Appendix

E

E.4 | Aboriginal Cultural Heritage Assessment Part 1

EMM creating opportunities | SPARK RENEWABLES

Dinawan Wind Farm

Aboriginal Cultural Heritage Assessment

Prepared for Spark Renewables Pty Limited

May 2024

Dinawan Wind Farm

Aboriginal Cultural Heritage Assessment

Spark Renewables Pty Limited

E220305 RP1

May 2024

Version	Date	Prepared by	Reviewed by	Comments
V1	27 March 2024	T. Reid S. Elias C. Culley P. O'Brien-Pounde	S. Kennedy A. Williams	Draft for client review
V2	8 April 2024	T. Reid	A Williams	Draft for RAP review
V3	24 May 2024	D. Richards	A Williams	Final for client review
V4	30 May 2024	D. Richards	A Williams	Final

Approved by

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30 May 2024

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Content warning and Acknowledgement of Country

Aboriginal and Torres Strait Islander peoples are advised that the following report contains reference to, and images of, people who have died.

We would like to acknowledge and pay respects to the Traditional Owners on which the project is proposed including the Wiradjuri people and several smaller nations of the Murrumbidgee plains. We pay our respects to Elders past, present, and emerging.

We would like to thank all members of the Aboriginal community who generously gave their time and knowledge regarding the Aboriginal cultural heritage values associated with the project.

Executive summary

ES1 Project background

Spark Renewables Pty Limited (Spark Renewables) proposes to develop the Dinawan Wind Farm (the project). The project includes the installation, operation, maintenance and decommissioning of up to approximately 200 wind turbine generators (WTGs) and associated infrastructure. The project will have a generation capacity of up to approximately 1,200 megawatts (MW) (AC), equivalent to the needs of 700,000 NSW households per year. It will assist in meeting NSW and Australian Government emissions reduction targets and will abate approximately 3.2 million tonnes of greenhouse gases (GHG) annually. The project is State significant development (SSD) pursuant to schedule 1 of State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP).

The project is on the traditional lands of the Wiradjuri people and several smaller nations of the Murrumbidgee plains, about halfway between the towns of Coleambally and Jerilderie and lies within the Murrumbidgee and Edward River local government areas (LGAs) in New South Wales (NSW).

This Aboriginal Cultural Heritage Assessment (ACHA) forms part of the environmental impact statement (EIS) for the project. It presents the findings of the Aboriginal community consultation, previous investigations regarding Aboriginal cultural and archaeological heritage values within the region and outcomes of physical investigations and ground-truthing within the project area. It provides information on the location, distribution and significance of Aboriginal objects identified within the project area and environs, documents the potential impacts to objects by the project and makes recommendations for the management of such impacts.

ES2 Aboriginal consultation

The project assessment adopted the processes and methods outlined in Heritage NSW's *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010), as well as additional project-specific communication strategies to promote transparent and frequent two-way dialogue between the Aboriginal community and the project. These latter activities included several Aboriginal focus group meetings (face-to-face) throughout the assessment process, and other meetings as requested by the local Aboriginal community.

Overall, the project has been liaising with six registered Aboriginal parties (RAP) organisations and/or individuals since its inception in November 2022. These organisations have been identified through the formal notification as part of the Heritage NSW consultation requirements and/or through contacting the project following word of mouth within the local Aboriginal community. The RAPs include well-established Wiradjuri individuals and/or organisations based in Narrandera and Griffith, as well as Bangarang representatives from Shepparton, Victoria.

Opportunity for Aboriginal involvement in consultation for the project was provided throughout the preparation of this ACHA, including:

- attendance at five face-to-face meetings during key phases of the project
- participation in a 34-day field survey of the development corridor and surroundings
- participation in a 9-day archaeological test excavation program within the development corridor.

Ultimately, over 240 interactions have been undertaken with the RAPs across these opportunities. With five of the six organisations, Griffith LALC, Bundyi Aboriginal Cultural Knowledge, Bidya Marra Consultancy, Bangarang Aboriginal Corporation, and Roley Williams, participating in these opportunities, and totalling over 170 person days on-site cumulatively.

Discussions with the RAPs have been extensive over the assessment process. Feedback on the project and ACHA activities has generally been positive, with a strong focus on the wide variety of cultural materials identified during the survey efforts, and particularly the cultural values of the region, acknowledging Aboriginal burials in the broader region, and broader socio-economic benefits from the project. Later discussions have focussed on post-approval management of identified cultural materials, and these are integrated into this report.

ES3 Results and findings

The assessment undertook archaeological field survey and test excavations to explore and document the Aboriginal objects and sites within the project area, and to align them within the regional context. Overall, the regional context has extensive archaeological information, with numerous archaeological sites including many of Pleistocene age (>10,000 years), as well as historical and post-Contact places including reserves and missions. The regional archaeological record is characterised by stone artefact sites, hearths, culturally modified trees, earth mounds, and burials, and the findings of this ACHA largely conformed with this model.

Nearly all sites identified as part of this ACHA were found in association with water sources, such as ephemeral wetlands and drainage lines, Gilgai, and paleochannels, and/or within and surrounding the source-bordering sand dune landforms in the western portion of the project area. These latter features were assessed as having high archaeological sensitivity with the potential to contain ancestral remains.

A large number of discrete sites have been recorded across the project area over an approximately 18-month period. The results have been combined and ratified with 32 identified sites and places along with a low-density distribution of predominantly surface and shallowly buried cultural materials distributed across the project area. These can be broken down as:

- ten hearths with various associated stone cultural materials
- four culturally modified trees. Many of these sites were assigned a tentative classification requiring further assessment or specialist investigation to confirm their status
- twelve occupation areas characterised as locales where a range of cultural materials are found in proximity and where further objects and/or sites are expected. These include hearth/oven complexes, moderate and/or dense stone artefact scatters (>15/m^2), culturally modified trees, and/or subsurface cultural deposits; these occupation areas range from 0.6 hectares (ha) up to 485 ha, with an average size of approximately 69 ha
- five cultural sites including two potential ring trees, a potential women's tree, a historic blaze tree and a cluster of culturally significant sites, cumulatively described as DEHW-CS1 (AHIMS #48-6-0310), and encompassing a source-bordering dune in the centre of the western part of the project area
- a low-density stone artefact background scatter (1–15 artefacts/m^2) and eroded hearths or scattered heat retainers intermittently dispersed across the project area, which are collectively referred to as DEHW-BS1. This site includes 51 discrete site recordings.

ES4 Potential impacts

Project redesign undertaken through the assessment process has resulted in the avoidance of 15 of the discrete Aboriginal sites and site complexes identified by the field investigations. This equates to approximately ~47% of the identified cultural assemblage being unharmed. A further five occupation areas within the development corridor will also be avoided. Notably, avoidance has focused on cultural sites and places considered of high value to the local Aboriginal community, and sand dune and aeolian landforms within which ancestral remains and/or other deep-time cultural material may occur.

A total of 17 of the identified Aboriginal sites and places are within the development corridor. Of these, only two moderately significant sites are entirely within the development footprint (DEHW-2024-H1 [#48-6-0289] and DEHW-2024-HAS2 [#48-6-0271]), with the majority of the remaining sites only partially within the development corridor and/or development footprint. Given the large size of the occupation areas, several of them intersect with the development corridor and/or development footprint. The survey effort to date has mapped approximately 311 ha (34.7%) of these sites within the development corridor, with approximately 57 ha (6.3%) within the development footprint. In many instances, however, the curtilage within the development corridor and/or development footprint does not contain the discrete cultural materials identified within these broader occupation areas.

ES5 Management and mitigation measures

Based on the findings of the ACHA, Section 11 provides a series of recommendations to be implemented for the project (see Table ES1 below). These should be read in conjunction with the guiding principles in Attachment F.

Table ES1 Management and mitigation measures for Aboriginal cultural heritage

Reference	Impact	Mitigation measure	Timing	Applicable location
AH1	Impact avoidance and minimisation	The project will avoid impacts to the following identified Aboriginal objects and/or sites within or near the development corridor: • hearths and associated cultural materials: DEHW-2023-HAS13 (#55-1-0162), DEHW-2023-HIF5 (#48-6-0283), PEC-E-47 (#55-1-0057), PEC-E-50 (#55-1-0060), DEHW-2023-HAS1 (#54-3-0071), PEC-E-49 (#55-1-0059), DEHW-2023-ST1 (#48-6-0273), and DEHW-2023-ST8 (#48-6-0253). • occupation area: DEHW-OA3 (#48-6-0308), DEHW-OA6 (#54-3-0076), and DEHW-2023-HAS4 (#54-3-0070) • cultural sites: DEHW-CS1 (#48-6-0310) and other significant cultural areas including two potential ring trees (DEHW-2023-STAS2 (#48-6-0250) and DEHW-2023-ST12 (#55-1-0144)), a potential culturally modified tree, DEHW-2023-HH1 (#49-4-0245), and key identified cultural material components within a potential women's area DEHW-2023-STAS1 (#55-1-0143). Some guiding principles for consideration of avoidance are presented in Attachment F. Site-specific avoidance measures developed to address this commitment will be integrated into AH3.	Pre-construction Construction	PEC -E-49 (#55-1-0059), PEC -E-47 (#55-1-0057), PEC -E-50 (#55-1-0060), DEHW-2023-HAS4 (#54-3-0070), DEHW-2023-HAS1 (#54-3-0071), DEHW-OA6 (#54-3-0076), DEHW-2023-STAS1 (#55-1-0143) (part), DEHW-2023-ST12 (#55-1-0144), DEHW-2023-HAS13 (#55-1-0162), DEHW-2023-STAS2 (#48-6-0250), DEHW-2023-ST8 (#48-6-0253), DEHW-2023-ST1 (#48-6-0273), DEHW-2023-HIF5 (#48-6-0283), DEHW-OA3 (#48-6-0308), DEHW-CS1 (#48-6-0310), and DEHW-2023-HH1 (#49-4-0245).
AH2	Impact avoidance and minimisation	The project will investigate the micro-siting of project infrastructure and construction activities in consultation with an Aboriginal heritage specialist to avoid or minimise impacts to: • hearths and associated cultural materials: DEHW-2023-H3 (#48-6-0257), DEHW-2024-HAS8 (#48-6-0267), DEHW-2024-HAS7 (#55-1-0165) and DEHW-2023-HAS12 (#55-1-0163) • a culturally modified tree: DEHW-2023-ST10 (#48-6-0251) • occupation area: DEHW-2023-HASST1 (#48-6-0264), DEHW-OA1 (#55-1-0172), DEHW-OA2 (#49-4-0243), DEHW-OA4 (#49-4-0244), DEHW-OA5 (#48-6-0309), DEHW-OA7 (#55-1-0171), DEHW-OA8 (#55-1-0169), and DEHW-OA9 (#55-1-0170) • areas of higher archaeological potential including identified aeolian, paleochannels, and watercourses features; and the eastern fringes of Gilgai and ephemeral wetlands. These are prevalent in the western project area, where sand dunes and/or sandy soil profiles have been predicted and/or observed. Some guiding principles for consideration of avoidance and/or impact minimisation are presented in Attachment F. Management and any site-specific mitigation measures developed to address this commitment will be integrated into AH3.	Pre-construction Construction	DEHW-2023-HAS12 (#55-1-0163), DEHW-2024-HAS7 (#55-1-0165), DEHW-OA8 (#55-1-0169), DEHW-OA9 (#55-1-0170), DEHW-OA7 (#55-1-0171), DEHW-OA1 (#55-1-0172), DEHW-OA2 (#49-4-0243), DEHW-OA4 (#49-4-0244), DEHW-2023-ST10 (#48-6-0251), DEHW-2023-H3 (#48-6-0257), DEHW-2023-HASST1 (#48-6-0264), DEHW-2024-HAS8 (#48-6-0267), and DEHW-OA5 (#48-6-0309).

Table ES1 Management and mitigation measures for Aboriginal cultural heritage

Reference	Impact	Mitigation measure	Timing	Applicable location
AH3	Cultural heritage management	An Aboriginal Cultural Heritage Management Plan (ACHMP) will be prepared by a suitably qualified heritage professional in consultation with the RAPs and Heritage NSW. The contents and guiding principles for the management of identified site types for the ACHMP are presented in Attachment F, and include: • processes, timing, communication methods and project involvement for maintaining Aboriginal community consultation and participation through the remainder of the project • inputs and content of a cultural heritage induction package for all construction personnel and subcontractors • descriptions and methods for suitably documenting and archivally recording any Aboriginal sites and/or objects that will be adversely affected by the project • recording and archaeological mitigation of requirements of archaeological test/salvage excavations/monitoring of occupation areas, stone artefact scatters, potential archaeological deposits, and cultural deposits that will be adversely affected by the project • descriptions and methods for surface collection of identified isolated objects and stone artefact scatters that will be adversely affected by the project • descriptions and methods for mitigation and/or recovery of culturally modified trees that will be adversely affected by the project • delineating and protecting Aboriginal and cultural sites within or in close proximity to the development corridor, including clear marking, appropriate screen for any gender-specific areas, surface protection, etc • procedures for managing the unexpected discovery of Aboriginal objects, sites and/or human remains during the project • procedures for the curation and long-term management of recovered cultural materials • methods of post-excavation analysis and reporting of the archaeological investigations, including suitable collection and processing of stone artefacts, paleo-environmental, chronological and other soils from archaeological activities • a monitoring regime for implementing the above measures.	Pre-construction Construction	Project area, and all identified Aboriginal objects, sites and deposits in Section 8 that will be adversely impacted by the project.

Table ES1 Management and mitigation measures for Aboriginal cultural heritage

Reference	Impact	Mitigation measure	Timing	Applicable location
AH4	Cultural heritage management	An inspection will be undertaken by a qualified arboriculturist of all tentatively identified culturally modified trees to confirm whether they have formed through anthropogenic or natural processes, and where these sites are anticipated to be adversely affected by the project. The findings of this inspection and subsequent management of the trees confirmed as being culturally modified will be integrated into the ACHMP (AH3) as required.	Pre-construction	DEHW-OA9 (#55-1-0170), DEHW-OA2 (#49-4-0243), DEHW-OA4 (#49-4-0244), DEHW-2023-ST10 (#48-6-0251), DEHW-2023-HASST1 (#48-6-0264), and DEHW-2023-HH1 (#49-4-0245).
AH5	Heritage interpretation	An Aboriginal heritage interpretation strategy and plan will be developed by an Aboriginal heritage specialist, in consultation with RAPs, which will identify the interpretive values of the project area (and specifically Aboriginal heritage values) and provide direction for interpretive installations and devices. The contents and guiding principles for the management of the strategy and plan are presented in Attachment F and include the need to incorporate RAPs' views on traditional and contemporary values, local ethnographic and post-Contact information, and archaeological data developed for the project.	Construction Post-construction	Project area
AH6	Aboriginal engagement	Consultation will be maintained with the RAPs where cultural heritage requires management.	Pre-construction Construction	-
AH7	Administrative	A copy of the ACHA and all relevant AHIMS site recording forms and information for the project will be lodged with Heritage NSW and provided to each of the RAPs.	Pre-construction Construction	-

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1 Introduction

1.1 Overview

Spark Renewables Pty Limited (Spark Renewables) proposes to develop the Dinawan Wind Farm (the project). The project includes the installation, operation, maintenance and decommissioning of up to approximately 200 wind turbine generators (WTGs) and associated infrastructure. The project is on the traditional lands of the Wiradjuri people and several smaller nations of the Murrumbidgee plains, about halfway between the towns of Coleambally and Jerilderie and lies within the Murrumbidgee and Edward River local government areas (LGAs) in New South Wales (NSW). The regional and local context of the project is shown in Figure 1.1 and Figure 1.2, respectively.

The project is within the South West Renewable Energy Zone (REZ), a region selected by the NSW Government for its significant potential for renewable energy generation and regional development.

The project will connect to the Dinawan Substation, currently under construction as part of the Project EnergyConnect interconnector that will run between Robertstown in South Australia and Wagga Wagga in NSW. The substation and interconnector are a separate approved project that is being built by Transgrid.

The main objective of the project is to generate renewable energy, consistent with NSW Government policy for development of infrastructure for renewable energy generation, and will significantly contribute to the target of 3.98 gigawatts (GW) of generation planned in the South West REZ. The project will have a generation capacity of up to approximately 1,200 megawatts (MW) (AC), equivalent to the needs of 700,000 NSW households per year. It will assist in meeting NSW and Australian Government emissions reduction targets and will abate approximately 3.2 million tonnes of greenhouse gases (GHG) annually.

The project is State significant development (SSD) pursuant to schedule 1 of State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP). Accordingly, approval for the project is required under Part 4, Division 4.7 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

This Aboriginal cultural heritage assessment (ACHA) forms part of the environmental impact statement (EIS) for the project. It presents the findings of the Aboriginal community consultation, previous investigations regarding Aboriginal cultural and archaeological heritage values within the region and outcomes of physical investigations and ground-truthing within the development corridor. It provides information on the location, distribution and significance of Aboriginal objects identified within the development corridor and environs, the potential impacts to objects by the project and recommendations for the management of such impacts.

1.2 Assessment approach and requirements

This ACHA has been prepared in accordance with the requirements of the following NSW government guidelines:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011)
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010)
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010).

The ACHA has been prepared as part of the EIS to assess the potential Aboriginal cultural heritage impacts from constructing and operating the project. The report:

- addresses the relevant SEARs listed in Table 1.1
- describes the existing environment with respect to Aboriginal heritage
- documents the results of consultation with and involvement of key Aboriginal community members and knowledge holders to identify areas and places of cultural value within or in the vicinity of the project area

- assesses the impacts of constructing and operating the project on Aboriginal heritage
- recommends measures to mitigate and manage the impacts identified.

This assessment has been prepared in accordance with requirements of the NSW Department of Planning, Housing and Infrastructure (DPHI) (formally NSW Department of Planning and Environment (DPE)) which were set out in the Planning Secretary's Environmental Assessment Requirements (SEARs) for the project, issued on 14 December 2022 and reissued on 22 August 2023 with additional requirements from the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW). The SEARs identify matters which must be addressed in the EIS. Table 1.1 lists individual requirements relevant to this Aboriginal cultural heritage assessment and where they have been addressed in the report.

Table 1.1 Relevant matters raised in the SEARs

Requirement	Section addressed
Heritage – including:	
• An assessment of the impact to Aboriginal cultural heritage items (cultural and archaeological) 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), including results of archaeological test excavations (if required).	Entire report, and specifically Chapters 7, 10, and Attachment E.
• 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).	Chapter 3 and Attachment B.
• Assess the impact to historic heritage having regard to the NSW Heritage Manual.	N/A

To inform the preparation of the SEARs, DPHI invited other government agencies to recommend matters to be addressed in the EIS. Heritage NSW responded to DPHI on 17 November 2022 to note they were satisfised that the proposed SEARs were adequate to assess any Aboriginal sites or values associated with the project, and raised no additional matters for consideration.

A number of technical terms have been utilised throughout this report for the discussion of Aboriginal cultural heritage. These are explained in the abbreviations and glossary sections.

1.3 Legislative context

Commonwealth and State Acts (and associated regulations) that manage and protect Aboriginal cultural heritage are summarised in Table 1.2 (Attachment A provides further details).

Table 1.2 Commonwealth and State legislation with potential relevance to the project

Legislation	Description	Relevant to the project?	Details
Commonwealth			
Environment Protection and Biodiversity Conservation Act 1999	Recognises sites with universal value on the World Heritage List (WHL). Protects Indigenous heritage places with outstanding heritage value to the nation on the National Heritage List (NHL), and significant heritage value on the Commonwealth Heritage List (CHL).	No	There are no Indigenous heritage places within the project area that are listed on the WHL, NHL, or the CHL.
Native Title Act 1993	Established a system for recognising Aboriginal and Torres Strait Islander peoples' rights and interests over lands and waters by Aboriginal people. Provides for negotiation and registration of Indigenous Land Use Agreements (ILUAs). Often used in NSW to identify relevant stakeholders for consultation.	No	Requests to search the National Native Title Tribunal were made on 23 November 2022 and 3 April 2024. There are no active Native Title claims which interact with the project area.
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	Preserves and protects declared areas and objects of particular significance to Aboriginal and Torres Strait Islander people that are under threat from injury or desecration.	No	There are no areas or objects within the project area subject to a Declaration under the Act.
State			
Environmental Planning and Assessment Act 1979	Requires environmental impacts, including to Aboriginal heritage, to be considered in land use planning. Provides for the development of environmental planning instruments, including State Environmental Planning Policies and Local Environmental Plans.	Yes	The project is being assessed as SSD under Part 4, Division 4.7, of this Act, and is subject to project-specific environmental assessment and reporting requirements. These requirements (SEARs) stipulate that an Aboriginal heritage impact assessment is required (in accordance with standard Heritage NSW procedures and guidelines) to assess whether the project has the potential to impact on Aboriginal objects, sites, or places of Aboriginal heritage significance.
National Parks and Wildlife Act 1974	Provides blanket protection for all Aboriginal objects and declared Aboriginal places. Includes processes and mechanisms for development where Aboriginal objects are present, or where Aboriginal Places are proposed for harm.	Yes	The NPW Act would generally remain in force for the project in relation to the discovery, impact notification and care of Aboriginal objects in NSW. However, as the project is classed as SSD, an Aboriginal heritage impact permit (AHIP) is not required to permit harm to tangible Aboriginal cultural heritage where project approval is granted. Instead, an approved management plan would manage relevant Aboriginal cultural heritage sites and heritage values.

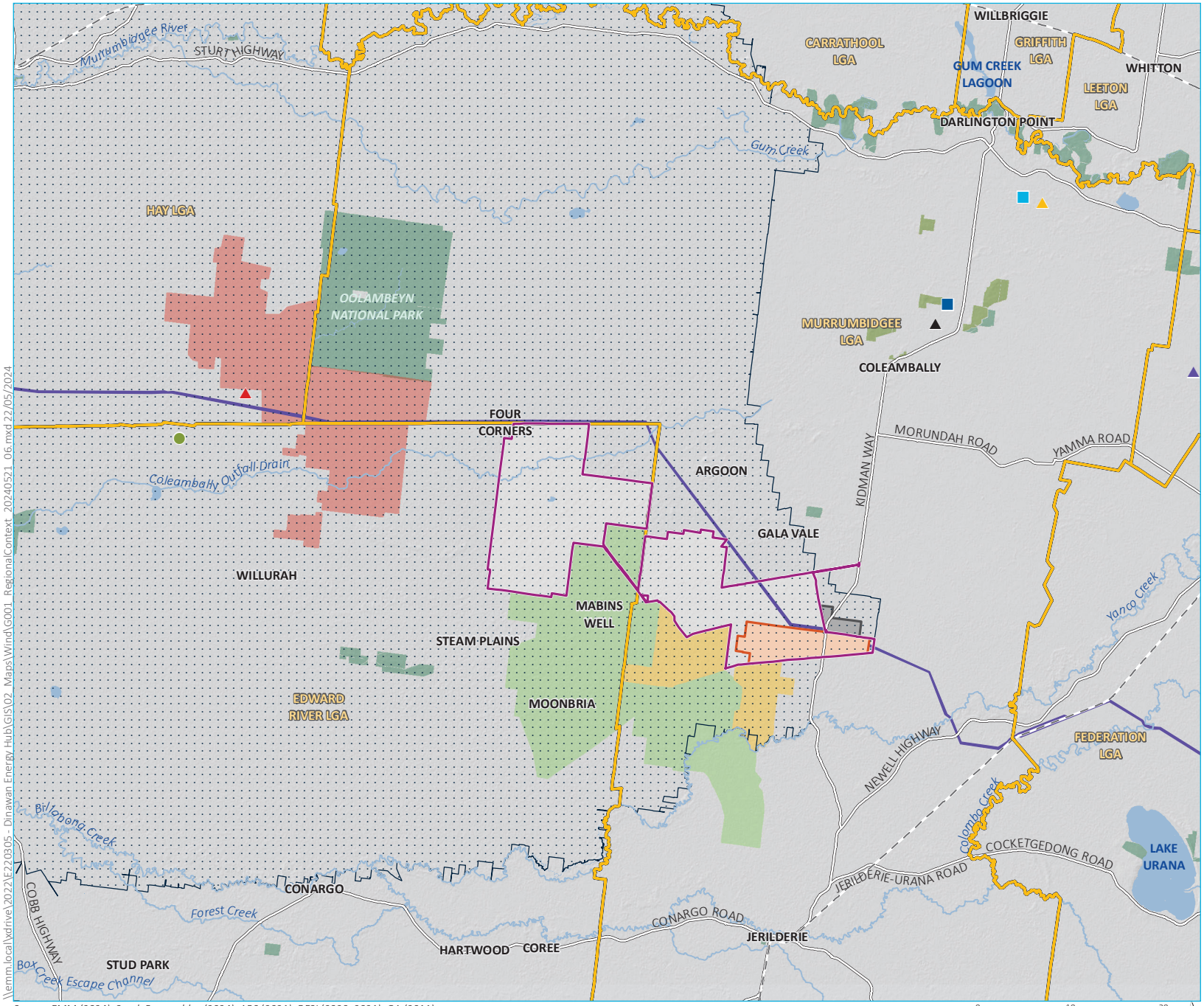
Table 1.2 Commonwealth and State legislation with potential relevance to the project

Legislation	Description	Relevant to the project?	Details
Aboriginal Land Rights Act 1983	Establishes Local Aboriginal Land Councils (LALCs). Allows transfer of ownership of vacant Crown land to a LALC. The Office of the Registrar, *Aboriginal Land Rights Act 1983* (ORALRA), registers Aboriginal land claims and maintains the Register of Aboriginal Owners. Often used in NSW to identify relevant stakeholders for consultation.	No	The project area is within the boundaries of the Griffith Local Aboriginal Land Council, which is a registered Aboriginal party (RAP) for this project. The project area also extends into the Cummeragunja Local Aboriginal Land Council; however, they did not register for the project stating it was outside their area (Attachment B.1). A request to search the Register of Aboriginal Owners was made to the ORALRA on 23 November 2022. The project area does not appear to have Registered Aboriginal Owners pursuant to Division 3 of the Act.

1.4 Limitations

This report is based on existing and publicly available environmental and archaeological information (including data from the Aboriginal Heritage Information Management System (AHIMS)) and reports about the project area. The background research did not include any independent verification of the results and interpretations of externally sourced existing reports (except where ground-truthing was undertaken). The report further makes archaeological predictions based on this existing data and targeted ground-truthing, and that may contain errors depending on the accuracy of these third-party studies and the extent of ground-truthing investigations.

This report does not consider historical and/or built heritage unless specifically related to Aboriginal heritage values. Such heritage items are addressed in the Statement of Heritage Impact (SOHI) appended to the EIS (refer Appendix E.5 of the EIS).



KEY

- Project area
- Dinawan Solar Farm project area
- Renewable Energy Zone

Project EnergyConnect (Transgrid)

- Dinawan Substation
- Transmission line

Neighbouring renewable energy developments

- Coleambally Solar Farm (operating)
- Darlington Point Solar Farm (operating)
- Coleambally BESS (approved)
- Yarrabee Solar Farm (approved)
- Pottinger Solar Farm (proposed)
- Pottinger Wind Farm (proposed)
- Woodland BESS (proposed)
- Yanco Delta Wind Farm (approved)
- Argoon Wind Farm (proposed)
- Bullawah Wind Farm (proposed)

Existing environment

- Rail line
- Major road
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest
- Local government area

Source: EMM (2024); Spark Renewables (2024); ABS (2021); DFSI (2020, 2021); GA (2011)

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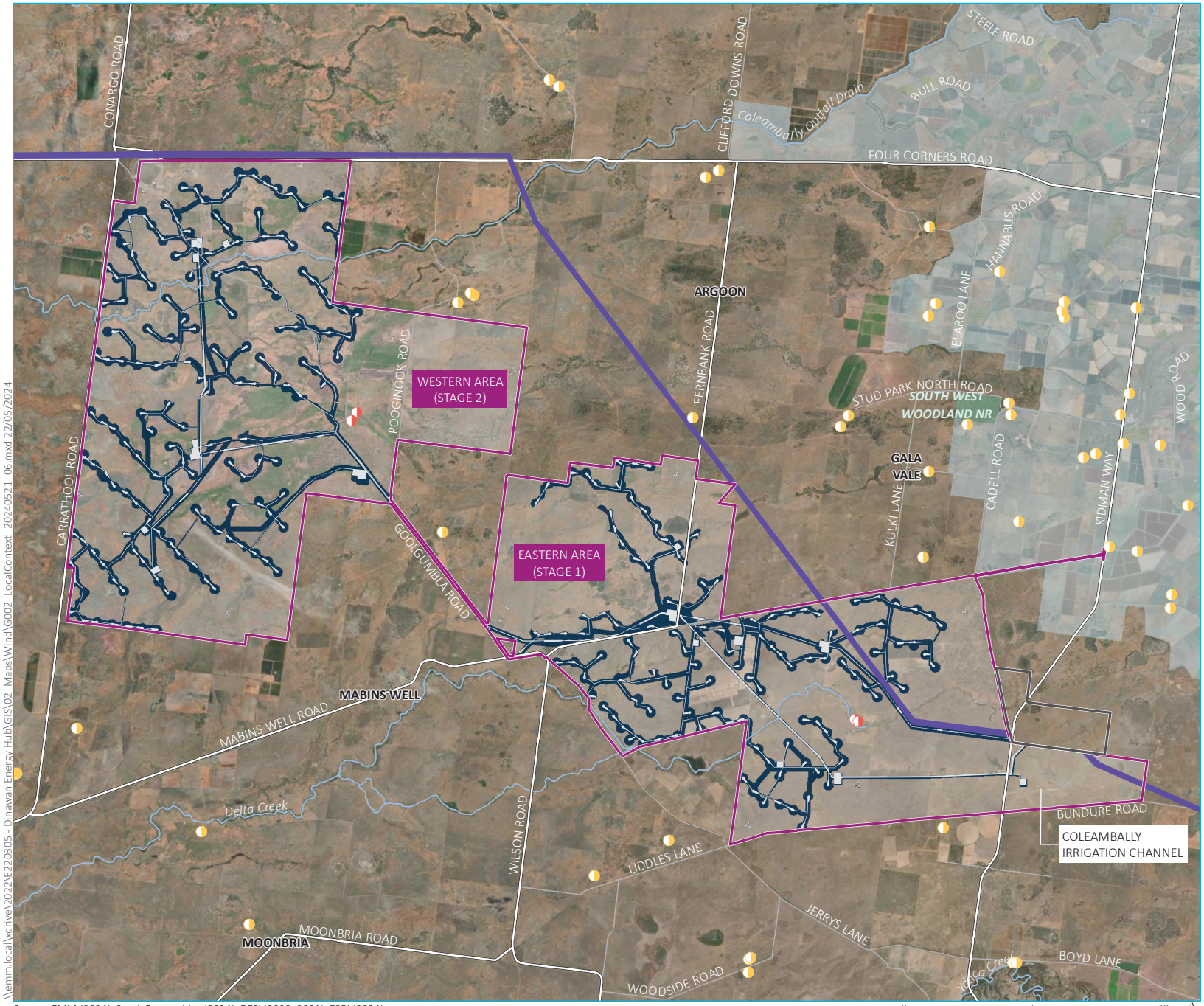
Regional context

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 1.1

EMM creating opportunities



KEY

- Project area
- Development corridor
- Development footprint

Project EnergyConnect (Transgrid)

- Dinawan Substation
- Transmission line

Residence

- Associated
- Non-associated

Existing environment

- Major road
- Minor road
- Watercourse (third order and higher)
- Coleambally irrigation area
- NPWS reserve

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Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

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N

Local context

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 1.2

EMM creating opportunities

2 Project description and setting

2.1 Project overview

A full project description is provided in Chapter 3 of the EIS and an indicative project layout is shown in Figure 2.1 and Figure 2.2. The project will comprise the following key components:

- a network of approximately 200 (3 blade) WTGs across two areas
- electrical collection system, substations and control rooms
- electricity transmission line infrastructure connecting the project substations to the Dinawan Substation
- operations and maintenance (O&M) infrastructure, including site offices and amenities, buildings, equipment and maintenance sheds and laydown, storage and parking areas
- temporary construction facilities, including worker accommodation facilities, construction compounds, site offices and amenities, concrete batching plants, construction materials storage (including stockpiles), laydown areas, temporary meteorological masts, borrow pits, water tanks and storage and parking areas
- other permanent infrastructure, including hardstands, water tanks, permanent meteorological masts, new access tracks and upgrades to existing access tracks
- access points from the public road network and public road upgrades to facilitate the delivery of WTG components.

2.2 Project area

The project area is approximately 39,061 hectares (ha) and encompasses 349 land parcels. The majority of the land within the project area is privately owned, and can be considered as two distinct areas, the eastern wind area (Figure 2.1) and the western wind area (Figure 2.2). The land within the project area is predominantly used for sheep and cattle grazing and some irrigated cropping.

Within the project area, the development corridor is approximately 7,256 ha. The development corridor is the land within the project area where project components may be placed, providing the necessary flexibility for component placement during detailed design (i.e. micro-siting). The development corridor has been refined based on the results of environmental surveys, including biodiversity, Aboriginal cultural and historical heritage surveys, and with consideration of community and regulatory stakeholder feedback.

A development footprint has also been provided and is approximately 1,339 ha within the development corridor. This assessment assumes that the development footprint will be disturbed. As part of detailed design, the development footprint may move within the development corridor; however, total direct surface disturbance is not anticipated to increase.

Direct impacts for public road upgrade works are required on Kidman Way, McLennons Bore Road, Wilson Road, Fernbank Road and Goolgumbla Road and will facilitate access to the development corridor. From the site access points, private internal roads will be used to traverse the development corridor.

The preferred point of connection to Transgrid's network is via the Dinawan Substation, which forms part of Project EnergyConnect and will be constructed on land adjacent to the project area. An overhead transmission line will connect the project's collector substations to the Dinawan Substation.

2.2.1 Terminology

A summary of the key terminology used throughout this assessment is provided below. A full list of abbreviated terms is provided in the Glossary of this report.

- **Project area**: The land required for the project. The project area contains the entirety of all 349 landholdings (Figure 1.2) that overlap with the development corridor and is approximately 39,061 ha. There are two private landholders with land within the project area. The project area includes parts of Goolgumbla Road, Wilson Road, Fernbank Road, McLennons Bore Road and Kidman Way (including the road easement) and Coleambally Outfall Drain, where site access and/or electrical cabling may be required.

- **Development corridor:** The development corridor is the land within the project area where project components may be placed, providing the necessary flexibility for component placement during detailed design (i.e. micro-siting). The development corridor is approximately 7,256 ha and includes the land required for the permanent and temporary project components. The development corridor is wholly within the project area. The development corridor has been refined based on the results of environmental surveys, including biodiversity and Aboriginal cultural heritage surveys, and with consideration of community and regulatory stakeholder feedback.

  Development footprint: The indicative extent of the project's ground disturbance area (1,339 ha), including earthworks, associated with permanent infrastructure and temporary construction facilities. The development footprint will be within the development corridor; however, its exact location will be confirmed following detailed design.

- **Operational footprint:** The area required to support permanent infrastructure. It will include internal roads, hardstands, site offices, electrical infrastructure and swept area of WTGs. The operational footprint will be within the development corridor. The operational footprint will be confirmed following detailed design.

- **Site access point**: The proposed locations where all construction and operations traffic will access the project from the public road network. Access within the development footprint will be via internal tracks.

- **Associated residence:** A dwelling whose owners have parts of their property included in a land agreement with Spark Renewables for the project (i.e. host landholder dwellings).

- **Non-associated residence**: A dwelling whose owners do not have parts of their property included in a land agreement with Spark Renewables for the project.

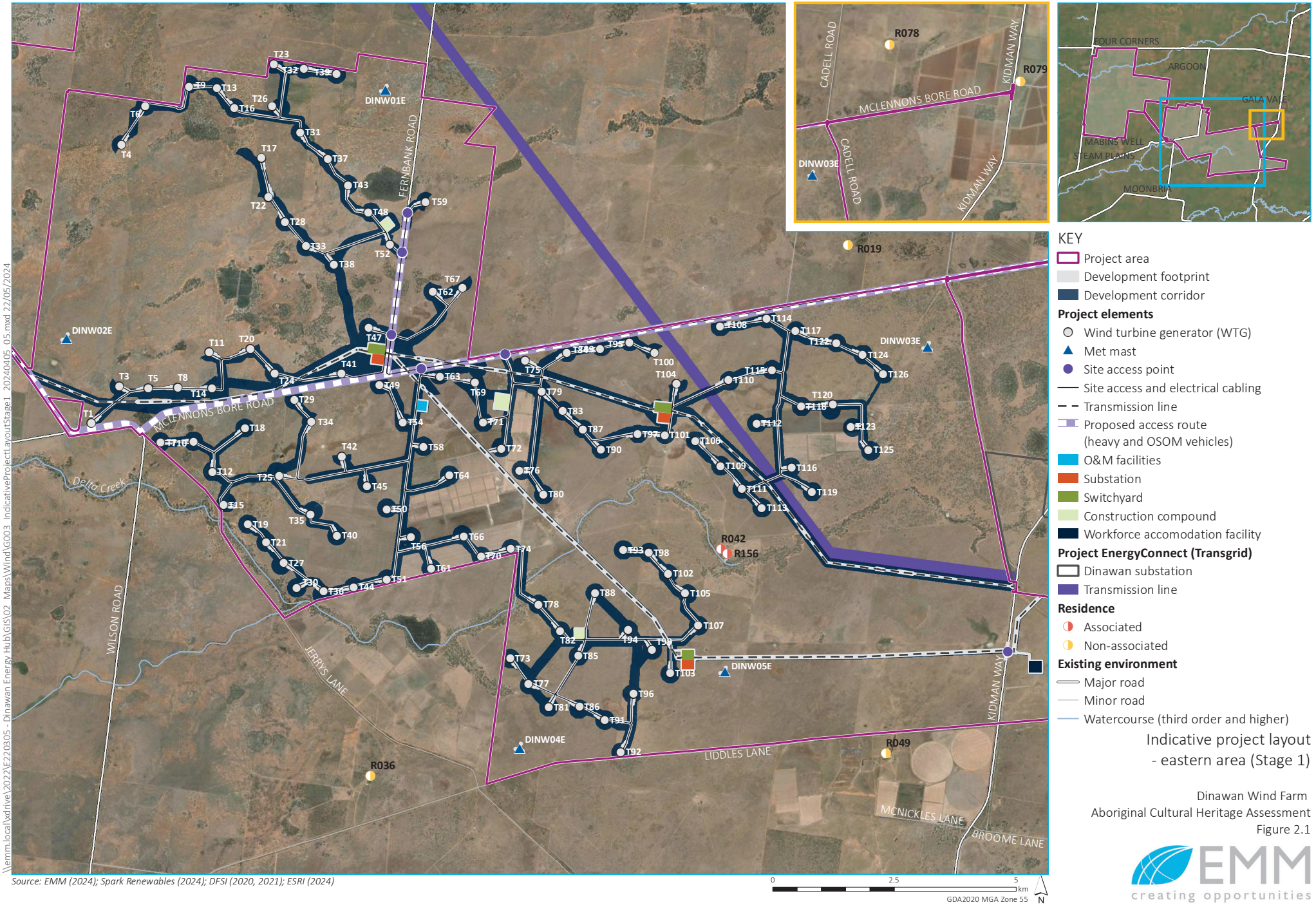
2.3 Project staging

It is anticipated that the project will be constructed in two stages:

- Stage 1 will be the construction of the eastern wind area, including associated public road upgrades, grid connection infrastructure and workforce accommodation facility. Stage 1 is within the Murrumbidgee LGA.

- Stage 2 will be the construction of the western wind area, including associated public road upgrades, grid connection infrastructure and workforce accommodation facility. Stage 2 is predominantly within the Edward River LGA, with the exception of additional public road upgrades and grid connection infrastructure within Murrumbidgee LGA.

The project's generation capacity and connection to the electricity grid is dependent on the outcomes of the South West REZ Access Scheme and the construction of electricity grid infrastructure (including Dinawan Substation). For the purposes of this assessment, it has been assumed that the project will connect to Dinawan Substation and project infrastructure will be housed within the full extent of the development footprint (i.e. this assessment has assessed impacts associated with the construction and operation of both Stages 1 and 2).



Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

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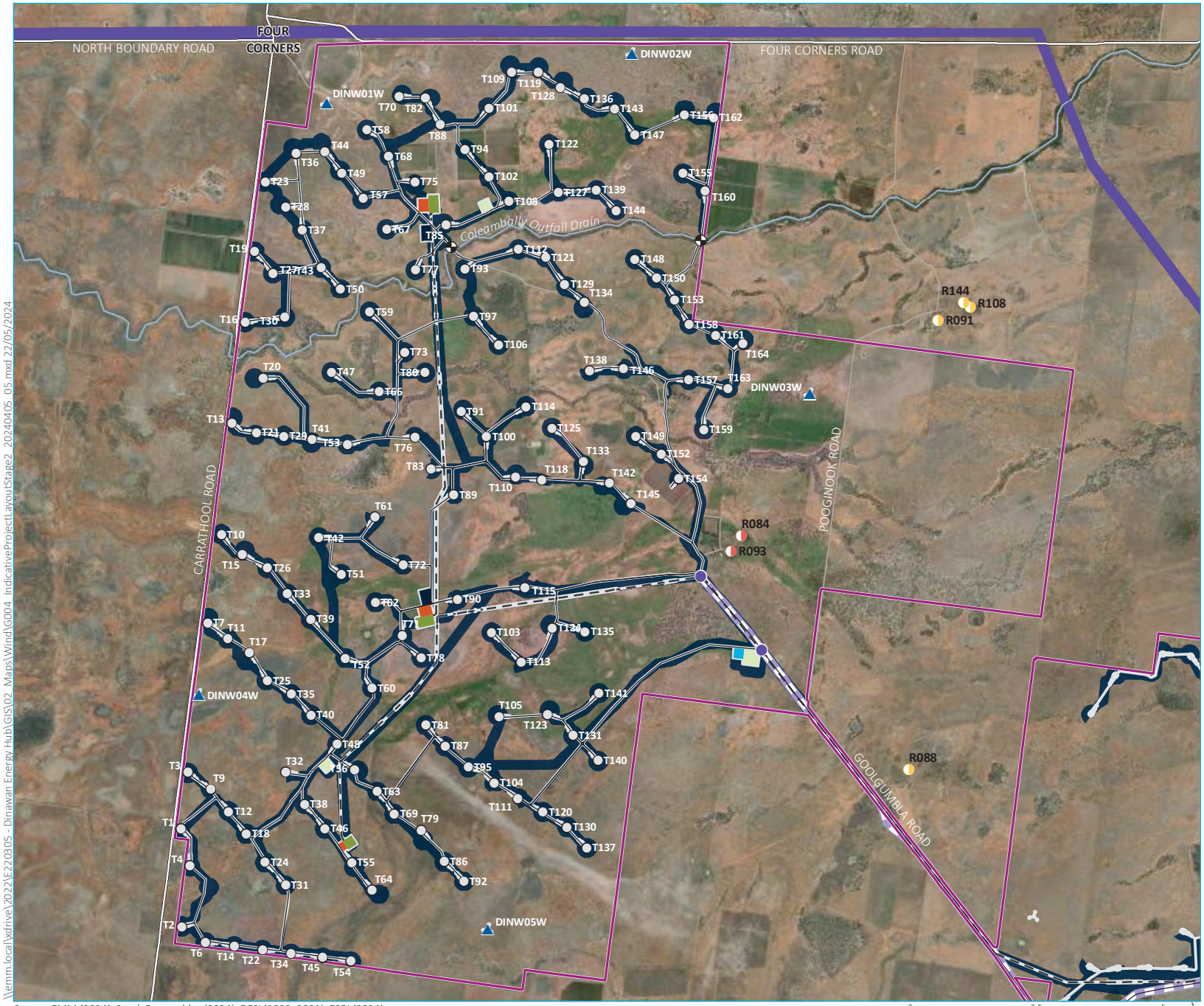

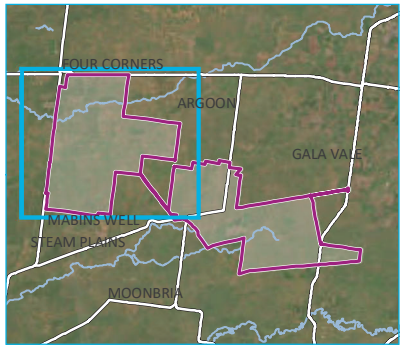

KEY

- Project area
- Development footprint
- Development corridor

Project elements

- Wind turbine generator (WTG)
- Met mast
- Site access point
- Site access and electrical cabling
- Transmission line
- Proposed access route (heavy and OSOM vehicles)
- O&M facilities
- Substation
- Switchyard
- Construction compound
- Workforce accomodation facility

Project EnergyConnect (Transgrid)

- Transmission line

Residence

- Associated
- Non-associated

Existing environment

- Bridge
- Major road
- Minor road
- Watercourse (third order and higher)

Indicative project layout
- western area (Stage 2)

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 2.2

EMM
creating opportunities

Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

0 2.5 5 km

GDA2020 MGA Zone 55

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3 Aboriginal consultation

3.1 Key findings

- The project assessment adopted the processes and methods outlined in Heritage NSW's *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010), as well as additional project-specific communication strategies to promote transparent and frequent two-way dialogue between the Aboriginal community and the project. These latter activities included several Aboriginal focus group meetings (face-to-face) throughout the assessment process, and other meetings as requested by the local Aboriginal community.

- Consultation with Heritage NSW has conformed with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010) and included provision of information on registered Aboriginal parties (RAPs) and notification of the various field survey and excavation activities associated with the project.

- Overall, the project has been liaising with six RAP organisations and/or individuals since its inception in November 2022. These organisations have been identified through the formal notification process as part of the Heritage NSW consultation requirements and/or through contacting the project following word of mouth within the local Aboriginal community. The RAPs include well-established Wiradjuri individuals and/or organisations based in Narrandera and Griffith, as well as Bangarang representatives from Shepparton, Victoria.

- Due to the complexity and fluidity of the ACHAs for Dinawan Solar Farm and Dinawan Wind Farm, communications have involved aspects of both projects, particularly given the RAPs considered them both part of the same cultural landscape. As such, communications for both projects have been documented in one consultation log.

- Opportunity for Aboriginal involvement in consultation for the project was provided throughout the preparation of this ACHA, including:

    - attendance at four face-to-face meetings during key phases of the project

    - participation in a 34-day field survey of the development corridor and surrounds

    - participation in a 9-day archaeological test excavation program within the development corridor.

- Ultimately, over 240 interactions have been undertaken with the RAPs across these opportunities. With five of the six organisations, Griffith LALC, Bundyi Aboriginal Cultural Knowledge, Bidya Marra Consultancy, Bangarang Aboriginal Corporation, and Roley Williams, participating in these opportunities, and totalling over 170 person days on-site cumulatively.

- Discussions with the RAPs have been extensive over the 18-month assessment process. Feedback on the project and ACHA activities has generally been positive, with a strong focus on the wide variety of cultural materials identified during the survey efforts, and particularly the cultural values of the region, acknowledging Aboriginal burials in the broader region, and broader socio-economic benefits from the project.

- Outcomes from the consultation process have resulted in the redesign of the development footprint and development corridor to avoid impacts to Aboriginal sites and areas of high archaeological potential (see Section 10 for more detail).

3.2 The process

As a requirement of the SEARs, consultation was undertaken in accordance with Heritage NSW guidelines (refer to Section 3.2.1). In addition, due to the size, complexity and fluidity of the project, numerous other communication strategies were employed to improve and maintain dialogue with the local Aboriginal community (refer to Section 3.3.2).

3.2.1 Heritage NSW guidelines

Aboriginal consultation for this project has been undertaken in accordance with procedures set out in the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010). These guidelines identify a five-stage process:

1. Pre-notification – identification of the Aboriginal individuals and/or communities relevant to the project area by contacting several state government agencies.

2. Notification – contacting all Aboriginal individuals and/or communities identified in Stage 1 to determine their interest in being consulted during the project. This includes direct communication and the placement of advertisements in local media seeking further expressions of interest from Aboriginal individuals and/or communities that may have been missed through Stage 1. Those Aboriginal individuals and/or communities that wish to be consulted become a 'registered' Aboriginal party (RAP).

3. Presentation of project information/assessment methodology – briefing RAPs about the project and scope of any Aboriginal heritage assessment and investigations. This is usually undertaken through written correspondence, but can include meetings, and may undergo several iterations throughout the project as the nature of the assessment changes (e.g. surface ground-truthing may lead to a requirement for test excavations).

4. Impacts and mitigation strategies – discussion of potential impacts to cultural materials and mitigation options with the RAPs prior to developing the ACHA. This is often undertaken either on-site at the end of any field program and/or as part of Stage 5.

5. Report review – the RAPs are provided an opportunity to review and comment upon the draft ACHA, to contribute input into the overall findings, significance and management of cultural heritage.

The consultation process for the project had two aims:

- to comply with the Heritage NSW consultation procedures to obtain input on the ACHA process

- to identify cultural places and intangible values that may be affected by the project.

3.2.2 Other communication strategies

In addition to the required steps outlined above, Spark Renewables and EMM implemented a range of other strategies to promote transparent and frequent two-way dialogue between the Aboriginal community and the project. Specifically, the strategy included the following additional activities:

1. Face-to-face meetings – Aboriginal focus group (AFG) meetings were held to promote two-way dialogue, inform project design and to maintain regular interaction with the RAPs. These were held during the initial stages of the project, and during report finalisation, at a location within proximity to the project area, with options for online and/or phone meetings as required.

2. Social impact assessment (SIA) – Several meetings were held on-Country with local RAPs (identities were kept confidential) as part of the project's SIA (refer Appendix E.14 of the EIS). A summary of topics discussed has been provided in Attachment B.6.

3. Field investigation participation – all RAPs were offered the opportunity to attend a range of field survey and test excavation activities carried out throughout the development corridor. Ultimately, some 170 person days of participation in the project were undertaken by the RAPs.

3.3 This project

3.3.1 Liaising with Heritage NSW

As part of the ACHA, various interactions with Heritage NSW have been undertaken:

- provision of information on the RAPs involved in the project following the notification process (Table 3.1) – 24 January 2023 (Attachment B.1[1] and Attachment B.3)

- notification of the initiation of archaeological test excavations for the project as required by the *Code of Practise for the Archaeological Investigation of Aboriginal Objects in NSW* guidelines – 13 July 2023 (Attachment B.1).

3.3.2 Liaising with the RAPs

Aboriginal consultation for this project has been undertaken in accordance with procedures set out in Section 3.2.1 and included over 200 interactions with the RAPs between November 2022 and February 2024 (refer to Table 3.1 and Attachment B); and over 170 person days of on-site participation.

Initial stages of the consultation process identified 12 Aboriginal stakeholders in the region (Attachment B.2). Following notification, six organisations and/or individuals registered an interest in the project (Attachment B.3). The RAPs included Griffith LALC, Bundyi Aboriginal Cultural Knowledge, Bidya Marra Consultancy, and Roley Williams, all locally based and representing the local Wiradjuri traditional owners. In addition, Bangarang Aboriginal Corporation and Yarkuwa Indigenous Knowledge Centre also registered for the project representing the Bangarang people and living south of the project area in Shepparton and Deniliquin respectively. The project has been willing to register additional Aboriginal organisations and/or individuals throughout the project regardless of when they have become known or expressed their interest.

Table 3.1 provides a summary of the main steps undertaken to conform with Heritage NSW guidelines. Table 3.2 and Table 3.3 provide information on participation of RAPs in AFG meetings, field survey and test excavations.

Table 3.1 Summary of Aboriginal consultation steps required by Heritage NSW guidelines

Consultation stage	Description	Date initiated	Date completed	Notes
1	Government agency pre-notification	23 November 2022	7 December 2022	Additional details provided in Attachment B.3

[1] Note: Due to the complexity and fluidity of the Aboriginal cultural heritage assessments for Dinawan Solar Farm and Dinawan Wind Farm, communications would often involve aspects of both projects. As such, communications for both projects have been documented in one consultation log (Attachment B.1).

Table 3.1 Summary of Aboriginal consultation steps required by Heritage NSW guidelines

Consultation stage	Description	Date initiated	Date completed	Notes
	Advertisement in the: • Narrandera Angus • The Area News • Weekend Advertiser	15 December 2022 9 December 2022 10 December 2022	29 December 2022 23 December 2022 24 December 2022	A tearsheet is provided in Attachment B.3
	Notification and registration of potential Aboriginal stakeholders	9 December 2022	23 December 2022	Additional details are provided in Attachment B.3
	Advising Heritage NSW and Griffith LALC of RAPs	24 January 2023	-	Additional details are provided in Attachment B.3
2/3	Presentation of information about the proposed project; and gathering information about cultural significance	23 January 2023	20 February 2023	Additional details are provided in Attachment B.4
-	Field investigations	19 April 2023	19 January 2024	Additional details are provided in Chapter 7
4	Review of draft report	8 April 2024	6 May 2024	Additional details are provided in Attachment B.5

Table 3.2 Aboriginal Focus Group meetings

Date	Description	Location
6 March 2023	Introduction to Dinawan Solar Farm and Dinawan Wind Farm and assessment aims and methods.	Coleambally
11 April 2023	Refinement of Dinawan Solar Farm layout following results of the survey, introduction of proposed Dinawan Wind Farm field program.	Griffith/Narrandera
17 August 2023	Overview of Dinawan Solar Farm ACHA findings and update on Dinawan Wind Farm ACHA progress to date.	Yanco
28 February 2024	Overview of Dinawan Wind Farm ACHA findings and Dinawan Solar Farm ACHA addendum following Heritage NSW submission during public exhibition.	Griffith/Narrandera
8 May 2024	Detailed review of Dinawan Wind Farm ACHA findings, potential impacts and mitigation measures and final results of the changes in the Dinawan Solar Farm ACHA	Griffith/Narrandera

Table 3.3 List of Aboriginal parties for the project and their involvment in survey and test excavations

Organisation	Contact	Location	Date of registration	Survey	Test Excavations
Griffith LALC	Stephen Young	Griffith	25 November 2022	Yes	Yes
Bundyi Aboriginal Cultural Knowledge	Mark Saddler	Wagga Wagga	12 December 2022	Yes	Yes
Bidya Marra Consultancy	James Ingram	Narrandera	30 December 2022	Yes	Yes
Bangarang Aboriginal Corporation	Kevin Atkinson	Shepparton VIC	14 January 2023	Yes	Yes
Yarkuwa Indigenous Knowledge Centre	David Crew	Deniliquin	14 December 2022	Opted not to	Opted not to
Roley Williams	Roley Williams	Narrandera	4 January 2023	Yes	Yes

3.4 Aboriginal stakeholder feedback

Aboriginal consultation has been extensive between November 2022 and May 2024, and included over 240 interactions, including five discrete meetings with RAPs in groups or one-on-one meetings (Attachment B.1 and Attachment B.6), and some 43 days of on-site activity. As such, discussions have been wide-ranging, initially focussing on who is relevant to the project area, then the methods and approach to field investigation, noting areas of risk and concern for cultural heritage, and finally into the potential impacts and management of identified cultural sites and values. Where captured, minutes of the meetings are presented in Attachment B.6.

In summary, the main discussion topics have included:

- Outlining the proposed projects (both Dinawan Solar Farm and Dinawan Wind Farm), including general locations, context related to other nearby studies, EMM's involvement with the project, and the ACHA process and proposed field investigation methodologies.
- Improving participants' understanding of the process and project, and how it relates to other nearby projects (mostly as a result of being in the South West REZ).
- Discussion around other recent studies, including the Yanco Delta Wind Farm to the south, with an exploration of their findings and what it might mean for this project. References were made to the discovery of camp sites, culturally modified trees, hearths, and oven mounds elsewhere, and which may be expected in the project area. Reference was also made to a wetland and associated cultural deposits within, or in proximity to, the Yanco Delta Wind Farm site; and that a similar landscape with deposits may also be present in the project area.
- Discussion of the broader environment, with a focus on major river systems such as the Murrumbidgee River to the north, demonstrating the importance of the region to the Wiradjuri people. This included discussions around the Bangarang people and their ancestral lands, clarifying that the misconception is the Bangarang people only inhabited the lands south of the Murray River, when they occupied both sides of the river and interacted regularly with the Wiradjuri people and other smaller Murrumbidgee Plains clans.
- Discussion and translation (Mark Saddler, Bundyi Aboriginal Cultural Knowledge) of some of the place and town names in the region, all being based on Wiradjuri language, further reiterating the importance of this landscape to the Wiradjuri people.

- Discussion of numerous Aboriginal burials recorded in the broader region lead by James Ingram (Bidya Marra Consultancy), Roley Williams, Jason Matthews (Roley Williams/Narrandera Aboriginal Community Inc) and Mark Saddler (Bundyi Aboriginal Cultural Knowledge). Known burial sites within the region include: Dry Lake near Euroley, the Koonadan burial in Leeton, Lake Bogan west of the project area, the Warangedsa Mission near Darlington Point, the town of Coleambally (is a known Aboriginal burial ground), and the Limondale Solar Farm north-west of the project area (which EMM developed a Heritage Management Plan (HMP) following discovery of ancestral remains during construction works). Additionally, discussions on-site included numerous burials around the Hay Plains north of the project area, Salt Lake (location unconfirmed but in general region, possibly Lake Urana east of the project area), burials that were found during a Transgrid survey (Roland Atkinson, Bangarang Aboriginal Corporation) near to the project area though exact location was unknown, and a burial that was recovered from a sand quarry in 2003 located ~12 km north-east of Coleambally off McGrath Road (Mark Saddler, Bundyi Aboriginal Cultural Knowledge).

- Further project discussions occurred following the initial surveys of the Dinawan Solar Farm, noting that Heritage NSW had rejected the Yanco Delta Wind Farm ACHA in February 2023 due to insufficient survey coverage (10% of the project area), despite low levels of visibility due to dense vegetation coverage. EMM had received advice from Heritage NSW for other projects (e.g. Central West Orana REZ Transmission Line) that 70% coverage was considered robust. As such, extensive survey efforts were employed, resulting in 68% (4,952 ha) coverage of the development corridor. Additional areas were investigated outside of the development corridor prior to project redesign excluding these areas; however, these transects have been excluded from the survey effort calculations. Visibility was poor across much of the development corridor (~10%), resulting in 12% effective survey coverage. During the initial phase of the field investigations, it was suggested by Roley Williams that the use of a drone for survey would be more suitable for survey in flat plains with limited visibility to better identify areas of exposure, which could then be explored on foot.

- Discussion occurred around a moderate (~6 m high) source-bordering sand dune (DEHW-2023-Dune) in the middle of the western (Stage 2) area as a high archaeologically sensitive landform with the potential to contain deeply buried cultural sites and/or burials. Several hearth and artefact scatters were identified in exposures in the general vicinity around the base of the dune. Discussions occurred both on and offsite with RAPs and Spark Renewables about redesigning the development corridor to avoid this landform entirely, which has been incorporated into the design.

- Assessment process – understanding how SSD projects are assessed and how Aboriginal heritage fits into this process; and the key components of the ACHA process.

- Field survey and excavation findings – the nature of cultural materials found within the development corridor, and how they may be further investigated, managed and/or protected into the future. This included the identification of several culturally significant sites that should be avoided by the project. Mark Saddler (Bundyi Aboriginal Cultural Knowledge) provided a site report following the survey, highlighting identified sites and Wiradjuri words and language. A copy of the report is included in Attachment B.6, with his permission.

- Post-approval mitigation measures and actions – discussion over the proposed Aboriginal cultural heritage management plan (ACHMP) and activities that are expected to result from it in relation to the management of adversely affected cultural materials. This included discussions that any adversely affected site should be visited by senior Wiradjuri traditional owners during the formulation of the ACHMP to ensure appropriate measures are developed and some discussion over long-term repository with most preferring retention on Country. Discussions over potential heritage interpretation from the project was also explored and of interest to the RAPs.

The outcomes of these discussions have been considered in the development and content of the ACHA. While not necessarily individually mentioned throughout the report, they have nonetheless been considered throughout the formulation of this ACHA.

A copy of the ACHA was provided to the RAPs (Attachment B.5) on 8 April 2024, but no written comments were submitted by any parties.

4 Existing environment

4.1 Key findings

- The project area is characterised as an exceptionally flat, open riverine plain landscape with low relief and low slope gradients. Lunettes and source-bordering dunes are common in the broader regional landscape where previous ground disturbance is minimal, such as those associated with Lake Mungo, Lake Urana, and Barren Box swamp, among others in the Riverina region. In addition, prevailing winds cause similar crescent-shaped accumulations of sediment on the eastern margins of shallow wetlands and shallow depressions (known by the Wiradjuri word, Gilgai), but these 'Gilgai mounds' are comparatively very shallow and of a far younger antiquity then the lunettes associated with the lakes.

- The project area is situated in the Riverina catchment, which incorporates the floodplains of the Murrumbidgee and Murray Rivers and their various anabranches and tributaries. There are several 1st and 2nd order watercourses that intersect with the project area. With more prominent watercourses including a 3rd order tributary from Delta Creek, located within the south-eastern portion of the project area, and a 9th order watercourse referred to as the Coleambally Outfall Drain, that transects the north-western portion of the project area (see Figure 4.1). Other perennial watercourses in the locality include Delta Creek, a 3rd order watercourse approximately 2.5 km west of the project area, and Yanco Creek, a 9th order watercourse approximately 7 km south of the project area. Other water sources in the locality include Gilgai and shallow, ephemeral wetlands which are scattered across the project area. These watercourses support a number of small ephemeral wetlands in the area.

- The Riverine floodplain would have contained a variety of resources that would have been attractive to Aboriginal people in the past, but also would have influenced the potential cultural materials that may have been deposited and survived. Due to a lack of suitable sandstone geology and steep relief, it is highly unlikely that grinding grooves and rockshelters (or associated features) would be present within the project area. Conversely, culturally modified trees where remnant vegetation remains, hearths, and surface stone materials have greater potential to be present in these environments.

- From a geological perspective, the project area contains alluvial floodplain deposits of unconsolidated sand, clay, silt and gravels, but there are no notable stone outcrops that may have been conducive to manufacturing Aboriginal stone tools, indicating raw materials have been transported to the project area. The closest known Aboriginal quarry site is approximately 70 km north-east of the project area on Whitton Road, near Leeton, where quartz, siltstone and quartzite were obtained. Silcrete, mudstone and claystone have also been recovered from Lake Urana, approximately 35 km south-east of the project area. Regionally, stone artefacts are typically manufactured from quartz, quartzite, silcrete, and sandstone.

- The Australian soil classification (ASC) soil groups mapped within the project area include Vertosols, Chromosols and Rudosols. These soils are frequently shallow with a high clay content and are prone to wind and sheet erosion which exposes the cracking clay subsoils.

- The project area contains a wide variety of flora and fauna that would have been desirable for Aboriginal people to procure food, tools, and medicine, as well as totemic and/or cultural purposes. Much of this vegetation has been cleared during the historical period as a result of the extensive pastoral industry in this region.

- The project area has been subject to both natural and anthropogenic disturbances that will affect the survivability of cultural materials if present. These include agricultural, pastoral activities and vegetation clearance across much of the project area, most notably that of laser-levelling, an agricultural practice that was introduced to the local area after 1977, as a way to grade the land to a single uniform level. This disruption and removal of the upper soil profile would have also resulted in the removal or displacement of any associated cultural materials.

4.2 General

Understanding environmental context assists with predictions of archaeological potential, such as the likelihood of archaeological material being present in the landscape, its spatial distribution and its preservation. Landscape features were an important factor for the choice of camping, transitory and ceremonial areas used by Aboriginal people. Similarly, these landscape features and historical land-use play a role in the level of preservation and the integrity of archaeological sites.

A landscape consisting of suitable topography, hydrology, geology and soils has strong links with natural resources that would have been available to, and sought after by, Aboriginal people. Flora and fauna would have provided food, tools and ceremony (culturally modified trees); proximity to fresh water was necessary for life and growing crops, as well as gathering fish, molluscs, and eels.

4.3 Landscape overview

The project area is situated wholly within the Riverina Bioregion, also known as the Riverine Plains, which extends from Ivanhoe in the north to Bendigo VIC in the south, from Narrandera in the east to Balranald in the west (NPWS 2003, p. 91). The Riverine Plains are exceptionally flat, with an average gradient of 20 cm/km from 120 m above sea level (asl) in the east to 65 m asl in the west. This is a product of its geological evolution from a shallow embayment of the Southern Ocean (Pardoe and Martin 2011, p. 16; Soil Conservation Service of NSW 1990). The subtle landforms across the Plains are a result of the evolution of its major river systems, the Murray and Murrumbidgee Rivers, and their major tributaries and anabranches the Lachlan, Willandra, Edward, Yanco, and Goulburn Rivers, throughout the Pleistocene and Holocene periods (Pardoe and Martin 2011 , p. 16). The result of these hydrological processes is that the upper catchment, including the project area, consist of three overlapping alluvial fans. The project area is located between the Murrumbidgee and Yanco Rivers within the Murrumbidgee subregion, which is characterised by alluvial fans with distributary channels and floodplains overlying Quaternary alluvial clays and sands, and where lunettes, and low source-bordering dunes are common (NPWS 2003, p. 97).

Further away from these large watercourses and their floodplains, Gilgai, a Wiradjuri term for ‘water hole’, are shallow depressions in the ground that collect and retain water during localised rain events, and these are scattered throughout the project area. On the eastern side of the Gilgai, minor crescent-shaped ‘Gilgai mounds’ are formed through a similar process as lunettes, with prevailing western winds causing a very shallow build-up of sediments.

The relief of the topography within the project area is minute, with slopes of <1% and local relief of <5 m.

The Riverine Plains are characterised by a dry, semi-arid climate with hot summers and cool winters, with varying vegetation communities. These broadly include river red gums (*Eucalyptus camaldulensis*), river cooba (*Acacia stenophylla*), black box (*Eucalyptus largiflorens*), and white cypress pine (*Callitris glaucophylla*) in sandy areas, as well as saltbush shrubland, numerous grassland communities, and water plants in swamps.

4.4 Hydrology

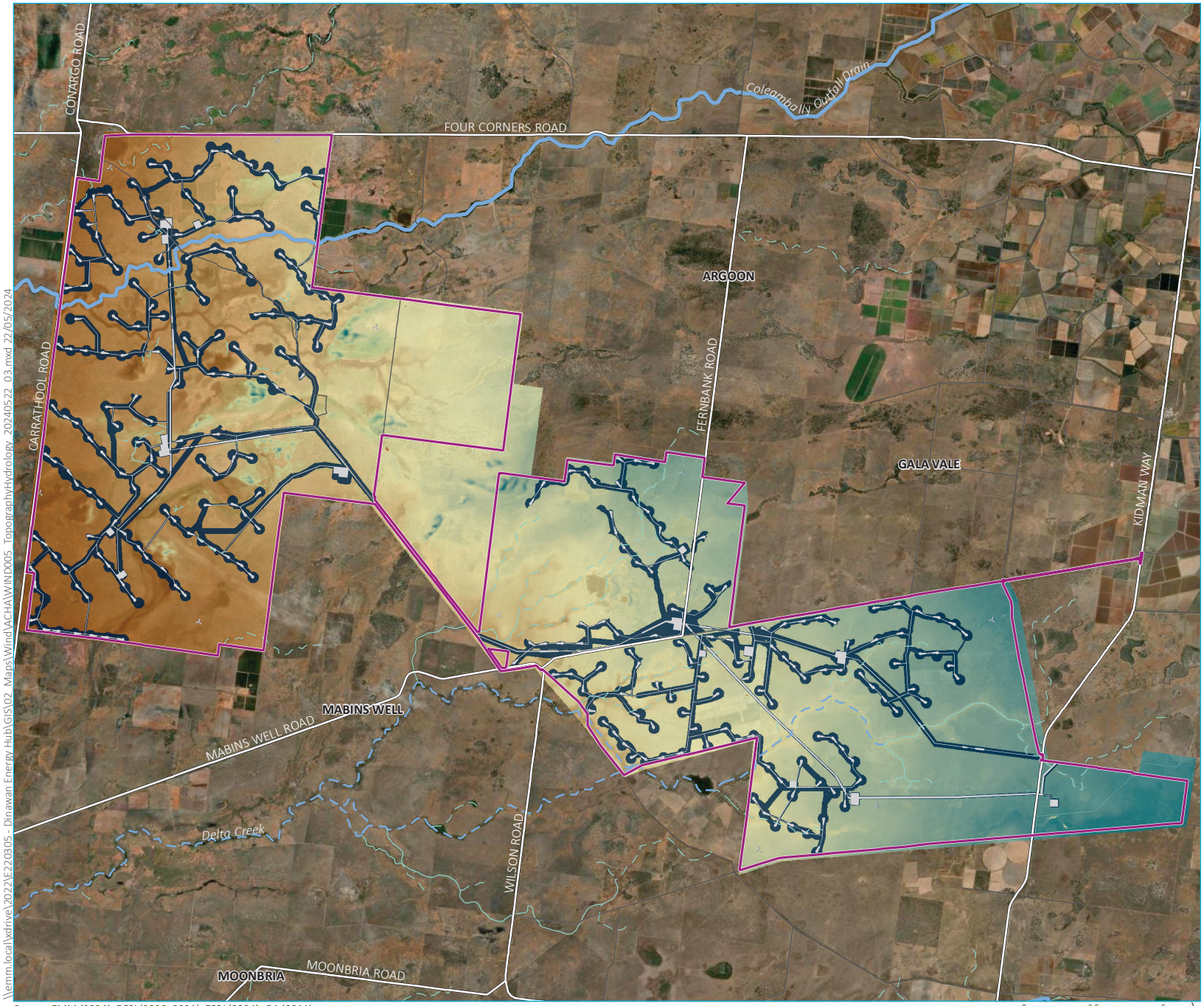
There are two major hydrological systems in the Riverina Bioregion. The Murrumbidgee River is located 52 km north of the project area and the Murray River is located 82 km to the south. A large ephemeral low-lying swamp, measuring an area of 1.76 km^2, is approximately 1 km north-east of the project area. Lake Urana, a 65 km^2 ephemeral lake, is located 35 km south-east of the project area and contains evidence of Pleistocene-age Aboriginal occupation (see Section 6.2). When overflowing, discharge from Lake Urana has been known to flow west into the Yanco Creek system (Bowler 1986, Page 1994, p. 159-161). Yanco Creek is a 9th order watercourse located 7 km south of the project area. The locations of major named watercourses within the broader region, including Yanco Creek and Murrumbidgee River, are shown on Figure 1.1.

Several 1st and 2nd order watercourses intersect the project area, and support a number of shallow, ephemeral wetlands. There are some 3rd order and named waterways within the project area, including Delta Creek, Blind Creek, and Bublebundie Creek. The 9th order stream that bisects the western part of the project area is the Coleambally Outfall Drain, that likely follows the alignment of a much lower order stream that eventually flows into Coleambally Creek (see Figure 4.1). In addition, Gilgai are scattered throughout the project area, which would have served as temporary water sources following localised rain events, and would have supported small, transitory groups of Aboriginal people traversing the landscape.

A geomorphological study of paleochannels in the region determined that the Murrumbidgee channel and floodplain was predominately larger in the Pleistocene than the Holocene, denoting a wider distribution of Aboriginal sites prior to the Holocene (Austral Archaeology 2021, p. 4). Thermoluminescence dating of the Coleambally paleo-system[2] confirmed these ancient stream channels were active around 105,000 years before present (BP), 80,000 BP, and 9,000 BP (Banerjee, Page, and Lepper 2002, p. 327, Pardoe and Martin 2011, p. 17). While the earlier dates of 105,000 BP and 80,000 BP exceed the earliest known dates of human occupation in Australia (~50,000 BP), it indicates these paleochannels were active from this early time period through to the early Holocene (10,000 BP) where long-term Aboriginal occupation of the area was well established (see Section 6.2). Paleochannels within the region retreated between the Holocene arid period, dating between 10,000–8,000 years ago, and a thermal maximum, dating between 6,000–4,000 BP. There are four main paleochannel phases in the area, the Coleambally phase (105,000–80,000 BP), the Kerarbury phase (55,000–35,000 BP), the Gum Creek phase (35,000–25,000 BP), and the Yanco phase (20,000–12,000 BP) (Page et al. 2009, p. 25). Through spatial analysis the remnants of these phases are identifiable in the landscape. While paleochannels can be obscured by wind swept sands, they are often identified in proximity to source-bordering dunes and ridges (Langford-Smith 1960, p. 377). Importantly, at times of extreme flood flow, water from the different streams can cross the fan surfaces and enter channels of another system (NPWS 2003).

The hydrology of the region and project area suggests that there are several locations where water may have been seasonally or periodically available. Whilst these water sources were temporary, they would have provided Aboriginal people with resources at different times, such as when travelling between locations, or when major watercourses were in flood and unavailable.

[2] The Coleambally paleo-system is not related to the Coleambally Creek mentioned above, but relates to Delta Creek (Yamma Arm) and another channel further south (Bundure Arm).



KEY

- Project area
- Development corridor
- Development footprint

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 9th order

Existing environment

- Major road
- Minor road

Elevation (mAHD)

117.7

100.2

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Topography and hydrology

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 4.1

EMM
creating opportunities

4.5 Geology

The nature of the surrounding and local geology along with the availability and distribution of stone materials has a number of implications for Aboriginal land use and archaeological investigations. Evidence of stone extraction and manufacture can be predicted to be concentrated in areas where outcroppings of suitable raw materials occur. However, where suitable outcroppings are rare, stone can be transported for manufacture and/or traded across the region.

While the outcropping geology of the project area is minimal, an Aboriginal stone quarry has been identified approximately 60 km north-east of the project area on Whitton Road. The raw material, believed to be sourced from the pebbles of the pebbly sandstone and conglomerate beds, were identified as basalt, quartz, quartzite, chert, and greenstone (Gollan 1982, NGH Environmental 2019, p. 28). Within the larger Coleambally Irrigation Area north of the project area, finer grained sandstone has additionally been noted (Belthuis 1968, p. 128). Pardoe & Martin (2011) have identified quartz, quartzite and silcrete to be among the most common raw material chosen for stone tool manufacture within the region. They also note the minimal cortex retained on many of the stone cultural materials, indicative that the raw materials are being transported into the area due to the absence of suitable locally available stone resources.

The geology of the project area is from the Quaternary of the Cainozoic era, consisting of alluvial and aeolian deposits. The unconsolidated riverine deposits of clay, sand, silt and gravels is common throughout most of the Riverina Bioregion (NPWS 2003, Tuckwell 1976). This period of time, between 5 million years ago (Mya) and 0.4 Mya is characterised by the formation and decline of the 33,000 km^2 freshwater Lake Bungunnia, resulting in the formation of the semi-arid landscape of the Murray Basin by 0.5 Mya (Page 1994, p. 20-22). Alluvial flood plain deposits cover the majority of the project area while a discrete aeolian sandplain is mapped in the north-eastern portion of the eastern project area (Figure 4.2). Alluvium is mapped along one of the tributaries of Delta Creek in the eastern portion of the project area (Figure 4.2).

There are two localities mapped as source-bordering dunes in the western portion of the project area (Figure 4.2), which were validated during the field investigations (Section 7). Source-bordering dunes typically form single isolated ridges but have been known to merge into considerable levee belts, extending up to a kilometre wide (Langford-Smith 1960, p. 377). Multiple dunes systems along the Murrumbidgee River have been given thermoluminescence (TL) ages ranging between 19 and 120 ka, while TL samples from the Goulburn River, a major tributary of the Murray River, have identified younger dune systems dating between 13 and 16 ka (Chen et al. 2002, p. 20). The volume of these dunes is heterogeneous, with Australian Parna deposits measuring <5 m thick. However, dune depths between 50–80 cm thick have been identified along the Murrumbidgee River in the Wagga Wagga area (Chen et al. 2002, p1, 24).

Within western NSW white cypress pine is often located within deep sand sheets and sand ridges, in soils with a pH range between 5.0–7.5 (Thompson and Eldridge 2005, p. 556–7). Bone preservation is more likely to take place within alkaline soils >pH 6.0, with hydroxyapatite forming and increasing crystallinity at >pH 7.5 (Nielsen-Marsh et al. 2000, p. 446). This suggests that the identification of this species in sources bordering dunes may indicate the increased potential for the preservation of organic cultural materials (if present) including ancestral remains. Furthermore, when considering the preservation of buried material, parna deposition in source bordering dunes that have clay microaggregates dispersed into <2 µm particles will create poor air quality due to surface sealing, crusting and hard setting (Cattle, Greene, and McPherson 2005, p. 40), which would further reduce the decomposition of organic materials and improve their preservation.

4.6 Soils

4.6.1 Regional classifications

Soil landscape classifications and their boundaries provide pre-defined areas that are classified by several geographic features, and which are informative for the archaeological investigation. They provide localised information including landform patterns, soils, geology, rock outcrop percentage, land use and vegetation. This information provides another layer to categorise the landscape for the predictive model, additional to what a topographic description can provide. Soil landscape information builds on underlying geology and describes the depths of residual soils and colluvial soils and identifies areas that are characterised by erosion or skeletal soils and exposed bedrock versus those that may contain a deeper profile where cultural material may be buried. The project area is predominantly mapped within the Murrumbidgee Scalded Plains (Mbd) soil landscape unit with discrete areas mapped within the Murrumbidgee Source-Bordering Dune (Mrd) and Murrumbidgee Depression Plains (Mud) Mitchell Landscape units (Department of Planning and Environment 2016). Dr Peter Mitchell defines the following landscape units as (Mitchell 2002, p. 105):

- Murrumbdigee Scalded Plains – Quaternary alluvial plains with extensive scalding interpreted as relic floodplains or terraces. Grey, brown and red cracking clays, red brown texture-contrast soils with scalds. Levees traces evident, relief generally <1 m, up to 5 m on associated pans, swamps and lunettes.

- Murrumbidgee Source-Bordering Dune – sandy rises adjacent to river channels and along prior streambeds, deep red and brown sands and loams, relief 3–12 m. Often heavily grazed and subject to wind erosion.

- Murrumbidgee Depression Plains – Quaternary alluvial plains with numerous depressions interpreted as high floodplains or low terraces beyond the reach of average floodwaters, relief to 10 m. Grey to brown clays and clay loams with linear patterns of sandy prior streams.

Sedimentation across the plain in association with flooding events from the Pleistocene and Holocene lessened in connection with the depletion of the prior-stream system between the Holocene arid period, dating between 8,000–10,000 years ago, and a thermal maximum period 4,000–6,000 years bp. Primary sedimentation during the Cenozoic is due to eolian *parna*, an Australian Aboriginal word meaning *dusty surface*, a calcareous material with a matrix of silt sized quartz grains and clay particles that were re-deposited to the Riverine plains by a westerly wind. There are four identified parna series, of which the youngest Yarabee Parna is found only in dune landscapes. Parna zones are more likely to be identified in areas of vegetation, as they form a physiographic catchment for deposition (Chen et al. 2002, p. 2, Langford-Smith 1960, p. 385).

Based on publicly available Australian soil classification (ASC) mapping data (Isbell and The National Committee on Soil and Terrain 2021), the project area is dominated by Vertosols and sporadic portions of Rudosols and Chromosols (see Table 4.1 and Figure 4.3). In general, these soil groups are observed to:

- have a relatively shallow topsoil unit (<30 cm), with a strong texture contrast between the topsoil (A horizon) and subsoil (B horizon) units

- comprise a high clay content (35%) that frequently exhibits cracking when dry

- exhibit good water holding capacity

- be highly mobile and erosive.

Table 4.1 Summary of regional ASC soil mapping

Soil type	Description
Vertosols (VE)	• Soils with a clay field texture or 35% or more clay throughout the solum except for thin, surface crusty horizons 30 mm or less thick. • When dry, open cracks occur at some time in most years – being at least 5 mm wide and extending upward to the surface, or to the base of any plough layer, peaty horizon, or other surface horizon. • Slickensides and/or lenticular peds occur at some depth in the solum. Often can exhibit Gilgai microrelief.
Chromosols	• Soils with a strong texture contrast between A horizons and B horizons. • Soils other than Hydrosols: – with a clear or abrupt textural B horizon, and – in which a major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is not sodic and not strongly acid. Many of these soils often have calcareous horizon or calcrete pan, or a red-brown hardpan either within or directly underlying the B horizon.
Rudosols (RU)	• Soils with generally little, if any, pedologic organisation apart from: – minimal development of an A horizon, or – presence of less than 10% of a B horizon in fissures of the parent material or saprolite. • The soils are apedal or only weakly structured in the A1 horizon and show no pedological colour changes apart from the darkening of an A1 horizon. • Typically, young soils in the sense that soil forming factors have had little time to pedologically modify parent rocks or sediments. Component soils can vary widely in terms of texture and depth; many are stratified and some are highly saline.

4.6.2 On-site soil investigations

These desktop findings have been validated through field investigations by EMM as part of the land and rehabilitation assessment for the EIS. Specifically, four main soil types were encountered (EMM 2024):

- SPC01: Deep, cracking, reddish brown clays with sodic, moderately structured, medium clay subsoils, which exhibited the following units:
  - A1 – topsoil (0.00–0.20 cm below surface) - Dark greyish brown (10YR 4/2); light medium clay; strong subangular blocky structure of 5–10 mm; pH 7.0; gradual boundary to -
  - B21 – subsoil (0.20–0.50 cm below surface) -Brown (10YR 4/3); medium clay; strong subangular blocky/lenticular structure of 5–10 mm; pH 8.5; diffuse boundary to -
  - B22 – subsoil (0.50–0.80 cm below surface) - Brown (7.5YR 4/4); light medium clay; moderate subangular blocky structure of 5–10 mm; 2–10% faint orange mottles of <2 mm; <2% soft calcareous segregations of 2 6 mm; pH 9.0; diffuse boundary to -
  - B3 – transition subsoil (0.80–1.20 cm below surface) - Light reddish brown (2.5YR 6/3); clay loam; weak structure of 2–5 mm, <2% faint orange mottles of 5–15 mm; 2–10% soft calcareous segregations of 2–6 mm; pH 9.0; layer continues.

- SPC01a: Deep, hardsetting, reddish brown clays with surfaces of clay loams grading to sodic, moderately structured, medium clay subsoils, which exhibited the following units:
    - A1 – topsoil (0.00–0.20 cm below surface) - Dark brown (7.5YR 3/3); clay loam, fine sandy; massive; pH 6.5; abrupt boundary to -
    - B21 – subsoil (0.20–0.50 cm below surface) - Dusky red (2.5YR 3/2); light medium clay; strong subangular blocky of 5–10 mm; pH 7.0; clear boundary to -
    - B22 – subsoil (0.50–0.60 cm below surface) - Reddish brown (5YR 4/3); light medium clay; moderate to strong subangular blocky structure of 5–10 mm; 2–10% calcareous nodular segregations; pH 8.0; layer continues.
- SPC02: Deep sandy soils with minimal structural development and reddish brown, loamy coarse sands over yellowish red sandy loams, which exhibited the following units:
    - A1 – topsoil (0.00–0.15 cm below surface) - Dark brown (7.5YR 3/3); loamy coarse sand; single-grained; hydrophobic; pH 6.0; diffuse boundary to -
    - A12 – topsoil (0.15–0.65 cm below surface) - Reddish brown (5YR 4/4); coarse sand; single-grained; pH 6.0; diffuse boundary to -
    - B1 – subsoil (0.65–1.05 cm below surface) - Yellowish red (5YR 4/6); sand; single-grained; pH 6.5; gradual boundary to -
    - B2 – subsoil (1.05–1.20 cm below surface) - Reddish brown (5YR 4/4); sandy clay loam; single-grained; pH 7.5; layer continues.
- SPC03: Deep, texture contrast soils with surfaces of brown to red, sandy loams to sandy clay loams including bleached A2 horizon over subsoils of red, mottled light to light-medium sodic clays, which exhibited the following units:
    - A1 – topsoil (0.00–0.15 cm below surface Dark brown (7.5YR 3/3); sandy loam; massive; pH 7.0; gradual boundary to -
    - A2 – topsoil (0.15–0.25 cm below surface) - Brown (7.5YR 4/3 [M]) to light brown (7.5YR 6/4 [D]); sandy loam; massive; pH 7.5; abrupt boundary to -
    - B21 – subsoil (0.25–0.50 cm below surface) - Dark reddish brown (5YR 3/3); light-medium clay; strong subangular blocky structure of 10–20 mm; pH 8.5; gradual boundary to -
    - B22 – subsoil (0.50–0.80 cm below surface) - Brown (7.5YR 4/4); light medium clay; moderate subangular blocky structure of 10–20 mm; 2-10% faint orange mottles of <5 mm; 2-10% soft calcareous segregations of 2–6 mm; pH 8.5; gradual change to -
    - B23 – subsoil (0.80–1.05 cm below surface) - Yellowish brown (10YR 5/4); light clay; weakly to moderate subangular blocky structure of 5–10 mm; <2% distinct orange mottles of <5 mm; 10–20% soft calcareous segregations of 2–6 mm; pH 8.5; diffuse boundary to -
    - B3 – transitional subsoil (1.05–1.20 cm below surface) - Light olive brown (2.5Y 5/3); light clay; weakly structured to apedal; <2% faint orange mottles of <5 mm; pH 8.5.

This soil mapping within the project area indicates that the A horizon topsoils (the cultural bearing layer) are likely to be shallow (<30 cm deep) and vulnerable to erosion, significantly reducing the potential for buried cultural materials. This loss, or near-loss, of the A horizon over time results in cultural materials, if present, settling on the clayey B horizon which is less vulnerable to erosion. Only SPC02 soils have the potential for deeper cultural deposits. These soils were encountered in localised pockets, primarily in the north-east of the project area.

Further of note by these investigations was the findings that the majority of the upper soil profile (<20 cm) was weakly or moderately acidic. With increasing depth, alkalinity increased across most of these soil profiles. As such, where deep soils are encountered, the potential for buried organic cultural materials, such as ancestral remains, is more probable; and their survival more likely than near-surface deposits.

4.7 Flora and fauna

The plains of the project area have been subject to extensive land clearing altering the original vegetation of the landscape. However, low shrub and grasslands of saltbushes (*Atriplex* sp.) including bladder saltbush (*Atriplex veriscaria*), burrs (*Sclerolaena* sp.), cottonbush (*Maireana aphylla*) and numerous grasses would have likely been the dominant vegetation of the project area, and remnant and regrowth species are present today (Mitchell 2002, p. 105). Moreover, wetlands and Gilgai often harbour lignum, and where crumbly puff soils are located roly-poly (*Sclerolaena muricata var. muricata*) is often present (van Dijk and Talsma 1964, p. 12). Cypress pine (*Callitris columellaris)* is dominant in areas where prior stream beds, well drained levees, source-bordering dunes, and sand ridges are situated (Langford-Smith 1960, p. 388).

Prior to early land clearing practices, flora species of Aboriginal importance that would have grown within or in proximity to the project area included the Weeping Myall (*Acacia pendula)*, that was utilised in the making of boomerangs (Bell and Driscoll 2014, p. 186) and the river red gum (*Eucalyptus largiflorens*), used in the construction of canoes through the stripping of bark from a bent tree. River red gum has been recorded along the floodplains of the Murrumbidgee River and Yanco Creek, often associated with the physiographic pattern of paleochannel systems (van Dijk and Talsma 1964, p. 11-12). Eucalyptus species were often culturally modified to signify burial locations, boundary markers and to obtain cultural materials, such as the hardwoods needed for fire sawing (Arthur and Morphy 2005, p. 57). Furthermore, the Wiradjuri were known to give birth under such trees and the placenta was often buried in proximity, connecting that infant to Country (Adams et al. 2018, p. 84). Barks from such species were used to manufacture nets, utilised in this region when hunting bird species, such as the pink-eared duck (*Malacorhynchus membranaceu*).

Prior to European arrival, the landscape would have provided abundant resources for Aboriginal people. Notable faunal species that would have lived within and around the project area include the red kangaroo (*Osphranter rufus*) and emu (*Dromaius novaehollandiae*). Aboriginal people hunted kangaroo before dusk during peak times of feeding. Apart from their value as a food source, kangaroo skins could be purposed into clothing and waterbags, as the oils in fur act as a repellent from water, making the membrane permeable from one side (Cahir, Clark, and Clarke 2018, p. 111).

The cultural and spiritual idea of the celestial emu, *Gawarrgay/Gawarghoo*, and its influence on the life cycle of the terrestrial emu, *Dinawan*, was known throughout Australia prior to European arrival. The seasonal development of this configuration from the Coalsack of the Milky Way to Scorpius indicated when the hunting of Emu eggs was acceptable, this was practiced primarily from March to July (Fuller et al. 2014, p. 174-176). The change in orientation of the celestial emu in the sky is believed to be linked to the breeding cycle of the terrestrial emu and can be used to inform hunting practices.

4.8 Previous disturbance and land use

Previous land disturbance has a significant impact to the survivability of cultural materials if present. While there are natural processes that can disturb and/or destroy cultural material, more frequently it is increasing urbanisation over the last 200 years that has resulted in the most significant impacts. The history and land-use of the project area is outlined in detail in the *Statement of Heritage Impact* (Appendix E.5 of the EIS) and summarised below. Historical aerials of the project area are presented in Attachment C.

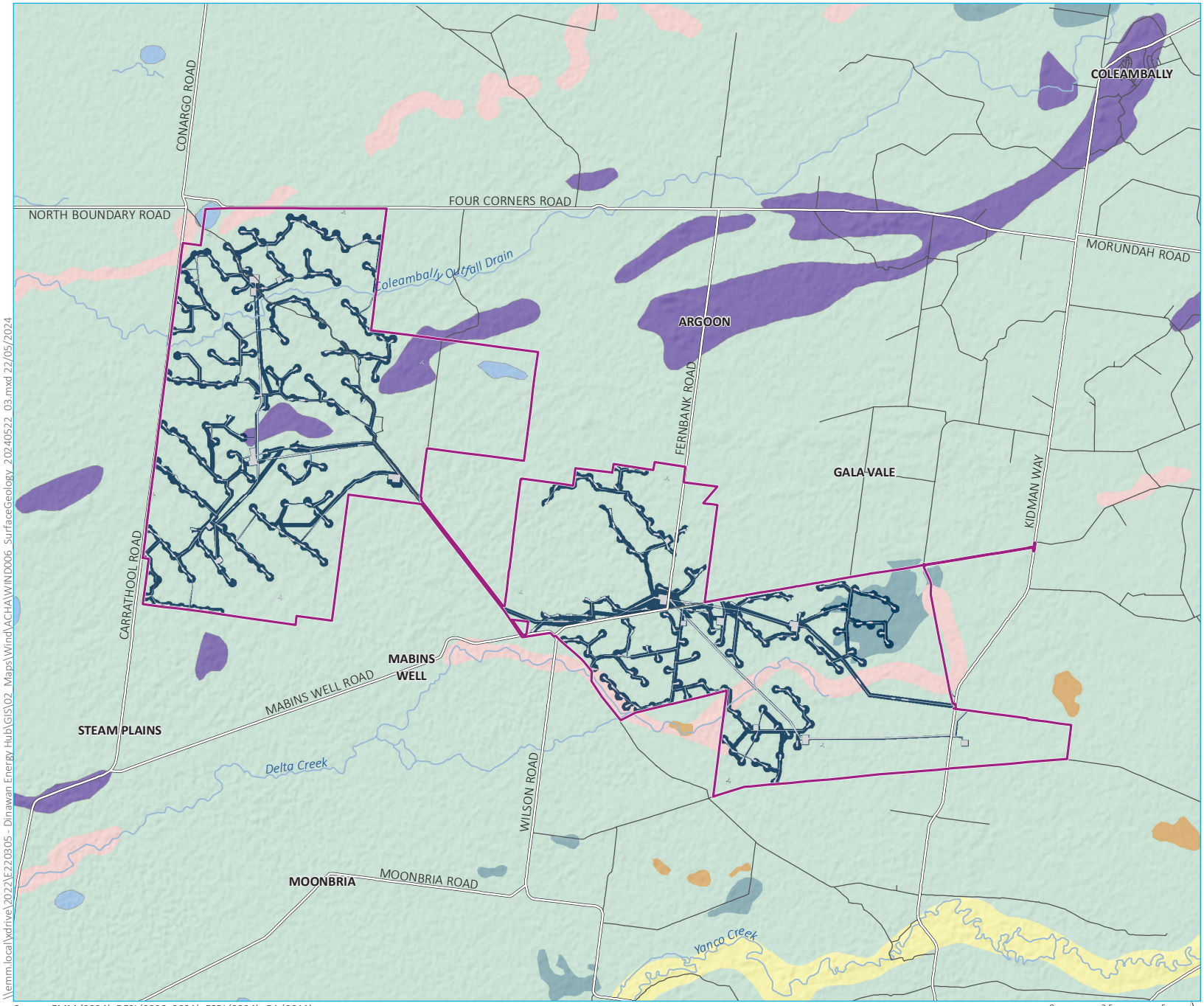
The first European to have travelled through the area was Charles Sturt in 1829, who surveyed the Murrumbidgee and Murray Rivers on his way to South Australia. By 1838, illegal squatters were reported to be living in the area and by 1843, this developed into established pastoral settlements with cattle grazing and sheep ranching having visible impacts on the landscape (Belthuis 1968, p. 128).

The project area is just south of the Coleambally Irrigation Area, which started the construction of irrigation canals in 1960 due to the development of the Snowy Mountain Hydroelectric Scheme which increased water flow to the Murrumbidgee River (Belthuis 1968, p. 128).

'Laser-levelling' was an agricultural practice that was introduced to the local area after its invention in 1977. This system comprised a laser beam transmitter, a receiver, and a 'carry drag scoop' fitted to a tractor. Where the landscape rises above the chosen level a cutting blade grades the surface and deposits the soil in areas which fall below the chosen level, resulting in an incredibly flat landscape. This may be identified in proximity to irrigation canals identified sporadically within the eastern and western portions of the project area. This practice reduced watering requirements per hectare from 1 megalitre (ML) to roughly 0.5 ML (Green and Middlemas 1985, p. 40-42). However, it would have had considerable implications for the integrity of cultural materials in the landscape if present, resulting in their displacement, breakage, loss of topsoils and loss of certain site types such as hearths and oven mounds.

Evidence of prior land disturbances within the project area are associated with these early irrigation and agricultural practices. This includes a number of significant irrigation canals that bisect both the eastern and western portions of the project area (Plate 4.1) and extensive borrow pits of heterogenous measurement identified largely within the eastern portion of the project area. The southern section of the project area is bisected by smaller irrigation trenches, with evidence of other agricultural disturbances including the installation of fences, dams, access tracks, historical sheds, water tanks, culverts and several large slash piles of cleared vegetation and timber.

Plate 4.1 **Example of an irrigation canal bisecting the western portion of the project area, view south**



KEY

- Project area
- Development corridor
- Development footprint

Existing environment

- Major road
- Minor road
- Watercourse (third order and higher)

Surface geology (250K)

- Aeolian sand plain
- Alluvial channel deposits - meander-plain facies
- Alluvial floodplain deposits
- Alluvium
- Claypan and lacustrine deposits
- Playa lake deposits
- Source-bordering dunes

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Source: EMM (2024); DFSI (2020, 2021); ESRI (2024); GA (2011)

Geology

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 4.2

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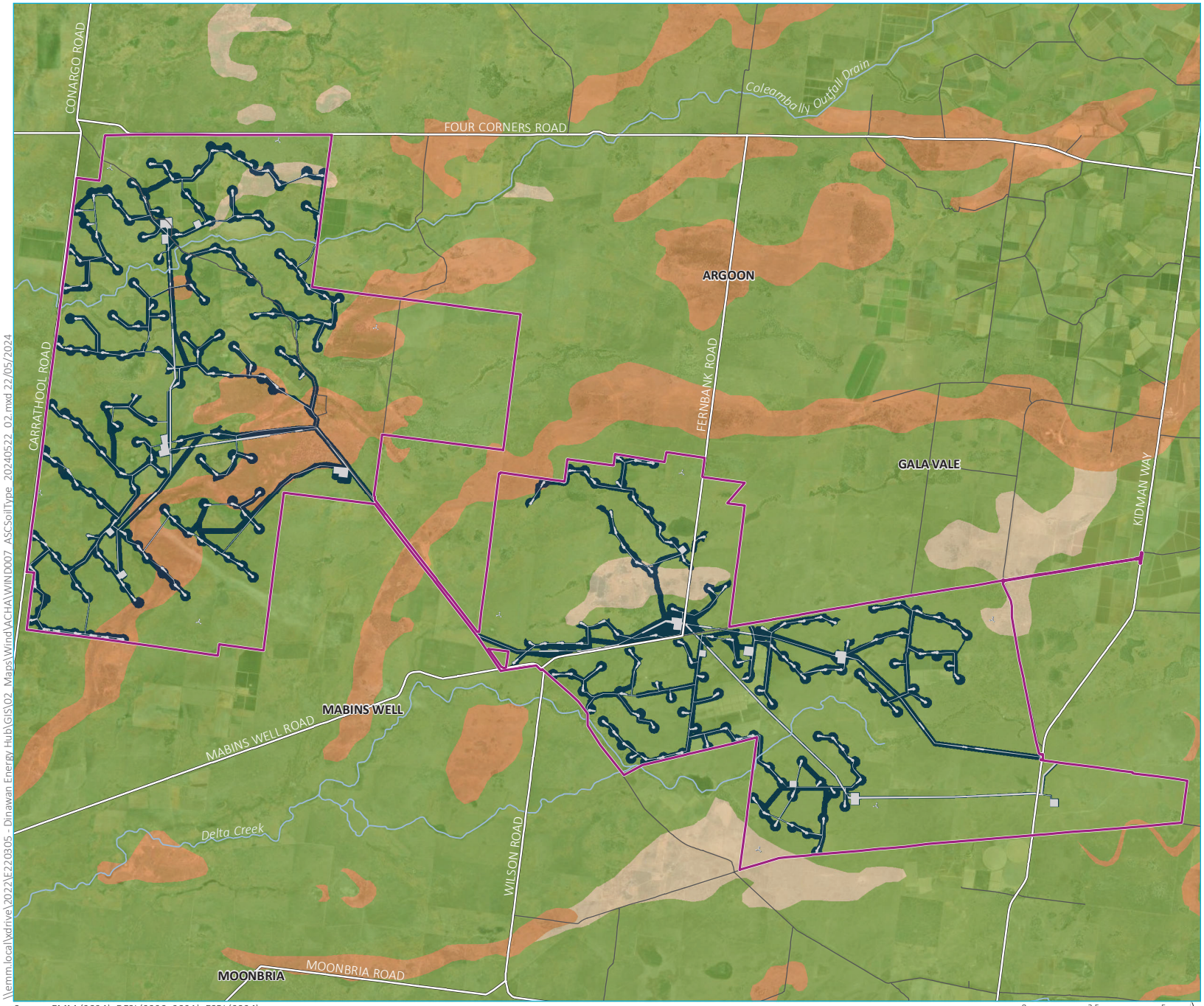

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Source: EMM (2024); DFSI (2020, 2021); ESRI (2024)

Soil landscapes

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 4.3

EMM
creating opportunities

5 Ethnography

5.1 Key findings

- The project area is situated within the Riverine Plains region, which is composed of three language groups: the Wiradjuri in the north and east, the Kulin language group (Mathi Mathi, Wathi Wathi, Nari Nari and Wemba Wemba) in the west, and the Murray River language group (Yita Yita, Yota Yota, and Pangerang/Bangerang) in the south. The Wiradjuri represents the largest Aboriginal territory in NSW, and their descendants are still based in NSW today.

- The Dreaming incorporates shared laws, histories and lessons that continues to connect Australian Aboriginal people to Country through a much deeper level of understanding, and in many cases ensured their survival in harsh terrain. *Baiame* is a central figure, known as the Sky God, who created people during the Dreamtime before returning to the Milky Way (Konishi 2019, p. 155). Marriage laws and initiation ceremonies such as the *Burbung*, tattooing and scarification were commonly shared amongst tribes in the region.

- A review of historical records for the region shows extensive interactions with Europeans over the last 200 years, including numerous incidences of frontier violence. Although recorded events occurred nearby, no incidents appear directly associated with the project area itself. Due to the negative impacts of European settlement, a breakdown of the clan system occurred in the late 19th century, wherein Aboriginal people in the Lachlan to Murrumbidgee River regions primarily lived in settlements and large pastoral properties, continuing to maintain their identity as Wiradjuri people.

5.2 Documentary ethnography

5.2.1 Regional information

Information about the socio-cultural structure of Aboriginal society prior to European contact largely comes from ethno-historical accounts made by colonial settlers. These accounts and observations were often made after significant social disruption due to disease and displacement. As a result, this information is often contentious, particularly in relation to language group boundaries. Therefore, it is likely that language group boundaries were far more diffuse than the arbitrary demarcations drawn by colonial observers.

The project area is situated within the Riverine Plains region, which is composed of three language groups: the Wiradjuri in the north and east, the Kulin language group (Mathi Mathi, Wathi Wathi, Nari Nari and Wemba Wemba) in the west, and the Murray River language group (Yita Yita, Yota Yota, and Pangerang/Bangerang) in the south (Pardoe & Martin, 2011; NOHC 2022, p. 44). In geographic terms, the Wiradjuri are the largest tribal group in NSW, extending from the Blue Mountains in the east to Hay in the west, and from Nyngan in the north to Albury in the south (Read 1988) (see Plate 5.1). However, Tindale (1974, p. 201) in contrast notes that the south-west boundary of the Wiradjuri was located near Hay and Narrandera, though as a result of European expansion, were pushed further south to the Murray River. The name 'Wiradjuri' means 'people of the three rivers', named for the main rivers in Wiradjuri country: the Murrumbidgee (Murrumbidjeri), Lachlan (Kalari) and Macquarie-Wambuul rivers (NPWS 2003, p. 121).

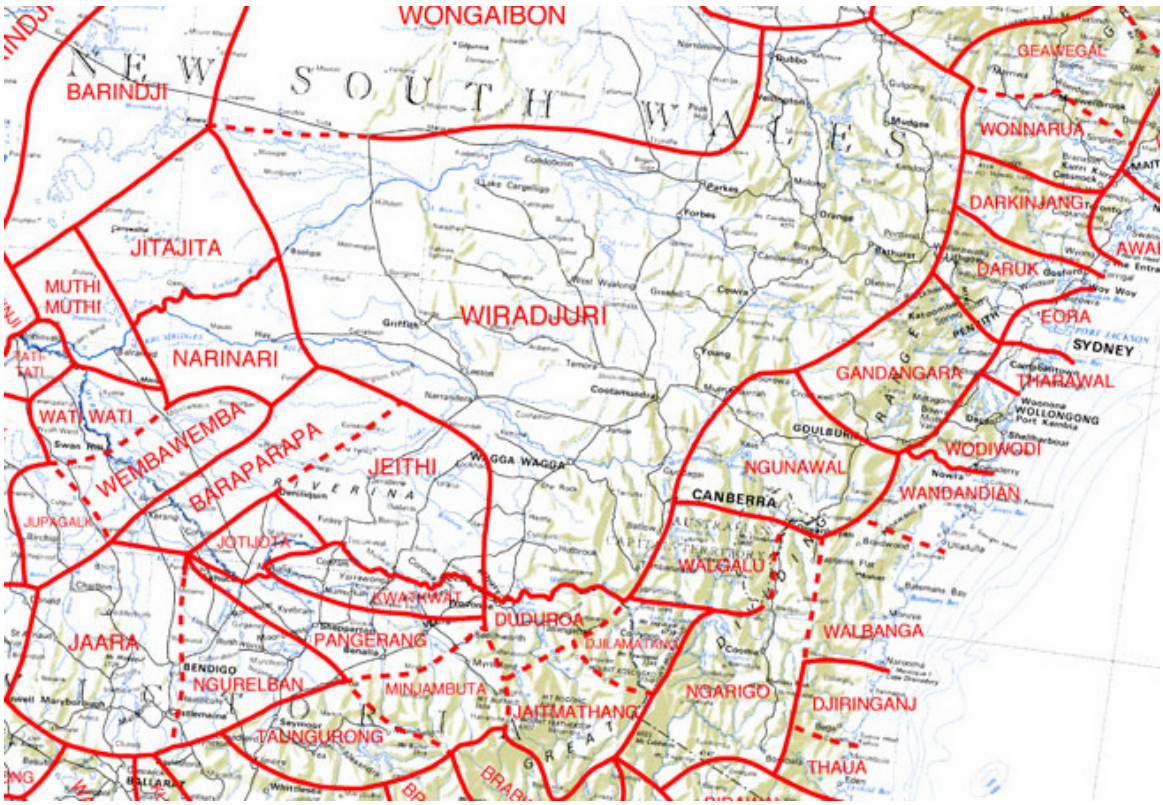
Documentary evidence suggests the Wiradjuri cultural-linguistic group comprised several smaller sub-groupings. Surveyor and early anthropologist Robert Hamilton Mathews (1841–1918) wrote that the Wiradjuri nation was a 'vast confederation' made up of several smaller groups each with 'recognised hunting grounds.' In turn, these economic groups comprised smaller extended family groups (or 'clans') who were caretakers of a certain area by virtue of birthright (Mathews 1896a, 1898a, 1898b). Pearson's research also suggests that seasonality influenced social organisation, with people breaking into smaller groups during lean times (Pearson 1984).

Conversely, feasts and ceremonial activities occurred in established meeting places between large groups of people during resource-rich periods. There is evidence to suggest that intra-group differences were sufficient that information relating to Wiradjuri country 'should not be taken to show much more than the areas where the Wiradjuri language was principally spoken' (Read 1988, p. 14). A number of clans, descending from a female line, make up a conglomerate within the project area, these principally include Narrandera (*Prickly lizard*), Kuta-mundra (*River turtle*) and Murring-bulla (*Two bark canoes*) (Howitt 1884, Tindale 1974, p. 201). Unlike Europeans, watercourses were not always boundaries to the Aboriginal occupation of the region. The Wiradjuri have been documented on both sides of the Murrumbidgee, just as the Bangerang have been recorded from Albury to Moama on both sides of the Murray River (NPWS 2003, p. 95). An ethnographic example of the diffusion between nation's boundaries can be seen through an ethnographic report by W. S. Parkes at Brungle Reserve in 1948:

> W. S. Parkes reported to me an interesting conversation he had had with an aged Wiradjuri living at Brungle Reserve in 1948. This man said that the Wiradjuri spoke of their country as a "line" rather than as an enclosed area. Parkes, quoting from memory, detailed the "line" as passing through Brungle, Gobarlong, Jugiong, Harden, Cowra, Orange, Dubbo, Condobolin, Hillston, Hay, Darling Point (south of Griffith), Wagga Wagga, Tarcutta, Adelong, and returning to Brungle. Tumut was on the "line" of an adjoining tribe for which he gave the name Gurmal. Gurmal ['Guramal'] is the Wiradjuri name for the Ngarigo; it is based on their term ['gurai], meaning "hostile people." Parkes also indicated that the area south of Wagga Wagga was not Wiradjuri country. Other information has confirmed this and the tribal name Jeithi is shown as belonging to the region north of the Murray River and south and southwest of the Wagga Wagga area (Parkes in Tindale 1974, p. 129).

As detailed, the Jeithi tribal group are located north of the Murray River from west of Tocumwal to Howlong. Their territory extends north to Lake Urana, Jerilderie, and Lockhart, particularly around Yanco Creek and Billabong Creek, covering roughly 5,000 m^2. As discussed previously, Jeithi territory possibly extended further towards the east prior to the ascendancy of the Wiradjuri nation during early European expansion. Several clans were attached to this nation group, as are the names Yeridthee and Pikkolatpan (Tindale 1974, p. 193-4). In accordance with pioneer settler notes from 1841, 10 localised tribes including the Pikkolatpan tribe, regarded themselves as Bangerang/Pangerang (Curr 1886, p. 567). The Bangerang are often affiliated with localised tribes ending in -pan and -ban (Tindale 1974, p. 41 and 207), and this termination has been linked linguistically to yellum and illum, translating to camp or 'the people who dwelt in any land' (Barwick 1984, p. 106). This is reinforced through the locality of the Murray River Language group, encompassing the Yita Yita, Yota Yota and Bangarang, on the southern margins of the Murrumbidgee Province and along the Murray River (Pardoe and Martin 2011, p. 21). Tindale describes the 'Pangerang' territory boundary as the 'broad valley of the lower Goulburn west to the Murray River east and west of Shepparton; at Wangaratta, Benalla, and Kyabram; south to Toolamba and Violet Town. Not at Albury as stated incorrectly in the 1940 edition' (Tindale 1974, p. 207). However, Matthews (Mathews 1898b, p. 326) remarks that while the Bangerang comprised a large tract of country in Victoria, they overlapped Wiradjuri Country and are 'bounded on the north by a line some miles beyond the river Murray'. The Bangerang were also known in their northern territory as Jurta (Yurt Yoorta), meaning no, but this may represent a separate, if not affiliated, tribal group (Tindale 1974, p. 207).

In accordance with Tindale (1974, p. 191), the Baraparapa boundaries are 'chiefly on southern tributaries of the Murrumbidgee River from above Hay, NSW, to Kerang, VIC; at Cohuna, Gunbower, Brassi, Conargo, and across the river from Carrathool'. Baraparapa, also known as the Burreba-burreba, in the dialect of Burêba, is spoken from Deniliquin to Moulamein and south towards the Murray River. 'Burreba' translates to 'no' (Matthews 1904, p. 291-3), a linguistic similarity to that of Bangerang through their northern name, Yurta.



Source: Tindale (1974)

Plate 5.1 Aboriginal Tribal Groups of Australia

5.2.2 Local beliefs and ceremonial practices

Local beliefs in the region were incorporated into different aspects of *the Dreaming*, an anthropological term created by Francis Gillen to conceptualise the enormity of Indigenous belief within a broad framework (Wolfe 1991, p. 201). The Dreaming incorporates shared laws, histories and lessons that continues to connect Australian Aboriginal people to Country through a much deeper level of understanding, and in many cases ensured their survival in harsh terrain.

Dreaming narratives from a Wiradjuri corroboree in 1979 near Euabalong preformed rituals in association with *wa'wi*, the great rainbow snake that lived in the waterholes of the Lachlan River, to ensure the safety of newcomers (Read 1988, p. 76-7).

Within the project area, *Baiame,* is a central figure, known as the Sky God, who created people during the Dreamtime before returning to the Milky Way (Konishi 2019, p. 155). Dreaming stories state that Baiame's voice can be heard within the trees, and it is believed that he instituted the *Burbung* initiation ceremony (Hartland 1898, p. 299). Matthews (1904, p. 294) remarks that the initiation ceremonies of the Baraparapa and the Wiradjuri were largely homogenous. Initiation ceremonies such as the *Burbung*, recorded in 1898 in Mossgiel, were commonly shared amongst tribes of the Lachlan and Murrumbidgee rivers. This ceremony incorporated the use of a *boorbung*, a circular enclosure formed through the excavation of soils around its circumference, and groove cut iconography of spiritual beings such as the snake-like *kurrea* (Matthews 1904, pp. 337-9).

The Bangerang also participated in the *Narramang* initiation ceremony, recorded along the Murray River. This initiation is thought to be corresponding with the Wiradjuri *Burbong*, in which two of the upper incisors were knocked out with a "wooden punch" (Mathews 1898b, p. 327).

Additional ceremonies incorporating cultural body modification is evident when examining settler notes, in which the Wiradjuri were described as 'regularly tattooed, particularly the breast and shoulders, which are strongly tubercled in a kind of systematical diagonal style' and with perforated cartilage of the nose. Aboriginal women on the Murrumbidgee additionally performed scarification of the leg, through the burning of a pith from an unidentified plant before pressing it into the skin, leaving circular markings (Cunningham 1817 in Pardoe and Martin 2011, p. 27).

Brumm (2010, p. 193) has additionally theorised that a 'falling sky' belief existed prior to, or alternatively in reaction to, European expansion. The foundation of this belief is conceptualised by the distribution of greenstone axe heads that were symbolically used to reinforce a number of pillars that held up the sky. Distribution patterns of Mount Williams greenstone axes has been identified along the Murray River (McBryde and Watchman 1976, p. 169-70), and greenstone has additionally been identified in Darlington Point (NGH Environmental 2019, p. 28).

Marriage laws were also similarly shared throughout the region. Within the Wiradjuri community marriage laws were divided into four groups consisting of Ippai, Oombi, Murri and Kubbi following laws of descent. Similarly, the Baraparapa consisted of two phratries, comprising two parts, as seen in Table 5.1. Marriages could deviate from these laws on the condition that clan totems were not shared (Matthews 1904, p. 294). Moreover, the Bangerang additionally had two phratries, called the *Boonjil* and *Wah*. The Wah, represented by the brown hawk totem, is the equivalent of the Wiradjuri Murri-Kubbi, while the Boonjil corresponds with the Ippai-Kumbo (Mathews 1898b, p. 326-7).

Table 5.1 Marriage laws of the Baraparapa

Phratry	Patrilineal partner	Matrilineal partner	Sons	Daughters
A	*Murri*	*Ippatha*	*Umbi*	*Butha*
	Kubbi	*Butha*	*Ippai*	*Ippatha*
B	*Ippai*	*Matha*	*Kubbi*	*Kubbitha*
	Umbi	*Kubbitha*	*Murri*	*Matha*

Source: Matthews (1904, p. 294).

5.2.3 Tools, weapons and apparel

Wiradjuri clans would generally build small villages that acted as a home base for wider foraging, hunting and social activity that would take people into other areas. Small houses were constructed using sapling branches covered with tree bark.

Stone and wooden implements were commonly used by the Wiradjuri. Due to their material type, stone implements are still apparent in the landscape today, and include many items from ground edge axes, adze, blades, scrapers, grinding stones, hammer stones bull-roarer (*mudthega*; Mathews 1896b, p. 298) and others made from sedimentary and volcanic rock. Mitchell, who undertook journeys across Central NSW in his role as Surveyor-General in the 1830s and 1840s, observed notches cut into tree trunks using stone axes.

> On my journeys in the interior I knew, by their being in a recent state, when I was approaching a tribe; or when they were not quite recent how long it was since the natives had been in such parts of the woods; whether they had any iron hatchets or used still those of stone only; etc The notches made in climbing trees are cut by means of a small stone hatchet and, as already observed, with each hand alternatively. By long practice a native can support himself with his toes on very small notches, not only in climbing but while he cuts other notches, necessary for his further ascent, with one hand, the other arm embracing the tree. The elasticity and lightness of the simple handle of the mogo or stone hatchet employed are well adapted to the weight of the head and assist the blow necessary to cut the thick bark with an edge of stone (Mitchell 1839, p. 199-200).

Wooden implements also were important and used daily but have not survived within the archaeological record. Wooden implements described by historical accounts include "boomerangs, nulla-nullas, bundies, hielamans etc" (Mathews 1896b, p. 301). Many raw stone materials were sourced locally from quarries, outcrops and cobbles found in alluvium. However, not all raw materials were available locally and trade routes extended both north and south over the mountains to the coast (Clayton 1985). It has been stated that the Darling River (~438 km north-west of the project area), on the western boundary of Wiradjuri country, was a meeting or exchange place for central and eastern groups (Clayton 1985).

The most common apparel recognised in the region is possum skin cloaks, recognised from known ceremonial practices and historical accounts of Wiradjuri campsites during the late 19th century.

5.2.4 Contact and post-Contact overview

European expansion in the Riverine Plain dates to the early 1800s, at which time surveyors such as John Oxley traversed the Murrumbidgee area (Morey n.d., Pardoe and Martin 2011, p. 26). The first European settlers to establish themselves within the area, in 1838, were squatting illegally. By 1843, the legalisation of European settlement was established, with Europeans largely focusing on cattle grazing (Belthuis 1968, p. 128).

While documented accounts of early contact between Europeans and Australian Aboriginal people is lacking, early settler notes state that Aboriginal people located in proximity to the Murrumbidgee River helped settlers, in contrast to the Indigenous groups along the Murray River that were more prone to attacking settlers (Morey n.d., Pardoe and Martin 2011, p. 26). Later accounts attest to a waring campaign between the Wiradjuri and settlers and near Narrandera that ended in 1841, however accounts from this event are limited (Read 1988, p. 24). Accounts attest to a massacre site on Wagga Road, in proximity to Narrandera, where waterholes were poisoned in an attempt to eradicate the local Aboriginal population living in the area. Dame Mary Gilmore, born in 1864, attests to these events from her childhood. Stating that the Indigenous of the Riverina area were often drowned and killed in such a manner. European news articles from 1951 dispute these events, claiming that applied poisons were utilised to cull dingo populations (Gow 1951).

By 1880, the Warangesda Mission, established by Reverend JB Gribble, was utilised as a depot in which displaced Aboriginal people suffering from illness, infirmity and unemployment were housed. The Aborigines Protection Board, which oversaw the Warangesda's Girl Dormitory, forcibly separated Aboriginal children from their families. Warangesda girls were relocated to Sydney to work as domestic servants and were discouraged from expressing matters of cultural descent (High Ground Consulting 2014, p. 7-8). Not all Wiradjuri members wanted to live within the mission, with 50 Indigenous individuals recorded camping 1 km away from the mission's gates (High Ground Consulting 2014, p. 11). The mission became a public school in 1883, possibly as a result of a 'strike' in which Aboriginal participants protested against the conditions, expulsions, and the confinement of their daughters (High Ground Consulting 2014, p. 14).

6 Archaeological context

6.1 Key findings

- Human occupation of the broader Murray-Darling Basin has been well documented, with archaeological sites including burials recorded at Lake Urana, Willandra Lakes, the Menindee Lakes, Lake Tandou, and Lake Victoria, representing both the oldest and the longest sequences of human occupation.

- Burial sites in the Murray-Darling Basin are well documented, with sites prevalent in source-bordering sand dunes and lunettes. In a regional study of burial sites in the Murray Basin (Littleton 1999), notably the Murray and Murrumbidgee Rivers, a total of 739 burials (164 sites) were recorded in the Riverine Plain. Over 56% of burials were situated in earth mounds, with the remainder in a variety of different landforms (including source-bordering dunes, lunettes, irregular sandsheets and claypans). Based on this study, it is evident that there are widespread, low-density burials across the Riverine, with large sand dunes in the Mallee Plain a more densely populated location for burial sites.

- The AHIMS search returned 227 Aboriginal sites and/or objects recorded within the 6,900 km^2 search area centred on the project area. The search results included a variety of site types often with multiple site features, but generally comprising stone artefact sites (n=118, 52.4%), culturally modified trees (n=71, 31.7%), hearth sites (n=42, 18.8%), as well as earth mounds (n=15, 6.6%), potential archaeological deposits (PADs), a burial (AHIMS #53-2-0034), and a water hole (AHIMS #48-6-0137). Nearly all sites were documented in proximity to water sources including perennial and ephemeral creeklines, Gilgai, swamps and/or wetlands.

- Numerous compliance-based archaeological assessments have been conducted in proximity to the project area, notably for other renewable energy generation and transmission projects. Their findings are consistent with the regional context, with the identification of artefact sites, hearths, culturally modified trees and, to a lesser extent, earth mounds and burials within alluvial and floodplain contexts. The areas that were the subject of these assessments have been exposed to significant levels of previous ground disturbance through laser levelling and/or other irrigation agriculture practices.

6.2 Regional context

While many contemporary Aboriginal cultures note their custodianship of the landscape since time immemorial, from an archaeological perspective, the first peopling of Australia by large groups of hunter-gatherers occurred ~50,000 years ago (Bradshaw et al. 2019; O'Connell et al. 2018). The peopling of the continent was rapid, with sites such as Devil's Lair (WA), Warratyi (SA), and Lake Mungo (NSW) all occupied within a few thousand years of arrival (Bowler et al. 2003; Hamm et al. 2016; Turney et al. 2001). Genomic research has shown that following these initial explorations of the continent, regional populations or nomadic sedentism, was established by ~40,000 years ago (Tobler et al. 2017). These small populations were highly mobile, but remained within a broad spatial geographic area, dictated in general by the nature of resources and water availability. In the case of some of the arid parts of the continent, mobility encompassed thousands of square kilometres (Gould 1977), while major riverine corridors such as the Murray River had near permanent settlements (Pardoe 1995).

In NSW, the earliest evidence of Aboriginal people are human remains recovered from the lunette in Lake Mungo and dating to ~42,000 years ago (Bowler et al. 2003; O'Connell et al. 2018). The presence of red ochre covering the remains represents a society with significant cultural and symbolic complexity (Langley et al. 2011). Near the coastal edge, the earliest populations were found at Cranebrook Terrace, near Penrith. Here, a handful of rudimentary stone tools were found in an alluvial unit, some 8 m below the current surface, which were dated to ~40,000–45,000 years ago (Williams et al. 2017).

However, it is not until ~35,000 years ago, that regional populations appear to have become established in the Sydney Basin, and which appeared to consist of small bands of people focussed mainly along major river systems, including the Hawkesbury-Nepean, Parramatta, Georges and Hunter Rivers (Hughes et al. 2014; Williams et al. 2012; 2014). These rivers formed key ecological refuges that hunter-gatherer groups used to survive major climatic events such as the Last Glacial Maximum (21,000 ±3,000 years ago) – a cool and arid climatic period. Well-established archaeological models suggest populations experienced a major reduction in size (by as much as 60%), and settlement contraction and abandonment across much of the continent during this time (Veth 1993; Williams et al. 2013). Although, recent research suggests that the story may be more complex than this (e.g. Tobler et al. 2017).

The terminal Pleistocene and early Holocene (~18,000–8,000 years ago) was characterized by significant environmental change, notably the rapid inundation of much of the coastal shelf, resulting in the reduction of the continent by ~21% (~2 million km^2) (Williams et al. 2018), in tandem with improving climatic conditions – the Holocene climatic optimum (Williams et al. 2015a; 2015b). More broadly, these conditions resulted in increasing population growth, expansion of ranging territories, increasing sedentism (longer patch residence time) and the beginnings of low-level food production (e.g. aquaculture), and ultimately the initiation of social and cultural groupings observed in the late Holocene (Williams et al. 2015b). Within the Sydney Basin, a large number of sites are first initiated during this time, including Burrill Lake (~20,000 years ago), Bass Point (~17 ka), and Loggers Shelter in Mangrove Creek (~11,000 years ago) (Bowdler 1970; Lampert 1971; Attenbrow 2004; AMBS 2006, p.87). This is also the case in the greater Blue Mountains area, where dated rockshelter sites in the area suggest that Aboriginal occupation extended as far back as 14,000 years ago, and potentially as early as 22,000 years ago (Stockton 1973; Stockton & Holland 1974).

More broadly, at this time we see a much broader range of archaeological site types occurring, such as the Roonka Flat burial ground on the banks of the Murray River, within which some 147 individuals were interred through the Holocene (Pate et al. 1998), and the increasing use of marine resources. Many of the previous refuges were subject to abandonment or a re-structuring of land use (Dortch 1979; Fitzsimmons et al. 2019). These activities suggest the ability to undertake large-scale movements to mitigate environmental distress was becoming increasingly difficult and was addressed through diversification of hunter-gathering behaviours and, at least in part, technological advances and investment (Williams et al. 2015b).

The late Holocene saw significant population increase, with hunter-gatherers reaching their zenith of ~1.2 million at 5,000 years ago, a tenfold increase on Pleistocene levels (Williams, 2013). Data suggests that the highest populations during this time were in the south-east of Australia. Williams et al. (2015b) suggest that this increase was likely a result of intensification of earlier technological advancements, including hafting-technology, plant and seed processing, and localised landscape management (using fire), allowing climatic downturns to be successfully weathered. These included strong arid El Nino Southern Oscillation (ENSO) conditions between 4,000–2,000 and increasingly turbulent climatic conditions during the Medieval Climatic Anomaly (1,300–1,000 years ago) (generally wetter) and Little Ice Age (0.3–0.5 ka) (generally drier) (Williams et al. 2010; 2015a). A result of these denser populations was decreasing freedom of movement and formation of strong classificatory kinship systems, complex cultural and symbolic landscapes based on geographic totemism (the 'Dreaming'), distinctive graphic art systems, land rights in the form of ritual property, and formalised exchange networks (Williams et al. 2015a).

Human occupation of the broader Murray-Darling Basin has been well documented, with archaeological sites including burials recorded at Willandra Lakes, the Menindee Lakes, Lake Tandou, and Lake Victoria, representing both the oldest and the longest sequences of human occupation (Pardoe & Martin 2011, p.44). Burial sites within the Riverine Plain are abundant, including several significant sites of Pleistocene age, the most famous being Lake Mungo (280 km north-west of the project area), as well as Lake Tyrrell (260 km west of the project area), Kow Swamp (165 km south-west of the project area) and Lake Urana (35 km south-east of the project area). The remains found at Lake Urana consisted of a single fragmented female, unintentionally exposed during quarrying activities of the dry lake's eastern lunette. Thermoluminescence (TL) dating of the sediments surrounding the remains indicated an antiquity of ~20,000–30,000 years old, making Lake Urana the oldest human remains documented on Wiradjuri country.

Aside from these well documented sites, a considerable amount of research regarding burials has been conducted within the Murray-Darling Basin since the late 1980s (Bonhomme 1990; Edmonds 1995; Kelton 1998, 1999; Klaver 1987, 1998; Littleton 1999; Martin 1996a & b, 1998, 1999, 2000; Pardoe 1988, 1995, Pardoe & Grist 2001, Pardoe & Martin 2011). The research has shown differences in burial practices, density, and distribution between the Riverine Plain, the Mallee Plain, and the Darling and Murray River regions. Bonhomme conducted a survey of burials within the Riverine Plain and the Mallee Plain to the west, categorising them into three types: isolated and individual burials, many individual/unrelated burials, and cemeteries (Bonhomme 1990, p. 9 and 147-149, Pardoe & Martin 2011, p. 42). Her analysis showed that geomorphology was the determining factor for site location, where consistent and long-term use of certain landforms such as lunettes and source-bordering dunes along stream channels resulted in a considerably large number of burials (Pardoe & Martin 2011, p. 42). She also found that cemeteries were numerous in the Mallee Plain with burials increasing in number and density towards the south-west, while no cemeteries had been recorded in the Riverine Plain east of Echuca VIC and Hay NSW. She attributed this to the greater variety of landscape features, and therefore greater resource availability, supporting larger populations in the west, which leads to greater complexities of burial practices (Pardoe & Martin 2011, p. 42). The two areas have considerable differences between the soil and environment, and this is reflected in the biology and cultural materials of the people as well (Pardoe & Martin 2011, p. 42).

Bonhomme's (1990) findings were further extrapolated by Judith Littleton's (1999) major research of over 2,000 burials in the Murray Basin, with a focus on the Murray and Murrumbidgee Rivers and their floodplains. Her analysis confirmed a considerable difference between burials in the Mallee Plain and the Riverine Plain, with greater heterogeneity of burial practices in the Riverine Plain, and relative homogeneity of practices in the Mallee Plain (Littleton 1999, p. 1). She too attributes these differences to the variations in environments between the rivers and floodplains of the Riverine and the irregular dune fields of the Mallee, and their resulting differences in population density and distribution across the landscape (Littleton 1999, p. 1). While most burials in the broader Murray Basin are located in source-bordering sand dunes and lunettes, Littleton demonstrated that of the 739 burials (164 sites) recorded in the Riverine, over 56% were buried in earth mounds, with the remainder located in a variety of landforms, including source-bordering dunes, lunettes, irregular sandsheets, and claypans (Littleton 1999). Based on this study, it is evident that there are widespread, low-density burials across the Riverine, with large sand dunes in the Mallee Plain a more densely populated location for burial sites.

The difference between the burial practices of the Riverine and the broader Murray-Darling Basin is not just limited to environmental factors, but the treatment of the dead reflects considerable social and cultural differences. Earth mounds are prevalent across the Riverine Plain, representing both occupation and cooking areas, where repeated use of the site causes an accumulation of ash, charcoal, bones, and baked clay heat retainers to form a large mound or 'ash hill' (Mitchell 1839; Pardoe & Martin 2011, p. 42). Earth mounds are predominantly located along rivers, paleochannels, and lunettes, and can vary from 4 m in diameter up to the largest recorded as the same size as the Melbourne Cricket Ground (Pardoe & Martin 2011, p. 68). Unique to the Riverine Plain, Littleton's research determined that after a burial occurred in a mound, there would be a short period of mourning, after which the mound would continue to be occupied, sometimes resulting in two or three burials accumulating in a mound over time (Littleton 1999). This means that unlike the rest of the Murray Basin where there is a distinct separation between burial and occupation sites, in the Riverine, not only are burial sites widespread across the Plain, but they also often occur in association with occupation sites.

The project area is situated within the Coleambally and Yanco paleo-systems and is associated with prior streams (paleochannels), modern ephemeral creeklines, and two source-bordering dunes are mapped in the western portion of the project area. As discussed further in Section 6.4, earth mounds have been well documented in the region and found in association with ephemeral and perennial watercourses, and paleochannels. Discussions with the RAPs during the assessment process (see Section 3.3.2) have indicated that burials are prevalent within the local area and have the potential to be present within the project area where suitable landforms, such as sand dunes and paleochannels, are present.

6.3 Local context

Numerous archaeological investigations have been conducted in the Riverina region, including both research and compliance-based environmental assessments, providing a robust volume of archaeological information. The following sections provide summaries of the archaeological investigations completed in the region.

i Buchan (1974) *Archaeological Survey in the Murray Valley, New South Wales 1973-1974*

In 1974, Buchan was engaged to conduct an extensive archaeological survey of land extending from Albury to Mildura, south of the project area. The survey resulted in the documentation of 198 Aboriginal sites, and Buchan's analysis demonstrated that occupation sites characterised by ovens/hearths, scarred trees, and middens were typically located along riverbanks and creeklines, while burials were predominantly located in sand dunes.

ii Simmons (1980) *Site survey of the floodplains between the Murray and Wakool Rivers, NSW*

Simmons was engaged to conduct an extensive survey of the Murray Floodplain and Channels, which resulted in the documentation of 75 earth mounds, 17 culturally modified trees, as well as several artefact scatters, hearths, middens, and burials. All modified trees were mature river red gums, and the earth mounds were characterised by clay nodules, burnt shell, and bone fragments. All sites were associated with water sources, notably floodplains, anabranches, and lake systems.

iii McIntyre (1985) *Archaeological Survey of the Proposed Darlington Point to Deniliquin 132 kV Transmission Line*

McIntyre was engaged to conduct an extensive survey of a 167 km transmission line between Darlington Point and Deniliquin, which passes within 10 km north-west of the project area. The survey resulted in the documentation of 27 previously unrecorded Aboriginal sites, comprising culturally modified trees with artefact scatters, as well as numerous hearths and earth mounds associated with dry box swamps. A post-contact site with historic features was also identified. The raw stone materials comprised silcrete, quartz, basalt, siltstone, and chert and all culturally modified trees were grey box trees. These sites were also closely associated with water sources.

iv Hamm (1995) *An archaeological assessment of Telecom's proposed optical Fibre Cable routes Darlington*

Hamm was engaged to conduct an extensive survey of a 117 km optic fibre cable proposed to connect telephone networks in Darlington Point, Coleambally, Finley, and Jerilderie. The survey terminated 20 km north of the project area and resulted in the documentation of 20 previously unrecorded Aboriginal sites, all culturally modified trees, which in contrast to McIntyre's findings were all located on yellow box trees.

v Edmonds (1996a) *An Archaeological Survey of the Benerembah Irrigation District Stage 4 Drainage, West of Griffith*

Edmonds conducted pedestrian and vehicular survey along the Edwards River, located 100 km south-west of the project area. The previous archaeological research in the region indicated that culturally modified trees, earth mounds, and burials would be the predominant site types identified during the survey. Edmonds further predicted that earth mounds and modified trees would be found on the high and low alluvial plains, while burials would likely be found in sand bodies associated with the lower alluvial plains. The survey resulted in the documentation of 10 previously unrecorded Aboriginal sites: nine culturally modified trees and one burial in a source-bordering dune. The modified tree species were river red gums along riverbanks and creeklines, and black box trees within the floodplain. Edmonds attributed the absence of earth mounds to agricultural disturbances and lack of suitable landforms.

vi Edmonds (1996b) *An Archaeological Survey of the Pinelea Drainage Basin, near Finley, south-western NSW*

Edmonds conducted pedestrian and vehicular survey of the Pinelea Drainage Basin near Finlay, located 45 km south of the project area. Edmonds predicted that similar site types as the previous survey would occur, and the survey resulted in the documentation of six culturally modified trees. The modified tree species were grey box trees associated with swamps, depressions, and floodplains, river red gums associated with riverbanks and creeklines, and one Callitris pine tree which was associated with a sand hill.

vii Kelton (1998) *An Archaeological Study of the Proposed Optic Fibre Cable Route Between Morundah and Bundure, South-Western New South Wales*

Kelton was engaged to conduct an archaeological survey between Morundah and Bundure, east of the project area. The survey documented five previously unrecorded Aboriginal sites, comprising three earth mounds, a culturally modified tree, and an artefact scatter. Kelton noted the key factors that influenced site distribution included accessibility to water, elevated land particularly with good views of the river flats, the ability to shelter from winter winds and source sufficient fuel supplies.

viii NGH Environmental (2017) *Coleambally Solar Farm – Aboriginal Cultural Heritage Assessment*

NGH Environmental (NGH) was engaged by Neoen Australia Pty Ltd (Neoen) to prepare an ACHA for a proposed solar farm with a capacity up to 150 MW, located at Coleambally, 33 km north of the project area. The project area is approximately 550 ha and is situated on the Murrumbidgee scalded plains landscape unit, in proximity to the Murrumbidgee source-bordering dunes and depression plains landscape units (DECC 2012). The archaeological context indicated that sandhills and Black Box depressions were the key archaeologically sensitive landforms in the locality. The closest previously documented Aboriginal site was a modified tree (AHIMS #49-4-0014), located 200 m north of the project area.

The field survey involved pedestrian traverses across the project area, resulting in 33 km of transects, or 16.5 ha of coverage. When accounting for poor visibility conditions, the effective survey coverage was reduced to 13.3 ha or 2.4% of the project area.

The field investigation did not identify any new Aboriginal objects and/or sites; however, three European survey or blaze marker trees were recorded (Coleambally European Survey marker tree 1, 2, and 3). This was anticipated as the project area had been laser levelled and heavily modified from agricultural practices. The lack of potential culturally modified trees within the remnant stands of Black Box vegetation was unexpected, but this too was attributed to historical land clearing practices.

The ACHA recommended the avoidance of the blaze trees, if possible, otherwise further recording would be needed to assess if they had any historical significance. Otherwise, the ACHA recommended the proposed project could proceed with caution and implemented an unexpected finds protocol.

ix NGH Environmental (2019) *Yanco Solar Farm – Aboriginal Cultural Heritage Assessment*

NGH was engaged by ib vogt GmbH (ib vogt) to prepare an ACHA for a proposed solar farm with a capacity of ~72 MW, located 75 km north-east of the project area just west of Leeton NSW. The project area comprised 204 ha, with a transmission line proposed to connect to a nearby existing Transgrid substation. The closest previously documented Aboriginal sites were three culturally modified trees located approximately 1 km north of the project area, noting that many modified trees had been recorded in the wider region, and that most Aboriginal sites were directly associated with water and elevated land.

The survey involved 25 km of pedestrian traverses across the project area, covering 52 ha, noting the effective survey coverage was reduced further due to the low visibility. Despite the high levels of previous ground disturbance from laser levelling and agricultural practices, one isolated find (YSF_IF_001) was identified on the banks of an irrigation channel. The ACHA recommended avoidance of this site, otherwise the proposed project could proceed with caution and implemented an unexpected finds protocol.

x Austral Archaeology Pty Ltd (2021) *Heritage Sensitivity Advice for Dinawan Energy Hub*

Austral Archaeology Pty Ltd (Austral) was engaged by Spark Renewables to provide heritage advice for the Dinawan Energy Hub (which includes Dinawan Solar Farm and Dinawan Wind Farm), by conducting a preliminary overview of the Aboriginal and non-Aboriginal heritage sensitivities and constraints within a broad investigation area (including the project area that is the subject of this ACHA).

The archaeological context suggested that hearths, culturally modified trees, artefact sites, earth mounds and burials had potential to be in the investigation area. The landscape analysis showed that paleochannels were prevalent throughout the locality, noting that the Coleambally paleo-system is the oldest in the region and its tributaries were in flow during the period of human occupation. Lunettes and lakes were also assessed as archaeologically sensitive landforms, and despite the significant variability in size, all have a distinctive round or 'kidney' shape (Austral 2021, p. 4). Austral developed a predictive model for the investigation area, which considered all landscape features including paleochannels and past waterways, and demonstrated that artefact sites (isolated and scattered), resource and gathering sites, earth mounds, hearths (ovens), culturally modified trees, and burials had the highest potential to occur within the project area, and would likely occur within 40 m–400 m from watercourses, with each site type varying in distance within these parameters.

A brief site inspection was undertaken to ground-truth the predictive model, confirming its accuracy in archaeological sensitivity, with several Aboriginal objects/sites observed in areas mapped as moderate and high archaeological potential. The predictive mapping was updated following the site inspection reducing areas anticipated to be of moderate or high sensitivity to low where evidence of high levels of disturbance were observed. A hearth, artefacts, and culturally modified trees were observed during the site inspection and supported the predictive model; however, no further details were provided.

xi Navin Officer Heritage Consultants (2022) *EnergyConnect (NSW – Eastern Section) Environmental Impact Statement – Aboriginal Cultural Heritage Assessment*

Navin Officer Heritage Consultants (NOHC) was engaged by Transgrid and ElectraNet to prepare an ACHA for the approval of the construction and operation of a new transmission line between NSW, South Australia and Victoria (collectively known as Project EnergyConnect). The proposed project would involve the installation of 375 km of transmission line and associated infrastructure between the Buronga substation in the west, the Dinawan substation immediately north of the project area, and the Wagga Wagga substation in the east, including ancillary areas for construction infrastructure. The project area comprised a 1 km wide corridor between the Buronga and Wagga Wagga substations and additional areas proposed for construction compounds, and extended through several bioregions, including the Murray Darling Depression, the Riverina, and the NSW South Western Slopes. NOHC's predictive model determined that artefact scatters and isolated finds were the dominant site types across the regions, with hearths, burials (generally in mound sites), freshwater middens, and culturally modified trees most likely to occur within the project area.

The survey efforts covered 5,027 ha including vehicular traverses, with a total of approximately 53% inspected via pedestrian traverses, with 35% of the project area providing useable archaeological exposures. The survey effectiveness was estimated to cover 22% of the total surveyed area.

Despite the low visibility and useable exposures, the survey efforts recorded 91 previously undocumented Aboriginal sites and 44 areas of PAD, which were documented separately as they were not associated with any other cultural materials or sites and therefore given a tentative site classification. Isolated finds and artefact scatters were the most common site types recorded (50%), followed by culturally modified trees (n=9, 9%), hearths (n=5, 5%), earth mounds (n=3), and a shell midden. Almost all sites were observed within disturbed contexts from natural and anthropogenic erosion. The landscape varied across the survey corridor; however, most of the sites were identified on alluvial plain landforms and flat plain landforms, as well as floodplains, undulating sandplains, plains, a hill, a dune crest, and a levee on a stream channel. Nearly all sites were associated with water sources, including both low-order ephemeral drainage lines, perennial watercourses, dry lakes and waterbodies.

The project is expected to directly impact 94 sites, and the ACHA recommended the avoidance of sites with moderate to high scientific significance, avoidance of PADs where possible or test excavation to determine appropriate mitigation measures, avoidance or mitigation of culturally modified trees, and surface collection and salvage of artefact and hearth sites prior to construction.

xii Jacobs (2022) *Yanco Delta Wind Farm, Technical Report – Aboriginal Cultural Heritage Assessment*

Jacobs was engaged by Virya Energy to prepare an ACHA for the Yanco Delta Wind Farm, an SSD project located immediately to the west and south of the project area. The project proposes more than 200 wind turbines, a BESS and associated infrastructure. Two previously documented Aboriginal sites were located within the project area, consisting of an isolated artefact (PEC-E-G2, #55-1-0052) adjacent to an artefact scatter (PEC-E-43, #55-1-0053). The project area was situated on sediments of the Shepparton Formation, with soils mapped as predominantly grey, brown, and red clays with discrete areas of silicious sands, which are often associated with paleochannels and though they are highly susceptible to wind erosion, could contain deep deposits (>1 m) with Aboriginal sites dating to the Pleistocene period (>10,000 years old).

The field investigation involved archaeological survey covering approximately 958 ha, noting only a sample of the project area was surveyed due to thick impenetrable vegetation and safety constraints (Jacobs 2022, p. 18). When considering the effective survey coverage, the survey efforts resulted in approximately 86 ha (9%) coverage of the project area. Despite the low visibility, the survey resulted in the identification of eight previously undocumented sites, comprising: two PADs with artefact scatters, one PAD with an artefact scatter and hearth, three hearth sites with two containing stone artefacts, and an artefact scatter (AHIMS numbers not known). All sites were situated on the flat plains, except for an artefact scatter (Yanco Delta AS 01) and a hearth site (Yanco Delta Hearth 01) which were both found on terraces.

The ACHA recommendations included the preliminary excavation of hearth sites where harm was unavoidable, which determines appropriate management and mitigation measures, and the surface collection of AHIMS sites PEC-E-G2 (#55-1-0052) and PEC-E-43 (#55-1-0053). The PAD sites would be avoided by the project. The remaining recommendations included the development of an Aboriginal Cultural Heritage Management Plan (ACHMP).

xiii Jacobs (2023) Yanco Delta Wind Farm, Technical Report – Revised Aboriginal Cultural Heritage Assessment

Following submission of the Yanco Delta Wind Farm EIS (SSD-41743746) in February 2023, Heritage NSW provided the advice that the survey coverage of 10% of the project area was insufficient and further survey was required. These additional works were undertaken in August 2023 and the combined efforts resulted in survey coverage of a further 3.5% of the 33,000 ha project area, comprising the investigation of 1,071 ha of moderate-high archaeological sensitivity and 86 ha of land identified as having low potential. The additional survey resulted in the effective survey coverage of 12%, similar to the earlier survey efforts. The combined survey efforts resulted in the identification of 34 previously unrecorded Aboriginal sites, comprising stone artefacts (isolated and scattered), PADs, hearths, and culturally modified trees. These sites were predominantly located on the eroded alluvial plains, with some located on ‘terrace flats’ which were differentiated by their slightly higher elevation than the alluvial flats.

The ACHA recommendations were updated, and 19 identified sites are proposed to be avoided by the project. Where harm was unavoidable, the recommendations required the preliminary excavation of hearths and PADs to determine appropriate management and mitigation measures, as well as the surface collection and salvage excavation of sites with moderate significance (Yanco Delta AS Hearth 01–02, 04; Yanco Delta Hearth 01 and 02) where harm was unavoidable. The remaining recommendations included the development of an ACHMP.

xiv EMM Consulting (2023) *Dinawan Solar Farm – Aboriginal Cultural Heritage Assessment*

EMM was engaged by Spark Renewables to prepare an ACHA for the Dinawan Solar Farm. The project includes the construction of a large-scale solar PV generation facility and BESS, supported by associated infrastructure, located immediately to the south-east of Dinawan Wind Farm, and includes some overlapping project elements. Only four previously recorded AHIMS sites were documented in proximity to the project area for Dinawan Solar Farm, comprising two hearth sites (AHIMS #55-1-0060 and #55-1-0057) and two culturally modified trees (AHIMS #55-1-0058 and #55-1-0059), situated along a 2nd order watercourse north of the project area.

The assessment undertook archaeological field survey and test excavations to explore and document the Aboriginal objects and sites within the project area and to align them within the regional context. Overall, the findings of the ACHA largely conformed with the predictive model, with the exception of burial sites. While burial sites are associated with particular landforms prevalent in the broader region such as source-bordering dunes, lunettes, and paleochannels, the project area for Dinawan Solar Farm did not exhibit these landscape features and none were identified.

The field survey encompassed ~108 km (~1,298 ha or 52% of the project area) of pedestrian transects across the project area and included >190 individual points of observation and documentation. The exposure was considerably high due to previous irrigation and laser-levelling practices in the paddocks, varying between 90% within the alluvial plains and 70% within the ephemeral drainage lines. However, visibility and effective survey coverage were poor (~8%) due to dense groundcovers and thick grass obscuring the ground surface. Despite this, some 35 Aboriginal objects, sites and/or places were documented. These included:

- eight artefact scatters
- seven hearths
- six isolated stone artefacts
- six culturally modified trees
- four hearths with artefact scatters
- three hearths with isolated artefacts
- one potential women's tree with an isolated artefact.

The sites were identified primarily on the alluvial plains (n=19, 54%) followed by the watercourses (n=16, 46%); however, seven of these sites, comprising six culturally modified trees and one artefact scatter, were opportunistically identified outside of the project area while travelling between survey locations.

A small test excavation program was conducted within two areas, Area A and Area B, identified as having potential for shallow subsurface cultural materials. Additionally, a sample of a potential hearth site (DEHS-2023-H5, AHIMS #55-1-0089) was excavated to investigate whether the hearth was likely the result of anthropogenic or natural fire events, serving as a representative sample for other hearth sites identified in the project area. Area A (site DEHS-2023-AS3, AHIMS #55-1-0085) consisted of a low-density stone artefact scatter of over 60 artefacts and was situated on the eastern side of a Gilgai depression, where an erosion scald exposed the flakes eroding from the surrounding grassy hummocks. The second site, Area B (site DEHS-2023-HIF1, AHIMS #55-1-0102), contained a small quartz flake and a potential hearth on the eastern edge of a Gilgai depression with very limited visibility. The program resulted in the excavation of 63 test pits (50 cm x 50 cm pits), predominantly to a depth of 10 cm, though 20 cm was achieved in several pits. Only two stone artefacts were recovered from the efforts, both located in Area A (DEHS-2023-AS3, AHIMS #55-1-0085), demonstrating the limited potential for subsurface cultural materials within the highly eroded and disturbed project area. The potential hearth associated with Area B (DEHS-2023-HIF1, AHIMS #55-1-0102) was determined to be natural, and likely the result of termite activity, due to the lack of burnt or baked clay, charcoal, or ash below the identified clay balls. The excavated sample from the potential hearth site DEHS-2023-H5 (AHIMS #55-1-0089) revealed an oval “dish” of charcoal and ash, indicating the hearth was likely of anthropogenic origin.

The development and refinement of the project’s development footprint (i.e. the area within which direct surface disturbance would occur) was iterative throughout the assessment process as informed by the findings of the ACHA. Of the 35 identified Aboriginal objects/sites, project redesign resulted in the avoidance of the majority (n=23) of these sites, including several sites of high cultural significance, such as a potential women’s tree (DEHS-2023-WT1, AHIMS #55-1-0101) and a hearth and artefact site including a possible oven mound and glass core (DEHS-2023-HAS2, AHIMS #55-1-0077). One site (DEHS-2023-HIF1, AHIMS #55-1-0102) was considered to have been destroyed as a result of test excavation.

Recommendations were proposed for inclusion in the project approval to minimise and mitigate impacts to the cultural materials associated with the 11 sites remaining within the development footprint, and to guide post-approval requirements for Aboriginal heritage. These include the development of an ACHMP providing the framework for Aboriginal heritage management during the construction and operation of the project, including guidance around additional archaeological investigations, an unexpected finds protocol, and procedures for the recovery of cultural materials where further avoidance of identified sites would not be possible.

6.4 AHIMS data

The AHIMS database is managed by Heritage NSW and includes a location and description of Aboriginal objects and sites recorded through academic research and cultural heritage management (see Attachment D.1 for further explanation of Aboriginal site features). The search identifies any Aboriginal sites or places registered in the area and aids archaeological predictions for the project area by showing the frequency and distribution of Aboriginal site types in the broader landscape. It is important to note that most Aboriginal sites registered on the AHIMS database have been the result of compliance-based investigations, and the AHIMS search results should be used as a guide only.

EMM conducted several initial searches of the AHIMS database on 27 February 2023 (ID 756900) and 22 March 2023 (ID 766109 & ID 766066) covering an area of approximately 6,900 km² centred on the project area, with a recent search undertaken 23 November 2023 (ID 766066) of the same localities. The latest AHIMS database search in November identified 227 Aboriginal sites and/or objects for the same localities. This marked a significant increase in the number of sites recorded following the February 2023 search, which initially only returned a total of nine sites. The substantial rise in documented cultural sites and/or materials within the landscape is indicative of the archaeological investigations recently carried out within the general locale.

The search results are categorised in Table 6.1 with a discussion of the search results presented below. Figure 6.1 presents the location of Aboriginal sites and/or objects within the locale. The registered burial is not situated within the project area, and there is no additional publicly available information about its location due to its culturally sensitive nature. A copy of the AHIMS search results is provided in Attachment D.5.

The AHIMS searches identified a total of 227 Aboriginal sites and/or objects within the search area, excluding the duplicated sites from the combined search efforts. Of these, 35 sites identified by EMM were captured in the recent AHIMS database search following the field investigations undertaken for the Dinawan Solar Farm ACHA in March to September 2023 – as the project area for Dinawan Solar Farm and Dinawan Wind Farm overlap (see Section 6.3). The search results included a variety of site types often with multiple site features, but generally comprised of stone artefact sites, culturally modified trees, hearth sites, earth mounds, PADs, a burial (AHIMS #52-2-0034), and a water hole (AHIMS #48-6-0137). The most common site types recorded in the region are stone artefact sites (n=118, 52.4%). These sites are inclusive of isolated finds with additional components such as earth mounds, hearths, and PADs (n=32, 20.7%) and artefact scatters with additional components such as earth mounds, hearths, PADs, and culturally modified trees (n=71, 31.7%). They also include those sites containing an unspecified number of stone artefacts (n=15, 6.6%).

There are 73 culturally modified trees in the search area (32.2%) one of which includes a PAD. Notably, two culturally modified trees were included in the stone artefact site count which, when combined with the individual sites, results in a total of 75 modified trees (33.1%) documented in the area. Hearth sites are also well represented in the search area and combined with the sites included in the stone artefact site count, results in a total of 42 (18.8%) sites, including those with associated stone artefacts, earth mounds, PADs, the burial (AHIMS #52-2-0034), and culturally modified trees. Similarly, earth mounds (n=15, 6.6%) were often recorded with multiple site features including stone artefacts, PADs, and hearths. The water hole (#48-6-0137) recorded 24 km north-west of the project area, is a rarer site type and often associated with ceremonial, ritual, and/or gendered activities.

Table 6.1 shows the results of the AHIMS extensive search, excluding duplicate site types resulting from the combined searches.

Table 6.1 AHIMS extensive search

Site type	Frequency (n)	Percentage (%)
Stone artefact site	**118**	**52.4**
Artefact scatter (exclusive)	31	13.7
w/ hearth	18	7.9
w/ PAD	8	3.5
w/ earth mound	4	1.8
w/ earth mound, non-human bone & organic material, shell	2	0.9
w/ earth mound, hearth	1	0.4
w/ hearth, modified tree (carved or scarred), PAD	1	0.9
w/ hearth, PAD	5	2.2
w/ modified tree (carved or scarred)	1	0.4
Isolated find (exclusive)	20	8.8
w/ PAD	4	1.8
w/ hearth, PAD	7	3.1
w/ earth mound, hearth, PAD	1	0.4
Unspecified artefact site	15	6.6

Table 6.1 AHIMS extensive search

Site type	Frequency (n)	Percentage (%)
Modified tree (carved or scarred)	**73**	**32.2**
Modified tree (carved or scarred) (exclusive)	72	31.7
w/ PAD	1	0.4
Hearth site	**16**	**7**
Hearth (exclusive)	14	6.2
w/ PAD	1	0.4
w/ modified tree (carved or scarred)	1	0.4
Burial *w/ hearth, non-human bone & organic material, shell*	**1**	**0.4**
Earth mound	**15**	**6.6**
Earth mound (exclusive)	11	4.8
w/ hearth	3	1.3
w/ PAD	1	0.4
Potential Archaeological Deposit (PAD)	**2**	**0.9**
Water hole	**1**	**0.4**
Total	**227**	**100%**

Nearly all sites identified in the AHIMS search results are associated with water sources, such as perennial and ephemeral watercourses, creek lines, paleochannels, swamps, wetlands and Gilgai. Of the 227 Aboriginal sites and/or objects identified in the search results, 42 of these sites are located within the project area in proximity to 1st order watercourses, with 13 sites situated within and/or along the designed road access paths. Many of these sites have been exposed by previous access tracks, along streambanks, and erosion scalds. Of these, 34 sites were recorded by EMM in March to September 2023, with the remaining eight sites identified during an assessment undertaken by Navin Officer Cultural Heritage in May to September 2021 (refer to Section 6.3).

Table 6.2 details the documented AHIMS sites and their location within the project area and which sites are situated within the project's designed access routes and roadways.

Table 6.2 Documented AHIMS sites within the project area

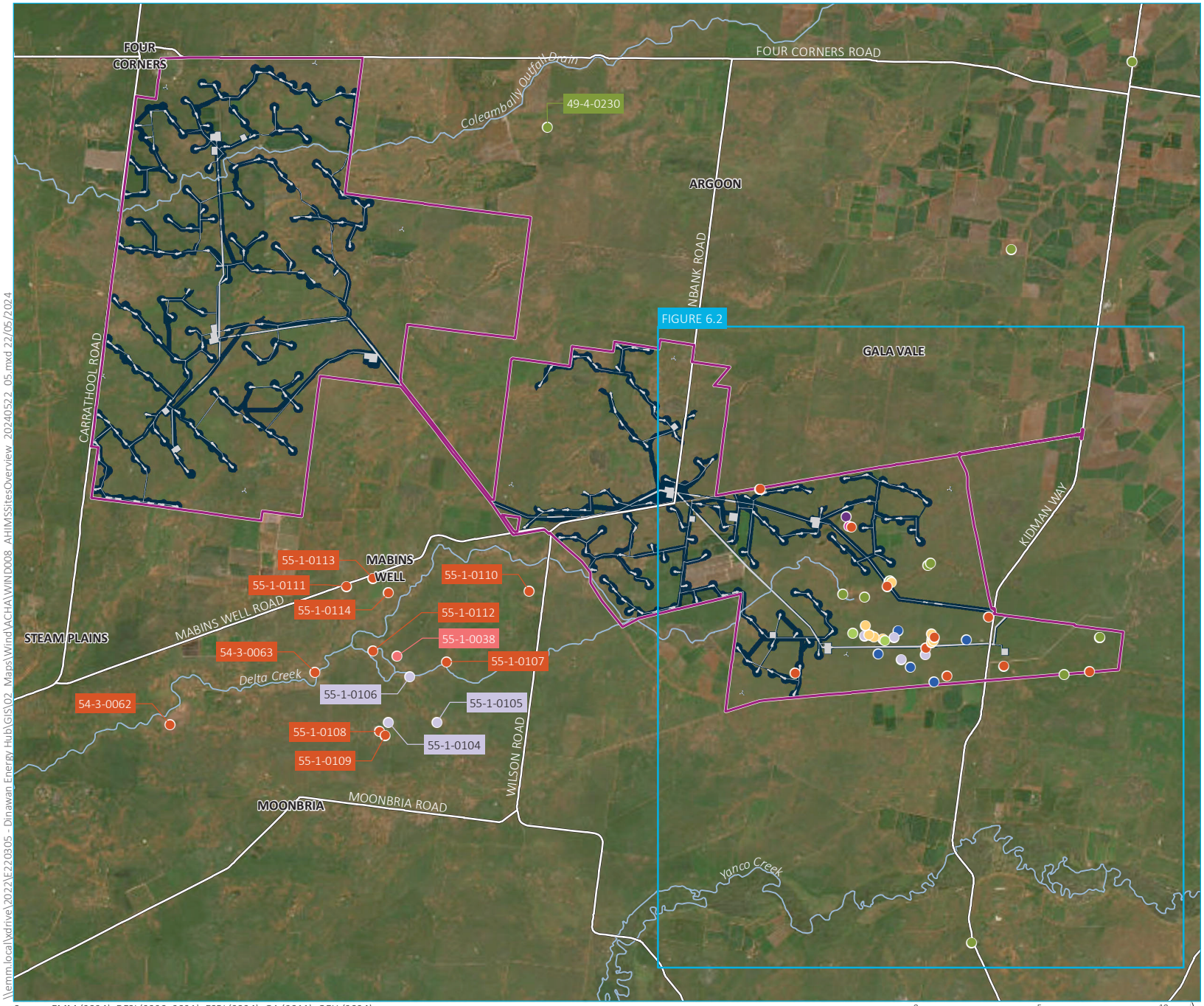
Site ID	Recorder	Site name	Site type	Location relative to the development corridor
#55-1-0052	Navin Officer Cultural Heritage	PEC-E-G2	Isolated find	Within McLennons Bore Road, eastern project area.
#55-1-0053	Navin Officer Cultural Heritage	PEC-E-43	Artefact scatter	Within McLennons Bore Road, eastern project area.
#55-1-0054	Navin Officer Cultural Heritage	PEC-E-44	Isolated find, PAD	210 m south-west of turbine T110, eastern project area.
#55-1-0055	Navin Officer Cultural Heritage	PEC-E-45	Artefact scatter, PAD	340 m east, eastern project area.
#55-1-0056	Navin Officer Cultural Heritage	PEC-E-46	Artefact scatter	250 m west of turbine T112, eastern project area.
#55-1-0057	Navin Officer Cultural Heritage	PEC-E-47	Hearth	22 m north-east, eastern project area.
#55-1-0059	Navin Officer Cultural Heritage	PEC-E-49	Modified tree (carved or scarred)	55 m north-east, eastern project area.
#55-1-0060	Navin Officer Cultural Heritage	PEC-E-50	Hearth	80 m north-east, eastern project area.
#55-1-0068	EMM Consulting	DEHS-2023-ST4	Modified tree (carved or scarred)	900 m north-east of turbine T102, eastern project area.
#55-1-0069	EMM Consulting	DEHS-2023-ST1	Modified tree (carved or scarred)	4,300 m east, eastern project area.
#55-1-0070	EMM Consulting	DEHS-2023-ST2	Modified tree (carved or scarred)	4,300 m east, eastern project area.
#55-1-0071	EMM Consulting	DEHS-2023-ST3	Modified tree (carved or scarred)	950 m south-west, eastern project area.
#55-1-0072	EMM Consulting	DEHS-2023-IF6	Isolated find	1,000 m south, eastern project area.
#55-1-0073	EMM Consulting	DEHS-2023-IF5	Isolated find	260 m north, eastern project area.
#55-1-0074	EMM Consulting	DEHS-2023-IF4	Isolated find	1,600 m south, eastern project area.
#55-1-0075	EMM Consulting	DEHS-2023-IF4	Isolated find	Within development corridor, eastern project area.
#55-1-0076	EMM Consulting	DEHS-2023-HAS3	Artefact scatter, hearth	500 m south, eastern project area.
#55-1-0077	EMM Consulting	DEHS-2023-HAS2	Artefact scatter, hearth	Within development corridor, eastern project area.
#55-1-0078	EMM Consulting	DEHS-2023-HAS3	Artefact scatter, hearth	Within development corridor, eastern project area.

Table 6.2 Documented AHIMS sites within the project area

Site ID	Recorder	Site name	Site type	Location relative to the development corridor
#55-1-0079	EMM Consulting	DEHS-2023-HAS4	Artefact scatter, hearth	700 m south, eastern project area.
#55-1-0080	EMM Consulting	DEHS-2023-IF2	Isolated find	50 m north, eastern project area.
#55-1-0081	EMM Consulting	DEHS-2023-HIF3	Isolated find, hearth, PAD	Within development corridor, eastern project area.
#55-1-0081	EMM Consulting	DEHS-2023-IF1	Isolated find	500 m south, eastern project area.
#55-1-0083	EMM Consulting	DEHS-2023-AS1	Artefact scatter	1,200 m south-east, eastern project area.
#55-1-0084	EMM Consulting	DEHS-2023-AS2	Artefact scatter	220 m south, eastern project area.
#55-1-0086	EMM Consulting	DEHS-2023-AS4	Artefact scatter	1,300 m south, eastern project area.
#55-1-0087	EMM Consulting	DEHS-2023-H7	Hearth	Within development corridor, eastern project area.
#55-1-0088	EMM Consulting	DEHS-2023-H6	Hearth	Within development corridor, eastern project area.
#55-1-0089	EMM Consulting	DEHS-2023-H5	Hearth	80 m north, eastern project area.
#55-1-0090	EMM Consulting	DEHS-2023-H4	Hearth	460 m north, eastern project area.
#55-1-0091	EMM Consulting	DEHS-2023-H3	Hearth	Within development corridor, eastern project area.
#55-1-0092	EMM Consulting	DEHS-2023-H2	Hearth	Within development corridor, eastern project area.
#55-1-0093	EMM Consulting	DEHS-2023-H1	Hearth	160 m north, eastern project area.
#55-1-0094	EMM Consulting	DEHS-2023-AS7	Artefact scatter	Within development corridor, eastern project area.
#55-1-0095	EMM Consulting	DEHS-2023-AS6	Artefact scatter	4,100 m south-east, eastern project area.
#55-1-0096	EMM Consulting	DEHS-2023-AS5	Artefact scatter	Within development corridor, eastern project area.
#55-1-0097	EMM Consulting	DEHS-2023-ST5	Modified tree (carved or scarred)	1,300 m south-east of turbine T119, eastern project area.
#55-1-0098	EMM Consulting	DEHS-2023-ST6	Modified tree (carved or scarred)	1,400 m south-east of turbine T119, eastern project area.

Table 6.2 Documented AHIMS sites within the project area

Site ID	Recorder	Site name	Site type	Location relative to the development corridor
#55-1-0099	EMM Consulting	DEHS-2023-AS2	Artefact scatter	50 m west, eastern project area.
#55-1-0101	EMM Consulting	DEHS-2023-WT1	Modified tree (carved or scarred)	3,200 m south-east, eastern project area.
#55-1-0102	EMM Consulting	DEHS-2023-HIF1	Isolated find, hearth, PAD	140 m north, eastern project area.
#55-1-0103	EMM Consulting	DEHS-2023-HIF2	Isolated find, hearth, PAD	Within development corridor, eastern project area.



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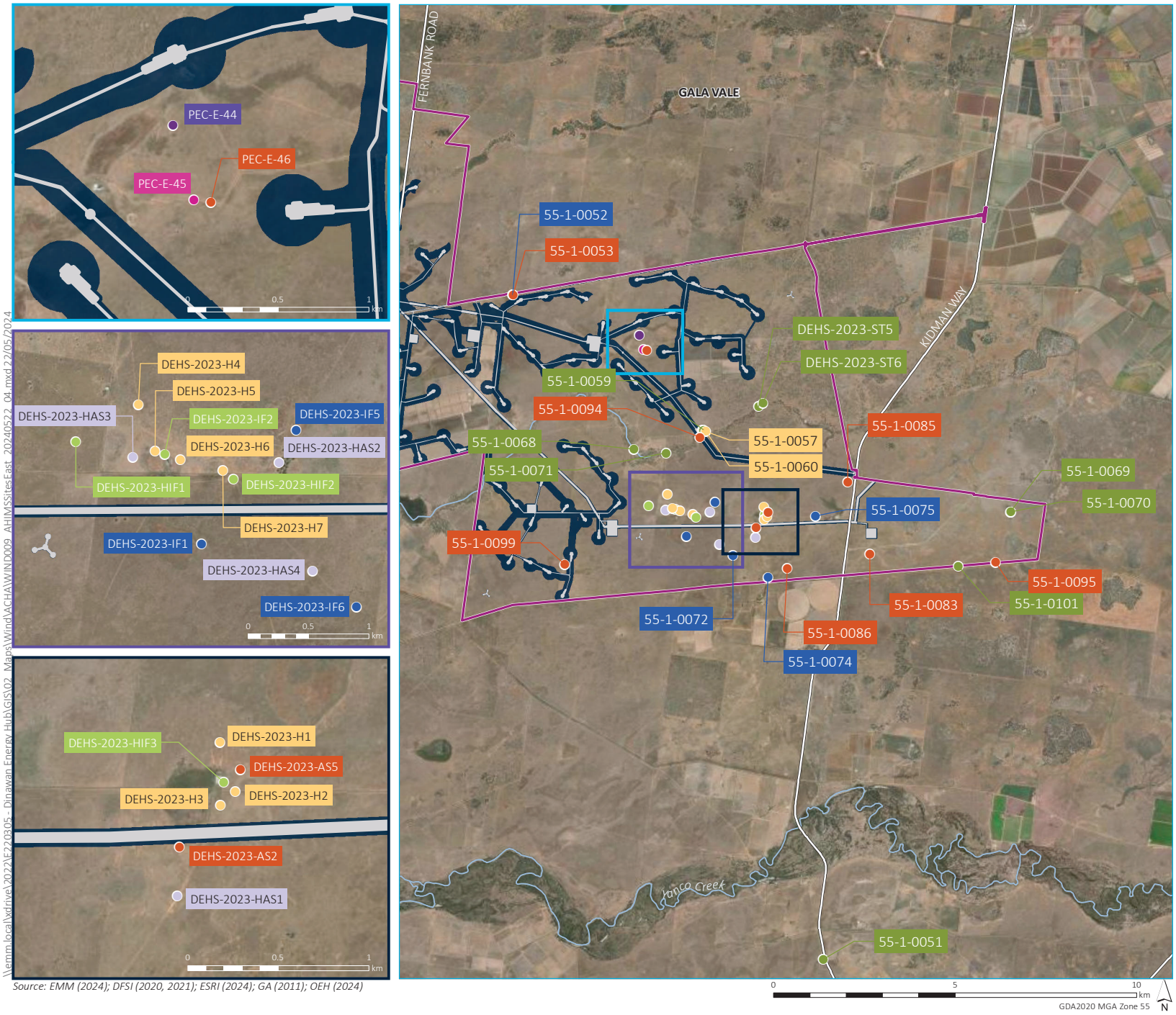
Source: EMM (2024); DFSI (2020, 2021); ESRI (2024); GA (2011); OEH (2024)

Previously documented AHIMS sites overview map

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 6.1

EMM
creating opportunities



KEY

- Project area
- Development corridor
- Development footprint

AHIMS - site type

- Artefact scatter
- Artefact scatter, PAD
- Artefact scatter, hearth
- Hearth
- Isolated find
- Isolated find, PAD
- Isolated find, hearth, PAD
- Modified tree

Existing environment

- Major road
- Watercourse (third order and higher)

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Source: EMM (2024); DFSI (2020, 2021); ESRI (2024); GA (2011); OEH (2024)

Previously documented AHIMS sites eastern detail map

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 6.2

EMM creating opportunities

6.5 Predictive model

A predictive model of Aboriginal site location has been devised based on the data presented in the preceding sections. In summary, the model has been formed by an analysis of:

- landscape features in the project area and surrounds
- pre-colonial period ecological conditions
- advice from Aboriginal knowledge holders, including RAPs
- ethno-historical information about Aboriginal life and material culture
- the type and distribution of Aboriginal sites described in previous reports and AHIMS data.

The model enabled the following predictions to be made about the location of Aboriginal sites within the project area, which has guided the archaeological survey performed as part of this ACHA. Based on the archaeological sites registered in the region, a review of previous archaeological studies and the environmental context, the following conclusions can be drawn regarding the potential presence and location of Aboriginal sites within the project area:

- Isolated finds and open artefact scatters are the most common site types within the region and can occur across most landforms, even in disturbed contexts. Isolated finds may be indicative of random loss or deliberate discard of a single artefact, the remnant of a now dispersed and disturbed artefact scatter, or an otherwise obscured or subsurface artefact scatter. Open artefact scatters or clusters of sites are usually found in association with both perennial and ephemeral water sources, such as lakes, creeklines, wetlands, and Gilgai. The most common site type is likely to be surface stone artefactual material reflective of past visitation and/or occupation. Available data suggests that such sites frequently contain few Aboriginal objects (<10) and are predominantly reflective of transitory movement or short-term camping by small parties. It would be expected that most artefact sites located would date to the mid- to late-Holocene (i.e. less than 4,000 years), the age attributed to the A-Horizon artefact bearing deposits. Though Pleistocene sites (i.e. older than 10,000 years old) have been well documented in the broader region, none have been previously recorded in the project area to date, and previous investigations in the locality suggest that historical ground disturbance has likely reduced the potential for this site type to be present, particularly in situ.

- Culturally modified trees, including scarred and carved trees, may occur where native vegetation has been preserved. Culturally modified trees typically served utilitarian purposes and, as such, are often associated with waterways and other natural resources associated with short- and long-term occupation. Conversely, carved trees may occur in association with burials, ceremonial sites or as indicators of 'dreaming' tracks and pathways. As such, they may occur only where native vegetation has been preserved, but their location within the landscape is difficult to predict without the aid of cultural knowledge. The project area has largely been cleared; however there remains small clusters of trees and individual trees distributed across the landscape and there are 75 AHIMS records for culturally modified trees within the search area, 8 of which were identified during the Dinawan Solar Farm surveys within and adjacent to the project area. As such, despite historic land clearing practices, it is likely that culturally modified trees will be present where mature vegetation remains, typically in association with present and prior watercourses.

- Hearths are frequently encountered in this region based on the AHIMS data. These features reflect a past foci of activity and are generally documented in proximity to watercourses. Where prior ground disturbance is minimal, smaller hearths that are representative of transient campsites can also be found in association with Gilgai and ephemeral wetlands. This spatial distribution is likely, in part, a result of the survivability and visibility of these features in alluvial and/or floodplain landscapes that periodically have excellent visibility, as well as less exposure to extensive agricultural disturbances when located in proximity to established watercourses. The presence of creeklines, paleochannels, Gilgai and wetlands in the project area indicates that this site type has a high probability of being present in the project area.
- Earth mounds (middens) of bone, charcoal, stone, clay heat retainers, and freshwater shells are documented in the region along established watercourses, such as Yanco Creek (9th order stream) south of the project area. The modification of the Coleambally Outfall Drain greatly reduces the potential for this site type to be present in its vicinity, and the lack of other established watercourses in the project area combined with historic agricultural and land clearing practices reduces the likelihood this site type will occur in the project area.
- Burials can occur anywhere in the landscape but are notably associated with landforms retaining deeper soil profiles, such as along watercourses, source-bordering dunes, or lunettes, within earth mounds, or under rock ledges. Landform elements, such as Gilgai mounds, do not retain sufficient soil depths suitable for burials. The identification of burials in the landscape is generally rare; however, >2,000 burials have been recorded within the Riverine region, with the closest documented site located at Lake Urana (37 km south-east of the project area), and the McGrath Road sand quarry burial located ~12 km north-east of Coleambally (>40 km north-east of the project area). Further discussion with the RAPs confirmed that numerous burials are known in the region, usually in association with established watercourses or sand dunes. Generally, burials would be identified by mounds of earth, carved trees, or stone markers. Evidence of burials is generally rare because human bodies are susceptible to the acidic Australian environments and other taphonomic processes. Where subsurface burial is not performed, human bodies can have limited preservation in the archaeological record. Such sites and their component parts are also more susceptible to the impacts of low-level development (such as farming) than other sites. The geological mapping, which is supported by LiDAR imagery, demonstrates that source-bordering dunes are present in discrete locales within the western portion of the project area, and the north-western corner of the eastern project area and therefore would have potential to contain burials.
- PADs have the potential to occur in the landscape, generally in proximity to watercourses where prior ground disturbance is minimal, retaining the natural soil profile. The geological mapping and LiDAR imagery demonstrates that PADs, in the form of source-bordering dunes and smaller silicious sand accumulations associated with ephemeral watercourses, are present in the project area.
- Water holes are rare and significant site types that are often associated with ceremony and/or culturally significant landforms. Their identification in the landscape is rare and difficult to predict without the aid of cultural knowledge. Their rarity and the lack of established watercourses within the project area indicates it is highly unlikely this site type will occur.

7 Field investigation

7.1 Key findings

- On-site validation consisted of field surveys and test excavations undertaken by EMM archaeologists and representatives of five RAPs. The field investigations focussed on the development corridor for the project, with test excavations targeting six locales to further define the potential for subsurface cultural materials within specific landforms. The field survey encompassed 34 days, the majority being conducted over a six week period from April to July 2023. Additional survey occurred for the proposed public road upgrades in early September 2023, and surveying realignments of the development corridor in January 2024. The test excavations consisted of a nine-day program from late September to early October 2023.

- The field survey encompassed ~413 km (~4,952 ha, or 68% of the development corridor) of pedestrian transects across the development corridor and included >700 individual points of observation and documentation. Visibility and effective survey coverage were poor (12%) due to dense groundcovers and thick grass obscuring the ground surface. Despite this, some 107 Aboriginal objects, sites and/or places were documented (Figure 7.2 and Figure 7.3). These included:

    - 29 artefact scatters
    - 8 artefact scatters with PAD
    - 9 hearths
    - 17 hearths with artefact scatters
    - 3 hearths with artefacts and PADs
    - 2 hearths with artefacts and culturally modified trees
    - 1 historic blaze tree/modified tree
    - 5 hearths with isolated finds
    - 15 isolated finds
    - 2 isolated stone artefacts with PADs
    - 1 PAD
    - 13 culturally modified trees
    - 2 culturally modified trees with artefact scatters.

- Test excavations consisted of 97 x 0.25 m^2 manually excavated test pits across six areas, Area 1 – Area 6 with Area 1 including three sub-areas Area 1.1, 1.2 and 1.3, with discrete transects aligned across previously identified sites and landforms that were representative across the project area (Figure 7.4 and Figure 7.5). The intention was to determine both the potential for subsurface cultural materials in areas with PAD, as well as investigate the soil profile more broadly in areas with very limited visibility and potentially deep sandy soils. All sites were in proximity to water sources such as Gilgai depressions, ephemeral wetlands, or paleochannels. A total of 41 artefacts were recovered primarily between 10 cm–50 cm below ground surface, with 20 recovered from one site (DEHW-2023-ASPAD4) in Area 1.2, which was located on a low rise on the eastern fringe of a wide, shallow Gilgai depression.

- Several test pits were excavated to 80 cm deep in Areas 4 and Area 5 that contained homogenous redeposited aeolian sands (A1–A2 horizon), at which manual excavations were ceased due to health and safety. No artefacts were recovered from these pits indicating that cultural materials are primarily surficial where eroded and scalded soils are present. Dating of these deep sand deposits through Optically-Stimulated Luminescence (OSL) dating indicate that the landscape in this region may have begun forming 8–10 ka. However, upper portions of the soil profile return ages of 0.2–0.8 ka. A radiocarbon sample from a hearth, DEH23-HASPAD3, aligns with this latter value providing an age of 1,180–1,060 calibrated years BP.

7.2 Archaeological survey

7.2.1 Approach and methods

EMM conducted an archaeological field survey of the development corridor with the assistance of Aboriginal participants over a six-week period (30 days), from April to July 2023, with an additional day surveying proposed public road upgrades in early September 2023, and three days of surveying realignments of the development corridor in January 2024. The survey was directed by Taylar Reid, Sam Elias, Amber Morgan and Megan Sheppard-Brennand (EMM archaeologists) with Aboriginal community representation provided through the participation of field officers from Griffith LALC, Bundyi Aboriginal Cultural Knowledge, Bidya Marra Consultancy, Bangarang Aboriginal Corporation and Roley Williams (Table 7.1).

The survey involved both pedestrian and vehicle traverses of the development corridor, targeting areas both predicted to be of moderate and high archaeological sensitivity, such as Gilgai, watercourses and paleochannels, and source-bordering dunes; and areas predicted to be of low archaeological sensitivity (e.g. floodplains and extant rice paddocks). The exposure varied across the development corridor, with high exposure in scalds, floodplains, and disturbed areas (90%), and low within paleochannels and sand dunes (30%). The visibility was generally very low across the development corridor (10%), with areas of higher visibility (>60%) on access tracks and erosion scalds. As such, vehicles were used to assist the survey team in locating areas of exposure, after which pedestrian survey of the surrounds occurred. In accordance with Requirement 5 of the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010), vehicle traverses have been excluded from the survey effectiveness calculations and discussion (see Section 7.2.2 and Table 7.2).

There were several iterations of project redesign, as the development corridor and development footprint were refined by Spark Renewables to avoid key sites and areas of moderate and high archaeological sensitivity that were identified during the field excursions. The survey results from areas no longer proposed for impacts are included in this report to contribute to a more in-depth understanding of the local archaeology.

The primary aims of the survey were to:

- identify Aboriginal archaeological sites and/or places with the assistance of Aboriginal participants
- characterise the landscape to aid predictions of archaeological potential and sensitivity
- identify sites or areas that would require further investigation if planned for disturbance as part of the project
- identify sites or areas to be avoided by the project, where possible
- identify areas with minor or negligible Aboriginal cultural heritage values that hold no constraint for disturbance.

The archaeological survey and data collection methods followed Section 2.2 of the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010). The project area was divided into transects and aligned with discrete landforms where feasible. The six survey participants were spaced evenly at ~20 m intervals; and when considering that each individual had a view corridor of 20 m (10 m either side of their person), the transects had an effective survey coverage corridor width of 120 m. This method was considered to be suitable for a largely flat landscape characterised by densely grassed paddocks with low visibility, whereby suitable ground exposures were easy to identify and target. Due to poor visibility across the development corridor, the assessment calculations assume that each participant could identify and inspect exposures within 10 m either side of them. Notwithstanding, this calculation does not account for more obtrusive site types such as scar trees which are observable from a much greater distance.

The survey team targeted ground exposures along transects where cultural materials were able to be identified throughout the deflated landscape. Archaeological surveys are inherently limited by ground surface visibility conditions and therefore any survey, despite the intensity of survey effort and spacing of survey transects, is considered to only sample the archaeological landscape. The archaeological survey did not aim to cover the entire ground surface within the development corridor, but rather to characterise the archaeological landscape.

The effectiveness of the survey is determined through recording and analysing survey coverage data. It is evaluated for its effectiveness in identifying the distribution of Aboriginal objects across the landscape, considering the potential for archaeological deposits. The percentage of the ground surface exposed in each landform and the visible ground surface within exposures (as ground exposures are often obscured by vegetation, gravel, etc.) influences the survey results. For example, an archaeologically sensitive landform surface that is highly exposed by erosion is likely to reveal Aboriginal objects, whereas a similar landform that is thickly grassed will obscure surface artefacts if they are present. Overall, calculation of effective survey coverage is used to estimate not only how much area was physically surveyed, but also how favourable the survey conditions were for the identification of Aboriginal sites.

Site recording was completed in accordance with the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010). Site locations and their details were recorded with digital tablets using site recording forms created by EMM on the Survey123 application for ArcGIS (Esri© software). The digital tablets had a location accuracy of up to ±3 m which is similar to hand-held non-differential GPS units (~5 m). The Survey123 forms allowed for a site's location, details and representative photographs to be linked together, which avoided potential post-fieldwork issues around data integrity.

Survey transects were recorded as tracks on GPS units and detailed information about each transect recorded on a separate Survey123 form created by EMM. The Survey123 form allowed for survey transect starting points, details and representative photographs to be recorded. The course of survey transects were recorded as tracks on hand-held non-differential GPS units which were linked to the Survey123 forms.

Table 7.1 Aboriginal stakeholder representatives present during survey

Organisation	Representatives
Griffith Local Aboriginal Land Council	Roslyn Simpson Allan McKenzie
Bidya Marra Consultancy	Bruce Crowe Jason Crowe Brandon Crowe Mitchell Crowe Quentin Ingram
Roley Williams	Roley Williams Jason Matthews

Table 7.1 Aboriginal stakeholder representatives present during survey

Organisation	Representatives
Bundyi Aboriginal Cultural Knowledge	Mark Saddler
Bangarang Aboriginal Corporation	Roland Atkinson Matthew Atkinson David Edwards

7.2.2

7.2.3 Results

Overall, the survey encompassed two survey units, comprising alluvial plains and paleochannels, with pedestrian transects totalling 413 km in length and ~4,952 ha across the development footprint. Over 700 discrete observations were documented to show representative samples of all landform elements, where a participant entered notes, photographs, descriptions, etc, about the landscape, and/or identified cultural materials (Figure 7.1, Attachment E). Vehicles were used to enable the survey team to better traverse the expansive project area and target areas of exposure within the heavily grassed plains in the development corridor (with tracks excluded from the final ground coverage calculations). The exposure varied between the two survey units, with high rates (~90%) viewed within the alluvial plains survey unit, while the paleochannels, despite historic land clearing practices and topsoil loss, were assessed as having much lower levels of exposure (~30%). The visibility was consistently low (0–30%) across the development corridor for both survey units, with discrete areas of high visibility (>60%) viewed within access/cattle tracks and erosion scalds.

The sources of exposure were the result of both natural erosional processes and agricultural practices. The previous ground disturbance across the development corridor was extensive, initially being cleared in the 19th century up to the present day for irrigation farming, with evidence of laser-levelling, irrigation farming, dams, access tracks, fence lines, and animal tracks present across the development corridor. Furthermore, the northern portion of the western area is bisected by the Coleambally Outfall Drain, an ephemeral drainage line that has since been modified with a large irrigation canal. The skeletal topsoils of the alluvial plains are vulnerable to wind erosion, with historic grazing and agricultural practices exacerbating topsoil loss, resulting in scalded plains. At the time of survey, wet weather resulted in the proliferation of grasses across the development corridor even where only skeletal topsoils remained. The sandy soils of the paleochannels and sand dunes are stabilised by thicker grasses and native pine trees, reducing the rate of natural erosion.

Topographically, the project area is situated within a generally flat floodplain, with discrete areas of undulating low sand dunes and rises. Several shallow drainage depressions, including lower order tributaries to Delta Creek and Blind Creek, intersect the development corridor in multiple places across the landscape. Other hydrological features include several wetlands with stands of remnant grey box trees, and wide, shallow Gilgai concentrated mostly throughout the western portion of the project area. The soils across the development corridor were dominated by eroded red and brown clays (vertosols), interspersed with grey-brown soils in areas prone to flooding. Areas of red aeolian sands (rudosols) were evident across large tracts of the development corridor, especially in areas associated with paleochannels, which is consistent with the soil mapping and predictions. Additional sections of chromosols (pebbled upper layers with a contrast to reddish sand soils below) were evident across the north-eastern corner of the western section of the development corridor and along the northern border of the eastern section of the development corridor. These areas were later targeted for test excavations (Area 1 and Area 4).

The field investigation identified 107 previously undocumented Aboriginal objects/sites (Section 7.2.3i, Table 7.3, Figure 7.2 and Figure 7.3). The sites were identified primarily on the alluvial plains (n=79, 74%) followed by paleochannels (n=28, 26%). The distribution of sites between the surveyed landforms is proportional, with the alluvial plains survey unit representing 76% of the total surveyed area and the paleochannel survey unit representing 24% of the total surveyed area. This is also demonstrative of the survey bias, where watercourses were surveyed more intensely as there was better visibility where large exposures (e.g. erosion scalds) and cattle tracks and other agricultural disturbances resulted in topsoil loss and high exposures. The sandy alluvial soils of the paleochannel survey unit retained deeper profiles that encouraged thick grass growth obscuring both ground surface visibility and exposures. The results of the pedestrian survey indicate that the presence of Aboriginal occupation across the alluvial plains was heavily associated with ephemeral water sources such as Gilgai, wetlands, and drainage lines, though more complex sites comprising multiple site features (e.g. sites composed of hearths, artefacts, and culturally modified trees in a localised area) were predominantly identified along the paleochannels.

The effective survey coverage calculations are shown below in Table 7.2 and representative photos of the survey are shown in Plate 7.1 to Plate 7.12.

Table 7.2 Survey effective coverage summary

Survey unit (landform)	Area (m^2)	Length (m)	Exposure (%)	Visibility (%)	Effective coverage (m^2)	Effective coverage (%)	Aboriginal sites identified
Alluvial plains	37,633,680	313,614	90	10	3,387,031	9%	79
Paleochannels	11,884,320	99,036	30	10	356,530	3%	28
Total	**49,518,000**	**412,650**	-	-	**3,743,561**	**12%**	**107**

Plate 7.1 Western portion of the project area, alluvial plains, view south

Plate 7.2 An example of exposures, western portion of the project area, view west

Plate 7.3 Western portion of the project area, paleochannel landform, view south

Plate 7.4 Eastern portion of the project area, ecotone, paleochannel down to alluvial plain, view north-west

Plate 7.5 Western portion of the project area, mallee landscape, view east

Plate 7.6 Western portion of the project area, irrigation canal, view north

Plate 7.7 Eastern portion of the project area, ephemeral watercourse, view south

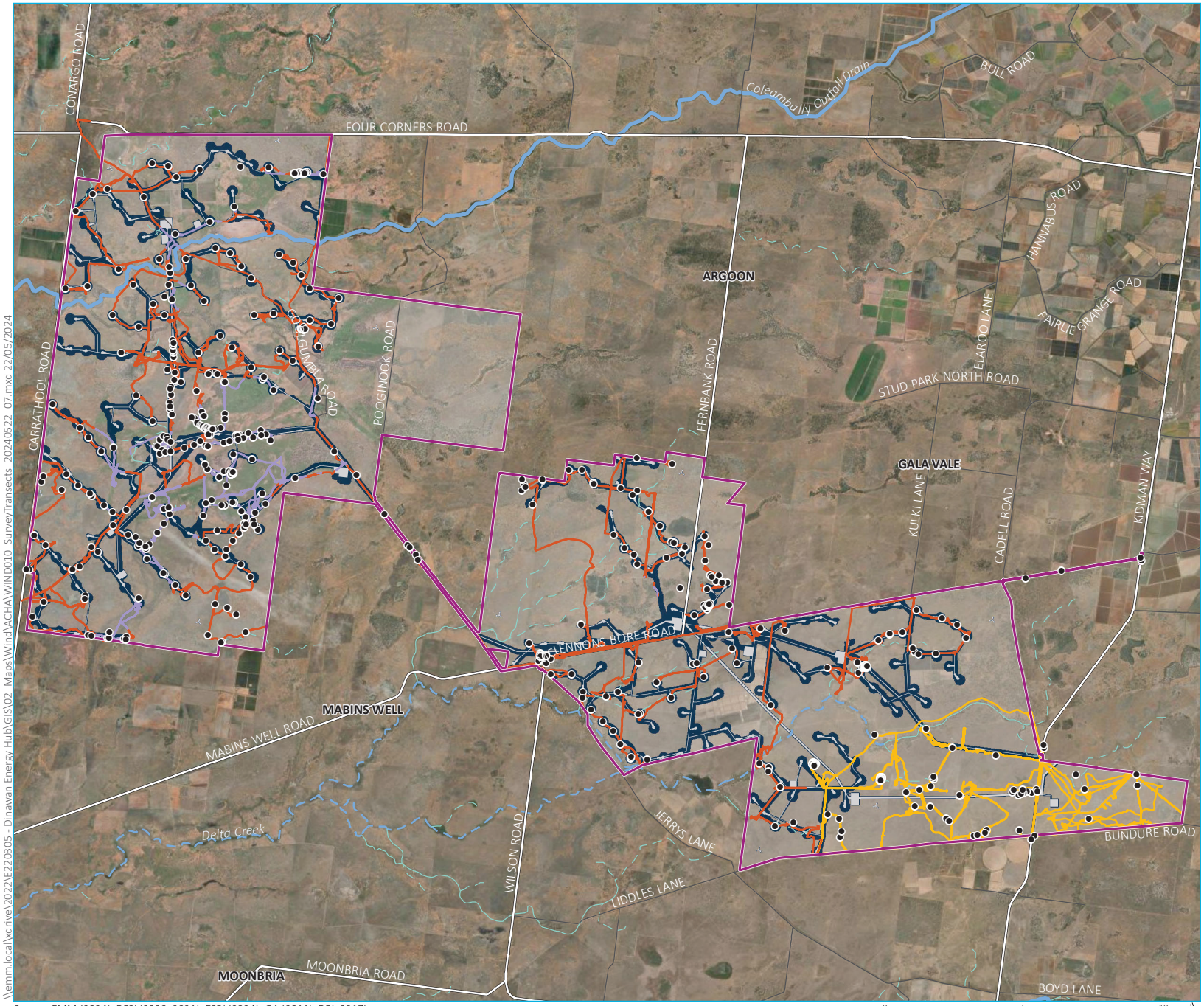
Plate 7.8 Eastern portion of the project area, vehicle track exposure, view west

Plate 7.9 Eastern portion of the project area, alluvial plain, view north

Plate 7.10 Eastern portion of the project area, scald exposure, view south

Plate 7.11 Eastern portion of the project area, Mclennons Bore Rd, view east

Plate 7.12 Western portion of the project area, fenceline exposure, view east



KEY

- Project area
- Development corridor
- Development footprint
- Photograph point

Survey Transect

- Paleochannel
- Alluvial plain
- Dinawan Solar Farm (indicative survey coverage)

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 9th order

Existing environment

- Major road
- Minor road

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Source: EMM (2024); DFSI (2020, 2021); ESRI (2024); GA (2011); DPI, 2017)

0 5 10 km

GDA2020 MGA Zone 55

N

Survey transects

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 7.1

EMM
creating opportunities

i Aboriginal sites identified

The field investigation resulted in the identification of 107 previously undocumented Aboriginal sites (Figure 7.2 and Figure 7.3, Plate 7.13 to Plate 7.30, Table 7.3). These included:

- 29 artefact scatters
- 8 artefact scatters with PAD
- 9 hearths
- 17 hearths with artefact scatters
- 3 hearths with artefacts and PADs
- 2 hearths with artefacts and culturally modified trees
- 1 historic blaze tree/modified tree
- 5 hearths with isolated finds
- 15 isolated finds
- 2 isolated stone artefacts with PADs
- 1 PAD
- 13 culturally modified trees
- 2 culturally modified trees with artefact scatters.

As predicted by the findings of the ACHA for Dinawan Solar Farm, the location of identified sites during the survey was concentrated around paleochannels, and ephemeral watercourses such as wetlands, Gilgai, and drainage lines on the alluvial plains. Notably the higher density stone artefact scatter sites are along ephemeral drainage lines in the north and east of the western portion, and the south-west of the eastern portion. As previously mentioned, this may partially be the result of survey bias, as dams were constructed around the terminus of the drainage lines, resulting in higher erosion and better visibility caused by cattle and sheep regularly visiting the dams in these locales. Comparatively, most of the hearth sites were identified on erosion or scald exposures and access tracks.

Nearly all sites identified during the survey were found in association with water sources. Sites identified in the alluvial plains survey unit were situated on the eastern fringes of Gilgai, ephemeral wetlands and along drainage lines, on very shallow soil accumulations, similar to the formation of lunettes on larger waterbodies and lakes. Of the 107 sites recorded, a total of 79 Aboriginal sites were identified within the western project area and 28 were located in the eastern portion (see Table 7.3, Figure 7.2 and Figure 7.3). This is likely the result of higher ground disturbance in the eastern project area where more laser-levelled and inundated rice paddocks were encountered, reducing the amount of attainable survey coverage, as well as disturbing or removing sites that may have been present. Though the western project area featured agricultural disturbances such as irrigation channels, dams, fences, and access tracks, it is likely that the deep sandy soil profiles of the paleochannels and sand dunes were more suitable for grazing practices, rather than more invasive agricultural practices such as laser levelling and cropping, improving the likelihood that sites would be retained in the landscape.

The artefact scatters were mostly low density (~1 artefact/m^2), with the exception of DEHW-2023-AS3, DEHW-2023-AS4, DEHW-2023-AS6, DEHW-2023-AS7, DEHW-2023-AS24, DEHW-2023-ASPAD4 and DEHW-2023-ASPAD8. They were comprised of <15 stone artefacts containing highly utilised quartz, silcrete, quartzite flakes, and occasionally chert, basalt and volcanic flakes with minimal cores recorded. Many of the flakes were small, crescent shaped micro-flakes with retouch along the lateral margin (DEHW-2023-AS7, see Plate 7.13 and Plate 7.14).

The hearth sites were generally identified as circular clusters of clay heat retainers, either wholly contained within the ground (e.g. ovens/in situ hearths) or the eroded remains of a hearth exposed on a scad. All hearth sites were found in association with paleochannels, drainage lines or Gilgai depressions. As natural fire events can cause similar markings on the earth, some sites are identified as 'tentative', with recommendations for further investigation where they may be affected by the project. The validity of some scar trees was of some debate between the Aboriginal stakeholders, and it is recommended that any culturally modified trees that may be affected by the project have their site status validated through expert assessment. However, most trees were grey boxes with oval scarring that were situated in proximity to drainage lines within the alluvial plains. Two hearth complexes with artefact scatters and culturally modified trees (DEHW-2023-HASST1 and DEHW-2023-HASST2) were found associated with paleochannels, within the western project area and Goolgumbla Road, respectively (see Figure 7.2).

Several notable sites including artefact scatters, hearth sites and culturally modified trees were identified during the survey (DEHW-2023-ASPAD4, DEHW-2023-HAS10, DEHW-2023-HASST1, DEHW-2023-HASST2 and DEHW-2023-STAS1). A brief description of these sites is provided below:

- DEHW-2023-ASPAD4 contained the highest number of stone artefacts identified during the survey, comprising more than 70 flakes in a 350 m x 20 m area on the eastern side of a lunette. The assemblage mainly comprised quartz and silcrete flakes, with some tentative volcanic flakes. All artefacts had been heavily utilised, with multiple featuring retouch (Plate 7.25 and Plate 7.26). One blue silcrete core and a quartzite multi-platform core were identified, suggesting to some of the Aboriginal stakeholders that the site may be related to men's activities (Plate 7.26). A grinding stone fragment and four clay balls were also observed.

- DEHW-2023-HAS10 included seven hearths measuring from 0.2 m x 0.4 m to 1.3 m x 0.7 m in size with associated artefact scatters (Plate 7.20). This site was identified in the western portion of the project area situated along a paleochannel extending to the north-east. The general area was disturbed with the site recorded on a large scald exposure with evidence of pastoral grazing. The site featured seven eroded hearths with one hearth containing quartz material and another hearth was considered to contain remnant material spread from a hearth potentially indicating a larger extent due to the presence of in situ clay balls in proximity to the main hearth. Vegetation had obstructed the full extent of one of the hearths identified.

- DEHW-2023-HASST1 contained a low density artefact scatter (n=10), a culturally modified tree and four hearths identified along a fence line within the paleochannel (Plate 7.15 and Plate 7.16). One hearth, measuring 0.8 m x 0.6 m, exhibits two silcrete flakes imbedded on its surface. The site includes seven silcrete flakes, two quartz flakes, and a single quartzite flake.

- DEHW-2023-HASST2 contained ten tentative hearths, two culturally modified trees including one with historic engravings (blaze tree), five in situ hearths (ovens) and an artefact scatter assemblage comprising of six quartz and silcrete flakes (Plate 7.15 and Plate 7.16). The site was identified in an ephemeral depression along Goolgumbla Road, which connects the eastern and western portions of the project area. The greater area showed evidence of disturbance with large amounts of dispersal of clay balls across the site, potentially indicating signs of flooding.

- DEHW-2023-STAS1 comprised of seven culturally modified trees with an associated artefact scatter. The artefacts included tentative silcrete and quartz flakes along with a manuport. The site was recorded in the eastern portion of the project area, situated along a paleochannel extending to the north-east. The general area was disturbed with evidence of pastoral grazing scars with vegetation removal. The site was identified as a potential women's place by one of the Aboriginal stakeholders during the survey. One culturally modified tree showed evidence of axe marks at the bottom of the scar. Several of the grey and/or black box eucalypt trees were noted by one of the Aboriginal stakeholders to be quite old and growing slowly due to the ephemeral water conditions and semi-arid landscape. This site is prominent in the landscape and is visibly situated within the narrow paleochannel. Its size and antiquity suggest an established or reliable water source was present at one time in this highly disturbed floodplain.

A representative sample of identified sites are provided in Plate 7.13 to Plate 7.30.

Plate 7.13 A sample of silcrete flakes associated with DEHW-2023-AS7

Plate 7.14 Location of DEHW-2023-AS7, scald exposure, view north

Plate 7.15 Example of a hearth, from hearth complex DEHW-2023-HASST1

Plate 7.16 Location of DEHW-2023-HASST1, scald exposure, view south-east

Plate 7.17 Quandong stone, pitted facet, from DEHW-2023-ASPAD5

Plate 7.18 Quandong stone from DEHW-2023-ASPAD5

Plate 7.19 Example of an eroded hearth, from hearth complex DEHW-2023-HIF4

Plate 7.20 Example of an eroded hearth, from hearth complex DEHW-2023-HAS10

Plate 7.21 Tentative culturally modified tree (ring tree) identified as part of DEHW-2023-STAS2

Plate 7.22 Example of a culturally modified tree, identified as part of DEHW-2023-ST11

Plate 7.23 Microlith flake, part of assemblage from DEHW-2023-ASPAD5

Plate 7.24 Microlithic with polish, part of assemblage from DEHW-2023-HAS5

Plate 7.25 Mutli-platform quartzite core, associated with DEHW-2023-ASPAD4

Plate 7.26 A blue silcrete core associated with DEHW-2023-ASPAD4

Plate 7.27 Example of an anvil, from DEHW-2023-HASPAD1

Plate 7.28 Showing polished sides of an anvil/Kulki Percussion Muller from DEHW-2023-HASPAD1

Plate 7.29 Sandstone grinding plate fragment, associated with DEHW-2023-IF6

Plate 7.30 Example of silcrete and quartz flakes identified within DEHW-2023-AS12

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-AS1	Artefact scatter	Alluvial plain	376,385	6,130,172	No	No	Artefact scatter (n=2) identified to the east of irrigation paddocks on an erosion exposure. Significant disturbance observed. The site consists of one crystal quartz flake with a single negative scar, and one red quartzite flake with hinge termination. Artefacts spaced 3 m apart.
DEHW-2023-AS2	Artefact scatter	Paleochannel	360,390	6,129,766	Partial	Partial	Artefact scatter (n=5) identified on a scald exposure. The site includes two silcrete micro-flakes, two quartz flakes with negative scarring, and one sandstone grinding plate fragment. The site is located to the north of a dissipating source-bordering dune. Artefacts are located within a 50 m wide radius.
DEHW-2023-AS3	Artefact scatter	Alluvial plain	360,275	6,123,651	No	No	Artefact scatter (n=15) located to the north of 1st order watercourse on a scald exposure. Site includes one quartz core, one quartzite core, silcrete flakes (n=10), two quartz flakes and one quartzite flake. Site is likely associated with DEHW-2023-AS4.
DEHW-2023-AS4	Artefact scatter	Alluvial plain	361,119	6,123,989	No	No	Artefact scatter (n=15) located to the north of 1st order watercourse on a scald exposure. The site includes three silcrete flakes, nine quartz flakes, one red quartzite core with two negative flake scars, one quartz core and one sandstone grinding implement. Artefacts are located within a 50 m radius. Site is likely associated with DEHW-2023-AS3.
DEHW-2023-AS5	Artefact scatter	Alluvial plain	374,521	6,121,945	Yes	No	Artefact scatter (n=3) identified to the south of ephemeral 1st order watercourse on fence-line exposure. Site includes one quartz flake, one silcrete flake, and one quartzite flake. Artefacts are spaced 3 m apart.
DEHW-2023-AS6	Artefact scatter	Alluvial plain	377,574	6,125,621	Partial	No	Artefact scatter (n=21) identified on road exposure to the south-east of billabong. The site includes silcrete flakes (n=15), one basalt flake, four quartzite flakes, and one silcrete flake with evident cortex. Visibility is low, and therefore the potential for additional artefacts within surrounding grass coverage is likely. Artefacts are located within a 50 m wide radius. Site is likely associated with DEHW-2023-AS7, ASPAD2–4, ST2–4.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-AS7	Artefact scatter	Alluvial plain	378,030	6,125,758	Partial	No	Artefact scatter (n=23) identified on scald exposure to the south-east of billabong. The site includes one grinding plate fragment, silcrete flakes (n=12), nine quartz flakes, and one crystal quartz flake. Artefacts are located within a 50 m wide radius. Site is likely associated with DEHW-2023-AS6, ASPAD2–4, ST2–4.
DEHW-2023-AS8	Artefact scatter	Alluvial plain	377,384	6,124,274	Yes	Partial	Artefact scatter (n=2) identified on scald exposure, on south-eastern side of Gilgai. The site includes one silcrete flake, and one quartzite flake, roughly separated by 20 m. Artefacts are spaced 2 m apart.
DEHW-2023-AS9	Artefact scatter	Alluvial plain	373,514	6,123,876	Yes	Partial	Artefact scatter (n=5) identified on road track exposure, located to the east of a significant Gilgai. The site includes two silcrete flakes, one black chert flake, and two quartz flakes. Spaced 15 m apart.
DEHW-2023-AS10	Artefact scatter	Paleochannel	360,269	6,133,006	No	No	Artefact scatter (n=9) identified to the east of ephemeral drainage depression, on erosion exposure, on deflated source-bordering dune. The site includes seven silcrete flakes, and two quartz flakes. Artefacts are spaced 6 m apart.
DEHW-2023-AS11	Artefact scatter	Paleochannel	359,706	6,132,005	No	No	Artefact scatter (n=2) identified on an erosion exposure, located within a deflated source-bordering dune (DEHW-2023-Dune). One tentative silcrete core and one quartz flake identified. Artefacts are spaced within a 30 m wide radius. This site is associated with DEHW-2023-Dune, HAS3, AS11, HAS6, AS12, HAS2, and DEHW-2024-AS2.
DEHW-2023-AS12	Artefact scatter	Paleochannel	359,691	6,131,281	Partial	Partial	Artefact scatter (n=8) located on scald exposures, located within a 150 m radius, towards the south of a deflated source-bordering dune (DEHW-2023-Dune). The site includes five silcrete flakes, one quartzite flake, and two quartz flakes. One silcrete flake exhibits evident signs of water rolling. This site is associated with DEHW-2023-Dune, HAS3, AS11, HAS6, HAS2, and DEHW-2024-AS2.
DEHW-2023-AS13	Artefact scatter	Alluvial plain	360,733	6,138,923	Yes	No	Artefact scatter (n=6) identified on scald and road track exposure, towards the south of a paleochannel landform. The site includes four silcrete flakes, one quartz flake, and one quartzite flake. Artefacts are located within a 30 m radius.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-AS14	Artefact scatter	Paleochannel	363,808	6,140,531	Partial	No	Artefact scatter (n=2) identified towards the north of a source-bordering dune, and to the west of a cluster of Eucalyptus vegetation. Two flakes were located on a scald exposure, including one quartz flake and one basalt flake. This site is associated with DEHW-2023-HASPAD3.
DEHW-2023-AS15	Artefact scatter	Paleochannel	358,626	6,136,340	No	No	Artefact scatter (n=3) identified on the gradual slope of source bordering dune, possibly associated with DEHW-2023-HIF2. Three flakes identified on scald exposure, including two silcrete flakes, and two quartzite flakes.
DEHW-2023-AS16	Artefact scatter	Paleochannel	361,805	6,133,199	Yes	Partial	Artefact scatter (n=3) identified on the northern border of dissipating source-bordering dune, and to the south of an alluvial plain with dense Mallee vegetation. Two quartz flakes and one silcrete flake were identified on scald exposure. A number of scattered heat retainer nodules were identified.
DEHW-2023-AS17	Artefact scatter	Alluvial plain	356,779	6,123,902	Partial	No	Artefact scatter (n=9) identified to the east of a paleochannel landform. The site includes three silcrete flakes, five quartz flakes, and one tentative chert flake. Artefacts were located on scald exposure. One ambiguous hollowed rolled pebble was identified, possible ant activity.
DEHW-2023-AS18	Artefact scatter	Alluvial plain	354,940	6,126,271	Partial	No	Artefact scatter (n=4) identified to the east of vehicle track, and to the west of an irrigation canal. Artefacts are roughly 200 m in proximity to each other, identified on scald exposures. Artefacts included one silcrete core, one quartz flake, one silcrete flake and one sandstone grindstone fragment.
DEHW-2023-AS19	Artefact scatter	Alluvial plain	355,106	6,126,478	Yes	Partial	Artefact scatter (n=3) identified on vehicle exposure, located south-west of irrigation dam. The site included three silcrete flakes and is within a secondary context, possibly relating to site DEHW-2023-AS18.
DEHW-2023-AS20	Artefact scatter	Alluvial plain	361,062	6,133,881	Partial	No	Artefact scatter (n=2) is located on alluvial landscape, east of an irrigation canal. The site includes one tentative quartz flake and one silcrete flake. The site appears disturbed and likely associated with DEHW-2023-AS25.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-AS21	Artefact scatter	Alluvial plain	379,544	6,124,017	Yes	No	Artefact scatter (n=5) is located on a scald exposure roughly 100 m east of the vehicle track. The site includes four quartz flakes, and one silcrete flake. This site may relate to DEHW-2023-HAS7, located 250 m towards the south-west.
DEHW-2023-AS22	Artefact scatter	Alluvial plain	372,872	6,122,445	Yes	No	Artefact scatter (n=2) identified 75 m south-west of an irrigation dam, and 118 m north-east of a cluster of eucalyptus trees. The site includes two tentative quartz flakes, that were identified on a scald exposure.
DEHW-2023-AS23	Artefact scatter	Alluvial plain	387,046	6,123,890	Yes	Partial	Artefact scatter (n=3) identified on vehicle track exposure, towards the west of an irrigation canal. The site includes one silcrete core with evident cortex, and two quartz fakes. The site is disturbed with large irrigation paddocks identified roughly 400 m south-west of the site.
DEHW-2023-AS24	Artefact scatter	Alluvial plain	374,866	6,122,309	Partial	Partial	Artefact scatter (n=28) comprising four silcrete flakes, two chert flakes, two quartz flakes, one crystal quartz flake and one basalt flake identified on sheet wash exposure to the south-west, and on a scald exposure towards the north-east. Many potential quartz flakes (n=14) identified on scald exposure. The artefacts were located on a scald exposure in proximity to an ephemeral watercourse. Three tentative grinding stones and an anvil were also identified.
DEHW-2023-AS25	Artefact scatter	Alluvial plain	360,951	6,133,275	No	No	Artefact scatter (n=2) is located on an alluvial landform, located towards the east of an irrigation canal. The site is likely associated with DEHW-2023-AS20. The site includes one quartz flake, and one silcrete flake.
DEHW-2023-AS26	Artefact scatter	Paleochannel	359,945	6,138,803	Yes	Partial	Artefact scatter (n=11) identified on vehicle track exposure, located on a deflated source-bordering dune. Site includes two quartz flakes, five silcrete flakes, three tentative quartzite flakes and one highly tentative grinding stone fragment. The site is heavily disturbed and irrigation paddocks identified 20 m south.
DEHW-2024-AS1	Artefact scatter	Paleochannel	359,300	6,127,510	Partial	Partial	Artefact scatter (n=2) identified on a vehicle track exposure alongside irrigation canal, 250 m north-east of dam. The site includes one grey silcrete flake, and one milky quartz flake.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2024-AS2	Artefact scatter	Paleochannel	359, 608	6,131,096	Yes	Partial	Artefact scatter (n=2) identified on scald exposure, on the north-western boundary of a cluster of eucalyptus vegetation. The site is located 50 m east and 50 m south of fence line. The site includes one silcrete flake and one quartz flake. Scattered clay heat retainer nodules located in the vicinity. This site is associated with DEHW-2023-Dune, HAS2-HAS3, HAS6, AS11-AS12.
DEHW-2024-AS3	Artefact scatter	Paleochannel	360, 941	6, 131, 138	Yes	Partial	Artefact scatter (n=2) identified on vehicle track exposure, to the north of fence line. The site includes two silcrete flakes, grey and red. Flakes are located 250 m apart, within a secondary context.
DEHW-2023-ASPAD1	Artefact scatter, PAD	Alluvial plain	375,315	6,119,392	Partial	No	Artefact scatter (n=11) and PAD identified on the eastern boundary of ephemeral watercourse. The site includes silcrete flakes (n=10) and one IMT/Volcanic flake, identified on a scald exposure.
DEHW-2023-ASPAD2	Artefact scatter, PAD	Alluvial plain	378,317	6,125,882	Partial	No	Artefact scatter (n=26) and PAD identified to the east of dam, within an alluvial plain. The site includes silcrete flakes (n=18), three quartz flakes, one sandstone artefact with polished edges, and two possible grinding plate fragments were identified with two tentative basalt flakes. Located on scald exposure. Site is likely associated with DEHW-2023-AS6-7, ASPAD2–4, ST2–4.
DEHW-2023-ASPAD3	Artefact scatter, PAD	Alluvial plain	377,809	6,126,139	No	No	Artefact scatter (n=12) and PAD identified on a vehicle track exposure, north of eucalyptus cluster, and 200 m north-west of dam. The site includes one quartz core, nine red, yellow and grey silcrete flakes, and two red quartzite flakes. Artefacts are located within a 200 m radius. Site is likely associated with DEHW-2023-AS6-7, ASPAD2, ASPAD4, ST2–4.
DEHW-2023-ASPAD4	Artefact scatter, PAD	Alluvial plain	377,727	6,125,072	Partial	No	Artefact scatter (n=70) and PAD identified to the eastern side of two significant Gilgai, atop scald exposures. The site includes approximately 70+ artefacts, comprising silcrete flakes (n=50), quartz flakes (n=10), and three tentative volcanic flakes, one blue silcrete core, one quartzite multi-platform core, and one grinding stone fragment. Scattered clay heat retainer nodules were identified throughout the site. Site is likely associated with DEHW-2023-AS6-7, ASPAD2–3, ST2–4.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-ASPAD5	Artefact scatter, PAD	Alluvial plain	383,449	6,122,839	Partial	Partial	Artefact scatter (n=11) and PAD identified to the east of ephemeral watercourse, and south-west of 'borrow-pit'. The site includes one tentative highly eroded hearth, one quandong stone, seven quartz flakes, one chert flake, and one tentative quartzite grinding implement, or manuport. Artefacts are scattered atop scald exposures, presumed secondary context due to alluvial activity.
DEHW-2023-ASPAD6	Artefact scatter, PAD	Alluvial plain	355,574	6,126,915	Partial	Partial	Artefact scatter (n=3) and PAD identified 170 m north of dam, and west of irrigation canal. The site includes two silcrete flakes, both exhibit cortex, and one tentative quartzite muller fragment. Identified on a vehicle track exposure and on a scald exposure, on the boundary of two drainage depressions. Several scattered clay heat retainers were found in proximity.
DEHW-2023-ASPAD7	Artefact scatter, PAD	Paleochannel	356,277	6,124,054	Partial	No	Artefact scatter (n=2) and PAD identified on slight rise within paleochannel landform, on a scald exposure. The site includes one highly eroded hearth and two tentative quartz flakes.
DEHW-2023-ASPAD8	Artefact scatter, PAD	Alluvial plain	374,101	6,121,708	Partial	No	Artefact scatter (n=21) and PAD identified south of ephemeral watercourse, amongst cluster of Eucalyptus vegetation. The site includes two silcrete flakes, two basalt flakes, quartz flakes (n=12), one basalt microlith cutting tool, one sandstone grinding implement, one basalt anvil with signs of pitting, one tentative quartz microlith, and one sandstone axe. Located on the eroding banks of a potential borrow pit, used in a historic context as a rubbish tip. Site is within a secondary context and is highly disturbed.
DEHW-2023-Dune	PAD	Paleochannel	359,783	6,131,451	No	No	A source-bordering dune identified as a PAD with the potential to contain burials and was identified as a culturally significant landform by the RAPs. This site is associated with DEHW-2023-HAS3, AS11, HAS6, AS12, HAS2, and DEHW-2024-AS2.
DEHW-2023-H1	Hearth	Alluvial plain	358,650	6,135,501	Partial	No	Hearth identified on a scald exposure, on the northern boundary of an ephemeral watercourse, hearth diameter measures 2 m by 1 m. Hearth is highly eroded, heat retainer nodules vary from roughly 10 cm to a diminutive size. No charcoal identified.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-H2	Hearth	Paleochannel	358,138	6,128,541	Yes	No	Hearth identified on a scald exposure, on the southern side of paleochannel lunette, and 50 m north-west of fence line and irrigation canal. Hearth measures 0.2 m by 0.5 m and is highly eroded. Heat retainer nodules are diminutive, and no charcoal was identified.
DEHW-2023-H3	Hearth	Alluvial plain	353,610	6,127,609	Yes	No	Hearth identified within alluvial floodplain on a slight rise. Several in situ clay heat retainer nodules were identified in a semi-circular pattern. Estimated to measure 1 m by 1.2 m. No charcoal identified.
DEHW-2023-H4	Hearth	Paleochannel	358,249	6,128,957	No	No	Hearth identified on a scald exposure, 50 m west of a vehicle track, within a paleochannel landform. Hearth measures 0.7 m by 0.4 m and is heavily eroded. Potential charcoal identified.
DEHW-2023-H5	Hearth	Alluvial plain	354,286	6,132,164	Partial	Partial	Hearth identified south-west of Mallee vegetation, on scald exposure. Hearth measures roughly 0.9 m by 0.9 m and is heavily eroded with very few in situ clay heat retainer nodules. No charcoal was identified. A single quartz core/scrapper was identified in proximity.
DEHW-2023-H6	Hearth	Alluvial plain	355,433	6,131,075	Partial	No	Hearth identified south-west of Gilgai, measuring roughly 1.3 m by 0.5 m, and is heavily eroded. Few in situ clay heat retainer nodules identified, with several scattered nodules. No charcoal was identified.
DEHW-2023-H7	Hearth	Paleochannel	359,740	6,128,712	Yes	No	Tentative hearth identified on a vehicle track exposure, 17 m east of canal, and 40 m west of fence-line. No evident shape. Diffused and scattered clay heat retainer nodules. Highly disturbed context. No charcoal identified.
DEHW-2024-H1	Hearth	Alluvial plain	358,452	6,132,797	Yes	Yes	Highly eroded hearth identified within grass plain, located 230 m north-west of Gilgai. Hearth measures 0.8 m by 0.6 m, includes a small density of clay heat retainer nodules. The shape of hearth dissipates from a central point. No clear charcoal identified.
DEHW-2024-H2	Hearth	Alluvial plain	358, 465	6,131,879	Yes	Yes	Highly eroded hearth identified on scald exposure on the south-western edge of Gilgai. Hearth measures 1 m by 2 m, includes three identifiable clay heat retainer nodules. No distinct shape, and no charcoal identified.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-HAS1	Hearth, artefact scatter	Alluvial plain	360,514	6,124,913	No	No	Hearth and artefact scatter (n=11) identified south-west of Gilgai on scald exposure. The site includes seven quartz flakes, one red quartzite flake, three silcrete flakes, and one potential hearth measuring 1.5 m by 1 m in diameter. Six significant clay heat retainer nodules identified. No charcoal.
DEHW-2023-HAS2	Hearth, artefact scatter	Paleochannel	360,381	6,131,348	No	No	Artefact scatter (n=9) and two hearths identified on vehicle track and scald exposures. Disturbed secondary context. The site includes five silcrete flakes, and four quartz flakes. Hearths measuring 1 m by 1 m, and 0.3 m by 0.3 m. Low density of small clay heat retainer nodules identified with no significant shape. No charcoal was identified. This site is associated with DEHW-2023-Dune, HAS3, AS11, HAS6, AS12, and DEHW-2024-AS2.
DEHW-2023-HAS3	Hearth, artefact scatter	Paleochannel	359,536	6,132,211	No	No	Artefact scatter (n=14) and six hearths identified north of dissipating source-bordering dune, on eroding alluvial plain. Drainage depression, with eucalyptus vegetation located to the east of site. The site includes four silcrete flakes, nine quartz flakes, and one microlithic basalt scraper. Four hearths may be natural, with diminutive clay heat retainer nodules and no clear shape. Two hearths appear cultural, with clay heat retainer nodules located within a triangular and semi-circular pattern. Measuring 1.6 m by 1 m, and 1 m by 1 m. Possible charcoal was identified. This site is associated with DEHW-2023-Dune, AS11, HAS6, AS12, HAS2, and DEHW-2024-AS2.
DEHW-2023-HAS4	Hearth, artefact scatter	Paleochannel	357,279	6,124,976	Partial	No	Artefact scatter (n=8) and small hearth complex comprising four hearths identified in paleochannel on scald exposures. The site includes one basalt flake, three quartz flakes, a single crystal quartz flake and three silcrete flakes. Hearth sizes range from 1 m x 1 m, to 0.5 m x 0.5 m. Significant clay heat retainer nodules identified potentially in-situ. Potential charcoal identified.
DEHW-2023-HAS5	Hearth, artefact scatter	Paleochannel	357,557	6,128,719	Partial	Partial	Artefact scatter (n=9) and four hearths identified on a terrace within a paleochannel landform, on the eastern side of a drainage depression, atop scald exposures. The site includes nine flakes of silcrete and quartz. The hearths measure 1.2 m by 0.9 m, 1.2 m by 1 m, 0.5 m by 0.5 m, and 1 m by 1 m. All hearths have a significant shape, while differing in their level of erosion and heat retainer size.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-HAS6	Hearth, artefact scatter	Paleochannel	359,321	6,131,712	No	No	Artefact scatter (n=2) and hearth identified on the western side of a dissipating source-bordering dune. The site includes two silcrete flakes, and a hearth measuring 2 m by 1.4 m, located on atop a scald exposure. Clay heat retainer nodules form a significant shape, no charcoal was identified. This site is associated with DEHW-2023-Dune, HAS3, AS11, AS12, HAS2, and DEHW-2024-AS2.
DEHW-2023-HAS7	Hearth, artefact scatter	Alluvial plain	379,360	6,123,800	Yes	Partial	Artefact scatter (n=14) and four hearths were located within a heavily disturbed context north of farmer's shed and west of a dirt vehicle track. The site included one silcrete core, one quartzite hammerstone, seven quartz flakes, one basalt flake, three silcrete flakes, and a single crystal quartz flake. Hearths differentiate from 0.4 m by 0.35 m, to 0.8 m by 0.8 m. No charcoal identified.
DEHW-2023-HAS8	Hearth, artefact scatter	Alluvial plain	361,399	6,136,695	Yes	No	Artefact scatter (n=3) and hearth site were identified 250 m north-east of drainage depression, and 80 m south-west of a vehicle track exposure. Hearth is heavily eroded, measuring 1.5 m by 0.6 m. No charcoal identified. Site includes three quartz flakes.
DEHW-2023-HAS9	Hearth, artefact scatter	Alluvial plain	383,137	6,122,931	Partial	No	Artefact scatter (n=6) and hearth site identified to the west of ephemeral watercourse, in possible association with DEHW-2023-ASPAD5. The site is located 180 m south of a significant irrigation canal, atop scald exposures. Hearth is possibly natural, with no evident shape or consistently sized heat retainers. Site included five quartz flakes and one silcrete flake.
DEHW-2023-HAS10	Artefact scatter	Alluvial plain	354,283	6,129,816	Partial	No	Several hearths measuring from 0.2 m x 0.4 m to 1.3 m x 0.7 m located on scald exposures situated on paleochannel, with an additional four eroded hearths located on an erosion scar. Many large clay balls are scattered throughout the site possibly indicating the remains of a larger hearth. Several flaked pieces of quartz material in proximity to site, likely cultural. Low visibility in the locality, some hearths extend further under the grass. Rabbit burrows into the sandy soils in proximity to the site. Site is likely associated with DEHW-2023-ST9.
DEHW-2023-HAS11	Hearth, Artefact scatter	Paleochannel	360,708	6,129,789	No	No	Hearth and artefact scatter (n=5) identified in proximity to two Gilgai, located 150 m south-east of vehicle track exposure. Significant in situ heat retainer nodules identified, with no particular shape. Site includes four silcrete flakes, and one quartz flakes.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-HAS12	Hearth, Artefact scatter	Alluvial plain	390,345	6,126,225	Partial	Partial	Artefact scatter (n=5) and hearth identified on vehicle track exposure. Hearths are heavily eroded, with no significant shape. Many clay heat retainer nodules are too large to be considered cultural. Signs of a recent fire event were evident, possible burn event. The site includes four silcrete flakes, and one quartz flake. One tentative oven mound was identified, measuring roughly 3 m by 2 m. Clay heat retainer nodules were identified eroding from oven mound.
DEHW-2023-HAS13	Hearth, Artefact scatter	Alluvial plain	380,363	6,124,477	Partial	No	Artefact scatter (n=21) and hearth site identified on the southern side of McLennons Bore Rd. Site is very disturbed and includes 14 flakes, consisting of quartz and silcrete. Tentative hearth is eroding from scald exposure, in direct proximity to artefact scatter. Site incorporates #55-1-0053 and #55-1-0052. Secondary cluster of five quartz and 2 silcrete artefacts are located 70 m south-east, on a vehicle track exposure.
DEHW-2024-HAS1	Hearth, Artefact scatter	Paleochannel	357,791	6,127,342	Partial	Partial	Two hearths and an artefact scatter (n=2) identified on scald exposure. The site is divided by a fence line, located 500 m east of Gilgai. Hearth measures 2 m by 0.7 m, and 1.2 m by 0.6 m. The site includes one silcrete flake and one sandstone anvil, within a 140 m radius.
DEHW-2024-HAS2	Hearth, Artefact scatter	Paleochannel	358,251	6,130,829	Yes	Partial	Hearth and an artefact scatter (n=7) identified on vehicle track exposure. Hearth includes a very small density of clay heat retainer nodules, no distinguishable shape. Hearth measures 0.4 m by 0.4 m. Charcoal identified. The site includes seven quartz flakes, one chert flake, and five silcrete flakes.
DEHW-2024-HAS3	Hearth, Artefact scatter	Paleochannel	361,767	6,131,322	Partial	Partial	Hearth and artefact scatter (n=4) identified on vehicle track exposure, on the northern side of fence line. Hearth measures 0.5 m by 0.5 m, includes a low density of clay heat retainer nodules and has very little shape. Charcoal is identifiable. The site includes one silcrete flake, two quartz flakes and one quartzite core.
DEHW-2024-HAS4	Hearth, Artefact scatter	Alluvial plain	375,931	6,125,587	Partial	No	Four tentative hearths and an artefact scatter (n=10) identified on scald exposure, on the eastern boundary of a drainage depression with dense Eucalyptus vegetation. Hearths measure between 1.3 m x 0.5 m, and 0.4 m x 0.4 m. Hearths include a moderate to limited amount of clay heat retainer nodules and are ambiguous in shape. The site includes one grinding plate fragment, six quartz flakes, and three silcrete flakes.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-HASPAD1	Hearth, artefact scatter, PAD	Alluvial plain	371,756	6,123,237	Partial	No	Artefact scatter (n=25), PAD and hearth site identified north of ephemeral drainage depression with dense Eucalyptus vegetation. The site includes one sandstone anvil, 22 flaked pieces of silcrete and quartz, a sandstone grinding stone fragment and a quartzite core. Hearth measures 0.2 m by 0.2 m, with no evident shape and irregularly sized heat retainer.
DEHW-2023-HASPAD2	Hearth, artefact scatter, PAD	Alluvial plain	375,700	6,124,332	Partial	No	Artefact scatter (n=5), PAD and hearth site identified to the east of ephemeral drainage depression, with dense Eucalyptus vegetation. Site includes four quartz flakes, and one quartzite flake on erosion scald. Three hearths, measuring roughly 1.2 m by 1 m, all had appropriately sized heat retainer nodules, forming a relative shape. No charcoal was identified.
DEHW-2023-HASPAD3	Hearth, artefact scatter, PAD	Paleochannel	363,304	6,140,613	Yes	No	Artefact scatter (n=2), PAD and hearth site identified on the northern side of source-bordering dune, and atop alluvial plain, densely populated by Mallee. Two hearths were identified, measuring 2 m x 0.7 m, and 1.5 m x 0.6 m. One quartz flake and one silcrete flake were found in proximity, on scald exposure. This site is likely associated with DEHW-2023-AS14.
DEHW-2023-HASST1	Hearth, artefact scatter, culturally modified tree	Paleochannel	356,482	6,129,754	Partial	Partial	An artefact scatter (n=10), a culturally modified tree and a hearth site were identified along a fence line, and towards some Eucalyptus vegetation. On numerous scald exposures, four hearths were identified, all oval shaped. One hearth, measuring 0.8 m x 0.6 m, exhibits two silcrete flakes imbedded within the surface. One culturally modified tree is located within cluster of vegetation towards the south. Tree circumference is ~4 m. The distance from the ground is 70 cm, and the scar measures 54 cm by 33 cm, with a depth of 7 cm. The site includes seven silcrete flakes, two quartz flakes, and a single quartzite flake.
DEHW-2023-HASST2	Hearth, artefact scatter, culturally modified tree	Alluvial plain	367,441	6,126,672	Partial	Partial	An artefact scatter (n=2), two culturally modified trees, one with historic markings (blaze tree), and a hearth complex identified in proximity to Goolgumbla Road. Ten tentative hearths and five ovens were identified within an ephemeral depression. Clay heat retainer nodules were identified eroding from oven structure, and two silcrete artefacts were located atop oven mound. Site includes an additional five quartz flakes located south of the oven mounds. A culturally modified tree was also located within the vicinity, north of the oven mounds. The circumference of the tree is 1.4 m, and the

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
							scar is 40 cm x 1.7 m. The other potential culturally modified tree with historic engravings (blaze tree) is located west of Goolgumbla Road, measuring 95 cm x 35 cm.
DEHW-2023-HIF1	Hearth, Isolated artefact	Alluvial plain	364,374	6,135,649	Yes	No	An isolated find and a hearth were identified 25 m north and 50 m east of two separate irrigation canals. Fenceline is located 60 m towards the east. Hearth measures 1.6 m by 0.7 m, has subsurface clay heat retainer nodules. The shape is not clear. One tentative quartz flake was located on scald exposure, in proximity. No charcoal identified.
DEHW-2023-HIF2	Hearth, Isolated artefact	Paleochannel	358,514	6,136,524	Partial	Partial	An isolated quartz flake and an eroded hearth were identified on a vehicle track exposure, and within the cluster of Eucalyptus vegetation. Site is likely associated with DEHW-2023-AS15.
DEHW-2023-HIF3	Hearth, Isolated artefact	Alluvial plain	382,177	6,122,804	Yes	No	An isolated find, and a hearth site were identified on a vehicle track exposure, identified 300 m to the north of an ephemeral watercourse. Eroding hearth site measures 250 mm by 350 mm. Shape not evident, heat retainer nodules appear to be of an appropriate size. No charcoal identified.
DEHW-2023-HIF4	Hearth, Isolated artefact	Paleochannel	358,044	6,129,023	Partial	Partial	An isolated find, and a hearth site were identified on the northern side of a source bordering dune, and to the south of a fence line and vehicle track. A quartz flake was identified on cattle track next to fence line. Three hearths were identified, measuring 1.2 m x 2 m, 1.5 m x 1.2 m, 1.2 m x 1.4 m, and 0.5 m x 0.3 m. Hearths included a high density of clay heat retainer nodules, with an evident shape. Hearth appears oval in shape. Smallest of the hearths may be natural, no clear shape. Hearths are located within roughly 10 m of each other, while the flake is identified 140 m towards the east.
DEHW-2023-HIF5	Hearth, Isolated artefact	Alluvial plain	357,414	6,133,955	Partial	No	An isolated find, and a hearth site were identified within cluster of Eucalyptus vegetation, located 100 m east of a large dam. Both hearths have a low density of clay heat retainer nodules, no significant shape, and no charcoal. One tentative quartz flake was identified 200 m to the south of tentative hearth sites.
DEHW-2023-IF1	Isolated artefact	Paleochannel	361,464	6,128,374	Yes	No	Isolated find identified on a vehicle track exposure; 40 m south-east of source-bordering dune. Site includes one yellow silcrete complete flake with hinge termination and retouch on lateral margin.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-IF2	Isolated artefact	Paleochannel	360,720	6,128,743	Yes	No	Isolated find identified on scald exposure, on the south-west boundary of a source bordering dune. The site included one quartzite flake, with evident erosion scar.
DEHW-2023-IF3	Isolated artefact	Alluvial plain	355,607	6,139,751	Yes	No	Isolated find identified on vehicle track exposure, on the eastern rise of paleochannel landform. One tentative quartz flake was identified.
DEHW-2023-IF4	Isolated artefact	Paleochannel	358,131	6,126,108	Yes	No	Isolated find identified within paleochannel landscape, one silcrete flake was identified on scald exposure 62 m east of vehicle track.
DEHW-2023-IF5	Isolated artefact	Alluvial plain	377,558	6,127,107	No	No	Isolated find identified to the south of ephemeral wetland, located 130 m south-west of irrigation canal. The site includes one silcrete core, with possible heat treatment, identified on scald exposure within grass plain.
DEHW-2023-IF6	Isolated artefact	Alluvial plain	353,399	6,126,295	Yes	No	Isolated find located within an alluvial plain. The site includes one tentative sandstone grinding plate fragment, located on a gradual rise atop a scald exposure. Polish is visible on one side.
DEHW-2023-IF7	Isolated artefact	Alluvial plain	375,284	6,121,153	Yes	No	Isolated find identified 30 m west of canal, within alluvial plain landscape. The site includes one grinding stone fragment, identified atop animal track exposure. Polished surfaces on both sides.
DEHW-2023-IF8	Isolated artefact	Alluvial plain	364,225	6,135,135	Yes	Partial	Isolated find identified 96 m east of vehicle track within an alluvial plain. The site included one tentative mudstone flake, located atop scald exposure.
DEHW-2023-IF9	Isolated artefact	Paleochannel	363,921	6,134,191	Partial	No	Isolated find identified on western boundary of ephemeral watercourse, with tree line of eucalyptus vegetation. The site includes one tentative quartz flake, located atop scald exposure.
DEHW-2023-IF10	Isolated artefact	Alluvial plain	358,423	6,137,169	Yes	Partial	Isolated find identified on the northern boundary of watercourse, within eucalyptus vegetation. The site includes one quartz flake, possibly a scraper, located atop scalding. Found in proximity to Old Man Sneeze Weed (‘*budhaany budhaany*’).
DEHW-2023-IF11	Isolated artefact	Alluvial plain	361,790	6,140,726	Partial	No	Isolated find identified on eastern boundary of a cluster of eucalyptus vegetation, atop scald exposure. The site includes one tentative quartz flake.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-IF12	Isolated artefact	Alluvial plain	356,175	6,139,996	Yes	No	Isolated find identified on fence-line exposure within alluvial plain, roughly 350 m from corner post. The site includes one tentative silcrete flake.
DEHW-2023-IF13	Isolated artefact	Alluvial plain	375,874	6,127,968	Yes	Partial	Isolated find identified on scald exposure, 122 m above irrigation canal 'intersection'. The site includes one quartz core, with evident bulb of percussion and negative flake scaring. The site is located within an alluvial plain landscape, 400 m west of large drainage depression.
DEHW-2023-IF14	Isolated artefact	Alluvial plain	372,337	6,123,261	Yes	No	Isolated find identified on vehicle track exposure. The site includes one quartz core, located on a scald exposure. Site likely associated with DEHW-2023-HASPAD1.
DEHW-2024-IF1	Isolated artefact	Paleochannel	357,950	6,130,724	Partial	Partial	The isolated find is located 45 m south of vehicle track, on scald exposure in proximity to a very small cluster of eucalyptus trees. The site includes one tentative quartz flake.
DEHW-2023-IFPAD1	Isolated artefact, PAD	Alluvial plain	356,385	6,127,913	Partial	Partial	Isolated find identified on a vehicle track exposure, 140 m west of irrigation canal. The site includes one silcrete flake. Dark brown silty loam soils with isolated trees and very few exposures.
DEHW-2023-IFPAD2	Isolated artefact, PAD	Alluvial plain	353,969	6,125,301	Yes	No	PAD of brown silty sand with many rabbit burrows in vicinity. Native pines identified within the area. The site includes one tentative quartz flake. Exposure estimated to be 50% but visibility very low at time of survey.
DEHW-2023-ST1	Potential Culturally modified tree	Alluvial plain	354,278	6,127,289	No	No	Culturally modified tree identified within small cluster of Eucalyptus vegetation. The tree is in poor condition, with a cultural scar measuring 65 cm long, by 17 cm wide, with a depth of 8 cm. The scar is located on the south-eastern side of tree.
DEHW-2023-ST2	Potential Culturally modified tree	Alluvial plain	377,526	6,125,755	No	No	Culturally modified tree identified within cluster of eucalyptus vegetation. The species variety is Grey Box, and it is in moderate condition. Termite damage identified. Scar measures 170 cm long, by 20 cm wide, with a depth of 21 cm. Scar is located 65 cm off the ground and is south facing. Site is likely associated with DEHW-2023-AS6-7, ASPAD2–4, ST3–4.

Table 7.3 Aboriginal sites identified during survey

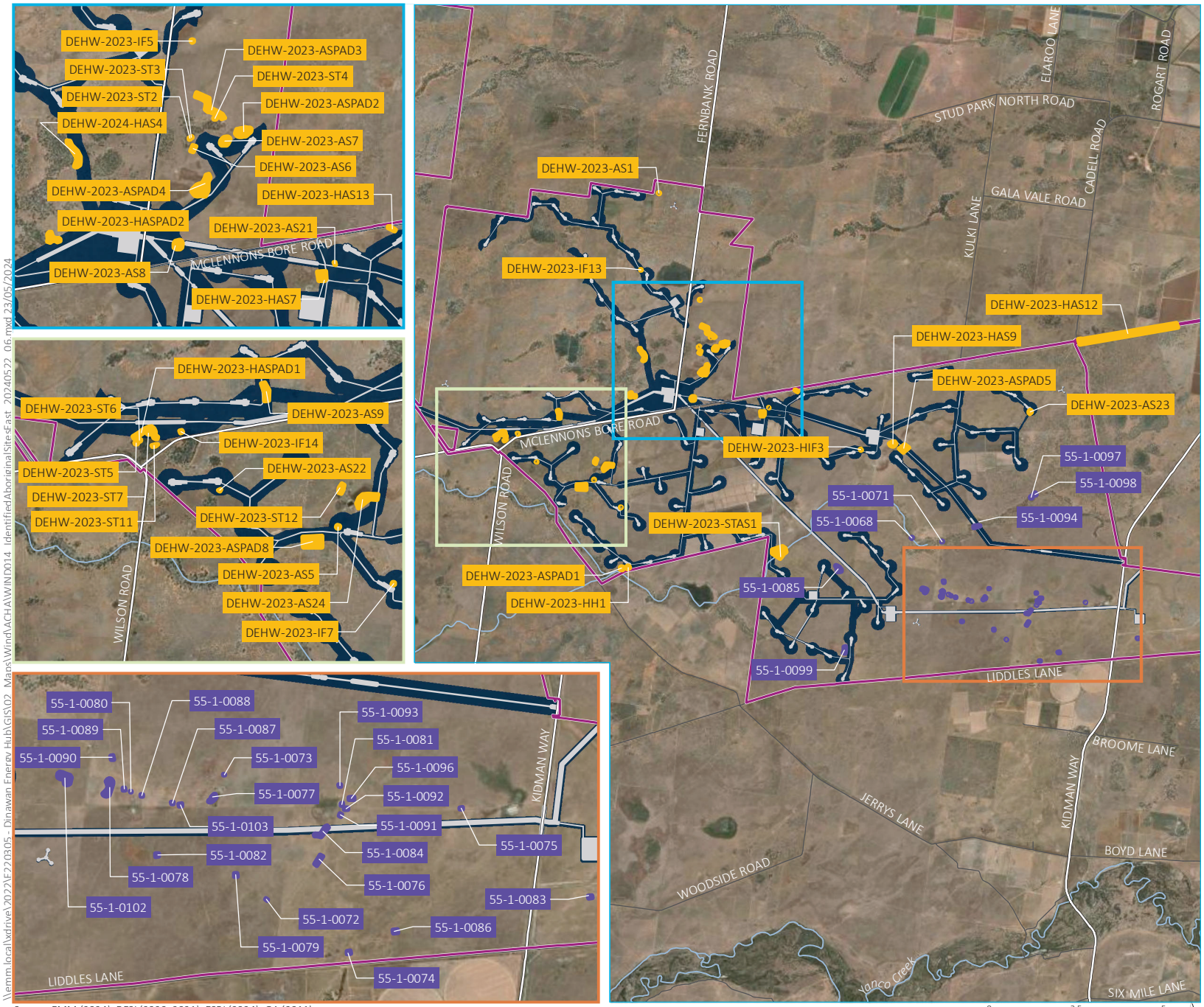
Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-ST3	Potential Culturally modified tree	Alluvial plain	377,555	6,125,765	No	No	Culturally modified tree identified within cluster of eucalyptus vegetation. The species variety is Grey Box, and it is in moderate condition. Potential canoe scar. Termite damage and scaring on opposite side. Potential cut mark identified towards the bottom of scar. Scar measures 220 cm long, by 50 cm wide, with a depth of 12 cm. Scar is located 53 cm from ground level. Metal fragments identified at base of tree, and possible collar cut marks may indicate an attempt to fell tree. Scar is south facing. Site is likely associated with DEHW-2023-AS6-7, ASPAD2–4, ST2, ST3.
DEHW-2023-ST4	Potential Culturally modified tree	Alluvial plain	377,872	6,126,030	No	No	Culturally modified tree identified on northern boundary of Eucalyptus cluster. Evident exit marks from termites may indicate natural scaring event. The scar is 1.32 m long, by 100 mm wide. The base of the scar is 200 mm above ground level. The grey box tree is in a moderate condition. Site is likely associated with DEHW-2023-AS6-7, ASPAD2–4, ST3–4.
DEHW-2023-ST5	Potential Culturally modified tree	Alluvial plain	371,715	6,123,102	No	No	Culturally modified tree identified within billabong of dense eucalyptus vegetation. Scar measures 60 cm x 15 cm, with a depth of 25 cm. The scar is located 1 m high above ground level. The Grey Box tree is in good condition, with evident termite damage on its branches. Two prominent cut marks were identified, characteristic of steel axe marks. Site is likely associated with DEHW-2023-HASPAD1 and DEHW-2023-ST6 and DEHW-2023-ST7.
DEHW-2023-ST6	Potential Culturally modified tree	Alluvial plain	371,756	6,123,143	No	No	Culturally modified tree identified within billabong of dense eucalyptus vegetation. Scar measures 85 cm x 50 cm, with a depth of 6 cm. Site is likely associated with DEHW-2023-HASPAD1, DEHW-2023-ST5 and DEHW-2023-ST7.
DEHW-2023-ST7	Potential Culturally modified tree	Alluvial plain	371,884	6,123,242	Yes	No	Culturally modified tree identified within billabong of dense eucalyptus vegetation. The Grey Box tree is in moderate condition, with a west facing scar. Termite damage is evident on the east facing side and the tree is hollow. It is undetermined whether the termite damage happened post cultural scarring or if it is the cause. The scar measures 2.5 m x 30 cm wide, with a depth of 25 cm. The site is likely associated with DEHW-2023-HASPAD1, DEHW-2023-ST5 and DEHW-2023-ST6.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2023-ST8	Potential Culturally modified tree	Alluvial plain	361,874	6,135,210	No	No	Culturally modified tree is identified on the northern boundary of watercourse, located 100 south of a fence-line. The Grey Box tree is in moderate condition, with a north-west facing scar. The scar measures 0.95 m long, by 0.50 m wide, with a depth of 0.07 m. Three tentative stone axe marks are located at base of scar. One large epicormic branch is evident.
DEHW-2023-ST9	Potential Culturally modified tree	Alluvial plain	354,680	6,129,793	Yes	No	Culturally modified tree identified within small cluster of Eucalyptus vegetation, identified 280 m south of a fence line. The Grey Box tree is in poor condition. Scar south facing. Scar measures 60 cm long, by 19 cm wide, with a depth of 7 cm. Branch tear evident above. Site is likely associated with DEHW-2023-HAS10.
DEHW-2023-ST10	Potential Culturally modified tree	Alluvial plain	358,416	6,136,966	Yes	Partial	Tentative culturally modified tree identified on the southern boundary of watercourse. Eucalyptus species in poor condition, with 80% of the tree having died off. The scar measures 90 cm x 23 cm, depth of 7 cm. The scar is located 20 cm above the ground and is likely natural, showing signs of a lightning strike. However, it has been noted that a cultural scar may have previously existed before the strike occurred.
DEHW-2023-ST11	Potential Culturally modified tree	Alluvial plain	371,990	6,123,074	No	No	Three culturally modified trees have been identified within a billabong. Eucalyptus trees are in good condition. On the first tree, the scar is west facing, measuring 70 cm x 60 cm, with a depth of 5 cm. The scar is located 60 cm above the ground. The second tree is east facing, 40 cm above ground. Measuring 1.2 m x 40 cm wide, with a depth of 5 cm. The third tree is a potential coolomon scar, identified on the south facing side. The scar is 95 cm x 40 cm and is located 75 cm above the ground. All three culturally modified trees are identified within a 50 m radius. Site is likely associated with DEHW-2023-ST5–7, DEHW-2023-HASPAD1.
DEHW-2023-ST12	Potential Culturally modified tree	Alluvial plain	374,545	6,122,432	No	No	A potential ring tree is in proximity to a set of cattle yards. The eucalyptus species is in good condition. The ring is located 0.9 m above the ground, measuring 80 cm x 35 cm. The circumference of the tree is ~5 m. Discussion with Aboriginal participants on-site suggested the tree may represent a 'boundary marker' for a nearby site, possibly DEHW-2023-AS24.

Table 7.3 Aboriginal sites identified during survey

Site name	Site type	Landform	Easting	Northing	Within development corridor	Within development footprint	Description
DEHW-2024-ST1	Potential Culturally modified tree	Alluvial plain	367,106	6,119,415	Partial	Partial	Culturally modified tree identified on the northern boundary of large billabong with thick Eucalyptus vegetation. The Black Box tree is in moderate condition and the scar is south facing, with a measurement of 1.1 m x 23 cm with a depth of 18 cm. The scar is located 22 cm above ground.
DEHW-2023-HH1	Potential culturally modified tree, historic blaze tree	Paleochannel	375,504	6,119,392	Yes	Partial	Survey reference tree (blaze tree), possibly Indigenous in origin. The Eucalyptus variant is in good condition, with a scar measuring 75 cm x 35 cm and south facing. Tree circumference ~3 m. Site is located north of a creekline in a paddock north of Jerrys Lane.
DEHW-2023-STAS1	Potential Culturally modified tree, artefact scatter	Alluvial plain	379,663	6,119,890	Partial	No	Seven culturally modified trees identified within ephemeral watercourse, all Grey and Black Boxes. It was suggested by the Aboriginal representatives on-site that this may represent a women's place, as similar sites have been identified along the Murray River (~85 km south of the project area). The scars are south-east facing. Axe marks have been identified on multiple scars. The first tree scar measures 90 cm x 30 cm, 6 cm above ground. The second tree is 15 m tall, circumference of 2.5 cm, scar measures 75 cm x 30 cm, 6 cm above ground. The third tree measures 57 cm x 30 cm, depth of 10 cm. Fourth tree is 80 cm x 25 cm, depth of 10 cm, 40 cm above ground, circumference of tree is 2.7 m. Fifth tree is 60 cm x 20 cm, depth of 15 cm, scar is 50 cm above ground, circumference of tree is 2 m. Sixth tree is 90 cm x 40 cm, depth of 10 cm, and 80 cm above ground. Seventh tree is 1 m x 25 cm, depth of 20 cm, scar located 80 cm above ground, circumference of tree is 2.6 m. All trees are located within a 200 m radius. Site includes a silcrete flake and potential manuport.
DEHW-2023-STAS2	Potential Culturally modified tree, artefact scatter	Paleochannel	357,945	6,128,422	No	No	A potential ring tree (red gum) is located on a paleochannel, 80 m north-west of a vehicle track. Discussions with Aboriginal participants on-site indicate this could be a 'journey tree', denoting that this landscape may be important when considering regional song lines. The tree is in good condition and the ring is in the centre of the tree. It measures 90 cm x 50 cm, and the ring is located 1.7 m above the ground. The tree has a circumference of 4–5 m. The site includes one crystal quartz flake, identified 110 m north-west, and one silcrete flake, identified 300 m north-west of the ring tree.



KEY

- Project area
- Development footprint
- Development corridor
- Identified Aboriginal sites (Dinawan Wind farm)
- Previously documented sites (Dinawan Solar farm)

Existing environment

- Major road
- Minor road
- Watercourse (third order and higher)

Identified Aboriginal sites
- eastern area

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 7.2

EMM
creating opportunities

Source: EMM (2024); DFSI (2020, 2021); ESRI (2024); GA (2011)

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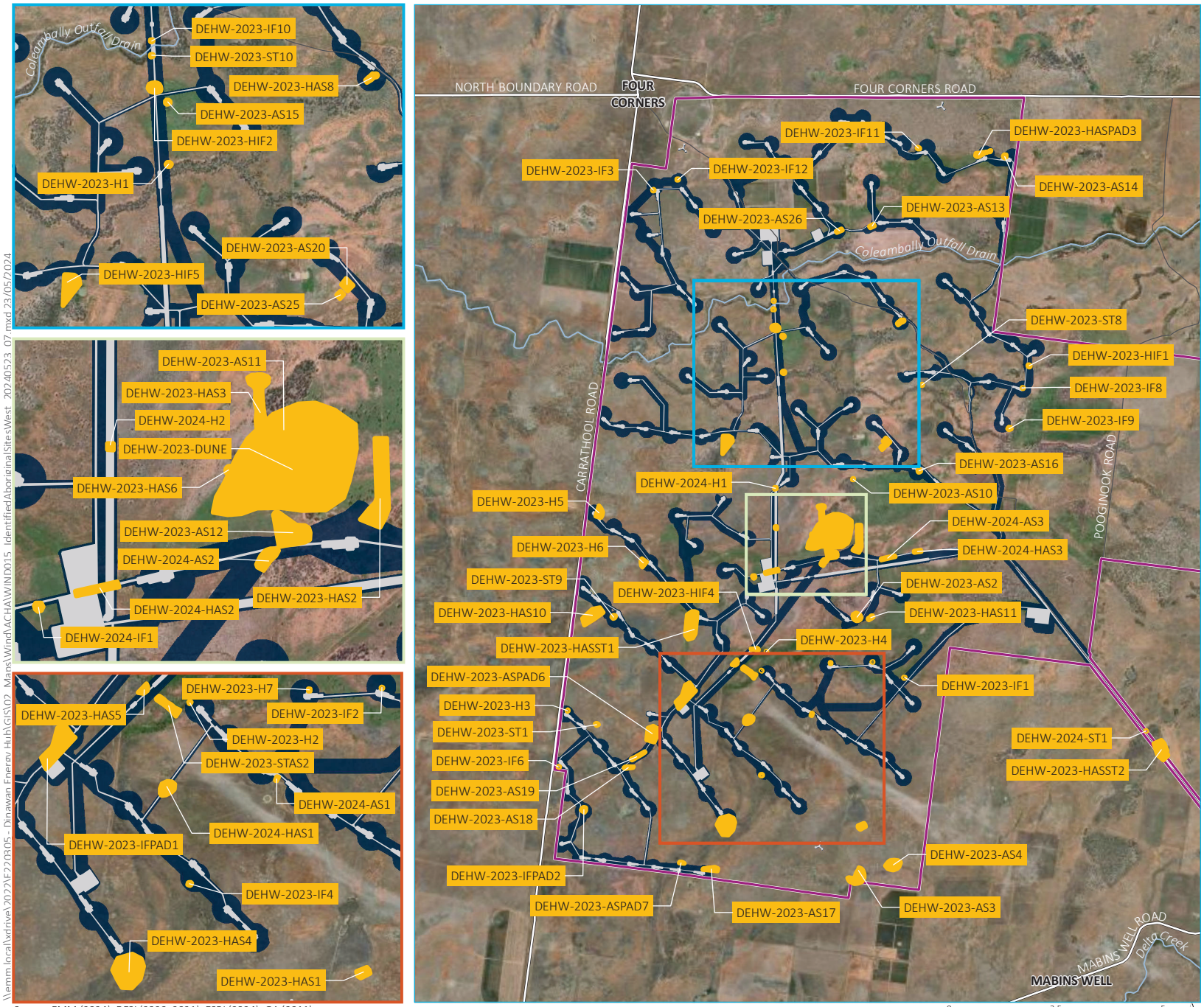

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Source: EMM (2024); DFSI (2020, 2021); ESRI (2024); GA (2011)

Identified Aboriginal sites
- western area

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 7.3

EMM
creating opportunities

7.3 Archaeological excavations

7.3.1 Approach and aims

EMM conducted an archaeological test excavation program in six localities with the assistance of the RAPs, over a nine-day period from 28 August to 8 September 2023. These works were undertaken in accordance with the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010) and consisted of 0.25 m^2 (50 cm x 50 cm) manually excavated test pits in transects across six discrete areas identified as having potential cultural deposits within the project area. The excavation program was directed by Peter Douglas (EMM subcontractor, senior archaeologist), with the archaeological team consisting of Samuel Elias, Amber Morgan, and Courtney Culley (EMM archaeologists). Five stakeholder groups were represented throughout the course of the excavation program. A list of these groups is presented in Table 7.4.

The primary aims of the excavations were as follows:

- identify, map, and characterise the nature, age, extent, integrity and significance of the Aboriginal cultural material within the project area
- collect data to answer the following research questions:
    - what are the environmental characteristics associated with the distribution of cultural materials within the project area?
    - can the formative processes of the stratigraphic profile provide information on the nature and/or survivability of the archaeological resources?
    - what are the cultural, social and public values associated with the Aboriginal archaeological resource within the project area?
    - how should the Aboriginal sites in the region be conserved and managed in the future?
- better assess the significance and historical meaning of the cultural materials that exist within the project area so that future archaeological investigation can advance our understanding of past Aboriginal cultural behaviour and environmental adaptation
- direct future heritage activities and mitigation measures (if required) for the development footprint.

To achieve these aims, the archaeological program consisted of transects aligned across six discrete areas (Figure 7.4 and Figure 7.5) of sensitivity proposed by Austral (2021) and selected based on outcomes of desktop information summarised in Sections 4–6, which was validated and refined by the field survey (Section 7.2). Additional areas of undeterminable subsurface potential were identified during the survey in proximity to paleochannels and extant swamps, and subsequently included in the excavation program. The rationale was that while the project design was conceptual and the WTG locations may be refined as the project progresses, the archaeological program would enable:

1. an overall predictive model of the distribution of cultural material across the project area, since several WTG locations were proposed across the plains and at varying distances from ephemeral and extant watercourses
2. provide a general indication of the cultural materials at a given locale even where WTGs may be subject to some change.

Archaeological test excavations were implemented in accordance with Requirements 16 and 17 of the *Code of Practice for the Investigation of Aboriginal Objects in NSW* (DECCW 2010). In summary, the following methods were adopted for the excavation:

- all test excavation pits were spatially located using a differential GPS device
- manual excavation of 0.25 m^2 test pits aligned in transects across areas of archaeological interest within the project area
- all excavation used hand tools, such as shovels, mattocks and trowels
- excavation of the first unit was in 5 cm spits, with subsequent excavation of each excavation unit in 10 cm spits
- manual excavation continued to either: i) the base of the cultural deposits or ii) to the depth of the underlying geology
- soil profiles were recorded in accordance with the *Code of Practice for the Investigation of Aboriginal Objects in NSW* (DECCW 2010), including scaled drawings, photographs, and written descriptions
- soil samples were collected for description, sedimentological and chronological analysis where such analysis is considered likely to contribute significant information.

Table 7.4 Aboriginal representatives involved in the test excavation

Organisation	Representative
Griffith Local Aboriginal Land Council	Roslyn Simpson Allan McKenzie
Bidya Marra Consultancy	Bruce Crowe Mitchell Crowe
Bundyi Aboriginal Cultural Knowledge	Mark Saddler
Bangarang Aboriginal Corporation	Roland Atkinson David Edwards
Roley Williams	Roley Williams Jason Matthews

7.3.2 Results

This section provides a summary of the excavations and subsequent analysis (Figure 7.4 and Figure 7.5), with further detail provided in Attachment E. This includes test pit information (Attachment E.2), a full photographic catalogue of the excavated test pits (Attachment E.3), section drawings (Attachment E.4), OSL dating and analysis (Attachment E.5), radiocarbon dating and analysis (Attachment E.6), and a detailed lithic catalogue and analysis (Attachment E.7 and E.8). A summary of the stratigraphy, chronology, and artefact information from the excavations is provided below.

Overall, a total of 97, 0.25 m^2 test pits were excavated in transects across the six discrete areas, targeting several landforms associated with extant and ephemeral watercourses such as Gilgai and paleochannels (Figure 7.4 and Figure 7.5). In addition, two hearth sites were excavated to determine the nature of this site type across the project area. This involved the sample excavation of hearth sites DEHW-2023-HASPAD3 in Area 4 (Figure 7.4), and DEHW-2023-HAS11 in Area 3. Area 1 (Figure 7.4) was divided into three discrete testing locations associated with sites DEHW-2023-ASPAD2 (Area 1.1), DEHW-2023-ASPAD4 (Area 1.2), and DEHW-2023-ASPAD3 (Area 1.3). All three sites were identified as low-density artefact scatters with PADs, situated predominantly on the eastern fringes of an ephemeral wetland and a Gilgai depression. A total of 16 test pits were excavated between the three areas: 2 in Area 1.1, 11 in Area 1.2, and 3 in Area 1.3 (Figure 7.4). The subsequent five areas (Area 2 to Area 6) were targeted in proximity to identified sites or to sample different landscape features present across the project area.

The test pits averaged depths of ~30 cm but with several extending to 80 cm below the surface before excavations were halted due to health and safety. A total of 337 spits were excavated from which 7.95 m^3 of sediment was recovered and dry-sieved. Spatially, these test pits were predominantly situated on the eastern fringes of Gilgai or on low rises in proximity to paleochannels. As outlined in Section 7.2, most cultural materials were encountered within, or in proximity to ephemeral drainage lines in the north and east of the western portion, and the south-west of the eastern portion of the project area. Soil samples were obtained in Area 5 from TP50 and TP54 (Figure 7.4) for the purposes of OSL dating, and several charcoal samples from a potential hearth site in Area 4 (Figure 7.4) (see below).

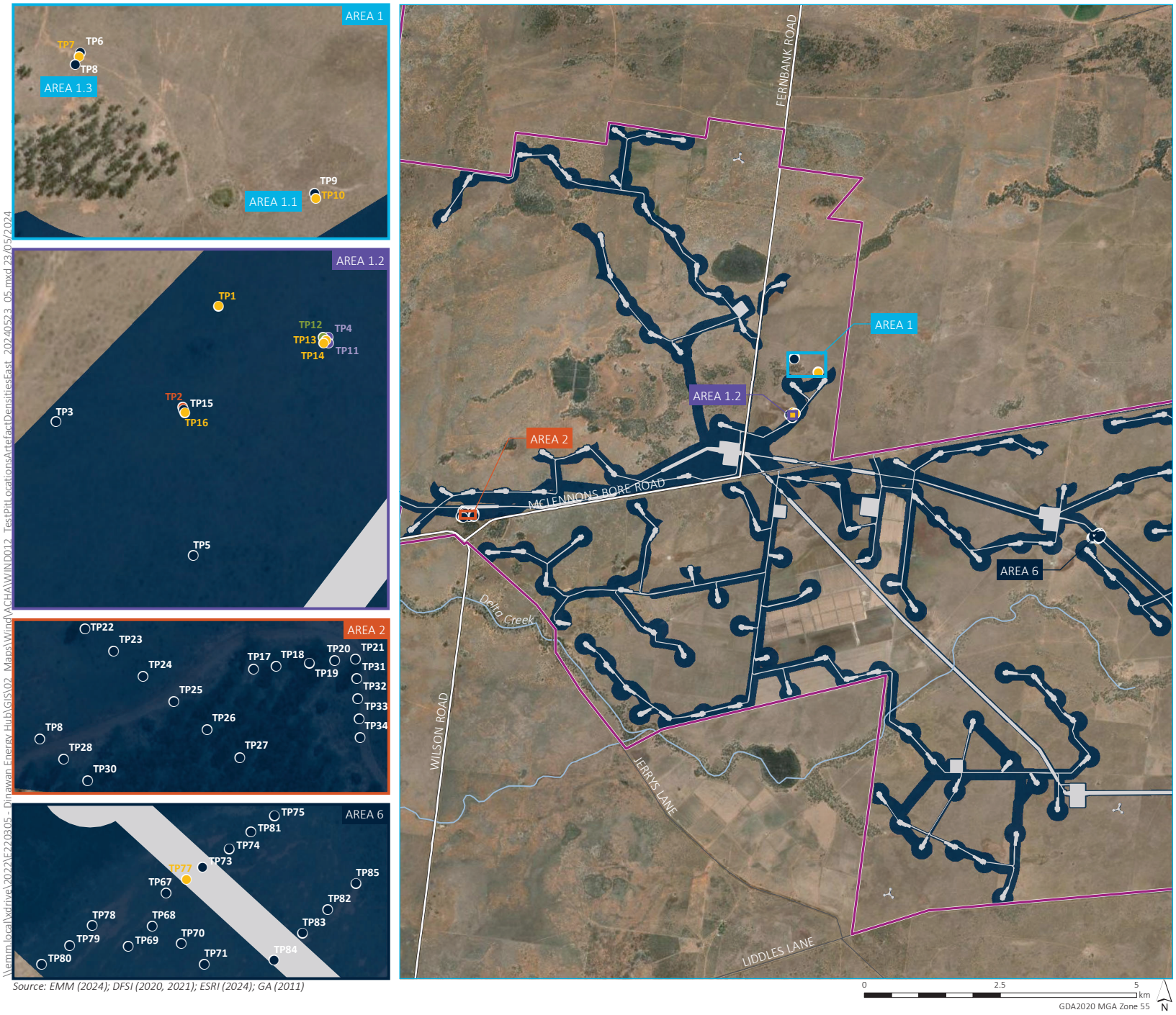
Artefacts were recovered from 23 of the 97 test pits (~24%), while an additional artefact was recovered from the excavation of a hearth (DEHW-2023-HASPAD3) in Area 4. This artefact assemblage is analysed in Section 7.3.2(iii) and Attachment E.7 below. A total of 40 stone artefacts were recovered, the majority of which were from sediments excavated to 30 cm below the current ground surface (n=26) with a small portion identified at lower depths between spits 4-6 (n=13). When extrapolating each 0.25 m^2 test pit to 1 m^2, which is commonly how artefact densities are discussed in the archaeological literature, an extrapolated average density of <1.9/m^2 was found across the project area. In Area 4 (Figure 7.4), a cross-section of hearth site DEHW-2023-HASPAD3 (~1 m x 1.5 m) was excavated to examine the characteristics of this site type (Plate 7.43 and Plate 7.44). The trench was excavated to a maximum depth of 20 cm, where the base of the hearth stones was exposed. A single quartz flake was identified within the deposit along with charcoal that was sampled for dating, which returned a date of 1,235 +/- 16 ^{14}C years BP (~1.1 ka when calibrated). This is aligned with the stone tool typologies identified during the surveys and test excavations reflecting a late Holocene occupation. The surrounding test pits (inclusive of TP37, 38, 43, 46 and 49) had culturally sterile soil deposits from 0–40 cm, with artefacts recovered starting from spit five into spit six, with culturally sterile deposits identified deeper than spit seven (70 cm). This demonstrates a downward movement of material through the paleochannel soils, likely the result of external factors such as flooding, bioturbation, etc. In contrast, the test excavation of hearth and artefact site DEHW-2023-HAS11 in Area 3 was revealed to be the result of a natural burning event as opposed to being of cultural origin; the burnt clay nodules continued in a long and thin horizonal pattern reflective of a branch or root burn.

Table 7.5 Targeted test excavation areas

Zone	Location	Landscape features	Identified sites	Number of test pits	Figure reference
Area 1.1	<1 km north of McLennons Bore Road, has been removed from development corridor	Targeted area located on the eastern side of Gilgai depressions near an open artefact scatter (n=60 artefacts) on inclined lunette with surrounding grassy hummocks.	DEHW-2023-ASPAD4	11 (TP1–5 and TP11–16)	Figure 7.5

Table 7.5 Targeted test excavation areas

Zone	Location	Landscape features	Identified sites	Number of test pits	Figure reference
Area 1.2	~1.7 km north of McLennons Bore Road, remains within development corridor but outside of development footprint	Targeted area split between an exposed access track and slightly inclined grassy plain (n=<30 artefacts across two areas).	DEHW-2023-ASPAD2	2 (TP6–7)	Figure 7.4
Area 1.3	~1.9 km north of McLennons Bore Road, has been removed from development corridor	Targeted area split between an exposed access track and slightly inclined grassy plain (n=<30 artefacts across two areas).	DEHW-2023-ASPAD3	3 (TP8–10)	Figure 7.4
Area 2	400 m north of intersection of McLennons Bore Road and Wilson Road, remains within development corridor but outside of development footprint	An array of test pits spread across a level access track (with a low-density artefact scatter) and two transects of pits targeted north-west to south-east across vegetated areas of potential drainage/runoff.	DEHW-2023-HASPAD1	18 (TP17–34)	Figure 7.4
Area 3	~4.2 km west of Goolgumbla Road, has been partially removed from development corridor	Targeted area on the eastern perimeter of a Gilgai, situated on a low rise in proximity to an open artefact scatter (n=2 artefacts).	DEHW-2023-AS2 DEHW-2023-HAS11	12 (TP86–97)	Figure 7.4
Area 4	2.3 km north of Coleambally Outfall Drain, has been partially removed from development corridor	Test pits orientated across a grassy, sand swept plain with a gentle slope to the north abutting a seasonal wetland. One of the identified hearths excavated in cross section and sampled (see radiocarbon dating below).	DEHW-2023-HASPAD3	15 (TP35–49) TP37 OSL sample Hearth with radiocarbon sample	Figure 7.5
Area 5	~3.6 km west of Goolgumbla Road, has been partially removed from development corridor	Located on a deflated sandplain, immediately south-east of a source-bordering dune, with a low-density artefact scatter (n=6 artefacts) identified in the locality. Two OSL samples were collected to determine the likely age of the dune formation.	DEHW-2023-Dune DEHW-2023-AS12 DEHW-2023-HAS2	17 (TP50–66) TP50 OSL sample (x2) TP54 OSL sample	Figure 7.5
Area 6	2 km south of McLennons Bore Road, remains partially within development corridor and development footprint	Located within DEHW-2023-ASPAD5, test pits were targeted across a gently inclined grassy plain west of a dam and south-east of a drainage line. A low density artefact scatter (n=3) was identified atop the PAD.	DEHW-2023-ASPAD5 DEHW-2023-HAS9	18 (TP67–85)	Figure 7.4



KEY

- Project area
- Development corridor
- Development footprint

Test pit count

- 0
- 1
- 2
- 4
- 5

Existing environment

- Major road
- Minor road
- Watercourse (third order and higher)

Source: EMM (2024); DFSI (2020, 2021); ESRI (2024); GA (2011)

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Test pit locations and artefact densities - eastern area

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 7.4

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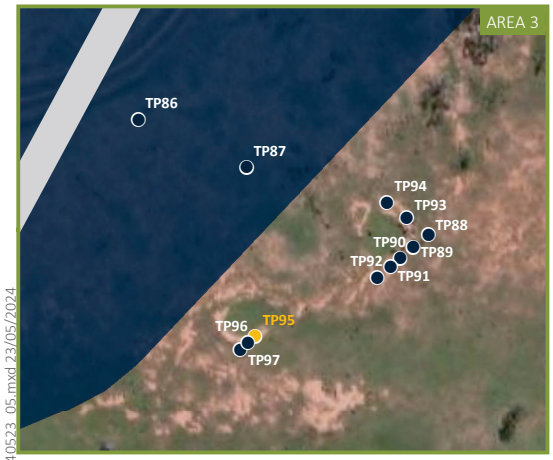

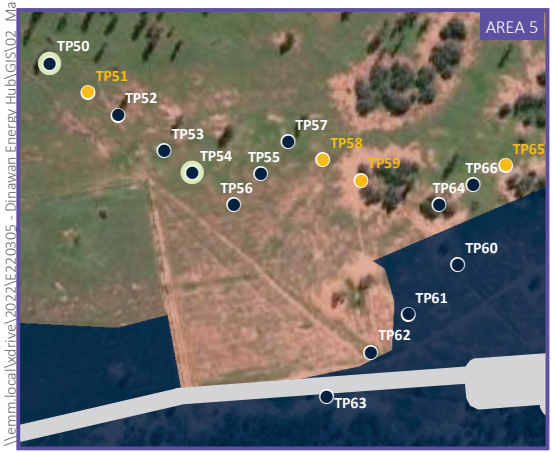

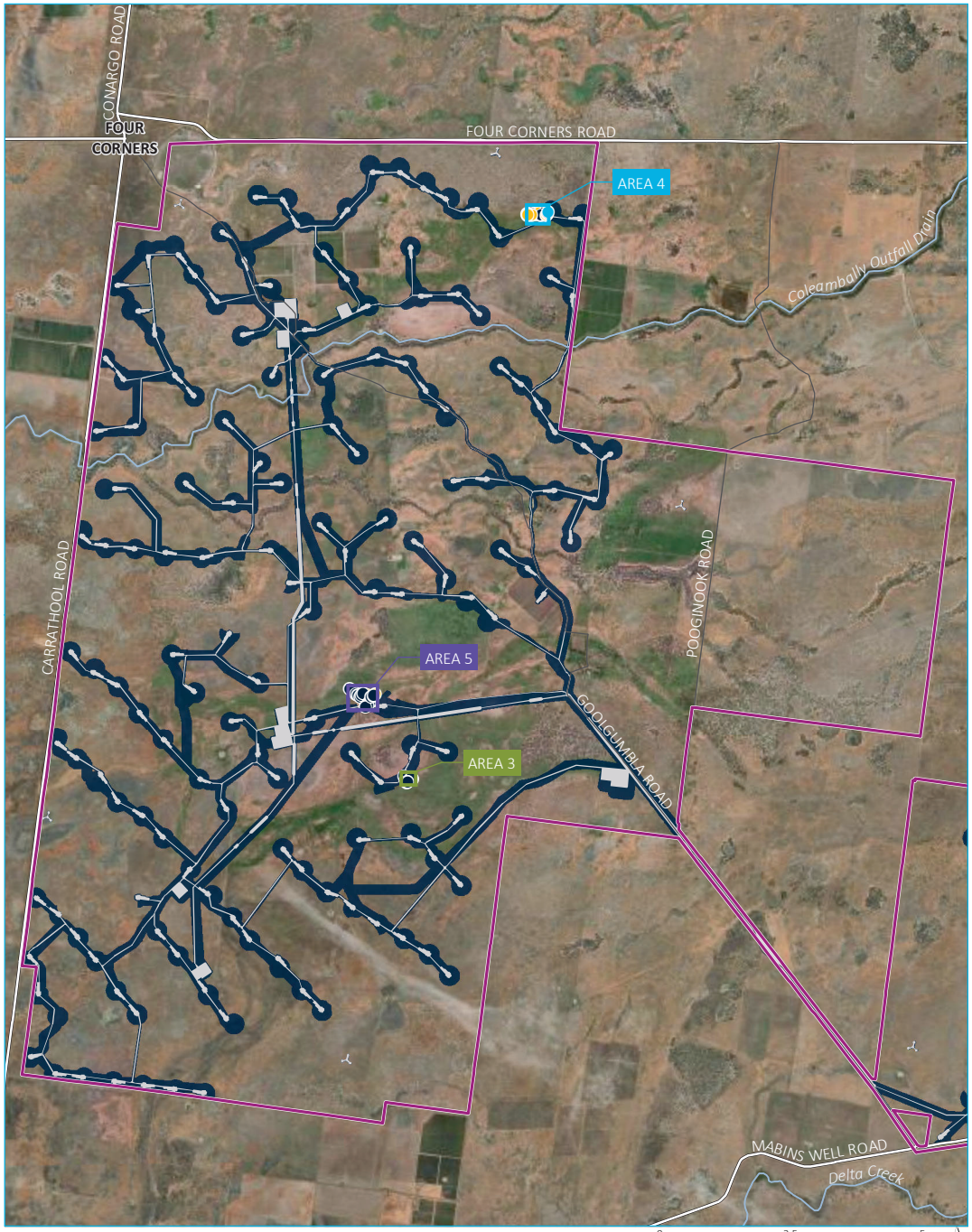

KEY

- Project area
- Development corridor
- Development footprint
- Radiocarbon sample
- OSL sample

Test pit count

- 0
- 1
- 2
- 3

Existing environment

- Major road
- Minor road
- Watercourse (third order and higher)

Test pit locations and artefact densities - western area

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 7.5

EMM creating opportunities

Source: EMM (2024); DFSI (2020, 2021); ESRI (2024); GA (2011)

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Plate 7.31 Alluvial plain landform, taken from TP1 in proximity to Gilgai, view north

Plate 7.32 Soil profile of alluvial plain in proximity to Gilgai, taken from TP1, view north

Plate 7.33 Alluvial plain landform, taken from TP78 in proximity to ephemeral watercourse, view north

Plate 7.34 Soil profile of alluvial plain in proximity to ephemeral watercourse, taken from TP77 in proximity to TP78, view north

Plate 7.35 Bank of ephemeral wetland, taken from TP33, view north

Plate 7.36 Soil profile of ephemeral wetland, taken from TP32 in proximity to TP33, view north

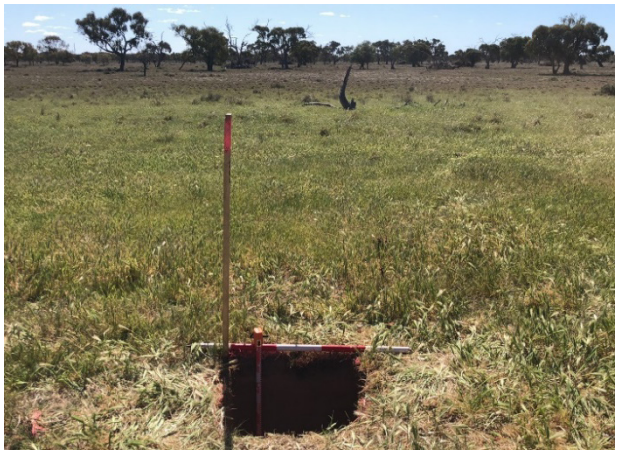


Plate 7.37 Paleochannel landscape in proximity to alluvial plain, taken from TP36, view north

Plate 7.38 Soil profile of paleochannel landform, taken from TP46, in proximity to TP36, view north

Plate 7.39 Dune landform in western portion of the project area, taken from TP50, view north

Plate 7.40 Soil profile of dune landform, taken from TP50, view north

Plate 7.41 Gilgai mound within alluvial plain, taken from TP90, view north

Plate 7.42 Soil profile of Gilgai mound, taken from TP92 in proximity to TP90, view north

Plate 7.43 DEHW-2023-HASPAD3 prior to excavation

Plate 7.44 DEHW-2023-HASPAD3 post excavation

i Stratigraphy

The soil profiles encountered across the 97 test pits were generally consistent with those outlined in Section 4.6 and can be described as follows:

1. Within alluvial plain landforms:

    a) skeletal A horizon comprising fine grained brown, orange silt, overlaying

    b) pale, brown compacted silty clay, with quartz sand faction (A1 horizon), averaging ~20 cm

c) dark, brown silty clay (A2 horizon) averaging ~20 cm depth

d) dark, brown/orange cracking plastic clay (B2 horizon).

2. Within paleochannel/source-bordering dune landforms:

a) brown, grey silty loam (A1 horizon) averaging ~10 cm in depth, overlaying

b) orange, brown compacted aggregated silt (A1 horizon), averaging ~20 cm in depth

c) orange, brown fine silt (A2 horizon) averaging ~50–70 cm in depth.

ii Chronology

To provide a chronology of the deposits in the project area, a number of samples were collected for chronological dating (Table 7.6 and Plate 7.45). This included a single sample from hearth feature DEHW-2023-HASPAD3 for radiocarbon sampling, as well as three samples in Area 5 from test pits TP50 and TP54 for OSL dating.

The OSL samples were collected from test pits containing dense cultural materials and/or where the deepest deposits were reached; of these, three samples were analysed (Table 7.6). These samples were selected to provide an initial understanding of the formation history of the deflated dune landform and the age of encompassed cultural materials. All samples were processed by Zenobia Jacobs at the University of Wollongong Centre of Excellence for Australian Biodiversity and Heritage (CABAH) and are reported upon in detail in Attachment E.5.

The samples show that the base of the excavations were typically between ~8–10 ka in age, and which aligns well with the broader region following the end of the Last Glacial Maximum (~21 ka) and sea-level inundation (~14–8 ka) – the latter influencing continental weather systems, rather than directly affecting the project area. No cultural materials were recovered from these depths, and evidence from the field investigations to date has not robustly demonstrated a Pleistocene (>10 ka) or early Holocene (5–10 ka) use of the project area. The upper OSL sample, CABAH-1648, was recovered from within the cultural assemblage, and returned an average age of ~0.76 ka. Dr Jacobs suggests that a younger age may be more probable given the level of surface bioturbation, however, 0.76 ka aligns closely with the radiocarbon age recovered from DEHW-2023-HASPAD3 (see below), and may suggest a general use of the region only in the last thousand or so years.

During excavation of hearth DEHW-2023-HASPAD3, deposits containing burnt clay and charcoal were identified, so a soil sample was collected at a depth of 15 cm below surface (Plate 7.43 and Plate 7.44). Ultimately, the charcoal sample was analysed by Fiona Petchey (Radiocarbon Dating Laboratory, The University of Waikato), returning an age of 1,235 ± 16 ^{14}C years BP. When calibrated, this returns an age of 1.18–1.06 ka. This value aligns closely with the OSL ages outlined above, and which suggest a cultural assemblage predominantly having formed in the last millennia or so, and disconformably situated on an earlier landscape.

Table 7.6 OSL ages

Test pit #	Depth (cm below surface)	Lab code	MAM (ka)	CAM (ka)
TP50	20	CABAH-1638	280 ± 45	**760 ± 60**
TP50	70	CABAH-1639	-	**8,800 ± 715**
TP54	75	CABAH-1640	-	**10,440 ± 625**

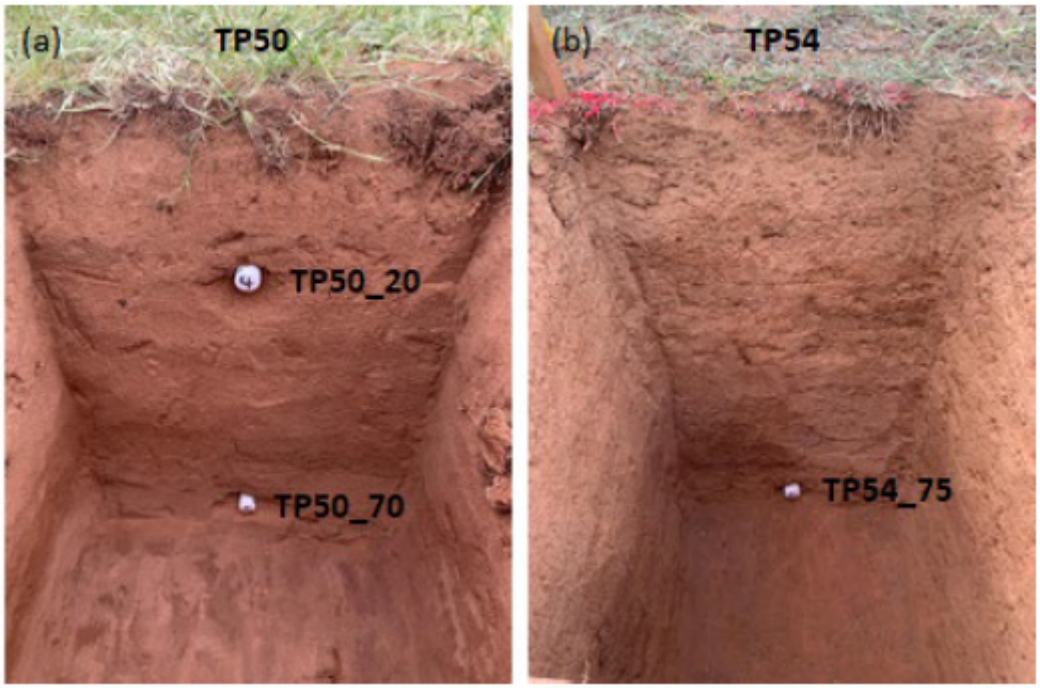


Plate 7.45 **OSL samples taken from TP50 and TP54, view north**

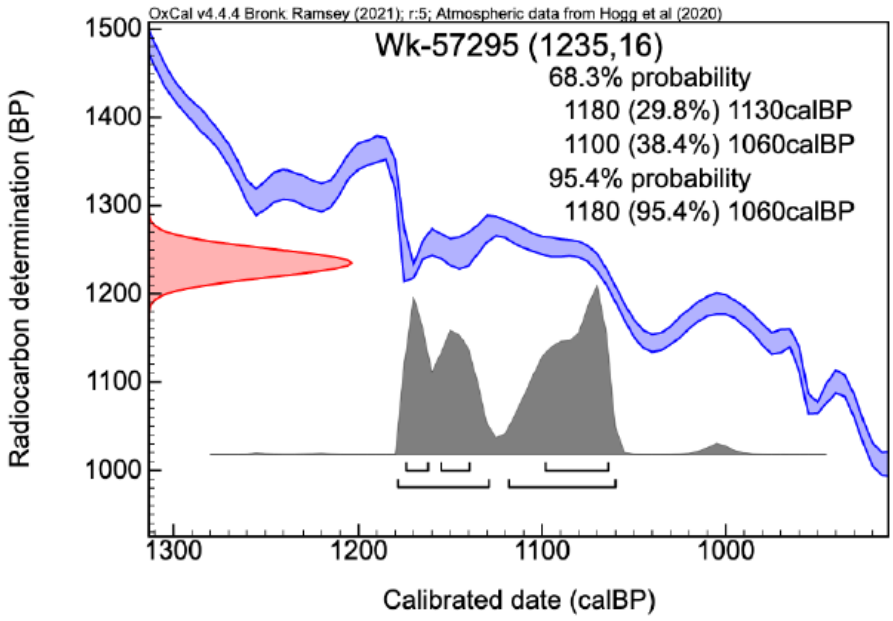


Plate 7.46 **Calibrated Oxcal plot showing the calibrated radiocarbon date sampled from DEHW-2023-HASPAD3**

iii Lithics

Analysis of the stone artefacts recovered by the test excavations was undertaken by Dr Trudy Doleman, University of Sydney, and her full report is presented in Attachment E.7. A summary is provided below.

Overall, 40 lithics were recovered during archaeological excavations, representing an average artefact density of <1.9 lithics/m^2. The highest number of artefacts were recovered from TP11 and TP4 (both n=5, 12.5% of the total excavated assemblage) while TP12 contained 4 artefacts (10% of the total assemblage). The low artefact density is shown by the number of test pits (n=16) containing only one artefact, while nearly a third of all test pits had no artefacts.

Across the project area, the highest concentration of artefacts occurred at 10–20 cm (n=11, 27.5%) and 20–30 cm below ground surface (n=10, 25%), which may suggest a singular phase of concentrated Aboriginal occupation within the last ~800–1,000 years (Table 7.6). However, while artefact densities diminish below this depth (only 13 artefacts were in spits 4–6, at depths of between 30–60 cm), the number, weight and size of these artefacts may indicate that downwards vertical displacement of the cultural material occurred – by as much as 30 cm.

The lithic assemblage is dominated by silcrete (n=18, 45%) and milky quartz (n=18, 45%), with the remaining 10% made up of unidentified volcanic material (n=2), chalcedony (n=1) and quartzite (n=1). The silcrete artefacts were typically light grey (n=8) but varied in colour to include red (n=2), pink (n=2), white (n=1), and red/grey (n=1). Most of the silcrete artefacts were fine-grained (n=14). Two artefacts were made from high quality, matrix-dominated silcrete and two flakes from medium, grain-dominated silcrete. Silcrete is associated with basalts in eastern Australia (Webb et al. 2003) Relatively large numbers of milky quartz (n=18) suggest the use of local sources. Other material types used include chalcedony, a cryptocrystalline quartz, quartzite and volcanics.

The cortex (or weathered exterior of the parent rock) provides information about the type of stone sources used (i.e. a primary or secondary source). Artefacts with a rough cortex were acquired from a primary source (or an in-situ outcrop). Artefacts with a smooth or water-rolled cortex originate from a secondary source (e.g. a cobble from a waterway) (c.f. Doelman 2008). A crazed cortex is associated with heat treatment prior to flaking but can be attributed to natural burning of outcrops (bush fires). Lastly, a polished cortex can be a gibber corte or from an exposed gravel source (e.g. a paleochannel).

Milky quartz (n=1) and volcanics (n=1) have a water-rolled cortex while five artefacts of silcrete have a rough or weathered cortex from a primary outcrop, a crazed/burnt surface (n=1) or a polished cortex (n=1). The fine-grained silcrete artefacts are small by maximum length in comparison to the other silcrete types indicating the on-site reduction of this material type. Quartzite and volcanic artefacts are also large compared to the milky quartz and chalcedony artefacts.

Complete flakes dominate the assemblage (n=13, 32.5%). Broken flakes, including distal, medial and proximal flakes, account for 37.5% (n=15) of the assemblage (Table 5). There is a high frequency of cores in the assemblage (n=5, 12.5%). Only one flaked tool on a complete flake was found. Surprisingly, a small axe/chisel was found in TP11. Two of the cores were also found in this test pit. In addition, two heat shattered fragments (HSA) and three angular fragments were also found. Both HSAs were found in TP4.

The cores were found in TPs 11, 2, 16 and 33 (Figure 3). Three of the cores were made from milky quartz while two were made from high quality, light grey silcrete. One silcrete core was obtained from a primary outcrop while the milky quartz cores were made from small, water-rolled pebbles. Four of the cores have elongated flake scars, while one (id=12) silcrete core has expanding flake scars. Two of the cores were made on flakes which might indicate the recycling of artefacts to extend use. All the cores are highly reduced, flaked using a bipolar technique and have evidence of anvil resting i.e., crushing. This technique is used to extend the use-life of a core or is commonly used on small milky quartz pebbles to remove flakes (Holdaway and Stern:2004: 194). One core (id=12) was bifacially flaked in multiple directions, has numerous step terminations and expanding flake scars. All cores were 20 mm or below. The small size of the cores coupled with the anvil resting and bipolar flaking indicates a need to conserve and maximise the flakes manufactured from each core. This scenario suggests extreme raw

material stress equating to an increased distance from silcrete sources and only the local availability of small, milky quartz pebbles.

Only one blade, indicative of a mid-late Holocene occupation (c.f. Holdaway and Stern 2004) was found in TP49. Small, presumably local, pebbles of milky quartz were flaked using a bipolar technique. Silcrete cores were also found in the assemblage. Silcrete was obtained from non-local primary outcropping source. Evidence for raw material conservation and intensive use was seen in the assemblage indicating the lack of available stone resources and the distance from silcrete sources. In particular, cores were small, sometimes rotated or bifacially flaked using an anvil. These factors have contributed to a low artefact density.

Plate 7.47 Example of cores identified in the assemblage

8 The archaeological resource

8.1 Key findings

- The assessment undertook archaeological field survey and test excavations to explore and document the Aboriginal objects and sites within the project area, and to align them within the regional context. Overall, the regional context has extensive archaeological information, with numerous archaeological sites including many of Pleistocene age (>10,000 years), as well as historical and post-Contact places including reserves and missions. The regional archaeological record is characterised by stone artefact sites, hearths, culturally modified trees, earth mounds, and burials, and the findings of this ACHA largely conformed with this model (see Figure 8.1). Nearly all sites were found in association with water sources, such as ephemeral wetlands and drainage lines, Gilgai, and paleochannels, and/or within and surrounding the source-bordering sand dune landforms in the western portion of the project area. These latter features were assessed as having high archaeological sensitivity with the potential to contain ancestral remains.

- Overall, various site validation activities undertaken over a 18-month period resulted in the duplication and overlap of results presented in Sections 6.4, 7.2.2 and 7.3.2. When combining and ratifying these findings, there are some 32 identified sites and places along with a low-density distribution of predominantly surface and shallowly buried cultural materials distributed across the project area. These can be broken down as:

    - Ten hearths, with various associated stone cultural materials, including DEHW-2023-H3 (#48-6-0257), DEHW-2024-H1 (#48-6-0289), #55-1-0057, #55-1-0060, DEHW-2023-HAS1 (#54-3-0071), DEHW-2023-HAS7 (#55-1-0165), DEHW-2023-HAS8 (#48-6-0267), DEHW-2023-HAS13 (#55-1-0162, including #55-1-0052, #55-1-0053), DEHW-2024-HAS2 (#48-6-0292), and DEHW-2023-HIF5 (#48-6-0283)

    - Four culturally modified trees, including DEHW-2023-ST1 (#48-6-0273), DEHW-2023-ST8 (#48-6-0253), DEHW-2023-ST10 (#48-6-0251), and #55-1-0059. Many of these sites were assigned a tentative classification requiring further assessment or specialist investigation to confirm their status.

    - Twelve occupation areas characterised as locales where a range of cultural materials are found in proximity and where further objects and/or sites are expected. These include hearth/oven complexes, moderate and/or dense stone artefact scatters (>15/m^2), culturally modified trees, and/or subsurface cultural deposits. These areas are typically ~69 ha in size, and include:

        - DEHW-2023-HASST1 (#48-6-0264)
        - DEHW-2023-HAS4 (#54-3-0070)
        - DEHW-2023-HAS12 (#55-1-0163)
        - DEHW-OA1 (#55-1-0172), which encompasses DEHW-2023-HASPAD1 (#55-1-0161), DEHW-2023-ST5 (#55-1-0148), DEHW-2023-ST6 (#55-1-0147), DEHW-2023-ST7 (#55-1-0146), DEHW-2023-ST11(#55-1-0145), and DEHW-2023-IF14 (#55-1-0142)
        - DEHW-OA2 (#49-4-0243), which encompasses DEHW-2023-HASPAD3 (#49-4-0237) and DEHW-2023-AS14 (#49-4-0234)
        - DEHW-OA3 (#48-6-0308), which encompasses DEHW-2023-HAS10 (#48-6-0266) and DEHW-2023-ST9 (#48-6-0252)

- DEHW-OA4 (#49-4-0244), which encompasses DEHW-2023-HASST2 (#49-4-0236) and DEHW-2024-ST1 (#48-6-0273)
- DEHW-OA5 (#48-6-0309), which encompasses DEHW-2023-HAS5 (#48-6-0269), DEHW-2023-H2 (#48-6-0258), DEHW-2023-H4 (#48-6-0256), and DEHW-2023-HIF4 (#48-6-0284)
- DEHW-OA6 (#54-3-0076), which encompasses DEHW-2023-AS3 (#54-3-0068) and DEHW-2023-AS4 (#54-3-0067)
- DEHW-OA7 (#55-1-0171), which encompasses DEHW-2023-ASPAD8 (#55-1-0152), DEHW-2023-AS5 (#55-1-0141), and DEHW-2023-AS24 (#55-1-0158)
- DEHW-OA8 (#55-1-0169), which encompasses DEHW-2023-HIF3 (#55-1-0167), DEHW-2023-ASPAD5 (#55-1-0153), DEHW-2023-HAS9 (#55-1-0164), #55-1-0054, #55-1-0055, and #55-1-0056.
- DEHW-OA9 (#55-1-0170), which is located on the eastern fringe of a system of ephemeral wetlands, and encompasses DEHW-2023-ASPAD2 (#55-1-0156), DEHW-2023-ASPAD3 (#55-1-0155), DEHW-2023-ASPAD4 (#55-1-0154), DEHW-2023-HASPAD2 (#55-1-0160), DEHW-2023-AS6 (#55-1-0140), DEHW-2023-AS7 (#55-1-0139), DEHW-2023-AS8 (#55-1-0138), DEHW-2023-ST2 (#55-1-0151), DEHW-2023-ST3 (#55-1-0150), DEHW-2023-ST4 (#55-1-0149), and DEHW-2024-HAS4 (#55-1-0168).

- Five cultural sites including two potential ring trees (DEHW-2023-STAS2 (#48-6-0250) and DEHW-2023-ST12 (#55-1-0144)), a potential women's tree (DEHW-2023-STAS1 (#55-1-0143)), a historic blaze tree (DEHW-2023-HH1 (#49-4-0245)); and a cluster of culturally significant sites, cumulatively described as DEHW-CS1 (#48-6-0310). DEHW-CS1 encompasses a source-bordering dune (DEHW-2023-Dune (#48-6-0260)) and associated cultural materials (DEHW-2023-HAS2 (#48-6-0271), DEHW-2023-HAS3 (#48-6-0270), DEHW-2023-HAS6 (#48-6-0268), DEHW-2023-AS10 (#48-6-0249), DEHW-2023-AS11 (#48-6-0248) and DEHW-2023-AS12 (#48-6-0247)). These were identified as culturally significant sites by the RAPs and their preservation of high importance to the Aboriginal community.
- A low-density stone artefact background scatter (1–15 artefacts/m^2) and eroded hearths or scattered heat retainers intermittently dispersed across the project area collectively referred to as DEHW-BS1. This site includes 51 discrete site recordings outlined in previous sections of the report, and elaborated on in Section 8.2.

8.2 Results and synthesis

Past studies and previously documented Aboriginal heritage within the region have been extensive and has provided a robust archaeological model for the project area. Specifically, they have demonstrated that the archaeological record is dominated by stone artefact sites, hearths, culturally modified trees, earth mounds, and burials, generally found in association with perennial and ephemeral water sources. Despite the extensive history of irrigation agriculture and laser levelling in the region and limited visibility observed during the field investigations of nearby projects, nearly all archaeological investigations in the locality resulted in the documentation of cultural materials; and validated this established model. Most sites were documented on alluvial and flat plains, in association with water sources such as perennial watercourses, paleochannels, drainage lines, and ephemeral lakes, wetlands, and Gilgai.

When considering the robust documentation of Pleistocene-age (>10,000 years) sites in the broader region, such as Lake Mungo and Willandra Lakes, and the nearby Lake Urana burial site, there is some potential for extremely old and significant cultural materials to be encountered in this region. Indeed, the findings of compliance-based investigations support both long-term occupation of the region and widespread exploitation of ancient, established, and ephemeral water sources across the landscape. It must, however, be noted that recent investigations of the nearby Yanco Delta Wind Farm and Project EnergyConnect (Section 6.3) have failed to identify the potential for any sites of great antiquity in this specific locale, despite this broader regional archaeological record.

The results of this ACHA support the findings of the broader regional studies and the predictive model, with the identification of 107 previously undocumented discrete Aboriginal objects and sites within and in proximity to the project area. These include a range of stone artefact densities, hearth features with various cultural materials, and culturally modified trees. They suggest a cultural landscape focussed on intermittent visitation and activity, primarily with a domestic focus of hunting and plant exploitation. The presence of culturally modified trees, primarily small scars, suggest recovery and transportation of water, while a potential woman's site may indicate childbirth occurred within the project area. These sites are predominantly located along the paleochannels in the western portion of the project area, but also other Gilgai and wetland environments.

Most of the raw stone material encountered includes milky quartz and silcrete, as well as quartzite, volcanics, chalcedony, and sandstone, all of which has likely been sourced regionally with little evidence of outcropping within the project area or nearby. Indeed, the assemblage is characterised by small, highly reduced flakes and angular shatter, pebble cores, as well as microliths, retouched and backed artefacts, sandstone anvils and grinding implements such as mullers/top-stones. The prevalence of milky quartz flakes and small, bipolarly-flaked pebble cores with evidence of anvil resting suggests the exploitation of local quartz sources, with the need to conserve and maximise flakes produced from the cores (Doelman 2023, p.4, Attachment E.7). This, in combination with the highly reduced tertiary silcrete flakes indicates an increased distance from silcrete sources and overall significant raw material stress. This was validated during the field investigations, where minimal stone outcroppings of any kind were observed in the project area. Numerous sandstone anvils and quandong stones were identified during the surveys, although this may largely be in part due to their more obstruse size and ability to be seen in the landscape despite poor visibility. The limited availability of raw materials in the locality likely contributes to the low artefact density (~2/m^2) observed across the project area.

This is evident in the identified cultural assemblage with few sites exhibiting substantive densities of stone artefacts. Values of <15 per site recording or per square metre are common, with the high densities across the field campaign <100. Isolated stone artefacts and eroded hearth bases or scattered heat retainers, were also common, typically in proximity to wetlands, Gilgai, and drainage lines. While these sites comprise the low distribution of cultural materials across the project area, they are not considered to reflect specific occupation or habitation activities. Rather, they reflect a discontinuous and intermittent low density distribution of cultural materials present across the project area and reflecting occasional visitation of the last millennia or longer.

The test excavation program demonstrated that the cultural assemblage within the project area is largely characterised by surface artefacts, with limited stone artefacts below 30 cm. While deeper soil profiles were investigated, they were typically culturally sterile. Indeed, several sites previously identified as potentially containing archaeological deposits have since been verified to be surface artefact scatters only (e.g. DEHW-2023-HASPAD1 (#55-1-0161), DEHW-2023-ASPAD2 (#55-1-0156), DEHW-2023-ASPAD3 (#55-1-0155), and DEHW-2023-ASPAD5 (#55-1-0153), DEHW-2023-HAS11 (#48-6-0265). Limited chronological samples recovered from the excavations indicate that the current landscape may have begun forming some 8-10,000 years ago, potentially following major climate change after the Last Glacial Maximum (~21 ka) and sea-level change (~14-8 ka). However, the cultural assemblage appears to be constrained to the last 1,000 or so years. The high bioturbation and deflated nature of many of the dunes suggest major change has occurred following historical land clearing and de-vegetation is also likely to have influenced the survivability of some of the cultural assemblage.

It must be highlighted, however, that large and deep sand dune features are evident in the western portions of the project area and may have potential for deeply buried and/or ancient cultural materials. The alkaline pH of much of the landscape at depth raises the potential for the survivability of ancestral remains if present. These landforms, such as DEHW-2023-Dune (#48-6-0260) have only been subject to limited investigation by the project as the Heritage NSW guidelines limit methods that can be used for their investigation (notably the ability to undertake deep excavations) and the project has been redesigned to avoid them in almost all instances due to the risk of ancestral remains and their significance to the RAPs.

In synthesising the cultural assemblage documented in the field program, it is apparent that there have been occupation areas, or areas of foci, where people in the past have visited, occupied and undertaken activities. These are typically evident as hearths, stone artefact scatters and/or culturally modified trees all in relative proximity to each other. Where these are encountered for management purposes, they have been combined into a 'site complex', with any activities in their broader curtilage likely to encounter documented sites or further expected cultural materials. There are 12 such locales within the project area (see below), typically associated with water features or large sand dune landforms – the latter representing some of the limited elevation in the locale. Discrete sites and places that do not fit within these complexes are individually documented and may reflect part of the same landscape use in the past.

There were several sites nominated as culturally significant to the Aboriginal community. In some instances, these reflect archaeological features or landforms where they are expected to occur, notably a large sand dune surrounded by hearths and stone artefacts (DEHW-2023-Dune (#48-6-0260)). However, a number of them reflect natural vegetation and/or landscape features that are entirely based on the views of Aboriginal participants, including ring trees (DEHW-2023-STAS2 (#48-6-0250) and DEHW-2023-ST12 (#55-1-0144)), and a potential women's tree (DEHW-2023-STAS1 (#55-1-0143)). These sites and their cultural significance were raised with Spark Renewables during the field investigation, and several design iterations and field investigations took place to avoid any impacts to these sites.

Overall, various site validation activities undertaken over a 18-month period resulted in the duplication, refinement, re-interpretation and overlap of results presented in Sections 6.4, 7.2.2 and 7.3.2. When combining and ratifying these findings, there are some 32 identified sites along with a continuous low-density distribution of predominantly surface and shallowly buried cultural materials distributed across the project area. These can be broken down as:

- Ten hearths, with various associated stone cultural materials, including DEHW-2023-H3 (#48-6-0257), DEHW-2024-H1 (#48-6-0289), #55-1-0057, #55-1-0060, DEHW-2023-HAS1 (#54-3-0071), DEHW-2023-HAS7 (#55-1-0165), DEHW-2023-HAS8 (#48-6-0267), DEHW-2023-HAS13 (#55-1-0162, including #55-1-0052, #55-1-0053), DEHW-2024-HAS2 (#48-6-0292), and DEHW-2023-HIF5 (#48-6-0283).

- Four culturally modified trees, including DEHW-2023-ST1 (#48-6-0273), DEHW-2023-ST8 (#48-6-0253), DEHW-2023-ST10 (#48-6-0251), and #55-1-0059. Many of these sites were assigned a tentative classification requiring further assessment or specialist investigation to confirm their status.

- Twelve occupation areas characterised as locales where a range of cultural materials are found in proximity and where further objects and/or sites are expected. These include hearth/oven complexes, moderate and/or dense stone artefact scatters (>15/m^2), culturally modified trees, and/or subsurface cultural deposits. These areas are typically ~69 ha in size, and include:

    - DEHW-2023-HASST1 (#48-6-0264)

    - DEHW-2023-HAS4 (#54-3-0070)

    - DEHW-2023-HAS12 (#55-1-0163)

- DEHW-OA1 (#55-1-0172), which encompasses DEHW-2023-HASPAD1 (#55-1-0161), DEHW-2023-ST5 (#55-1-0148), DEHW-2023-ST6 (#55-1-0147), DEHW-2023-ST7 (#55-1-0146), DEHW-2023-ST11(#55-1-0145), and DEHW-2023-IF14 (#55-1-0142)

- DEHW-OA2 (#49-4-0243), which encompasses DEHW-2023-HASPAD3 (#49-4-0237) and DEHW-2023-AS14 (#49-4-0234)

- DEHW-OA3 (#48-6-0308), which encompasses DEHW-2023-HAS10 (#48-6-0266) and DEHW-2023-ST9 (#48-6-0252)

- DEHW-OA4 (#49-4-0244), which encompasses DEHW-2023-HASST2 (#49-4-0236) and DEHW-2024-ST1 (#48-6-0273)

- DEHW-OA5 (#48-6-0309), which encompasses DEHW-2023-HAS5 (#48-6-0269), DEHW-2023-H2 (#48-6-0258), DEHW-2023-H4 (#48-6-0256), and DEHW-2023-HIF4 (#48-6-0284)

- DEHW-OA6 (#54-3-0076), which encompasses DEHW-2023-AS3 (#54-3-0068) and DEHW-2023-AS4 (#54-3-0067)

- DEHW-OA7 (#55-1-0171), which encompasses DEHW-2023-ASPAD8 (#55-1-0152), DEHW-2023-AS5 (#55-1-0141), and DEHW-2023-AS24 (#55-1-0158)

- DEHW-OA8 (#55-1-0169), which encompasses DEHW-2023-HIF3 (#55-1-0167), DEHW-2023-ASPAD5 (#55-1-0153), DEHW-2023-HAS9 (#55-1-0164), #55-1-0054, #55-1-0055 and #55-1-0056

- DEHW-OA9 (#55-1-0170), which is located on the eastern fringe of a system of ephemeral wetlands, and encompasses DEHW-2023-ASPAD2 (#55-1-0156), DEHW-2023-ASPAD3 (#55-1-0155), DEHW-2023-ASPAD4 (#55-1-0154), DEHW-2023-HASPAD2 (#55-1-0160), DEHW-2023-AS6 (#55-1-0140), DEHW-2023-AS7 (#55-1-0139), DEHW-2023-AS8 (#55-1-0138), DEHW-2023-ST2 (#55-1-0151), DEHW-2023-ST3 (#55-1-0150), DEHW-2023-ST4 (#55-1-0149), and DEHW-2024-HAS4 (#55-1-0168).

- Five cultural sites including two potential ring trees (DEHW-2023-STAS2 (#48-6-0250) and DEHW-2023-ST12 (#55-1-0144)), a potential women's tree (DEHW-2023-STAS1 (#55-1-0143)), a historic blaze tree (DEHW-2023-HH1 (#49-4-0245)); and a cluster of culturally significant sites, cumulatively described as DEHW-CS1 (#48-6-0310). DEHW-CS1 encompasses a source-bordering dune (DEHW-2023-Dune (#48-6-0260)) and associated cultural materials (DEHW-2023-HAS2 (#48-6-0271), DEHW-2023-HAS3 (#48-6-0270), DEHW-2023-HAS6 (#48-6-0268), DEHW-2023-AS10 (#48-6-0249), DEHW-2023-AS11 (#48-6-0248) and DEHW-2023-AS12 (#48-6-0247)). These were identified as culturally significant sites and their preservation of high importance to the Aboriginal community.

- A low-density stone artefact background scatter (1-15 artefacts/m^2) and eroded hearths or scattered heat retainers intermittently dispersed across the project area collectively referred to as DEHW-BS1. This site includes 51 discrete site recordings, including:

  - 22 low density artefact scatters (DEHW-2023-AS1 (#49-4-0233), DEHW-2023-AS2 (#48-6-0240), DEHW-2023-AS9 (#55-1-0137), DEHW-2023-AS13 (#48-6-0246), DEHW-2023-AS15 (#48-6-0245), DEHW-2023-AS16 (#48-6-0244), DEHW-2023-AS17 (#54-3-0066), DEHW-2023-AS18 (#48-6-0243), DEHW-2023-AS19 (#48-6-0242), DEHW-2023-AS20 (#48-6-0241), DEHW-2023-AS21 (#55-1-0136), DEHW-2023-AS22 (#55-1-0135), DEHW-2023-AS23 (#55-1-0159), DEHW-2023-AS25 (#48-6-0263), DEHW-2023-AS26 (#48-6-0262), DEHW-2024-AS1 (#48-6-0286), DEHW-2024-AS2 (#48-6-0287), DEHW-2024-AS3 (#48-6-0288), DEHW-2023-HASPAD1 (#55-1-0161), #55-1-0094, #55-1-0099, and #55-1-0084)

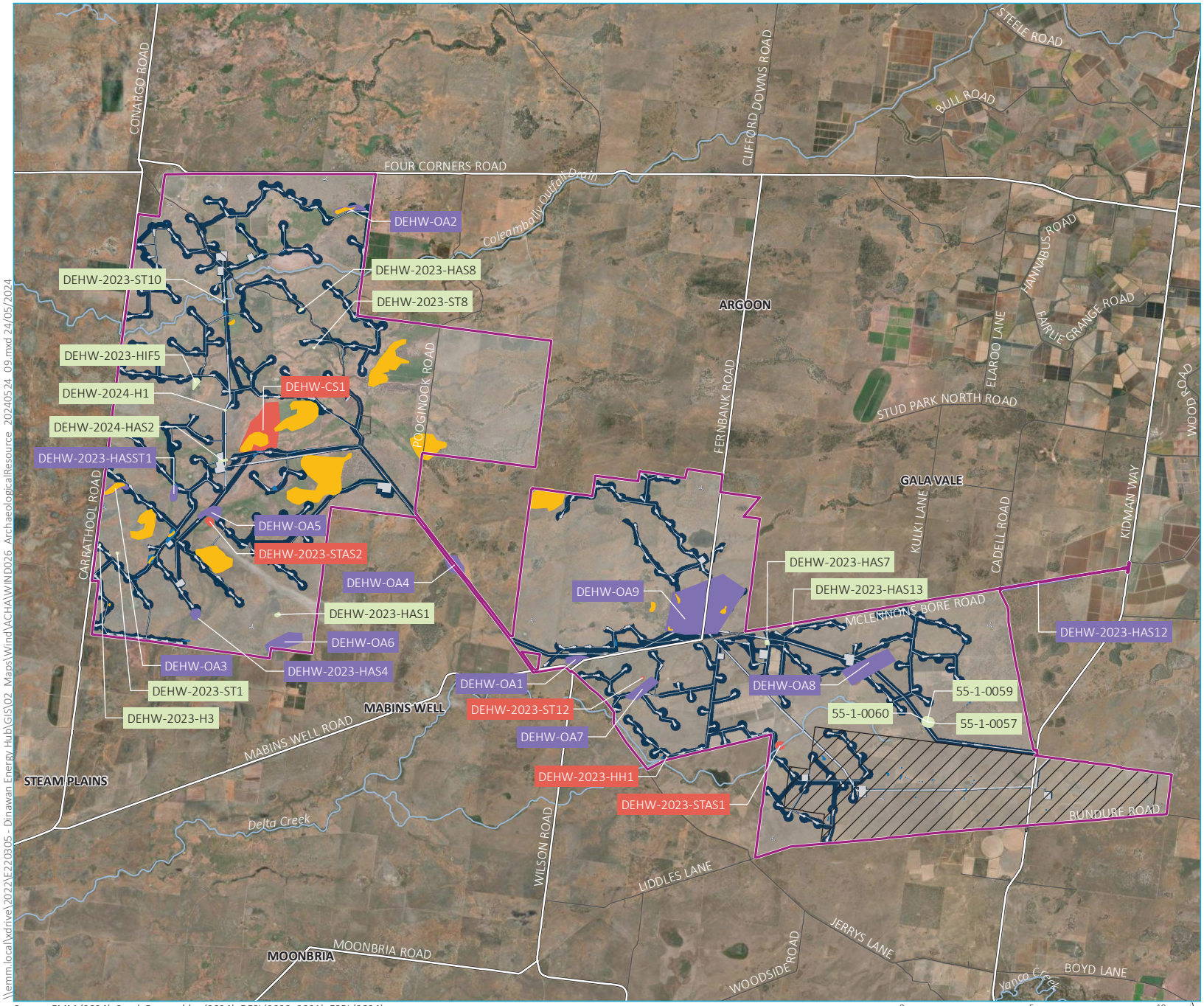
  - 3 artefact scatters with disturbed PADs (DEHW-2023-ASPAD1 (#55-1-0157), DEHW-2023-ASPAD6 (#48-6-0261) and DEHW-2023-ASPAD7 (#54-3-0069))

  - 14 isolated finds (DEHW-2023-IF1 (#48-6-0282), DEHW-2023-IF2 (#48-6-0281), DEHW-2023-IF3 (#48-6-0280), DEHW-2023-IF4 (#48-6-0279), DEHW-2023-IF5 (#49-4-0241), DEHW-2023-IF6 (#48-6-0278), DEHW-2023-IF7 (#55-1-0166), DEHW-2023-IF8 (#49-4-0240), DEHW-2023-IF9 (#49-4-0239), DEHW-2023-IF10 (#48-6-0277), DEHW-2023-IF11 (#48-6-0276), DEHW-2023-IF12 (#48-6-0275), DEHW-2023-IF13 (#49-4-0238), DEHW-2024-IF1 (#48-6-0307)

  - 2 isolated finds with disturbed PAD (DEHW-2023-IFPAD1 (#48-6-0274) and DEHW-2023-IFPAD2 (#54-3-0072))

  - 5 eroded hearth sites (DEHW-2023-H1 (#48-6-0259), DEHW-2023-H5 (#48-6-0255), DEHW-2023-H6 (#48-6-0254), DEHW-2023-H7 (#48-6-0272) and DEHW-2024-H2 (#48-6-0290))

  - 5 eroded hearth sites with low density artefact scatters (DEHW-2023-HAS11 (#48-6-0265), DEHW-2024-HAS1 (#48-6-0291), DEHW-2024-HAS3 (#48-6-0293), DEHW-2023-HIF1 (#49-4-0235), and DEHW-2023-HIF2 (#48-6-0285)).



\\emm.local\xdrive\2022\E220305 - Dinawan Energy Hub\GIS\02 Maps\Wind\ACHA\WIND026 ArchaeologicalResource 20240524 09.mxd 24/05/2024

Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

The archaeological resource

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 8.1

EMM
creating opportunities

9 Significance assessment

9.1 General

All Aboriginal objects in NSW are protected under the NSW *National Parks and Wildlife Act 1974.* It is recognised that the destruction of sites may be necessary to allow other activities or developments to occur if they cannot be avoided. For the consent authority to make informed decisions on such matters, an important element of cultural heritage management is determining the significance of cultural heritage places to understand what may be lost and how best it can be mitigated.

Cultural significance is outlined in Article 1.2 of the *Burra Charter* – the best practise document for managing cultural heritage – as 'aesthetic, historic, scientific, social or spiritual value for past, present or future generations' (Australia ICOMOS 2013). These values are reiterated in the NSW guidelines, which determines that cultural significance of a place can be assessed by identifying the values that are present across the subject area and assessing what is important and why (OEH 2011). In assessing the scientific significance of sites, aspects such as rarity and representativeness and the integrity must be considered. Generally speaking, a site or object that is rare will have a heightened significance, although a site that is suitable of conservation as 'representative' of its type will also be significant. Conversely an extremely rare site may no longer be significant if its integrity has been sufficiently compromised.

The criteria adopted for this report are defined in Table 9.1. The management implications of these sites' significance are discussed in subsequent sections.

Table 9.1 A summary of criteria used to assess the cultural significance

Criterion	Definition
Social value – Does the place have a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons?	Social (or cultural) value refers to the spiritual, traditional, historical or contemporary associations and attachments the place or area has for Aboriginal people. Social or cultural value is how people express their connection with a place and the meaning that place has for them. Social or cultural value can only be identified through consultation with Aboriginal people.
Historic value – Is the place important to the cultural or natural history of the local area and/or region and/or state?	Historic value refers to the association of a place with a historically important person, event, phase or activity. Historic places do not always have physical evidence of their historical importance (such as structures, planted vegetation or landscape modifications). They may have 'shared' historic values with other (non-Aboriginal) communities.
Scientific (archaeological) value – Does the place have potential to yield information that will contribute to an understanding of the cultural or natural history of the local area and/or region and/or state?	Scientific (archaeological) value refers to the importance of a landscape, area, place or object because of its rarity, representativeness and the extent to which it may contribute to further understanding and information. Information about scientific values is gathered through archaeological investigation undertaken in this report.
Aesthetic value – Is the place important in demonstrating aesthetic characteristics in the local, regional, and/or State environment?	Aesthetic value refers to the sensory, scenic, architectural and creative aspects of the place. It is often linked with social value, and can consider form, scale, colour, texture and material of the fabric or landscape, and the smell and sounds associated with the place and its use. This value is only relevant to archaeological sites on only rare occasions, such as rock shelters that contain art, or culturally modified trees in prominent positions, etc.

Source: OEH (2011, p.8-10).

9.2 Statement of significance

This assessment identified 32 discrete Aboriginal sites and objects within and in proximity to the development corridor (see Table 7.3, Section 8.2, Figure 8.1) characterised by occupation area 'complexes', hearths and culturally modified trees associated with water sources such as paleochannels, ephemeral wetlands, Gilgai and drainage lines, and which aligns well with the broader archaeological record of the region. A number of cultural sites important to the Aboriginal participants was also documented.

For the purposes of significance assessment, all sites have been assigned a classification, even where they are only identified as of tentative status to allow the ACHA to be completed. It must be noted that validation of these sites, some of which are ranked as moderate or high (i.e. regional) importance, may require their significance to be re-classified in the future. A range of recommendations to further clarify the classification of these sites is proposed in Section 11 to resolve this uncertainty where required.

When considering the scientific significance, several of the complexes and sites can be considered to have moderate (local) or high (regional) significance with the ability to provide information on the past activities of the area (research potential). These sites are generally the complexes that contain hearth sites, particularly those with other site features such as artefacts and/or culturally modified trees. Those containing oven mounds, which both typically reflect multiple visits and occupation (in contrast to hearths that can reflect a single use), and can be found in association with ancestral remains are assigned higher values. While there have been significant camp sites robustly documented in the region, such as those in the Willandra Lakes system (>10,000 years), and many hearth sites documented by compliance-driven investigations in the locality, few sites have been excavated and samples collected for dating purposes. It must also be noted that while Willandra Lakes and immediate surrounds are heavily investigated, other parts of the river systems in the south of NSW have limited investigation. As such, there is strong opportunity for research of these sites to further inform the past of this region.

Generally, culturally modified trees have limited research potential. However, recent analysis has begun to explore the age of scarring and other aspects of trees that may change this view in the future. However, typically the value of these sites is in their rarity, generally not surviving historical agricultural practices over the last 200 years. In this region culturally modified trees are common, and many have been identified during other previous archaeological investigations in the locality. Additionally, many culturally modified trees identified during the field investigation were found in association with other archaeological features such as artefact scatters and/or hearths. It is for this reason that individually recorded culturally modified trees (DEHW-2023-ST1 (#48-6-0273), DEHW-2023-ST8 (#48-6-0253), DEHW-2023-ST10 (#48-6-0251), and #55-1-0059) have been given a moderate scientific value. Additionally, two potential ring trees (DEHW-2023-ST12 (#55-1-0144) and DEHW-2023-STAS2 (#48-6-0250)) and a potential women's area (DEHW-2023-STAS1 (#55-1-0143)) were documented, and which are entirely based on the views of Aboriginal participants. These have limited, if any, scientific values, and are assessed under social and cultural criteria.

The remaining identified sites, including the broader background artefact scatter, are considered to have limited, if any research potential (Table 9.1). While important in demonstrating the longevity and continued use of the region by Aboriginal people in the past, it is considered that little further information can be obtained from additional investigation of these sites, places and objects.

All the sites have some level of aesthetic significance, but only few can consider it an intrinsic part of their significance. These include the potential women's area that require some form of running water usually (although various isolated pools following rain can also be used), and several of the site complexes and areas adjacent to creeks that were likely selected by people in the past, at least in part, due to their aesthetic appeal.

Table 9.2 provides a summary of the significance values for each Aboriginal object and/or site identified. A total of 6 sites were identified as having high overall significance, 25 sites were assessed as moderate significance, and one was assessed as low significance. Sites requiring further investigation and/or validation are considered of a tentative status and are indicated with red font within the table, and their significance rating is assessed as though they have been confirmed to be valid.

Table 9.2 Significance of Aboriginal objects and/or sites identified within or in proximity to the development corridor

Site	AHIMS #	Incorporates	Site type	Site status	Significance				
					Scientific	Aesthetic	Historical	Cultural	Overall
DEHW-2023-H3	48-6-0257	-	Hearth	Valid	M	L	-	M	M
DEHW-2024-H1	48-6-0289	-	Hearth	Valid	M	L	-	M	M
PEC-E-47	55-1-0057	-	Hearth	Valid	M	-	-	M	M
PEC-E-50	55-1-0060	-	Hearth	Valid	M	-	-	M	M
DEHW-2023-HAS1	54-3-0071	-	Hearth, artefact scatter	Valid	M	L	-	M	M
DEHW-2023-HAS7	55-1-0165	-	Hearth, artefact scatter	Valid	M	L	-	M	M
DEHW-2023-HAS8	48-6-0267	-	Hearth, artefact scatter	Valid	M	-	-	M	M
DEHW-2023-HAS13	55-1-0162	#55-1-0052, #55-1-0053	Hearth, artefact scatter	Valid	M	-	-	M	M
DEHW-2024-HAS2	48-6-0271	-	Hearth, artefact scatter	Valid	M	-	-	M	M
DEHW-2023-HIF5	48-6-0283	-	Hearth, isolated find	Valid	M	L	-	M	M
DEHW-2023-ST1	48-6-0273	-	Culturally modified tree	Tentative	L	-	-	M	M
DEHW-2023-ST8	48-6-0253	-	Culturally modified tree	Tentative	L	-	-	M	M
DEHW-2023-ST10	48-6-0251	-	Culturally modified tree	Tentative	L	-	-	M	M
PEC-E-49	55-1-0059	-	Culturally modified tree	Tentative	L	-	-	M	M
DEHW-2023-HASST1	48-6-0264	-	Hearth, artefact scatter, culturally modified tree	Valid	H	L	-	M	H
DEHW-2023-HAS4	54-3-0070	-	Hearth, artefact scatter	Valid	M	L	-	M	M
DEHW-2023-HAS12	55-1-0163	-	Hearth, artefact scatter	Valid	H	L	-	M	H

Table 9.2 Significance of Aboriginal objects and/or sites identified within or in proximity to the development corridor

Site	AHIMS #	Incorporates	Site type	Site status	Significance				
					Scientific	Aesthetic	Historical	Cultural	Overall
DEHW-OA1	55-1-0172	#55-1-0161, #55-1-0148, #55-1-0147, #55-1-0146, #55-1-0145, #48-6-0279.	Hearth, artefact scatter, culturally modified tree	Valid	H	L	-	M	H
DEHW-OA2	49-4-0243	#49-4-0237, #49-4-0234	Hearth, artefact scatter	Valid	M	L	-	M	M
DEHW-OA3	48-6-0308	#48-6-0266, #48-6-0252	Hearth, artefact scatter, archaeological deposit, culturally modified tree	Valid	H	L	-	M	H
DEHW-OA4	49-4-0244	#49-4-0236, #48-6-0273	Hearth, artefact scatter, archaeological deposits, culturally modified tree	Valid	H	L	-	M	H
DEHW-OA5	48-6-0309	#48-6-026, #48-6-0258, #48-6-0256, #48-6-0284	Hearth, artefact scatter	Valid	M	L	-	M	M
DEHW-OA6	54-3-0076	#54-3-0068, #54-3-0067	Artefact scatter	Valid	M	L	-	M	M
DEHW-OA7	55-1-0171	#55-1-0152, #55-1-0141, #55-1-0158	Artefact scatter	Valid	M	L	-	M	M
DEHW-OA8	55-1-0169	#55-1-0167, #55-1-0153, #55-1-0164, #55-1-0054, #55-1-0055, #55-1-0056	Hearth, artefact scatter	Valid	M	L	-	M	M
DEHW-OA9	55-1-0170	#55-1-0156, #55-1-0155, #55-1-0154, #55-1-0160, #55-1-0140, #55-1-0139, #55-1-0138, #55-1-0151, #55-1-0150, #55-1-0149, #55-1-0168	Artefact scatter, archaeological deposit, culturally modified tree, hearth	Valid	M	L	-	M	M
DEHW-2023-STAS2	48-6-0250	-	Cultural site	Valid	-	-	-	M	M
DEHW-2023-ST12	55-1-0144	-	Cultural site	Valid	-	-	-	M	M

Table 9.2 Significance of Aboriginal objects and/or sites identified within or in proximity to the development corridor

Site	AHIMS #	Incorporates	Site type	Site status	Significance				
					Scientific	Aesthetic	Historical	Cultural	Overall
DEHW-2023-STAS1	55-1-0143	-	Cultural site	Valid	M	L	-	M	M
DEHW-2023-HH1	49-4-0245	-	Culturally modified tree	Valid	M	L	M	M	M
DEHW-CS1	48-6-0310	#48-6-0260, #48-6-0249, #48-6-0248, #48-6-0247, #48-6-0271, #48-6-0270, #48-6-0268	Cultural site	Valid	H	L	-	H	H
DEHW-BS1	-	See note 5	Low density artefact scatter	Valid	L	L	-	-	L

Notes:

1. Values are only assigned where the site fulfils that specific criterion. H = high, M= moderate, L = low.
2. In the case of the cultural criterion, it is ranked in relation to whether the site is important to one individual (low), a mixed view from the Aboriginal participants (moderate) or broad-scale support from all stakeholders (high).
3. Sites requiring further investigation and/or validation, are ranked based on the assumption the site proves valid. However, their significance should be revisited when further analysis and classification of them occurs. These values are presented in red to demonstrate their tentative status.
4. The overall significance is comparable with the highest ranking achieved in any of the four main criteria.
5. DEHW-BS1 incorporates DEHW-2023-AS1 (#49-4-0233), DEHW-2023-AS2 (#48-6-0240), DEHW-2023-AS9 (#55-1-0137), DEHW-2023-AS13 (#48-6-0246), DEHW-2023-AS15 (#48-6-0245), DEHW-2023-AS16 (#48-6-0244), DEHW-2023-AS17 (#54-3-0066), DEHW-2023-AS18 (#48-6-0243), DEHW-2023-AS19 (#48-6-0242), DEHW-2023-AS20 (#48-6-0241), DEHW-2023-AS21 (#55-1-0136), DEHW-2023-AS22 (#55-1-0135), DEHW-2023-AS23 (#55-1-0159), DEHW-2023-AS25 (#48-6-0263), DEHW-2023-AS26 (#48-6-0262), DEHW-2024-AS1 (#48-6-0286), DEHW-2024-AS2 (#48-6-0287), DEHW-2024-AS3 (#48-6-0288), #55-1-0053, #55-1-0094, #55-1-0099, and #55-1-0084, DEHW-2023-ASPAD1 (#55-1-0157), DEHW-2023-ASPAD6 (#48-6-0261), DEHW-2023-ASPAD7 (#54-3-0069) DEHW-2023-IF1 (#48-6-0282), DEHW-2023-IF2 (#48-6-0281), DEHW-2023-IF3 (#48-6-0280), DEHW-2023-IF5 (#49-4-0241), DEHW-2023-IF6 (#48-6-0278), DEHW-2023-IF7 (#55-1-0166), DEHW-2023-IF8 (#49-4-0240), DEHW-2023-IF9 (#49-4-0239), DEHW-2023-IF10 (#48-6-0277), DEHW-2023-IF11 (#48-6-0276), DEHW-2023-IF12 (#48-6-0275), DEHW-2023-IF13 (#49-4-0238), DEHW-2023-IF14 (#55-1-0142), DEHW-2024-IF1 (#48-6-0307), #55-1-0052, DEHW-2023-IFPAD1 (#48-6-0274), DEHW-2023-H1 (#48-6-0259), DEHW-2023-H5 (#48-6-0255), DEHW-2023-H6 (#48-6-0254), DEHW-2023-H7 (#48-6-0272), DEHW-2024-H2 (#48-6-0290), DEHW-2023-HAS11 (#48-6-0265), DEHW-2024-HAS1 (#54-3-0071), DEHW-2024-HAS3 (#48-6-0270), DEHW-2023-HIF1 (#49-4-0235), and DEHW-2024-HIF2 (#48-6-0285).

10 Impact assessment

10.1 Key findings

- The project includes the installation up to approximately 200 WTGs and associated infrastructure, electrical collection system, substations and control rooms, electricity transmission line infrastructure connecting the project substations to the Dinawan Substation, operations maintenance infrastructure, temporary construction facilities, and permanent infrastructure including hardstands, water tanks, permanent meteorological masts, new access tracks and upgrades to existing access tracks. The development corridor is 7,256 ha; however, the construction and operation of the project within the development footprint will result in the direct disturbance of only a fraction of this (1,339 ha).

- Project redesign undertaken through the assessment process has resulted in the avoidance of 15 of the discrete Aboriginal sites and site complexes identified by the field investigations. This equates to ~47% of the identified cultural assemblage. Notably, avoidance has focused on cultural sites and places considered of high value to the local Aboriginal community, and sand dune and aeolian landforms within which ancestral remains and/or other deep-time cultural material may occur.

- A total of 17 of the identified Aboriginal sites and places within the development corridor would be adversely affected by the project. Of these, only two moderately significant sites are entirely within the development footprint, DEHW-2024-H1 (#48-6-0289) and DEHW-2024-HAS2 (#48-6-0271), with the remaining sites only partially within the development corridor and/or development footprint. It is predicted that approximately 311 ha (34.7%) of these sites are within the development corridor, with approximately 57 ha (6.3%) within the development footprint. The identified occupation areas range from 0.6 ha to 485 ha, with an average size of approximately 69 ha. Given the large size of the occupation areas, in many instances, the curtilage predicted to experience direct impacts does not contain the identified discrete cultural materials that have been documented within each occupation area.

- Extensive project re-design has limited the potential cumulative impacts from the project, with some ~47% of the cultural assemblage avoided or committed to be avoided, the majority being high and moderate significant sites. Where impacts are proposed, they seek to prioritise partial impacts, and substantive portions of the cultural materials will remain unaffected. Regardless, archaeological mitigation of cultural materials being adversely affected is proposed to offset some of these impacts.

10.2 Avoidance and minimisation of impacts through design refinements

The development and refinement of the project's development corridor (i.e. the area within which direct surface disturbances may occur) and the development footprint (i.e. the area within which direct surface disturbance will occur) has been iterative throughout the assessment process and has been informed by the findings of the ACHA as they have become available, as well as in discussion with RAPs. Changes have included:

- avoidance of the source-bordering dune DEHW-CS1 (#48-6-0310) and other significant cultural areas including two potential ring trees DEHW-2023-STAS2 (#48-6-0250) and DEHW-2023-ST12 (#55-1-0144) and key cultural components of a potential women's area DEHW-2023-STAS1 (#55-1-0143). Following meetings to discuss the review of this report, DEHW-2023-HH1 (#49-4-0245) will also be avoided by the project

- avoidance of archaeologically significant sites, including PEC-E-47 (#55-1-0057), PEC-E-50 (#55-1-0060), DEHW-2023-HAS1 (#54-3-0071), DEHW-OA6 (#54-3-0076), PEC-E-49 (#55-1-0059), DEHW-2023-ST1 (#48-6-0273), and DEHW-2023-ST8 (#48-6-0253)

- commitment to avoid the curtilages of archaeologically significant sites within the development corridor, including DEHW-OA3 (#48-6-0308), DEHW-2023-HAS4 (#54-3-0070), DEHW-2023-HAS13 (#55-1-0162), and DEHW-2023-HIF5 (#48-6-0283), and key identified cultural material components within DEHW-OA1 (#55-1-0172) and DEHW-OA2 (#49-4-0243), and DEHW-OA9 (#55-1-0170)

- maximising avoidance of areas of higher archaeological potential identified in the initial archaeological constraints modelling including identified aeolian, paleochannels, and watercourses features; and the eastern fringes of Gilgai and ephemeral wetlands. This is most noticeable in the western project area, where sand dunes and/or sandy soil profiles have been predicted and/or observed.

10.3 Project impacts

As outlined in Chapter 1, the project includes the installation up to approximately 200 WTGs and associated infrastructure, electrical collection system, substations and control rooms, electricity transmission line infrastructure connecting the project substations to the Dinawan Substation, operations maintenance infrastructure, temporary construction facilities, and permanent infrastructure including hardstands, water tanks, permanent meteorological masts, new access tracks and upgrades to existing access tracks. To determine how these impacts intersect with the environment, the ACHA considers both the development corridor and the development footprint. The project is seeking approval for a development corridor of approximately 7,256 ha within which actual disturbance is predicted to be approximately 1,339 ha (i.e. the development footprint).

While construction methods will be finalised through detailed design, construction and land preparation for a wind farm and associated infrastructure will generally require removal of vegetation within the development footprint. Activities such as the installation of the WTGs, substations, access tracks, temporary and permanent construction and laydown facilities, and permanent meteorological masts, will all require earthworks that could result in the total removal of the upper soil profile, within which cultural material is typically documented. As outlined above, cultural materials are typically encountered within the upper 30 cm of the soil profile, and which would be removed by any of these activities.

Other construction activities are likely to require less disturbance, but adverse effects on the underlying ground surface may still occur due to increased vehicle movements, compression, et cetera. This is particularly applicable to the development corridor, which has demonstrated both shallow and highly eroded soils where cultural materials are generally found on the surface or very shallowly buried, and deeper alluvial soils where nearby artefact sites may filter through the soils via bioturbation, sheetwash, and other previous ground disturbances.

Based on this, it is considered that any activities in the development footprint would result in complete harm/impact to any identified Aboriginal objects or sites present.

10.4 Aboriginal heritage impact

Generally, two types of potential impact are considered, direct and indirect. Direct impact relates to the construction activities and their removal, truncation and/or disturbance of the ground surface. This would include the removal of vegetation, and the removal or disturbance of the upper soil profile. Indirect impacts are the result of both construction and post-construction activities that may result in environmental changes that would affect cultural material within, or near the project activities. General examples of indirect impacts may include the burial of a soil profile resulting in its compression and indirectly damaging buried cultural materials, or an increase in dust being blown into a rock shelter and negatively affecting art motifs should they be present, etc.

All cultural material identified within the development corridor was either identified on the current land surface and/or buried within the upper ~0.5 m of the soil profile. As outlined in Section 10.3, project-related construction activities would result in direct impacts to these sites and deposits where situated within the development footprint (Table 10.1 and Figure 10.).

Of the 32 documented sites identified within or in proximity to the project area, a total of 15 (~47%) sites will be avoided by the project. Of these 15 sites, 9 are outside of the development corridor, and 6 are within the development corridor; however, Spark Renewables are committed to their avoidance (refer Section 10.2).

The nine sites that are outside of the development corridor are all classified to be of moderate significance and comprise:

- three hearths (PEC-E-47 [#55-1-0057], PEC-E-50 [#55-1-0060], and DEHW-2023-HAS1 [#54-3-0071])
- one occupation area (DEHW-OA6 [#54-3-0076])
- three culturally modified trees (DEHW-2023-ST8 [#48-6-0253], DEHW-2023-ST1 [#48-6-0273], and PEC-E-49 [#55-1-0059])
- two cultural sites (DEHW-2023-STAS2 [#48-6-0250] and DEHW-2023-ST12 [#55-1-0144]).

Of the six sites within the development corridor that are being avoided, two are of high significance, including one occupation area (DEHW-OA3 [#48-6-0308]) and the large sand dune (DEHW-CS1). The six sites within the development corridor that will be avoided comprise:

- two hearth sites with associated cultural materials (DEHW-2023-HAS13 [#55-1-0162, #55-1-052, and #55-1-0053] and DEHW-2023-HIF5 [#48-6-0283])
- two occupation areas (DEHW-2023-HAS4 [#54-3-0070] and DEHW-OA3 [#48-6-0308])
- two cultural sites (DEHW-CS1, DEHW-2023-HH1).

Overall, 17 Aboriginal sites would be adversely affected by the project (Table 10.1), with six of these subject to complete loss. Of these six sites, only two are wholly within the development footprint (#48-6-0289 and #48-6-0271). The six sites to be subject to complete loss are all classified of moderate significance and include:

- one hearth (DEHW-2024-H1 [#48-6-0289])
- four hearths with associated features (DEHW-2023-H3 [#48-6-0257], DEHW-2023-HAS7 [#55-1-0165], DEHW-2023-HAS8 [#48-6-0267], and DEHW-2024-HAS2 [#48-6-0271])
- one potentially culturally modified tree (DEHW-2023-ST10 [#48-6-0251]).

The remaining 11 sites (within the 17 Aboriginal sites that would be adversely affected by the project) would not be subject to complete loss, with many only partially within the development corridor and/or development footprint. The remaining 11 sites consist of 3 sites of high significance (DEHW-OA4 [#49-4-0244], DEHW-2023-HASST1 [#48-6-0264], and DEHW-2023-HAS12 [#55-1-0163]) and 8 of moderate significance, as well as the broader background scatter, DEHW-BS1, of low value. These sites encompass six of the occupation areas, all of which are spatially extensive. These sites also include DEHW-2023-STAS1 (#55-1-0143), an important cultural site, however, none of the identified trees that inform the site's significance would be affected, with only stone artefactual materials within or in proximity to the development corridor. It is also highlighted that while impacts are predicted to DEHW-OA9 (#55-1-0169) and DEHW-2023-STAS1 (#55-1-0143), the loss of value will be negligible because the identified cultural materials within their large curtilages remain outside the development corridor and/or development footprint, even where the broad site listing does not.

When considering the broader occupation areas, ~311 ha is within the development corridor and ~57 ha is within the development footprint. This accounts for some 34.7% and 6.3%, respectively, of the overall spatial area encompassed within the nine occupation areas (~896 ha) proposed for partial impact. Across all sites, <10% of the site areas are within the development footprint, with on average ~28% within the development corridor. Approximately 28 ha of the total site area within the development corridor (associated with DEHW-OA1, DEHW-OA2 and DEHW-OA3), is proposed for avoidance.

As demonstrated in Section 8, the entire project area is considered to contain interspersed cultural materials including low-density artefact scatters, isolated finds, and eroded hearths where ephemeral drainage lines, Gilgai, and wetlands are located. These sites now encompassed within DEHW-BS1 reflect the long-term, transient use of the landscape over several thousand years but are considered to have limited archaeological significance. It would be expected that these interspersed campsites would be encountered disparately across the development corridor, as well as within the development footprint.

10.5 Intergenerational loss/equity

Ecologically sustainable development, or intergenerational equity, is the principle whereby the current generation should maintain the health, diversity, and longevity of the environment for the benefit of future generations. For Aboriginal heritage management, intergenerational equity can be considered primarily in terms of the cumulative impacts to Aboriginal objects, sites and/or places in a region. If few Aboriginal objects and places remain in a region (e.g. due to development impacts), there are fewer opportunities for future generations of Aboriginal people and the broader community to enjoy the cultural benefits. Information about the integrity, rarity, and representativeness of the Aboriginal objects, sites, and places that may be impacted, and how they inform the past visitation and occupation of land by Aboriginal people, are relevant to the consideration of intergenerational equity and the understanding of the cumulative impacts of a project. While not directly related to the ACHA process, such (future) impacts are also a critical issue for consideration under the *Native Title Act 1993* (see Attachment A for a brief discussion).

Overall, the project would potentially result in adverse impacts to 17 identified Aboriginal sites, objects and/or places, as well as various amounts of buried stone or artefactual material. These consist of hearths, culturally modified trees and parts of large occupation areas. However, of these 17, only 2 are wholly within the development footprint, with the remainder either partially affected or within the development corridor where avoidance may still be achieved.

Through ongoing project refinement and liaison with the RAPs, ~47% of the cultural assemblage has been avoided completely or impacts minimised across the project area. This includes several of the high and moderate significant sites, including 4 of the 5 cultural places (the fifth will result in no loss of value from its intersection with the project) and 5 of the 12 occupation areas. Those occupation areas that intersect the project will only be partially impacted (generally <10% of the designated spatial area), noting some of them are several hundred hectares in size.

When reviewing the sites that would be adversely affected, these are dominated by discrete hearths and associated cultural materials, stone artefact deposits, and culturally modified trees. All site types that are common across the region (Sections 6.3 and 6.4), and none of which were identified as being rare or representativeness (Section 9.2). Acknowledging the substantive development from other renewable projects in the South West REZ, the loss of such sites – all demonstrating domestic activities in the last millennium – are unlikely to result in cumulative impacts to the regional cultural assemblage. While the potential presence of sand dune units within which sites of greater antiquity may be present, none of these are currently proposed for impact; and none have exhibited such cultural materials to date.

Given the levels of avoidance, the limited impact to sites of high significance, and the prevalence of these site types in the region, it is considered that the cumulative impact from the project would be minimal. Indeed, the long term protection of the identified sites, which would be encompassed within the project area curtilage and subject to ongoing and future management would result in positive conservation outcomes from the activity. It is worth noting that many of these areas are currently subject to agricultural activity, including large-scale landscape levelling. Despite this, management and mitigation measures are proposed to avoid and/or mitigate cultural materials to offset the impacts wherever feasible, and further minimise any potential cumulative impact.

Table 10.1 Summary of potential impacts to Aboriginal objects and/or sites

Site	AHIMS #	Incorporates	Site type	Status	Significance	Type of harm	Location and/or activity causing harm	Degree of harm	Consequence of harm	Notes
DEHW-2023-H3	48-6-0257	-	Hearth	Valid	M	Direct	Within development corridor, outside development footprint	Whole	Total loss of value	Approximately 0.1 ha (100%) of the site is within the development corridor, but outside the development footprint.
DEHW-2024-H1	48-6-0289	-	Hearth	Valid	M	Direct	Within development corridor and development footprint	Whole	Total loss of value	Approximately 0.1 ha (100%) of the site is within the development footprint.
PEC-E-47	55-1-0057	-	Hearth	Valid	M	N/A	-	N/A	N/A	The site is outside the development corridor.
PEC-E-50	55-1-0060	-	Hearth	Valid	M	N/A	-	N/A	N/A	The site is outside the development corridor.
DEHW-2023-HAS1	54-3-0071	-	Hearth, artefact scatter	Valid	M	N/A	-	N/A	N/A	The site is outside the development corridor.
DEHW-2023-HAS7	55-1-0165	-	Hearth, artefact scatter	Valid	M	Direct	Within development corridor and development footprint	Whole	Total loss of value	Approximately 1.2 ha (86%) of the site is within the development corridor, with the eastern edge abutting the development footprint.
DEHW-2023-HAS8	48-6-0267	-	Hearth, artefact scatter	Valid	M	Direct	Within development corridor, outside development footprint	Whole	Total loss of value	Approximately 0.8 ha (100%) of the site is within the development corridor, but outside of the development footprint.

Table 10.1 Summary of potential impacts to Aboriginal objects and/or sites

Site	AHIMS #	Incorporates	Site type	Status	Significance	Type of harm	Location and/or activity causing harm	Degree of harm	Consequence of harm	Notes
DEHW-2023-HAS13	55-1-0162	#55-1-0052, #55-1-0053	Hearth, artefact scatter	Valid	M	N/A	Within development corridor, outside development footprint	N/A	N/A	Approximately 0.02 ha (6%) of the site is within the development corridor, but outside the development footprint and will be avoided by the project. Spark Renewables have committed to avoiding this site, and it is expected to be unaffected.
DEHW-2024-HAS2	48-6-0271	-	Hearth, artefact scatter	Valid	M	Direct	Within development corridor and development footprint	Whole	Total loss of value	Approximately 1.2 ha (100%) of this site is within the development corridor, of which 1.05 ha is within the development footprint.
DEHW-2023-HIF5	48-6-0283	-	Hearth, isolated find	Valid	M	N/A	Within development corridor, outside development footprint	N/A	N/A	Approximately 0.7 ha (13%) of the site is within the development corridor, but outside of the development footprint. Spark Renewables have committed to avoiding this site, and it is expected to be unaffected.
DEHW-2023-ST1	48-6-0273	-	Culturally modified tree	Tentative	M	N/A	-	N/A	N/A	The site is outside the development corridor.
DEHW-2023-ST8	48-6-0253	-	Culturally modified tree	Tentative	M	N/A	-	N/A	N/A	The site is outside the development corridor.
DEHW-2023-ST10	48-6-0251	-	Culturally modified tree	Tentative	M	Direct	Within development corridor and development footprint	Whole	Total loss of value	Approximately 0.15 ha (100%) of this site is within the development corridor, of which 0.1 ha is within the development footprint.

Table 10.1 Summary of potential impacts to Aboriginal objects and/or sites

Site	AHIMS #	Incorporates	Site type	Status	Significance	Type of harm	Location and/or activity causing harm	Degree of harm	Consequence of harm	Notes
PEC-E-49	55-1-0059	-	Culturally modified tree	Tentative	M	N/A	-	N/A	N/A	The site is outside the development corridor.
DEHW-2023-HASST1	48-6-0264	-	Hearth, artefact scatter, culturally modified tree	Valid	H	Direct	Within development corridor, outside the development footprint.	Partial	Partial loss of value	Approximately 3 ha (18%) of the site is within the development corridor, but outside the development footprint.
DEHW-2023-HAS4	54-3-0070	-	Hearth, artefact scatter	Valid	M	N/A	Within development corridor, outside the development footprint	N/A	N/A	Approximately 6 ha (42%) of this site is within the development corridor, but outside the development footprint. Spark Renewables have committed to avoiding this site, and it is expected to be unaffected.
DEHW-2023-HAS12	55-1-0163	-	Hearth, artefact scatter	Valid	H	Direct	Within development corridor and development footprint - McLennons Bore Road upgrade	Partial	Partial loss of value	Approximately 8 ha (14%) of this site is within the development corridor and footprint.
DEHW-OA1	55-1-0172	#55-1-0161, #55-1-0148, #55-1-0147, #55-1-0146, #55-1-0145, #48-6-0279.	Hearth, artefact scatter, culturally modified tree	Valid	H	Direct	Within development corridor and development footprint	Partial	Partial loss of value	Approximately 13 ha (54%) of this site is within the development corridor, and a very small portion within the development footprint. All discrete site recordings within the occupation area are outside of the development footprint.

Table 10.1 Summary of potential impacts to Aboriginal objects and/or sites

Site	AHIMS #	Incorporates	Site type	Status	Significance	Type of harm	Location and/or activity causing harm	Degree of harm	Consequence of harm	Notes
DEHW-OA2	49-4-0243	#49-4-0237, #49-4-0234	Hearth, artefact scatter	Valid	M	Direct	Within development corridor and development footprint	Partial	Partial loss of value	Approximately 7 ha (31%) of this site is within the development corridor, of which 0.2 ha is within the development footprint. All discrete site recordings within the occupation area are outside of the development footprint.
DEHW-OA3	48-6-0308	#48-6-0266, #48-6-0252	Hearth, artefact scatter, archaeological deposit, culturally modified tree	Valid	H	N/A	Within development corridor and development footprint	N/A	N/A	Approximately 8 ha (28.5%) of this site is within the development corridor, and a very small portion in the development footprint. However, Spark Renewables have committed to avoiding this site, and it is expected to be unaffected.
DEHW-OA4	49-4-0244	#49-4-0236, #48-6-0273	Hearth, artefact scatter, archaeological deposits, culturally modified tree	Valid	H	Direct	Within development corridor and development footprint - Goolgumbla Road	Partial	Partial loss of value	Approximately 10 ha (24%) of this site is within the development corridor, and 6 ha (13%) of the site is within the development footprint, this includes a substantive portion of the cultural materials documented within this site.
DEHW-OA5	48-6-0309	#48-6-026, #48-6-0258, #48-6-0256, #48-6-0284	Hearth, artefact scatter	Valid	M	Direct	Within development corridor and development footprint	Partial	Partial loss of value	Approximately 15 ha (43%) of the site is within the development corridor, of which ~3.5 ha (10%) is within the development footprint. Several discrete site recordings within the occupation area are outside of the development corridor.
DEHW-OA6	54-3-0076	#54-3-0068, #54-3-0067	Artefact scatter	Valid	M	N/A	-	N/A	N/A	The site is outside the development corridor.

Table 10.1 Summary of potential impacts to Aboriginal objects and/or sites

Site	AHIMS #	Incorporates	Site type	Status	Significance	Type of harm	Location and/or activity causing harm	Degree of harm	Consequence of harm	Notes
DEHW-OA7	55-1-0171	#55-1-0152, #55-1-0141, #55-1-0158	Artefact scatter	Valid	M	Direct	Within development corridor and development footprint	Partial	Partial loss of value	Approximately 28 ha (58%) of the site is within the development corridor, of which ~2 ha (4%) is within the development footprint. Several discrete site recordings within the occupation area are outside of the development corridor.
DEHW-OA8	55-1-0169	#55-1-0167, #55-1-0153, #55-1-0164, #55-1-0054, #55-1-0055, #55-1-0056	Hearth, artefact scatter	Valid	M	Direct	Within development corridor and development footprint	Partial	Partial loss of value	Approximately 37.5 ha (31.5%) of the site is within the development corridor, of which ~6 ha (5%) is within the development footprint. Several discrete site recordings within the occupation area are outside of the development corridor.
DEHW-OA9	55-1-0170	#55-1-0156, #55-1-0155, #55-1-0154, #55-1-0160, #55-1-0140, #55-1-0139, #55-1-0138, #55-1-0151, #55-1-0150, #55-1-0149, #55-1-0168	Artefact scatter, archaeological deposit, culturally modified tree, hearth	Valid	M	Direct	Within development corridor and development footprint	Partial	No loss of value	Approximately 184 ha (38%) of the site is within the development corridor, of which ~45 ha (9%) is within the development footprint. All discrete site recordings within the occupation area, except for #55-1-0138, are outside of the development footprint.
DEHW-2023-STAS2	48-6-0250	-	Cultural site	Valid	M	N/A	-	N/A	N/A	The site is outside the development corridor.
DEHW-2023-ST12	55-1-0144	-	Cultural site	Valid	M	N/A	-	N/A	N/A	The site is outside the development corridor.

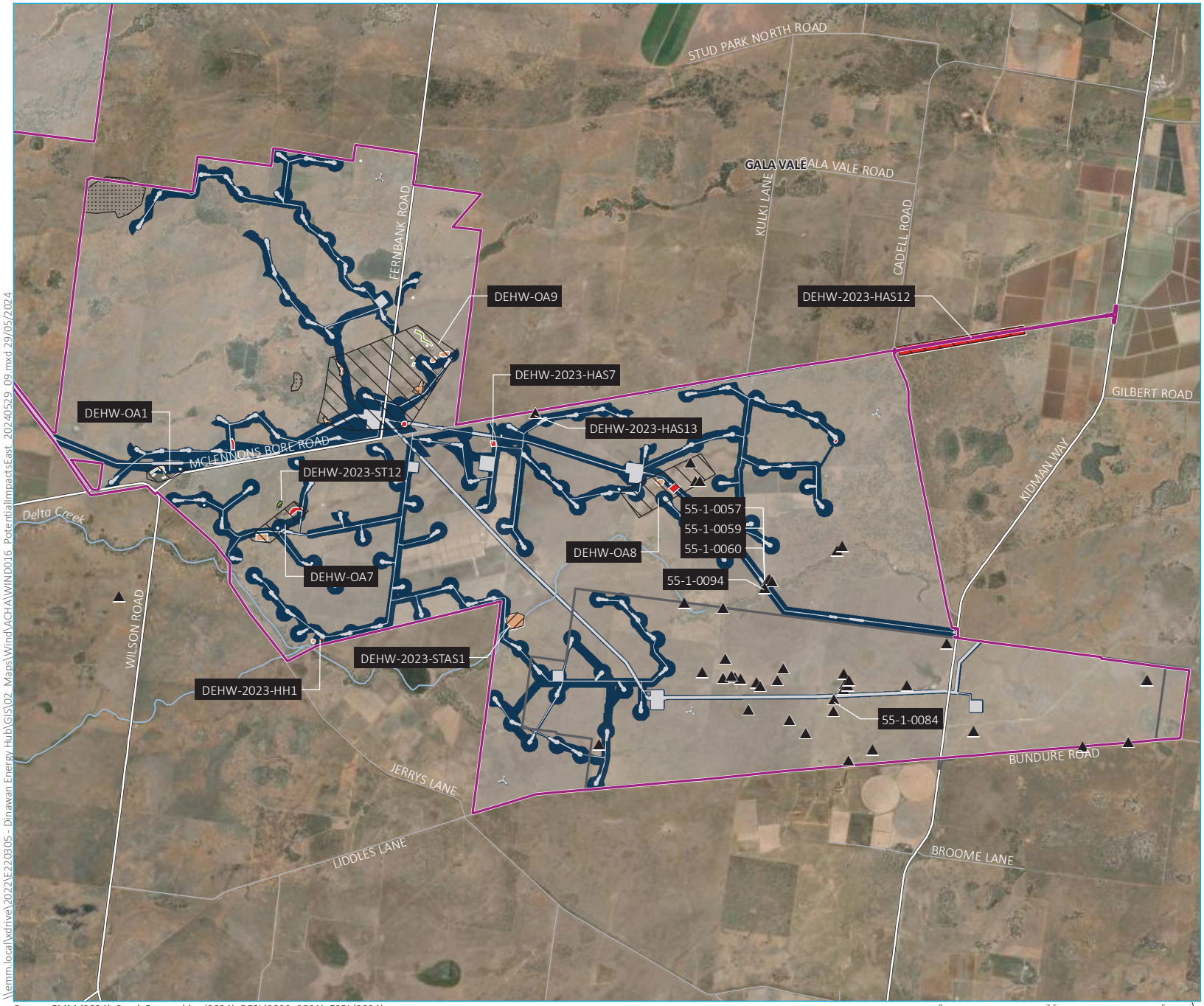
Table 10.1 Summary of potential impacts to Aboriginal objects and/or sites

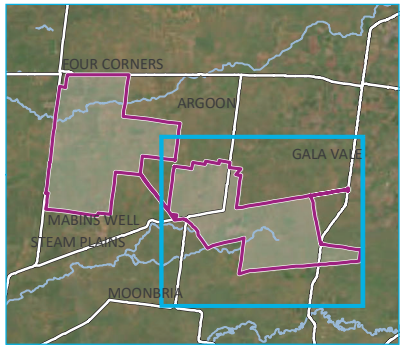
Site	AHIMS #	Incorporates	Site type	Status	Significance	Type of harm	Location and/or activity causing harm	Degree of harm	Consequence of harm	Notes
DEHW-2023-STAS1	55-1-0143	-	Cultural site	Valid	M	Direct	Within development corridor, outside the development footprint.	Partial	No loss of value	Approximately 1.2 ha (13%) of this site extends into development corridor, but is outside the development footprint. No trees associated with the site will be adversely affected.
DEHW-2023-HH1	49-4-0245	-	Culturally modified tree	Valid	M	N/A	Within development corridor, outside the development footprint	N/A	N/A	Approximately 0.6 ha (100%) of the site is within the development corridor, but is outside the development footprint. Spark Renewables have committed to avoiding this site, and it is expected to be unaffected.
DEHW-CS1	48-6-0310	#48-6-0260, #48-6-0249, #48-6-0248, #48-6-0247, #48-6-0271, #48-6-0270, #48-6-0268	Cultural site	Valid	H	N/A	Within development corridor, in proximity to development footprint	N/A	N/A	Approximately 6 ha (3%) of this site is within the development corridor, but outside the development footprint. Spark Renewables have committed to avoiding this site, and it is expected to be unaffected.
DEHW-BS1		See note 3	Low density artefact scatter	Valid	L	Direct	Within development corridor and development footprint	Partial	Partial loss of value	This site is considered to be intermittently dispersed across the project area in association with Gilgai, ephemeral wetlands, and drainage lines.

Notes:

1. The type, degree, and consequence of harm definitions are based on DECCW's (2010) *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW*.
2. Sites requiring further investigation and/or validation have their significance status ranked based on the assumption the site proves valid. However, their significance should be revisited when further analysis and classification occurs. These values are presented in red to demonstrate their tentative status.

3. DEHW-BS1 incorporates DEHW-2023-AS1 (#49-4-0233), DEHW-2023-AS2 (#48-6-0240), DEHW-2023-AS9 (#55-1-0137), DEHW-2023-AS13 (#48-6-0246), DEHW-2023-AS15 (#48-6-0245), DEHW-2023-AS16 (#48-6-0244), DEHW-2023-AS17 (#54-3-0066), DEHW-2023-AS18 (#48-6-0243), DEHW-2023-AS19 (#48-6-0242), DEHW-2023-AS20 (#48-6-0241), DEHW-2023-AS21 (#55-1-0136), DEHW-2023-AS22 (#55-1-0135), DEHW-2023-AS23 (#55-1-0159), DEHW-2023-AS25 (#48-6-0263), DEHW-2023-AS26 (#48-6-0262), DEHW-2024-AS1 (#48-6-0286), DEHW-2024-AS2 (#48-6-0287), DEHW-2024-AS3 (#48-6-0288), #55-1-0053, #55-1-0094, #55-1-0099, and #55-1-0084, DEHW-2023-ASPAD1 (#55-1-0157), DEHW-2023-ASPAD6 (#48-6-0261), DEHW-2023-ASPAD7 (#54-3-0069) DEHW-2023-IF1 (#48-6-0282), DEHW-2023-IF2 (#48-6-0281), DEHW-2023-IF3 (#48-6-0280), DEHW-2023-IF5 (#49-4-0241), DEHW-2023-IF6 (#48-6-0278), DEHW-2023-IF7 (#55-1-0166), DEHW-2023-IF8 (#49-4-0240), DEHW-2023-IF9 (#49-4-0239), DEHW-2023-IF10 (#48-6-0277), DEHW-2023-IF11 (#48-6-0276), DEHW-2023-IF12 (#48-6-0275), DEHW-2023-IF13 (#49-4-0238), DEHW-2023-IF14 (#55-1-0142), DEHW-2024-IF1 (#48-6-0307), #55-1-0052, DEHW-2023-IFPAD1 (#48-6-0274), DEHW-2023-H1 (#48-6-0259), DEHW-2023-H5 (#48-6-0255), DEHW-2023-H6 (#48-6-0254), DEHW-2023-H7 (#48-6-0272), DEHW-2024-H2 (#48-6-0290), DEHW-2023-HAS11 (#48-6-0265), DEHW-2024-HAS1 (#54-3-0071), DEHW-2024-HAS3 (#48-6-0270), DEHW-2023-HIF1 (#49-4-0235), and DEHW-2024-HIF2 (#48-6-0285).





KEY

- Project area
- Project area - solar
- Development corridor
- Development footprint
- Existing AHIMS site

Project impact

- Directly impacted
- Potentially impacted
- No impacts

Identified cultural materials

- Cultural site
- Occupation area
- Sand body

Existing environment

- Major road
- Minor road
- Watercourse (third order and higher)

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Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

0 2.5 5 km

GDA2020 MGA Zone 55

N

Potential impacts to identified cultural heritage - east overview

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 10.1a

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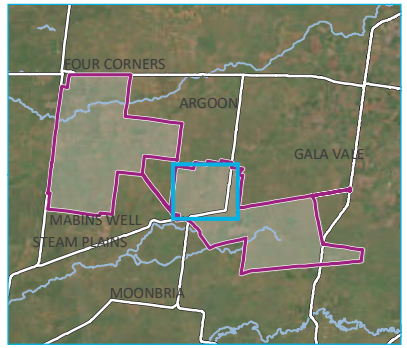

KEY

- Project area
- Development corridor
- Development footprint

Project impact

- Directly impacted
- Potentially impacted
- No impacts

Identified cultural materials

- Occupation area
- Sand body

Existing environment

- Major road
- Minor road
- Watercourse (third order and higher)

Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

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Potential impacts to identified cultural heritage - east detail map 1 of 4

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 10.1b

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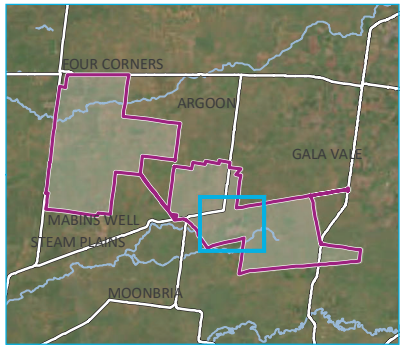

KEY

- Project area
- Development corridor
- Development footprint
- Existing AHIMS site

Project impact

- Directly impacted
- Potentially impacted
- No impacts

Identified cultural materials

- Cultural site
- Occupation area
- Sand body

Existing environment

- Major road
- Minor road
- Watercourse (3rd order and higher)

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Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

0 1 2 km

GDA2020 MGA Zone 55

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Potential impacts to identified cultural heritage - east detail map 2 of 4

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 10.1c

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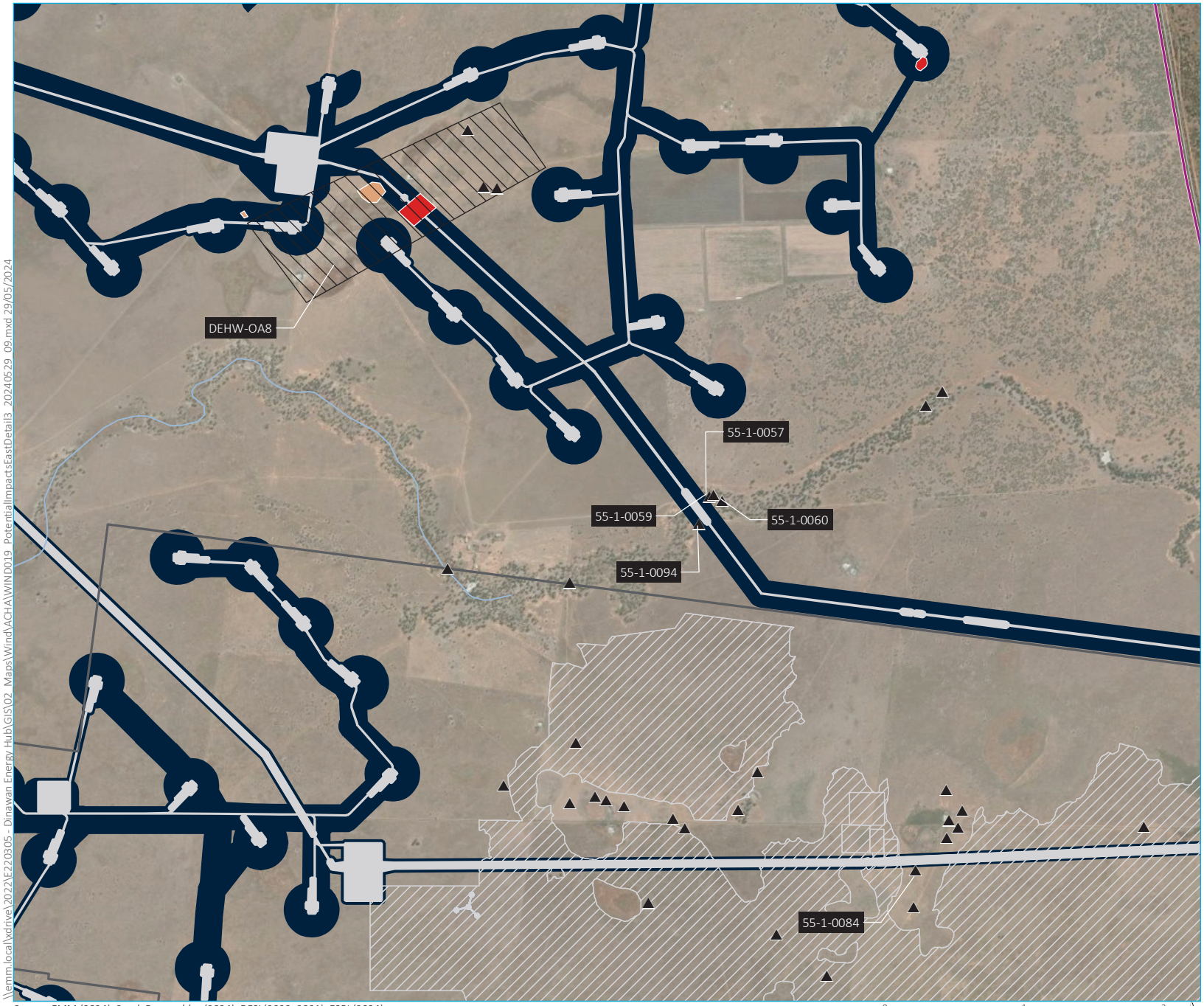

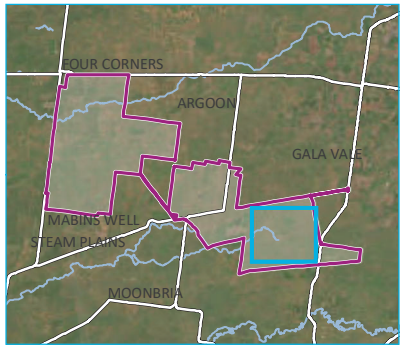

KEY

- Project area
- Project area - solar
- Development corridor
- Development footprint
- Development footprint - solar
- Existing AHIMS site

Project impact

- Directly impacted
- Potentially impacted

Identified cultural materials

- Occupation area

Existing environment

- Major road
- Minor road
- Watercourse (3rd order and higher)

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Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

0 1 2 km

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Potential impacts to identified cultural heritage - east detail map 3 of 4

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 10.1d

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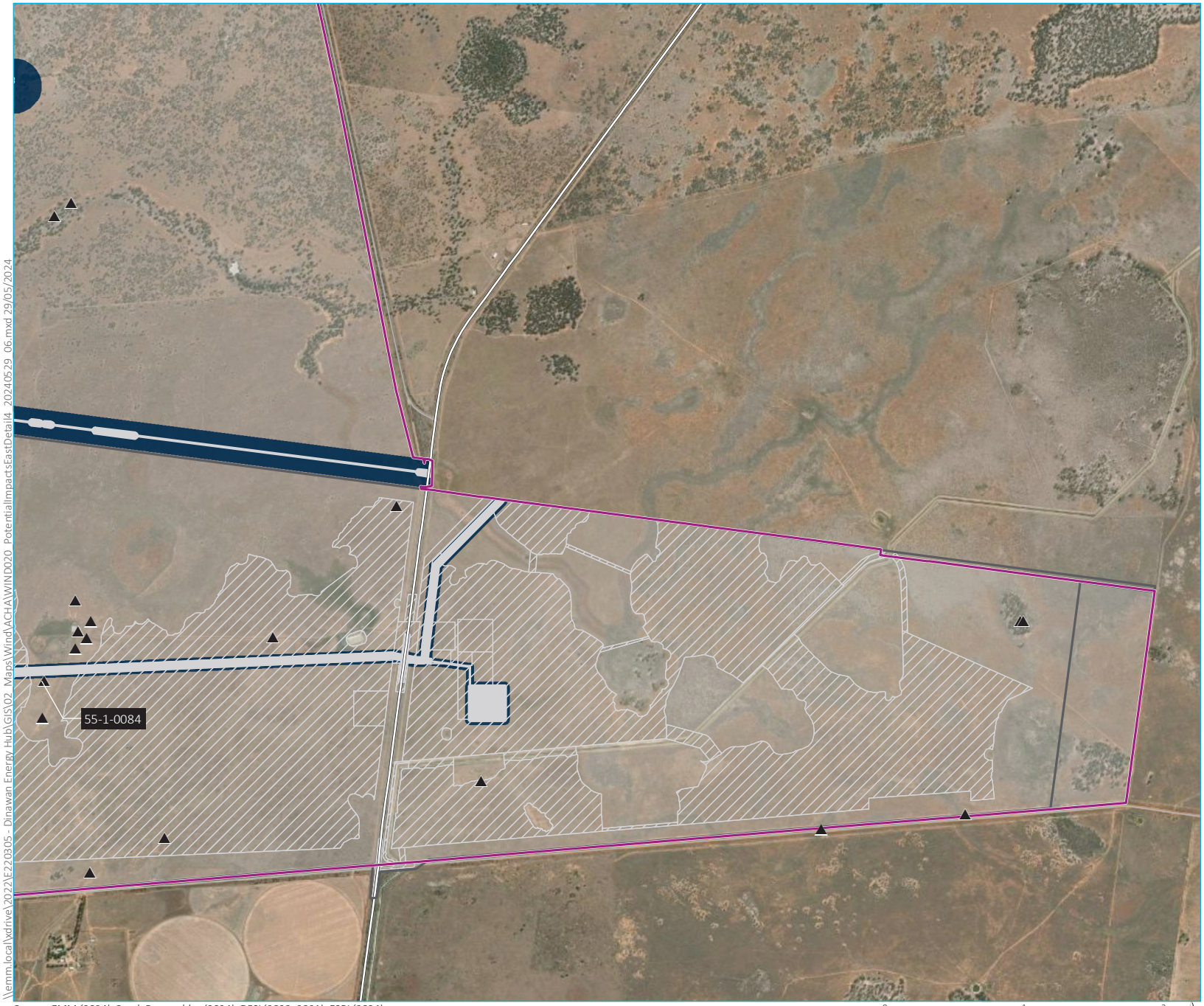

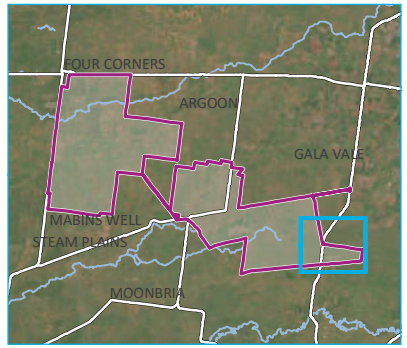

KEY

- Project area
- Project area - solar
- Development corridor
- Development footprint
- Development footprint - solar
- Existing AHIMS site

Existing environment

- Major road
- Minor road
- Watercourse (third order and higher)

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Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

0 1 2 km

GDA2020 MGA Zone 55

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Potential impacts to identified cultural heritage - east detail map 4 of 4

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 10.1e

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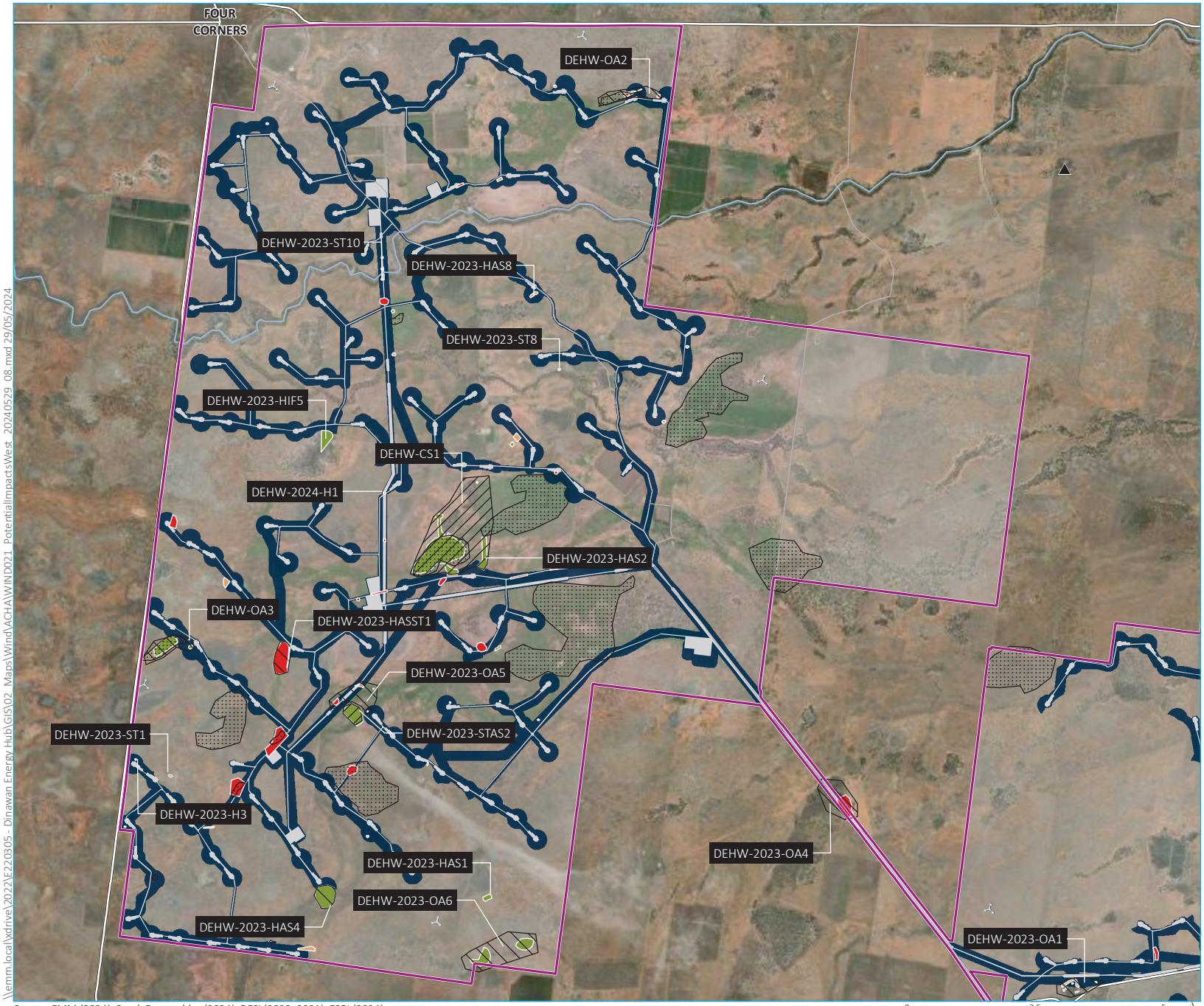
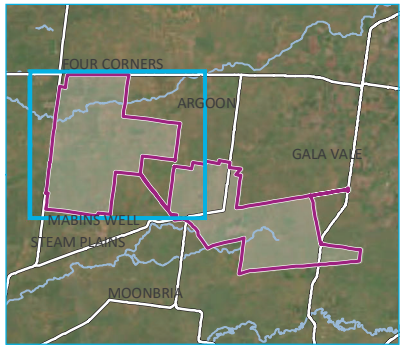
creating opportunities





KEY

- Project area
- Development corridor
- Development footprint
- Existing AHIMS site

Project impact

- Directly impacted
- Potentially impacted
- No impacts

Identified cultural materials

- Cultural site
- Occupation area
- Sand body

Existing environment

- Major road
- Minor road
- Watercourse (3rd order and higher)

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Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

0 2.5 5 km

GDA2020 MGA Zone 55

N

Potential impacts to identified cultural heritage - west overview

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 10.1f

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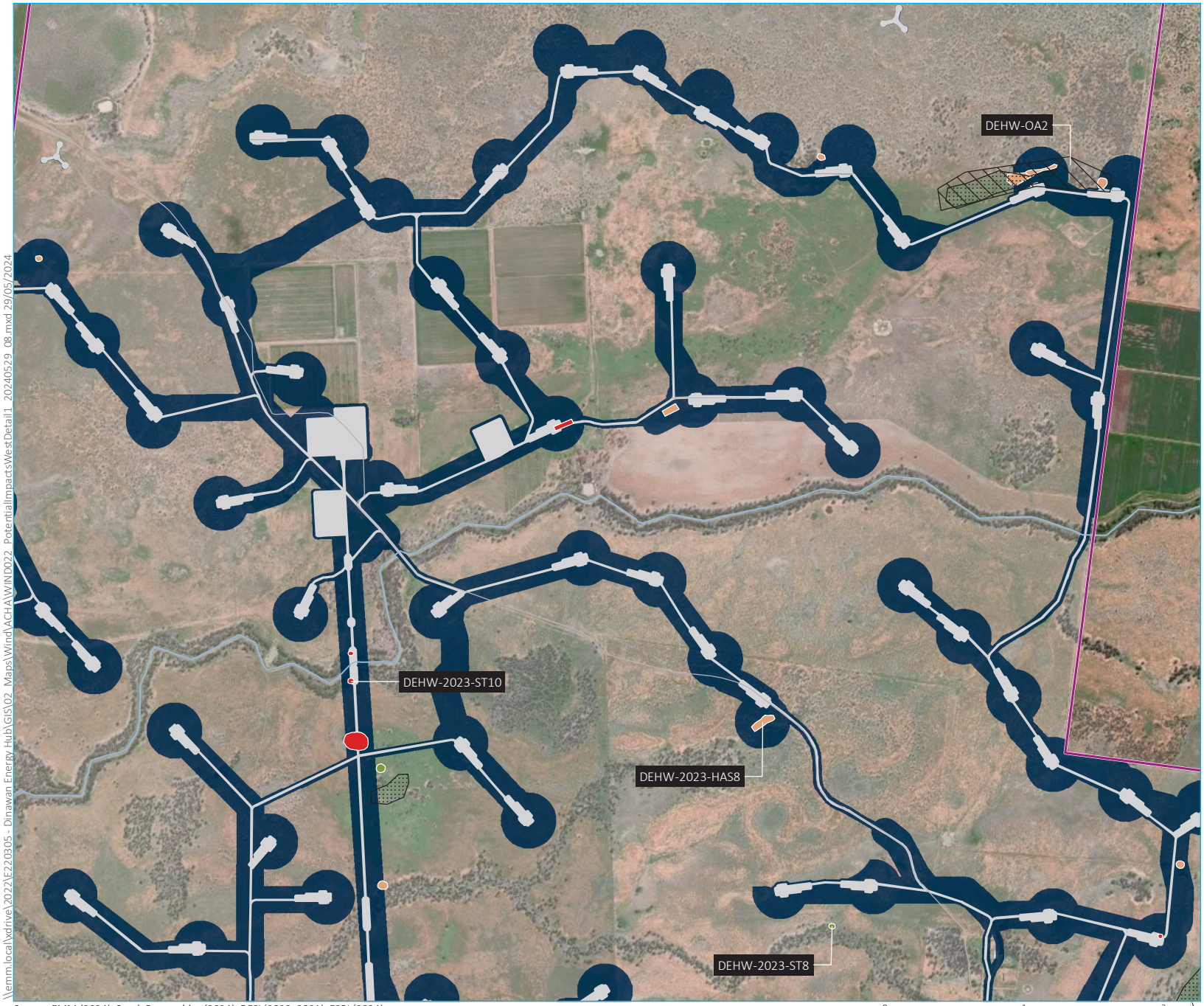
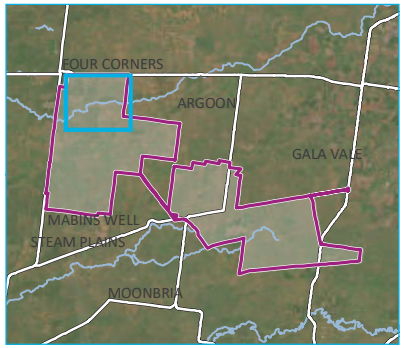
creating opportunities





KEY

- Project area
- Development corridor
- Development footprint

Project impact

- Directly impacted
- Potentially impacted
- No impacts

Identified cultural materials

- Occupation area
- Sand body

Existing environment

- Major road
- Minor road
- Watercourse (3rd order and higher)

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Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

0 1 2 km

GDA2020 MGA Zone 55

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Potential impacts to identified cultural heritage - west detail map 1 of 4

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 10.1g

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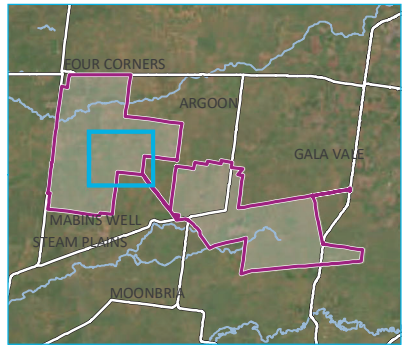
creating opportunities



KEY

- Project area
- Development corridor
- Development footprint

Project impact

- Directly impacted
- Potentially impacted
- No impacts

Identified cultural materials

- Cultural site
- Occupation area
- Sand body

Existing environment

- Major road
- Minor road
- Watercourse (third order and higher)

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Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

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GDA2020 MGA Zone 55

N

Potential impacts to identified cultural heritage - west detail map 2 of 4

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 10.1h

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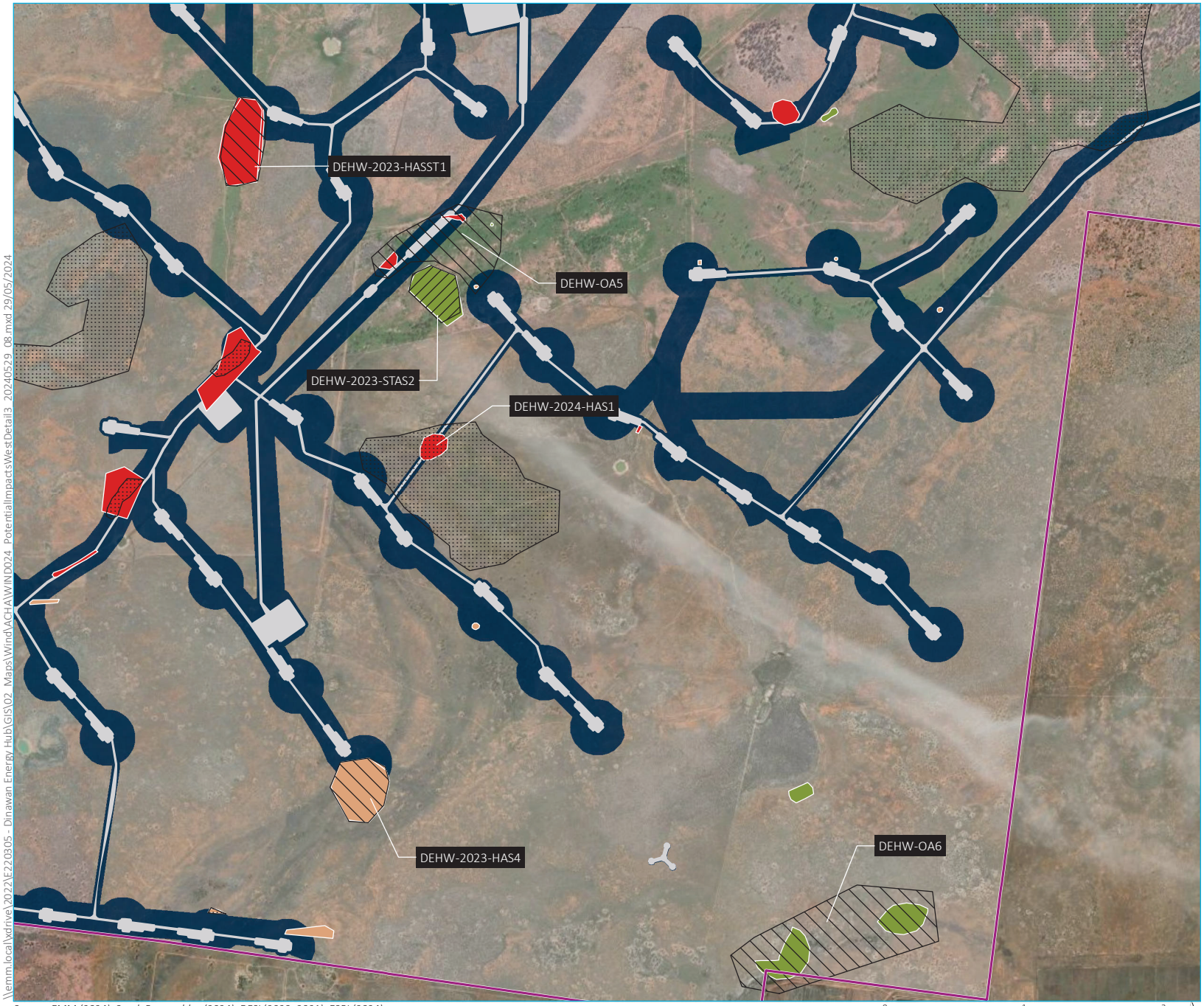

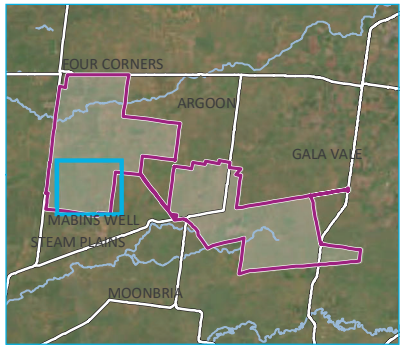

KEY

- Project area
- Development corridor
- Development footprint

Project impact

- Directly impacted
- Potentially impacted
- No impacts

Identified cultural materials

- Cultural site
- Occupation area
- Sand body

Existing environment

- Major road
- Watercourse (third order and higher)

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Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

0 1 2 km

GDA2020 MGA Zone 55

N

Potential impacts to identified cultural heritage - west detail map 3 of 4

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 10.1i

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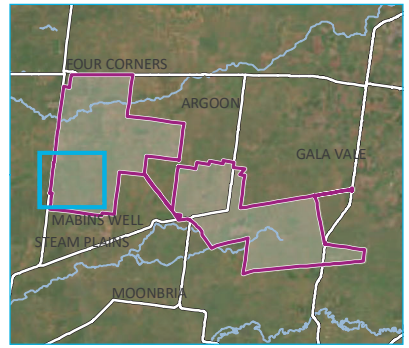

KEY

- Project area
- Development corridor
- Development footprint

Project impact

- Directly impacted
- Potentially impacted
- No impacts

Identified cultural materials

- Cultural site
- Occupation area
- Sand body

Existing environment

- Major road
- Watercourse (third order and higher)

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Source: EMM (2024); Spark Renewables (2024); DFSI (2020, 2021); ESRI (2024)

0 1 2 km

GDA2020 MGA Zone 55

N

Potential impacts to identified cultural heritage - west detail map 4 of 4

Dinawan Wind Farm
Aboriginal Cultural Heritage Assessment
Figure 10.1j

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11 Management strategy and recommendations

11.1 Key findings

- The ACHA concludes that 32 Aboriginal objects and/or sites are within the project area, along with a complex landscape of buried stone artefactual material (Section 8). These include hearths and associated cultural materials, culturally modified trees, occupation areas that include a range of cultural materials across areas approximately 69 ha in size on average, and a number of cultural sites primarily associated with landscape features and/or established trees.

- Of the identified sites, up to 17 would be directly affected by the project, being within the development corridor and/or development footprint. Approximately 311 ha (34.7%) of occupation areas within which more extensive cultural materials may be present are within the development corridor, with approximately 57 ha (6.3%) within the development footprint.

- Mitigation measures are proposed for inclusion in the project approval to guide post-approval requirements for the protection and management of Aboriginal heritage. These include the development of an Aboriginal Cultural Heritage Management Plan (ACHMP) to provide a framework for such activities, as well as direction on its content; and the development of an Interpretation Strategy and Plan to provide acknowledgement and other visual/educational opportunities for the Aboriginal and broader local community.

11.2 Management strategy

11.2.1 Summary of findings and impacts

The assessment outlined in the preceding sections, including Aboriginal consultation with the Wiradjuri traditional owners, included field survey and test excavations. Each of these activities identified various areas and locales of archaeological and/or cultural value.

Ultimately on ratifying this data, some 32 Aboriginal objects and/or sites were identified within the project area, as well as a complex pattern of surface and buried stone artefactual material. These appear to have been focussed on paleo-channels, Gilgai, and other water sources (e.g. swamps and temporary wetlands). Cultural materials included hearths, stone artefactual material and culturally modified trees. Overwhelmingly these sites were encountered on the surface, with test excavations revealing a limited buried cultural deposit (intermittently <30 cm). These were typically captured as part of larger occupation areas or site complexes, within which a number of the disparate listings and recordings of cultural materials were encountered. On average, these areas were some 69 ha in size, but with some extending to several hundred hectares along key landform features.

In addition, as is common in the broader region, various sand bodies, were encountered on the eastern side of water sources within the project area. These were predominantly found in the western project area. Investigation of these was limited, since they were typically too deep to undertake excavations under Heritage NSW guidelines robustly, but also since the project is seeking to avoid these features wherever feasible. The potential for ancestral remains and/or sites of great antiquity within these deposits was considered probable in the earliest stages of the project, and avoidance of them maximised throughout the assessment process. Only one major sand dune was documented, DEHW-2023-CS1, and this is proposed for avoidance.

Of the identified sites, 15 sites were avoided by project redesign including several sites of high significance, and all of the places identified as of high cultural importance by the RAPs. The remaining 17 Aboriginal sites are variously present within the development corridor and/or development footprint. Only two of these are entirely within the development footprint (#48-6-0271 and #48-6-0257), with the remaining sites only present within the development corridor (with potential to be avoided during subsequent project design stages) or partially within the development footprint. Of the nearly 900 ha encompassed within occupation areas, some 34.7% is within the development corridor, of which only 57 ha (6.3%) is within the development footprint.

While cumulative impacts are not expected from the project, it will result in the harm and/or destruction of a range of surface and/or subsurface stone and hearth cultural materials; and potential culturally modified trees. Given these potential impacts, and in discussion with the RAPs, archaeological mitigation of the adversely affected cultural assemblage should the project be approved is considered necessary (Section 11.2.2). The implementation of these measures will help to provide further information on the past use of the region, which has been a focus of consultation with the RAPs, further reduce the project's cumulative impacts, and ensure ongoing on-Country activities with the RAPs.

11.2.2 Post-approval requirements

In NSW, Aboriginal objects are provided with statutory protection by the NSW *National Parks and Wildlife Act 1974*. In general, where a proposed activity will result in harm to an Aboriginal object, an application must be made, and an AHIP must be granted before any harm may occur. If granted, the AHIP will contain conditions intended to manage and mitigate the identified impact and allowing harm to proceed. As the project is SSD, an AHIP is not required. The identified harm and any mitigation measures will instead be assessed through the EIS and, if consent to harm is granted, included within the project's conditions of approval. The conditions of approval of a SSD project generally incorporate Aboriginal heritage management requirements based on advice from Heritage NSW, and the recommendations of this assessment (Section 11.3).

For the purposes of this project, recommendations below include the development of an ACHMP to provide the post-approval management framework for all future Aboriginal heritage requirements for the project. The recommendations also outline the further specific mitigation measures to be included in the ACHMP that should be implemented prior to and through the project's life, and which are elaborated upon in Attachment F of this report. These include measures to ensure the avoidance of Aboriginal objects and sites outside of the development corridor, as well as:

- the recording and recovery of an adversely affected culturally modified tree (DEHW-2023-ST10 [#48-6-0251])[3]
- investigate and salvage (conservation *ex situ*) hearth sites (including #48-6-0257, #48-6-0289, #48-6-0267, #48-6-0271, and #55-1-0165) and representative components of the broader occupation areas of high and moderate significance (#48-6-0264, #55-1-0163, #55-1-0143, DEHW-OA1, DEHW-OA2, DEHW-OA4 and DEHW–OA9)
- archival recording of all identified sites subject to impact.

While the specific methodologies and quantum of these archaeological mitigations would be developed as part of the ACHMP in consultation with the project team and Aboriginal participants, a number of guiding principles should be adopted. These are presented in Attachment F.

[3] DEHW-2023-ST10 is situated close to a proposed transmission line that will cross Coleambally Outfall Drain. A commitment to avoidance of this site cannot be made without further detailed design of the transmission line, which will be done prior to construction and will consider opportunities to avoid impacts to this site.

In the case of the background artefact scatter (DEHW-BS1), no further mitigation measures are recommended. It has been demonstrated that 1–15 artefacts/m^2 would be expected intermittently and disparately across the project area, which reflects the ephemeral use of the region by Aboriginal people for several millennia. Recovery of such cultural material would have limited scientific value. However, it is acknowledged that the RAPs may wish to collect some of, or all, identified cultural materials which included infrequent exotic materials and formal tool types that may assist education. Where desired, collection of such cultural materials should be incorporated into the ACHMP.

In addition to the tangible cultural materials within the project, a wide range of intangible and cultural values were identified, most evident in the five discrete cultural places documented. To address and further explore these values and as further offset of proposed harm to the cultural assemblage (Section 10), it is recommended that an interpretation strategy, interpretation plan, and their implementation be developed to explore, develop and present Aboriginal heritage values of the site. As with the ACHMP, guiding principles to be integrated into these documents are presented in Attachment F.

11.3 Mitigation measures

Based on the findings of the ACHA, Table 11.1 provides a series of recommendations to be implemented for the project. These should be read in conjunction with the guiding principles in Attachment F.

Table 11.1 Management and mitigation measures for Aboriginal cultural heritage

Reference	Impact	Mitigation measure	Timing	Applicable location
AH1	Impact avoidance and minimisation	The project will avoid impacts to the following identified Aboriginal objects and/or sites within or near the development corridor: • hearths and associated cultural materials: DEHW-2023-HAS13 (#55-1-0162), DEHW-2023-HIF5 (#48-6-0283), PEC-E-47 (#55-1-0057), PEC-E-50 (#55-1-0060), DEHW-2023-HAS1 (#54-3-0071), PEC-E-49 (#55-1-0059), DEHW-2023-ST1 (#48-6-0273), and DEHW-2023-ST8 (#48-6-0253). • occupation area: DEHW-OA3 (#48-6-0308), DEHW-OA6 (#54-3-0076), and DEHW-2023-HAS4 (#54-3-0070) • cultural sites: DEHW-CS1 (#48-6-0310) and other significant cultural areas including two potential ring trees (DEHW-2023-STAS2 (#48-6-0250) and DEHW-2023-ST12 (#55-1-0144)), a potential culturally modified tree, DEHW-2023-HH1 (#49-4-0245), and key identified cultural material components within a potential women's area DEHW-2023-STAS1 (#55-1-0143). Some guiding principles for consideration of avoidance are presented in Attachment F. Site-specific avoidance measures developed to address this commitment will be integrated into AH3.	Pre-construction Construction	PEC -E-49 (#55-1-0059), PEC -E-47 (#55-1-0057), PEC -E-50 (#55-1-0060), DEHW-2023-HAS4 (#54-3-0070), DEHW-2023-HAS1 (#54-3-0071), DEHW-OA6 (#54-3-0076), DEHW-2023-STAS1 (#55-1-0143) (part), DEHW-2023-ST12 (#55-1-0144), DEHW-2023-HAS13 (#55-1-0162), DEHW-2023-STAS2 (#48-6-0250), DEHW-2023-ST8 (#48-6-0253), DEHW-2023-ST1 (#48-6-0273), DEHW-2023-HIF5 (#48-6-0283), DEHW-OA3 (#48-6-0308), DEHW-CS1 (#48-6-0310), and DEHW-2023-HH1 (#49-4-0245).
AH2	Impact avoidance and minimisation	The project will investigate the micro-siting of project infrastructure and construction activities in consultation with an Aboriginal heritage specialist to avoid or minimise impacts to: • hearths and associated cultural materials: DEHW-2023-H3 (#48-6-0257), DEHW-2024-HAS8 (#48-6-0267), DEHW-2024-HAS7 (#55-1-0165) and DEHW-2023-HAS12 (#55-1-0163) • a culturally modified tree: DEHW-2023-ST10 (#48-6-0251) • occupation area: DEHW-2023-HASST1 (#48-6-0264), DEHW-OA1 (#55-1-0172), DEHW-OA2 (#49-4-0243), DEHW-OA4 (#49-4-0244), DEHW-OA5 (#48-6-0309), DEHW-OA7 (#55-1-0171), DEHW-OA8 (#55-1-0169), and DEHW-OA9 (#55-1-0170) • areas of higher archaeological potential including identified aeolian, paleochannels, and watercourses features; and the eastern fringes of Gilgai and ephemeral wetlands. These are prevalent in the western project area, where sand dunes and/or sandy soil profiles have been predicted and/or observed. Some guiding principles for consideration of avoidance and/or impact minimisation are presented in Attachment F. Management and any site-specific mitigation measures developed to address this commitment will be integrated into AH3.	Pre-construction Construction	DEHW-2023-HAS12 (#55-1-0163), DEHW-2024-HAS7 (#55-1-0165), DEHW-OA8 (#55-1-0169), DEHW-OA9 (#55-1-0170), DEHW-OA7 (#55-1-0171), DEHW-OA1 (#55-1-0172), DEHW-OA2 (#49-4-0243), DEHW-OA4 (#49-4-0244), DEHW-2023-ST10 (#48-6-0251), DEHW-2023-H3 (#48-6-0257), DEHW-2023-HASST1 (#48-6-0264), DEHW-2024-HAS8 (#48-6-0267), and DEHW-OA5 (#48-6-0309).

Table 11.1 Management and mitigation measures for Aboriginal cultural heritage

Reference	Impact	Mitigation measure	Timing	Applicable location
AH3	Cultural heritage management	An ACHMP will be prepared a suitably qualified heritage professional in consultation with the RAPs and Heritage NSW. The contents and guiding principles for the management of identified site types for the ACHMP are presented in Attachment F, and include: • processes, timing, communication methods and project involvement for maintaining Aboriginal community consultation and participation through the remainder of the project • inputs and content of a cultural heritage induction package for all construction personnel and subcontractors • descriptions and methods for suitably documenting and archivally recording any Aboriginal sites and/or objects that will be adversely affected by the project • recording and archaeological mitigation of requirements of archaeological test/salvage excavations/monitoring of occupation areas, stone artefact scatters, PADs, and cultural deposits that will be adversely affected by the project • descriptions and methods for surface collection of identified isolated objects and stone artefact scatters that will be adversely affected by the project • descriptions and methods for mitigation and/or recovery of culturally modified trees that will be adversely affected by the project • delineating and protecting Aboriginal and cultural sites within or in close proximity to the development corridor, including clear marking, appropriate screen for any gender-specific areas, surface protection, etc • procedures for managing the unexpected discovery of Aboriginal objects, sites and/or human remains during the project • procedures for the curation and long-term management of recovered cultural materials • methods of post-excavation analysis and reporting of the archaeological investigations, including suitable collection and processing of stone artefacts, paleo-environmental, chronological and other soils from archaeological activities • a monitoring regime for implementing the above measures.	Pre-construction Construction	Project area, and all identified Aboriginal objects, sites and deposits in Section 8 that will be adversely impacted by the project.

Table 11.1 Management and mitigation measures for Aboriginal cultural heritage

Reference	Impact	Mitigation measure	Timing	Applicable location
AH4	Cultural heritage management	An inspection will be undertaken by a qualified arboriculturist of all tentatively identified culturally modified trees to confirm whether they have formed through anthropogenic or natural processes, and where these sites are anticipated to be adversely affected by the project. The findings of this inspection and subsequent management of the trees confirmed as being culturally modified will be integrated into the ACHMP (AH3) as required.	Pre-construction	DEHW-OA9 (#55-1-0170), DEHW-OA2 (#49-4-0243), DEHW-OA4 (#49-4-0244), DEHW-2023-ST10 (#48-6-0251), DEHW-2023-HASST1 (#48-6-0264), and DEHW-2023-HH1 (#49-4-0245).
AH5	Heritage interpretation	An Aboriginal heritage-interpretation strategy and plan will be developed by an Aboriginal heritage specialist, in consultation with RAPs, which will identify the interpretive values of the project area (and specifically Aboriginal heritage values) and provide direction for interpretive installations and devices. The contents and guiding principles for the management of the strategy and plan are presented in Attachment F and include the need to incorporate RAPs' views on traditional and contemporary values, local ethnographic and post-Contact information, and archaeological data developed for the project.	Construction Post-construction	Project area
AH6	Aboriginal engagement	Consultation will be maintained with the RAPs where cultural heritage requires management.	Pre-construction Construction	-
AH7	Administrative	A copy of the ACHA and all relevant AHIMS site recording forms and information for the project will be lodged with Heritage NSW and provided to each of the RAPs.	Pre-construction Construction	-

References

Adams, K, Faulkhead, S, Standfield, R and Atkinson, P 2018, Challenging the colonisation of birth: Koori women's birthing knowledge and practice, *Elsevier*, 2018, pp. 81-88.

Arthur, B & Morphy, F 2005, *Macquarie Atlas of Living Australia*, Macquarie Dictionary Publishers, Australian National University, the Australian Bureau of Statistics and Macquarie Dictionary.

Atlas of Living Australia 2016*, Biodiversity Data Journal*, viewed 1 March 2023, http://www.ala.org.au.

Attenbrow V, Fullagar, R 2004, A Pacific Odyssey: Essays on Archaeology and Anthropology in the Western Pacific in Honour of Jim Specht, *Records of the Australian Museum, Supplement*, 29: 1–186.

Attenbrow V 2010, Sydney's Aboriginal Past: Investigating the Archaeological and Historical Records, UNSW Press, Sydney.

Austral Archaeology 2021, Heritage Sensitivity Advise for Dinawan Energy Hub, prepared for Sparks Renewables by Austral Archaeology.

Banerjee, D, Page, K & Lepper, K. 2002. Optical Dating of Paleochannel Deposits in the Riverine Plain, Southeastern Australia: Testing the Reliability of Existing Thermoluminescence Dates. Radiation protection dosimetry, 2002, pp. 327-32.

Barwick, D, E 1984, Mapping The Past: An Atlas of Victorian Clans 1835-1904: Part 1, *Aboriginal History*, 1984, pp. 100-131.

Bell, S, A, J & Driscoll, C, 2014, Acacia pendula (Weeping Myall) in the Hunter Valley of New South Wales: early explorers' journals, database records and habitat assessments raise doubts over naturally occurring populations, *Cunninghamia V14*, 2014, p. 186.

Belthuis, L 1968, Coleambally Irrigation Area: Herds, Crops, Fruit, Journal of the Minnesota Academy of Science, 1968, pp. 128-131.

Bonhomme, T 1990, Sandmining and burials on the Riverine Plain. Unpublished report to NP&WS, NSW.

Bowdler, S 1970, Bass Point: The Excavation of a South-east Australian Shell Midden Showing Cultural and Economic Change. Unpub. B.A. thesis.

Bowler, JM 1986, Quaternary landform evolution, *Australia, a Geography V1*, Sydney.

Bowler, J, Johnston, H, Olley, J *et al.* 2003, New ages for human occupation and climatic change at Lake Mungo, Australia. *Nature* 421, 837–840.

Bradshaw, CJA, Ulm, S, Williams, AN *et al.* 2019, Minimum founding populations for the first peopling of Sahul. *Nat Ecol Evol* **3**, 1057–1063.

Brumm, A. R., (2010) "The Falling Sky": Symbolic and Cosmological Associations of the Mt William Greenstone Axe Quarry, Central Victoria, Australia. Cambridge Archaeological Journal 20(2):179–196.

Buchan, R 1974, Report on an Archaeological Survey in the Murray Valley, New South Wales 1973-1974, Unpublished report to NPWS.

Cahir, F, Clark, ID, Clarke, PA 2018, *Aboriginal Biocultural Knowledge in South-eastern Australia: Perspectives of Early Colonists*, CSIRO Publishing.

Cattle, S., R. Greene, and A. McPherson, (2005) Aeolian Dust Deposition in South Eastern Australia: Impacts on Slainity and Erosion. Pp. 38–42 in *CRC LEME Regional Regolith Symposia 2005*, edited by I. C. Roach. Bentley, CRC LEME.

Chen, X., N. Spooner, J. Olley, and D. Questiaux, (2002) Addition of Aeolian Dusts to Soils in Southeastern Australia: Red Silty Clay Trapped in Dunes Bordering Murrumbidgee River in the Wagga Wagga Region. *CATENA* 47(1):1–27.

Clayton S 1985, Central New South Wales an Aboriginal perspective, Information and Public Awareness Branch DAA.

Curr, EM 1887, The Australian Race: Its origins, languages, customs, place of landing in Australia and the routes by which it spread itself over that continent, Melbourne.

Department of Environment, Climate Change and Water (DECCW) NSW 2010, COLLEAMBALLY VARIANT B, retrieved 1 March 2023 from https://www.environment.nsw.gov.au/eSpade2Webapp/.

Department of Environment, Climate Change and Water NSW 2010, Jerilderie, retrieved 1 March 2023 from https://www.environment.nsw.gov.au/eSpade2Webapp/.

Dijk, D. C., and T. Talsma, (1964) *Soils of Portion of the Coleambally Irrigation Area, NSW*, Melbourne, CSIRO.

Dortch, C 1979. Devil's Lair, an example of prolonged cave use in southwestern Australia. *World Archaeology* 10, 258–279.

Doelman, T 2023. Artefact analysis from Dinawan Wind Farm. Unpublished report produced for EMM Consulting.

Edmonds, V 1995, An Archaeological Survey of Wyvern Station, West of Griffith, New South Wales. A Report to Booth and Associates, Hay.

- 1996a, An Archaeological Survey of the Benerembah Irrigation District Stage 4 Drainage, West of Griffith. Unpublished report to Booth Associates.

- 1996b, An Archaeological Survey of the Pinelea Drainage Basin, near Finley, southwestern NSW. Unpublished report to Kinhill Engineers Pty Ltd, Sydney.

Fitzsimmons, KE, Spry, C, Stern, N 2019 Holocene and recent aeolian reactivation of the Willandra Lakes lunettes, semi-arid southeastern Australia. *The Holocene*, 29 (4): 606-621.

Fuller, RF, Trudgett, M and Norris, RP 2014, The Emu Sky Knowledge of the Kamilaroi and Euahlayi Peoples, *Journal of Astronomical History and Heritage*, 2014, pp. 1-13.

Geological Survey of New South Wales, Department of Mines 1976, Jerilderie 1:250,000 Geological Series Sheet, retrieved 1 March 2023 from https://gmaps.geoscience.nsw.gov.au/250K/Jerilderie/.

Geospatial & Information Analytics Branch, Australian Government Department of Agriculture, Water and the Environment 2021, Interim Biogeographic Regionalisation for Australia, Version 7, retrieved 1 March 2023 from https://www.dcceew.gov.au/sites/default/files/env/pages/5b3d2d31-2355-4b60-820c-e370572b2520/files/ibra-regions.pdf.

Gollan, K., (1982) Archaeological Survey of 132 Kv Transmission Line, Griffith to Darlington Point, Unpublished report for NSW National Parks and Wildlife Service.

Gould, R 1977, 'Puntutjarpa Rockshelter and the Australian desert culture', *Anthropological Paper of the American Museum of Natural History*, pp. 5-187.

Gow, G 1951, The Poisoned Water Holes, *The Narandera Argus*, 5 February, p. 2.

Gray, JM & Murphy, BW 1999, *Parent Marial and Soils A guide to the influence of parent material on soil distribution in eastern Australia*, Technical Report 45, Department of Land and Water Conservation.

Green, MD & Middlemas, JP 1985, Laser levelling land for flood irrigation, Journal of Department of Agriculture, Western Australia, January 1985, pp. 39-42.

Hamm, G 1995, An archaeological assessment of Telecom's proposed optical Fibre Cable routes. Darlington.

Hamm, G, Mitchell, P, Arnold, LJ, Prideaux, GJ, Questiaux, D, Spooner, NA, Levchenko, VA, Foley, EC, Worthy, TH, Stephenson, B, Coulthard, V, Coulthard, C, Wilton, S, Johnston, D 2016, Cultural innovation and megafauna interaction in the early settlement of arid Australia. *Nature*, 539, 280–283.

Hartland, ES 1898, The "High Gods" of Australia. *Folklore*, 9(4), pp. 290–329.

Howitt, AW, 1884, Remarks on the class system collected by Mr E Palmer, E. Notes on some Australian tribes, Anthrop, London, 1884, pp. 276-347.

High Ground Consulting, (2014) Warangesda Aboriginal Mission and Station - Conservation Management Plan, Unpublished CMP for Leeton Aboriginal Land Council.

Isbell, RF & the National Committee on Soil and Terrain (NCST) 2021, *The Australian Soil Classification* Third Edition, CSIRO Publishing.

Kelton, J 1998, An Archaeological Survey for the Proposed Gundaline Irrigation Development, between Darlington Point and Hay, South-Western New South Wales. A report to Twynam Pastoral Company & Booth Associates.

- 1999, An Archaeological Study of Martin's and West Ray's Paddocks: Gundaline Property, between Darlington Point and Hay, South-Western New South Wales. A report to Twynam Pastoral Company & Booth Associates.

Kibblewhite, M, Toth, G & Hermann, T 2015, Predicting the preservation of cultural artefacts and burial materials in soil, *Elsevier* V529, 2015, pp. 249-263.

Klaver, J 1987, Old Ovens are Soon Hot. A Study of the Function and Location of Aboriginal Mounds along the Murrumbidgee River. Unpublished BA Hons Thesis, Australian National University, Canberra.

- 1998, Late Occupation of the Central Murrumbidgee Riverine Plain. Unpublished PhD Thesis, Australian National University, Canberra.

Konishi, S 2019, AN INDIGENOUS AUSTRALIAN DICTIONARY OF BIOGRAPHY. In K. FOX (Ed.), *True Biographies of Nations?': The Cultural Journeys of Dictionaries of National Biography*. ANU Press.

Lampert, RJ 1971, *Burrill Lake and Currarong: Coastal sites in southern New South Wales*, Terra Australis.

Langford-Smith, T., (1960) The Dead River Systems of the Murrumbidgee. *Geographical Review* 50(3):368–389.

Langley, M, Clarkson, C, Ulm, S 2011, From small holes to grand narratives: The impact of taphonomy and sample size on the modernity debate in Australia and New Guinea. *Journal of Human Evolution*, 61(2011): 197-208.

Littleton, J 1999, East and West: Burial Practices along the Murray River, *Archaeology in Oceania*, 1999, pp. 1-14.

Martin, S 1996a, Hay Plain Burials Management Project. Draft report on the National Estate Project for the Hay Local Aboriginal Land Council.

- 1996b, The Tchelery 1 Aboriginal Earth Mound, Hay Plain South. Excavation Report for the Hay Local Aboriginal Land Council.

- 1998, The Hay Plain Earth Mounds. Submitted to *Archaeology in Oceania*.

- 1999, Ravensworth Black Earth Mounds, Near Hay, NSW. Report on field work for Hay LALC and NSW NP&WS.

- 2000, Archaeological Salvage of the Sam's Paddock Sites at Gundaline Station East of Hay, N.S.W. A Report for Booth Associates.

Mathews, R. H., (1896a) The Bunan Ceremony of New South Wales. *American Anthropologist* 9(10):327–344.

Mathews, R. H., (1896b) The Burbung of the Wiradthuri Tribes. *The Journal of the Anthropological Insitute of Great Britain and Ireland* 25:295–318.

Mathews, R. H., (1898a) Initiation Ceremonies of Australian Tribes. *Proceeding of the American Philosophical Society* 37(157):54–73.

Mathews, R. H., (1898b) The Victorian Aborigines: Their Initiation Ceremonies and Divisional Systems. *American Anthropologist* 11(11):325–343.

Mathews, R. H., (1904) The Wiradyuri and Other Languages of New South Wales, *The Journal of the Anthropological Institute of Great Britain and Ireland* (34):284–305.

Mathews, R, H., (1901), Initiation ceremonies of the Wiradjuri tribes, American Anthropologists, New Series, vol.3, part 2, pp. 337 341.

McBryde, I & Watchman, AL 2010, The Distribution of Greenstone Axes in Southeastern Australia: A Preliminary Report, *Mankind*, 10, 163 - 174.

McIntyre, S 1985, Archaeological Survey of the Proposed Darlington Point to Deniliquin 132 kV Transmission Line. Unpublished report to the Electricity Commission of NSW.

Memmott, P 2022, Gunyah Goondie + Wurley: The Aboriginal Architecture of Australia, Thames & Hudson, Victoria.

Mitchell, T, L (1839) *Three expeditions into the interior of eastern Australia : with descriptions of the recently explored region of Australia Felix, and of the present colony of New South Wales*, London, T. & W. Boone.

Mitchell, P., (2002) *Description of NSW (Mitchell) Landscapes*, Department of Environment & Climate Change.

Morey, E., (n.d.) *The Morey Papers 1893-1908*, Sydney NSW, ML MSS. 1456 (and see MSS. 883).

Nash, D 2004, Aboriginal Plant Use in south-eastern Australia, *Education Services Australian National Botanic Gardens*, 2004, pp. 1-20.

Navin Officer Cultural Heritage (NOHC) 2022, EnergyConnect (NSW – Eastern Section) Environmental Impact Statement – Aboriginal cultural heritage assessment, report prepared for TransGrid.

Nielsen-Marsh, et al. 2000, "The Chemical Degradation of Bone", *Human Osteology: In Archaeology and Forensic Science*, Cambridge University Press.

NGH Environmental 2019, *Aboriginal Cultural Heritage Assessment, Yanco Solar Farm*, report prepared for ib vogt GmbH by NGH Environmental.

NPWS 2003, *The bioregions of NSW: their biodiversity, conservation and histories, National Parks and Wildlife Services*, Hurstville.

O'Connell, JF, Allen, J, Williams, MAJ, Cooper, A, Williams, AN, Turney, CSM, Spooner, NA, Kamminga, J, Brown, G 2018, When did Homo Sapiens first reach Southeast Asia and Sahul? Proceedings of the National Academy of Sciences of the United States (Perspectives).

Oghenemavwe, LE, Orupabo, CD & Horsfall, TJ 2023, Soil pH effect on bone degradation: Implications in forensic investigations, *Adv Biomed Health Sci,* 2022, pp. 156-61

Page, J 1994, Late quaternary stratigraphy and chronology of the Riverine Plain, Southeastern Australia, *Universtiy of Wollongong Research Online*, 1994, pp. 1-221.

Page, K. J, Kemp, J. and Nanson, G. C. 2009, Late Quaternary evolution of Riverine Plain paleochannels, southeastern Australia, *Australian Journal of Earth Sciences*, 56: S1, S19 — S33

Page K, Dare-Edwards T, Thorne A, Webb S & Price DM 1994, Pleistocene Human Occupation site at Lake Urana, New South Wales, *Australian Archaeology,* 38, pp.38-44.

Pardoe, C 1988, The cemetery as symbol. The distribution of Aboriginal burial grounds in southeastern Australia. *Archaeology in Oceania,* 23, pp. 1-16.

- 1995, 'Riverine, biological and cultural evolution in southeastern Australia', *Antiquity*, 69, pp. 696-713.

Pardoe, C & Grist, M 2001, Lake Baker Burial Protection Project, Swan Hill, Victoria. Unpublished report to Aboriginal Affairs Victoria and North West Regional Aboriginal Cultural Heritage Program

Pardoe, C & Martin, S 2011, Murrumbidgee Province Aboriginal Cultural Heritage Study, Australian Archaeological Consultancy Monograph Series V4, Victoria, 2011, pp. 1-155.

Parkes, W, S 1952, MS: Letters to N, B, Tindale.

Pate, FD, Pretty, GL, Hunter, R, Tuniz, C, Lawson, EM 1998, New radiocarbon dates for the Roonka Flat Aboriginal burial ground, *South Australia Australian Archaeology*, 46: 36-37

Patron, TR 1974, Origin and Terminology for Gilgai in Australia, Geoderma, 1974, pp. 221-242.

Pearson, M., (1984) Bathurst Plains and beyond: European Colosniation and Aboriginal Resistance. *Aboriginal History* 8(1):63–79.

Read, P 1988, A Hundred Years War: The Wiradjuri People and the State, Australian University Press, Sydney.

SEED: The Central Resource for Sharing and Enabling Environmental Data in NSW 2016, NSW Government, viewed 1 March 2023, https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU&runWorkflow=AppendLayerCatalog&CatalogLayer=SEED_Catalog.124.NSW%20(Mitchell)%20Landscapes%20v3.1%20-%20ECOS_MESO%20LandscapeName,SEED_Catalog.125.NSW%20(Mitchell)%20L

Simmons, S 1980, Site survey of the floodplains between the Murray and Wakool Rivers, NSW. Records of the Victorian Archaeological Survey, vol. 10, pp. 57-86.

Soil Conservation Service of NSW, 1990, *Hay District Technical Manual.*

Stockton, ED 1973, Shaw's Creek Shelter: Human displacement of artefacts and its significance. *Mankind* 9:112-7.

Stockton, E, Holland, W 1974, 'Cultral sites and their environment in the Blue Mountains, *Archaeology and Physical Anthropology in Oceania*, 9, pp. 36-65

The State of Queensland 2013, Gilgai wetlands, retrieved 1 March 2023 from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://wetlandinfo.des.qld.gov.au/resources/static/pdf/resources/tools/conceptual-model-case-studies/cs-Gilgai-12-04-13.pdf.

Thompson, W, A, Eldridge, D, J 2005, *White cypress pine (Callitris glaucophylla): a review of its role in the landscape and ecological processes in eastern Australia*, Australian Journal of Botany, 53: 555-570.

Tindale, NB 1974, *Aboriginal Tribes of Australia*, Australian National University Press, Canberra.

Tobler, R, Rohrlach, A, Soubrier, J, Bover, P, Llamas, B, Tuke, J, Bean, N, Abdullah-Highfold, A, Agius, S, O'Donoghue, A, O'Loughlin, I, Sutton, P, Zilio, F, Walshe, K, Williams, AN, Turney, CSM, Williams, M, Richards, SM, Mitchell, RJ, Kowal, E, Stephen, JR, Williams, L, Haak, W, Cooper, A 2017. Aboriginal mitogenomes reveal 50,000 years of regionalism in Australia. *Nature*, 544: 180–184.

Tuckwell, K. D., (1976) *Jerilderie 1:250,000 Geological Sheet*, Sydney, NSW, Geological Survey of New South Wales.

Turney, CSM, Bird, MI, Fifield, LK, Roberts, RG, Smith, M, Dortch, CE, Grun, R, Lawson, E, Ayliffe, LK, Miller, GH, Dortch, J, Cresswell, R, 2001. Early human occupation at Devil's Lair, southwestern Australia 50,000 years ago. Quaternary Research 55, 3-13.

Van Dijk, DC & Talsma, T 1964, Soils of Portion of the Coleambally Irrigation Area, N.S.W., Division of Soils Commonwealth Scientific and Industrial Research Organisation, Melbourne, 1964, pp. 1-46.

Veth, PM, 1993. Islands in the Interior: The Dynamics of Prehistoric Adaptations within the Arid Zone of Australia. *International Monographs in Prehistory*, Ann Arbor, Michigan.

Williams, AN 2013, A new population curve for prehistoric Australia. Proceedings of the Royal Society B, 280: 20130486.

Williams, AN, Ulm, S, Cook, AR, Langley, M, Collard, M 2013, Human refugia in Australia during the Last Glacial Maximum and Terminal Pleistocene: A geo-spatial analysis of the 25-12ka Australian archaeological record. *Journal of Archaeological Science*, 40: 4612-4625.

Williams, AN, Ulm, S, Sapienza, T, Lewis, S, Turney, CSM 2018, Sea-Level Change and Demography during the Last Glacial Termination and Early Holocene across the Australian Continent. *Quaternary Science Reviews* 182: 144-154.

Williams, AN, Veth, PM, Steffen, W, Ulm, S, Turney, CSM, Reeves, J, Phipps, S, Smith, M 2015a, A Continental Narrative: Human Settlement Patterns and Australian Climate Change over the last 35,000 Years. *Quaternary Science Reviews* 123, 91-112.

Williams, AN and Ulm, S 2014, AustArch: A Database of 14C and Luminescence Ages from Archaeological Sites in Australia. *York: Archaeology Data Service*.

Williams, AN, Ulm, S, Turney, CSM, Rodhe, D, White, G 2015b, The Establishment of Complex Society in Prehistoric Australia: Demographic and Mobility Changes in the Late Holocene. *Plos One*, 10(6): e0128661.

Williams, EM, Gordon, AD, & Richmond, BG 2012, Hand pressure distribution during Oldowan stone tool production. *Journal of Human Evolution*, 62(4), 520-532.

Wolfe, P 1991, On Being Woken Up: The Dreamtime in Anthropology and in Australian Settler Culture. *Comparative Studies in Society and History*, 33(2), pp. 197–224.

Abbreviations

Abbreviation	Definition
AC	alternating current
AHD	Australian Height Datum
ACHA/ACHAR	Aboriginal cultural heritage assessment report
AHIMS	Aboriginal Heritage Information Management System
ACHMP	Aboriginal Cultural Heritage Management Plan
BESS	battery energy storage system
BP	years before present
c.	circa
cm	centimetres
DC	direct current
DEC	Department of Environment and Conservation, now Heritage NSW
DECCW	Department of Environment Climate Change and Water, now Heritage NSW
DP	deposited plan
DPC	Department of Premier and Cabinet
DPHI	Department of Planning, Housing and Infrastructure
EIS	Environmental Impact Statement
EMM	EMM Consulting Pty Ltd
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FGS	fine grained siliceous
g	grams
GHG	greenhouse gas
GIS	geographical information system
GPS	global positioning system
GW	gigawatts
ha	hectare
ICOMOS	International Council on Monuments and Sites
IMTC	indurated mudstone/tuff/chert
km	kilometres
kv	kilovolts
LALC	Local Aboriginal Land Council

Abbreviation	Definition
LEP	Local Environmental Plan
LGA	Local Government Area
m	metres
m^2	square metres
mm	millimetres
MW	megawatts
MYA	million years ago
n	number
NSW	New South Wales
OEH	Office of Environment and Heritage, now Heritage NSW
PAD	potential archaeological deposit
Planning Systems SEPP	State Environmental Planning Policy (Planning Systems) 2021
PV	photovoltaic
RAP	registered Aboriginal party
REZ	renewable energy zone
SEARs	Secretary's Environmental Assessment Requirements
SSD	State significant development
SSI	State significant infrastructure
t	tonne
TP	test pit

Glossary

Many of these definitions have been taken from the *Code of Practice for archaeological investigation of Aboriginal objects in NSW* (DECCW 2010).

Aboriginal object: A physical manifestation of past Aboriginal activity. The legal term is defined in the *National Parks and Wildlife Act 1974* Section 5 as: any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.

Typical examples include stone artefacts, grinding grooves, Aboriginal rock shelters which by definition include physical evidence of occupation, midden shell, hearths, stone arrangements and other landscape features which derive from past Aboriginal activity.

Archaeological survey: A method of data collection for Aboriginal heritage assessment. It involved a survey team walking over the land in a systematic way, recording information. Activities are not invasive or destructive.

Aboriginal culturally modified tree: A tree of sufficient age to have been mature at the time of traditional Aboriginal hunter-gatherer life and therefore generally of more than 220 years ago with evidence of bark or cambium wood removal for the purpose of implement manufacture, footholds, bark sheet removal for shelter, or extraction of animals or other food. Care must be taken to distinguish Aboriginal scars from the much more common natural causes of branch tear, insect attack, animal impact, lightning strike and dieback. Culturally modified tree recognition guidelines exist to distinguish these features. Naturally scarred trees are often misidentified as Aboriginal culturally modified trees.

Aboriginal site: The location where a person in the present day can observe one or more Aboriginal objects. The boundaries of a site are limited to the extent of the observed evidence. In the context of this report a 'site' does not include the assumed extent of unobserved Aboriginal objects (such as archaeological deposit). Different archaeologists can have varying definitions of a 'site' and may use the term to reflect the assumed extent of past Aboriginal activity beyond visible Aboriginal objects. Such use of the term risks defining all of Australia as a single 'site'.

Aboriginal stone artefact: A stone object with morphological features derived from past Aboriginal activity such as intentional fracture, abrasion or impact. Artefacts are distinguished by morphology and context. Typically flaked stone artefacts are distinguished from naturally broken stone by recognition of clear marginal fracture initiation (typically herzian/conchoidal or wedging initiation) on highly siliceous stone types which can often be exotic to the area. Care must be taken to distinguish modern broken stone in machine impacted contexts and therefore context must be carefully considered as well as morphology.

Aggradation: a term used in geology for the increase in land elevation, typically in a river system, due to the deposition of sediment.

AHIMS: Aboriginal Heritage Information Management System — a computer software system employed by the Office of Environment and Heritage to manage many aspects of Aboriginal site recording and permitting. AHIMS includes an Aboriginal sites database which can be accessed via an internet portal.

Archaeological deposit: Aboriginal objects occurring in one or more soil strata. The most common form of archaeological deposit relates to the presence of a single conflated layer of Aboriginal stone artefacts worked into the topsoil through **bioturbation**.

Backed artefact: A thin flake or blade-flake that has been shaped by secondary flaking (**retouch**) along one lateral margin. The retouched margin is typically steep and bipolar to form a blunt 'back' in the manner of a modern scalpel blade. Distinctive symmetrical and asymmetrical forms are typically found called geometric **microliths** and Bondi points respectively. A thick symmetrical form, called an Elouera, is typically the size of a mandarin segment.

Bioturbation: Is the reworking of soils and sediments by animals or plants. Its effects include changing texture of sediments (diagenetic), bioirrigation and displacement of microorganisms and non-living particles.

Bipolar flaking: Where the stone to be worked is rested on an anvil or other stone before being hit by the hammerstone. This results in the presence of negative flake scars on both ends of the core.

Bondi point: See backed artefact definition.

Brown podosols: Topsoils have loamy textures. A2 horizons are common, there is a clear boundary onto the B horizon. They have a sandy clay to heavy clay texture (typically occur on upper and mid-slopes).

Chocolate Soils: Soils that are typically formed in a basaltic parent material where slope or bedrock strata influence drainage. Surface horizons comprise loam, clay loam or silty clay loam. There is a gradual boundary to a brown or brownish black B horizon. There is no A2 horizons.

Conchoidal: A term used in relation to fracture surfaces on Aboriginal stone artefacts - bulb-like in the manner of a bulbous protrusion on a bivalve shell.

Elouera: See backed artefact definition.

Eraillure scar: The small flake scar on the dorsal side of a flake next to the platform. It is the result of rebounding force during percussion flaking.

Exposure: estimates the area with a likelihood of revealing buried artefacts or deposits, not just an observation of the amount of bare ground.

Geometric microlith: See backed artefact definition.

Grinding grooves: Grinding grooves typically derive from the sharpening of stone hatchet heads on sandstone rock. Grooves appear as elliptical depressions of around 25 cm length with smooth bases. Although mostly occurring in association with water to wash the abraded stone dust away from the groove, such sites have been recorded away from water. Narrow grooves or broad abraded areas may occur less commonly and may be derived from spear sharpening or other grinding activities.

Haematite: a pigment featured in ochre used for tinting with a permanent colour.

Holocene: A period of time generally 10,000 years, which marks the end of the last ice age, to the present.

Igneous: relating to or involving volcanic or plutonic processes.

Indurated mudstone/tuff (IMT): the fine textured, very hard, yellowish, orange, reddish-brown or grey rocks from which stone artefacts are made.

Isotropic: Having a physical property that has the same value when measured in different directions. In relation to stone used for stone tools a fracture path is not hindered by layer boundaries or other favoured plane of cleavage.

Keeping place: A room or facility with the express and exclusive purpose of storing Aboriginal cultural heritage materials with accompanying documentation in a secure and accessible manner which protects their cultural heritage values.

Knapping: This term is used in reference to stone tool production. Specifically, it relates to the production and shaping of a block of stone (e.g. a cobble) into a stone tool. The process is called knapping, while the individual undertaking the task is often called a knapper. A knapping floor or event often referenced in the literature relates to an archaeological deposit, usually of high densities of stone artefacts, where researchers believe this process has occurred in a given locale.

Krasnozems: Mainly loams, clay loams and silty clay loams with a clear or gradual boundary to a dark reddish brown B horizon. Clays are typically light to medium and occasionally heavy.

Lithosols: Soils that have little or no profile development. They occur on steep slopes and are usually shallow and are left mainly as uncleared native bushland.

Microlith: Very small fragments of flakes retouched into geometric shapes and usually present on tools like barbed spears, arrows and sickles.

Midden: A collection of shells and associated economic remains resulting from Aboriginal food gathering and processing activity. Middens comprise shellfish remains of consistent size in a rich dark earth matrix commonly associated with stone artefacts, fish bone and animal bone although shells are commonly the most obtrusive element.

Open stone artefact site/stone artefact site: An unenclosed area where Aboriginal stone artefacts occur – typically exposed from a topsoil archaeological deposit by erosion. Typically the term is used to refer to two or more artefacts although this is an arbitrary distinction. A general 'rule of thumb' boundary definition employed by archaeologists is that artefacts or features more than 50 m apart are regarded as separate sites, however there is no theoretical imperative dictating such as rule. (The 50 m separation rule is used for the most part in EMM's work).

Pirri point: A leaf-shaped stone implement with unifacial retouch extending from the lateral margins to a central keel running the length of the dorsal surface.

Pleistocene: A period of time 2.6 million years ago to 10,000 years ago. Reference to 'Pleistocene sites' generally means reference to sites older than 10,000 years.

Podosols: Soils with accumulations of organic matter, iron and aluminium. They are usually sand textured to depth. Yellow and red podosols are generally acid neutral. Yellow podosols have coarse to medium textured A horizons.

Point cluster: A group of GPS points used to identify the locations of individual artefacts in the field.

Potential Archaeological Deposit (PAD): An area where there is an inferred presence of Aboriginal objects in the soil based on the environmental context which is typically associated with discovery of Aboriginal objects in analogous areas. This is not strictly a 'site' type, although AHIMS records it as such for the purpose of associating Aboriginal heritage Impact Permits with geographical areas.

Red podosols: Podosols with a pronounced texture contrast and clear to abrupt boundaries between A and B horizons. A2 is often massive and gravelly.

Retouch: The modification of the edges of a flake or tool by the removal of a series of small flakes.

Siliceous Sands: Sands that are usually found on coarse-grained sandstones and in sandstone colluvium. They are often sandstone outcrops present in the landscape. The topsoil has a loamy sand to light sandy clay.

Scarp: a steep slope characterised by outcropping bedrock. In this report, scarp refers to a combination of landform elements including scarp foot slopes, scarps, and cliff lines where outcropping sandstone is present in the landscape 10% and above.

Spit/s: This term reflects an arbitrary unit of depth that archaeologists excavate when lacking evidence of a stratigraphy within the soil profile. Commonly, archaeologists remove vertical intervals of 5, 10 or 20 cm, each representing a spit, down the soil profile. Through this process, archaeologists can determine the depth at which archaeological materials are found, even in soil profiles with no clear divisions or boundaries.

Spur: The lateral crests of land that descend from the summit of hills or ridges. Spurs typically extend, with decreasing elevation, closer to streams and valley floors than the main crest of a hill.

Taphonomic: The events and processes, such as burial in sediment, leading to the degradation, decomposition or preservation of objects.

Thumbnail scraper: A thumbnail sized thin flake with steep unidirectional retouch or use-wear around a convex working edge.

Transect: A sample unit which is walking line or corridor across the project area.

Upsidence: phenomena of uplift in the ground surface that can occur when underground mining approaches and undermines river valleys. It can result in cracking and buckling of river beds and rock bars and localised loss of water flow.

Visibility: The amount of bare ground on exposures which might reveal artefacts or other archaeological materials.

Yellow earths: predominantly sandy-textured soils with earthy porous fabric, weak profile differentiation and gradual or diffuse boundaries except for the darker A1 horizon.

Yellow podosols: Podosols which typically occur on the upper slopes of steep landscapes and on the mid to lower slopes of others. The A2 soil horizon is present in most profiles and the boundary change to the B horizon is generally clear. The B horizon is typically sandy clay to heavy clay.