
Annexure A

Advice on EIS – Heritage NSW



Mr Anthony Ko
Team Leader
Energy Assessments
Department of Planning and Environment
anthony.ko@dpie.nsw.gov.au

Your reference: SSI-12422997
Our reference: DOC23/830120

Dear Anthony,

Heritage NSW - Advice on Environmental Impact Statement (EIS) - State Significant Infrastructure (SSI-12422997) – Oven Mountain Pumped Hydro Energy Storage Project

Thank you for your referral on 15 September 2023 seeking advice on the above State Significance Infrastructure (SSI) proposal. We understand that the proposal involves the development of an off-river pumped hydro energy storage system, adjacent to the Macleay River. For the purposes of assessment, the Project Area comprises a larger area within which there is a defined construction envelope of approximately 780 hectares. The construction envelope is generated by buffering key project elements and infrastructure to allow for flexibility in design. A disturbance footprint of 330 hectares sits within the construction envelope and represents the total area of physical disturbance expected as part of the project works.

In preparing this advice, Heritage NSW has reviewed the following documents:

1. Relevant sections of Oven Mountain Pumped Hydro Energy Storage Environmental Impact Statement – prepared by EMM Pty Ltd, dated July 2023
2. Relevant sections of Appendix V -Oven Mountain Pumped Hydro Energy Storage EIS World and National Heritage impact assessment – prepared by EMM Pty Ltd, dated 23 March 2023
3. Appendix K - Oven Mountain Pumped Hydro Energy Storage EIS Aboriginal Cultural Heritage Assessment Report – by EMM Pty Ltd, dated 3 March 2023.

Following the review of the above documents, Heritage NSW requests additional information to inform its advice to the Department on whether the management recommendations provided in the Aboriginal Cultural Heritage Assessment Report are adequate. Additional information is required in relation to the following matters.

Aboriginal Party Consultation

1. Some additional information to that provided in Appendix B is required, as follows:
 - a) Please provide evidence of provision of both versions of the draft assessment methodologies (as dated November 2021 and February 2022) to all 19 Registered Aboriginal Parties.



- b) Please provide evidence that the draft ACHAR was provided to all Registered Aboriginal Parties (such as an email with all relevant email addresses shown).
2. The last documented consultation event in the ACHAR closed on 23 December 2022. Please provide a summary of any consultation that has been undertaken since December 2022, noting that under our guidelines, breaks in consultation of over six months may not constitute continuous consultation.

Cultural values mapping

3. The ACHAR references the completion of cultural values mapping; however, it is understood that the report is subject to finalisation. Heritage NSW require that a copy of Appendix D be provided for review, noting that if gender restrictions are specified in the cultural values mapping, an assessments officer of the appropriate gender only will review the report. Additional clarifications may be sought once the cultural values mapping report has been provided.

Impact to areas of identified cultural value (excluding archaeological sites)

4. The ACHAR recommends that the ACHMP should include provisions for ongoing consultation to discuss any potential indirect or visual impacts of the proposal on the areas of identified cultural value, being Kunderang East Station (OMPS-CS3), Lower Creek/Long Flat Station (OMPS-CS5) and George's Creek Camp (OMPS-CS4). Heritage NSW recommends that these meetings and discussions must occur prior to project approval to provide accurate information on the nature of any such impacts.
 5. Lower Creek/Long Flat Station is recognised as having Aboriginal cultural value and potential but is identified as being subject to indirect impact only. However, the consideration of historical heritage provided in Chapter 6.5 of the EIS identifies that the project may directly impact archaeological resources related to Long Flat Station. Please clarify the potential for these archaeological resources to have Aboriginal cultural value and provide information on impacts to these deposits will be managed with reference to Aboriginal cultural heritage.
 6. The Registered Aboriginal Parties have identified significant concerns regarding the importance of maintaining cultural flows within the Macleay River, both more generally and in relation to specific sites/places of cultural value. The ACHAR proposes that this will be further considered as part of water licensing processes. Please clarify why this cannot occur as part of the current assessment process.
 7. The ACHAR notes the presence of a 'significant part of the cultural landscape biographies of the Aboriginal women connected to Kunderang', being a travel route between the Georges Creek camp and Kunderang Station. Please confirm how the potential impacts of the proposal on this portion of the cultural landscape have been considered.

Adequacy of survey

8. The ACHAR identifies that an escarpment is present within the project area but was not surveyed due to safety concerns. Please clarify whether this escarpment is within the construction envelope and, if so, whether there is potential to undertake survey of this area with a team of appropriately physical fitness.
9. Please confirm that the survey transects shown in Figure 7.1 represent pedestrian survey. If these transects reflect a mix of pedestrian and vehicle survey, please adjust the figure to distinguish each of these survey methods.
10. The mapping of survey effort shows an unsurveyed area on the construction envelope to the north-east of the intersection with Waterloo Creek. Given that the adjoining surveyed areas contain a relatively high distribution of artefact scatters/isolated artefacts, please confirm if there is an intention to survey this area, potentially in association with the finalisation of test excavations.

Landform mapping

11. The ACHAR does not include mapping of specific landforms within the project area. The mapping and definition of landforms across the project area is critical given that the acknowledged association between landform and the distribution of archaeological sites and deposits. To comply with Requirement 2 of the Code of Practice, please provide landform mapping using standard classifications, preferably referencing landform units as defined in the 'Landform' chapter of the *Australian Soil and Land Survey Field Handbook* (3rd edition).

Test excavation outcomes

12. The ACHAR identifies that some planned test pits were 'discounted' on the basis that there were situated in areas considered to have low archaeological potential. In presenting the test excavation results, please provide clear explanation for the final distribution of test pits with reference to considerations of archaeological potential.
13. It is understood that approximately 25% of the planned test excavation program could not be completed due to weather and access conditions. Heritage NSW strongly supports the recommendation in the ACHAR that the remainder of test excavation be completed prior to project approval in order to inform final consideration of harm to Aboriginal objects. This is particularly applicable to the eastern portion of the construction envelope, which is also identified as having the potential to contain deeper alluvial soils. The results of these test excavations will inform final consideration of the adequacy of proposed mitigation measures.
14. The ACHAR states that test excavation was focused on elevated landforms (mainly spurs and crests) associated with the Macleay River and that limited test excavation was undertaken in the areas of moderate to steep relief associated with the proposed reservoir locations and no test excavation was undertaken in the elevated northern portion of the construction envelope. Given this, please justify the basis for extrapolating the results of test excavation to assess the entirety of

the construction envelope as comprising low density artefact scatter. The response should consider the landforms across the construction envelope and the site density data by landform presented for the survey in Table 7.2.

15. Please provide a table correlating recorded sites and test pits with identified focal areas.

Clarification of harm to archaeological sites

16. The ACHAR identifies that three recorded sites will be inundated as a result of the proposal but specifies that this will not result in any loss of value. Please clarify this statement with reference to the potential impacts to sites of this type from increased water movement, changes to site context and potential impacts on site accessibility.
17. The ACHAR identifies that six potential culturally modified trees and three potential stone arrangements will be subject to complete harm from the project, with indirect harm (through inundation) to a potential quarry site, potential stone arrangement and potential grinding groove. It is noted that the Registered Aboriginal Parties identified one tentatively recorded site subject to direct impact (OMPS-SA6) as possibly being associated with a burial. The ACHAR must confirm the status of these sites (as either Aboriginal cultural sites or not) and appropriately assess their significance to inform Heritage NSW's consideration of project impacts. Consideration should also be given to clarifying the status of other tentatively identified sites that are located outside the construction envelope however this may occur following project approval.
18. The ACHAR includes a recommendation that consideration should be given to optimising design to avoid harm to the identified sites. Please provide further information on the timing of this consideration and the likelihood of site avoidance.

Consideration of Ecologically Sustainable Development and Cumulative Impacts

19. The ACHAR states that 'the current and proposed impacts of the Project and associated material culture loss, can be considered to have significant benefits.' Heritage NSW disagrees with this conclusion. Harm to Aboriginal cultural heritage from the proposal is irreversible and while obtaining additional information can mitigate this loss, it does not constitute a positive outcome.

Management and Mitigation Recommendations

20. An indicative methodology for further investigation and salvage of the identified foci subject to harm (as may be applied to OMPS-FA1-4 and 8-12) is provided. It is understood that a detailed methodology has not been provided pending design finalisation. Please clarify whether this detail will be available prior to project approval.
21. The detailed methodology will be developed on the basis that the sites subject to salvage have moderate significance. Heritage NSW recommends that the methodology should include a requirement that, where salvage excavation indicates that a site has a level of significance higher than that considered in the

ACHAR, salvage excavation will be paused until additional consultation is undertaken with the Registered Aboriginal Parties and Heritage NSW to determine whether salvage should continue, should be modified or whether the significance is such that the site or portion of the site should be avoided.

22. Specific methodologies for the archival recording and proposed management of scarred trees, stone arrangements and quarry sites subject to harm by the proposal should be provided to allow Heritage NSW to comment on the adequacy of any such mitigation works. Given that work will be undertaken to confirm the status of these sites, the methodologies (if required) must be developed for all sites identified as valid.

Management of artefacts collected on tracks

23. Correspondence with Heritage NSW dated 28 June 2022 states that artefacts located on key access tracks would be moved off the access track but remain in the general vicinity of the identified location (generally no more than 15 metres from its current location). However, the ACHAR indicates that artefacts were collected and subject to several different storage options including temporary storage in a locked box attached to a tree, placement in the vicinity of an identified landmark and potentially storage in another location on site. Please clarify if any additional consultation was undertaken in relation to this apparent change in the agreed methodology.

Environment Protection and Biodiversity Conservation Act 1999

- Kunderang East Pastoral Station (listed on the SHR as having significant Aboriginal cultural values) is located within the World Heritage and National Heritage listed GRA but is outside of the project area. The World and National Heritage Impact Assessment report has assessed that the Project will not result in visual impacts to Kunderang East Pastoral Station. However, the ACHAR identifies that additional consideration of potential indirect and visual impacts to this site is required. Any revised visual impact assessment for Kunderang East Pastoral Station may subsequently need to be considered in the World and National Heritage impact assessment.
- The World and National Heritage Impact Assessment report has assessed that no Project activities will interact with Aboriginal cultural sites in the World Heritage area and National Heritage place.
- Based on the above, Heritage NSW has no further comment on Aboriginal cultural heritage in relation to Commonwealth matters of national environmental significance, pending further consideration of visual impacts.

Administrative Matters

24. The AHIMS searches provided in Appendix E are over 12 months old. Please undertake an updated AHIMS search and confirm that there are no additional



sites recorded within or immediately adjacent to the project area that require inclusion in the ACHAR.

25. Based on a review of AHIMS, a portion of the sites identified during the ACHAR have been registered on AHIMS. Please provide a table listing sites by name, AHIMS ID and site type for ease of comparison.

If you have any questions regarding the above, please contact Nicola Roche, Principal Assessments Officer, on (02) 9228 6424 or at nicola.roche@environment.nsw.gov.au.

Yours sincerely

Nicole Davis

Nicole Davis

Manager Assessments

Heritage NSW

Department of Climate Change, Energy, the Environment and Water (DCCEEW)

As Delegate under *National Parks and Wildlife Act 1974*

1 March 2023

Annexure B

Aboriginal stakeholder consultation

This annexure has been redacted because it contains personal or sensitive information.

Annexure C

Additional desktop information data

C.1 Updated AHIMS search results

EMM Consulting - St Leonards - Individual users

Date: 24 April 2024

Ground Level, Suite 01 20 Chandos Street
 St Leonards New South Wales 2065

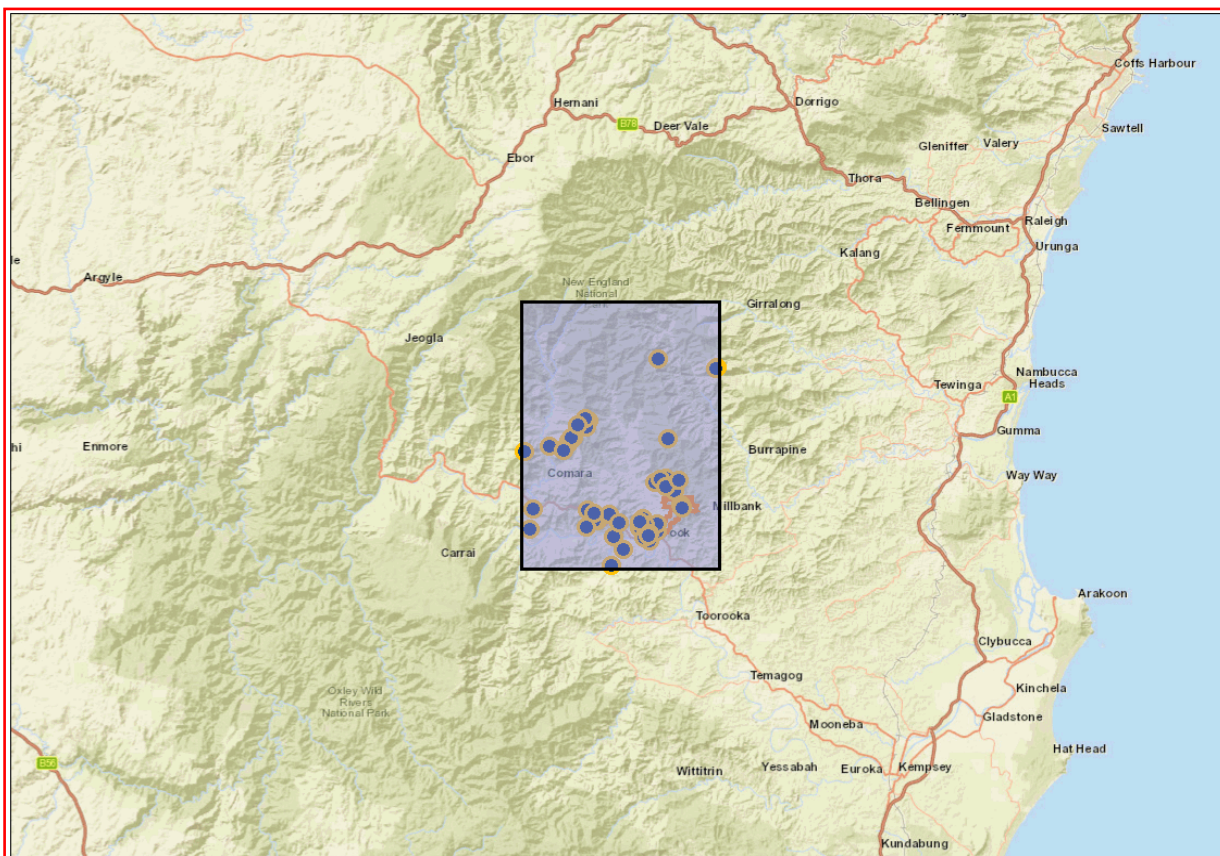
Attention: Nicolas Reilly (Emm Consulting)

Email: nreilly@emmconsulting.com.au

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : -30.8525, 152.3669 - Lat, Long To : -30.5573, 152.6171, conducted by Nicolas Reilly (Emm Consulting) on 24 April 2024.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

51	Aboriginal sites are recorded in or near the above location.
2	Aboriginal places have been declared in or near the above location. *

<u>ID</u>	<u>Aboriginal Place Name</u>
45	Burrel Bulai
46	Long Gully

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the [NSW Government Gazette \(https://www.legislation.nsw.gov.au/gazette\)](https://www.legislation.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not to be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Heritage NSW and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

EMM Consulting - St Leonards - Individual users

Date: 24 April 2024

Ground Level, Suite 01 20 Chandos Street
 St Leonards New South Wales 2065

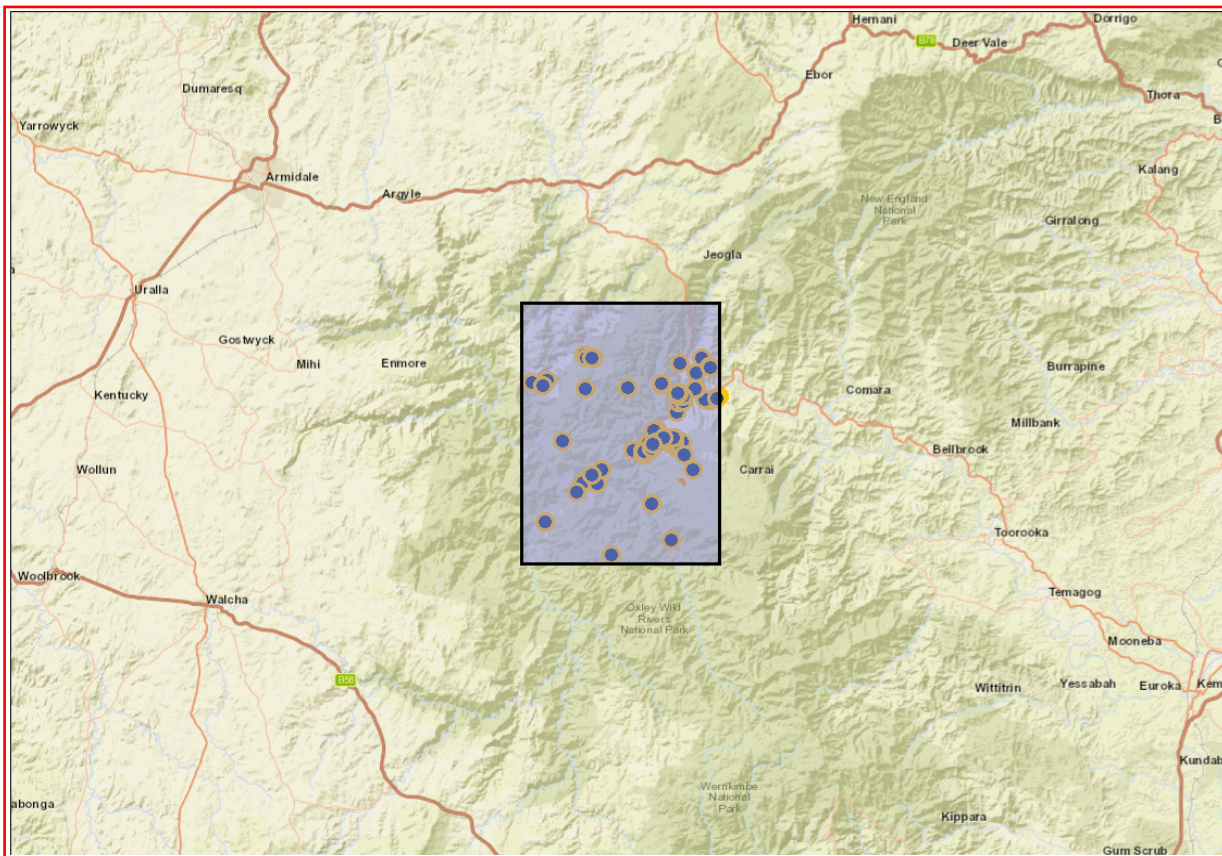
Attention: Nicolas Reilly (Emm Consulting)

Email: nreilly@emmconsulting.com.au

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : -30.94, 151.99 - Lat, Long To : -30.65, 152.24, conducted by Nicolas Reilly (Emm Consulting) on 24 April 2024.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

92	Aboriginal sites are recorded in or near the above location.
1	Aboriginal places have been declared in or near the above location. *

<u>ID</u>	<u>Aboriginal Place Name</u>
3	Carraí Waterholes

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the [NSW Government Gazette \(https://www.legislation.nsw.gov.au/gazette\)](https://www.legislation.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

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- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
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- This search can form part of your due diligence and remains valid for 12 months.

EMM Consulting - St Leonards - Individual users

Date: 24 April 2024

Ground Level, Suite 01 20 Chandos Street
 St Leonards New South Wales 2065

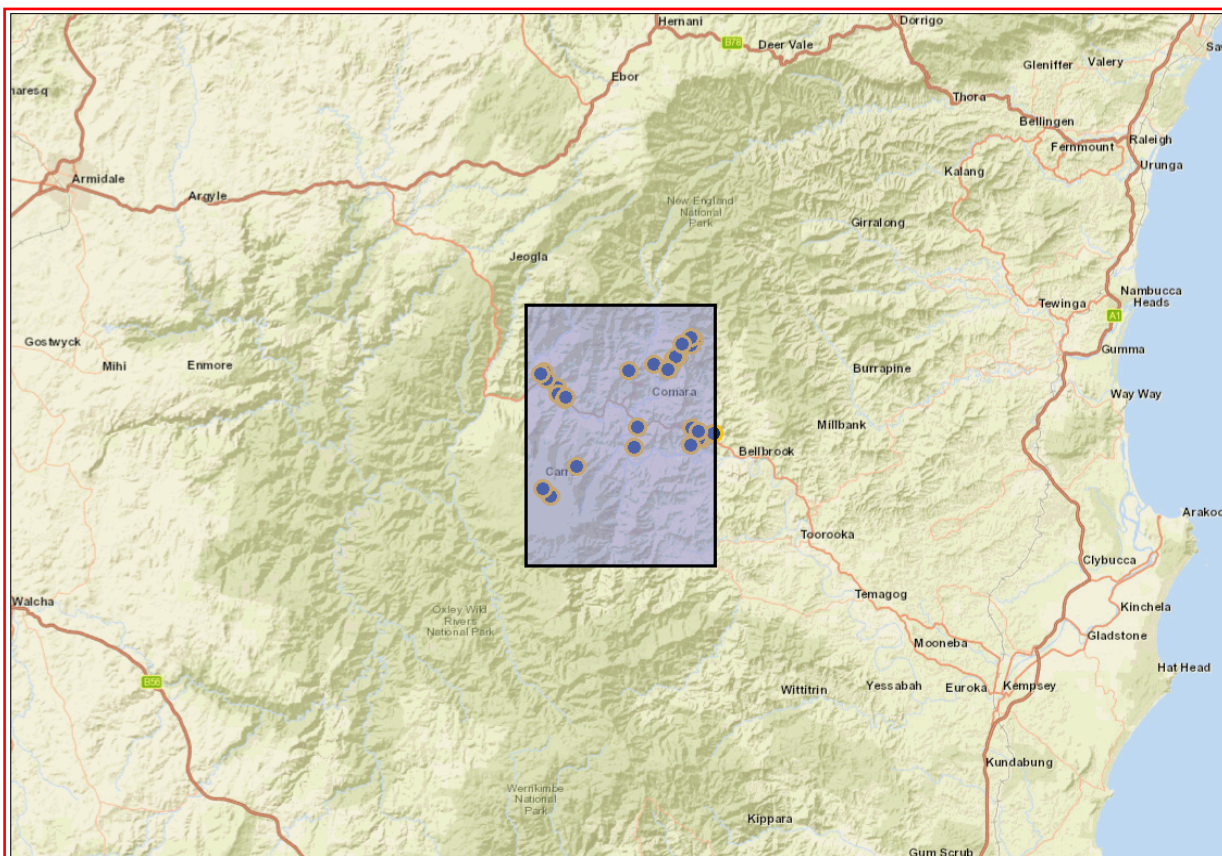
Attention: Nicolas Reilly (Emm Consulting)

Email: nreilly@emmconsulting.com.au

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : -30.94, 152.24 - Lat, Long To : -30.65, 152.48, conducted by Nicolas Reilly (Emm Consulting) on 24 April 2024.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

30	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the [NSW Government Gazette \(https://www.legislation.nsw.gov.au/gazette\)](https://www.legislation.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

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- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

Information redacted because it contains sensitive information.

C.2 AHIMS Site cards

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID:

Date recorded:

Site Location Information

Site name:

Easting: Northing: Coordinates must be in GDA (MGA)

Horizontal Accuracy (m):

Zone: Location method:

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
<input type="text" value="Mr"/>	<input type="text" value="Ahoy"/>	<input type="text" value="Steven"/>

Organisation:

Address:

Phone: E-mail:

Site Context Information

Land Form Pattern: Land Use:

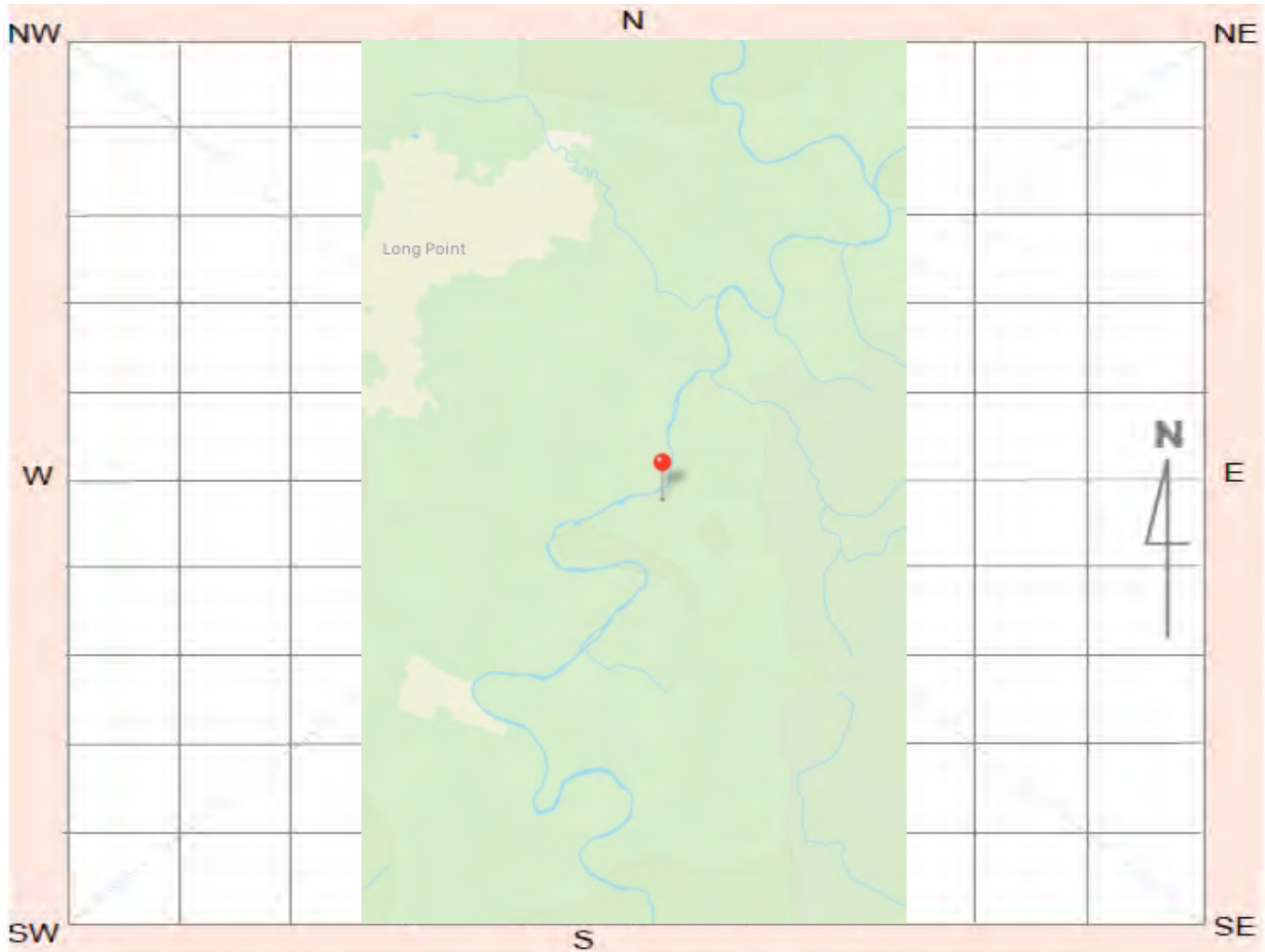
Land Form Unit: Vegetation:

Distance to Water (m): Primary Report:

How to get to the site:

Other site information:

Site location map



Site contents information

open/closed site:

Site condition:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
1. <input type="text" value="Artefact"/>	<input type="text" value="1"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

Description:

Scarred Trees

Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
2. <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Description:

Scarred Trees

Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Features:

3.

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Description:

Features:

4.

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Description:

Features:

5.

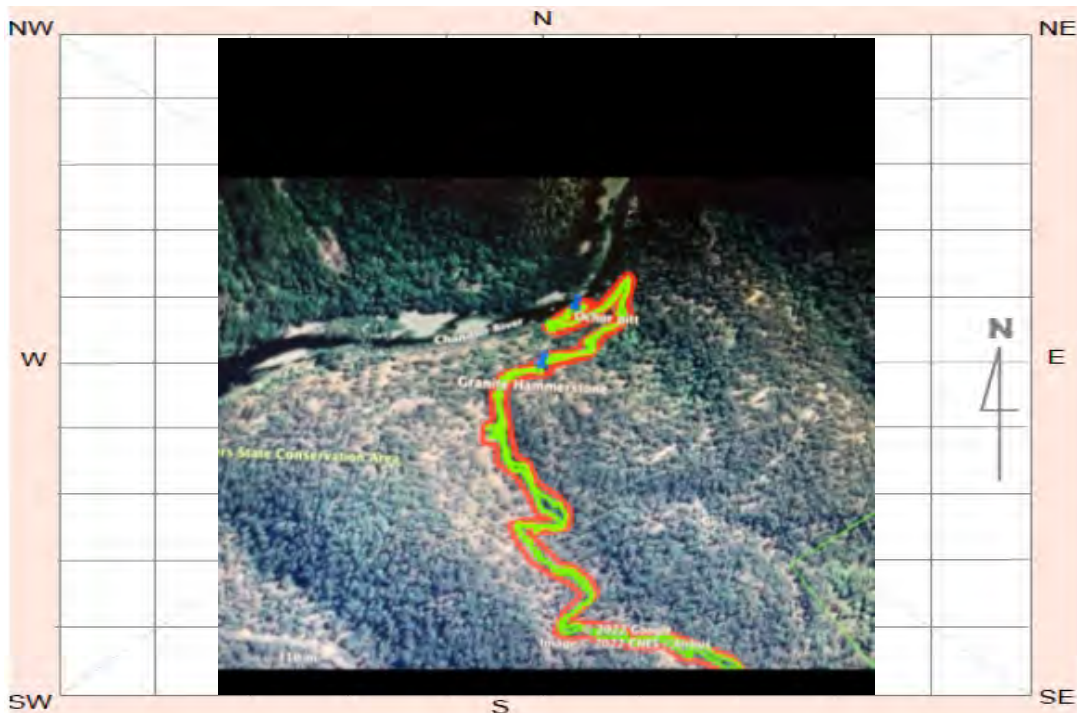
Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Description:

Other Site Info:

Located in a erosion site

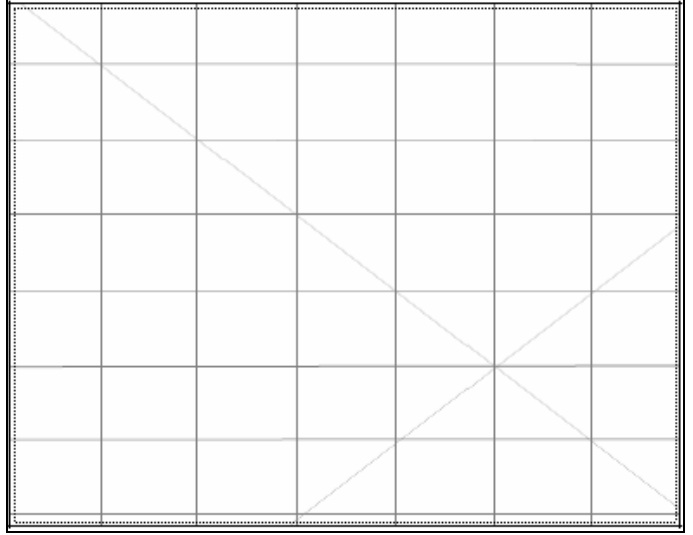
Site plan



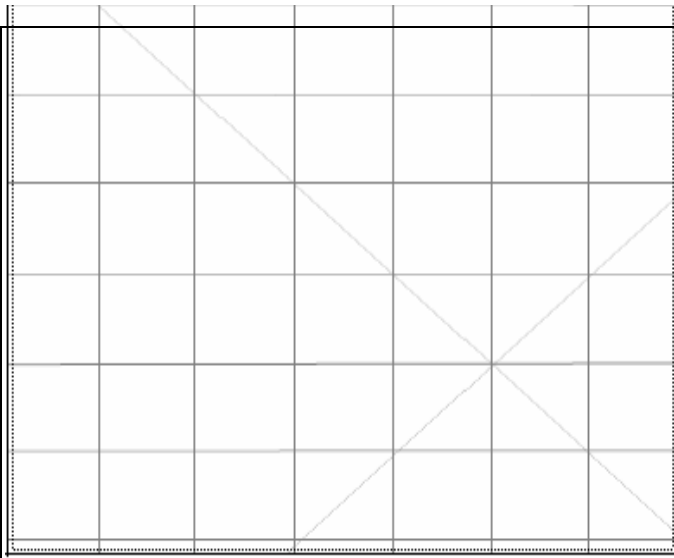
Site photographs



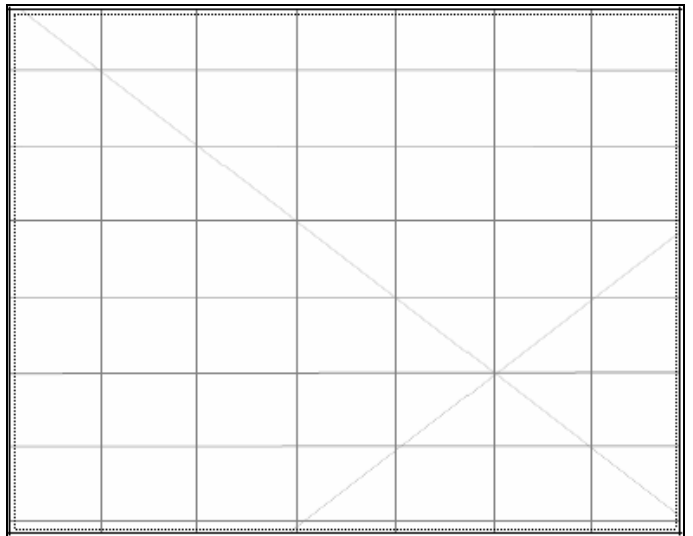
Description:



Description:



Description:



Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title Surname First name

Organisation:

Address:

Phone: E-mail:



Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID:

Date recorded:

Site Location Information

Site name:

Easting: Northing: Coordinates must be in GDA (MGA)

Horizontal Accuracy (m):

Zone: Location method:

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
<input type="text" value="Mr"/>	<input type="text" value="Ahoy"/>	<input type="text" value="Steven"/>

Organisation:

Address:

Phone: E-mail:

Site Context Information

Land Form Pattern: Land Use:

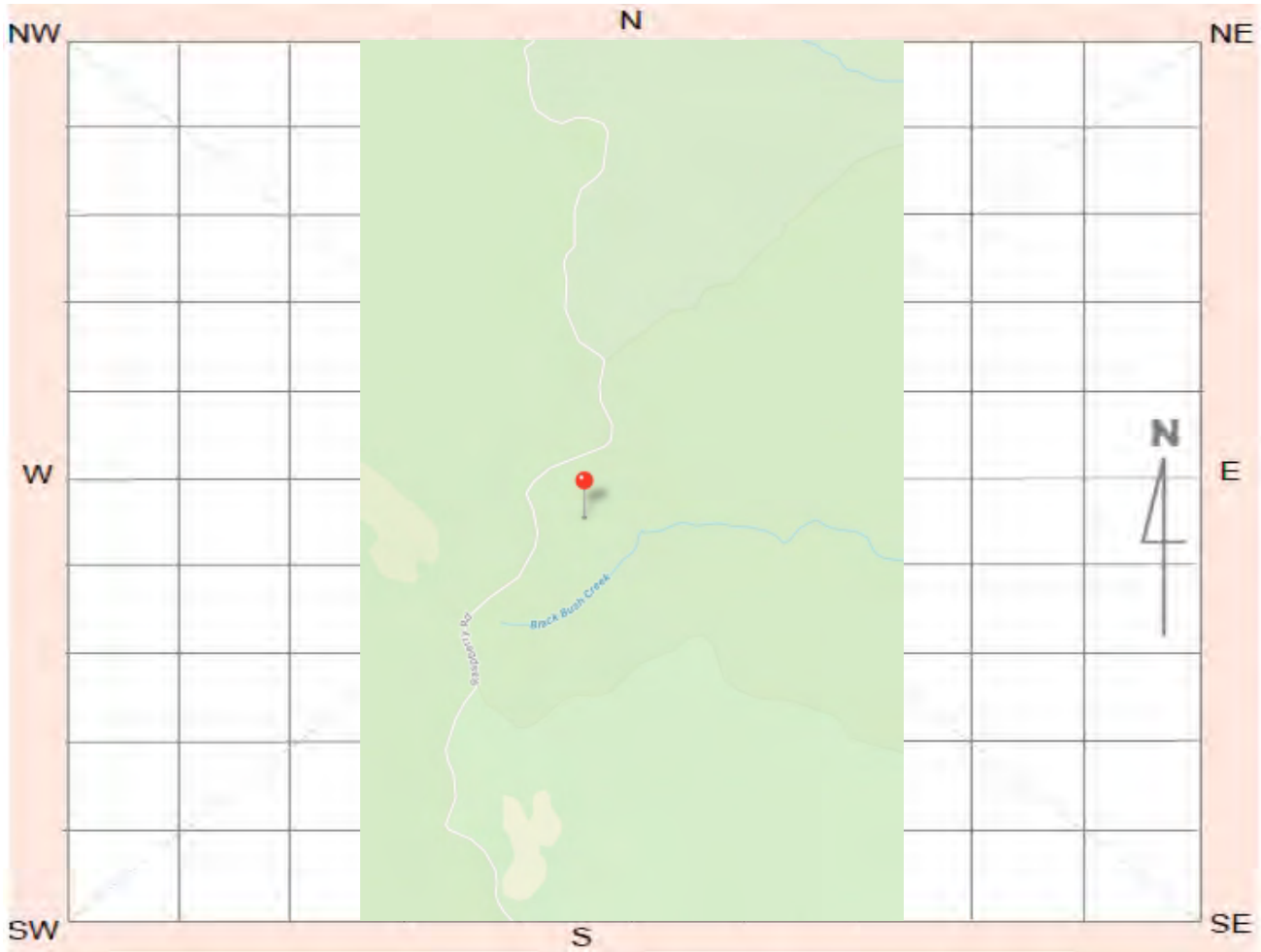
Land Form Unit: Vegetation:

Distance to Water (m): Primary Report:

How to get to the site:

Other site information:

Site location map



Site contents information

open/closed site:

Site condition:

Features:

1.

Number of features: Length of feature(s) extent (m): Width of feature (s) extent (m):

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="Elongated"/>	<input type="text" value="Box"/>

Description:

Features:

2.

Number of features: Length of feature(s) extent (m): Width of feature (s) extent (m):

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Description:

Features:

3.

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Description:

Features:

4.

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Description:

Features:

5.

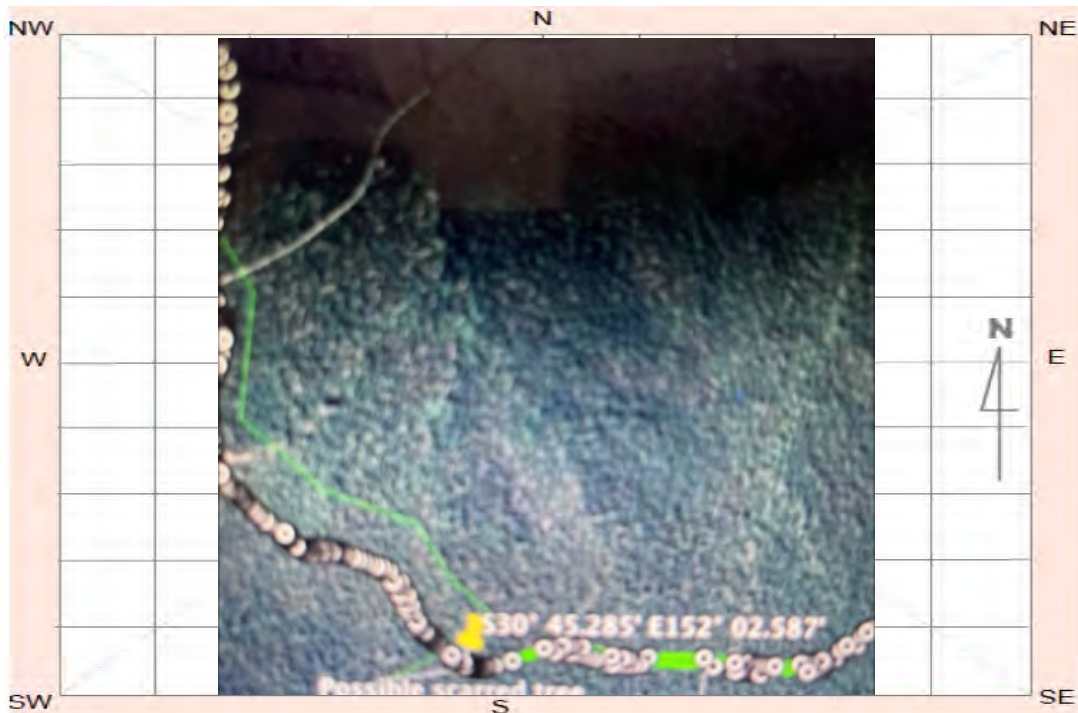
Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Description:

Other Site Info:

On the side of track

Site plan

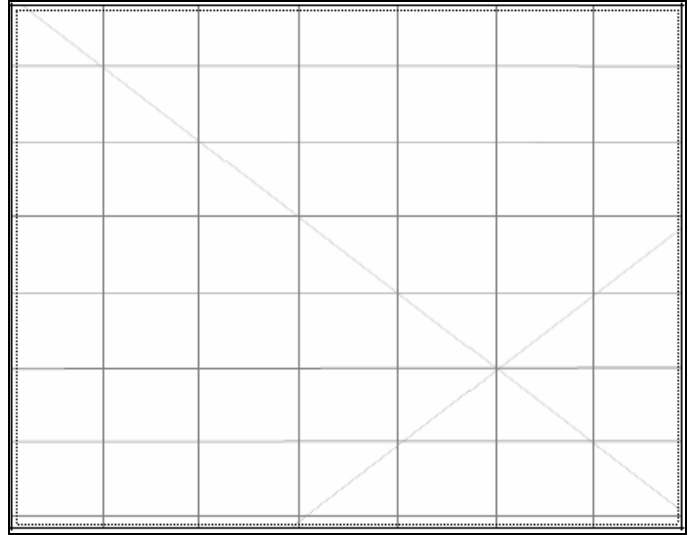


Site photographs

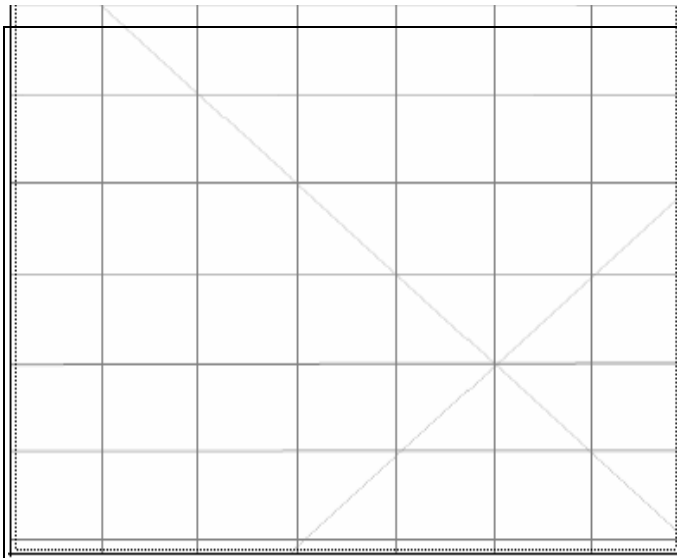


Description:

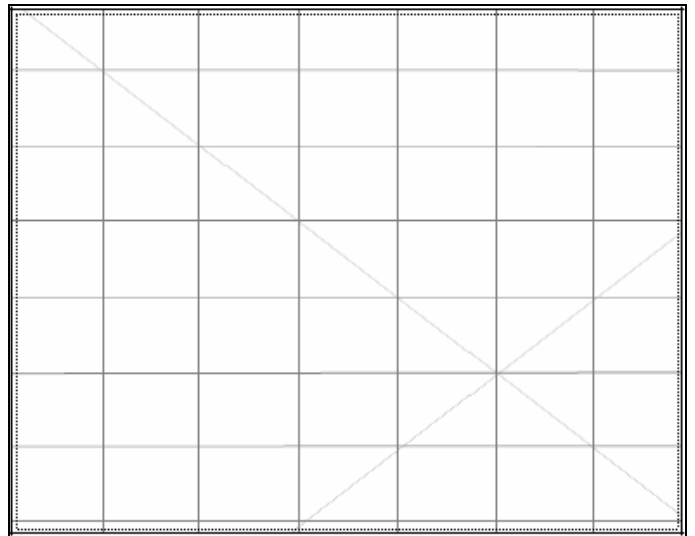
nil



Description:



Description:



Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title Surname First name

Organisation:

Address:

Phone: E-mail:

C.3 Culturally modified tree report



CONSULTING
ARBORICULTURISTS
& HORTICULTURISTS

Urban Tree Management
Australia Pty Ltd
ACN 098 599 805
ABN 56 098 599 805

65 Excelsior Street
Merrylands NSW 2160

D Draper m. 0418 471 806

L Dorfer m. 0439 605 038

admin@utma.com.au
www.utma.com.au

INSTITUTE OF AUSTRALIAN
CONSULTING ARBORICULTURISTS



REPORT:

ARBORICULTURAL ASSESSMENT OF Scarred Tree/s

AT

Oven Mountain Pumped Hydro Energy Storage Project Oven Mountain NSW

On behalf of

EMM Consulting Pty Ltd

Prepared 4/7/2024.
Reference 26070

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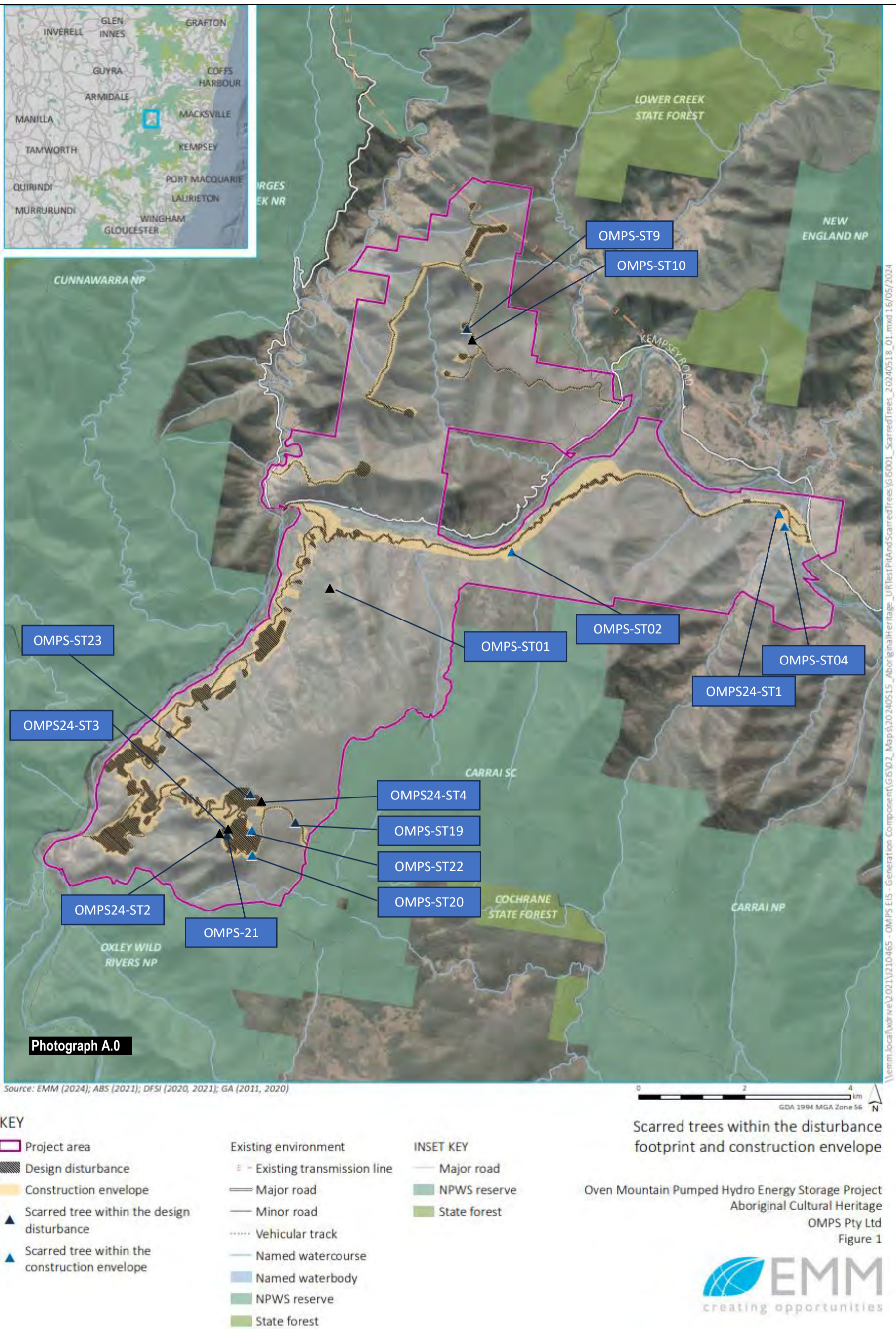
1.0 SUMMARY

Urban Tree Management Australia© (UTMA) has prepared this report for Nic Reilley and Mikhaila Chaplin of EMM, Ground floor, 20 Chandos Street, St Leonards NSW 2065 on behalf of OMPS Pty Ltd. This report examines the wounds on 14 trees within the Oven Mountain Pumped Hydro Energy Storage Project Aboriginal Cultural Heritage study area. Nine trees had wounds of Aboriginal cultural origins (OMPS-ST01, OMPS-ST02, OMPS-ST04, OMPS-ST19, OMPS-ST22, OMPS24-ST1, OMPS24-ST2, OMPS24-ST3 and OMPS24-ST4, and five trees contained wounds from other sources. The locations of the subject trees are shown in the aerial photograph (Photograph A.0), and assessment findings summarised in Table 1.0.

The inspections were conducted in the Lower Reservoir area (11-14 June 2024) with First Nations stake holders Steve Cohen, Bruce Cohen and elder Gordon Jacky (JJ) and Nic Reilley of EMM, and in the Upper Reservoir area (15-16 June 2024) with First Nations stake holders, elders Gordon Jacky (JJ) and Elwyn Toby, and Mikhaila Chaplin of EMM.

Table 1.0 Summary of each tree including likely age, wound/s, and cause.

Tree No. / Archaeological No.	Genus and species / Common name	1. Age range of tree in yrs. approx. / 2. Age range of wound/s in yrs. approx.	Likely origin of wound/s
TN1 / OMPS-ST01	<i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. 200 - <250 2.1 120 - <150 (W1)	Wound 1 (W1), of Aboriginal cultural origin.
TN2 / OMPS-ST02	<i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. 250 - <300 2.1 100 - <150 (W1)	Wound 1 (W1), of Aboriginal cultural origin.
TN3 / OMPS-ST04	<i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. 300 - <350 2.1 150 - <200 (W1)	Wound 1 (W1), of Aboriginal cultural origin.
TN4 / OMPS-ST09	<i>Corymbia maculata</i> (Hook.) K.D.Hill & L.A.S.Johnson Spotted Gum	1. 75 - <100 2.1 20 - <40 (W1)	Wound 1 (W1) Mechanical wound from abrasion impact event.
TN5 / OMPS-ST10	<i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. 20 - <40 2.1 5 - <15 (W1)	Wound 1 (W1) Mechanical wound from abrasion impact event and secondary wounding by fire.
TN6 / OMPS-ST19	<i>Eucalyptus microcorys</i> F.Muell. Tallowwood	1. 150 - <200 2.1 100 - <150 (W1) 2.2 20 - <40 (W2)	Wound 1 (W1), of Aboriginal cultural origin. Wound 2 (W2), insect damage primarily from Longicorn Borers and secondary wounding by fire.
TN7 / OMPS-ST20	<i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. 125 - <150 2.1 20 - <40 (W1) 2.2 20 - <40 (W2) 2.3 20 - <40 (W3)	Wounds 1-3 (W1 – W3), insect damage primarily from Longicorn Borers and secondary wounding by fire.
TN8 / OMPS-ST21	<i>Eucalyptus biturbinata</i> L.A.S.Johnson & K.D.Hill Grey Gum	1. 200 - <250 2.1 25 - <50 (W1)	Wound 1 (W1) Mechanical wound from abrasion impact event and secondary by Longicorn Borers.
TN9 / OMPS-ST22	<i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. 300 - <375 2.1 150 - <200 (W1)	Wound 1 (W1), of Aboriginal cultural origin.
TN10 / OMPS-ST23	<i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. 300 - <350 2.1 50 - <75 (W1)	Wound 1 (W1), insect damage primarily from Longicorn Borers.
TN11 / OMPS24-ST1	<i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. 325 - <375 2.1 150 - <200 (W1)	Wound 1 (W1), of Aboriginal cultural origin.
TN12 / OMPS24-ST2	<i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. 250 - <275 2.1 125 - <150 (W1)	Wound 1 (W1), of Aboriginal cultural origin.
TN13 / OMPS24-ST3	<i>Eucalyptus acmenoides?</i> Schauer White Mahogany	1. 350 - <400 2.1 100 - <125 (W1)	Wound 1 (W1), of Aboriginal cultural origin.
TN14 / OMPS24-ST4	<i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. 325 - <375 2.1 150 - <200 (W1)	Wound 1 (W1), of Aboriginal cultural origin.



Photograph A.0 Aerial photograph showing the location and numbers of the trees inspected.
Source: EMM

2.0 INTRODUCTION

Danny Draper (the author) attended the site containing the trees on 11-16 June 2024, and the trees and their growing environment and wounding, were examined and assessed from the ground to consider the aetiology of each wound. This was undertaken to determine the likely causes and estimated age of scarring, the wounds' longevity and protection if shown to be of Aboriginal cultural origin, subject to proposed works nearby or removal and conservation, where appropriate.

The dimensions of the tree wound/s were recorded, and each tree and wound/s photographed by the author. The age of each tree provided is an estimate only and offered within a range due to the uncertainty of such unsubstantiated field observations without the application of Dendrochronology or other records. Without such precise data the age of trees is usually considered in stages of life span against their biomass *in situ* as Young (0-20%), Mature (20-80%) and Over-mature (senescent) (80-100%).

3.0 METHODOLOGY

Each inspection was undertaken by a visual assessment conducted from the ground and considered as part of the assessment/s the remaining lifespan of a live tree or durability of the remains of a dead tree where the scarred section is to be preserved.

A glossary of terms is included as Appendix B covering the description of the tree/s.

Assessment of Trees

The following criteria were recorded to reflect the status of the trees being: Age class, Condition class, Form class, Dimensions, Crown cover (live foliage as %), Crown density (density of live foliage evident as %), vigour class and Sustainable Retention Index Value (SRIV) version 4 (ICA, 2010) of each live tree (Appendix A), where appropriate.

The age of the trees was estimated from a sound professional knowledge or research of the individual tree taxa, growth of trees within the region based on habitat, rainfall, soil type and land use practices and considered against the dimensions of each tree encountered and the limitations of its growing environment *in situ*. A tree may be described in greater detail than others where it was considered appropriate to describe the location of the wound or the circumstances which may have led more accurately to its formation.

The height of the remains of the tree was recorded using a Nikon Forestry Pro laser guided clinometer or by approximation.

Assessment of Wounds to Determine Arboricultural Status of Scarred Tree/s

As a tree grows vascular cambium as a thin layer of dynamic cells close to the surface produces xylem to form wood on the inner side, and phloem to form bark on the outer side. The cambium grows as a continuous ring and is laid down as fibres along the trunk, stems, and roots when a new growth increment layer is developed. The vascular cambium translocates nutrients in solution through the fibres from the roots to the leaves through the xylem and sugars produced in the leaves as photosynthates through the phloem and ray cells and to the roots. Their structural importance allows for strength and flexibility as energy from loading forces from the tree's mass and wind movement stimulates adaptive growth and reactive growth. The shape and form of a tree is affected as wind moves energy along stems from the distal to proximal end dissipating and diminishing through damping, through the trunk and roots, and out into the ground (James *et al* 2006, Mattheck & Breloer 1994, pp. 14-19).

When the vascular cambium is disrupted, a wound occurs. If the vascular cambium is severed to a sufficient depth, fibres above and below will become desiccated and die forming a wound with the extent of tissue dieback often unpredictable and extending beyond the initial point of wounding. The coating of live tissue allows for dispersal of energy through damping to be distributed over the entire tree, with additional or less wood produced locally on trunk, branches and roots depending on loading forces of compression, tension, torsion, and shear. The stimulus of wounding usually changes the distribution of loading forces and the growth responses from the tree which can manifest as altered growth patterns as the load bearing capacity of the tree is modified and the crown and growing conditions alter over the life of the tree. Such changes may be caused by shedding branches, hollowing from termites, ants, fungal decay or fire, clearing of nearby trees increasing exposure to winds, branch shedding, further wounding, e.g., by borer insects, bird grazing or fire, and root damage from excavation, root pruning, fire, soil cultivation or erosion.

When wounding occurs the tree's biomechanics predispose it to attempt to restore the alignment of its fibres and to protect it from pathogens by the growth of new wood and to isolate the wound through 4 walls of defence as provided by (CODIT) Compartmentalization of Decay In Trees (Shigo and Marx 1977, and Shigo 1989, p. 45 and Kevin T. Smith and Walter C. Shortle US Dept Agriculture 2020) by chemically altering surrounding wood and walling off the damage using barriers provided by existing cellular structures as Walls 1-3 and finally to conceal the wound separating it from the damage caused at the time of wounding beneath layers of new wood as Wall 4. While the CODIT model interprets compartmentalisation as defence against microorganisms, the response of trees is also considered biological to seal a wound from penetrating air, to prevent an embolism where air is required for wood fungi spores to settle and colonise the disrupted tissue (Schmidt, 2006, p. 175 and Liese & Dujesiefkem, 1996).

At the time of wounding Wall 1 is formed by plugging xylem vessels vertically above and below the wound. Wall 2 is formed tangentially in growth rings by the concentration of lignin in the cells of late season's growth acting to prevent the inward spread of pathogens. Wall 3 forms at the sides of the wound from ray cells producing toxins which limits the spread laterally. Wall 4 is formed from intensified cell formation in the cambium forming callus as undifferentiated and unligified wood around the wound site after wounding and forms the wound margins initially to wall off and separate damaged wood tissue from live tissue (Schmidt, 2006, p. 175 and Stobbe *et al.* 2002, 1996). Later outside the callus the cambium produces *Wound wood* differentiated to produce lignin (Schmidt, 2006, p. 177). Research on callus tissue formed after trunk wounding (Stobbe *et al.*, 2002) noted that surface callus were usually clearly divided into three stages: an initial stage of parenchyma cell formation (first stage), and two stages of restructuring, being the formation of a wound periderm in the outer callus (second stage) and the subsequent formation of a wound cambium in the inner tissue (third stage), and noted that surface callus was only fully developed when the wound cambium had formed. Allowing a fully functional tissue of bark, cambium, and wood to develop at the edges of the wound surface (wound face) where bark and most of the cambium had been removed (Stobbe *et al.*, 2002).

Wound wood cells may be slightly larger and stronger and can be stimulated by loading forces, particularly as the wounded trunk or branch becomes hollow. The sides of the wound are *wound margin left* and *wound margin right* which slowly converge and usually form an oblong, circular, awl or elliptical shape (Draper and Richards 2009). The distal and proximal ends of a wound are the *wound apex* and *wound base* respectively, and may be irregular, jagged, obtuse, rounded, truncate to acute ($<90^\circ$) where the margins converge often forming a wound seam or partial occlusion above the *wound apex* and below the *wound base* extending from the wound face (Draper and Richards 2009). The necrotic sapwood exposed by the removal of the bark and dysfunctional cambium is the *wound face*, although on older wounds this may be absent if a void is evident as a *cavity* or a deeper void as a *hollow* in heartwood (Draper and Richards 2009). The sapwood of most species has very poor durability once exposed to the atmosphere (Bootle, 2005, p. 234).

No matter what the shape of the wound the tree will ultimately attempt to align the living fibres to grow over and conceal the wound to restore the cover of living wood around and along the stem. Ultimately most margins converge as a wound seam of wound wood and graft to conceal the *wound face* and it is then that the tree has achieved wound *occlusion* (Draper and Richards 2009). The living tissue disrupted at the time of wounding will always die, remain damaged and continue to deteriorate even when a wound is occluded by successive growth rings because trees do not heal, they can only conceal the damaged cells with consecutive layers formed by each season's growth (Mattheck and Breloer 1994, pp. 12-16) of cells added radially as rings in the diameter of stems and roots by the elongation of roots and stems by tip extension.

Wound margins encroach over the wound face as each successive growth ring increment is added around the tree. The *wound margin depth* on the left and right sides usually deepens over time before the wound is occluded and can be measured perpendicular from the wound face to the outer edge of the trunk, or from the outer edge of the trunk to the inner edge of the void if the wound face is absent and margins are incurved (Draper and Richards 2009). It is not uncommon for the depth of the *wound margin right* and *wound margin left* or the distances from the *initial wound margin* to the *wound margin* to be different because of *reaction wood* growth along each margin stimulated by differential loading along the stem in compression, tension, torsion or shear stimulating more wood to be laid down on the side bearing the greatest load and cell distortion (Mattheck and Breloer 1994, pp. 12-16). Where margins are of a similar width and depth they are usually equally loaded or both neutrally loaded (Mattheck, 2004, p. 17).

As the wound wood margins grow across the wound face from the point of initial wounding a general differentiation in the colour of bark and its texture from surrounding unwounded tissue will sometimes be evident and can assist to indicate the extent of the width of the wound and the approximate location or extent of the *initial wound margin* (Draper and Richards 2009). However, this may become less apparent over time with wounds that have been *occluded* for long periods due to the successive growth increments added sometimes concealing the wound entirely, or on trees with thick bark.

By measuring the width of the wound between the left and right *initial wound margin* the diameter of the trunk at the time of wounding and the approximate age of the tree can be estimated. The location of a wound on a trunk is static as necrotic tissue although the diameter of the live stem is increased circumferentially by rings as growth increments, hence the wound margins and wound occlusion. The circumference of the trunk and stems of large old trees increases with age and the layers may be slightly thinner over a radial distance where such growth has slowed, than for younger trees or where they are not stimulated by loading where a crown has been partly shed or died back.

The trees *in situ* were expected to have had a relatively good growth rate due to their location on well-drained soil with a comparable average annual rainfall of 752.9 mm recorded 65 km away at the nearby Station: Armidale (Tree Group Nursery), Number: 056037, Opened: 1997 Now: Open, Latitude: 30.52° S, Longitude: 151.67° E, Elevation: 987 m (Australian Government Bureau of Meteorology, 2024). However, the trees in the upper and lower parts were expected to have had different soil types and rainfall with some on more fertile riparian alluvial soil in the lower part and others on drier well drained less fertile granitic soil in the upper parts.

To differentiate between cultural scarring, historical scarring, recent mechanical damage or natural causes, the following were considered:

1. Age class
2. Ease of access to the location of wounding
3. Tree and its dimensions at the time of wounding
4. Extent of wounding, its symmetry (symmetrical / asymmetrical)
5. Extent of growth around wound site since initial wounding whether tree alive/dead
6. Impact of that wounding on the tree since the wounding event
7. Land use history
8. Condition class
9. Vigour class
10. Influence of its growing environment and its constraints
11. Proximity to other trees, shape and growth habit
12. Crown form
13. Shading
14. Rainfall
15. Insect damage
16. Fire
17. Soil
18. Aspect
19. Slope
20. Drainage

This Arboricultural assessment will assist to determine the status of scarred tree/s and to manage the tree/s. This is achieved by eliminating natural or mechanical causes of wounding, and by determining the estimated remaining safe life span or works to prolong a live tree *in situ* or to conserve and protect remaining sections that may be recovered and relocated to a *Keeping Place*, or similar, as appropriate.

4.0 TREE ASSESSMENT

4.1 Assessment of Tree/s – TN1 / OMPS-ST01

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. %	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN1 / OMPS-ST01 <i>Eucalyptus tereticornis</i> Sm. Forest Red Gum	1. M 2. 200 - <250 3.1 120 - <150 (W1) 4. N/A	F	D	17 / 8	360x300, 330 Av., N/S	30 / 80	MGVF – 8 / 1

Description

Eucalyptus tereticornis Smith – Forest Red Gum, is a medium-sized to tall woodland or forest tree (Brooker and Kleinig, 1999, p. 101) can attain a height of 20-30 m (Elliot and Jones, 1986, p.222) to 50 m with a trunk diameter up to 2000 mm DBH, typically with a straight trunk without branching for half the height (Boland *et al*, 2006, p. 322) with a crown spread of 10-25 m (Elliot and Jones, 1986, p.222).

E. tereticornis Sm. has a high green density of 800-1100 kg / m³ (Boland *et al*, 2006, p. 322) to 1200 kg/m³ and air dry density (ADD) 1050 kg / m³, sapwood not susceptible to Lyctids and heartwood above ground resistant to termites (Bootle, 2005, p. 280). The heartwood has an inground durability of 1 which is high and above ground durability of 1 which is high durability (Bootle, 2005, p. 280). *E. tereticornis* Sm. heartwood is hard, strong and durable, used for heavy engineering and construction (Boland *et al*, 2006, p. 322).

Tree TN1 / OMPS-ST01 (Photograph 1.0) was growing in a moderate rainfall area on well drained poor granitic soil on the moderate slope of a hillside in the valley near the lower reservoir, with an expected comparable average annual rainfall of 752.9 mm recorded 65 km away at the nearby Station: Armidale (Number: 056037), from 1997 to present, and was expected to be growing at a rate atypical and slower for the species with an estimated age of 200-<250 years. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree had 1 trunk wound on its north side which contemporarily had been further impacted and partly consumed by fire.

Wound 1 (W1)

Wound on north side, narrow, linear, vertical, symmetrical (Photograph 1.1). The wound extended from 100 - 840 mm. Wound face extended from 105 - 510 mm and was 90 mm at widest at centre. Wound margin right and left each extended as curves around the trunk of 160 mm and the wound was 350-<400 mm at widest overall (Photographs 1.2, 1.5 and 1.6). A partial occlusion seam 320 mm long extended distally from the wound apex (Photograph 1.3). Wound margin depth, right 65 mm and 55 mm proximally and distally, and left 40 mm and 30 mm proximally and distally. The shallow wound margins are expected to be older than they seem due to narrow ring growth by the tree on a hill side with well drained shallow rocky soil of low fertility.

Wound apex acute, base 95 mm high, rounded, broken, likely desiccated from last fire 3 years ago with recent basal epicormic shoots emanating from the right at 85 mm from the broken edge (Photographs 1.2 and 1.4). Wound margin right separated from wound face at base by 15 mm

tapering to 270 mm (Photograph 1.4). Wound face entire with superficial fire damage to 2 mm deep (Photograph 1.2). Root buttress 150 mm wide adjacent wound margin left forming the wound margin with necrotic sapwood at the wound base 140 mm wide at base to 160 mm high (Photographs 1.2, 1.4 and 1.5).

Summary

Wound 1 – Due to the depth of the wound margins, extent of wound and its shape and location it is highly likely to be a wound of Aboriginal cultural origin, 120 -150 years old, affecting 25% approx. of trunk circumference *in situ*.

Risks to tree

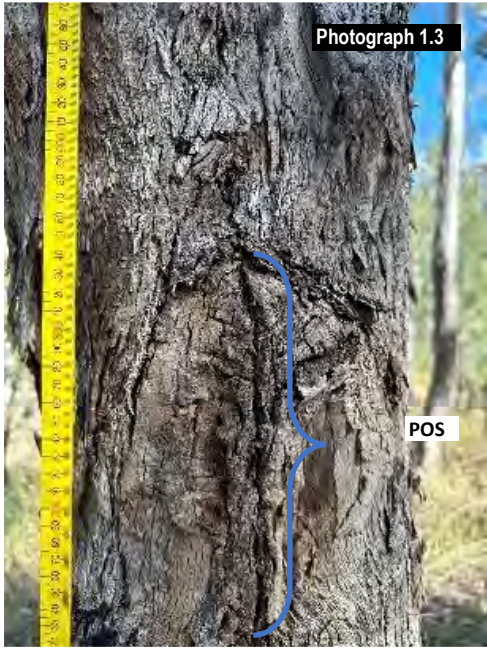
The tree wound can be expected to continue to decay over time but likely in balance with new wood growth sustaining structural integrity for some time. The tree remains at risk from fire and decay. If the tree is to be inundated it or a section containing the wound could be moved to a keeping place in consultation with Aboriginal stake holders.



Photograph 1.0 Taken 12/06/2024 by Danny Draper. View to west of tree TN1 / OMPS-ST01 *Eucalyptus tereticornis* Sm. - Forest Red Gum (centre), showing Wound 1 (W1) on the north of the trunk with a yellow ruler extended to 1 m.

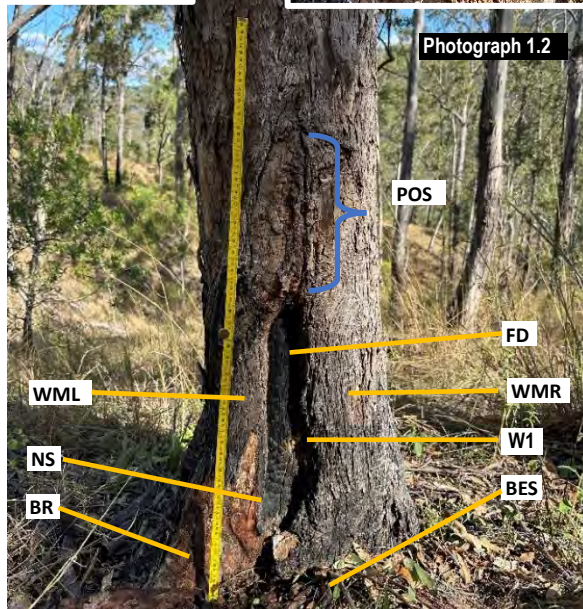
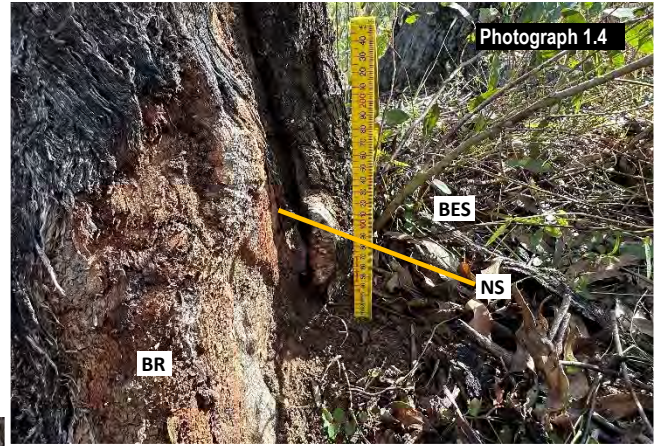


Photograph 1.1 Taken 12/06/2024 by Danny Draper. View to south of tree TN1 / OMPS-ST01 *E. tereticornis* Sm. - Forest Red Gum, showing Wound 1 (W1) on the north of the trunk with a yellow ruler extended to 1 m.



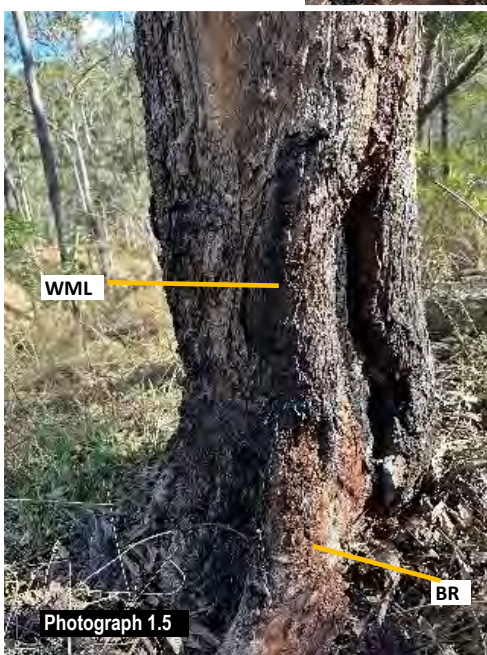
Photograph 1.3 Taken 12/06/2024 by Danny Draper. View to south of tree TN1 / OMPS-ST01 *E. tereticornis* Sm. - Forest Red Gum (centre), showing Wound 1 (W1) with a partial occlusion seam (POS) 320 mm long extended distally from the wound apex (blue brace).

Photograph 1.4 Taken 12/06/2024 by Danny Draper. View to west of tree TN1 / OMPS-ST01 *E. tereticornis* Sm. - Forest Red Gum (centre), showing Wound 1 (W1) base, on the north of the trunk with a yellow ruler extended to 250 mm. Wound base 95 mm high, rounded, broken, likely desiccated from last fire 3 years ago with recent basal epicormic shoots (BES) emanating from the right at 85 mm from the broken edge. Wound margin right separated from wound face at base by 15 mm tapering to 270 mm. Wound face entire with superficial fire damage to 2 mm deep. Root buttress (RB) 150 mm wide adjacent wound margin left with necrotic sapwood (NS) at the wound base 140 mm wide at base to 160 mm high.

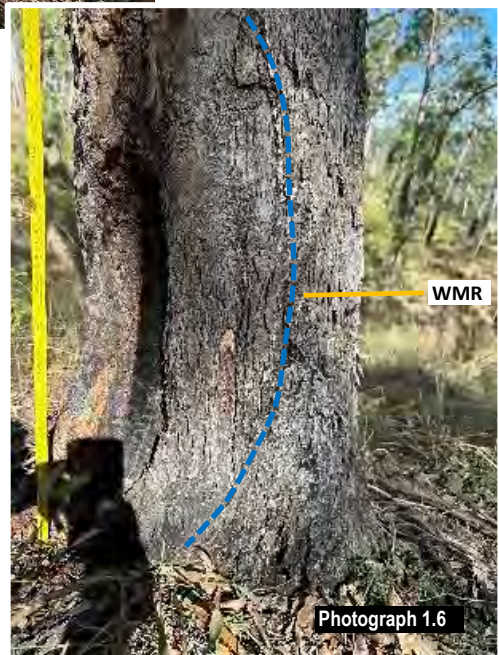


Photograph 1.2 Taken 12/06/2024 by Danny Draper. View to south of tree TN1 / OMPS-ST01 *Eucalyptus tereticornis* Sm. - Forest Red Gum (centre), showing Wound 1 (W1) on the north of the trunk with a yellow ruler extended to 1 m showing recent fire damage (FD) at the wound face.

Showing:
 Partial occlusion seam (POS) Photograph 1.3,
 Buttress root (BR) forming the wound margin left, basal epicormic shoots (BES) and necrotic sapwood (NS), Photograph 1.4,
 Wound margin left (WML) and buttress root (BR), Photograph 1.5, and
 Wound margin right (WMR) Photograph 1.6.



Photographs 1.5 and 1.6 Taken 12/06/2024 by Danny Draper. View to south of tree TN1 / OMPS-ST01 *E. tereticornis* Sm. - Forest Red Gum (centre), showing Wound 1 (W1) on the north of the trunk. Wound margin left (WML) (Photograph 1.5) and buttress (RB) 150 mm wide adjacent forming wound margin left and right wound margin (WMR), blue dotted outline, (Photograph 1.6). Each margin extended as curves around the trunk for 160 mm and the wound was 350-400 mm at widest overall.



4.1 Assessment of Tree/s – TN2 / OMPS-ST02

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. %	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN2 / OMPS-ST02 <i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. M 2. 250 - <300 3.1 100 - <150 (W1) 4. N/A	P	C	17 / 13	1450 x 1900 / NE/SW	70 / 80	MGVP – 6 / 1

Description

Eucalyptus tereticornis Smith – Forest Red Gum, is a medium-sized to tall woodland or forest tree (Brooker and Kleinig, 1999, p. 101) can attain a height of 20-30 m (Elliot and Jones, 1986, p.222) to 50 m with a trunk diameter up to 2000 mm DBH, typically with a straight trunk without branching for half the height (Boland *et al*, 2006, p. 322) with a crown spread of 10-25 m (Elliot and Jones, 1986, p.222).

E. tereticornis Sm. has a high green density of 800-1100 kg / m³ (Boland *et al*, 2006, p. 322) to 1200 kg/m³ and air dry density (ADD) 1050 kg / m³, sapwood not susceptible to Lyctids and heartwood above ground resistant to termites (Bootle, 2005, p. 280). The heartwood has an inground durability of 1 which is high and above ground durability of 1 which is high durability (Bootle, 2005, p. 280). *E. tereticornis* Sm. heartwood is hard, strong and durable, used for heavy engineering and construction (Boland *et al*, 2006, p. 322).

Tree TN2 / OMPS-ST02 (Photograph 2.0) was growing in a moderate rainfall area, on what appeared to be well drained alluvial soil on the river valley flood plain, with an expected comparable average annual rainfall of 752.9 mm recorded 65 km away at the nearby Station: Armidale (Number: 056037), from 1997 to present, and was expected to be growing at a rate typical for the species with an estimated age of 250 - <300 years. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree had 1 trunk wound on its southwest. The tree had a moderate 15-19 degree lean to NE but appeared stable.

Wound 1 (W1)

Wound, oval, symmetrical, vertical, on SW side (Photograph 2.1). The wound extended from 300 - 3400 mm and margins extending Left 850 mm and Right 500 mm around trunk. Wound face extended 500 - 3200 mm and 370 mm at widest at 1800 mm. Wound face entire with weathered necrotic heartwood with circular holes 1-<2 mm evident, and weathered galleries as concave tubes in section consistent with Lyctid Borers that reside in the necrotic tissue (Photographs 2.2-2.4). Margin depth Right 400 mm and Left 250 mm.

Tree had hollow dead structural branches in the mid crown with a trunk cavity and humus as detritus present behind the wound face, indicative of the tree being hollow with the ingress of moisture from cracks or hollow branches in the mid-upper crown. Wound face slightly deformed longitudinally but remaining cylindrical with linear cracks 1-4 mm wide, consistent with desiccated Ray cells (Photographs 2.2-2.3). A *Ficus rubiginosa* Desf. ex Vent. – Port Jackson Fig was evident growing saprophytically in the crown at 6 m.

Summary

Wound 1 – Due to the depth of the wound margins, extent of wound and its shape and location it is highly likely to be a wound of Aboriginal cultural origin, 100 - <150 years old, affecting 40% approx. of trunk circumference *in situ*.

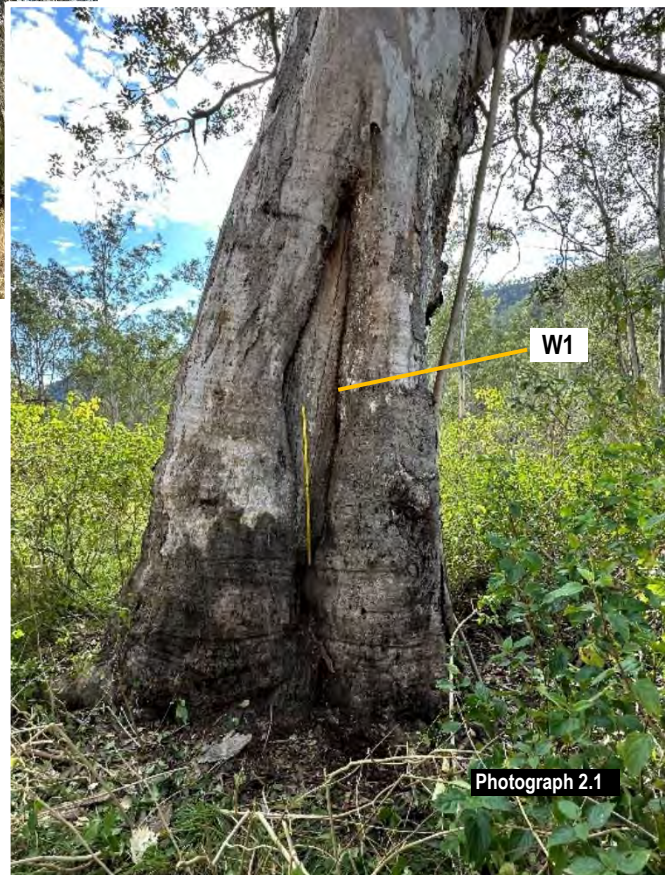
Risks to tree

The tree wound can be expected to continue to decay over time but likely in balance with new wood growth sustaining structural integrity for some time. The tree remains at risk from fire and decay. If the tree is to be inundated it or a section containing the wound could be moved to a keeping place in consultation with Aboriginal stake holders.



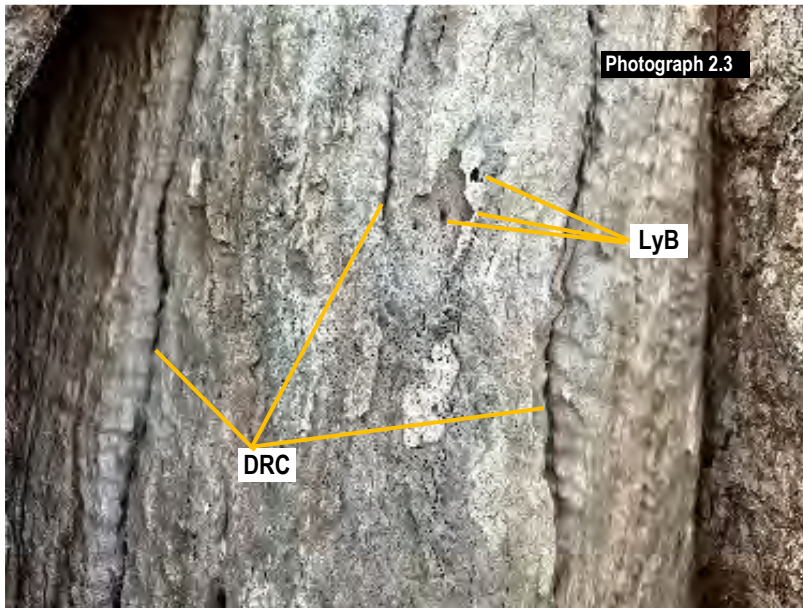
Photograph 2.0

Photograph 2.0 Taken 13/06/2024 by Danny Draper. View to NE of tree TN2 / OMPS-ST02 *Eucalyptus tereticornis* Sm. - Forest Red Gum, showing Wound 1 (W1) on the SW side of the trunk.



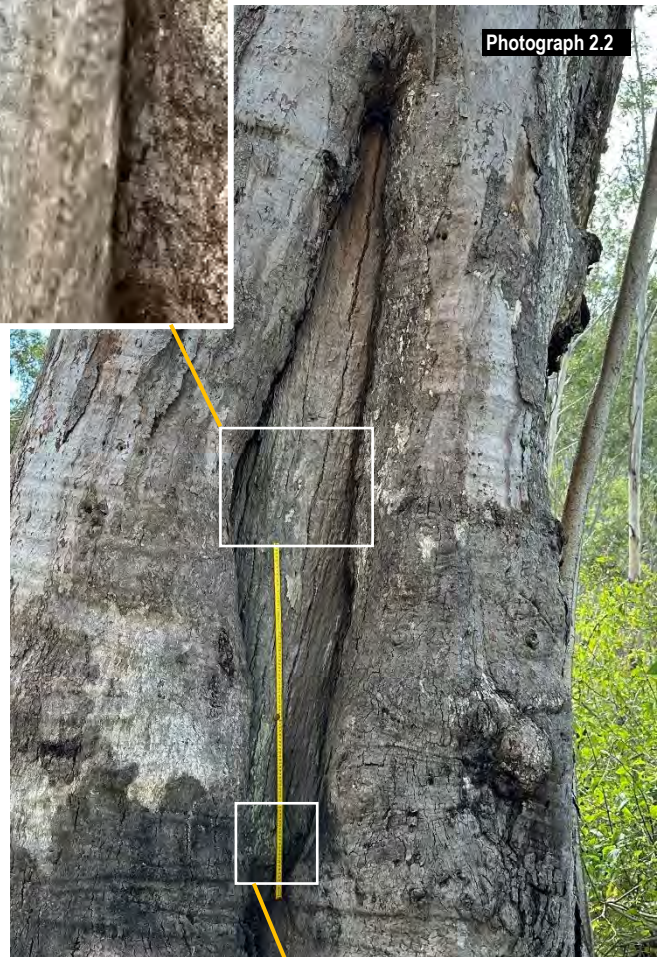
Photograph 2.1

Photograph 2.1 Taken 13/06/2024 by Danny Draper. View to NE of tree TN2 / OMPS-ST02 *E. tereticornis* Sm. - Forest Red Gum, showing Wound 1 (W1) centred, on the SW side of the trunk with a yellow 1 m ruler.

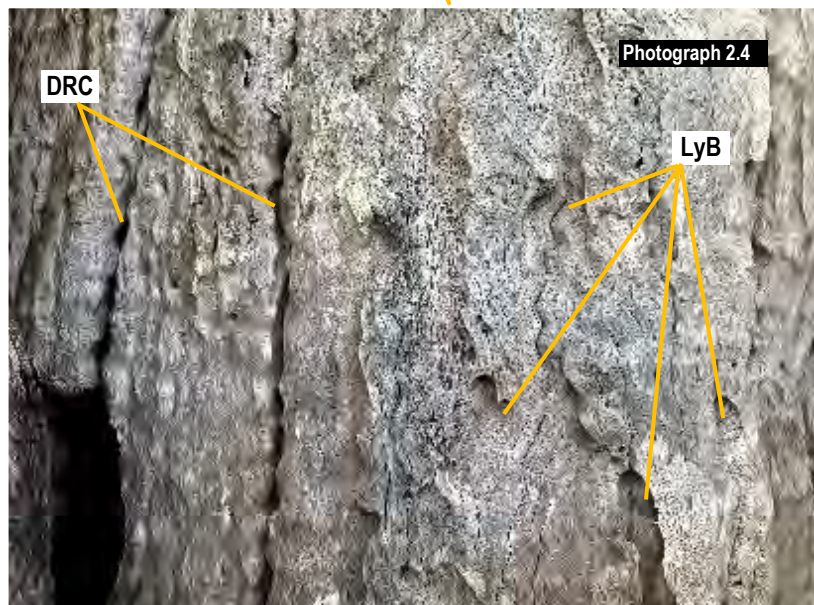


Photograph 2.2 Taken 13/06/2024 by Danny Draper. View to NE of tree TN2 / OMPS-ST02 *Eucalyptus tereticornis* Sm. - Forest Red Gum, showing Wound 1 (W1) on the SW side of the trunk with a yellow 1 m ruler. White squares showing areas detailed in Photographs 2.3 and 2.4.

Photograph 2.3 Taken 13/06/2024 by Danny Draper. View to NE of tree TN2 / OMPS-ST02 *E. tereticornis* Sm. - Forest Red Gum, showing Wound 1 (W1) with linear cracks 1-4 mm wide, consistent with desiccated Ray cells (DRC) and weathered necrotic heartwood with circular holes 1-<2 mm consistent with Lyctid Borers (LyB) that reside in the necrotic tissue.



Photograph 2.4 Taken 13/06/2024 by Danny Draper. View to NE of tree TN2 / OMPS-ST02 *E. tereticornis* Sm. - Forest Red Gum, showing Wound 1 (W1) with linear cracks 1-4 mm wide, consistent with desiccated Ray cells (DRC) and weathered necrotic heartwood with circular holes 1-<2 mm evident, and weathered galleries as concave tubes in section consistent with Lyctid Borers (LyB) that reside in the necrotic tissue.



4.1 Assessment of Tree/s – TN3 / OMPS-ST04

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. % %	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN3 / OMPS-ST04 <i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. M 2. 300 - <350 3.1 150 - <200 (W1) 4. N/A	F	C	32 / 18	1500 x 1300, 1400 Av., / E/W	90 / 90	MGVF – 9 / 1

Description

Eucalyptus tereticornis Smith – Forest Red Gum, is a medium-sized to tall woodland or forest tree (Brooker and Kleinig, 1999, p. 101) can attain a height of 20-30 m (Elliot and Jones, 1986, p.222) to 50 m with a trunk diameter up to 2000 mm DBH, typically with a straight trunk without branching for half the height (Boland *et al*, 2006, p. 322) with a crown spread of 10-25 m (Elliot and Jones, 1986, p.222).

E. tereticornis Sm. has a high green density of 800-1100 kg / m³ (Boland *et al*, 2006, p. 322) to 1200 kg/m³ and air dry density (ADD) 1050 kg / m³, sapwood not susceptible to Lyctids and heartwood above ground resistant to termites (Bootle, 2005, p. 280). The heartwood has an inground durability of 1 which is high and above ground durability of 1 which is high durability (Bootle, 2005, p. 280). *E. tereticornis* Sm. heartwood is hard, strong and durable, used for heavy engineering and construction (Boland *et al*, 2006, p. 322).

Tree TN3 / OMPS-ST04 (Photograph 3.0) was growing in a moderate rainfall area, on what appeared to be well drained alluvial soil on the river valley flood plain, with an expected comparable average annual rainfall of 752.9 mm recorded 65 km away at the nearby Station: Armidale (Number: 056037), from 1997 to present, and was expected to be growing at a rate typical for the species with an estimated age of 300 - <350 years. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree had 1 trunk wound on its north side. The tree had a slight lean to the east.

Wound 1 (W1)

Basal, on SE side, triangular, symmetrical (Photographs 3.0 and 3.1). Wound on north side, oval, symmetrical, vertical (Photograph 3.1). Wound extended from 450 - 3710 mm. The wound face extended from 1600 - 3070 mm and 270 mm at widest at 2070 mm. Wound face necrotic heartwood, entire with minimal weathering as delignification, likely due to the high durability above ground of the heartwood (Bootle, 2005, p. 280). A shallow section of necrotic sapwood was evident on the wound face adjacent the wound margin right from 1900 - 2045 mm and 90 mm wide (Photograph 3.2). A deformed and crushed section of the wound face protruded 70 mm above the wound base and became embedded in the occlusion seam, where moisture had accumulated, and wound wood pressure gradually increased with incremental ring growth (Photographs 3.2 and 3.5).

Wound margin depth right 220 mm and left 190 mm proximally. Margin width around trunk, right 350 mm on tension wood side of trunk and left 430 mm on compression wood side of trunk (Photographs 3.3 and 3.4).

Summary

Wound 1 – Due to the depth of the wound margins, extent of wound and its symmetrical shape and location, it is highly likely to be a wound of Aboriginal cultural origin, 150 - <200 years old, affecting 40% approx. of trunk circumference *in situ*.

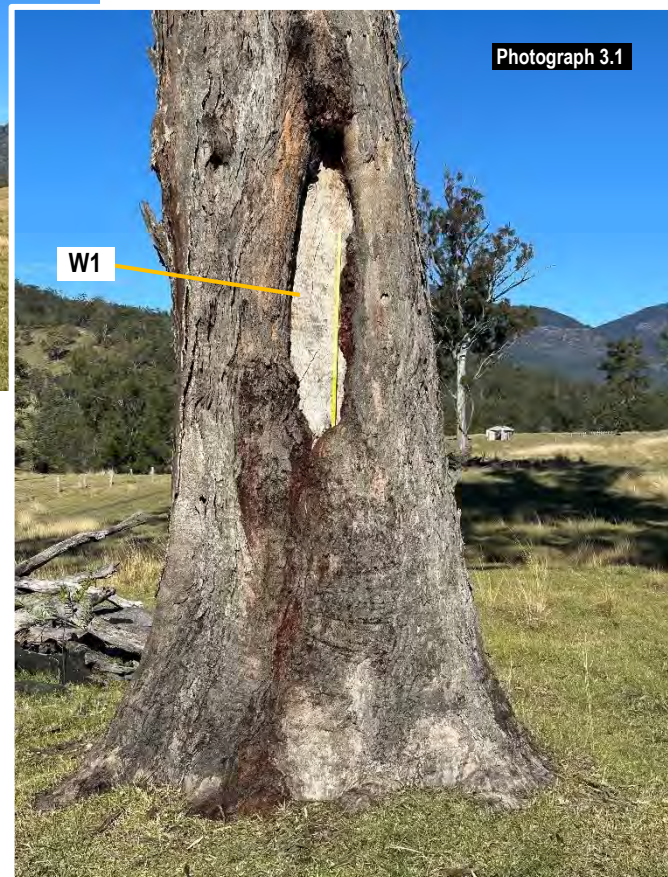
Risks to tree

The tree wound can be expected to continue to decay over time but likely in balance with new wood growth sustaining structural integrity for some time. The tree remains at risk from fire and decay. If the tree is to be inundated it or a section containing the wound could be moved to a keeping place in consultation with Aboriginal stake holders.



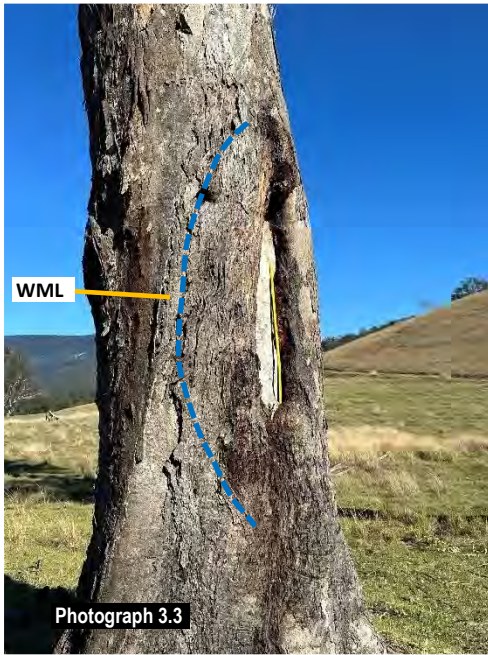
Photograph 3.0

Photograph 3.0 Taken 13/06/2024 by Danny Draper. View to south of tree TN3 / OMPS-ST04 *Eucalyptus tereticornis* Sm. - Forest Red Gum, showing Wound 1 (W1) on the north side of the trunk.

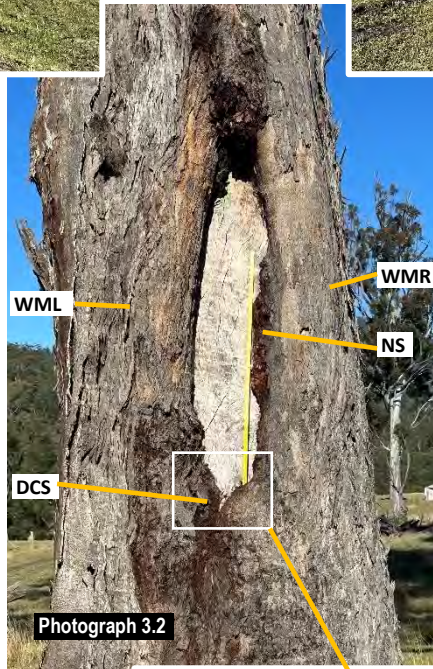
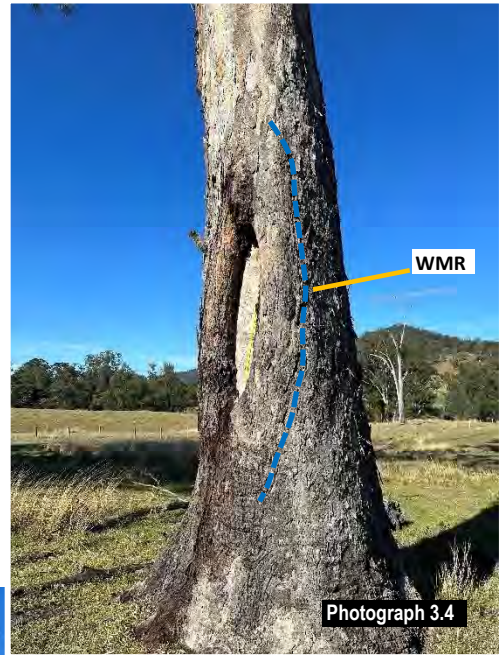


Photograph 3.1

Photograph 3.1 Taken 13/06/2024 by Danny Draper. View to south of tree TN3 / OMPS-ST04 *E. tereticornis* Sm. - Forest Red Gum, showing Wound 1 (W1) on the north of the trunk with a yellow ruler extended to 1 m.

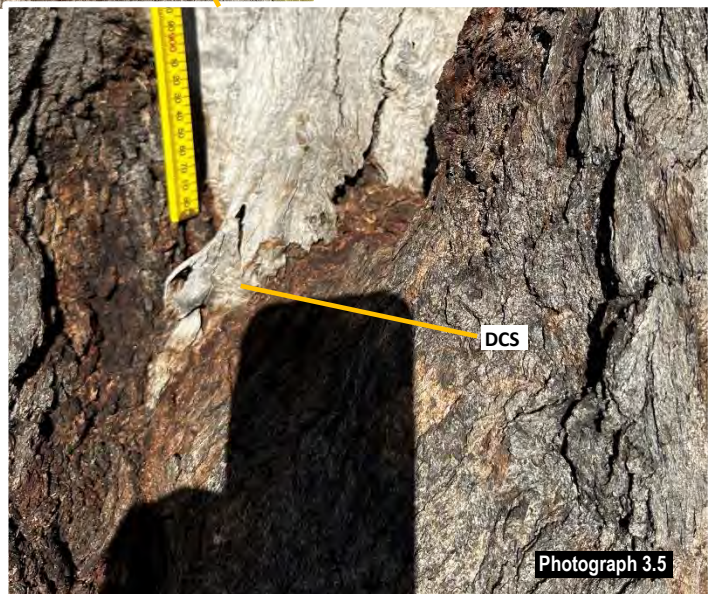


Photographs 3.3 and 3.4 Taken 13/06/2024 by Danny Draper. Views to southwest (Photograph 3.3) and southeast (Photograph 3.4) of tree TN3 / OMPS-ST04 *E. tereticornis* Sm. - Forest Red Gum (centre), showing Wound 1 (W1) on the north of the trunk. Wound margin left (WML) blue dotted outline (Photograph 3.3), and right wound margin (WMR), blue dotted outline, (Photograph 3.4). Each margin extended as curves around the trunk for right 350 mm on tension wood side of trunk and left 430 mm on compression wood side of trunk as the tree had a slight lean to the east.



Photograph 3.2 Taken 13/06/2024 by Danny Draper. View to south of tree TN3 / OMPS-ST04 *Eucalyptus tereticornis* Sm. - Forest Red Gum (centre), showing Wound 1 (W1) on the north of the trunk with a yellow ruler extended to 1 m. A shallow section of necrotic sapwood (NS), brown coloured, evident on the wound face adjacent the wound margin right from 1900 - 2045 mm and 90 mm wide.

Showing:
 Wound margin left (WML) Wound margin right (WMR) Photographs 3.3 and 3.4, and Deformed and crushed section (DCS) of the wound face protruding 70 mm above the wound base and became embedded in the occlusion seam, where moisture had accumulated, and wound wood pressure gradually increased with incremental ring growth, Photograph 3.5.



Photograph 3.5 Taken 13/06/2024 by Danny Draper. View to south of tree TN3 / OMPS-ST04 *E. tereticornis* Sm. - Forest Red Gum (centre), showing Wound 1 (W1) near the wound base with a deformed and crushed section (DCS) of the wound face protruding 70 mm above the wound base and becoming embedded in the occlusion seam, where moisture had accumulated, and wound wood pressure gradually increased with incremental ring growth.

4.1 Assessment of Tree/s – TN4 / OMPS-ST09

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. %	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN4 / OMPS-ST09 <i>Corymbia maculata</i> (Hook.) K.D.Hill & L.A.S.Johnson Spotted Gum	1. M 2. 75 - <100 3.1 20 - <40 (W1) 4. N/A	F	F	17 / 6	300	30 / 80	MGVF – 6 / 1

Description

Corymbia maculata (Hook.) K.D. Hill & L.A.S. Johnson – Spotted Gum, is a medium to very tall forest tree with a coastal distribution on heavy clays and other soils from the Manning Valley to Bega NSW (Brooker and Kleinig, 1999, p. 60) and can attain a height of 20-30 m (Elliot and Jones, 1986, p. 139) to 35-45 m on favourable sites (Boland *et al*, 2006, p. 260) with a trunk diameter up to 1-1.3 m DBH with exceptional specimens to 70 m high and >3 m DBH (Boland *et al*, 2006, p. 260) with a crown spread of 10-20 m (Elliot and Jones, 1986, p. 139). *C. maculata* heartwood has a green density of 745 – 1080 kg / m³ (Boland *et al*, 2006, p. 260) to 1150 kg / m³ (Bootle 2005, p. 283) and air dry density (ADD) of approx. 950 kg / m³ (Bootle 2005, p. 257).

Sapwood is very susceptible to Lyctid borers (Boland *et al*, 2006, p. 260 and Bootle 2005, p. 284) and heartwood is termite resistant (Bootle 2005, p. 284) the wood is durable and used for heavy engineering construction and flooring (Bootle 2005, p. 284, Boland *et al*, 2006, p. 260). The wood has a medium durability in the ground and a high durability above ground (Bootle 2005, p. 284).

The tree grows within a rainfall range of 680 - 1700 mm (Boland *et al*, 2006, p. 260) and tree TN4 / OMPS-ST04 (Photograph 4.0) was growing in a moderate rainfall area, on what appeared to be a steep well drained mountain side, with an expected comparable average annual rainfall of 752.9 mm recorded 65 km away at the nearby Station: Armidale (Number: 056037), from 1997 to present, and was expected to be growing at a rate typical for the species with an estimated age of 75 - <100 years. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree had 1 trunk wound on its northeast side. Crown asymmetrical with a bias to northwest.

Wound 1 (W1)

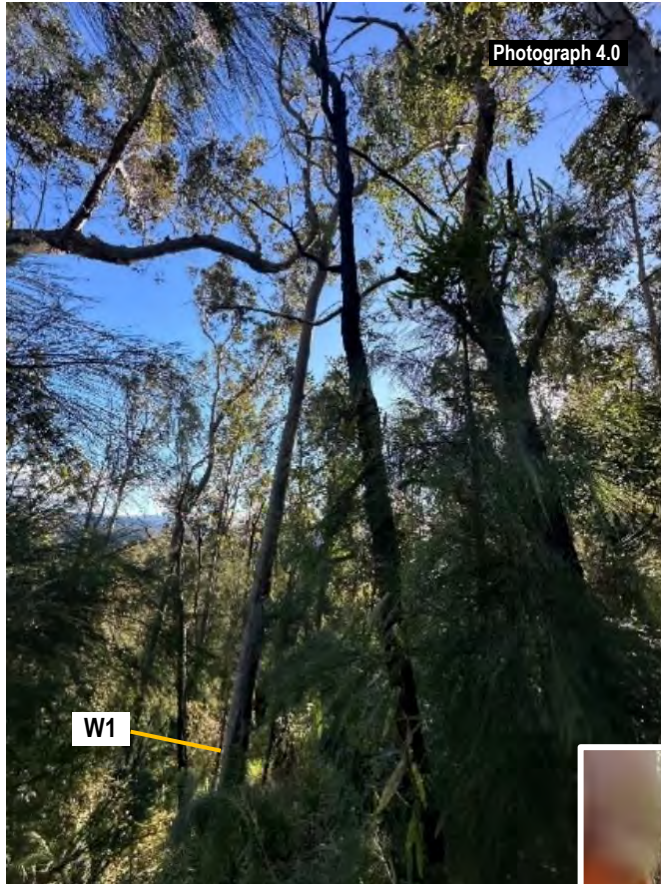
Wound on NE side, narrow oval to linear, vertical, asymmetrical (Photograph 4.1). Wound extended from 150 – 1600 mm. The wound face extended from 250 – 1270 mm and 120 mm at widest at centre. Wound face entire to necrotic sapwood with negligible weathering, with round holes 1-2 mm diam indicative of Lyctid Borer in necrotic tissue. Wound margins entire but irregular. Wound margin depth, right 35 mm proximally and distally, and left 20 mm proximally and 30 mm distally. High wind country and wound expected from an abrasion impact event.

Summary

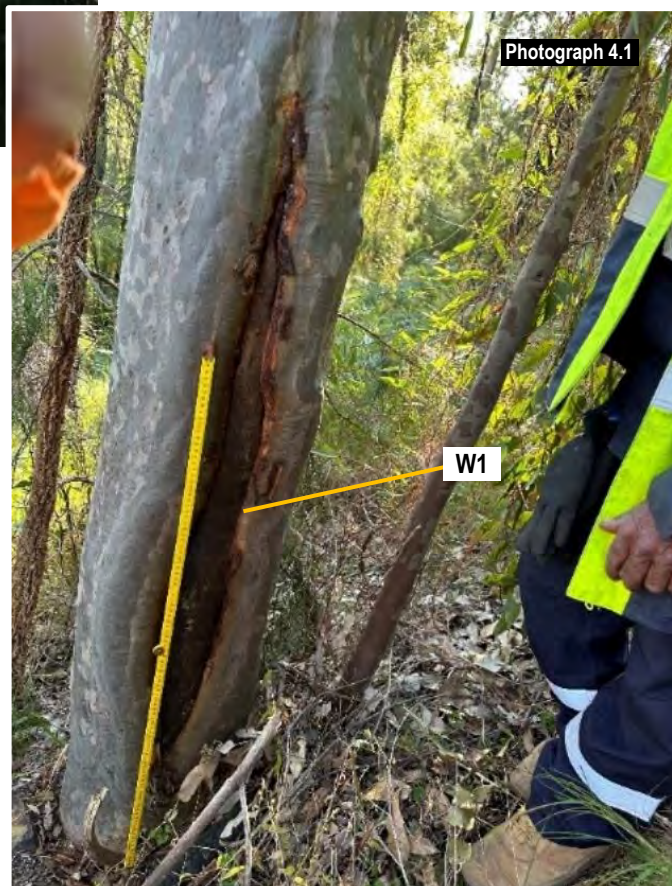
Wound 1 – A mechanical wound, asymmetrical, with shallow wound margins and wound face with negligible weathering from a contemporary abrasion impact event from a falling branch or tree, occurring 20 - <40 years ago, affecting 30% approx. of trunk circumference *in situ*.

Risks to tree

Not applicable as Wound 1 (W1) not of Aboriginal cultural origin. This tree can be expected to continue to structurally deteriorate over time if retained *in situ*. The tree remains at risk from fire and decay.



Photograph 4.0 Taken 13/06/2024 by Danny Draper. View to southwest of tree TN4 / OMPS-ST09 *Corymbia maculata* (Hook.) K.D. Hill & L.A.S. Johnson – Spotted Gum, showing Wound 1 (W1) on the northeast side of the trunk.



Photograph 4.1 Taken 13/06/2024 by Danny Draper. View to southwest of tree TN4 / OMPS-ST09 *C. maculata* (Hook.) K.D. Hill & L.A.S. Johnson – Spotted Gum, showing Wound 1 (W1) on the northeast side of the trunk with a yellow ruler extended to 1 m.

4.1 Assessment of Tree/s – TN5 / OMPS-ST10

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. %.	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN5 / OMPS-ST10 <i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. Y 2. 20 - <40 3.1 5 - <15 (W1) 4. N/A	F	D	9 / 2	200 x 230, 215 Av., E/W	85 / 90	YGVF – 8 / 2

Description

Eucalyptus tereticornis Smith – Forest Red Gum, is a medium-sized to tall woodland or forest tree (Brooker and Kleinig, 1999, p. 101) can attain a height of 20-30 m (Elliot and Jones, 1986, p.222) to 50 m with a trunk diameter up to 2000 mm DBH, typically with a straight trunk without branching for half the height (Boland *et al*, 2006, p. 322) with a crown spread of 10-25 m (Elliot and Jones, 1986, p.222).

E. tereticornis Sm. has a high green density of 800-1100 kg / m³ (Boland *et al*, 2006, p. 322) to 1200 kg/m³ and air dry density (ADD) 1050 kg / m³, sapwood not susceptible to Lyctids and heartwood above ground resistant to termites (Bootle, 2005, p. 280). The heartwood has an inground durability of 1 which is high and above ground durability of 1 which is high durability (Bootle, 2005, p. 280). *E. tereticornis* Sm. heartwood is hard, strong and durable, used for heavy engineering and construction (Boland *et al*, 2006, p. 322).

Tree TN5 / OMPS-ST10 (Photograph 5.0) was growing in a moderate rainfall area, on what appeared to be a steep well drained mountain side, with an expected comparable average annual rainfall of 752.9 mm recorded 65 km away at the nearby Station: Armidale (Number: 056037), from 1997 to present, and was expected to be growing at a rate typical for the species with an estimated age of 20 - <40 years. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree had 1 trunk wound on its northeast side which contemporarily had been further impacted and partly consumed by fire extending from the tree's base. Tree adjacent to track. Crown appeared to be comprised of regrowth from epicormic shoots after fire had consumed the previous crown.

Wound 1 (W1)

Wound on northeast side, narrow, linear, vertical, asymmetrical (Photograph 5.0). The wound extended from 450 - 1200 mm. The wound face extended from 700 - 1080 mm and was 70 mm at widest at centre. Wound face entire, burnt and partly consumed by fire. Wound margins irregular to entire with successional wound margins due to secondary wounding by fire damage (Photograph 5.1). Initial wound margin right partly delaminated, peeling the bark at the cambium at 1030 mm with collision exiting to northwest (Photograph 5.1). Wound margin depth left 15 mm, and right 15 mm with secondary outer contemporary margins 3-5 mm deep.

Summary

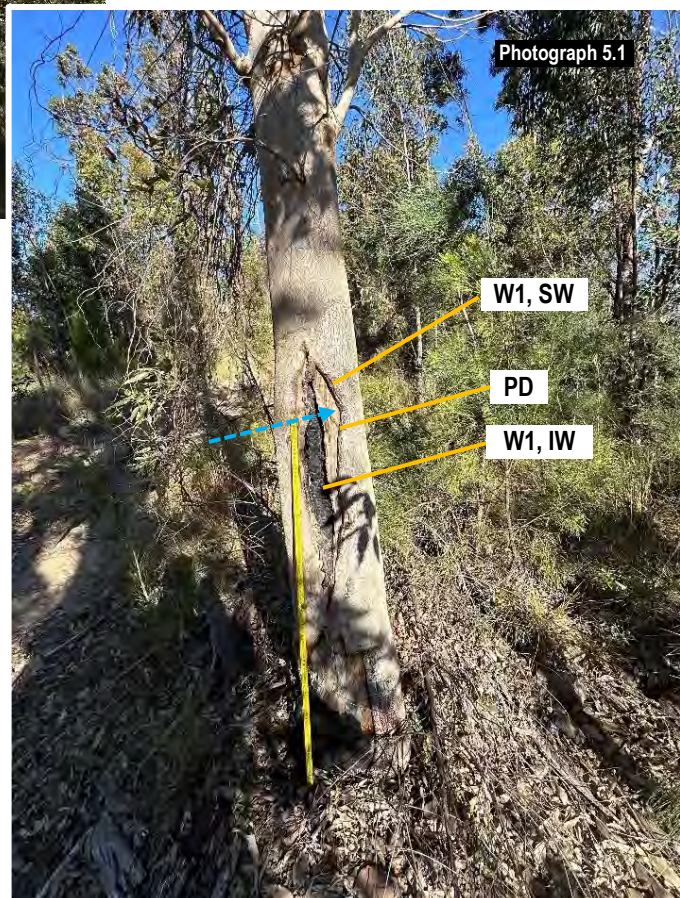
Wound 1 – A mechanical wound, asymmetrical, with shallow initial wound margins, highly likely a contemporary abrasion impact event from collision with a motor vehicle, occurring 5 - <15 years ago and subsequent fire damage, affecting 15% approx. of trunk circumference *in situ*.

Risks to tree

Not applicable as Wound 1 (W1) not of Aboriginal cultural origin. This tree with a trunk wound can be expected to continue to structurally deteriorate over time if retained *in situ*, although new growth should be capable of keeping pace with decay while the tree remains vigorous, maintaining structural integrity and possible wound occlusion over time. The tree remains at risk from fire and decay.



Photograph 5.0 Taken 12/06/2024 by Danny Draper. View to southwest of tree TN5 / OMPS-ST10 *Eucalyptus tereticornis* Smith – Forest Red Gum, showing Wound 1 (W1) on the northeast side of the trunk.



Photograph 5.1 Taken 12/06/2024 by Danny Draper. View to southwest of tree TN5 / OMPS-ST10 *E. tereticornis* Smith – Forest Red Gum, showing Wound 1 (W1) on the northeast side of the trunk with a yellow ruler extended to 1 m. Showing successional wounding as an initial wound (W1, IW) from an abrasion impact event and secondary wounding from fire (W1, SW). Initial wound margin right partly delaminated (PD) at 1030 mm with collision exiting to northwest, direction and exit shown by dotted blue arrow.

4.1 Assessment of Tree/s – TN6 / OMPS-ST19

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. %	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN6 / OMPS-ST19 <i>Eucalyptus microcorys</i> F.Muell. Tallowwood	1. M 2. 150 - <200 3.1 100 - <150 (W1) 3.2 20 - <40 (W2) 4. N/A	P	F	28 / 8	450 x 400, 425 Av., / E/W	60 / 85	MGVP – 6 / 3

Description

Eucalyptus microcorys F. Muell. – Tallowwood, is a tall to very tall forest tree (Brooker and Kleinig, 1999, p. 251, and Boland *et al*, 2006, p. 506), with a distribution to the coastal ranges from the Hunter River NSW to Maryborough Queensland (Bootle 2005, p. 350) and the higher altitudes of the coastal escarpment of the Great Dividing Range to Maryborough and K’gari, Butchulla Country (Fraser Island) (Boland *et al*, 2006, p. 506) and associated tablelands, e.g. east of Tenterfield NSW (Brooker and Kleinig, 1999, p. 251). It occurs mainly in tall open forest on rainforest fringes (Boland *et al*, 2006, p. 506). “*It prefers fertile soils but will also grow on rather poor sand if subsoil moisture is adequate*” (Boland *et al*, 2006, p. 506). It can attain a height of 25 – 40 m (Elliot and Jones, 1986, p. 146) or 35 – 60 m with a trunk diameter 1 - 2 m DBH and occasionally 70 m high and 3 m DBH (Boland *et al*, 2006, p. 506 and PlantNET, 2023) and a crown spread of 10-20 m (Elliot and Jones, 1986, p. 146). “*Bark persistent, red brown or brown to black, stringy with included mica-like flakes*”, (PlantNET, 2023).

E. microcorys F. Muell. heartwood has a green density of 1230 kg / m³ approx. (Bootle 2005, p. 350) and air dry density (ADD) 990 kg / m³ approx. (Bootle 2005, p. 350) and 875 - 1065 kg / m³ (Boland *et al*, 2006, p. 506). Sapwood susceptible to Lyctid borers (Boland *et al*, 2006, p. 506, Bootle 2005, p. 350) and heartwood is termite resistant (Bootle 2005, p. 346). The wood is strong and extremely durable Boland *et al*, 2006, p. 506), with an above ground durability class of AG1, and an inground durability class of IG1 (Bootle 2005, p. 350) and is used for heavy engineering structures, sleepers, bridges, wharfage, flooring, cladding sills, cross-arm, poles and piles, flooring and decking (Bootle 2005, p. 350, and Boland *et al*, 2006, p. 506). The tree grows within a rainfall range of 1000-1800 mm (Boland *et al*, 2006, p. 506).

Tree TN6 / OMPS-ST19 (Photograph 6.0) was growing in a moderate rainfall area, on what appeared to be an elevated forest near Carrai State Conservation Area, with an expected comparable average annual rainfall slightly greater than 752.9 mm recorded 65 km away at the nearby Station: Armidale (Number: 056037), from 1997 to present, and was expected to be growing at a rate typical for the species with an estimated age of 150 - <200 years. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree was hollow at its base and had 2 trunk wounds Wound 1 (W1) on its south side and Wound 2 (W2) on its west side and each contemporarily had been further impacted and partly consumed by fire. Due to the reduced trunk volume and hollow near the base of the stem the tree was structurally compromised with shear fractures evident along the stem at wound margins (Photographs 6.1 and 6.2). Tree with a slight 9.1° lean to west.

Wound 1 (W1)

Wound on south side of trunk narrow oval, linear, vertical, symmetrical (Photographs 6.0 and 6.1). The wound extended from 400 – 1120 mm. The wound occlusion seam was examined from inside the hollow trunk and extended 170 mm distally from wound apex (Photographs 6.3 and 6.6). Wound face absent to hollow trunk, with wound opening extending from 500 – 1040 mm (Photograph 6.3). Trunk hollow 270 mm deep N/S, and 340 mm deep E/W (measured from Wound 2 (W2)). Wound margins entire, incurved around the inner edges of the hollow trunk extending for 200 mm left and right (Photograph 6.6).

Wound opening, base acute and apex rounded. Wound margin depth 130 mm at wound base. Bark at wound margins stretched by shear fracture, evident as bark partly delaminated forming a separation crack 10 mm wide left and right (Photographs 6.3-6.5). New wound wood adjacent wound margins L and R, indicative of good vigour.

Wound 2 (W2)

Wound on west side of trunk, basal, oval, linear, vertical, asymmetrical, affected by fire (Photographs 6.0 and 6.2). The wound extended from ground to 2630 mm and was 400 mm at widest at 500 mm. The wound margin depth left, and right was 100 mm. The wound face was incomplete, entire at apex, acute, and consumed by fire at base, rounded, and hollow trunk section extending 340 mm deep E/W. Wound face fragmented at centre with oval hollow sections longitudinally 10x<20 mm consistent with Longicorn Borer galleries and tunnelling extended by fire (Photograph 6.7).

Longicorn Borers attack live trees, and their larvae generally burrow in sapwood along the grain disrupting the cambial layer causing localised wounds as the cambium dies (Jones and Elliot, 1986, pp. 195 – 198, Jones, Elliot and Jones 2015, p. 310, and Creffield, 1996, pp. 4-7). “*They mainly enter trees through wounds and their attacks may be cumulative with adult females laying eggs in tissue damaged by active borer larvae*” (Jones and Elliot, 1986, p. 196). The longicorn larvae burrow in circular holes and may burrow deeper into heartwood to pupate with adults exiting via flight holes, oval, 6x10 mm at the trunk surface (Jones and Elliot, 1986, pp. 195 – 198, Jones, Elliot and Jones 2015, p. 310, and Creffield, 1996, pp. 4-7). “*Most species in this genus of wood borers (Phoracantha), primarily attack only damaged or stressed (often drought-stressed) native trees*” (Angus, 2023, p. 111).

The *Phoracantha semipunctata* - Eucalyptus Longicorn Borer Beetle (order Cerambycidae), can survive for several years in a Eucalypt as larvae or pupae before emerging (Angus, 2023, p. 111), increasing the damage from burrowing and grazing in the cambium. As the clutch of insect eggs develop, the larvae and pupae spread out, continue to develop, and grow and their burrowing increases in diameter as they chew and tunnel through the live cambial tissue creating a wound by ringbarking areas of Xylem and Phloem, until emerging as adults at the trunk surface from oval holes 8-10 mm up to 10-15 mm (Photographs 1.4 and 1.5). Severe, prolonged, or repeated attacks by Longicorn borers can ringbark and kill trees with reduced vigour and resilience.

Summary

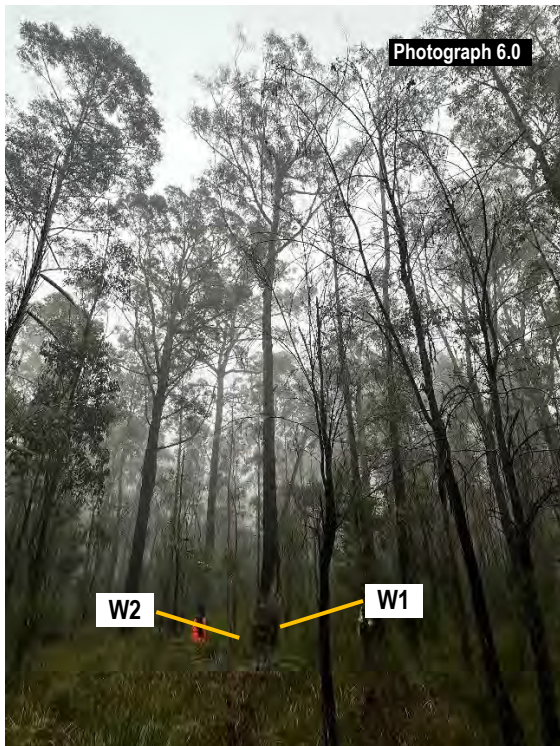
Wound 1 – Due to the depth of the wound margins as the extent of incurved growth around the inner side of the hollow trunk and length of the partial occlusion seam at the wound apex and symmetrical shape of the wound formed over a long time, it is highly likely to be a wound formed of Aboriginal cultural origin, 100 - <150 years old, affecting 30% approx. of trunk circumference *in situ*.

Wound 2 – A wound caused by Longicorn Borers evident by tunnelling fragments forming 20-<40 years ago and contemporarily enlarged by being consumed by fire, affecting 20% approx. of trunk circumference *in situ*.

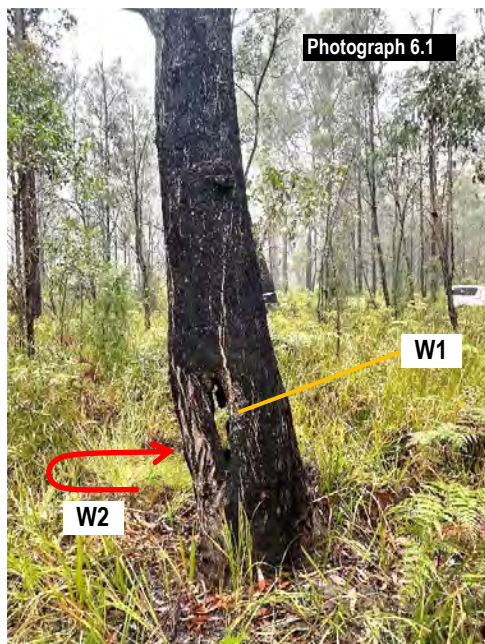
Risks to tree

The tree wounds can be expected to continue to decay over time and remain at risk from fire. The shear fractures evident at the lower trunk at wound margins are indicative of structural failure and potential collapse which may be unpredictable. Caution should be applied when working within a 40 m radius of this tree which has the potential to collapse in a westerly direction in line with its existing lean and basal wound on that side.

If the tree is to be inundated, it or a section containing the wound of Aboriginal cultural origin could be moved to a keeping place in consultation with Aboriginal stake holders. If the tree is to be retained *in situ* and the cultural wound protected it may be prudent to cut the tree down at 1 m above the wound apex of Wound 1 to prevent the wound from being crushed and destroyed in a collapse event of the tree.

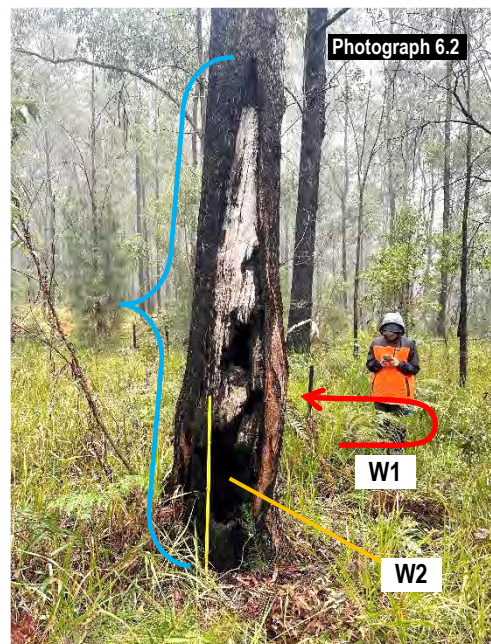


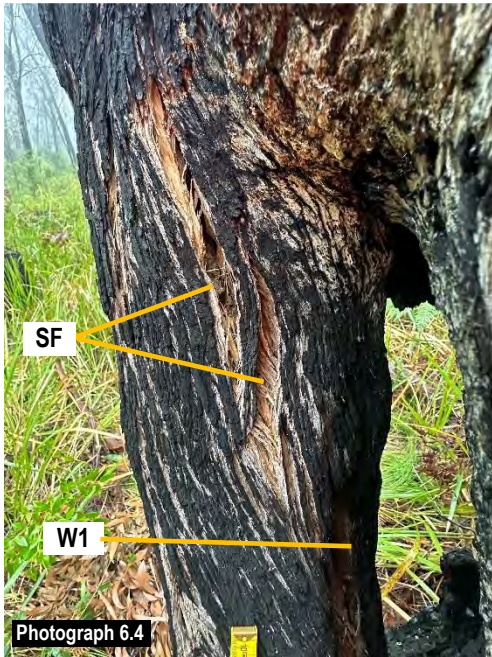
Photograph 6.0 Taken 15/06/2024 by Danny Draper. View to south of tree TN6 / OMPS-ST19 *Eucalyptus microcorys* F. Muell. – Tallowood, showing Wound 1 (W1) on the south side and Wound 2 (W2) on the west side of the trunk.



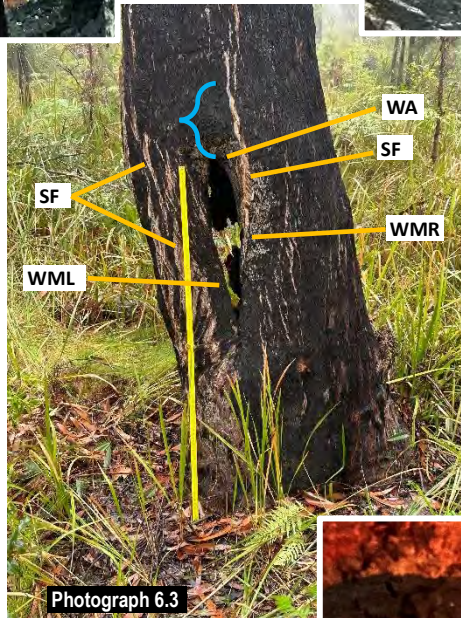
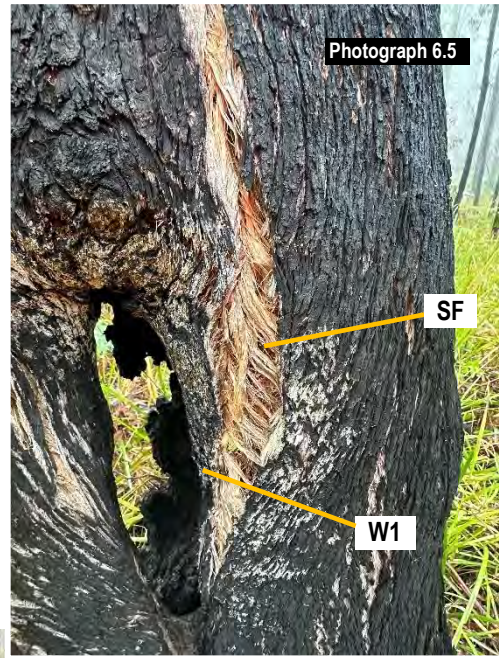
Photograph 6.1 Taken 15/06/2024 by Danny Draper. View to south of tree TN6 / OMPS-ST19 *E. microcorys* F. Muell. – Tallowood, showing Wound 1 (W1) on the south side and Wound 2 (W2) on the west side of the trunk (red arrow).

Photograph 6.2 Taken 15/06/2024 by Danny Draper. View to west of tree TN6 / OMPS-ST19 *E. microcorys* F. Muell. – Tallowood, showing Wound 2 (W2) (blue brace) on the east side, and Wound 1 (W1) on the north side of the trunk (red arrow).



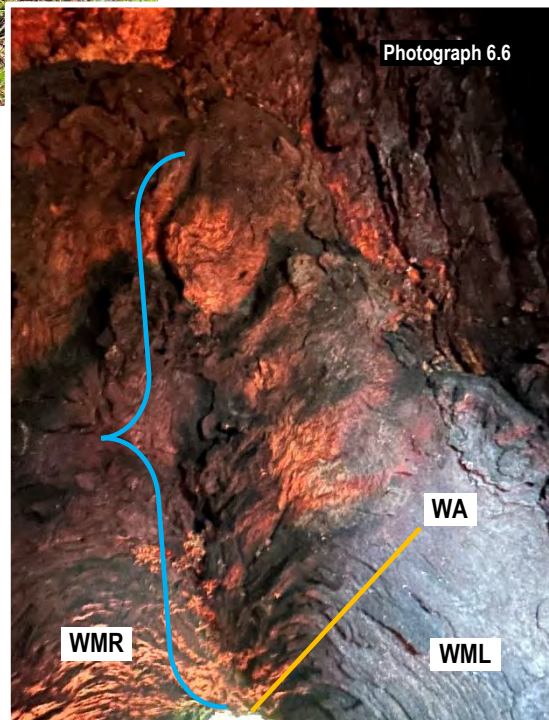


Photographs 6.4 and 6.5 Taken 15/06/2024 by Danny Draper. Views to north of tree TN6 / OMPS-ST19 *Eucalyptus microcorys* F. Muell. – Tallowood, showing Wound 1 (W1) wound margin left (Photograph 6.4) and wound margin right (Photograph 6.5) each with stretched bark partly delaminated along a vertical shear fracture (SF).



Photograph 3.2 Taken 15/06/2024 by Danny Draper. View to north of tree TN6 / OMPS-ST19 *E. microcorys* F. Muell. – Tallowood, showing Wound 1 (W1) on the north of the trunk with a yellow ruler extended to 1 m.

Showing:
 Wound margin left (WML) Wound margin right (WMR) Photographs 6.4 and 6.5 each with stretched bark partly delaminated along a vertical shear fracture (SF), and
 The wound occlusion seam extended 170 mm distally (blue brace) from wound apex (WA) Photograph 6.6.

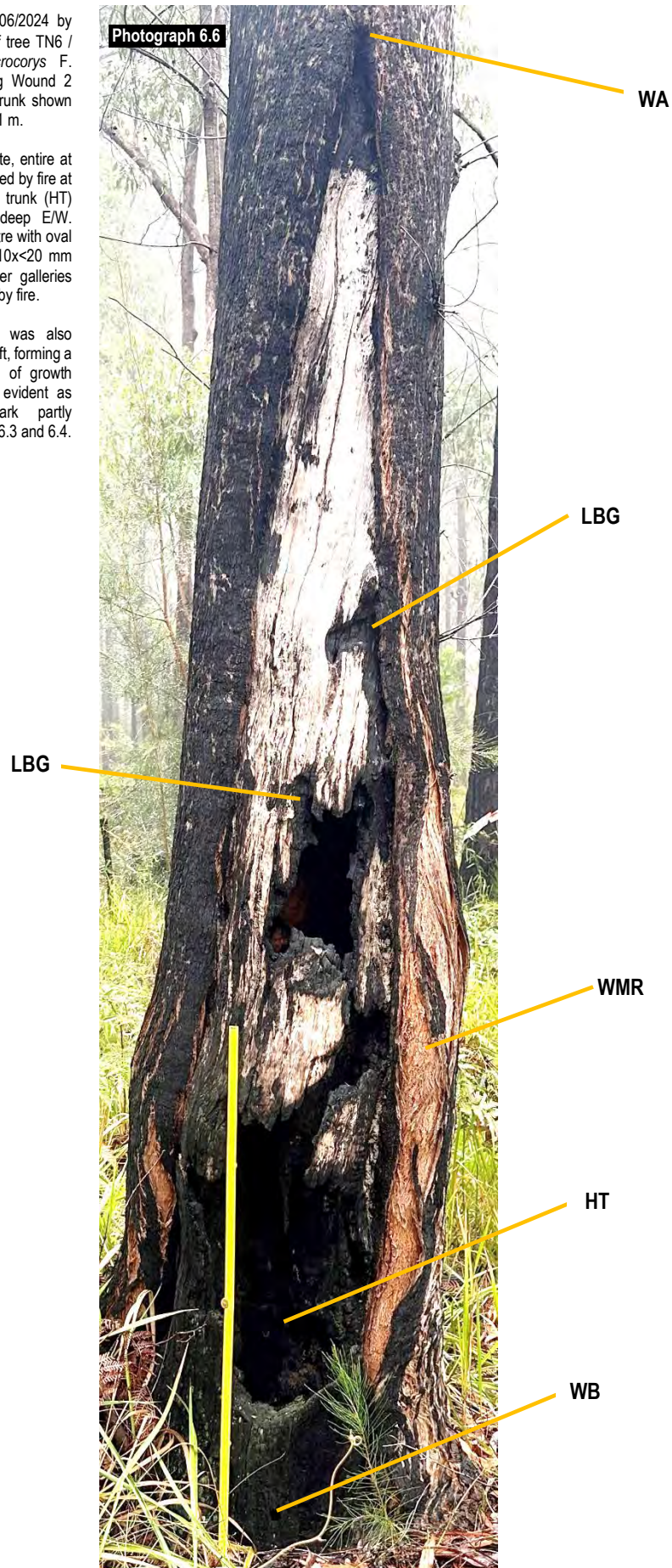


Photograph 6.6 Taken 15/06/2024 by Danny Draper. View to south from inside of tree TN6 / OMPS-ST19 *E. microcorys* F. Muell. – Tallowood, showing the wound occlusion seam where it extended 170 mm distally from the wound apex (WA). Wound margin left (WML) and wound margin right (WMR). Wound margins entire, incurved around the inner edges of the hollow trunk extending for 200 mm left and right.

Photograph 6.7 Taken 15/06/2024 by Danny Draper. View to east of tree TN6 / OMPS-ST19 *Eucalyptus microcorys* F. Muell. – Tallowood, showing Wound 2 (W2) on the west side of the trunk shown with a yellow ruler extended to 1 m.

The wound face was incomplete, entire at wound apex (WA), and consumed by fire at wound base (WB) and hollow trunk (HT) section extending 340 mm deep E/W. Wound face fragmented at centre with oval hollow sections longitudinally 10x<20 mm consistent with Longicorn Borer galleries (LBG) and tunnelling extended by fire.

Wound margin right (WMR) was also Wound 1 (W1) wound margin left, forming a narrow vertical rib or column of growth affected by a shear fracture evident as stretched and splitting bark partly delaminated, see Photographs 6.3 and 6.4.



4.1 Assessment of Tree/s – TN7 / OMPS-ST20

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. %	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN7 / OMPS-ST20 <i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. M 2. 125 - <150 3.1 20 - <40 (W1) 3.2 20 - <40 (W2) 3.3 20 - <40 (W3) 4. N/A	F	D	16 / 12	640 x 700, 670 Av., / N/S	70 / 80	MGVF – 9 / 2

Description

Eucalyptus acmenoides Schauer. – White Mahogany is a tree of open and tall open forest (Brooker and Kleinig, 1999, p. 251, and Boland et al, 2006, p. 506), persistent bark throughout, grey to red-brown, thin, and stringy (Elliot and Jones, 1986, p. 15 and PlantNET, 2024). It has a distribution along the coastal plain extending to the ranges from near Sydney in NSW to north of Cooktown in Queensland (Brooker and Kleinig, 1999, p. 283 and Boland et al, 2006, p. 544). In NSW it commonly occurs on hills and ridges below 300 mm altitude growing on clay and loam soils (Boland et al, 2006, p. 544). It can attain a height of 15 – 30 m (Elliot and Jones, 1986, p. 15) or 25 – 60 m with a trunk diameter 1 m DBH (Boland et al, 2006, p. 526) and a crown spread of 5-15 m (Elliot and Jones, 1986, p. 15).

E. acmenoides Schauer. – White Mahogany, heartwood has a green density of 1200 kg / m³ approx. (Bootle 2005, p. 303) and air dry density (ADD) 1000 kg / m³ approx. (Bootle 2005, p. 350) and 795 - 1010 kg / m³ (Boland et al, 2006, p. 526). Sapwood rarely attacked by Lyctus borers and heartwood is termite resistant (Boland et al, 2006, p. 526, Bootle 2005, p. 303). The wood is strong and very durable (Boland et al, 2006, p. 526), with an above ground durability class of AG1, and an inground durability class of IG1 (Bootle 2005, p. 303) and is used for heavy engineering construction, poles, sleeper, ship building, flooring, joists, and weatherboards (Bootle 2005, p. 303, and Boland et al, 2006, p. 526). The tree grows within a rainfall range of 700-1700 mm (Boland et al, 2006, p. 506).

Tree TN7 / OMPS-ST20 (Photograph 7.0) was growing in a moderate rainfall area, on what appeared to be a granite outcrop in an elevated forest near Carrai State Conservation Area, with an expected comparable average annual rainfall slightly greater than 752.9 mm recorded 65 km away at the nearby Station: Armidale (Number: 056037), from 1997 to present, and was expected to be growing at a rate typical for the species with an estimated age of 125 - <150 years. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree had 3 trunk contemporary trunk wounds which appeared to be caused by fire.

Wound 1 (W1)

Wound on south side, narrow, linear, vertical, asymmetrical (Photograph 7.1). The wound extended from 170 - 2280 mm. Previously burnt to near ground with partial occlusion seam. The wound extended around the trunk 170 mm to right and 250 mm to left. Wound face extended from 150 - 2190 mm and was 160 mm at widest at 1300 mm. Wound margin depth left and right 100 mm. Wound face entire to burnt necrotic sapwood at heartwood interface. Right margin successive from fire damage (Photographs 7.1).

Wound 2 (W2)

Wound on east side, narrow, linear, vertical, asymmetrical (Photograph 7.2). The wound extended from 70 - 700 mm. The wound face extended from 70 - 590 mm and was 100 mm at widest at 200 mm. Margin depth left and right 60 mm. Shallow wounding forming a succession of 3 right wound margins and 2 on the wound margin left, with right damaged by fire with charcoal 100 mm wide and right new wound wood margin 60 mm wide (photograph 7.2) with damage caused by successive fires. Wound face shallowly concave, to 80 mm deep at 120 - 250 mm with termite mud at wound face from 250 mm to 600 mm tapering along the left wound margin to apex. Wound face successions dead and burnt along right margin.

Wound 3 (W3)

Wound on northeast side, narrow, linear, vertical, asymmetrical (Photograph 7.3). The wound extended from 1090 - 1850 mm and 360 mm at widest at centre. The wound face extended from 1180 - 1765 mm and 75 mm at widest at centre. Wound margin depth right 80 mm proximally and 70 mm distally and left 10 mm and 15 mm proximally and distally, respectively, left margin necrotic, died back 220 mm to the wound margin of Wound 1 as a rib of wound wood (Photograph 7.3).

Summary

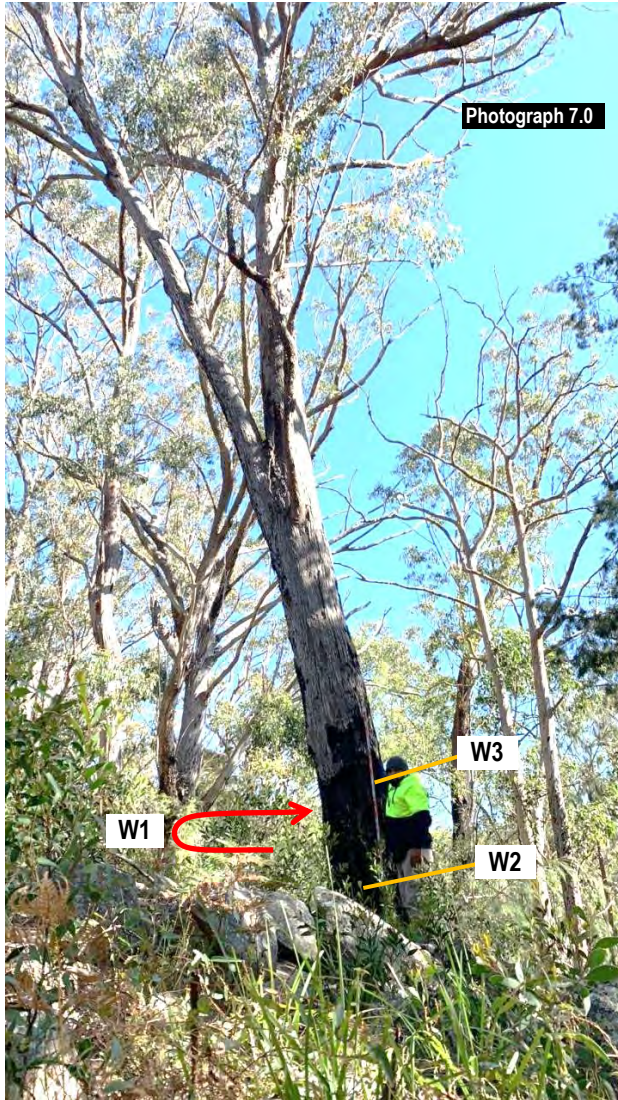
Wound 1 – A wound caused by a succession of fire events forming 20-<40 years ago and contemporarily enlarged by fire, affecting 20% approx. of trunk circumference *in situ*.

Wound 2 – A wound caused by a succession of fire events forming 20-<40 years ago and contemporarily enlarged by fire, affecting 10% approx. of trunk circumference *in situ*.

Wound 3 – A wound caused by a succession of fire events forming 20-<40 years ago and contemporarily enlarged by fire, affecting 20% approx. of trunk circumference *in situ*.

Risks to tree

Not applicable as Wound 1 (W1) not of Aboriginal cultural origin. The tree wounds can be expected to continue to decay over time but likely in balance with new wood growth sustaining structural integrity for some time. The tree remains at risk from fire and decay.



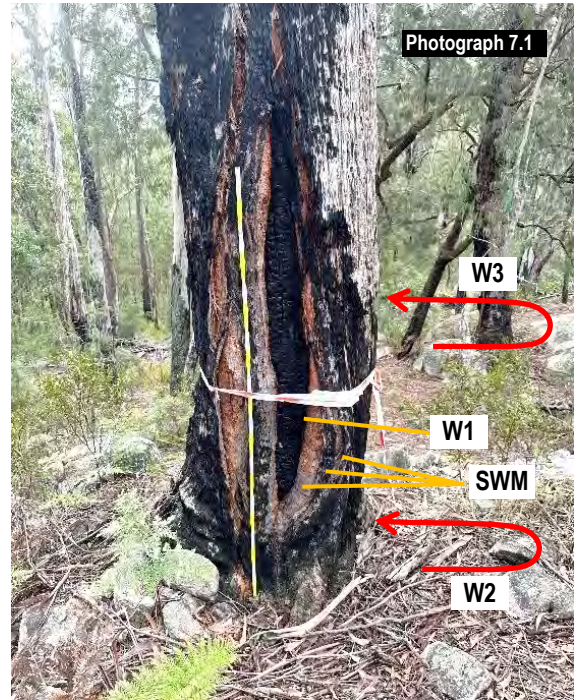
Photograph 7.0

Photograph 7.0 Source EMM, taken 18/5/2024. View to west of tree *Eucalyptus acmenoides* Schauer - White Mahogany, showing Wounds 1-3 (W1-W3).

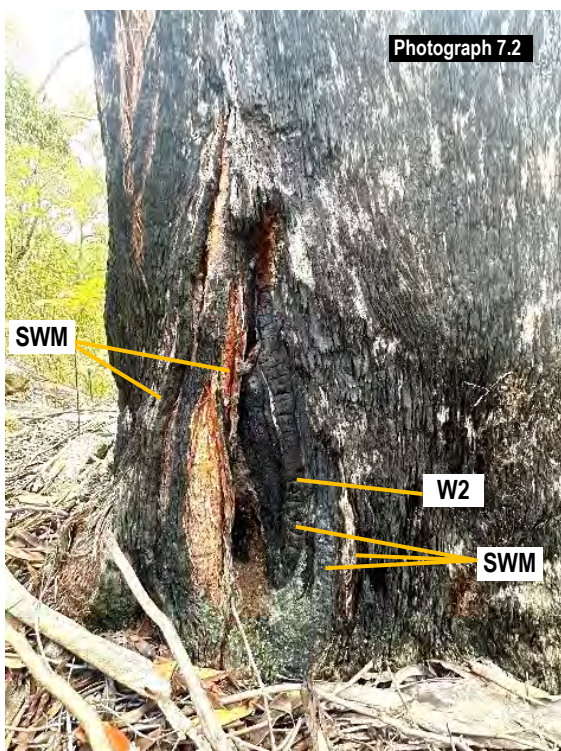
Photograph 7.1 Taken 16/06/2024 by Danny Draper. View to north of tree TN6 / OMPS-ST19 *E. microcorys* F. Muell. - Tallowwood, showing Wound 1 (W1) on the north side and Wounds 2 (W2) and wound 3 (W3), red arrows, on the east and NE sides respectively. Right margin successive (SWM) from fire damage.

Photograph 7.2 Taken 16/06/2024 by Danny Draper. View to west of tree TN6 / OMPS-ST19 *E. microcorys* F. Muell. - Tallowwood, showing Wound 2 (W2) on the east. Right and left wound margins successive (SWM) from fire damage.

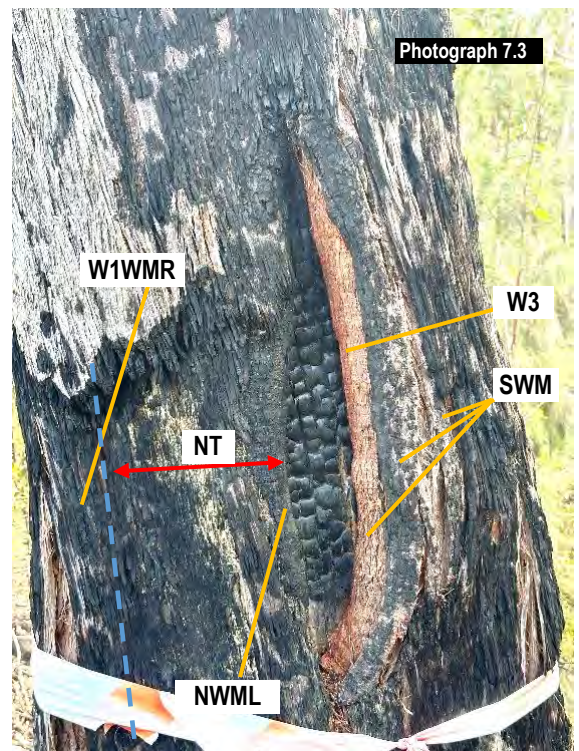
Photograph 7.3 Taken 16/06/2024 by Danny Draper. View to SW of tree TN6 / OMPS-ST19 *E. microcorys* F. Muell. - Tallowwood, showing Wound 3 (W3) on the NE. Right margin successive (SWM) from fire damage. Necrotic tissue (NT) red arrow extending to W1 wound margin right (W1WMR) blue dotted line to necrotic wound margin left (NWML).



Photograph 7.1



Photograph 7.2



Photograph 7.3

4.1 Assessment of Tree/s – TN8 / OMPS-ST21

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. %.	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN8 / OMPS-ST21 <i>Eucalyptus biturbinata</i> L.A. .S.Johnson & K.D.Hill Grey Gum	1. M 2. 200 - <250 3.1 25 - <50 (W1) 4. N/A	F	D	19 / 10	900 – 1700, 1300 Av., / E/W	30 / 80	MFVF – 9 / 1

Description

Eucalyptus biturbinata L.A.S.Johnson & K.D.Hill – Grey Gum related to Grey Gum *E. punctata* DC. – Grey Gum, *E. longirostrata* (Blakely) L.A.S.Johnson & K.D.Hill and *E. canaliculata* Maiden, is a medium to tall forest tree (Brooker and Kleinig, 1999, pp. 80 and 81, and Boland *et al*, 2006, p. 306) with a distribution from Gloucester NSW to Nanango to west of Gympie in Queensland (Brooker and Kleinig, 1999, p. 81, Boland *et al*, 2006, p. 306) to Maryborough (Bootle 2005, p. 279). “They (sic Grey Gum) grow on hills and ridges of undulating country adjacent to the coast and on the ridges and slopes of the tablelands on a wide range of substrates” (Boland *et al*, 2006, p. 306).

Grey Gum can attain a height of 20 – 30 m (Elliot and Jones, 1986, p. 190) to 35 m with a trunk diameter 1 m DBH (Boland *et al*, 2006, p. 306) with a crown spread of 10-20 m (Elliot and Jones, 1986, p. 190). “Bark smooth, patchy, matte, white, grey or grey-brown, shedding in large plates or flakes” (PlantNET, 2023). Some trees on poor soil may only attain heights of 10 m with densely branched crowns (Boland *et al*, 2006, p. 306).

E. punctata DC. differs from *E. biturbinata* L.A.S.Johnson & K.D.Hill “by the retention of the outer operculum till late in bud development and preference for more fertile soils” (Brooker and Kleinig, 1999, p. 82). *E. punctata* DC. – Grey Gum heartwood has a green density (GD) of 1240 kg / m³ approx. and air dry density (ADD) 1080 kg / m³ approx. (Bootle 2005, p. 279) and 945 - 1105 kg / m³ (Boland *et al*, 2006, p. 306). Sapwood generally not susceptible to Lyctid borers (Boland *et al*, 2006, p. 506, Bootle 2005, p. 350) and heartwood is termite resistant (Bootle 2005, p. 279). The wood is strong and extremely durable (Boland *et al*, 2006, p. 306), with an above ground durability class of AG1, and an inground durability class of IG1 (Bootle 2005, p. 279) and is used for heavy engineering construction and poles (Bootle 2005, p. 279, and Boland *et al*, 2006, p. 306). The tree grows within a rainfall range of 700-1200 mm (Boland *et al*, 2006, p. 306).

Tree TN8 / OMPS-ST21 (Photograph 8.0) was growing in a moderate rainfall area, on what appeared to be an elevated forest near Carrai State Conservation Area, with an expected comparable average annual rainfall slightly greater than 752.9 mm recorded 65 km away at the nearby Station: Armidale (Number: 056037), from 1997 to present, and was expected to be growing at a rate typical for the species with an estimated age of 200 - <250 years. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree had 1 trunk wound on its south side.

Wound 1 (W1)

Wound on south side, narrow, linear, vertical on a slightly crooked trunk, asymmetrical (Photograph 8.1). The wound extended from 900 - 1700 mm. The wound face extended from 940

- 1570 mm and was 135 mm at widest at centre. Wound margin depth right 30 mm and left 35 mm. Wound face entire to sapwood with some wound wood bark at 1200 - 1320 mm (Photographs 8.2 and 8.4) with fire damage above from 1320 - 1380 mm (Photographs 8.2 and 8.3), with depressions to 12 mm wide adjacent the wound base and apex consistent with Longicorn Borer galleries (Photographs 8.2 and 8.5). Wound consistent with an abrasion wound initially and then a succession of damage by Longicorn Borers and lastly fire.

Summary

Wound 1 – A wound caused by mechanical wounding from an abrasion impact event, likely a branch or tree collapse, and subsequently a succession of Longicorn Borers and fire, 25-<50 years ago, affecting 15% approx. of trunk circumference *in situ*.

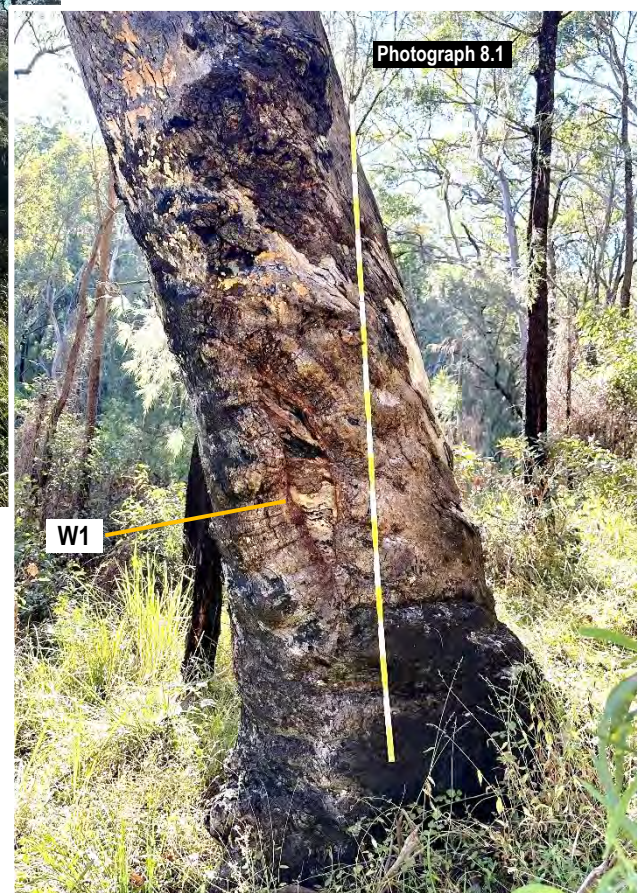
Risks to tree

Not applicable as Wound 1 (W1) not of Aboriginal cultural origin. The tree wound can be expected to continue to decay over time but likely in balance with new wood growth sustaining structural integrity for some time. The tree remains at risk from fire and decay.



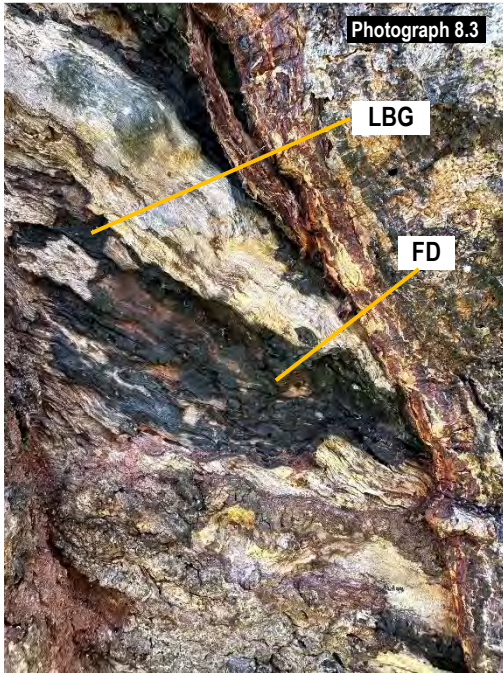
Photograph 8.0

Photograph 8.0 Taken 16/06/2024 by Danny Draper. View to northeast of tree TN8 / OMPS-ST20 *Eucalyptus biturbinata* L.A.S.Johnson & K.D.Hill - Grey Gum, showing Wound 1 (W1) on the south side of the trunk.



Photograph 8.1

Photograph 5.1 Taken 16/06/2024 by Danny Draper. View to north of tree TN8 / OMPS-ST20 *E. biturbinata* L.A.S.Johnson & K.D.Hill - Grey Gum, showing Wound 1 (W1) on the south side of the trunk with a yellow ruler extended to 2 m.



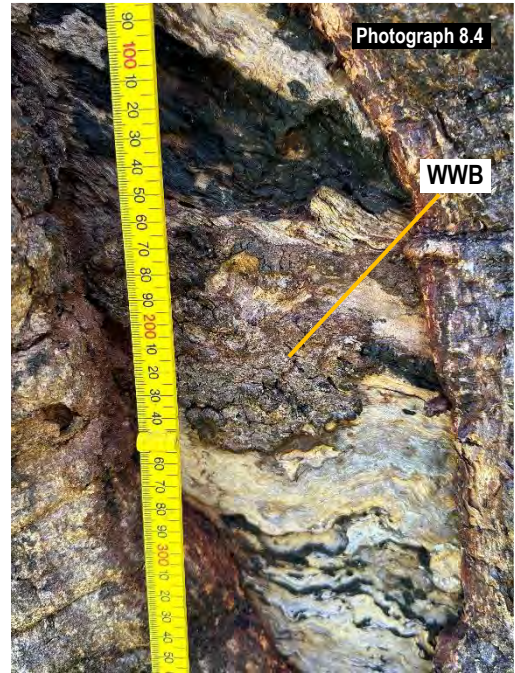
Photograph 8.3

LBG

FD

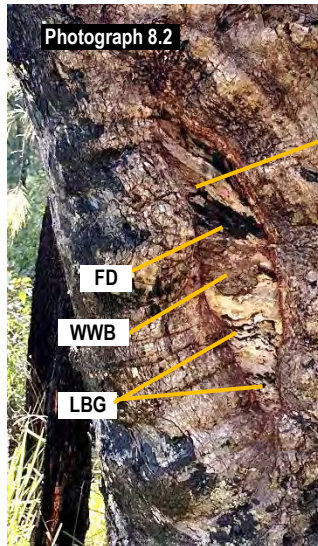
Photograph 8.3
 Taken 16/06/2024 by Danny Draper. View to north of tree TN8 / OMPS-ST21 *Eucalyptus biturbinata* L. A.S. Johnson & K.D.Hill - Grey Gum, showing Wound 1 (W1) on the north of the trunk with fire damage (FD) from 1320 - 1380 mm. Longicorn borer galleries (LBG) near the wound apex.

Photograph 8.4
 Taken 16/06/2024 by Danny Draper. View to north of tree TN8 / OMPS-ST21 *E. biturbinata* L.A.S. Johnson & K.D.Hill - Grey Gum, showing Wound 1 (W1) on the north of the trunk with wound face entire to sapwood with some wound wood bark (WWB) at 1200 - 1320 mm.



Photograph 8.4

WWB



Photograph 8.2

FD

WWB

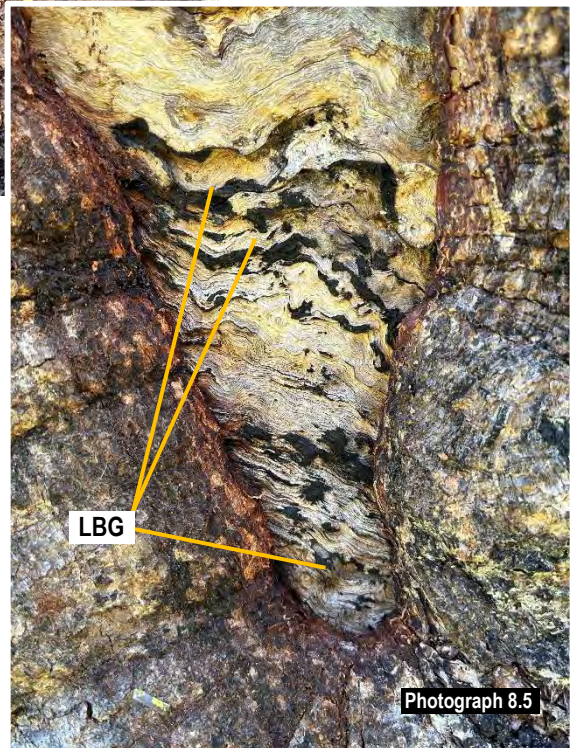
LBG



LBG

Photograph 8.2 Taken 16/06/2024 by Danny Draper. View to north of tree TN8 / OMPS-ST21 *Eucalyptus biturbinata* L.A.S. Johnson & K.D.Hill - Grey Gum, showing Wound 1 (W1) on the south side of the trunk with a white and yellow ruler extended to 2 m.

Showing:
 Fire damage (FD) and Longicorn borer galleries Photograph 8.3, Wound wood bark (WWB) Photograph 8.4, and Longicorn borer galleries (LBG) near wound base, Photograph 8.5.



LBG

Photograph 8.5

Photograph 8.5 Taken 16/06/2024 by Danny Draper. View to north of tree TN8 / OMPS-ST21 *E. biturbinata* L.A.S. Johnson & K.D.Hill - Grey Gum, showing Wound 1 (W1) on the south side of the trunk with a Longicorn borer galleries (LBG) near the wound base.

4.1 Assessment of Tree/s – TN9 / OMPS-ST22

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. %.	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN9 / OMPS-ST22 <i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. M 2. 300 - <375 3.1 150 - <200 (W1) 4. 5 - <10	D	F	28 / 15	1100	N/A	N/A

Description

Eucalyptus acmenoides Schauer. – White Mahogany is a tree of open and tall open forest (Brooker and Kleinig, 1999, p. 251, and Boland et al, 2006, p. 506), persistent bark throughout, grey to red-brown, thin, and stringy (Elliot and Jones, 1986, p. 15 and PlantNET, 2024). It has a distribution along the coastal plain extending to the ranges from near Sydney in NSW to north of Cooktown in Queensland (Brooker and Kleinig, 1999, p. 283 and Boland et al, 2006, p. 544). In NSW it commonly occurs on hills and ridges below 300 mm altitude growing on clay and loam soils (Boland et al, 2006, p. 544). It can attain a height of 15 – 30 m (Elliot and Jones, 1986, p. 15) or 25 – 60 m with a trunk diameter 1 m DBH (Boland et al, 2006, p. 526) and a crown spread of 5-15 m (Elliot and Jones, 1986, p. 15).

E. acmenoides Schauer. – White Mahogany, heartwood has a green density of 1200 kg / m³ approx. (Bootle 2005, p. 303) and air dry density (ADD) 1000 kg / m³ approx. (Bootle 2005, p. 350) and 795 - 1010 kg / m³ (Boland et al, 2006, p. 526). Sapwood rarely attacked by Lyctus borers and heartwood is termite resistant (Boland et al, 2006, p. 526, Bootle 2005, p. 303). The wood is strong and very durable (Boland et al, 2006, p. 526), with an above ground durability class of AG1, and an inground durability class of IG1 (Bootle 2005, p. 303) and is used for heavy engineering construction, poles, sleeper, ship building, flooring, joists, and weatherboards (Bootle 2005, p. 303, and Boland et al, 2006, p. 526). The tree grows within a rainfall range of 700-1700 mm (Boland et al, 2006, p. 506).

Tree TN9 / OMPS-ST22 (Photograph 9.0) was growing in a moderate rainfall area, on what appeared to be a granite outcrop in an elevated forest near Carrai State Conservation Area, with an expected comparable average annual rainfall slightly greater than 752.9 mm recorded 65 km away at the nearby Station: Armidale (Number: 056037), from 1997 to present, and was expected to be growing at a rate typical for the species with an estimated age of 300 - <375 years and died approx. 5 - <10 years ago. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree had 1 trunk wound on its north side and had contemporarily been further impacted by fire.

Wound 1 (W1)

The wound on west side, elongated, oval, linear, vertical, symmetrical, and prominent facing down slope (Photograph 9.0). The wound margin depth was 210 mm deep left and right. The wound extended from 1300 – 3750 mm and was 250 mm wide approx. (Photographs 9.0 and 9.1). The wound face extended from 1900 – 3070 mm and was 200 mm wide, wound margins approx. 200 mm wide. Wound face entire to fire affected heartwood. Large buttress root extended down slope 950 mm wide.

Summary

Wound 1 – Due to the depth of the wound margins, extent of wound, durability of the wood, and its symmetrical shape and location it is highly likely to be a wound of Aboriginal cultural origin, 150 - <200 years old, affecting 40% approx. of trunk circumference *in situ*.

Risks to tree

The tree wound can be expected to continue to decay over time. The tree remains at risk from fire and decay. If the tree is to be inundated it or a section containing the wound could be moved to a keeping place in consultation with Aboriginal stake holders.



Photograph 9.0 Taken 15/06/2024 by Danny Draper. View to east of tree TN9 / OMPS-ST22 *Eucalyptus acmenoides* Schauer - White Mahogany, showing Wound 1 (W1) on the west side of the trunk.



Photograph 9.1 Source EMM, taken 18/05/2024. View to east of tree TN9 / OMPS-ST22 *E. acmenoides* Schauer - White Mahogany, showing Wound 1 (W1) on the west side of the trunk with a red and white tape measure extended to 2 m.

4.1 Assessment of Tree/s – TN10 / OMPS-ST23

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. %	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN10 / OMPS-ST23 <i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. M 2. 300 - <350 3.1 50 - <75 (W1) 4. 5 - <10	D	F	17 / 18x12, N/S	780x720, 750 Av., / N/S	N/A	N/A

Description

Eucalyptus acmenoides Schauer. – White Mahogany is a tree of open and tall open forest (Brooker and Kleinig, 1999, p. 251, and Boland et al, 2006, p. 506), persistent bark throughout, grey to red-brown, thin, and stringy (Elliot and Jones, 1986, p. 15 and PlantNET, 2024). It has a distribution along the coastal plain extending to the ranges from near Sydney in NSW to north of Cooktown in Queensland (Brooker and Kleinig, 1999, p. 283 and Boland et al, 2006, p. 544). In NSW it commonly occurs on hills and ridges below 300 mm altitude growing on clay and loam soils (Boland et al, 2006, p. 544). It can attain a height of 15 – 30 m (Elliot and Jones, 1986, p. 15) or 25 – 60 m with a trunk diameter 1 m DBH (Boland et al, 2006, p. 526) and a crown spread of 5-15 m (Elliot and Jones, 1986, p. 15).

E. acmenoides Schauer. – White Mahogany, heartwood has a green density of 1200 kg / m³ approx. (Bootle 2005, p. 303) and air dry density (ADD) 1000 kg / m³ approx. (Bootle 2005, p. 350) and 795 - 1010 kg / m³ (Boland et al, 2006, p. 526). Sapwood rarely attacked by Lyctus borers and heartwood is termite resistant (Boland et al, 2006, p. 526, Bootle 2005, p. 303). The wood is strong and very durable (Boland et al, 2006, p. 526), with an above ground durability class of AG1, and an inground durability class of IG1 (Bootle 2005, p. 303) and is used for heavy engineering construction, poles, sleeper, ship building, flooring, joists, and weatherboards (Bootle 2005, p. 303, and Boland et al, 2006, p. 526). The tree grows within a rainfall range of 700-1700 mm (Boland et al, 2006, p. 506).

Tree TN10 / OMPS-ST23 (Photograph 10.0) was growing in a moderate rainfall area, on what appeared to be well drained soil, with an average annual rainfall of 1143.2 mm recorded at the nearby Belmont WWTP, Station Number: 61299, from 1990 to present, and was expected to be growing at a rate typical for the species with an estimated age of 300 - <350 years and died approx. 5 - <10 years ago. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree had 1 trunk wound on its east side which contemporarily had been further impacted and partly consumed by fire.

Wound 1 (W1)

Wound on east side, broad oval, vertical, asymmetrical (Photographs 10.0 and 10.1). The wound extended from 3650 – 5670 mm approx. The found face extended from 3300 – 5300 mm approx. and was approx. 600 mm at widest at centre. The wound margins entire, irregular, left and right appeared approx. 50-75 mm wide and approx. 90 mm deep. Wound face to necrotic sapwood and heartwood with burrows and galleries consistent with Longicorn Borers (Photograph 10.1).

Longicorn Borers attack live trees, and their larvae generally burrow in sapwood along the grain disrupting the cambial layer causing localised wounds as the cambium dies (Jones and Elliot, 1986, pp. 195 – 198, Jones, Elliot and Jones 2015, p. 310, and Creffield, 1996, pp. 4-7). “They

mainly enter trees through wounds and their attacks may be cumulative with adult females laying eggs in tissue damaged by active borer larvae” (Jones and Elliot, 1986, p. 196). The longicorn larvae burrow in circular holes and may burrow deeper into heartwood to pupate with adults exiting via flight holes, oval, 6x10 mm at the trunk surface (Jones and Elliot, 1986, pp. 195 – 198, Jones, Elliot and Jones 2015, p. 310, and Creffield, 1996, pp. 4-7). “*Most species in this genus of wood borers (Phoracantha), primarily attack only damaged or stressed (often drought-stressed) native trees”* (Angus, 2023, p. 111).

The *Phoracantha semipunctata* - Eucalyptus Longicorn Borer Beetle (order Cerambycidae), can survive for several years in a Eucalypt as larvae or pupae before emerging (Angus, 2023, p. 111), increasing the damage from burrowing and grazing in the cambium. As the clutch of insect eggs develop, the larvae and pupae spread out, continue to develop, and grow and their burrowing increases in diameter as they chew and tunnel through the live cambial tissue creating a wound by ringbarking areas of Xylem and Phloem, until emerging as adults at the trunk surface from oval holes 8-10 mm up to 10-15 mm (Photographs 1.4 and 1.5). Severe, prolonged, or repeated attacks by Longicorn borers can ringbark and kill trees with reduced vigour and resilience.

Summary

Wound 1 – A wound caused by Longicorn Borers, 50 - <75 years ago, affecting 30% approx. of trunk circumference *in situ*.

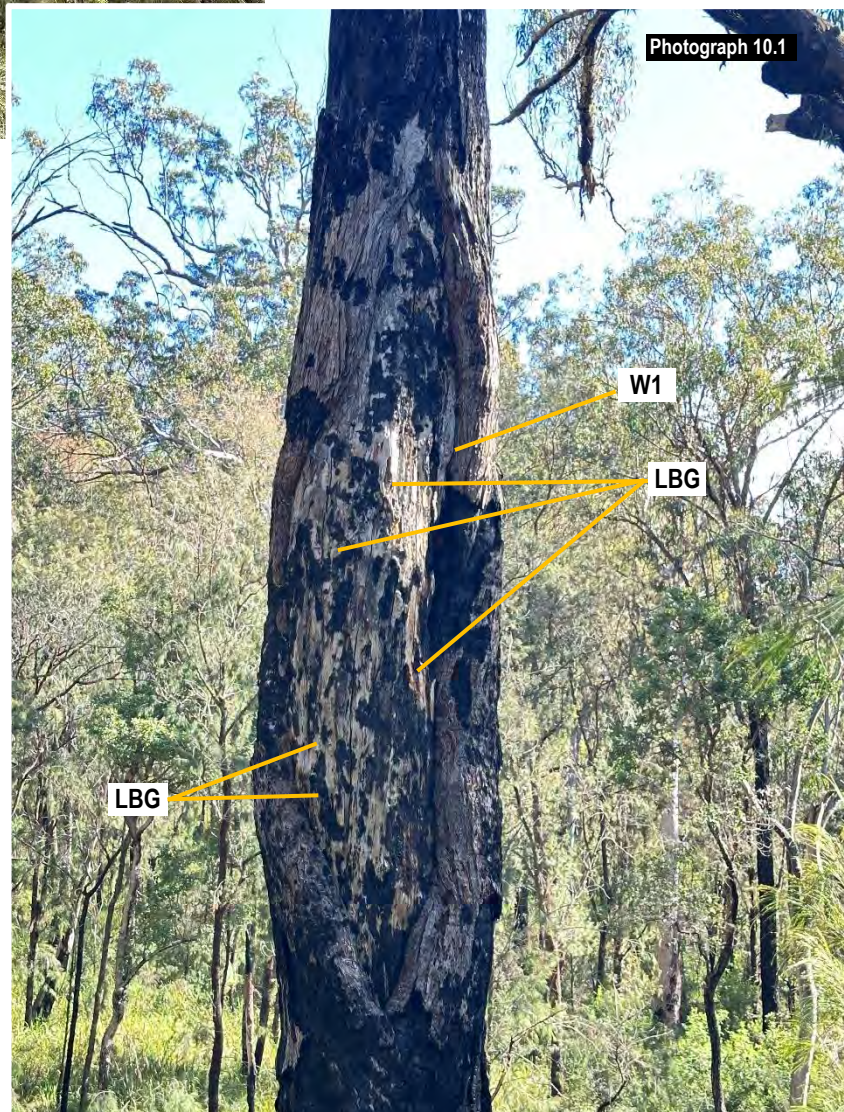
Risks to tree

Not applicable as Wound 1 (W1) not of Aboriginal cultural origin.



Photograph 10.0

Photograph 10.0 Taken 16/06/2024 by Danny Draper. View to west of tree TN10 / OMPS-ST23 *Eucalyptus acmenoides* Schauer - White Mahogany, showing Wound 1 (W1) on the east side of the trunk.



Photograph 10.1

Photograph 10.1 Taken 16/06/2024 by Danny Draper. View to west of tree TN10 / OMPS-ST23 *Eucalyptus acmenoides* Schauer - White Mahogany, showing Wound 1 (W1) on the east side of the trunk Longicorn Borer galleries (LBG).

4.1 Assessment of Tree/s – TN11 / OMPS24-ST1

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. %	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN11 / OMPS24-ST1 <i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. O 2. 325 - <375 3.1 150 - <200 (W1) 4. N/A	P	F	28 / 16	1800x1500, 1650 Av., / N/S	60 / 80	MGVP – 6 / 2

Description

Eucalyptus tereticornis Smith – Forest Red Gum, Buringoa (D'harawal), is a medium-sized to tall woodland or forest tree (Brooker and Kleinig, 1999, p. 101) can attain a height of 20-30 m (Elliot and Jones, 1986, p.222) to 50 m with a trunk diameter up to 2000 mm DBH, typically with a straight trunk without branching for half the height (Boland *et al*, 2006, p. 322) with a crown spread of 10-25 m (Elliot and Jones, 1986, p.222).

E. tereticornis Sm. has a high green density of 800-1100 kg / m³ (Boland *et al*, 2006, p. 322) to 1200 kg/m³ and air dry density (ADD) 1050 kg / m³, sapwood not susceptible to Lyctids and heartwood above ground resistant to termites (Bootle, 2005, p. 280). The heartwood has an inground durability of 1 which is high and above ground durability of 1 which is high durability (Bootle, 2005, p. 280). *E. tereticornis* Sm. heartwood is hard, strong and durable, used for heavy engineering and construction (Boland *et al*, 2006, p. 322).

Tree TN11 / OMPS24-ST1 (Photograph 11.0) was growing in a moderate rainfall area, on what appeared to be well drained alluvial soil on the river valley flood plain, with an expected comparable average annual rainfall of 752.9 mm recorded 65 km away at the nearby Station: Armidale (Number: 056037), from 1997 to present, and was expected to be growing at a rate typical for the species with an estimated age of 325-<375 years. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree had 1 trunk basal wound on its east side.

Wound 1 (W1)

Basal wound on east side, parabolic, symmetrical (Photograph 11.1). Initial wound estimated to have extended 250-300 mm above ground to 1010 - 1150 mm. Wound from ground to 970 mm to apex. Trunk hollow, 970 mm deep. Wound margin depth right 230 mm to edge of hollow and incurved around the inner side of the trunk for 200 mm, and wound margin left 230 mm deep to edge of hollow and incurved around inner side of the trunk for 200 mm. Weathered fragments of wound face or slightly deeper section adjacent wound margins right and left at 560 mm deep and 400 mm deep respectively, displaced and pushed inwards by incurved wound margins growth.

Summary

Wound 1 – Due to the depth of the wound margins and their extend around the inner side of the hollow trunk, extent of wound, durability of the wood, and its symmetrical shape and location it is highly likely to be a wound of Aboriginal cultural origin, 150 - <200 years old, affecting 40% approx. of trunk circumference *in situ*.

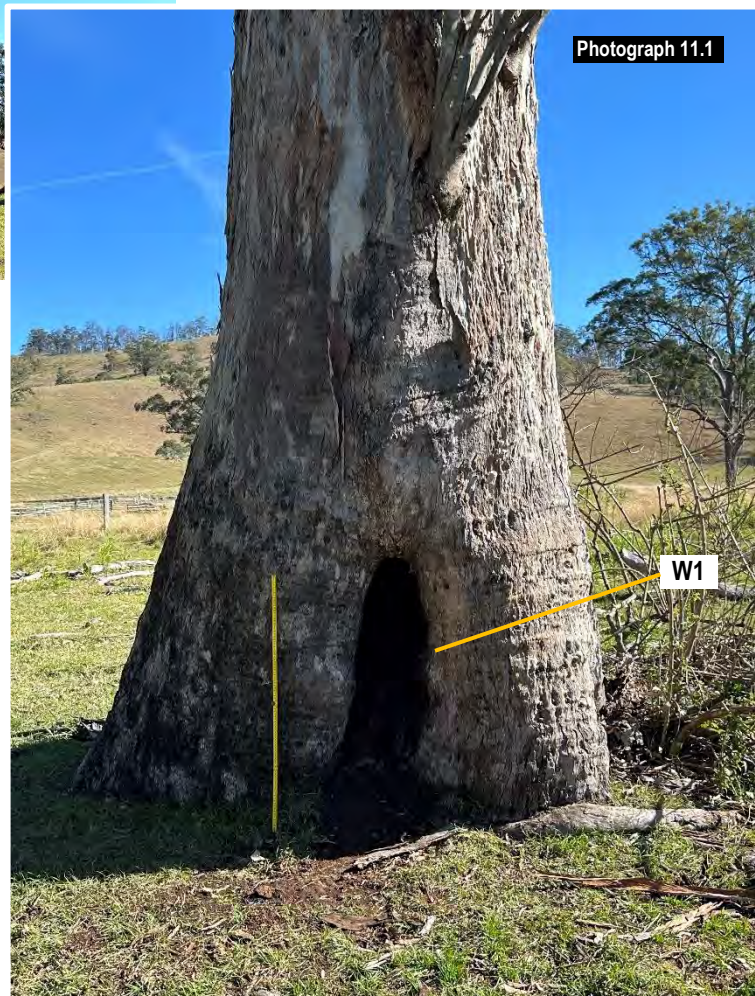
Risks to tree

This senescent tree and wound can be expected to continue to decay over time and the tree to continue to gradually deteriorate structurally and remains at risk from fire. If the tree is to be inundated it or a section containing the wound could be moved to a keeping place in consultation with Aboriginal stake holders.



Photograph 11.0

Photograph 11.0 Taken 16/06/2024 by Danny Draper. View to west of tree TN11 / OMPS24-ST1 *Eucalyptus tereticornis* Sm. - Forst Red Gum, showing Wound 1 (W1) on the east side of the trunk.



Photograph 11.1

Photograph 11.1 Taken 16/06/2024 by Danny Draper. View to west of tree TN11 / OMPS24-ST1 *E. tereticornis* Sm. - Forst Red Gum, showing Wound 1 (W1), basal, on the east side of the trunk with a yellow ruler extended to 1 m.

4.1 Assessment of Tree/s – TN12 / OMPS24-ST2

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. %	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN12 / OMPS24-ST2 <i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. O 2. 250 - <275 3.1 125 - <150 (W1) 4. N/A	F	D	16 / 9	600x700, 650 Av., / N/S	10 / 85	OLVF – 2 / 2

Description

Eucalyptus acmenoides Schauer. – White Mahogany is a tree of open and tall open forest (Brooker and Kleinig, 1999, p. 251, and Boland et al, 2006, p. 506), persistent bark throughout, grey to red-brown, thin, and stringy (Elliot and Jones, 1986, p. 15 and PlantNET, 2024). It has a distribution along the coastal plain extending to the ranges from near Sydney in NSW to north of Cooktown in Queensland (Brooker and Kleinig, 1999, p. 283 and Boland et al, 2006, p. 544). In NSW it commonly occurs on hills and ridges below 300 mm altitude growing on clay and loam soils (Boland et al, 2006, p. 544). It can attain a height of 15 – 30 m (Elliot and Jones, 1986, p. 15) or 25 – 60 m with a trunk diameter 1 m DBH (Boland et al, 2006, p. 526) and a crown spread of 5-15 m (Elliot and Jones, 1986, p. 15).

E. acmenoides Schauer. – White Mahogany, heartwood has a green density of 1200 kg / m³ approx. (Bootle 2005, p. 303) and air dry density (ADD) 1000 kg / m³ approx. (Bootle 2005, p. 350) and 795 - 1010 kg / m³ (Boland et al, 2006, p. 526). Sapwood rarely attacked by Lyctus borers and heartwood is termite resistant (Boland et al, 2006, p. 526, Bootle 2005, p. 303). The wood is strong and very durable (Boland et al, 2006, p. 526), with an above ground durability class of AG1, and an inground durability class of IG1 (Bootle 2005, p. 303) and is used for heavy engineering construction, poles, sleeper, ship building, flooring, joists, and weatherboards (Bootle 2005, p. 303, and Boland et al, 2006, p. 526). The tree grows within a rainfall range of 700-1700 mm (Boland et al, 2006, p. 506).

Tree TN12 / OMPS24-ST2 (Photograph 12.0) was growing in a moderate rainfall area, on what appeared to be an elevated forest near Carrai State Conservation Area, with an expected comparable average annual rainfall slightly greater than 752.9 mm recorded 65 km away at the nearby Station: Armidale (Number: 056037), from 1997 to present, and was expected to be growing at a rate typical for the species with an estimated age of 250-<275 years. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree had 1 trunk wound on its north side which contemporarily had been further impacted and partly consumed by fire.

Wound 1 (W1)

Wound on north side, facing along the contours of the slope to the valley, narrow oval, vertical, symmetrical (Photograph 12.1). The wound extended from 1070 - 2200 mm. The wound face extended from 1170 - 1920 mm and was 130 mm at widest at centre. Wound margin width left 230 mm and right 260 mm. Apex and base tapering but rounded, indicative of age of wound. Wound margin depth right 125 mm proximally and 115 mm distally, left 125 mm proximally and 130 mm distally. Superficial basal wounds below from fire extending to 750 mm.

Summary

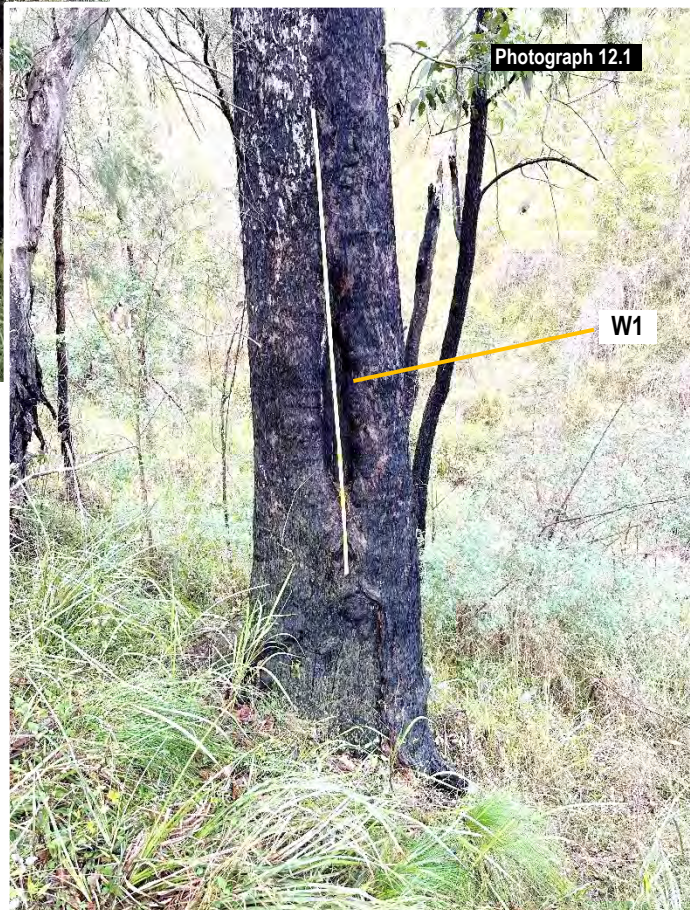
Due to the extent of the width and depth of the wound margins, durability of the wood, and its symmetrical shape and location it is highly likely to be a wound of Aboriginal cultural origin, 125 - <150 years old, affecting 30% approx. of trunk circumference *in situ*.

Risks to tree

This senescent tree and wound can be expected to continue to decay over time and the tree to continue to gradually deteriorate structurally and remains at risk from fire. If the tree is to be inundated it or a section containing the wound could be moved to a keeping place in consultation with Aboriginal stake holders.



Photograph 12.0 Taken 16/06/2024 by Danny Draper. View to east of tree TN12 / OMPS24-ST2 *Eucalyptus acmenoides* Schauer - White Mahogany, showing Wound 1 (W1) on the north side of the trunk.



Photograph 12.1 Taken 16/06/2024 by Danny Draper. View to south of tree TN12 / OMPS24-ST2 *E. acmenoides* Schauer - White Mahogany, showing Wound 1 (W1) on the north side of the trunk. with a white and yellow ruler extended to 2 m.

4.1 Assessment of Tree/s – TN13 / OMPS24-ST3

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. %	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN13 / OMPS24-ST3 <i>Eucalyptus acmenoides?</i> Schauer White Mahogany	1. O 2. 350 - <400 (overall tree) 2.1 125 - <150 (stump) 3.1 100 - <125 (W1) 4. 10 - <30	D	D	9 (stump)	460x340, 400 Av.	N/A	N/A

Description

Eucalyptus acmenoides Schauer. – White Mahogany is a tree of open and tall open forest (Brooker and Kleinig, 1999, p. 251, and Boland et al, 2006, p. 506), persistent bark throughout, grey to red-brown, thin, and stringy (Elliot and Jones, 1986, p. 15 and PlantNET, 2024). It has a distribution along the coastal plain extending to the ranges from near Sydney in NSW to north of Cooktown in Queensland (Brooker and Kleinig, 1999, p. 283 and Boland et al, 2006, p. 544). In NSW it commonly occurs on hills and ridges below 300 mm altitude growing on clay and loam soils (Boland et al, 2006, p. 544). It can attain a height of 15 – 30 m (Elliot and Jones, 1986, p. 15) or 25 – 60 m with a trunk diameter 1 m DBH (Boland et al, 2006, p. 526) and a crown spread of 5-15 m (Elliot and Jones, 1986, p. 15).

E. acmenoides Schauer. – White Mahogany, heartwood has a green density of 1200 kg / m³ approx. (Bootle 2005, p. 303) and air dry density (ADD) 1000 kg / m³ approx. (Bootle 2005, p. 350) and 795 - 1010 kg / m³ (Boland et al, 2006, p. 526). Sapwood rarely attacked by Lyctus borers and heartwood is termite resistant (Boland et al, 2006, p. 526, Bootle 2005, p. 303). The wood is strong and very durable (Boland et al, 2006, p. 526), with an above ground durability class of AG1, and an inground durability class of IG1 (Bootle 2005, p. 303) and is used for heavy engineering construction, poles, sleeper, ship building, flooring, joists, and weatherboards (Bootle 2005, p. 303, and Boland et al, 2006, p. 526). The tree grows within a rainfall range of 700-1700 mm (Boland et al, 2006, p. 506).

Tree TN13 / OMPS24-ST3 (Photograph 13.0) was growing in a moderate rainfall area, on what appeared to be an elevated forest near Carrai State Conservation Area, with an expected comparable average annual rainfall slightly greater than 752.9 mm recorded 65 km away at the nearby Station: Armidale (Number: 056037), from 1997 to present, and was expected to be growing at a rate typical for the species with an estimated age of 350-<400 years. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree had 1 series of wounds from axe cuts on its side which contemporarily had been further impacted and partly consumed by fire.

The stump with an estimated age of 125-<150 years, was a mature basal epicormic shoot as the last remains of a much older tree on its upslope side. This was evident by the presence of a longitudinally concave section of the stem on its upslope side where it had once been shaped as it grew upright for the sun against the upright trunk of the initial tree (Photograph 13.3). While this section had recently sustained fire damage it appeared superficial and did not alter the overall shape or exaggerate it by its consumption.

Wound 1 (W1)

A series of contiguous small axe cuts on the north side of the trunk, horizontal, linear (Photographs 13.-13.3). The circumference of the curved axe cut section was 1030 mm and partly cut horizontally by a small axe or hatchet for 780 mm.

The stub of an epicormic shoot 40 mm diameter, beneath the axe cuts was evident on the west side at 1040 mm (Photographs 13.1 and 13.2). The horizontal line of the axe cut section extended from 1100 to east to 1300 to west (Photographs 13.1 and 13.2). The axe cuts were 70-90 mm long and 30-40 mm wide, edges linear to slightly curved and likely made with a steel hatchet (Photograph 13.2). The durable wood exposed by the cuts exhibited minor weathering. The cuts extended to the depth of the Longicorn Borer burrows and galleries (Photographs 13.1 and 13.2).

Elder Elwyn Toby advised that as a child he visited the area many times with his father and that the Longicorn Borer larvae were a food source called “*Dhubble*”. *Dhubble* pronounced - **Dh** as in Door, **oo** as in look, **bble** as in bull - “Whichety grub” - Longicorn Borer.

Longicorn Borers attack live trees, and their larvae generally burrow in sapwood along the grain disrupting the cambial layer causing localised wounds as the cambium dies (Jones and Elliot, 1986, pp. 195 – 198, Jones, Elliot and Jones 2015, p. 310, and Creffield, 1996, pp. 4-7). “*They mainly enter trees through wounds and their attacks may be cumulative with adult females laying eggs in tissue damaged by active borer larvae*” (Jones and Elliot, 1986, p. 196). The longicorn larvae burrow in circular holes and may burrow deeper into heartwood to pupate with adults exiting via flight holes, oval, 6x10 mm at the trunk surface (Jones and Elliot, 1986, pp. 195 – 198, Jones, Elliot and Jones 2015, p. 310, and Creffield, 1996, pp. 4-7). “*Most species in this genus of wood borers (Phoracantha), primarily attack only damaged or stressed (often drought-stressed) native trees*” (Angus, 2023, p. 111).

The *Phoracantha semipunctata* - Eucalyptus Longicorn Borer Beetle (order Cerambycidae), can survive for several years in a Eucalypt as larvae or pupae before emerging (Angus, 2023, p. 111), increasing the damage from burrowing and grazing in the cambium. As the clutch of insect eggs develop, the larvae and pupae spread out, continue to develop, and grow and their burrowing increases in diameter as they chew and tunnel through the live cambial tissue creating a wound by ringbarking areas of Xylem and Phloem, until emerging as adults at the trunk surface from oval holes 8-10 mm up to 10-15 mm (Photographs 1.4 and 1.5). Severe, prolonged, or repeated attacks by Longicorn borers can ringbark and kill trees with reduced vigour and resilience.

Summary

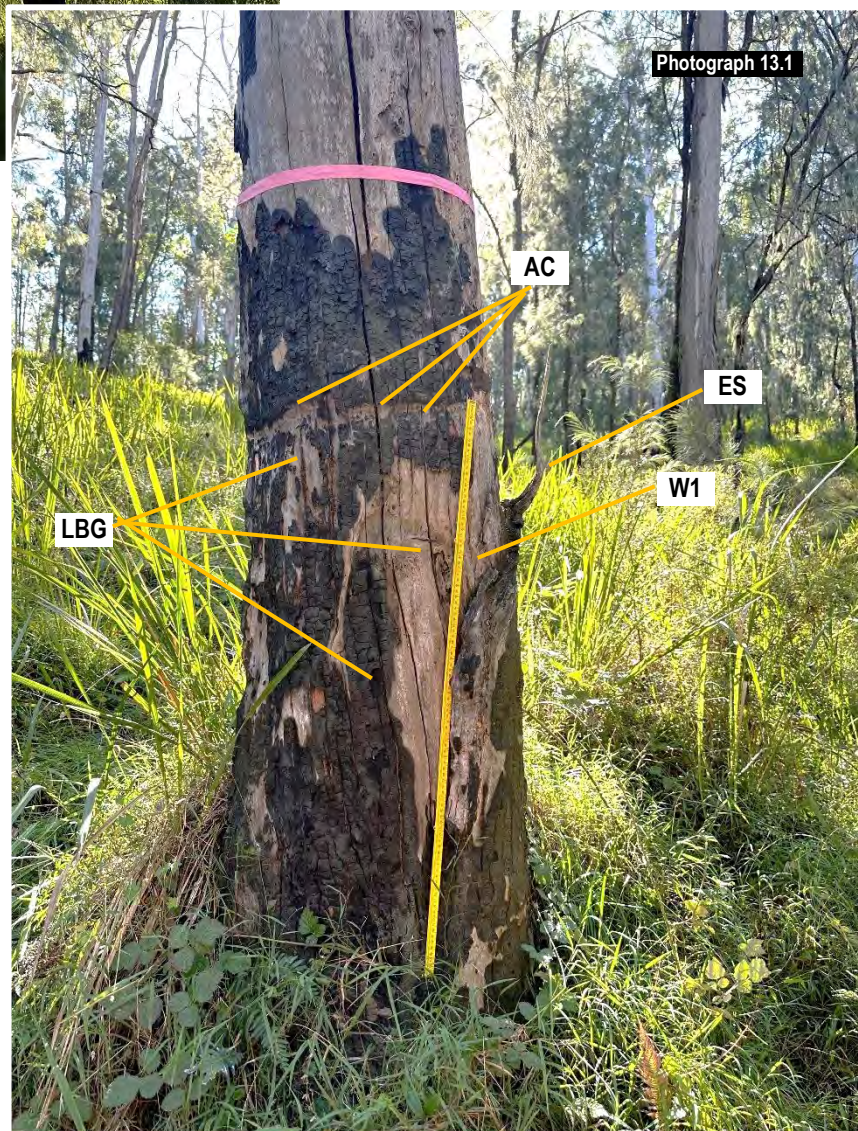
Wound 1 – A single horizontal series of small axe cuts to expose Longicorn Borers, 100 - <125 years ago, and highly likely of Aboriginal cultural origin due to the remoteness of the tree and location, affecting 40% approx. of trunk circumference *in situ*.

Risks to tree

The tree wound can be expected to continue to decay over time and remains susceptible to fire. If the tree is to be inundated it or a section containing the wound and associated Longicorn Borer gallery workings could be moved to a keeping place in consultation with Aboriginal stake holders.



Photograph 13.0 Taken 16/06/2024 by Danny Draper. View to east of tree TN13 / OMPS24-ST3 *Eucalyptus acmenoides?* Schauer - White Mahogany, showing Wound 1 (W1) on the north side of the trunk.

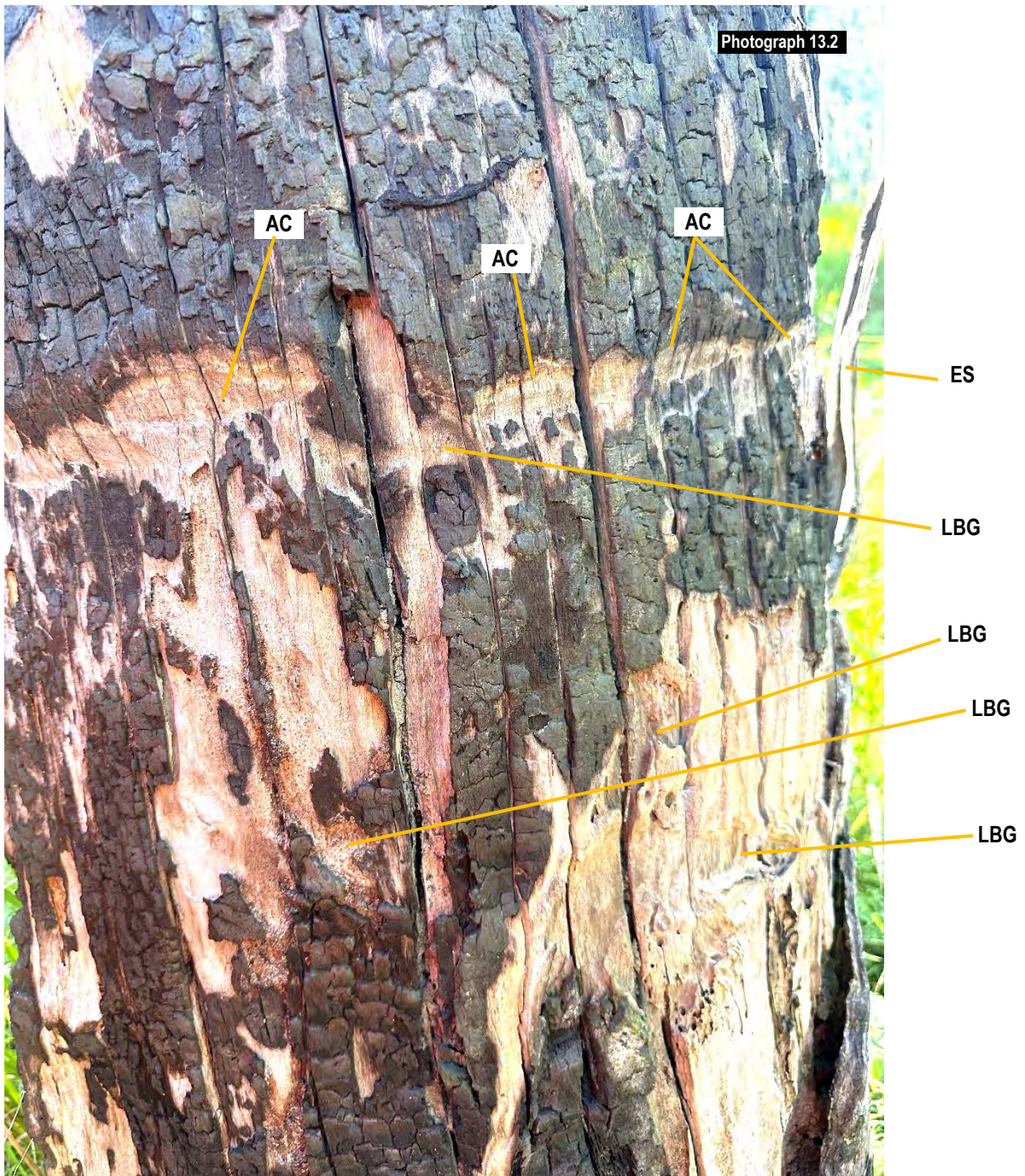


Photograph 13.1 Taken 16/06/2024 by Danny Draper. View to south of tree TN13 / OMPS24-ST3 *E. acmenoides?* Schauer - White Mahogany, showing Wound 1 (W1) on the north side of the trunk with a white and yellow ruler extended to 2 m. Wound shown in greater detail in Photograph 13.2.

The circumference of the curved axe cut section was 1030 mm and partly cut horizontally for 780 mm by a small axe (AC) or hatchet.

The stub of an epicormic shoot (ES) 40 mm diameter, beneath the axe cuts on the west side at 1040 mm.

The cuts extended to the depth of the Longicorn Borer burrows and galleries (LBG).



Photograph 13.2 Taken 16/06/2024 by Danny Draper. View to south of tree TN13 / OMPS24-ST3 *E. acmenoides*? Schauer - White Mahogany, showing Wound 1 (W1) on the north side of the trunk comprised of a series of horizontal downward cuts with a small axe or hatchet (AC) to the depth of the slightly lower Longicorn Borer gallery (LBG) to collect the larvae. The stub of an epicormic shoot (ES) 40 mm diameter, beneath the axe cuts on the west side at 1040 mm.



Photograph 13.3 Taken 16/06/2024 by Danny Draper. View to northwest of tree TN13 / OMPS24-ST3 *E. acmenoides?* Schauer - White Mahogany, showing Wound 1 (W1) on the north side of the trunk comprised of a horizontal ring of downward cuts with a small axe or hatchet (AC) to the depth of the slightly lower Longicorn Borer gallery (LBG) to collect the larvae. Also showing on the south side of the trunk a longitudinally concave section (CS) dotted blue, of the stem on its upslope side where it had once been shaped as a basal epicormic shoot as it grew upright for the sun against the upright trunk of the initial tree.

4.1 Assessment of Tree/s – TN14 / OMPS24-ST4

Tree No. / Archaeological No. Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound/s, in yrs. approx. 4. Date range since tree died in yrs. approx., e.g., died, cut down, ring-barked	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation	Crown cover / Crown density approx. %.	SRIV Age, Vigour, Condition / Index Rating App A. / Remaining life expectancy 1. Long 2. Medium 3. Short
TN14 / OMPS24-ST4 <i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. O 2. 325 - <375 3.1 150 - <200 (W1) 4. 5 - <10	D	F	16 / 12	900	N/A	N/A

Description

Eucalyptus acmenoides Schauer. – White Mahogany is a tree of open and tall open forest (Brooker and Kleinig, 1999, p. 251, and Boland et al, 2006, p. 506), persistent bark throughout, grey to red-brown, thin, and stringy (Elliot and Jones, 1986, p. 15 and PlantNET, 2024). It has a distribution along the coastal plain extending to the ranges from near Sydney in NSW to north of Cooktown in Queensland (Brooker and Kleinig, 1999, p. 283 and Boland et al, 2006, p. 544). In NSW it commonly occurs on hills and ridges below 300 mm altitude growing on clay and loam soils (Boland et al, 2006, p. 544). It can attain a height of 15 – 30 m (Elliot and Jones, 1986, p. 15) or 25 – 60 m with a trunk diameter 1 m DBH (Boland et al, 2006, p. 526) and a crown spread of 5-15 m (Elliot and Jones, 1986, p. 15).

E. acmenoides Schauer. – White Mahogany, heartwood has a green density of 1200 kg / m³ approx. (Bootle 2005, p. 303) and air dry density (ADD) 1000 kg / m³ approx. (Bootle 2005, p. 350) and 795 - 1010 kg / m³ (Boland et al, 2006, p. 526). Sapwood rarely attacked by Lyctus borers and heartwood is termite resistant (Boland et al, 2006, p. 526, Bootle 2005, p. 303). The wood is strong and very durable (Boland et al, 2006, p. 526), with an above ground durability class of AG1, and an inground durability class of IG1 (Bootle 2005, p. 303) and is used for heavy engineering construction, poles, sleeper, ship building, flooring, joists, and weatherboards (Bootle 2005, p. 303, and Boland et al, 2006, p. 526). The tree grows within a rainfall range of 700-1700 mm (Boland et al, 2006, p. 506).

Tree TN14 / OMPS24-ST4 (Photograph 14.0) was growing in a moderate rainfall area, on what appeared to be well drained soil, with an average annual rainfall of 1143.2 mm recorded at the nearby Belmont WWTP, Station Number: 61299, from 1990 to present, and was expected to be growing at a rate typical for the species with an estimated age of 325 - <375 years and died approx. 5 - <10 years ago. However, this age had not been confirmed by cross referencing with other research material such as early aerial photographs. The tree had 1 trunk wound on its north side which contemporarily had been further impacted and partly consumed by fire.

Wound 1 (W1)

Wound, extended recently to ground by fire, linear, vertical, asymmetrical (Photograph 14.0). Wound extended 6 m approx. and extended further by fire and from termite damage at base in hollowed trunk. Three successional wound margins were observed at wound margin left. A fragment of the inner 3rd left margin incurred 230 mm (Photograph 14.xx) and this section not consumed by fire was 70 mm long and 80 mm high. A concave section on the inner side of the trunk was 200 mm deep on or wound margin left and perpendicular to wound depth 500 mm approx. around trunk (measured on the outside) consumed by fire. Depth of tree hollow 700 mm. Wound margin left fragment 140 mm deep. A preform curve was evident in the ash and

accentuated by cracks in the ray cells showed a vertical shallow curve outward to the left starting at the wound base left (Photographs 14.2 and 14.3). From fragments measured, possibly a coolamon estimated 400-500 mm wide by 500-600 mm high. Incurved at 150 above base and possible buttress root connection.

Summary

Wound 1 – Due to the extent of the depth of the wound margin fragment, durability of the wood, and its symmetrical shape, location and preform outline, it is highly likely that the now fire consumed and extended wound was a lower trunk wound of Aboriginal cultural origin, 100 - <200 years old, affecting 30% approx. of trunk circumference *in situ*.

Risks to tree

The tree wound can be expected to continue to decay over time and remains susceptible to fire. If the tree is to be inundated it or a section containing the wound could be moved to a keeping place in consultation with Aboriginal stake holders.

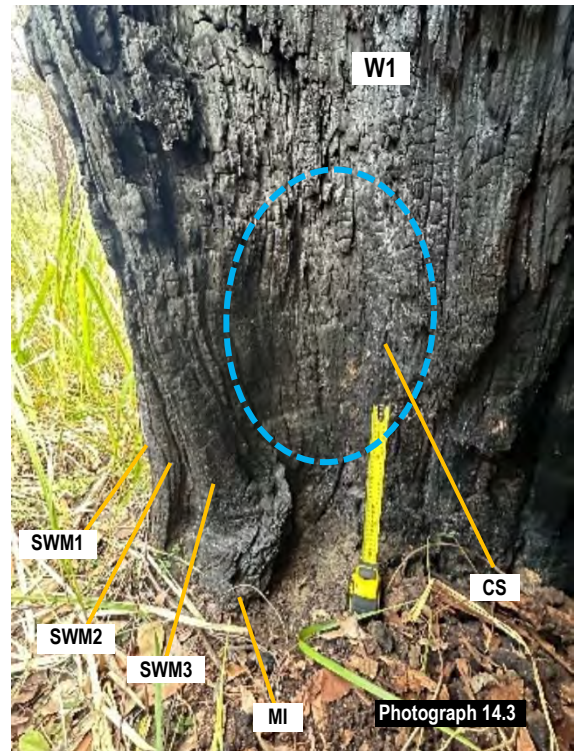
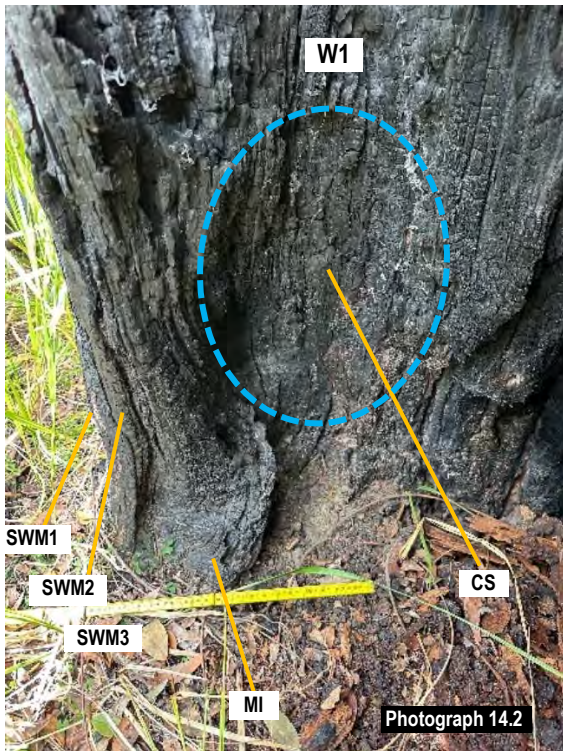


Photograph 14.0 Taken 16/06/2024 by Danny Draper. View to south of tree TN14 / OMPS24-ST4 *Eucalyptus acmenoides* Schauer - White Mahogany, showing Wound 1 (W1) on the north side of the trunk.



Photograph 14.1 Taken 16/06/2024 by Danny Draper. View to south of tree TN14 / OMPS24-ST4 *Eucalyptus acmenoides* Schauer - White Mahogany, showing Wound 1 (W1) on the north side of the trunk with a white and yellow ruler extended to 2 m.

Blue dotted line showing the basal opening to trunk hollow.



Photographs 14.2 and 14.3 Taken 16/06/2024 by Danny Draper. View to southeast of tree TN14 / OMPS24-ST4 *Eucalyptus acmenoides* Schauer - White Mahogany, showing Wound 1 (W1) on the north side of the trunk with a yellow ruler extended to 300 mm (Photograph 14.2) and yellow retractable tape measure extended to 300 mm (Photograph 14.3).

Showing 3 successional wound margins (SWM1-3) at wound margin left. A fragment of the inner 3rd left margin incurred (MI) 230 mm and this section not consumed by fire was 70 mm long and 80 mm high. A concave section (CS) dotted blue, on the inner side of the trunk was 200 mm deep on or beside wound margin left and perpendicular to wound depth 500 mm approx. around trunk (measured on the outside) consumed by fire.

Photograph 14.4 Taken 16/06/2024 by Danny Draper. View to southeast of tree TN14 / OMPS24-ST4 *Eucalyptus acmenoides* Schauer - White Mahogany, showing Wound 1 (W1) on the north side of the trunk with a yellow retractable tape measure extended to 100 mm.

Showing a fragment of the inner 3rd left margin incurred (MI) 230 mm and this section not consumed by fire was 70 mm long and 80 mm high.



5.0 CONCLUSION

This is provided in tabular form and summarizes the key information.

Tree No. / Archaeological No.	Genus and species / Common name	1. Age range of tree in yrs. approx. / 2. Age range of wound/s in yrs. approx.	Likely origin of wound/s	Risk to tree and mitigation
TN1 / OMPS-ST01	<i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. 200 - <250 2.1 120 - <150 (W1)	Wound 1 (W1), of Aboriginal cultural origin.	The tree wound can be expected to continue to decay over time but likely in balance with new wood growth sustaining structural integrity for some time. The tree remains at risk from fire and decay. If the tree is to be inundated it or a section containing the wound could be moved to a keeping place in consultation with Aboriginal stake holders.
TN2 / OMPS-ST02	<i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. 250 - <300 2.1 100 - <150 (W1)	Wound 1 (W1), of Aboriginal cultural origin.	Per tree TN1 / OMPS-ST01.
TN3 / OMPS-ST04	<i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. 300 - <350 2.1 150 - <200 (W1)	Wound 1 (W1), of Aboriginal cultural origin.	Per tree TN1 / OMPS-ST01.
TN4 / OMPS-ST09	<i>Corymbia maculata</i> (Hook.) K.D.Hill & L.A.S.Johnson Spotted Gum	1. 75 - <100 2.1 20 - <40 (W1)	Wound 1 (W1) Mechanical wound from abrasion impact event.	Not applicable as Wound not of Aboriginal cultural origin.
TN5 / OMPS-ST10	<i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. 20 - <40 2.1 5 - <15 (W1)	Wound 1 (W1) Mechanical wound from abrasion impact event and secondary wounding by fire.	Not applicable as Wound not of Aboriginal cultural origin.
TN6 / OMPS-ST19	<i>Eucalyptus microcorys</i> F.Muell. Tallowwood	1. 150 - <200 2.1 100 - <150 (W1) 2.2 20 - <40 (W2)	Wound 1 (W1), of Aboriginal cultural origin. Wound 2 (W2), insect damage primarily from Longicorn Borers and secondary wounding by fire.	Tree is structurally unsound, and caution is required within a 40 m radius due to the risk of collapse. Other comments per tree TN1 / OMPS-ST01.
TN7 / OMPS-ST20	<i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. 125 - <150 2.1 20 - <40 (W1) 2.2 20 - <40 (W2) 2.3 20 - <40 (W3)	Wounds 1-3 (W1 – W3), insect damage primarily from Longicorn Borers and secondary wounding by fire.	Not applicable as Wound not of Aboriginal cultural origin.
TN8 / OMPS-ST21	<i>Eucalyptus biturbinata</i> L.A.S. Johnson & K.D.Hill Grey Gum	1. 200 - <250 2.1 25 - <50 (W1)	Wound 1 (W1) Mechanical wound from abrasion impact event and secondary by Longicorn Borers.	Not applicable as Wound not of Aboriginal cultural origin.
TN9 / OMPS-ST22	<i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. 300 - <375 2.1 150 - <200 (W1)	Wound 1 (W1), of Aboriginal cultural origin.	Per tree TN1 / OMPS-ST01.
TN10 / OMPS-ST23	<i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. 300 - <350 2.1 50 - <75 (W1)	Wound 1 (W1), insect damage primarily from Longicorn Borers.	Not applicable as Wound not of Aboriginal cultural origin.
TN11 / OMPS24-ST1	<i>Eucalyptus tereticornis</i> Sm. Forst Red Gum	1. 325 - <375 2.1 150 - <200 (W1)	Wound 1 (W1), of Aboriginal cultural origin.	Per tree TN1 / OMPS-ST01.
TN12 / OMPS24-ST2	<i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. 250 - <275 2.1 125 - <150 (W1)	Wound 1 (W1), of Aboriginal cultural origin.	Per tree TN1 / OMPS-ST01.
TN13 / OMPS24-ST3	<i>Eucalyptus acmenoides?</i> Schauer White Mahogany	1. 350 - <400 2.1 100 - <125 (W1)	Wound 1 (W1), of Aboriginal cultural origin.	Per tree TN1 / OMPS-ST01.
TN14 / OMPS24-ST4	<i>Eucalyptus acmenoides</i> Schauer White Mahogany	1. 325 - <375 2.1 150 - <200 (W1)	Wound 1 (W1), of Aboriginal cultural origin.	Per tree TN1 / OMPS-ST01.



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References

1. Angus G, 2023, 100 Australian Butterflies, Bees, Beetles and Bugs, Hardie Grant Explore (Sydney), Hardie Grant Publishing, Ultimo NSW, Australia.
2. Australian Government, Bureau of Meteorology, Monthly rainfall, Armidale, viewed 12/7/2024, http://www.bom.gov.au/climate/averages/tables/cw_056037.shtml
3. Boland DJ, Brooker MIH, Chippendale GM, Hall N, Hyland BPM, Johnson RD, Kleinig DA, McDonald MW & Turner JD 2006, *Forest Trees of Australia*, (5th edn.), CSIRO Publishing, Victoria, Australia.
4. Bottle KR 2005, *Wood in Australia - types properties and uses*, (2nd edn.), McGraw Hill Book Company Australia P/L, NSW.
5. Brooker MIH & Kleinig DA 1999, *Field Guide to Eucalypts - South-eastern Australia (Vol. 1)*, (2nd edn.), Blooming Books, Hawthorn, Victoria, Australia.
6. Burrows GE 2002, 'Epicormic strand structure in *Angophora*, *Eucalyptus* and *Lophostemon* (Myrtaceae) – implications for fire resistance and recovery', *New Phytologist* vol. 153, pp. 111–131.
7. Creffield JW 1996, *Wood destroying Insects - Wood Borers and Termites*, 2nd edition, CSIRO Publishing, Collingwood, Victoria, Australia.
8. Draper DB & Richards PA 2009, *Dictionary for Managing Trees in Urban Environments*, Institute of Australian Consulting Arboriculturists (IACA), CSIRO Publishing, Collingwood, Victoria, Australia.
9. Elliot WR & Jones DL 1982, *Encyclopaedia of Australian Plants - suitable for cultivation (Vol. 1)*, Lothian Publishing Company, Port Melbourne, Australia.
10. Elliot WR & Jones DL 1986, *Encyclopaedia of Australian Plants - suitable for cultivation (Vol. 4)*, Lothian Publishing Company, Port Melbourne, Australia.
11. IACA, 2010, *Sustainable Retention Index Value (SRIV)*, Version 4, A visual method of objectively rating the viability of urban trees for development sites and management, based on general tree and landscape assessment criteria, Institute of Australian Consulting Arboriculturists, Australia, www.iaca.org.au.
12. James, KR Haritos, N & Ades, PK 2006, 'Mechanical Stability of Trees Under Dynamic Loads', *American Journal of Botany* vol. 93, (10), pp. 1361-1369.
13. Jones DL & Elliot WR 1986, *Pests, Diseases and Ailments of Australian Plants*, Thomas C Lothian P/L, Port Melbourne, Victoria, Australia.
14. Jones DL, Elliot WR and Jones SR 2015, *Pests, Diseases, Ailments and Allies of Australian Plants*, New Holland Publishers, Chatswood, New South Wales, Australia.
15. Liese W, Dujesiefken D 1996, Wound reactions of trees. in Raychaudhuri SP, Maramorosch K (eds) *Forest trees and palms. Diseases and control*. Oxford and IHB Publishing Co., New Delh, Calcutta, pp. 23-35.
16. Mattheck K & Breloer H 1994, *The body language of trees*. A handbook for failure analysis, Published by TSO London.
17. Mattheck C 2004, *The Face of Failure – In Nature and Engineering*, Forschungszentrum Karlsruhe, Karlsruhe, Germany.
18. Schmidt O 2006, *Wood and Tree Fungi*, Springer-Verlag, Berlin, Germany.
19. Shigo AL 1989, *A New Tree Biology* (2nd edn.), Shigo and Tree Associates. Durham, New Hampshire USA.
20. Shigo, A. L. and H. G. Marx. 1977. Compartmentalization of Decay in Trees. United States Department of Agriculture (USDA) Forest Service, Agriculture Information Bulletin No. 405, 74 p. United States Government.
21. Stobbe, H., Schmitt, U., Eckstein, D., & Dujesiefken, D. (2002). Developmental Stages and Fine Structure of Surface Callus Formed after Debarking of Living Lime Trees (*Tillia* sp.) *Annals of Botany*, 89(6), 773-782.
22. United States Government, Department of Agriculture, Forest Service, Northeastern Area State and Private Forestry NA-PR-02-98, A First Look at Tree Decay An Introduction to How Injury and Decay Affect Trees by Kevin T. Smith and Walter C. Shortle Northeastern Research Station USDA Forest Service

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Appendix A

Matrix - Sustainable Retention Index Value (SRIV) ©

Version 4, 2010

Developed by IACA – Institute of Australian Consulting Arboriculturists www.iaca.org.au

The matrix is to be used with the value classes defined in the Glossary for Age / Vigour / Condition.
 An index value is given to each category where ten (10) is the highest value.

Age Class	Vigour Class and Condition Class					
	Good Vigour & Good Condition (GVG)	Good Vigour & Fair Condition (GVF)	Good Vigour & Poor Condition (GVP)	Low Vigour & Good Condition (LVG)	Low Vigour & Fair Condition (LVF)	Low Vigour & Poor Condition (LVP)
(Y) Young	<p>Able to be retained if sufficient space available above and below ground for future growth. No remedial work or improvement to growing environment required. May be subject to high vigour. Retention potential - Medium – Long Term.</p> <p>YGVG - 9 Index Value 9 Retention potential - Long Term. Likely to provide minimal contribution to local amenity if height <5 m. High potential for future growth and adaptability. Retain, move or replace.</p>	<p>Able to be retained if sufficient space available above and below ground for future growth. Remedial work may be required or improvement to growing environment may assist. Retention potential - Medium Term. Potential for longer with remediation or favourable environmental conditions.</p> <p>YGVF - 8 Index Value 8 Retention potential - Short – Medium Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5 m. Medium-high potential for future growth and adaptability. Retain, move or replace.</p>	<p>Able to be retained if sufficient space available above and below ground for future growth. Remedial work unlikely to assist condition, improvement to growing environment may assist. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.</p> <p>YGVP - 5 Index Value 5 Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5 m. Low-medium potential for future growth and adaptability. Retain, move or replace.</p>	<p>May be able to be retained if sufficient space available above and below ground for future growth. No remedial work required, but improvement to growing environment may assist vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.</p> <p>YLVG - 4 Index Value 4 Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5 m. Medium potential for future growth and adaptability. Retain, move or replace.</p>	<p>May be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment may assist condition and vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.</p> <p>YLVF - 3 Index Value 3 Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Low-medium potential for future growth and adaptability. Retain, move or replace.</p>	<p>Unlikely to be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment unlikely to assist condition or vigour. Retention potential - Likely to be removed immediately or retained for Short Term. Potential for longer with remediation or favourable environmental conditions.</p> <p>YLVP - 1 Index Value 1 Retention potential - Likely to be removed immediately or retained for Short Term. Likely to provide minimal contribution to local amenity if height <5 m. Low potential for future growth and adaptability.</p>
(M) Mature	<p>MGVG - 10 Index Value 10 Retention potential -Medium - Long Term.</p>	<p>MGVF - 9 Index Value 9 Retention potential - Medium Term. Potential for longer with improved growing conditions.</p>	<p>MGVP - 6 Index Value 6 Retention potential - Short Term. Potential for longer with improved growing conditions.</p>	<p>MLVG - 5 Index Value 5 Retention potential - Short Term. Potential for longer with improved growing conditions.</p>	<p>MLVF - 4 Index Value 4 Retention potential - Short Term. Potential for longer with improved growing conditions.</p>	<p>MLVP - 2 Index Value 2 Retention potential - Likely to be removed immediately or retained for Short Term.</p>
(O) Over-mature	<p>OGVG - 6 Index Value 6 Retention potential - Medium - Long Term.</p>	<p>OGVF - 5 Index Value 5 Retention potential - Medium Term.</p>	<p>OGVP - 4 Index Value 4 Retention potential - Short Term.</p>	<p>OLVG - 3 Index Value 3 Retention potential - Short Term. Potential for longer with improved growing conditions.</p>	<p>OLVF - 2 Index Value 2 Retention potential - Short Term.</p>	<p>OLVP - 0 Index Value 0 Retention potential - Likely to be removed immediately or retained for Short Term.</p>



Appendix B

Glossary

From
Dictionary for Managing Trees in Urban Environments
Institute of Australian Consulting Arboriculturists (IACA) 2009, CSIRO Publishing.

Wounds

Abrasion Wound *Mechanical wound causing laceration of tissue by an abrasive impact episode e.g. grazed by a motor vehicle or the continuous action of the rubbing of crossed branches or stems where no graft has formed.*

Basal Trunk Wound A wound on the trunk extending to the *root crown* where the base of the wound is open at the ground and usually truncated. Dependent upon the width of its base such a wound may not become *occluded*.

Blaze A wound cut into a tree usually to the sapwood and sometimes extending to heartwood to create a marker point e.g. by a surveyor, the *wound face* may be further incised or painted to denote additional information.

Branch Core After a branch fails or is removed, this is the remaining branch section within the connecting branch or trunk walled off by compartmentalisation.

Branch Tail The tapering underside of a branch at its proximal end where its fibres intertwine to provide some structural support with the fibres of the branch or trunk where it is attached and new layers of such growth are added by each successive growth increment, however, the branch collar forms the greater majority of strength of the branch union (Shigo 1989a, pp. 215–217). *See also Branch core.*

Branch Tear *See Branch Tear Out.*

Branch Tear Out Dislodging of a branch from its point of attachment where it is torn away from the *branch collar* snapping the *branch tail* causing a *laceration*, usually to the underside of the *branch union* of the branch or trunk to which it was attached forming a *tear out wound*.

Branch Tear Wound *See Tear Out Wound.*

Callus Wood Undifferentiated and unligified wood that forms initially after wounding around the margins of a wound separating damaged existing wood from the later forming lignified wood or *wound wood*.

Canker A *wound* created by repeated localised killing of the *vascular cambium* and bark by wood *decay* fungi and bacterium usually marked by concentric disfiguration. The wound may appear as a depression as each successive *growth increment* develops around the *lesion* forming a *wound margin* (Shigo 1991, p. 140, Keane *et al* 2000, p. 332).

Cavity A usually shallow void often localized initiated by a *wound* and subsequent *decay* within the trunk, branches or roots, or beneath bark, and may be enclosed or have one or more opening.

Decay Process of degradation of wood by microorganisms (Australian Standard 2007, p. 6) and fungus.

Delaminate A *mechanical wound* caused when the bark is stripped from a tree, usually from the trunk as a continuous sheet back to the vascular cambium. This may occur from an impact or abrasion *episode* such as a collision with a motor vehicle and the tree may become *ringbarked*. *See also Partially Delaminated.*

Delamination The separation of fibres often evident as longitudinal splitting of wood (Lonsdale 1999, p. 313).

Delignification The decomposition of *lignin* from *wood* by chemical deterioration, resulting in loss of strength, evident by separation of fibres into hair like strands. *See also Lignification.*

Depth of Margin Distance from outer trunk perpendicular to the *wound face*. This may assist in determining the age of a wound.

Dieback Wound Wounding where *dieback* extends beyond a branch collar as with *natural pruning* and extends to other branches, trunk or roots. *See also Secondary Crown and Stag-headed.*

Enclosed Wound Wound with a perimeter of *wound wood* with a well-defined apex, base and margins and often evident on an older wound. On a pruned branch that is rounded the enclosing wound wood from the branch collar may be circular with no definite apex or base evident. However, on a pruned branch where the *wound face* is oval in shape due to *reaction wood*, the enclosing *wound wood* from the branch collar may form a definite apex, base or margins.

Environmental Wounding/Damage Wounding inflicted by environmental factors or modifications to the growing *environment* of a tree, e.g., sun-scald, drought, fire, water logging, wind damage to leaves, branches, bark or roots, phytotoxic damage from chemicals, or air, soil or water pollution.

Fire Wound Wounding caused by fire. Such wounds may cause initial damage or may be secondary from a previous wounding *episode/s*. Some fire damage may be superficial or may destroy a tree in full or part rendering it potentially vulnerable to failure. Note: fire damaged trees can be potentially hazardous and should be assessed carefully.

Hollow A large void initiated by a *wound* forming a *cavity* in the trunk, branches or roots and usually increased over time by *decay* or other contributing factors, e.g., fire, or fauna such as birds or insects e.g., ants or termites. A hollow can be categorized as an *Ascending Hollow* or a *Descending Hollow*.

Horizontal Wound Usually superficial horizontal wounding from insects burrowing between bark layers and revealed by decorticating bark. Often evident on smooth bark Eucalypts.

Impact Wound *Mechanical wound* caused by an impact episode e.g., collision by a motor vehicle.

Incision Wound caused by cutting or engraving. See also *Laceration*.

Increment strip A linear, usually narrow, *fluted* section of *adaptive wood*, forming in a place of high *stress* indicating the pattern of *force flow* (Mattheck 2004, p. 140). Evident as lighter coloured bark usually occurring around the edges of a *notch* or *branch stub*, along a *buttress*, or along a *sharp-edged rib*.

Initial Wound Margin The site of initial wounding often evident as a faint line of discoloured bark or bark of a different texture to adjacent undamaged trunk. This may assist in determining the age of a wound.

Insect Wound Wounding to any part of a tree caused by insect activity, e.g., borers and termites.

Laceration Wound caused by tearing. See also *Incision*.

Lightning Strike Wound A wound from a lightning strike. Such a wound may kill a tree outright or cause it to catch fire, or may destroy the tree in full or part, or no injury may be evident, and a tree gradually declines through resulting *stress*. Bark may be exploded from the tree by pressure radiating from the core of the lightning path resulting in further compounded damage through water heating and steam explosions in the tissues and the electrical disruption of living cells (Coder 2004, pp. 35-44).

Mechanical Wound Wounding inflicted by abrasion e.g., by motor vehicles, grass mowing equipment, grazing by horses, cows or birds (parrots); impact e.g., by motor vehicle collisions; drilling e.g., with increment cores, Resistograph, cable bracing, hanging pots, hammocks etc.; branch tearing e.g., from wind damage, collision from falling branches, vandalism; and root severance e.g., root pruning for excavation for building or utility services or for agricultural cultivation.

Open Wound Wound with poor to non-existent perimeter or *callus wood* or *wound wood* on an older wound without well-defined apex, base or margins and often this will be associated with a recent wounding *episode* or an older episode on a senescent tree or a tree in *poor condition* or of *low vigour*, or where repeated wounding episodes such as inflicted by ongoing borer activity damages and continually alters wound perimeters, or repeated scalping of exposed roots by lawn mowing equipment.

Occlusion Growth processes where *wound wood* develops to enclose the *wound face* by the merging of *wound margins* concealing the *wound* and restoring the growing surface of the structure with each *growth increment* gradually realigning *fibres* in the wood longitudinally along the stem to maximise uniform stress loading.

Partial Occlusion *Wound wood* growth that encloses some of the *wound face* by the merging and *grafting* of some sections of the *wound margins*. Usually evident by reduced *wound face* width and indicated where an *apex* or *base* is *acute* with the vertical extent often indicated by the length of an *occlusion seam*.

Partially Bridged Occlusion *Wound wood* partly forming an *occlusion* by joining areas of the *wound margins* across the *wound face* at point/s other than the base or apex and may form an *occlusion seam*.

Pruning Wound A wound created by the act of *pruning*.

Ram's Horning *Wound wood* that becomes curled inward and can wrap around itself as it crosses a void such as a *cavity* and may succumb to cracking with those wounds susceptible to further infestation by *decay* pathogens.

Scarred Tree A tree containing a wound of cultural or scientific interest, inflicted initially for a specific purpose, e.g. by indigenous people to extract implements or carved as a marker or with a pattern for ceremonial purposes, or as a marker and *blaze* by a surveyor or explorer, or from an accidental *wound* that has not *occluded*.

Stepped Incision A localised area of deeper wounding often extending to the heartwood, usually proximally within a *blaze*, removing a vertical semi-circular wedge like section from the *wound face* with a horizontal bench like structure formed by deep cuts as its base. Such wound sections usually taper distally and may be cut around the outer edges to assist removal of the semi-circular wedge, and likely undertaken to inhibit regrowth.

Structural Wound Any wound occurring on a tree as a result of a structural failure e.g., branch splitting or *hazard beam*, diminishing its stability in full or part.

Succession Wound Preceding layers of failed wound margin/s forming a step like sequence away from the *wound face*, where present, to the current wound margin/s indicating repeated cycles of formation and failure of *CODIT Wall 4*.

Sun Scald Wounding usually on the upper side of branches after sudden exposure to sunlight especially in summer e.g., after excessive pruning of the upper crown, or following storm damage stripping foliage or branches e.g., *Ficus spp.*

Survey Marker Wound See *Blaze*.

Adaptive Wood Additional load-bearing wood formed in response to mechanical stresses and gravitational force upon the vascular cambium to provide a uniform distribution of loading. Examples are Ribs, Round-edged rib or Sharp-edged rib and Buttresses. See also Reaction wood, Compression wood and Tension wood.

Reaction Wood A negative geotropic response in some secondary xylem to counter a lean or predominant mechanical force, formed as tension wood in dicotyledonous angiosperms and as compression wood in gymnosperms (Figure 24). See also Adaptive wood.

Tear Out See *Branch Tear Out*.

Tear Out Wound A wound of usually concave shape created by a *branch tear out*.

Wound Damage inflicted upon a tree through injury to its living cells, from biotic or abiotic causes, e.g., where *vascular cambium* has been damaged by branch breakage, impact or insect attack. Some wounds *decay* and cause *structural deterioration* or *defects*. Trees of *normal vigour* are able to resist and contain infection by walling off areas within the wood by *compartmentalization*. See *Compartmentalization Of Decay In Trees (CODIT)*. An *occlusion* may eventually conceal a wound, but the enclosed *defect* remains internally, and *decay* may continue to develop further weakening the *heartwood* and *sapwood* compromising the tree's *structural integrity*. The cause of a wound may be accidental e.g., *branch tear out* or deliberate e.g. *carved tree*.

Wound Apex The distal end of a wound. The shape may be acute, irregular, jagged, obtuse, rounded, or truncate.

Wound Apex Acute Apex of a wound that is tapering and the *occlusion* interface angle is less than $<90^\circ$.

Wound Apex Irregular The *wound wood* growth at the apex mostly interrupted forming an edge that is not uniform or jagged. Often this may be influenced by a *successional wound* resulting in disproportionate development of *callous wood* and *wound wood*.

Wound Apex Jagged The *wound wood* growth or tissue damaged initially at the apex that is uneven and likely to have been caused by laceration.

Wound Apex Obtuse Apex of a wound that is tapering and the *occlusion* interface angle is greater than $>90^\circ$.

Wound Apex Rounded The *wound wood* growth at the apex that is curved.

Wound Apex Truncate The *wound wood* growth or tissue damaged initially at the apex that is even and likely to have been caused by incision.

Wound Base The proximal end of a wound. The shape may be acute, irregular, jagged, obtuse, rounded, or truncate.

Wound Base Acute Base of wound that is tapering and the *occlusion* interface angle is less than $<90^\circ$.

Wound Base Irregular The *wound wood* growth at the base mostly interrupted forming an edge that is not uniform or jagged. Often this may be influenced by a *successional wound* resulting in disproportionate development of *callous wood* and *wound wood*.

Wound Base Jagged The *wound wood* growth or tissue damaged initially at the base that is uneven and likely to have been caused by laceration.

Wound Base Obtuse Base of wound that is tapering and the *occlusion* interface angle is greater than $>90^\circ$.

Wound Base Rounded The *wound wood* growth at the base that is curved.

Wound Base Truncate The *wound wood* growth or tissue damaged initially at the base that is even and likely to have been caused by incision.

Wound Face Surface area of tissue exposed by injury, e.g. bark, sapwood, heartwood.

Wound Face Cracks Horizontal Transverse cracks in a *wound face* indicative of failure from *tension* force (Mattheck & Breloer 1994, p. 183).

Wound Face Cracks Vertical Longitudinal cracks in a *wound face* indicative of failure from *compression* force (Mattheck & Breloer 1994, p. 183).

Wound Face Entire Surface of exposed tissue is uniform without damage extending to a different layer or unaffected by borers or decay, e.g. possibly described as *wound face entire* to dead sapwood.

Wound Face Incomplete Surface of exposed tissue is not uniform with damage extending to different layers or affected by borers or decay, e.g. possibly described as *wound face incomplete* with cavity at apex. See also *Wound face entire*.

Wound Face Exposed Heartwood Wound extending to reveal the *heartwood*, or has deteriorated through *decay* to reveal this layer of wood.

Wound Face Exposed Sapwood Wound extending to reveal the sapwood, or has deteriorated through *decay* to reveal this layer of wood.

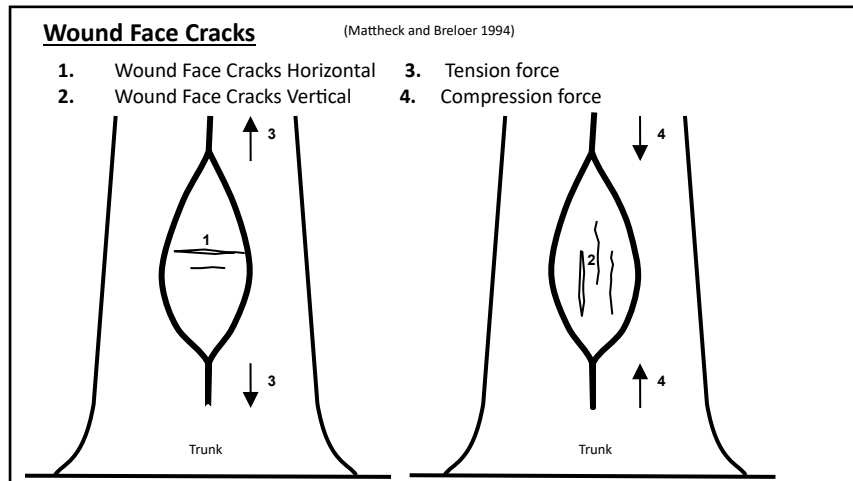
Wound Margin The left and right sides of a *wound* as bound by the alignment of fibres along a stem or root longitudinally, being either the remaining undamaged living cells and new *callus wood* and *wound wood* on older wounds. Here the fibres are usually formed from *meristematic* cells. A wound margin may be circular on a *pruning wound* or form around the perimeter of a *canker*.

Wound Margin Entire The *wound wood* growth in the margin is mostly uninterrupted forming a uniform edge.

Wound Margin Irregular The *wound wood* growth in the margin is mostly interrupted and forms an edge that is not uniform e.g. where repeated wounding *episodes* such as inflicted by ongoing borer activity damages and continually alters the *wound perimeter* with *callus wood* and *wound wood*. See also *Successional Wound*.

Wound Margin Left The left side of a wound margin when the distal and proximal ends of the wound is known, to determine the *wound apex* and *wound base*, respectively.

Wound Margin Right The right side of a wound margin when the distal and proximal end of the wound is known, to determine the *wound apex* and *wound base*, respectively.



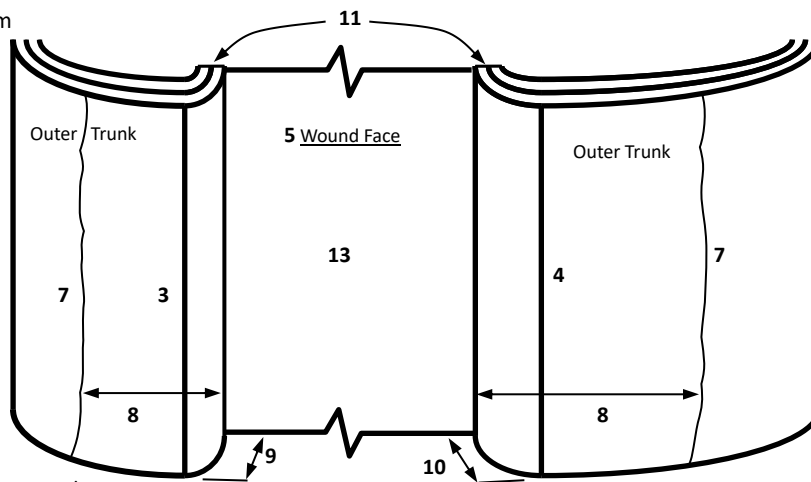
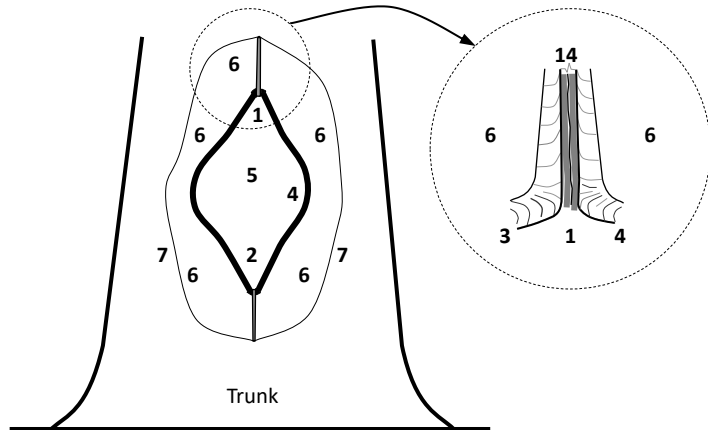
Wound Margin Width Distance from *wound margin* to the site of initial wounding. Where evident the *initial wound margin* may be identified by discoloured bark or bark of a different texture to adjacent undamaged trunk. This may also assist in determining the age of a wound.

Wound Wood Aged *callus wood* around the margins of a wound that becomes differentiated to form *CODIT Wall 4* producing new lignified wood. This wood may grow to surround a wound and may eventually develop to enclose the wound by *occlusion*.

Wound Diagrams

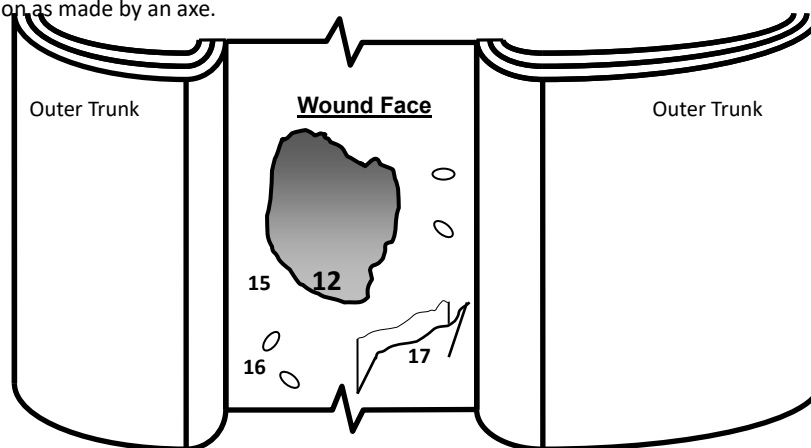
Wound Parts

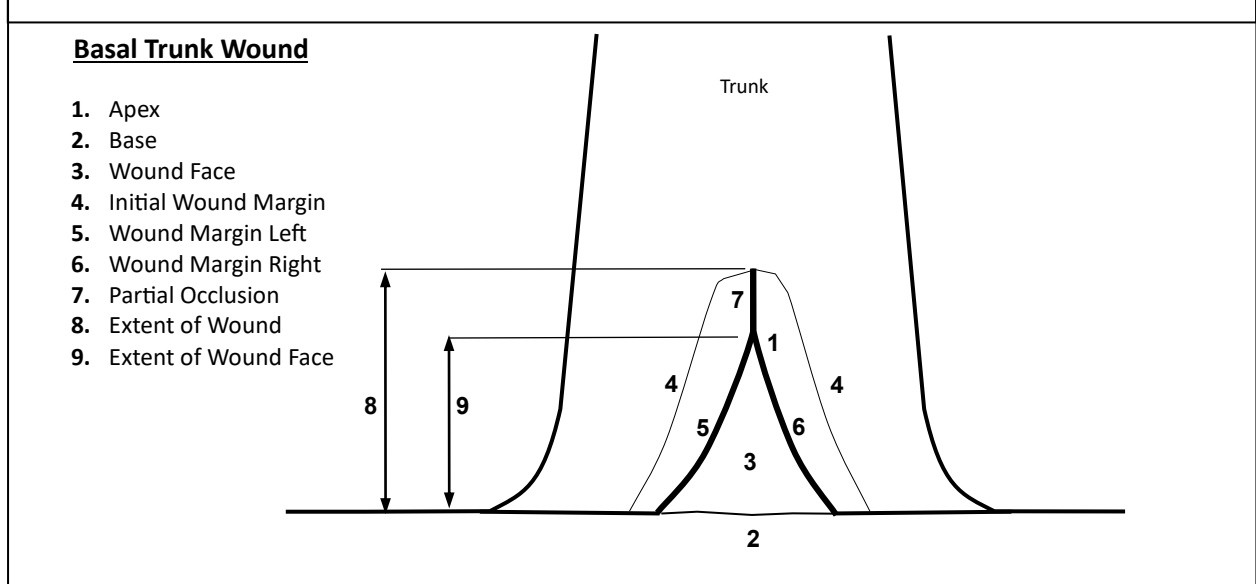
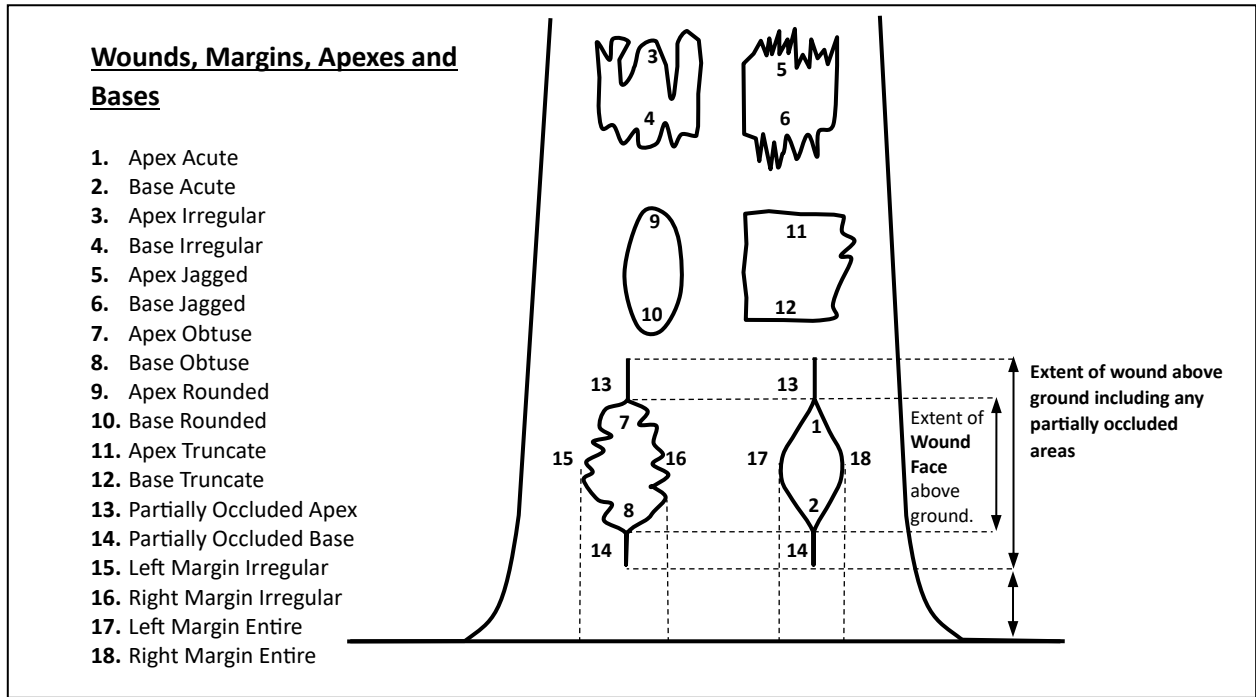
1. Apex
2. Base
3. Wound Margin Left
4. Wound Margin Right
5. Wound Face
6. Partial Occlusion
7. Initial Wound Margin
8. Margin Width
9. Left Margin Depth
10. Right Margin Depth
11. Wound Wood
12. Cavity
13. Wound Face Entire
14. Occlusion Seam



Examples of other Wound Faces

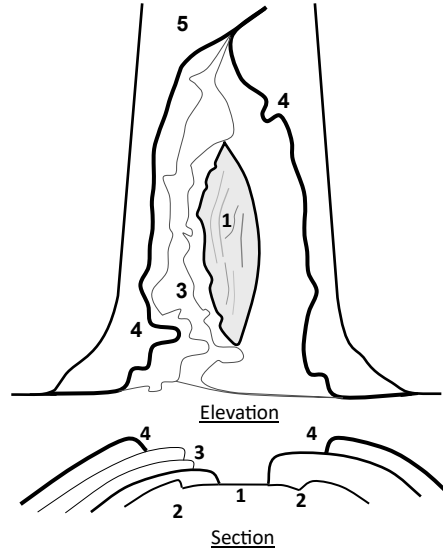
15. Wound face extending from dead sapwood to cavity in heartwood.
16. Oval shaped borer exit holes evident indicative of Longicorn Borer (Family Cerambycidae).
17. Linear laceration as made by an axe.





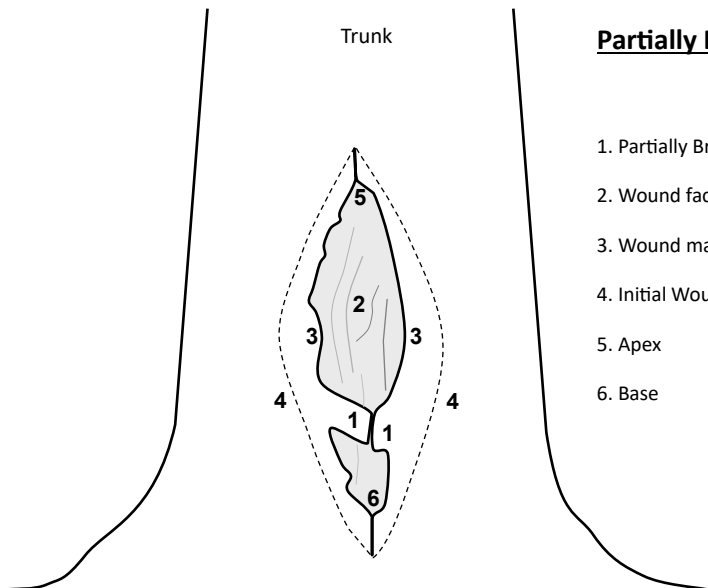
Successional Wound

1. Initial wound face
2. Initial wound margins (concealed when viewed in Elevation)
3. Successive wound margins
4. Wound margins (current)
5. Trunk



Partially Bridged Occlusion

1. Partially Bridged Occlusion
2. Wound face
3. Wound margins
4. Initial Wound Margins
5. Apex
6. Base



Condition of Trees

Condition A tree's *crown form* and growth habit, as modified by its *environment* (aspect, suppression by other trees, soils), the *stability* and *viability* of the *root plate*, trunk and structural branches (first (1st) and possibly second (2nd) order branches), including structural defects such as wounds, cavities or hollows, *crooked* trunk or weak trunk/branch junctions and the effects of predation by pests and diseases. These may not be directly connected with *vigour* and it is possible for a tree to be of *normal vigour* but in *poor condition*. Condition can be categorized as *Good Condition*, *Fair Condition*, *Poor Condition* and *Dead*.

Good Condition Tree is of good habit, with *crown form* not severely restricted for space and light, physically free from the adverse effects of *predation* by pests and diseases, obvious instability or structural weaknesses, fungal, bacterial or insect infestation and is expected to continue to live in much the same condition as at the time of inspection provided conditions around it for its basic survival do not alter greatly. This may be independent from, or contributed to by *vigour*. See also *Condition*, *Fair Condition* and *Poor Condition*.

Fair Condition Tree is of good habit or *misshapen*, a form not severely restricted for space and light, has some physical indication of *decline* due to the early effects of *predation* by pests and diseases, fungal, bacterial, or insect infestation, or has suffered physical injury to itself that may be contributing to instability or structural weaknesses, or is faltering due to the modification of the *environment* essential for its basic survival. Such a tree may recover with remedial works where appropriate, or without intervention may stabilise or improve over time, or in response to the implementation of beneficial changes to its local environment. This may be independent from, or contributed to by *vigour*. See also *Condition*, *Good Condition* and *Poor Condition*.

Poor Condition Tree is of good habit or *misshapen*, a form that may be severely restricted for space and light, exhibits symptoms of advanced and *irreversible decline* such as fungal, or bacterial infestation, major die-back in the branch and *foliage crown*, *structural deterioration* from insect damage e.g. termite infestation, or storm damage or lightning strike, ring barking from borer activity in the trunk, root damage or instability of the tree, or damage from physical wounding impacts or abrasion, or from altered local environmental conditions and has been unable to adapt to such changes and may decline further to death regardless of remedial works or other modifications to the local *environment* that would normally be sufficient to provide for its basic survival if in *good* to *fair* condition. Deterioration physically, often characterised by a gradual and continuous reduction in *vigour* but may be independent of a change in *vigour*, but characterised by a proportionate increase in susceptibility to, and *predation* by pests and diseases against which the tree cannot be sustained. Such conditions may also be evident in trees of advanced senescence due to normal phenological processes, without modifications to the growing environment or physical damage having been inflicted upon the tree. This may be independent from, or contributed to by *vigour*. See also *Condition*, *Good Condition* and *Fair Condition*.

Moribund Advanced state of decline, dying or nearly dead.

Dead Tree is no longer capable of performing any of the following processes or is exhibiting any of the following symptoms:

Processes

Photosynthesis via its foliage crown (as indicated by the presence of moist, green or other coloured leaves);

Osmosis (the ability of the root system to take up water);

Turgidity (the ability of the plant to sustain moisture pressure in its cells);

Epicormic shoots or *epicormic strands* in Eucalypts (the production of new shoots as a response to stress, generated from latent or adventitious buds or from a *lignotuber*);

Symptoms

Permanent leaf loss;

Permanent wilting (the loss of turgidity which is marked by desiccation of stems leaves and roots);

Abscission of the *epidermis* (bark desiccates and peels off to the beginning of the sapwood).

Removed No longer present, or tree not able to be located or having been cut down and retained on a site, or having been taken away from a site prior to site inspection.

Periods of Time

Periods of Time The life span of a tree in the urban environment may often be reduced by the influences of encroachment and the dynamics of the environment and can be categorized as *Immediate*, *Short Term*, *Medium Term* and *Long Term*.

Immediate An *episode* or occurrence, likely to happen within a twenty-four (24) hour period, e.g. tree failure or collapse in full or part posing an imminent danger. See also *Short Term*, *Medium Term* and *Long Term*.

Short Term A period of time less than <1 – 15 years. See also *Periods of Time*, *Immediate*, *Medium Term* and *Long Term*.

Medium Term A period of time 15 – 40 years. See also *Periods of Time*, *Immediate*, *Short Term* and *Long Term*.

Long Term A period of time greater than >40 years. See also *Periods of Time*, *Immediate*, *Medium Term* and *Short Term*.

Vigour

Vigour Ability of a tree to sustain its life processes. This is independent of the *condition* of a tree but may impact upon it. Vigour can appear to alter rapidly with change of seasons (seasonality) e.g. dormant, deciduous or semi-deciduous trees. Vigour can be categorized as *Normal Vigour*, *High Vigour*, *Low Vigour* and *Dormant Tree Vigour*.

Normal Vigour Ability of a tree to maintain and sustain its life processes. This may be evident by the *typical* growth of leaves, *crown cover* and *crown density*, branches, roots and trunk and *resistance to predation*. This is independent of the *condition* of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation. See also *Vigour*, *Low Vigour* and *High Vigour*.

High Vigour *Accelerated growth* of a tree due to incidental or deliberate artificial changes to its growing *environment* that are seemingly beneficial, but may result in *premature aging* or failure if the favourable conditions cease, or promote *prolonged senescence* if the favourable conditions remain, e.g. water from a leaking pipe; water and nutrients from a leaking or disrupted sewer pipe; nutrients from animal waste, a tree growing next to a chicken coop, or a stock feed lot, or a regularly used stockyard; a tree subject to a stringent watering and fertilising program; or some trees may achieve an extended lifespan from continuous *pollarding* practices over the life of the tree.

Low Vigour Reduced ability of a tree to sustain its life processes. This may be evident by the *atypical* growth of leaves, reduced *crown cover* and reduced *crown density*, branches, roots and trunk, and a deterioration of their functions with reduced *resistance to predation*. This is independent of the *condition* of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation. See also *Vigour*, *Normal Vigour* and *High Vigour*.

Dormant Tree Vigour Determined by existing turgidity in lowest order branches in the outer extremity of the crown, with good bud set and formation, and where the last *extension growth* is distinct from those most recently preceding it, evident by bud scale scars. Normal vigour during dormancy is achieved when such growth is evident on a majority of branches throughout the crown.

Good Vigour See *Normal Vigour*.

Poor Vigour See *Low Vigour*.

Health A tree's *vigour* as exhibited by *crown density*, *crown cover*, leaf colour, presence of epicormic shoots ability to withstand *predation* by pests and diseases, *resistance* and the degree of *dieback*.

Age of Trees

Age Most trees have a stable biomass for the major proportion of their life. The estimation of the age of a tree is based on the Knowledge of the expected lifespan of the taxa *in situ* divided into three distinct stages of measurable biomass, when the exact age of the tree from its date of cultivation or planting is unknown and can be categorized as *Young*, *Mature* and *Over-mature* (British Standards 1991, p. 13, Harris *et al*, 2004, p. 262).

Young Tree aged less than <20% of life expectancy, *in situ*. See also *Age*, *Mature* and *Over-mature*.

Mature Tree aged 20-80% of life expectancy, *in situ*. See also *Age*, *Young* and *Over-mature*.

Over-mature Tree aged greater than >80% of life expectancy, *in situ*, or *senescent* with or without reduced *vigour*, and declining gradually or rapidly but irreversibly to death. See also *Age*, *Young* and *Mature*.

Premature Aging Apparent hastened aging and deterioration of a tree where it has been subject to conditions or practices adverse to expected normal growth, resulting in a *spiral of decline*. The following are examples of processes that may start such cycles:

- Top lopping of a mature tree
- In a new car park, the excavation of soil severing the roots of a tree close to its trunk and then sealing the soil surface with asphalt or concrete up to the trunk
- Open trenching alongside a street tree severing all roots in the trench, then top lopping it for power line clearance, and then extensive damage to bark by abrasion by trucks and excavation equipment as tree is adjacent to a construction site
- Root damage from *soil compaction* to substantial areas of the root plate.

Prolonged Senescence A phenomenon in an *over-mature* tree or tree with *structural deterioration* in its *condition* and often *vigour* as *abnormal vigour* as a result of modifications to the tree or the growing environment essential for its survival where it is sustained beyond the *typical* extent of its life cycle, or prevented from failing in full or part from *structural deterioration* by a beneficial artificial modification to its growing environment either by deliberate or incidental intervention, e.g. water from a leaking tap, water and nutrients from a leaking sewer pipe creating a *hydroponic* environment, or by physically propping up a tree with *structural deterioration* as with a *veteran tree*, or by it *leaning* or growing against another tree or structure for support.

Visual Tree Assessment (VTA) A visual inspection of a tree from the ground based on the principle that, when a tree exhibits apparently superfluous material in its shape, this represents repair structures to rectify *defects* or to reinforce weak areas subject to additional loading forces of compression, tension, torsion and shear. Such assessments should only be undertaken by suitably competent practitioners.

Drop Zone The distance away from a tree that may be physically influenced by a falling branch.

Fall Zone The distance away from a tree that may be physically influenced if it was cut down or subject to *collapse*.

Leaning Trees

Leaning A tree where the *trunk* grows or moves away from upright. A lean may occur anywhere along the *trunk* influenced by a number of contributing factors e.g. genetically predetermined characteristics, competition for space or light, prevailing winds, aspect, slope, or other factors. A *leaning* tree may maintain a *static lean* or display an increasingly *progressive lean* over time and may be hazardous and prone to *failure* and *collapse*. The degrees of leaning can be categorized as *Slightly Leaning*, *Moderately Leaning*, *Severely Leaning* and *Critically Leaning*.

Slightly Leaning A leaning tree where the trunk is growing at an angle within 0°-15° from upright.

Moderately Leaning A leaning tree where the trunk is growing at an angle within 15°-30° from upright.

Severely Leaning A leaning tree where the trunk is growing at an angle within 30°-45° from upright.

Critically Leaning A leaning tree where the trunk is growing at an angle greater than >45° from upright.

Progressively Leaning A tree where the degree of *leaning* appears to be increasing over time.

Static Leaning A leaning tree whose lean appears to have stabilized over time.

Windthrow Tree failure and collapse when a *force* exerted by wind against the *crown* and *trunk* overcomes resistance to that force in the *root plate*, such that the *root plate* is lifted from the soil on one side as the tree tips over.

Symmetry

Symmetry Balance within a *crown*, or *root plate*, above or below the *axis* of the trunk of branch and foliage, and root distribution respectively and can be categorized as *Asymmetrical* and *Symmetrical*.

Asymmetrical Imbalance within a crown, where there is an uneven distribution of branches and the foliage *crown* or *root plate* around the vertical *axis* of the trunk. This may be due to *Crown Form Codominant* or *Crown Form Suppressed* as a result of natural restrictions e.g. from buildings, or from competition for space and light with other trees, or from exposure to wind, or artificially caused by pruning for clearance of roads, buildings or power lines. An example of an expression of this may be, crown asymmetrical, bias to west. See also *Symmetrical* and *Symmetry*.

Symmetrical Balance within a crown, where there is an even distribution of branches and the *foliage crown* around the vertical *axis* of the trunk. This usually applies to trees of *Crown Form Dominant* or *Crown Form Forest*. An example of an expression of this may be crown symmetrical. See also *Symmetry* and *Asymmetrical*.

Crown Spread Orientation Direction of the *axis* of *crown spread* which can be categorized as *Orientation Radial* and *Orientation Non-radial*.

Crown Spread Orientation Non-radial Where the crown extent is longer than it is wide, e.g. east/west or E/W. Further examples, north/south or N/S, and may be *Crown Form Codominant*, e.g. **A** or **B**, *Crown Form Intermediate* e.g. **A**, or *Crown Form Suppressed* e.g. **B**, and crown symmetry is *symmetrical* e.g. **A**, or *asymmetrical* e.g. **B**.

Crown Spread Orientation Radial Where the *crown spread* is generally an even distance in all directions from the trunk and often where a tree has *Crown Form Dominant* and is *symmetrical*.

Diameter at Breast Height (DBH) Measurement of trunk width calculated at a given distance above ground from the base of the tree often measured at 1.4 m. The trunk of a tree is usually not a circle when viewed in cross section, due to the presence of *reaction wood* or *adaptive wood*, therefore an average diameter is determined with a *diameter tape* or by recording the trunk along its narrowest and widest axes, adding the two dimensions together and dividing them by 2 to record an average and allowing the orientation of the longest axis of the trunk to also be recorded. Where a tree is growing on a lean the distance along the top of the trunk is measured to 1.4m and the diameter then recorded from that point perpendicular to the edge of the trunk. Where a *leaning* trunk is *crooked* a vertical distance of 1.4m is measured from the ground. Where a tree branches from a trunk that is less than 1.4m above ground, the trunk diameter is recorded perpendicular to the length of the *trunk* from the point immediately below the base of the flange of the *branch collar* extending the furthest down the trunk, and the distance of this point above ground recorded as *trunk length*. Where a tree is located on sloping ground the DBH should be measured at half way along the side of the tree to average out the angle of slope. Where a tree is *acaulescent* or *trunkless* branching at or near ground an average diameter is determined by recording the radial extent of the trunk at or near ground and noting where the measurement was recorded e.g. at ground.

Significant Important, weighty or more than ordinary.

Significant Tree A tree considered important, weighty or more than ordinary. Example: due to prominence of location, or *in situ*, or contribution as a component of the overall landscape for *amenity* or aesthetic qualities, or *curtilage* to structures, or importance due to uniqueness of taxa for species, subspecies, variety, *crown form*, or as an historical or cultural planting, or for age, or substantial dimensions, or habit, or as *remnant vegetation*, or habitat potential, or a rare or threatened species, or uncommon in cultivation, or of aboriginal cultural importance, or is a commemorative planting.

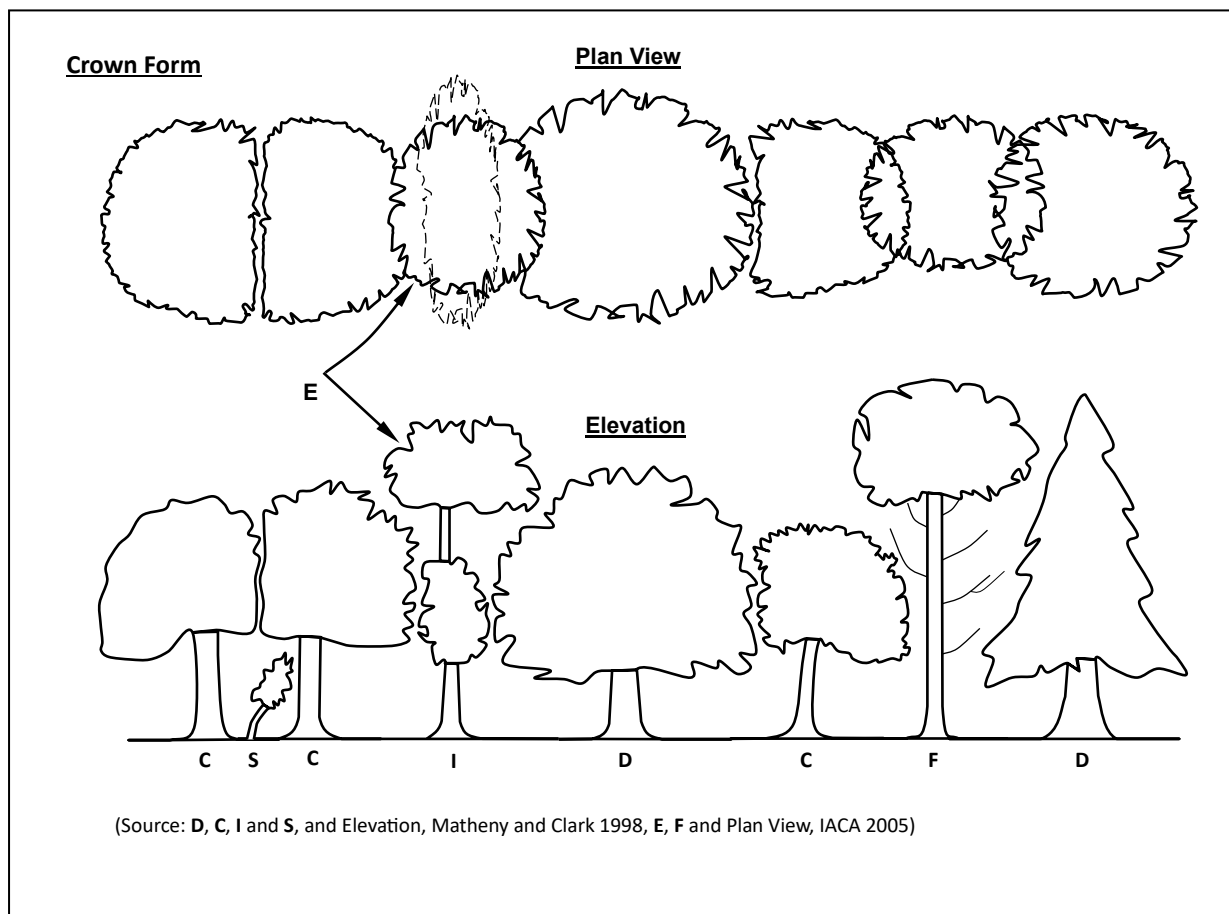
Sustainable Retention Index Value (SRIV) A visual tree assessment method to determine a qualitative and numerical rating for the viability of urban trees for development sites and management purposes, based on general tree and landscape assessment criteria using classes of *age*, *condition* and *vigour*. SRIV is for the professional manager of urban trees to consider the tree *in situ* with an assumed knowledge of the *taxon* and its growing environment. It is based on the physical attributes of the tree and its response to its environment considering its position in a matrix for age class, vigour class, condition class and its sustainable retention with regard to the safety of people or damage to property. This also factors the ability to retain the tree with remedial work or beneficial modifications to its growing environment or removal and replacement. SRIV is supplementary to the decision made by a tree management professional as to whether a tree is retained or removed (IACA - Institute of Australian Consulting Arboriculturists 2005).

Form of Trees

Crown Form The shape of the crown of a tree as influenced by the availability or restriction of space and light, or other contributing factors within its growing environment. Crown Form may be determined for tree shape and habit generally as *Dominant*, *Codominant*, *Intermediate*, *Emergent*, *Forest* and *Suppressed*. The habit and shape of a *crown* may also be considered qualitatively and can be categorized as *Good Form* or *Poor Form*. See also *Forest Grown* and *Open Grown*.

Good Form Tree of *typical* crown shape and habit with proportions representative of the taxa considering constraints such as origin e.g. indigenous or exotic, but does not appear to have been adversely influenced in its development by environmental factors in situ such as *soil water* availability, prevailing wind, or cultural practices such as lopping and competition for space and light. See also *Poor Form*.

Poor Form Tree of *atypical* crown shape and habit with proportions not representative of the species considering constraints and appears to have been adversely influenced in its development by environmental factors in situ such as *soil water* availability, prevailing wind, cultural practices such as lopping and competition for space and light; causing it to be *misshapen* or disfigured by disease or vandalism. See also *Good Form*.



Crown Form Codominant Crowns of trees restricted for space and light on one or more sides and receiving light primarily from above e.g. constrained by another tree/s or a building.

Crown Form Dominant Crowns of trees generally not restricted for space and light receiving light from above and all sides. See also *Crown Form Emergent* and *Open Grown*.

Crown Form Emergent Crowns of trees restricted for space on most sides receiving most light from above until the *upper crown* grows to protrude above the canopy in a stand or forest environment. Such trees may be *crown form dominant* or transitional from *crown form intermediate* to *crown form forest* asserting both *apical dominance* and *axillary dominance* once free of constraints for space and light.

Crown Form Forest Crowns of trees restricted for space and light except from above forming tall trees with narrow spreading crowns with foliage restricted generally to the top of the tree. The trunk is usually erect, straight and continuous, tapering gradually, crown often excurrent, with first order branches becoming structural, supporting the live crown concentrated towards the top of the tree, and below this point other first order branches arising radially with each *inferior* and usually temporary, divergent and ranging from horizontal to ascending, often with internodes exaggerated due to competition for space and light in the *lower crown*.

Crown Form Intermediate Crowns of trees restricted for space on most sides with light primarily from above and on some sides only.

Crown Form Suppressed Crowns of trees generally not restricted for space but restricted for light by being *overtopped* by other trees and occupying an understorey position in the canopy and growing slowly.

Forest Grown A tree with *crown form forest* grown in a group with competition for space and light protected from wind, often resulting in a taller tree with a narrow spreading crown that is concentrated towards the top of the tree (Matheny & Clark 1998, p. 18).

Open Grown A tree with *crown form dominant*, grown singly without competition for space and light, exposed to wind, often resulting in a shorter tree with a broad spreading crown that extends towards the ground (Matheny & Clark 1998, p. 18).

Deadwood

Deadwood Dead branches within a tree's crown and considered quantitatively as separate to *crown cover* and can be categorised as *Small Deadwood* and *Large Deadwood* according to diameter, length and subsequent *risk potential*. The amount of dead branches on a tree can be categorized as *Low Volume Deadwood*, *Medium Volume Deadwood* and *High Volume Deadwood*. See also *Dieback*.

Deadwooding Removing of dead branches by *pruning*. Such pruning may assist in the prevention of the spread of *decay* from *dieback* or for reasons of safety near an identifiable target.

Small Deadwood A dead branch up to 10 mm diameter and usually <2 metres long, generally considered of low *risk potential*.

Large Deadwood A dead branch >10 mm diameter and usually >2 metres long, generally considered of high *risk potential*.

Low Volume Deadwood Where <5 dead branches occur that may require *removal*.

Medium Volume Deadwood Where 5-10 dead branches occur that may require *removal*.

High Volume Deadwood Where >10 dead branches occur that may require *removal*.

Dieback

Dieback The death of some areas of the *crown*. Symptoms are leaf drop, bare twigs, dead branches and tree death, respectively. This can be caused by root damage, root disease, bacterial or fungal canker, severe bark damage, intensive grazing by insects, *abrupt changes* in growth conditions, drought, water-logging or over-maturity. Dieback often implies reduced *resistance*, *stress* or *decline* which may be temporary. Dieback can be categorized as *Low Volume Dieback*, *Medium Volume Dieback* and *High Volume Dieback*.

Low Volume Dieback Where <10% of the *crown cover* has died. See also *Dieback*, *High Volume Dieback* and *Medium Volume Dieback*.

Medium Volume Dieback Where 10-50% of the *crown cover* has died.

High Volume Dieback Where >50% of the *crown cover* has died.

Epicormic Shoots

Epicormic Shoots Juvenile shoots produced at branches or trunk from *epicormic strands* in some Eucalypts (Burrows 2002, pp. 111-131) or sprouts produced from dormant or latent buds concealed beneath the bark in some trees. Production can be triggered by fire, pruning, wounding, or root damage but may also be as a result of *stress* or *decline*. Epicormic shoots can be categorized as *Low Volume Epicormic Shoots*, *Medium Volume Epicormic Shoots* and *High Volume Epicormic Shoots*.

Low Volume Epicormic Shoots Where <10% of the *crown cover* is comprised of live *epicormic shoots*.

Medium Volume Epicormic Shoots Where 10-50% of the *crown cover* is comprised of live *epicormic shoots*.

High Volume Epicormic Shoots Where >50% of the *crown cover* is comprised of live *epicormic shoots*.

Epicormic Strands In some taxa of the Myrtaceae family narrow bands of meristematic tissue radiate in stems from pith extending to the outer bark containing bud primordia evident as small prickle or dimple structures up to 10 mm diameter, that after the stimulus of a trauma event such as fire or defoliation develop to form new buds allowing *crown regeneration* (Burrows 2001, Pp. 111-131).

Trunk

Acaulescent A *trunkless* tree or tree growth forming a very short *trunk*. See also *Caulescent*.

Caulescent Tree grows to form a *trunk*. See also *Acaulescent*.

Trunk A single stem extending from the *root crown* to support or elevate the *crown*, terminating where it divides into separate *stems* forming *first order branches*. A trunk may be evident at or near ground or be absent in *acaulescent* trees of *deliquescent* habit, or may be continuous in trees of *excurrent* habit. The trunk of any *caulescent* tree can be divided vertically into three (3) sections and can be categorized as *Lower Trunk*, *Mid Trunk* and *Upper Trunk*. For a *leaning* tree these may be divided evenly into sections of one third along the trunk.

Annexure D

Field investigation

D.1 OzArk's supplementary report on test excavations of the EAR



View of the test excavation program at Transect 34.

ADDENDUM ABORIGINAL CULTURAL HERITAGE ASSESSMENT REPORT

OVEN MOUNTAIN PUMPED HYDRO ENERGY STORAGE

LOWER CREEK NSW

JUNE 2024

Report prepared by
OzArk Environment & Heritage
for EMM Consulting on behalf of Alinta Energy



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ABORIGINAL CULTURAL HERITAGE ASSESSMENT REPORT COVER SHEET

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Ben Churcher, OzArk Environment & Heritage. Director and Principal Archaeologist

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Acknowledgement

OzArk acknowledge the traditional custodians of the area on which this assessment took place and pay respect to their beliefs, cultural heritage, and continuing connection with the land. We also acknowledge and pay respect to the post-contact experiences of Aboriginal people with attachment to the area and to the Elders, past and present, as the next generation of role models and vessels for memories, traditions, culture and hopes of local Aboriginal people.

ABBREVIATIONS AND GLOSSARY

ACHMP	Aboriginal Cultural Heritage Management Plan
ACHAR	Aboriginal Cultural Heritage Assessment Report. As set out in the <i>Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales</i> , all developments where harm to Aboriginal objects is likely must be assessed in an ACHAR.
ACHCRs	<i>Aboriginal Cultural Heritage Consultation Requirements for Proponents</i> . Guidelines for conducting Aboriginal community consultation for developments where harm to Aboriginal objects is likely.
AHIMS	Aboriginal Heritage Information Management System. Administered by the Heritage NSW, AHIMS is the central register of all Aboriginal sites within NSW.
Assemblage:	All artefacts recorded at a location. In this report, assemblage refers to stone artefacts as this was the only artefact class recorded.
Code of Practice	<i>Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales</i> under Part 6 NPW Act. Issued by DECCW in 2010, the Code of Practice is a set of guidelines that allows limited test excavation without the need to apply for an AHIP. The test excavation program for this assessment was conducted under the Code of Practice.
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water. DCCEEW contains the Environment and Heritage Group including Heritage NSW.
DPHI	NSW Department of Planning, Housing and Infrastructure. DPHI contains the Planning agency.
Heritage NSW	Government department tasked with ensuring compliance with the NPW Act. Heritage NSW is advised by the Aboriginal Cultural Heritage Advisory Committee (ACHAC).
NPW Act	<i>National Parks and Wildlife Act 1974</i> . Primary legislation governing Aboriginal cultural heritage within NSW.
PAD	Potential archaeological deposit. Indicates that a particular location has potential to contain subsurface archaeological deposits, although no Aboriginal objects are visible.
RAP	Registered Aboriginal Party. An individual or group who have indicated through the ACHCR process that they wish to be consulted regarding the project.

EXECUTIVE SUMMARY

OzArk Environment & Heritage (OzArk) has been engaged by EMM Consulting (EMM), on behalf of Alinta Energy to complete an Addendum Aboriginal Cultural Heritage Assessment Report (ACHAR) for the proposed Oven Mountain Pumped Hydro Energy Storage (OMPHEs). Alinta Energy propose to construct an upper and lower water containment reservoir and associated access tracks and infrastructure near Lower Creek NSW. The project is located within the Armidale Regional Local Government Area.

The project is a critical state significant infrastructure (CSSI) under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). An infrastructure project is declared critical by the NSW Minister for Planning when they are necessary for economic, environmental, or social reasons.

In 2023 EMM completed an ACHAR for the project which included the survey and part of the test excavation component. The EMM report (2023a) should be referred to when seeking the environmental context, *Aboriginal Cultural Heritage Consultation Requirements* (ACHCRs), archaeological background, predictive modelling, and survey results. The test excavation component of EMM (2023a) was directed by Niche Environment and Heritage (Niche) and encompassed 116 of the 176 proposed test excavation TUs (test units [TU]) within the construction envelope. Weather conditions delayed the test excavation program, and it could therefore not be entirely completed to be reported in the EMM ACHAR (2023a). A recommendation of the ACHAR was to continue the test excavation program before project approval as it was expected that the results would not result in fundamental changes to findings or recommendations.

The purpose of this addendum ACHAR is to report the test excavation of the remaining 61 proposed TUs within the construction envelope. The test excavation program was directed by OzArk in 2023.

The findings of this addendum should be integrated into the recommendations of EMM (2023a).

These include:

- 1) A stone artefact background scatter is predicted to occur across the entire construction envelope and extending beyond its limits within which low artefact densities of ~16/m² may be expected (OMPS-BS1), and which includes identified isolated Aboriginal objects (OMPS-IF1 – 32 inclusive, and OMPS IF-1 recorded by OzArk) and low-density artefact scatters (OMPS OS-1 – OS-4 inclusive recorded by OzArk, OMPS-AS2–25, 27–32, 34–35, and 37–42 inclusive). These sites are typically of low significance and reflect the long-term, transient use of the entire landscape by Aboriginal people in the past.
- 2) The foci of activity recorded at Transect 26 TU3, 21-5-0218 (OMPS OS-1), is outside of the design disturbance but is within the construction envelope. Avoidance of this area will

be attempted, but if the area is impacted, further archaeological investigation is not required as the small foci is part of the background scatter OMPS-BS1.

- 3) Sites within the design disturbance, 21-5-0219 (OMPS OS-2) and 21-5-0221 (OMPS OS-3) do not require further archaeological investigation as they are part of the background scatter OMPS-BS1.
- 4) If portions of site 21-5-0219 (OMPS OS-2) outside of the design disturbance can be conserved, protection measures should include, but not be limited to, cultural inductions for all personnel and subcontractors outlining their location and significance, fencing and clear marking of heritage sites and zones of interest near proposed works.
- 5) AHIMS Site Recording Forms for the newly identified Aboriginal objects and/or sites within the Project area and areas of archaeological sensitivity should be submitted to the AHIMS database once their validation has been completed.
- 6) A copy of the addendum ACHA should be lodged with AHIMS and provided to each of the RAPs.

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1 INTRODUCTION

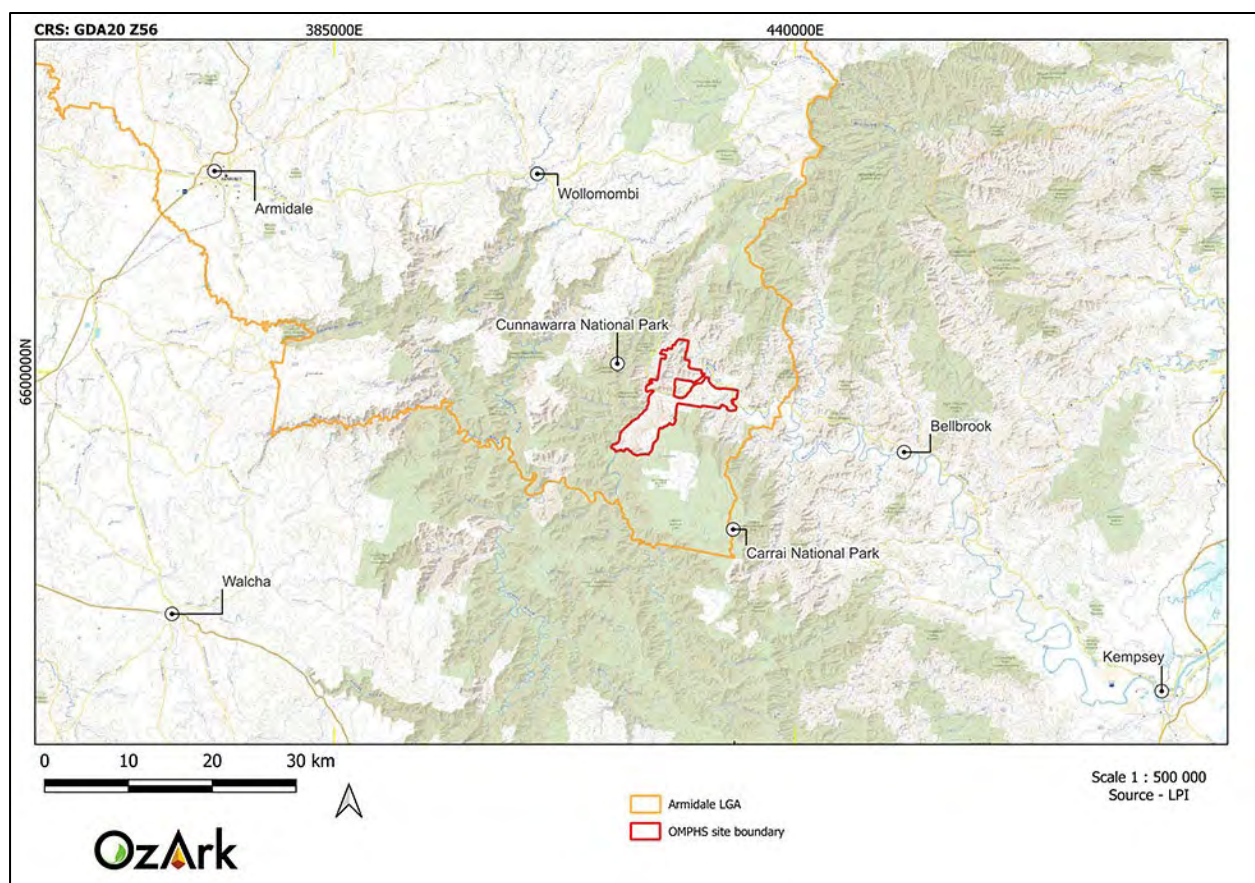
1.1 DESCRIPTION OF THE PROJECT

OzArk Environment & Heritage (OzArk) has been engaged by EMM Consulting (EMM) (the client), on behalf of Alinta Energy (the proponent) to complete an Addendum Aboriginal Cultural Heritage Assessment Report for the Oven Mountain Pumped Hydro Energy Storage (OMPHEs) (the project). The project is in the New England Renewable Energy Zone (REZ) and the Armidale Regional Local Government Area (LGA) (**Figure 1-1**).

The project is a critical state significant infrastructure (CSSI) under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). An infrastructure project is declared critical by the NSW Minister for Planning when they are necessary for economic, environmental, or social reasons.

The test excavation program was conducted under the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010a). Aboriginal consultation continued the program established for the OMPHEs following the guidelines in *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010b). Reporting follows the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011).

Figure 1-1: Location of the project.



1.2 BACKGROUND AND ROLE OF THIS DOCUMENT

In 2023 EMM completed an Aboriginal Cultural Heritage Assessment Report (ACHAR) for the project which included the results of the survey and part of the test excavation program. The EMM report (2023a) should be referred for the environmental context, Aboriginal consultation, archaeological background, predictive modelling, survey results, and the results of the first phase of test excavation by Niche Environment and Heritage (Niche).

The test excavation component of EMM (2023a) was directed by Niche and included excavating 116 of the 176 proposed excavation TUs (test units [TU]) within the construction envelope. Weather conditions delayed the test excavation program and therefore the program could not be fully completed to be reported the EMM ACHAR (2023a).

A recommendation of the ACHAR was to continue the test excavation program before project approval, as it was expected that the results would not result in fundamental changes to findings or recommendations.

This purpose of this addendum ACHAR is to present a test excavation report for the remaining 60 TUs within the construction envelope that were excavated by OzArk in 2023.

The location of the TUs excavated is shown on **Figure 1-3**.

Figure 1-2: Proposed work showing the site boundary in relation to the construction envelope and design disturbance.

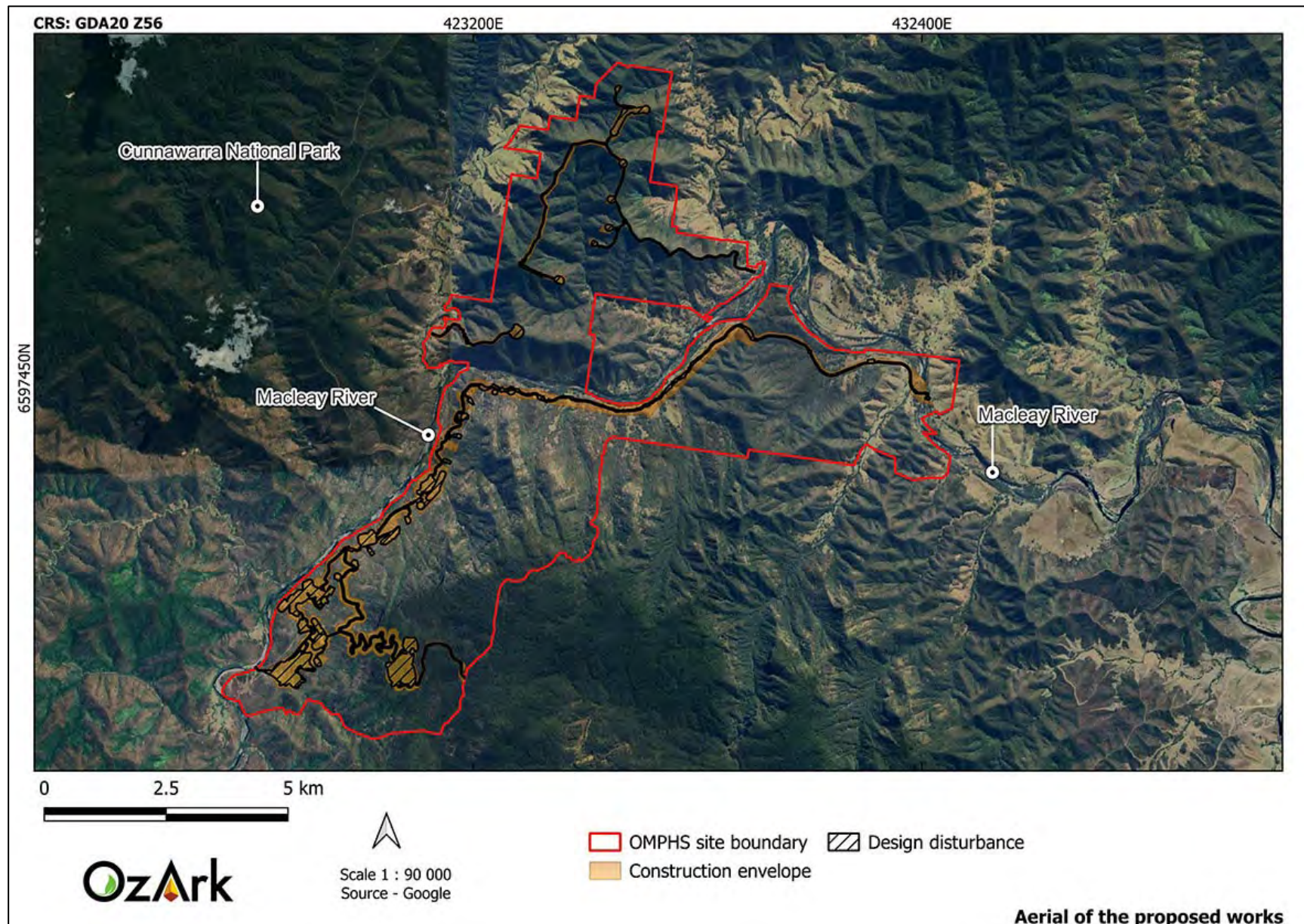
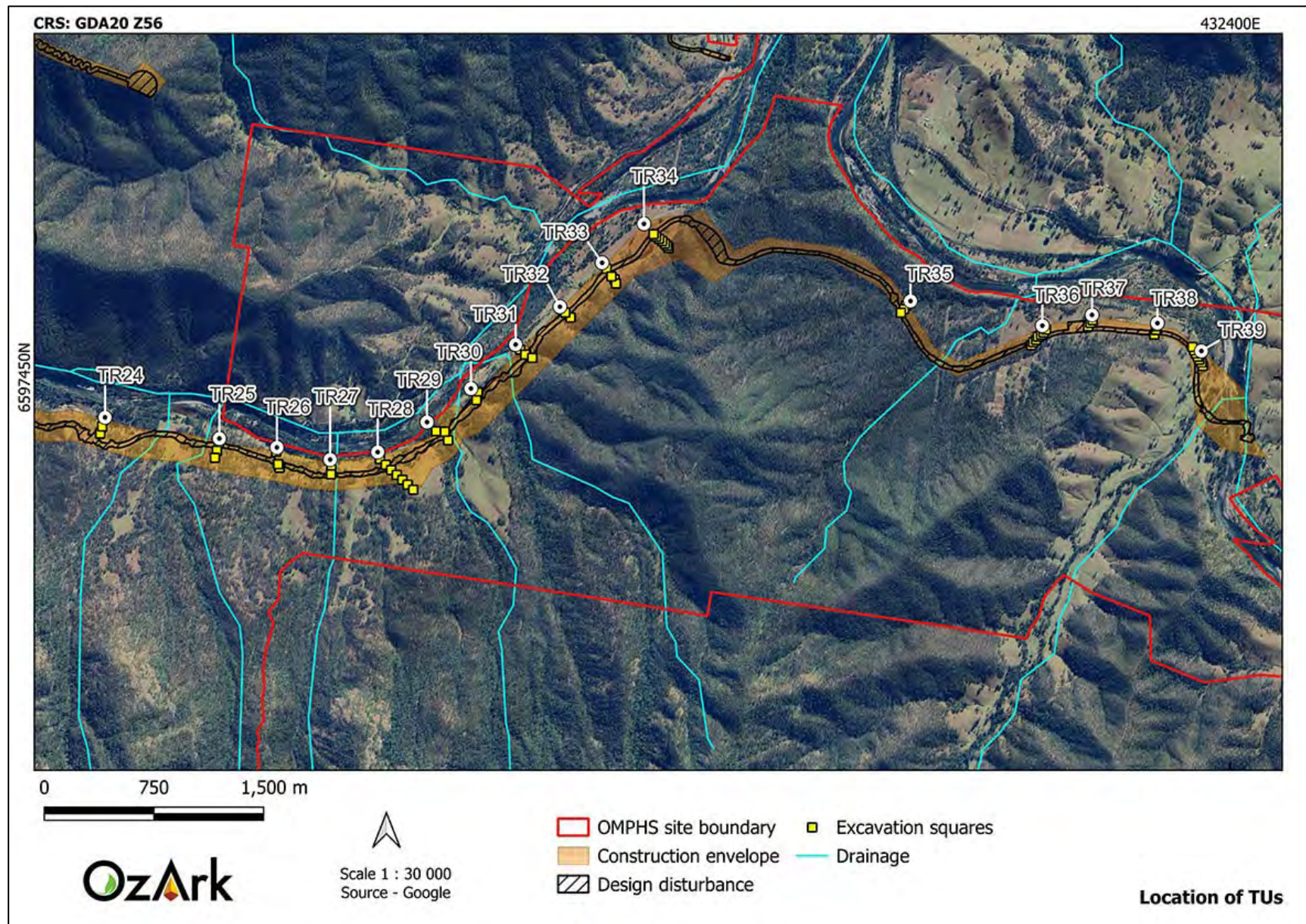


Figure 1-3: Location of test excavation program within the construction envelope.



2 TEST EXCAVATION PROGRAM

2.1 BACKGROUND TO THE TEST EXCAVATION PROGRAM

The test excavation program took place over six days on 22 to 29 May 2023 (excluding 27 and 28 May). The notification of test excavation was sent to Heritage NSW on 10 May 2023.

Aboriginal site officers for the test program were engaged directly by the proponent.

2.2 EXCAVATION METHODOLOGY

2.2.1 Purpose of the test excavation program

The test excavation program followed the methodology that was sent to all Registered Aboriginal Parties (RAPs) and is presented in **Appendix 2**.

The test excavation program sampled all landforms across the portion of the construction envelope being assessed.

The aims of the test excavation were to:

- Establish whether there are subsurface deposits within the construction envelope
- Establish which landforms within the construction envelope have a higher subsurface archaeological potential
- Use the data gained from the test excavation program to better evaluate the archaeological significance and potential of the construction envelope to inform future management of sites that could be impacted from proposed works.

2.2.2 Rationale of the test excavation program

The test excavation methodology is provided in **Appendix 2**. This document sets out the predictive model used to design the test excavation program.

While any test excavation program is limited in the level of research objectives it can achieve due to the restricted nature of the excavations, the test excavations attempted to answer the following research questions:

- What are the characteristics (density, depth, spatial distribution, diversity) of the expected subsurface deposits within the assessed portion of the construction envelope?
- How do the findings in terms of raw material use compare to the surface manifestations at the sites and other investigations nearby?
- How do the findings in terms of subsurface deposits compare to other investigations nearby?

2.3 SAMPLING METHODOLOGY FOR THE TEST EXCAVATION PROGRAM

A total of 61 TUs, measuring 0.5 metre (m) by 0.5 m were excavated to provide a sample of deposits to characterise the subsurface potential of landforms within the portion of the construction envelope assessed.

Table 2-1 summarises the sampling methodology for the test excavation program.

Table 2-1: Sampling for the test excavation program.

Transect (numbering continued from EMM 2023a test excavation program)	Test excavation methodology
24	50 m transect with two TUs spaced 50 m apart.
25	100 m transect with three TUs spaced 50 m apart.
26	100 m transect with three TUs. Space between excavation TU one and two was 50 m, and 25 m between excavation TU two and three due to landform constraints (to avoid excavating in drainage line). All RAPs agreed to adjust the spacing of the TUs.
27	50 m transect with two TUs spaced 50 m apart.
28	300 m transect with seven TUs spaced 50 m apart.
29	100 m transect with three TUs spaced 50 m apart.
30	50 m transect with two TUs spaced 50 m apart.
31	100 m transect with three TUs spaced 50 m apart.
32	50 m transect with two TUs spaced 50 m apart.
33	100 m transect with four TUs. Excavation TU one and two were spaced by 50 m to avoid excavating in an overflowed swamp. TUs 2, 3, and 4 were spaced by 25 m to avoid excavating beyond the construction envelope.
34	150 m transect with seven TUs spaced 25 m apart due to landform constraints (to avoid excavating within the floodplain of the Macleay River and have all TUs on an elevated terrace). All RAPs agreed to adjust the spacing of the TUs.
35	50 m transect with three TUs spaced 25 m apart due to landform constraints (to avoid excavating on eroded slope). All RAPs agreed to adjust the spacing of the TUs.
36	150 m transect with seven TUs spaced 25 m apart to remain within construction envelope. Three TUs were added to this transect, as a transect originally located along a stony ridgeline was removed during the test excavation program. This was due to the inability to excavate from the absence of topsoil. All RAPs agreed with this decision to move the transect.
37	50 m transect with three TUs spaced 25 m apart. This transect was moved during the test excavation program, as a transect along a stony ridgeline was removed due to the absence of topsoil. The current location was selected as it is an elevated terrace associated with the Macleay River. All RAPs agreed with this decision to move the transect.
38	50 m transect with three TUs spaced 25 m apart. The location and spacing between TUs of this transect were adjusted during the test excavation program due to landform constraints. The proposed TUs were situated within a drainage line. All RAPs agreed to adjust the location and spacing of the TUs.
39	150 m transect with seven TUs spaced 25 m apart. The location and spacing between TUs of this transect were adjusted during the test excavation program due to landform constraints. The proposed TUs were situated within the floodplain of the Macleay River. All RAPs agreed to adjust the location and spacing of the TUs.

As detailed in **Table 2-1**, some transects and TUs were adjusted during the test excavation program due to various landform constraints.

Note that three transects at the centre of the test excavation program were not excavated due to the lack of a soil profile along a stony ridgeline. RAPs agreed to move these TUs to an elevated terrace of the Macleay River to the east. The transects already located near the Macleay River

had TUs added on, however, the spacing between these was shortened to 25 m to remain within the construction envelope.

2.4 THE ARTEFACT CATALOGUE

2.4.1 Analysis terminology

The abbreviations shown in **Table 2-2** have been used in the catalogue of the artefact assemblage from the test excavation program (**Table 2-6**).

Table 2-2: Abbreviations used in the artefact catalogue.

Artefact Analysis Abbreviations	
Artefact Type	
flake	An unmodified artefact that is broader than it is long
shatter	Shatter does not refer solely to heat shatter but also chips of raw material clearly the result of the knapping process
Raw Material	
mudstone	
silcrete	
chert	
basalt	
quartzite	
quartz	
red jasper	
chalcedony	
Integrity	
complete	Complete artefact
proximal fragment	i.e. the distal is missing
distal fragment	i.e. the proximal is missing
longitudinal break	Broken down through the platform
medial break	Broken across the angle of strike
Reduction	
Primary: greater than c. 50% cortex, dorsal surface entirely cortex	
Secondary: displaying cortex but either incomplete on dorsal surface or less than c. 50%	
Tertiary: no cortex	

A discussion on why these attributes were analysed follows.

Artefact type

Description: Possible artefact types include flakes, blades, retouched flakes/blades, cores, scrapers, shatter/fragments and other (hammerstones, grindstones, ground-edge hatchets) although not all may be present at any one site.

Issues: Classing artefacts, generally, does not usually entail significant problems. A minority of artefacts are difficult to define such as ambiguities between recognising flaked pieces (flakes subsequently used as a core to source further flakes), and between cores and scrapers.

Uses: This category will be used to assess differences in provisioning strategies (e.g. core provisioning as opposed to flake provisioning), differences in site function/use (e.g. presence/absence of grindstones), and the taphonomic effects of past land use on the site (are more broken artefacts part of the assemblage?).

Raw Material

Description: A largely self-explanatory attribute, raw materials expected to be present include basalt and quartz, and to a lesser extent, silcrete or chert.

Issues: This category often has problems for analysts without a geological background. Even then, without breaking an artefact, the true nature of the stone will sometimes remain uncertain. This will allow other researchers to identify the type of stone recorded here as, for example, 'basalt'.

The most common materials utilised for artefact manufacture in the local region tend to be quartz, which tends to come in different variations such as milky or crystal quartz.

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 Breakage (Integrity)

Description: At a basic level, flakes break in three different ways. Two are transverse (at 90 degrees to the direction of percussion) – proximal and distal; one is longitudinal (along the plane of percussion).

Issues: 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 regarding several 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.

Reduction

Description: This category refers to the level of reduction evident on an artefact, assessed by the amount of cortex remaining on the artefact. 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 of time. The amount of cortex as a percentage of surface area will be measured on all

artefacts (in relation to flakes, cortex can 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. This measurement will help determine if an artefact is at a primary, secondary, or tertiary level of reduction.

Issues: 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). Because 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 near the source. Differences between the proportions of artefacts retaining cortex between different raw material 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.

2.4.2 Research considerations

Stone artefacts are probably the most resilient physical evidence of Aboriginal occupation in Australia and for many parts of the country form the most abundant archaeological evidence of Aboriginal occupation. Stone artefacts are important because they are tangible evidence of Aboriginal use of an area and can potentially contain information about lithic activities, the organisation of stone technologies, and potentially information about larger-scale issues of settlement organisation across regions and even social change over time.

The kinds of information which can be obtained from stone artefacts may vary considerably, depending in part on:

- The numbers of artefacts which can be examined and recorded: generally, the larger the number of artefacts the more reliable will be statistical statements about them
- The presence of other assemblages with which the artefacts can be compared

- The condition of sites in which they occur: generally undisturbed sites have more information potential than disturbed sites, depending on the scale at which research is carried out
- The theory which underlies the artefact recording and analysis.

2.5 TEST EXCAVATION RESULTS

2.5.1 Description of excavation areas

2.5.1.1 Soil profile




A full log of all photos taken during the test excavation program and a log of all drawn TU sections are presented in **Appendix 3** and **Appendix 4** respectively.




The soil profile tended to vary not only across transects, but also within transects. Alluvial soils, slope wash, and stony ridgelines tended to disrupt the soil strata across most of the transects.





The general soil profile is a brown sandy loam topsoil with thick grasses and few inclusions. The brown sandy loam topsoil graduates into a light grey light brown sandy loam with some inclusions and clay content, and then becomes a thick grey or orange clay. **Table 2-3** shows the soil profile of one excavated TU at each of the transects.





Table 2-3: Soil profiles from a sample of TUs from each transect.

Transect & TU	GDA94 Zone 56 East	GDA94 Zone 56 North	Description	Site photograph of north section (10cm scale increments)
Transect 24, TU 2	424672	6597067	Excavated in five centimetre (cm) spits. Layer A: 0-1 cm. Light brown loam topsoil. Layer B: 1-10 cm. Light brown sandy loam with abundant gravels and larger granite rocks. Layer C: 10+ cm. Granite bedrock.	
Transect 25, TU 1	425483	6596997	Spit 1-2 excavated in 5 cm spits. Spit 3-5 excavated in 10 cm spits. Layer A: 0-3 cm. Dark brown topsoil. Layer B: 3-35 cm. Dark brown loam with common small inclusions (less than 1 cm).	

Transect & TU	GDA94 Zone 56 East	GDA94 Zone 56 North	Description	Site photograph of north section (10cm scale increments)
			Layer C: 35+ cm. Granite bedrock.	
Transect 26, TU 1	425875	6596943	<p>Spit 1-2 excavated in 5 cm. Spit 3-6 excavated in 10 cm spits.</p> <p>Layer A: 0-10 cm. Dark brown compact sandy loam.</p> <p>Layer B: 10-50 cm. Light brown sandy loam with no inclusions.</p> <p>Layer C: 50+ cm. Light grey thick clay.</p>	
Transect 27, TU 1	426253	6596823	<p>Spit 1-2 excavated in 5 cm. Spit 3-6 excavated in 10 cm.</p> <p>Layer A: 0-8 cm. Dark brown topsoil.</p> <p>Layer B: 8-50 cm. Mid brown sandy loam with very small gravels increasing with depth.</p> <p>Layer C: 50+ cm. Decomposing granite.</p>	
Transect 28, TU 1	426585	6596892	<p>Spit 1-2 excavated in 5 cm. Spit 3-6 excavated in 10 cm.</p> <p>Layer A: 0-12 cm. Brown sandy loam.</p> <p>Layer B: 12-45 cm. Light brown sandy loam.</p> <p>Layer C: 45+ cm. Light brown clay.</p>	

Transect & TU	GDA94 Zone 56 East	GDA94 Zone 56 North	Description	Site photograph of north section (10cm scale increments)
Transect 29, TU 2	427028	6597079	Spit 1-2 excavated in 5 cm. Spit 3-5 excavated in 10 cm. Layer A: 0-1 cm. Mid brown topsoil. Layer B: 1-28/40 cm. Brown/orange sandy loam with many small gravels. Layer C: 28/40+ cm. Decomposing granite.	
Transect 30, TU 2	427245	6597295	Spit 1-2 excavated in 5 cm. Layer A: 0-5/10 cm. Mid brown/orange loam with small gravels. Layer B: 5/10+ cm. Dark orange clay with gravels.	
Transect 31, TU 1	427544	6597641	Spit 1-2 excavated in 5 cm. Spit 3-9 excavated in 10 cm. Layer A: 0-3 cm. Mid brown topsoil. Layer B: 3-28/32 cm. Light brown sandy loam with rocks (approximately 3- 6 cm in width). Layer C: 28/32- 80 cm. Light brown sandy loam with many rocks at base.	

Transect & TU	GDA94 Zone 56 East	GDA94 Zone 56 North	Description	Site photograph of north section (10cm scale increments)
Transect 32, TU 2	427889	6597861	<p>Spit 1-2 excavated in 5 cm.</p> <p>Layer A: 0-5 cm. Brown sandy loam.</p> <p>Layer B: 5-10 cm. Light brown sandy loam.</p> <p>Layer C: 10+ cm. Bedrock.</p>	
Transect 33, TU 1	428134	6598195	<p>Spit 1-2 excavated in 5 cm. Spit 3-9 excavated in 10 cm.</p> <p>Layer A: 0-8 cm. Mid brown topsoil.</p> <p>Layer B: 8-80 cm. Mid brown loam with no inclusion. Stopped at 80 cm as culturally sterile.</p>	
Transect 34, TU 2	428474	6598415	<p>Spit 1-2 excavated in 5 cm. Spit 3 excavated in 10 cm.</p> <p>Layer A: 0-12 cm. Mid brown loam.</p> <p>Layer B: 12-25/27 cm. Light brown loam with shale.</p> <p>Layer C: 25/27+ cm. Brown clay.</p>	
Transect 35, TU 2	430169	6597918	<p>Spit 1-2 excavated in 5 cm. Spit 3-4 excavated in 10 cm.</p> <p>Layer A: 0-1 cm. Mid brown topsoil.</p> <p>Layer B: 1-10/18 cm. Light brown loam with gravels.</p> <p>Layer C: 10/18+ cm. Orange clay.</p>	

Transect & TU	GDA94 Zone 56 East	GDA94 Zone 56 North	Description	Site photograph of north section (10cm scale increments)
Transect 36, TU 1	431139	6597778	<p>Spit 1-3 excavated in 5 cm.</p> <p>Layer A: 0-5 cm. Brown/grey topsoil.</p> <p>Layer B: 5-15 cm. Brown/grey silty clay.</p> <p>Layer C: 15+ cm. Thick orange/grey clay.</p>	
Transect 37, TU 3	431428	6597801	<p>Spit 1-2 excavated in 5 cm.</p> <p>Layer A: 0-14 cm. Light brown loam.</p> <p>Layer B: 14+ cm. Pale brown clay with decomposing shale.</p>	
Transect 38, TU 1	431898	6597800	<p>Spit 1-2 excavated in 5 cm.</p> <p>Layer A: 0-6 cm. Brown sandy loam.</p> <p>Layer B: 6-10 cm. Brown sandy loam with many small flecks of charcoal.</p> <p>Layer C: 10+ cm. Thick brown/grey clay.</p>	
Transect 39, TU 5	432188	6597572	<p>Spit 1-2 excavated in 5 cm. Spit 3-9 excavated in 10 cm.</p> <p>Layer A: 0-11 cm. Light brown silty sand.</p> <p>Layer B: 11-80 cm. Orange silty sand. Stopped at 80 cm as culturally sterile.</p>	

2.5.1.2 *Artefact distribution*

A total of 32 artefacts were recorded during the test excavation. Details of the artefacts are presented in **Table 2-6** and photos of the artefacts on **Figure 2-2**.

The assemblage can be considered a statistically useful sample in some regards and the initial characteristics of the assemblage are below:

- There was a total of 32 subsurface artefacts recorded
- Flakes were the most common type of artefact (n=27)
- Basalt was the predominant raw material present (n=13)
- Most artefacts had tertiary reduction (n=31).

2.5.1.3 *Artefact types and features*

There were only two artefact types identified in the test excavation program, unmodified flakes (84.38%) and angular shatter (15.6%) (**Table 2-4**). No formal tool types were recorded. This type of assemblage is typical of a background scatter of artefacts found in most landscapes in NSW where ubiquitous flakes have been distributed across a landscape over time. As formal tool types and/or assemblage complexity are absent, it is unlikely that the test excavation program encountered an intact camping area.

Table 2-4: Artefact types.

Artefact Type	Number	% Frequency
Flake	27	84.38%
Angular shatter	5	15.62%

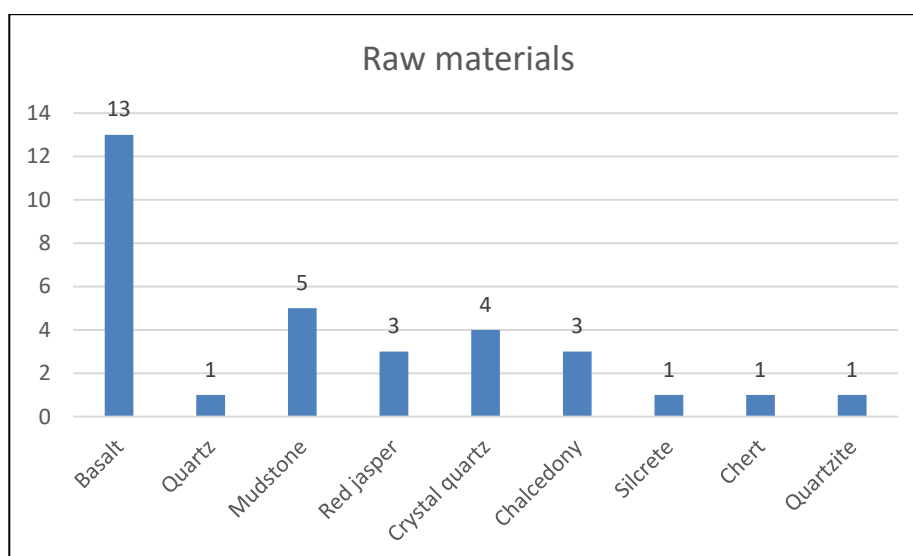
2.5.1.4 *Raw materials*

The raw materials of the assemblage were markedly different to that recorded by Niche (EMM 2023a). In the current program, basalt and mudstone dominate the assemblage and quartz artefacts are very underrepresented (**Figure 2-1**).

Conversely, 2,090 artefacts of the 2,462 in the assemblage recorded by Niche were milk quartz and only 14 of the artefacts were volcanic (basalt?).

As there is no probability of confusing these two types of raw materials (milk quartz and volcanic), this difference in raw material between the two investigation areas is a valid observation. The Niche investigations, however, was dominated by one excavation TU that contained 82% of the artefacts in the assemblage. As these artefacts were milk quartz debitage from a possible knapping event, this one event may have skewed the Niche data in favour of milk quartz.

Figure 2-1: Raw material type of subsurface artefacts recorded.



2.5.1.5 Integrity

Table 2-5 shows that the number of artefacts determined to be complete (n=14) comprised of almost half of the total artefacts, however, broken flakes in total comprise 56.25%. This indicates substantial disturbance across the transects where artefacts were identified.

All artefacts, except one, were recorded in Spits 3 or 4 (10–20 cm or 20–30 cm) and this suggests movement of stone artefacts into the soil profile (bioturbation, stock trampling) where perhaps breakages have occurred.

A stone was also noted as being out of place within transect 27 TU 2 spit 4, however, it was not recorded as an artefact or manuport. This is because there is no evidence of pecking or flecking on the edges, and all scuffs seen on **Figure 2-3**, were impact marks from the shovel during excavation. This stone is being noted due to its abnormal shape (possible river cobble broken longitudinally) and the depth it was recorded (20–30 cm).

Table 2-5: Artefact integrity.

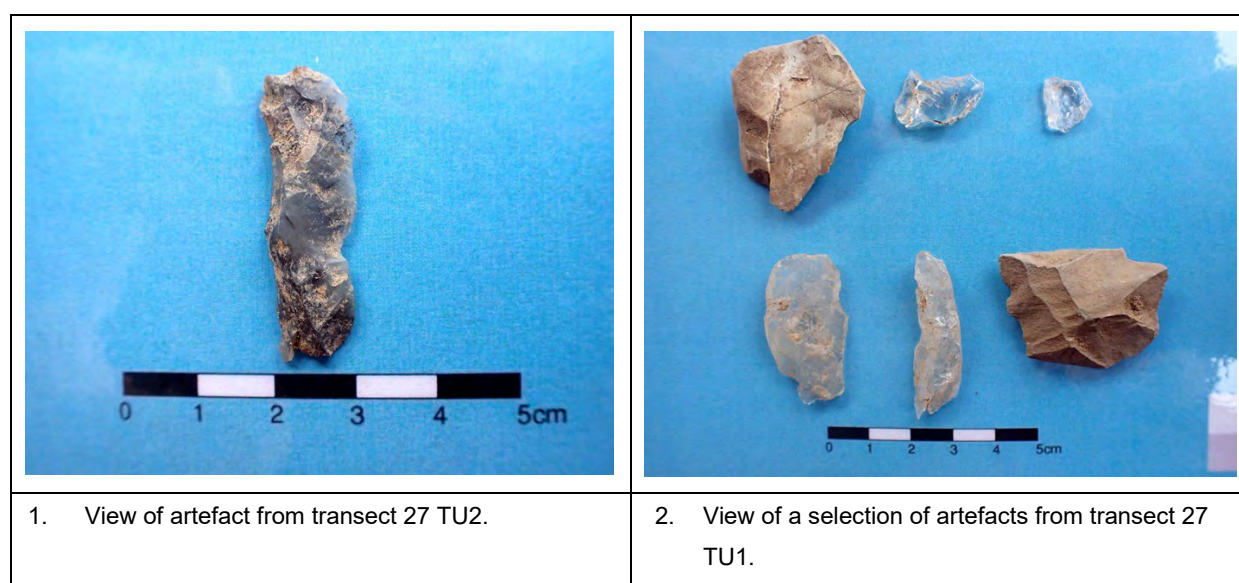
Artefact Type	Number	% Frequency
Complete	14	43.75
Proximal fragment	7	21.88
Distal fragment	4	12.50
Medial break	2	6.25
Not discernible (shatter)	5	15.63

Table 2-6: Test excavation artefact catalogue.

Transect	TU	Spit	Artefact ID	Artefact type	Material	Integrity	Size (L x W x T) (mm)	Reduction
26	3	4	1	Flake	Quartz	Complete	32 x 30 x 10	Secondary
26	3	4	2	Flake	Mudstone	Medial	14 x 21 x 3	Tertiary
26	3	4	3	Flake	Red jasper	Complete	8 x 2 x 1	Tertiary
26	3	4	4	Flake	Basalt	Distal	20 x 20 x 3	Tertiary

Transect	TU	Spit	Artefact ID	Artefact type	Material	Integrity	Size (L x W x T) (mm)	Reduction
26	3	4	5	Flake	Basalt	Proximal	31 x 38 x 10	Tertiary
26	3	4	6	Flake	Basalt	Distal	34 x 17 x 2	Tertiary
26	3	4	7	Flake	Basalt	Proximal	28 x 20 x 4	Tertiary
26	3	4	8	Flake	Basalt	Proximal	18 x 21 x 2	Tertiary
26	3	4	9	Flake	Basalt	Complete	26 x 29 x 5	Tertiary
26	3	4	10	Flake	Mudstone	Complete	30 x 12 x 5	Tertiary
26	3	4	11	Flake	Basalt	Medial	5 x 17 x 1	Tertiary
26	3	4	12	Flake	Basalt	Complete	12 x 12 x 3	Tertiary
26	3	4	13	Flake	Basalt	Complete	14 x 9 x 3	Tertiary
26	3	4	14	Shatter	Basalt	N/A	6 x 6 x 1	Tertiary
27	1	3	1	Flake	Mudstone	Complete	30 x 28 x 7	Tertiary
27	1	3	2	Flake	Basalt	Complete	30 x 22 x 6	Tertiary
27	1	3	3	Flake	Crystal quartz	Complete	29 x 14 x 4	Tertiary
27	1	3	4	Shatter	Crystal quartz	N/A	32 x 7 x 3	Tertiary
27	1	3	5	Flake	Crystal quartz	Complete	16 x 9 x 1	Tertiary
27	1	3	6	Shatter	Crystal quartz	N/A	8 x 8 x 2	Tertiary
27	2	4	1	Flake	Chalcedony	Complete	28 x 8 x 1	Tertiary
29	2	3	1	Flake	Mudstone	Complete	15 x 15 x 3	Tertiary
29	2	3	2	Flake	Red jasper	Proximal	30 x 24 x 10	Tertiary
29	2	3	3	Shatter	Silcrete	N/A	13 x 20 x 1	Tertiary
29	2	3	4	Flake	Mudstone	Distal	10 x 8 x 3	Tertiary
29	2	3	5	Flake	Basalt	Complete	12 x 5 x 3	Tertiary
29	2	3	6	Shatter	Chalcedony	N/A	7 x 6 x 1	Tertiary
29	2	3	7	Flake	Red jasper	Complete	30 x 15 x 7	Tertiary
30	1	2	1	Flake	Chert	Proximal	19 x 15 x 5	Tertiary
39	6	3	1	Flake	Quartzite	Proximal	23 X 13 X 3	Tertiary
39	6	3	2	Flake	Chalcedony	Proximal	15 x 10 x 2	Tertiary
39	7	4	1	Flake	Basalt	Distal	12 x 12 x 2	Tertiary

Figure 2-2: View of artefacts from the test excavation program.





3. View of artefacts from transect 39 TU6.



4. View of an artefact from transect 26 TU3.

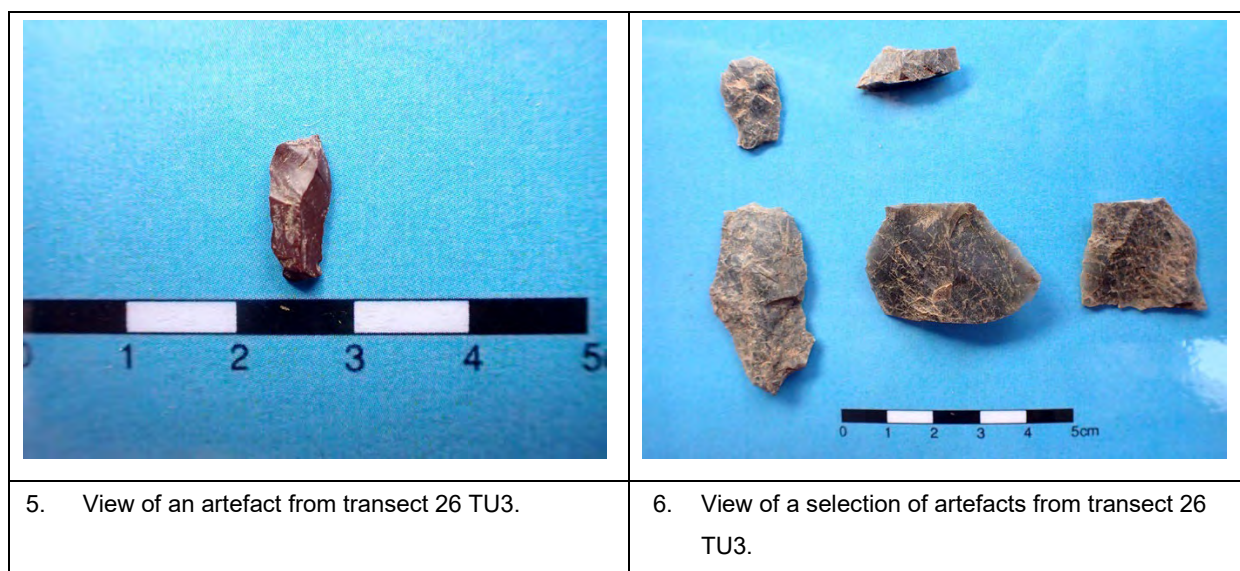
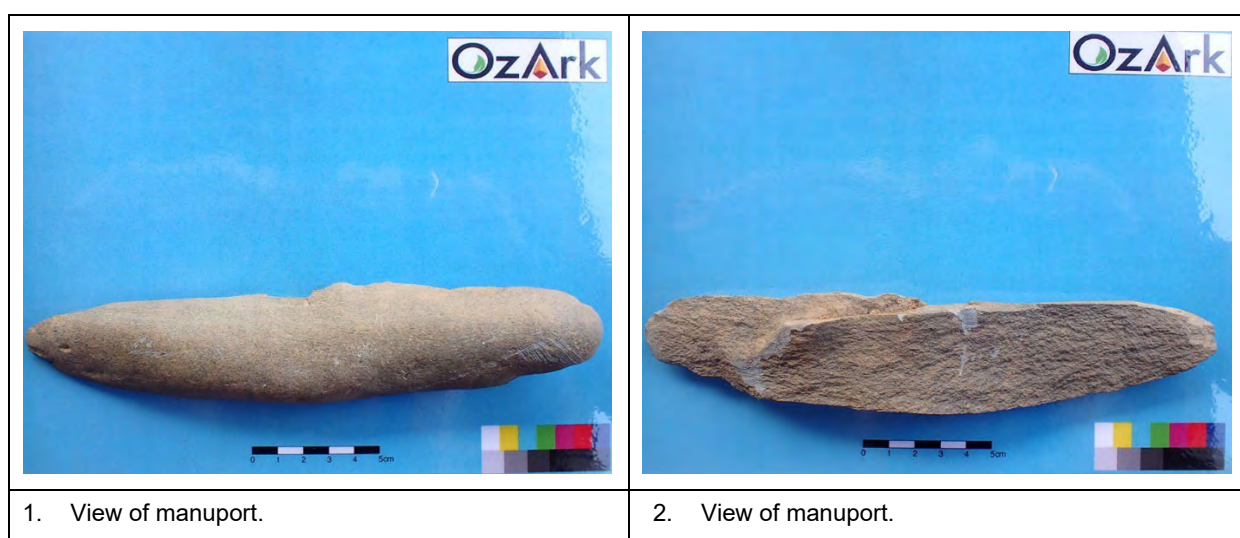


Figure 2-3: View of potential manuport.



2.6 DISCUSSION OF THE TEST EXCAVATION PROGRAM

2.6.1 Test excavation summary

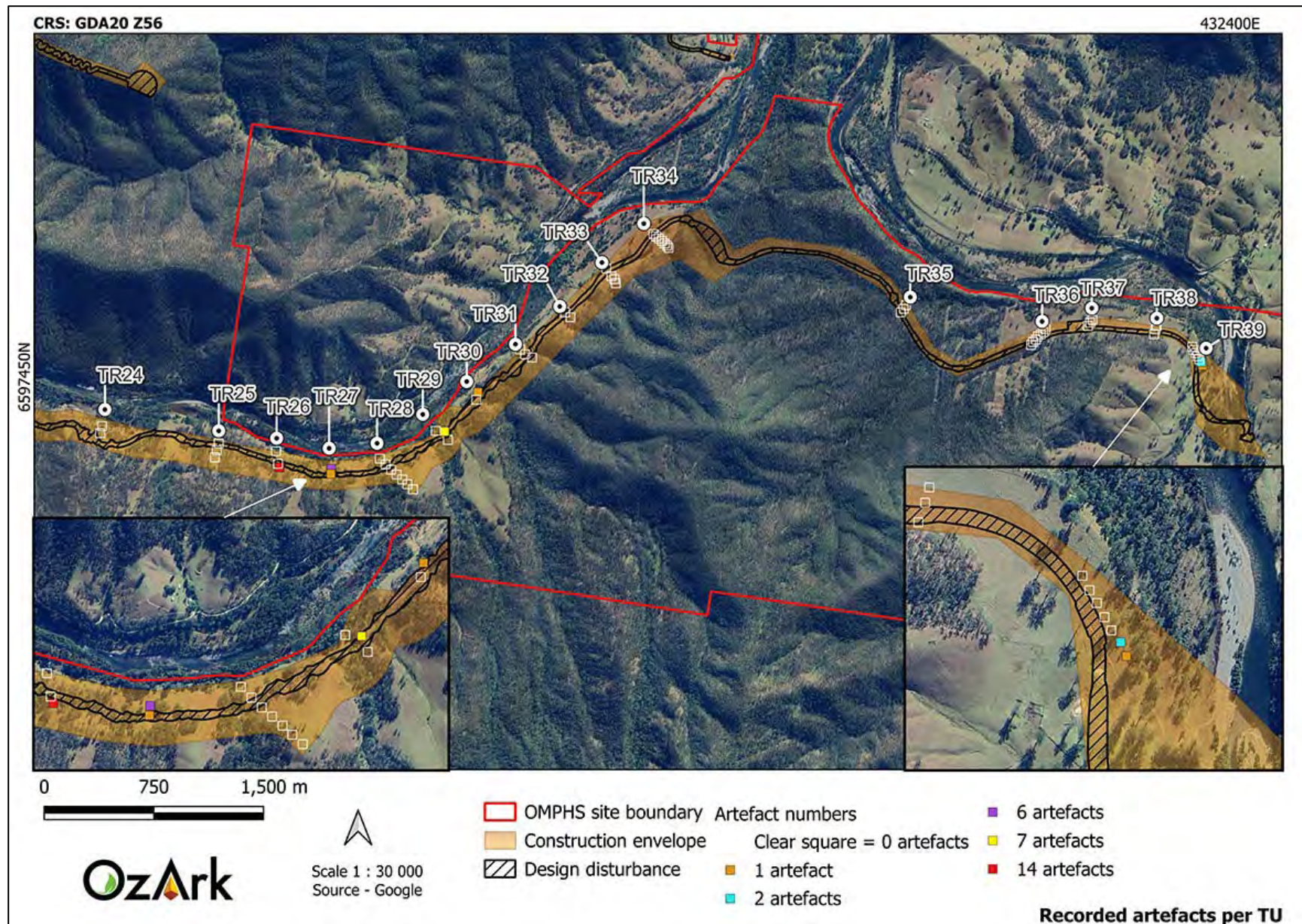
The results of the test excavation confirmed the presence of subsurface artefacts within parts of the construction envelope. The density and nature of these artefacts suggests that they are part of a general background of artefacts that could be found in most NSW landscapes.

The results from the test excavation are as follows:

- A total of 32 artefacts were recorded in 61 TUs within the portion of the construction envelope assessed
- Of the 61 TUs, only seven contained artefacts
- The most artefacts in one excavation TU (Transect 26 TU3) was 14. Elsewhere the program recorded a low artefact density

- The foci at Transect 26 TU3 potentially reflects a site with an artefact density 56/m² although this foci had a limited spatial spread.
- All artefacts, except one (transect 30 TU1 spit 2), were recorded in Spits 3 and 4 (depths of 10–20 cm and 20–30 cm respectively)
- Most subsurface artefacts are manufactured from basalt, which was expected based on the local geology that includes an extinct volcano (Carrai) located approximately 6 km to the south
- The soil profile in the area investigated does not display archaeological stratigraphy
- TU depth varied not only between transects, but also between TUs along the same transect. Many TUs reached bedrock or clay at 10–40 cm, while some continued to 80 cm
- Disturbances at the study area include vegetation clearance, grazing, and slope wash erosion. The accumulation of these disturbances has may have removed artefacts from their original context.

Figure 2-4: Artefact numbers in individual TUs.



2.6.2 Comparison of results with Niche test excavation results EMM (2023a)

The results from the Niche test excavation program in EMM 2023a differs from that obtained during the current test excavation program. **Figure 2-5** below shows the number of artefacts per excavation square of the Niche program in comparison to OzArk's.

Niche recorded a total of 2,462 artefacts, whereas only 32 were recorded during the OzArk test excavation program. Although 2,014 of the 2,462 artefacts were from one excavation square alone, the number of artefacts within squares containing artefacts was higher on average. As the layout of transects for both test excavation programs were identical (linear testing of all landforms within the construction envelope), it is likely that different landforms are the main reason for the observed difference in artefact densities.

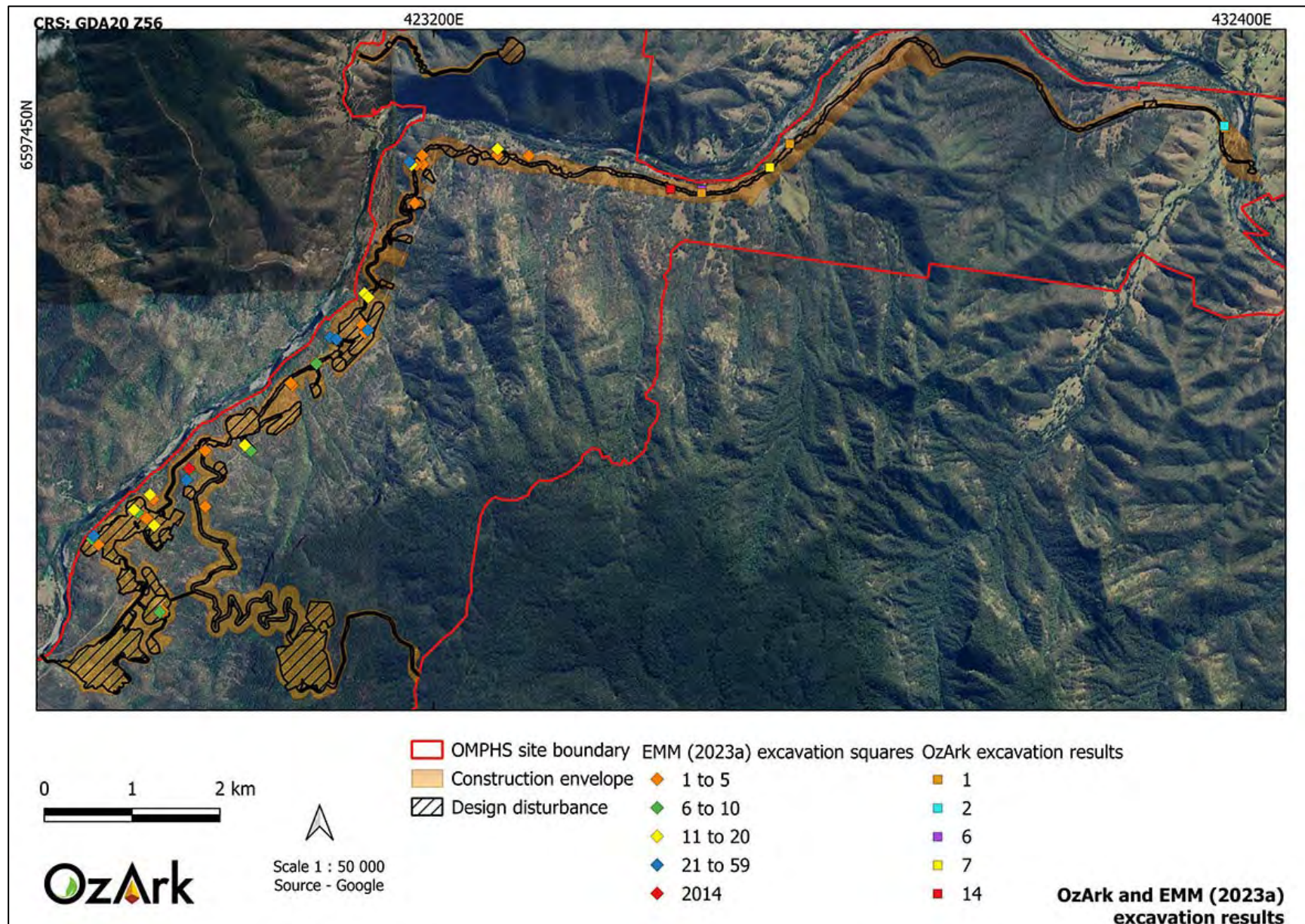
The Niche investigation area (EMM 2023a) had most transects situated along spur crests associated with the Macleay River, whereas most of the transects for the current program were situated on steep slopes or the alluvial plains and lower terraces of the Macleay River (each of which are susceptible to significant flooding and contained a high level of soil loss).

The Niche results concluded that (excluding T7P1, the excavation square with 2,014 artefacts), the construction envelope contain discrete foci of a low-density background of cultural material. The results of the current program confirm this conclusion, as the additional sites recorded had a low artefact density and likely represent short-term occupation sites. The additionally recorded sites have been assessed as discrete foci within this low-density background scatter of artefacts.

Both excavations recorded a foci of artefacts. The OzArk excavations recorded 14 artefacts at (Transect 26 TU3) that potentially reflects a site with an artefact density $56/m^2$ while the foci at the Niche excavations at T7P1 recorded 2,014 artefacts ($8,000/m^2$). The average artefact density at the Niche excavations was $84.9/m^2$ which dropped to $16/m^2$ when the foci of T7P1 is removed. Conversely, the OzArk excavations recorded an average artefact density of $2/m^2$ which drops to $1.18/m^2$ when the foci of Transect 26 TU3 is removed. These results show that while activity foci are common to both excavation areas, that the lower artefact density in the OzArk excavation area is clearly obvious.

While the low artefact density was common between both test excavation areas, the results also indicate that the more sheltered and narrow valley system investigated by Niche preserves archaeological evidence better than the alluvial landforms investigated by OzArk. This observation assumes that both areas would have been equally visited by traditional Aboriginal people due to the association of the Macleay River, but that archaeological evidence has been potentially removed or scattered in the more alluvial landforms to the east of the construction envelope.

Figure 2-5: EMM (2023a) and OzArk excavation results.



2.6.3 Research questions

In **Section 2.2.2**, several research questions were posed for the test excavation program. These will be answered below.

- What are the characteristics (density, depth, spatial distribution, diversity) of the expected subsurface deposits within the assessed portion of the construction envelope?
 - The density of artefacts in the subsurface deposits was assessed as low across all transects. One foci had an average artefact density of 56/m² although this was very isolated and adjacent TUs did not record artefacts
 - All except one artefact were recorded in Spits 3 and 4 (10–20 cm and 20–30 cm). This is similar to the EMM (2023a) test excavation program, which had most artefacts occurring at depths of 10–50 cm, with most occurring between 10–20 cm and 30–40 cm
 - There was a low density of artefact types identified during the excavation with flakes and shatter being the only artefact types identified
 - The results indicate that there is low potential for intact archaeological deposits in the alluvial plains and terraces of the Macleay River within this portion of the construction envelope.
- How do the findings in terms of raw material use compare to the surface manifestations at the sites and other investigations nearby?
 - The current investigation recorded a high percentage of artefacts made from basalt rock sources, while the Niche excavation, in contrast, recorded mostly artefacts made from milk quartz. This may be explained by the Niche excavations recording a concentration of quartz debitage at one location. The current program shows that in the east of the construction envelope, local volcanic stone sources were the preferred source for stone tools.

2.7 CONCLUSION

The archaeological assessment conducted within the assessed portion of the construction envelope for the project, has determined that site density in alluvial plains and terraces of the Macleay River comprise of low-density subsurface artefact sites that extend from a depth between 10 and 30 cm. While floodings, erosion, and vegetation clearing has disturbed the soil profile in this area of the construction envelope, the presence of subsurface artefacts indicates that these landforms contain a background scatter of artefacts representing many individual events across a long period of time. These events range from the loss of artefacts in the past and the movement of artefacts by flooding and erosion.

The archaeological sensitivity of the landforms adjacent to the Macleay River were assessed as high during the EMM (2023a) survey, however, the test excavation program has shown that the alluvial flats and lower terraces in the east of the construction envelope do not have high Aboriginal archaeological values.

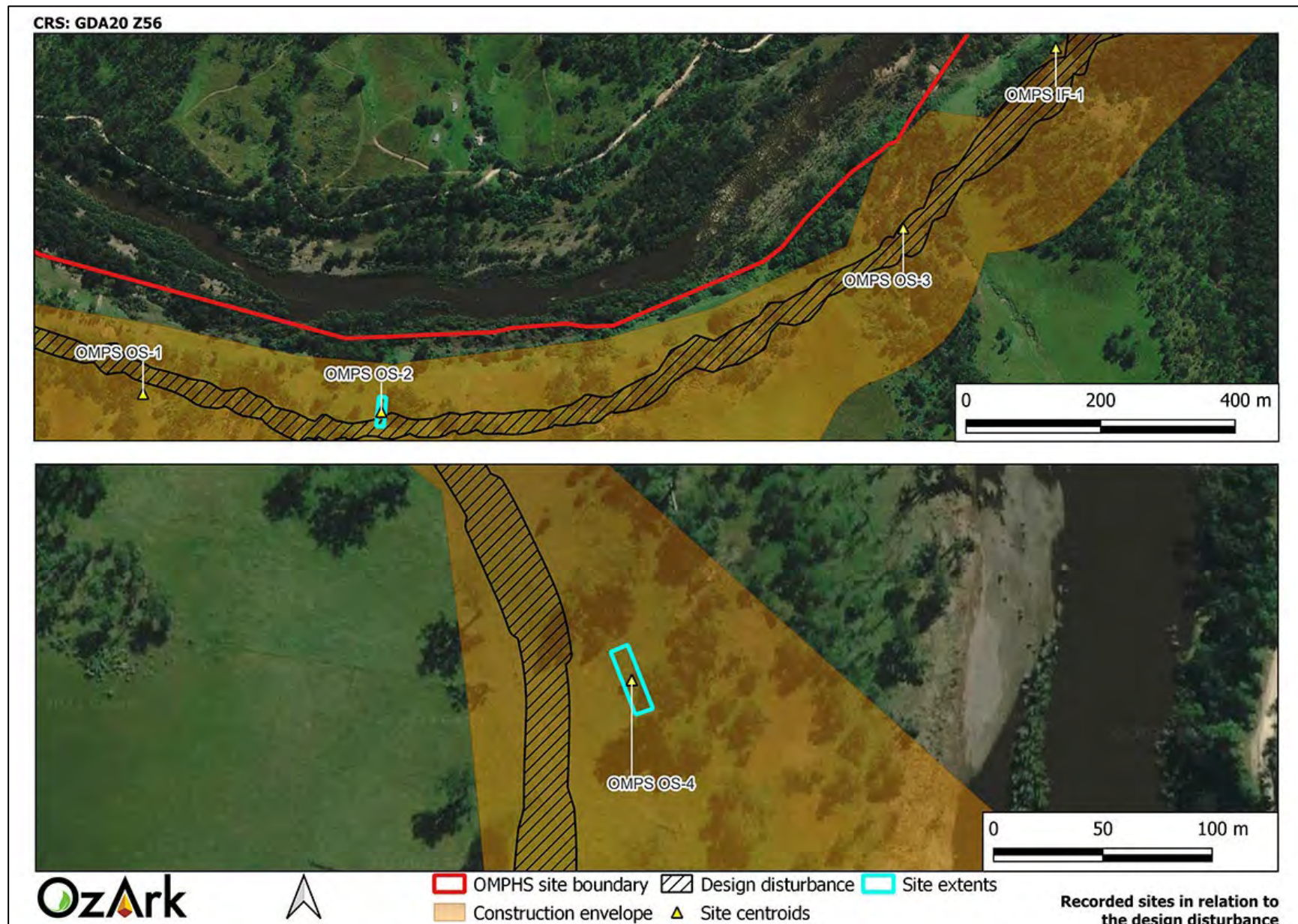
Early ethnographic evidence (EMM 2023a) suggested that the region of the project had significant spiritual meaning to the traditional Aboriginal people, as the Carrai area is associated with multiple creation stories and ceremonial sites. This was supported by the recording of multiple stone arrangements during the EMM (2023a) survey. However, the portion of the construction envelope assessed for the test excavation program indicates that the lower elevation landforms do not preserve archaeological evidence of past activity that is noted along the ridgelines and spur crests of the Carrai.

As a result of the test excavation program, five additional sites have been registered with AHIMS (**Table 2-7**). These sites are shown on **Figure 2-6**. These sites account for artefacts recorded in the test excavation program outside of the site extent of known sites. These sites are subsurface manifestations only and are likely to represent a low density of artefacts.

Table 2-7: Sites recorded during the test excavation.

AHIMS ID	Site Name	Coordinates (GDA) (centre point)	Site type	Transect and TU
21-5-0217	OMPS IF-1	427255E / 6597347N	Isolated find	T30 TU1
21-5-0218	OMPS OS-1	425898E / 6596833N	Artefact scatter	T26 TU3
21-5-0219	OMPS OS-2	426252E / 6596806N	Artefact scatter	T27 TU1 and TU2
21-5-0221	OMPS OS-3	427028E / 6597079N	Artefact scatter	T29 TU2
21-5-0220	OMPS OS-4	432207E / 6597541N	Artefact scatter	T39 TU6 and TU7

Figure 2-6: Recorded sites in relation to the design disturbance footprint.



3 SIGNIFICANCE ASSESSMENT

3.1 INTRODUCTION TO SIGNIFICANCE ASSESSMENT

The general description of each value assessed is in the EMM ACHAR (2023a) and should be referred to when seeking clarification on how the significance of each Aboriginal site has been assessed in **Section 3.2**.

3.2 ASSESSED SIGNIFICANCE OF THE RECORDED SITES

Social or Cultural Value

The social and cultural value of Aboriginal sites is generally determined through consultation with Aboriginal people. Generally, the Aboriginal community regard all sites as having high cultural significance. This is due to all sites, even displaced artefact sites, being able to provide a connection to their ancestors, as well as being a tangible reminder of the past Aboriginal occupation of the area.

Archaeological/Scientific Value

All sites recorded during the test excavation have been assessed as having low archaeological significance. Unfortunately, subsurface disturbance in the form of flooding, erosion, and vegetation clearing has disturbed the integrity of all sites, lowering their potential to add to our knowledge of the area.

Aesthetic Value

All sites do not manifest themselves obviously in the landscape and are difficult for the layperson to appreciate, hence, all sites have a low aesthetic value.

Historic Value

The recorded Aboriginal sites do not have any association with important persons, places, or events. Therefore, the sites have no historic values.

Table 3-1: Aboriginal cultural heritage: significance assessment.

AHIMS ID	Site Name	Social or Cultural Value	Archaeological / Scientific Value	Aesthetic Value	Historic Value
21-5-0217	OMPS IF-1	High	Low	Low	None
21-5-0218	OMPS OS-1	High	Low	Low	None
21-5-0219	OMPS OS-2	High	Low	Low	None
21-5-0221	OMPS OS-3	High	Low	Low	None
21-5-0220	OMPS OS-4	High	Low	Low	None

4 ASSESSING HARM

4.1 AVOIDING AND MINIMISING HARM

4.1.1 Conserving significant Aboriginal cultural heritage

An object of the NPW Act is the '*conservation of objects places and features... of cultural value within the landscape, including... places, objects and features of significance to Aboriginal people*' (s.2A(1(b)(i)).

As heritage professionals, OzArk, strives for good conservation outcomes. In particular, OzArk is primarily concerned with the conservation and protection of Aboriginal cultural heritage that is of significance to Aboriginal people.

Two primary objectives when managing harm to an Aboriginal object are:

- Impacts to significant Aboriginal objects and places should always be avoided wherever possible
- Where impacts to Aboriginal objects and places cannot be avoided, proposals should be amended to reduce the extent and severity of impacts to significant Aboriginal objects and places using reasonable and feasible measures.

4.1.2 Opportunities to conserve Aboriginal cultural heritage values

Avoidance of three of the five recorded sites (OMPS OS-1, OMPS IF-1, and OMPS OS-4) will be attempted by the project as they are located outside the design disturbance footprint where impacts will be located. All sites are within the construction envelope where construction activity may occur. The location of all sites in relation to the design disturbance is shown on **Figure 2-6**.

4.2 LIKELY IMPACTS TO ABORIGINAL HERITAGE FROM THE PROJECT

Table 4-1 presents a summary of potential impacts to Aboriginal cultural heritage associated with the proposal.

Table 4-1: Aboriginal cultural heritage: impact assessment.

AHIMS ID	Site Name	Type of Harm (Direct/Indirect / None)	Degree of Harm (Total/Partial / None)	Consequence of Harm (Total/Partial/No Loss of Value)
21-5-0217	OMPS IF-1	Potential	Potential	Will attempt to avoid
21-5-0218	OMPS OS-1	Potential	Potential	Will attempt to avoid
21-5-0219	OMPS OS-2	Direct	Partial	Partial loss of value
21-5-0221	OMPS OS-3	Direct	Whole	Total loss of value
21-5-0220	OMPS OS-4	Potential	Potential	Will attempt to avoid

4.3 ECOLOGICALLY SUSTAINABLE DEVELOPMENT PRINCIPLES

Ecologically sustainable development principles (ESD) (defined in s.6 of the *Protection of the Environment Administration Act 1991*) requires the integration of economic and environmental

considerations (including cultural heritage) in the decision-making process. Regarding Aboriginal cultural heritage, ESD can be achieved by applying the principle of intergenerational equity and the precautionary principle.

4.3.1 Intergenerational equity

Intergenerational equity is the principle whereby the present generation should ensure the health, diversity, and productivity of the environment for the benefit of future generations.

In terms of Aboriginal heritage, intergenerational equity can be considered in terms of the cumulative impacts to Aboriginal objects and places in a region. If few Aboriginal objects and places remain in a region (for example, because of impacts under previous permits), fewer opportunities remain for future generations of Aboriginal people to enjoy the cultural benefits of those Aboriginal objects and places.

Information about the integrity, rarity or representativeness of the Aboriginal objects and places proposed to be impacted, and how they illustrate the occupation and use of land by Aboriginal people across the region, will be relevant to the consideration of intergenerational equity and the understanding of the cumulative impacts of the project.

Where there is uncertainty, the precautionary principle should also be followed.

4.3.2 The precautionary principle

The precautionary principle states that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

In relation to Aboriginal cultural heritage values, the precautionary principle should be applied if:

- The proposal involves a risk of serious or irreversible damage to Aboriginal objects or places or to the value of those objects or places
- There is uncertainty about the Aboriginal cultural heritage values or scientific or archaeological values, including in relation to the integrity, rarity or representativeness of the Aboriginal objects or places proposed to be impacted.

4.3.3 Principle of Integration

The Plan of Implementation of the World Summit on Sustainable Development held in Johannesburg, 2002, noted the need to “*promote the integration of the three components of sustainable development- economic development, social development and environmental protection- as interdependent and mutually reinforcing pillars*”.

The principle of integration ensures mutual respect and reciprocity between economic and environmental considerations:

- Environmental considerations are to be integrated into economic and other development plans, programs, and projects
- Development needs are to be considered in applying environmental objectives.

4.3.4 Applicability to the project

The loss of any Aboriginal cultural values, be physical sites or intangible values, is to be avoided as much as is possible to ensure that the environment impacts of the project are as acceptable as possible. If as many sites as is possible are conserved in the landscape the project will adhere to the ESD principles of ensuring that impacts are minimised and that the Aboriginal cultural heritage values within the project area are maintained or enhanced.

Table 4-2 examines the application of ESD principles to the proposal.

Table 4-2: Application of ESD principles to the proposal.

ESD principle	Response
Avoiding and minimising harm	The project has avoided three of the five identified Aboriginal sites.
The integration principle	The proposal has sought to minimise impacts to Aboriginal cultural heritage wherever possible. Management of unavoidable impacts will ensure that information regarding these sites is maintained.
The precautionary principle	The archaeological assessment has followed the precautionary principle through undertaking a robust impact assessment to ensure that harm to Aboriginal objects is minimised.
The intergenerational equity principle	The archaeological measures and management proposed in this report are designed to mitigate the loss of inter-generational equity as much as possible.

5 MANAGEMENT OF ABORIGINAL CULTURAL HERITAGE SITES

5.1 GENERAL MANAGEMENT PRINCIPLES

Appropriate management of cultural heritage items is primarily determined based on their assessed significance as well as the likely impacts of the project. **Section 3.2** and **Section 4.2** describe, respectively, the significance / potential of the recorded sites and the likely impacts of the project. The following management options are general principles, in terms of best practice and desired outcomes, rather than mitigation measures against individual site disturbance.

- Avoid impact by altering the proposal to avoid impact to a recorded Aboriginal site. If plans are altered, care must be taken to ensure that impacts do not occur to areas not previously assessed
- If impact is unavoidable then approval to disturb sites under the authority of an Aboriginal Cultural Heritage Management Plan (ACHMP) must be sought from NSW Department of Planning, Housing and Infrastructure (DPHI). Normally the management recommendations contained in the ACHAR become policies of the ACHMP. The ACHMP policies will often stipulate that the Aboriginal community should be involved in any salvage activities and will dictate what the fate of any salvaged Aboriginal objects will be.

5.2 MANAGEMENT AND MITIGATION OF RECORDED ABORIGINAL SITES

Impact to two of the five sites (OMPS OS-2 and OMPS OS-3) by the project is unavoidable. OMPS OS-2 will be partially impacted, and OMPS OS-3 will be totally impacted. In accordance with the management and mitigation of impacts to Aboriginal cultural heritage, an ACHMP to permit harm to Aboriginal objects with the design disturbance will be required.

As OMPS OS-2 and OMPS OS-3 are low density artefact scatters and part of OMPS-BS1, and artefact numbers within each TU do not warrant expansion of excavation, no further archaeological investigation is required at either site. However, the northern portion of the site extent of OMPS OS-2 that is outside the design disturbance should be fenced if impact to this portion of the site can be avoided.

Although OMPS OS-1, OMPS OS-4, and OMPS IF-1 are located outside the design disturbance, they are within the construction envelope. The project will attempt to avoid these sites, but if impact in these areas is necessary, no further archaeological investigation is required as all sites are part of OMPS-BS1.

6 RECOMMENDATIONS

Under Section 89A of the NPW Act it is mandatory that all newly recorded Aboriginal sites be registered with AHIMS. As a professional in the field of cultural heritage management it is the responsibility of OzArk to ensure this process is undertaken.

To this end it is noted that five Aboriginal sites were recorded during the assessment.

The findings of this addendum should be integrated into the recommendations of EMM (2023a).

These include:

- 1) A stone artefact background scatter is predicted to occur across the entire construction envelope and extending beyond its limits within which low artefact densities of $\sim 16/m^2$ may be expected (OMPS-BS1), and which includes identified isolated Aboriginal objects (OMPS-IF1 – 32 inclusive, and OMPS IF-1 recorded by OzArk) and low-density artefact scatters (OMPS OS-1 – OS-4 inclusive recorded by OzArk, OMPS-AS2–25, 27–32, 34–35, and 37–42 inclusive). These sites are typically of low significance and reflect the long-term, transient use of the entire landscape by Aboriginal people in the past.
- 2) The foci of activity recorded at Transect 26 TU3, 21-5-0218 (OMPS OS-1), is outside of the design disturbance but is within the construction envelope. Avoidance of this area will be attempted, but if the area is impacted, further archaeological investigation is not required as the small foci is part of the background scatter OMPS-BS1.
- 3) Sites within the design disturbance, 21-5-0219 (OMPS OS-2) and 21-5-0221 (OMPS OS-3) do not require further archaeological investigation as they are part of the background scatter OMPS-BS1.
- 4) If portions of site 21-5-0219 (OMPS OS-2) outside of the design disturbance can be conserved, protection measures should include, but not be limited to, cultural inductions for all personnel and subcontractors outlining their location and significance, fencing and clear marking of heritage sites and zones of interest near proposed works.
- 5) AHIMS Site Recording Forms for the newly identified Aboriginal objects and/or sites within the Project area and areas of archaeological sensitivity should be submitted to the AHIMS database once their validation has been completed.
- 6) A copy of the addendum ACHA should be lodged with AHIMS and provided to each of the RAPs.

REFERENCES

- DECCW 2010a *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*. Department of Environment, Climate Change and Water. 2010.
- DECCW 2010b *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*. Department of Environment, Climate Change and Water. 2010.
- EMM 2023a EMM Consulting. 2023. *Aboriginal Cultural Heritage Assessment Report: Oven Mountain Pumped Hydro Energy Storage*. Report for OMPS.
- EMM2023b EMM Consulting. 2023. *Project information and assessment methods – Aboriginal Cultural Heritage – Oven Mountain Pumped Hydro Energy Storage Project*. Report for OMPS.
- OEH 2011 *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW*. Office of Environment and Heritage. 2011.

APPENDIX 1: AHIMS

AHIMS Web Services (AWS)										Your Ref/FOI Number - Oven Mount Client Service ID: 795316	
Extensive search - Site list report											
SiteID	SiteName	Datum	Zone	Eastings	Northings	Context	Site Status **	SiteFeatures	SiteTypes	Remarks	
21-5-0162	OMPS-FA4	GDA	56	419000	6593165	Open site	Valid	Aboriginal Resource and Gathering: -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0129	KR-C-5 (Carra)	AGD	56	417950	6590100	Open site	Valid	Habitation Structure :-			
	Contact		Recorders	Jim Nelson				Permits			
21-5-0071	KR-C-1 (Carra)	AGD	56	417950	6590100	Open site	Valid	Habitation Structure :-			
	Contact		Recorders	Central West Archaeological and Heritage Services Pty Ltd				Permits			
21-5-0147	OMPS-FA8	GDA	56	421111	6593852	Open site	Valid	Aboriginal Resource and Gathering: - Artefact: -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0169	OMPS-FA10	GDA	56	421864	6594845	Open site	Valid	Aboriginal Resource and Gathering: - Artefact: -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0176	OMPS-ST23	GDA	56	421929	6591569	Open site	Valid	Modified Tree (Carved or Scarred): -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0207	OMPS-SA1	GDA	56	419761	6593223	Open site	Valid	Stone Arrangement: -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0113	East Runderang Homestead Water Pipeline Artefact 1	AGD	56	418175	6590250	Open site	Valid	Artefact: 2			
	Contact		Recorders	Mr Bruce Cohen				Permits			
21-5-0160	OMPS-FA5	GDA	56	420017	6590001	Open site	Valid	Aboriginal Resource and Gathering: -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0164	OMPS-FA1	GDA	56	420081	6590916	Open site	Valid	Aboriginal Resource and Gathering: -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0159	OMPS-R2	GDA	56	420584	6592303	Closed site	Valid	Habitation Structure :-			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0175	OMPS-ST21	GDA	56	421583	6591502	Open site	Valid	Modified Tree (Carved or Scarred): -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0173	OMPS-ST20	GDA	56	421992	6591097	Open site	Valid	Modified Tree (Carved or Scarred): -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			

Report generated by AHIMS Web Service on 27/06/2023 for Brendan Fisher for the following area at Datum :GDA, Zone: 56, Eastings: 414907.0 -424907.0, Northings: 6596860.0 - 6596860.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 47
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Page 1 of 4

AHIMS Web Services (AWS)										Your Ref/FOI Number - Oven Mount Client Service ID: 795316	
Extensive search - Site list report											
SiteID	SiteName	Datum	Zone	Eastings	Northings	Context	Site Status **	SiteFeatures	SiteTypes	Remarks	
21-5-0066	ME-RS-1	AGD	56	419000	6590400	Open site	Valid	Burial: -	Burial/s		
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0041	Runderang East site	AGD	56	418200	6590300	Open site	Valid	Artefact: -	Open Camp Site		
	Contact		Recorders	Central West Archaeological and Heritage Services Pty Ltd				Permits			
21-5-0115	East Runderang Homestead Water Pipeline Artefact 3	AGD	56	418205	6590452	Open site	Valid	Artefact: 2			
	Contact		Recorders	Mr Bruce Cohen				Permits			
21-5-0160	OMPS-SA2	GDA	56	421127	6594513	Open site	Valid	Stone Arrangement: -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0172	OMPS-ST19	GDA	56	422003	6591722	Open site	Valid	Modified Tree (Carved or Scarred): -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0116	East Runderang Homestead Water Pipeline Artefact 4	AGD	56	418191	6589955	Open site	Valid	Artefact: 2			
	Contact		Recorders	Mr Bruce Cohen				Permits			
21-5-0160	OMPS-SA6	GDA	56	421263	6591976	Open site	Valid	Stone Arrangement: -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0161	OMPS-SA4	GDA	56	421924	6591738	Open site	Valid	Stone Arrangement: -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0003	Oven Mounthole	AGD	56	423000	6590000	Open site	Valid	Aboriginal Ceremony and Dreaming: -	Aboriginal (Mystical Ritual)		
	Contact		Recorders	Ray Kelly, Mr. Bernard Robly				Permits			
21-5-0161	OMPS-PA5	GDA	56	419969	6593854	Open site	Valid	Aboriginal Resource and Gathering: -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			
21-5-0130	KR-C-6 (Carra)	AGD	56	417950	6590100	Open site	Valid	Habitation Structure :-			
	Contact		Recorders	Jim Nelson				Permits			
21-5-0120	East Runderang Water pipeline Artefact 5	AGD	56	418200	6589933	Open site	Valid	Artefact: 2			
	Contact		Recorders	Mr Bruce Cohen				Permits			
21-5-0114	East Runderang Homestead Water Pipeline Artefact 2	AGD	56	418112	6589990	Open site	Valid	Artefact: 2			
	Contact		Recorders	Mr Bruce Cohen				Permits			
21-5-0177	OMPS-ST28	GDA	56	421953	6592257	Open site	Valid	Modified Tree (Carved or Scarred): -			
	Contact		Recorders	AHIMS APP Users, Miss. Robani Dutch				Permits			

Report generated by AHIMS Web Service on 27/06/2023 for Brendan Fisher for the following area at Datum :GDA, Zone: 56, Eastings: 414907.0 -424907.0, Northings: 6596860.0 - 6596860.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 47
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Page 2 of 4



AHIMS Web Services (AWS)
Extensive search - Site list report

Your Ref/EOI Number : Oven Mount
Client Service ID : 795316

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Remarks
21-5-0120	OMPS-AB01 Contact	GDA	56	419363	6590070	Open site	Valid	Artefact:-		
	Contact	Recorders	AHIMS APP Users,Miss.Robani Dutch							
21-5-0127	KE-C-3 (Corral) Contact	AGD	56	417950	6590100	Open site	Valid	Habitation Structure		
	Contact	Recorders	Jim Kelton							
21-5-0123	Restriction applied. Please contact ahims@environment.nsw.gov.au. Contact					Open site	Valid			
	Contact	Recorders	Mr Bruce Cohen							
21-5-0119	East Kunderang Waterank Artefact 1 Contact	AGD	56	418175	6589960	Open site	Valid	Artefact: 5		
	Contact	Recorders	Mr Bruce Cohen							
21-5-0264	OMPS-Q1 Contact	GDA	56	418799	6591493	Open site	Valid	Stone Quarry		
	Contact	Recorders	AHIMS APP Users,Miss.Robani Dutch							
21-5-0163	OMPS-FA2 Contact	GDA	56	419319	6592868	Open site	Valid	Aboriginal Resource and Gathering :-		
	Contact	Recorders	AHIMS APP Users,Miss.Robani Dutch							
21-5-0165	OMPS-FA6 Contact	GDA	56	420386	6593522	Open site	Valid	Aboriginal Resource and Gathering :-		
	Contact	Recorders	AHIMS APP Users,Miss.Robani Dutch							
21-5-0199	OMPS-G01 Contact	GDA	56	419632	6591634	Open site	Valid	Grinding Groove:-		
	Contact	Recorders	AHIMS APP Users,Miss.Robani Dutch							
21-5-0120	KB0C-4 (Corral) Contact	AGD	56	417950	6590100	Open site	Valid	Habitation Structure :-		
	Contact	Recorders	Jim Kelton							
21-5-0118	East Kunderang Homestead Artefact 3 Contact	AGD	56	418071	6590281	Open site	Valid	Artefact: 2		
	Contact	Recorders	Mr Bruce Cohen							
21-5-0117	East Kunderang Homestead Artefact 2 Contact	AGD	56	418098	6590279	Open site	Valid	Artefact: 1		
	Contact	Recorders	Mr Bruce Cohen							
21-5-0126	KE-C-2 (Corral) Contact	AGD	56	418290	6589990	Open site	Valid	Habitation Structure :-		
	Contact	Recorders	Jim Kelton							
21-5-0168	OMPS-FA9 Contact	GDA	56	421050	6593936	Open site	Valid	Aboriginal Resource and Gathering :-		
	Contact	Recorders	AHIMS APP Users,Miss.Robani Dutch							
21-5-0192	OMPS-SA5 Contact	GDA	56	421817	6592279	Open site	Valid	Stone Arrangement :-		
	Contact	Recorders	AHIMS APP Users,Miss.Robani Dutch							
21-5-0093	Georges Creek Contact	AGD	56	433770	6596230	Open site	Valid	Aboriginal Ceremony and Dreaming :-	Natural Mythological (Ritual)	1160,1191

Report generated by AHIMS Web Service on 27/06/2023 for Brendan Fisher for the following area at Datum :GDA, Zone : 56, Eastings : 414907.0 - 424907.0, Northings : 6586860.0 - 6596860.0 with a Buffer of 0 meters. Number of Aboriginal sites and Aboriginal objects found is 47

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AHIMS Web Services (AWS)
Extensive search - Site list report

Your Ref/EOI Number : Oven Mount
Client Service ID : 795316

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Remarks
21-5-0184	OMPS-ST01 Contact	GDA	56	422913	6596681	Open site	Valid	Modified Time (Carved or Scarred) :-		
	Contact	Recorders	AHIMS APP Users,Miss.Robani Dutch							
21-5-0005	Restriction applied. Please contact ahims@environment.nsw.gov.au. Contact					Open site	Valid			1027M
	Contact	Recorders	Unknown Airline							
21-5-0011	Kunderang Station,Oven Mountain; Contact	AGD	56	419000	6590700	Open site	Valid	Stone Arrangement:-	Stone Arrangement	
	Contact	Recorders	Glen Mervin							
21-5-0265	OMPS-Q2 Contact	GDA	56	419309	6591441	Open site	Valid	Stone Quarry		
	Contact	Recorders	AHIMS APP Users,Miss.Robani Dutch							
21-5-0158	OMPS-R1 Contact	GDA	56	420649	6592257	Closed site	Valid	Habitation Structure :-		
	Contact	Recorders	AHIMS APP Users,Miss.Robani Dutch							

**** Site Status**

Valid - The site has been recorded and accepted into the system's valid.

Destroyed - The site has been completely impacted or harmed usually as a consequence of permit activity but sometimes also after natural events. There is nothing left of the site on the ground (the components should proceed with caution).

Partially Destroyed - The site has been only partially impacted or harmed usually as a consequence of permit activity but sometimes also after natural events. There might be parts or sections of the original site still present on the ground.

Not a site - The site has been originally entered into (accepted into) AHIMS as a valid site but after further investigations it was deemed it is NOT an Aboriginal site. Impact of this type of site does not require permit but Heritage NSW should be notified.

Report generated by AHIMS Web Service on 27/06/2023 for Brendan Fisher for the following area at Datum :GDA, Zone : 56, Eastings : 414907.0 - 424907.0, Northings : 6586860.0 - 6596860.0 with a Buffer of 0 meters. Number of Aboriginal sites and Aboriginal objects found is 47

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APPENDIX 2: TEST EXCAVATION METHODOLOGY (EMM 2023B)

12 November 2021



Ground floor, 20 Chandos Street
 St Leonards NSW 2065
 PO Box 21
 St Leonards NSW 1590
 T 02 9493 9500
 E info@emmconsulting.com.au
www.emmconsulting.com.au

Re: Project information and assessment methods - Aboriginal Cultural Heritage - Oven Mountain Pumped Hydro Energy Storage Project, Armidale Regional LGA, NSW

1 Introduction

Thank you for registering your interest as a registered Aboriginal party (RAP) for the Oven Mountain Pumped Hydro Energy Storage Project (the project), Armidale Regional LGA, NSW (Figure 1). OMPS Pty Ltd (OMPS) propose to develop a pumped hydro energy storage project, a scheme that will provide 600 megawatts (MW) of electricity generating capacity and up to 12 hours of energy storage. The project is off-Macleay River at Oven Mountain, Armidale Regional LGA (Lots 18, 19 and 37, DP 756471) (Figure 2). EMM Consulting Pty Ltd (EMM) is undertaking an Aboriginal cultural heritage assessment (ACHA) to identify the Aboriginal cultural heritage values relevant to the project area, and support OMPS Pty Ltd to avoid and minimise impacts to these values as a result of the project.

The project is identified as Critical State Significant Infrastructure (CSSI, SSI-12422997) under the provisions of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). A CSSI project requires approval from the NSW Minister for Planning and Public Spaces and is accompanied by an environmental impact statement (EIS). The assessment of Aboriginal cultural heritage will be one of several investigations included in the EIS. However, it should be noted that CSSI projects do not require separate approvals under the *National Parks and Wildlife Act 1974* (eg Aboriginal heritage impact permits), rather any subsequent requirements for heritage are managed in accordance with the conditions of approval, provided by the Minister.

This document is provided in accordance with sections 4.2 and 4.3 of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010), which sets out the Aboriginal consultation requirements for the project.

The aims of this letter are to:

- provide an overview of the project and how it will be assessed;
- provide background on the project and some of the initial desktop investigations to date;
- establish the purpose and aims of the Aboriginal consultation process;
- seek information about any Aboriginal cultural heritage values associated with the project and how they may affect, inform or refine the project and/or assessment methods;
- seek information on any cultural activities (such as fishing and hunting) that have historically and/or is actively being undertaken in the project area;

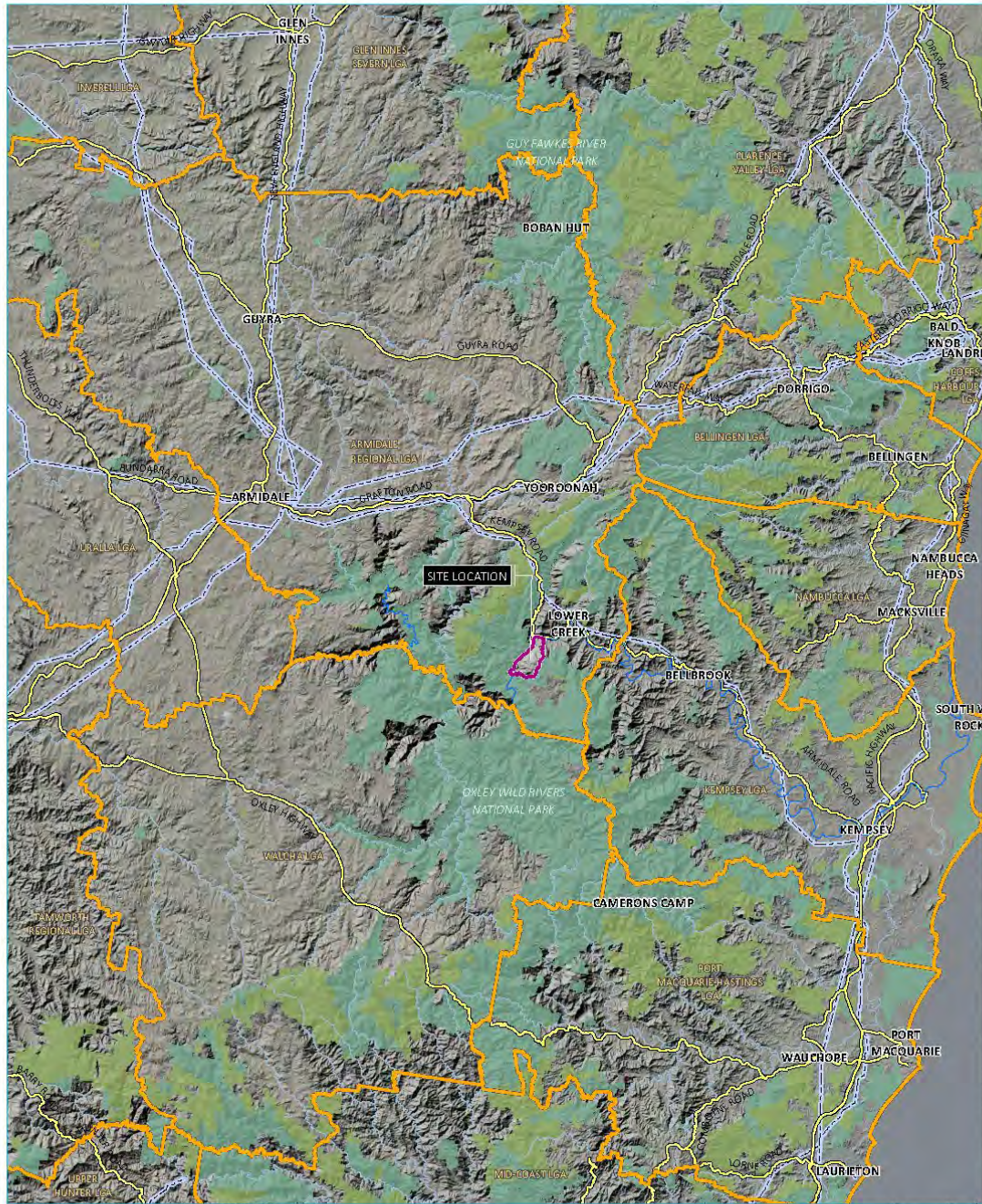
- identify any culturally appropriate protocols that registered parties wish to be adopted during the information gathering process (eg protocols during field survey, or handling of culturally sensitive information); and
- present a draft of the intended assessment methods for your review and comment.

We welcome your feedback at your earliest convenience and will be consulting with RAPs for the duration of the ACHA, currently proposed to extend into mid-2022. However, for the purposes of this initial stage and in accordance with the Heritage NSW guidelines, we request any written response on the information and process below by **10 December 2021**.

OMPS and EMM propose to hold an Aboriginal focus group meeting with RAPs during this first 28 day review period to expand on the information provided in this letter, gather any RAP feedback about the project and assessment methods, and to gather any cultural information that knowledge holders wish to share at this stage. We will be in contact shortly with further details about the meeting.

For reference, the proponent contact is: Anthony Melov and/or Jeremy Moon, Directors (A: PO Box 1071, North Sydney NSW 2060; T: 0426 235 089; E: info@ompshydro.com).

EMM is working on the proponent's behalf, and all queries should be directed through EMM. Feedback can be provided to Georgia Burnett (A: Ground Floor, 20 Chandos Street, St Leonards, NSW 2065; T:02 9493 9500; E: gburnett@emmconsulting.com.au).



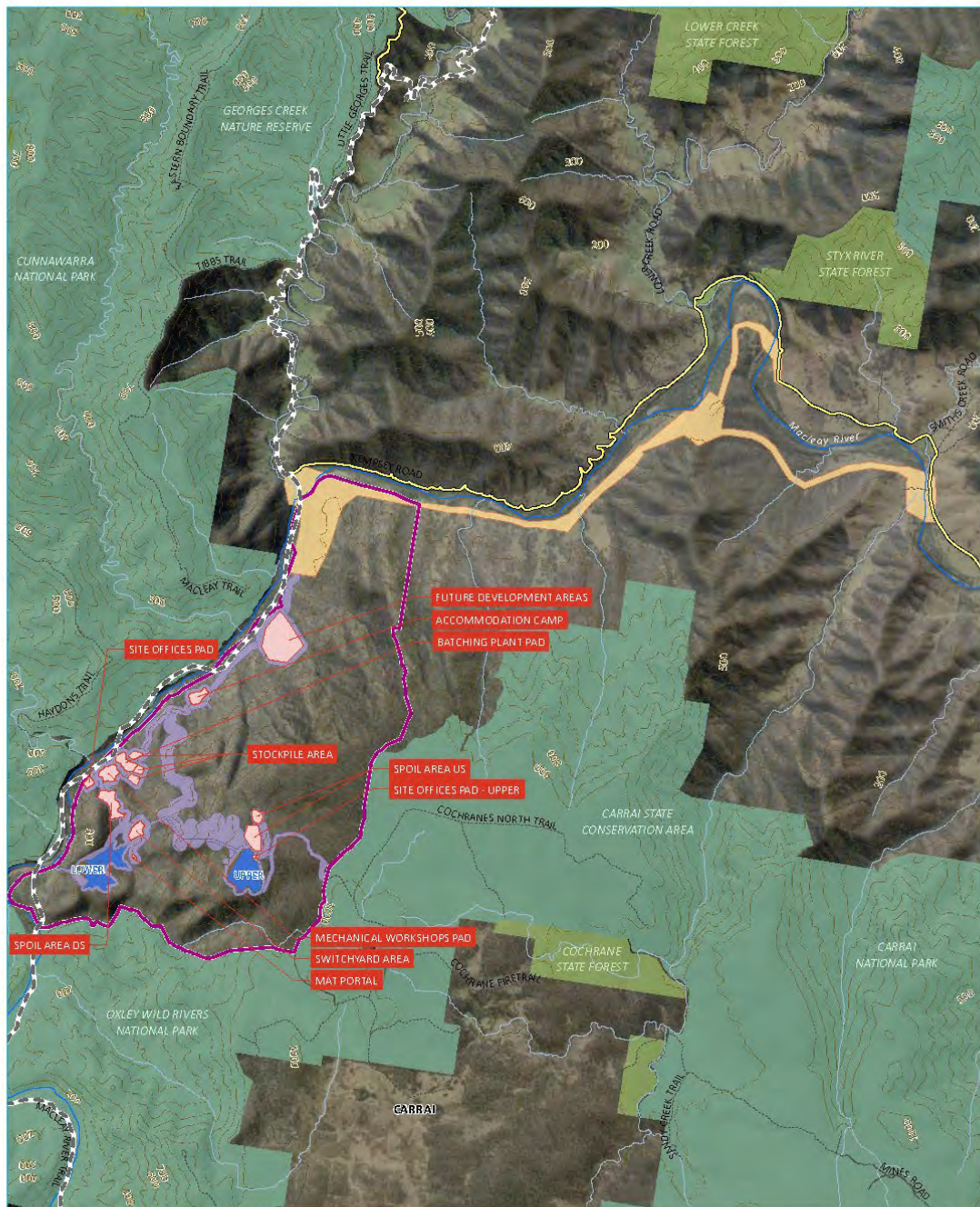
Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

- KEY**
- Project boundary
 - Existing environment
 - Macleay River
 - Transmission line
 - Watercourse/drainage line
 - Major road
 - NPWS reserve
 - State forest
 - Local government area

Regional location

Oven Mountain Pumped Storage: Generation
 Presentation of project information and
 proposed Aboriginal heritage assessment methods
 OMPS Pty Ltd
 Figure 1





Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

KEY

- | | |
|------------------------------------|------------------------------------|
| Construction envelope | Existing environment |
| Access options under investigation | Macleay River |
| Indicative surface areas | Bicentennial National Trail |
| Project boundary | Watercourse/drainage line |
| Indicative water storage locations | 100 m contour (derived from LiDAR) |
| Dam | Road |
| Reservoir | Vehicular trail |
| | NPWS reserve |
| | State forest |

Overview of the project elements

Oven Mountain Pumped Storage: Generation
 Presentation of project information and
 proposed Aboriginal heritage assessment methods
 OMPs Pty Ltd
 Figure 2



2 Project information

2.1 Project overview

The Oven Mountain Pumped Hydro Energy Storage Project (the "Project") comprises of a pumped storage hydropower plant capable of generating at least 600 MW of electricity over a storage period of up to 12 hours (Plate 3.1). The Project will connect to the proposed New England Renewable Energy Zone and will facilitate the transition of the NSW electricity mix as aging coal-fired power stations are closed.

The Project will include upper and lower water reservoirs constructed on an ephemeral tributary of the Macleay River and will operate as a closed-loop circuit. An underground power station will be connected to the reservoirs by power waterways or tunnels.

Water access from the Macleay River will be required for an initial, one-off fill of the reservoirs and minimal top-up will be required thereafter. The initial fill will occur during high flow periods only and in a manner which does not compete against downstream water uses.

Once constructed, operation of the Project will involve the generation of hydroelectricity when water is transferred through underground tunnels from the upper reservoir, through turbines in the proposed underground power station, and transferred to the lower reservoir. The Project will allow water to be pumped back to the upper reservoir so it can be used again. Being 'off river' or a 'closed loop' scheme means that once filled, the Project have little annual water needs over an operational life in excess of 50 years.

The Project intends to connect at or near the Armidale substation on TransGrid's high voltage transmission backbone which extends from the Queensland-NSW Interconnector (QNI) down to the Hunter Valley. Upgrades to existing, nearby TransGrid transmission assets back to Armidale are required. The transmission works will be assessed under a separate EIS application.

2.2 Site elements

The Table 1.1 outlines the key project elements associated with the generation works and should be read in conjunction with the provided Figure 2.

The permanent components of the Project are those that are required to remain post completion of the construction period to support the on-going operation and maintenance of the new power station.

The temporary components are the elements that a required to support the construction efforts and will be decommissioned and rehabilitated post Project completion.

The design of the Project's elements is still progressing, and therefore the team has adopted a methodology for assessment that allows flexibility for design changes throughout the approval and design processes. Figure 2 show the "Construction envelope" for the Project, which allows for flexibility to move elements within the buffer throughout the process. The physical disturbance that occurs as a result of the Project will be significantly smaller than the construction envelope that is shown.

Table 1.1 Project key elements

Project component	Description
Key project elements – permanent operational infrastructure	<ul style="list-style-type: none"> • an underground pumped hydro-electric power station complex, comprising of a main cavern, transformer hall and connecting tunnels; • lower reservoir, including a dam wall, spillway, and associated infrastructure; • upper reservoir, including a dam wall, spillway, and associated infrastructure; • intake structures, gates, trash racks and associated buildings at each reservoir; • power waterway tunnels, chambers, and shafts to convey water between the two reservoirs; • access tunnels and associated portals, comprising of a Main Access Tunnel (MAT) and an Emergency Cable and Ventilation Tunnel (ECVT); • new and upgraded roads and bridge(s) required to perform maintenance and operational activities across the site; • switchyard used to facilitate the connection to the electricity grid; • water pumping plant and infrastructure to allow for on-going water supply required during operations; • spoil stockpiles to store material excavated from the tunnels and power station complex, to be rehabilitated at the end of the project; and • utilities including power, water and communication required as part of operation of the new power station.
Key project elements – temporary construction infrastructure. The following elements and activities are required to support the construction of the new power station, and include:	<ul style="list-style-type: none"> • construction water infrastructure and supply including: <ul style="list-style-type: none"> – temporary water storages such as a turkey's nest or similar for construction water supply; – pump station, pipes and tanks required to facilitate water supply from the Macleay River; and – water bores and temporary storage across the site. • Excavations or borrow pits within the footprints of both reservoirs to obtain materials for construction of the dam walls; • various level pads across the project site to support temporary construction infrastructure including: <ul style="list-style-type: none"> – site offices on the lower and upper sides of the Project; – mechanical workshops; – an onsite batching plant; – stockpile areas for stockpiling of materials; – an on-site accommodation camp for at least 600 personnel; and – a lay-down area for receipt and storage of materials and plant delivered to site. • establishment of temporary drainage structures to manage surface flows through the construction period, including sediment basins, culverts and new drainage lines. • emergency infrastructure, including: <ul style="list-style-type: none"> – helicopter access; and – water tanks for fire control. • temporary utilities to support construction activities. These may include: <ul style="list-style-type: none"> – water supply infrastructure; – communications towers, lines and cables; – waste and wastewater management; and – power supply, upgrades to existing overhead lines and diesel generator. • Rehabilitation works required at the conclusion of the construction period.

2.3 Site access

Options for establishing access to the Project site are currently being investigated. Several options for accessing the site from the Kempsey-Armidale Road have been identified and the feasibility and impacts of each potential route are being assessed.

Figure 2 highlights the area that is being considered to establish access to the site, shown as the orange layer labelled as "Access options under investigation". The same construction envelope methodology will be applied for the access road options. The final disturbance footprint will be significantly smaller than the area that is currently shown.

2.4 Bicentennial Trail (BNT)

One of the key considerations included for the design to date has been to ensure that impacts or overlap with the Bicentennial Trail is avoided. The project has designated the BNT as a no-go area and potential impacts are to be avoided as much as possible.



Plate 3.1 Artistic interpretation of the upper and lower reservoirs.

2.5 Previous investigations

A desktop overview of Aboriginal heritage and the potential for cultural material to be present in the project area was undertaken as part of the scoping study – the document lodged in January 2021 with DPIE to inform the requirements of the EIS. This study was a desktop investigation, including a preliminary review of select previous investigations and the consideration of key environmental landforms to identify areas of archaeological interest.¹ The study resulted in the following preliminary findings:

Certain landforms are considered to have higher archaeological potential including areas within 200 m of water, raised flat areas near water, hill crest and sand bodies. The existing AHIMS data indicates that previous studies have been undertaken on the western side of the Macleay River and identified a concentration of artefact sites associated with the confluence of the river and high order creeks. A ceremonial site and a stone arrangement are registered on the eastern side of the river, though neither

¹ EMM Consulting Pty Ltd 2021, *Oven Mountain Pumped Hydro Energy Storage Project: Scoping Report*, prepared for OMPS Pty Ltd.

are within the project area. The landforms and environmental context indicate that sites are likely to be present along the gently sloping lower slopes and banks of the Macleay River, in the form of open artefact scatters. Burials are unlikely within the project area due to the shallow soils, however where deep sandy soils are identified, the potential for burials would be increased. Additional sites may be present on the upper slopes and the plateau where appropriate outcrops of stone may have provided shelter, or where previously unrecorded cultural sites are present.

The scoping study concluded that the following site types may be present within the project area:

- presence of open artefact sites and archaeological deposits along lower slopes and banks of Macleay River;
- presence of rock shelters, low density artefact sites on upper slopes and plateau; and,
- presence of cultural sites (intangible and tangible) throughout the landscape, which can be determined only by local Aboriginal knowledge holders.

Following these findings, EMM is now undertaking a more extensive investigation of the Aboriginal heritage values of the project area, including consultation with and participation of RAPs. Our investigations will broadly follow Heritage NSW guidelines, as outlined in Section 4 of this letter.

3 Registered Aboriginal parties

The *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010) has been followed to identify RAPs. Following the notification process undertaken between 30 September–15 October 2021, the following 14 Aboriginal parties have registered their interest in being consulted for the project:

- Thungguti Local Aboriginal Lands Council;
- Three Ducks Dreaming;
- Dunghutti Elders Council;
- Murrabidgee Mullangari;
- Muragadi;
- Merrigarn;
- Nunawanna Aboriginal Corporation;
- AT Gomilaroi Cultural Consultancy;
- Iwatta Aboriginal Corporation;
- DFTV Enterprises;
- Bruce Cohen;
- Gomeroi Traditional Owners;
- Patricia Hampton; and
- Gumaraa Aboriginal Experience Pty Ltd.

The roles, functions and responsibilities of all parties involved in the consultation process are outlined in Table 2. The information and feedback relevant to this project assessment we are currently requesting from RAPs is detailed in Section 5 of this letter.

Table 2 Roles, functions and responsibilities

Stakeholder	Roles and responsibilities
RAPs	<ul style="list-style-type: none"> • Provide cultural perspectives, views, knowledge and advice to EMM. • Indicate areas of cultural significance. • Provide Aboriginal sites representatives for archaeological fieldwork (if desired and suitably qualified and insured). • Have an awareness and understanding of the commercial environment and constraints in which the proponent operates. • Demonstrate awareness and understanding of the opportunities to provide input into the ACHA and management recommendations. • Identify, raise, and discuss cultural concerns, perspectives and assessment requirements (if any)
EMM (on behalf of OMPS)	<ul style="list-style-type: none"> • Undertake the ACHA, including coordinating and directing the fieldwork. • Facilitate the Aboriginal consultation process. • Consider the cultural perspectives, views, knowledge and advice of the RAPs in assessing cultural significance and developing management measures. • Provide clear management measures that comply with relevant legislation, guidelines and significance.
All stakeholders	<ul style="list-style-type: none"> • Mutual respect (each person has the right to have a say and be heard) • Communicate in a professional manner.

4 Draft assessment methodology

4.1 Assessment requirements

The purpose of the ACHA is to identify, assess and manage the Aboriginal heritage values related to the project area, specifically those that are at risk of being impacted. The assessment will be developed in response to Secretary's Environmental Assessment Requirements (SEARs) issued by DPIE, which will outline the investigative requirements for Aboriginal heritage. The following assessment requirements for heritage have been identified in the SEARs:

- assess the impact to Aboriginal cultural heritage items (archaeological and cultural) in accordance with the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) and the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010);
- provide evidence of consultation with Aboriginal communities in determining and assessing impacts, developing options and selecting options and mitigation measures (including the final proposed measures), having regard to the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010); and,
- assess the impact to historic heritage (including East Kunderang Homestead) having regard to the NSW Heritage Manual.

The final item will be excluded from the ACHA and addressed in EMM's historical heritage assessment, which will also assess the project's potential impacts on the listed values of the World Heritage listing (Gondwana Rainforests of Australia), particularly regarding potential impacts on the diversity or composition of plant and animal species. Please note, the World Heritage listing significance criteria relates to biological, ecological and geological significance criteria, and does not include criteria relating to Aboriginal heritage significance and therefore will not be addressed in the ACHA.

With the above in mind, the ACHA will be developed in broad accordance with the following guidelines:

- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (DECCW 2010);
- *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010); and,
- *Aboriginal Consultation Requirements for Proponents 2010* (DECCW 2010).

4.2 Methodology overview

The purpose of the assessment is to identify and manage the Aboriginal cultural heritage values of all areas that will be affected by the study. In summary, this will involve:

- consultation with RAPs to identify socio-cultural values of the project area and places of special significance that should be considered;
- a search of the AHIMS register for records of previously registered Aboriginal sites;
- a review of past Aboriginal heritage reports covering the project area;
- environmental landscape analysis to identify past Aboriginal resources and suitable occupation areas;
- synthesis of background research to develop a predictive model of Aboriginal site location;
- field investigation to validate the findings of the desktop and identify any previously undocumented cultural material. This would include surface inspection and may extend to test excavations of areas of archaeological interest (refer Section 4.3);
- an assessment of significance for Aboriginal cultural heritage values in the project area (with input from the registered Aboriginal stakeholders);
- an impact assessment of how the project will affect Aboriginal cultural heritage values in the project area; and
- development of management recommendations based on the results of the assessment and input from RAPs during the consultation process and particularly from the draft ACHA review period.

4.3 Field investigation

4.3.1 Field survey

EMM propose to conduct an archaeological field survey of the project area with the assistance of RAP representatives. It is anticipated that the survey will take approximately two weeks, but the timeframe may be refined based on developments in project design and layout.

The primary aims of the survey will be to:

- identify Aboriginal sites or potential Aboriginal places with the assistance of Aboriginal knowledge holders;
- characterise the landscape to aid predictions of surface and sub-surface archaeological potential;
- identify areas that may require further investigation if planned for development;
- identify areas that should be avoided by project construction where possible; and
- identify areas with minor or no heritage constraints that are suitable for development.

Survey of the project area would be undertaken to identify any extant Aboriginal objects or sites. Surface investigation will consist of the survey team evenly spaced walking transects across accessible parts of the project area. At present, the investigation area for the construction footprint as specified in Figure 2 will be the areas of focus for the archaeological survey, and as the layout of project elements is refined, the survey plan will be revised to target those areas.

The focus of the team will be to both investigate ground exposures, trees and landscape features for Aboriginal objects and identify landforms that have potential for cultural material to be present (either surface or subsurface). Given the large size of the project area, and the fact much of the escarpment between the Carrai Plateau and the Macleay River valley is too steep and hazardous to be safely surveyed, it will not be possible to survey the whole project area. As such, representative samples of each landform element type within the project area will be surveyed and information gathered to characterise the archaeology, or its potential, of the project area. The weighting of the survey effort will be geared towards areas of high archaeological sensitivity, with a smaller portion allocated to areas with low or negligible potential. All Aboriginal objects and/or landforms of interest would be mapped and documented using hand-held GPS, photographs, sketches and written description.

The survey will be undertaken using the following general methodology:

- pedestrian survey;
- survey and recording according to landform element units and/or other changes in landscape characteristics.
- recording of beginning and end points of transects or the boundaries of survey units, and the spacing between survey personnel;
- recording of landform, soil information, land surface, vegetation conditions, visibility and exposure, and survey coverage;
- recording of any identified Aboriginal sites identified according to Requirements 6-8, and recording of any identified Aboriginal objects in accordance with Requirements 18-24 of the Code of Practice; and
- if any Aboriginal objects and/or sites are identified in the course of the survey, site cards will be completed and submitted to the AHIMS registrar.

4.3.2 Test excavations

EMM will aim to update RAPs shortly after the archaeological survey if test excavation is required for the project. If test excavations are required to further characterise the archaeological resource of an area identified in the survey, they would be implemented shortly following the survey, in accordance with the Code of Practice. Specifically, they would include the following activities:

- all test excavation pits would be spatially located using a differential GPS device, which would also provide elevation data;
- manual excavation of 0.25 m² test pits in a systematic grid across areas of archaeological interest within the impact footprint. The spatial resolution of the grid would be dependent on on-ground conditions, but would likely have test pits between 20-50 m apart;
- all excavation would use hand tools. Excavation of the first unit would be in 5 cm spits, with subsequent excavation allowed in 10 cm spits or according to stratigraphy (whichever is smallest) depending on the results of the first unit. Manual excavation would continue to either: i) the base of the cultural deposits; ii) to the depth of the underlying geology; or iii) to the maximum depth possible via hand excavation (likely ~ 80 cm).
- sieving of all manually excavated material through a 5 mm sieve;
- reduced levels of the top and bottom of the test pit would be documented using a dumpy level against a known elevation. Other levels may be taken as required;
- soil profiles would be recorded in accordance with the Code of Practice, including scaled drawings, photographs, and written descriptions;
- soil samples may be collected for description, sedimentological and chronological analysis where such analysis is considered likely to contribute significant information; and
- excavation procedures and protocols may be modified at the discretion of the Excavation Director, in consultation with the Aboriginal stakeholders and the proponent as the conditions in the field and nature of the excavations develop. This includes the movement of test pits to avoid existing built structures, buried services and disturbances not identified during the desktop phase.

4.4 Timeframes

The following indicative timeframes for the works would apply (noting these will be subject to test excavation requirements, and may change depending on health advice relating to COVID-19):

- distribution of this document to the registered Aboriginal stakeholders: **12 November 2021**;
- field investigation of the project area: January to February 2022;
- distribution of the draft report: May 2022;
- input of RAP feedback into recommendations and review of draft report: June 2022; and
- report finalisation: late June 2022.

5 What we need from you

In addition to the archaeological evidence described above, Aboriginal heritage incorporates a wide range of values such as stories, traditions and cultural practices. EMM welcomes advice from the Aboriginal community about cultural values (which might include archaeological sites or other types of values) relevant to the project area and its surrounds. EMM is relying on the Aboriginal community for advice on non-archaeological and intangible Aboriginal values for the project area. We are happy to discuss any information which you are willing to share and will respect confidentiality where requested.

EMM would appreciate your feedback on the above methodology proposed for the investigation and assessment of the project area. In responding, please also consider the following questions:

- Are there any other knowledge-holders or traditional owner groups we should be contacting to obtain cultural information on this area?
- Are there any protocols in relation to community interaction and/or cultural heritage that you would like adopted during the project?
- Are you aware of any Aboriginal objects, places, sites or stories of cultural significance and/or importance that you are aware of within the project area? If so, please advise us how you wish them to be dealt with during the project.
- Are you aware of any past or current fishing and hunting activities within the project area? Do you have any views on how these should be managed into the future?
- Is the information you are providing sensitive, gender specific, etc? If so, how would you like the information you provide to EMM to be managed? Noting that some documentation for the ACHA process will be required.
- Do you require any further information prior to EMM proceeding with the project?

In your response, can you please also clearly identify who you would like EMM to talk to within your organisation, and provide contact details for these individuals. Please also ensure your preferred method of communication (eg telephone call, e-mail, letter, etc) is highlighted for subsequent stages of the project.

6 Closing

We look forward to receiving any response your organisation wishes to make about the proposed method by **10 December 2021**. Your response will be documented and considered in the assessment. Most importantly, your cultural information is also welcome within this timeframe; but it can also be submitted up until the completion of the draft ACHA.







Please feel free to contact me with any questions.
















Yours sincerely




Georgia Burnett
Archaeologist
gburnett@emmconsulting.com.au

APPENDIX 3: PHOTOGRAPH CATALOGUE (TEST EXCAVATION PROGRAM)

		
Transect 24 TU 1 pit overview.	Transect 24 TU 2 pit overview.	View east across Transect 24 TU 1.
		
Transect 25 TU 1 pit overview.	Transect 25 TU 2 pit overview.	Transect 25 TU 3 pit overview.
		
Transect 26 TU 1 pit overview.	Transect 26 TU 2 pit overview.	Transect 26 TU 3 pit overview.
		
Transect 27 TU 1 pit overview.	Transect 27 TU 2 pit overview.	View across transect 27 TU 2.
		
Transect 28 TU 1 pit overview.	Transect 28 TU 2 pit overview.	Transect 28 TU 3 pit overview.

		
Transect 28 TU 4 pit overview.	Transect 28 TU 5 pit overview.	View south across Transect 28 TU 5.
		
Transect 28 TU 6 pit overview.	Transect 28 TU 7 pit overview.	View west across Transect 28 TU 7.
		
Transect 29 TU 1 pit overview.	Transect 29 TU 2 pit overview.	Transect 29 TU 3 pit overview.
		
Transect 30 TU 1 pit overview.	View south across Transect 30 TU 1.	Transect 30 TU 2 pit overview.
		
Transect 31 TU 1 pit overview.	Transect 31 TU 2 pit overview.	Transect 31 TU 3 pit overview.

		
<p>Transect 32 TU 1 pit overview.</p>	<p>Transect 32 TU 2 pit overview.</p>	<p>View across Transect 32 TU 2.</p>
		
<p>Transect 33 TU 1 pit overview.</p>	<p>View of northern profile at Transect 33 TU 1.</p>	<p>View north across Transect 33 TU 1.</p>
		
<p>Transect 33 TU 2 pit overview.</p>	<p>Transect 33 TU 3 pit overview.</p>	<p>Transect 33 TU 4 pit overview.</p>
		
<p>Transect 34 TU 1 pit overview.</p>	<p>Transect 34 TU 2 pit overview.</p>	<p>Transect 34 TU 3 pit overview.</p>
		
<p>One of the artefacts recovered from Transect 34 TU 3.</p>	<p>Transect 34 TU 4 pit overview.</p>	<p>Transect 34 TU 5 pit overview.</p>

		
Transect 34 TU 6 pit overview.	Transect 34 TU 7 pit overview.	View of the north profile of Transect 34 TU 7.
		
Transect 35 TU 1 pit overview.	Transect 35 TU 2 pit overview.	View northeast across Transect 35 TU 3.
		
Transect 36 TU 1 pit overview.	Transect 36 TU 2 pit overview.	Transect 36 TU 3 pit overview.
		
View of north profile of Transect 36 TU 3.	Transect 36 TU 5 pit overview.	Transect 36 TU 6 pit overview.
		
Transect 36 TU 7 pit overview.	View of north profile at Transect 36 TU 7.	View north across Transect 36 TU 7.

		
Transect 37 TU 1 pit overview.	Transect 37 TU 2 pit overview.	Transect 37 TU 3 pit overview.
		
Transect 38 TU 1 pit overview.	View of north profile at Transect 38 TU 1.	View across Transect 38 TU 1.
		
Transect 39 TU 1 pit overview.	Transect 39 TU 2 pit overview.	Transect 39 TU 3 pit overview.
		
Transect 39 TU 4 pit overview.	Transect 39 TU 5 pit overview.	Transect 39 TU 6 pit overview.
		
Transect 39 TU 7 pit overview.	View of north profile at Transect 39 TU 7.	

APPENDIX 4 SECTION DRAWINGS CATALOGUE (TEST EXCAVATION)

<p>Transect 24 TU 1 south section. <u>Layer A:</u> Light brown loam topsoil. <u>Layer B:</u> Mid brown sandy loam with abundant gravels and large granite rocks.</p>	<p>Transect 24 TU 2 south section. <u>Layer A:</u> Thin light brown loam topsoil. <u>Layer B:</u> Light brown sandy loam with abundant gravels and larger granite rocks. <u>Note:</u> Southern section 10cm deep but north section only 5cm deep.</p>	<p>Transect 25 TU 1 section. <u>Layer A:</u> Dark brown topsoil. <u>Layer B:</u> Dark brown loam with common small (>1cm) inclusions. <u>Layer C:</u> Granite bedrock.</p>
<p>Transect 25 TU 2 north section. <u>Layer A:</u> Mid-brown topsoils. <u>Layer B:</u> Mid-brown/reddish sandy loam with very few gravel inclusions. <u>Layer C:</u> Decomposing granite base.</p>	<p>Transect 25 TU 3 north section. <u>Layer A:</u> Very compact brown/grey sandy loam. <u>Layer B:</u> Light yellow sand with granite and quartz inclusions.</p>	<p>Transect 26 TU 1 north section. <u>Layer A:</u> Very compact dark brown sandy loam. <u>Layer B:</u> Light brown sandy loam with no inclusions.</p>

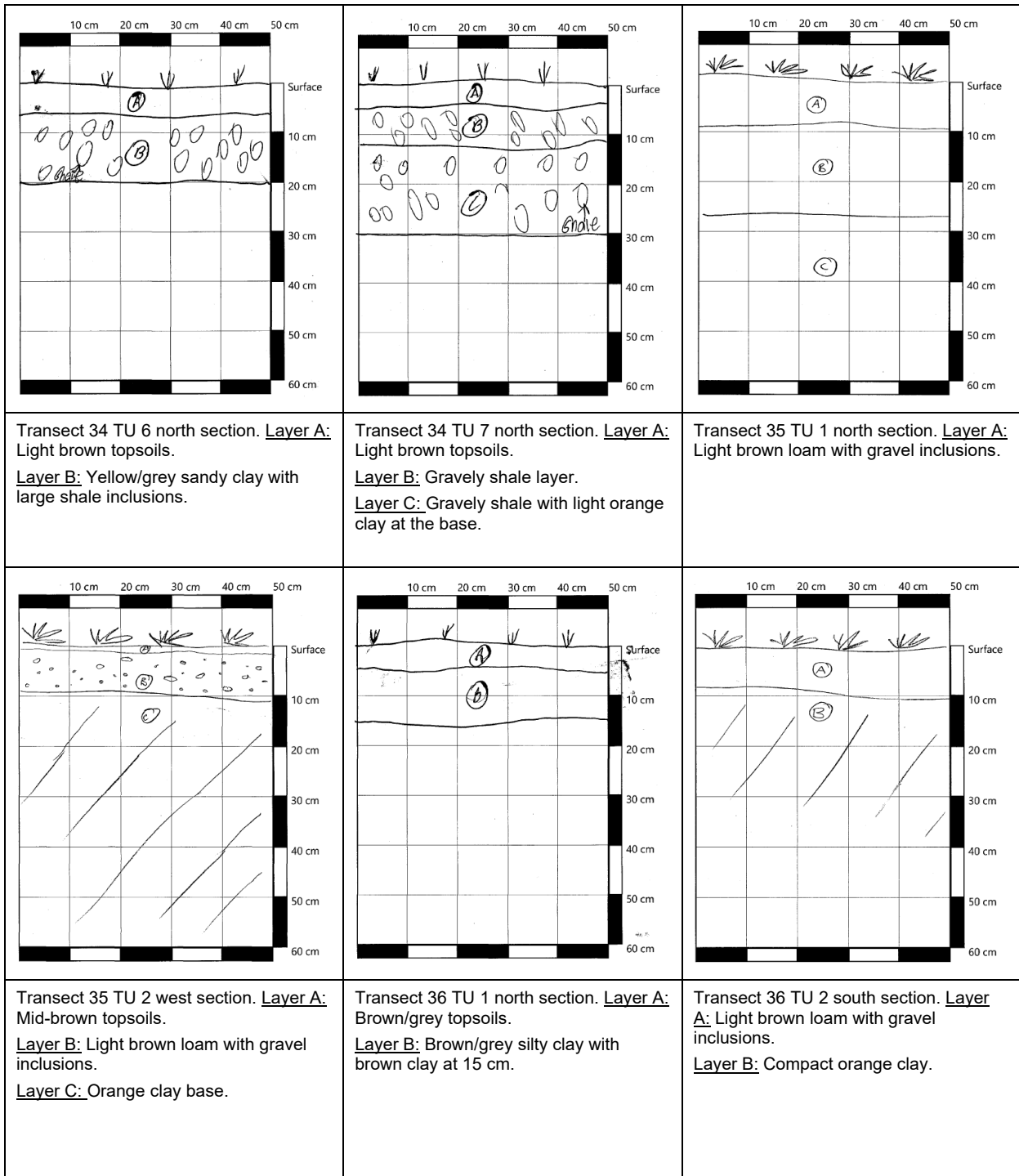
<p>Transect 26 TU 2 north section. <u>Layer A:</u> Dark brown topsoil. <u>Layer B:</u> Mid-brown loam with few small gravels and granite starting from 15 cm. <u>Layer C:</u> Granite rock.</p>	<p>Transect 26 TU 3 north section. <u>Layer A:</u> Mid-brown topsoil. <u>Layer B:</u> Mid-brown loam with few very small gravel inclusions. <u>Layer C:</u> Mid-brown/red loam with few very small gravel inclusions. <u>Layer D:</u> Mid-brown/red with compact decomposing granite bedrock.</p>	<p>Transect 27 TU 1 north section. <u>Layer A:</u> Dark brown topsoil. <u>Layer B:</u> Mid-brown sandy loam with very small gravels increasing frequency with depth. <u>Layer C:</u> Decomposing granite bedrock.</p>
<p>Transect 27 TU 2 north section. <u>Layer A:</u> Brown sandy loam with lots of roots. <u>Layer B:</u> Light brown to orange sandy loam with common to many gravel inclusions. <u>Layer C:</u> Dark brown sandy gravel with pebbles and cobbles or granite.</p>	<p>Transect 28 TU 1 north section. <u>Layer A:</u> Dark brown sandy loam. <u>Layer B:</u> Light brown sandy loam. <u>Layer C:</u> Light clay.</p>	<p>Transect 28 TU 2 north section. <u>Layer A:</u> Brown sandy loam with no inclusions. <u>Layer B:</u> Light brown to yellow sandy gravel.</p>

<p>Transect 28 TU 3 north section. <u>Layer A:</u> Low compaction, light brown loam with grass and gumtree roots. <u>Layer B:</u> Medium to hard compact lighter brown loam with some tree roots.</p>	<p>Transect 28 TU 4 north section. <u>Layer A:</u> Light brown sandy loam. <u>Layer B:</u> Orange sandy loam with many gravels.</p>	<p>Transect 28 TU 5 north section. <u>Layer A:</u> Mid-brown sandy loam. <u>Layer B:</u> Light brown/orange sandy loam with common to many small gravels. <u>Layer C:</u> Decomposing granite.</p>
<p>Transect 28 TU 6 north section. <u>Layer A:</u> Mid-brown topsoil. <u>Layer B:</u> Mid-brown sandy loam with common very small gravels increasing with depth. <u>Layer C:</u> Culturally sterile layer.</p>	<p>Transect 28 TU 7 north section. <u>Layer A:</u> Mid-brown topsoil. <u>Layer B:</u> Mid-brown loam with common small gravels. <u>Layer C:</u> Pale orange loam with many small gravels. <u>Layer D:</u> Orange clay loam with small gravels.</p>	<p>Transect 29 TU 1 north section. <u>Layer A:</u> Light brown sandy deposit. <u>Layer B:</u> Lighter brown sandy deposit. <u>Layer C:</u> Fine grained eroded granite sand. <u>Layer D:</u> Coarse grained eroded granite sand.</p>

<p>Diagram of Transect 29 TU 2 east section. The diagram shows a 60 cm depth scale on the right and a 50 cm horizontal scale at the top. Layer A (0-10 cm) is mid-brown topsoils. Layer B (10-35 cm) is brown/orange sandy loam with many small gravels. Layer C (35-60 cm) is decomposing granite bedrock. A small circle labeled 'C' is at the bottom of layer B.</p>	<p>Diagram of Transect 29 TU 3 north section. The diagram shows a 60 cm depth scale on the right and a 50 cm horizontal scale at the top. Layer A (0-10 cm) is mid-brown topsoils. Layer B (10-30 cm) is orangey brown sandy loam with small gravels increasing with depth. Layer C (30-60 cm) is orange sandy clay base with charcoal in the southwest corner. A small circle labeled 'C' is at the bottom of layer B, and a small circle labeled 'C' is in the southwest corner of layer C.</p>	<p>Diagram of Transect 30 TU 1 north section. The diagram shows a 60 cm depth scale on the right and a 50 cm horizontal scale at the top. Layer A (0-10 cm) is mid-brown topsoils. Layer B (10-25 cm) is mid-brown loam with no inclusions. Layer C (25-60 cm) is mid-brown clay with orange pockets. A small circle labeled 'C' is at the bottom of layer B.</p>
<p>Transect 29 TU 2 east section. <u>Layer A:</u> Mid-brown topsoils. <u>Layer B:</u> Brown/orange sandy loam with many small gravels. <u>Layer C:</u> Decomposing granite bedrock.</p>	<p>Transect 29 TU 3 north section. <u>Layer A:</u> Mid-brown topsoils. <u>Layer B:</u> Orangey brown sandy loam with small gravels increasing with depth. <u>Layer C:</u> Orange sandy clay base with charcoal in the southwest corner.</p>	<p>Transect 30 TU 1 north section. <u>Layer A:</u> Mid-brown topsoils. <u>Layer B:</u> Mid-brown loam with no inclusions. <u>Layer C:</u> Mid-brown clay with orange pockets.</p>
<p>Diagram of Transect 30 TU 2 east section. The diagram shows a 60 cm depth scale on the right and a 50 cm horizontal scale at the top. Layer A (0-10 cm) is mid brown/orange loam with small gravels. Layer B (10-30 cm) is dark orange clay loam with gravels. Layer C (30-60 cm) is light brown loam with constant rock inclusions at the base. A small circle labeled 'C' is at the bottom of layer B.</p>	<p>Diagram of Transect 31 TU 1 north section. The diagram shows a 60 cm depth scale on the right and a 50 cm horizontal scale at the top. Layer A (0-10 cm) is mid-brown topsoils. Layer B (10-30 cm) is light-brown loam with large (~3-6 cm) rock inclusions. Layer C (30-60 cm) is light brown loam with constant rock inclusions at the base. A small circle labeled 'C' is at the bottom of layer B.</p>	<p>Diagram of Transect 31 TU 2 east section. The diagram shows a 60 cm depth scale on the right and a 50 cm horizontal scale at the top. Layer A (0-20 cm) is mid-brown loam with larger (~4-6 cm) rock inclusions. Layer B (20-60 cm) is pale brown/white clay with rock inclusions. A small circle labeled 'C' is at the bottom of layer A.</p>
<p>Transect 30 TU 2 east section. <u>Layer A:</u> Mid brown/orange loam with small gravels. <u>Layer B:</u> Dark orange clay loam with gravels.</p>	<p>Transect 31 TU 1 north section. <u>Layer A:</u> Mid-brown topsoils. <u>Layer B:</u> Light-brown loam with large (~3-6 cm) rock inclusions. <u>Layer C:</u> Light brown loam with constant rock inclusions at the base.</p>	<p>Transect 31 TU 2 east section. <u>Layer A:</u> Mid-brown loam with larger (~4-6 cm) rock inclusions. <u>Layer B:</u> Pale brown/white clay with rock inclusions.</p>

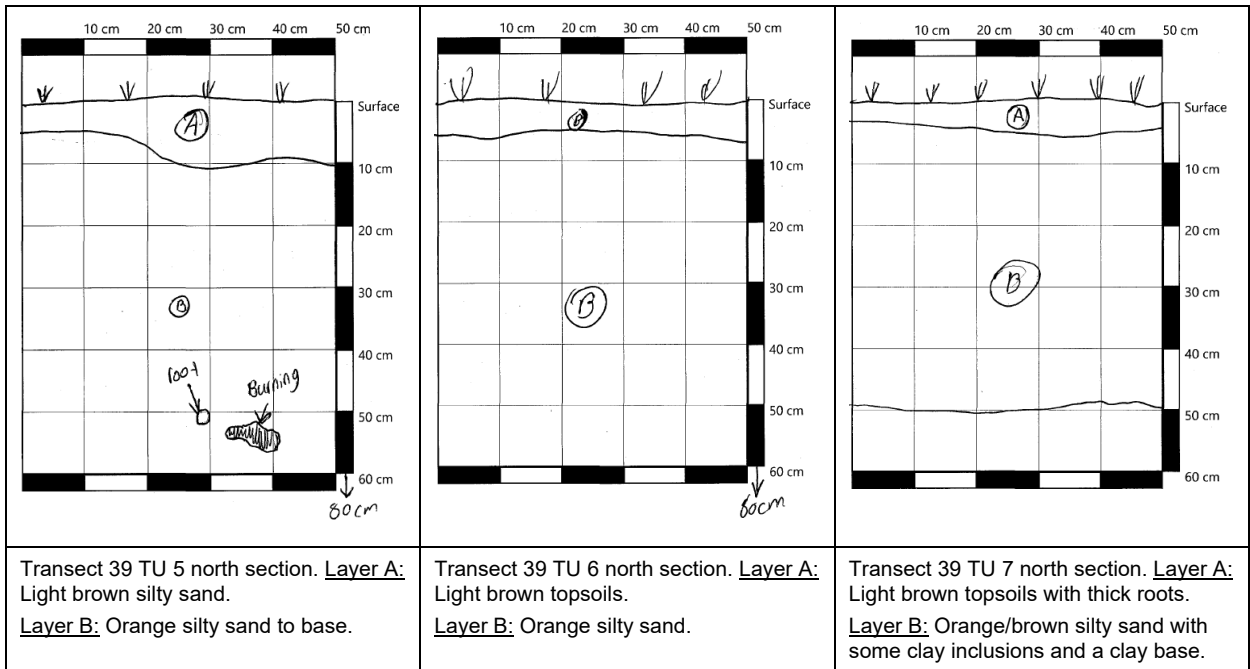
<p>Transect 31 TU 3 north section. <u>Layer A:</u> Sandy loam with common gravel inclusions. <u>Layer B:</u> Bedrock.</p>	<p>Transect 32 TU 1 north section. <u>Layer A:</u> Light brown sandy loam with common gravel inclusions. <u>Layer B:</u> Light brown sandy loam with shale inclusions, on top of bedrock.</p>	<p>Transect 32 TU 2 north section. <u>Layer A:</u> Brown sandy loam. <u>Layer B:</u> Light brown sandy loam.</p>
<p>Transect 33 TU 1 north section. <u>Layer A:</u> Mid-brown topsoils. <u>Layer B:</u> Mid-brown loam with no inclusions. <u>Layer C:</u> Stopped at 80cm as culturally sterile.</p>	<p>Transect 33 TU 2 north section. <u>Layer A:</u> Light brown sandy loam topsoils. <u>Layer B:</u> Light grey sandy gravels. <u>Layer C:</u> Sandy loam in matrix of shale with large shale inclusions as base of the pit.</p>	<p>Transect 33 TU 3 north section. <u>Layer A:</u> Brown topsoils. <u>Layer B:</u> Orange sandy clay onto clay base.</p>

<p>Transect 33 TU 4 north section. <u>Layer A:</u> Mid-brown topsoils. <u>Layer B:</u> Mid-brown loam with irregular large (~5 cm) rock inclusions. <u>Layer C:</u> Light brown sandy loam with abundant gravels. <u>Layer D:</u> Mid-brown loam with many gravels (shale). <u>Layer E:</u> Shale base.</p>	<p>Transect 34 TU 1 north section. <u>Layer A:</u> Mid-brown topsoils. <u>Layer B:</u> Light mid-brown loam. Compacted at depth. <u>Layer C:</u> Mid-brown clay loam.</p>	<p>Transect 34 TU 2 south section. <u>Layer A:</u> Mid-brown loam topsoils. <u>Layer B:</u> Light brown loam with shale. <u>Layer C:</u> Brown clay.</p>
<p>Transect 34 TU 3 west section. <u>Layer A:</u> Mid-brown topsoils. <u>Layer B:</u> Light brown sandy loam with abundant gravels. <u>Layer C:</u> Mid-brown loam with gravels. <u>Layer D:</u> Shale base with mid-brown loam.</p>	<p>Transect 34 TU 4 north section. <u>Layer A:</u> Mid-brown topsoils. <u>Layer B:</u> Shale base with mid-brown loam. <u>Layer C:</u> Shale base with mid-brown loam.</p>	<p>Transect 34 TU 5 pit overview. <u>Layer A:</u> Mid-brown topsoils. <u>Layer B:</u> Shale base with mid-brown loam.</p>



<p>Transect 36 TU 3 east section. <u>Layer A:</u> Mid-brown topsoils. <u>Layer B:</u> Very compact light brown loam with no inclusions. <u>Layer C:</u> Compact orange clay.</p>	<p>Transect 36 TU 4 north section. <u>Layer A:</u> Very compact light brown loam with gravel inclusions. <u>Layer B:</u> Very compact orange clay.</p>	<p>Transect 36 TU 5 north section. <u>Layer A:</u> Mid-brown topsoils. <u>Layer B:</u> Mid-brown/orange clay loam. <u>Layer C:</u> Mid-brown/orange clay with small gravel inclusions.</p>
<p>Transect 36 TU 6 north section. <u>Layer A:</u> Light brown/grey topsoils. <u>Layer B:</u> Light brown/grey silty sand.</p>	<p>Transect 36 TU 7 north section. <u>Layer A:</u> Sandy clay topsoils. <u>Layer B:</u> Orange/grey clay with few large stone inclusions.</p>	<p>Transect 37 TU 1 north section. <u>Layer A:</u> Dark brown topsoils. <u>Layer B:</u> Light brown sandy clay. <u>Layer C:</u> Dried yellow/grey clay.</p>
<p>Transect 37 TU 2 north section. <u>Layer A:</u> Mid-brown topsoils.</p>	<p>Transect 37 TU 3 north section. <u>Layer A:</u> Light brown loam.</p>	<p>Transect 38 TU 1 north section. <u>Layer A:</u> Brown sandy loam.</p>

<p><u>Layer B:</u> Light brown loam. <u>Layer C:</u> Light brown clay.</p>	<p><u>Layer B:</u> Pale brown clay loam with decomposing shale.</p>	<p><u>Layer B:</u> Brown sandy loam with many small flecks of charcoal. Thick orange/grey clay at base.</p>
<p>Transect 38 TU 2 north section. <u>Layer A:</u> Light brown sandy loam. <u>Layer B:</u> Light grey clay with gravel inclusions and orange clay inclusions.</p>	<p>Transect 38 TU 3 north section. <u>Layer A:</u> Dark brown sandy loam. <u>Layer B:</u> Light grey clay.</p>	<p>Transect 39 TU 1 north section. <u>Layer A:</u> Brown topsoils. <u>Layer B:</u> Brown sandy clay. <u>Layer C:</u> Light clay becoming denser at 40 cm.</p>
<p>Transect 39 TU 2 north section. <u>Layer A:</u> Brown topsoils. <u>Layer B:</u> Mottled clay onto a thick clay base.</p>	<p>Transect 39 TU 3 north section. <u>Layer A:</u> Light brown topsoils. <u>Layer B:</u> Light grey sand with mottled orange clay.</p>	<p>Transect 39 TU 4 north section. <u>Layer A:</u> Light brown silty sand topsoils. <u>Layer B:</u> Orange silty sand with mottled clay onto a thick clay base at 60 cm.</p>



D.2 Lithics analysis report

22 July 2024

1 Introduction

The analysis of the Oven Mountain Pumped Hydro (OMPS) Upper Reservoir test excavation was carried out to align and be compared to the initial artefact analysis for the earlier phases of test excavation carried out by Dr Trudy Doelman. With this in mind, the analysis followed the same research questions that were broadly divided into six categories:

1. Site occupation
2. Lithic source procurement
3. Stone reduction technology
4. Site function
5. Regional comparisons
6. Spatial patterning
7. Site disturbance.

1.1 Analysis methodology

The attributes selected mirrored those of the earlier analysis, where additional attributes were selected to provide further information regarding cores. This includes the examination of the different types of technological strategies used to prepare and reduce cores and the intensity of core reduction.

Artefacts were cleaned, sorted, individually analysed, and attributes entered into a Microsoft Excel database. The location of the excavated artefacts were also recorded by site, spit/depth and excavation square. Analysis was aided using a 10x hand lens and a standard digital vernier calliper. Measurements were made to one decimal place, and weights recorded to two decimal places. Attributes and description are in

Table 1.1 Artefact attributes recorded for the OMPS upper reservoir assemblage (as per Doelman)

<i>Attributes</i>	<i>Description</i>
Technological class	Artefact type (e.g. core, complete flake, longitudinal split, flake fragmentation, retouch, angular fragments/lithic fragments, other (axe, grindstone etc.).
Material	Raw Material type (silcrete tuff, chert, quartz, quartzite etc.).
Translucency	Clear, translucent, opaque.
Colour	Raw material colour.

Attributes	Description
Cortex	Percentage of cortex (if on a flake – amount on the dorsal surface of a flake).
Cortex type	Type of cortex (rough/terrestrial, water-rolled/tabular).
Platform type	Unifacial, crushing/missing, Flaked (>2 flake scars), Faceted (3 or more small, systematic flake removals), Cortical (with cortex), n/a (complete flakes and complete tools)
Termination type	Feather, hinge, step, plunge, step, cortical, platform, abrupt.
Tool type	Select the type of tool – use wear, concave scraper, convex scraper, straight scraper, elouera (backed artefact), notched scraper, end scraper, saw, stepped scraper, drill, backed (generic), bondi point, thumbnail scraper, denticulate, burin, geometric microlith, nosed scraper.
Maximum dimension	All artefacts (in size groupings).
Length complete flake	Axial length of the complete flake/complete tool (in mm to 1 dp).
Weight	Weight of the artefact in grams to 1 dp.
Complete flakes and complete tools	
Form	Form of the flake – Indeterminate, Expanding, Block (angular Fragment), Blade, N/A, Platform Rejuvenation Flake (tablet), Bipolar, Errailure, Ridge straightening flake, elongated flake. These attributes reflect core reduction strategies.
Complete tools	(Examines measures of curation and use).
Retouch edge	The number of retouched quadrants (on complete tools only).
Retouch type 1, 2, 3, 4	Select the retouch type for quadrants 1, 2, 3 and 4.
Cores Identifying technological strategies and intensity of reduction	
Core type	Uni-, bi-, and multi-platform, prismatic, burin-blade core, test, bipolar, bifacial.
Core body	Core body form – block, flake, nodule, non-diagnostic.
Scar form	Primary scar form? – elongated, expanding, blade, mixed.
Core platform no.	Number of platforms on the core.
Step termination	Number of step terminations on the core.
Hinge termination	Number of hinge terminations on the core.
Number of Core Scars	Number of core scars.
Metrical attributes (In mm to 1 dp).	
Maximum length	
Length complete flake	Axial length of the complete flake/complete tool.
Width	Maximum width of the complete flake/tool/core.
Thickness	Maximum thickness of the complete flake/tool/core at mid-point.
Core length	Maximum length from the working platform.
Platform width	Platform width – proximal and complete flakes and tools.
Platform thickness	Platform thickness – proximal and complete flakes and tools (and complete splits).
Weight	Weight of the artefact in grams to 2dp.

2 Assemblage

2.1 Assemblage distribution

A series of 29 0.5 x 0.5 m test pits were excavated in 100 m grids across two impact areas within the proposed 'upper reservoir' of the project. These areas are adjacent to Peach Tree Creek, a tributary of the Macleay River. A total of 138 artefacts were collected from these excavations. Of the five test pits that contained artefactual material, four contained a single artefact, and 134 artefacts were collected from test pit UR 8 (Table 2.1).

Table 2.1 Counts of artefacts from the OMPS assemblage

Test Excavation	Quadrant	Total artefacts	Weight (g)
UR 8		134	374.05
	A	60	229.21
	B	30	67.26
	C	25	32.96
	D	19	44.62
UR 16		1	11.53
UR 18		1	10.61
UR 32		1	3.54
UR 34		1	0.5
Total		138	400.23

Of the 138 artefacts recovered from these excavations, 66% (n=91) were collected in spit 2 (depth of 100–200 m) and 29% (n=40) from spit 3 (200–300 mm). Figure 2.1 shows the average weight, total weights accounts of artefacts per spit. This figure shows a decrease in counts and overall weight from spits 2 to 3, and then again from spit 3 to 4.

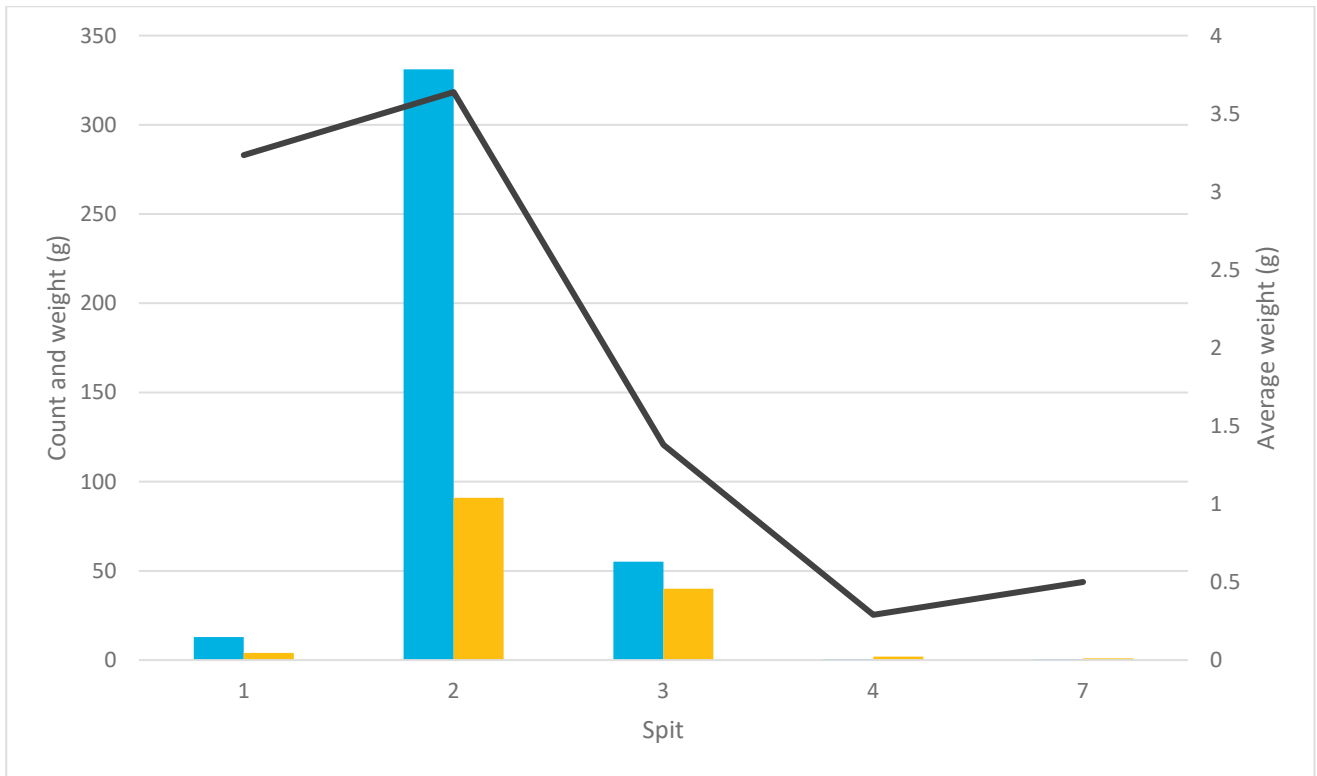


Figure 2.1 Artefact counts by spit and weight in the OMPS upper reservoir assemblage

Table 2.2 shows that the complete flakes in the assemblage are distributed with decreases in length and weight with depth, suggesting a single occupation surface with downward movement of smaller flakes through the profile.

Table 2.2 Complete flakes by spit, length and weight in the OMPS UR assemblage

Spit	Count	Percentage (%)	Mean Length (mm)	Total weight (g)	Mean weight (mm)
1	3	4.6	12.7	2.3	0.8
2	42	64.6	15.1	95.1	2.3
3	17	26.2	13.3	20.7	1.2
4	2	3.1	11.0	0.6	0.3
7	1	1.5	12.4	0.5	0.5

2.2 Site Chronology/Occupation

As addressed by Doelman in the analysis in the earlier phases of test excavation analysis, the presence or absence of backed artefacts can be a useful guide to assessing the age of a site. These artefacts are typically found in mid to late Holocene sites (<5000 years BP) in most of eastern Australia (Attenbrow 2002: 115-159, Hiscock 2008). There were three backed tools identified within the assemblage, as well as several blades. Blades are also typically associated with the mid to late Holocene. An increase in the use of macrocrystalline or milky quartz is thought to be an indicator of the late Holocene (Attenbrow 2002)

2.3 Stone procurement

A limited range of raw material types were recorded in the assemblage (Table 2.3). Quartz was the dominant material in the assemblage, with a high proportion of crystalline material. There were limited amounts of cortex observed (<10% of assemblage) and where it was recorded, there were only small amounts (1-33%). This indicates that stone material had been brought in from elsewhere.

Table 2.3 Raw materials from OMPS UR assemblage

Material	Count	Percentage (%)
Chalcedony	3	2.2
Chert	1	0.7
Crystal Quartz	18	13.0
IMT	9	6.5
Milky Quartz	98	71.0
Volcanic	9	6.5

2.4 Stone reduction technology

The assemblage of quartz (including crystal quartz, chalcedony and chert) was dominated by complete and broken flakes (Table 2.4). Broken flakes (proximal, medial, distal and longitudinal splits) account for 47.9% (n=56). Complete flakes were also a high proportion (44.1%), with only two cores present. 5% of the quartz assemblage was associated with retouched flakes or tools.

Table 2.4 OMPS UR assemblage composition for

Test excavation	Complete flake	Core	Broken flake	Retouched flakes
8	64	2	62	6
16	0	0	0	1
18	0	1	0	0
32	0	0	1	0
34	1	0	0	0

Due to 97% of the assemblage coming from a single excavation, no comparisons could be made to identify different discard behaviours.

There were only three cores identified, with one IMT and two quartz. All cores were bidirectional and were on average 30.7 mm in length.

There is evidence of bipolar flaking, particularly regarding quartz material, with a high proportion of crushed platforms (65.8%). The presence of flaked platforms are indicative of core rotation.

A limited number of artefacts displayed retouch (n=7), and only 5 formal tools were identified (Table 2.5).

Table 2.5 **Characteristics of tools in the OMPS UR assemblage**

ID	Excavation Unit	Tool type	Material	Fragmentation	Length (mm)
21	16	End scraper	Quartz	Complete	34.1
32	8D	Backed tool	Quartz	Complete	13.9
35	8D	Backed tool	Crystal Quartz	Complete	17.3
73	8B	Backed tool	Crystal Quartz	Complete	12.4
138	8A	Straight scraper	IMT	Complete	57.8

2.5 Spatial distribution and site occupation

In examining whether spatial differences in reduction activities occur in the project area the location of the cores, tools, raw material colour and flake form can be compared. However, only one location represents greater discard activity: UR 8. High proportions of milky quartz and crystal quartz were found in this excavation, reflecting not only its fragmentary nature, but also its abundance. Few tools were found in the assemblage, and those that were identified included scrapers and backed implements.

2.6 Archaeological potential and comparative analysis

As outlined by Doelman, limited archaeological work has been undertaken in the region. Based on previous reporting for OMPS, and studies in the Nundle-Walcha and Styx Rivers (upstream of the Macleay), quartz appears to be the dominant material used. Large proportions of both assemblages were broken artefacts and angular fragments, although there appears to be differences in the amount of cortex in both assemblages that could be reflective of stone sources or the use of an outcrop (such as a vein of quartz).

3 Summary

3.1 Site occupation

Like the earlier phase of OMPS test excavation, the site was likely occupied in the late Holocene. With the use of milky quartz raw materials and the presence of backed implements, although this could reflect the limited availability of other raw material types immediately available. It is also likely that occupation was short term, single events with limited food processing and tool manufacture. Due to the number of artefacts from a single excavation, it is unclear to determine any spatial patterning.

3.2 Lithic source procurement

The excavated assemblage is dominated by milky quartz material, from one dominant location. Given that much of the material consists of broken and complete flakes, it is less likely that there is a vein of quartz nearby. This is in part due to the overall quality of the quartz being good, with fewer low quality material (brittle and flawed) observed.

3.3 Stone reduction technology

Overall, there were a low number of cores found relative to complete flakes. Fragmentation of milky quartz artefacts is shown by the high proportion of broken flakes. Given the presence of backed implements, it is likely that this assemblage fits the regional model of the systematic and controlled reduction of macrocrystalline quartz to produce elongated flakes for backed artefact manufacture (Witter 1992: 43-44, 57).

3.4 Site function

The overall low frequency of processing tool types suggest that this location was not occupied for a long duration but rather for transient use. It is possible that there is a stone source nearby UR 8, or that there was a knapping event at this location.

3.5 Regional comparisons

There are similarities to this assemblage and that of earlier excavations for OMPS and the Styx River, where low density, quartz dominated assemblages were present.

3.6 Site disturbance

With the gradual decrease in the size and weight of artefacts as depth of excavation increases, there are post-depositional processes impacting the site. This is most likely due to bioturbation and other natural processes.

4 Conclusion

The assemblage from this later phase of excavation is dominated in number and weight by quartz artefacts in UR 8. Artefacts from this excavation account for 97% of the total assemblage. The lack of cortical material and lower quality quartz makes it seem unlikely that there is a quartz vein in the immediate vicinity.

There is evidence of a combination of freehand percussion and bipolar, reflected in the size of the limited cores available and the presence of crushed platforms and split flakes.

There is a low frequency of processing tool types, indicating a more transient occupation of the area.

References

Attenbrow, V., (2002) *Sydney's Aboriginal Past. Investigating the Archaeological and Historical Records*, 1st ed., Sydney, UNSW Press.

D.3 Lithics catalogue

ID	Project	Location	Excavation	Quadrant	Spit No	Depth (mm)	Technological Class	Material	Translucency	Colour	Cortex	Cortex type	Platform type	Termination type	Tool type	Max Dimension	Length complete flake	Form	Complete tools	Retouch edge	Retouch type	Core type	Core body	Scar form	Core platform no	Step termination	Hinge termination	Number of core scars	Metrical attributes	Max length	Length complete flake	Width	Thickness	Core Length	Platform width	Platform thickness	Weight
13	OMPS	Upper reservoir	18		1	0-100	Core	Jasper	Opaque	Reddish brown	1-33	Terrestrial				35.4						Bidirection Nodule	Mixed		3 5+		1 10+			10.6	29.3	12.7	17.0				10.61
24	OMPS	Upper reservoir	8 D		2	100-200	Core	Quartz	Translucent	White	1-33	Terrestrial				28.4						Bidirection Nodule	Mixed		2	0	0	3		13.2	15.7	18.5	19.6			10.62	
78	OMPS	Upper reservoir	8 B		2	100-200	Core	Quartz	Translucent	White	None					28.5						Bidirection Nodule			1	0	0	3		15.4	16.8	13.1	25.6			8.77	

Annexure E

Post approval requirements – updated guiding principles

E.1 Guiding principles

The key recommendation of the EIS ACHA and Section 9 of this report is the development of an Aboriginal cultural heritage management plan (ACHMP) to guide the management and mitigation of cultural materials within the Project area. While specific approaches and methodology would be developed as part of the ACHMP, the below section provides over-arching guiding principles for the management of key content requirements and each site type that may be adversely affected by the Project.

E.1.1 Avoidance and/or impact minimisation approaches

The specific methods for avoiding or minimising impacts to identified Aboriginal sites and places would typically be highly specific to the cultural materials in question and the development activities occurring nearby. Below are some general approaches that can be applied with site specific options developed and applied as part of the ACHMP:

- incorporation of the sites, cultural deposits, curtilages, and obligations for their protection into cultural inductions for site personnel
- where available, incorporation of the sites and curtilage into 'no-go' and/or constraint layers within the development document packages; and their inclusion into ground disturbance permit/approval requirements for the Project
- establishment of fencing and/or signage during works in and around identified sites and cultural deposits. In the case of sensitive sites, this may require appropriate buffers and/or opaque/cloth fencing. These should be developed in conjunction with an Aboriginal heritage specialist and/or RAPs
- where necessary, establishment of surface protection such as heavy-duty ground protection mats, or equivalent; these should be developed in conjunction with an Aboriginal heritage specialist and/or RAPs
- in the case of buried cultural deposits, the installation of underground/detectable tape at depths of 50 cm below current ground surface across the surface of the cultural deposits
- establishment of permanent (non-intrusive) signage to indicate cultural deposits and to contact an Aboriginal heritage specialist prior to development activity
- where vibration intense activities (e.g. blasting, tunnelling) are in close proximity to identified cultural materials (nominally 100 metres), a geotechnical engineer or other suitable specialist should be first engaged to determine project-specific restrictions and requirements prior to the activity proceeding; and which may result in modifications to vibration limits and/or distance of activities from the Aboriginal site. This may extend to on-site monitoring where high risk is identified, and/or suitable mitigation triggers where impacts eventuate. Where impacts are observed, they would be mitigated in accordance with guiding principles for the respective Aboriginal site in the addendum report.

E.1.2 Methods for identified site types

In terms of each site type, the following provides a number of guiding principles that should be adopted in the ACHMP and other relevant documents *where sites and/or cultural deposits would be adversely affected (direct and indirect)*, including the following:

- Management of high and moderate density artefact scatters (OMPS-AS33 [#21-5-0201], OMPS-Q2 [#21-5-0205]):
 - detailed field survey should be undertaken to identify the curtilage of the site and all observable surface cultural materials; once identified, cultural materials should be spatially documented, collected and subject to detailed lithic analysis
 - where subsurface potential is identified, it should be subjected to archaeological excavations as outlined below.
- Management of stone arrangements (OMPS-SA1 [#21-5-0207], OMPS24-SA1):
 - suitable removal of vegetation from the site and its surrounds to ensure all features of the stone arrangement are clearly visible
 - archival recording of the stone arrangement both in its landscape context and the specific features prior to disturbance
 - temporary marking of all stones within the feature/s with a unique identifier to allow the site's deconstruction and reconstruction elsewhere (if required)
 - careful and progressive documentation of the deconstruction of any features, noting key construction elements, phases and recovering any materials that may assist in determining the formation history and use of the feature/s (e.g. charcoal samples for dating, sediment/soil from crevices and cracks for palaeoenvironmental analysis, stone artefacts, etc.)
 - temporary storage of stones from the feature/s until suitable management and/or curation of the materials is determined in consultation with the RAPs.
- Management of culturally modified trees (OMPS-ST1 [#21-5-0184], OMPS-ST4 [#21-5-0201], OMPS-ST19 [#21-5-0172], OMPS-ST22 [#21-5-0205], OMPS24-ST1, OMPS24-ST2, OMPS24-ST3, OMPS24-ST4):
 - archival recording of the tree both in its landscape context and the specific features of the modifications prior to disturbance
 - methods for protection in situ and/or suitable relocation of the tree, either in its entirety and/or via the removal of the 'scar' portion of the tree. It should be dictated that these approaches should be overseen by a qualified arboriculturist
 - where left in situ, the processes and methods for long term monitoring of the culturally modified tree to ensure its ongoing preservation
 - where relocated, methods for the long-term curation and conservation of the removed tree or tree fragment, including suitable conditions and preservation agents as required.

- Management of high density stone artefact cultural deposits (OMPS-FA1, OMPS-FA2, OMPS-FA3, OMPS-FA4, OMPS-FA5, OMPS-FA6, OMPS-FA8, OMPS-FA9, OMPS-FA10, OMPS-FA11, OMPS-FA13, OMPS-FA14, OMPS-FA15, OMPS-FA16, OMPS-OS1 [#21-5-0218], OMPS-OS2 [#21-5-0221], OMPS-OS3 [#21-5-0221]):
 - where test pit/s containing the highest significance are identified, archaeological salvage excavation (conservation *ex situ*) of the area/s should be undertaken. Depending on the number of high value locales and the nature of the impacts, salvage excavation may focus on some or all of these test pits. In accordance with current best practice, all salvage works should consist of initially 25 m² of contiguous open area excavation centred on the test pit/s of interest and expanding up to 100 m² where suitable thresholds are met (e.g. continuing high density of artefact numbers, unique characteristics, etc). Excavations should be undertaken manually in discrete test pits (0.25–1 m²), use 5 cm spits for recovery, sieve all sediment through a 3 mm mesh, recover suitable palaeo environmental and chronological sampling, and undertake appropriate recording.
- Management of low density background artefact scatter cultural materials (OMPS-BS1):
 - no further mitigation measures are recommended. It has been demonstrated that ~1–<24 artefacts/m² would be expected intermittently across the Project area, which reflects the ephemeral use of the region by Aboriginal people for several millennia. It is considered that further investigation of these areas would not alter the significance or understanding of these cultural deposits.
- Analysis and reporting:
 - all additional investigation, mitigation and monitoring activities should ensure suitable reporting and lodgement with relevant repositories, such as the Heritage NSW AHIMS database
 - in the case of excavations, post- excavation analysis should be undertaken for all recovered sedimentological and cultural materials. Analysis should include processing of chronological samples (e.g. optically stimulated luminescence, radiocarbon), palaeo environmental samples (e.g. particle size, geochemistry, pollen analysis, etc), and stone tool analysis
 - identification of short and long term repositories for recovered cultural materials and other collected samples.

E.1.3 Contents and methods for interpretation strategy, plan and implementation

The following points provide some guiding principles for consideration in the development of heritage interpretation of the project:

- Initially an interpretation strategy should be developed to identify key and over-arching themes. Subsequently, a plan would refine the strategy with content (visual and textual) and design details in order to allow the implementation stage.
- The documents should be co-designed and closely developed with local Thunggutti, Dhungutti and Anaiwan traditional owners. This includes identification of initial aims and ideas, content and structure.
- Given the nature of the project, these documents may consider off-site public outreach opportunities at nearby townships such as Bellbrook, etc.

- The content should include, but not be limited to:
 - the ethnographic and historical record, which includes post-Contact and contemporary associations with the site and immediate environs
 - consultation and input from the Thunggutti, Dhunggutti and Anaiwan traditional owners
 - information obtained from the archaeological excavations and findings undertaken for the Project on the cultural and environmental landscape within which past Aboriginal people interacted with in the past.

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