pers comm. 2005).
Rocky hilltops (for the project area this could relate to the high points on rocky ridge and spur crests).	Burials	*Generally Aborigines were buried on the top of rocky hilltops…* (Lance and Koettig 1986:15).
Hilltops. (for the project area this could relate to the high points on rocky ridge and spur crests).	Burials and ceremonial sites	*Historical records suggest that burial and ceremonial sites were located on hill tops …* (Lance and Koettig 1986: 25).

Table 3.5 – Landform/Cultural Contexts (cont)

Landform Element	Cultural Context	Reference
Small hill (for the project area this could relate to the ridge and spur crests).	Ceremonial	*These sites were the locations at which some of the most important ceremonial activities took place. They often comprised earth mounds, circular in shape in locations distant from usual habitation sites. Several bora grounds are known to have existed in the Goulburn district. One site was on a small hill near the existing Kenmore hospital …* (MacAlister 1907:85)
Spur crest and slopes within hidden valley (view into valley restricted by spurs that leave narrow entrance to the valley and vegetation).	Ceremonial Precinct Women's campground Men's campground	*The stone arrangement was interpreted by Bill Hardie (GTCAC) as occupying part of a women's campground (the men's campground would have been located across the valley among the stringybarks).* Further descriptions of the stone arrangement in this area provided by Bill Hardie have been omitted from this text at the request of Delise Freeman of Pejar Local Aboriginal Land Council (phone conversation 24 July 2007).
Lower slopes.	Camp sites	*Historical records suggest that stone artefact scatters [were located] on lower slopes. Few sites are found on middle slopes, especially on steeply sloping ground* (Lance and Koettig 1986: 25).
Areas of low to very low gradient exposed to/protected from the prevailing winds.	Camp sites	Comments provided by Bill Hardie (GTCAC) and Pat Little (PLALC) during the survey of the Lynwood Quarry project area (Umwelt 2005) indicated that summer camps would have been located in areas of low gradient exposed to the prevailing (cooling) westerly/south-westerly winds; however, camp sites for the winter would have been located in areas protected from these winds.

The ceremonial precinct marked on **Figure 3.4** incorporates a stone arrangement (MRN9), three scarred trees (MRN8, MRN10 and MRN11) and an artefact scatter (MRN13). This area is unique within the Lynwood Quarry project area as it is the only valley within the area where the topography is of a nature that obscures the ceremonial area from view from all compass directions. MRN13 is technically not within the hidden valley, it is at the opening of the valley and was associated with the ceremonial ground through the Aboriginal oral history (Bill Hardie 2004: pers. comm.). Also in the close proximity are two further scarred trees (MRN75 and MRN76), three artefact scatters (MRN12, MRN14 and MRN22) and an isolated find (MRN 21). The proximity of these sites suggests some association with the ceremonial area.

Whilst this information in relation to the hidden valley/ceremonial precinct is important in terms of helping gain an understanding of the Aboriginal use of the landscape within the project area, the hidden valley has not been incorporated as a separate cultural context within the ATUs as this landform element is not repeated within the project area and as the only area in which it occurs will be conserved within an AHMZ (thus negating the requirement to subsurface test this landform/cultural context). **Figure 3.4** indicates that apart from within the hidden valley there are currently no known sites related to ceremony in the areas suggested by the ethnography and Aboriginal oral history (i.e. on crests).



Base Source: Readymix Holding Pty Ltd and LPI 2004

0 0.25 0.5 1km
1:20 000

Legend

- Project Area
- Modified
- Sites Recorded During the CE Survey
- Rocky Ridge or Spur Crest
- Areas with Potential for Camp Sites
- Area with Potential for Hunting and Gathering
- Areas with Potential for Ceremonial Sites
- Areas with Potential for Burial
- Area with Known Ceremonial Site and Associated Sites
- Ceremony and/or Burial
- Creek Lines
- Drainage
- Prevailing Winds
- Sites Subsurface Tested in Stage 2A
- Artefact Scatter s87/90 Collection/Monitoring
- Artefact Scatter salvaged during Stage 1A
- Isolated Find salvaged during Stage 1A
- Artefact Scatter (CE) Conservation
- Artefact Scatter Located During Stage 2B s87/90 No Further Subsurface Salvage
- Isolated Find Located During Stage 2B s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 Further Subsurface Salvage
- Artefact Scatter located during Stage 2B Surface Collection only
- Isolated Find (CE) Conservation
- Grinding Stone (CE) Conservation
- Stone Arrangement Conservation
- Scarred Tree Conservation
- Isolated Find Conservation
- Artefact Scatter Conservation
- Isolated Find s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 No Further Subsurface Salvage

FIGURE 3.4

Potential Cultural Contexts

File Name (A3): R21_V1/2238_277.dgn

In relation to burials, Packard (1986:45) notes the following for the Southern Tablelands:

> *The apparent lack of burials recorded in sand deposits in the study area and elsewhere in the region is in contrast to the general experience for sand deposits in NSW (e.g. coastal middens or the Murray River region). It is possible that the local tribes did not use sand deposits to bury their dead as part of simple or complex disposal procedures. However, ethnohistorical records of burials in the region (e.g. Wright, 1923, Helms, 1895, Howitt 1904 in Flood 1980:117-121; Brennan, 1907 in Stone, 1985:50), mention graves being dug into rocky, clayey and 'gritty' (i.e. sandy) deposits. They also sometimes refer to rocks, grave goods such as stone tools, and organic matter such as sticks being included. So far no clusters of stone tools, ochre or rocks which might otherwise indicate the presence of a burial from which all organic material had decayed have been recorded in sand deposit sites in the region.*

Packard's (1986) evidence suggests that it is unlikely that burials will be found in the deep sands within the Lynwood Quarry project area. This suggestion has been supported by the subsurface testing program which four sites and three ATUs in the deep sands. The preference for the wombats to burrow in these deposits may also have been a factor that deterred Aboriginal people from using the deep sands for burials. Thus, the deep sands on ridge and spur crests are not identified as a cultural context for burials within the Lynwood Quarry Project Area.

Figure 3.4 indicates the location of the potential cultural contexts drawn from the ethnographic/ethnohistoric records and from the Aboriginal oral history. The figure also indicates the prevailing wind direction (refer also to **Figure 3.3**). Based on the prevailing wind direction (and field observations) the known artefact scatter and isolated find sites can be divided into summer (cool winds), spring and autumn (very cool to cold winds) and winter camps (extremely cold winds) as indicated in **Table 3.6**.

Table 3.6 – Potential Summer/Winter Camp Sites

Summer Camps	**Spring, Autumn and Winter Camps**
Marulan T1 S2 Marulan T1 S3 Marulan T1 S4 Marulan T1 S5 Marulan T1 S6 Marulan T1 S8 Marulan T1 S9 MRN1 MRN2 MRN3 MRN4 MRN5/MQ2 MRN20 MRN2 MRN24 **MRN28** MRN30 MRN33 MRN35 MRN36 MRN37 MRN38 MRN50 MRN53 MRN54 MRN55 MRN56 MRN57 MRN60 MRN61 **MRN62** MRN63 MRN65 MRN67 MRN68 MRN70 MRN71 MRN72 **MRN73** MRN77 MRN78 **MRN79** IF1 IF3	Marulan T1 S1 Marulan T5 S1 Marulan T5 S2 Marulan T6 S2 Marulan T6 S3 Marulan T6 S4 Marulan T6 S1 MRN6 MRN12 **MRN13** MRN14 MRN15 MRN16 MRN 17 MRN18 MRN19 MRN21 **MRN25** MRN26 **MRN27** **MRN34** MRN39 **MRN40** **MRN41** **MRN42** **MRN43** MRN45 MRN46 MRN48 MRN52 MRN58 MRN59 **MRN64** MRN66 **MRN69** IF2 MQ1
48 (58%)	**35 (42%)**

The sites indicated in bold within **Table 3.6** are those that contain 10 or more artefacts (only artefact scatters and isolated finds are tabulated and results relate to total counts from both surface and subsurface investigation – MRN7 and MRN44 are not listed as these represent sites where artefacts have washed down the channel of the creekline and the provenance of the artefacts is unknown). Based on the location/exposure of the tabulated sites, 42% were located in areas protected to some degree from very cool (spring and autumn) to cold to

extremely cold winds (winter) and were not likely to have received cooling summer winds. The remaining 56% of the sites were in areas exposed to these winds year round making them more suitable as summer camps. It is apparent that the majority of the larger artefact scatters (>10 artefacts) were in areas that would have been better spring, autumn and winter camps. However, as the weather is so unpredictable in Marulan and varies widely within and between days it is not surprising that sites indicating relatively longer occupation, or multiple visits over time are in more protected areas. Overall the evidence is suggestive of the whole of the project area being utilised by Aboriginal people with a preference for camping for longer periods of time/more often in areas out of the wind.

3.5 Archaeological Terrain Units

A total of 34 ATUs have been identified within the Lynwood Quarry Project Area. **Figure 3.5** indicates the location and extent of the ATUs identified using the map codes presented in **Table 3.7**. The ATUs have been derived from a combination of the information gathered in relation to stream order, geology, soils, landform element and cultural context (refer to **Sections 3.1** through **3.4**).

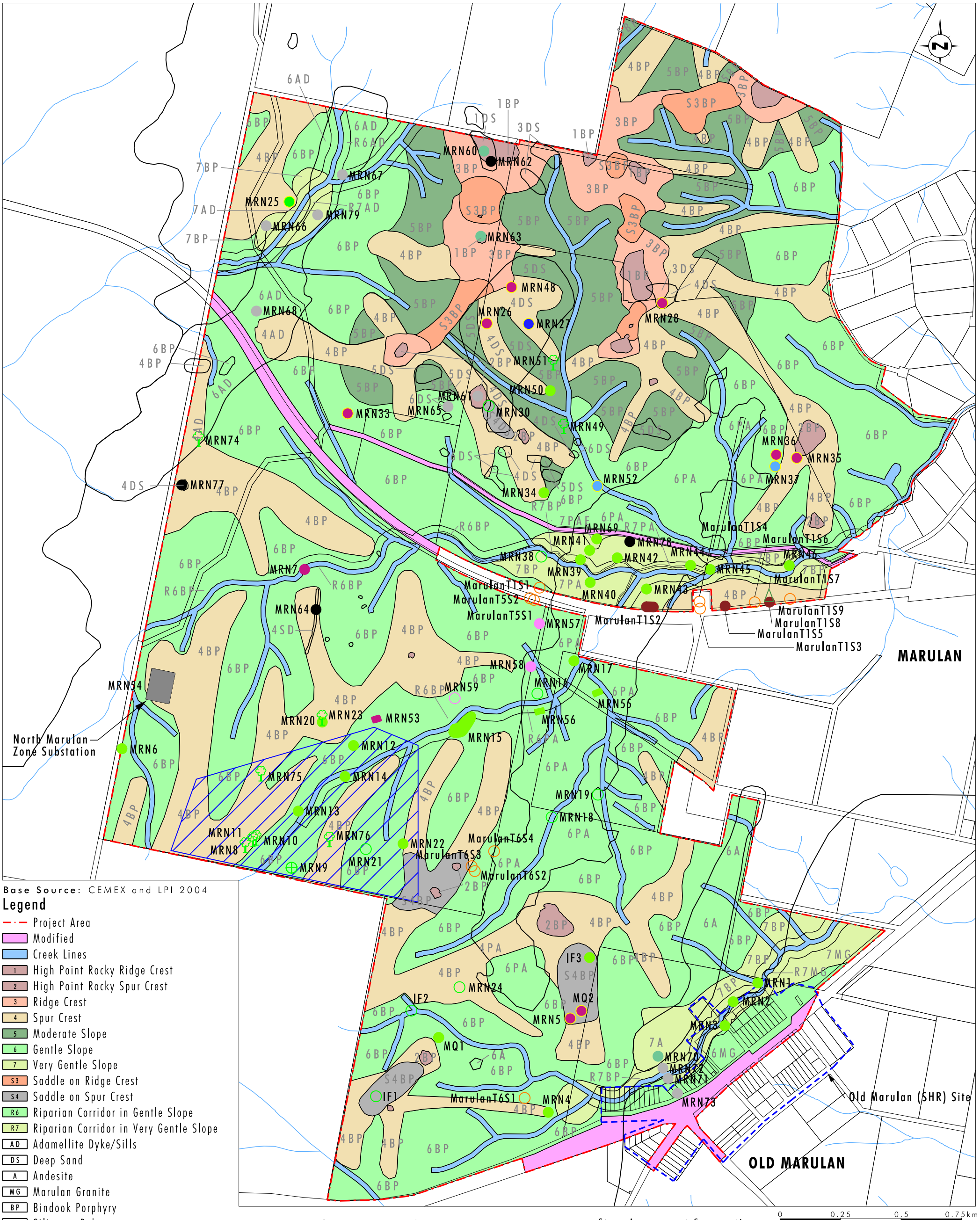
The information presented in **Table 3.7** has been revised from that presented in Umwelt (2007a) to incorporate information derived from the staged subsurface testing and salvage program for both the Lynwood Quarry Project and the Country Energy Marulan Electricity Upgrade (Umwelt 2007b, 2007c, 2007d; 2008a, 2008b, 2008c, 2008d, 2008e, 2008f, 2009).

It should be noted that information related to wind direction has also been considered and whilst not forming a criterion for identifying the ATUs, it will be used to assist with interpretation of the evidence collected during the subsurface testing and salvage program (Umwelt in prep.).

Table 3.7 indicates the following for the 34 identified ATUs:

- 29 have known sites;
- 5 do not have known sites;
- the largest numbers of known sites in the ATUs are within the Bindook Porphyry, in the spur crest landform element (4BP - 26% of total sites) and within the gentle slope landform element (6BP - 23.5% of total sites) respectively;
- three sites (two isolated finds and one artefact scatter) are located in ATUs predicted from the ethnographic/ethnohistoric review to have been associated with ceremony or burial;
- two sites (both scarred trees) are located in the ATU predicted from the landform element analysis to have been used for hunting and gathering rather than camping - due to the steepness of the gradient; and
- 89 sites (isolated finds, artefact scatters, an artefact scatter with an in-situ boulder used for grinding, scarred trees and a stone arrangement) are in ATUs predicted from the ethnographic/ethnohistoric review and the landform element analysis to have been used for camping.

It is noted that the data used for **Table 3.7** is biased to some extent by the relative size of the ATUs and the degree of survey and subsurface testing; however, it does provide a useful framework for predicting the likelihood of Aboriginal archaeological sites within the proposed



Base Source: CEMEX and LPI 2004

Legend

- Project Area
- Modified
- Creek Lines
- 1 High Point Rocky Ridge Crest
- 2 High Point Rocky Spur Crest
- 3 Ridge Crest
- 4 Spur Crest
- 5 Moderate Slope
- 6 Gentle Slope
- 7 Very Gentle Slope
- S3 Saddle on Ridge Crest
- S4 Saddle on Spur Crest
- R6 Riparian Corridor in Gentle Slope
- R7 Riparian Corridor in Very Gentle Slope
- AD Adamellite Dyke/Sills
- DS Deep Sand
- A Andesite
- MG Marulan Granite
- BP Bindook Porphyry
- SD Siliceous Dyke
- PA Porphyritic Adamellite
- AD Adamellite Dyke
- PAE Elevated Area within Gentle Slope
- Cultural Heritage Management Zone
- Sites Subsurface Tested in Stage 2A
- Artefact Scatter s87/90 Collection/Monitoring
- Artefact Scatter salvaged during Stage 1A
- Isolated Find salvaged during Stage 1A
- Artefact Scatter (CE) Conservation
- Artefact Scatter Located During Stage 2B s87/90 No Further Subsurface Salvage
- Isolated Find Located During Stage 2B s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 Further Subsurface Salvage
- Isolated Find s87/90 No Further Subsurface Salvage
- Isolated Find (CE) Conservation
- Artefact Scatter located during Stage 2B Surface Collection only
- Isolated Find (CE) Conservation
- Grinding Stone (CE) Conservation
- Stone Arrangement Conservation
- Scarred Tree Conservation
- Isolated Find s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 No Further Subsurface Salvage

0 0.25 0.5 0.75km
1:15 000

FIGURE 3.5

Archaeological Terrain Units and Aboriginal Archaeological Sites

modification areas as these are located in ATUs (6BP, R6BP and 4BP) that have been subject to extensive survey and subsurface testing.

Table 3.7 – Archaeological Terrain Units

ATU	Landform Element	Geology	Potential Cultural Context	Known Sites
1DS	High Point on Rocky Ridge Crest	– Deep Sand/Bindook Porphyry	Ceremony and/or Burial	MRN60 **Total 1**
1BP		– Bindook Porphyry		MRN63 **Total 1**
2BP	High Point on Rocky Spur Crest	– Bindook Porphyry	Ceremony and/or Burial	MRN 61 **Total 1**
3DS	Ridge Crest (level to very gentle gradient)	– Deep Sand/Bindook Porphyry	Camp site	MRN62 **Total 1**
3BP		- Bindook Porphyry		**Total 0**
S3BP	Saddle on Ridge Crest	- Bindook Porphyry	Camp site	**Total 0**
4DS	Spur Crest (level to very gentle gradient)	– Deep Sand/Bindook Porphyry	Camp site	MRN26 MRN27 MRN28 MRN48 **Total 4**

Table 3.7 – Archaeological Terrain Units (cont)

ATU	Landform Element	Geology	Potential Cultural Context	Known Sites
4BP	Spur Crest (level to very gentle gradient) (cont)	– Bindook Porphyry	Camp site	Marulan T1 S3 Marulan T1 S4 Marulan T1 S5 Marulan T1 S6 Marulan T1 S7 Marulan T1 S8 Marulan T1 S9 MRN4 MRN8 MRN10 MRN11 MRN20 MRN22 MRN23 MRN24 MRN25 MRN34 MRN35 MRN50 MRN54 MRN74 MRN75 MRN76 MRN77 **Total 24**
4AD		- Adamellite Dyke		**Total 0**
4PA		– Porphyritic Adamellite		Marulan T1 S2 **Total 1**
4SD		– Siliceous Dyke		MRN64 **Total 1**

Table 3.7 – Archaeological Terrain Units (cont)

ATU	Landform Element	Geology	Potential Cultural Context	Known Sites
S4DS	Saddle on Spur Crest	– Deep Sand/Bindook Porphyry	Camp site	MRN30 **Total 1**
S4BP		– Bindook Porphyry		MRN5/MQ2 IF1 IF3 **Total 3**
5DS	Moderate Slope	– Deep Sand/Bindook Porphyry	Hunting and gathering only – too steep for camp site	**Total 0**
5BP		– Bindook Porphyry		MRN49 MRN51 **Total 2**
6DS	Gentle Slope	– Deep Sand/Bindook Porphyry	Camp site	MRN65 **Total 1**
6AD		– Adamellite Dyke		MRN68 **Total 1**

Table 3.7 – Archaeological Terrain Units (cont)

ATU	Landform Element	Geology	Potential Cultural Context	Known Sites
6BP	Gentle Slope	– Bindook Porphyry	Camp site	Marulan T1 S1 Marulan T5 S1 Marulan T5 S2 Marulan T6 S1 Marulan T6 S2 Marulan T6 S3 Marulan T6 S4 IF2 MQ1 MRN6 MRN9 MRN12 MRN19 MRN21 MRN33 MRN36 MRN37 MRN52 MRN53 MRN57 MRN58 MRN59 **Total 22**
6PA		– Porphyritic Adamellite		MRN18, MRN55 **Total 2**
6MG	Gentle Slope (continued)	– Marulan Granite	Camp site (continued)	MRN73 **Total 1**
6A		- Andesite		**Total 0**

Table 3.7 – Archaeological Terrain Units (cont)

ATU	Landform Element	Geology	Potential Cultural Context	Known Sites
7A	Very Gentle Slope	– Andesite	Camp site	MRN70 **Total 1**
7AD		– Adamellite Dyke		MRN79 **Total 1**
7BP		– Bindook Porphyry		MRN66 **Total 1**
7PA		– Porphyritic Adamellite		MRN41, MRN42 MRN43, MRN78 **Total 4**
7PAE		– Porphyritic Adamellite		MRN69 **Total 1**
7MG		- Marulan Granite		**Total 0**

Table 3.7 – Archaeological Terrain Units (cont)

ATU	Landform Element	Geology	Potential Cultural Context	Known Sites
R6AD	Riparian Corridor	– Adamellite Dykes/Dykes and sills	Camp site	MRN67 **Total 1**
R7AD				**Total 0**
R7MG		– Marulan Granite		MRN2 MRN3 MRN71 **Total 3**
R6PA		– Porphyritic Adamellite		MRN16 MRN17 MRN56 **Total 3**
R7PA				MRN39 MRN40 MRN44 **Total 3**
R6BP		– Bindook Porphyry		MRN7 MRN13 MRN14 MRN15 **Total 4**
R7BP				MRN1 MRN38 MRN45 MRN46 MRN72 (AS) **Total 5**

4.0 Predictive Model

The model for predicting Aboriginal archaeological site within the ATUs proposed for impact by the modifications has been drawn from the information provided in **Section 3** which in turn is based on the information provided in **Appendices C**, **D** and **E**.

4.1 ATUs within the Proposed Modification Areas

As noted in **Section 3.5**, there are three ATUs proposed for impact by the modifications. These are:

- 6BP - this ATU will be impacted by access road widening and construction, trenching for the underground electricity feeder, construction of the tarping area and double weighbridge and office facilities and works associated with the rail siding;
- R6BP – this ATU will be impacted by access road widening and construction, culverts in creek crossings, trenching for the underground electricity feeder, construction of the tarping area facilities and works associated with the construction of the rail siding and associated drainage infrastructure; and
- 4BP - this ATU will be impacted by access road widening and construction and trenching for the underground electricity feeder.

4.2 Aboriginal Archaeological Sites Predicted within ATUs

4.2.1 ATU 6BP

Based on the information provided in **Section 3** and **Appendix E**, it can be predicted that ATU 6BP is likely to have:

- isolated finds and small, low density, low complexity artefact scatters;
- any subsurface artefactual material associated with sites is unlikely to retain archaeological integrity due to topsoil disturbance and topsoil loss (downslope movement due to gravity and slopewash); and
- if sites are located they are most likely to contain flakes, broken flakes and flaked pieces manufactured from silcrete, quartz and quartzite.

4.2.2 ATU R6BP

Based on the information provided in **Section 3** and **Appendix E**, it can be predicted that ATU R6BP is likely to have:

- isolated finds and moderate density and low complexity artefact scatters;
- any subsurface artefactual material associated with sites is unlikely to retain archaeological integrity due to topsoil disturbance and topsoil loss (scouring by overbank flows), except where they are in an aggradational/stable context (e.g. colluvial deposit at the base of the slope) and where they are above the level scoured by high water flows – in these cases they may retain some archaeological integrity; and

- if sites are located they are most likely to contain flakes, broken flakes, retouched flakes and cores manufactured from silcrete, quartz and quartzite and to a lesser extent, chert and volcanic.

4.2.3 ATU R4BP

Based on the information provided in **Section 3** and **Appendix E**, it can be predicted that ATU 4BP is likely to have:

- isolated finds and low to moderate to high density and low to moderate complexity artefact scatters (density and complexity was found to vary between various testing locations with those sheltered from spring, autumn and winter winds having higher densities and greater complexity);

- any subsurface artefactual material associated with sites is unlikely to retain archaeological integrity due to topsoil disturbance and topsoil loss (downslope movement due to slopewash); except where they are in a fairly stable context (i.e. on level spur crests where rock outcrops and/or remnant vegetation has acted to stabilise the soil) - in these cases they may retain some archaeological integrity;

- the sites are most likely to contain flakes, broken flakes, retouched flakes and cores manufactured from silcrete, quartz and quartzite and to a lesser extent, chert and volcanic; and

- scarred trees may be present in areas where remnant vegetation exists.

5.0 Survey Methodology and Results

This section of the report provides details of the survey methodology and results including effective coverage tables.

5.1 Methodology

The survey was conducted on 6 July 2010. Survey participants were:

- Sharon Halls representing GAHAI;
- Tom Brown representing GTCAC;
- Justin Boney representing PLALC;
- Richard Savage representing Holcim; and
- Jan Wilson representing Umwelt.

Prior to commencing the survey all of the survey areas were driven across and plans viewed to ensure that all survey participants understood the nature of the proposed modification and potential impacts that may arise from works associated with the modification.

The survey transects were recorded based on the ATUs as presented in **Section 3.5**. The ATUs have been used as the analytical units for prior subsurface testing and salvage across the Lynwood Quarry project area. Prior survey, subsurface testing and salvage results have provided for a well informed predictive model (refer to **Section 4**), that was used throughout the survey to provide an understanding of the archaeological potential of areas where ground surface visibility was restricted.

During the survey Richard Savage (Holcim) provided specific detail of proposed impacts and discussions were held in relation to the management strategy proposed by Holcim as part of its planning and the various management options thought appropriate from an Aboriginal cultural heritage and archaeological perspective.

5.1.1 Modified Access Road Survey Methodology

The proposed modified access road survey was divided into nine transects based on the ATUs traversed. ATUs within the proposed modified access road survey area included 6BP, R6BP and 4BP. The proposed modified access road was clearly pegged to ensure that the correct corridor was surveyed.

For the majority of the length of the proposed section of the modified access road the survey followed the existing Country Energy access road (refer to **Figure 5.1**). The survey commenced at the existing Joarimin Creek crossing which is adjacent (on the opposite side of Joarimin Creek) to the previously recorded and subsurface tested MRN15 (#51-6-0256) artefact scatter site (Umwelt 2005, 2007a, 2007b, 2007c, 2007d, 2008a, 2008b, 2008c, 2008d). Holcim has an existing s.87/90 AHIP (#1100264) for the section of the MRN15 site area that falls within the bounds of its approved access road. Under the conditions of s.87/90 AHIP (#1100264) Holcim is required to build its access road over geotextile using imported fill to prevent ground surface disturbance in the MRN15 site and for 100 metres either side of Joarimin Creek. Ground surface disturbance, however, is approved within the recent alluvial deposits associated with the creek channel and thus Holcim has been able to incorporate works associated with a culvert at this location.

Area North of Railway Siding

Transect Railway Siding

North Marulan Zone Substation

MARULAN

OLD MARULAN

Old Marulan (SHR) Site

0 0.25 0.5 0.75km
1:15 000

Base Source: CEMEX and LPI 2004

Legend

- Project Area
- Modified
- Creek Lines
- 1 High Point Rocky Ridge Crest
- 2 High Point Rocky Spur Crest
- 3 Ridge Crest
- 4 Spur Crest
- 5 Moderate Slope
- 6 Gentle Slope
- 7 Very Gentle Slope
- S3 Saddle on Ridge Crest
- S4 Saddle on Spur Crest
- R6 Riparian Corridor in Gentle Slope
- R7 Riparian Corridor in Very Gentle Slope
- AD Adamellite Dyke/Sills
- DS Deep Sand
- A Andesite
- MG Marulan Granite
- BP Bindook Porphyry
- SD Siliceous Dyke
- PA Porphyritic Adamellite
- AD Adamellite Dyke
- PAE Elevated Area within Gentle Slope
- Stage 1 Construction Access Road to Substation
- Approved Underground Transmission Line
- Approved Transmission Line Easement
- Stage 1 Post Hole Monitoring Area
- 30 Year Approved Footprint/s.87/90 AHIP area
- Modified Disturbance Footprint
- Cultural Heritage Management Zone

- Artefact Scatter s87/90 Collection/Monitoring
- Artefact Scatter salvaged during Stage 1A
- Isolated Find salvaged during Stage 1A
- Artefact Scatter (CE) Conservation
- Artefact Scatter Located During Stage 2B s87/90 No Further Subsurface Salvage
- Isolated Find Located During Stage 2B s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 Further Subsurface Salvage
- Isolated Find s87/90 No Further Subsurface Salvage
- Isolated Find (CE) Conservation
- Sites Subsurface Tested in Stage 2A
- Artefact Scatter located during Stage 2B Surface Collection only
- Isolated Find (CE) Conservation
- Grinding Stone (CE) Conservation
- Stone Arrangement Conservation
- Scarred Tree Conservation
- Isolated Find s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 No Further Subsurface Salvage
- Transect

FIGURE 5.1

Survey Transects

As part of the modification Holcim will require to place a slightly larger culvert in the creekline at this point, however, this will not encroach outside the currently approved s.87/90 AHIP area or the current Project Approval area.

Holcim will be required to widen the existing Country Energy access road by approximately 5 to 10 metres. It was not known at the time of the survey if this would relate to widening on one or both sides of the existing roadway. Thus a corridor of 20 metres either side of the existing access road was inspected. Participants were spaced at 5 to 10 metre intervals and all exposures were checked for artefacts.

At the point where the proposed modified access road diverges from the existing Country Energy access road (refer to **Figure 5.1**), a corridor 25 metres wide was inspected based on the centreline of the proposed access road which was pegged. Once again all exposures were subject to inspection.

All remnant mature trees, stumps and logs in proximity to the proposed access road were inspected for evidence of scarring/carving. There were no mature trees, stumps and logs within the proposed modified road corridor.

For the majority of the area surveyed a previously excavated trench ran alongside the existing access road. This trench relates to an underground Country Energy feeder excavated under s.87/90 AHIP (#1089392). There was no vegetation growth along the infilled trench and thus it provided a corridor of visibility approximately 1 metre to 1.5 metres in width along the southern side of the majority of the modified access survey area.

5.1.2 Underground Electricity Feeder Survey

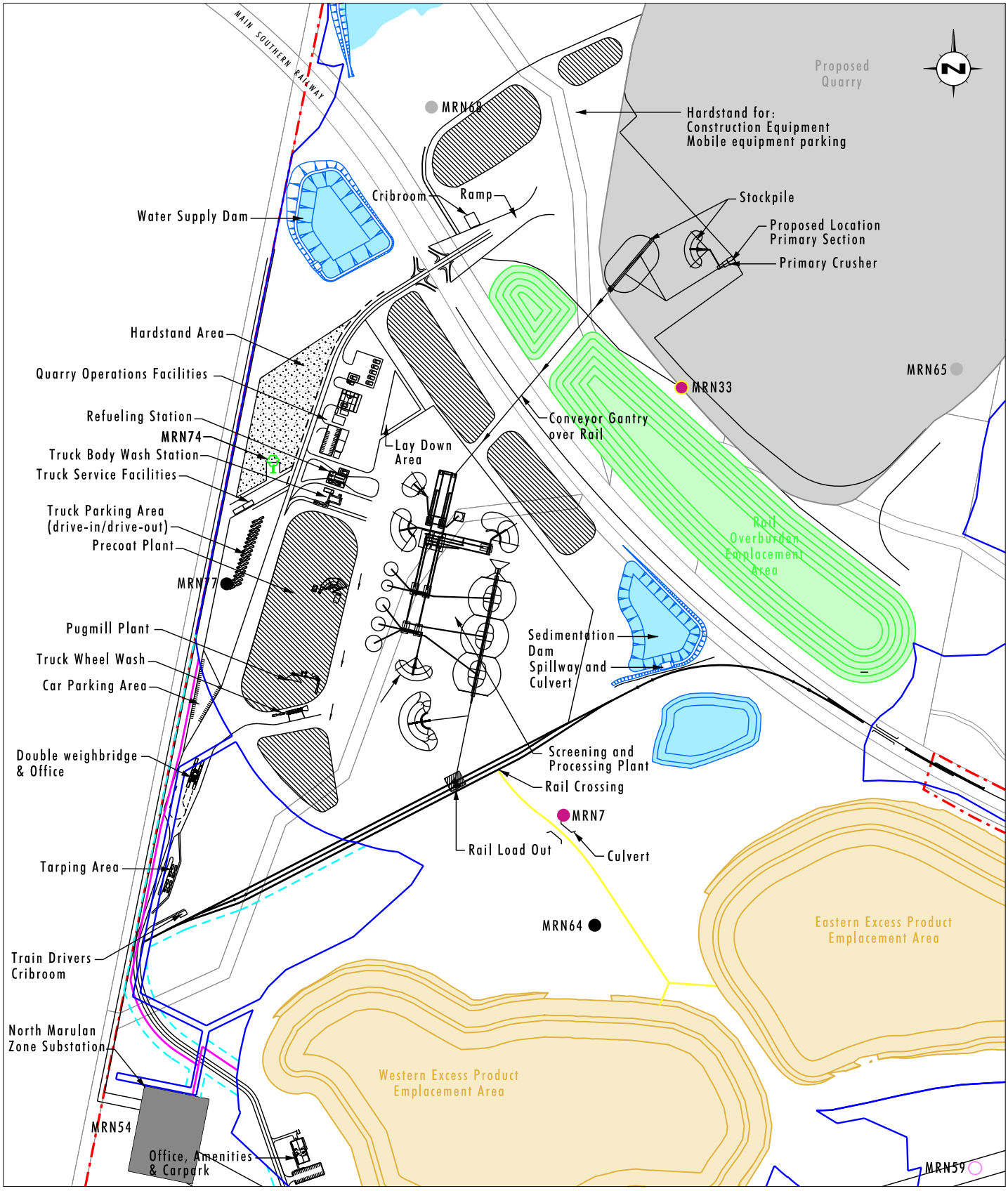
The proposed underground electricity feeder was not pegged at the time of the survey. Richard Savage (Holcim) explained that the trench would exit from the NMZS on its northern side following an existing approved easement. It would then extend to the south-east along the alignment of the proposed modified access road to the approved (relocated) office, amenities and car park area (refer to **Figure 5.2**). The area to be impacted by the proposed trench to the approved (relocated) office, amenities and car park area that is outside the current s.87/90 AHIP (#1100264) and Project Approval boundary was surveyed as part of Transect 7 for the proposed modified access road (refer to **Figure 5.1**).

A second trench is also proposed to branch from the first to turn north-west to follow the alignment of the proposed modified access road to the infrastructure area (refer to **Figure 5.2**). This area was surveyed as Transects 7, 8 and 9 of the modified access road survey and as part of Transect 1 of the rail siding survey (refer to **Section 5.1.3**) and Transect 1 of the area to the north of the rail siding area (refer to **Section 5.1.4**).

The potential subsurface impacts associated with the trenches were discussed with the participating Aboriginal Parties and their advice was taken into account when determining management recommendations.

5.1.3 Proposed Rail Siding

The centreline of the alignment for the proposed rail siding was pegged in the area outside the Project Approval boundary and the current s.87/90 AHIP (#1100264) area (refer to **Figure 5.2**). The survey transect in this area included a corridor of 50 to 80 metres in width to ensure that the area between the proposed railway siding and the tributary of Joarimin Creek was intensively inspected as well as a corridor of 25 metres to the north and west of the proposed railway siding (refer to **Figure 5.1**). All exposures in this area were inspected



Source: Holcim
Base Source: LPI 2010

0 100 200 400m
1:8000

Legend

- Project Area
- Proposed Infrastructure
- Proposed Haul Road
- Product Stockpiling Area
- Approved Disturbance Footprint
- Modified Disturbance Footprint
- Sites Subsurface Tested in Stage 2A
- Artefact Scatter s87/90 Collection/Monitoring
- Isolated Find salvaged during Stage 1A
- Artefact Scatter located during Stage 2B Surface Collection only
- Scarred Tree Conservation
- Artefact Scatter s87/90 No Further Subsurface Salvage

FIGURE 5.2

Proposed Infrastructure Layout

by the survey participants. Participants were generally spaced between 5 and 10 metres apart. The survey team initially walked the corridor along the proposed rail siding alignment and to its north and west; returning to survey to the south and east of the pegged alignment. The Joarimin Creek channel and both banks were then subject to inspection. All remnant mature trees, stumps and logs were inspected for evidence of scarring/carving.

5.1.4 Area to North of Proposed Rail Siding

An area of approximately 4 hectares to the north and west of the proposed rail siding also falls outside the current approved development disturbance area and s.87/90 AHIP (#1100294) area (refer to **Figure 5.1**). Only part of this area is currently proposed for impact by construction of a tarping area facility and double weighbridge and office. However, as the remainder of the area is wedged between this infrastructure, the proposed rail siding and the approved plant to the north it is expected that it will be impacted and it is therefore included in the proposed disturbance area.. Thus the area was surveyed. Survey participants inspected the area using a rough grid pattern with transects walked east and west and then north and south. Participants walked at roughly 20 metre intervals and inspected all areas of exposure. All remnant mature trees, stumps and logs were inspected for evidence of scarring/carving.

5.1.5 Methodology for Survey Recording

Survey data was recorded using a hand-held GPS, maps, compass and standardised field recording forms. Information recorded during the survey included:

- the nature of the landforms and vegetation;
- the levels of visibility and exposure within the surveyed area;
- the effects of erosion and disturbance;
- the availability of Aboriginal resources;
- any Aboriginal archaeological sites that may be present (with recording to comply with DECCW standards and requirements);
- the likelihood that potential archaeological deposits (PADs - refer to **Section 5.2.3** for the definition of a PAD) may be present within the proposed impact area; and
- any information provided by the registered Aboriginal Parties regarding the cultural significance of the area.

Visibility was recorded in terms of the percentage of ground surface upon which artefacts may be sighted. Exposure was also recorded as the percentage of the survey transect in which disturbance has removed or exposed the upper soil layer to permit the detection of artefacts (if any) that were formerly located in a subsurface context (NSW NPWS 1997:18). In accordance with NPWS's *Cultural Heritage Guidelines* (NSW NPWS 1997), the description of survey coverage includes the transect area and the estimate of exposure and visibility within that transect.

5.2 Results

5.2.1 Survey Results

Table 5.1 provides a summary of the survey transects undertaken for the proposed modifications and lists the relevant plates for each section. From **Table 5.1** it can be noted that:

- no artefactual material was located within the survey areas;
- areas within three ATUs were identified as being likely to retain artefacts in a subsurface context (refer to **Section 5.3**);
- this included three separate areas of ATU R6BP, one area of ATU 4BP and a very limited area of ATU 6BP (that is located between an area of R6BP and 4BP identified as being likely to retain artefacts in a subsurface context);
- all the survey areas had been heavily cleared;
- much of the length of the modified access road (where it follows the existing Country Energy access road) appears to have been ripped historically (this is apparent from small to medium boulders brought to the surface or overturned and/or piled in the paddocks and from the results of earlier subsurface testing – refer to **Appendix E**);
- almost all areas surveyed had lost the A1 soil horizon and parts of the A2 soil horizon due to ongoing downslope movement of the coarse, sandy, granitic soils through gravity and slopewash;
- slopewash had resulted in many areas of scouring;
- the soils of the spur crests were generally shallow to skeletal and more sparsely vegetated;
- minor areas of recent soil aggradation were noted in association relatively broad, shallow grassy waterways (first order streams); and
- only the area of riparian corridor at the start of the modified access road (north of MRN15) and the area associated with the central section of the Rail Siding survey area) are assessed as likely to have retained semi-permanent water within chains of ponds in their respective creek channels (refer to **Figure 5.1**).

The management recommendations provided in **Table 5.1** were reached following discussions with the Registered Aboriginal Parties during the survey. Each management recommendation was prepared taking into account the nature of the proposed impact, the results of the survey and the in-depth knowledge each of the Aboriginal stakeholders and the archaeologist had of the Aboriginal cultural and archaeological context of the Lynwood Quarry project area.

Please note that in **Table 5.1** the five metre wide access road which was constructed of imported fill and allowed for 0% ground surface visibility, has not been included in the area calculations for Transects one through six.

Table 5.1 – Summary of Survey Transects Lynwood Quarry Modification

Modified Access Road and Underground Electricity Feeder (where applicable)								
Transect	**ATU**	**Total Survey Area in m^2**	**Ground Surface % Visibility General**	**Additional Areas of Exposure in m^2 ((LXW)/100 x % vis)**	**Prior Disturbance/Erosion**	**Sites/PADs Located**	**Plates**	**Preferred Management Option**
1	R6BP Riparian Corridor/Gentle Slope/Bindook Porphyry	1400	0% Total area of visibility = 0 m^2	0 m^2	Existing access track, culvert, clearing, ripping, grazing. Slopewash and scouring on slope/creek channel widening and entrenchment. Some A1 associated with creek channel – recent A1 over truncated A2.	No sites located. Riparian corridor in this area has potential for subsurface artefacts and is assessed as PAD.	**1, 2**	Place geotextile over ground surface and construct road with imported fill. Restrict ground disturbance to creek channel and culverts. Restrict vehicle movements associated with road construction to surveyed corridor.
2	6BP Gentle Slope/Bindook Porphyry	8680	10% Total area of visibility = 868 m^2	1 x 217 (100%) = 217 m^2 3 x 0.5 (50%) = 0.75 m^2 2 x 1 (100%) = 2 m^2 1 x 0.5 (50%) = 0.25 m^2 2 x 1 (50%) = 1 m^2 Total = 221 m^2	Existing access track, culverts, clearing, ripping, grazing. Slopewash and scouring – A2 exposed in scours.	No sites/PADs located.	**3, 4**	Construct road using imported fill. Minimise ground disturbance. Restrict vehicle movements associated with road construction to surveyed corridor.
3	4BP Spur Crest/Bindook Porphyry	6640	20% Total area of visibility = 1328 m^2	1 x 166 (100%) = 166 m^2 20 x 3 (40%) = 24 m^2 1 x 1 (100%) = 1 m^2 30 x 5 (40%) = 60m^2 Total = 251 m^2	Existing access track, culverts, clearing, ripping, grazing. Slopewash and scouring – A2 exposed in scours – bedrock exposed.	No sites/PADs located.	**5, 6**	Construct road using imported fill. Minimise ground disturbance. Restrict vehicle movements associated with road construction to surveyed corridor.

Table 5.1 – Summary of Survey Transects Lynwood Quarry Modification (cont)

Transect	ATU	Total Survey Area	Ground Surface % Visibility General	Additional Areas of Exposure in m2 ((LXW)/100 x % vis)	Prior Disturbance/Erosion	Sites/PADs Located	Plates	Preferred Management Option
4	6BP Gentle Slope/Bindook Porphyry	2400	20% Total area of visibility = 480 m^2	1 x 60 (100%) = 60 m^2 1 x 1 (100%) = 1 m^2 0.5 x 0.5 (50%) = 0.125 m^2 Total = 61.1 m^2	Existing access track, culverts, clearing, ripping, grazing. Some aggradation footslope. Slopewash and scouring on slopes. A2 exposed in scours.	No sites/PADs located.	**7**	Construct road using imported fill. Minimise ground disturbance. Restrict vehicle movements associated with road construction to surveyed corridor.
5	4BP Spur Crest/Bindook Porphyry	7520	25% Total area of visibility = 1880 m^2	1 x 188 (100%) = 188 m^2 Total = 188 m^2	Existing access track, culverts, clearing, ripping, grazing. Slopewash and scouring on slopes. A2 exposed in scours. Bedrock exposed.	No sites/PADs located.	**8**	Construct road using imported fill. Minimise ground disturbance. Restrict vehicle movements associated with road construction to surveyed corridor.
6	6BP Gentle Slope/Bindook Porphyry	7760	2% Total area of visibility = 155.2 m^2	1 x 194 (100%) = 194 m^2 5 x 8 (50%) = 20 m^2 1 x 1 (100%) = 1 m^2 Total = 215 m^2	Existing access track, culverts, clearing, ripping, grazing. Some aggradation footslope. Slopewash and scouring on slopes. A2 exposed in scours.	No sites/PADs located.	**9**	Construct road using imported fill. Minimise ground disturbance. Restrict vehicle movements associated with road construction to surveyed corridor.

Table 5.1 – Summary of Survey Transects Lynwood Quarry Modification (cont)

Transect	ATU	Total Survey Area	Ground Surface % Visibility General	Additional Areas of Exposure in m2 ((LXW)/100 x % vis)	Prior Disturbance/Erosion	Sites/PADs Located	Plates	Preferred Management Option
7	4BP Spur Crest/Bindook Porphyry (2 adjoining crests)	10425	5% Total area of visibility = 521.3 m^2	1 x 50 (100%) = 50 m^2 10 x 8 (35%) = 28 m^2 2 x 2 (30%) = 1.2 m^2 Total = 79.2 m^2	Existing access track, culverts, clearing, ripping, grazing (first 50 m) then clearing, grazing, dam construction. Slopewash and scouring on slopes. A2 exposed in scours. Some bedrock exposed.	No sites located. In close proximity MRN54 – same ATU. Likely to be subsurface artefacts and assessed as PAD.	**10, 11, 12**	Place geotextile over ground surface and construct road with imported fill. Restrict ground disturbance associated with the access road to culverts. Construct road using imported fill. Minimise ground disturbance. Restrict vehicle movements associated with road construction to surveyed corridor. Monitor topsoil removal from powerline trench.

Table 5.1 – Summary of Survey Transects Lynwood Quarry Modification (cont)

Transect	ATU	Total Survey Area	Ground Surface % Visibility General	Additional Areas of Exposure in m2 ((LXW)/100 x % vis)	Prior Disturbance/Erosion	Sites/PADs Located	Plates	Preferred Management Option
8	6BP Gentle Slope/Bindook Porphyry	850	10% Total area of visibility = 85 m^2	0.5 x 0.5 (100%) = 0.25 m^2 8 x 8 (50%) = 32 m^2 6 x 1 (50%) = 3 m^2 2 x 1 (100%) = 2 m^2 20 x 8 (80%) =128 m^2 3 x 0.5 (0%) =1.35 m^2 5 x 5 (50%) =12.5 m^2 Total = 179.1 m^2	Clearing, grazing, very hummocky. Some aggradation footslope. Slopewash and scouring on slope. A2 exposed in scours. Some outcropping boulders.	No sites located Area between MRN54 and riparian corridor – both assessed as likely to have PAD. Less likelihood in this ATU – but possible.	**12, 13**	Place geotextile over ground surface and construct road with imported fill. Restrict ground disturbance associated with access road to culverts. Construct road using imported fill. Minimise ground disturbance. Restrict vehicle movements associated with road construction to surveyed corridor. Monitor topsoil removal from powerline trench.

Table 5.1 – Summary of Survey Transects Lynwood Quarry Modification (cont)

Transect	ATU	Total Survey Area	Ground Surface % Visibility General	Additional Areas of Exposure in m2 ((LXW)/100 x % vis)	Prior Disturbance/Erosion	Sites/PADs Located	Plates	Preferred Management Option
9	R6BP Riparian Corridor/Gentle Slope/Bindook Porphyry	1125	5% Total area of visibility = 58.25 m^2	2 x 2 (30%) = 1.2 m^2 1 x 2 (40%) =0.8 m^2 Total = 2 m^2	Clearing, grazing, cattle trampling when muddy. Slopewash and scouring on slope/multiple minor creek channels widening and entrenchment and migration. Some A1 associated with creek channel – rest recent A1 over truncated A2 based on exposure further downstream in creek channel.	No sites located Riparian corridor in this area has potential for subsurface artefacts and is assessed as PAD.	**14, 15**	Place geotextile over ground surface and construct road with imported fill. Restrict ground disturbance to creek channel and culverts. Restrict vehicle movements associated with road construction to surveyed corridor.

Table 5.1 – Summary of Survey Transects Lynwood Quarry Modification (cont)

Modified Rail Siding								
Transect	**ATU**	**Area Surveyed**	**Ground Surface % Visibility General**	**Areas of Exposure/ %visibility**	**Prior Disturbance**	**Sites/PADs Located**	**Plates**	**Management Option**
1	R6BP Riparian Corridor/Gentle Slope/Bindook Porphyry	24500	5% Total area of visibility = 1225 m^2	4 x 4 (100%) = 16 m^2 20 x 8 (100%) =160m^2 10 x 3 (100%) = 30 m^2 5 x 8 (100%) =40m^2 20 x 4 (100%) = 80m^2 40 x 40 (50%) = 800m^2 5 x 50 (100%) = 250 m Total = 1376 m^2	Clearing, grazing, cattle trampling when muddy. Slopewash and scouring on slope/ creek channel widening and entrenchment. Flood prone, heavily scoured beside creek channel. One elevated terrace which may be more intact/colluvial/alluvial overlapping sequence.	No sites located. Area of elevated terrace between MGA 770949E 6154902N and 770956E 6154885N assessed as PAD.	**16, 17, 18 19, 20, 21**	Much of the area has been scoured by floods and damaged by stock trampling. What appears to be a relatively intact elevated terrace is assessed as PAD. Subsurface testing of PAD required. Followed by salvage if necessary. Methodology to be the same as in Stages, 1, 2 and 3.
Area to North of Rail Siding								
Transect	**ATU**	**Area Surveyed**	**Ground Surface % Visibility General**	**Areas of Exposure/ %visibility**	**Prior Disturbance**	**Sites/PADs Located**	**Plates**	**Management Option**
1	6BP Gentle Slope/Bindook Porphyry	40780	5 % Total area of visibility = 2039 m^2	2 x 1 (100%) = 2 m^2 4 x 4 (100%) = 16 m^2 1 x 1 (100%) = 1 m^2 4 x 2 (50%) = 4 m^2 15 x 3 (100%) = 45m^2 0.5 x 300 (100%) = 150m^2 Total = 218 m^2	Clearing, grazing, very hummocky. Slopewash and scouring on slope. A2 to base of A2 exposed in scours. Cattle camps under few remnant trees – lots of scuffage.	No sites/PADS located.	**19, 20**	No specific management options required.

PLATE 1
MRN15 - access track constructed on geotextile facing E

PLATE 2
Transect 1 Joarimin Creek crossing to north of MRN15.
Showing culvert and road constructed on geotextile

PLATE 3
Transect 2 mid to upper slope facing WNW

PLATE 4
Transect 2 looking downslope to Joarimin Creek facing ESE

PLATE 5
Transect 3 looking towards spur crest - facing SW

PLATE 6
Transect 3 looking towards spur crest facing NE

PLATE 7
Transect 4 looking across to next spur crest - facing NE

PLATE 8
Transect 5 spur crest facing WSW

PLATE 9
Transect 6 looking across to next spur crest - facing WNW

PLATE 10
Transect 7 spur crest facing WNW -
note piles of rock rubble that have been ripped and rock picked

PLATE 11
Transect 7 showing Peg 3 from this point to NNW road to be constructed on geotextile

PLATE 12
Transect 7 and 8 across nose of second spur crest and downslope - facing NNW

PLATE 13
Transect 8 lower slope above upper tributary of Joarimin Creek - facing NNW

PLATE 14
Transect 9 downslope to Joarimin Creek crossing - facing NNW

PLATE 15
Transect 9 Joarimin Creek crossing - two culverts will be required at this location - facing W

PLATE 16
Transect 1 Proposed Railway Siding location facing NE

PLATE 17
Transect 1 Proposed Railway Siding location central section facing NE

PLATE 18
Transect 1 Proposed Railway Siding - NE end of area not covered by existing s.8790 AHIP

PLATE 19
Area N of Proposed Rail Siding - facing SE - area proposed for subsurface testing to right of vehicle and nearer the creekline

PLATE 20
Proposed Railway Siding - slightly elevated area proposed for subsurface testing

PLATE 21
Area N of Proposed Rail Siding - facing S

PLATE 22
Part PAD2 Area facing west towards North Marulan Zone Substation and MRN54 site

PLATE 23
PAD3 Area facing north-west towards Joarimin Creek

5.2.2 Effective Coverage

Table 5.2 provides data in relation to the effective coverage of the survey. Effective coverage is a general estimate of the actual ground surface visible at the time of the survey (i.e. ground surface exposed to a level where archaeological material should be evident if present).

Table 5.2 – Effective Coverage – Lynwood Quarry Modifications Survey

Transect	ATU	Total Area of ATU Surveyed (m^2)	General Ground surface visibility %	General Ground Surface Visibility (m^2)	Area of Additional Exposure	Total Area available for detection (m^2)	% of ATU available for site detection
Access Track 1	R6BP	1400	0	0	0	0	0
Access Track 2	6BP	8680	10	868	54	922	12.5
Access Track 3	4BP	6640	20	1328	230	1558	23.4
Access Track 4	6BP	2400	20	480	61.1	541.1	22.5
Access Track 5	4BP	7520	25	1880	188	2068	27.5
Access Track 6	6BP	7760	2	155.2	215	370.2	4.8
Access Track 7	4BP	10425	5	521.3	79.2	600.5	5.7
Access Track 8	6BP	850	10	85	179.1	264.1	31
Access Track 9	R6BP	1125	5	56.25	2	58.25	5.1
Railway Siding 1	R6BP	24500	5	1225	1376	2601	10.6
North of Railway Siding	6BP	40780	5	2039	218	2257	5.5
Total		**112080**		**8637.75**	**2602.4**	**11240.15**	**10**

Table 5.2 indicates that of 112,080 m^2 surveyed ground surface visibility conducive to exposing archaeological material was only present for 11,240.15 m^2. Therefore, the overall effective survey coverage was 10% which is relatively low. Visibility was, however, highly variable ranging from 0% to 31%. Therefore, where ground surface visibility was low (e.g. Transect 1, 6, 7, 9 and the Area North of the Railway Siding), the management recommendations relied heavily on the predictive model (refer to **Section 4**) which in turn was based on an understanding of the subsurface potential of the ATUs obtained through the Stage 1 and Stage 2 subsurface testing program (refer to **Appendix E**).

5.2.3 Potential Archaeological Deposit

The detection and identification of archaeological material is closely related to levels of exposure and visibility, that is, archaeological material that is obscured by vegetation or is beneath the ground surface will not be recorded during an archaeological survey. For the purposes of archaeological assessment and cultural heritage management, the likelihood that artefacts may be present below the ground surface has important archaeological and legislative implications for any proposed development impact. In terms of the archaeological assessment, it is also necessary to consider whether areas with subsurface archaeological material should be identified as potential archaeological deposit.

The term 'potential archaeological deposit' (PAD) can be defined in a number of different ways. However, the primary archaeological importance of subsurface deposits is the possibility that they will provide information that can be used to interpret changes in the archaeological record through time and space. Consequently, for the purposes of this assessment, an ATU or area within an ATU will only be designated as a PAD if it meets one or more of the following criteria:

1. it should be likely that the PAD will contain sufficient archaeological material to allow for statistically viable detailed analysis and comparison of the artefact assemblage both within and between sites; and/or

2. the PAD should not have been significantly disturbed and should retain a degree of archaeological integrity; and/or

3. it is predicted that the PAD may contain materials that can be dated, either in relative or absolute terms.

Table 5.1 identifies five areas assessed as having the likelihood of retaining PAD. These areas are highlighted on **Figure 5.3**. The areas have been identified as PADs as it is assessed that they have:

- the potential to contain sufficient archaeological material to allow for statistically viable detailed analysis and comparison of the artefact assemblage both within and between sites; and

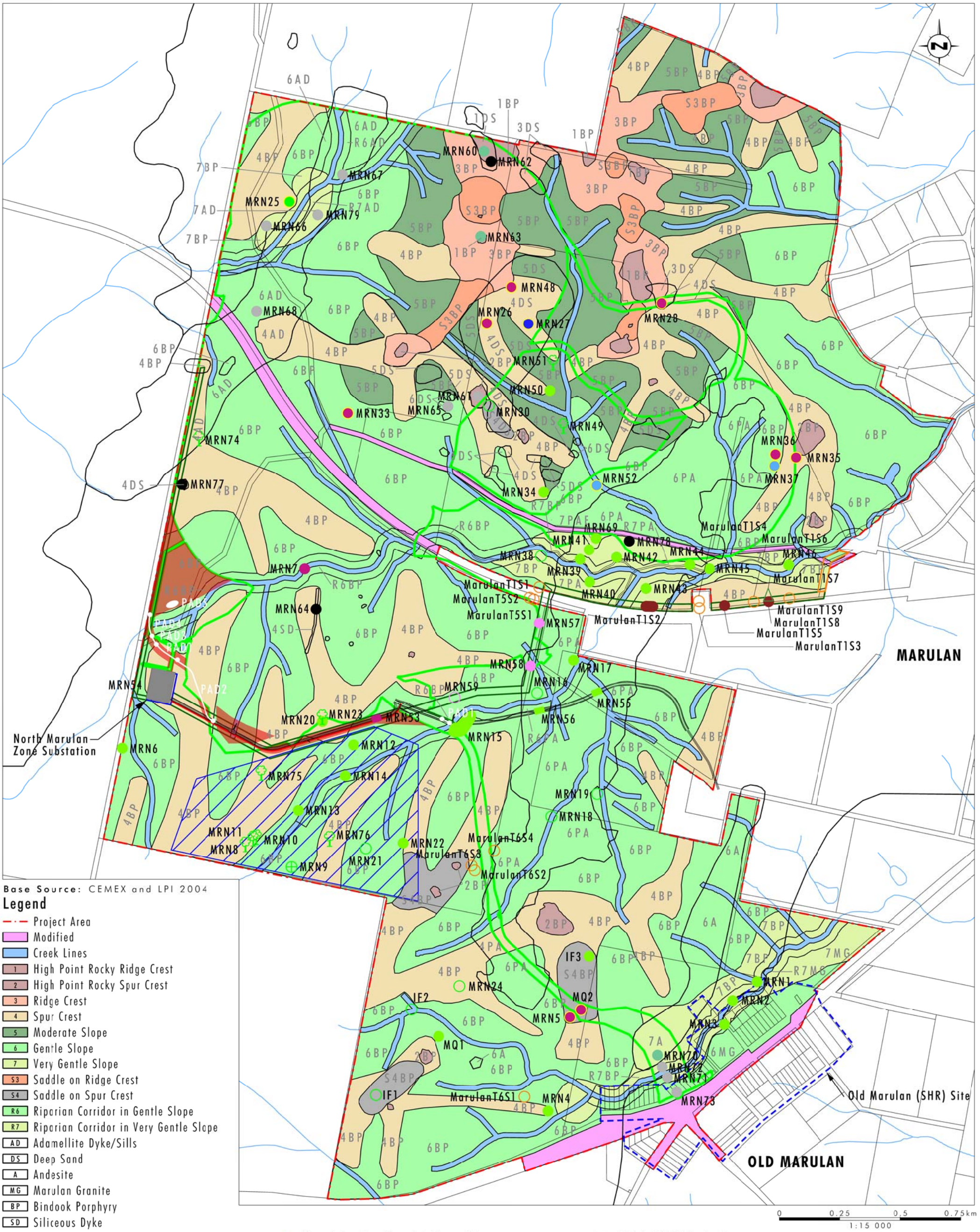
- that they may retain some areas of spatial integrity (based on the results of prior subsurface investigations (refer to **Appendix E**).

5.3 PAD Descriptions

The areas assessed as PADs identified during the survey are indicated on **Figure 5.3**. The PADs have been numbered 1 to 5 in the order they were recorded during the survey. Note that only the area proposed for impact is shown as PAD, rather than the full extent of the PAD.

5.3.1 PAD1 ATU R6BP

PAD1 incorporates the area of riparian corridor to the north of a tributary of Joarimin Creek (refer to **Plate 2**). The area has been totally cleared and is heavily grassed. No surface artefacts were exposed in this area. The PAD is identified as extending from 5 metres north of the current creek bank (the area beside the creek bank is recent alluvial deposit) to 50 metres north of the creek bank. It is assessed that the PAD area extends to the east and



Base Source: CEMEX and LPI 2004

Legend

- Project Area
- Modified
- Creek Lines
- 1 High Point Rocky Ridge Crest
- 2 High Point Rocky Spur Crest
- 3 Ridge Crest
- 4 Spur Crest
- 5 Moderate Slope
- 6 Gentle Slope
- 7 Very Gentle Slope
- S3 Saddle on Ridge Crest
- S4 Saddle on Spur Crest
- R6 Riparian Corridor in Gentle Slope
- R7 Riparian Corridor in Very Gentle Slope
- AD Adamellite Dyke/Sills
- DS Deep Sand
- A Andesite
- MG Marulan Granite
- BP Bindook Porphyry
- SD Siliceous Dyke
- PA Porphyritic Adamellite
- AD Adamellite Dyke
- PAE Elevated Area within Gentle Slope
- Stage 1 Construction Access Road to Substation
- Approved Underground Transmission Line
- Approved Transmission Line Easement
- Stage 1 Post Hole Monitoring Area
- 30 Year Approved Footprint/s.87/90 AHIP area
- Modified Disturbance Footprint
- Cultural Heritage Management Zone

- Sites Subsurface Tested in Stage 2A
- Artefact Scatter s87/90 Collection/Monitoring
- Artefact Scatter salvaged during Stage 1A
- Isolated Find salvaged during Stage 1A
- Artefact Scatter (CE) Conservation
- Artefact Scatter Located During Stage 2B s87/90 No Further Subsurface Salvage
- Isolated Find Located During Stage 2B s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 Further Subsurface Salvage
- Isolated Find s87/90 No Further Subsurface Salvage
- Isolated Find (CE) Conservation
- Artefact Scatter located during Stage 2B Surface Collection only
- Isolated Find (CE) Conservation
- Grinding Stone (CE) Conservation
- Stone Arrangement Conservation
- Scarred Tree Conservation
- Isolated Find s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 No Further Subsurface Salvage

FIGURE 5.3

Areas of Potential Archaeological Deposit

File Name (A3): R21_V1/2238_273.dgn

west along the riparian corridor in this general area, however, only the area to be impacted by the modified access road was assessed. One of the major determinants of this area being assessed as PAD is its proximity to the MRN15 site which has artefacts in a surface and subsurface context and the likelihood that the creekline in this area retained semi-permanent water in a chain of ponds context (refer to **Figure 5.3** and **Appendix E**).

5.3.2 PAD2 ATU 4BP

PAD2 incorporates an area of two adjoining spur crests encircled to the south west and north by a tributary of Joarimin Creek. The area to be impacted by the access road and underground trenches for the modification is to the east and north of the known extent of the MRN54 site (i.e. the area currently subject to disturbance by the construction of the NMZS) (refer to **Plate 22**). The area has been totally cleared and is heavily grassed. No surface artefacts were exposed in this area. The PAD is identified as extending along the whole of the survey transect in this area and is assessed as incorporating the extremities of the MRN54 site (the NMZS location) which had few surface artefacts but over 1300 subsurface artefacts (refer to **Appendix E**). It is predicted that subsurface artefact numbers will be relatively low in the eastern and northern extremities of the proposed modified impact areas (access road and underground trenches) and higher in proximity to the known extent of the MRN54 site (refer to **Figure 5.2**).

5.3.3 PAD3 ATU 6BP

PAD3 incorporates an area of gentle slope to the north of the MRN54 site and PAD2 and to the south and east of a tributary of Joarimin Creek. PAD3 is the northerly extension of PAD2 and has only been identified separately as it is a different ATU (refer to **Plate 12**). The area has been totally cleared and is heavily grassed. No surface artefacts were exposed in this area. The PAD is identified as extending along the whole of the survey transect in this area and is assessed as incorporating the extremities of the MRN54 site (the NMZS location) which had few surface artefacts but over 1300 subsurface artefacts (refer to **Appendix E**). It is predicted that subsurface artefact numbers will be relatively low in this area compared to the area of MRN54 exposed by the construction of the NMZS (refer to **Plate 22** and **Figure 5.2**).

5.3.4 PAD4 ATU R6BP

PAD4 incorporates an area of gentle slope in the riparian corridor to the north of the MRN54 site and PAD 2 and PAD3 and to the south and east of a tributary of Joarimin Creek. PAD4 is the northerly extension of PAD2 and PAD3 and has only been identified separately as it is a different ATU (refer to **Plate 14**). The area has been totally cleared and is heavily grassed. No surface artefacts were exposed in this area. The PAD is identified as extending along the whole of the survey transect in this area and is assessed as incorporating the extremities of the MRN54 site (the NMZS location) which had few surface artefacts but over 1300 subsurface artefacts (refer to **Appendix E**). It is predicted that subsurface artefact numbers will be relatively low in this area compared to the area of MRN54 exposed by the construction of the NMZS (refer to **Plate 22** and **Figure 5.2**).

PAD4 ends approximately 10 metres before it reaches the tributary of Joarimin Creek. It does not continue to the creek bank as the creek line has multiple mobile channels in this area which migrate across the valley floor (refer to **Plate 23**). The riparian corridor on the northern side of the creekline is lower lying and of gentler gradient but has been subject to scouring during high water flows and substantial bioturbation due to cattle trampling when wet and boggy. The riparian corridor on the northern side of the creekline was not assessed

as PAD in the area crossed by the proposed access road and underground feeder for the modification.

5.3.5 PAD5 ATU R6BP

PAD5 is a small area of elevated terrace within the riparian corridor on the northern side of tributary of Joarimin Creek and within the area proposed for impact by the construction of the rail siding (refer to **Plate 19**). PAD5 is at the base of the footslope and between the footslope and the creekline. In this area the creekline has been prevented from migrating by rock outcropping along a small section of the creek bank. Behind and to the north of the outcropping rock there is an area approximately 50 metres by 50 metres that has not been scoured and as it is better drained has not been as badly affected by cattle trampling as the majority of the riparian corridor along the northern bank of the tributary. It is possible that this area has retained a relatively intact soil profile, though it is unlikely that this soil profile will retain stratigraphic integrity due to land clearance and grazing, it is possible that some spatial integrity may remain.

The tributary of Joarimin Creek currently contains a fairly deeply entrenched chain of ponds in this area. Prior to European land clearance it is assessed that the creekline would have been a fairly broad, grassy waterway and that it is likely that a chain of ponds was present near the elevated terrace. This suggestion is supported by the location of a relatively large number of artefacts in the nearby MRN54 site. PAD5 does not extend throughout the riparian corridor ATU on the northern side of the tributary as this area has been heavily scoured (evidenced by the few remaining stumps and trees standing on pedestals of remnant soil with most of their roots exposed) and subject to cattle trampling when wet and boggy (refer to **Plate 17**).

6.0 Current Lynwood Quarry Aboriginal Cultural Heritage and Archaeological Management Strategy

An important aspect of the management of Aboriginal archaeological sites and ATUs within the Lynwood Quarry Project Area is the conservation of a representative sample of site types (and resources) within the various ATUs present in the project area. **Table 6.1** sets out those sites and ATUs within the Lynwood Quarry project area that:

- will not be impacted by the approved or proposed modified disturbance footprint;
- will be impacted/partially impacted by the approved or proposed modified disturbance footprint;
- will be managed *in-situ* for their conservation throughout the 30 year life of the quarry; or
- will be conserved long-term within a CHMZ.

Table 6.1 – Impact, Conservation and Management Outcomes

ATU	ATU Impacted/Partially Impacted	Known Sites Impacted	To be Conserved *In-situ*	To be Conserved in CHMZ
1DS	Partial impact	MRN60 (IF)	N/A	N/A
1BP	Partial impact	MRN63 (IF)	N/A	N/A
2BP	Partial impact	MRN61 (AS)	N/A	N/A
3DS	Partial impact	MRN62 (AS)	N/A	N/A
3BP	Partial impact	N/A	N/A	N/A
S3BP	Partial impact	N/A	N/A	N/A
4DS	Partial impact	MRN26(IF) MRN27(AS) MRN28(AS) MRN48(AS)	N/A	N/A
4BP	Partial impact	MRN35(IF) MRN54(AS) MRN77 (AS)	Marulan T1 S3 (AS) Marulan T1 S4 (IF) Marulan T1 S5 (AS) Marulan T1 S6 (IF) Marulan T1 S7 (G) Marulan T1 S8 (AS) Marulan T1 S9 (IF) MRN4 (AS) MRN20 (AS) MRN23 (ST) MRN24 (IF) MRN25(AS) MRN34 (AS) MRN50 (AS) MRN74 (ST)	MRN8 (ST) MRN10 (ST) MRN11 (ST) MRN22 (AS) MRN75 (ST) MRN76 (ST)
4AD	Partial impact	N/A	N/A	N/A
4PA	Partial impact	N/A	Marulan T1 S2 (AS)	N/A
4SD	Total impact	MRN64 (AS)	N/A	N/A
S4DS	Not impacted	N/A	MRN30 (IF)	N/A

Table 6.1 – Impact, Conservation and Management Outcomes (cont)

ATU	ATU Impacted/Partially Impacted	Known Sites Impacted	Known Sites to be Conserved *In-situ*	Known Sites to be Conserved in CHMZ
S4BP	Partial impact	MRN5/MQ2 (AS)	IF1 (IF) IF3 (IF)	N/A
5DS	Partial impact	N/A	N/A	N/A
5BP	Partial impact	N/A	MRN49 (ST) MRN51 (ST)	N/A
6DS	Partial impact	MRN65 (AS)	N/A	N/A
6AD	Partial impact	MRN68 (AS)	N/A	N/A
6BP	Partial impact	MRN33(AS) MRN36(AS) MRN37(IF) MRN52(IF) MRN53(AS) MRN57(AS) MRN58(AS) MRN59(IF)	Marulan T1 S1 (IF) Marulan T5 S1 (IF) Marulan T5 S2 (IF) Marulan T6 S1 (IF) Marulan T6 S2 (IF) Marulan T6 S3 (IF) Marulan T6 S4 (IF) IF2 (IF) MQ1 (AS) MRN6 (AS) MRN19 (IF)	MRN9 (SA) MRN12 (AS) MRN21 (IF)
6PA	Partial impact	N/A	MRN18 (IF) MRN55(AS)	N/A
6MG	Partial impact	MRN73 (AS)	N/A	N/A
6A	Minor impact	N/A	N/A	N/A
7BP	Minor impact	MRN66(AS)	N/A	N/A
7PA	Minor Impact	MRN78(AS)	MRN41 (AS) MRN42 (AS) MRN43 (AS)	N/A
7PAE	Not Impacted	N/A	MRN69 (AS)	N/A
7MG	Not impacted	N/A	N/A	N/A
7A	Minor impact	MRN70 (AS)	N/A	N/A
7AD	Total Impact	MRN79 (AS)	N/A	N/A
R6AD	Total impact	MRN67 (AS)	N/A	N/A
R7AD	Total impact	N/A	N/A	N/A
R7MG	Minor impact	MRN71 (AS)	MRN2 (AS) MRN3 (AS)	N/A
R6PA	Minor impact	N/A	MRN16 (IF) MRN17 (AS) MRN56 (AS)	N/A
R7PA	Not impacted	N/A	MRN39 (AS) MRN40 (AS) MRN44 (AS)	N/A
R6BP	Minor impact	MRN7 (AS)	MRN15 (AS)	MRN13 (AS) MRN14 (AS
R7BP	Minor impact	MRN72 (AS)	MRN38 (IF) MRN1 (AS) MRN45 (AS) MRN46 (AS)	N/A

Table 6.1 – Impact, Conservation and Management Outcomes (cont)

ATU	ATU Impacted/Partially Impacted	Known Sites Impacted	Known Sites to be Conserved *In-situ*	Known Sites to be Conserved in CHMZ
Total **34 ATUs** **94 sites**	**3 not impacted** **7 minor impact** **19 partial impact** **4 total impact**	7 Isolated Finds 25 Artefact Scatters **Total 32**	19 Isolated Finds 27 Artefact Scatters 1 In-situ Boulder used as Grindstone 4 Scarred Trees **Total 51**	1 Isolated Find 4 Artefact Scatters 1 Stone Arrangement 5 Scarred Trees **Total 11**

Key: IF = Isolated Find SA = Stone Arrangement AS = Artefact Scatter ST = Scarred Tree
G = In-situ boulder used as grindstone

Figure 5.1 indicates the ATUs overlain with the disturbance footprint including the areas to be impacted/partially impacted by works associated with the Country Energy Marulan Electricity Supply Upgrade, the approved disturbance footprint and the footprint associated with the proposed modification. From **Table 6.1** and **Figure 5.1** it can be noted that of the 34 ATUs identified within the project area:

- 4 (4SD, R6AD, R7AD, 7AD) will be impacted in total or will have only small areas remaining in association with active quarrying and infrastructure[10];
- 18 will be partially impacted (i.e. only parts of the ATU will be impacted and/or at least one similar ATU will be conserved outside the disturbance footprint and within the broader project area and/or the CHMZ);
- 8 will be subject to only minor impact (i.e. part of an ATU is crossed by a road or is peripheral to an impact area and other similar ATUs fall outside the disturbance footprint); and
- 4 will not be impacted (S4DS, 7MG, R7PA, R7PAE).

From **Figure 5.1** it can be seen that the ATUs proposed for impact by the modification (6BP, R6BP and 4BP) will have a representative sample set aside for long term conservation within the CHMZ and also being managed for their *in-situ* management outside the disturbance footprint for the 30 year life of the quarry.

Figure 5.1 also indicates the known sites overlain with the disturbance footprint including the areas associated with the Country Energy Marulan Electricity Supply Upgrade, the approved disturbance footprint and the proposed modification. From **Table 6.1** and **Figure 5.1** it can be noted that of the 94 known sites within the project area:

- 32 will be impacted by the currently approved Lynwood Quarry disturbance footprint including works associated with the Country Energy infrastructure related to the Marulan Electricity Supply Upgrade;

[10] In relation to the three ATUs that will be totally or almost totally impacted, it should be noted that they only occur as restricted areas within the Project Area and that these ATUs do re-occur outside the Project Area.

- 51 sites will be conserved *in-situ* and managed for conservation during the 30 year life of the quarry; and

- 11 sites will be conserved in perpetuity within the CHMZ.

There are currently no known sites within the specific ATUs proposed for impact by the modification.

Table 6.1 indicates for ATU 6BP that eight sites are proposed for impact and 14 for conservation; for ATU R6BP that one site is proposed for impact and three for conservation; for ATU 4BP that three sites are proposed for impact and 21 for conservation. In terms of site types **Table 6.1** indicates that a greater number of site types (isolated finds, artefact scatters, *in-situ* boulder used for grinding, scarred trees and stone arrangement) are being conserved within ATUs 6BP, R6BP and 4BP than are being impacted (isolated finds and artefact scatters). Thus it can be assessed that a more than representative sample of site types is being conserved.

There have, however, been five PADs identified. If all five PADs do contain artefact scatters (ie. are sites) that will be impacted by the modification this will mean for ATU R6BP that there will be more sites being impacted than conserved. This will not be the case for ATUs 6BP and 4BP which will still retain more sites/site types in conservation than being impacted. This outcome will be taken into account when discussing management options and preparing the management strategy for the ATUs proposed for impact by the modification.

7.0 Significance Assessment

Cultural heritage significance is a measure of the relative value or importance of heritage sites. Significance is assessed according to principles outlined originally in Australia in the Burra Charter (1979), which was adapted from the UNESCO sponsored ICOMOS (International Council for Monuments and Sites) Venice Charter. The assessment of significance assists in the determination of appropriate cultural heritage management procedures for Aboriginal archaeological sites/artefacts that may be threatened by development activities. Assessing the significance of Aboriginal archaeological sites is an extremely complicated process that must take into account the interests of many parties.

The Burra Charter defines cultural significance as the 'aesthetic, historic, scientific or social value for past, present or future generations' of a place. The NSW NPWS (1997 – now part of the DECCW) provides further discussion on the assessment of cultural significance for Aboriginal archaeological sites. Categories of significance relevant to Aboriginal archaeological sites include Aboriginal significance, archaeological/scientific significance, aesthetic significance, tourism potential and educational significance. *The NSW NPWS Guidelines for Archaeological Report Writing* (1997: 25) states:

> While Aboriginal sites and places may have educational, tourism, and other values to groups in society their principle values are likely to be in terms of their cultural/social significance to Aboriginal people and their scientific significance to archaeologists. It is thus possible to identify two main streams in the overall significance assessment process: the assessment of cultural/social significance to Aboriginal people and the assessment of scientific significance to archaeologists.

As no Aboriginal archaeological sites were located during the survey the significance assessment will be related to the Aboriginal cultural significance and archaeological significance of the ATUs surveyed and the areas identified as PADs within the area proposed for modification. The criteria for assessing each type of 'significance' will be detailed in the sections to follow.

7.1 Aboriginal Cultural Significance of the ATUs

Aboriginal cultural significance can only be assessed by Aboriginal Peoples and often varies from that of archaeological significance. Throughout the history of the Lynwood Quarry Project Area survey, assessment and subsurface investigations it has been made clear by the GAHAI, GTCAC, PLALC and PFC that the entire Project Area and its surrounds are of traditional, historic and contemporary cultural significance to the Gundungurra Peoples and the Aboriginal Peoples that have associations with Gundungurra Country (refer to the **Aboriginal Cultural Significance Statements** in the preface of this report).

The division of the landscape into ATUs for significance assessment was not thought very meaningful in terms of Aboriginal cultural heritage significance by the representatives of GAHAI, GTCAC, PFC and PLALC participating in the Stage 1 and Stage 2 subsurface testing programs (Umwelt 2008f). It was the preference of the Registered Aboriginal Parties to assess Aboriginal cultural heritage significance based on the individual site and how each site would have been used by Aboriginal people as they hunted and gathered across the broader landscape. Thus the assessment of the ATUs in 2008 could not be divorced from the assessment of the sites and still remain appropriate from an Aboriginal cultural perspective. It was concluded that all ATUs had cultural significance, but their level of significance was assessed as higher if the specific ATU had sites with larger assemblages or that were perceived to have an association with a ceremonial site/area (Umwelt 2008f).

In relation to the ATUs proposed for impact by the modification the following comments were provided by the Registered Aboriginal Parties.

7.1.1 Gundungurra Aboriginal Heritage Association Inc.

This section of the report will be completed based on GAHAI's comments on the draft report.

7.1.2 Gundungurra Tribal Council Aboriginal Corporation

This section of the report will be completed based on GTCAC's comments on the draft report.

7.1.3 Pejar Local Aboriginal Land Council

This section of the report will be completed based on PLALC's comments on the draft report.

7.1.4 Peter Falk Consultancy

This section of the report will be completed based on PFC's comments on the draft report.

7.1.5 Summary of Aboriginal Cultural Significance

Table 7.1 summarises the Aboriginal cultural significance assessment of the ATUs within the areas proposed for impact by the modification. The information within the table was supplied as verbal comments by GAHAI, GTCAC and PLALC representatives in the field on 6 July 2010.

PFC's comments will be provided following review of the draft report.

The comments in the following table may require revision based on further comment on the draft report by the broader group membership.

Table 7.1 – Aboriginal Cultural ATU Significance

ATU	Aboriginal Cultural Significance	Comments
6BP Gentle slope in Bindook Porphyry	GAHAI – low to moderate significance GTCAC – low to moderate significance PLALC -– low to moderate significance *PFC – to be provided following review of the draft report*	Sharyn Halls, Tom Brown and Justin Boney were in agreement that this ATU was variable in its cultural significance. Most of the area surveyed within this ATU was assessed as unlikely to have significant numbers of artefacts buried under the surface and most of this ATU was very badly disturbed and eroded. The one area that was assessed as having moderate significance is the area of ATU 6BP immediately to the north of the NMZS and the MRN54 site. Based on the large number of artefacts recovered from MRN54 it was thought that this section of ATU6BP had a moderate likelihood of having a moderate number of artefacts buried in the area.
R6BP Very gentle slope in riparian corridor in Bindook Porphyry	GAHAI – very high significance GTCAC – very high significance PLALC -– very high significance *PFC – to be provided following review of the draft report*	Sharyn Halls, Tom Brown and Justin Boney were in agreement that this ATU was highly likely to have been used by Aboriginal people in the past and that based on the results of subsurface testing in the area of the MRN15 site that it was highly likely that there would be artefacts buried in all of the areas of R6BP with the exception of the badly eroded area associated with the north-eastern end of the rail siding survey area and to the north of Joarimin Creek.

Table 7.1 – Aboriginal Cultural ATU Significance (cont)

ATU	Aboriginal Cultural Significance	Comments
4BP Spur crest in Bindook Porphyry	GAHAI – low to extremely high significance GTCAC – low to extremely high significance PLALC -– low to extremely high significance *PFC – to be provided following review of the draft report*	Sharyn Halls, Tom Brown and Justin Boney were in agreement that this ATU was variable in its cultural significance. Most areas of this ATU surveyed were assessed as having low potential for buried artefacts as they were eroded, disturbed, had pretty good visibility and no artefacts. However Sharyn Halls, Tom Brown and Justin Boney all felt that the western-most area of ATU 4BP surveyed for the access road and underground electricity feeder had an extremely high likelihood to have a moderate number of buried artefacts. This assessment was based on the number of artefacts salvaged from the MRN54 site.

7.2 Archaeological Significance

As no Aboriginal archaeological sites were located during the survey of the areas proposed for impact by the modification the archaeological significance assessment will be based on the ATUs and the PADs identified during the survey. The ATUs have been previously assessed for their significance based on the outcomes of the surface survey and subsurface testing of Aboriginal archaeological sites and ATUs (Umwelt 2008f). The significance assessment for ATU 4BP has subsequently been revised based on the outcomes of the monitoring of works in the NMZS area under Country Energy s.87/90 AHIP (#1089392) (Umwelt in prep. – refer to **Appendix E**).

The Umwelt (2008f) ATU significance assessment was based on the archaeological significance of the known sites within each of the ATUs. The archaeological significance was assessed according to the value each site had to contribute to furthering the archaeological/scientific understanding of Aboriginal use of the landscape (their archaeological research potential). Six criteria were assessed for each site to deduce its archaeological research potential from a local and regional perspective. These criteria were:

- rarity;
- representativeness;
- integrity;
- connectedness;
- complexity; and
- potential for archaeological deposit.

7.2.1 Ranking of Criteria for Evaluating Archaeological Significance

Table 7.2 indicates how the sites within the Project Area were evaluated in relation to each of the six criteria to assess their overall archaeological research potential. The sites were afforded a numerical value for each significance criterion so that an overall significance assessment could be quantified. The values for each criterion were scored as follows:

- low significance was afforded a score of 1;
- moderate significance was afforded a score of 2; and
- high significance was afforded a score of 3.

Overall significance was scored as follows:

- low significance 12-15;
- low to moderate significance 16-19;
- moderate significance 20-23;
- moderate to high significance 24-27; and
- high significance 27+.

If a site was assessed to have low local significance (when compared to other sites known locally) for any criterion then this aspect of the site was also deemed to be low at the regional level. If, however, the site was assessed as having moderate or high archaeological significance on a local scale, it was then assessed against other sites known from the literature in the broader region. In most cases this resulted in the site having lower significance on a regional level.

For the purpose of this assessment the archaeological significance of the known sites will be used to assess archaeological significance of the ATUs.

Table 7.2 – Criteria Used in Evaluating Archaeological Significance

Criterion	Low (Score of 1)	Moderate (Score of 2)	High (Score of 3)
Rarity	The location of the site within the landscape, its type, integrity, contents and/or potential for subsurface artefacts, are common within the local and regional context.	The location of the site within the landscape, its type, integrity, contents and/or potential for subsurface artefacts, are common within the regional context but not the local context.	The location of the site within the landscape, its type, integrity, contents and/or potential for subsurface artefacts, are rare within the local and regional context.
Representativeness	This site, when viewed in relation to its type, contents, integrity and location in the landscape, is common within a local and regional context and sites of similar nature (or in better condition) are already set aside for conservation within the region.	This site, when viewed in relation to its type, contents, integrity and location in the landscape, is uncommon within a local context but common in a regional context and sites of similar nature (or in better condition) are already set aside for conservation within the region.	This site, when viewed in relation to its type, contents, integrity and location in the landscape, is uncommon within a local and regional context and sites of similar nature (or in better condition) are not already set aside for conservation within the locality or region.
Integrity	Stratigraphic integrity of the site has clearly been destroyed due to major disturbance/loss of topsoil. The level of disturbance is likely to have removed all spatial and stratigraphic integrity (and thus any ability to supply information related to the chronology of use of the site).	The site appears to have been subject to moderate levels of disturbance, however, there is a moderate possibility that useful spatial information can still be obtained from subsurface investigation of the site, even if it is unlikely that any stratigraphic integrity survives (and thus any ability to supply information related to the chronology of use of the site).	The site appears relatively undisturbed and there is a high possibility that useful spatial information can still be obtained from subsurface investigation of the site, even if it is still unlikely that any useful chronological evidence survives (and thus any ability to supply information related to the chronology of use of the site). (In cases where both spatial and chronological evidence is likely to survive the site will gain additional significance from high scores for rarity and representativeness if there are no similar sites known outside the impact area).

Table 7.2 – Criteria Used in Evaluating Archaeological Significance (cont)

Criterion	Low (Score of 1)	Moderate (Score of 2)	High (Score of 3)
Connectedness	There is no evidence to suggest that the site is connected to other sites in the local area or the region through: • their chronology (rarely known); • their site type (e.g. connectedness could be argued between an axe quarry, a nearby set of axe grinding grooves and an adjacent site exhibiting evidence of axe reduction); • by the use of an unusual raw material, knapping technique/reduction strategy; • similar designs/motifs in the case of art sites and engravings; and/or • information provided by Aboriginal oral history.	There is some evidence to suggest that the site is connected to other sites in the local area or the region through: • their chronology (rarely known); • their site type (e.g. connectedness could be argued between an axe quarry, a nearby set of axe grinding grooves and an adjacent site exhibiting evidence of axe reduction); • by the use of an unusual raw material, knapping technique/reduction strategy; • similar designs/motifs in the case of art sites and engravings; and/or • information provided by Aboriginal oral history.	There is good evidence to support the theory that the site is connected to other sites in the local area or the region through: • their chronology (rarely known); • their site type (e.g. connectedness could be argued between an axe quarry, a nearby set of axe grinding grooves and an adjacent site exhibiting evidence of axe reduction); • by the use of an unusual raw material, knapping technique/reduction strategy; • similar designs/motifs in the case of art sites and engravings; and/or • information provided by Aboriginal oral history.
Complexity	The site does not exhibit and is not predicted to contain either of the following in a subsurface context: • a complex assemblage of stone artefacts in terms of artefact types and/or raw materials (including use of local and imported raw materials) and/or knapping techniques/reduction strategies; and/or • features such as hearths or heat treatment pits, activity areas.	The site exhibits or can be predicted to contain one of the following in a subsurface context: • a complex assemblage of stone artefacts in terms of artefact types and/or raw materials and/or knapping techniques/reduction strategies and/or use of local and imported raw materials; and/or • features such as hearths or heat treatment pits, activity areas.	The site exhibits or can be predicted to contain both of the following in a subsurface context: • a complex assemblage of stone artefacts in terms of artefact types and/or raw materials and/or knapping techniques/reduction strategies and/or use of local and imported raw materials; and • features such as hearths or heat treatment pits, activity areas.

Table 7.2 – Criteria used in Evaluating Archaeological Significance (cont)

Criterion	Low (Score of 1)	Moderate (Score of 2)	High (Score of 3)
PAD	The site does not have or has only a low potential to contain subsurface archaeological material that has stratigraphic integrity or is of a nature that suggests its subsurface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.	The site has a moderate potential to contain subsurface archaeological material that has stratigraphic integrity or is of a nature that its subsurface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.	The site has a high potential to contain subsurface archaeological material that has stratigraphic integrity or is of a nature that its subsurface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.

7.3 Archaeological Significance of the Archaeological Terrain Units

The archaeological significance of the ATUs was assessed in 2008 according to their research potential and thus their known/predicted capacity to have sites that could contain evidence which by its study could add to the current understanding of the nature and chronology of the Aboriginal use of the landscape within the Lynwood Quarry disturbance footprint (Umwelt 2008f).

Due to the long history of disturbance from European land-use of this area, high bioturbation levels and the extremely erodible nature of the sandy soils, it was assessed that there was very limited opportunity for there to be ATUs where there might be substantive areas that retained archaeological research potential. The results of the subsurface testing of the ATUs indicated there was a possibility that very small areas within some ATU testing locations (dependant on the levels of past disturbance and erosion) did retain some spatial integrity while other parts of the same ATU within the same testing area lacked any integrity. Of the ATUs subsurface tested that did retain some spatial integrity, only three ATUs also indicated they had the potential to contain a sufficiently complex assemblage to warrant further investigation (4BP, 4DS, 7PAE). Results of the Stage 1 and Stage 2 subsurface testing indicated that it was unlikely that datable material would be located and thus that chronological sequences of use could be established. Subsequent manual excavation in ATU 4BP and ATU 4DS has supported this hypothesis (Umwelt in prep.).

Based on the results of the subsurface investigations of the ATUs and the subsurface investigations of sites within those ATUs it was concluded that it was not possible to provide universal assessments of ATU significance from an archaeological perspective. Thus, as has been done in the Aboriginal cultural heritage assessment of the ATUs, the assessment afforded to a site was extrapolated to the area of ATU in its near surrounds.

Table 7.3 provides the archaeological significance assessment for each of the ATUs within the modification area. Within the table the significance assessment is broken down into the transects as each transect represents a single ATU and each individual ATU was found to have been impacted to varying extents by agricultural practices and to have differing value as an area for a camp site that was used sufficiently by Aboriginal people to result in the discard of significant archaeological material.

Table 7.3 – Significance Assessment and Conservation Status – Archaeological Terrain Units

ATU Description	Aboriginal Significance	Archaeological Significance	Research Potential	Conservation Status
6BP – gentle slope on Bindook Porphyry	low to moderate (variable)	Transect 2 – low Transect 4 – low Transect 6 – low Transect 8 – low to moderate Area North of proposed Rail siding - low	low low low low to moderate low	ATU6BP is the most commonly occurring ATU across the project area. A relatively large area of ATU 6BP will be impacted by the Lynwood Quarry disturbance footprint, however, a larger area outside the disturbance footprint will be managed in-situ throughout the 30 year life of the quarry or conserved long-term within the CHMZ.

Table 7.3 – Significance Assessment and Conservation Status – Archaeological Terrain Units (cont)

ATU Description	Aboriginal Significance	Archaeological Significance	Research Potential	Conservation Status
R6BP – gentle slope within the riparian corridor in the Bindook Porphyry	very high except where very eroded	Transect 1 – low Transect 8 – low to moderate Railway Siding Scoured/highly disturbed areas - low Elevated terrace - moderate	low low to moderate low moderate	The majority of R6BP will be conserved within the Joarimin Creek Riparian Corridor and the broader Lynwood Quarry project area and also within the CHMZ.
4BP – spur crest in the Bindook Porphyry	low to extremely high (variable)	Transect 3 - low Transect 5 - low Transect 7 - moderate	low low moderate	ATU 4BP is the second most common ATU within the Lynwood Quarry project area. While a relatively large area of the ATU is within the disturbance footprint an even larger area outside the disturbance footprint will be managed in-situ throughout the 30 year life of the quarry or conserved long-term within the CHMZ.

In general, the ATUs within the areas proposed for impact by the modifications were assessed as having low archaeological significance and low research potential. The areas of ATUs where this was not the case are within the areas identified as PAD (refer to **Section 7.4**).

7.4 Archaeological Significance of PADs

For this assessment archaeological significance of the PADs will be ranked according to their potential to have a subsurface artefactual assemblage that through its investigation could contribute to the archaeological/scientific understanding of the Aboriginal use of the landscape (their research potential) using five of the six criterion identified for sites (rarity, representativeness, integrity, connectedness and complexity). The sixth criterion – potential for archaeological deposit – is not relevant as the areas are already assessed as being PAD.

7.4.1 Evaluation of Criteria

As there are only five criteria, rather than the six used for sites (refer to **Section 7.2.1**) the overall numerical value for archaeological significance differs for PADs.

- low significance was afforded a score of 1;
- moderate significance was afforded a score of 2; and
- high significance was afforded a score of 3.

Overall significance was scored as follows:

- low significance 10 to 13;
- low to moderate significance 14 to 17;
- moderate significance 18 to 20;
- moderate to high significance 21 to 25; and
- high significance 25+.

Local significance was ranked based on information known about the Project Area and in relation to other sites (predicted to be of the same type/within the same landform element) known from the local area and regional significance was based on a comparison with other sites known from the broader region.

From **Table 7.4** it can be seen that PAD1 was assessed as having low overall archaeological significance, PAD2, 3 and 4 as having low to moderate overall archaeological significance and PAD5 as having moderate overall archaeological significance.

PAD5 was assessed as having the highest significance as elevated terraces in the upper tributary system are rare and representative locally and only slightly less rare and representative regionally (based on current knowledge of similar landscapes). PAD2, 3 and 4 owe their slightly higher overall archaeological significance to their proximity to the MRN54 site. None of the PADs were assessed as having overall high archaeological significance due to the levels of disturbance and the nature of size of their predicted assemblages.

Table 7.4 – Archaeological Significance Assessment

Site Name	Rarity		Represent-ativeness		Archaeological Integrity		Connectedness		Complexity		Overall Archaeological Significance	
	Local	*Regional*	*Local*	*Regional*	*Local*	*Regional*	*Local*	*Regional*	*Local*	*Regional*		
ATU R6BP PAD1	2	1	2	1	1	1	1	1	2	1	13	low
ATU 4BP PAD2	3	1	3	1	2	1	1	1	2	1	16	low to moderate
ATU 6BP PAD3	3	1	3	1	1	1	1	1	2	1	15	low to moderate
ATU R6BP PAD4	3	1	3	1	1	1	1	1	2	1	15	low to moderate
ATU R6BP PAD5	3	2	3	2	2	1	1	1	2	1	18	moderate

8.0 Management Options

From an Aboriginal cultural and archaeological perspective, Aboriginal archaeological sites and PADs are a finite and irreplaceable resource that has already been heavily impacted by development in the Southern Highlands. Thus DECCW requires proposals for site/PAD damage/destruction to be accompanied by appropriate mitigation (salvage and/or management) and to be balanced by conservation offset measures. Therefore, the management options discussed within this section of the report span ATU/PAD conservation, existing conservation offsets and impact mitigation.

Within **Sections 8.1** to **8.4** mitigation and management (including protection) measures are discussed and it is proposed by Holcim that these will be implemented in compliance with the existing AHMP (Umwelt 2007d) for the Lynwood Quarry Project Area. The AHMP was prepared in consultation with the Registered Aboriginal Parties and DECCW.

The management options, discussed in **Sections 8.1** to **8.4** have been prepared taking into account the need for the project outcomes to demonstrate Intergenerational Equity. **Section 8.5** explores the concept of Intergenerational Equity and determines if the preferred management options recommended for each PAD and ATU within the areas proposed for impact by the modification can be seen to conform to the concept of Intergenerational Equity.

There are three potential management options to be considered for the ATUs and the PADs located during the survey of the modification areas. The options are:

- Conservation;
- Impact without subsurface investigation;
- Impact following subsurface investigation and subsequent salvage (where required).

Each management option will be outlined below and each option will be discussed in relation to the identified ATU/PAD, taking into account the Aboriginal cultural significance, the archaeological significance and the proposed level of impact.

It is acknowledged that Holcim has considered a number of management methodologies within its planning for the proposed modifications (refer to **Table 1.1**). This section of the report seeks to determine the preferred management outcomes from an Aboriginal cultural and archaeological perspective.

8.1 Conservation

Conservation of sites/PADs/ATUs acts to offset the overall loss of Aboriginal cultural heritage and archaeological values as the result of a proposed project. Conservation strategies are of importance in the Southern Highlands Region, where ongoing development – forestry, quarrying, agriculture, urban development and infrastructure has already resulted in a significant loss of Aboriginal archaeological sites and values. In response, remaining Aboriginal archaeological sites/PADS and the ATUs in which they occur are of ever-increasing Aboriginal cultural and archaeological value. For all sites/PADS/ATUs of Aboriginal cultural and archaeological value to be protected, this would mean that the majority of currently proposed developments would not be feasible/viable and that Intergenerational Equity would not be being practiced in relation to the contemporary community having rights to access to resources. Thus conservation as a management option is generally restricted to Aboriginal archaeological sites/PADs/ATUs of high Aboriginal cultural heritage significance/value and of moderate, moderate to high or high archaeological

significance and research potential. As Aboriginal archaeological sites/PADs/ATUs with this level of significance are rare (and becoming rarer) due to impacts by development and time, it is becoming imperative (in terms of Intergenerational Equity) that a suite of these sites/PADs in the various ATUs in which they occur are conserved for the future.

As discussed in **Section 6** and **Section 7**, Holcim has an existing conservation strategy that has been implemented in order to offset the loss of Aboriginal and archaeological values within the Lynwood Quarry Project Area that will occur under the current Project Approval This conservation management strategy was previously assessed as being adequate in terms of Intergenerational Equity (refer to **Section 8.5**). If, however, Holcim proceeds with the modification as proposed, Intergenerational Equity would not be met in terms of ATU R6BP, especially in relation to the PAD1, PAD4 and PAD5 identified within this ATU (refer to **Figure 5.3**).

In addition, although a large number of sites within large areas of ATU 6BP are being conserved, the area of ATU 6BP that falls within Transect 8 is assessed as having slightly higher Aboriginal cultural heritage and archaeological significance and research potential than those currently in conservation (refer to **Figure 5.3**). This significance is associated with the MRN54 site which it is predicted will continue into the area surrounding Transect 8.

Similarly, although a large number of sites within large areas of ATU 4BP are being conserved, the area of ATU 4BP that falls within Transect 7 is assessed as having higher Aboriginal cultural heritage and archaeological significance and research potential than the majority of those currently in conservation (refer to **Figure 5.3**). This significance is also associated with the MRN54 site which it is predicted will continue into the area surrounding Transect 7.

8.2 PAD/ATU Impact without Subsurface Investigation

This option is not thought appropriate for any of the PADs proposed for impact by the modifications; however, it is assessed as appropriate for those ATUs/areas of ATUs not identified as PADs. Previous subsurface testing of these ATUs and a detailed understanding of past disturbance regimes has informed this decision.

8.3 PAD/ATU Impact with Subsurface Investigation and Salvage (if required)

Only the PADs located within the ATUs proposed for impact by the modification are assessed as warranting subsurface testing. Conservation, however, is the preferred management outcome for the PADs. Therefore, if it is not possible for Holcim to conserve the PADs without impacting on the viability of the proposed modification, the PAD should be subsurface tested and salvaged (if warranted) using previously approved excavation methodologies for the project (Umwelt 2007c, 2008d, 2008f – refer to **Appendix F**).

8.4 Preferred Management Options

Following discussions with the Registered Aboriginal Parties the following options were assessed as appropriate from an Aboriginal cultural and archaeological perspective.

Please note that these may require revision based on further consultation with the broader membership of GAHI, GTCAC, PLALC and PFC.

- PAD1 (ATU R6BP), PAD2 (ATU 4BP), PAD3 (ATU 6BP) and PAD 4 (ATU R6BP) - within the access road corridor should be covered in geotextile and the modified access road constructed with imported fill in the same manner as across the MRN15 site – the only ground disturbance should be in relation to culverts – and all topsoil disturbed must be retained in the area for landscaping.

- PAD2 (ATU 4BP), PAD3 (ATU 6BP) and PAD 4 (ATU R6BP) - to be impacted by trench excavations related to the proposed underground electricity feeder should be monitored by Registered Aboriginal Parties and an archaeologist during topsoil removal -– and all topsoil disturbed should be spread over infilled trench (refer to **Appendix F** for details of methodology).

- PAD5 (ATU R6BP) - to be subsurface tested using the same methodology approved for all previous subsurface testing of ATUs under DECCW s.87 AHIP (#1077225) (Umwelt 2007c) – if warranted by the results of the subsurface testing further salvage will be undertaken using the same methodology as approved for prior salvage under DECCW s.87/90 AHIPs (#1100264) (refer to **Appendix F**).

- Impact without mitigation is endorsed for the remaining ATUs/sections of ATUs that are outside the areas identified as PAD.

It is noted that the preferred management outcomes, while more specific are generally in accordance with the management outcomes Holcim has included in its planning process (refer to **Table 1.1**).

8.5 Do the Management Options Proposed Address Intergenerational Equity?

Ecologically sustainable development is defined as:

> 'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs'
> http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/s3a.html

Intergenerational equity is defined as:

> The present generation should ensure the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations (http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/s3a.html)

In both cases, the focus is on the long term time scale – generations and longer into the future. The management challenge is to achieve short term objectives (i.e. meet the needs of current generations, meet current production targets, meet current State policy and planning targets), but maintain confidence that similar opportunities, resources and environmental conditions will be available for future generations to manage.

Intergenerational Equity incorporates physical (natural), social and economic aspects of the environment, as filtered through cultural perspectives. In a cultural context and for this project, Intergenerational Equity therefore requires that Gundungurra cultural assets (be they sites, artefacts, PADS, ATUs, or capacity to maintain cultural identity and attachment to place) will still be present and will maintain integrity in the future.

While landscapes and Aboriginal Peoples wants and needs change over time, a continuing theme is that Aboriginal Peoples seek to maintain a sense of identity and attachment to

places within the landscape that are known/important to them. Cultural concepts of Intergenerational Equity incorporate (but are not restricted to):

- cultural values: past, contemporary and future;
- sense of cultural identity (in this case what it means to be a Gundungurra person or an Aboriginal person who associates with Gundungurra Country);
- attachment to the Gundungurra traditional landscape;
- the connection of culture and country – the dependence of cultural continuity on a 'healthy' natural landscape where biodiversity, watercourse health, land surface integrity etc are maintained or improved;
- capacity to use cultural identity as a valid reason to influence approaches to land use, planning and management;
- protection of a diverse and accessible suite of physical evidence of cultural connectedness to the landscape, through sites, artefacts and landscape features of cultural value;
- ongoing awareness and passing on, within the community, of traditional knowledge (stories, resources, methods, rights, obligations and ceremonies); and
- Aboriginal community well being, as indicated by feelings of involvement/engagement, respect, trust and cooperation.

8.5.1 Does the management approach proposed for the project give effect to these cultural concepts of Intergenerational Equity?

Cultural values: past, contemporary and future.

The assessment process has provided all Registered Aboriginal Party participants with the opportunity to provide information in relation to the contemporary and past cultural value of the Project Area and to identify those resources and landscape values that are/have been important to them through the survey and assessment process and from their oral history. Past and contemporary cultural values have been incorporated into the significance assessment and have been used to justify/support the various management options presented in **Section 8.4**. Cultural values of the future have been addressed (as far as possible) through a variety of management outcomes aimed towards ensuring the conservation of a representative sample of sites/PADs/ATUs into the future.

Cultural practice has been viewed in relation to the provision of access to the project area for the Registered Aboriginal Parties in order to continue the use of an area of cultural importance. In this regard the AHMP for the Project Area and ongoing site monitoring support ongoing participation, visitation and Aboriginal practice.

Sense of cultural identity (in this case what it means to be a Gundungurra person or an Aboriginal person with association with Gundungurra Country)

Participating Registered Aboriginal Parties have been encouraged to provide information in relation to their sense of cultural identity and how this may be impacted by damage/destruction of Aboriginal archaeological sites/PADs/ATUs. Information provided has been used to assess PAD/ATU significance and to provide management outcomes that will allow Gundungurra descendents to maintain the same sense of cultural identity when they visit the broader Project Area and the CHMZ.

Attachment to the Gundungurra traditional landscape

Participating Registered Aboriginal Parties provided a heartfelt assessment of their attachment to the landscape of the Lynwood Quarry Project Area in the preface and in **Sections 7.1.1** to **7.1.4** of this assessment report. This attachment to the landscape was taken into account when preparing the management strategy which aims to ensure that a representative sample of sites/PADs/ATUs is conserved for the contemporary and future Gundungurra Peoples.

The connection of culture and country – the dependence of cultural continuity on a 'healthy' natural landscape where biodiversity, watercourse health, land surface integrity etc are maintained or improved

During the survey period and throughout the history of consultation for this project the Registered Aboriginal Parties have spoken of the importance of keeping Country healthy. A great deal was said of the impacts to sites, places and resources that have occurred due to historic and contemporary agricultural practices. It is proposed that the AHMP and the site monitoring program for the Project Area has, and will continue to, enable better management of Aboriginal cultural heritage and archaeological values for contemporary and future generations of Gundungurra Peoples. This is an opportunity that would not have been available had the land remained part of a working farm.

Capacity to use cultural identity as a valid reason to influence approaches to land use, planning and management

It is proposed that by participation in this assessment process and by having full input into the management outcomes that the Registered Aboriginal Parties have had the opportunity to influence Holcim's approach to land use planning and management, so that it is more culturally appropriate. This opportunity will continue to be available through participation in the tasks required by the AHMP.

Protection of a diverse and accessible suite of physical evidence of cultural connectedness to the landscape, through sites, artefacts and landscape features of cultural value

It is proposed that Holcim's current conservation management strategy presented within **Section 6** of this report (prepared in consultation with the Registered Aboriginal Parties) and the outcomes of the current assessment will protect a 'suite of physical evidence of cultural connectedness to the landscape' through culturally appropriate management of sites/PADs/ATUs. Holcim has provided for accessibility to the CHMZ and other areas outside the project impact area.

Ongoing awareness and passing on, within the community, of traditional knowledge (stories, resources, methods, rights, obligations and ceremonies)

It is proposed that this will be enabled through access for teaching purposes to the sites/PADs/ATUs that are being conserved and through ongoing involvement of the Registered Aboriginal Parties in the management of this resource.

Aboriginal community well being, as indicated by feelings of involvement/engagement, respect, trust and cooperation

This is being achieved through the involvement of the Registered Aboriginal Parties in the management of the Project Area and as an outcome of the working relationship that has

developed between Holcim and the Registered Aboriginal Parties, this has resulted in mutual respect, trust and cooperation.

8.5.2 Summary Intergenerational Equity

In summary, it is assessed that the management outcomes proposed in **Section 8.4**, when added to the existing Lynwood Quarry Project Area conservation strategy as discussed in **Section 6**, meet the requirements of Intergenerational Equity.

9.0 Management Strategy

The following management strategy has been prepared taking into account:

- an evaluation of the impacts of the modification proposed within the Lynwood Quarry Project Area (refer to **Section 1.1**);
- the outcome of ongoing consultation with the Registered Aboriginal Parties in relation to the Aboriginal cultural significance of the Lynwood Quarry Project Area and its environs (refer to **Section 2**, **Section 7** and **Appendix A**);
- an analysis of the ATUs proposed for impact by the modification (refer to **Section 3** and **Appendices C, D** and **E**);
- the results of the survey (refer to **Section 5**);
- an understanding of the current Lynwood Quarry Project Area Aboriginal cultural heritage and archaeological conservation strategy (refer to **Section 6**);
- an assessment of the Aboriginal cultural and archaeological significance of the PADs/ATUs proposed for impact by the modification (refer to **Section 7**);
- an evaluation of available management/mitigation options from an Aboriginal cultural and archaeological perspective (refer to **Section 8**); and
- an assessment of the management outcomes proposed taking into account Intergenerational Equity (refer to **Section 8.5**).

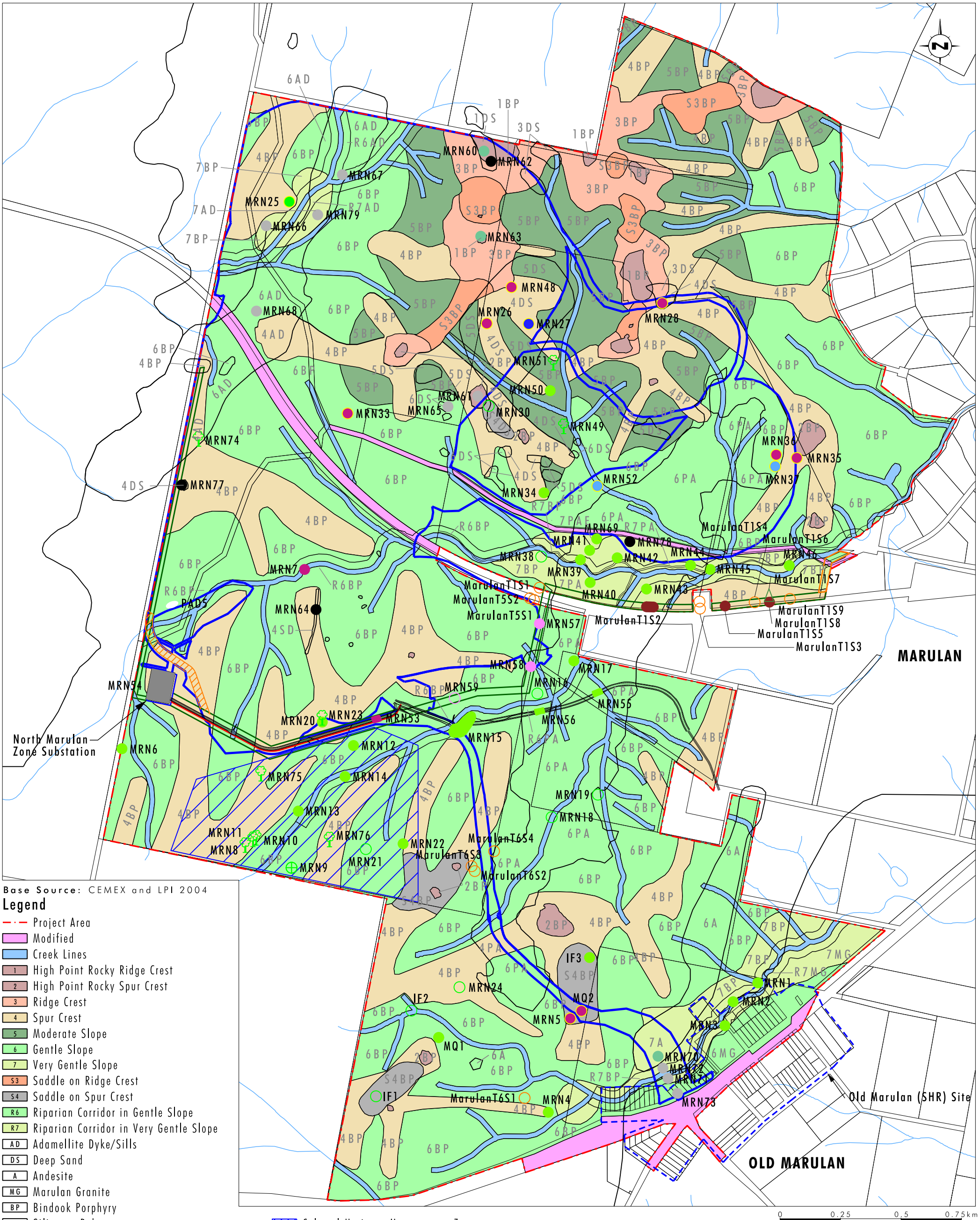
9.1 Specific Recommendations

The management strategy includes specific recommendations relating to each of the proposed modification areas and general recommendations that relate to all ground disturbing works associated with the modification.

9.1.1 Proposed Modified Access Road and Underground Electricity Feeder

It is recommended that Holcim obtains a variation to its existing s.87/90 AHIP (#1100264) to modify its current s.87/90 AHIP boundary to allow the construction of the proposed modified access road and underground feeder as shown on **Figure 9.1**. The variation should be conditional on the following:

- Holcim will construct the modified access road over geotextile using imported fill in those areas of ATU R6BP, 6BP and 4BP indicated by orange hatching on **Figure 9.1**;
- within the orange hatched areas Holcim will keep all machinery associated with road construction in the surveyed corridor;
- Holcim will not undertake any works in the orange hatched areas if the ground is wet and boggy;
- Holcim will restrict ground disturbance within the orange hatched areas to culverts and to works associated with the proposed underground electricity feeder;



Base Source: CEMEX and LPI 2004

Legend

- Project Area
- Modified
- Creek Lines
- 1 High Point Rocky Ridge Crest
- 2 High Point Rocky Spur Crest
- 3 Ridge Crest
- 4 Spur Crest
- 5 Moderate Slope
- 6 Gentle Slope
- 7 Very Gentle Slope
- S3 Saddle on Ridge Crest
- S4 Saddle on Spur Crest
- R6 Riparian Corridor in Gentle Slope
- R7 Riparian Corridor in Very Gentle Slope
- AD Adamellite Dyke/Sills
- DS Deep Sand
- A Andesite
- MG Marulan Granite
- BP Bindook Porphyry
- SD Siliceous Dyke
- PA Porphyritic Adamellite
- AD Adamellite Dyke
- PAE Elevated Area within Gentle Slope
- Stage 1 Construction Access Road to Substation
- Approved Underground Transmission Line
- Approved Transmission Line Easement
- Stage 1 Post Hole Monitoring Area
- Area to be covered with geotextile and road constructed with imported fill
- Modified s.87/90 AHIP area
- Cultural Heritage Management Zone
- Sites Subsurface Tested in Stage 2A
- Artefact Scatter s87/90 Collection/Monitoring
- Artefact Scatter salvaged during Stage 1A
- Isolated Find salvaged during Stage 1A
- Artefact Scatter (CE) Conservation
- Artefact Scatter Located During Stage 2B s87/90 No Further Subsurface Salvage
- Isolated Find Located During Stage 2B s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 Further Subsurface Salvage
- Isolated Find s87/90 No Further Subsurface Salvage
- Isolated Find (CE) Conservation
- Artefact Scatter located during Stage 2B Surface Collection only
- Isolated Find (CE) Conservation
- Grinding Stone (CE) Conservation
- Stone Arrangement Conservation
- Scarred Tree Conservation
- Isolated Find s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 No Further Subsurface Salvage

FIGURE 9.1

Management Recommendations

- Holcim will ensure that all topsoil disturbed is kept for landscaping/spreading over the backfilled trenches; and

- Holcim will provide the opportunity for the Registered Aboriginal Parties and an archaeologist to monitor all topsoil disturbance related to the underground powerline within the orange hatched areas (refer to **Appendix F** for monitoring methodology).

For the remainder of the modified access road (incorporating areas of ATU 4BP and 6BP) the variation should be conditional on the following:

- Holcim will restrict all ground disturbing works to within the surveyed corridor.

9.1.2 Rail Siding

It is recommended that Holcim obtains a variation to its existing s.87/90 AHIP (#1100264) to modify its current s.87/90 AHIP boundary to allow the construction of the rail siding as shown on **Figure 9.1**. The variation should be conditional on the following:

- prior to any works in this area of ATU R6BP, Holcim will commission a suitably qualified archaeologist and the Registered Aboriginal Parties to undertake subsurface testing within the white hatched area (PAD5 - slightly elevated terrace) indicated on **Figure 9.1**;

- the subsurface testing will be undertaken using the same methodology as all previous subsurface testing of ATUs undertaken during Stages 1 and 2 of the Lynwood Quarry Project subsurface investigations (refer to **Appendix F** for details);

- following subsurface testing discussions will be held with DECCW (Southern Directorate) and the Registered Aboriginal Parties to determine if further subsurface salvage is required;

- if further salvage is required it will be undertaken using the same methodology as undertaken during Stage 3 of the Lynwood Quarry Project subsurface investigations (refer to **Appendix F** for details); and

- Holcim will ensure that all topsoil disturbed is used for landscaping purposes as close as possible to its area of derivation.

9.1.3 Area North of Rail Siding

It is recommended that Holcim obtains a variation to its existing s.87/90 AHIP (#1100264) to modify its current s.87/90 AHIP boundary to allow impact within this area resulting from the construction of the tarping area and double weighbridge facilities, works associated with the rail siding and other works as required, as shown on **Figure 9.1**. The variation should be conditional on the following:

- Holcim will ensure that all topsoil disturbed is used for landscaping purposes as close as possible to its area of derivation.

9.2 General Conditions

It is recommended that Holcim obtains a variation to its existing s.87/90 AHIP (#1100264) to modify its current s.87/90 AHIP boundary in compliance with the following general conditions:

- Holcim will incorporate the results of all subsurface testing and monitoring of works within the PADs and any subsequent artefact analysis into the Stage 3 report for the broader Project Area (Umwelt in prep.);
- Holcim must ensure that all its personnel and contractors are aware of the relevant requirements of the Lynwood Quarry AHMP;
- all Holcim personnel and contractors working on the modification within the Lynwood Quarry Project Area must undertake the Holcim Aboriginal Cultural Heritage Awareness Training package that forms part of the Holcim induction procedure;
- all Holcim personnel and contractors working on the modification within the Lynwood Quarry Project Area must be made aware of the location of known Aboriginal sites, PADS and ATUs that are to be protected from impact;
- in compliance with the Lynwood Quarry AHMP and DECCW AHIP (#1100264), in the event that previously unknown artefactual is uncovered during operations, ground disturbance works should cease and DECCW and the Registered Aboriginal Parties should be contacted so that appropriate management strategies can be identified. Work may recommence at a distance approved by the DECCW and the Registered Aboriginal Parties; and
- in the event that any skeletal material of possible human origin is uncovered during the proposed works, ground disturbance works should cease to allow management in accordance with the *Skeletal Remains – Guidelines for the Management of Human Skeletal Remains under the Heritage Act 1977* (NSW Heritage Office 1998) and the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NPWS 1997). This would first involve notification of local police and, for potential Aboriginal remains, the DECCW and Registered Aboriginal Parties; followed by an inspection by a physical or forensic anthropologist/archaeologist to determine the ancestry and antiquity of the remains, on which basis appropriate management strategies will be identified. Work may recommence at a distance approved by the DECCW and the Registered Aboriginal Parties.

9.3 Care and Control

The care and control of all 'Aboriginal objects' (stone artefacts) recovered from the Lynwood Quarry disturbance footprint is detailed within the current 'Care' Permits #2761 (related to s87/S90 AHIP #1077294 and s.87/90 AHIP #1100264 approved 20 May 2009) and #2762 (related to s87 AHIP #1077225 approved by the DECC on 27 August 2007). Until such time as the final artefact analysis and reporting are completed the artefacts recovered as part of the Stage 1 to 3 investigations are being temporarily stored at Umwelt's Toronto Offices as per Schedule D of AHIPs #1077225, #1077294 and #1100264.

In relation to any artefacts recovered during subsurface testing (and salvage if required) of PAD5 (as proposed in the management recommendations in **Section 9.1.2**), it is proposed that existing 'Care' Permit #2761 is varied to enable the 'Care' of any artefacts salvaged in the same manner.

On completion of the reporting process and following the construction of the appropriate facilities within the Lynwood Quarry Office complex, the artefacts will be handed over to the Lynwood Quarry Aboriginal Heritage Management Committee to be placed in the appropriate storage facility or on display.

9.4 Timeframes for Implementation of the Management Strategy

Table 9.1 provides a timeframe for the implementation of the management strategy.

Table 9.1 – Timeframes for Implementation of the Management Strategy

Task	Timeframe
Subsurface testing of ATU R6BP/PAD5 – proposed Rail Siding location	Holcim should commence the subsurface testing as soon as feasible after obtaining approval.
Aboriginal Cultural Heritage Awareness Training	Must be provided to all personnel and contractors prior to any works being carried out within the modified Lynwood Quarry Project Area.
Laying of geotextile in specified areas	Must be undertaken prior to any road construction works.
Monitoring of topsoil removal from trenches required for the underground electricity feeder in areas outside the current Project Approval and s.87/90 AHIP (1100264) boundary.	No ground disturbing works are permitted for the trench unless representatives of the Registered Aboriginal Parties and an archaeologist are present. The monitoring should be undertaken at least 1 month prior to the date when the electricity feeder must be connected. This is to ensure that there is sufficient time to undertake any necessary additional salvage that may arise from the outcomes of the monitoring (i.e. if a feature is located – for details refer to **Appendix F**).

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APPENDIX A

Registered Aboriginal Party Correspondence

APPENDIX B

Search Results

National Native Title Tribunal

New South Wales and Australian Capital Territory Registry
Level 25, 25 Bligh Street
Sydney NSW 2000
GPO Box 9973
Sydney NSW 2000
Telephone (02) 9235 6300
Facsimile (02) 9233 5613

19 July 2010

Kirwan Williams
Archaeologist
Umwelt (Australia) Pty Limited
PO Box 838
TORONTO NSW 2283

Our Reference: 3639/10kc
Your Reference: 2853

Dear Kirwan

Native Title Search Results of Goulburn Local Government Area

Thank you for your letter of 15 July 2010.

My search on 19 July 2010 found:

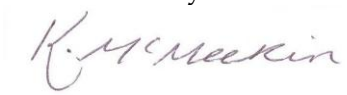
Register Type	NNTT Reference Numbers
National Native Title Register	Nil.
Register of Native Title Claims	NC97/7
Unregistered Claimant applications	NC09/3
Register of Indigenous Land Use Agreements	Nil.

I have included an extract from the Register of Native Title Claims, an unregistered claimant application summary, mapping of the application areas and a NNTT Registers fact sheet to help you understand the search result.

Please note that there may be a delay between a native title determination application being lodged in the Federal Court and its transfer to the Tribunal. As a result, some native title determination applications recently filed in the Federal Court may not appear on the Tribunal's databases.

If you need more information please call me on 1800 640 501.

Yours sincerely



Kashana Cohen-McMeekin
Receptionist/Search Coordinator
Telephone (02) 9235 6300
Facsimile (02) 9235 5613
Email Kashana.Cohen-McMeekin@nntt.gov.au

Encl

NATIONAL NATIVE TITLE TRIBUNAL

Application Information and Extract from the Register of Native Title Claims

Application Information

Application numbers: Federal Court number: NSD6060/98
NNTT number: NC97/7

Application name: Gundungurra Tribal Council Aboriginal Corporation #6

Registration history: Registered from 29/04/1997.

Register Extract (pursuant to s.186 of the *Native Title Act 1993*)

Application lodged with: National Native Title Tribunal

Date application lodged: 29/04/1997

Date claim entered on Register: 29/04/1997

Applicants: Ms Elsie Stockwell, Ms Pamela Stockwell

Address for service: Eddy Neumann
Eddy Neumann Lawyers
Level 1
255 Castlereagh Street
SYDNEY NSW 2000
Phone: (02) 9264 9933
Fax: (02) 9264 9966

Additional Information:

Not Applicable

Area covered by the claim:

(a) Commencing at 150.52997 east longitude and 34.591636 south latitude, approximately 15.5 kilometres east south east of Moss Vale, the application traverses clockwise starting in a south-westerly direction, passing through points 2 to 36,765 of the following geographic coordinates. They are in decimal degrees and referenced to Australian Geodetic Datum 1984 (AGD84). These coordinates are based on the position of spatial reference data sourced by Land Information Centre, Department of Information Management and Technology, New South Wales as of 18 May 1999.

(b) Subject to clauses (d) and (e) the area covered by the application excludes any land or waters covered by:

(i) a scheduled interest;
(ii) freehold estate;
(iii) a commercial lease that is neither an agricultural lease nor a pastoral lease;
(iv) an exclusive agricultural lease or an exclusive pastoral lease;
(v) a residential lease;
(vi) a community purposes lease;
(vii) a lease dissected from a mining lease as referred to in s23B(2)(vii);
(viii) any lease (other than a mining lease) that confers a right of exclusive use over particular land or waters;

which was validly vested or granted on or before 23 December 1996.

(c) Subject to clauses (d) and (e) the area covered by the application excludes any area covered by the valid construction or establishment of any public work, where the construction or establishment of the public work commenced on or before 23 December 1996.

(d) Where the act specified in (b) and (c) falls within the provisions of

(i) s23B(9) - Exclusion of acts benefiting Aboriginal peoples or Torres Strait Islanders;
(ii) s23B (9A) - Establishment of a national or state park;
(iii) s23B (9B) - Acts where legislation provides for non-extinguishment;
(iv) s23B (9C) - Exclusion of Crown to Crown grants; and
(v) s23B (10) - Exclusion by regulation,

the area covered by the act is not excluded from this application.

(e) Where an act referred to in clauses (b) and (c) covers land or waters referred to in:

s47 - Pastoral leases held by native title claimants;
s47A - Reserves etc covered by claimant applications; and
s47B - Vacant crown land covered by claimant applications,

the area covered by the act is not excluded from the application.

(f) Where an area is covered by a previous non-exclusive possession act (s 23F) the native title claim group does not claim possession, occupation, use and enjoyment to the exclusion of all others.

(g) The area covered by the application excludes land where native title has been extinguished at common law.

(h) The area covered by the application excludes areas covered by prior Gundungurra claims filed with the National Native Title Tribunal being NC96/7, NC96/27, NC96/30, NC96/36 and NC97/4.

Persons claiming to hold native title:

The native title claim group comprises all members of the Gundungurra Tribal Council Aboriginal Corporation

Registered native title rights and interests:

The following Native Title Rights & Interests were entered on the Register on 23/06/2000:
1. Subject to (2) - (5) below, the full and free enjoyment of the following native title rights and interests area are claimed in relation to the land and waters the subject of the application:

a. A right to possess, occupy, use and enjoy the claim area;

b. A right to make decisions about the use and enjoyment of the claim area;

c. A right of access to the claimed area;

d. A right to control the access of others to the claimed area;

e. The right to control the use and enjoyment of others of resources of the claimed area.

f. (Right not registered)

g. (Right not registered)

h. (Right not registered)

2. With respect of those parts of the area the subject of the application which are, or have been, the subject of a previous non-exclusive possession act within the meaning of s 23F of the Native Title Act 1993, the native title rights and interests area set out in (1) are claimed subject to the rights and interests created in the 'non-exclusive possession act' which are not inconsistent with the rights and interests claimed and, in the case of rights granted which are inconsistent with the rights and interests claimed, subject to any suspension of the native title rights and interests which those inconsistent rights and interests cause.

3. With respect to those parts of the area the subject of the application which are, or have been, the subject of:

a. a category B intermediate period act within the meaning of s232C of the Native Title Act 1993;

b. a category C intermediate period act within the meaning of s232D of the Native Title Act 1993;

c. a category D intermediate period act within the meaning of s232E of the Native Title Act 1993;

the native title rights and interests claimed are those set out in (1) above subject to the rights and interests created in the non-exclusive possession act which are not inconsistent with the rights and interests claimed and, in the case of any rights granted which are inconsistent with the rights and interests claimed, subject to any suspension of the native title rights and interests which those inconsistent rights and interests cause.

4. With respect to those parts of the area of the application which are, or have been, the subject of:

a. a category B past act within the meaning of s230 of the Native Title Act 1993;

b. a category C past act within the meaning of s231 of the Native Title Act 1993;

c. a category D past act within the meaning of s232 of the Native Title Act 1993;

the native title rights and interests claimed area those set out in (1) above subject to the rights and interests created in the non-exclusive possession act which are not inconsistent with the rights and interests claimed and, in the case of any rights granted which are inconsistent with the rights and interests claimed, subject to any extinguishment or suspension of the native title rights and interests which those inconsistent rights and interests cause.

5. The native title rights and interests identified above do not extend to ownership of any minerals, petroleum or gas which are wholly owned by the Crown.

6. The native title rights and interests identified above do not include a claim for exclusive occupation and use of offshore areas as defined by s253 of the Native Title Act 1993.

Register attachments:

1. Plan of Application Area, Attachment C of the Application, 1 page - A4, Attached 29/04/1997.

Note: The Register may, in accordance with s.188 of the Native Title Act 1993, contain confidential information that will not appear on the Extract.

NATIONAL NATIVE TITLE TRIBUNAL

Claimant Application Summary

Application numbers	Federal Court number: NSD808/09 NNTT number: NC09/3
Application name	Ngunawal People (Ngunawal People (NSW))
Name of body where application filed	Federal Court of Australia
Date application filed	06/08/2009
Current stage(s)	Pre Notification
Registration information	*Please refer to the Register of Native Title Claims/National Native Title Register (as appropriate) for registered details of this application.* **Registration test status:** Not Accepted for registration
Applicants	Mrs Ruth Bell
Address for service	Ruth Bell 10 Traegar Street DUNLOP ACT 2615 Phone: 02 6259 1672 Fax: 02 6258 1264
Persons claiming to hold native title	Wally Bell, Keri Bell, Jasmine Bell, Tyronne Bell, Jada Bell, Curtis Honeysett, Barry Honeysett, Dean Honeysett, James Honeysett, Colleen Honeysett, Hilary Honeysett, Shaun Honeysett, Wayne Honeysett, Cameron Honeysett, Dean Denny, Tegan Denny, Darroll Tighe Jnr, Evelyn Tighe, Don Bell (Don Bell Jnr's son), Justin Bell, Bronwyn Bell, Danicka Bell, Pamela Honeysett, Darryl Honeysett, Donna Honeysett, Angela Honeysett, Lyle Honeysett, Annika Honeysett, Jessica Honeysett, Letisha Honeysett, Rhiana Honeysett, Rebecca Denny, Dorothy Dixon, Aaron Tighe, Carl Brown, Don Bell (Jnr), Melissa Bell, Jai Bell, Craig Honeysett, Kaziah Honeysett, Lucille Honeysett, Dwayne Honeysett, Gordon Honeysett, Isobella Honeysett, Teresa Honeysett, Maxine Honeysett, Shiana Honeysett, Karen Denny, Damien Denny, Cecil Dixon, Alex Tighe, Ruth Bell
Native title rights and interests claimed	The native title rights and interest claimed are the rights to the possession, occupation, use and enjoyment as against the whole world (subject to any native title rights and interests which may be shared with any others who establish that they are native title holders) of an area, and in particular comprise: (a) rights to possess, occupy, use and enjoy the area; (b) the right to make decisions about the use and enjoyment of the area; (c) the right of access the area; (d) the right to control the access of others to the area; (e) the right to use and enjoy resources of the area; (f) the right to control the use and enjoyment of others of resources of the area; (g) the right to trade in resources in the area; (h) the right to receive a portion of any resources taken by others from the area; (i) the right to maintain and protect places of importance under traditional laws, customs and practices in the area; and (j) the right to maintain, protect and prevent the misuse of cultural knowledge of the common law holders associated with the area.

	Subject to: (i) To the extent that any minerals, petroleum or gas within the area of the claim are wholly owned by the Crown in the right of the Commonwealth of the State of New South Wales, they are not claimed by the applicants. (ii) The claim area does not include any offshore place. (iii) The applicants do not make a claim to native title rights and interests which confer possession, occupation, use and enjoyment to the exclusion of all others in respect of any areas in relation to which a previous non-exclusive possession act, as defined in section 23F of the NTA, was done in relation to an area, and, either the act was an act attributable to the Commonwealth, or the act was attributable to the State of New South Wales and a law of that State has made provision as mentioned in section 231 in relation to the act; (iv) Paragraph (iii) above is subject to such of the provisions of section 47, 47A and 47B of the Act as apply to any part of the area contained within this application, particulars of which will be provided prior to the hearing. (v) The said native title rights and interests are not claimed to the exclusion of any other rights or interests validly created by or pursuant to the common law, a law of the State or a law of the Commonwealth.
Area	**Jurisdiction:** New South Wales **Location:** The application covers an area of 14,437 square km in south-east NSW, surrounding the ACT. (The application excludes the ACT). **Local government region(s):** Boorowa Council, Cooma-Monaro Shire Council, Cootamundra Shire Council, Upper Lachlan Shire Council, Gundagai Shire Council, Harden Shire Council, Queanbeyan City Council, Snowy River Shire Council, Tumut Shire Council, Yass Valley Council, Palerang Council, Goulburn Mulwaree Council **Representative A/TSI body(s):** NTSCORP Limited **Approximate size:** 14437 square km (Note: There may be areas within the external boundary of the application that are not claimed.) **Land/water and/or sea:** Land/Water **Area covered by the claim (as detailed in the application):** Area of application (geographic extent) - 14,437 sq km Commencing at Longitude 149.371904 degrees east, Latitude 36.182838 degrees south being a point approximately 3km north west of Umaralla Mountain, the application boundary traverses generally north westerly, crossing the Monaro Highway and the Reynolds Barkersdale Creek until Longitude 148.726600 degrees east, Latitude 35.783503 degrees south, being a point approximately 6km to the east of the southern end of the Tantangara Reservoir. Points 1 to 22 reference this section of the boundary as listed on Attachment B - Geographic Coordinates. From here the boundary traverses generally northerly through the Kosciusko National Park until Longitude 148.694374 degrees east, Latitude 35.234315 degrees south, then traverses generally north westerly until Longitude 148.543060 degrees east, Latitude 35.090910 degrees south, being a point south of the Bungongo State Forest.. The boundary then traverses generally westerly, south of Paddy's Rock Hill, across Serpentine Ridge and the Tumut River until Longitude 148.161500 degrees east, Latitude 35.039421 degrees south. From this point the boundary traverses generally north westerly until Longitude 148.144685 degrees east, Latitude 35.030631 degrees south being a point approximately located on the Murrumbidgee River. From here the boundary traverses northerly over the Murrumbidgee River again, until Latitude 148.132133 degrees east, Longitude 34.977345 degrees south, being a point approximately on the northern side of the Hume Highway. The boundary then traverses generally north easterly to the east of Nimby until Longitude 148.376766 east, Latitude 34.548290 degrees south, being a point approximately on the eastern side of the town of Harden. Points 23 to 50 reference this section of the boundary as listed on Attachment B - Geographic Coordinates. From here the boundary traverses generally east south easterly crossing the Galong Boorowa Railway, then through the Midgee Range until Longitude 149.145529 degrees east, Latitude 34.667445 degrees south. From here the boundary traverses generally north easterly crossing the Lachlan River until Longitude 149.374453 degrees east, Latitude 34.530503 degrees south. From this point the boundary traverses generally south easterly, north of Lake Sooley and across the Oberon Goulburn Road until Longitude 149.742200 degrees east, Latitude 34.737239 degrees south, being a point approximately on the north eastern outskirts of Goulburn. From here the boundary traverses generally southerly, approximately 2.75km to the west of Blacks Peak until Longitude 149.806458 degrees east, Latitude 35.505121 degrees south, approximately 7km south of Braidwood. From here the

boundary traverses generally south westerly through the Bedland, Tallaganda and Badja State Forests back to the commencement point. Points 51 to 116 reference this section of the boundary as listed on Attachment B - Geographic Coordinates.

Geographic coordinates are referenced to Australian Geodetic Datum (AGD) 84, in decimal degrees and area based on the spatial reference data acquired from the various custodians at the time.

Use of Coordinates

Where coordinates are used within the description to represent cadastral or topographic boundaries of the intersection with such, they are intended as a guide only. As an outcome of the custodians of cadastral and topographic data continuously recalculating the geographic position of their data based on improved survey and data maintenance procedures, it is not possible to accurately define such a position other than by detailed ground survey.

Internal Boundaries

(1) The application excludes the are covered by the Australian Capital Territory.

(2) The applicants exclude from the claim any areas covered by valid acts on or before 23 December 1996 comprising such of the following as are included as extinguishing acts within the Native Title Act 1993, as amended, or Native Title (New South Wales) Act 1994, as amended, at the time of the Registrar's consideration:

Category A past acts, as defined in NTA s228 and s229;

Category A intermediate period acts as defined in NTA s232A and s232B.

(3) The Applicants exclude from the claim any areas in relation to which a previous exclusive possession act, as defined in section 23B of the NTA, was done in relation to an area, and, either the act was an act attributable to the Commonwealth, or the act was attributable to the State of New South Wales and a law of that State has made provision as mentioned in section 23E in relation to the act.

(4) The Applicants exclude from the claim areas in relation to which native title rights and interests have otherwise been extinguished, including areas subject to:-

(a) an act authorised by legislation which demonstrated the exercise of permanent adverse dominion in relation to native title; or

(b) actual use made by the holder of a tenure other than native title which is permanently inconsistent with the continued existence of native title.

To avoid any uncertainty, the Applicants exclude from the claim area any of the areas contained within the following descriptions or tenures which have been validly granted, set out in Schedule B1.

Schedule B1

B1.1 Any former or current unqualified grant of an estate in fee simple and all other freehold land.

B1.2 A permanent public work and "the land or waters on which a public work is constructed, established or situated" within the meaning given to that phrase by the Native Title Act 1993 (Cth) s251D.

B1.3 An existing public road or street used by the public, or dedicated road.

(5) Paragraphs (2) to (4) above are subject to such of the provisions of section 47, 47A and 47B of the Act as apply to any part of the area contained within this application, particulars of which will be provided prior to the hearing but which include such areas as may be listed in Schedule L.

Attachments	1. External boundary of application area, Attachment C of the Application, 1 page - A4, Attached 06/08/2009.

NNTT contact details	**Case manager:**	Tom O'Reilly
	Address:	National Native Title Tribunal Level 25 25 Bligh Street SYDNEY NSW 2000 GPO Box 9973 SYDNEY NSW 2001
	Phone:	(02) 9235 6300 Freecall 1800 640 501
	Fax:	(02) 9233 5613
	Web page:	www.nntt.gov.au

Searching the NNTT Registers in New South Wales

Search service
On request the National Native Title Tribunal will search its public registers for you. A search may assist you in finding out whether any native title applications (claims), determinations or agreements exist over a particular area of land or water.

In New South Wales native title cannot exist on privately owned land including family homes or farms.

What information can a search provide?
A search can confirm whether any applications, agreements or determinations are registered in a local government area. Relevant information, including register extracts and application summaries, will be provided.

In NSW because we cannot search the registers in relation to individual parcels of land we search by local government area.

Most native title applications do not identify each parcel of land claimed. They have an external boundary and then identify the areas not claimed within the boundary by reference to types of land tenure e.g., freehold, agricultural leasehold, public works.

What if the search shows no current applications?
If there is no application covering the local government area this only indicates that at the time of the search either the Federal Court had not received any claims in relation to the local government area or the Tribunal had not yet been notified of any new native title claims.

It does not mean that native title does not exist in the area.

Native title may exist over an area of land or waters whether or not a claim for native title has been made.

Where the information is found
The information you are seeking is held in three registers and on an applications database.

National Native Title Register
The National Native Title Register contains determinations of native title by the High Court, Federal Court and other courts.

Register of Native Title Claims
The Register of Native Title Claims contains applications for native title that have passed a registration test.

Registered claims attract rights, including the right to negotiate about some types of proposed developments.

Register of Indigenous Land Use Agreements
The Register of Indigenous Land Use Agreements contains agreements made with people who hold or assert native title in an area.

The register identifies development activities that have been agreed by the parties.

Application summaries
An application summary contains a description of the location, content and status of a native title claim.

This information may be different to the information on the Register of Native Title Claims, e.g., because an amendment has not yet been tested.

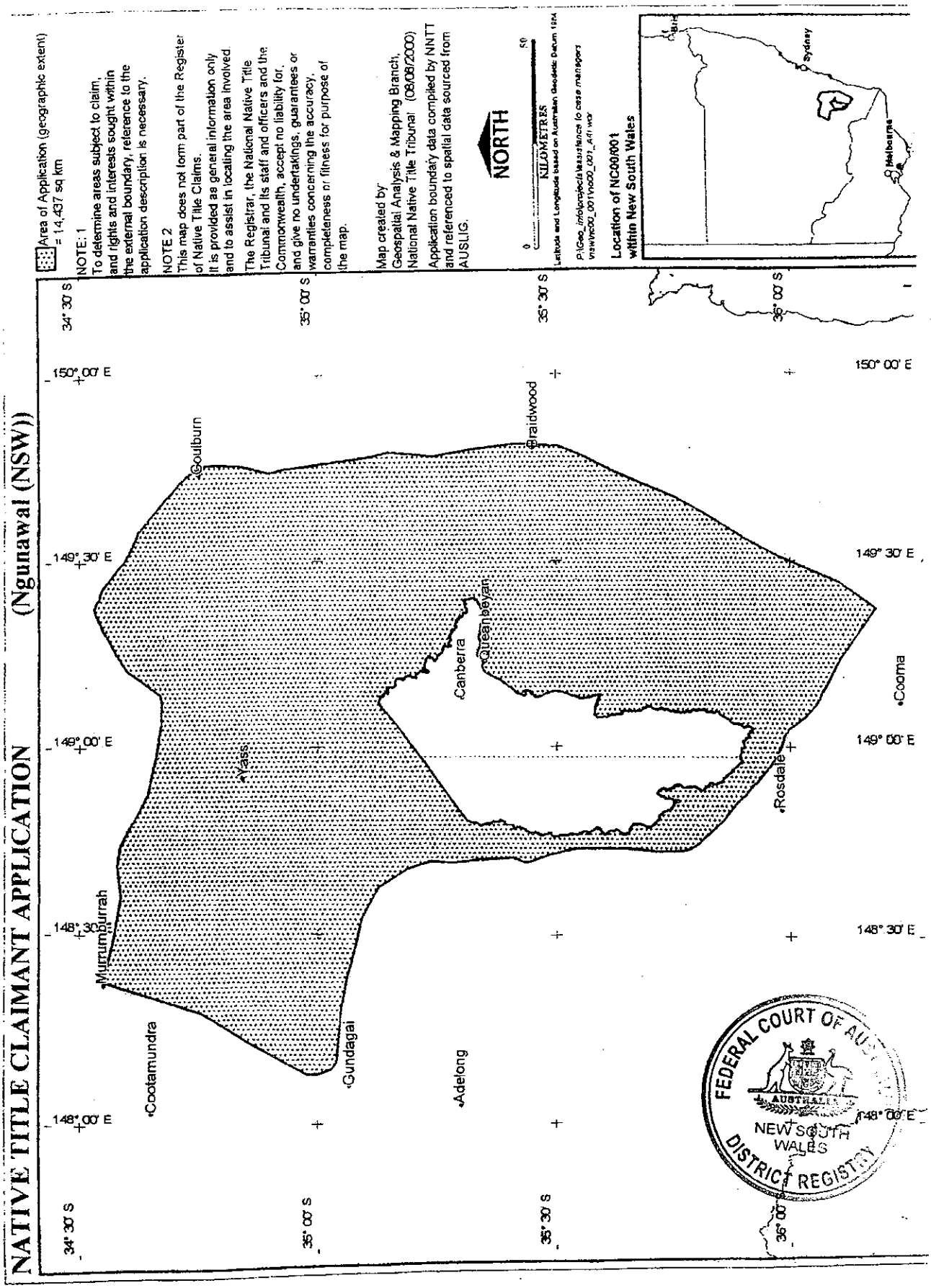
How do you request a search?

A search request form is available on the Tribunal's web site at:
http://www.nntt.gov.au/registers/search.html
This form says how much searches cost.
Mail, fax or email your request to the Tribunal's Sydney registry, identifying the local government area/s you want searched.

Email: SydneySearch@nntt.gov.au
Fax: (02) 9233 5613
Address: GPO Box 9973, Sydney NSW 2001
Phone: (02) 9235 6300

ATTACHMENT C

NSD808/09 (NC09/3)
External boundary of application area
Attachment C of the Application
Page 1 of 1, A4, 06/08/2009



NATIVE TITLE APPLICATION

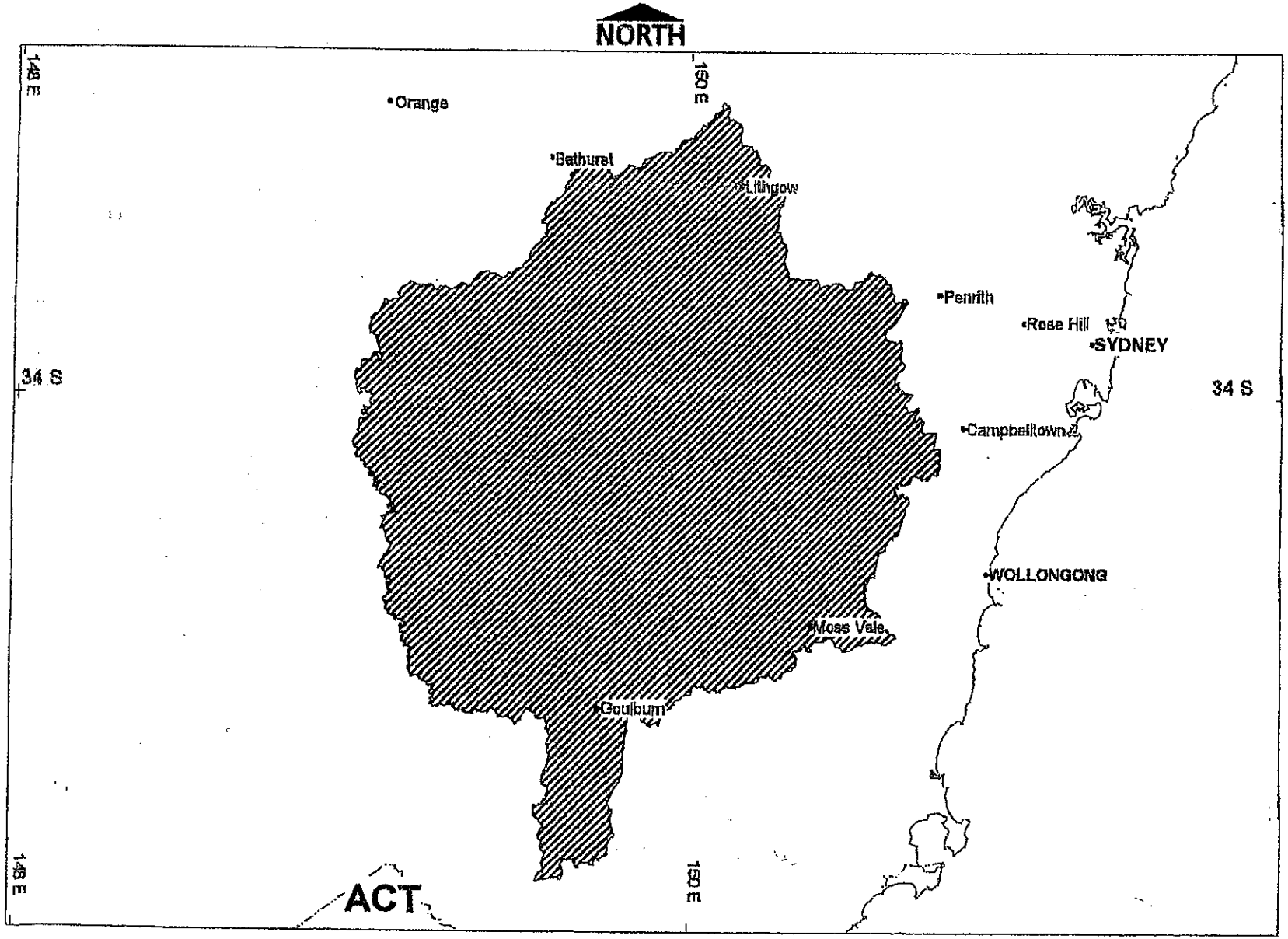
as at 18/05/1999

Map created from data sourced from Land Information Centre, DIM&T, NSW
by Geospatial Information Unit, National Native Title Tribunal

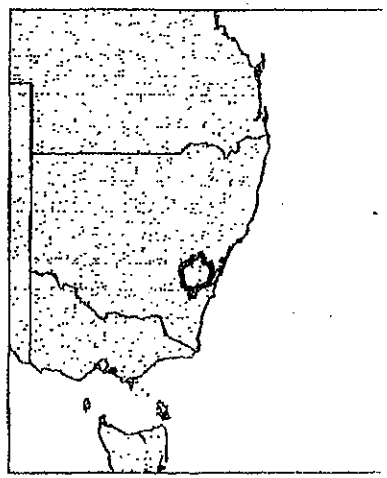
0 60
KILOMETRES

Latitude and Longitude based on Australian Geodetic Datum 1984

NSD6060/98 (NC97/7)
Plan of Application Area
Attachment C of the Application
Page 1 of 1, A4, 29/04/1997



Location of NC97/007
Within New South Wales & ACT



TOTAL P.02

APPENDIX C

Environmental Context

Appendix C - Excerpt from Umwelt 2005

ENVIRONMENTAL CONTEXT

This section of the report presents information about the landscape within the project area. Details of the impact of European land-use practices are considered initially to gain an understanding of how these practices may have impacted upon Aboriginal resource distribution and abundance and the likelihood of finding cultural heritage material in a relatively undisturbed context.

EUROPEAN IMPACT HISTORY

A full historic heritage assessment has been completed by Umwelt as a separate report. The following European impact history summarises key historic land uses to provide context for this Aboriginal archaeology assessment.

The project area and its surrounds have a long history of European impact. The site of Old Marulan (on the southern boundary of the Readymix holdings) was selected by Surveyor-General Mitchell at the junction of the roads to Goulburn to the southwest and Bungonia to the south. Before the design of the village was finally approved, several allotments were marked out so as to allow occupation in 1834. The final layout was approved in March 1835 although it did not follow the regulations laid down by the Government six years earlier. The allotments all fronted the main roads and there were no side streets. Among the earliest buildings were the church and the Woolpack Inn. Ten years later Old Marulan had several stores, a post office and two hotels.

The building of the railway to the north of the village in the late 1860s refocused traffic and thus trade away from the Old Marulan village toward where the road and railway crossed to the northeast. This caused a relocation of the businesses and community to a new site known originally as 'Mooroowoolen', which is the site of the present day village of Marulan. The relocation began in 1868 and the Old Marulan site was almost completely abandoned soon after.

The location of Old Marulan on the southern boundary of the project area suggests that this general area would have been the first to be targeted for the removal of trees for building materials and fuel and to improve pasture. The early years of settlement saw the introduction of hard-hoofed grazing animals such as sheep, cattle and horses which, in addition to tree clearance, would have left the ground surface lacking in vegetative cover to stabilise the soil. This undoubtedly led to the downslope movement of the sandy soil from areas of higher gradient and its deposition in areas of negligible gradient in valley bottoms. In many cases this soil would have been removed by the local watercourses. In other areas it could have resulted in the build up of substantial depths of colluvium. These agricultural land use practices have occurred across the entire project area.

Implications for Aboriginal Site Location/Site Integrity

Prior land-use practices in the general area are likely to have resulted in the following:

- the removal of scarred and/or carved trees during land clearing;
- the removal of plant species that were valued economic resources for Aboriginal people;
- competition for prey species;

- the introduction of non-endemic flora and fauna that out-competed native flora and fauna;
- a change in the hydrology of the creeks and thus in their morphology and endemic flora and fauna;
- an increase in the downslope movement of soil and any artefacts it may contain;
- the mixing and reburial of artefacts from different sites and of different ages in areas where colluvium has aggraded;
- in areas of cultivation both vertical and horizontal movement and mixing of artefacts of different ages within the soil profile; and
- damage/destruction by cultivation or stock trampling of sites such as bora rings and stone arrangements.

In summary, the previous land-use in the area has the potential to have destroyed or at least damaged the integrity of any Aboriginal sites that may have been located in the area. It has almost certainly had the effect of removing many species of flora and fauna that would have been useful Aboriginal resources.

CLIMATE

The following information is based on Goulburn which is the closest long-term weather station for which the relevant data was available. The information is based on records kept since 1857 (Bureau of Meteorology 2005).

Average maximum temperature for the area is 28.1 ºC for January. Temperatures over 20 ºC are only recorded between October and April. Average minimum temperature is 1.3 ºC in July. Maximum temperature recorded in the area over the period of record is 37.8 ºC in January with a minimum of -7.8 ºC in June.

Average annual rainfall is 735 mm with maximum average monthly rainfall (64.8 mm) occurring in January and average monthly minimum rainfall (47.8 mm) in July. The wettest months overall are November through March. Marulan is approximately 80 kilometres from the coast and has an elevation of 650 metres.

July, August and September are the windiest months and the winds generally blow from the west or southwest throughout the year. June to August are recorded as months when most days are overcast.

In sum, the project area is generally dry, with a warm summer, relatively cool spring and autumn and a cold, windy and overcast winter.

Implications for Aboriginal Resource Exploitation/Site Location

The climatic data suggest that since the mid-Holocene the most comfortable times of the year for Aboriginal occupation may have been late spring, summer and early autumn. The cold southwesterly winds can drastically reduce temperatures and require humans to find shelter when camping for the night and it is probable that in spring, autumn and winter, Aboriginal people would have sought shelter from the wind when camping. In summer, they may have chosen to camp in areas where the southwesterly winds brought respite from the heat.

Late spring, summer and early autumn would have provided sufficient warmth and moisture to encourage the growth of the food plants that both the Aboriginal inhabitants and the animals they preyed upon required for nutrition. In winter the cold temperatures and shorter days would have inhibited most plant growth. During this period most of the staple (carbohydrate) food plants would subsist on their own stores, reducing their nutritional value and increasing the amount of work required in their gathering and processing. Prey animals also use up their stores of fat at this time of the year. Without the lipids provided by the fats, protein is not able to be absorbed by the body, inducing what is termed 'protein starvation" in individuals forced to subsist on the meat provided by these animals. Thus the project area could have been undesirable for anything but transient use in the winter from the perspective of optimal nutrition.

This information suggests that though Aboriginal people may have made transient use of the area in the winter they were more likely to have camped in the area for more extended periods of time in the warmer months when resources would have been more plentiful and more nutritious.

In terms of the location of the camp sites, the overall rainfall for the area is not high and only the main channels of the creeks would have retained water for any time after rain. As water is a determining factor in the location of camp sites it can be predicted that the main campsites, and thus the areas where the majority of artefactual material would have been discarded, would be in proximity to the main creek channels.

In light of the cold west and southwesterly winds it is likely that preferred camping locations in spring, autumn and winter would be on the northern to eastern side of higher ground which provided some protection from the elements. In summer, the reverse may have been the case with Aboriginal people seeking respite from heat by camping in areas with a west or southwesterly aspect.

TOPOGRAPHY AND HYDROLOGY

The topography of the project area consists of ridges with saddles and crests to the north and south, with the Joarimin Creek valley running through the middle from the southwest to the northeast. The southern portion of the project area slopes towards the south and southeast towards Marulan Creek and the Hume Highway. The topography of the project area ranges from approximately 710 mAHD in the north, to around 630 mAHD near Joarimin Creek. There are no areas of very steep gradient, however, some of the spurs have short, steep slopes which can range in gradient up to 5-8 degrees.

The project area is located within the catchments of Joarimin, Lockyersleigh and Marulan Creeks. Joarimin Creek flows in a northeasterly direction into the Wollondilly River. Lockyersleigh Creek drains in a northwesterly direction and also flows into the Wollondilly River, which is part of the Warragamba catchment area. Marulan Creek flows in a southeasterly direction to the Shoalhaven River via Barbers Creek.

Joarimin Creek is a fifth order stream and has a catchment area of approximately 5440 hectares. Marulan Creek is a fourth order stream and has a catchment area of approximately 2055 hectares. Lockyersleigh Creek has a catchment area of approximately 2630 hectares.

None of the creeks were flowing during the survey period, however, Joarimin Creek did have a few isolated pools of stagnant water in its lower reaches. The creeks were observed again in February 2005 following four inches of overnight rain. All of the creeks were running within their banks the next morning, however, overnight they had overflowed their banks and the

resultant wash had scoured an area 5 to 10 metres back from the banks of the creek, removing all loose surface soil and small stones.

Floodplain development along the creeklines appears to be restricted to small areas where recent infrastructure (mainly culverts under the Main Southern Railway) slows the waters forcing them to drop some of their bedload. In general the creeks flow in bedrock defined channels and creek migration in most areas has been limited by this factor. The stream channels towards the headwaters were usually simple grassy depressions, often difficult to define, however, as the tributary order increases the channels become deeper and wider due to recent entrenchment.

The area north of the Main Southern Railway rises gently from Joarimin Creek then more steeply to low rocky crests (maximum elevation 700 mAHD) with skeletal soils which for the most part support regrowth woodland. To the south of the Main Southern Railway the relief is more gently undulating with broad ridges and slopes, saddles and low spurs. As in the northern area, the steeper country and crests have rock outcrop and skeletal soils, but again, these areas support the only significant regrowth tree cover in the area

Implications for Aboriginal Resource Exploitation/Site Location

Areas of low gradient associated with Joarimin Creek and Marulan Creek are likely to have supplied attractive camp locations for small numbers of people during times of creek flow. Camp sites of longer duration, or for larger groups of people, are more likely to have been located in the lower reaches of Joarimin Creek where it appears water was available for longer periods in pools.

It is assumed that moderately to steeply sloping areas are unlikely to have been utilised by Aboriginal people for camping and that their use was generally transient in nature and therefore, did not result in the discard of large amounts of cultural material making the use of these areas harder to discern archaeologically. Within the Readymix holdings, footslopes, lower slopes, crests, and saddles generally have gentle gradients and so may have provided suitable camping locations.

The higher country in the north is of an elevation which would have provided an extensive outlook across the landscape. Such a vantage point may have allowed people to become aware of the movements of other people (through the observance of fires or smoke) and/or game, and perhaps plan hunting expeditions.

In sum, the information related to the topography and hydrology suggests that the creeklines within the area would have been attractive camping places and that the low gradient and high elevation of the crests in the north would have made them attractive as an area for camping when an extensive outlook was required. The lack of water in these elevated areas would suggest, however, that camping would only have been short term.

GEOLOGY AND SOILS

The Bindook Porphyry is the predominant geological feature of the project area and is the resource being targeted by the proposed quarry. The Bindook Porphyry is a Devonian acid volcanic ignimbritic tuff (Bell, Cochrane and Associates 2004) which extends across the project area on both the northern and southern sides of the Main Southern Railway. The eastern side of the project area is composed of the Marulan Granite and the western side of the Lockyersleigh Adamellite. These bands of rock are generally deeply weathered with little or no outcrop except along ridge crests. The large tors (large rounded boulders) so common in granitic country are absent from the project area.

The southeastern edge of the project area also contains an andesite intrusion. Minor accumulations of dune sand over the Bindook Porphyry have also occurred in recent geological times (refer to Figure 3.2 in the main text). Finally a narrow dyke of siliceous material is mapped in the central portion of the area to the south of the Main Southern Railway

The depth of weathering across the site is variable. Weathering is mostly shallow (1 to 10 metres), although weathering is in excess of 30 metres in places. The weathering profile ranges from decomposed porphyry with essentially clay properties (overburden) to a mixture of jointed hard and softer brown rock (weathered porphyry). The porphyry ranges from massive, to strongly fractured with closely spaced near-vertical joints/fracture planes. These fracture/shear zones often appear pale in colour due to secondary alteration. The fresh porphyry is typically dense and dark in colour and exhibits a porphyritic texture of coarse quartz and feldspar grains in a fine tuffaceous to glassy groundmass.

Whilst some limited areas have deep sands derived from the *in situ* weathering of the porphyry (refer to Figure 3.2 in the main text). Most other areas, especially crests and areas of steeper gradient have skeletal soils. Massive downslope movement of the sandy soil was evident in February 2005 when heavy rain followed a long dry spell. This massive downslope movement of the soil must have happened on innumerable occasions in the past when heavy rain followed bushfire or drought.

Colluvial aggradation was also observed at the base of some lower slopes, however, alluvial aggradation and floodplain development were largely absent. Only one area, where creek flow was impeded by the Main Southern Railway, was observed to have recent and limited floodplain development.

Implications for Aboriginal Resource Exploitation/Site Location

Porphyry was not a preferred stone for the manufacture of Aboriginal tools, however, its use has been recorded in the Hunter Valley of NSW, where the local porphyry (occurring as cobbles in the creek) was used to supplement the supply of better flaking materials transported long distances into the area (Umwelt 2004).

Granitic rock types are not preferred raw materials for stone tool manufacture either. However, the use of adamellite for the production of flakes and even for food processing (grinding) has previously been recorded in the Northern Tablelands of NSW (Wilson and Gaynor 1995) in a very similar geological landscape to the current project area. Therefore, there may be some use of the local rock outcrops for tool manufacture and for food processing. Granitic rock types are also often associated with quartz veins and pockets, and quartz generally makes up a high percentage of the stone artefact assemblages from granitic areas with other imported raw materials found in lower numbers (Gaynor and Wilson 1997; Wilson and McAdam 2000).

The use of andesite for the manufacture of stone axes has been recorded in Northern Tablelands assemblages and it is possible that if this stone outcrops in the area, it may have been a source of axe material. The siliceous dyke mapped on Figure 3.2 (in the main text). may also have been suitable for stone tool manufacture and may have formed a focus for Aboriginal activity.

Overall, as the stone types available within the project area would not have been preferred for tool manufacture, it is highly probable that a large proportion of the stone requirements would be brought in from elsewhere.

As there are no large tors within the project area, rock overhangs with occupation and/or art that are common in both the Northern (Wilson and Gaynor 1995) and Southern Tablelands (Flood 1995) are not possible.

In terms of the soils, the massive downslope movement of the sandy soils following initial land clearing and at other times due to drought and bushfire followed by heavy rains will have resulted in the downslope movement of any artefacts within the soil profile. Therefore, it can be expected that the majority of the artefacts on the slopes will have been subject to both vertical and horizontal displacement and a loss of stratigraphic integrity.

The location of areas of deep sand suggests that these areas may have provided pockets where the vegetation may have been quite distinct from other areas within the project area. These areas may have been targeted by Aboriginal people for the exploitation of resources (both plant and animal) not located elsewhere in the area. The deep sands are exposed on crests and on the valley slopes and in some areas reach down to the local tributaries (refer to Figure 3.2 in the main text).

The lack of floodplain development indicates that there are unlikely to be areas where alluvial deposits have buried Aboriginal sites, however, those areas where colluvial deposits have built up at the lower slope/footslope boundary have the potential to have buried *in situ* sites.

FLORA AND FAUNA

The project area has been extensively cleared and the make-up of the remnant vegetation has been modified by introduced species. The most extensive regrowth woodlands is on the ridges and crests. Dominant tree species in these areas are stringybark (*Eucalyptus macrorhyncha* and *E. agglomerata),* broad-leaved peppermint (*E. dives)* and western scribbly gum (*E. rossii),* usually with little understorey.

The larger riparian corridors of Joarimin and Marulan Creeks have retained a more diverse, albeit highly disturbed, native vegetation assemblage. Dominant species include Argyle apple (*E. cinerea)*, forest red gum (*E. tereticornis)* and swamp gum (*E. ovata)*. The shrub layer is degraded, lacking in diversity and in many areas absent altogether. It consists largely of those species unpalatable to introduced grazers.

Introduced grasses and herbs dominate the pastoral grasslands of the slopes, and creek banks and drier creek beds, however, native rushes and sedges are present in the moister soils. Some of the more common species include: couch (*Cynodon dactylon*), three-awn wire grass (*Aristida ramosa*), wallaby grasses (*Austrodanthonia laevis* and *A. racemosa* var. *racemosa*), corkscrew grass (*Austrostipa scabra*), sheep burr (*Acaena novae-zeelandiae*), fireweed (*Senecio madagascariensis**), cat's ear (*Hypochaeris radicata**), sorrel (*Acetosella vulgaris*), soft brome (*Bromus molliformis*), squirrel tail fescue (*Vulpia bromoides*), white clover (*Trifolium repens**), sedges (*Cyperus eragrostis** and *Cyperus laevis*,), and rushes (*Juncus planifolius*, *J. sarophorus* and *J. usitatus*).

Some subtle differences were observed in the dominance of plant species in the areas of deep sands formed on the ridges in association with the deep weathering of the porphyry. In these areas there was often an understorey or even a dominance of bracken fern (*Pteridium esculentum*) and tea-tree scrub (*Leptospermum sp.)* with occasional narrow-leafed Geebung (*Persoonia linearis*), grass tree (*Xanthorrhoea australis*) and numerous peach heath (*Lissanthe strigosa*) and urn heath (*Melichrus urceolatus*).

In relation to fauna, prey animals such as kangaroo, wallaby, wombat, reptiles and birds were observed during the survey. In addition the remains of turtles and crayfish were also noted near the watercourses. Wombat burrows were concentrated in those areas of deep weathering and colluvial aggradation where the deep sandy soils provided an ideal medium

for the wombat burrows in what was otherwise an area of relatively shallow soils and rocky outcrop.

Implications for Aboriginal Resource Exploitation/Site Location

Evidence for food plants was sparse at the time of survey due to drought conditions, however those that were observed are noted in **Table 1**. Aboriginal representatives also recognised plants used for the manufacture of artefacts; these ranged from large scarred trees providing evidence of both shelter and coolamon manufacture, to gummy exudates from species such as black wattle (*Acacia decurrens).*

Table 1 - Aboriginal Food and Useful Plants

Common Name and *Scientific Name*	**Use**	**Reference**
appleberry *Billardiera scandens*	Fruit eaten	Low 1989:40 Zola & Gott 1992:26
black wattle *Acacia decurrens*	Gum eaten	Bill Hardie 2004: pers. comm
bracken fern *Pteridium esculentum*	Underground fibrous stem roasted and beaten with a stone to remove starch	Zola & Gott 1992: 37
dianella *Dianella revolute var. revoluta*	Berries eaten; roots of some species can be eaten after pounding and roasting; leaves split and used for weaving	Low 1989:8 Stewart & Percival 1997:17
grass tree *Xanthorrhoea australis*	Base of leaves and pith inside eaten, resin used for hafting stone tools, flowering stems used for spear shafts	Low 1989: 130; Zola & Gott 1992: 58-59
grey box *Eucalyptus moluccana*	Bark favoured for manufacture of coolamons and shields	Wilson pers. obs.
kangaroo grass *Themeda australis*	Seeds ground for flour, leaves and stems used for fibre and weaving	Greenway 1910: 16 Zola & Gott 1992: 58
mat-rush *Lomandra* sp.	Long pliable leaves used for weaving baskets, leaf bases and flowers edible	Low 1989: 131, 174; Zola & Gott 1992: 59
narrow-leafed geebung *Persoonia linearis*	Ripe fruit pulp eaten; fine scrapings of wood from young stems mixed with breast milk for use as eye treatment; solution made from bark strengthened fishing lines	Stewart & Percival 1997:42
native cherry *Exocarpus cupressiformis*	Enlarged succulent stalklet (pedicel) eaten	Low 1989: 46
peach heath *Lissanthe strigosa*	Small sweet berries eaten raw	Low 1989: 42
rushes and sedges *Juncus and Cyperus* spp.	Underground stem or tuber can be eaten in some species, leaves used for weaving	Low 1989: 105; Zola & Gott 1992: 60
stringybark *Eucalyptus sp.*	Fibrous bark used to manufacture string, sheets of bark used for shelter and containers	Bill Hardie 2004: pers. comm
urn heath *Melichrus urceolatus*	Small sweet berries eaten raw	Low 1989: 42
water ribbons *Triglochin procerum*	Small bullet shaped tubers roasted	Low 1989: 109

The list of plants shown in **Table 1** must be seen to reflect a very limited number of the useful plants available for gathering by Aboriginal people prior to European land clearing and the introduction of hard-hoofed grazing animals. In general, useful plant species were identified in very low numbers across the project area with minor concentrations noted in the area of the deep sands associated with the deeply weathered porphyry.

Wombats have had a major impact on the areas of deeply weathered porphyry and of colluvial aggradation at the lower slope/footslope boundary. These areas have large numbers of active burrows and widespread evidence of former collapsed burrows. It is likely that these areas formed a target for Aboriginal hunters who could have smoked out/dug out the wombats. Thus these areas may have concentrations of Aboriginal artefacts. The wombat burrowing activity, however, will have acted to destroy the likelihood of site integrity.

APPENDIX D

Cultural Context

Appendix D - Excerpt from Umwelt 2005

CULTURAL CONTEXT

PREVIOUS ETHNOGRAPHIC AND ARCHAEOLOGICAL RESEARCH

This section of the report commences with definitions of site types referred to in the text. The known ethnographic and archaeological context of the general Marulan area and the project area is then discussed. The information provided by the ethnography and archaeological context combined with the conclusions drawn from the environmental context (refer to **Section 2.6**) are then used to formulate a predictive model for site location, site type and site contents.

SITE DEFINITIONS

The most common site types located by archaeologists during survey in NSW are sites that contain scatters of stone artefacts. Stone artefacts are pieces of stone modified for, or by, human use. Stone artefacts are robust and preserve well in the archaeological record when other forms of evidence of Aboriginal exploitation are lost due to preservation biases (wooden and bone implements, food remains), however, their associations are rapidly modified after their initial discard due to natural and cultural impacts on the landscape.

Aboriginal archaeological sites can be divided roughly into secular (concerned with worldly things) and non-secular (concerned with secret, sacred, ceremonial and ritual things) site types. This division is not made by archaeologists, it is drawn from Aboriginal ideologies (manners of thinking, systems of belief). The division is not always clear cut as some site types may be secular in some circumstances and non-secular in others. The secular or non-secular nature of each of the site types is indicated below. Sites that are non-secular in nature generally have much higher Aboriginal cultural heritage significance than sites of a secular nature. Due to the rarity of non-secular sites they generally also have high archaeological significance.

In accordance with the DEC Guidelines for archaeological reporting (1997), this section provides definitions of the various types of Aboriginal sites known from the archaeological record of the broader Southern Tablelands region. It should be noted that many of these site types will not be relevant to the current project area.

Isolated Find/Artefact

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

Artefact Scatter or Open Campsite

An artefact scatter or open campsite refers to areas (in the open landscape, not in a rockshelter or cave), that contain two or more stone artefacts, generally located within 100 metres of each other. In general, artefact scatters are secular in nature. Artefact

scatters may result from the activities of a single person or a group of people. They may reflect a single occupation episode, or multiple episodes of occupation of a single place.

Rock Art Site

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

Engraving Site

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

Rockshelter Sites

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

Precontact Burial Sites

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

Stone Arrangements

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

Shell Middens

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

Grinding Grooves

Grinding grooves are grooves on rock surfaces that have been manufactured by the sharpening of stone axe heads, stone chisels or fire-hardened wooden spear points.

Grinding grooves are commonly located on sandstone ledges that outcrop in creek and river beds, as the availability of water enhances the speed with which grinding proceeds. Less commonly, grinding grooves are located on rock surfaces away from water and on stone types other than sandstone. Grinding grooves appear to be secular in nature.

Stone Quarries

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

Ochre Quarries

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

Ceremonial Grounds

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

Scarred and Carved Trees

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

Post-contact Burial Sites

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

Aboriginal Fringe Camps/Missions/Reserves

These terms refer to those places where Aboriginal people lived in post-contact times. To be archaeological sites they will not be documented in the historic literature; if they are

documented, they will be called Aboriginal historic sites. These site types are generally secular in nature.

Waterholes/Wells

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

Massacre Sites

This term refers to an area known from the Aboriginal oral history, or from local history, to have been the location of an Aboriginal massacre. Most Aboriginal massacres in NSW occurred during the early European settlement period. Massacre sites are secular in nature, however, they have great significance to the Aboriginal community.

ETHNOGRAPHY

Care must be taken with the use of ethnographic observations of Aboriginal people in the early contact period. The European surveyors and explorers who wrote the majority of the earliest recordings carried with them a notion of racial superiority which tainted their perspective. It must also be recognised that by the time of the first ethnographic observations the traditional Aboriginal ways of life had already been altered due to loss of territory and introduced disease. However, some useful information can be gleaned from the ethnographic record to assist with the formulation of a predictive model for site type and location.

Eddie (1985) compiled a short chapter on the Aboriginal people of the Marulan area for inclusion in a book celebrating Marulan's 150th anniversary. Eddie (1985: 5) reports that:

> Their main implements were spears with stone or bone points, woomeras, boomerangs, stone axes and stone skinning knives. Some of these, along with sharpening stones have variously been found in the district.

Drawing on research by Tindale (1974) in relation to tribal boundaries, Eddie (1985: 5) states that the Marulan area was at the junction of four major tribes. These were the:

- Ngunawal who inhabited the area from Canberra to Yass and north to Goulburn;
- Wandandian who inhabited the area from Ulladulla to Nowra and west to the mountains;
- Wodi Wodi who inhabited the area north of the Shoalhaven River to Wollongong; and
- Gandangara (alternatively spelt Gundungurra) who inhabited the area from Camden to just south of Marulan.

Eddie (1985: 5) also suggests that coastal tribes like the Wodi Wodi had much smaller territories than the Gundungurra due to the abundance of resources associated with the coast.

Tindale (1974) drew his information from recordings made by early explorers and settlers. Early exploration of the area was begun in 1798 when an expedition by John Wilson reached Mt Towrang (about 9 kilometres northeast of Goulburn). Participants in the exploration team

commented on the scarcity of Aboriginal people in the area; "…and we really believe that there never was a native in this part of the country" (Collins 1798-1802: 87-91).

Navin (1990: 6) provided the following comments in relation to the Marulan area.

> An apparent scarcity of Aboriginal people in the Southern Tablelands was commented upon by early explorers. Not a single Aboriginal person was encountered in the course of early explorations by Meehan (1818), Throsby (1818), Throsby-Smith (1820), Wild (1820) and Kearnes (1822). References to 'several native fires' (Charles Throsby-Smith) and 'the Fires of the Natives who appeared numerous' (Joseph Wild) were the only signs recorded by the explorers of the presence of Aborigines in the region.

The sighting of fires by the early explorers, indicate that rather than there being no Aboriginal people in the area, that the Aboriginal people were purposefully avoiding contact with the explorers.

Linguistic studies record that the Gundungurra and the Ngunawal shared a common language (Eades 1976: 6). This suggests that these two groups interacted on a regular basis and that they probably shared some parts of their ceremonial lives. In the NSW Northern Tablelands where the granitic uplands provided an area of interaction between the Anaiwan and the Gamilaroi, there have been many ceremonial sites (Bora rings, stone arrangements, carved trees, rock art sites) recorded in areas along the boundary between the two groups (McBryde 1974; Wilson 1995) and it is possible that similar sites (with the exception of art sites) could be expected in the Marulan area.

As white settlement began to take hold in the Marulan area, there were accounts of attacks on the white settlers by the Aborigines and retaliatory attacks on the Aborigines by the settlers. In 1826 Governor Darling sent 30 troopers to the Bungonia area to act as a peace force following reports of bands of angry natives gathering. Governor Darling later wrote in a despatch to England (Governor Darling to Earl Bathurst Despatch No. 34 per Ship Toward Castle Government House, 23 May 1826 quoted in Eddie 1985: 7):

> My Lord,
> 1st I have much satisfaction in stating to your Lordship, in reference to my despatch No. 28 that the Natives, who had assembled in the County of Argyle, have been dispersed without committing any depredation or act of violence. It is supposed that the prompt and unexpected appearance of the Troops in that distant part of the County had some effect in producing this desirable end. If so it may be hoped that it will be attended with still further beneficial consequences by checking any disposition they might feel to re-assemble.
>
> 2nd The steps that have been taken will I trust ensure the native from further aggression, as there can be no doubt of their friendly disposition, when unmolested, and, though it may be politic to prove our superiority, it would be painful to punish an Act of retaliation with the severity necessary to prevent recurrence of such proceedings on their part.

From the dispatch it can be seen that the Aboriginal people of the area were being driven from their land by 1826. Further European settlement of the Marulan area followed and by 1832 there were already 12 properties listed between Marulan and Bungonia (NSW Calendar and General Post Office Directory).

Eddie (1985: 7) concludes:

> The Aboriginal population in Argyle gradually decreased, mainly from diseases introduced by the whites and the influenza epidemic of 1846/47 almost completely wiped them out. In *Settlers and Convicts* Harris states that the Aborigines complained:

> Plenty of water before white man come, plenty pish (fish), plenty kangaroo, plenty possum, plenty everything: now all gone. Poor fellow now, black fellow.

Ethnography/Implications for Aboriginal Site Location/Site Integrity

The ethnography suggests that the Marulan area was the focus of four Aboriginal tribal groups with the Marulan area and the project area at the southern extent of the Gundungurra tribal area and north of the northern extent of the Ngunawal tribe. As these groups shared a common language it is likely that they also shared ceremony and thus that sites associated with ceremonies (stone arrangements, bora grounds and carved trees, large camp sites) may exist near to the tribal boundaries and even within the project area.

In relation to ceremonies, the groups of "angry" natives gathering, remarked upon by Governor Darling (23 May 1826) may well have been Aboriginal people gathering for ceremony rather than gathering for an attack. There have been other recorded incidents where Aboriginal people were gathering and painting up for a ceremony. These people were thought to be painted up for attack and were subsequently massacred (Davidson and Lovell-Jones 1993).

The ethnography also indicates that the number of Aboriginal people in the area was likely to be low; this may have two causes. Firstly the climate and subsequent availability of food resources may have limited the number of people, in addition, if this area was commonly used for ceremony, it may have had areas that were off-limits for many people most of the time.

The use of the area for ceremony begs the question of what people would have eaten during the time that these large gatherings took place. It is possible that at these times the wombats and kangaroos were the target of large scale drives into standing nets which would have provided large amounts of food for a period of time (and subsequently leaves an area with scarce resources until faunal numbers build up again).

Finally it appears that the Aboriginal people that occupied the Marulan area were driven from their traditional lands in the years following initial white settlement, thus there is unlikely to be much Aboriginal artefactual material related to the early contact period.

PREVIOUS ARCHAEOLOGICAL SURVEY AND ASSESSMENT

Known Aboriginal Sites in proximity to the Project Area

A DEC/AHIMS (Aboriginal Heritage Information Management System) Site Register search was undertaken for an area approximately 20 kilometres square centred on the project area. The full results of the site search are included in **Appendix C** and are summarised in **Table 1**.

Table 1 - Sites Listed on the DEC/AHIMS Register

Site ID	Site Name	Easting	Northing	Site Type
51-6-0059	MQ 1	771860	6152890	Open Camp Site
51-6-0060	MQ 2	772450	6153000	Open Camp Site
51-6-0066	G11	765950	6158450	Open Camp Site
51-6-0068	G13	768800	6159650	Open Camp Site
51-6-0074	MAS 1	771450	6157600	Open Camp Site
51-6-0075	MIF 1	771900	6157800	Isolated Find

Site ID	Site Name	Easting	Northing	Site Type
51-6-0076	MAS 4	771400	6157280	Open Camp Site
51-6-0077	MAS 5	771450	6157320	Open Camp Site
51-6-0079	MAS 3	771300	6157250	Open Camp Site
51-6-0080	MAS 2	771300	6157320	Open Camp Site
51-6-0086	Marulan 1	774500	6153130	Open Camp Site
51-6-0087	Marulan 2	774530	6153100	Open Camp Site
51-6-0088	Marulan 3	774630	6153170	Open Camp Site
51-6-0089	Marulan 4	774510	6153000	Open Camp Site
51-6-0090	Marulan 5	774380	6153800	Open Camp Site
51-6-0091	Marulan 6	774310	6153270	Open Camp Site
51-6-0092	Marulan 7	774220	6153450	Open Camp Site
51-6-0093	MF 1 – Winfarthing Road	765080	6151200	Isolated Find
51-6-0094	MF 3 – Narambulla Creek	765870	6151120	Open Camp Site
51-6-0095	MF 2 – Winfarthing Road	765190	6151120	Isolated Find
51-6-0096	MF 4 – Narambulla Creek	765950	6150620	Open Camp Site
51-6-0097	MF 5 – Narambulla Creek	765700	6150360	Open Camp Site
51-6-0098	MF 6 – Narambulla Creek	765590	6150170	Isolated Find
51-6-0101	Isolated Find 2	774550	6152900	Isolated Find
51-6-0102	Isolated Find 3	777420	6153370	Isolated Find
51-6-0103	Isolated Find 1	774500	6153170	Isolated Find
51-6-0105	Marulan ER Site 1	774500	6153220	Open Camp Site
51-6-0114	Joarimin Creek 1	774710	6158610	Open Camp Site
57-3-0234	Millendale Creek	774880	6161071	Open Camp Site

In addition to the 29 sites on the DEC/AHIMS register there are three isolated find sites (IF1, 2 and 3) recorded by Navin (1990) and a quarry site G5 that do not appear in the register. Open camp sites (artefact scatters) are the most common site (22) followed by isolated finds (10). Five of these sites (two artefact scatters and three isolated finds) are within the project area.

According to the DEC/AHIMS Register search none of the sites listed has been granted Section 90 consent, however, the site cards indicate that a Section 90 consent (#570002) was approved on 5 April 1987 for Millendale Creek. Furthermore, a Section 87 Permit (#428) for further investigation was approved by NPWS on 7 October 1992 for G11 and G13. Taking this into account it can be suggested that more of the sites listed may also have been destroyed by development in the period since their recording.

Table 2 indicates the geographic location and distance of each of the sites from the nearest watercourse. No distinction has been made in terms of the reliability of the watercourse as this information was not available from the majority of the site cards. For those sites where site cards could not be located the information was derived from mapping the sites.

Table 2 - Geographic Location of the Known Sites

Site Name	Site Type	Landform Unit	Distance to Water (m)
MQ 1	Open Camp Site	Lower slopes of spur	200
MQ 2	Open Camp Site	Spur lower slope	220
IF1	Isolated find	Gully erosion	0

Site Name	Site Type	Landform Unit	Distance to Water (m)
IF2	Isolated find	Between two tributaries	10
IF3	Isolated find	Spur slope	10
G11	Open Camp Site	Lower slope	75
G13	Open Camp Site	Lower slope	0
MAS 1	Open Camp Site	Hill slope	500
MIF 1	Isolated Find	Ridge crest	500
MAS 4	Open Camp Site	Gentle slope	250
MAS 5	Open Camp Site	Ridge crest	400
MAS 3	Open Camp Site	Gentle slope	250
MAS 2	Open Camp Site	Gentle slope	400
Marulan 1	Open Camp Site	Elevated bench beside creek	0
Marulan 2	Open Camp Site	Elevated bench beside creek	0
Marulan 3	Open Camp Site	Elevated bench beside creek	0
Marulan 4	Open Camp Site	Elevated bench beside creek	0
Marulan 5	Open Camp Site	Footslope/creek terrace	0
Marulan 6	Open Camp Site	Elevated bench beside creek	0
Marulan 7	Open Camp Site	Elevated bench beside creek	0
MF 1 – Winfarthing Road	Isolated Find	Saddle	>900
MF 3 – Narambulla Creek	Open Camp Site	Midslope of low spur	250
MF 2 – Winfarthing Road	Isolated Find	Saddle	900
MF 4 – Narambulla Creek	Open Camp Site	Saddle	>900
MF 5 – Narambulla Creek	Open Camp Site	Footslope/creek terrace	50
MF 6 – Narambulla Creek	Isolated Find	Footslope/creek terrace	<50
Isolated Find 2	Isolated Find	Elevated bench beside creek	6
Isolated Find 3	Isolated Find	Elevated bench beside creek	5
Isolated Find 1	Isolated Find	Elevated bench beside creek	1
Marulan ER Site 1	Open Camp Site	Elevated bench beside creek	0
Joarimin Creek 1	Open Camp Site	Elevated bench beside creek	50
Millendale Creek	Open Camp Site	Hillslope	300

Table 2 indicates that the sites were most often located within 50 metres of creeklines (53%) and often directly adjacent to creek lines on elevated terraces. Sites were also relatively common on ridge crests and saddles and on spur slopes. This information will be used to assist with the formulation of the predictive model.

For the remainder of this discussion “open camp sites” will be referred to as “artefact scatters”. This is a more accurate description as many scatters of artefacts recorded as “open camp sites” do not necessarily represent camping activity.

Summary of Previous Survey and Assessment

There have been a number of archaeological assessments carried out in the general Marulan area over the last 25 years. Where possible, information from the reports in relation to site location, site type and site contents are summarised below. Where the reports could not be accessed and where the sites cards were available these were referenced instead.

Koettig 1981

In 1981 Koettig undertook a survey for the proposed F5 route alignment between Hoddles Crossing and Alpine to the north of Marulan. Koettig recorded 24 sites, including grinding grooves, scarred trees, artefact scatters and rockshelters with deposit and art. The rockshelter sites and grinding grooves were confined to the Hawkesbury Sandstone areas and the artefact scatter sites were located close to watercourses in the Wianamatta Shales and at the shale/sandstone boundaries.

Brayshaw and Associates 1984

In 1984 Brayshaw and Associates investigated an area proposed for a quarry and its associated infrastructure approximately 15 kilometres west of Marulan. No Aboriginal sites or objects were recorded during this survey and assessment. Brayshaw and Associates explained the lack of evidence as reflecting the lack of a reliable source of water locally.

Dallas 1985

In 1985, Dallas undertook a survey of a deviation for State Highway 2 in the Cullerin Range. Dallas located eight artefact scatters. The most common raw material in the sites was quartz, with indurated mudstone, silcrete and chert also present in low numbers. Sites were located on hillslopes (57%), along creeks (30%) and on ridge tops (13%).

Haglund 1986

In 1986, Haglund reported on a survey carried out in the Bungonia State Recreation Area 10 kilometres south of Marulan in anticipation of the impacts of recreational activities in that facility. Fifteen artefact scatter sites were located. Raw materials used for artefact manufacture were described as “typical” of the Southern Highlands and included quartz, silcrete and chert.

Byrne 1987

In 1987, Byrne surveyed an area 4 kilometres north of Berrima and located one artefact scatter and eight isolated finds. The sites were located on elevated areas beside creeks. Raw materials used for artefact manufacture included quartz, silcrete and chert.

Koettig 1988

East of Marulan, at Tallong, Koettig investigated a proposed rural subdivision and recorded nine sites. Seven of these were artefact scatters and two were rockshelters with potential archaeological deposits (PAD). The artefact scatters and isolated finds were located in association with watercourses.

Patton 1989

In 1989 Patton undertook a salvage excavation of a site on the south bank of the Mulwaree River at Goulburn. The excavation recovered over 15,000 artefacts. The dominant raw materials were quartz (85%) and silcrete (10%); artefact types included geometric microliths, backed blades, bipolar cores and an edge-ground axe.

Navin 1990

Navin carried out a survey of an area within the current project area for a proposed hard rock quarry at that time. Two artefact scatters (MQ 1 and 2) and three isolated finds (IF1, 2 and 3) where located.

MQ 1 was located on the lower slopes of a spur, 200 metres from a tributary of Marulan Creek. The site is reported to have contained three artefacts, consisting of two broken pebbles and a quartz flaked piece. The artefacts were located in a scour (8 metres by 6 metres) below a tree.

MQ 2 was located on a low spur. Nine artefacts were located in three exposures and consisted of a chalcedony core and flaked piece, a quartz flake, broken flake and flaked piece, a volcanic manuport, two flaked pieces and a chert flaked piece.

The isolated finds were located in association with eroding gullies and consisted of two grey silcrete broken flakes and a broken quartzite flake.

MQ 1 was assessed as having low archaeological significance and MQ 2 was assessed as having moderate archaeological significance.

It was recommended that as MQ 1 would be impacted if development of the quarry proceeded that the artefacts be collected under Section 90 consent. As MQ 2 was outside the area of impact it was recommended that the site be protected by revegetating the area. There were no recommendations made for the isolated finds.

McIntyre 1993

McIntyre reported on three sites located approximately 12 kilometres to the west of the project area. Two of these (G11 and G13), were artefact scatters located adjacent to the route of the 132 kV Marulan to Goulburn transmission line. G11 was located on the banks of Narrambulla Creek and contained five artefacts. The artefacts were manufactured from silcrete (4) and chert (1) and consisted of four cores and a flaked piece. G13 was described as located at the base of a tree and contained three artefacts manufactured from quartz (2) and silcrete (1). The third (G5) was described as a 'large quarry site and work floor overlooking Towrang Creek'. Its dimensions were given as 'at least 60 by 100 m on the east bank of the creek'. McIntyre reported that at the time of recording (1989), the site was already highly disturbed and on subsequent re-inspection was found to be effectively destroyed through additional clearance work. The "quarry site" was described as containing silcrete, indurated mudstone, chert and quartz. The NPWS site card for the site reports "At least some of these materials (quartz and silcrete) are being quarried at the site".

Sefton 1995, 1996

In 1995, Sefton carried out a survey of the site of a proposed water augmentation project to the north and east of Marulan (from 11 kilometres to 1.5 kilometres distant from the current project area). No sites were located during this survey. A subsequent survey for the Marulan Sewerage Augmentation project in 1996 resulted in the recording of seven artefact scatters and three isolated finds (NPWS site cards #51-6-0086 to #51-6-0104) The artefact scatters contained between six and 13 artefacts and were all located adjacent to Marulan Creek. Artefact types included flakes, cores, broken flakes, flaked pieces, one backed blade and numerous bipolar flakes and cores and one volcanic manuport (pebble). Silcrete was the dominant raw material then quartz and chert. Siltstone and volcanic rock were also present in low numbers. Bipolar flaking was taking place on the silcrete, quartz and chert.

The isolated finds were located beside a tributary of Marulan Creek and contained a quartz bipolar flake, a grey silcrete flake and a yellow silcrete core.

A subsequent review of the archaeological survey by the Department of Public Works recorded a further artefact scatter (Marulan 8). The site was located on the bank of a tributary of Marulan Creek. It contained 3 artefacts including two quartz flakes and a silcrete flaked piece (information from NPWS Site Card (#51-6-0105).

Johnston 1995

In 1995, Johnston (Australian Archaeology Survey Consultants) undertook a survey for a proposed extension to a sand quarry adjacent to the northwestern corner of the current project area. Johnston recorded five artefact scatter sites (MAS1-5) and one isolated find (MIF1) during his survey. The artefact scatter sites contained between two and six artefacts and were mainly located in highly disturbed contexts due to prior quarry activities. It was thought that the artefacts had come from slopes and benches on the slopes. Raw materials used in artefact manufacture included silcrete, quartz, quartzite, chert and volcanic pebbles. The isolated find was located on a ridge top and was a grey quartzite core.

In addition to the sites listed above, Laws, O'Connell and Pettigrew (1979) identified two "corroboree sites" an "initiation site" and a burial site all within 5 kilometres of Goulburn Railway Station. Unfortunately no details are given of the geographic locations of these sites.

Previous Archaeological Survey and Assessment/Implications for Aboriginal Site Location/Site Integrity

From the results of the previous archaeological survey and assessment it can be ascertained that:

- artefact scatter and isolated find sites have most commonly been located within close proximity to creeks;
- artefact scatter and isolated find sites have also been located on slopes, saddles and on ridge crests;
- rockshelters and grinding grooves have been recorded in areas of sandstone geology;
- sites were found along geological boundaries where it is probable that there was greater species diversity within a small area due to the different soils derived from the different parent materials;
- in areas assessed as having poor surface water availability, there were few/no sites recorded;
- most sites contained <10 artefacts;
- slightly larger numbers of artefacts were located in sites close to watercourses;
- the largest site known was located near a permanent water source (Mulwaree River, 15,000 artefacts);
- quartz and silcrete were the most common raw materials used for artefact manufacture. Chert, quartzite and volcanic (pebble) were also commonly found in sites but generally only made up a minor proportion of the assemblage. Siltstone and chalcedony are recorded but are rare components of the assemblages;

- bipolar reduction is commonly used to reduce quartz and to a lesser extent silcrete and chert;

- backed artefacts and edge-ground axes have been recorded but only in association with the largest assemblage (Mulwaree River);

- one raw material source was located 12 kilometres to the west of the project area which had both silcrete and quartz available; and

- it is highly probable that many of the sites recorded have since been destroyed by development, agricultural practices or natural geomorphological processes.

APPENDIX E

Summary – Results of Prior Subsurface Investigations

Appendix E - Previous Subsurface Testing and Salvage

Introduction

A report on the results of the Lynwood Quarry Project Area Stage 1, 2 and 3 subsurface testing and salvage program is currently in preparation (Umwelt in prep.). This report will detail the methodology and results of the testing/salvage program and the stone artefact analysis (including residue and use-wear studies). It will also seek to answer the research questions included in Appendix F of the main text and to provide an interpretation of the way in which Aboriginal hunter-gatherers were using the Lynwood Quarry Project Area and environs.

The purpose of this Appendix is to provide a summary of the results of the survey and subsurface testing and salvage program undertaken prior to the preparation of the assessment report for the proposed modification (Umwelt 2005, 2007a, 2007b, 2007c, 2008a, 2008b, 2008c, 2008d, 2009, in prep.).

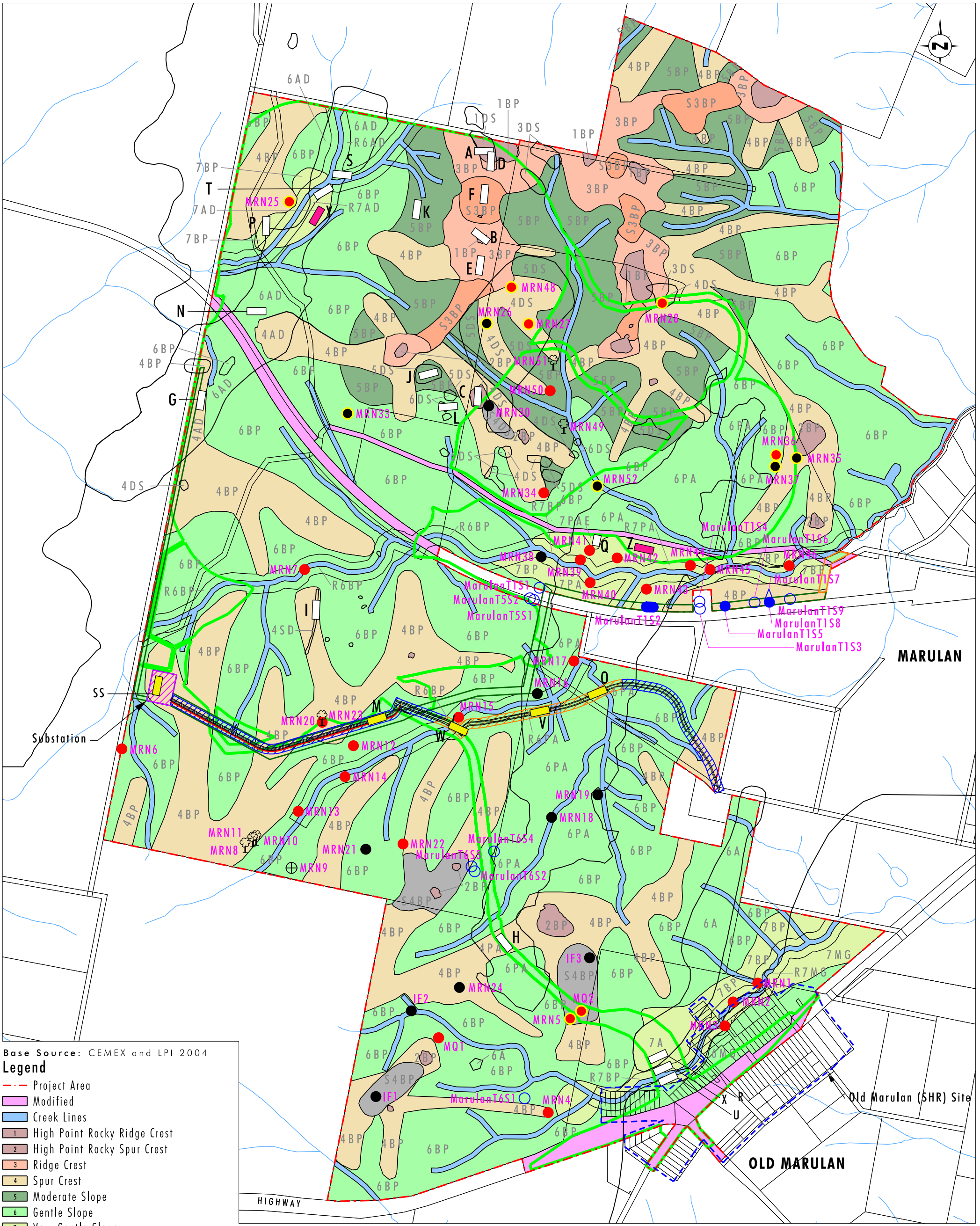
Summary

Table 1 summarises the information obtained through surface survey (for sites outside the project disturbance boundary), ATU and site subsurface testing and site salvage (surface and subsurface). **Table 1** also includes information provided from the subsurface testing of Country Energy pole locations across the broader Lynwood Quarry project area, the subsurface testing of ATUs crossed by the existing Country Energy access road and the MRN54 site impacted by construction of the Country Energy North Marulan Zone Substation (NMZS). **Table 1** also provides information related to whether particular ATUs and sites within particular ATUs are being conserved outside the combined Lynwood Quarry/Country Energy disturbance footprint (refer to Figure 1.4 in the main text), the relevant Department of Environment, Climate Change and Water (DECCW) Aboriginal Heritage Impact Permit (AHIP) number (where applicable), artefact numbers, artefact types and the Aboriginal cultural heritage significance assessments (provided by Gundungurra Aboriginal Heritage Association Aboriginal Corporation (GAHAI), Gundungurra Tribal Council Aboriginal Corporation (GTCAC), Pejar Local Aboriginal Land Council (PLALC) and Peter Falk Consultancy (PFC) throughout the consultation process for all stages of the project) and the archaeological significance assessments.

When comparing artefact numbers it should be noted that sites and ATUs outside the project disturbance boundary have not been subsurface tested. For those sites and ATUs subsurface investigated the area excavated varied according to the results of the subsurface testing. Only three sites were subject to broad area subsurface investigation (MRN27, MRN54 and MRN73).

Figure 1 indicates the locations of the ATUs subsurface tested. **Figure 2** shows the distribution of the sites (including those located during subsurface testing of ATUs and from surface survey) and their current management strategies.

A total of 34 ATUs have been subsurface tested (many more than once) and as a result of the survey and subsurface testing program a total of 94 Aboriginal archaeological sites have been identified. The sites are all listed separately, however, it should be noted that following subsurface testing in the area to the south of the main channel of Joarimin Creek that 10 sites have subsequently been incorporated into a single site – Joarimin Creek South (refer to **Figures 1** and **2**).



Base Source: CEMEX and LPI 2004

Legend

- Project Area
- Modified
- Creek Lines
- 1 High Point Rocky Ridge Crest
- 2 High Point Rocky Spur Crest
- 3 Ridge Crest
- 4 Spur Crest
- 5 Moderate Slope
- 6 Gentle Slope
- 7 Very Gentle Slope
- S3 Saddle on Ridge Crest
- S4 Saddle on Spur Crest
- R6 Riparian Corridor in Gentle Slope
- R7 Riparian Corridor in Very Gentle Slope
- AD Adamellite Dyke/Sills
- DS Deep Sand
- A Andesite
- MG Marulan Granite
- BP Bindook Porphyry
- SD Siliceous Dyke

- PA Porphyritic Adamellite
- AD Adamellite Dyke
- PAE Elevated Area within Gentle Slope
- Stage 1 Construction Access Road to Substation
- Approved Underground Transmission Line
- Approved Transmission Line Easement
- Stage 1 Post Hole Monitoring Area
- Area to be Covered with Geotextile and Road Constructed with Imported Fill
- Lynwood Quarry 30 Year Development Footprint

- Artefact Scatter
- Isolated Find
- Stone Arrangement
- Scarred Tree
- Artefact Scatter (CE)
- Isolated Find (CE)
- Grinding Stone (CE)
- Sites Subsurface Tested in Stage 2A
- Drainage
- ATU Subsurface Tested Under DECC s.87/90 AHIP #1100264

- Archaeological Terrain Unit Tested as Part of Stage 2B
- ATU Tested as Part of Stage 1B

FIGURE 1

Archaeological Terrain Units and Testing Locations

File Name (A3): R21_V1/2238_281.dgn

Table 1 – Site and ATU Summary

AHIP#	ATU Testing Location/ Pole #	Site ID	ATU Description	Site Type	# Artefacts	Raw Materials	Artefact Type	Aboriginal Significance	Archaeo-logical Significance	Management
N/A	N/A	MRN1	R7BP – gentle slope in riparian in the Bindook Porphyry	AS	3	quartz	flakes, broken flakes	low	low	managed in-situ for 30 year life of quarry
N/A	N/A	MRN2	R7MG – gentle slope in riparian in the Marulan Granite	AS	6	quartz	flakes, broken flakes	low	low	managed in-situ for 30 year life of quarry
N/A	N/A	MRN3	R7MG – gentle slope in riparian in the Marulan Granite	AS	8	quartz and chert	flakes, broken flakes	moderate	low	managed in-situ for 30 year life of quarry
N/A	N/A	MRN4	4BP – spur crest in the Bindook Porphyry	AS	6	quartz	flakes, broken flakes	moderate	low	managed in-situ for 30 year life of quarry
1077225	N/A	MRN5/ MQ2	S4BP – saddle on a spur crest in the Bindook Porphyry	AS	2	quartz and chert	broken flake, core	low to moderate	low	impacted
N/A	N/A	MRN6	6BP – gentle slope on Bindook Porphyry	AS	3	quartz	flakes, broken flakes	low	low	managed in-situ for 30 year life of quarry
1100264	N/A	MRN7	6BP – gentle slope on Bindook Porphyry	AS	5	quartz and chert	flakes, broken flakes	low	low	impacted
N/A	N/A	MRN8	4BP – spur crest in the Bindook Porphyry	ST	N/A	N/A	N/A	moderate to high	moderate to high	conserved in CHMZ
N/A	N/A	MRN9	6BP – gentle slope on Bindook Porphyry	SA	N/A	N/A	N/A	high	moderate	conserved in CHMZ
N/A	N/A	MRN10	4BP – spur crest in the Bindook Porphyry	ST	N/A	N/A	N/A	moderate to high	moderate to high	conserved in CHMZ
N/A	N/A	MRN11	4BP – spur crest in the Bindook Porphyry	ST	N/A	N/A	N/A	moderate to high	moderate to high	conserved in CHMZ

AHIP#	ATU Testing Location/ Pole #	Site ID	ATU Description	Site Type	# Artefacts	Raw Materials	Artefact Type	Aboriginal Significance	Archaeo-logical Significance	Management
N/A	N/A	MRN12	6BP – gentle slope on Bindook Porphyry	AS	2	chert	flakes	low	low	conserved in CHMZ
N/A	N/A	MRN13	R6BP – gentle slope in riparian corridor in Bindook Porphyry	AS	20	quartz, chert, ignimbrite and volcanic	flakes, broken flakes, axe	high	low	conserved in CHMZ
N/A	N/A	MRN14	R6BP – gentle slope in riparian corridor in Bindook Porphyry	AS	6	quartz and chert	flakes and broken flakes	moderate to high	low	conserved in CHMZ
1077225	W	MRN15	R6BP – gentle slope in riparian corridor in Bindook Porphyry	AS	9 surface 21 subsurface	quartz, quartzite, aplite, hornfels, silcrete	Flakes, broken flakes, retouched flake (used as core), core	moderate	low	conserved – part of site/ATU covered in geotextile for construction of CE access road
N/A	N/A	MRN16	R6PA – gentle slope in riparian corridor in Porphyritic Adamellite	IF	1	quartz	flake	low	low	managed in-situ for 30 year life of quarry
N/A	N/A	MRN17	R6PA – gentle slope in riparian corridor in Porphyritic Adamellite	AS	4	quartz	flakes and broken flakes	low	low	managed in-situ for 30 year life of quarry
N/A	N/A	MRN18	6PA – gentle slope Porphyritic Adamellite	IF	1	quartz	core	low	low	managed in-situ for 30 year life of quarry
N/A	N/A	MRN19	6BP – gentle slope on Bindook Porphyry	IF	1	quartz	flake	low	low	managed in-situ for 30 year life of quarry
N/A	N/A	MRN20	4BP – spur crest in the Bindook Porphyry	AS	2	granitic	upper grindstone fragments	low	low	managed in-situ for 30 year life of quarry
N/A	N/A	MRN21	6BP – gentle slope on Bindook Porphyry	IF	1	chert	flake	low	low	conserved in CHMZ
N/A	N/A	MRN22	6BP – gentle slope on Bindook Porphyry	AS	11	quartz, chert	flakes, broken flakes, core	low	low	managed in-situ for 30 year life of quarry

AHIP#	ATU Testing Location/ Pole #	Site ID	ATU Description	Site Type	# Artefacts	Raw Materials	Artefact Type	Aboriginal Significance	Archaeo-logical Significance	Management
N/A	N/A	MRN23	4BP – spur crest in the Bindook Porphyry	ST	N/A	N/A	N/A	moderate	moderate to high	managed in-situ for 30 year life of quarry
N/A	N/A	MRN24	4BP – spur crest in the Bindook Porphyry	IF	1	quartz	core	low	low	managed in-situ for 30 year life of quarry
1077225	N/A	MRN25	4BP – spur crest in the Bindook Porphyry	AS	326 subsurface 14 surface	quartz, chert, silcrete, basalt, hornfels, dolerite, ignimbrite, chalcedony	flakes, broken flakes, flaked pieces retouched flakes (flakes used as cores and backed), cores	high	moderate	conserved - If the overburden emplacement area extends to the area of MRN25 it will be buried and not impacted
1077225	N/A	MRN26	4DS – spur crest in the deep sands formed over the Bindook Porphyry	AS	6 subsurface 3 surface	quartz and silcrete	flakes, broken flakes, retouched flake	low to moderate	low	impacted
1077225	N/A	MRN27	4DS – spur crest in the deep sands formed over the Bindook Porphyry	AS	170 surface 99 subsurface testing	quartz, quartzite, chert, silcrete, hornfels, ignimbrite, chalcedony	flakes, broken flakes, retouched flakes (including a geometric microlith), cores and a hammerstone fragment	high	moderate to high	partially impacted/ partially conserved
1100264	N/A	MRN27	4DS – spur crest in the deep sands formed over the Bindook Porphyry	AS	60 surface 1168 subsurface	quartz, quartzite, chert, silcrete, hornfels, ignimbrite, chalcedony	flakes, broken flakes, retouched flakes, cores	high	moderate to high	partially impacted/ partially conserved
1077225	N/A	MRN28	4DS – spur crest in the deep sands formed over the Bindook Porphyry	AS	10	silcrete, quartz, quartzite	flakes, broken flakes,	low to moderate	low	partially impacted/ partially conserved

AHIP#	ATU Testing Location/ Pole #	Site ID	ATU Description	Site Type	# Artefacts	Raw Materials	Artefact Type	Aboriginal Significance	Archaeo-logical Significance	Management
N/A	N/A	MRN30	S4DS – saddle on spur crest in the deep sands formed over the Bindook Porphyry	IF	1	indeterminate	manuport/ cobble	low to moderate	low	managed in-situ for 30 year life of quarry
1077225	N/A	MRN33	6BP – gentle slope on Bindook Porphyry	AS	3	silcrete and quartz	broken flake, retouched flake, core	low	low	impacted
N/A	N/A	MRN34	6BP – gentle slope on Bindook Porphyry	AS	30	silcrete and chert	flakes, broken flakes, flaked pieces	moderate	low	managed in-situ for 30 year life of quarry
1077225	N/A	MRN35	4BP – spur crest in Bindook Porphyry	AS	4	silcrete and quartz	broken flakes	low	low	impacted
1077225	N/A	MRN36	6BP - Gentle slope in Bindook Porphyry	AS	8	silcrete and quartz	broken flakes, retouched flakes and core	low	low	impacted
1077225	N/A	MRN37	6BP - gentle slope in Bindook Porphyry	IF	1	silcrete	broken flake	low	low	impacted
N/A	N/A	MRN38	R7BP – gentle slope in riparian corridor in the Bindook Porphyry	IF	1	chert	flake	low	low	managed in-situ for 30 year life of quarry Part Joarimin Creek South
N/A	N/A	MRN39	R7PA – very gentle slope in riparian corridor in Porphyritic Adamellite	AS	3	quartz	flakes	low	low	managed in-situ for 30 year life of quarry
N/A	N/A	MRN40	R7PA – very gentle slope in riparian corridor in Porphyritic Adamellite	AS	25	quartz, silcrete, chert	flakes, broken flakes	moderate	low	managed in-situ for 30 year life of quarry Part Joarimin Creek South
N/A	N/A	MRN41	7PA – very gentle slope in Porphyritic Adamellite	AS	23	quartz, silcrete, chert	flakes, broken flakes	moderate	low	managed in-situ for 30 year life of quarry

AHIP#	ATU Testing Location/ Pole #	Site ID	ATU Description	Site Type	# Artefacts	Raw Materials	Artefact Type	Aboriginal Significance	Archaeo-logical Significance	Management
N/A	N/A	MRN42	7PA – very gentle slope in Porphyritic Adamellite	AS	10	quartz, silcrete, chert, ignimbrite	flakes, broken flakes, core	moderate	low	managed in-situ for 30 year life of quarry
N/A	N/A	MRN43	7PA – very gentle slope in Porphyritic Adamellite	AS	10	quartz, chert	flakes, broken flakes	moderate	low	managed in-situ for 30 year life of quarry Part Joarimin Creek South
N/A	N/A	MRN44	7PA – very gentle slope in Porphyritic Adamellite	AS	6	quartz	flakes, broken flakes	moderate	low	managed in-situ for 30 year life of quarry
N/A	N/A	MRN45	R7BP – gentle slope in riparian corridor in the Bindook Porphyry	AS	3	quartz	flakes	low	low	managed in-situ for 30 year life of quarry
N/A	N/A	MRN46	R7BP – gentle slope in riparian corridor in the Bindook Porphyry	AS	2	quartz, chert	flake and retouched flake	low	low	managed in-situ for 30 year life of quarry
1077225	N/A	MRN48	4DS – spur crest in the deep sands formed over the Bindook Porphyry	AS	5	quartz, silcrete	broken flake, flaked piece, retouched flake	low to moderate	low	impacted
N/A	N/A	MRN49	5BP – moderate slope in the Bindook Porphyry	ST	N/A	N/A	N/A	moderate to high	N/A[1]	managed in-situ for 30 year life of quarry
N/A	N/A	MRN50	4BP – spur crest in the Bindook Porphyry	AS	6	quartz	flakes, broken flakes	low	low	managed in-situ for 30 year life of quarry
N/A	N/A	MRN51	5BP – moderate slope in the Bindook Porphyry	ST	N/A	N/A	N/A	moderate to high	N/A[2]	managed in-situ for 30 year life of quarry
1077225	N/A	MRN52	6BP - gentle slope in Bindook Porphyry	IF	1	chert	flake	low to moderate	low	impacted

[1] Not assessed to be a site from an archaeological perspective
[2] Not assessed to be a site from an archaeological perspective

AHIP#	ATU Testing Location/ Pole #	Site ID	ATU Description	Site Type	# Artefacts	Raw Materials	Artefact Type	Aboriginal Significance	Archaeo-logical Significance	Management
1077225	M	MRN53	6BP – gentle slope in Bindook Porphyry	AS	4	quartz, silcrete	flakes, retouched flake, flaked piece	moderate	low	impacted
1077225 1089392	SS NMZS	MRN54	4BP – spur crest in Bindook Porphyry	AS	11 Subsurface testing	quartz, silcrete, chert	flakes, broken flakes, broke retouched flake	moderate	low	partially impacted
1089392	SS	MRN54	4BP – spur crest in Bindook Porphyry	AS	1269 monitoring and manual excavation	quartz, quartzite, chert, silcrete, hornfels, ignimbrite, chalcedony	flakes, broken flakes, retouched flakes, cores	high	moderate	partially impacted
1077225	O	MRN55	6PA – gentle slope in Porphyritic Adamellite	AS	6	quartzite, aplite	broken flake, broken core	moderate	low	covered by geotextile/no impact managed in-situ for 30 year life of quarry
1077225	V	MRN56	R6PA – gentle slope in riparian corridor in Porphyritic Adamellite	AS	10	quartz, quartzite, aplite, hornfels	flakes, broken flakes	moderate	low	covered by geotextile/no impact managed in-situ for 30 year life of quarry
1077294	Pole Location 8	MRN57	6BP – gentle slope in Bindook Porphyry	AS	2	quartz	broken flake, bipolar flake	low	low	impacted
1077294	Pole Location 6	MRN58	6PA – gentle slope in Porphyritic Adamellite	AS	7	quartz, quartzite, chert	flakes, broken flakes	low	low	impacted
1077294	Pole Location 2	MRN59	6BP – gentle slope in Bindook Porphyry	IF	1	quartzite	flake	low	low	impacted
1077225	A	MRN60	1DS – high point on rocky ridge crest in deep sands.	IF	1	quartz	flake	low	low	impacted

AHIP#	ATU Testing Location/ Pole #	Site ID	ATU Description	Site Type	# Artefacts	Raw Materials	Artefact Type	Aboriginal Significance	Archaeo-logical Significance	Management
1077225	C	MRN61	2BP- high point on rocky spur crest in Bindook Porphyry	AS	4	quartz	flake, broken flake, flaked piece	low	low	impacted
1077225 1100264	D	MRN62	3DS – ridge crest in deep sands	AS	14 (plus 6 surface)	quartz, silcrete, chert, chalcedony	broken flakes, flaked pieces, core	moderate	low	impacted
1077225	B	MRN63	1BP- high point on rocky ridge crest in Bindook Porphyry	IF	1	quartz	broken flake	low	low	impacted
1077225 1100264	I	MRN64	4SD – spur crest on a Siliceous Dyke	AS	19 (plus 6 surface)	quartz, silcrete, chert	broken flakes, flaked pieces, core	low to moderate	low	impacted
1077225	L	MRN65	6DS – gentle slope in deep sands	AS	2	silcrete	broken flake, retouched flake	low	low	impacted
1077225	P	MRN66	7BP – very gentle slope in Bindook Porphyry	AS	6	quartz, silcrete, basalt	flakes, broken flakes	low	low	impacted
1077225	S	MRN67	R6AD – gentle slope in riparian corridor in Adamellite Dykes and Sills	AS	5	quartz, silcrete	flakes, broken flakes	low	low	impacted
1077225	N	MRN68	6AD – gentle slope in Adamellite Dykes and Sills	AS	8	quartz, silcrete	flakes, broken flakes	low	low	impacted
1077225	Q	MRN69	7PAE – elevated landform within very gentle slope in Porphyritic Adamellite	AS	245	quartz, silcrete, chert, quartzite, hornfels, chalcedony, ignimbrite	flakes, broken flakes, flaked pieces, retouched flakes, cores	high	moderate to high	Managed for the 30 year life of the quarry – quarry plan modified to avoid impact
1077225	R	MRN70	7A – very gentle slope in Andesite	IF	1	quartz	broken flake	low	low	impacted
1077225	U	MRN71	R7MG – very gentle slope in riparian corridor in Marulan Granite	AS	2	silcrete, quartzite	flake, broken flake	low	low	impacted

AHIP#	ATU Testing Location/ Pole #	Site ID	ATU Description	Site Type	# Artefacts	Raw Materials	Artefact Type	Aboriginal Significance	Archaeo-logical Significance	Management
1077225	X	MRN72	R7BP – very gentle slope in riparian corridor in Bindook Porphyry	AS	3	quartz, silcrete, ignimbrite	flakes	low	low	impacted
1077225	OM (Old Marulan)	MRN73	6MG – gentle slope in Marulan Granite	AS	738	quartz, silcrete, chert, quartzite, hornfels, chalcedony,	flakes, broken flakes, flaked pieces, retouched flakes (backed blades, backed points, geometric microliths), cores	high	moderate	impacted
N/A	N/A	MRN74	4BP – spur crest in the Bindook Porphyry	ST	N/A	N/A	N/A	moderate to high	moderate	managed for the 30 year life of the quarry
N/A	N/A	MRN75	4BP – spur crest in the Bindook Porphyry	ST	N/A	N/A	N/A	moderate to high	moderate	conserved in CHMZ
N/A	N/A	MRN76	4BP – spur crest in the Bindook Porphyry	ST	N/A	N/A	N/A	moderate to high	moderate	conserved in CHMZ
1100264	N/A	MRN77	4BP – spur crest in the Bindook Porphyry	AS	5	quartz, silcrete	flake, broken flakes	low	low	impacted
1077225	Z	MRN78	7PA - very gentle slope in the Porphyritic Adamellite	AS	7	quartz, silcrete, ignimbrite, chert	flakes, broken flakes, flaked piece, core	low	low	impacted
1077225	Y	MRN79	7AD - very gentle slope in the Adamellite Dykes and Sills	AS	22	quartz, silcrete, quartzite, chert	flakes, broken flakes, flaked pieces	low	low to moderate	impacted
1077225	E	N/A	3BP – ridge crest on Bindook Porphyry	N/A	0	N/A	N/A	low	low	impacted
1077225	F	N/A	S3BP – saddle on ridge crest in Bindook Porphyry	N/A	0	N/A	N/A	low	low	impacted
1077225	G	N/A	4AD – spur crest in Adamellite Dykes and Sills	N/A	0	N/A	N/A	low	low	impacted
1077225	H	N/A	4PA – spur crest in Porphyritic Adamellite	N/A	0	N/A	N/A	low	low	impacted

AHIP#	ATU Testing Location/ Pole #	Site ID	ATU Description	Site Type	# Artefacts	Raw Materials	Artefact Type	Aboriginal Significance	Archaeo-logical Significance	Management
1077225	J	N/A	5DS – moderate slope in deep sands	N/A	0	N/A	N/A	low	low	impacted
1077225	K	N/A	5BP – moderate slope in Bindook Porphyry	N/A	0	N/A	N/A	low	low	impacted
1077225	T	N/A	R7AD – very gentle slope in riparian corridor in Adamellite Dykes and Sills	N/A	0	N/A	N/A	low	low	impacted
1077294	Pole Locations 1, 1A, 3, 4,7, 9, 10	N/A	6BP – gentle slope in Bindook Porphyry	N/A	0	N/A	N/A	low	low	pole location only impacted ($1m^2$)
1077294	Pole Location 5	N/A	6PA – gentle slope in Porphyritic Adamellite	N/A	0	N/A	N/A	low	low	pole location only impacted ($1m^2$)
1077294	Pole Location 11	Part Joarimin Creek South	7PA – very gentle slope in Porphyritic Adamellite	AS	15	quartz, silcrete, quartzite	flakes, broken flakes, flaked pieces	very high	moderate	pole location only impacted ($1m^2$) rest of ATU conserved for 30 year life of the quarry
1077294	Pole Location 12	Part Joarimin Creek South	7PA – gentle slope in Porphyritic Adamellite	AS	8	quartz, quartzite	flakes, broken flakes, flaked pieces	very high	moderate	pole location only impacted ($1m^2$) rest of ATU conserved for 30 year life of the quarry
1077294	Pole Location 13	Part Joarimin Creek South	7PA – gentle slope in Porphyritic Adamellite	AS	129	quartz, silcrete, quartzite, aplite	Flakes, broken flakes, flaked pieces, retouched flakes (geometric microlith), core, manuport	very high	moderate	pole location only impacted ($1m^2$) rest of ATU conserved for 30 year life of the quarry

AHIP#	ATU Testing Location/ Pole #	Site ID	ATU Description	Site Type	# Artefacts	Raw Materials	Artefact Type	Aboriginal Significance	Archaeo-logical Significance	Management
1077294	Pole Location 14	Part Joarimin Creek South	4BP – spur crest in Bindook Porphyry	N/A	0	N/A	N/A	very high	moderate	pole location only impacted ($1m^2$) rest of ATU conserved for 30 year life of the quarry
1077294	Pole Location 15	Part Joarimin Creek South	4BP – spur crest in Bindook Porphyry	AS	5	quartz, silcrete, quartzite	broken flakes, flaked pieces	very high	moderate	pole location only impacted ($1m^2$) rest of ATU conserved for 30 year life of the quarry
1077294	Pole Location 16	Part Joarimin Creek South	4BP – spur crest in Bindook Porphyry	N/A	0	N/A	N/A	very high	low	pole location only impacted ($1m^2$) rest of ATU conserved for 30 year life of the quarry
N/A	N/A	Marulan T1 S1	6BP – gentle slope in the Bindook Porphyry	IF	1	silcrete	broken flake	not provided	low	conserved for 30 year life of the quarry
N/A	N/A	Marulan T1 S2 (now part Joarimin Creek South)	7PA – very gentle slope in the Porphyritic Adamellite	AS	22	quartz, silcrete	flakes, broken flakes, retouched flakes (backed points), flaked pieces and cores	not provided	low	conserved for 30 year life of the quarry
N/A	N/A	Marulan T1 S3 (now part Joarimin Creek South)	4BP – spur crest in the Bindook Porphyry	AS	2	quartz, silcrete	broken flakes	not provided	low	conserved for 30 year life of the quarry

AHIP#	ATU Testing Location/ Pole #	Site ID	ATU Description	Site Type	# Artefacts	Raw Materials	Artefact Type	Aboriginal Significance	Archaeo-logical Significance	Management
N/A	N/A	Marulan T1 S4 (now part Joarimin Creek South)	4BP – spur crest in the Bindook Porphyry	IF	1	silcrete	flake	not provided	low	conserved for 30 year life of the quarry
N/A	N/A	Marulan T1 S5 (now part Joarimin Creek South)	4BP – spur crest in the Bindook Porphyry	AS	6	silcrete	flake, broken flakes, retouched flake (elouera)	not provided	low	conserved for 30 year life of the quarry
N/A	N/A	Marulan T1 S6 (now part Joarimin Creek South)	4BP – spur crest in the Bindook Porphyry	IF	1	silcrete	broken flake	not provided	low	conserved for 30 year life of the quarry
N/A	N/A	Marulan T1 S7 (now part Joarimin Creek South)	4BP – spur crest in the Bindook Porphyry	Grinding Boulder	1	N/A	In-situ boulder used for grinding	not provided	high	conserved for 30 year life of the quarry
N/A	N/A	Marulan T1 S8 (now part Joarimin Creek South)	4BP – spur crest in the Bindook Porphyry	AS	2	silcrete	broken flakes	not provided	low	conserved for 30 year life of the quarry

AHIP#	ATU Testing Location/ Pole #	Site ID	ATU Description	Site Type	# Artefacts	Raw Materials	Artefact Type	Aboriginal Significance	Archaeo-logical Significance	Management
N/A	N/A	Marulan T1 S9 (now part Joarimin Creek South)	4BP – spur crest in the Bindook Porphyry	IF	1	silcrete	core	not provided	low	conserved for 30 year life of the quarry
N/A	N/A	Marulan T5 S1	6BP – gentle slope in the Bindook Porphyry	IF	1	silcrete	flake	not provided	low	conserved for 30 year life of the quarry
N/A	N/A	Marulan T5 S2	6BP – gentle slope in the Bindook Porphyry	IF	1	silcrete	retouched broken flake	not provided	low	conserved for 30 year life of the quarry
N/A	N/A	Marulan T6 S1	6BP – gentle slope in the Bindook Porphyry	IF	1	silcrete	broken flake	not provided	low	conserved for 30 year life of the quarry
N/A	N/A	Marulan T6 S2	6BP – gentle slope in the Bindook Porphyry	IF	1	quartz	flake	not provided	low	conserved for 30 year life of the quarry
N/A	N/A	Marulan T6 S3	6BP – gentle slope in the Bindook Porphyry	IF	1	silcrete	broken flake	not provided	low	conserved for 30 year life of the quarry
N/A	N/A	Marulan T6 S4	6BP – gentle slope in the Bindook Porphyry	IF	1	quartz	flake	not provided	low	conserved for 30 year life of the quarry

IF = Isolated Find AS = Artefact Scatter ST = Scarred Tree SA = Stone Arrangement NMZS = North Marulan Zone Substation
CHMZ = Cultural Heritage Management Zone

Several conclusions can be drawn from the results provided in **Table 1** in relation to the 34 ATUs and 94 sites:

- 29 of the ATUs have known sites;
- the largest numbers of known sites in the ATUs are within the Bindook Porphyry, in the spur crest landform element (4BP - 26% of total sites) and within the gentle slope landform element (6BP - 23.5% of total sites) respectively;
- there were no subsurface artefacts observed/recovered and only scarred trees are known in ATU 5BP (i.e. moderate slope Bindook Porphyry);
- there were no subsurface artefacts recovered and no known sites in five ATUs (3BP, S3BP, 4AD, 5DS and R7AD – spur crest and saddle on spur crest in Bindook Porphyry, spur crest in Adamellite Dyke, moderate slope in Deep Sands and very gentle slope in riparian corridor on Adamellite Dyke respectively);
- only small numbers of artefacts (1 to 10) are known for 13 ATUs (1BP, 1DS, 2BP, S4BP, 6AD, 6DS, 6PA, R6AD, R6PA, 7A, 7BP R7BP and R7MG – high point on ridge crest in Bindook Porphyry and Deep Sands, high point on rocky spur crest in Bindook Porphyry, saddle on spur crest in Bindook Porphyry, gentle slope on Adamellite Dyke, Deep Sands, riparian corridor on Adamellite Dyke and Bindook Porphyry, very gentle slope on Andesite and very gentle slope in the riparian corridor in Bindook Porphyry and Marulan Granite respectively);
- small to medium sized assemblages (1 to 30) are known for six ATUs (3DS, 4SD, 6BP, R6BP, 7AD, and R7PA – ridge crest in Deep Sands, spur crest on Siliceous Dyke, gentle slope in Porphyritic Adamellite, very gentle slope in Bindook Porphyry; riparian corridor in Bindook Porphyry and riparian corridor in Porphyritic Adamellite respectively);
- small to large assemblages (1 to 1497) are known for five ATUs (4BP, 4DS, 6MG, 7PAE 7PA – spur crest in Bindook Porphyry, spur crest in Deep Sands, slightly elevated area in the very gentle slope in Porphyritic Adamellite and very gentle slope in Porphyritic Adamellite respectively);
- 21 of the ATUs to be impacted by the development footprint will still be partially conserved or conserved in other areas of the broader Lynwood Quarry Project Area; and
- there are only seven ATUs (containing 5 sites) for which there is no conservation option available within the project area. Of these;
    - two have no sites (4AD and R7AD);
    - three have <10 artefacts and are represented in adjacent farmland (1DS, 6AD and R6AD);
    - one has 25 artefacts and is not currently known outside the project area (4SD); and
    - one has a large assemblage (738 artefacts in ATU 6MG) and is represented in adjacent farmland.
- 51 sites that are within the broader Project Area boundary but which are outside the approved disturbance footprint will be managed *in-situ* for conservation during the 30 year life of the quarry (including 19 isolated finds, 27 artefact scatters, one in-situ boulder that has been used for grinding and four scarred trees); and

- 11 sites will be conserved long term within a CHMZ (including one stone arrangement, five scarred trees, one isolated find and four artefact scatters).

- 32 sites (seven isolated finds and 25 artefact scatters) will be impacted/partially impacted by the currently approved Lynwood Quarry disturbance footprint (27 sites) or have been impacted by works associated with Country Energy infrastructure related to the Marulan Electricity Supply Upgrade (5 sites).

High levels of soil profile disturbance were noted across the project area arising from agricultural practises (tree clearance, grazing, ripping, cultivating) and bioturbation (cattle, sheep, horses, wombats, rabbits and insects). The very sandy nature of the soils in the Lynwood Quarry Project Area means they are prone to massive downslope movement when heavy rain follows drought or vegetation loss due to bushfire or overstocking. Thus the ridge and spur crests and the slopes of moderate to gentle gradient have in general suffered massive soil loss. Only very limited areas exist where soils have aggraded and this is generally due to colluvial deposit, as in the area of the MRN25 site. In general the riparian corridors, if subject to flood, were areas of heavy erosion rather than areas of alluvial deposition and this is reflected by the lack of artefacts/low numbers of artefacts recovered from the riparian corridor terrain units within all geological contexts.

The levels of soil disturbance and soil loss and the general low numbers of artefacts recovered from the majority of the sites and ATUs tested resulted in generally low assessments for Aboriginal cultural and archaeological significance and extremely low to low research potential. Thus further salvage was not thought warranted for most sites/ATUs.

The area of seven sites (MRN15, 53, 54, 55, 56, 62 and 64) within their broader ATUs were assessed as having moderate Aboriginal cultural significance but only low archaeological significance due to their disturbed nature. Three of these sites (MRN15, 55 and 56) have been protected from impact during works by Country Energy by having geotextile put over their surface and then having road construction proceed using imported fill under DECCW s.87/90 AHIP #1089392. MRN15 (ATU R6BP) also extends into the Lynwood Quarry development footprint and it is proposed that the relevant area of the site and its surrounding ATU will also be covered by geotextile and imported fill used for the construction of the main access road under DECCW s.87/90 AHIP #11100264. MRN53 and MRN 54 were also covered by s.87/90 AHIP #1089392. MRN53 was assessed as not requiring any further salvage, while MRN54 was subject to surface collection and monitoring during topsoil removal. In compliance with DECCW s.87/90 AHIP #1089392, three areas of higher artefact concentration uncovered during monitoring were subject to manual excavation (Umwelt in prep.).

The remainder of the sites with moderate Aboriginal cultural significance but only low archaeological significance (MRN62 and 64) are within the CEMEX development footprint and will be impacted. It was assessed, in consultation with the Aboriginal stakeholders, that neither of these sites warranted further salvage or conservation.

Only five sites were found to have high to very high Aboriginal cultural significance (MRN25, 27, 69, 73 and the 10 sites that were subsumed into the Joarimin Creek South site). These sites were also found to have low to moderate (MRN25, MRN73), or moderate to high (MRN27, MRN69) archaeological significance and research potential (arising from their potential to have large and complex assemblages and in some cases some spatial integrity within the remnant A2 soil horizon). In relation to the Joarimin Creek South site the archaeological significance was assessed as moderate overall, however, within the actual site it varied from areas with low significance and research potential to areas with moderate or even high significance and research potential. The variable levels of significance and research potential relate to the number of artefacts located and the degree of disturbance

found across the site area. The method of subsurface testing (i.e. the pole location salvages) allowed a large area to be incorporated into a single site, however, not that entire site has the same level of significance or research potential. The evidence obtained from the subsurface testing of MRN25 and MRN27 indicated a similar pattern of specific localities where some integrity remained amongst a much larger and more highly disturbed site area.

Of the five sites:

- Subsurface testing indicated that MRN25 (ATU 4BP) had high artefact numbers and an area in the centre of the site that appeared to retain spatial integrity. This site may be impacted by overburden emplacement. The site, however, will not be salvaged, instead it will be carefully buried and sealed beneath the overburden if necessary.

- Subsurface testing indicated that MRN27 (ATU 4DS) had high artefact numbers and an area at the western end of the site that appeared to retain spatial integrity. This site will be partially impacted by the development footprint, however, part of the site and a large area of the ATU will be conserved within the broader Lynwood Quarry project area. This site was subject to further subsurface salvage. The subsurface salvage indicated an overall high level of disturbance and bioturbation, but also small areas where some spatial integrity remained. Artefact distribution was found to be patchy with small areas of artefact concentration interspersed by areas of very low artefact concentration.

- Subsurface testing indicated that MRN69 (ATU 7PAE) had high artefact numbers and may retain spatial integrity within the remnant A2 soil horizon. Following discussions with the Aboriginal stakeholders and CEMEX it was decided to modify the plan for the Eastern Overburden Emplacement Area haul road to avoid MRN69. A small section of ATU 7PA will still be impacted and this section will be subject to salvage.

- Monitoring of mechanical scrapes undertaken under a s.60 Heritage Impact Permit in the Old Marulan township located MRN73 (ATU 6MG). The site had high artefact numbers (mostly related to a single knapping event) but low potential for integrity. The artefacts exposed by the scrapes were salvaged under s87/90 AHIP #1077294. ATU 6MG is limited within the Lynwood Quarry project area but does continue in the adjoining farmland.

- Joarimin Creek South (4BP, 7PA, 7BP, R7BP, R7PA) had high overall artefact numbers that were concentrated in small areas within the 4BP and 7PA ATUs. The only impact to this area was from excavations for poles required by Country Energy. The pole locations have already been salvaged under s87/90 AHIP #1077294 and the remainder of the area will be conserved throughout the 30 year life of the Lynwood Quarry, thus no further salvage is required.

All sites proposed for conservation will be managed in compliance with the Lynwood Quarry Aboriginal Heritage Management Plan (Umwelt 2007c).

Preliminary Interpretation of the Aboriginal Use of the Landscape within the Lynwood Quarry Project Area

The distribution and density of artefacts recovered during the Stage 1 to Stage 3 subsurface testing and salvage investigations and known for surface finds within the Lynwood Quarry Project Area indicates that:

- the entire area was used by Aboriginal people and there is light background artefact scatter across all of the ATUs with the least evidence of Aboriginal use of the landscape associated with the ridge crests, saddles on ridge crests, saddles on spur crests and

slopes of moderate gradient. These latter areas most likely reflect only transient use for hunting/gathering/travel purposes;

- there are four ATUs (4BP, 4DS, 7PAE, 7PA) where artefact numbers and densities appear to reflect greater levels of occupation. These are the spur crests in the Deep Sands and in the Bindook Porphyry, but only in those areas protected from the south-westerly winds (MRN27 and MRN25 and parts of Joarimin Creek South); or on gentle slopes in the Porphyritic Adamellite in close association with a (relatively) more reliable water source (MRN69 and parts of Joarimin Creek South); and

- the relatively large number of artefacts recovered from MRN73 (ATU 6MG) relate to a single knapping event and thus probably only reflect a single short-term use of the area. Likewise the high artefact numbers in MRN54 may also relate to three separate knapping events in three different areas (the analysis of the artefact from MRN54 is not yet completed).

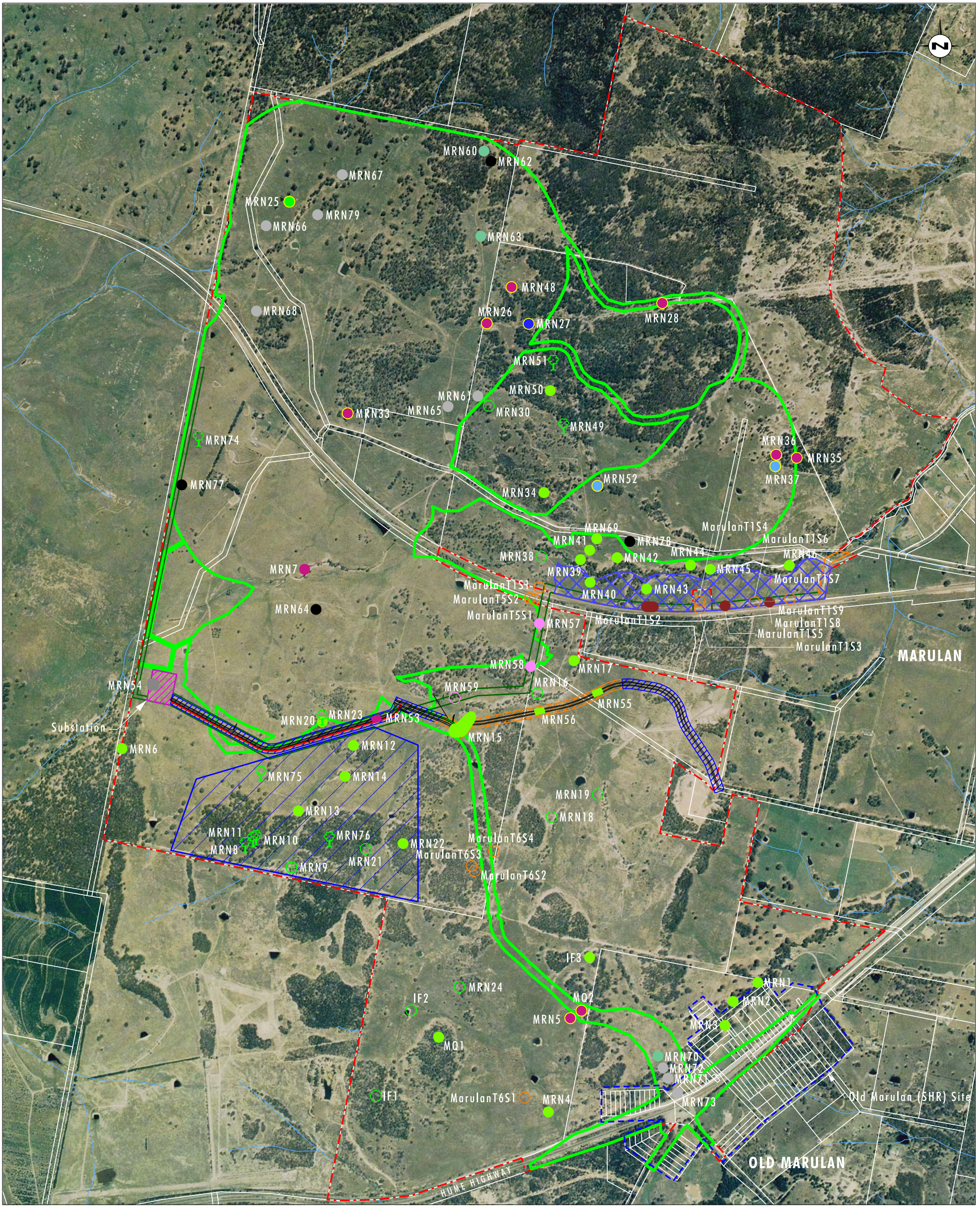
The MRN9 stone arrangement site (refer to **Figure 2**) indicates that some people visited the area for ceremonial purposes and it is probable that the sites falling along the tributary of Joarimin Creek that leads to the stone arrangement may have some connection with movements into the area for ceremony. The numbers of artefacts observed or recovered from sites such as MRN12, 13, 14, 15, 16, 17, 55 and 56 suggest that only small groups of people travelled this way. Whereas the size and number of artefacts associated with Joarimin Creek South and the sites on the northern side of Joarimin Creek (MRN41, 42, 43, 44, 45 and 69) suggest that this was a much more likely camping location for larger groups of people (perhaps a general camp site for those unable to attend the ceremony due to their gender or level of initiation). However, without any chronological information these interpretations are thought of as preliminary as there is currently no evidence to support that this suite of sites are related to the same time period.

The artefact types and reduction techniques indicate that the majority of the stone knapping taking place on site related to either the freehand reduction of cores or the bipolar reduction of pebbles (mainly quartz) to make amorphous flakes of stone for cutting, scraping, adzing etc. Only two sites appear to retain evidence of the manufacture of backed artefacts on site (MRN27 and MRN73 – detailed attribute analysis has yet to confirm this).

Silcrete and quartz were the dominant raw materials used within the Lynwood Quarry Project Area with ignimbrite, basalt, quartzite, dolerite, chert, chalcedony, aplite and hornfels making up only a minor percentage of the assemblages. Ignimbrite and dolerite are available locally, however, all ignimbrite (otherwise known as Bindook Porphyry) outcropping within the Lynwood Quarry Project Area is too weathered for use for artefact manufacture and the dolerite is not found in outcrop.

Small pockets of vein quartz have been noted in the area and it is possible that locally available reef quartz may have been used in the past. It is noted, however, that a relatively large proportion of the quartz artefacts that retain cortex have been manufactured from pebbles.

Thus it is assessed that most of the stone used for tool manufacture within the Lynwood Quarry Project Area was brought into the area. The similarity of the raw materials discarded in the sites suggests that the sites are being used by people that share a common resource exploitation area (i.e. there is no evidence that people from different areas are travelling to MRN9 for ceremony). However, it is possible that further investigation of sites to the south-west, west and north-east (and outside the Lynwood Quarry Project Area) may provide evidence of people travelling from different resource exploitation areas (e.g. raw materials sourced from different areas).



Base Source: CEMEX and LPI 2004

0 0.25 0.5 0.75km
1:15 000

Legend

- Project Area
- Stage 1 Construction Access Road to Substation
- Approved Underground Transmission Line
- Approved Transmission Line Easement
- Joarimin Creek South Area Conservation
- Stage 1 Post Hole Monitoring Area
- Area to be covered with geotextile and road constructed with imported fill
- Cultural Heritage Management Zone
- Lynwood Quarry 30 Year Development Footprint
- Drainage
- Sites Subsurface Tested in Stage 2A
- Artefact Scatter s87/90 Collection/Monitoring
- Artefact Scatter salvaged during Stage 1A
- Isolated Find salvaged during Stage 1A
- Artefact Scatter (CE) Conservation
- Artefact Scatter Located During Stage 2B s87/90 No Further Subsurface Salvage
- Isolated Find Located During Stage 2B s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 Further Subsurface Salvage
- Artefact Scatter located during Stage 2B Surface Collection only
- Isolated Find (CE) Conservation
- Grinding Stone (CE) Conservation
- Stone Arrangement Conservation
- Scarred Tree Conservation
- Isolated Find Conservation
- Artefact Scatter Conservation
- Isolated Find s87/90 No Further Subsurface Salvage
- Artefact Scatter s87/90 No Further Subsurface Salvage

FIGURE 2

Aboriginal Archaeological Site Management

The above interpretations are based on preliminary data only. Further detailed interpretation of Aboriginal use of the landscape within the Lynwood Quarry Project Area will be provided following the completion of the stone artefact recording and analysis and the site analysis (Umwelt in prep.).

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APPENDIX F

Research Design and Methodology

Appendix F – Research Design and Methodology

1.0 Introduction

As discussed in Appendix E and Section 1.3 of the main text there have been numerous surveys and extensive subsurface testing and salvage of Archaeological Terrain Units (ATUs) and Aboriginal archaeological sites across the Lynwood Quarry Project Area (Umwelt 2005; 2007a, b, c, d; 2008a,b, c, d, e). For comparability all of the subsurface testing and subsurface salvage has been undertaken using the same methodology and with the aim of answering a number of research questions of interest to the registered Aboriginal stakeholders and from an archaeological perspective.

Subsurface testing and salvage undertaken to date has been in compliance with Department of Environment Climate Change and Water (DECCW) Section 87 Aboriginal Heritage Impact Permit (s.87 AHIP) #1077225, s.87/90 AHIP #1077294, s.87/90 AHIP #1089392 and s.87/90 AHIP #1100264. It is proposed that the additional subsurface testing and monitoring discussed within the main text (refer to Section 9 of the main text) will be undertaken under a variation to the current s.87/90 AHIP #1100264.

Section 2 of this Appendix will reiterate the research design approved by the registered Aboriginal stakeholders and the DECCW for all prior subsurface investigations and surface collections. **Section 3** of this Appendix will present the methodologies previously approved by the registered Aboriginal stakeholders and the DECCW for s.87/90 AHIP #1100264 (held by Holcim) and in the case of monitoring for s.87/90 AHIP #1089392 (held by Country Energy). A methodology will also be provided for subsurface salvage. At this stage it is unknown if subsurface testing will lead to a requirement for further subsurface salvage, however, the methodology is included here to cover that eventuality.

2.0 Research Design

2.1 Research Design

The research design approved for all prior subsurface testing and salvage of Aboriginal objects/sites within the Lynwood Quarry project area has focused on four themes:

1. Is the distribution and density of the surface artefacts within the ATUs a true reflection of Aboriginal occupation patterns?

2. Does the distribution and density of the surface (including scarred trees, boulder used for grinding and the stone arrangement) and subsurface artefacts and features (if any) reflect the pattern of differential use of the landscape predicted from the ethnography/ethnohistory and Aboriginal oral history?

3. What does the artefactual evidence recovered indicate about Aboriginal use of the landscape?

4. Is it possible to provide some chronology for Aboriginal use of the Lynwood Quarry project area?

Research Theme 1 and 2 relate to refining predictive models for site location within the Southern Tablelands. Research Theme 3 relates to answering questions posed by the relevant Aboriginal stakeholders in relation to how their ancestors were using the land.

Research Theme 4 is an important consideration as obtaining dates for the use of sites by Aboriginal people assists with providing a chronological framework for Aboriginal use of the area (though it should be noted that it may not be possible to locate datable material).

In order to address the research themes a series of questions have been posed; however, it has been recognised that the ability to answer these questions; may be limited by the results of the subsurface investigations (how many artefacts are located and their distribution, artefact type, the variety of raw materials present, the location of datable material etc.).

1. Does the surface distribution and density of artefacts within the ATUs reflect the distribution and density of artefacts in a subsurface context?

2. Are there differences (e.g. artefact and raw material types, reduction methods, retouch type) between the surface and subsurface assemblages and/or between the ATUs?

3. Have local resources influenced site location and site use?

4. What stone resources were transported into the area and from where?

5. How far back in time does Aboriginal occupation of the area extend?

6. Is there evidence to indicate Aboriginal occupation continued after initial European settlement?

Addressing the research questions forms Stage 3 of the overall project which includes the final salvage of sites, detailed stone artefact attribute analysis and the final report which will encompass all subsurface testing and surface and subsurface salvage results (Umwelt in prep.). As part of the Stage 3 artefact analysis, residue and use-wear studies are being used to provide further information in relation to what Aboriginal people where doing in the sites. To date the subsurface testing and salvage program has been unable to locate a datable cultural feature; however, if suitable material is located during the proposed subsurface testing (possible salvage), direct dating will be used to assist with understanding the chronology of the Aboriginal use of the area.

3.0 Methodology

3.1 Subsurface Testing of ATU R6BP

The methodology previously used to subsurface test all ATUs within the Lynwood Quarry project impact area and that proposed for ATU R6BP (Rail Siding area) is as follows;

- a 50 metre by 5 metre grid will be demarcated at a location within the elevated terrace landform chosen in consultation with the Aboriginal stakeholders on site (refer to Figure 9.1 in the main text);

- a series of 0.5 metre squares will be excavated at 5 metre intervals along the 50 metre length of one side of the grid (a total of 11 x 0.5 metre squares). If no artefacts are located within the first 11 test pits then no further subsurface testing will be required within the ATU location. If artefacts are located within any of the initial 11 test pits excavated, a second row of test pits (a further 11 x 0.5 metre squares) will be excavated parallel and 5 metres from the first;

- each square will be excavated manually using spades and trowels;

- deposit will be removed as 10 centimetre spits;
- excavation will be continued to clay or bedrock/decomposed bedrock or until two sterile spits had been removed;
- excavated soil will be sieved using 5 mm and 2 mm nested sieves;
- soil samples will be collected from each spit and soil samples from squares with artefacts will be subject to Munsell and pH testing as part of Stage 3;
- stratigraphic profiles will be recorded for test pits from which artefacts are recovered;
- all artefacts recovered will be retained for analysis during Stage 3 of the Lynwood Quarry cultural heritage investigations before being returned to the Lynwood Quarry Office complex where there will be a facility for their care and display (refer to **Section 4** for details of the artefact analysis); and
- the results of any manual excavation will be reported in the final report (Stage 3) prepared for the cultural heritage work conducted within the Lynwood Quarry (Umwelt in prep.).

3.2 Manual Excavation

If a significant number of artefacts or any significant artefacts or features are recovered during the subsurface testing of ATU R6BP (Railway Siding) discussions will be held with DECCW and the registered Aboriginal stakeholders in relation to undertaking further salvage prior to Railway Siding construction. The area of the excavation will be the subject of thee discussions. The methodology for the manual excavation will be that employed for the manual salvage of the MRN27 site (undertaken under DECCW AHIP #1100264).

- a 2 metre by 2 metre square will be excavated centred on the 50 centimetre test pit/test pits that had significant numbers of artefacts/significant artefacts/a feature;
- additional 1 metre squares will be added around the periphery of the initial 2 metre by 2 metre square to follow areas of higher artefact density and/or features such as hearths, ground ovens/heat treatment pits/knapping floors;
- a minimum of 20 x 1 metre squares will be excavated;
- the 1 metre squares will be excavated stratigraphically and in five centimetre spits within deposits where a single stratigraphic layer exceeds 5 centimetres;
- the 1 metre squares will be excavated as four, 50 centimetre quadrants;
- excavation will continue until either the B soil horizon (clay) is reached and/or decomposed bedrock/bedrock is encountered or until all participants agree that excavation can stop (at least two sterile spits will be removed from the A2 soil horizon before excavation can cease in areas where deposits are very deep);
- the excavations will be undertaken using trowels and spades and all artefacts located within the excavations will be recorded using X, Y, Z coordinates;
- stratigraphic profiles will be prepared for the excavation;

- all soil removed will be sieved using 5 mm and 2 mm nested sieves. The only exception to this would be sediments associated with a hearth, ground oven or heat treatment pit. If a feature of this nature was excavated all the deposit removed would be retained for laboratory analysis (e.g. microscopic and macroscopic plant/seed collection, flotation to collect charcoal if charcoal is scarce and/or highly fragmented - for further details refer to **Section 3.2.1**);

- soil samples will be collected from each spit of each square and from any features for Munsell, pH testing and geomorphic analysis;

- wherever possible suitable materials will be collected for the generation of absolute dates;

- any features such as hearths, ground ovens and heat treatment pits encountered will be excavated first in cross-section and then in their entirety (and separate to the remainder of the square – refer to **Section 3.2.1** for further details);

- all artefacts recovered will be retained for analysis during Stage 3 of the Lynwood Quarry cultural heritage investigations before being returned to the Lynwood Quarry Office complex where there will be a facility for their care and display (refer to **Section 4** for details of the artefact analysis); and

- the results of any manual excavation will be reported in the final report (Stage 3) prepared for the cultural heritage work conducted within the Lynwood Quarry (Umwelt in prep.).

3.2.1 Excavation Methodology for Features

Should a possible hearth, ground oven, heat treatment pit or knapping floor be identified during subsurface testing or salvage activities, the following management strategy is proposed.

- the surface of the feature will be cleaned back (using trowels and brushes as required) to allow the edges of the feature to be identified;

- the top of the feature will be photographed and a plan drawn;

- the feature will then be excavated in cross-section (half-sectioned) to investigate the dimensions and orientation of the feature to more accurately assess whether it is a cultural or natural feature (for example, a burnt tree root/stump);

- the deposits from the feature will be excavated separately to the surrounding deposit to avoid contamination;

- if it is identified as a cultural feature, it will be photographed in cross-section and a stratigraphic profile of the cross-section will be recorded;

- if it is identified as a cultural feature, it will then be excavated in its entirety;

- all excavated materials from the feature will be retained for analysis and samples of relevant materials will be sent for additional analysis, including radiocarbon dating where applicable; and

- following the removal of the entire feature the excavation can resume using the methodology outlined in **Section 3.2**.

3.3 Monitoring of Trench - Topsoil Removal

The following methodology is proposed for monitoring of topsoil removal from the trench proposed for the underground electricity feeder that will run from the North Marulan Zone Substation to the Lynwood Quarry Office, Amenities and Carpark and the infrastructure area. This methodology also includes triggers and contingencies in the unlikely event that a feature (such as a hearth, ground oven or knapping floor) is discovered during the monitoring program. The trench will be between 0.3 metre and 0.6 metre wide and 1 metre to 1.2 metre in depth.

The topsoil will be removed as follows:

- the topsoil will be removed mechanically and spread along one side of the trench;
- the registered Aboriginal stakeholders and an archaeologist will rake over the topsoil to check for artefacts/cultural material;
- if artefacts are encountered their provenance will be recorded (i.e. grid coordinate, approximate subsurface depth);
- the artefacts will be collected;
- the excavated deposits and the profile of the trench will be assessed to check for any indications of features;
- if a feature is encountered (e.g. a hearth, suspected heat treatment pit or knapping floor) the mechanical excavation will cease and the feature will be removed manually. The manual excavation will allow the removal of the entire feature (refer to **Section 3.2.1** for details of the methodology proposed for manual excavation of features);
- all artefacts recovered will be retained for analysis during Stage 3 of the Lynwood Quarry cultural heritage investigations before being returned to the Lynwood Quarry Office complex where there will be a facility for their care and display (refer to **Section 4** for details of the artefact analysis); and
- the results of the monitoring program will be reported in the final report (Stage 3) prepared for the cultural heritage work conducted within the Lynwood Quarry (Umwelt in prep.).

3.3.1 Skeletal Material

In compliance with the Lynwood Quarry Aboriginal Heritage Management Plan, should human/possible human skeletal material be uncovered during subsurface testing, salvage or monitoring all works will halt. Holcim will inform the Lynwood Quarry Aboriginal Heritage Management Committee, the NSW Police Department and the DECCW. A suitably qualified forensic archaeologist or anthropologist will be employed to identify if the skeletal material is human and Aboriginal/non-Aboriginal in origin.

If the skeletal material is Aboriginal in origin, all works in the vicinity of the find site will cease until such time as appropriate management has been discussed with the registered Aboriginal stakeholders and endorsed by the DECCW.

4.0 Artefact Analysis

All artefacts recovered will be analysed using at least x10 magnification. Edges and artefacts suspected of having use-wear or residues will be inspected using at least x30 magnification. Artefacts suitable for residue and use-wear analysis will be set aside for this form of analysis.

The artefact analysis will centre on inter-assemblage comparisons for those assemblages located during the Section 87 subsurface testing program and Section 87/Section 90 subsurface testing and salvage. Numerous attributes (as described below) will be recorded, though not all will be analysed as part of the current investigations. Full details of the artefact data for all of the assemblages will be presented within the Stage 3 report, so that the data will be available for other analysts.

4.1.1 Discussion of Attributes to be Recorded for Analysis

The attributes to be recorded for the artefacts recovered from the development impact area are outlined below. A discussion follows each attribute, detailing the proposed method of recording, potential problems with the method proposed, and the possible behavioural implications of each attribute.

Not all attributes can be measured on all artefacts (e.g. termination type cannot be measured on proximal flake pieces). Therefore, after a discussion of the most basic common attributes, subsequent attributes are divided into sections, with subsections for categories.

Umwelt systematically records the same attributes for all assemblages with the ultimate objective of setting up a database that is comparable intra and inter-regionally.

4.1.1.1 Common Attributes

Artefact Type

Description: Artefact class is a technological category reflecting the mechanical processes which resulted in the physical form of the artefact at the time of recovery. Classes used will include flakes, broken flakes, retouched flakes, flaked pieces, cores, flake-cores, hammerstones, grindstones, ground-edge axes, heat-shattered fragments, and non-diagnostic fragments.

Problems: Classing artefacts does not usually entail significant problems, other than occasional ambiguities between flaked pieces and broken flakes, and between (retouched) flakes and flake-cores (see **Retouch** for a further explanation).

Uses: This category will be used to assess differences in provisioning strategies (e.g. core provisioning vs flake provisioning), differences in site function/use (e.g. presence/absence of grindstones), and the taphonomic effects of fire on site integrity (e.g. differences in the ratio of heat-shattered fragments: other artefact classes).

Raw Material

Description: A largely self-explanatory attribute, raw materials expected to be present include silcrete, quartz, crystalline tuff, quartzite, chert and basic volcanics.

Problems: This category is usually without problems, for analysts with a geological background.

Uses: Raw material is an important attribute, which may broadly indicate the place of origin of an artefact. The dominance of one raw material or another may also be used to group or differentiate sites. Raw material is also frequently used in concert with attributes in the creation of analytic units for more in-depth inter and intra site comparisons.

Artefact Weight

Description: Artefact weight will be measured for all artefacts to one tenth of a gram.

Problems: This attribute does not entail any difficulties.

Uses: Weight is an effective approximation of volume for a given raw material. As such it most accurately reflects the amount of stone being brought to a site. Average weight within a given artefact class is also a good indication of the amount of 'stress' that has been placed on the provisioned material. Large pieces of stone still retaining usable potential are unlikely to be discarded when people are conserving their technological resources (for example, as they move increasingly away from places where replacement material is available). Alternatively, when people are close to the raw material source, or when they are provisioning larger amounts of material to a site, the pressure on the 'exhaustion threshold' is relieved and there should be a resultant rise in the average weight of discarded artefacts.

Dimensions

Percussive Dimensions

Description: Percussive dimensions measure the length of the flake in the direction of force application from the point that force was applied. In this regard it relates to the length of core face that was removed during the manufacture of the artefact. Width is oriented across the face of the flake from the mid-point of length, and thickness from the mid-point of length and width of the ventral to the corresponding point on the ventral.

Problems: While not as arbitrary as maximum dimensions, there is some uncertainty as to what these attributes are actually measuring in terms of the flake manufacturing process.

Use: Variations in average flake dimensions, and in the distribution of flake sizes in histograms, are expected to correlate with differences in the provisioning and reduction strategies at different places. For example, the reduction of cores at a site will produce a large number of moderate to small flakes and some larger flakes. As a result, the histogram of flake length will show a relatively consistent increase in number of flakes from large to small. Contrastingly, when most flakes are the result of retouching or maintenance tasks on other flakes, the majority of the flakes remaining should be very small, with comparably few large to moderate flakes. However, it may be the case that a few moderate to large flakes will be discarded at the site as they are exhausted through excessive/heavy retouch or simply thrown away prior to a reprovisioning event. In such a case, a histogram of artefact size should show a bimodality in regard to length (a small peak in the moderate range and a large peak in the small range), and an even more pronounced bimodality in regard to thickness (most retouching flakes being very thin).

Maximum Dimensions

Description: Maximum length, width and thickness will be measured on all artefacts. 'Length' will arbitrarily be measured along the longest plain, with width the longest of the plains at 90° to length, and thickness measured at 90° to both.

Problems: There are no problems associated with taking this measurement, although it needs to be noted that the definitions of length, width and thickness are entirely arbitrary and do not reflect any aspect of artefact manufacture.

Uses: This measure is most useful as a broad measure of size, and may have a role in assessing fragmentation rates (particularly in the case of heat-shattered fragments) and calculating Minimum Numbers of Artefacts (MNA).

Cortex - Amount and Type

Description: Cortex refers to the 'skin' of a rock – the surface that has been weathered to a different texture and colour by exposure to the elements over a long period. The amount of cortex as a percentage of surface area will be measured on all artefacts (in relation to flakes, cortex can, by definition only occur on the dorsal and platform surfaces). The nature of cortex – its shape and texture – will vary depending on where the raw material was sourced. Cortex will be recorded in all instances where cortex is present.

Problems: This is a relatively unambiguous descriptive category.

Use: When a natural cobble is first selected it will usually be covered in cortex. Therefore the first artefacts produced from it will have a complete coverage of cortex on the dorsal side (primary reduction). As the cobble is increasingly reduced the amount of cortex on each artefact will rapidly decrease (secondary reduction) until it ceases to be present on artefacts (tertiary reduction). As a result of this trend, it should be possible to determine how early in the reduction sequence the artefact was produced. If large numbers of artefacts or a high proportion of the artefacts of a raw material retain cortex it may indicate that the site is located in close proximity to the source. Differences between the proportions of artefacts retaining cortex between different raw material sites indicates relative differences in distance to source. This does not necessarily mean distance in terms of measurable distance across the landscape; it may also reflect length of time since leaving the source. For example, the last campsite when a group is returning to the source of the raw material may be very close to the source in terms of distance, but distant in terms of time elapsed since the group left the source. If artefacts with cortex are occurring in sites a long distance from the place of origin of the natural cobble, then it is likely that cobbles were being transferred to the site when still only slightly reduced. This would imply an attempt to maximise the amount of stone being provisioned with the weight of transported material being a relatively minor concern.

Cortex type may help to clarify the source of the raw material (e.g. from river gravels [rounded, cortex many microscopic conchoidal fractures], surface scree [cortex weathered, porous, often oxidised, can be angular or rounded] or from outcrops [dependent on raw material type, more likely to have flat angular surfaces or recorticated flake scars]).

4.1.1.2 Attributes to be Recorded on Flakes

In most circumstances flakes, whether broken or whole, will account for the majority of artefacts in an assemblage. Flakes are frequently produced in large numbers during reduction events, though most are never subject to use. Flakes are generally inferred to be the most utilitarian of the basic artefact categories, usually possessing a sharp edge along the entire circumference when whole and amenable to reworking patterns which may yield formal 'implements' or 'tools', such as backed artefacts and scrapers.

Knapping Type

Description: Three main knapping methods are used in the production of flakes, resulting in flakes with distinctive characteristics. The first is freehand percussion, where the objective piece is held in the hand and struck with a hard hammer (e.g. a hammerstone), resulting in

'classic' flakes with a single bulb, and a ringcrack/PFA. The second is bipolar, where the objective piece is rested against an anvil and struck. This results in flakes that have straight sheer faces and crushing at both ends. The third is pressure flaking, where an indenter is placed against the edge from which the flake is to be removed and force is applied. The resulting flakes have a characteristically diffuse bulb, with no errailure scar and no PFA.

Problems: Ambiguities do exist in this classification, and the identification of pressure flakes in particular may be difficult, however difficulties are expected to be relatively infrequent.

Use: Freehand percussion, bipolar and pressure flaking are all different approaches to reduction, with different advantages and disadvantages. Pressure flaking is the most controlled method, in terms of how much force is applied and to where. However, pressure flaking does not produce large flakes and is usually associated with fine retouching work. Bipolar reduction is usually viewed as a system employed to increase core use-life. As cores become small their inertia thresholds drop making it difficult to reduce flakes via the freehand method. Resting the core and applying bipolar technique allows flakes to be reduced from a core too small to hold or from small round pebbles with no platform angle to initiate reduction. Pressure flaking when undertaken using an anvil often results in a form of bipolar reduction. Patterns in the distribution of flakes resulting from backing may be used to locate areas of backed artefact manufacture. Patterns in the distribution of flakes produced by bipolar knapping maybe used to indicate where there was pressure to maximize core potential.

Artefact Type

Description: Artefact type is a formal (e.g. less strictly technological), nominal category, similar to artefact class. Artefact types expected to be located include bondi points, microliths, scrapers, and adzes.

Problems: Ambiguity is an inherent feature of artefact typology, with the lines between different types frequently imprecise. Working definitions for each class used will be specified in the text of the analysis.

Use: Despite the problem discussed above, typology proceeds on the basis that at different places and at different times people manufactured artefacts with specific shapes and characteristics. As a result, the general period during which an artefact was made can be inferred if it is of a specific form. It is also not uncommon to infer that a given artefact form implies a given artefact function, and that from the shape of the artefact the activities taking place at the site can be specified, though these suggestions so far lack archaeological support. The problems with both of these uses are well documented, and any such inferences drawn here will be sparing. There is, however, some potential benefit in approaches based on subsistence patterns and the organization of technology. On this basis, it may be possible to make some assertions from artefact typology as to the way subsistence may have been organized at different places through the landscape.

Artefact Breakage

Description: At a basic level, flakes break in six different ways. Three are transverse (at 90° to the direction of percussion) – proximal, medial, distal; two are longitudinal (along the plane of percussion) – left, right (oriented from the ventral view); and one ambiguous – marginal (where dorsal and ventral can be clearly distinguished, but the margin from which the piece has detached is uncertain). All such breaks will be recorded.

Problems: It is occasionally difficult to be certain of the breakage on an artefact. In most cases, however, the kind of breakage can be ascertained.

Use: It is important to differentiate broken from complete flakes for the purposes of analysis, as the two are not comparable in regard to a number of measures. The amount of artefact breakage in an assemblage also indicates the degree of fragmentation to which the assemblage has been subject. In highly fragmented assemblages, the actual number of artefacts represented may be significantly exaggerated. Quantifying breakage allows a more accurate approximation of artefact numbers to be made.

Heat Affect

Description: Heat will affect artefacts in different ways, depending on the way it has occurred. Most heat affected flakes on fine-grained material will reveal a greasy surface lustre on newly flaked surfaces and some discoloration (e.g. porcellanite turns from white to blue), however as heat becomes excessive signs such as potlidding (the 'popping' of small plate-like pieces off the flake) or crazing (multiple fracture lines in multiple directions across the face of the flake) will occur. The presence of any of these features will be recorded.

Problems: This is a relatively unambiguous descriptive attribute for fine-grained materials – its application to coarse-grained materials is perhaps less certain.

Use: Trends in the spatial distribution of heat-affected artefacts may be used to indicate either heat-treatment (the controlled application of heat to improve flaking qualities) or post-depositional burning (uncontrolled heating through bush-fires or stump burning) depending on the signs of heating and associated archaeological features (e.g. hearths).

Platform Size – Width and Thickness

Description: The platform is the surface into which force is applied in the formation of a flake. Platform width is measured across the platform in the same direction as flake width, while platform thickness follows flake thickness.

Problems: Some ambiguity exists on 'where to stop measuring' platform width and thickness, particularly on primary cortical flakes on rounded cobbles (the first flakes removed from a natural cobble), and platform surfaces comprised of multiple flake scars. Despite this the measure appears to work quite well for the majority of flakes.

Use: Platform size is expected to decrease under two circumstances. The first is when flakes are produced from small cores. The second is somewhat more speculative and based on the premise of a correlation between very small (focalized) platforms and the production of parallel-sided flakes (blades) associated with backed artefact manufacture.

Differences in platform size averages within and between sites will be examined to test these correlations and to infer what these mean in terms of human behaviour patterns e.g. curation of stone, expedient use of stone.

Platform Surface

Description: Platform surface will be recorded as one of the following: cortical, single flake scar, multiple flake scars, or facetted.

Problems: This is a largely unambiguous descriptive attribute.

Use: The surface of a platform provides information about the history of the core prior to the detachment of the flake, and also about methods employed to control the flaking process. Faceting in particular has been linked to the systematic production of 'blades'. Patterns in the spatial distribution of these attributes may be used to infer differences in reduction strategies.

Overhang Removal

Description: Frequently prior to the detachment of a flake from a core, the thin overhanging 'lip' of the core was removed in order to stop 'crushing' or force dissipation at the point of force application. This process is known as overhang removal.

Problems: This is a largely unambiguous descriptive attribute.

Use: Overhang removal is often seen as a form of raw material conservation. If a knapper desires to remove thin flakes from the face of the core by striking close to its edge, overhang removal may avoid the platform crushing and the resultant flake ending in a step termination which must be removed from the face of the core before flake production can continue. Thus, raw materials within assemblages, that have high relative proportions of overhang removal, or total assemblages that have high relative proportions of overhang removal, will be used to indicate raw material conservation, which can then be interpreted in relation to human resource use patterns/preferences.

Dorsal Scar Count

Description: The dorsal face of a flake provides a partial record of previous flaking episodes to have occurred down the core face at or near the same point. The number of flake scars on the dorsal surface of a flake which can be oriented relative to their direction of percussion and which are clearly discernable will be recorded.

Problems: There is some ambiguity in this measure, hence the use of the term 'clearly discernable' above. Furthermore, by the nature of the flaking process, each subsequent scar will remove traces of the previous scars, resulting in an incomplete record. For these reasons, this measure needs to be treated with some caution.

Use: Dorsal scar count is a rough indication of how much flaking has occurred prior to the detachment of the flake in question. It also provides a maximum against which to form ratios of 'aberrant to non-aberrantly terminating scars', 'parallel to non-parallel scars' and 'number of scars per rotation' (see next three attributes), all of which may assist in clarifying the reduction process and assist in understanding differences in the Aboriginal use of raw materials and sites.

Number of Aberrantly Terminating Dorsal Scars

Description: Aberrant terminations are further discussed below under **Terminations**. For the purposes of this description it is sufficient to say that flake scars terminating as steps and hinges will be recorded as aberrant in this assessment.

Problems: The problem(s) with this count are the same as those for the previous.

Use: As cores become smaller and more heavily reduced, the inertia threshold will fall and platform angle will increase, resulting in an increase in the number of aberrant terminations as a percentage of the number of flakes removed. Flakes which have a high number of aberrantly terminating flake scars as a percentage of the total are expected to have been produced towards the exhaustion threshold of the core. This measure will be used to indicate pressure on raw material availability and provisioning strategies.

Number of Parallel Flake Scars

Description: A basic count of the number of parallel flake scars.

Problems: As previous.

Use: Examining the ratio of parallel to non-parallel scars on the dorsal surface of flakes may help to clarify the prevalence of 'blade' production in the reduction systems at different places. It may also be possible from examining this ratio in relation to flake size to test whether blade production occurred at a specific stage in the reduction sequence, or whether it was present throughout the complete reduction sequence.

Presence of Parallel Arrises

Description: Arrises or dorsal ridges are a way of controlling artefact morphology. Flakes struck down an existing ridge will tend to follow the direction that the ridge takes. This attribute will involve noting the presence or absence of dorsal ridges that run parallel to the length of the flake.

Problems: Unlike the previous measures, this attribute is largely unambiguous.

Use: Like faceting, the presence of parallel arrises is associated with more controlled flaking methods such as blade production. The relationship between flake size and the presence of parallel arrises may provide similar information to the previous attribute (while at a lower resolution, being presence/absence based, this attribute is less ambiguous than number of parallel scars), as well as helping clarify the spatial distribution of different reduction strategies.

Dorsal Scar Rotation Count

Description: As a core is reduced it may be turned or rotated to provide new platforms or overcome problems with increasing platform angles. As a result, flakes may be detached which cut across old flake scars. The result should be apparent as dorsal scars in different direction to the direction of percussion of the flake being recorded.

Problems: The problem with this measure is the same as that for dorsal scar counts in general.

Use: Core rotation is increasingly likely towards the exhaustion threshold of cores, when platform angles increasingly approach or exceed 90° (it becomes very difficult to remove flakes from platforms with angles exceeding 90°). If it is possible to show a correlation between flake size and number of dorsal scar rotations then it will become possible infer from differences in the spatial distribution of this data that core exhaustion was more frequently approached in some areas than in others. If it is not possible to show this correlation, then it may be taken to suggest that core rotation was part of the reduction strategy throughout the reduction continuum.

Termination

Description: Termination refers to the way in which force leaves a core during the detachment of a flake. Every complete flake has a termination. There are patterns in the form which terminations will take, with the four major categories (those to be used here) being: feather, hinge, step, and outrepasse (or plunging).

Problems: This is a largely unambiguous descriptive attribute. The only point at which uncertainty does enter is in differentiating some transversely snapped flakes from step terminated flakes. In the majority of cases, however, this problem does not arise.

Use: Different terminations have different implications both for flake and core morphology. A flake with a feather termination (in which force exits the core at a low or gradual angle) will

have a continuous sharp edge around the periphery beneath the platform. This has advantages in terms of the amount of the flake edge which can be used for cutting, and also makes the flake far more amenable to subsequent retouching or resharpening activities. Detaching flakes with feather terminations also has minimal impact on the effective platform angle of the core, and so platform angle thresholds are reached relatively slowly while feather terminating flakes continue to be produced.

Hinge and step terminating flakes have none of these advantages. They result in edges which are amenable neither to cutting nor to retouching. Furthermore, hinge and step terminations lead to rapidly increasing effective platform angles, leading to a requirement for core rejuvenation and core exhaustion. For these reasons, such terminations are considered undesirable or *aberrant*. The number of aberrant flake terminations is expected to increase towards the end of a core's uselife, as reduction in core size and increase in core platform angle make it increasingly difficult to detach feather terminating flakes. In areas where aberrantly terminating flakes are relatively common it may be inferred that core potential was more thoroughly exploited. From this it may in turn be inferred that the pressure to realize core potential (e.g. a strategy of heavy raw material conservation) was greater. Increased mobility/emphasis on portability is one possible explanation of such a pattern.

Outrepasse flakes have the opposite effect on core morphology to step and hinge flakes, in that they remove the entire core face and part of the core bottom. As a result, such flakes may be used to rejuvenate cores in which core angles have become high but which still retain useable potential (e.g. are still quite large). The presence of outrepasse flakes may be taken to indicate core rejuvenation and the requirement to increase core use-life.

Retouch

Description: Retouch is the term given to alterations made to a flake by the striking of subsequent flakes from its surface. Retouching may be done either to alter artefact form or to rejuvenate (resharpen) dulled edges, and possibly both. Degree/amount of will be recorded as presence/absence.

Problems: This is a largely unambiguous descriptive attribute. The only area in which difficulty may arise is in instances where edge damage cannot be differentiated from retouch. This occurs infrequently, as edge damage is usually a modern alteration to artefact form which can be noted through differences in surface colour between the flake scar and the rest of the artefact surface.

Use: The two main uses of retouch need to be separated for the purposes of this discussion. Retouch to achieve form (for example, artefact backing) is distinct from retouch for the purposes of edge rejuvenation. 'Formally retouched' artefacts are anticipated to occur at places of manufacture and places of discard. Importantly, such artefacts will be manufactured prior to use as part of a gearing up or preparation for activities such as hunting. The presence of concentrations of such artefacts, including incomplete specimens may indicate the base-camp locations from which mobile subsistence activities were conducted. Such artefacts are also expected to be present among very small assemblages at distances from occupational foci, as the result of discard, loss, or breakage.

Edge rejuvenation retouch is expected to increase as the availability of replacement materials decreases. Such artefacts are expected to represent 'personal gear', an implement carried with a person and maintained for repeated use. Unlike formally retouched pieces, artefacts with edge rejuvenation will not be produced *in preparation for* activities. The sharpest and most useful edge is a fresh edge. Rather, rejuvenation will occur as need arises. The presence of such artefacts at occupational foci is likely to represent discard following use and prior to reprovisioning/retooling. The percentage of artefacts exhibiting

retouch is expected to increase in systems where large amounts of replacement raw material are not available.

It needs to be noted that a third type of retouch also occurs, aimed at neither formalisation of shape or edge rejuvenation. This is when a flake (usually a large to very large flake) has been used for the subsequent production of utilitarian flakes (e.g. when it has been used as a core). This strategy is quite prevalent in NSW. Differentiating such artefacts from other retouched artefacts is empirically difficult, however, is intuitively quite easy. Any such intuitive judgements can, however, be tested during the analysis phase, as such flakes are expected to be quite distinct from other retouched artefacts in size and weight.

Retouch Type

Description: Retouch type is a technological attribute relating the way in which retouch was carried out. Categories to be used are steep, acute, unifacial, bifacial, tranchet and/or used as core.

Problems: This is a largely unambiguous descriptive attribute.

Use: Whether retouch results in a steep or acute edge is important in relation to the possible functions of those edges. Acute retouch results in sharp edges suitable for cutting whilst steep retouch can be used to totally remove a sharp edge (to blunt as in backed artefacts) or to produce thick strong edges suitable for adzing or scraping. Thus, artefact function can be suggested by recording this attribute (residue and use-wear analysis is also planned to substantiate these interpretations). The recording of the technique used for retouch addresses questions related to techniques of implement manufacture and thus another form of human behaviour that can be analysed within and between assemblages.

Retouch Location

Description: Each flake will be divided into eight segments: proximal end, proximal left, proximal right, marginal left, marginal right, distal left, distal right, and distal end; with the presence or absence of retouch in each to be recorded.

Problems: Apportioning sections relies on a visual division of the flake, which may be slightly inaccurate. This is not expected to be a significant effect.

Use: An examination of retouch location may reveal trends in distance decay (e.g. increasing number of margins retouched over distance, or may simply reveal non-random patterns in the way retouching was carried out. If the former, then the trend may be used to suggest trajectories along which flakes were being carried as personal gear. In the case of the latter, the information would provide an insight into the manufacturing/reduction systems being employed.

4.1.1.3 Attributes to be Recorded on Cores

The following attributes are to be recorded on cores. Most information taken from cores concerns the way in which they were reduced – what pressures, controls and systems were applied.

Percentage of Surface Flaked

Description: This attribute involves an estimate of the percentage of the outer surface of the core which has had flake scars removed from it.

Problems: This is a visual estimate and liable to prove reasonably inaccurate and coarse. Nevertheless, it remains useful.

Use: This measure can be useful in assessing degree of core reduction. In particular, it can be useful in locating areas of heavy core reduction, particularly when used in concert with the following two measures.

Number of Flake Scars

Description: This measure mirrors **dorsal scar count** from the previous section. All scars over the length of 10 mm will be measured (there are usually large numbers of flake scars between 10-3 mm, which relate more to platform preparation than flake production.

Problems: Most of the problems with this measure arise from fact that subsequent scars remove traces of former scars, leaving an incomplete record of the past. As a result, this measure will always underestimate the number of flakes removed from the core.

Use: Dorsal scar count provides an estimate of the amount of reduction to which a core has been subject. Used in concert with measures such as **number of rotations** and **percentage of surface flaked**, it may be help to locate differences in the degree of core reduction at different locations.

Number of Rotations

Description: This measure mirrors **dorsal scar rotation count** as discussed above.

Problems: This measure has the same problems as **number of flake scars**.

Use: Different reduction systems use core rotation in different ways. In some systems, cores are rotated only once, after the striking of the initial flake to form a platform. All subsequent scars are removed in one direction from that platform. Other systems will involve repeated rotations between two platforms, or may involve continuous core rotation and numerous platforms. It may be the case that through the use-life of a core a number of different strategies will be used.

Assessing core rotation may help to clarify reduction systems, and the stage in the reduction system at which the individual core was discarded. This can be used to indicate differences in use of raw materials both within assemblages and between assemblages.

Number of Aberrantly Terminating Scars

Description: Flake scars terminating as steps and hinges will be recorded as aberrant in this assessment.

Problems: There should be no problems with this simple count.

Use: As cores become smaller and more heavily reduced, the inertia threshold will fall and platform angle will increase, resulting in an increase in the number of aberrant terminations as a percentage of the number of flakes removed. Flakes which have a high number of aberrantly terminating flake scars as a percentage of the total are expected to have been produced towards the exhaustion threshold of the core. This measure will be used to indicate pressure on raw material availability and provisioning strategies.

Number of Parallel Flake Scars

Description: A basic count of the number of parallel flake scars.

Problems: There should be no problems with this simple count.

Use: Examining the ratio of parallel to non-parallel scars on cores may help to clarify the prevalence of 'blade' production in the reduction systems at different places. It may also be possible from examining this ratio in relation to flake size to test whether blade production occurred at a specific stage in the reduction sequence, or whether it was present throughout the complete reduction sequence.

4.1.1.4 Comments

Description: a column will be supplied in the data base for recording comments. This may include comments on attributes such as artefact colour, granularity, presence and nature of inclusions, or other comments that do not fit snugly inside one of the attribute classes.

Problems: There should be no problems.

Use: Descriptions of artefacts can sometimes be useful for assisting in locating conjoins.

4.2 Care and Control

The care and control of all 'Aboriginal objects' (stone artefacts) recovered from the Lynwood Quarry disturbance footprint is detailed within the current 'Care' Permits #2761 (related to s87/S90 AHIP #1077294 and s.87/90 AHIP #1100264 approved 20 May 2009) and #2762 (related to s87 AHIP #1077225 approved by the DECC on 27 August 2007). Until such time as the final artefact analysis and reporting are completed the artefacts recovered as part of the Stage 1 to 3 investigations are being temporarily stored at Umwelt's Toronto Offices as per Schedule D of AHIPs #1077225, #1077294 and #1100264.

In relation to any artefacts recovered during subsurface testing (and salvage if required) of ATU R6BP (as proposed in the management recommendations in Section 9.1.2 of the main text), it is proposed that existing 'Care' Permit #2761 is varied to enable the 'Care' of any artefacts salvaged in the same manner.

On completion of the reporting process and following the construction of the appropriate facilities within the CEMEX Office complex, the artefacts will be handed over to the Lynwood Quarry Aboriginal Heritage Management Committee to be placed in the appropriate storage facility or on display.

5.0 Reporting

It is proposed that the results of the monitoring of the trench excavations, the subsurface testing of ATU R6BP and salvage of ATU R6BP (if required) will be integrated in the Stage 3 report which is currently in preparation (Umwelt in prep.).

6.0 References

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