Central West Orana Renewable Energy Zone transmission project

Technical Paper 5 - Aboriginal cultural heritage assessment

Prepared for WSP

September 2023

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Content warning

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

Executive summary

ES1.1 Project overview

The NSW Government is leading the development of Renewable Energy Zones (REZ) across NSW to deliver renewable energy generation and storage, supported by transmission infrastructure. The Central-West Orana REZ was formally declared on 5 November 2021 under the *Electricity Infrastructure Investment Act 2020* with an intended network capacity of three gigawatts. As the existing transmission network is not capable of transferring at least three gigawatts of new electricity generation in the Central-West Orana REZ, new transmission infrastructure is needed to connect the new electricity generation and storage projects in the REZ to the National Energy Market (NEM). Energy Corporation of NSW (EnergyCo), a NSW Government statutory authority, has been appointed as the Infrastructure Planner responsible for delivering the Central-West Orana REZ. EnergyCo is seeking approval for the construction and operation of new high voltage electricity transmission infrastructure and new energy hubs and switching stations that are required to connect energy generation and storage projects within the Central-West Orana REZ to the existing electricity network (the project).

ES1.2 Purpose of this report

This Aboriginal cultural heritage assessment (ACHA) report provides an assessment of the potential impacts to Aboriginal cultural heritage from the construction and operation of the project and has been prepared to support and inform the environmental impact statement (EIS) being developed for the project. It documents the assessment methods, results and the initiatives built into the project design to avoid and minimise Aboriginal cultural heritage impacts, results of archaeological and anthropological investigations undertaken to identify the extent and significance of any physical remains and intangible values of past Aboriginal visitation, use and occupation within the study area, and the additional mitigation and management measures proposed to address residual impacts which cannot be avoided. The ACHA assessed both a broader region (study area) at a desktop level and the impact corridor (construction area) through field investigations, where possible.

This technical paper has been prepared to address the relevant Secretary's environmental assessment requirements (SEARs) for the project issued by the Secretary of the NSW Department of Planning and Environment (DPE) for the project on 7 October 2022 and 2 March 2023 (SSI-48323210).

ES1.3 Aboriginal consultation

Aboriginal consultation has been undertaken in accordance with the processes and methods outlined in *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.

Overall, the project through EMM and the proponent have been liaising with 39 Aboriginal organisations and/or individuals since its inception in August 2021 to April 2023. The RAPs include locally based Wiradjuri and/or Gomeroi individuals and/or organisations based primarily in Orange, Dubbo, Wellington and Gunnedah, as well as the broader Aboriginal community with an interest in cultural heritage management. Opportunity for Aboriginal involvement in consultation for the project was provided throughout the ACHA, including:

1. attendance at four face-to-face and/or online meetings during key phases of the project
2. participation in a 12-week field survey of the construction area
3. participation in a six-week archaeological test excavation of the construction area
4. participation for key knowledge-holders to undertake interviews with a highly experienced anthropologist to discuss cultural values.

Ultimately, over 490 interactions have been undertaken with the RAPs across these opportunities and included some 480 person days of on-site activities. Discussions with the RAPs have been extensive and wide-ranging over the 20-month assessment process. Feedback on the project and ACHA activities has generally focussed on who speaks for Country, the tangible sites and places identified as part of the field investigations, and targeted discussion around key sites including rockshelters and grinding grooves, and their future management. These are all acknowledged in this report in Section 4.3.4, Appendix A.5, and/or proposed for management following project approval.

ES1.4 Desktop information

Previous archaeological investigations in the Central-West Orana region have spanned more than 30 years for a range of road, telecommunication and electrical infrastructure, coal mining and, more recently, for solar and wind farm developments. While data remains constrained, these studies provide a robust model of cultural materials that may be expected across the construction area. Specifically, based on the regional information available from previous archaeological investigations, cultural materials are dominated by various stone artefact densities, typically as isolated finds or clusters of less than 20, and indicative of ongoing but transient use of much of the study area. There are also significant occurrences of culturally modified trees and grinding grooves where remnant vegetation and/or suitable sandstone surfaces, respectively, are encountered. Spatially, these appear to focus on moderate sized creek-lines, such as Laheys, Sandy and Wilpinjong, but are found in a variety of landforms and contexts.

In the south-east and eastern sections of the construction area, there is an extensive presence of rockshelters and associated features (such as art and deposits), with several hundred documented through the Ulan, Wilpinjong and Moolarben coal mining sites. Rockshelter sites are highly constrained by steep sandstone relief, a topographical feature which is only encountered in the south-east and eastern sections of the study area. Excavations to date have been limited, but generally find few cultural materials – suggesting field survey is an effective investigative tool for this region – and dominated by shallow duplex soil profiles.

A review of Heritage NSW's AHIMS database identified 2,809 previously documented sites within a search area of ~4,978,538 km^2 centred on the construction area. The most common site types registered included stone artefact sites (n=2,192, 78.0%); followed by areas of potential archaeological deposit (PAD) (n=186, 6.62%), culturally modified trees (n=144, 5.13%), rockshelters (n=137, 4.88%) and grinding grooves (n=59, 2.10%). Of note are several Aboriginal ceremonial sites, and artefact scatters of very high densities (>1,000), none of which are within the construction area, but reinforce the importance of the region and certain features within it, such as Laheys Creek. Of the 2,809 previously documented sites, there are 84 within the construction area. These are dominated by various stone artefact sites (n=73, 86.9%), with lesser occurrences of culturally modified trees (n=5, 5.95%), rockshelters (n=4, 4.76%), an art site (n=1, 1.19%), and a habitation structure (n=1, 1.19%). On further review of each site's data, one of the rockshelters and the art site are mis-identified and are actually various densities of stone artefacts, while the habitation structure is a natural collapsed overhang with no evidence of past use. Seven of these sites have been previously destroyed. These sites are primarily found in the south-east of the construction area, where coal mining activities have resulted in extensive documentation of the archaeological record.

ES1.5 Summary of known cultural values

A cultural values mapping study was undertaken by Dr Philip Clarke in participation of several Elders and/or knowledge-holders identified in discussions with the RAPs. This included speaking with representatives of Warabinga Wiradjuri #7 native title applicants, Gallanggabang Aboriginal Corporation and Wellington Wiradjuri Aboriginal Corporation, as well as other Wiradjuri and/or Gomeroi individuals.

The study presented in Appendix C provides further context on the spiritual, socio-economic and environmental interactions of the Wiradjuri and Gomeroi peoples that occupied and visited the construction area and surrounds. It further outlines the conflicts and impacts of the post Contact period in the 19 and 20th centuries. This information has been integrated throughout the ACHA, and notably in Chapter 6.

Six places of cultural value were identified in close proximity to the construction area (SNI-CS1-CS6 inclusive). These include both tangible sites, such as ceremonial sites and important rockshelters, burials, and bora grounds. Some 13 travelling routes or song-lines considered of intangible values were identified, and which primarily align with moderate to large river corridors. Two that align with Cockabutta Creek near the Merotherie energy hub, and along Laheys Creek and around the southern edge of Barney's Reef, were specifically discussed by the Aboriginal participants in relation to the project.

None of these places would be directly impacted, but there may be indirect impacts, notably view-lines, and recommendations to manage and mitigate these are outlined in Chapter 12.

ES1.6 Key findings from field investigations

On-site validation consisted of field surveys and test excavations undertaken over a 10-month period by EMM archaeologists, subcontractors and representatives of 15 of the registered Aboriginal parties. In discussions with Heritage NSW, the field survey sought to encompass at least 70% of the proposed construction area. Overall, approximately 79% of the construction area was subject to linear pedestrian transects. Test excavations utilised desktop site predictions and results of the field survey to target key locales.

ES1.6.1 Field survey

The field survey encompassed some 798 kilometres (or some 3,998 hectares) of linear pedestrian transects across the construction area and included 1,228 individual points of observation and documentation. These values are in excess of the approximate 260 km construction area, but account for the need to undertake multiple transects across some portions of the construction area where a wider footprint is expected, for example, at locations where the twin 500 kV network infrastructure is collocated with 330 kV network infrastructure. In addition, some of the pedestrian transects completed at the commencement of site validation activities are no longer within the construction area; however, these have still been considered as part of this assessment for the purposes of providing context and contributing to knowledge about the existing environment of the study area.

Overall, approximately 79% of the construction area was subject to linear pedestrian transects. Some 183 Aboriginal objects, sites and/or places were documented as part of these investigations. These were dominated by stone artefact scatters (n=78) and isolated stone objects (n=65), with lesser occurrences of grinding grooves (n=15) and culturally modified trees (n=14). Of these, 82 were situated within the construction area.

ES1.6.2 Test excavations

Test excavations consisted of 128 0.25 m^2 manually dug test pits at a small number of proposed transmission tower locations, extending across the construction area, to supplement and confirm the field survey findings. Overall, some 84 artefacts were recovered, primarily between 10–20 cm below surface, with no test pits exceeding 80 cm in depth. Overall, artefact densities of 2.1/m^2 were recovered. When extrapolating values from the test excavation, four test pits (and two groups of test pits) returned values of >17/m^2, which was considered to reflect above background levels of activity. These were on average ~104 m from 2nd–4th order creek lines, with the high densities along Copes Creek and Sportsman Hollow Creek. The assemblage indicates a focus on extraction of raw materials potentially from these (and other) creeks, notably a milky quartz, and likely dating to the last few thousand years.

ES1.6.3 Summary of findings

The field survey identified 84 previously documented Aboriginal sites, places and/or deposits, 82 newly identified sites through field survey and 6 cultural deposits from test excavations within the construction area. However, there is duplication across these different activities and several sites have either been destroyed or re-assessed through previous investigations and/or this report. Ultimately, when combining and ratifying these findings, there are some 46 discrete identified sites and places along with a continuous and complex distribution of surface and shallowly buried stone artefacts distributed across the construction area (SNI-BS1, see below) – the latter encompassing the majority of the discrete site recordings in the desktop information and field survey data. These can be broken down as the following:

- Eight rockshelters, including #36-3-3794 (habitation structure), #36-3-0449, #36-3-0570, #36-3-3790, SNI-RS01, SNI-RS02, SNI-RS03, and SNI-RS04. All previously documented sites presented here are located along the footslopes and hills north of Wilpinjong Creek within the Moolarben and Wilpinjong coal mining leases. SNI-RS01 and SNI-RS02 are two newly identified sites situated in vicinity of Deadmans Creek, west of Moolarben; and SNI-RS03 and SNI-RS04 are situated near the Tuckland State Forest.

- Nine culturally modified trees, including #36-3-0565, #36-6-0626, #36-3-0638, #36-3-0103, #36-3-0643, SNI CMT-01, SNI-CMT02, SNI-CMT03, and SNI-CMT11. Of these, #36-3-0643 and #36-3-0626 may be destroyed, given they are located within the active mine lease. All of these sites were assigned a tentative classification; and all are recommended for further specialist investigation.

- Eleven grinding grooves sites, including SNI-GG01-09 inclusive, SNI-GG15 and SNI-AS65. The majority of these are found in two discrete elevations to the north-west of the Merotherie Energy Hub. SNI-GG15 was found in the south-east corner of the energy hub. SNI-AS65 included a small number of grooves (n=3) in the bed of Ironbark Creek at the proposed Neelys Lane construction camp.

- Five high density artefact scatters (>100/m^2) that are indicative of above background activity levels and reflect intense past occupation and/or repeated visitation. These include #36-3-1140, #36-3-1141, SNI-AS41, SNI-AS43 and SNI-AS57, and which are found near Bora Creek, Browns Creek, and Whites Creek.

- Seven moderate density artefact scatters (>20–50+/m^2) that are above background activity levels, but which likely reflect less intense or repeat occupation in the past. These include #36-3-0496, #36-3-0503, #36-3-0658, #36-3-0685/SNI-FA03, #36-3-0720, #36-3-0793, and SNI-AS02, and located along Cumbo Creek, Wilpinjong Creek, and Planters Creek.

- Six areas of past foci and activity characterised by high densities of sub-surface artefacts (>20/m^2), including SNI-FA01, SNI-FA02, SNI-FA04, SNI-FA05, SNI-FA06 and SNI-FA07. These are found in close proximity to Laheys Creek, Tallawang Creek, Sportsmans Hollow Creek and Copes Creek.

- A stone artefact background scatter that is predicted to occur across the construction area and extending beyond its limits, within which low artefact densities of ~2.1 - 16/m^2 may be expected (SNI-BS1). This includes 113 previously recorded isolated and low-density stone artefact sites currently documented across the construction area. These sites are typically of low significance and reflect the long-term, transient use of the entire landscape by Aboriginal people in the past.

- A zone of ~150 m encompassing the banks on either side of Prospect Creek, Sandys Creek, Laheys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Planters Creek, Cockabutta Creek, Wilpinjong Creek, Tallawang Creek and Copes Creek, within which higher densities of stone artefacts and/or other areas of past foci may be expected to be present.

ES1.7 Potential impacts

The project would consist of construction and operation of the new high voltage electricity transmission infrastructure within the construction area. This would consist of 2 new energy hubs, 14 switching stations, 90 km of twin double circuit 500 kV transmission lines, 170 kilometres of single circuit, double circuit and twin double circuit 330 kV transmission lines, underground fibre optic cabling along the transmission lines, and various access tracks, workforce accommodation camps and other ancillary construction facilities. At the time of writing of this ACHA, the design of the project was conceptual and subject to further detailed design and, as such, for the purposes of the assessment of potential impact, the entire construction area has been considered as directly affected by the project. It is envisaged that continued development of the project design would result in refinements to the areas of direct impact within the construction area.

Through the iterative approach the project has undertaken since its inception, some 55%, or 101 of the 183 of the Aboriginal sites identified during the fieldwork, have been avoided through project refinement. This includes two of the most significant sites, grinding groove complexes at Prospect Creek and Talbragar River, and several areas of cultural importance as provided by the Aboriginal participants. Other avoidance and impact minimisation activities are outlined in further detail in Section 11.2.

Of the 46 discrete Aboriginal sites and places remaining within the construction area, 37 would be potentially subject to direct impacts resulting in their complete loss. These are dominated by rockshelters, grinding grooves, culturally modified trees – many only tentatively classified – and sub-surface moderate and high-density artefact sites in close proximity to identified creek corridors. In addition, the project would directly impact some 99.47 ha of creek banks identified as having sub-surface potential. A low-density stone artefact background scatter is considered present across the entire construction area and would also be adversely affected where ground disturbance occurs. Following stakeholder feedback, EnergyCo have identified nine sites that can be avoided, and includes several high value grinding groove sites at the proposed Merotherie energy hub (SNI-GG02-09), and a significant artefact site with associated grinding groves at the proposed Neelys Lane accommodation camp (SNI-AS65). These sites may be indirectly impacted by visual impacts, potentially resulting in partial loss of value, simply due to proximity to the proposed project infrastructure. In addition, EnergyCo is continuing to explore the potential avoidance of other sites of high and moderate significance within the construction area, especially within the energy hubs and switching station sites, construction compounds and workforce accommodation camps. It is expected that the eight rockshelters (#36-3-3794, #36-3-0449, #36-3-0570, #36-3-3790, SNI-RS01 – RS04 inclusive), two additional grinding groove sites (SNI-GG01, SNI-GG15), a culturally modified tree (SNI-CMT02), and two high density artefact scatters (#36-3-1140, #36-3-1141) would be avoided or minimally adversely affected by the project. Where achieved, this would significantly reduce the potential impacts of the project. Additional works to further validate and explore the culturally modified trees and cultural deposits during continued development of the project design would also further modify these values.

The project would result in some intergenerational/cumulative impacts to cultural materials, with the loss of between 5–16% of the main site types based on desktop data presented in the ACHA. Where EnergyCo can avoid sites of moderate and high significance as is proposed, especially in the case of the grinding groove sites, these values would be significantly reduced.

There would, however, be numerous cultural heritage benefits from the project. These include the conservation of numerous sites within the eventual transmission easement, and where other development activities would be limited, a greater understanding of the past and contemporary values in the region as a result of the project, and opportunities for heritage interpretation and both Aboriginal and public outreach. Further mitigations to maximise site retention as the project is further refined is also proposed in Chapter 12.

ES1.8 Management and mitigation measures

Based on the findings of the ACHA, Table ES1 provides a series of recommendations to be implemented for the project. These should be read in conjunction with guiding principles in Appendix F.

Table ES1 Management and mitigation measures for Aboriginal cultural heritage

Reference	Impact	Mitigation measure	To be implemented prior to, or completion of	Applicable location(s)
AH1	Impact avoidance and minimisation	The project will avoid impacts to the following identified Aboriginal objects and/or sites within the construction area: • the proposed workforce accommodation camps and construction activities at the Merotherie Energy Hub will establish a heritage protection zone to avoid SNI-GG02-GG09 inclusive • the proposed workforce accommodation camps and construction activities at Neeley's Lane will establish a heritage protection zone to avoid SNI-AS65 • a protection zone will also be implemented at the Elong Elong energy hub to protect cultural material within 150 m of the eastern bank of Laheys Creek (excluding the unavoidable impacts associated with the crossing of Laheys Creek by the transmission corridor, which will be minimised). Some guiding principles for consideration of avoidance are presented in Appendix F of Technical paper 5 (Aboriginal cultural heritage assessment report)	Pre-construction Construction	SNI-GG02 – GG09 inclusive, SNI-AS65; and 150 m of Laheys Creek
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: • rockshelters (#36-3-3794, #36-3-0449, #36-3-0570, #36-3-3790, SNI-RS01 – RS04 inclusive) • grinding groove sites (SNI-GG01 and SNI-GG15) • a culturally modified tree (SNI-CMT02) • high-density stone artefact sites (#36-3-1140, #36-3-1141) • 150 m of Prospect Creek, Sandys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Cockabutta Creek, Planters Creek, Wilpinjong Creek, Tallawang Creek and Copes Creek. Some guiding principles for consideration of avoidance and/or impact minimisation are presented in Appendix F of Technical paper 5 (Aboriginal cultural heritage assessment report).	Pre-construction Construction	#36-3-3794, #36-3-0449, #36-3-0570, #36-3-3790, SNI-RS01 – RS04 inclusive, SNI-GG01, SNI-GG15, SNI-CMT02, #36-3-1140, #36-3-1141, areas within 150 m of Prospect Creek, Sandys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Cockabutta Creek, Planters Creek, Wilpinjong Creek, Tallawang Creek and Copes Creek

Table ES1 Management and mitigation measures for Aboriginal cultural heritage

Reference	Impact	Mitigation measure	To be implemented prior to, or completion of	Applicable location(s)
AH3	Impact avoidance and minimisation	On-Country meetings will be undertaken with participating Elders and key knowledge-holders of the project to discuss any potential view-line impacts of the project and places of cultural value, and their subsequent management.	Pre-construction Construction	SNI-CS4 – CS6 inclusive, and travelling routes #1 and #5 where they intersect the construction area.
AH4	Cultural heritage management	An Aboriginal Cultural Heritage Management Plan (ACHMP) will be developed by an Aboriginal heritage specialist in consultation with the Registered Aboriginal Parties (RAPs) and Heritage NSW. The contents and guiding principles for the management of identified site types for the ACHMP are presented in Appendix F of Technical paper 5 (Aboriginal cultural heritage assessment report), 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 archaeological test/salvage excavations of rockshelters, 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 method for mitigation and/or recovery of grinding grooves and 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 construction area, 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	Pre-construction Construction	Construction area, and all identified Aboriginal objects, sites and deposits in the Chapter 9 of Technical paper 5 that will be adversely impacted by the project.

Table ES1 Management and mitigation measures for Aboriginal cultural heritage

Reference	Impact	Mitigation measure	To be implemented prior to, or completion of	Applicable location(s)
		• methods of post-excavation analysis and reporting of the archaeological investigations, including suitable collection and processing of stone artefacts, palaeo-environmental, chronological and other soils from archaeological activities • a monitoring regime for implementing the above measures.		
AH5	Cultural heritage management	Additional archaeological field survey will be undertaken of the portions of the construction area inaccessible during the Aboriginal cultural heritage assessment. Any identified Aboriginal objects, sites, places and/or deposits during these works will be integrated into the ACHMP (AH04).	Pre-construction	Previously unsurveyed portions of the construction area
AH6	Cultural heritage management	Where construction is unable to avoid areas within 150 m of Prospect Creek, Sandys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Cockabutta Creek, Planters Creek, Wilpinjong Creek, Tallawang Creek and Copes Creek, archaeological test excavations will be undertaken. Test excavations will adopt the methods outlined in Appendix F and/or developed in the ACHMP (AH04). The findings of the test excavations will be integrated into the ACHMP (AH04).	Pre-construction	The construction area, where it is located within 150 m of Prospect Creek, Sandys Creek, Laheys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Cockabutta Creek, Planters Creek, Wilpinjong Creek, Tallawang Creek, and Copes Creek
AH7	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. Where identified as of cultural formation, they will be integrated into the ACHMP (AH04). The findings of this investigation and subsequent management of the trees confirmed as being culturally modified will be integrated into the ACHMP (AH04) as required.	Pre-construction	#36-3-0565, #36-6-0626, #36-3-0638, #36-3-0103, #36-3-0643, SNI-CMT01, SNI-CMT02, SNI-CMT03, SNI-CMT06, SNI-CMT08, SNI-CMT11, SNI-CMT13, SNI-CMT15

Table ES1 Management and mitigation measures for Aboriginal cultural heritage

Reference	Impact	Mitigation measure	To be implemented prior to, or completion of	Applicable location(s)
AH8	Cultural heritage management	Archival recording will be undertaken of all rockshelters, grinding grooves, and culturally modified trees that may be adversely impacted by the project. Archival recording will be undertaken in accordance with relevant Heritage NSW guidelines.	Pre-construction	#36-3-3794, #36-3-0449, #36-3-0570, #36-3-3790, SNI-RS01 – RS04 inclusive, SNI-GG01, SNI-GG15, #36-3-1140, #36-3-114; and as required following AH03: #36-3-0565, #36-6-0626, #36-3-0638, #36-3-0103, #36-3-0643, SNI-CMT01, SNI-CMT02, SNI-CMT03, SNI-CMT06, SNI-CMT08, SNI-CMT11, SNI-CMT13, SNI-CMT15
AH9	Heritage interpretation	An Aboriginal heritage-interpretation strategy and plan will be developed by an Aboriginal heritage specialist, in consultation with Registered Aboriginal Parties, which will identify the interpretive values of the construction 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 Appendix F of Technical paper 5 and include the need to incorporate Registered Aboriginal Parties' views on traditional and contemporary values, local ethnographic and post-Contact information, and archaeological data developed for the project.	Construction Post-construction	Construction area
AH10	Aboriginal engagement	Consultation will be maintained with the Registered Aboriginal Parties during the finalisation of the assessment process and subsequent stages of the project where cultural heritage requires management.	Pre-construction Construction	-
AH11	Administrative	A copy of the Aboriginal cultural heritage assessment report 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	All Aboriginal objects, sites and places described in Chapter 9 of Technical paper 5.

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1 Introduction

1.1 Background

New South Wales (NSW) is currently undergoing an energy sector transformation that will change how we generate and use energy. The NSW Government is leading the development of Renewable Energy Zones (REZs) across NSW to deliver renewable energy generation and storage projects, supported by transmission infrastructure. A REZ connects renewable energy generation and energy storage systems to transmission infrastructure via energy hubs, requiring the coordination of power generation, power storage and transmission infrastructure. By doing so, REZs capitalise on economies of scale to deliver clean, affordable and reliable electricity for homes, businesses and industry in NSW.

The Central-West Orana REZ was formally declared on 5 November 2021 under the *Electricity Infrastructure Investment Act 2020*. As NSW's first REZ, the Central-West Orana REZ will play a pivotal role in underpinning NSW's transition to a clean, affordable and reliable energy sector. The Central-West Orana REZ declaration (November 2021) provides for an initial intended network capacity of three gigawatts. The NSW Government is proposing to amend the declaration to increase the intended network capacity to six gigawatts, which would allow for more renewable energy from solar, wind and storage projects to be distributed through the NSW transmission network.

The proposed amendment is consistent with the NSW Network Infrastructure Strategy (EnergyCo, 2023) which identifies options to increase network capacity to 4.5 gigawatts initially under Stage 1 (which would be based on the infrastructure proposed in this assessment) and up to six gigawatts by 2038 under Stage 2 (which would require additional infrastructure beyond the scope of this assessment, and subject to separate approval). The proposed amendment also supports recent modelling by the Consumer Trustee in the draft 2023 Infrastructure Investment Objectives Report (AEMO, 2023) showing more network capacity will be needed to meet NSW's future energy needs as coal-fired power stations progressively retire.

Energy Corporation of NSW (EnergyCo), a NSW Government statutory authority, has been appointed as the Infrastructure Planner under the *Electricity Infrastructure Investment Act 2020*, and is responsible for the development and delivery of the Central-West Orana REZ. EnergyCo is responsible for coordinating REZ transmission, generation, firming and storage projects to deliver efficient, timely and coordinated investment.

EnergyCo is seeking approval for the construction and operation of new electricity transmission infrastructure and new energy hubs and switching stations that are required to connect energy generation and storage projects within the Central-West Orana REZ to the existing electricity network (the project).

1.2 Project overview

The project comprises the construction and operation of new electricity transmission infrastructure, energy hubs and switching stations within the Central-West Orana REZ. The project would enable 4.5 gigawatts of new network capacity to be unlocked by the mid-2020s (noting the NSW Government's proposal to amend the Central-West Orana REZ declaration to allow for a transfer capacity of six gigawatts) and enable renewable energy generators within the Central-West Orana REZ who are successful in their bids to access the new transmission infrastructure to export electricity onto the National Electricity Market (NEM). A detailed description of the project, including a description of key project components, the construction methodology and how it would be operated is provided in Chapter 3 of the EIS.

1.2.1 Features

The project would comprise the following key features:

- a new 500 kV switching station (the New Wollar Switching Station), located at Wollar to connect the project to the existing 500 kV transmission network
- around 90 kilometres of twin double circuit 500 kV transmission lines and associated infrastructure to connect two energy hubs to the existing NSW transmission network via the New Wollar Switching Station
- energy hubs at Merotherie and Elong Elong (including potential battery storage at the Merotherie Energy Hub) to connect renewable energy generation projects within the Central-West Orana REZ to the 500 kV infrastructure
- around 150 kilometres of single circuit, double circuit and twin double circuit 330 kV transmission lines, supported on towers, to connect renewable energy generation projects within the Central-West Orana REZ to the two energy hubs
- thirteen switching stations along the 330 kV network infrastructure at Cassilis, Coolah, Leadville, Merotherie, Tallawang, Dunedoo, Cobbora and Goolma, to transfer the energy generated from the renewable energy generation projects within the Central-West Orana REZ onto the project's 330 kV network infrastructure
- underground fibre optic communication cables along the 330 kV and 500 kV transmission lines between the energy hubs and switching stations
- a maintenance facility within the Merotherie Energy Hub to support the operational requirements of the project
- microwave repeater sites at locations along the alignment, as well as outside of the alignment at Botobolar, to provide a communications link between the project and the existing electricity transmission and distribution network. The Botobolar site would be subject to assessment at the submissions report stage.
- establishment of new, and upgrade of existing access tracks for transmission lines, energy hubs, switching stations and other ancillary works areas within the construction area (such as temporary waterway crossings, laydown and staging areas, earthwork material sites with crushing, grinding and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps)
- property adjustment works to facilitate access to the transmission lines and switching stations. These works include the relocation of existing infrastructure on properties that are impacted by the project
- utility adjustments required for the construction of the transmission network infrastructure, along with other adjustments to existing communications, water and wastewater utilities. This includes adjustments to Transgrid's 500 kV transmission lines 5A3 (Bayswater to Mount Piper) and 5A5 (Wollar to Mount Piper) to provide a connection to the existing NSW transmission network, including new transmission line towers along the Transgrid network along the frontage of the New Wollar Switching Station, and other locations where there is an interface with Transgrid's network.

1.2.2 Location

The project is located in central-west NSW within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter Local Government Areas (LGAs). It extends north to south from Cassilis to Wollar and east to west from Cassilis to Goolma. The location of the project is shown in Figure 1.1.

1.2.3 Timing

Construction of the project would commence in the second half of 2024, subject to NSW Government and Commonwealth planning approvals, and is estimated to take about four years. The project is expected to be commissioned/energised (i.e. become operational) in late 2027.

1.2.4 Construction

Key construction activities for the project would occur in the following stages:

- enabling works
- construction works associated with the transmission lines
- construction works associated with energy hubs and switching stations
- pre-commissioning and commissioning of the project
- demobilisation and rehabilitation of areas disturbed by construction activities.

Excavation and land forming works within the construction area would be required for transmission line tower construction, site preparation works at the energy hubs and switching station sites to provide level surfaces, to create trenches for drainage, earthing, communications infrastructure and electrical conduits, and to construct and upgrade access tracks.

Construction vehicle movements would comprise heavy and light vehicles transporting equipment and plant, construction materials, spoil and waste from construction facilities and workforce accommodation camp sites. There would also be additional vehicle movements associated with construction workers travelling to and from construction areas and accommodation camp sites. These movements would occur daily for the duration of construction.

To support the construction of the project, a number of construction compounds would be required, including staging and laydown facilities, concrete batching plants, workforce accommodation camps and construction support facilities. The main construction compounds would be established as enabling works and demobilised at the completion of construction. The size of the construction workforce would vary depending on the stage of construction and associated activities. During the peak construction period, an estimated workforce of up to around 1,800 people would be required.

1.2.5 Operation activities

During operation, the project would transfer high voltage electricity from the Central West-Orana REZ to the NEM. Permanent project infrastructure would be inspected by field staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). Regular inspection and maintenance activities are expected to include:

- regular inspection (ground and aerial) and maintenance of electrical equipment and easements
- fault and emergency response (unplanned maintenance)
- general building, asset protection zone and landscaping maintenance
- fire detection system inspection and maintenance
- stormwater maintenance

- remote asset condition monitoring
- network infrastructure performance monitoring.

Operation of the project would require the establishment of transmission line easements. These easements would be around 60 metres for each 330 kV transmission line and 70 metres for each 500 kV transmission lines. Where network infrastructure is collocated, easement widths would increase accordingly (for example, a twin double circuit 500 kV transmission line would have an easement about 140 metres wide). Vegetation clearing would be required to some extent for the full width of the transmission line easement, depending on the vegetation types present.

1.2.6 Project terminology

The following terms are used throughout this report to define the various components of the project:

- Access roads: permanent access roads to switching stations and energy hubs
- Access tracks: temporary and permanent access tracks to transmission lines
- Construction area: the area that would be directly impacted by the construction of the project including (but not limited to) transmission towers and lines, brake and winch sites, access roads to switching stations and energy hubs (not including any public roads), energy hubs, switching stations, communications infrastructure, workforce accommodation camps, construction compounds and laydown and staging areas
- Energy hub/s: an energy hub is a substation where energy exported from renewable energy generators or storage is aggregated, transformed to 500 kV (where required) and exported to the transmission network. For the project, this includes Merotherie Energy Hub and Elong Elong Energy Hub
- Study area: a general region extending beyond the construction area, and which is used to obtain information and data to inform the potential for cultural materials to be present within the construction area. The study area is variable in size with different activities adopting different scales (e.g. consultation initially considering Local Government Areas in contrast to AHIMS database searches generally within 5 km of the construction area), but in general captures an area from Dubbo and Gilgandra in the west, Mudgee in the south, Bylong in the east, and Coolah in the north
- Substation: a facility used to increase or decrease voltages between incoming and outgoing lines (e.g. 330 kV to 500 kV)
- Switching station: a facility used to connect two or more distinct transmission lines of the same designated voltage.

1.3 Study area

The project is located in the Central-West Orana region of NSW within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter Local Government Areas (LGAs) and extends north to south from Coolah to Wollar and east to west from Cassilis to Goolma. The location of the project is shown in Figure 1.1 and Figure 1.2.

This assessment refers to two aspects of the project: the study area and the construction area (see Section 1.2.5). The study area refers to a general region around the project that is used to allow environmental constraints investigations to be completed in order to inform refinement of the design of the project, including consideration of avoiding and minimising impacts to Aboriginal heritage. This extends broadly across the four Local Government Areas (LGAs) that the project is situated in: the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs. The study area varied depending on the specific desktop information being sought and its availability. For example, soil landscapes and hydrology extended over 10 km from the construction area, whereas AHIMS data was dictated by the number of sites available for download in a given area and was generally <3 km from the study area.

The construction area reflects a corridor that will be directly impacted by the project.

1.4 Purpose and scope of this report

This technical paper assesses the potential impacts to Aboriginal cultural heritage from the construction and operation of the project and has been prepared to support and inform the Environmental Impact Statement (EIS).

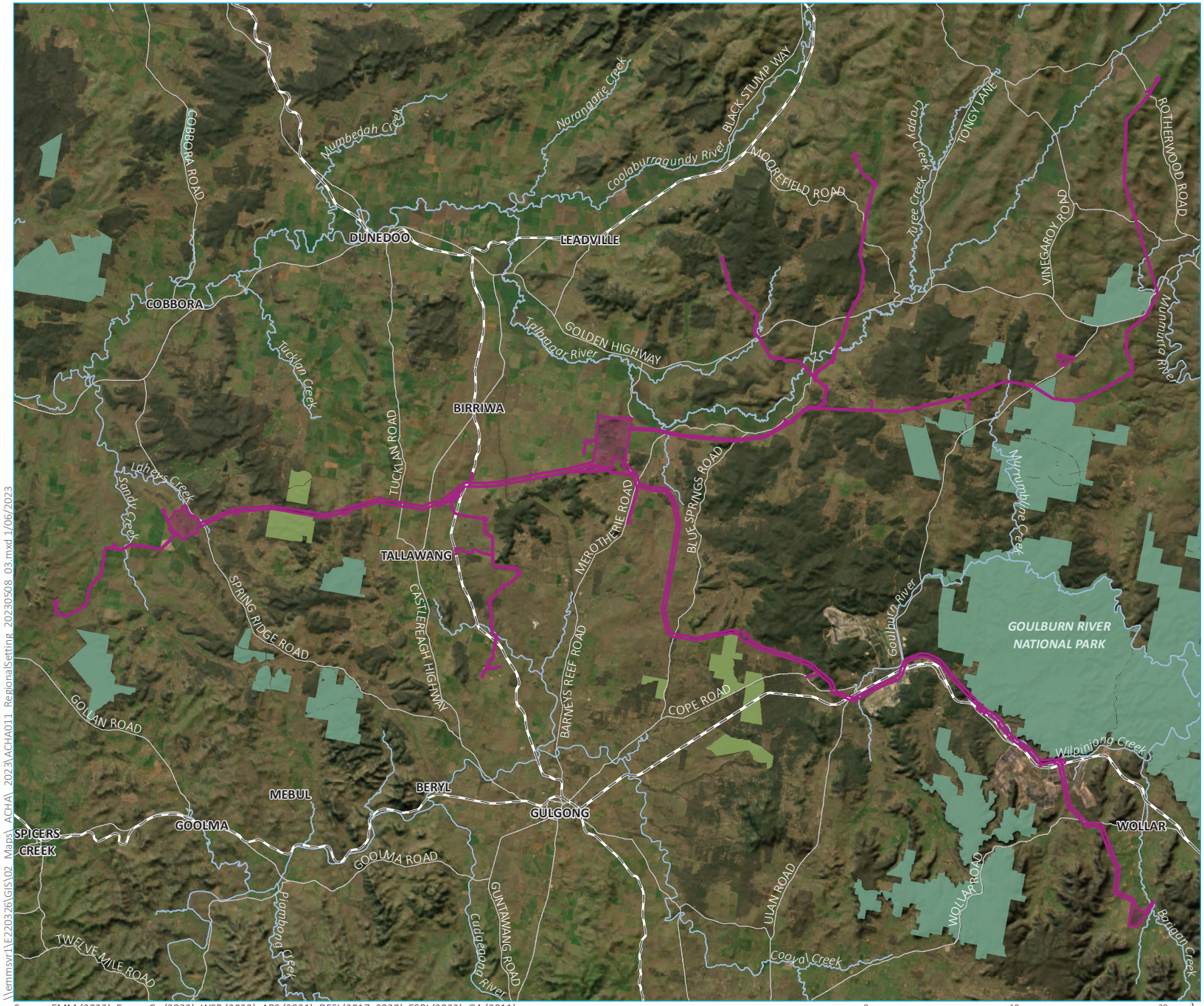
This technical paper has been prepared to address the relevant Secretary's environmental assessment requirements (SEARs) and supplementary SEARs for the project issued by the Secretary of the NSW Department of Planning and Environment (DPE) for the project on 7 October 2022 and 2 March 2023, respectively (SSI- 48323210), and the supplementary SEARs on 2 March 2023. The SEARs relevant to the assessment of Aboriginal cultural heritage are presented in Table 1.1.

This ACHA documents the results of archaeological and anthropological investigations undertaken to identify the extent and significance of any physical remains and intangible values of past Aboriginal visitation, use and occupation within the study area. The objectives of the investigations were to:

- consult with and involve key Aboriginal community members and knowledge holders to identify areas and places of cultural value within or in the vicinity of the study area
- compile a review of existing environmental, historical, and archaeological information for the study area (and focussing on the construction area) by identifying and summarising known and previously recorded Aboriginal heritage places, cultural values areas and landforms of archaeological interest in its immediate surrounds
- determine if any Aboriginal objects, places, cultural values areas, or areas of archaeological potential are present (or are likely to be present) within the construction area (with a focus on the additional study area), as well as areas of existing disturbance, through ground-truthing, including field survey and test excavations
- identify the type, nature, and extent of any Aboriginal sites, objects, archaeological deposits, potential archaeological deposits, and cultural values areas within or near the construction area
- map the locations of known and potential Aboriginal sites, objects and deposits and cultural values areas identified throughout the development of this ACHA
- assess the archaeological and cultural significance of the construction area
- assess and identify heritage constraints and opportunities and the potential impacts of the project
- identify and recommend measures to mitigate any heritage impacts and risks to the project.

Table 1.1 SEARS relevant to this report

Assessment requirement	Where addressed
- an assessment of the impact to Aboriginal cultural heritage items (cultural and archaeological) including impacts associated with transport route road upgrades, 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, including desktop information in Chapters 5 and 7, field investigations in Chapter 8, a synthesis in Chapter 9, significance assessment in Chapter 10, potential impacts in Chapter 11, and the proposed management of these impacts in Chapter 12.
- 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 4 and Appendix A.



KEY

- Construction area
- Rail line
- Major road
- Named watercourse
- NPWS reserve
- State forest

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2023); EnergyCo (2023); WSP (2023); ABS (2021); DFSI (2017, 2020); ESRI (2022); GA (2011)

0 10 20 km

GDA 1994 MGA Zone 55

N

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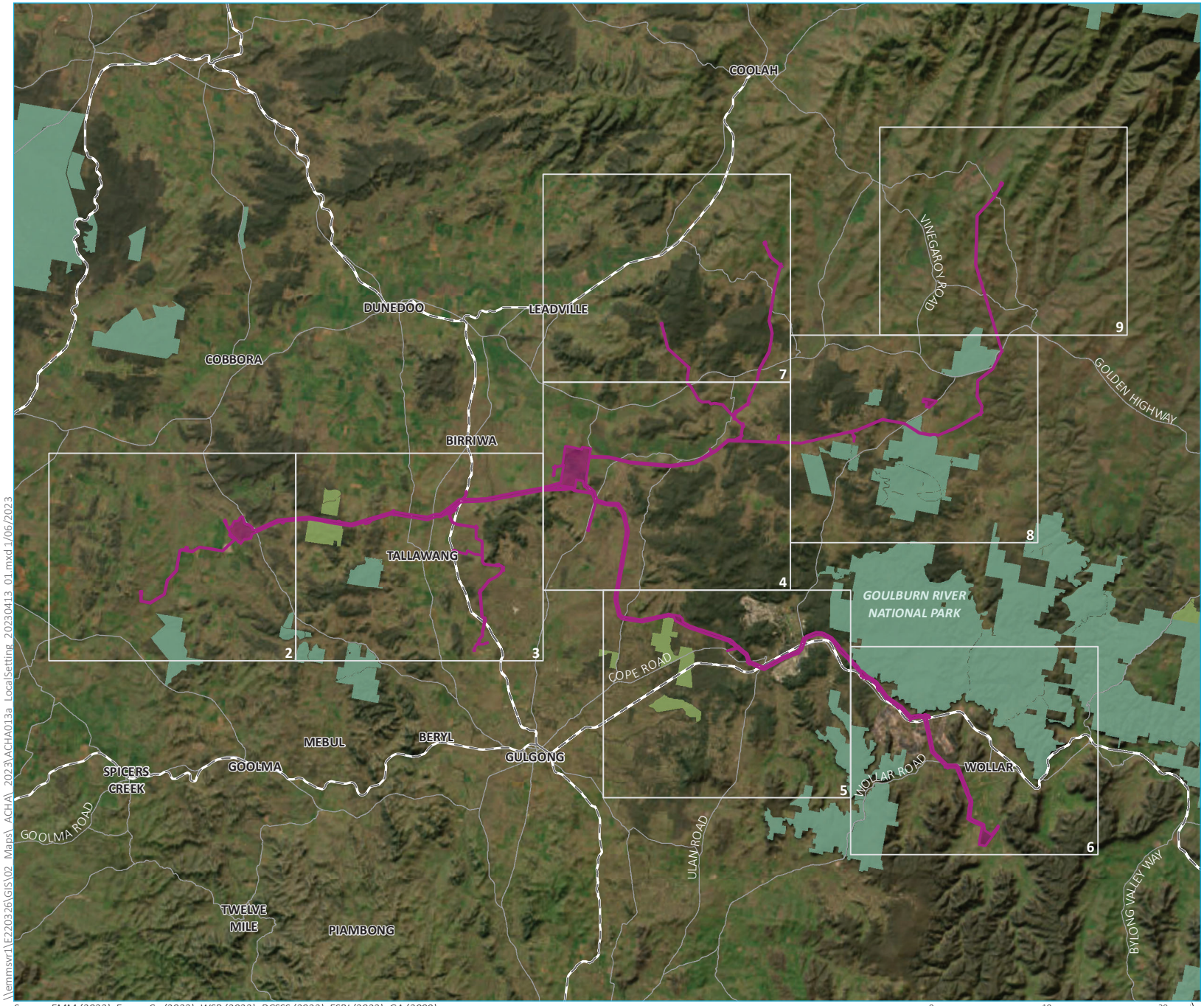
Regional setting

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 1.1

EMM creating opportunities



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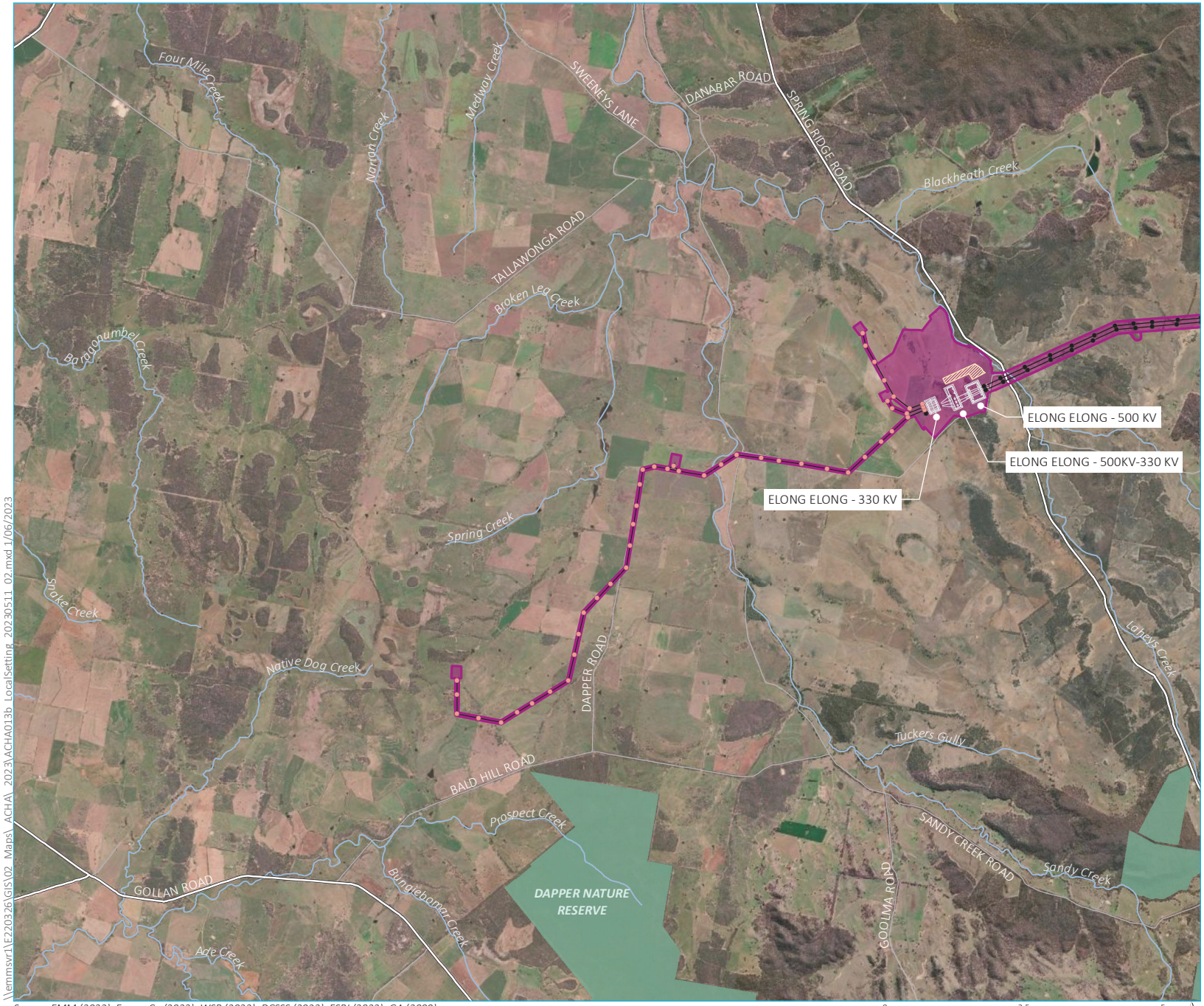
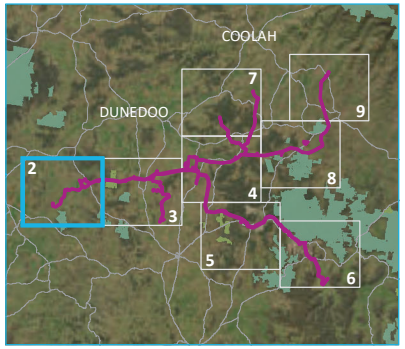
Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); GA (2009)

Local context
Map 1 of 9

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 1.2

EMM
creating opportunities





KEY

- Construction area
- Project element
- Proposed tower location
  - 330 kV
  - 500 kv
- Overhead powerline
- Substation design
- Ancillary facilities

Existing environment

- Major road
- Minor road
- Named watercourse
- NPWS reserve

Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); GA (2009)

0 2.5 5 km

GDA2020 MGA Zone 55

N

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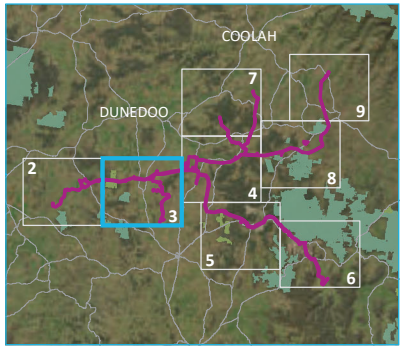
Local context
Map 2 of 9

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 1.2

EMM
creating opportunities



KEY

- Construction area
- Project element
- Proposed tower location
  - 330 kV
  - 500 kv
- Overhead powerline
- Break and winch site
- Existing environment
- Major road
- Minor road
- Rail line
- Named watercourse
- NPWS reserve
- State forest

Local context
Map 3 of 9

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 1.2

EMM creating opportunities

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); GA (2009)

0 2.5 5 km

GDA2020 MGA Zone 55

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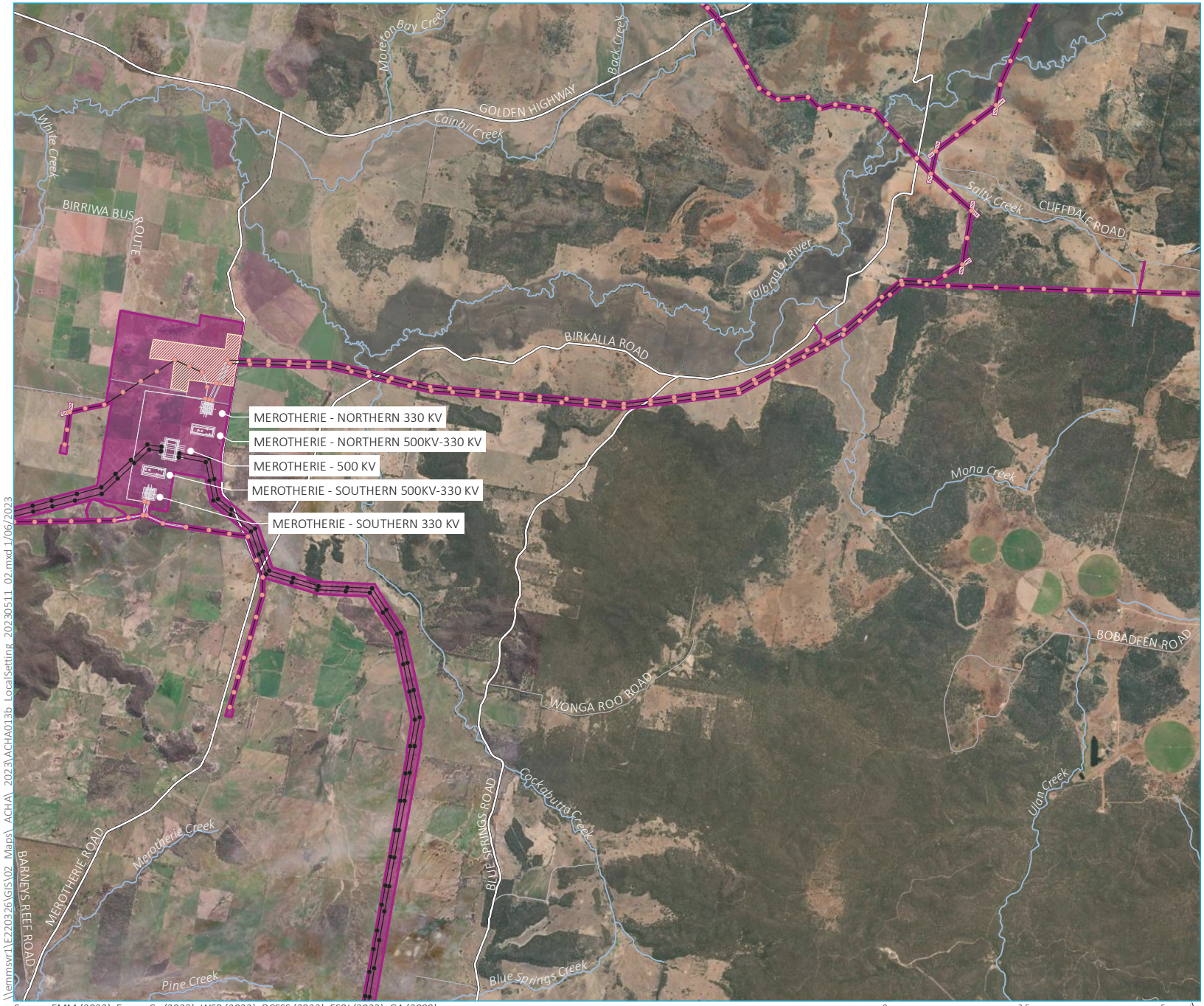

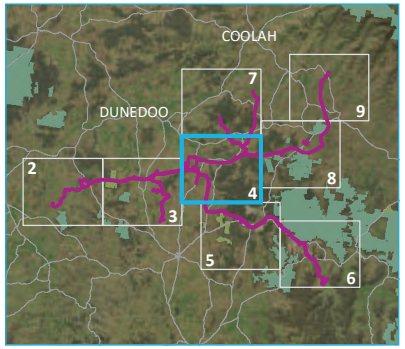

KEY

- Construction area
- Project element
- Proposed tower location
  - 330 kV
  - 500 kv
- Overhead powerline
- Substation design
- Ancillary facilities
- Break and winch site
- Existing environment
- Major road
- Minor road
- Named watercourse

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); GA (2009)

0 2.5 5 km

GDA2020 MGA Zone 55

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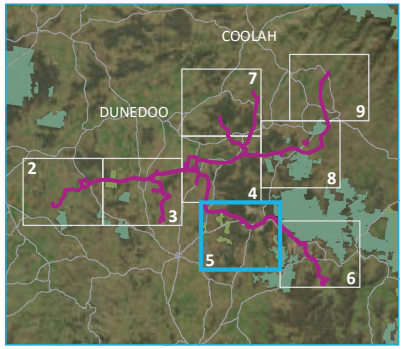
Local context
Map 4 of 9

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 1.2

EMM creating opportunities



KEY

- Construction area
- Project element
- Proposed tower location
- 500 kv
- Overhead powerline
- Break and winch site

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse
- NPWS reserve
- State forest

Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); GA (2009)

0 2.5 5 km

GDA2020 MGA Zone 55

N

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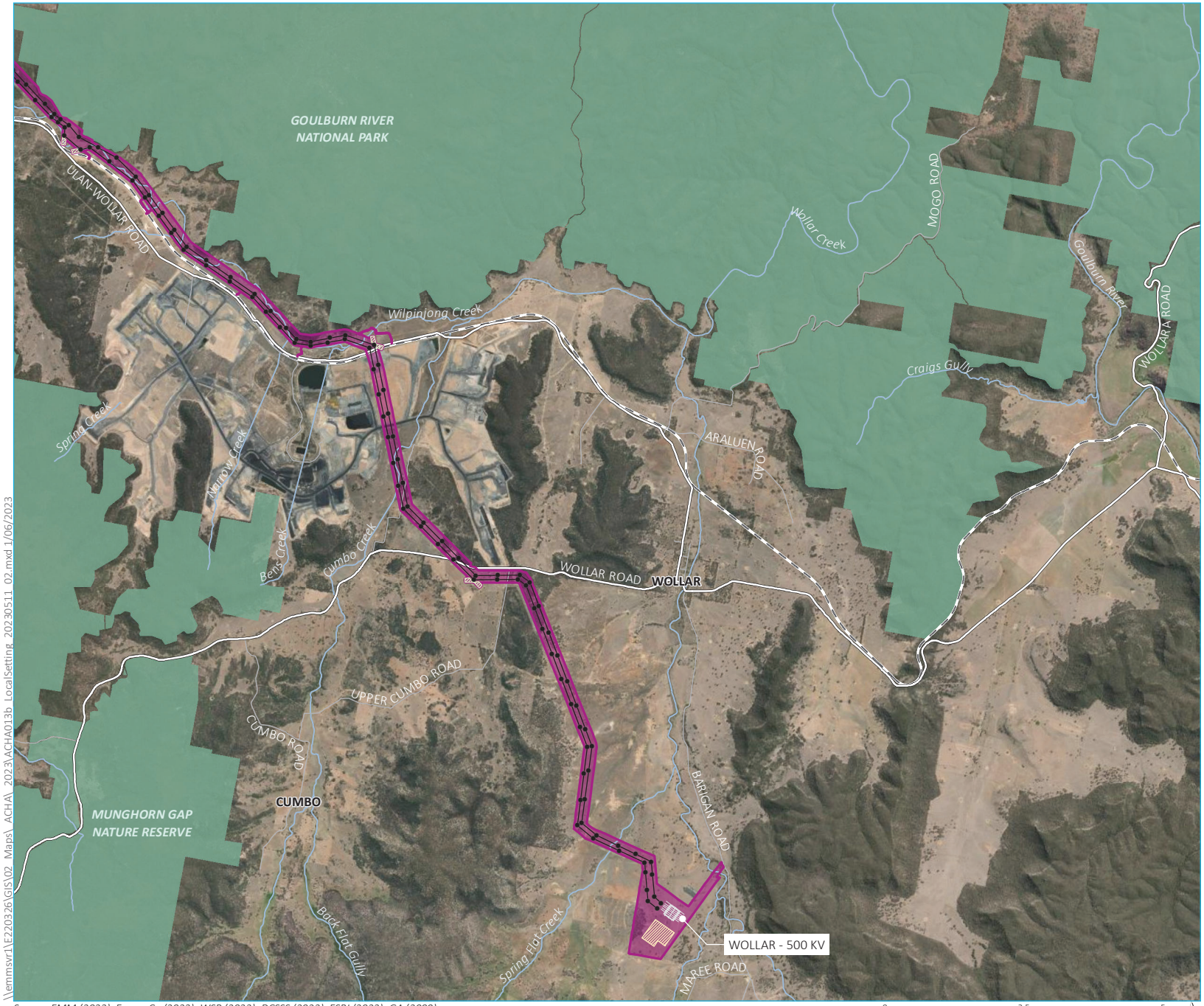
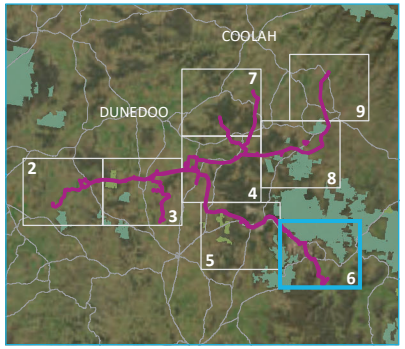
Local context
Map 5 of 9

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 1.2

EMM
creating opportunities





KEY

- Construction area
- Project element
- Proposed tower location
- 500 kv
- Overhead powerline
- Substation design
- Ancillary facilities
- Break and winch site
- Existing environment
- Major road
- Minor road
- Rail line
- Named watercourse
- NPWS reserve

Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); GA (2009)

0 2.5 5 km

GDA2020 MGA Zone 55

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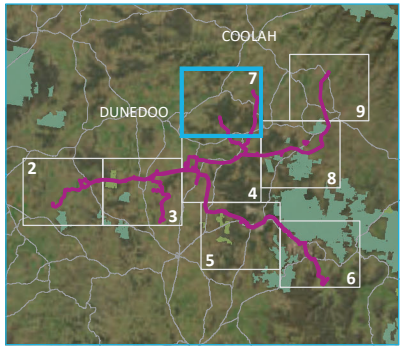
Local context
Map 6 of 9

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 1.2

EMM creating opportunities



KEY

- Construction area
- Project element
- Proposed tower location
  - 330 kV
- Overhead powerline
- Break and winch site

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

Local context
Map 7 of 9

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 1.2

EMM creating opportunities

Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); GA (2009)

0 2.5 5 km

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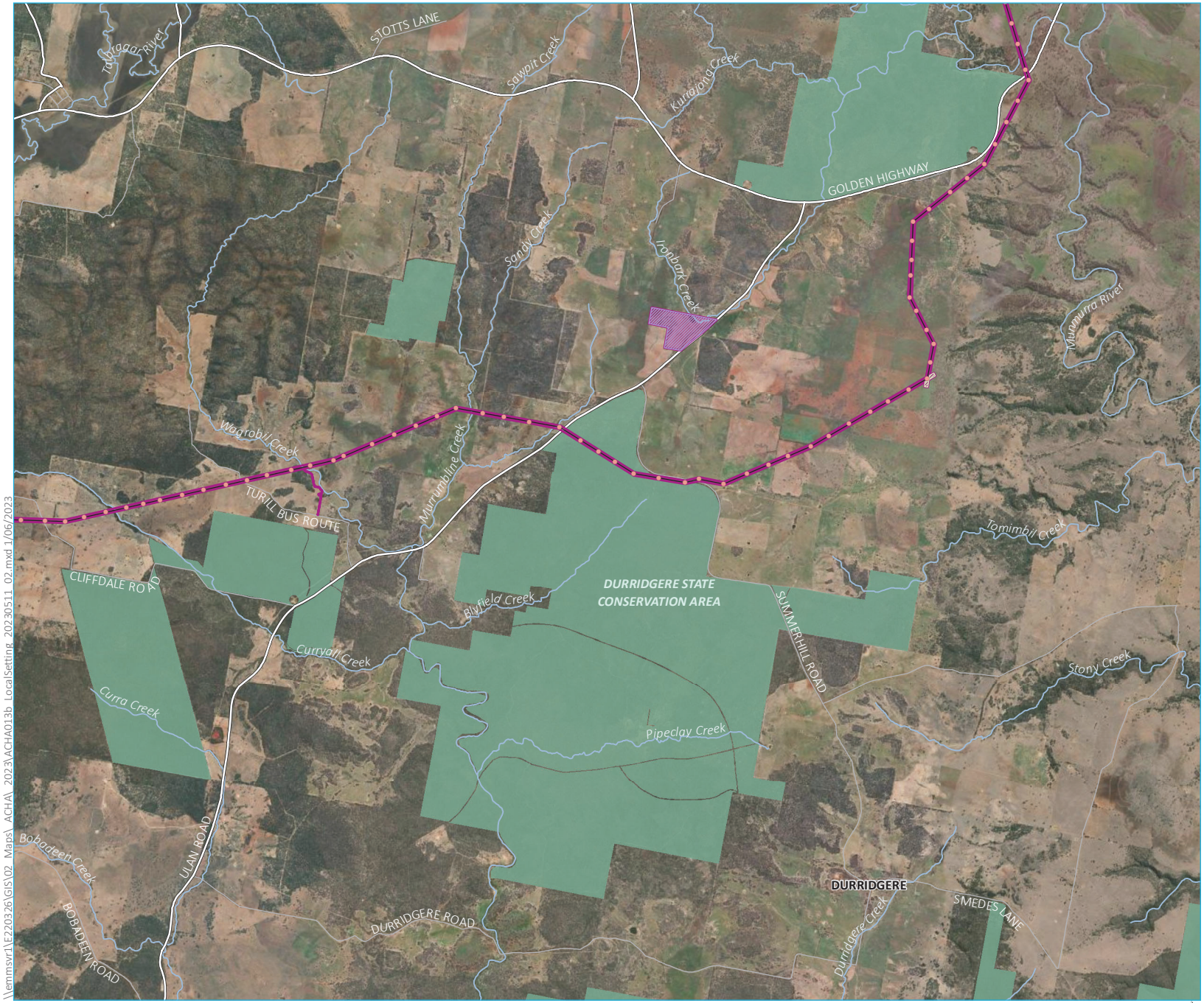

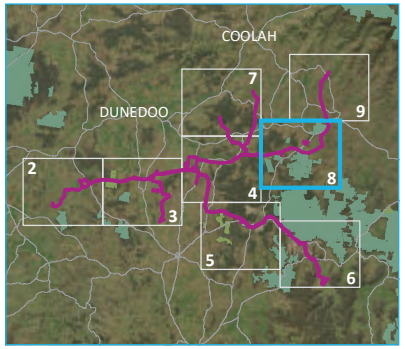

KEY

- Construction area
- Project element
- Proposed tower location
  - 330 kV
- Overhead powerline
- Accommodation camp
- Break and winch site
- Existing environment
- Major road
- Minor road
- Named watercourse
- NPWS reserve

Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); GA (2009)

0 2.5 5 km

GDA2020 MGA Zone 55

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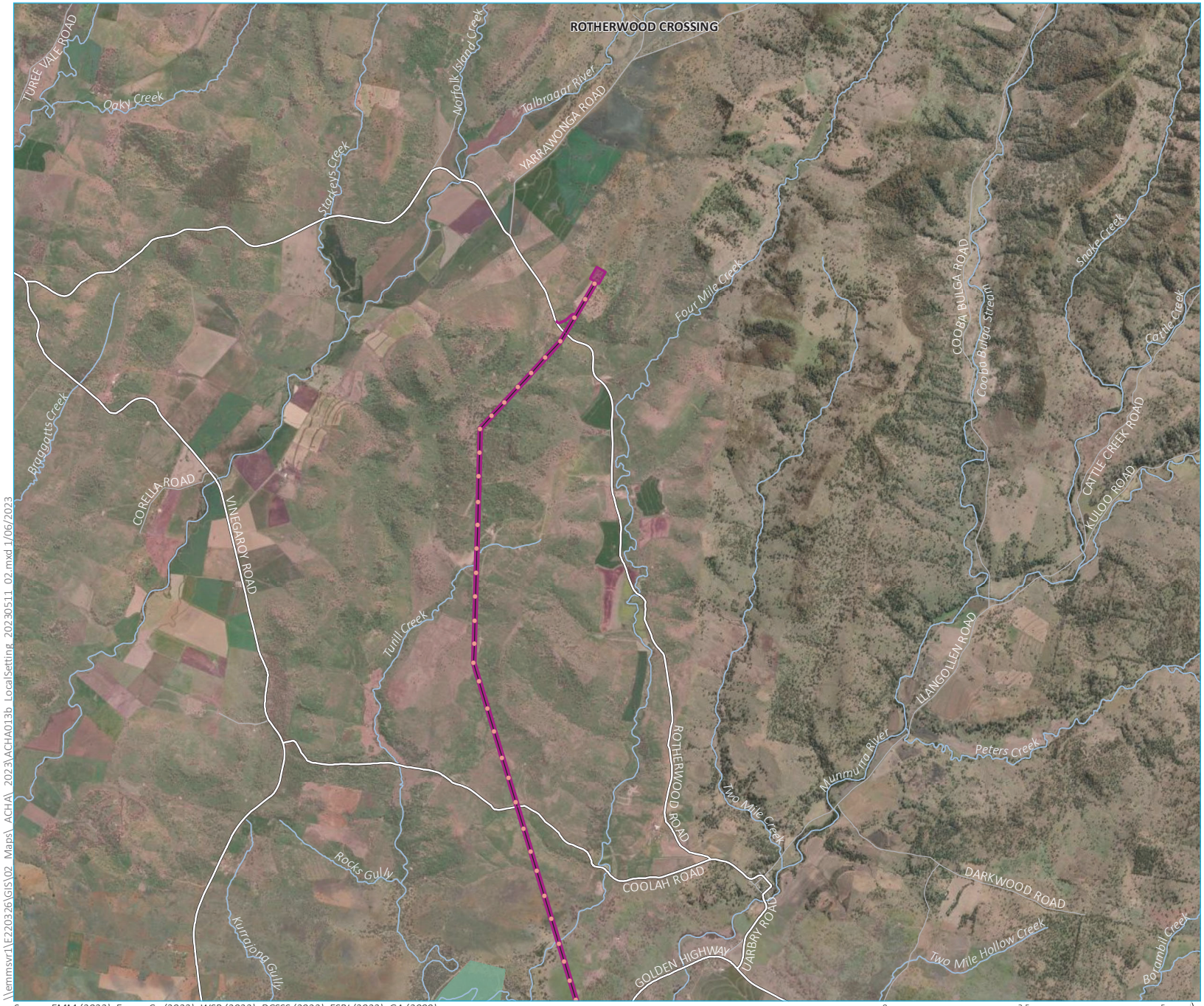
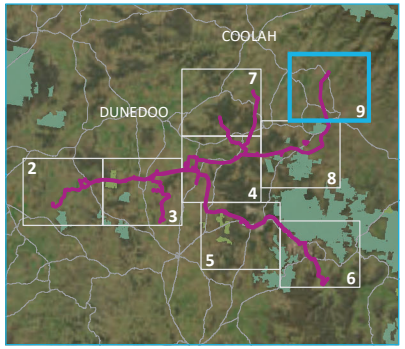
Local context
Map 8 of 9

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 1.2

EMM
creating opportunities





KEY

- Construction area
- Project element
- Proposed tower location
- 330 kV
- Overhead powerline

Existing environment

- Major road
- Minor road
- Named watercourse
- NPWS reserve

Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); GA (2009)

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Local context
Map 9 of 9

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 1.2

EMM
creating opportunities

1.4.1 Structure of the paper

The structure and content of this ACHA technical paper is as follows:

- Chapter 1 – provides an introduction to this technical paper (this chapter)
- Chapter 2 – provides the legislative framework for Aboriginal heritage
- Chapter 3 – provides the assessment methods applied to the ACHA
- Chapter 4 – provides an overview of the Aboriginal consultation undertaken in the development of the ACHA
- Chapter 5 – describes the existing environment of the study area
- Chapter 6 – describes the ethnographic history and places in the vicinity of the study area
- Chapter 7 – describes the archaeological background of the study area
- Chapter 8 – describes the field investigations undertaken across the construction area
- Chapter 9 – synthesises the information from Chapters 5–8 to provide an overall model of the cultural materials and values within the construction area
- Chapter 10 – outlines the significance of the cultural materials and values determined in Chapter 9
- Chapter 11 – outlines the potential impacts to from operation of the project, and including cumulative impacts
- Chapter 12 –provides recommended mitigation and management measures to avoid, minimise and manage any potential impacts from construction and/or operation of the project.

The appendices to this paper are:

- Appendix A – Aboriginal consultation documentation and feedback
- Appendix B – historical aerial imagery
- Appendix C – cultural values mapping report
- Appendix D – archaeological background, including AHIMS data and site cards
- Appendix E – field investigation data, including transects and photographs
- Appendix F – provides guiding principles and further detail to inform the mitigation measures outlined in this report.

1.5 Limitations

This report is based on existing and publicly available environmental and archaeological information (including the AHIMS data) and reports about the study area. The background research did not include any independent verification of the results and interpretations of externally sourced existing reports (except where the ground-truthing was undertaken). The report further makes archaeological predictions based on these 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 non-Aboriginal heritage assessment appended to the EIS (refer to Technical Paper #6).

2 Legislative context

The following chapter outlines the Commonwealth and Stage legislation that provides the framework for the preparation of this report, including liaising with the local Aboriginal community, identifying and assessing archaeological and cultural values, and determining impacts of the project on those values. Section 2.3 provides specific reference to how each piece of legislation relates to the project.

2.1 Commonwealth

2.1.1 *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* preserves and protects areas (especially sacred or intangible sites) and places of particular significance to Aboriginal people from damage or destruction. Steps necessary for the protection of a threatened place are outlined in a gazetted Ministerial Declaration (Sections 9 and 10) and which can result in a cessation of any development activity.

In addition, the Act also protects objects by Declaration, notably Aboriginal skeletal remains (Section 12). This can be applied at a State level where a State is unwilling or unable to provide such protection.

2.1.2 *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* provides for protection of natural and cultural heritage places. The Act establishes a National Heritage List (NHL) and a Commonwealth Heritage List (CHL) upon which places of natural or cultural significance can be listed. Sites at a national level and can be in public or private ownership. The CHL is limited to places owned by the Commonwealth, and most frequently encompass Department of Defence sites. Sites and places listed on the NHL are considered to be of State and local heritage value, even if they are not listed or documented as such at a State level.

The values of sites and places on the NHL/ CHL are protected under the Act. The Act requires that the Minister administering the Act assess any action which has, will have, or is likely to have, a significant impact on the heritage values. Where relevant, a referral is made to the relevant Commonwealth Department, and either approval, approval with controls, or rejection of the proposed action is determined.

2.1.3 *Native Title Act 1993*

The *Native Title Act 1993* provides recognition and protection for native title. The Act establishes the managing body, National Native Title Tribunal, who administers native title claims to rights and interests over lands and waters by Aboriginal people. It also administers the future act processes that allow proponents to identify and manage potential native title issues for a given activity on a site where a claim has yet to be made or finalised.

In addition, the Act provides for Indigenous Land Use Agreements (ILUA), which is an agreement between a native title group and others about the use and management of land and waters. ILUAs were introduced as a result of amendments to the Act in 1998. They allow people to negotiate flexible and bipartisan agreements to suit their particular circumstances often circumventing lengthy timeframes associated with the native title process. An ILUA can be negotiated over areas where native title has, or has not yet, been determined. They can be part of a broader determination or settled separately.

2.2 State

2.2.1 *Environmental Planning and Assessment Act 1979*

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the over-arching Act that dictates the nature of assessment and management of the environment during a development project, and within which heritage forms a component. It requires that environmental and heritage impacts are considered by consent authorities prior to granting development approvals.

The project has been declared Critical State Significant Infrastructure (CSSI) in accordance with Division 5.2, Part 5 of the EP&A Act and requires the approval of the NSW Minister of Planning and Public Spaces (or their delegate) under Section 5.13 of the EP&A Act.). This process requires an Environmental Impact Statement (EIS) to be developed for a project.

Under Section 5.23 of the EP&A Act, the following authorisations are not required under other legislation for the proposal:

- approvals under Part 4, or an excavation permit under section 139 of the *Heritage Act 1977*
- Aboriginal heritage impact permits under section 90 of the *National Parks and Wildlife Act 1974*.

In the case of Aboriginal heritage, both the assessment and approval for harm are dictated by the Secretary's Environmental Assessment Requirements (SEARs) outlining the contents and scope of the EIS, and the Project Approval that dictates controls on how a development should proceed.

2.2.2 *National Parks and Wildlife Act 1974*

The *National Parks and Wildlife Act 1974* (NPW Act) provides protection for Aboriginal objects and places across NSW:

- An Aboriginal object is defined 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".
- An Aboriginal place is defined as: "Any place declared to be an Aboriginal place under Section 84". This is a very specific piece of legislation that provides process and management of Aboriginal sites of cultural, but not necessarily scientific, values. They are commonly, but not always, associated with intangible values.
- Any place declared to be an Aboriginal place by the Minister for the Environment, under Section 84 of the Act, is also protected.

It is an offence to disturb Aboriginal objects or places without an Aboriginal Heritage Impact Permit (AHIP), which is outlined in Section 90 of the Act. Currently, such permits can be sought from the Chief Executive of the NSW Department of Premier and Cabinet (DPC), with the recent relocation of the Office of Environment and Heritage.

In the case of CSSI projects, an AHIP is not required to harm cultural materials. Rather, Aboriginal heritage is managed in accordance with the project conditions, which will have been drafted in consultation with Heritage NSW.

2.2.3 *Aboriginal Land Rights Act 1983*

The *Aboriginal Land Rights Act 1983* provides process and protocols for the transfer of vacant Crown land ownership to a Local Aboriginal Land Council, where the land is not for an essential purpose or for residential land. These lands are then managed and maintained by the Local Aboriginal Land Council.

For the purposes of this report, the Act is primarily important to inform relevant Aboriginal communities for consultation and where Crown land forms part of the development area may require additional liaison with the LALC as a potential, or existing, landowner.

2.3 Legislative context of the project

Table 2.1 presents the legislation outlined in Section 2.2 and how it relates to the project.

Table 2.1 Commonwealth and State legislation with potential relevance to the project

Legislation	Description	Relevant to Aboriginal cultural heritage assessment for 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 construction 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	Management of the *Native Title Act 1993* does not form part of the scope of this ACHA. Where crown land intersects with the construction area, it may be subject to processes and requirements under this Act. For the purposes of the Act, a review of the Native Title Tribunal website was undertaken, and identified two active claims encompassing the construction area, Warabinga Wiradjuri #7 (NC2018/002) and Gomeroi People (NC2011/006). Both of these claimant organisations were consulted as part of the ACHA process (Chapter 4). While not intersecting, the construction area, Warabinga Wiradjuri #6 (NC2016/005) also runs immediately south of the construction 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 construction area subject to a Declaration under the Act.

Table 2.1 Commonwealth and State legislation with potential relevance to the project

Legislation	Description	Relevant to Aboriginal cultural heritage assessment for the project?	Details
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 a CSSI project under Part 5, Division 5.2, of this Act, and is subject to project-specific environmental assessment and reporting requirements. These requirements (SEARs) stipulate that Aboriginal heritage must be considered as part of the EIS for the project (see Section 1.4).
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	While an Aboriginal heritage impact permit to harm tangible Aboriginal cultural heritage under this Act is not required for SSI projects, the SEARs require guidelines prepared under this Act to be adopted.
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 construction area is within the boundaries of the Mudgee, Dubbo, Gilgandra and Walhallow Local Aboriginal Land Council. Several of these are registered Aboriginal parties for this project and have been consulted. EMM has not been advised of any Registered Aboriginal Owners pursuant to Division 3 of the Act during the consultation process or field investigations.

3 Assessment methodology

This chapter provides an overview of the methods and activities implemented to develop and inform the ACHA. Further detailed information on some components is provided throughout the ACHA in Sections 4.1, 6.3, 8.2, 8.3, and 9.2.3.

3.1 Aboriginal consultation

Aboriginal consultation was carried out in accordance with the requirements of *Aboriginal cultural heritage consultation requirements for Proponents 2010* (DECCW 2010). Consultation included letters, emails and phone calls to and from Aboriginal participants, undertaken across four stages as follows:

1. Pre-notification and notification – the identification of Aboriginal individuals and/or organisations known to be interested in cultural heritage management in the region from various State and Commonwealth government agencies. Following compilation of this list, the notification (via direct correspondence, or newspaper) of these individuals and/or organisations to seek their interest in being involved (i.e. register) in the project.

2. Presentation of information and assessment methodology – the provision of project information for registered Aboriginal individuals and/or organisations (i.e. Registered Aboriginal Parties [RAPs]) to understand the proposed development activities associated within construction and operation of the project and outline the proposed assessment activities, processes and timing for the ACHA. A period of 28 days is provided to allow inputs and comment on this information.

3. Gathering information on cultural significance –liaison with registered Aboriginal individuals and/or organisations to identify tangible and intangible cultural and archaeological sites, places and values to inform the project.

4. Review of ACHA reporting – provision of the draft ACHAR to the registered Aboriginal individuals and/or organisations to provide an opportunity for input into the potential impacts, mitigation strategies and other components of the report prior to finalisation.

The project also undertook a range of other communication activities, including multiple Aboriginal focus group meetings, both on-Country and on-line, participation in cultural values mapping, field survey and test excavations.

3.2 Desktop review of existing information

A desktop review of relevant environmental databases and archaeological literature to understand the environmental conditions of the construction area, and to identify previously recorded and listed Aboriginal sites and places within the study area. The desktop review included the following:

- The identification and development of a study area (as defined in Section 1.3) to inform regional characteristics and how they extended into the construction area. The study area varied depending on the specific desktop information being sought and its availability. For example, soil landscapes and hydrology extended over 10 km from the construction area, whereas AHIMS data was dictated by the number of sites available for download in a given area and was generally <3 km from the study area.

- A review of geological, soil, elevational, hydrological and vegetation data from various public and project-specific data sources to determine the environmental characteristics of the study area, and to identify key features that may influence the presence and/or survivability of cultural materials (e.g. rockshelters will require steep rock escarpments to be present). A review of past land disturbance from aerial photography was also undertaken to determine the survivability of cultural materials within the study area, with some activities prone to removing vegetation and/or soil profiles within which they may be present.

- A review of existing archaeological studies and databases to identify previously documented cultural materials and the general characteristics of cultural materials found within the region, and which may therefore be present in the construction area. Database searches include the Heritage NSW AHIMS database and State Heritage registers, which form the primary repository of such information in NSW. A review of the Register of National Estate, Commonwealth and National Heritage lists were also undertaken.

- A review of existing ethnographic literature to identify the traditional and contemporary Aboriginal traditional owners of the construction area: identify any Contact or post-Contact sites and places that may be present and identify any intangible places, values and/or stories near the construction area. Where cultural values mapping is applied, additional oral histories, traditional and contemporary places and values may be captured.

3.3 Development of a predictive model

A preliminary Aboriginal heritage assessment was developed by EMM as part of the Scoping Report for the project. This was based on limited data but made several predictions about the potential cultural materials that may be encountered within the construction area and surrounds. Using the initial predictions of cultural materials across the construction area, combined with the additional information from the desktop review, the predictive model for the project was further refined, which identified known and/or potential cultural materials, sites and places that may be present in the construction area to be targeted for subsequent field investigations.

3.4 Field investigations

Field investigations were completed to validate the findings of the desktop review and refined predictive model. Investigations consisted of a combination of field surveys and test excavations, which are summarised below, and explained in detail in Chapter 6 and Chapter 8 of this ACHA.

3.4.1 Archaeological field survey

Archaeological field survey was completed over 12 weeks, primarily between 8 July and 24 November 2022 but extending up until 23 April 2023, and undertaken in the accordance with Heritage NSW's *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW 2010.* This included the participation of archaeologists and registered Aboriginal individuals and/or organisations undertaking pedestrian inspection of the construction area. Survey included revisitation of previously documented sites and places identified in the desktop review. The primary aims of the field 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 development as part of the project

- identify sites or areas to be avoided by development, where possible
- identify areas with minor or negligible Aboriginal cultural heritage values that hold no constraint for development as part of the project.

Following direction from Heritage NSW, the archaeological survey attempted to achieve near entire (100%) coverage of the construction area. For the majority of the project, archaeological surveys consisted of a pedestrian inspection of the construction area between ~200 and 400 m in width. A team of eight personnel (generally two archaeologists and six Aboriginal participants) spread between 10–20 m apart in a line and walked along the construction area either in a single direction or completed adjoining transects to ensure complete coverage. Overall, the archaeological field survey included the completion of about 798 km of survey units (SU) across the construction area and is equivalent to ~79% of the overall footprint. The ~21% of the construction area that was not surveyed as part of this ACHA was primarily a result of landowner access restrictions at the time of the field work being undertaken.

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). Site recording was completed in accordance with the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010). the following methods were adopted for the excavation:

- all test excavation pits were spatially located using a non-differential GPS device
- manual excavation of 0.25 m^2 test pits
- all excavation used hand tools, such as shovels, mattocks and trowels
- excavation of the first unit was in 5 cm spits, with subsequent excavation in 10 cm spits
- manual excavation continued to either: i) the base of the cultural deposits; ii) to the depth of the underlying geology; or iii) to the maximum depth possible via hand excavation (~1–1.5 m)
- wet sieving of all manually excavated material through a 5 mm sieve
- soil profiles were recorded in accordance with the Code of Practice, including scaled drawings, photographs, and written descriptions
- soil samples were collected for description, sedimentological and chronological analysis where such analysis was considered likely to contribute significant information.

3.4.2 Archaeological test excavation

A small, targeted program of test excavation was undertaken over a six-week period between 7 November and 15 December 2022 in accordance with Heritage NSW's *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW 2010.* The test excavations were carried out to validate the findings of the field survey, rather than implement a broader exploratory approach that may be employed on smaller sites. This included the participation of archaeologists and registered Aboriginal individuals and/or organisations undertaking small manually dug test pits to recover buried cultural material. All sediment recovered was wet-sieved through a 5 mm mesh, and all excavations suitably documented. The excavations for this project targeted areas identified in both the desktop information and field survey results as having potential for sub-surface cultural materials. The archaeological program focussed on proposed indicative tower pole locations in the vicinity of areas of archaeological potential based on the predictive model. These excavations are further discussed in Section 8.3, outlining the rationale, approach and findings of the archaeological program.

The archaeological program targeted 30 indicative transmission tower locations (based on a reference design for the project) that were either within or close to areas that were identified as PADs or in close proximity to 2nd order or above creek lines (Figure 8.5). The rationale was that, while the designs were conceptual and the transmission locations may change, the program would enable:

1. an overall predictive model of the cultural material distribution, with tower locations being found in a range of landforms and distances from water courses

2. provision of a general indication of the cultural materials at a given locale, even where transmission towers may be subject to some change.

3.4.3 Cultural values mapping

A cultural values mapping study was undertaken by Dr Phil Clarke, an anthropologist. This included liaison with the registered Aboriginal individuals and/or organisations to identify Elders and key knowledge-holders who may have knowledge of the intangible sites, places and stories for the construction area, and which may not have been captured during the other on-site activities. Dr Clarke undertook interviews with individuals selected by the registered Aboriginal individuals and/or organisations on Country and/or nearby to gather this information. The findings of the cultural mapping are outlined in Chapter 6 while detailed information is provided in Appendix C.

3.5 Analysis of findings

A compilation and ratification process was completed of all the disparate data collected across the various desktop and field-based activities into a single coherent understanding of the cultural materials across the construction area.

3.6 Impact assessment and mitigation

The impact assessment and mitigation approach undertaken as part of this ACHAR has included the following:

- Significance assessment – assigning a significance classification to each identified cultural site, place and story identified within the construction area. The significance of each site is determined using established criterion: scientific (including research potential), historical, aesthetic and cultural. Further details of the significance approach are provided in Section 10.1.

- Consideration of avoidance – exploration of how the project alignment was developed to avoid cultural materials identified during the ACHA process. Significant cultural materials were avoided through multiple iterations of the construction area, and these are outlined further in Section 11.2.

- Identification of potential impacts – identifying areas where avoidance and project re-design has not enabled conservation of cultural materials, and outlining where they would be adversely affected by the project. Impacts are considered by both site types and their significance to further inform the potential impacts of the project. This section also includes consideration of cumulative impacts from the project to the broader cultural assemblage of the region. Due to the indicative project design, it is assumed that complete impact of the construction area would occur, but opportunities and commitments to avoid many of the moderate and high significant sites are proposed and outlined further in Section 11.4.

- Management and mitigation strategies – provision of direction and recommendations in the management of identified cultural materials that may be adversely affected, or in close proximity to, the construction area. This includes opportunities for avoidance, conservation and mitigation measures prior to, during and following construction activities.

4 Aboriginal consultation

4.1 Summary

The following provides a summary of key activities and/or findings of the consultation activities completed as part of this ACHA:

- The consultation activities completed as part of this ACHA were undertaken in accordance with the *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, a cultural values mapping investigation with Elders and key-knowledge-holders, and extensive on-site field investigations.

- Consultation with Heritage NSW has conformed with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (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. Due to the changing nature of the project, multiple notification and information phases were implemented as part of the project between August 2021–June 2023. Several informal discussions with Heritage NSW were also undertaken primarily in relation to the scope and extent of the field investigations.

- Throughout the development of the project and progression of this ACHA, EMM and EnergyCo have been liaising with 39 RAP organisations and/or individuals since its inception in August 2021. These have been identified through the formal notification as part of the Heritage NSW consultation requirements. The RAPs include locally based Wiradjuri and/or Gomeroi individuals and/or organisations based primarily in Orange, Dubbo, Wellington and Gunnedah, as well as the broader Aboriginal community with an interest in cultural heritage management.

- Opportunity for Aboriginal involvement in consultation for the Project was provided throughout the ACHA, including: i) attendance at four face-to-face meetings during key phases of the project; ii) participation in a 12-week field survey of the construction area; iii) participation in a six week archaeological test excavation of the construction area; and iv) participation for key knowledge-holders to undertake interviews with a highly experienced anthropologist to discuss cultural values. Ultimately, over 490 interactions have been undertaken with the RAPs across these opportunities and included some 480 person days of on-site activities.

- Discussions with the RAPs have been extensive and wide-ranging over the 20-month assessment process. Feedback on the project and ACHA activities has generally focussed on who speaks for Country, the tangible sites and places identified, with a strong knowledge of numerous renewable energy projects around the construction area, targeted discussion around key sites including rockshelters and grinding grooves identified as part of the field investigation, and mitigation measures. These are all acknowledged in this report in Section 4.3.4, Appendix A.5, and/or proposed for management following project approval.

4.2 The process and methods adopted for the project

The consultation process for this project had two aims:

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

2. to identify cultural places and intangible values that may be affected by the proposed activity.

Two parallel and overlapping consultation processes were undertaken as part of the ACHA. In accordance with the SEARs, Aboriginal heritage consultation has been undertaken in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010) (Section 4.2.1).

In addition, due to the size, complexity and fluidity of the project, several project specific strategies were also employed to promote transparent and frequent two-way dialogue between the Aboriginal community and the project team (Section 4.2.2).

4.2.1 DECCW 2010 consultation guidelines

A summary of the Aboriginal consultation process for the project under these guidelines is described below.

i Notification of the project and registration of interest

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

ii Presentation of project information and 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 through the project as the nature of the assessment changes (e.g. surface ground-truthing may lead to a requirement for test excavations).

iii Gathering information about cultural significance

- Liaising with RAPs to identify both tangible and intangible cultural and archaeological sites, places and values to inform the project. While not required, this will often include on-Country activities, such as field survey and archaeological excavation, with the RAPs.

iv Review of ACHA reporting

- 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 onsite at the end of any field program and/or as part of (iii).
- 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.

4.2.2 Other communication strategies

In addition to the steps required by the guidelines outlined above, EMM implemented a range of other strategies to promote transparent and frequent two-way dialogue between the Aboriginal community and the project:

- Face-to-face and online meetings - Aboriginal focus group (AFG) meetings were held to promote two-way dialogue, allow project flexibility 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 the study area and/or nearby venue, with options for online and/or phone meetings as required.

- Field investigation participation – locally based RAPs were offered the opportunity to attend a range of field survey and test excavations activities carried out across the construction area.

- Cultural values mapping – a dedicated investigation of intangible and cultural places, stories and values by an experienced anthropologist in consultation with Elders and/or knowledge-holders across the Gulgong region. This enabled a broader range of the local Aboriginal community that would otherwise have been unable to provide input (given the rugged environment of the study area) to the project.

- Information packs and publications – the project distributed regular information to the RAPs via e-mail, phone and/or post. This was primarily project updates distributed as the project progressed through the main stages of the ACHA to keep RAPs briefed on activities. In addition, this also included the distribution of various project documents, including revisions to the ACHA methodology, maps, and various interim reporting throughout the ACHA process.

4.3 Consultation undertaken for the project

4.3.1 Liaising with the RAPs under the DECCW 2010 guidelines

Aboriginal consultation for this project has been undertaken in accordance with procedures set out in Section 4.2 and included over 480 interactions with the RAPs between August 2021 and June 2023 (Table 4.1; Appendix A.1) and 480 person days of on-site participation.

The project was subject to a number of changes in both proponent and construction area through the EIS process.

i Initial consultation by Transgrid

In 2020, the NSW Government engaged Transgrid, as NSW's jurisdictional transmission planner at the time, to carry out early development work to guide the planning of new transmission infrastructure for the Central-West Orana REZ. In December 2020, Transgrid released a preliminary study corridor for the project that ran north-west from the existing network near Merriwa, passing south of Dunedoo before connecting to the existing network east of Wellington. The preliminary study corridor developed by Transgrid also included an option to extend the new HV transmission infrastructure for the Central-West Orana REZ south of Wellington towards Lake Burrendong, including an upgrade of the existing substation at Wollar.

Between December 2020 and September 2021, Transgrid carried out community and stakeholder engagement on the preliminary study corridor for the transmission route, which included letters sent out to landowners, community information sessions, community events, social media posts and print advertisements, meetings with landowners, community members, Aboriginal stakeholders, local councils and other stakeholders, and establishment of a dedicated phone number, email address and website to provide project information.

As part of these preliminary works, initial stages of notification in accordance with the DECCW 2010 guideline was undertaken in August and September 2021 across a much broader region than present. A key outcome of these initial works was the assessment of the proposed Wollar substation (EMM 2022), which formed a small component of the broader project, and which was discussed as part of the broader construction area.

ii Current consultation by EnergyCo

In November 2021, the Central-West Orana REZ was formally declared by the Minister for Energy and Environment and EnergyCo was appointed as the Infrastructure Planner to lead the delivery of REZs in NSW. At this time, EnergyCo assumed responsibility for planning and design of the transmission corridor and engaging local communities and stakeholders to inform the development of new transmission network infrastructure within the REZ.

A second phase of notification was undertaken by EnergyCo in June and July 2022, concurrent with the development of the Scoping Report for the project. At this time, the Scoping Report corridor for the project was located within the Mid-Western Regional Council, Dubbo Regional Council and Warrumbungle Shire Council LGAs, and the notification process focussed on identified parties in these regions. This ultimately led to the discontinuance of consultation with a number of previous RAPs from the earlier phase of the project (Section 4.3.1i), who were generally within the Upper Hunter LGA (that was not part of the notification process due to the project extent at the time) and who did not respond during the second notification process.

In late 2022, continued design development resulted in the inclusion of 330 kV network infrastructure as part of the project, including transmission line connections to the (approved) Liverpool Range Wind Farm, which is partially located within the Upper Hunter LGA. As a result, a third phase of notification was undertaken – largely after field investigations – to capture this part of the construction area in the Upper Hunter LGA. This notification process used the original identified party information from the notification activities undertaken by Transgrid and EnergyCo, and undertook newspaper publications, and received additional registrants from the Upper Hunter region.

Across the three notification periods, the notification process identified 108 Aboriginal stakeholders in the region (Appendix A.2). Across the three discrete notification processes, 39 of these identified stakeholders registered an interest in the project (Appendix A.3; Table 4.2). These RAPs were dominated by locally based Wiradjuri traditional owners and organisations, but also included numerous Gomeroi individuals and organisations (with the construction area extending into the southern portion of this traditional country) as well as a number of broader Aboriginal community organisations interested in cultural heritage management. Of these 39 RAPs, 15 were more extensively involved in the on-site activities, including Mudgee and Dubbo Local Aboriginal Land Council (LALCs), the Warabinga Wiradjuri and Gomeroi native title applicants, and several other traditional owners locally based or demonstrating knowledge of the construction area and surrounds.

4.3.2 Other communication and liaison with the RAPs

A summary of the additional activities carried out with RAP involvement throughout the development of the ACHA (as outlined in Section 4.2.2) included:

- various discussions, documentation and meetings undertaken as part of the proposed Wollar substation (which at the time was part of the broader CWO REZ transmission project, but was ultimately discontinued) – 5 August 2021–24 February 2022
- Aboriginal focus group meeting (primarily focussed on Wollar substation, but included discussion of the broader project) – 26 October 2021
- project update (written/email distribution) – 16 December 2021
- Aboriginal focus group meeting 1 (introduction to project and assessment aims and methods) – 23 and 27 September 2023

- field survey of the Elong Elong energy hub and initial overview of construction area – 18–29 July 2022[1]
- project update (written/email distribution) – 11 October 2022
- field survey of the construction area – 5 September – 24 November 2022
- test excavation of targeted locations along the construction area – 7 November–15 December 2022
- project update (written/email distribution) – 7 December 2022
- field survey of proposed construction camps – 6–9 March 2023
- Aboriginal focus group meeting 2 (discussion of works to date, next steps and remaining on-site activities) – 3 and 4 April 2023
- cultural mapping field investigations – 23–27 April 2023
- opportunity for review and comment on the Draft ACHA by the RAPs in May and June 2023
- Aboriginal focus group meeting 3 (presentation of draft ACHA and discussion of key findings and proposed recommendations) – 7 and 8 June 2023.

4.3.3 Summary of Aboriginal stakeholder consultation process

Table 4.1 below provides a summary of the consultation process completed as part of this ACHA, including both steps associated with the DECCW 2010 guidelines and other communication strategies adopted for the project.

Table 4.1 Timeline and summary of the Aboriginal community consultation process completed as part of this ACHA

Stage*	Description	Date started	Date completed	Notes
1	Government Agency Pre-Notification	August 2021 2 June 2022	18 August 2021 6 July 2022	Additional details provided in Appendix A.3.
	Advertisement in *Daily Liberal, Mudgee Guardian, Koori Mail, Hunter Valley News*	7 September 2021	22 September 2021	Tearsheets are provided in Appendix A.3.
	Advertisement in Daily Liberal, Mudgee Guardian, Western Magazine, The Coolah District Dairy, Wellington & District Leader, The Merriwa District Diary, The Koori Mail	17 June 2022	13 July 2022	Tearsheets are provided in Appendix A.3.
	Advertisement in Hunter River Times, Hunter Valley News	21October 2022	9 November 2022	Tearsheets are provided in Appendix A.3.
	Notification and registration of potential Aboriginal stakeholders	8 September 2021 24 June 2022 21 October 2022	22 September 2021 13 July 2022 10 November 2022	Additional details are provided in Appendix A.3.

[1] All field activities included the participation of RAP representatives. Generally between four and six RAP representatives were involved in each day of field activities.

Table 4.1 Timeline and summary of the Aboriginal community consultation process completed as part of this ACHA

Stage*	Description	Date started	Date completed	Notes
	Provision of information to Heritage NSW and LALCs	29 September 2021 21 July 2022		Additional details are provided in Appendix A.3.
2/3	Presentation of information about the proposed project and gathering information about cultural significance	17 August 2022 13 March 2023	14 September 2022 10 April 2023	Additional details are provided in Appendix A.4.
	AFG meeting #1	23 and 27 September 2022		Additional details are provided in Appendix A.6.
	Field investigations (survey)	18 July 2022 September 2022 March 2023 17 April 2023	29 July 2022 24 November 2022 9 March 2023 21 April 2023	Additional details are provided in Chapter 8.
	Field investigation (test excavation)	7 November 2022	15 December 2022	Additional details are provided in Chapter 8.
	AFG meeting #2	3 and 4 April 2023		Additional details are provided in Appendix A.6.
4	Review of draft report	26 May 2023	16 June 2023	Additional details are provided in Appendix A.5.
	AFG meeting #3	7 and 8 June 2023		Additional details are provided in Appendix A.6.

Notes: *Consultation stages outlined in Section 4.2.1.

4.3.4 Aboriginal stakeholder feedback

Extensive Aboriginal consultation has been completed between March 2022 and June 2023. It has included over 490 interactions, including four discrete meetings with RAPs in groups or one-on-one meetings (Appendices A.1 and A.6), and some 480 person days of on-site activity. As such, discussions have been wide-ranging, initially focussing on who is relevant to the project, then the methods and approach to field investigation, and finally into the potential impacts and management of identified cultural sites and values. Where captured, minutes of the meetings are presented in Appendix A.6.

In summary, the main discussion topics have included the following:

- Who speaks for Country –early discussions were focussed on how the consultation process for the project was going to be undertaken, and who would speak for Country and participate in on-site activities. A strong preference from the local Wiradjuri traditional owners and organisations was to ensure that broader Aboriginal communities from outside of the study area that become involved through the notification of government agencies as part of the DECCW (2010) guidelines process be limited. The same sentiment was extended into concerns between several locally based Wiradjuri traditional owners and organisations and their involvement, as well as disagreement over the traditional boundaries between Wiradjuri and Gomeroi peoples, and their respective involvements in the project.

- Assessment process – understanding how SSI projects are assessed, how Aboriginal heritage fits into the SSI assessment process and the key components of the ACHA process.

- Field survey and test excavation methods and application – the continued development of the project design during the preparation of this ACHA, along with limited timeframes, resulted in ongoing communication and discussion with the RAPs with regards to changes to the construction area for this ACHA and subsequent on-site investigative activities and often multiple field mobilisations to visit and/or revisit areas as a result of these changes.

- Cultural values mapping – identification of Elders and key knowledge-holders, understanding the intangible and spiritual values of the project, sourced from both traditional and contemporary information, and subsequently discussions on the findings of these investigations towards the end of the project (Chapter 6).

- Field survey and test excavation findings – the nature of cultural materials found within the construction area and surrounds, and how they may be further investigated, managed and/or protected into the future. This included discussion over key sites identified through the field investigations, such as clusters of grinding grooves within the Merotherie Energy Hub, and several rockshelters near Deadman's Creek. A number of minor creek-lines were also highlighted as being of importance, including Laheys, Browns, Copes, Four Mile and Wilpinjong Creeks.

- Site significance, potential impacts and recommendations – discussions over the later sections of the ACHA, including the ratification process to determine how many sites and places where within the construction area, their values, the extent of potential impact and proposed mitigation measures to address these. Several participants were concerned by the number of potential impacts proposed, but acknowledged the uncertainty with the lack of detailed designs and the mitigation measures proposed that would ensure avoidance and impact minimisation of many of the key sites and places would have to be considered prior to development. More detailed discussion has also occurred on some aspects of any post approval requirements, notably the types and methods of archaeological mitigation, including 3D laser scanning of sites, archaeological salvage, et cetera.

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

A copy of the ACHA has been provided to the RAPs (Table 4.2). An original draft was provided on 26 May 2023, and a meeting was undertaken to discuss the report on 7 and 8 June 2023. Any comments are provided from this process are provided in Appendices A.5 and A.6 and summarised below:

- The meetings were well represented and are outlined in detail in Appendix A.6. Discussions indicated satisfaction with the level of on-site investigation and coverage, and the commitment to ensure any remaining areas not investigated by the ACHA would be explored in subsequent stages of the project. There were concerns over the proposal for 100% impact of the construction area given the number of Aboriginal sites and places identified; however, all acknowledged that this would ultimately be improbable with more detailed design ensuring some parts of the construction area would be minimally affected and that there are commitments in the ACHA to ensure significant sites and places would be avoided or subject to impact minimisation prior to development. Several conversations on the nature of any post-approval mitigation activities were initiated, including the need for suitable recording of all sites, the methods of managing/recovering culturally modified trees, and the need for further archaeological excavations.

    – In response to this concern, EnergyCo have committed nine sites (SNI-GG02-GG09 inclusive, and SNI-AS65) to be avoided by the proposed development and have strengthened the principles of avoidance that would apply to the detailed design phase of the proposed development.

- Jamie Currell (Kamilaroi-Yankuntjatjara Working Group) responded with a short email in support of the meeting resolutions from 8 June 2023, and in support of the ACHA outcomes and recommendations more generally.
- Bradley Bliss (Wellington Valley Wiradjuri Aboriginal Corporation) provided a letter (dated 15 June 2023) which detailed a small number of comments and corrections for the assessment. These have been considered in their relevant sections and changes integrated where possible. This included:
  - comments on the cultural mapping assessment, which have been captured in the section and the cultural values mapping report (Appendix C) and addressed specifically in Section 6.4.
  - reiterated that the location for Castle Rock's associated AHIMS site (#36-3-0646) is erroneous. Though no exact location was given, it was agreed that the site was likely a few hundred metres south.
  - noted the site name, UWF SU51/L3, for AHIMS site #36-3-0449 is erroneous in this report and should be WCP172. On checking the AHIMS search results, it appears UWF SU51/L3 is the correct site name for #36-3-0449, as it registered on the AHIMS database.
  - identified AHIMS #36-3-3794 as of moderate cultural (social) value. More broadly suggested all rockshelter sites are of, at minimum, moderate cultural (social) significance; this is captured in Chapter 10.
  - reiterated concerns regarding the 100% impact of the construction and the associated intergenerational loss for present and future generations of Aboriginal people; this is addressed in more detail above.

Table 4.2 Registered Aboriginal partes and involvement

Organisation	Date of registration	Location	AFG Meetings				Participation in field survey	Participation in test excavation
			26/10/21	23-27/9/22	3-4/4/23	7-8/6/23		
Dubbo LALC	-	Dubbo		✓		✓	✓	✓
Wellington LALC	-	Wellington					*	*
Woka Aboriginal Corporation	8 September 2021	Sydney		✓	✓	✓		
Ngumbaay Indigenous Corporation/Summit Employment	8 September 2021	Dubbo	✓					
Three Rivers Regional Assembly (TRRA)	28 June 2022	Dubbo						
Gallanggabang Aboriginal Corporation	12 August 2021	Orange	✓	✓	✓	✓	✓	✓
Murong Gialinga Aboriginal & Torres Strait Islander Corporation	4 July 2022	Mudgee		✓			✓	
Warabinga Native Title Claimants Aboriginal Corporation	28 August 2021	Kandos			✓	✓	**	**
Wurrumay Consultants	20 September 2021	Singleton						
Mudgee LALC	10 August 2021	Mudgee	✓				✓	✓
Wellington Valley Wiradjuri Aboriginal Corporation	12 August 2021; 6 July 2022	Orange	✓	✓	✓	✓	✓	✓
Natasha Rodgers	21 September 2021	-						
Corroboree Aboriginal Corporation	21 September 2021	Rouse Hill		✓	✓	✓		
Gomeroi Native Title Applicant	13 September 2021	Gunnedah				✓	✓	✓
The Gomeroi People	13 September 2021	Maitland					✓	✓

Table 4.2 Registered Aboriginal partes and involvement

Organisation	Date of registration	Location	AFG Meetings				Participation in field survey	Participation in test excavation
			26/10/21	23-27/9/22	3-4/4/23	7-8/6/23		
AT Gomilaroi Cultural Consultancy	10 September 2021; 27 June 2022	Gunnedah		✓		✓	✓	✓
Michael Long	9 July 2022	Gunnedah				✓		✓
Binjang Wellington Wiradjuri heritage Survey	13 September 2021	Dubbo		✓		✓		
Mingaan Aboriginal Corporation	28 June 2022	Lithgow						
Timothy Stubbs	27 June 2022	Blaxland		✓				
Kamilaroi Yankuntjatjara Working Group	27 June 2022	Emu Plains			✓	✓		
Edgerton Kwiembul Aboriginal Corporation	27 June 2022	Inverell					✓	✓
Jeremy Duncan	27 June 2022	Inverell						
Yurwang Gundana	28 June 2022	South Windsor						
Wiradjuri Elders Council/Wiradjuri Council of Elders	29 November 2021	Gunnedah					*	*
North- Eastern Wiradjuri	14 July 2022	Kandos		✓		✓	✓	✓
Didge Ngunawal Aboriginal Corporation	6 July 2022	Sydney		✓		✓		
Konanggo Aboriginal Cultural Heritage Services	8 July 2022	Windsor		✓	✓	✓		
Red Earth Gallery/Warrabinya Cultural Services	11 July 2022	-						
Thomas Dahlstrom	24 August 2022	Glebe		✓	✓		✓	✓
Ibbai Waggan Wiradjuri People	26 September 2022	Wellington		✓				
Ungooroo Aboriginal Corporation	21 October 2022	Singleton						

Table 4.2 Registered Aboriginal partes and involvement

Organisation	Date of registration	Location	AFG Meetings				Participation in field survey	Participation in test excavation
			26/10/21	23-27/9/22	3-4/4/23	7-8/6/23		
Jarban and Mugreba	24-October 2022	Bonnells Bay						
Hunters and Collectors	27 October 2022	Gunnedah						
AGA Services, Bawurra and Cactua	29 October 2022	Singleton						
Rose Nean***	1 November 2022	Scone						
A1 Indigenous Services Pty Ltd	6 November 2022	Glenmore Park						
Murra Bigee Mullangari	10 November 2022	Carlingford						
Girragirra Muran Aboriginal Corporation	23 August 2022	Wellington, NSW			✓			

Notes: 1. * denotes invited, but never responded/attended.

2. ** denotes invited and occasionally attended but limited by personnel availability.

3. *** Sought to be removed as a RAP on 22 May 2023.

4.4 Liaising with Heritage NSW

During the development of the ACHA for the project, various interactions with Heritage NSW have been undertaken:

- notification of the Aboriginal stakeholders involved in the project – 29 September 2021 and 21 July 2022 (Appendix A.1 and A.2)
- notification of the initiation of archaeological test excavations for the project –21 October 2022 (Appendix A.3)
- informal consultation – various discussions have occurred between EMM, EnergyCo and Heritage NSW (Nicole Davis, Manager Assessments) throughout the development of the ACHA. This has included:
  - discussions relating to the test excavation approach and strategy in late October 2021
  - provision of updates regarding the progress of the on-site investigations (including field survey and test excavations) in late November 2022.

5 Existing environment

5.1 Key findings

The following provides a summary of key activities and/or findings of this Chapter:

- The construction area extends across some 260 km between Elong Elong Merotherie, Wollar and Cassilis, and encompasses several bioregions, including Brigalow Belt South (BBS), Sydney Basin (SYB) and NSW South Western Slopes (NSS). It encompasses approximately 24 distinct geological units and nine major soil landscapes. Overall, it can be broadly divided into three main environments to inform cultural heritage:
  - In the east and south-east around Wollar and Ulan, the construction area is dominated by steep undulating hills, sandstone escarpments and ridges, with narrow defined river and creek valleys, reflecting its location along the western edge of the Great Dividing Range. These areas are more conducive to site types such as rockshelters and associated features, and grinding grooves.
  - In the west and central portions of the construction area, around Elong Elong, Tallawang, and Merotherie is dominated by gentle undulating hills and wide, poorly defined river and creek valleys. The region is more prone to flooding and swampy environments, especially west of the Merotherie Energy Hub. These areas are more conducive to site types such as surface and subsurface stone artefactual material, as well as grinding grooves where exposed bedrock is present.
  - In the north and north-east, between Merotherie and Cassilis, the construction area consists of moderate to steep undulating slopes with narrow river and creek valleys. Unlike the east and south-east of the construction area, the terrain is less steep or precipitous and lacks the open swampy resources of the west, and as such site types are likely to be limited to less intense surface and sub-surface stone artefact materials, as well as grinding grooves and cultural modified trees.
- Soil landscape mapping and field observations of the soil profiles was undertaken, focussing on the construction area. These found primarily shallow soil profiles, which limit the potential for deep cultural materials to be present and making them more prone to movement and/or loss through natural erosion processes. Deeper alluvial soils profiles were occasionally observed and constrained to larger creek corridors within the construction area, and that may be of archaeological interest depending on the age of formation.
- In terms of hydrology, the study area intersects with some 42 creek-lines. These include major watercourses, including the Macquarie, Talbragar and Goulburn Rivers, as well as significant local waterways, including Four Mile Creek, Sandy Creek, Laheys Creek, Wollar Creek, Coolaburragundy River, Tallawang Creek, and Turee Creek. These would have formed important resources to past Aboriginal populations in the region.
- The construction area has been subject to both natural and anthropogenic disturbance that will affect the survivability of cultural materials if present. These primarily include pastoral, agricultural and vegetation clearance across much of the construction area. More extensive impacts in the south-east of the construction area as a result of major coal mining activities and associated infrastructure are also evident. With these exceptions, the construction area has only been subject to localised impacts, such as dams, roads, fire trails, etc (see also Section 5.6).

5.2 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 and eels. Landscape features, such as sandstone overhangs, were useful for shelter; stone artefacts were manufactured from raw stone material that was collected from quarry sites; and stone arrangements relied on the landscape.

5.3 Landscape overview

The study area is situated within the Brigalow Belt South (BBS), Sydney Basin (SYB) and NSW South Western Slopes (NSS) bioregions (IBRA7 2012). These bioregions exhibit a wide variety of landscapes, including extensive foothills and isolated ranges, with much of the diverse topography derived from the Great Dividing Range. All three of these bioregions exhibit major river and catchment systems, including the Macquarie, Goulburn and Talbragar Rivers. These bioregions are broken down into subsequent subregions and the attributes of subregions present in the project study area are summarised in Table 5.1.

Historical agricultural, pastoral and mining activities have resulted in significant land clearance within the study area, starting from the early 1830s (Section 5.6). This long-term disturbance would have had a significant impact on the surface and subsurface integrity of the soils and archaeological material contained therein.

Table 5.1 Bioregions and subregions within the study area

Subregion	Summary
Liverpool Range (BBS)	Undulating plateau top with steep margins grading to long footslopes. Cenozoic basalt overlying Jurassic quartz sandstones and shale. Open forest of stringybark with small areas of vine forest on the plateau. Similar vegetation surrounding creeks.
Pilliga (BBS)	Extensive sandstone hills with areas of high basalt peaks. Includes the Great Artesian Basin aquifer. Jurassic age coarse-grained (quartz) Pilliga Sandstone underlies mostly sandy soils. Mainly open Eucalypt woodlands.
Talbragar Valley (BBS)	Smallest subregion included in the study area, includes the Talbragar River valley. High proportions of agriculture and pastures due to fertile soils. Mesozoic sediments formed from sandstone beds that are covered by Tertiary lava flows. Native vegetation comprising of mostly Eucalypt species and white cypress pine remains only on the slopes, as much of the environment has been cleared.
Inland Slopes (NSS)	Foothills and ranges including the western fall of the Great Dividing Range. Lachlan Fold Belt consisting of Cambrian to Early Carboniferous sedimentary and volcanic rock including granite and quartzite. Large proportion of minerals and coal found in this region. Open woodlands formed of White Box are dominant with many other Eucalypt derived tree species.
Kerrabee (SYB)	Sandstone plateau with cliffs into wide valleys with sandy alluvial fill. Triassic Narrabeen Group quartz, sandstone and shales. Volcanic derived basalt and sandy sediments also present. Ironbark forests with dry heath on the plateau. Red Gum, and Box, trees with spear grass in the valleys. River Oak along the main streams.

5.3.1 Geology

The construction area lies within the Lachlan Fold Belt (LFB) (Figure 5.1). The LFB extends approximately 700 km across south-eastern Australia primarily traversing New South Wales and Victoria, however, it also extends into south-eastern Queensland (north boundary) and north-eastern Tasmania (south boundary). It is bordered by the Thomson, New England and Delamerian orogens. Differing geodynamics in the mid-Palaeozoic along the former margin of Gondwana led to a series of compressional and extensional sporadic and migrating events which produced the LFB as it is today. Geology within the LFB typically comprises deformed, Palaeozoic deep and shallow marine sedimentary rocks, chert, mafic volcanic rock, turbidite, granite and metamorphic rocks (Gray 1997 pp. 149).

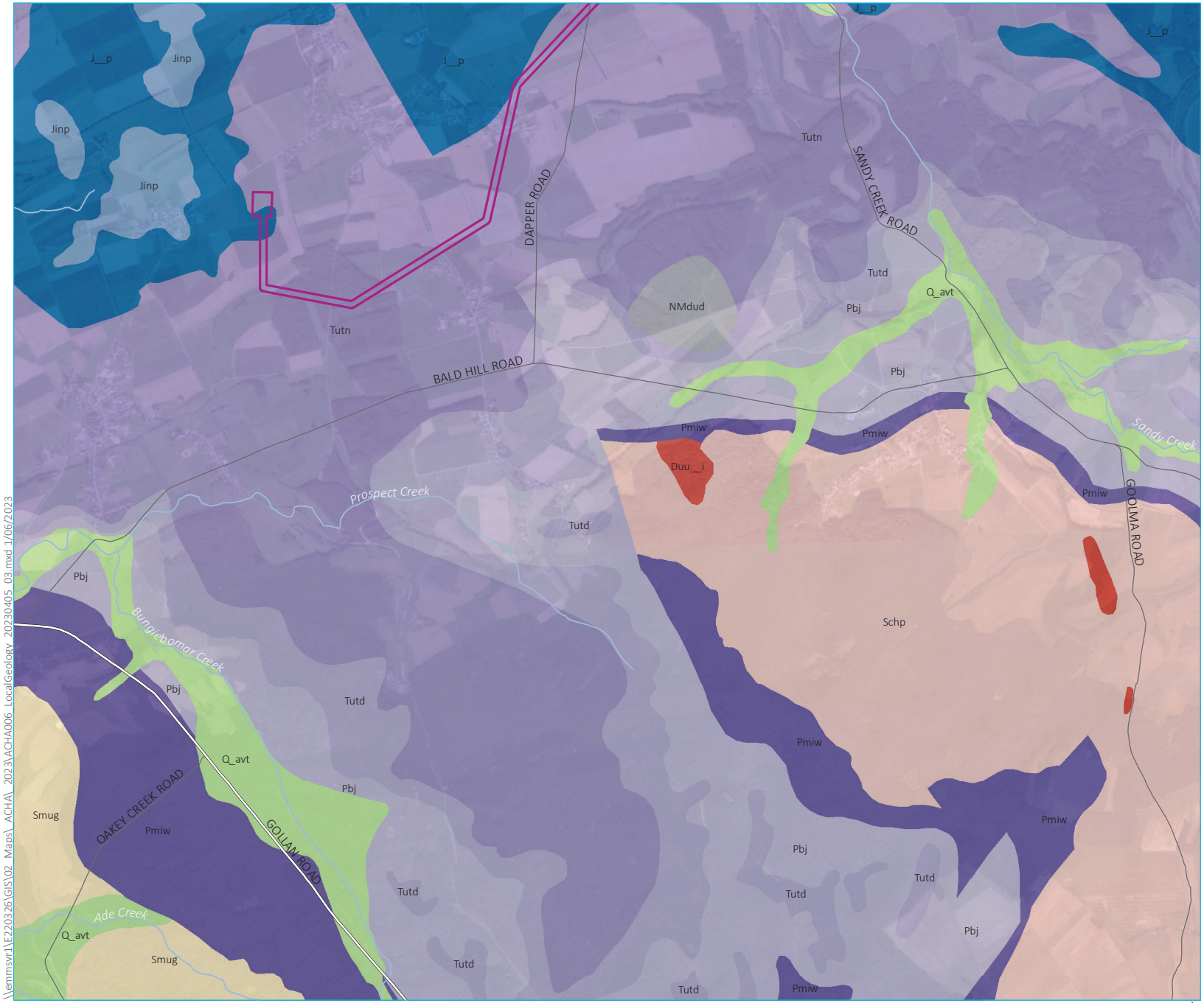
The geologic formations within the study area are diverse and consistent with the primary geological units found across the LFB (see Table 5.2). In summary, they suggest increasingly steep and rugged terrain in the eastern portions of the study area in the vicinity of Wollar, Ulan, Wilpinjong and Moolarben, which gives way to more gradual more undulating hills, flats and floodplains westwards, and including Merotherie and Elong Elong (Figure 5.2).

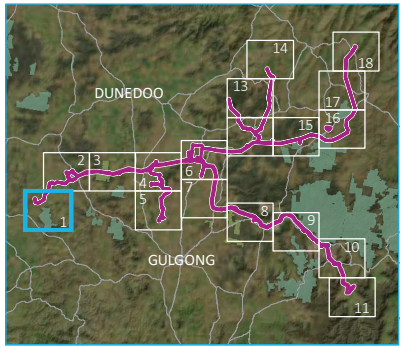
Table 5.2 Geological units within study area

Geology	Map unit	Description
Piliga Sandstone	Jp	Medium to very coarse-grained, well sorted, angular to subangular quartzose sandstone and conglomerate. Minor interbeds of mudstone, siltstone and fine-grained sandstone and coal. Common carbonaceous fragments and iron staining. Rare lithic fragments.
Narrabeen Group	Rn	Quartz-lithic to quartzose sandstone, conglomerate, mudstone, siltstone, rare coal.
Illawarra Coal Measures	Pi	Shale, quartz-lithic sandstone, conglomerate, chert, sporadically carbonaceous mudstone, coal and torbanite seams.
Shoalhaven Group	Ps	Polymictic pebble para-conglomerate, fine-grained muddy lithic sandstone, sandy micaceous siltstone, minor shale, sporadic minor carbonate and evaporite; sandstone sporadically bioturbated, abundant fossil shell fragments, drop-stones.
Gulgong Granite	Cgug	Lucocratic medium to coarse-grained porphyritic mega-crystic granite, minor aplite phases, minor quartz monzonite.
Tucklan Formation	Ocat	Dark mudstone, basalt to latite boulder conglomerate or breccia, lithic sandstone; basalt, andesite, dolerite, latite, limestone and rare chert.
Quaternary Alluvium	Cza	Unconsolidated grey to brown to beige humic micaceous silty clay, quartz-lithic silt, fine- to medium-grained quartz-rich to quartz-lithic sand, polymictic pebble to cobble gravel (as sporadic lenses); sporadic palaeosol horizons.
Comiala Shale	Jc	Shale of the Purlawaugh Formation.
Rouse Granite		Lucocratic medium to coarse-grained porphyritic mega-crystic granite, minor aplite phases, minor quartz monzonite.
Tertiary Basalt	Czb	Mafic volcanic rock; basalt from Tertiary period (~66 mya – 2.6 mya).
Botobolar Granite		Quartzolite (quartz dominated coarse grained rock) with wolframite (tungsten oxide).
Havilah Granite		Equi-granular to mega-crystic biotite granite, rare pegmatite.
Permian sandstones and shales	Pu	Conglomerate, sandstone, siltstone, shale.
Ballimore Formation	R-Jb	Quartz sandstone, lithic sandstone, conglomerate, ferruginous sandstone, red siltstone, carbonaceous shale and coal.

Table 5.2 Geological units within study area

Geology	Map unit	Description
Chesleigh Formation	Sch	Rhyolitic, felsitic and latitic volcaniclastic and quartz lithic, sandstone, siltstone, breccia, crystal tuff, vitric tuff and minor lava of the Silurian Period, Palaeozoic era.
Guroba Formation	S-Dcg	Quartzo-feldspathic arenite, siltstone, tuff and breccia.
Lana Formation	S-Dcl	Thickly bedded, crystal-lithic, rhyolitic to rhyodacitic volcaniclastic sandstone interbedded with lesser thinly-bedded, pelagic and volcaniclastic sandstone, siltstone and phyllitic shale; minor rhyolitc tuff and conglomerate.
Curoba Formation	S-Dc	Felspathic lithic greywacke and tuff, tuffaceous and quartz rich greywacke and slate, acid tuff.
Wuuluman Granite	Cgw	Quartz monzodiorite (3–8 mm) with 10% feldspar mega-crysts, accessory biotite, hornblende, sphene.
Gleneski Formation	Sg	Rhyolitic, felsic to latitic lava, intrusives and tuff.
Cuga Burga Volcanics	S-Dcb	Mafic submarine volcanics, Contian keratophyre and quartz keratophyre, lavas and tuffs, sedimentary rocks and limestone.
Mumbil Group	Sm	Comprised of poorly bedded to laminated, buff to brown to grey, quartzose shale and siltstone, minor rhyolitic tuff and tuffaceous sandstone, calcareous sandstone and siltstone of the Silurian Period, Palaeozoic era.
Oakdale Formation	Oo	Mafic volcanic sandstone; basalt, basaltic andesite, latite lavas and intrusions; volcaniclastic breccia and conglomerate, siltstone, shale, chert; minor allochthonous limestone and calcareous sediments.
Tolga Calcarenite	Dtf	Calcareous arenite and siltstone, allochthonous limestone, shale.





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Dubbo Volcanics (NMdud)

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)

Great Australian Basin

- Pilliga Sandstone (Jinp)
- Purlawaugh Formation (J__p)

Lachlan Orogen

- Gleneski Formation (Smug)
- Piambong Formation (Schp)
- Turondale Formation (Dcrt)
- Unassigned Devonian intrusions - mafic to intermediate intrusions (Duu__i)
- Unassigned Devonian intrusions - monzodiorite (Duu__x)

Permo-Triassic Basins

- Black Jack Group (Pbj)
- Digby Formation (Tutd)
- Napperby Formation (Tutn)
- Watermark Formation (Pmiw)

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

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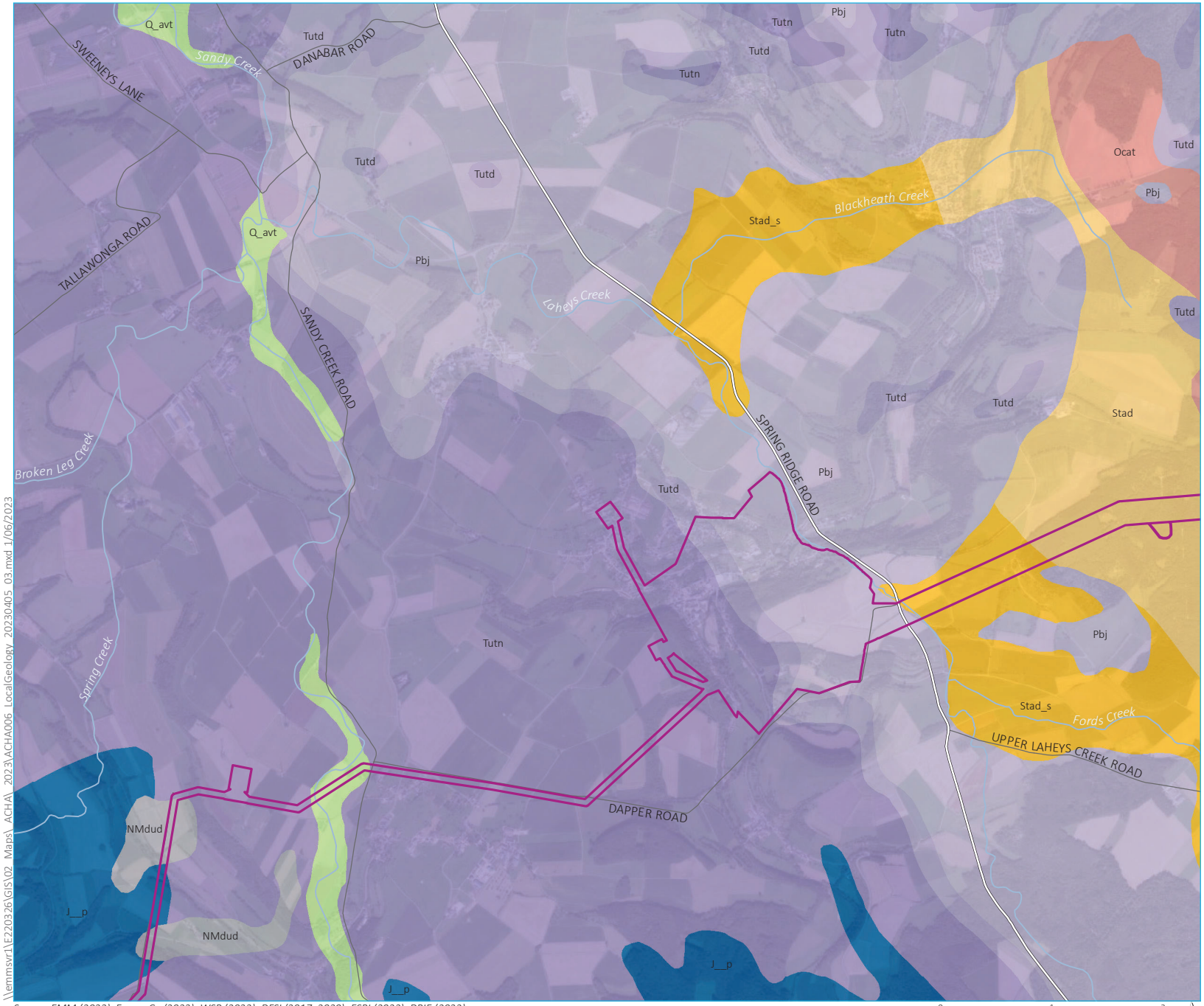
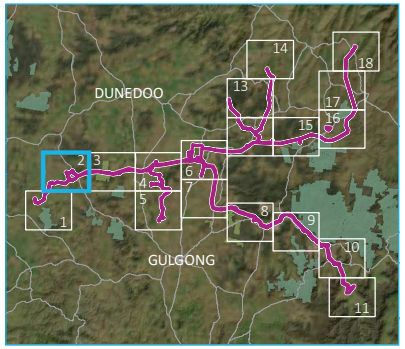
Geology
Map 1 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Dubbo Volcanics (NMdud)

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)

Great Australian Basin

- Purlawaugh Formation (J__p)

Lachlan Orogen

- Dungeree Volcanics (Stad)
- Dungeree Volcanics - shale (Stad_s)
- Tucklan Formation (Ocat)

Permo-Triassic Basins

- Black Jack Group (Pbj)
- Digby Formation (Tutd)
- Napperby Formation (Tutn)

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

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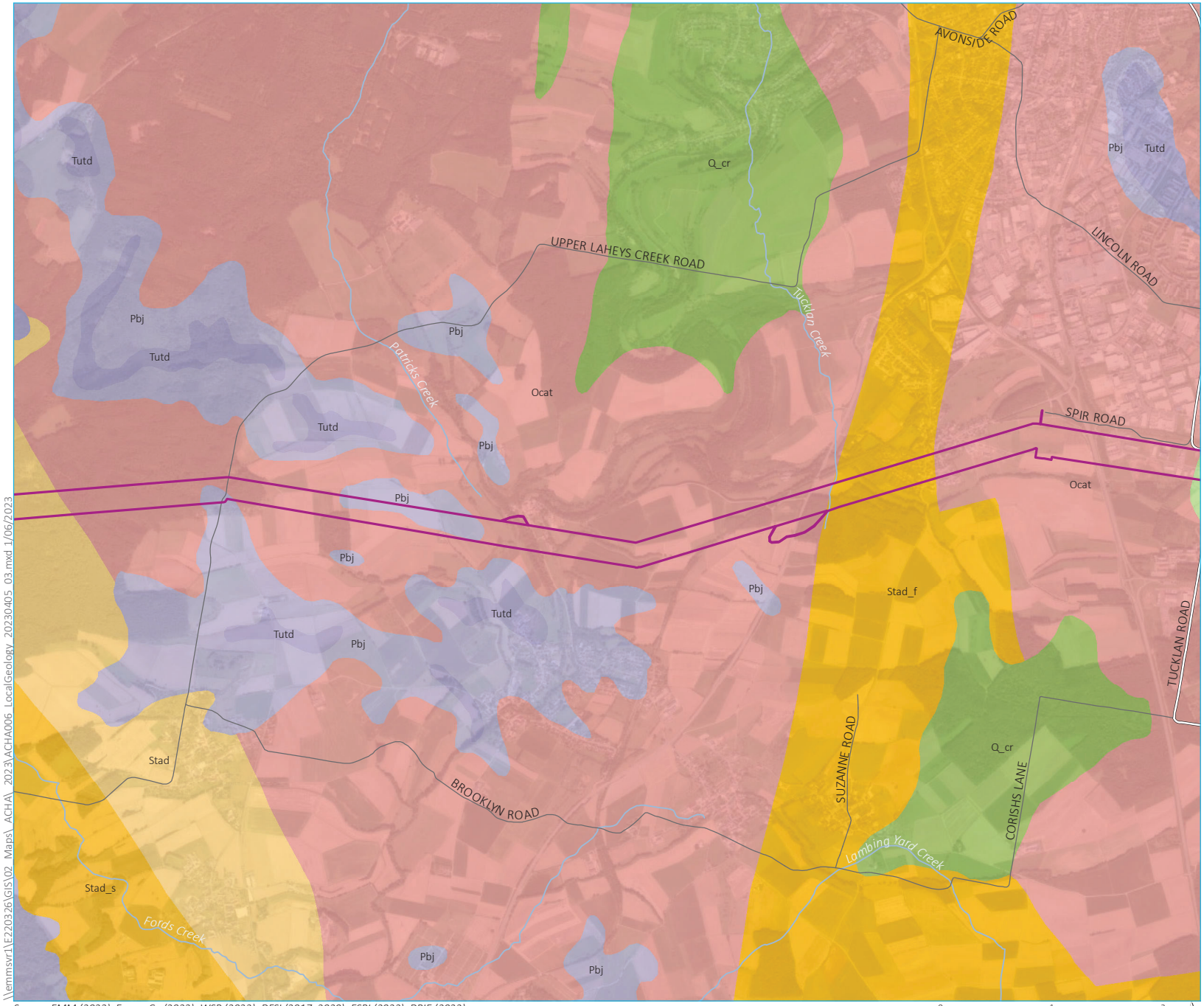
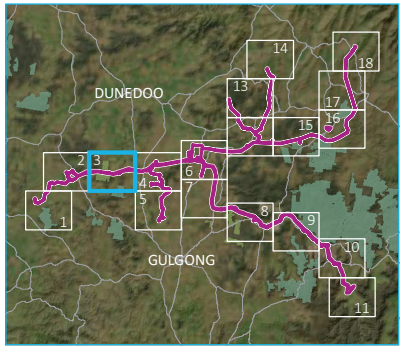
Geology
Map 2 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse

Geological unit

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)
- Colluvial and residual deposits (Q_cr)

Lachlan Orogen

- Dungeree Volcanics (Stad)
- Dungeree Volcanics - shale (Stad_s)
- Dungeree Volcanics - shale, felsic volcanic sandstone (Stad_f)
- Tucklan Formation (Ocat)

Permo-Triassic Basins

- Black Jack Group (Pbj)
- Digby Formation (Tutd)

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

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GDA2020 MGA Zone 55

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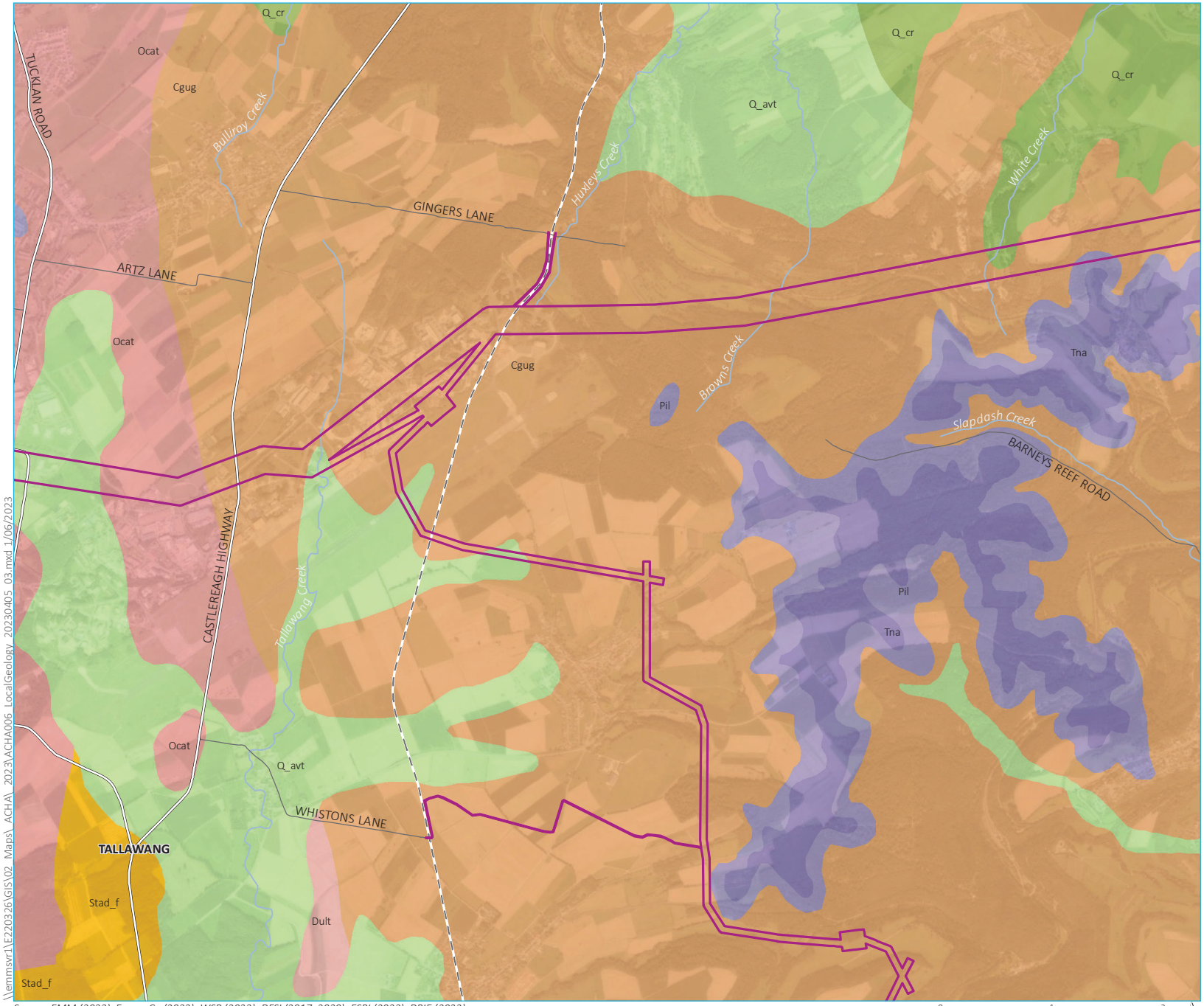
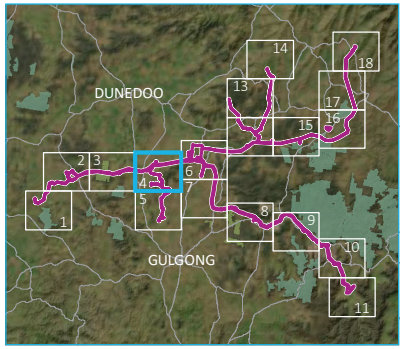
Geology
Map 3 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

Geological unit

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)
- Colluvial and residual deposits (Q_cr)

Lachlan Orogen

- Dungeree Volcanics (Stad)
- Dungeree Volcanics - shale, felsic volcanic sandstone (Stad_f)
- Gulgong Granite (Cgug)
- Tallawang Granite (Dult)
- Tucklan Formation (Ocat)

Permo-Triassic Basins

- Digby Formation (Tutd)
- Illawarra Coal Measures (Pil)
- Narrabeen Group (Tna)

INSET KEY

- Major road
- NPWS reserve
- State forest

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

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GDA2020 MGA Zone 55

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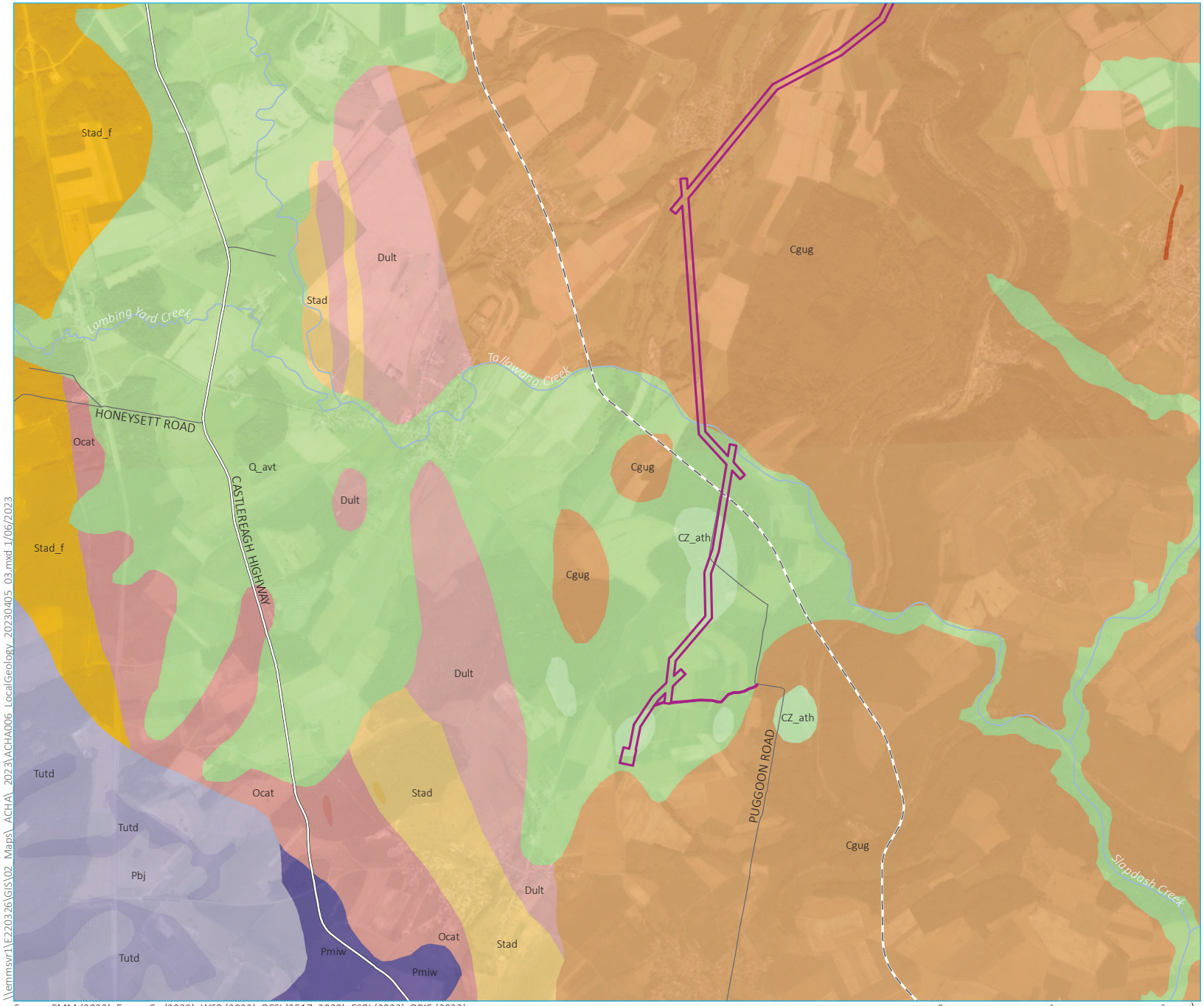
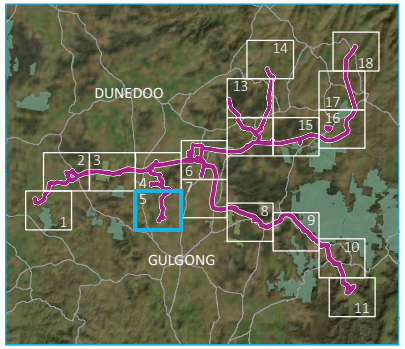
Geology
Map 4 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Dubbo Volcanics (NMdud)

Cenozoic Sedimentary Province

- Alluvial terrace deposits - high-stand facies (CZ_ath)
- Alluvial valley deposits - terraced (Q_avt)

Lachlan Orogen

- Dungeree Volcanics (Stad)
- Dungeree Volcanics - limestone (Stad_l)
- Dungeree Volcanics - shale, felsic volcanic sandstone (Stad_f)
- Gulgong Granite (Cgug)
- Gulgong Granite - rhyolite (Cgug_r)
- Tallawang Granite (Dult)
- Tucklan Formation (Ocat)
- Tucklan Formation - limestone (Ocat_l)

Permo-Triassic Basins

- Black Jack Group (Pbj)
- Digby Formation (Tutd)
- Watermark Formation (Pmiw)

INSET KEY

- Major road
- NPWS reserve
- State forest

Geology
Map 5 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM creating opportunities

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

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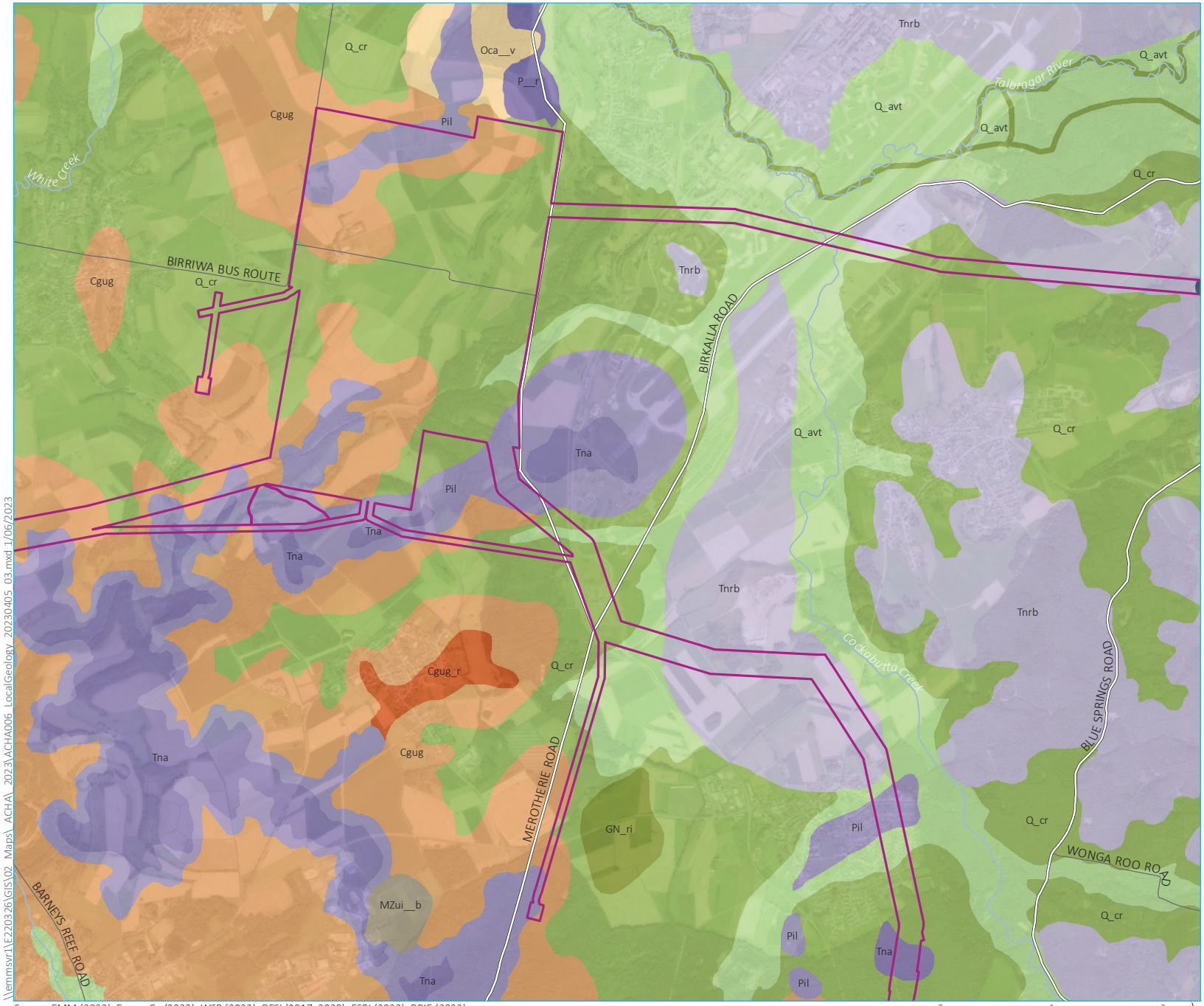

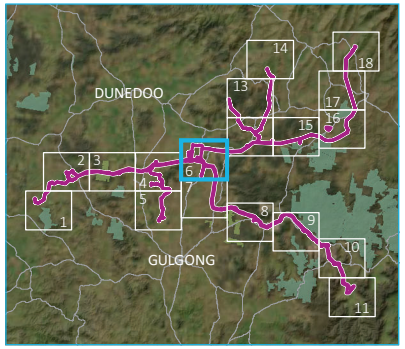

KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Liverpool West Basalt (GOliw)

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)
- Colluvial and residual deposits (Q_cr)
- Marra Creek Formation - channel facies (Q__m_c)
- Residual deposits - Silcrete (GN_ri)

Lachlan Orogen

- Cabonne Group - volcanics (Oca__v)
- Dungeree Volcanics (Stad)
- Gulgong Granite (Cgug)
- Gulgong Granite - rhyolite (Cgug_r)

Permian-Mesozoic Igneous Province

- Ungrouped Mesozoic igneous units - basalt (MZui__b)

Permo-Triassic Basins

- Banks Wall Sandstone (Tnrb)
- Illawarra Coal Measures (Pil)
- Narrabeen Group (Tna)
- Rylstone Volcanics (P__r)

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

0 1 2 km

GDA2020 MGA Zone 55

N

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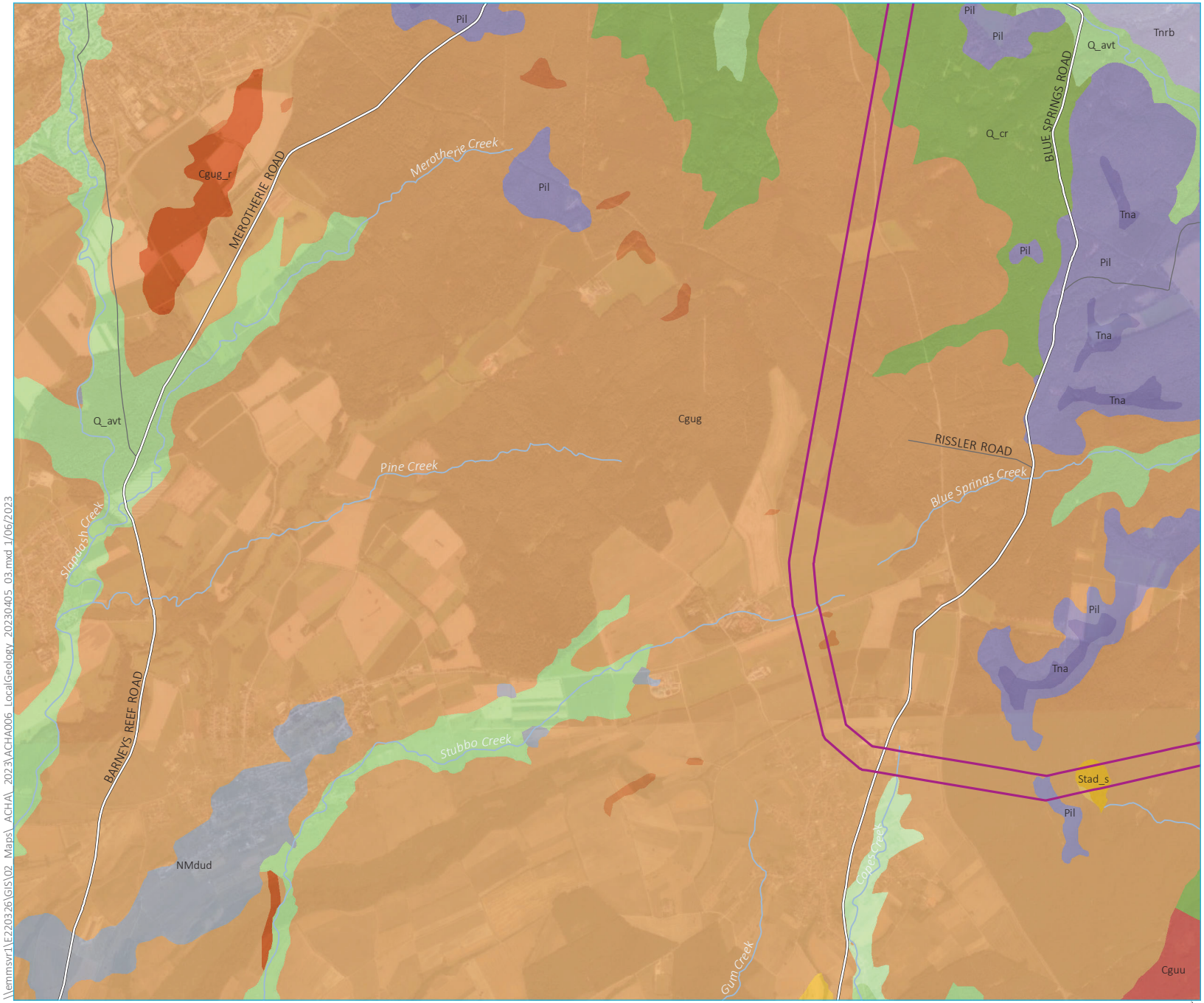
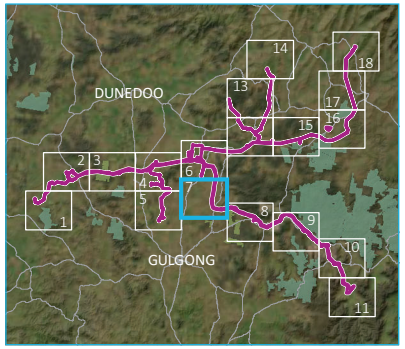
Geology
Map 6 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Dubbo Volcanics (NMdud)

Cenozoic Sedimentary Province

- Alluvial terrace deposits - high-stand facies (CZ_ath)
- Alluvial valley deposits - terraced (Q_avt)
- Colluvial and residual deposits (Q_cr)

Lachlan Orogen

- Dungeree Volcanics (Stad)
- Dungeree Volcanics - limestone (Stad_l)
- Dungeree Volcanics - sandstone (Stad_q)
- Dungeree Volcanics - shale (Stad_s)
- Gulgong Granite (Cgug)
- Gulgong Granite - aplite (Cgug_a)
- Gulgong Granite - rhyolite (Cgug_r)
- Ulan Quartz Monzonite (Cguu)

Permo-Triassic Basins

- Banks Wall Sandstone (Tnrb)
- Illawarra Coal Measures (Pil)
- Narrabeen Group (Tna)

INSET KEY

- Major road
- NPWS reserve
- State forest

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

0 1 2 km

GDA2020 MGA Zone 55

N

Geology
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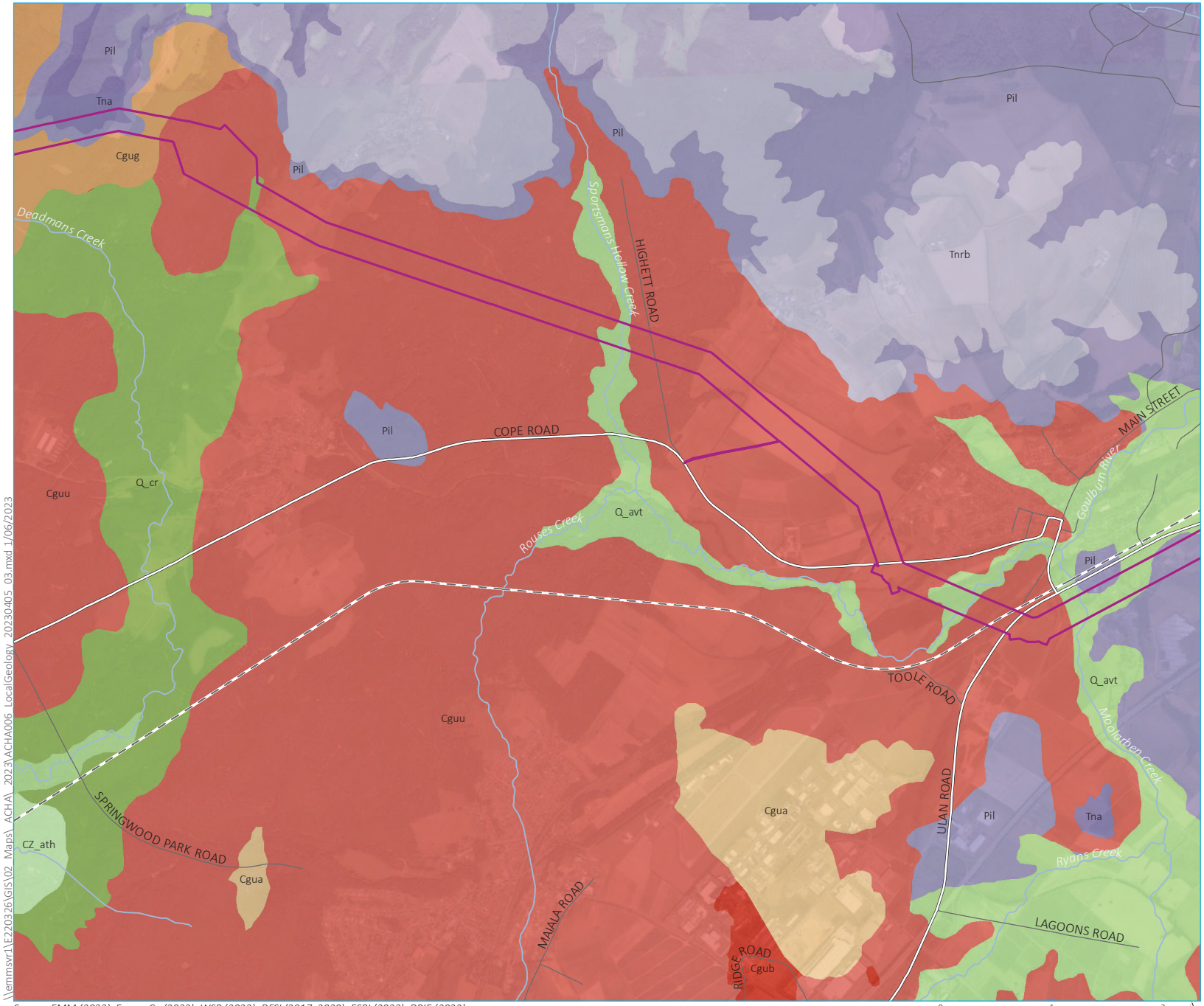
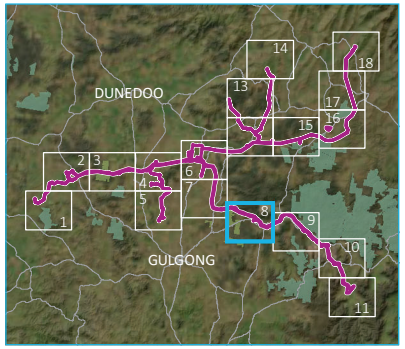
Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Dubbo Volcanics (NMdud)

Cenozoic Sedimentary Province

- Alluvial terrace deposits - high-stand facies (CZ_ath)
- Alluvial valley deposits - terraced (Q_avt)
- Colluvial and residual deposits (Q_cr)

Lachlan Orogen

- Goat Mountain Alkali Granite (Cgua)
- Gulgong Granite (Cgug)
- Ulan Quartz Monzonite (Cguu)
- Worobil Alkali Granite (Cgub)

Permo-Triassic Basins

- Banks Wall Sandstone (Tnrb)
- Illawarra Coal Measures (Pil)
- Narrabeen Group (Tna)

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA006_LocalGeology_20230405_03.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

0 1 2 km

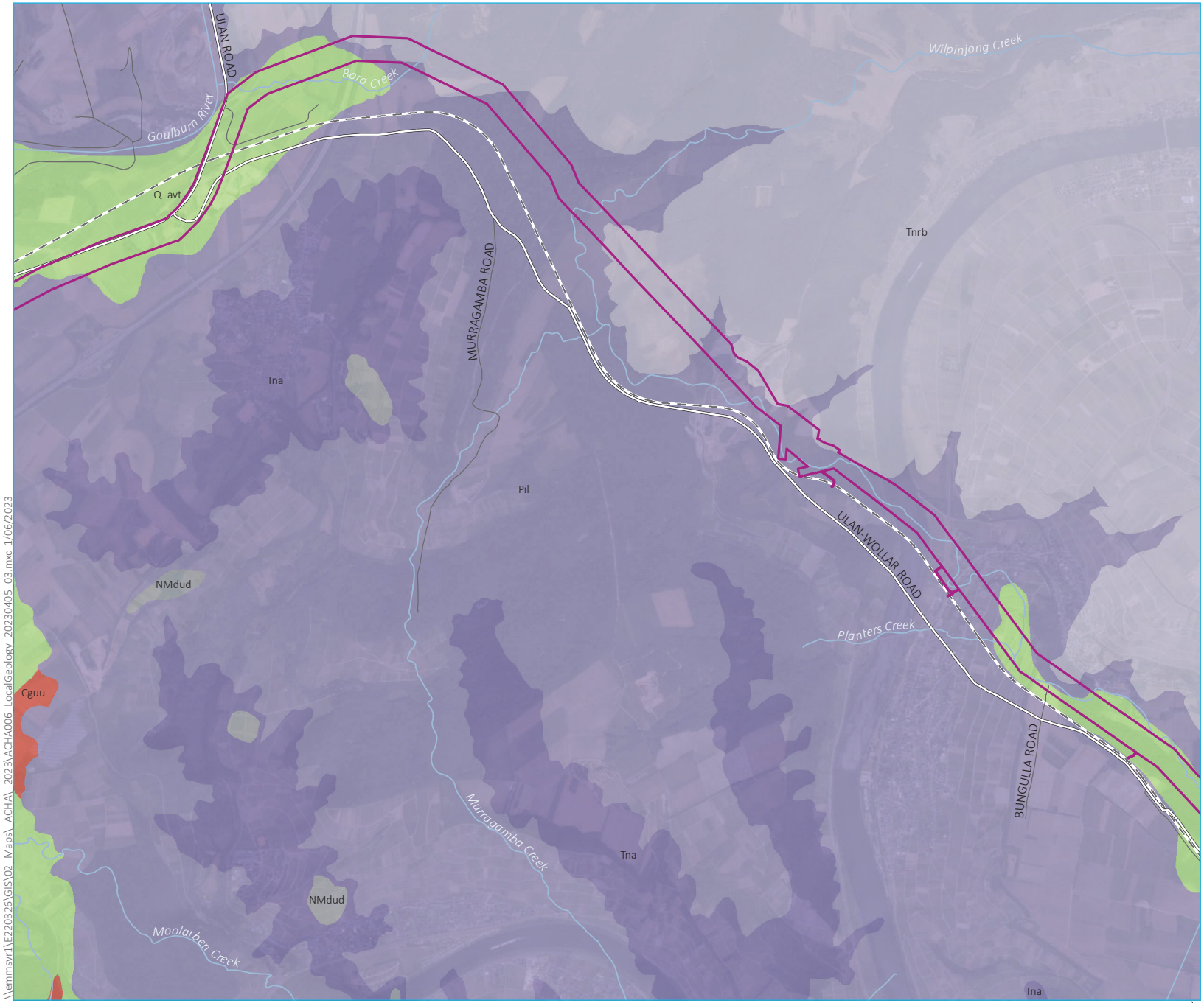
GDA2020 MGA Zone 55

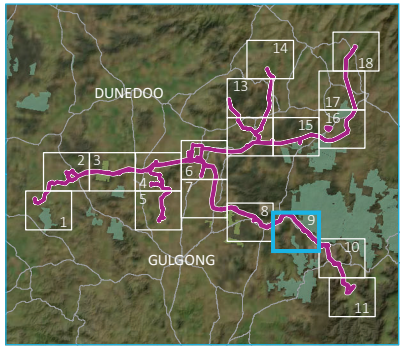
N

Geology
Map 8 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Dubbo Volcanics (NMdud)

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)

Lachlan Orogen

- Ulan Quartz Monzonite (Cguu)

Permo-Triassic Basins

- Banks Wall Sandstone (Tnrb)
- Illawarra Coal Measures (Pil)
- Narrabeen Group (Tna)

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA006_LocalGeology_20230405_03.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

0 1 2 km

GDA2020 MGA Zone 55

N

Geology
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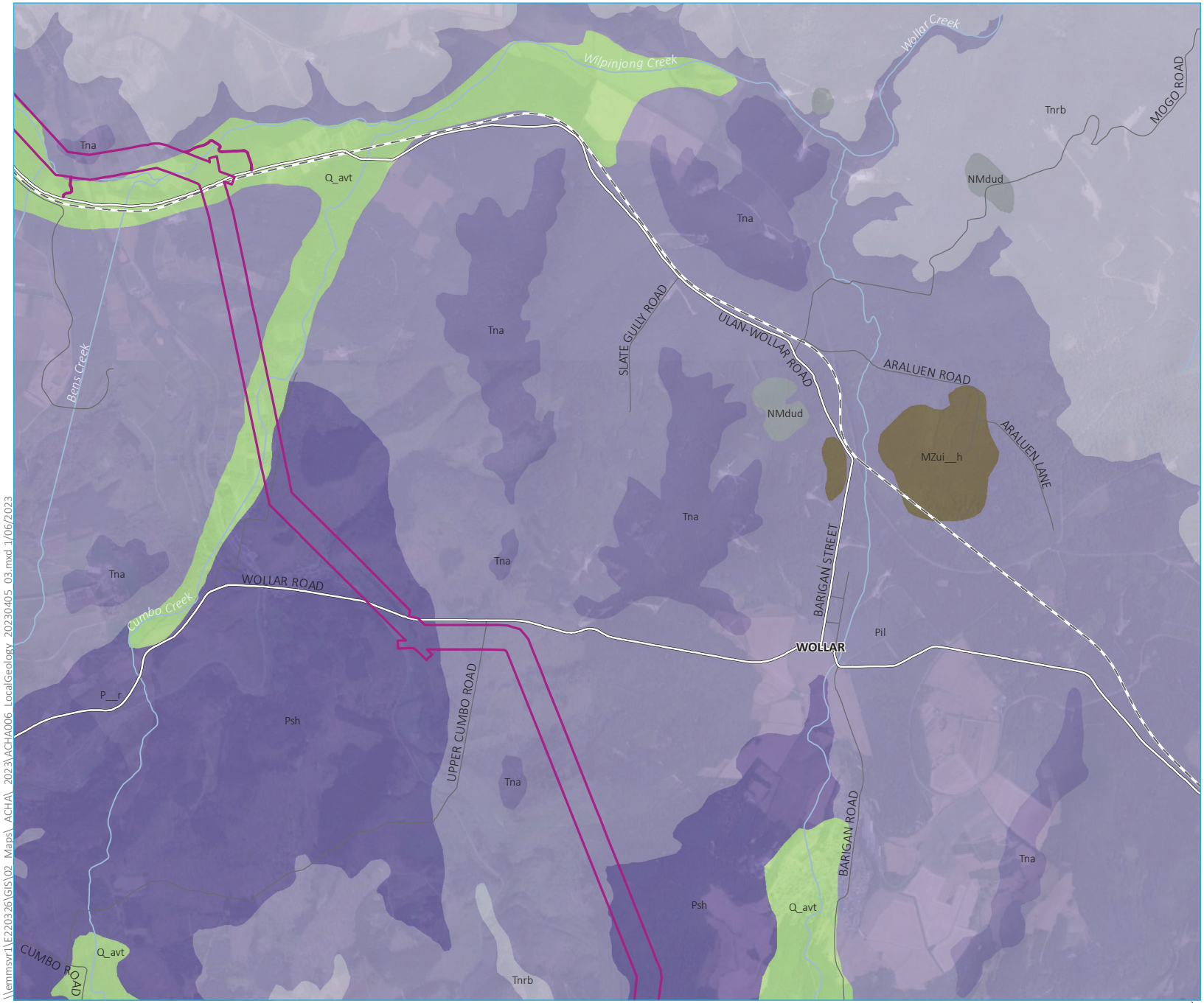
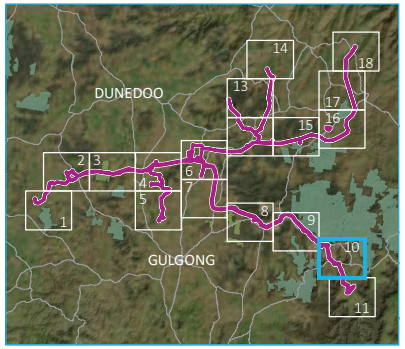
Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Dubbo Volcanics (NMdud)

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)

Lachlan Orogen

- Bathurst Supersuite (Cb)

Permian-Mesozoic Igneous Province

- Ungrouped Mesozoic igneous units - phonolite (MZui__h)

Permo-Triassic Basins

- Banks Wall Sandstone (Tnrb)
- Illawarra Coal Measures (Pil)
- Narrabeen Group (Tna)
- Rylstone Volcanics (P__r)
- Shoalhaven Group (Psh)

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

0 1 2 km

GDA2020 MGA Zone 55

N

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Geology
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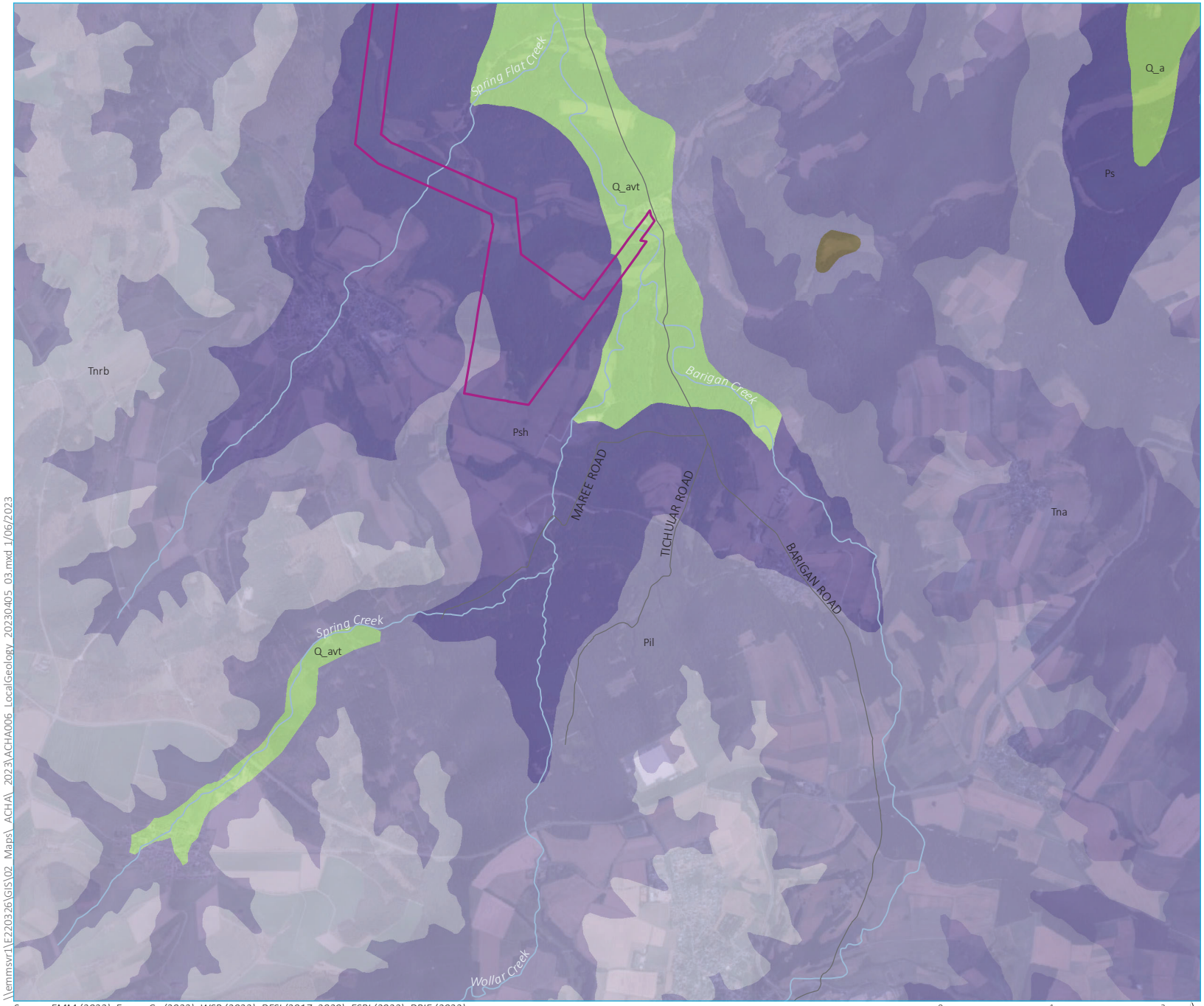
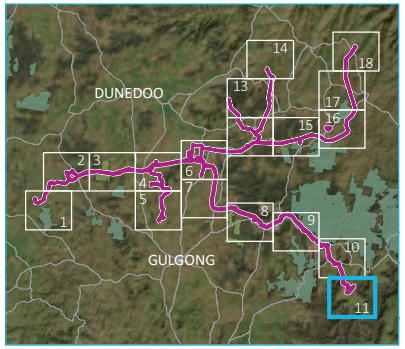
Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Minor road
- Named watercourse

Geological unit

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)
- Alluvium (Q_a)

Lachlan Orogen

- Cabonne Group - volcanics (Oca__v)

Permian-Mesozoic Igneous Province

- Ungrouped Mesozoic igneous units - phonolite (MZui__h)

Permo-Triassic Basins

- Banks Wall Sandstone (Tnrb)
- Illawarra Coal Measures (Pil)
- Narrabeen Group (Tna)
- Shoalhaven Group (Psh)
- Singleton Supergroup (Ps)

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

0 1 2 km

GDA2020 MGA Zone 55

N

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Geology
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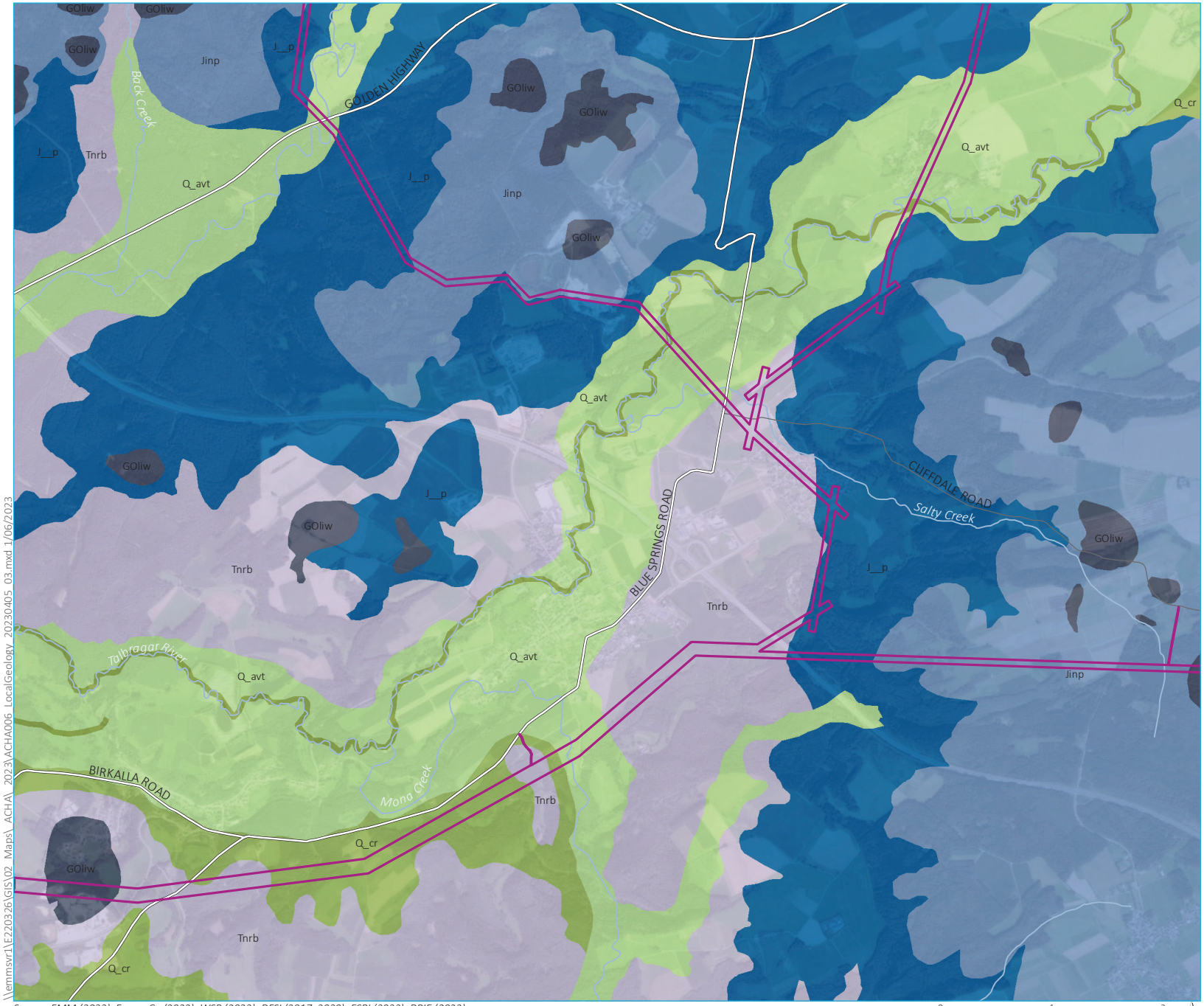
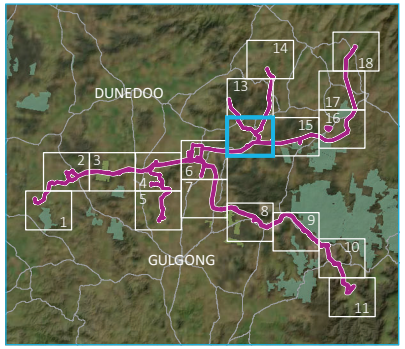
Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Liverpool West Basalt (GOliw)

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)
- Colluvial and residual deposits (Q_cr)
- Marra Creek Formation - channel facies (Q__m_c)

Great Australian Basin

- Pilliga Sandstone (Jinp)
- Purlawaugh Formation (J__p)

Permo-Triassic Basins

- Banks Wall Sandstone (Tnrb)

INSET KEY

- Major road
- NPWS reserve
- State forest

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

0 1 2 km

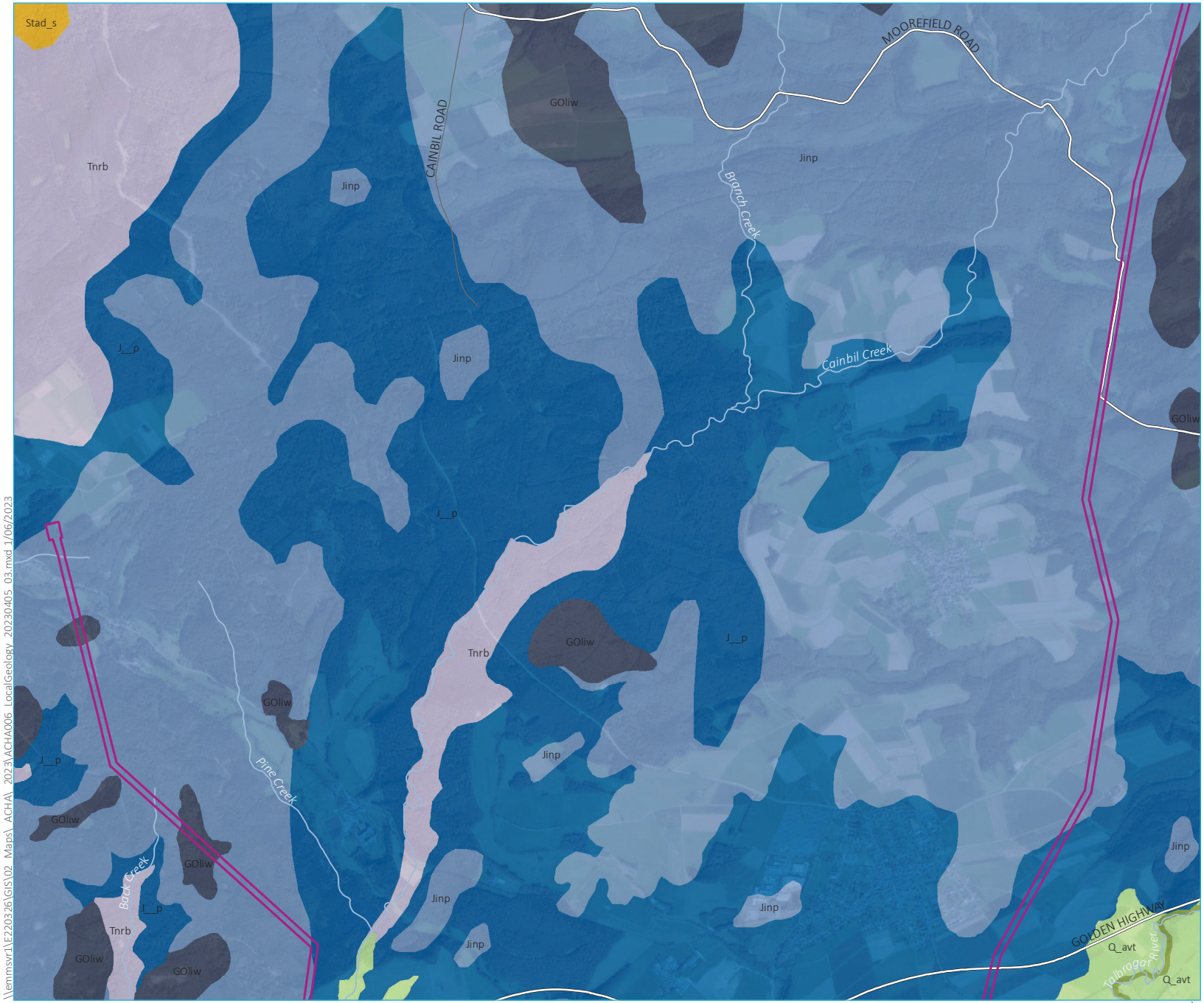
GDA2020 MGA Zone 55

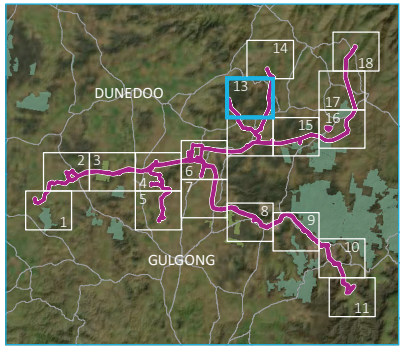
N

Geology
Map 12 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Liverpool West Basalt (GOliw)

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)
- Colluvial and residual deposits (Q_cr)
- Marra Creek Formation - channel facies (Q__m_c)

Great Australian Basin

- Pilliga Sandstone (Jinp)
- Purlawaugh Formation (J__p)

Lachlan Orogen

- Dungeree Volcanics - shale (Stad_s)

Permo-Triassic Basins

- Banks Wall Sandstone (Tnrb)

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA006_LocalGeology_20230405_03.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

0 1 2 km

GDA2020 MGA Zone 55

N

Geology
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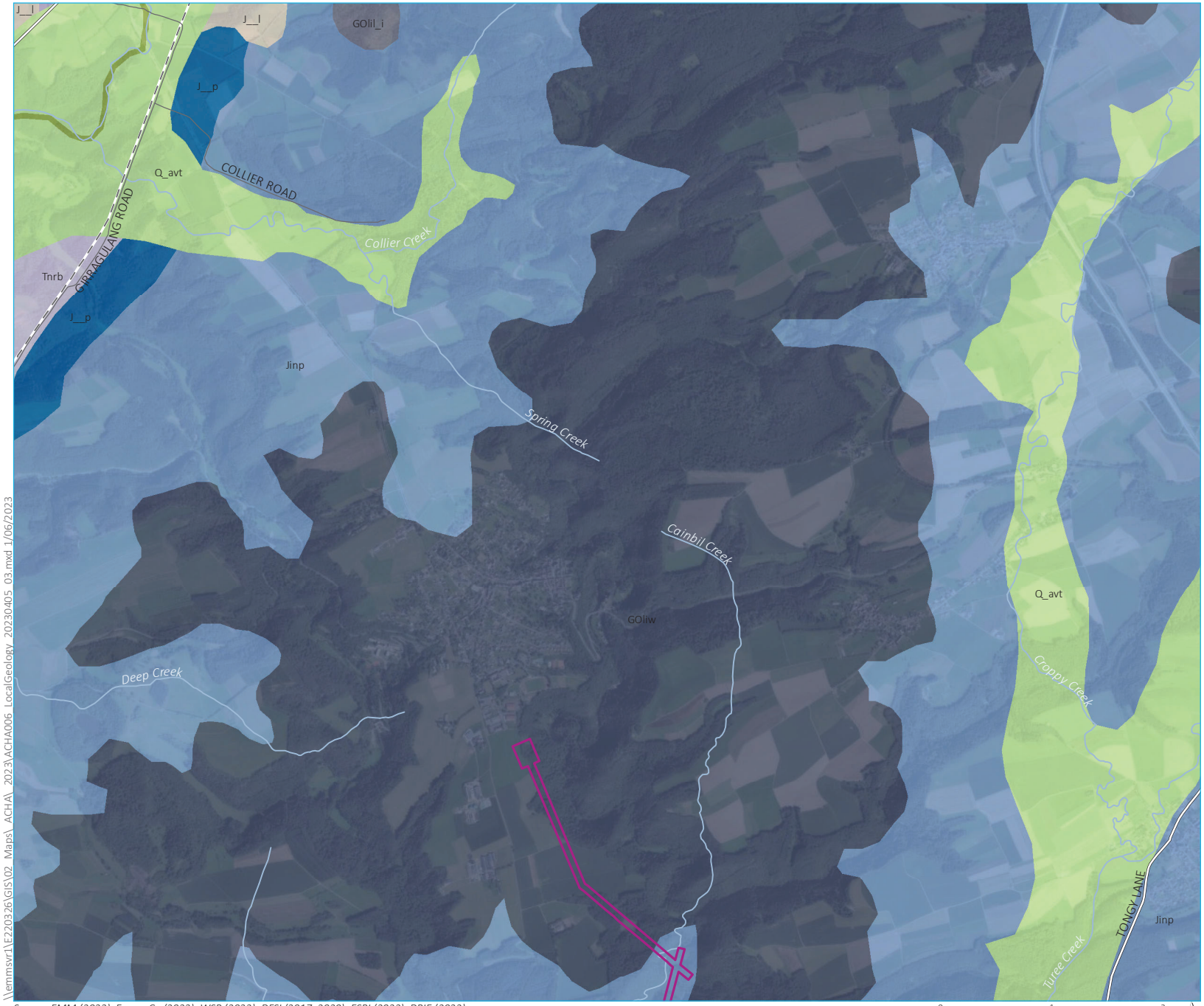
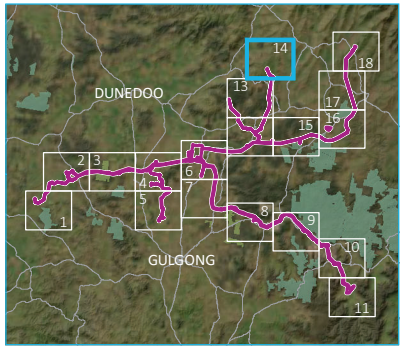
Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment
- Major road
- Minor road
- Rail line
- Named watercourse

Geological unit

Cenozoic Igneous Province
- Liverpool Range Volcanics - eastern intrusives (GOlil_i)
- Liverpool West Basalt (GOliw)

Cenozoic Sedimentary Province
- Alluvial valley deposits - terraced (Q_avt)
- Marra Creek Formation - channel facies (Q__m_c)

Great Australian Basin
- Pilliga Sandstone (Jinp)
- Purlawaugh Formation (J__p)

Permian-Mesozoic Igneous Province
- Glenrowan Intrusives (J__l)

Permo-Triassic Basins
- Banks Wall Sandstone (Tnrb)
- Digby Formation (Tutd)

INSET KEY
- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA006_LocalGeology_20230405_03.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

0 1 2 km

GDA2020 MGA Zone 55

N

Geology
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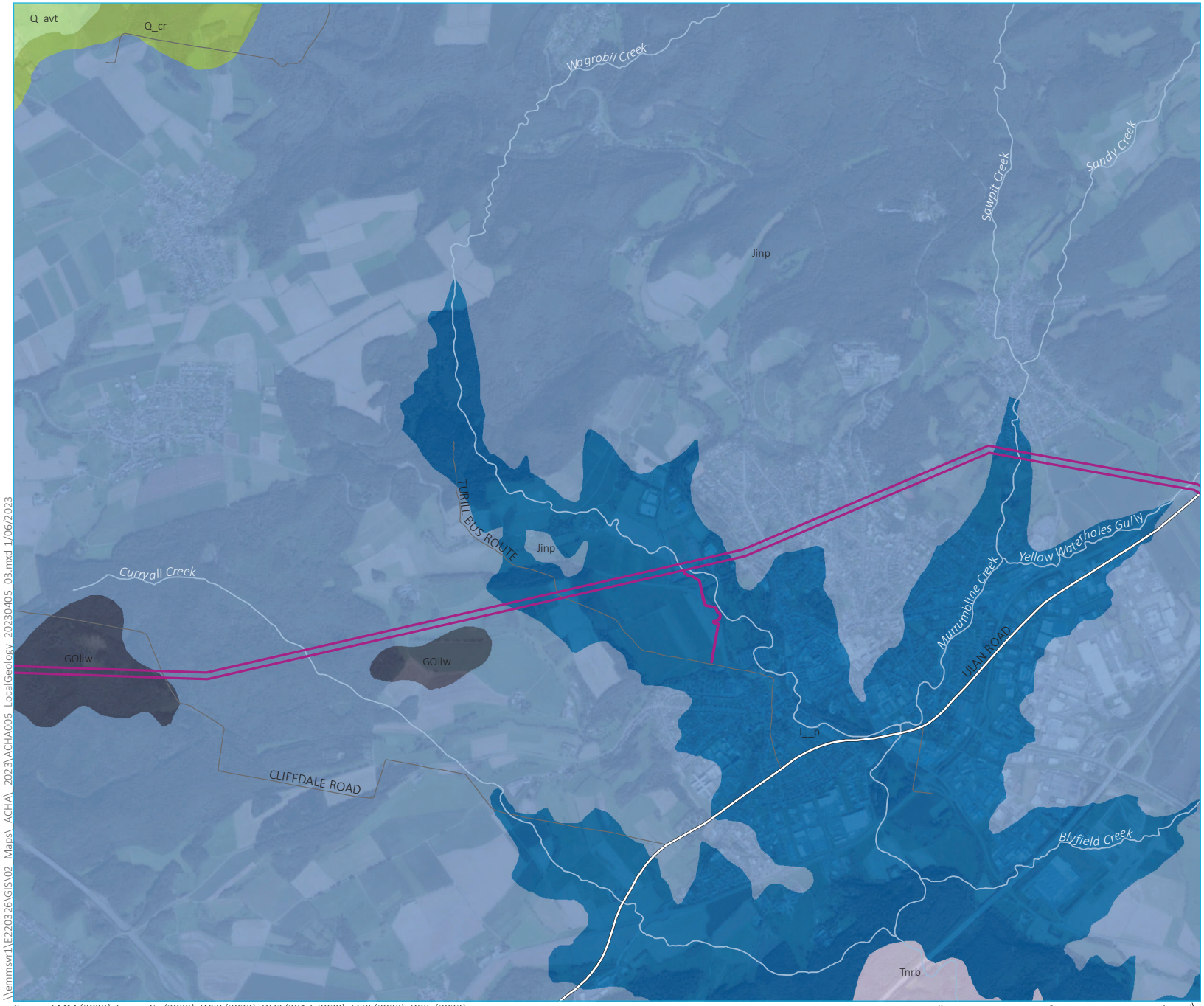
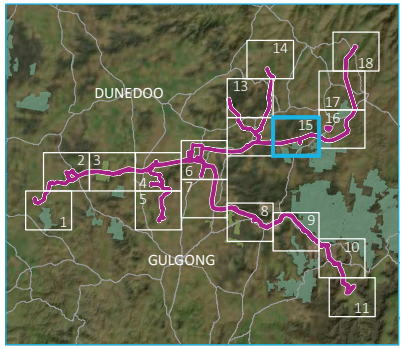
Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Liverpool West Basalt (GOliw)

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)
- Colluvial and residual deposits (Q_cr)

Great Australian Basin

- Pilliga Sandstone (Jinp)
- Purlawaugh Formation (J__p)

Permo-Triassic Basins

- Banks Wall Sandstone (Tnrb)

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

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Geology
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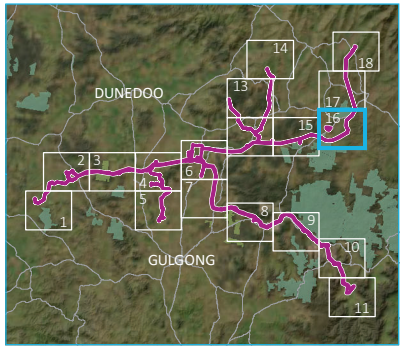
Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Liverpool West Basalt (GOliw)

Great Australian Basin

- Pilliga Sandstone (Jinp)
- Purlawaugh Formation (J__p)

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

0 1 2 km

GDA2020 MGA Zone 55

N

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Geology
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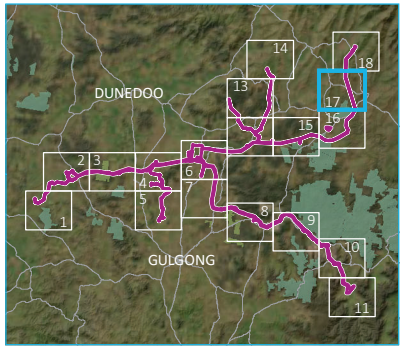
Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Liverpool West Basalt (GOliw)

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)

Great Australian Basin

- Pilliga Sandstone (Jinp)

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA006_LocalGeology_20230405_03.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

0 1 2 km

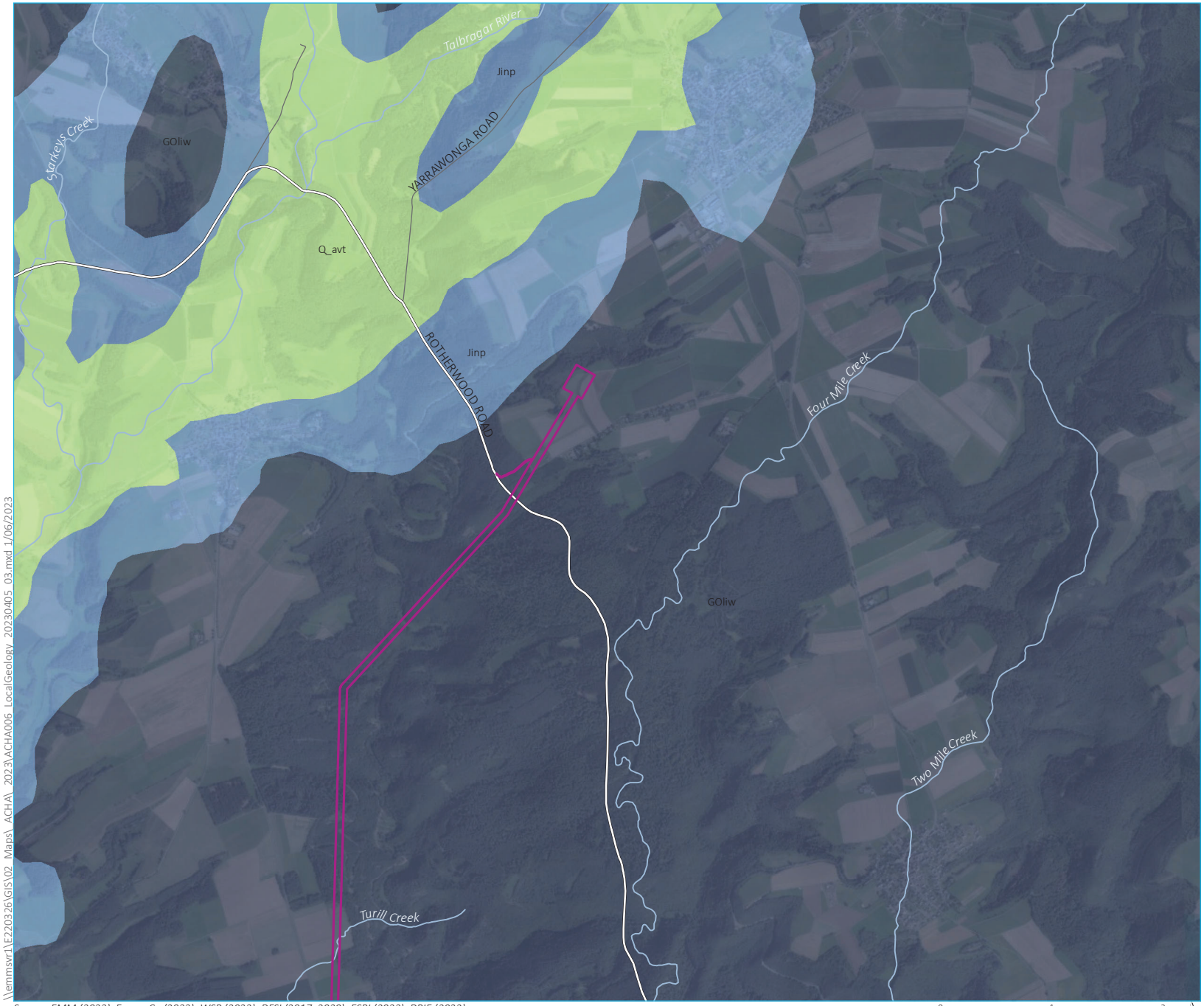
GDA2020 MGA Zone 55

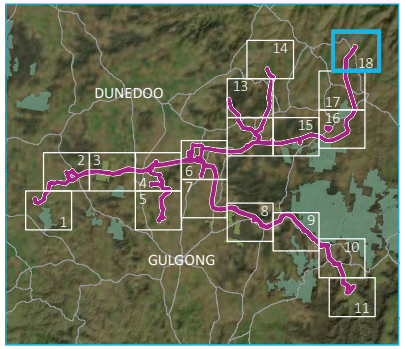
N

Geology
Map 17 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse

Geological unit

Cenozoic Igneous Province

- Liverpool West Basalt (GOliw)

Cenozoic Sedimentary Province

- Alluvial valley deposits - terraced (Q_avt)

Great Australian Basin

- Pilliga Sandstone (Jinp)

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA006_LocalGeology_20230405_03.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2022)

0 1 2 km

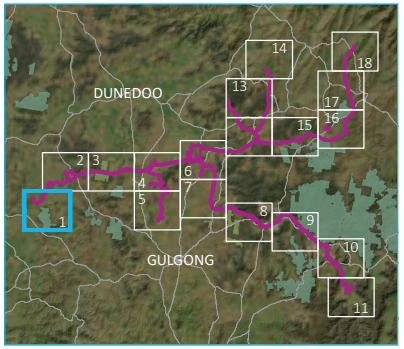
GDA2020 MGA Zone 55

N

Geology
Map 18 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.1

EMM
creating opportunities



KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA007 SlopeAnalysis 20230405 02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

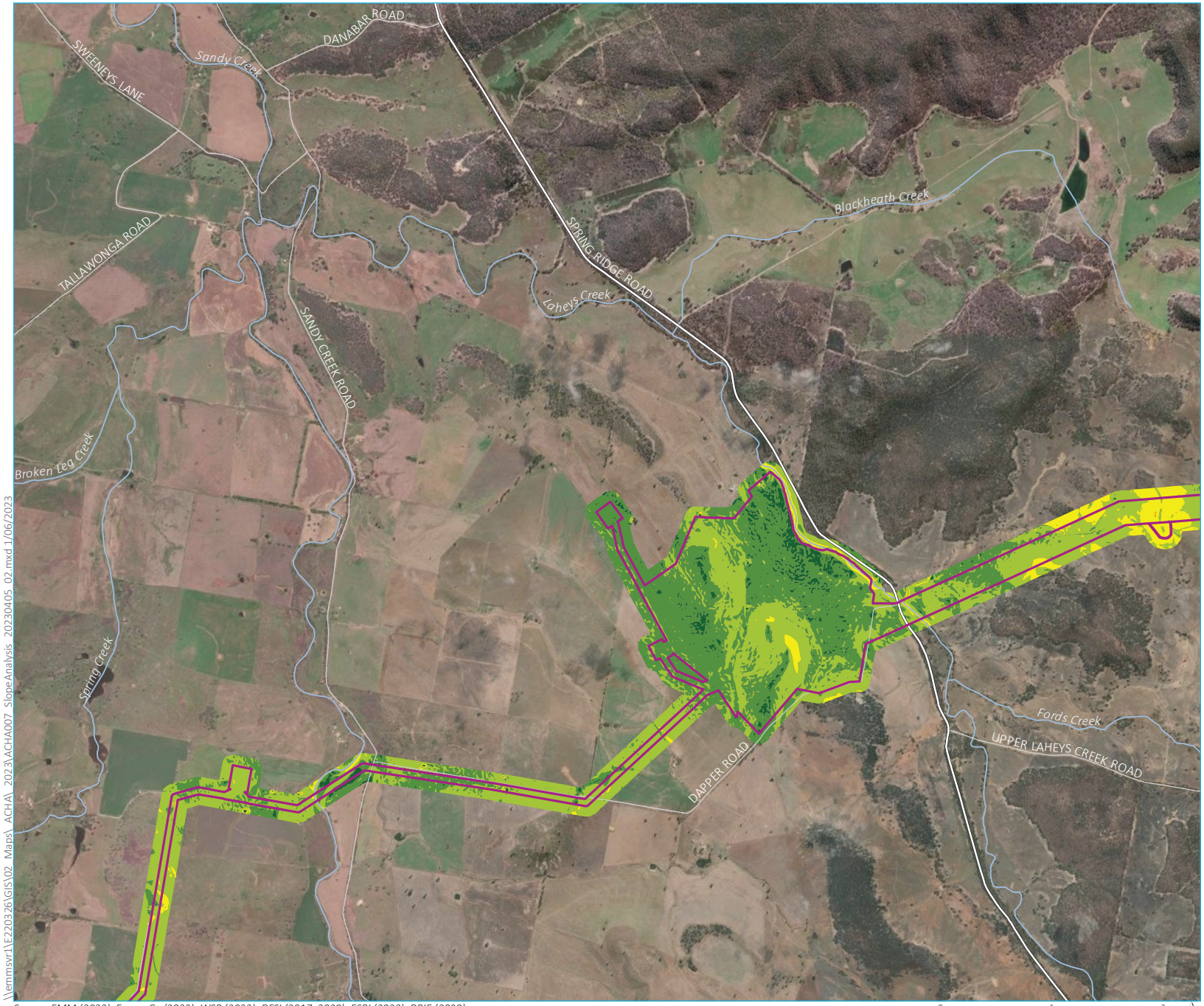
GDA2020 MGA Zone 55

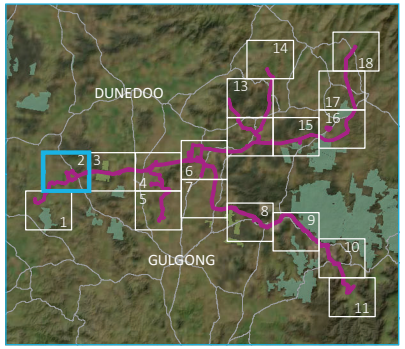
N

Slope analysis of the project area
Map 1 of 18

Central West Orana Renewable
Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities





KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA007_SlopeAnalysis_20230405_02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

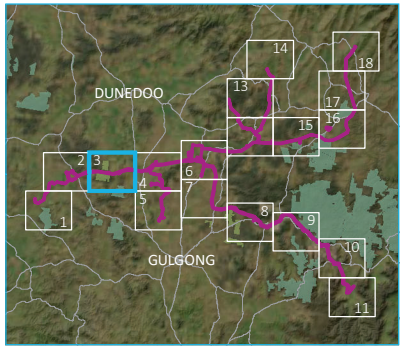
GDA2020 MGA Zone 55

N

Slope analysis of the project area
Map 2 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM creating opportunities



KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)
- Very Steep (56 - 100%)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA007 SlopeAnalysis 20230405 02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

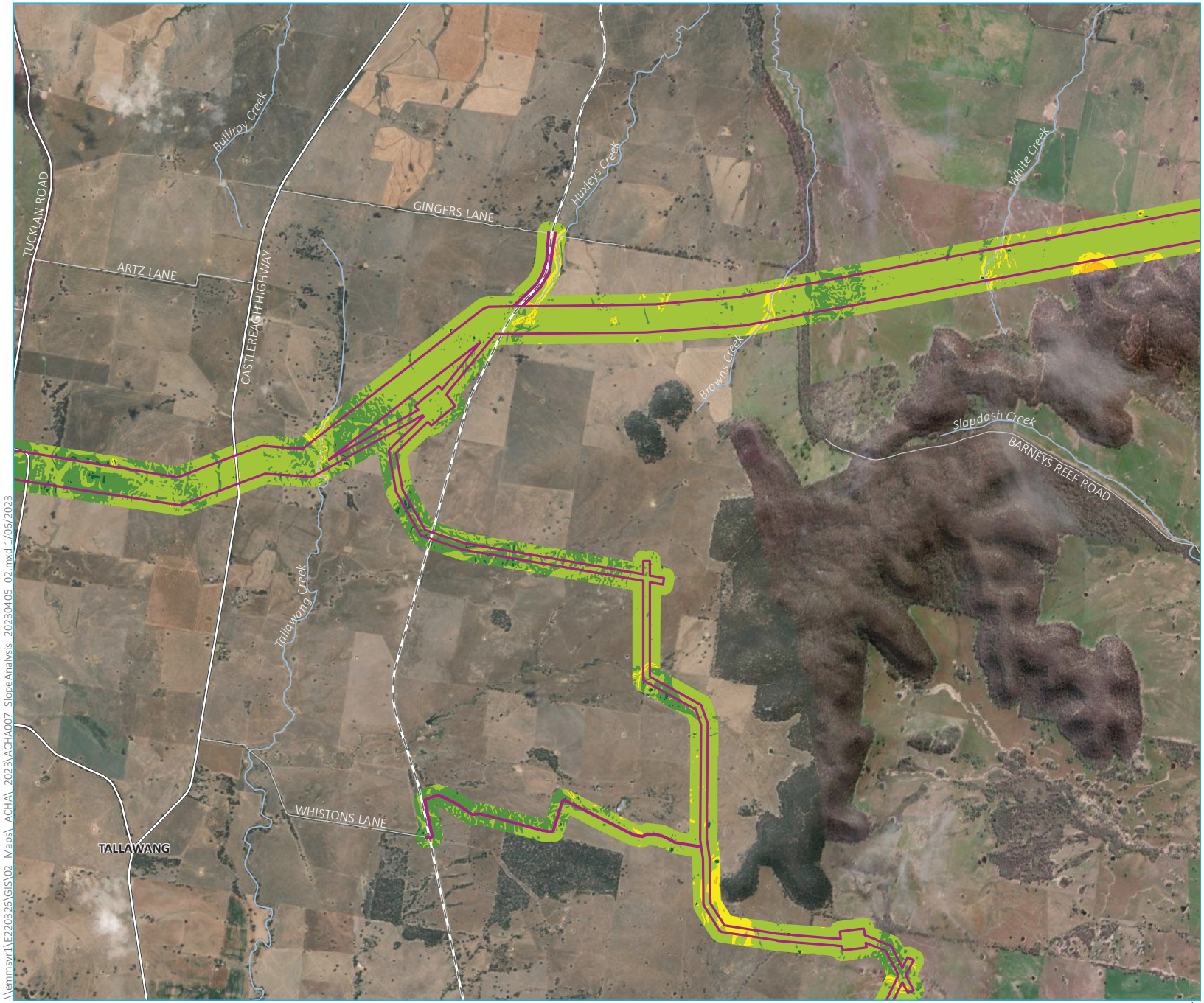
GDA2020 MGA Zone 55

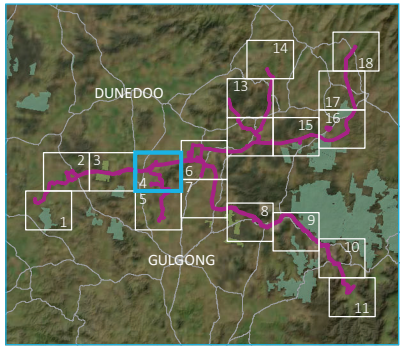
N

Slope analysis of the project area
Map 3 of 18

Central West Orana Renewable
Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities





KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)
- Very Steep (56 - 100%)

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA007 SlopeAnalysis 20230405 02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

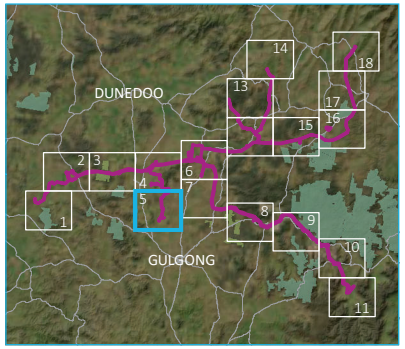
GDA2020 MGA Zone 55

N

Slope analysis of the project area
Map 4 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities



KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

GDA2020 MGA Zone 55

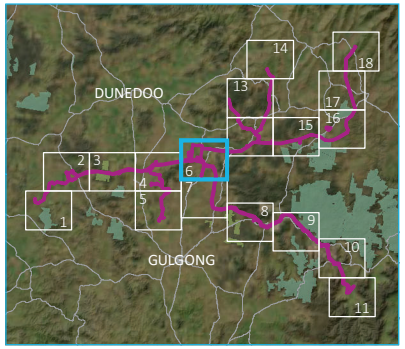
N

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA007 SlopeAnalysis 20230405 02.mxd 1/06/2023

Slope analysis of the project area
Map 5 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities



KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)
- Very Steep (56 - 100%)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA007 SlopeAnalysis 20230405 02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

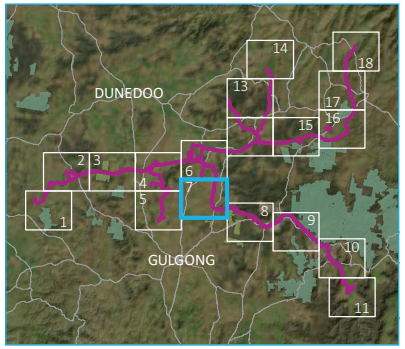
GDA2020 MGA Zone 55

N

Slope analysis of the project area
Map 6 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities



KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)
- Very Steep (56 - 100%)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA007_SlopeAnalysis_20230405_02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

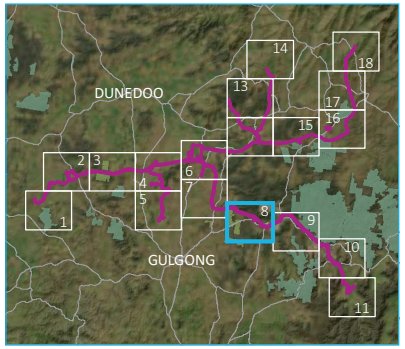
GDA2020 MGA Zone 55

N

Slope analysis of the project area
Map 7 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities



KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)
- Very Steep (56 - 100%)
- Precipitous (100 - 300%)

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA007 SlopeAnalysis 20230405 02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

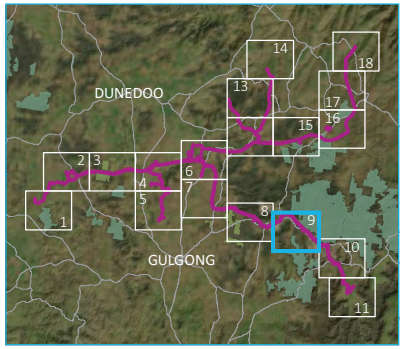
GDA2020 MGA Zone 55

N

Slope analysis of the project area
Map 8 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities



KEY

Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)
- Very Steep (56 - 100%)
- Precipitous (100 - 300%)

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA007 SlopeAnalysis 20230405 02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

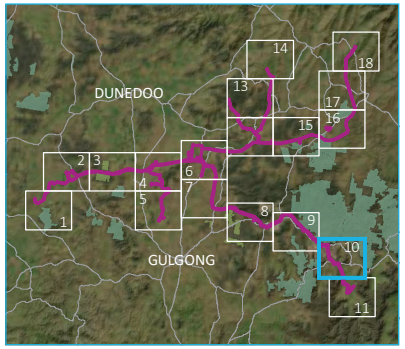
GDA2020 MGA Zone 55

N

Slope analysis of the project area
Map 9 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities



KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)
- Very Steep (56 - 100%)
- Precipitous (100 - 300%)

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA007 SlopeAnalysis 20230405 02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

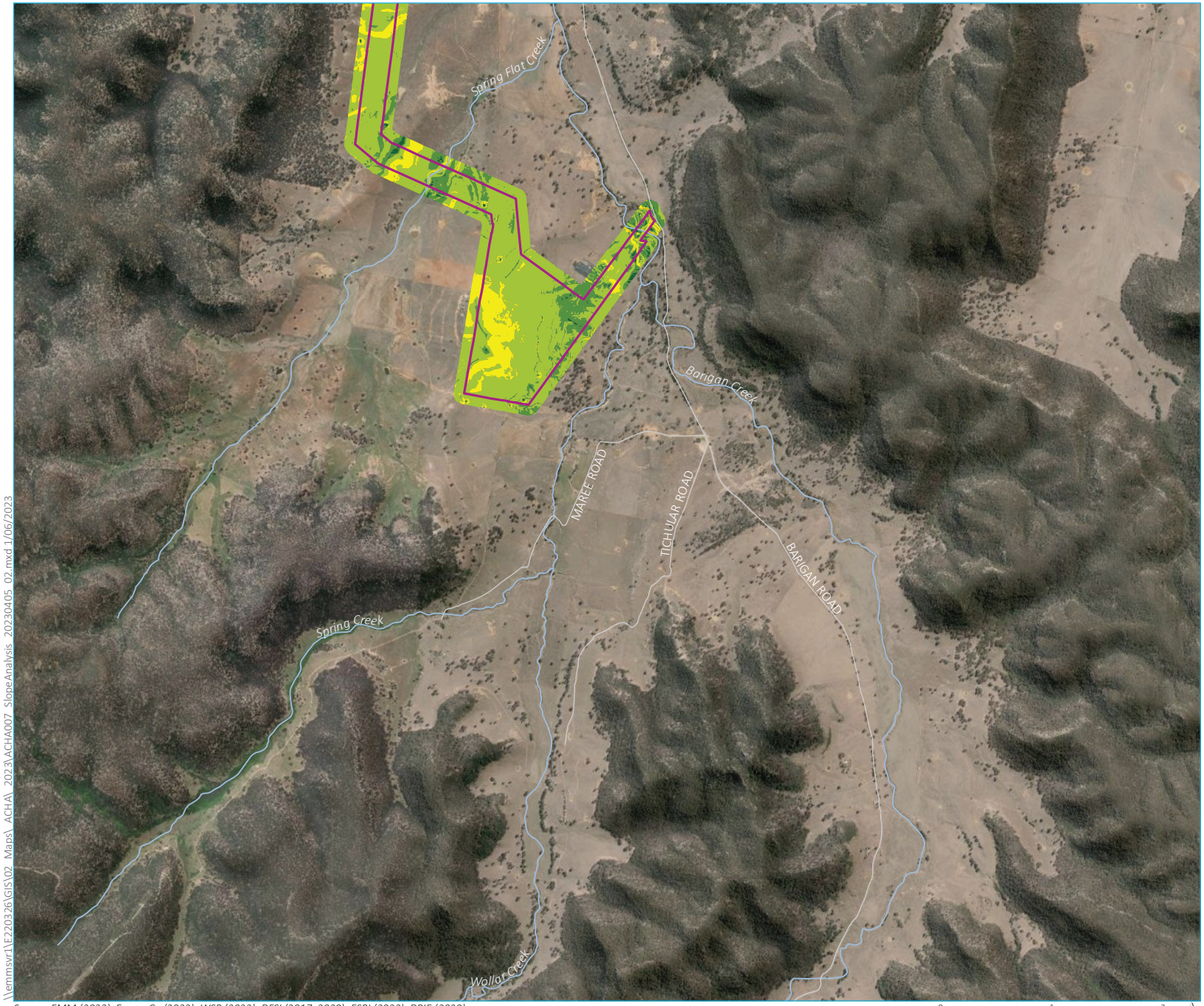
GDA2020 MGA Zone 55

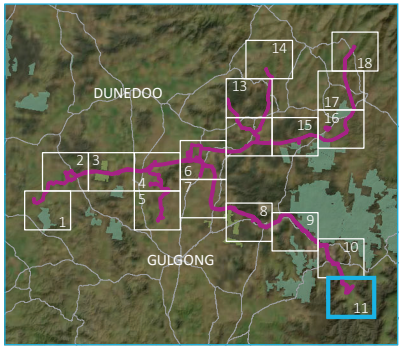
N

Slope analysis of the project area
Map 10 of 18

Central West Orana Renewable
Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities





KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)

Existing environment

- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA007 SlopeAnalysis 20230405 02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

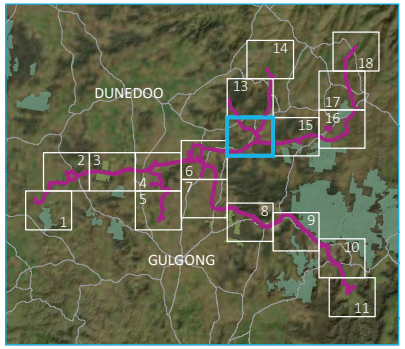
GDA2020 MGA Zone 55

N

Slope analysis of the project area
Map 11 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM creating opportunities



KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)
- Very Steep (56 - 100%)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA007 SlopeAnalysis 20230405 02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

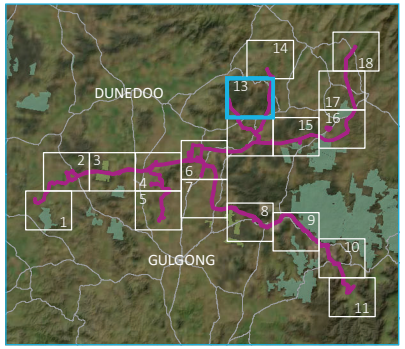
GDA2020 MGA Zone 55

N

Slope analysis of the project area
Map 12 of 18

Central West Orana Renewable
Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities



KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)
- Very Steep (56 - 100%)
- Precipitous (100 - 300%)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA007_SlopeAnalysis_20230405_02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

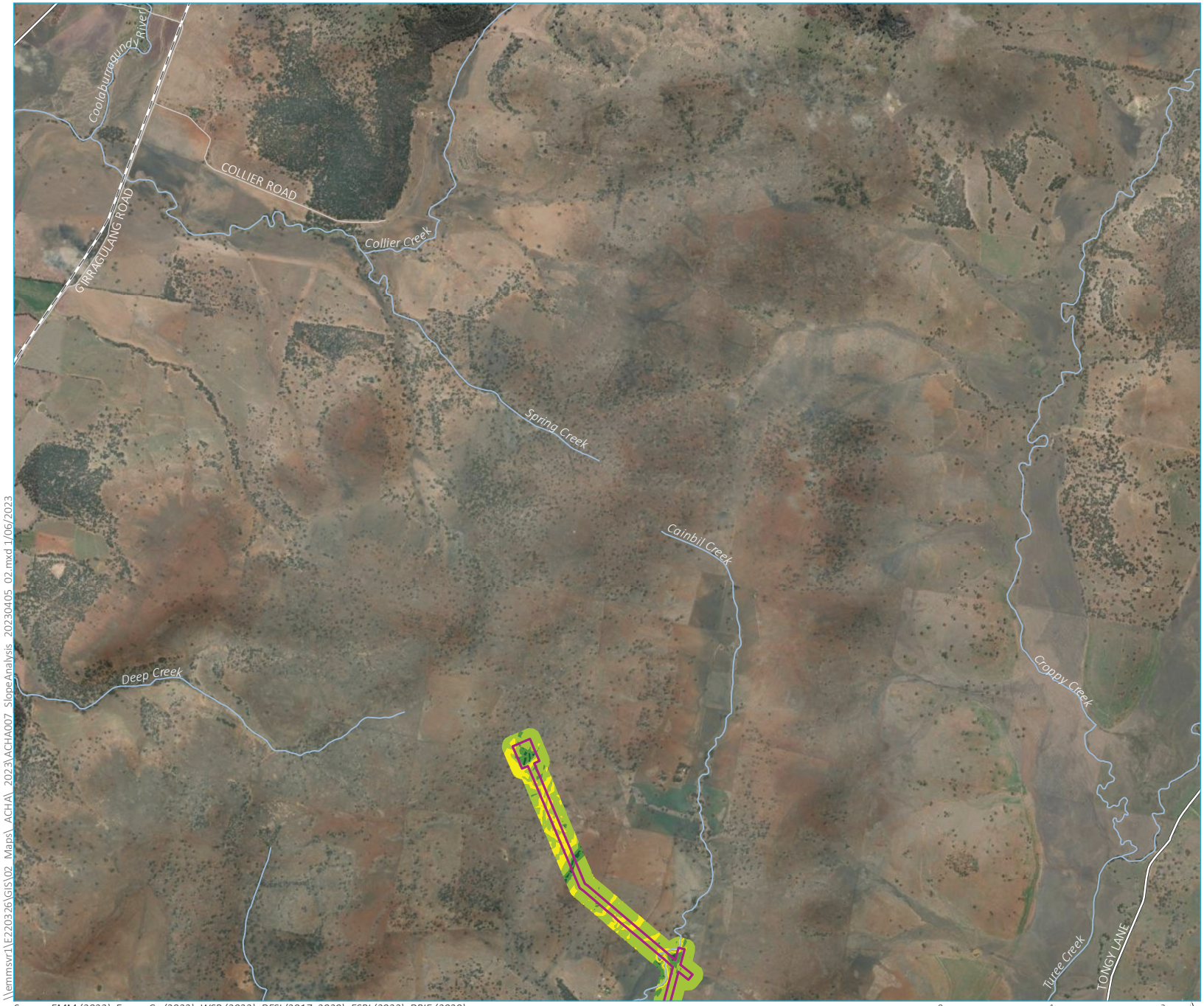
GDA2020 MGA Zone 55

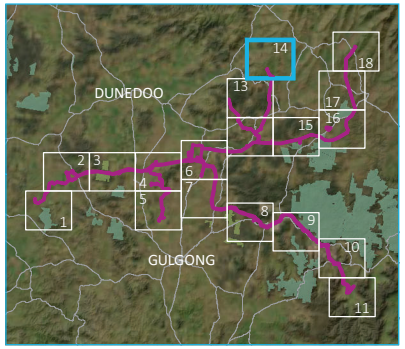
N

Slope analysis of the project area
Map 13 of 18

Central West Orana Renewable
Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities





KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA007_SlopeAnalysis_20230405_02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

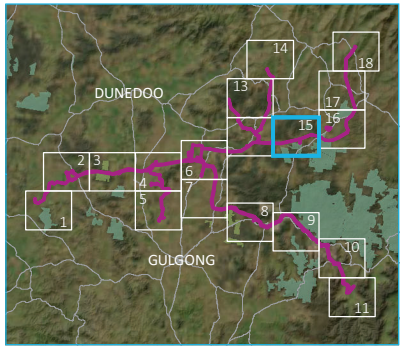
GDA2020 MGA Zone 55

N

Slope analysis of the project area
Map 14 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities



KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)
- Very Steep (56 - 100%)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA007_SlopeAnalysis_20230405_02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

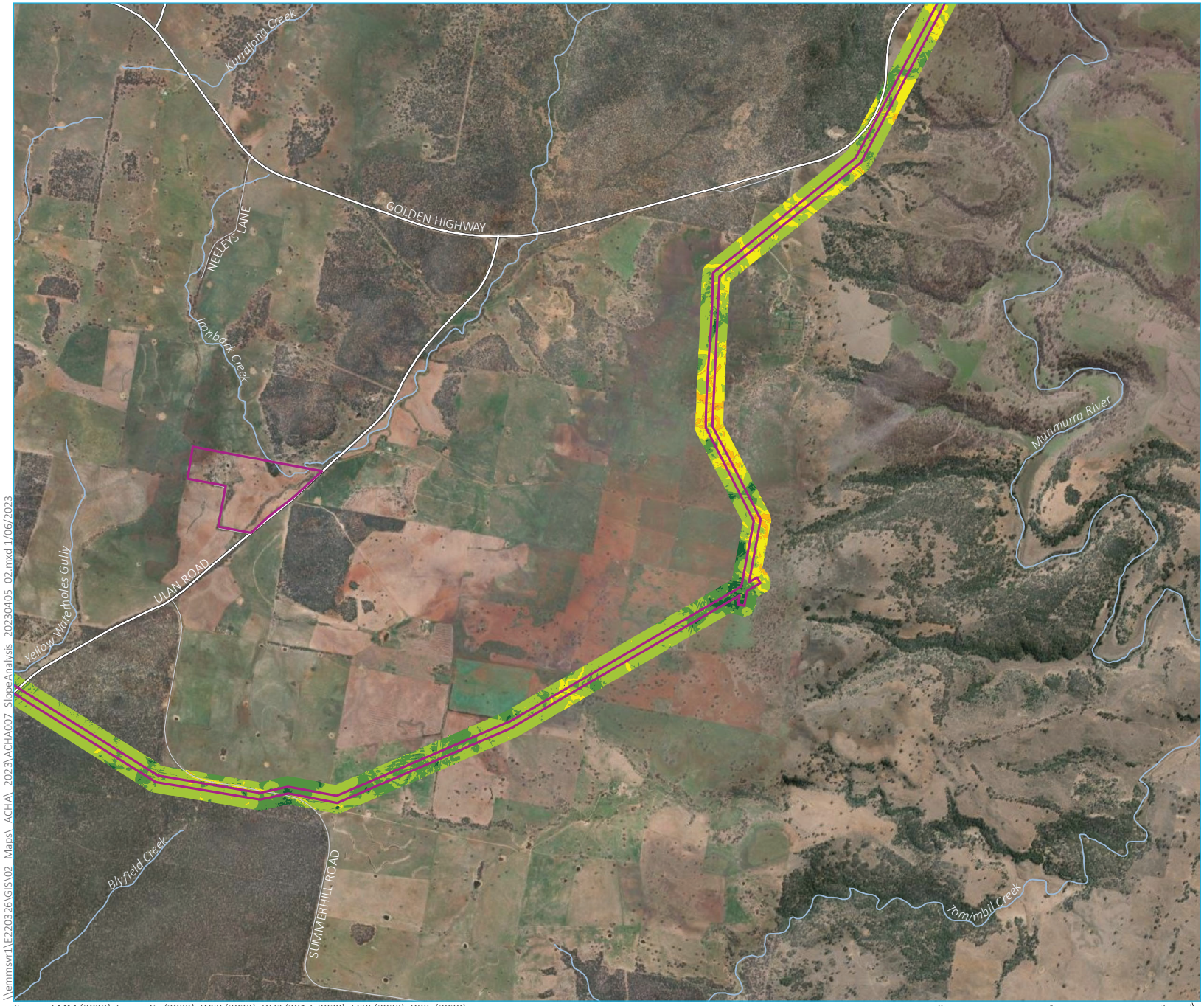
GDA2020 MGA Zone 55

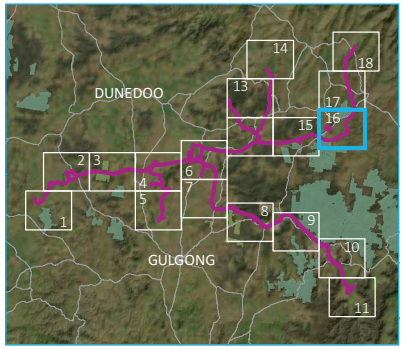
N

Slope analysis of the project area
Map 15 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities





KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)
- Very Steep (56 - 100%)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA007_SlopeAnalysis_20230405_02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

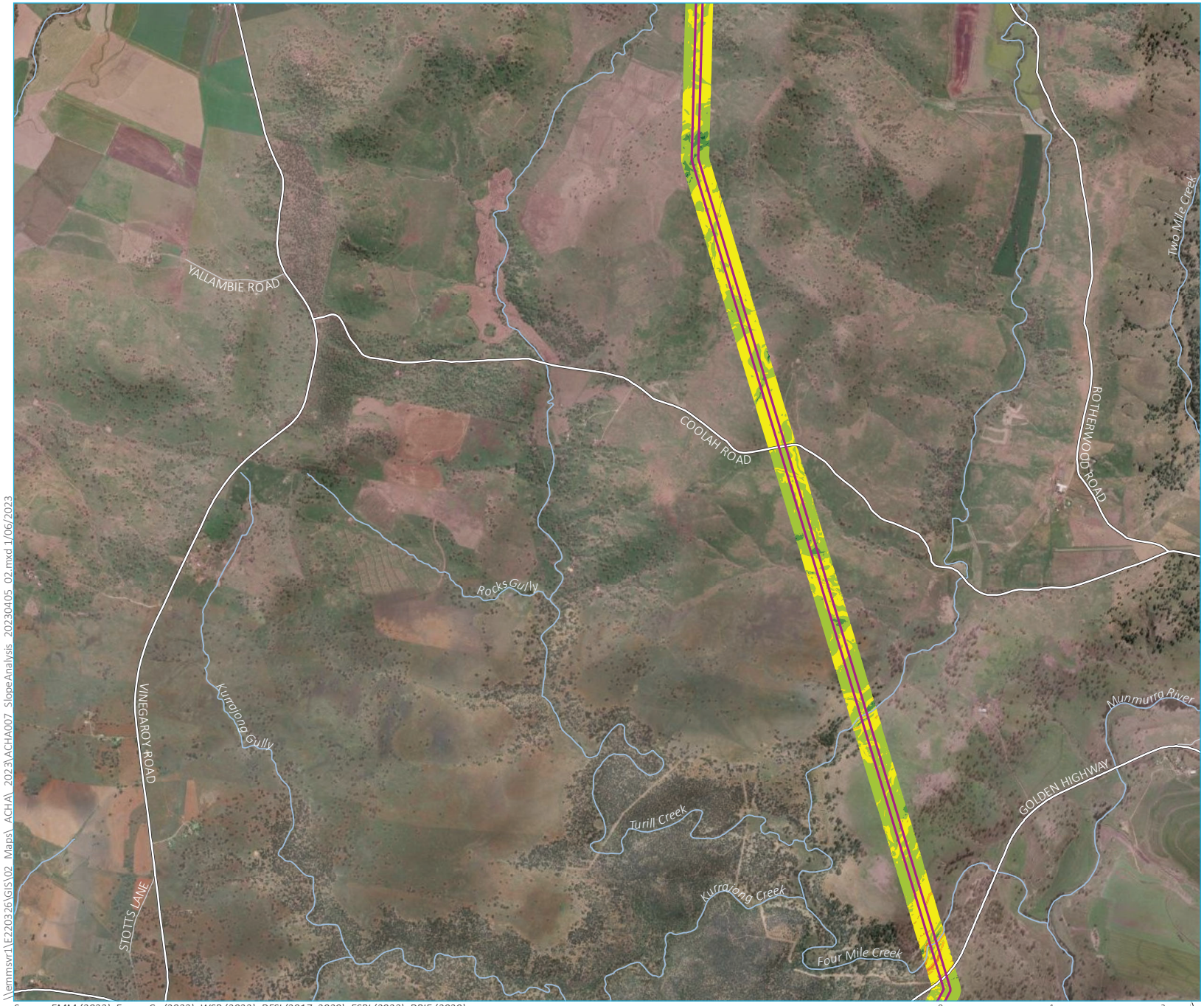
GDA2020 MGA Zone 55

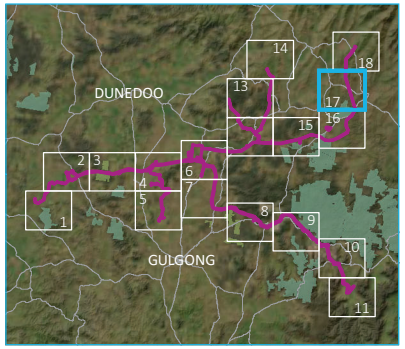
N

Slope analysis of the project area
Map 16 of 18

Central West Orana Renewable
Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities





KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)
- Very Steep (56 - 100%)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA007 SlopeAnalysis 20230405 02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

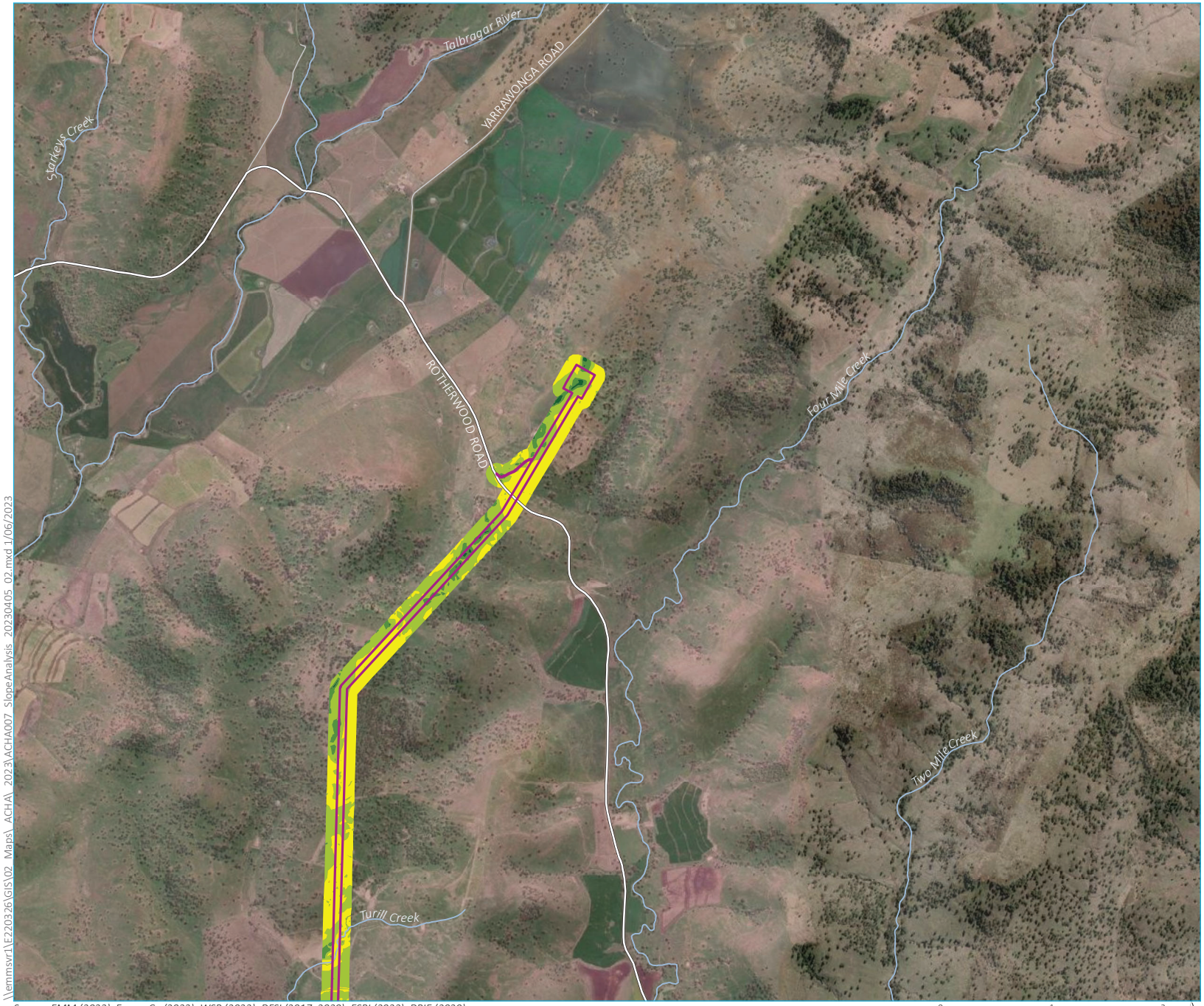
GDA2020 MGA Zone 55

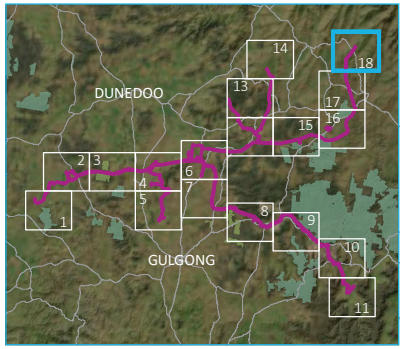
N

Slope analysis of the project area
Map 17 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities





KEY

- Construction area

Slope (percentage rise)

- Level (0 - 1%)
- Very gently inclined (1 - 3%)
- Gently inclined (3 - 10%)
- Moderately inclined (10 - 32%)
- Steep (32 - 56%)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA007 SlopeAnalysis 20230405 02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020)

0 1 2 km

GDA2020 MGA Zone 55

N

Slope analysis of the project area
Map 18 of 18

Central West Orana Renewable
Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.2

EMM
creating opportunities

5.3.2 Soil landscapes

Soil landscapes and their boundaries provide pre-defined areas that are classified by several geographic features, and which are informative for archaeological investigations. They provide localised information including landform patterns, soils, geology, rock outcrop percentage, land use and vegetation, which 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.

Soil landscapes which contribute a cumulative coverage of the study area greater than 150 ha (totalling ~85%) are summarised in Table 5.3 and shown on Figure 5.3 (Murphy & Lawrie 1998). Some 5,464 ha (~21%) is not included in established soil landscape data, mostly in the northern part of the construction area. Common across all soil landscapes within the study area is that they are topographically characterised by undulating low hills. However, within the Rouse, Ulan, Lees Pinch and Barigan Creek landscapes, which cumulatively account for around 43% of the study area, a prevalence of sandstone, limestone and granite geologies results in escarpment and plateau landforms with frequent outcropping. The archaeological implications for this are an increased likelihood of rock shelter (including both habitation and art) sites, as well as grinding groove and quarry sites within areas that these soil landscapes are present. However, an analysis of slope data within these soil landscapes throughout the study area failed to identify any areas with a slope gradient of 80 degrees or higher, which is typically used to target areas of high potential for rockshelters (Figure 5.2).

Within the Turill, Wuuluman, Laheys Creek, Ballimore, and Barigan Creek landscapes, which cumulatively account for around 46% of the study area, there is a prevalence of low gradient slopes and rises, and small flats adjacent to waterways. The archaeological implications for this are an increased likelihood of open occupation areas reflected by artefact scatters, hearths and areas of potential archaeological deposits (PAD), as well as the potential to retain significant cultural features which have been documented throughout the region including stone arrangements and bora grounds. These landscapes typically have a greater depth of deposit, with topsoils generally ranging from 10–60 cm and subsoils greater than 100 cm, increasing the potential for landforms to retain subsurface archaeological material. Deeper alluvial and colluvial soil profiles present along the major river systems and at the base of elevations have the potential to retain PAD of significant antiquity. A prevalence of acid soils common across many of the soil landscapes within the project study area would likely result in a lack of preservation for organic artefact materials such as shell, bone and wood. As such cultural assemblages would likely be dominated by varying densities of stone artefacts.

Disturbances associated with agricultural land uses across the region including grazing and cultivation are prevalent across all soil landscapes and has frequently resulted in extensive vegetation clearance. The archaeological implications of these historic and ongoing landform disturbances are the deleterious effect they can have on more intrusive Aboriginal sites such as culturally modified trees and stone arrangements. Destabilisation of land surfaces as a result of vegetation clearance as well as ongoing cultivation or livestock impacts, is well documented throughout the region to have increased landform susceptibility to erosion. Erosional impacts can contribute to the degradation of surface and subsurface archaeological material, and the movement of cultural objects into secondary contexts.

Table 5.3 Major soil landscapes within the study area in order of prevalence (Murphy & Lawrie 1998)

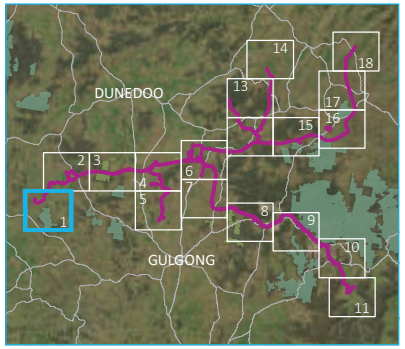
Soil landscape and type	Cumulative coverage within project study area		Landform pattern and hydrology	Landform elements	Slope and relief	Geology	Soil summary	Implications for archaeology
	(ha)	(%)						
Rouse (rs)	884	22	Undulating hills and low hills with granite outcropping as tors and sloping pavements. Drainage lines 300–1,000 m apart.	Landform elements affected include drainage lines, depressions, footslopes, lower slopes and more rarely, mid and upper slopes.	Relief 50–90 m. Slopes 5–15%.	Gulgong Granite, biotite granite, adamellite, granodiorite.	Loamy sand to clayey sand topsoil extending to 10–20 cm. Loamy sand to light sandy clay loam subsoil extending to 50 cm. Grazing and cultivation. Minor sheet and gully erosion, some areas of severe gully erosion.	Potential for rockshelters, grinding grooves, quarries.
Home Rule (hr)	533	13	Undulating low rises ranging from 420–500 m in elevation. Drainage lines are 300–1,000 m apart.	Landform elements affected include drainage lines, footslopes, lower slopes and more rarely mid and upper slopes.	Relief 30-60 m. Slopes 4-8%.	Gulgong and Rouse Granites.	Loose loamy sand topsoil 10–35 cm, and loose clayey sand subsoil on upper slopes. Hard-setting sandy loams to 40 cm and sandy clay or sandy loam subsoils on mid to lower slopes. Grazing and cultivation. Minor sheet and gully erosion, some areas of severe gully erosion.	Potential for surface and sub-surface stone artefacts, grinding grooves, stone arrangements
Turill (ti)	480	12	Undulating low hills with small flats adjacent to creeks. Elevations vary from 440–560 m above sea level.	Landform elements affected include footslopes, lower slopes and more rarely, mid and upper slopes.	Relief 30-90 m. Slopes 5-20%.	Narrabeen Sandstone, mudstone, and Jurassic shale and sandstone.	Loose clayey sand or sandy loam topsoil to 30 cm. Sandy loam or sandy clay subsoil. Grazing and cultivation. Minor to moderate sheet erosion on the slopes, with minor gully erosion in drainage lines.	Potential for surface and sub-surface stone artefacts, grinding grooves, stone arrangements

Table 5.3 Major soil landscapes within the study area in order of prevalence (Murphy & Lawrie 1998)

Soil landscape and type	Cumulative coverage within project study area		Landform pattern and hydrology	Landform elements	Slope and relief	Geology	Soil summary	Implications for archaeology
	(ha)	(%)						
Ulan (ul)	449	11	Lower colluvial slopes of sandstone plateaux escarpments; low undulating rises, creek flats and tributary stream channels.	Landforms elements affected include footslopes, lower and mid slopes and banks.	Relief 10–40 m. Slopes 2 -10%.	Quaternary Alluvium and Illawarra Coal Measures, shale, sandstone, conglomerate, chert, coal and torbanite seams	Hard-setting sandy loam topsoil to 8–20 cm. Sandy clay to 60 cm. Grazing and cultivation. Coal mining. Minor sheet and gully erosion, some areas of severe gully erosion.	Potential for rockshelters, grinding grooves, quarries.
Barigan Creek (bc)	311	8	Lower slopes of sandstone plateaux escarpments, low undulating rises and creek flats. Horizontal beds of sandstone outcrop as benches. Elevations vary from 360 m–470 m above sea level. Stream channels are tributaries to larger streams.	Landforms elements affected include footslopes, lower and mid slopes and banks.	Relief 10–30 m. Slopes 2–10%.	Illawarra Coal Measures, Shoalhaven Group, shale, sandstone, siltstone, conglomerate, chert	Sandy loam topsoil overlying light to medium clay subsoil. Grazing and cultivation. Minor to moderate gully erosion; areas of severe sheet erosion. Some areas of severe localised salinity.	Potential for rockshelters, grinding grooves, quarries.
Lahey's Creek (lc)	238	6	Undulating low hills with elevations between 400–520 m. Drainage lines are spaced 400–1,200 m apart.	Landform elements affected include drainage lines, depressions, footslopes, lower slopes and more rarely, mid and upper slopes.	Relief 40–50 m. Slopes 3–10%.	Permian sandstone, shales, alluvium, Ballimore Formation, Chesleigh Formation, Curoba Formation	Sandy loam with sharp change to light clay or sandy clay loam overlying weathered shale or sandstone at 50–70 cm on upper slopes and crests. Extensive clearance. Grazing and cultivation. Moderate sheet erosion and moderate gully erosion common; some areas of severe gully erosion. Surface soils moderately acidic.	Potential for surface and sub-surface stone artefacts, grinding grooves, stone arrangements.

Table 5.3 Major soil landscapes within the study area in order of prevalence (Murphy & Lawrie 1998)

Soil landscape and type	Cumulative coverage within project study area		Landform pattern and hydrology	Landform elements	Slope and relief	Geology	Soil summary	Implications for archaeology
	(ha)	(%)						
Ballimore (bm)	182	5	Undulating low hills with elevations from 280–400 m. Drainage lines are spaced at 500–1500 m intervals.	Landform elements affected include drainage lines, depressions, footslopes, lower slopes and more rarely, mid and upper slopes.	Relief 20–40 m. Slopes 3–6%.	Ballimore Sandstone	Sandy loam to 15–40 cm and light to medium clay subsoil to 80 cm. Extensive clearance. Grazing and cultivation. Moderate to severe sheet and gully erosion.	Potential for surface and sub-surface stone artefacts, grinding grooves, stone arrangements.
Lees Pinch (lp)	169	4	Sandstone plateaux and hillslopes with boulder debris, from 400–680 m above sea level. Drainage lines are 400–1,200 m apart.	Landform elements affected include drainage lines, depressions, footslopes, lower slopes, mid and upper slopes.	Relief 60–240 m. Slopes 15–40%.	Narrabeen sandstone, conglomerate sandstone, shale, conglomerate, mudstone, chert, coal and torbanite seams	Loamy sand or gravelly sandy clay loam topsoil 10–15 cm and clayey sand subsoil with a clear change to weathered sandstone at 15–50 cm on plateaus and slopes. Hard-setting loam topsoil to 30–60 cm followed by sandy clay loam to 80–115 cm on lower slopes and depressions. Grazing. Minor sheet erosion.	Potential for rockshelters, grinding grooves, quarries.
Goonoo (gn)	166	4	Undulating low rises ranging from 280–560 m in elevation. Drainage lines are 1,000 m apart.	Landform elements affected include drainage lines, footslopes, lower slopes and more rarely mid and upper slopes.	Relief 10–15 m. Slopes 2–10%.	Pilliga Sandstones	Soils: earthy sands, yellow solodic, red earth and yellow earth soils. Typically, a loamy sands topsoil of ~20 cm overlying sandy clay loam ~30-40 cm, over hard clay and/or geological substrate. Grazing and cultivation. Minor sheet and gully erosion, some areas of severe gully erosion.	Potential for surface and sub-surface stone artefacts, grinding grooves, stone arrangements.



KEY

- Construction area

Soil landscapes

- Ballimore (RBEbm)
- Dapper Hill (SHdh)
- Laheys Creek (YSlc)
- Mebul (CSme)
- Mookerawa (SHmk)
- Mullion Creek (SHmu)
- Spring Ridge (SLsr)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 1 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

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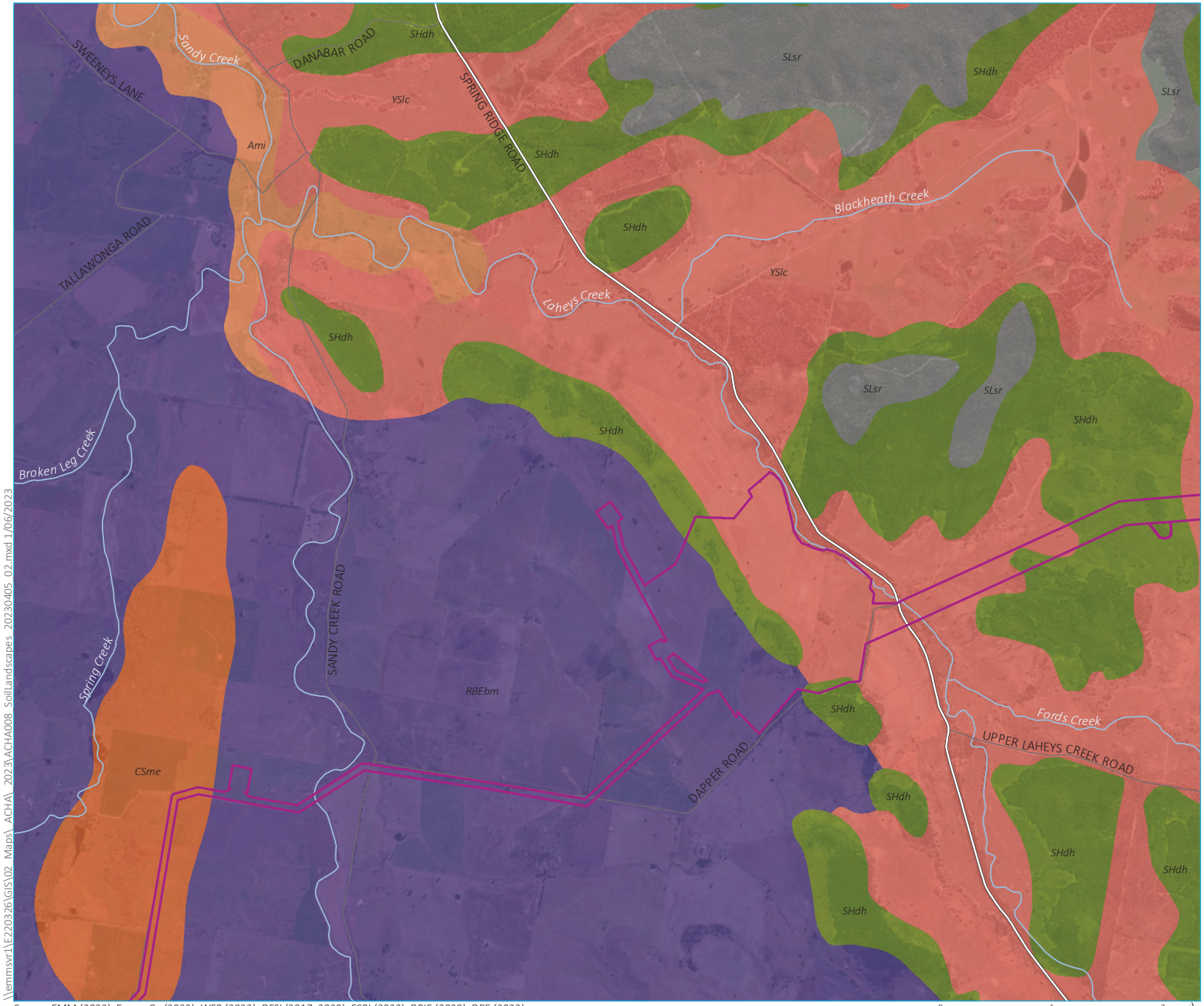

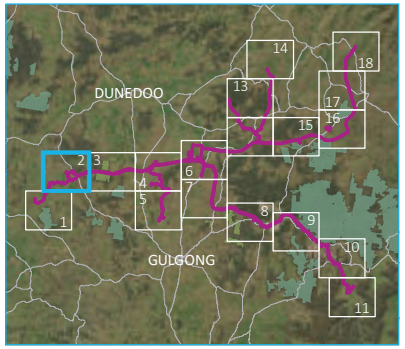

KEY

- Construction area

Soil landscapes

- Ballimore (RBEbm)
- Dapper Hill (SHdh)
- Laheys Creek (YSlc)
- Mebul (CSme)
- Mitchell Creek (Ami)
- Spring Ridge (SLsr)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 2 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

EMM creating opportunities

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

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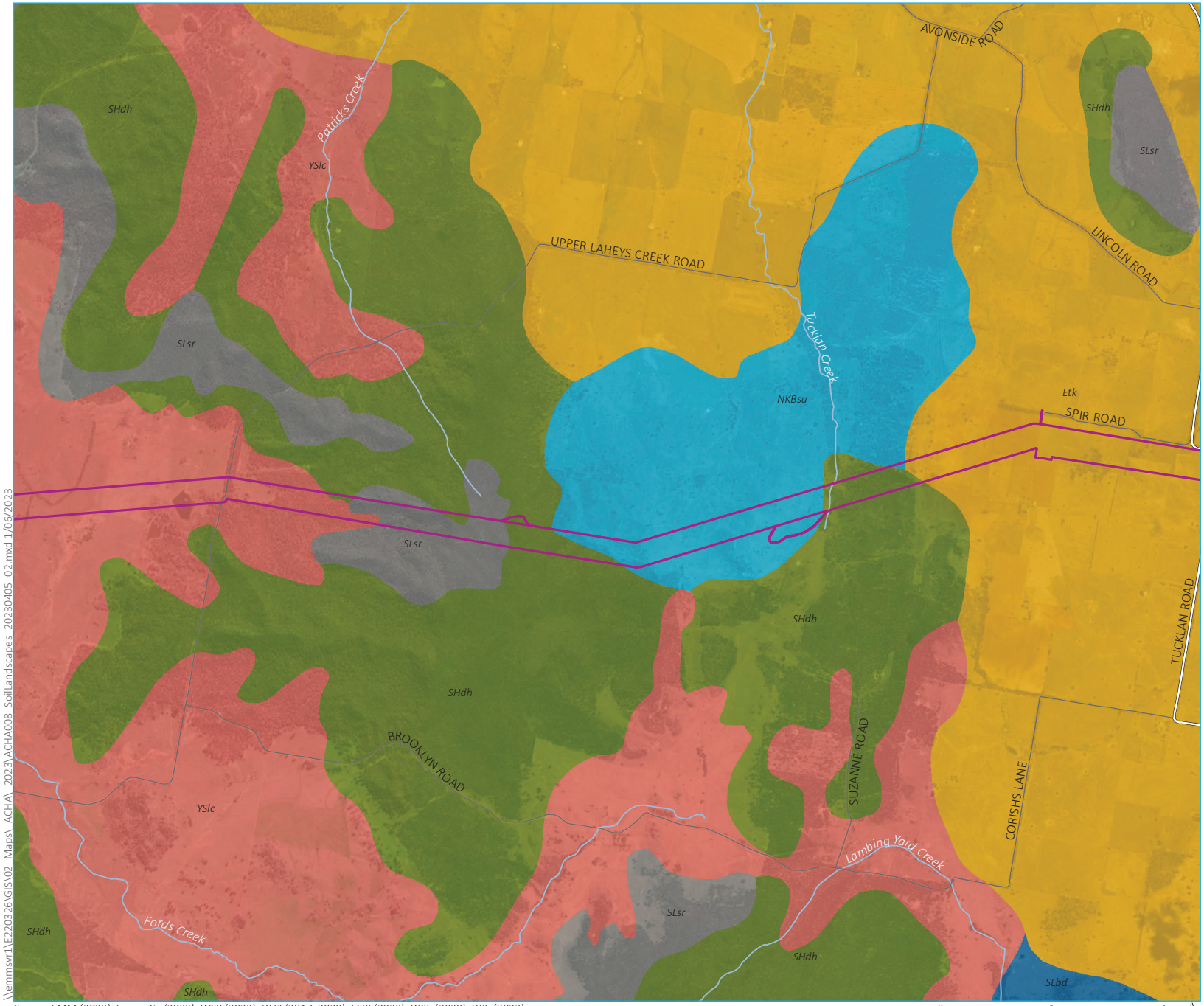

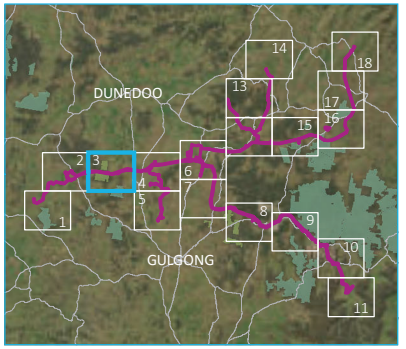

KEY

- Construction area

Soil landscapes

- Burrendong (SLbd)
- Dapper Hill (SHdh)
- Laheys Creek (YSlc)
- Spring Ridge (SLsr)
- Surface Hill (NKBsu)
- Tucklan (Etk)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

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GDA2020 MGA Zone 55

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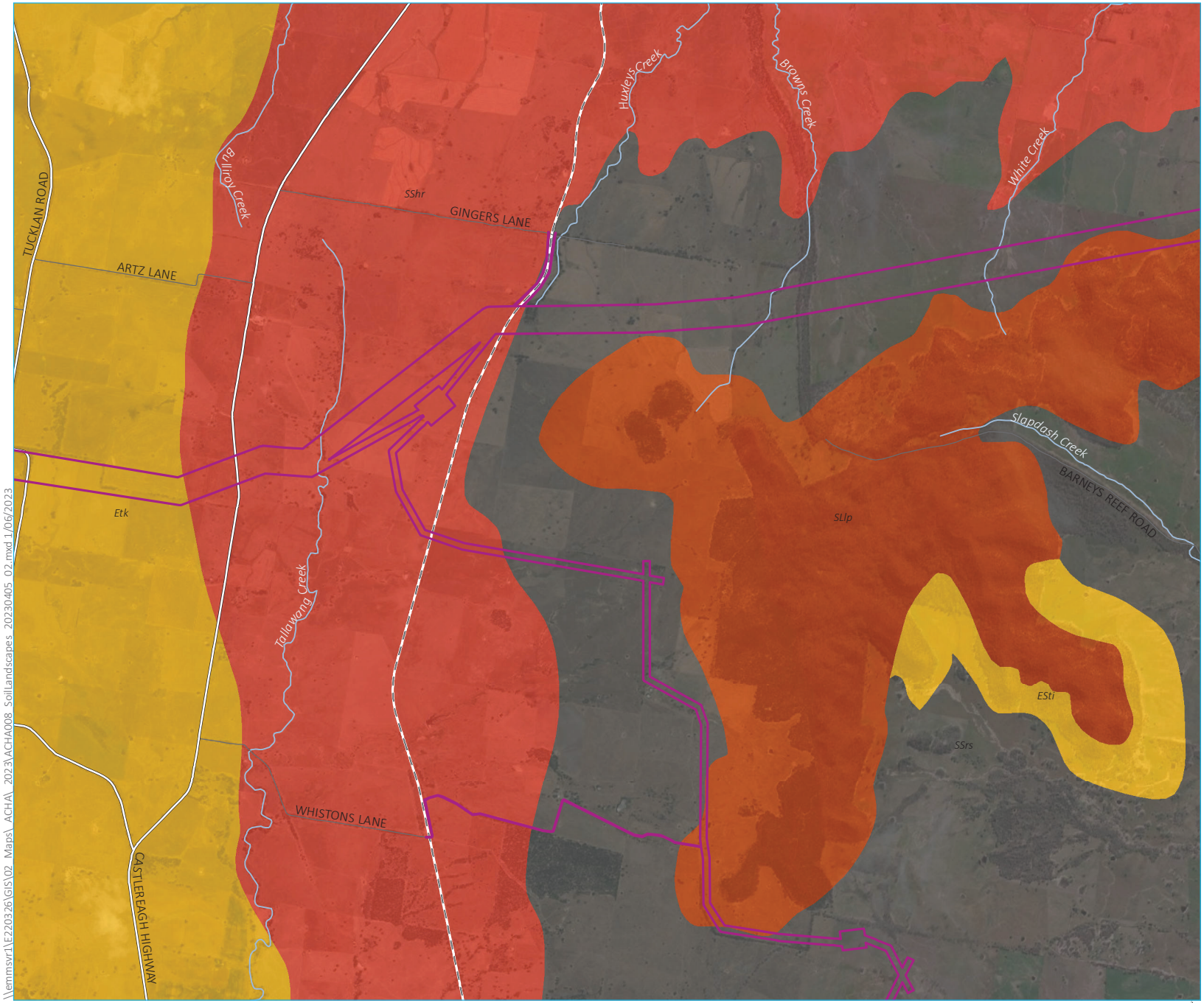
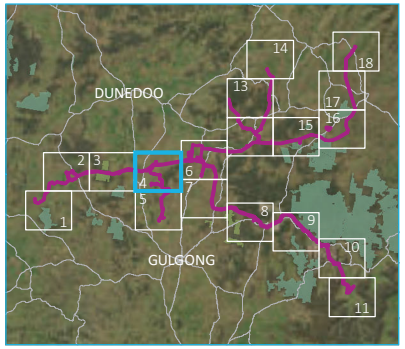
Soil landscapes
Map 3 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

EMM
creating opportunities





KEY

- Construction area

Soil landscapes

- Home Rule (SShr)
- Lees Pinch (SLlp)
- Rouse (SSrs)
- Tucklan (Etk)
- Turill (ESti)

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 4 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

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GDA2020 MGA Zone 55
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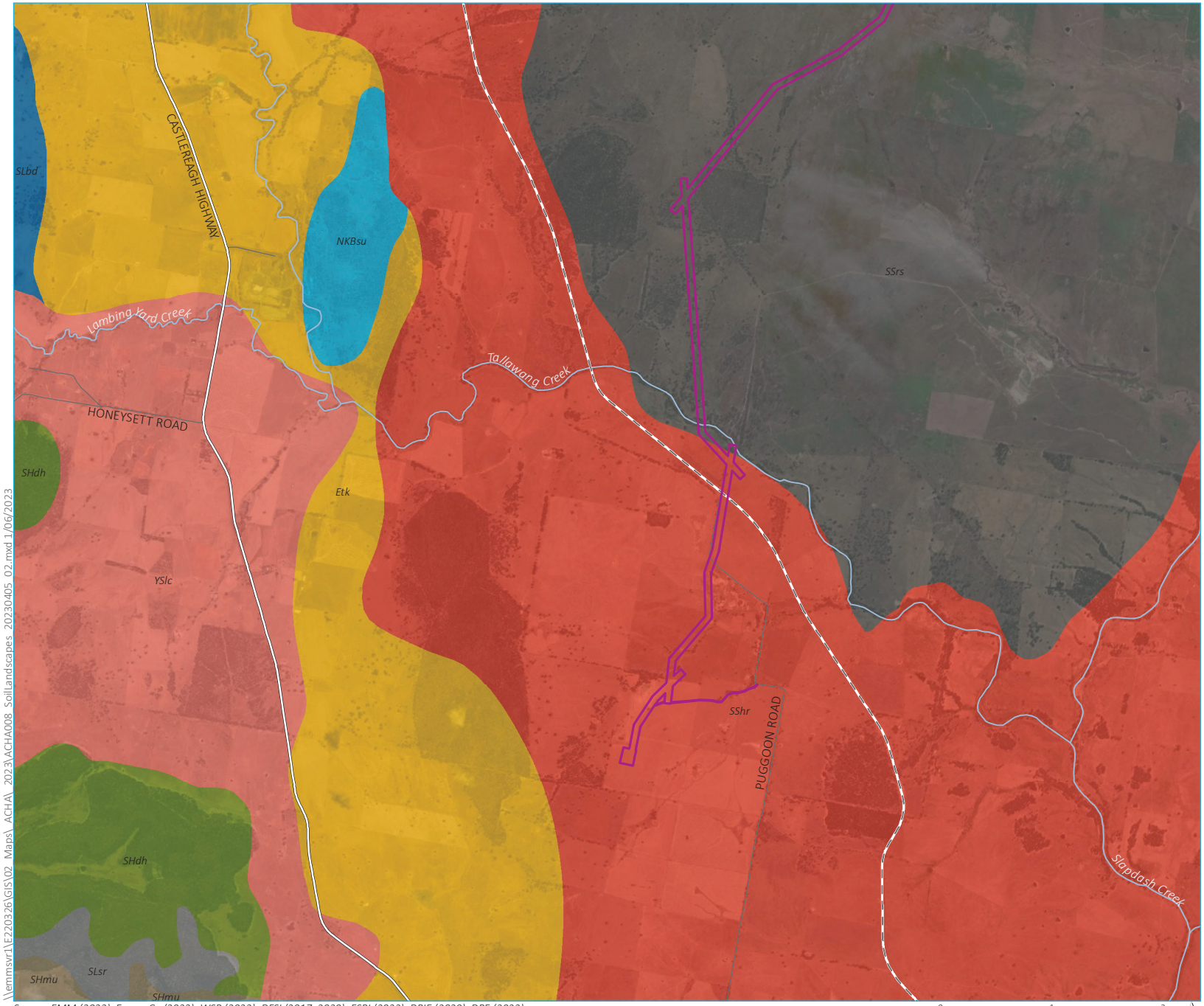
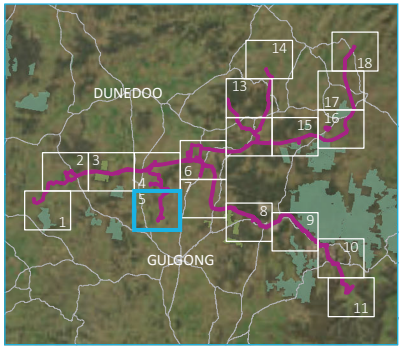
creating opportunities





KEY

- Construction area

Soil landscapes

- Burrendong (SLbd)
- Dapper Hill (SHdh)
- Home Rule (SShr)
- Laheys Creek (YSlc)
- Mullion Creek (SHmu)
- Rouse (SSrs)
- Spring Ridge (SLsr)
- Surface Hill (NKBsu)
- Tucklan (Etk)

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 5 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

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GDA2020 MGA Zone 55

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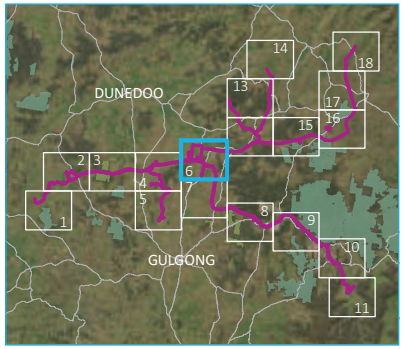
creating opportunities



KEY

- Construction area

Soil landscapes

- Bald Hill (Ebh)
- Belowrie (RPbi)
- Home Rule (SShr)
- Lees Pinch (SLlp)
- Munghorn Plateau (SSmp)
- Rouse (SSrs)
- Talbragar (Atb)
- Turill (ESti)
- Ulan (YPul)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 6 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

EMM creating opportunities

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

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GDA2020 MGA Zone 55

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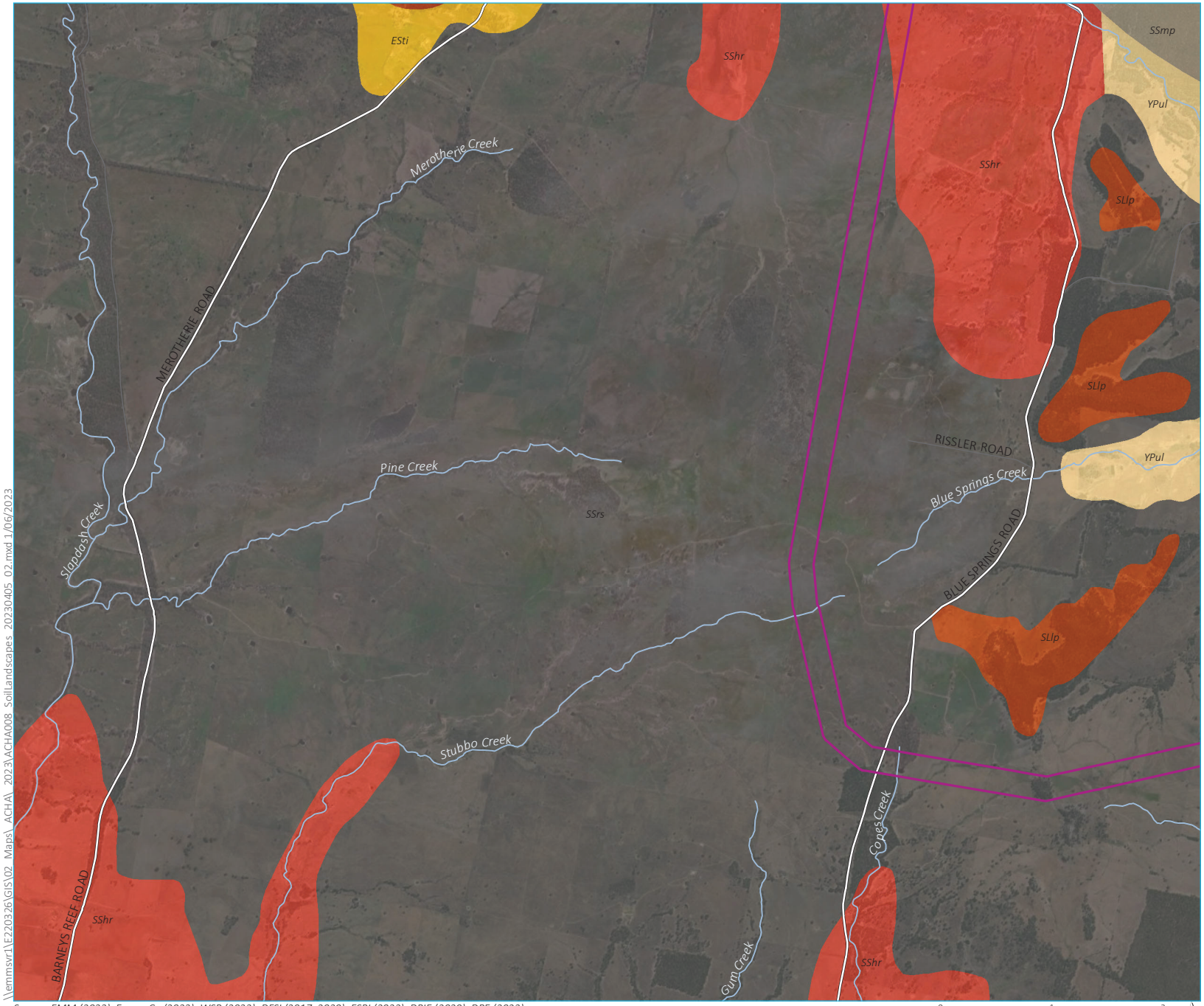

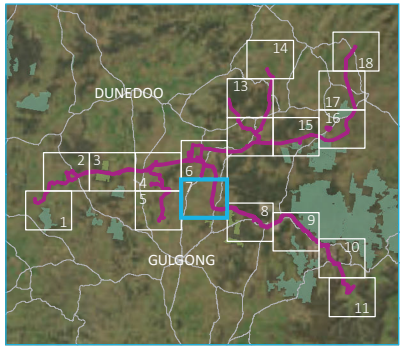

KEY

- Construction area

Soil landscapes

- Home Rule (SShr)
- Lees Pinch (SLlp)
- Munghorn Plateau (SSmp)
- Rouse (SSrs)
- Turill (ESti)
- Ulan (YPul)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 7 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

EMM creating opportunities

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

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GDA2020 MGA Zone 55

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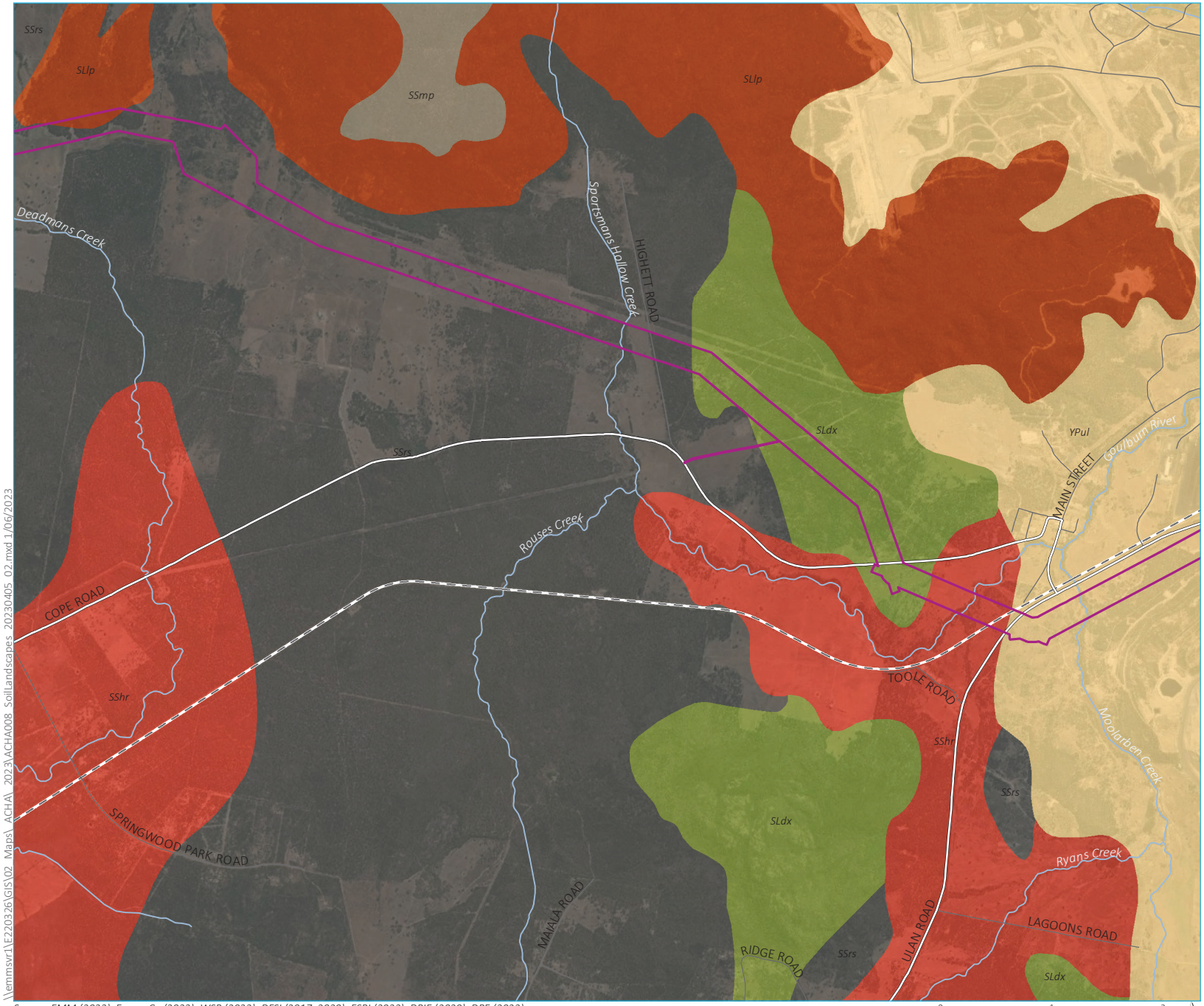

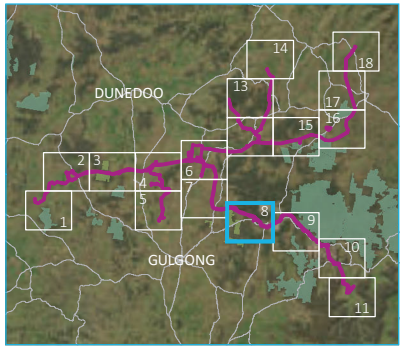

KEY

Construction area

Soil landscapes
- Dexter (SLdx)
- Home Rule (SShr)
- Lees Pinch (SLlp)
- Munghorn Plateau (SSmp)
- Rouse (SSrs)
- Ulan (YPul)

Existing environment
- Major road
- Minor road
- Rail line
- Named watercourse

INSET KEY
- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 8 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

EMM creating opportunities

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

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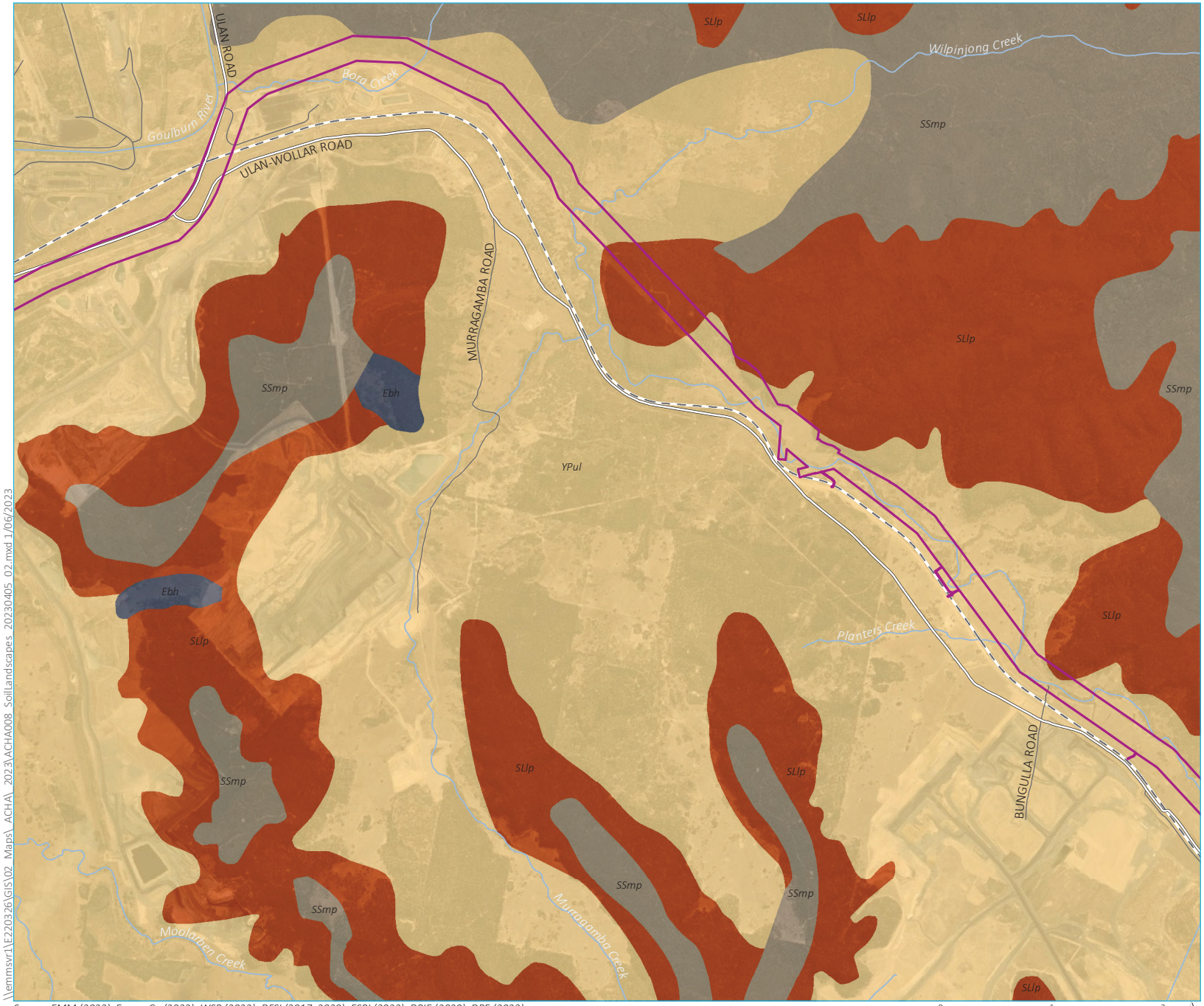

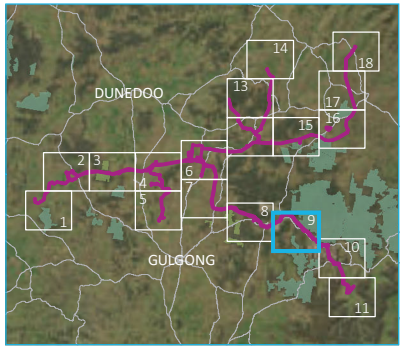

KEY

- Construction area

Soil landscapes

- Bald Hill (Ebh)
- Lees Pinch (SLlp)
- Munghorn Plateau (SSmp)
- Ulan (YPul)

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 9 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

EMM creating opportunities

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

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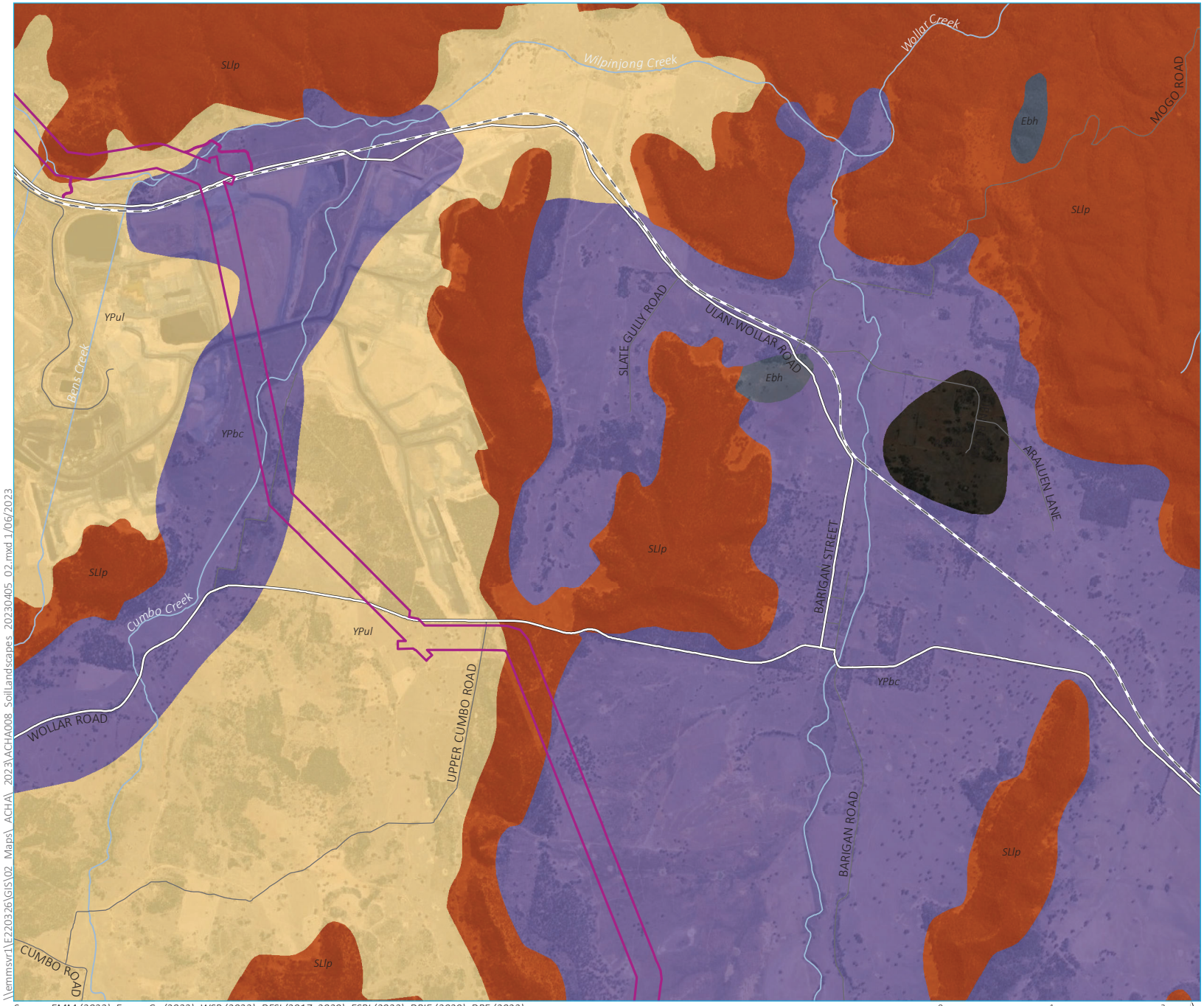
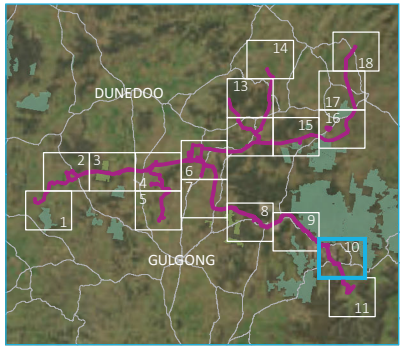
GDA2020 MGA Zone 55

N





KEY

- Construction area

Soil landscapes

- Bald Hill (Ebh)
- Barigan Creek (YPbc)
- Lees Pinch (SLlp)
- Murrumbo (REmb)
- Ulan (YPul)

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

0 1 2 km

GDA2020 MGA Zone 55

N

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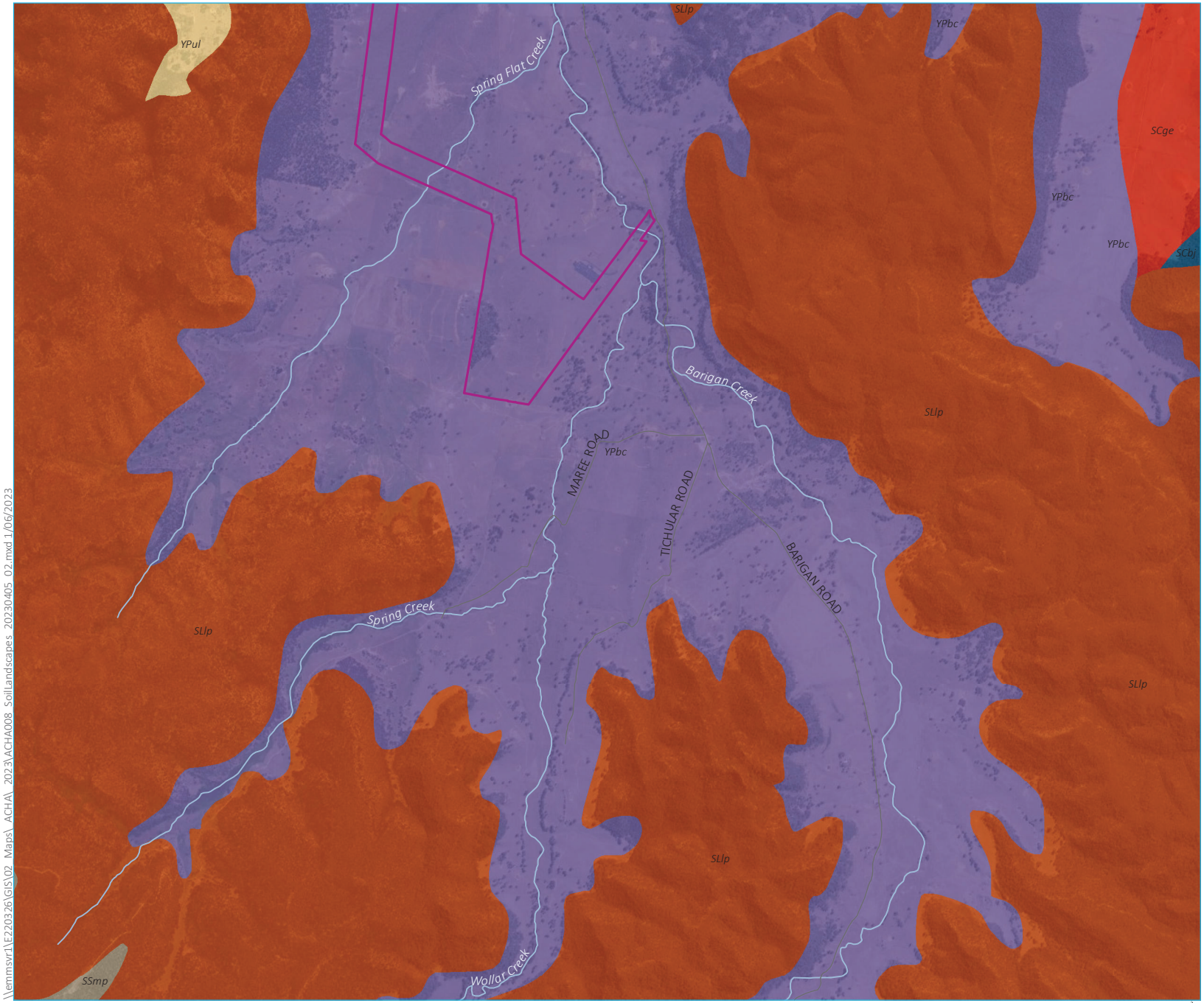
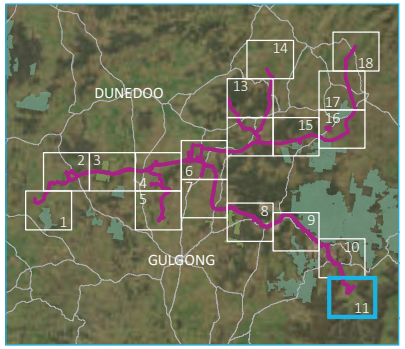
Soil landscapes
Map 10 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

EMM
creating opportunities





KEY

- Construction area

Soil landscapes

- Barigan Creek (YPbc)
- Benjang (SCbj)
- Growee (SCge)
- Lees Pinch (SLlp)
- Munghorn Plateau (SSmp)
- Ulan (YPul)

Existing environment

- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 11 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

EMM creating opportunities

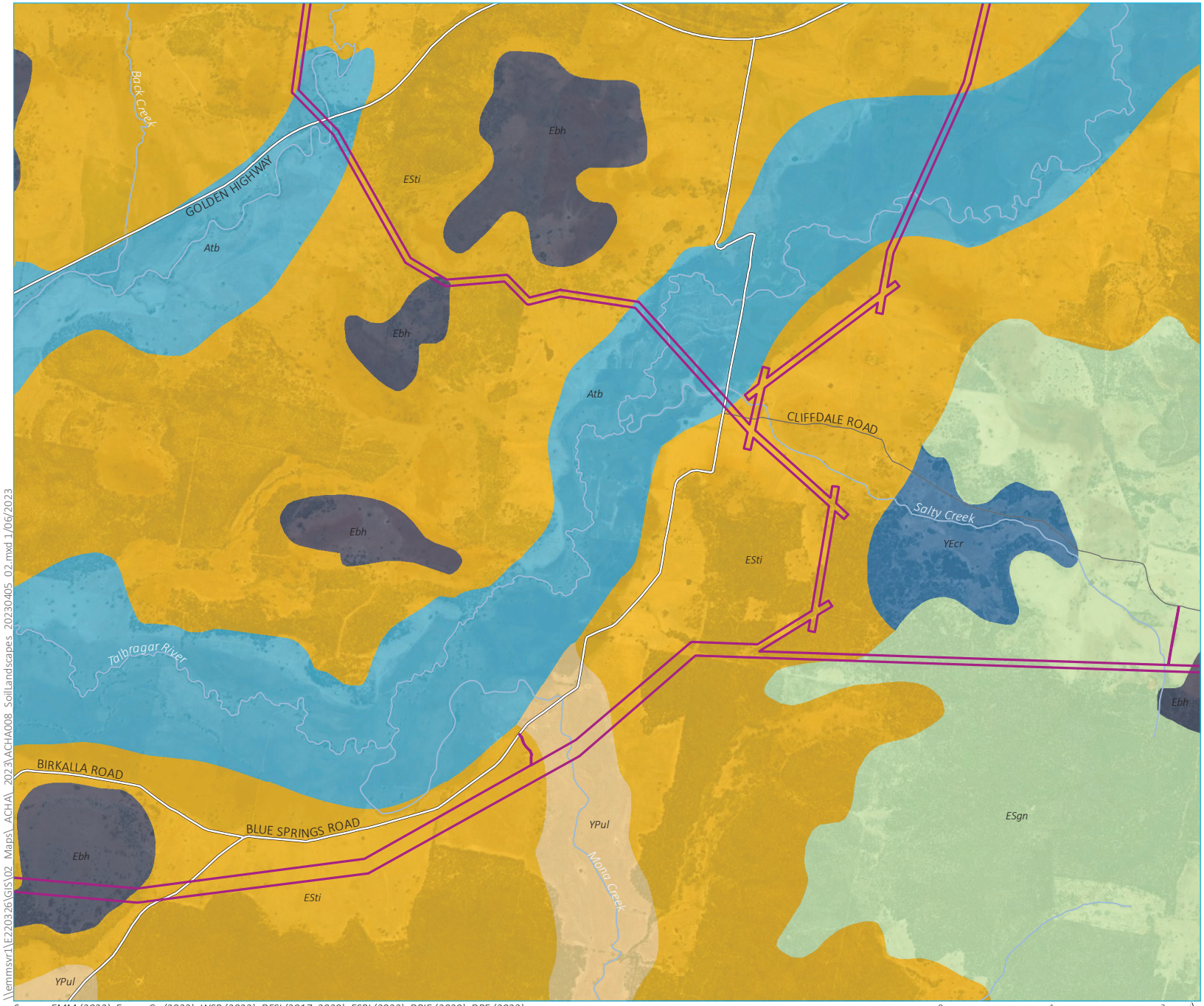
\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA008_SoilLandscapes_20230405_02.mxd 1/06/2023

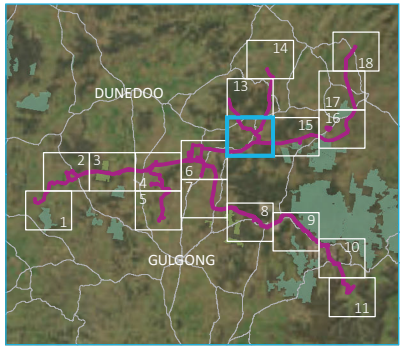
Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

0 1 2 km

GDA2020 MGA Zone 55

N





KEY

- Construction area

Soil landscapes

- Bald Hill (Ebh)
- Crowee (YEcr)
- Goonoo (ESgn)
- Talbragar (Atb)
- Turill (ESti)
- Ulan (YPul)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 12 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA008 SoilLandscapes 20230405 02.mxd 1/06/2023

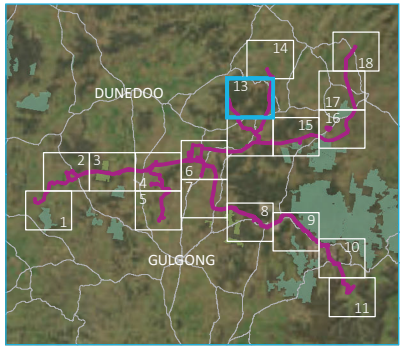
Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

0 1 2 km

GDA2020 MGA Zone 55

N

EMM creating opportunities



KEY

- Construction area

Soil landscapes

- Ant Hill (BEah)
- Balladoran (ESbn)
- Goonoo (ESgn)
- Talbragar (Atb)
- Turill (ESti)

Hydrogeological landcapes*

- Biranganbil
- Coolah Basalt
- Goolma
- Pilliga
- Purlewaugh/Napperby
- Rylstone - Sydney Basin Sediments

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

0 1 2 km

GDA2020 MGA Zone 55

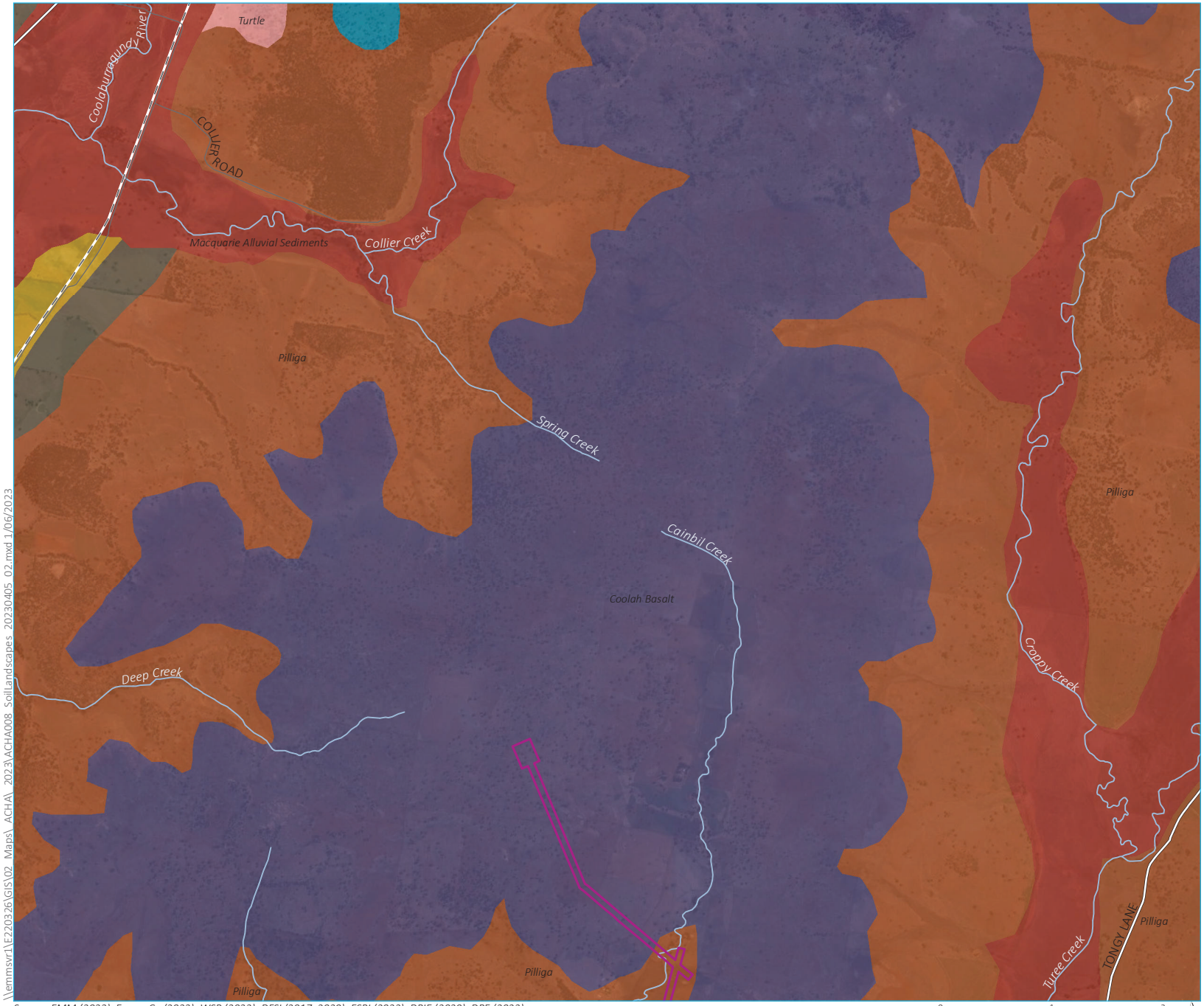
N

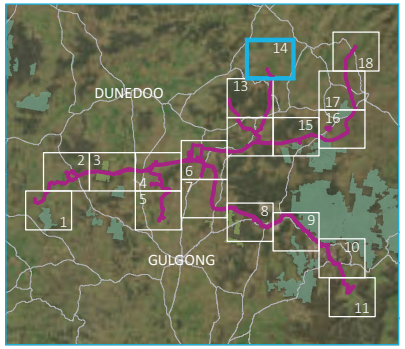
\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA008_SoilLandscapes_20230405_02.mxd 1/06/2023

Soil landscapes
Map 13 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

EMM
creating opportunities





KEY

- Construction area

Hydrogeological landcapes*

- Coolah Basalt
- Dubbo Basalt (East)
- Macquarie Alluvial Sediments
- Pilliga
- Purlewaugh/Napperby
- Rylstone - Sydney Basin Sediments
- Turtle

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 14 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

EMM creating opportunities

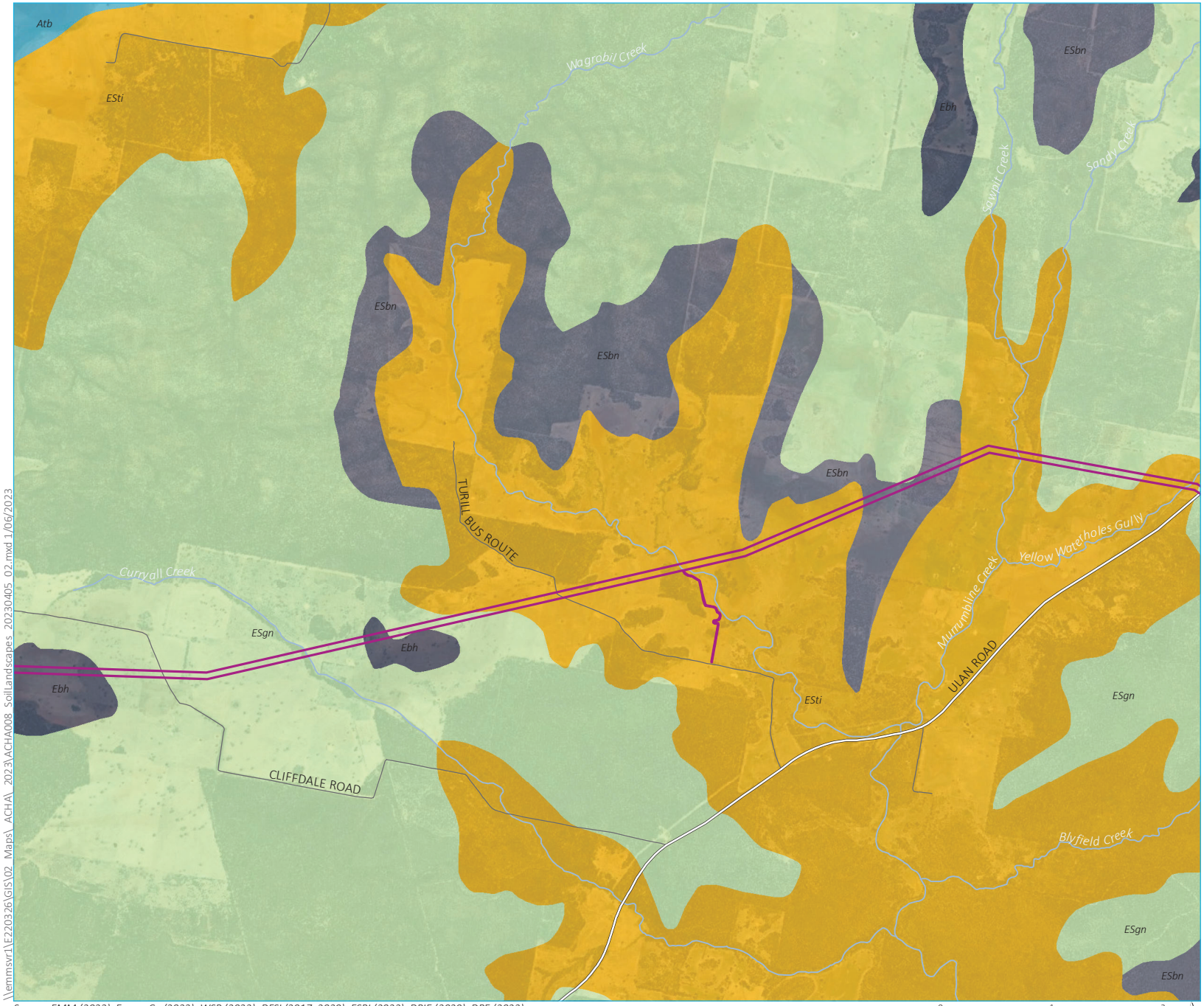
\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA008_SoilLandscapes_20230405_02.mxd 1/06/2023

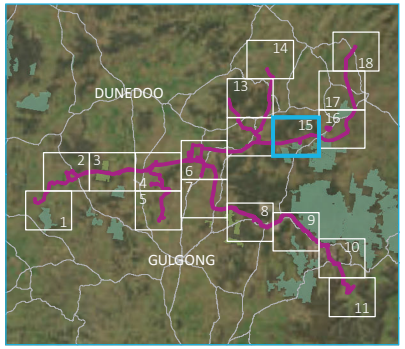
Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

0 1 2 km

GDA2020 MGA Zone 55

N





KEY

- Construction area

Soil landscapes

- Bald Hill (Ebh)
- Balladoran (ESbn)
- Goonoo (ESgn)
- Talbragar (Atb)
- Turill (ESti)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 15 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA008 SoilLandscapes 20230405 02.mxd 1/06/2023

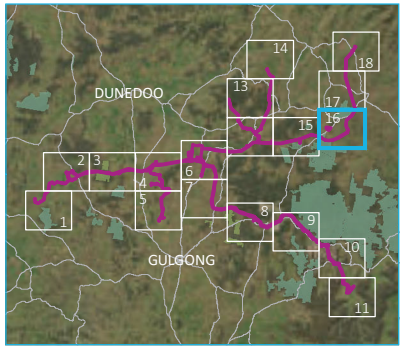
Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

0 1 2 km

GDA2020 MGA Zone 55

N

creating opportunities



KEY

- Construction area

Soil landscapes

- Ant Hill (BEah)
- Bald Hill (Ebh)
- Balladoran (ESbn)
- Goonoo (ESgn)
- Talbragar (Atb)
- Turill (ESti)

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 16 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

EMM creating opportunities

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

0 1 2 km

GDA2020 MGA Zone 55

N

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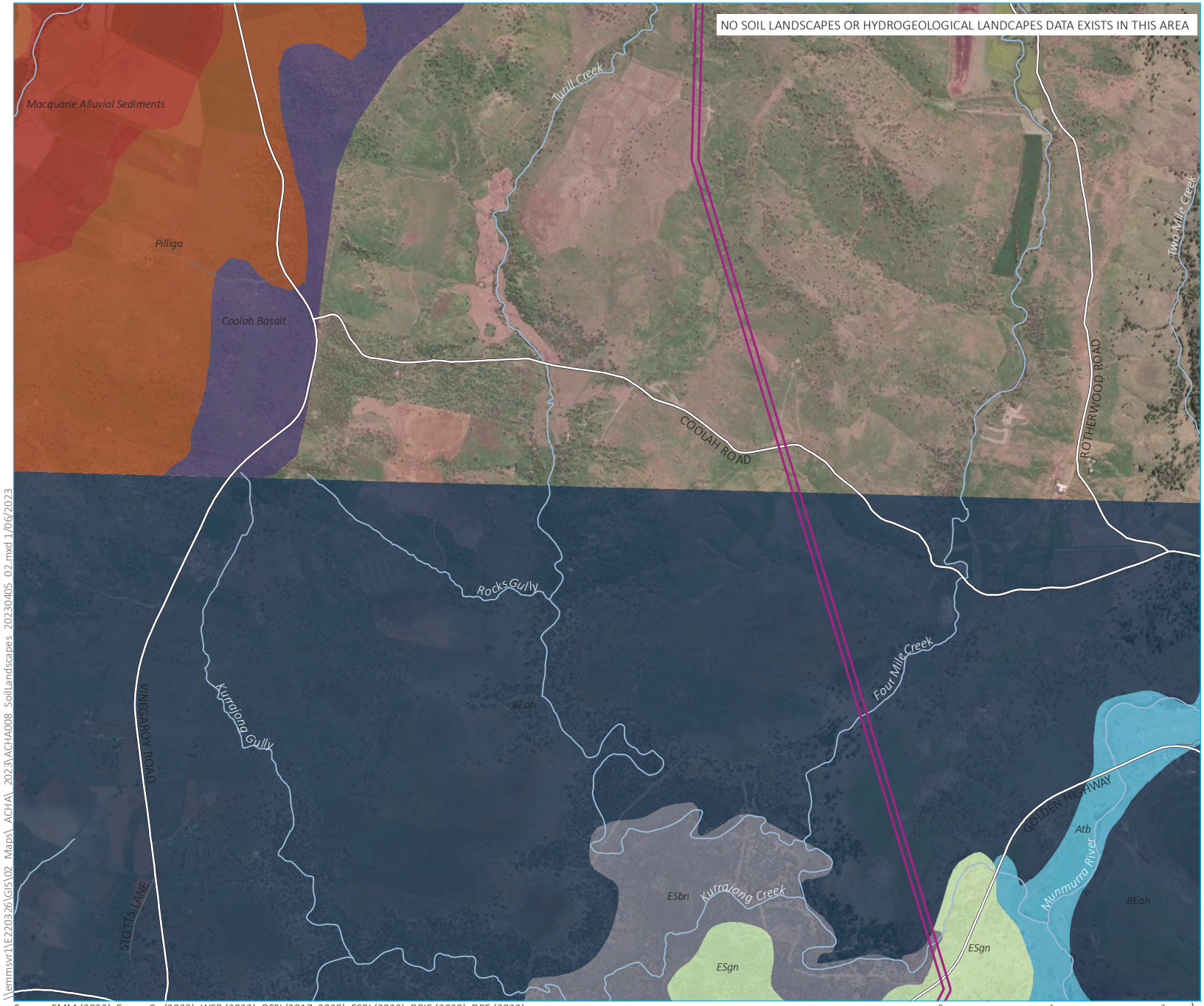
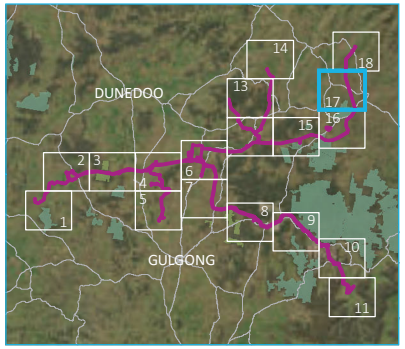




KEY

- Construction area

Soil landscapes

- Ant Hill (BEah)
- Balladoran (ESbn)
- Goonoo (ESgn)
- Talbragar (Atb)

Hydrogeological landcapes*

- Coolah Basalt
- Macquarie Alluvial Sediments
- Pilliga

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 17 of 18

Central West Orana Renewable
Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

EMM
creating opportunities

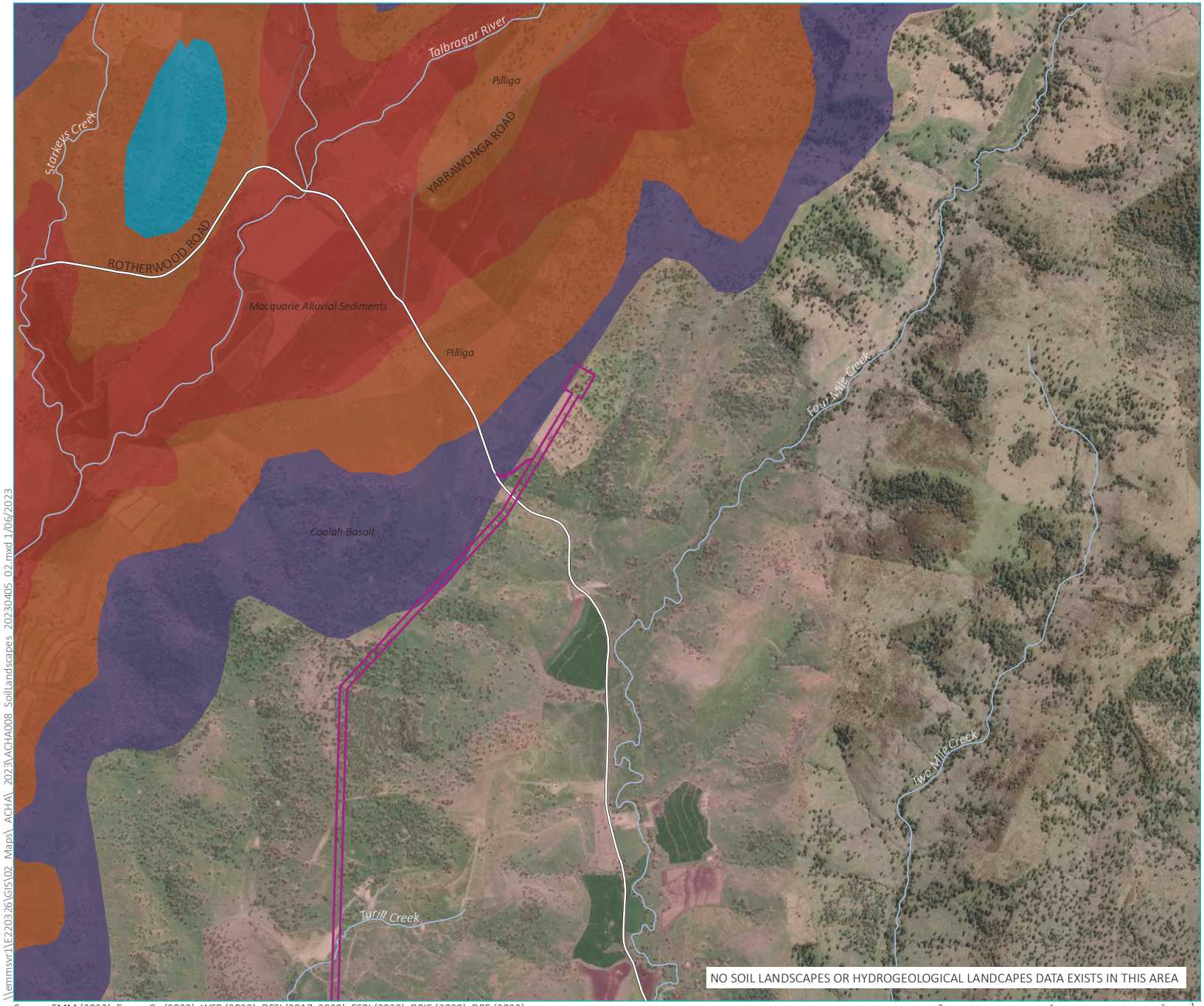
\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA008 SoilLandscapes 20230405 02.mxd 1/06/2023

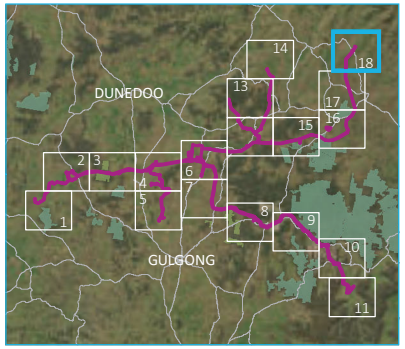
Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

0 1 2 km

GDA2020 MGA Zone 55

N





KEY

Construction area

Hydrogeological landcapes*

- Coolah Basalt
- Dubbo Basalt (East)
- Macquarie Alluvial Sediments
- Pilliga

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

* Note: Hydrogeological landscapes replaces soil landscapes data in northern extent of the Construction area boundary. Where blank no datasets exist within the view extent

Soil landscapes
Map 18 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.3

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA008 SoilLandscapes 20230405 02.mxd 1/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); DPIE (2020); DPE (2023)

0 1 2 km

GDA2020 MGA Zone 55

N

EMM creating opportunities

5.4 Hydrology

Hydrological features are the most likely to indicate areas of archaeological potential within the study area. Access to water and the natural resources associated with it will have dominated the distribution of habitation throughout the area, with landforms in close proximity to major and/or perennial waterways often resulting in prolonged habitation and hence more substantial archaeological material. This is corroborated by previous archaeological works in the area and ethnographic accounts of the area (Sections 4 and 5).

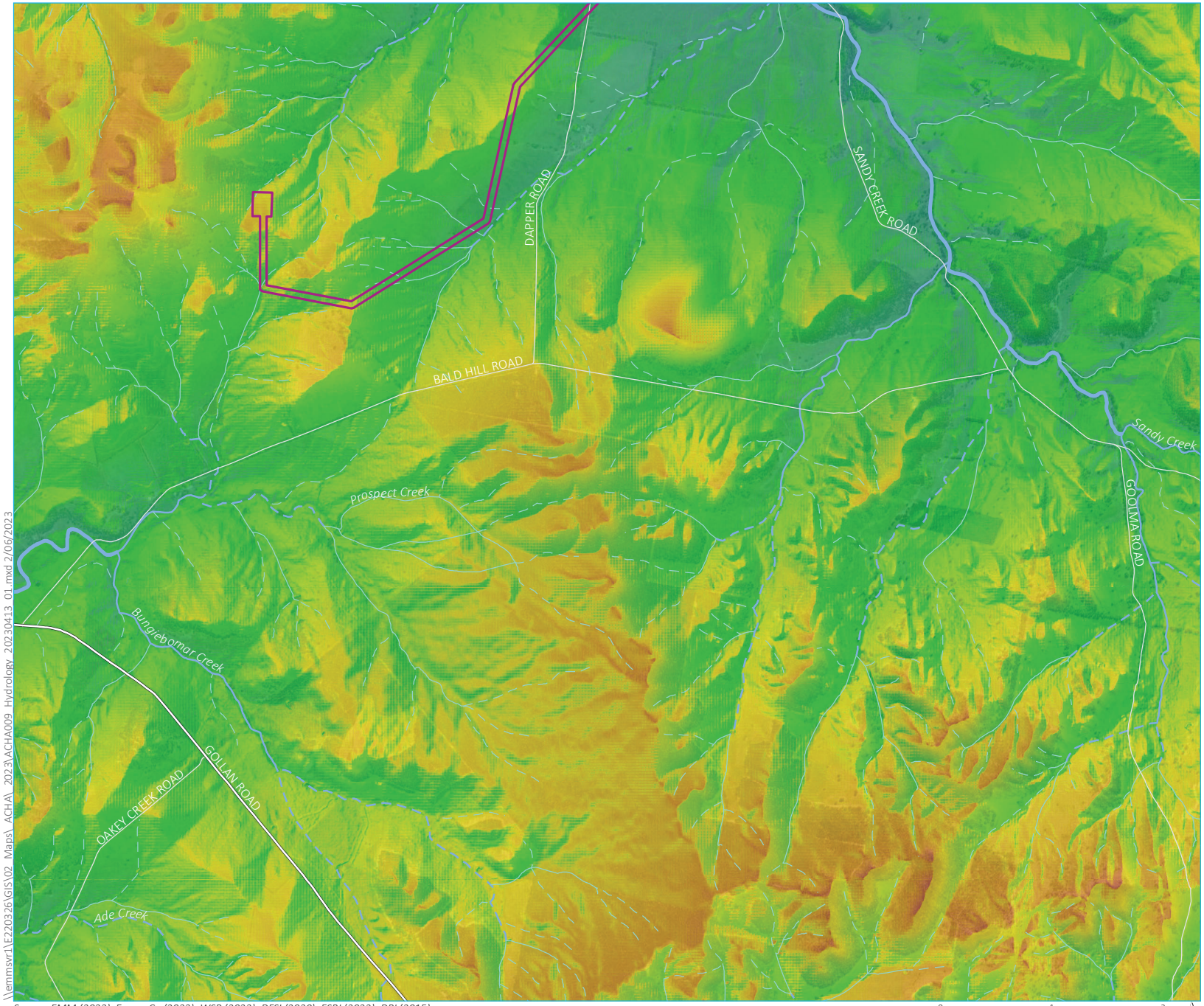
Watercourses, aggregated by Strahler stream order, and the number of occurrences within the study area are listed in Table 5.4 and shown on Figure 5.4. The known archaeological record for the region supports a predictive model for location of Aboriginal sites within 200 m of a water source. Throughout the majority of central western NSW where watercourses are regularly dispersed, significant archaeological material is most frequently identified in association with perennial or semi-permanent waterways (typically 3rd order Strahler and above). There are 42 occurrences of named watercourses 3rd order and above intersecting with the construction area. The study area interacts and/or is in close proximity with the three major waterways for the region, the Macquarie, Talbragar and Goulburn Rivers, as well as significant local waterways, such as Four Mile Creek, Sandy Creek, Laheys Creek, Wollar Creek, Coolaburragundy River, Tallawang Creek, and Turee Creek. Terraces and flats associated with these major waterways may feature deep alluvial soil profiles and hence have the potential to retain subsurface deposits of significant quantity and antiquity.

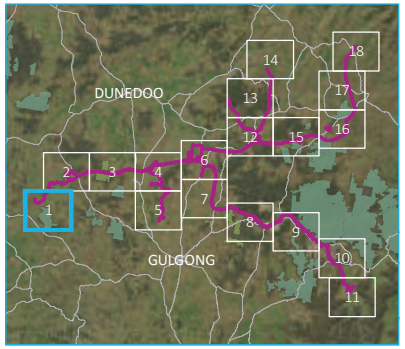
Previous archaeological investigations within and in proximity to the study area have demonstrated a significant concentration of cultural materials associated with Wollar Creek, Barigan Creek, Laheys Creek and Sandy Creek, among others, with the cultural resource declining significantly with distances exceeding 200 m from the waterway. Cultural materials representative of short-term or opportunistic activities is more often associated with ephemeral waterways, drainage lines or other features such as Gilgai or rock outcropping which can retain water following rainfall events. There are also 28 occurrences of named 1st and 2nd order watercourses within the study area (Table 5.4).

Table 5.4 Named watercourses intersecting the project study area

Strahler Order	Occurrences within project study area	Watercourse Names
6	4	Talbragar River, Four Mile Creek, Moolarben Creek, Coolaburragundy River.
5	10	Bounty Creek, Busbys Creek, Cainbil Creek, Cockabutta Creek, Cumbo Creek, Sandy Creek, Sportsmans Hollow Creek, Tallawang Creek, Turee Creek, Wilpinjong Creek.
4	16	Bounty Creek, Cainbil Creek, Collier Creek, Four Mile Creek, Green Wattle Gully, Ironbark Creek, Laheys Creek, Miangulliah Creek, Mona Creek, Murragamba Creek, Sportsmans Hollow Creek, Spring Flat Creek, Starkeys Creek, Talbragar River, Wagrobil Creek, Wilpinjong Creek.
3	12	Bens Creek, Bowenbong Creek, Curryall Creek, Ironbark Creek, Miangulliah Creek, Murrumbline Creek, Norfolk Island Creek, Pine Creek, Salty Creek, Sportsmans Hollow Creek, Spring Creek, Turrill Creek.
2	15	Back Creek, Blackheath Creek, Copes Creek, Curryall Creek, Deep Creek, Huxleys Creek, Junction Creek, Miangulliah Creek, Moreton Bay Creek, Narrow Creek, Planters Creek, Tallawang Creek, Tucklan Creek, Turill Creek, White Creek.
1	13	Back Creek, Browns Creek, Deadmans Creek, Junction Creek, Miangulliah Creek, Oliver Creek, Patricks Creek, Salty Creek, Spring Creek, Stubbo Creek, Tallawang Creek, White Creek, Yellow Waterholes Gully

Notes: Several creek-lines appear in more than one category. This reflects the multiple intersection of the creek-line with the construction area, and where in some locations the creek may be of a different size (or Strahler order).





KEY

Construction area

Existing environment

Major road

Minor road

Strahler stream order

1st order

2nd order

3rd order

4th order

5th order

INSET KEY

Major road

NPWS reserve

State forest

Elevation (m)

787

243

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

GDA2020 MGA Zone 55

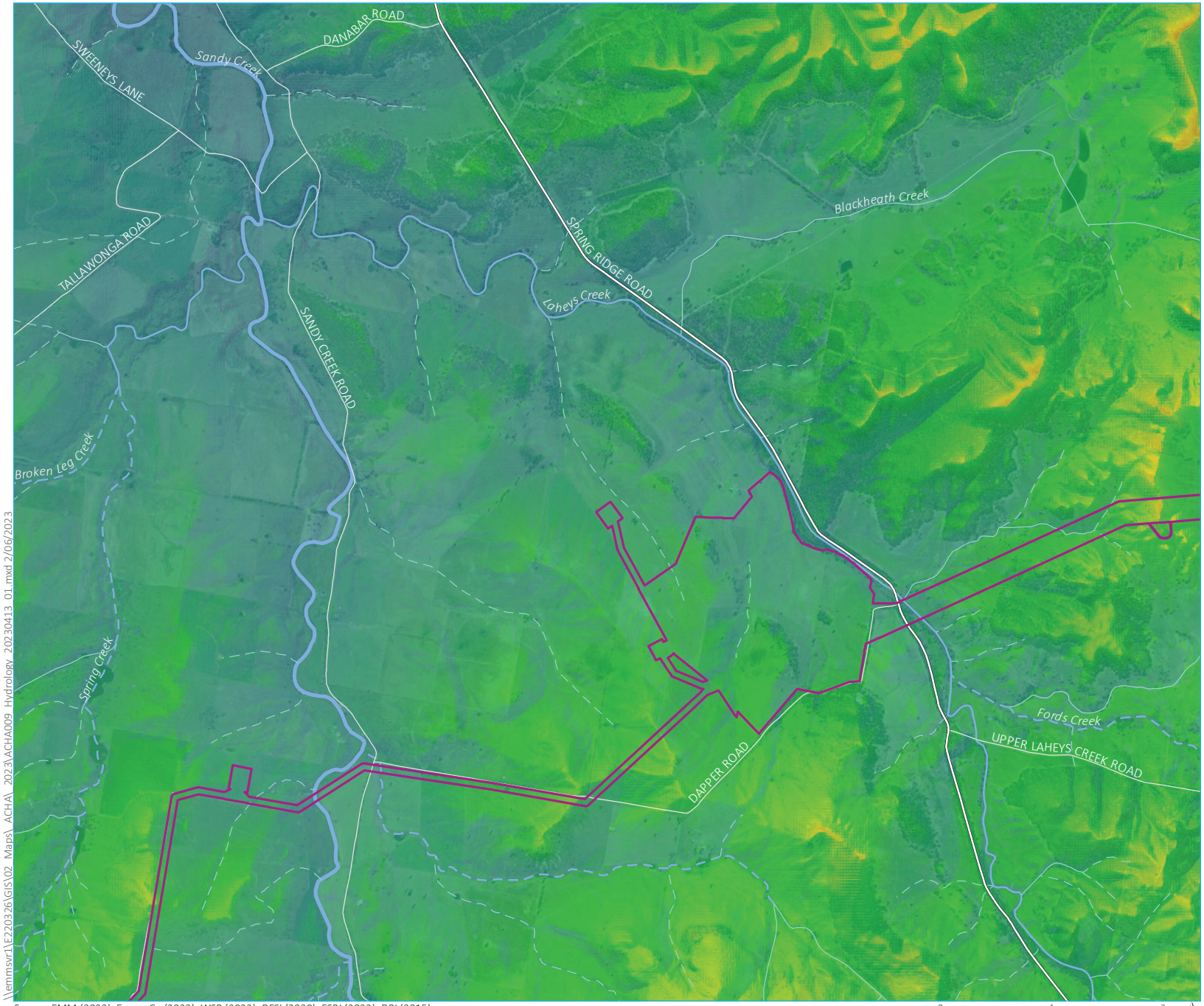
N

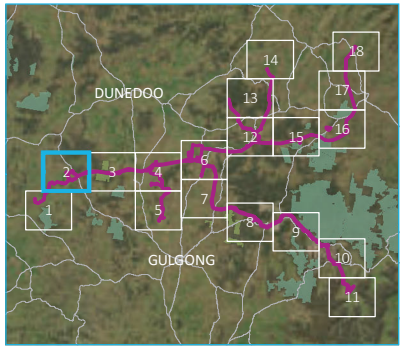
\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA009 Hydrology 20230413 01.mxd 2/06/2023

Hydrology of the study area
Map 1 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

Major road

Minor road

Strahler stream order

1st order

2nd order

3rd order

4th order

5th order

INSET KEY

Major road

NPWS reserve

State forest

Elevation (m)

787

243

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA009_Hydrology_20230413_01.mxd 2/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

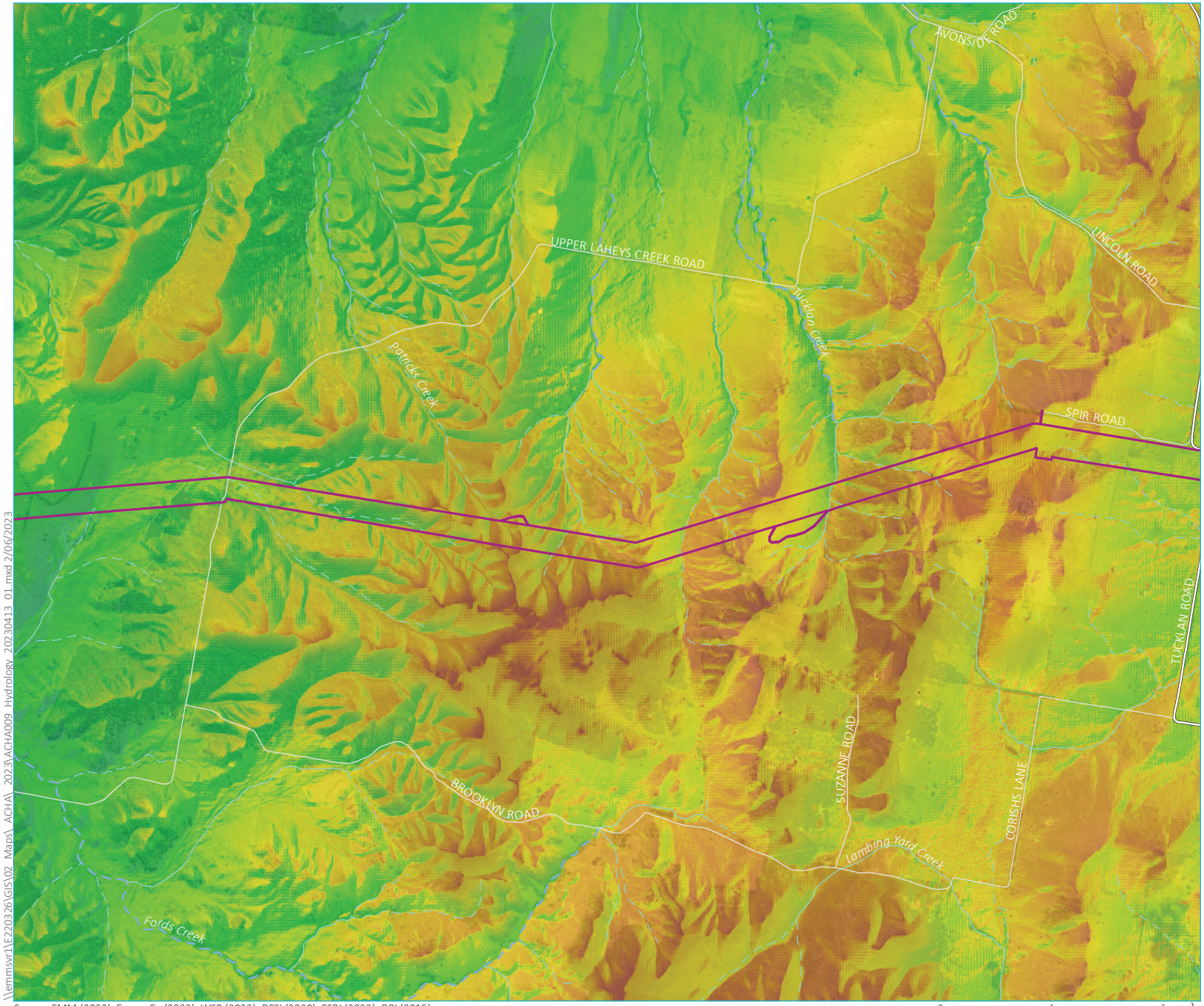
GDA2020 MGA Zone 55

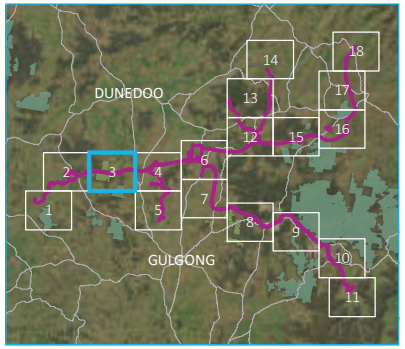
N

Hydrology of the study area
Map 2 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

Major road

Minor road

Strahler stream order

1st order

2nd order

3rd order

INSET KEY

Major road

NPWS reserve

State forest

Elevation (m)

787

243

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA009 Hydrology 20230413 01.mxd 2/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

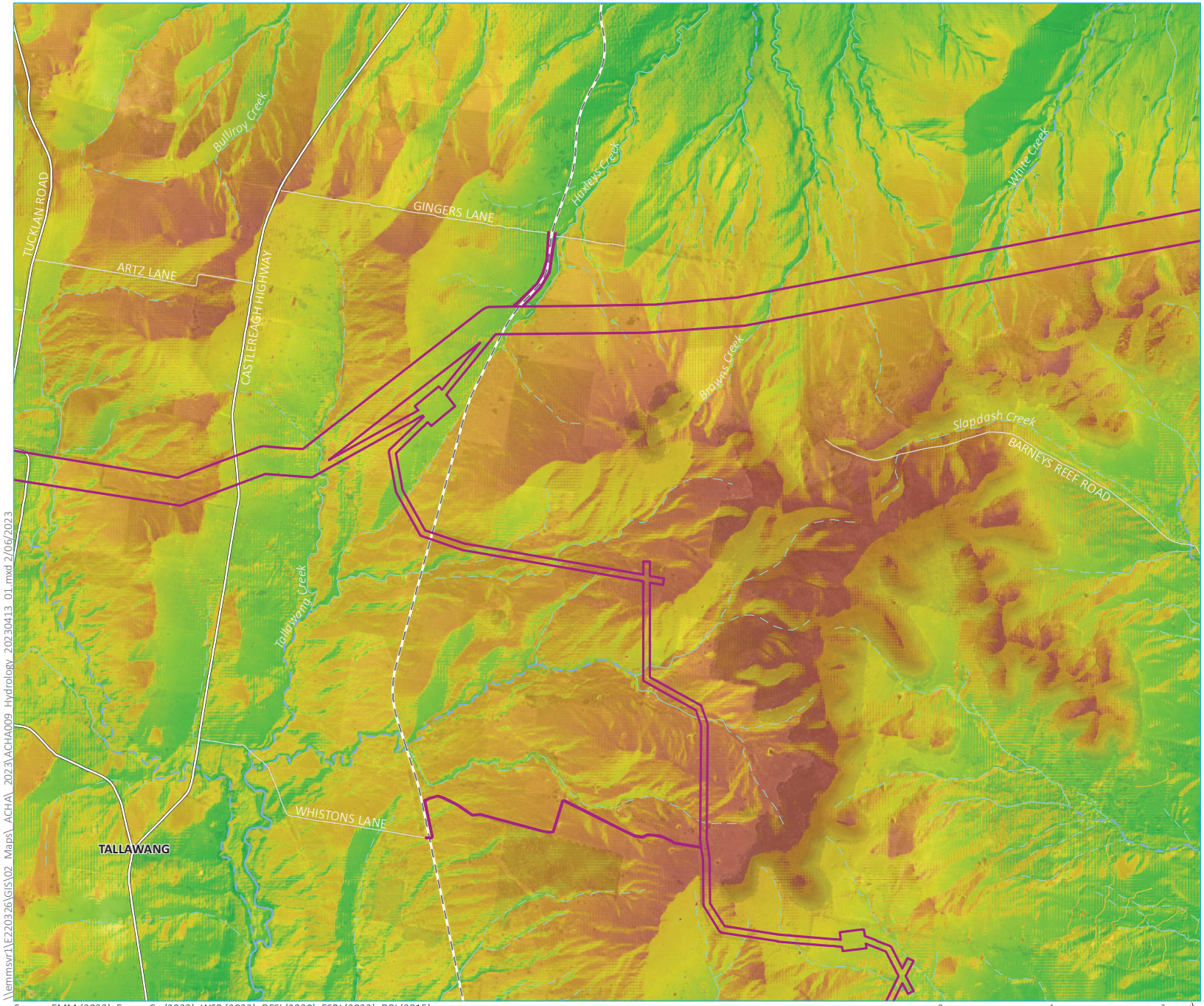
GDA2020 MGA Zone 55

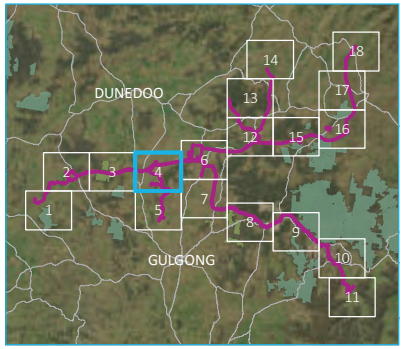
N

Hydrology of the study area
Map 3 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

Major road

Minor road

Rail line

Strahler stream order

1st order

2nd order

3rd order

4th order

INSET KEY

Major road

NPWS reserve

State forest

Elevation (m)

787

243

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA009_Hydrology_20230413_01.mxd 2/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

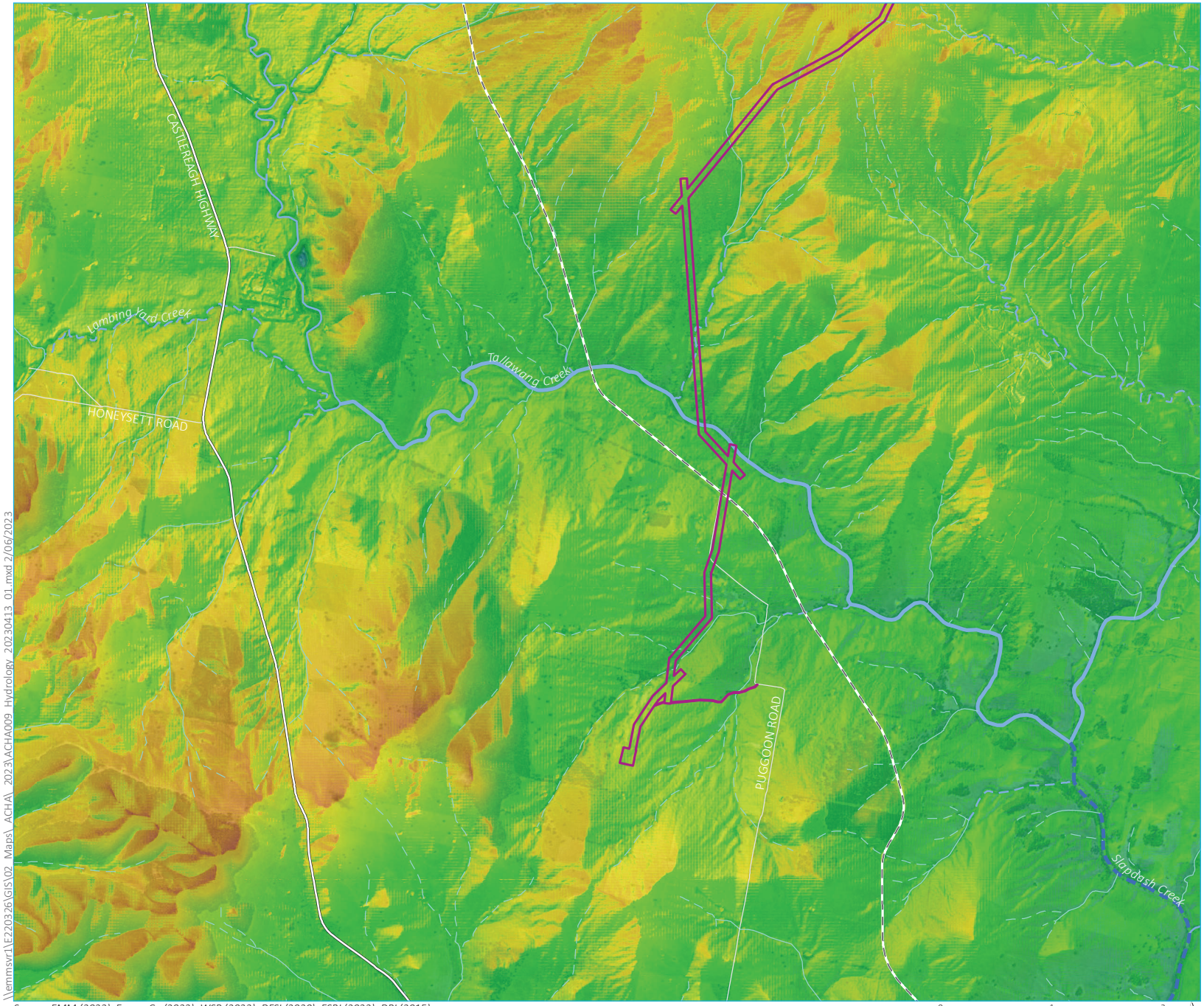
GDA2020 MGA Zone 55

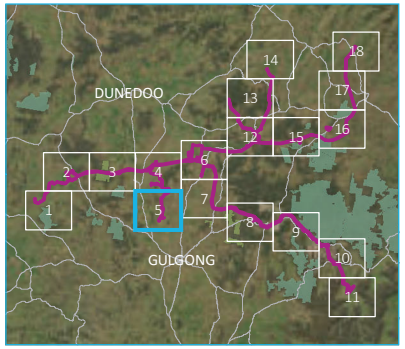
N

Hydrology of the study area
Map 4 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

- Major road
- Minor road
- Rail line

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

INSET KEY

- Major road
- NPWS reserve
- State forest

Elevation (m)

787

243

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA009_Hydrology_20230413_01.mxd 2/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

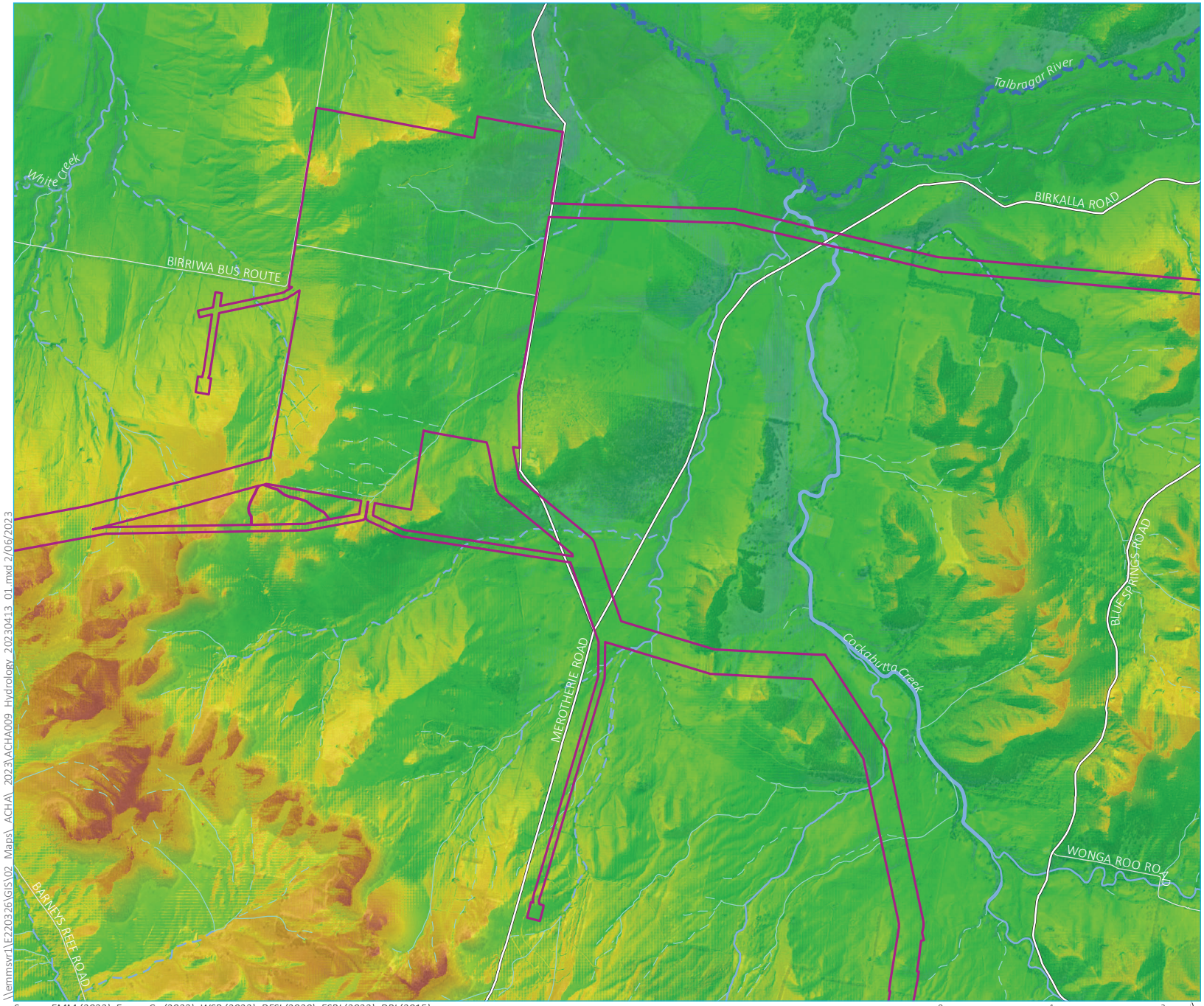
GDA2020 MGA Zone 55

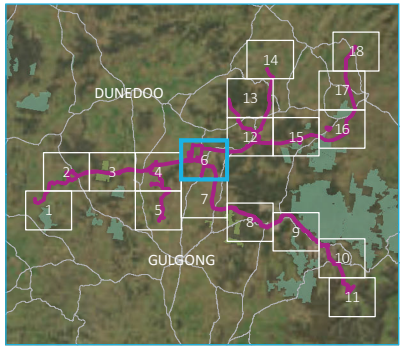
N

Hydrology of the study area
Map 5 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

Major road

Minor road

Strahler stream order

1st order

2nd order

3rd order

4th order

5th order

6th order

INSET KEY

Major road

NPWS reserve

State forest

Elevation (m)

787

243

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA009_Hydrology_20230413_01.mxd 2/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

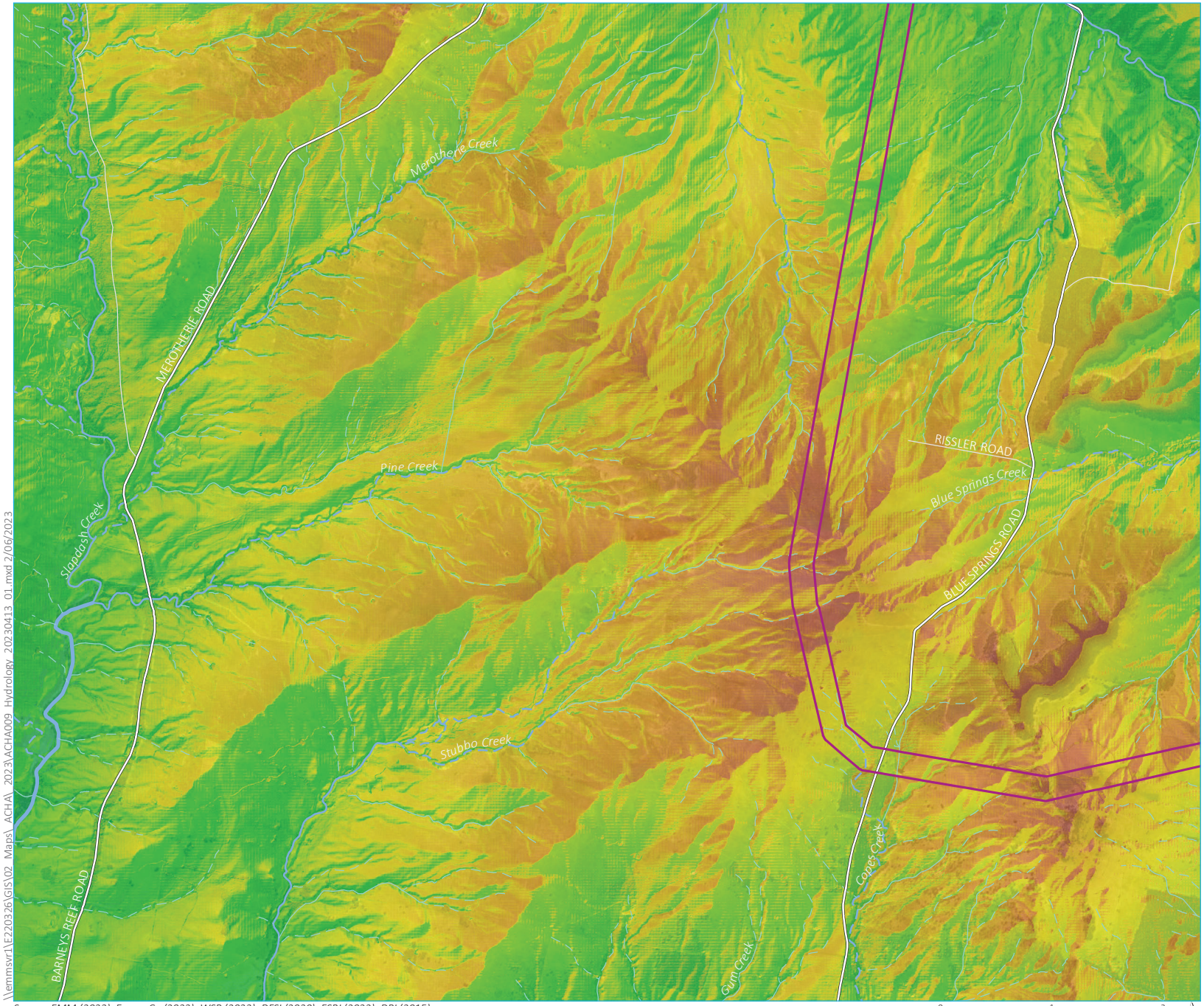
GDA2020 MGA Zone 55

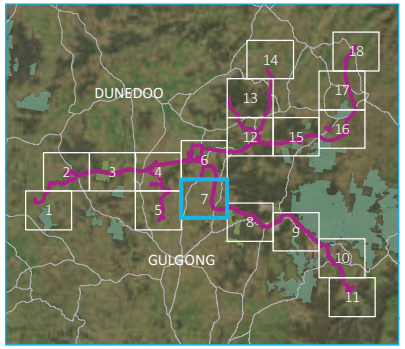
N

Hydrology of the study area
Map 6 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

Major road

Minor road

Strahler stream order

1st order

2nd order

3rd order

4th order

5th order

INSET KEY

Major road

NPWS reserve

State forest

Elevation (m)

787

243

0 1 2 km

GDA2020 MGA Zone 55

N

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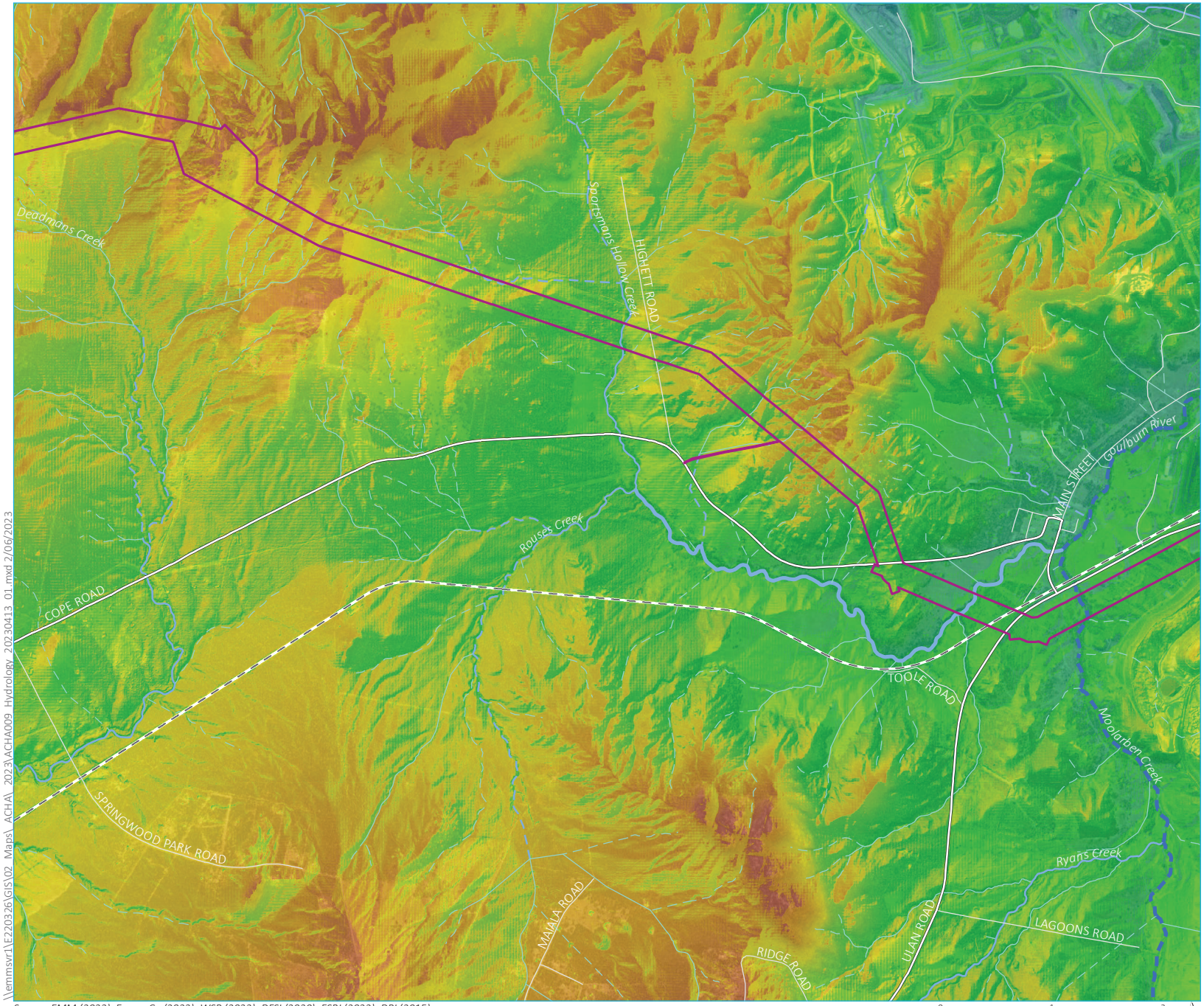
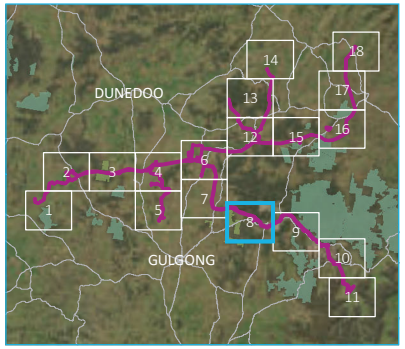
Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

Hydrology of the study area
Map 7 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

- Major road
- Minor road
- Rail line

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

INSET KEY

- Major road
- NPWS reserve
- State forest

Elevation (m)

787

243

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA009_Hydrology_20230413_01.mxd 2/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

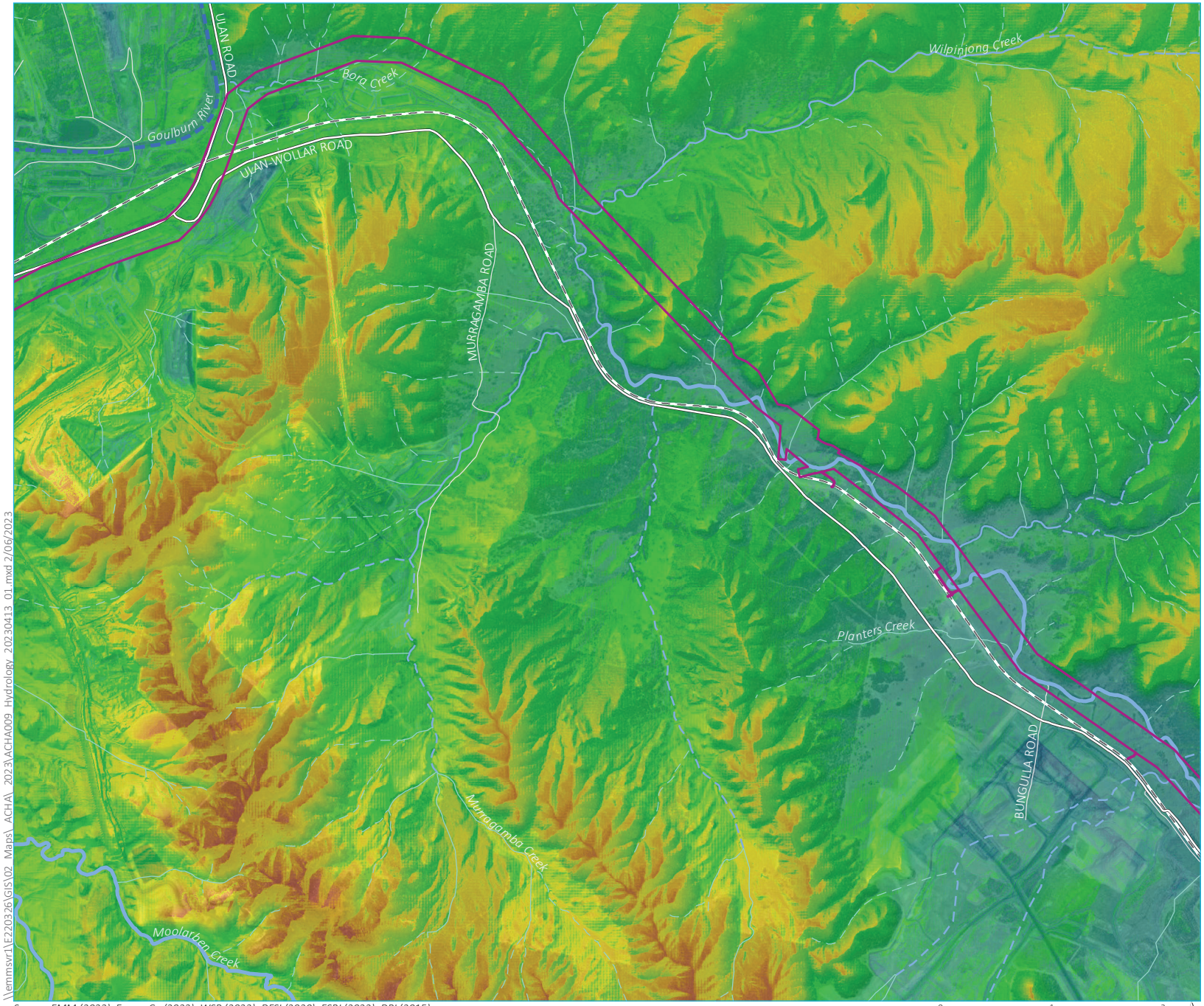
GDA2020 MGA Zone 55

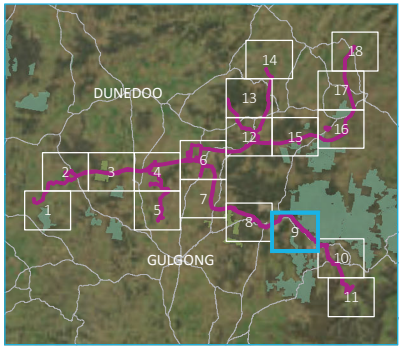
N

Hydrology of the study area
Map 8 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

- Major road
- Minor road
- Rail line

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

INSET KEY

- Major road
- NPWS reserve
- State forest

Elevation (m)

787

243

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA009_Hydrology_20230413_01.mxd 2/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

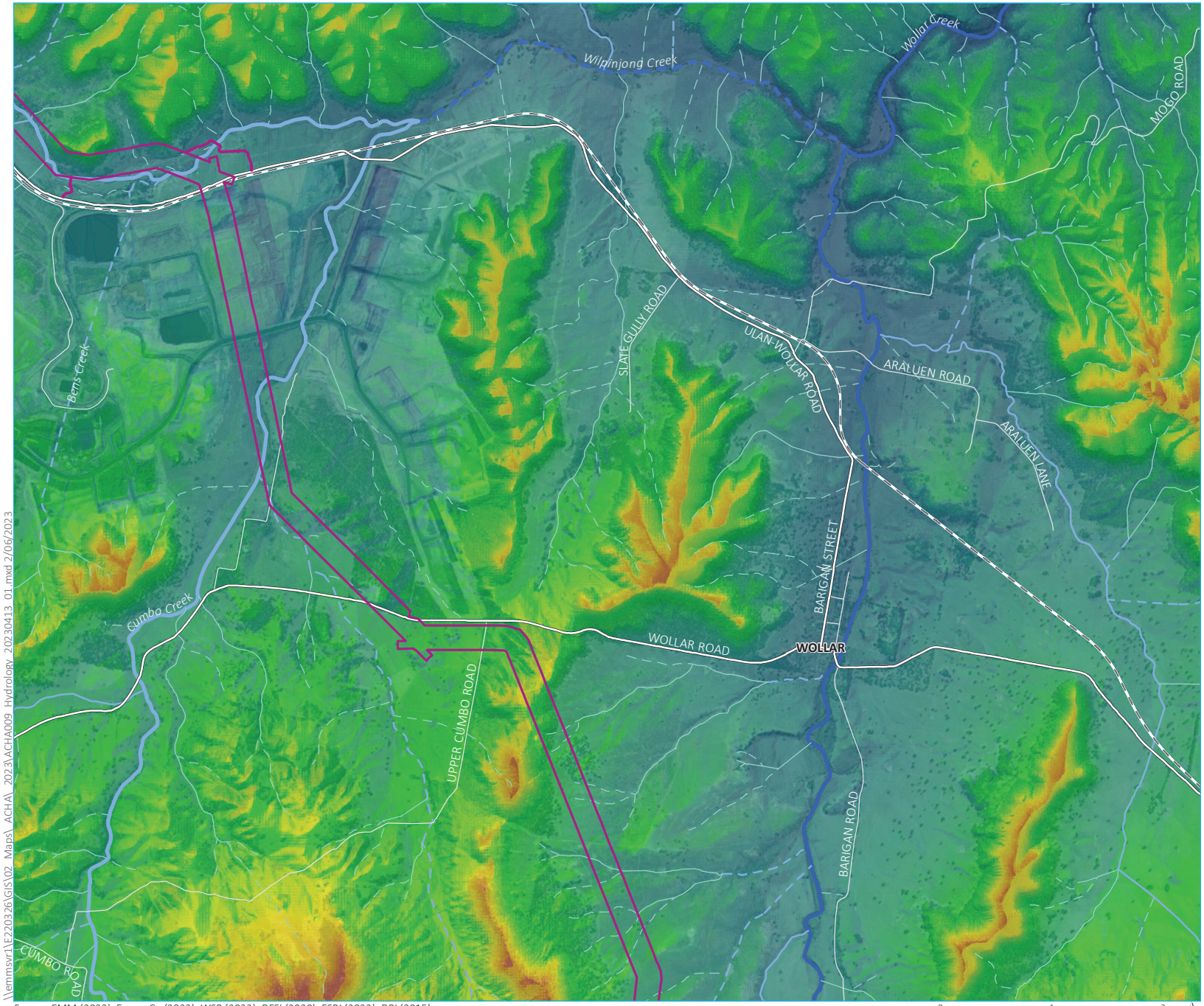
GDA2020 MGA Zone 55

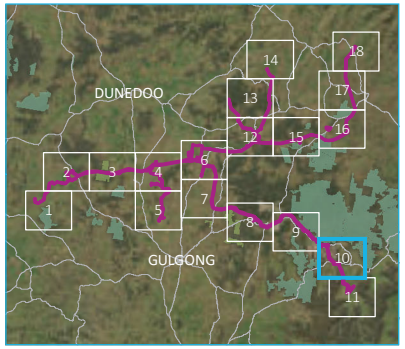
N

Hydrology of the study area
Map 9 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

- Major road
- Minor road
- Rail line

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order
- 7th order

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA009_Hydrology_20230413_01.mxd 2/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

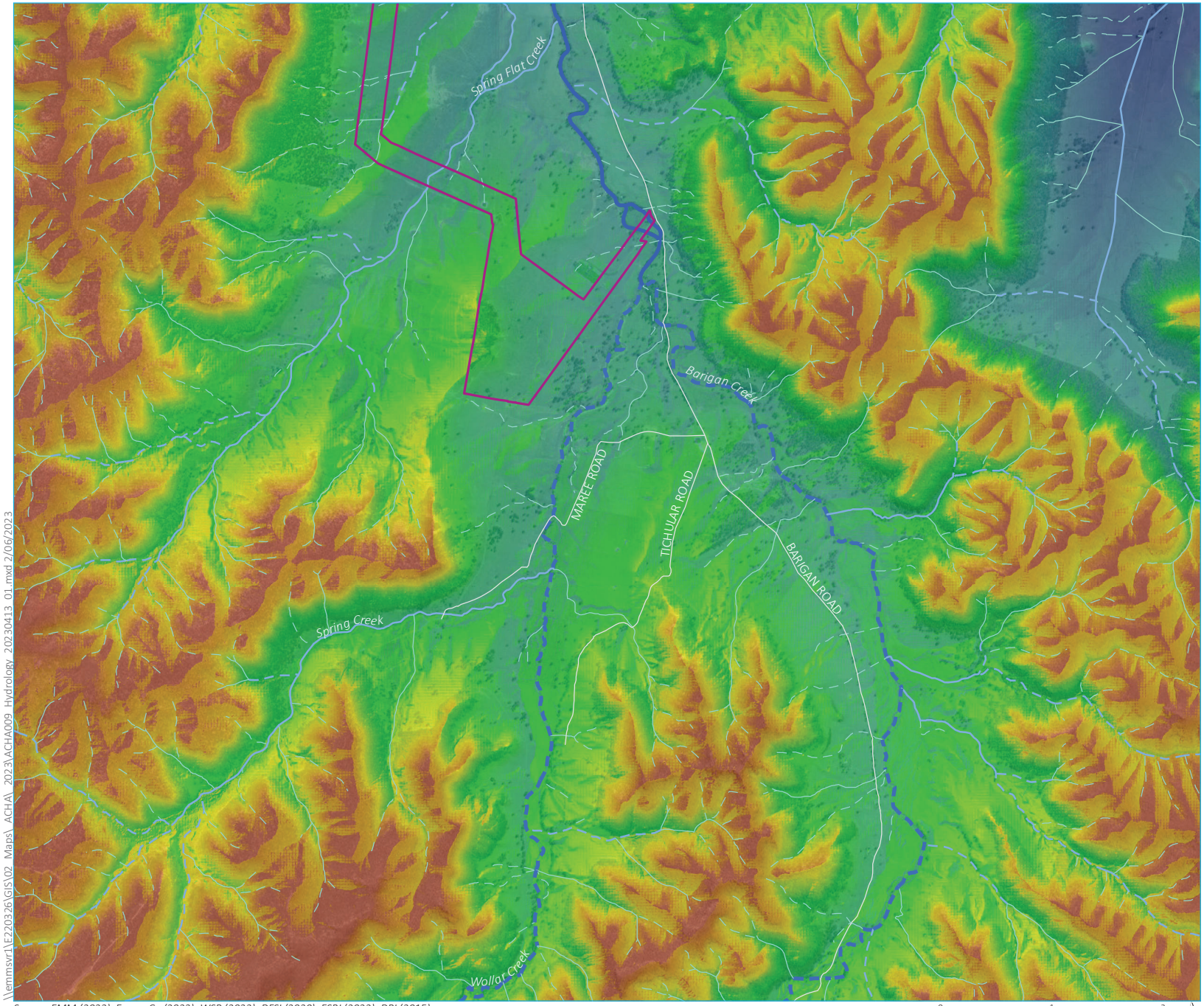
GDA2020 MGA Zone 55

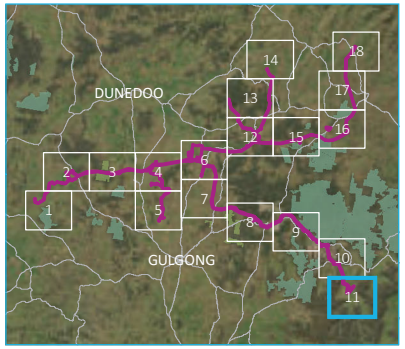
N

Hydrology of the study area
Map 10 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

Minor road

Strahler stream order

1st order

2nd order

3rd order

4th order

6th order

7th order

INSET KEY

Major road

NPWS reserve

State forest

Elevation (m)

787

243

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

GDA2020 MGA Zone 55

N

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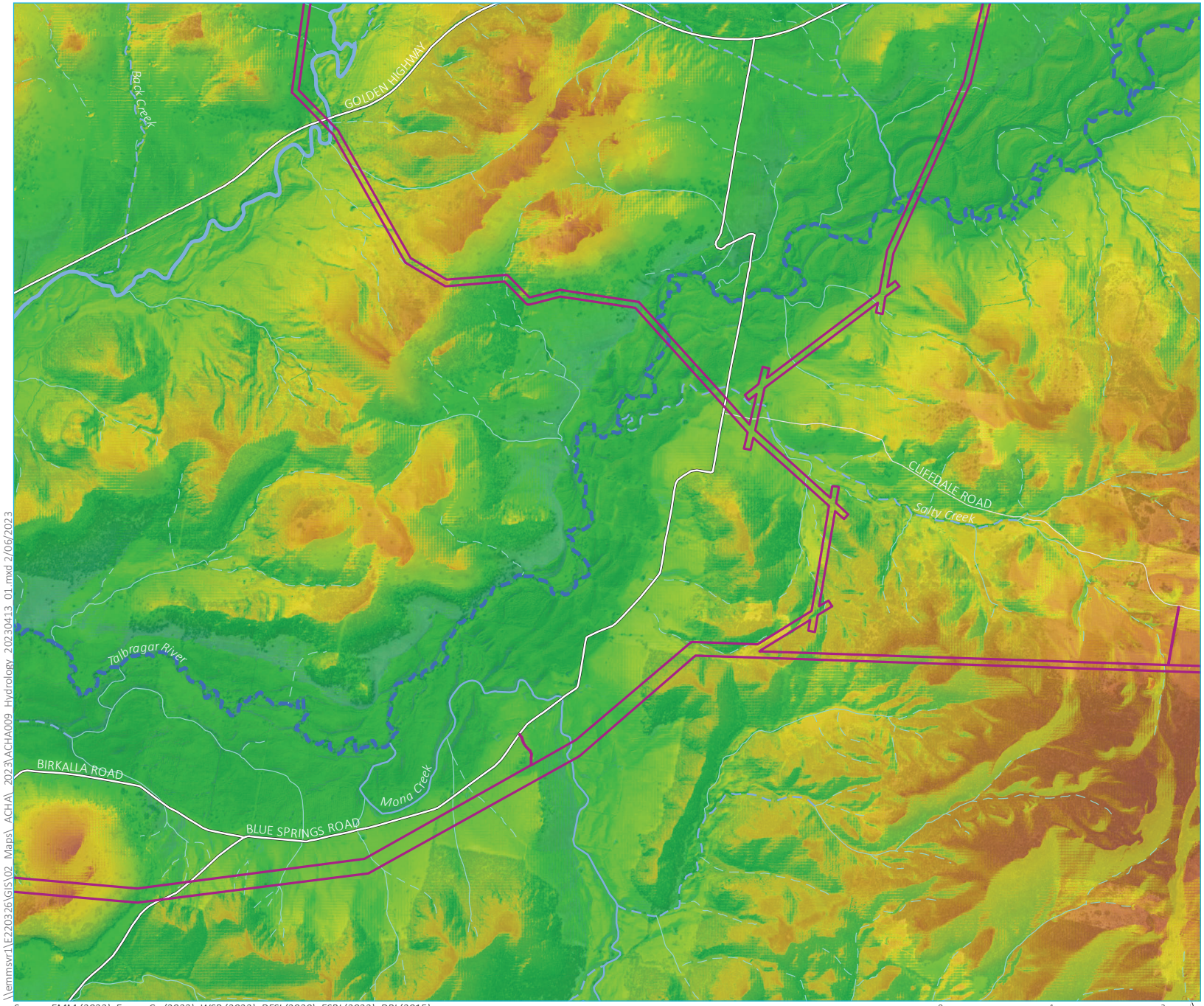
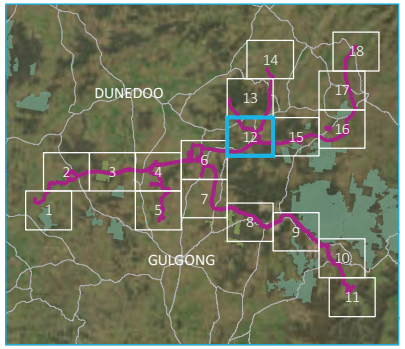
Hydrology of the study area
Map 11 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

Major road

Minor road

Strahler stream order

1st order

2nd order

3rd order

4th order

5th order

6th order

INSET KEY

Major road

NPWS reserve

State forest

Elevation (m)

787

243

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA009 Hydrology 20230413 01.mxd 2/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

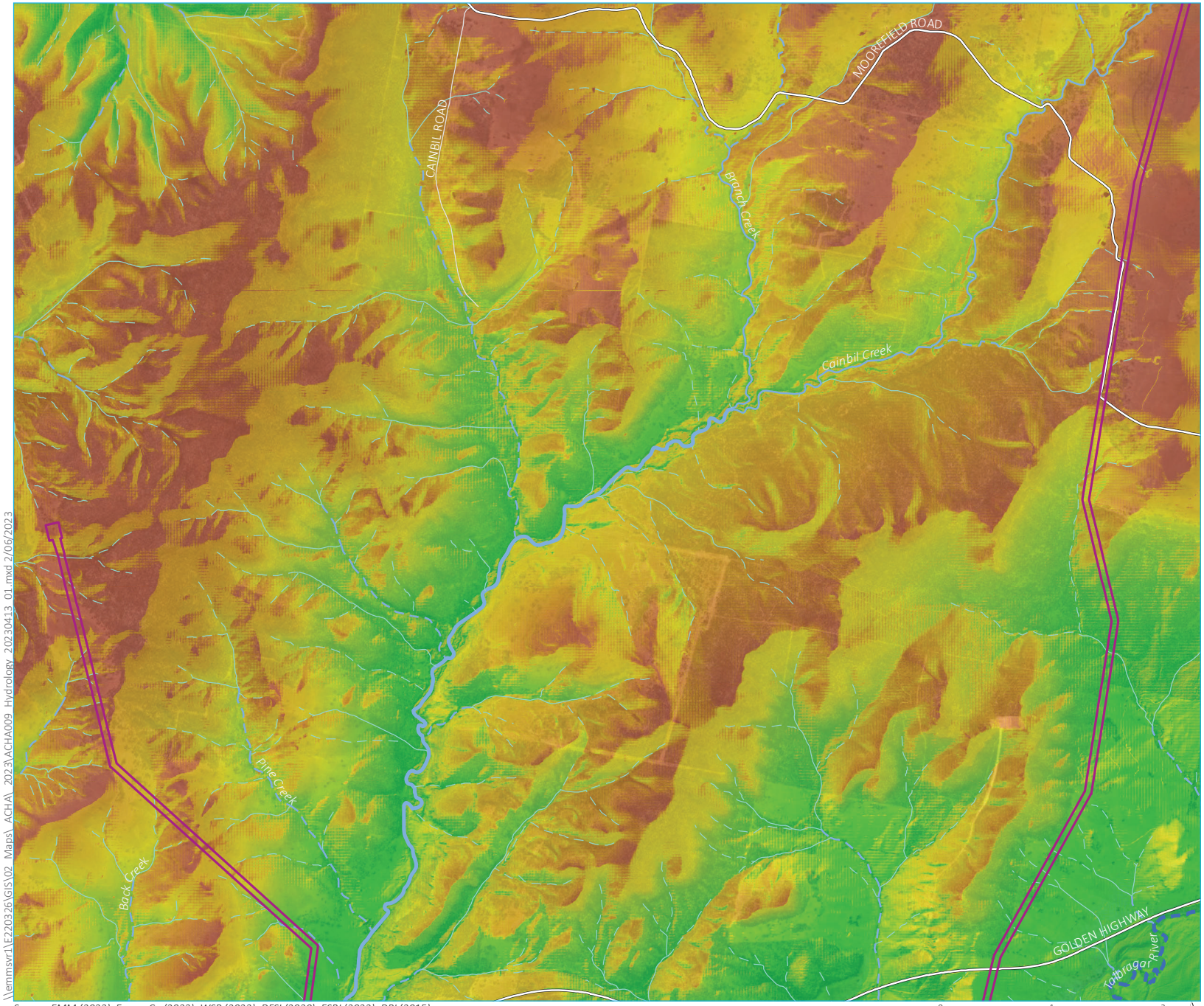
GDA2020 MGA Zone 55

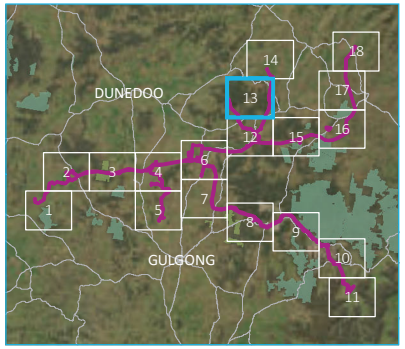
N

Hydrology of the study area
Map 12 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

Major road

Minor road

Strahler stream order

1st order

2nd order

3rd order

4th order

5th order

6th order

INSET KEY

Major road

NPWS reserve

State forest

Elevation (m)

787

243

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

GDA2020 MGA Zone 55

N

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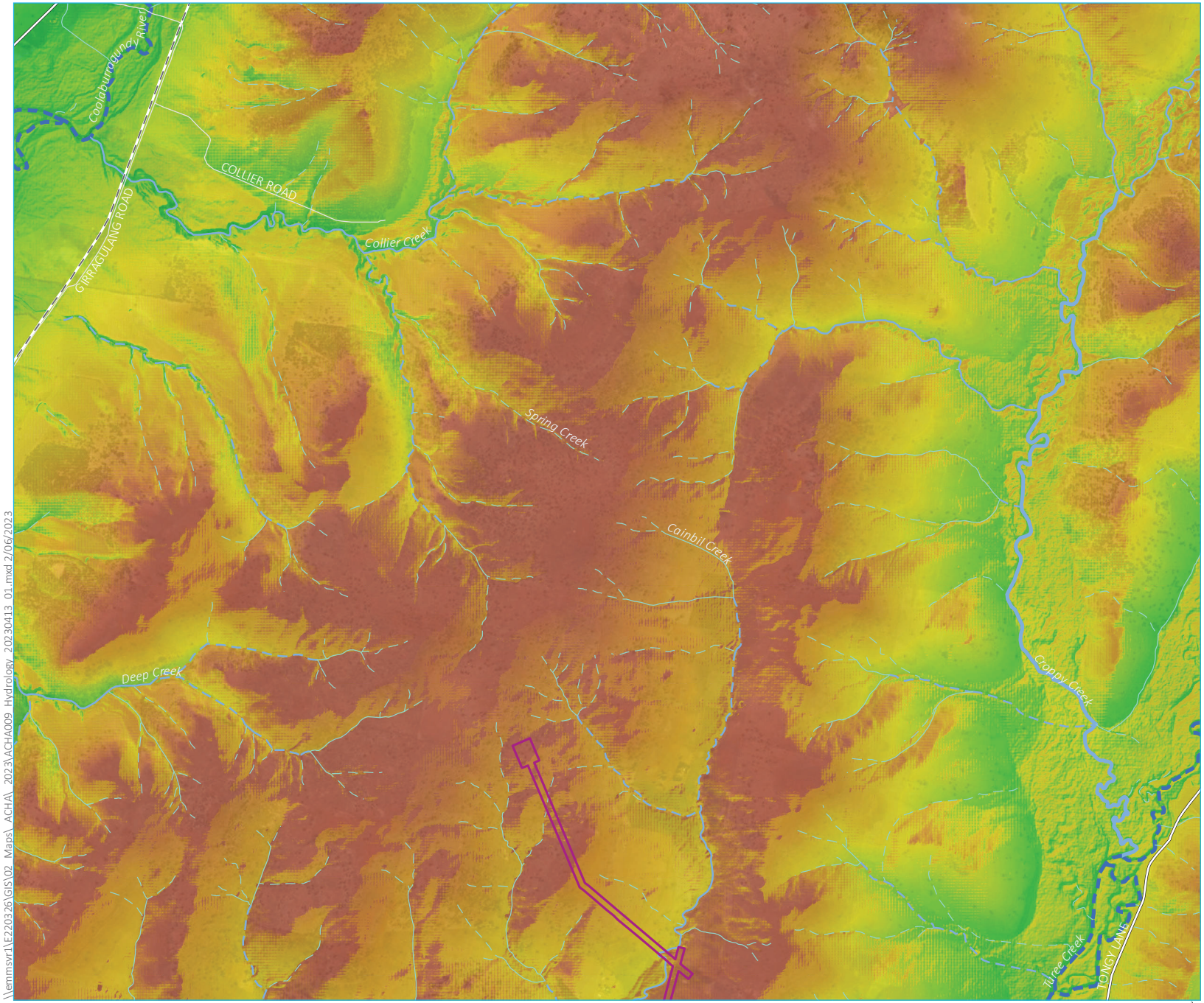
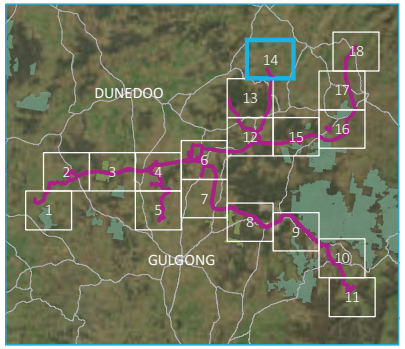
Hydrology of the study area
Map 13 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

- Major road
- Minor road
- Rail line

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order
- 6th order

INSET KEY

- Major road
- NPWS reserve
- State forest

Elevation (m)

787

243

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

GDA2020 MGA Zone 55

N

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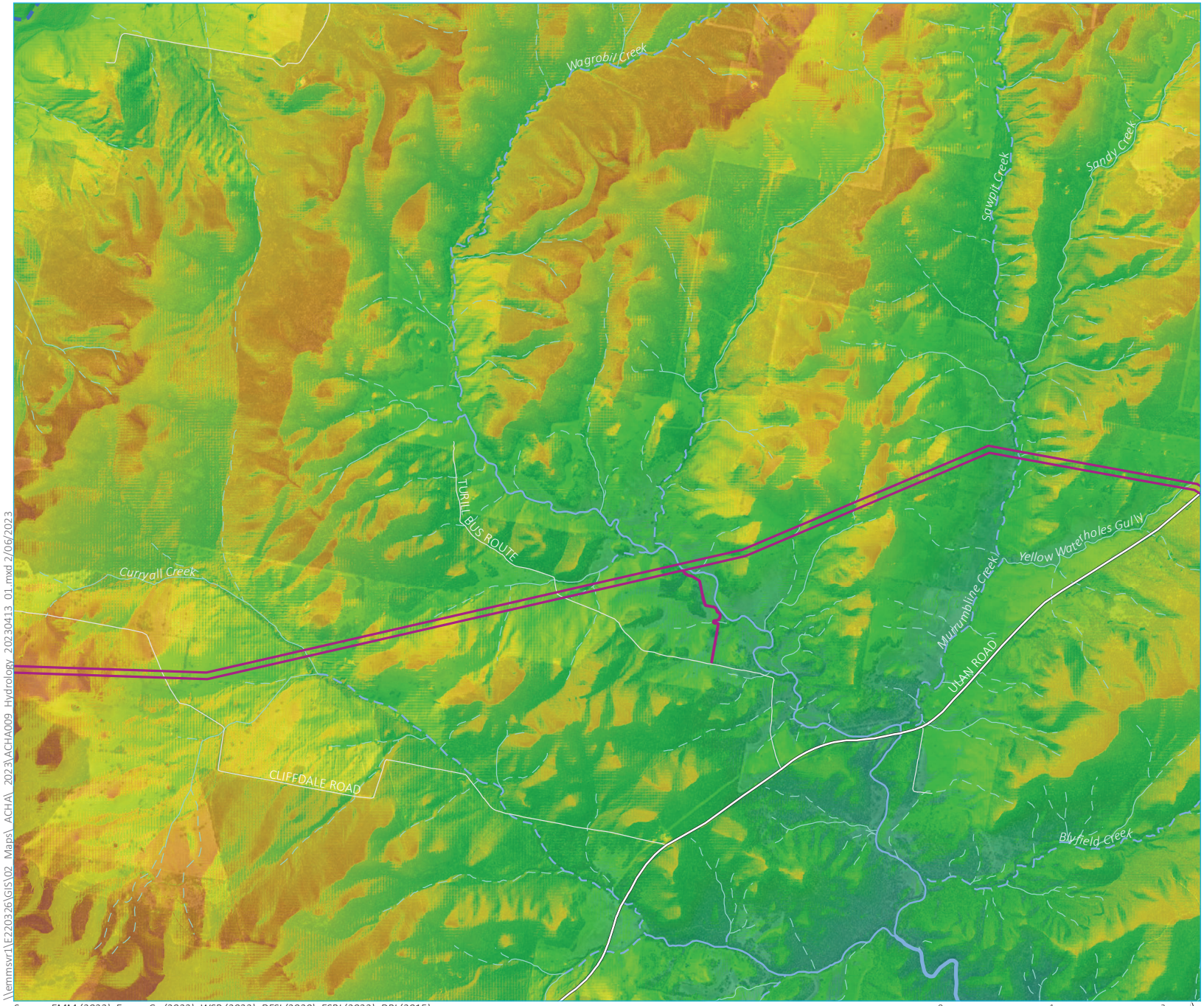
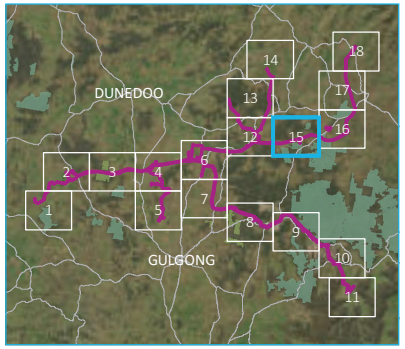
Hydrology of the study area
Map 14 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

Major road

Minor road

Strahler stream order

1st order

2nd order

3rd order

4th order

5th order

6th order

INSET KEY

Major road

NPWS reserve

State forest

Elevation (m)

787

243

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA009_Hydrology_20230413_01.mxd 2/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

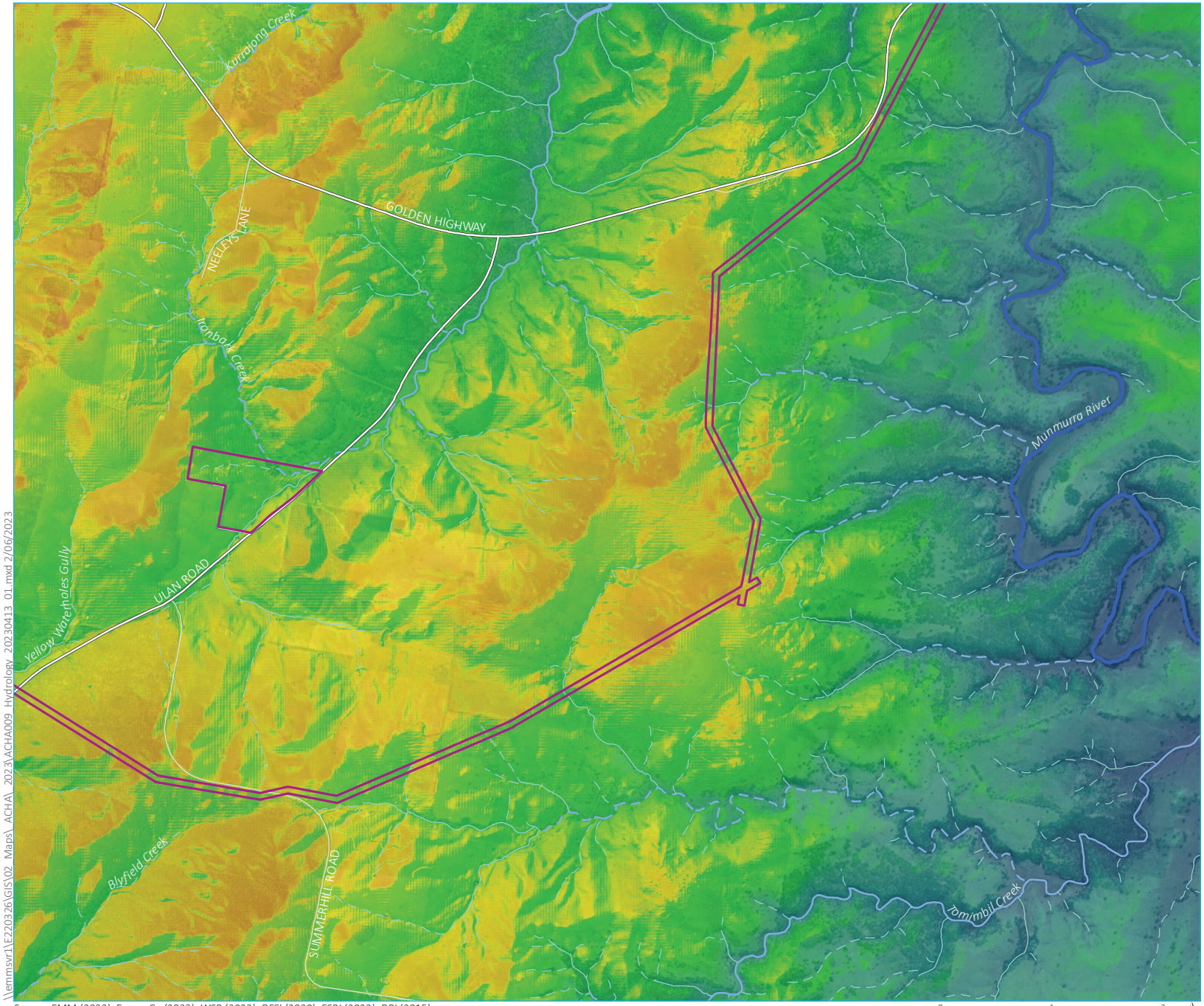
GDA2020 MGA Zone 55

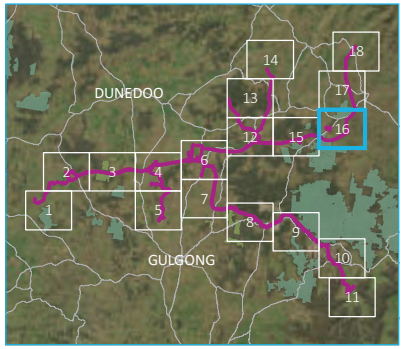
N

Hydrology of the study area
Map 15 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

Major road

Minor road

Strahler stream order

1st order

2nd order

3rd order

4th order

5th order

7th order

INSET KEY

Major road

NPWS reserve

State forest

Elevation (m)

787

243

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

GDA2020 MGA Zone 55

N

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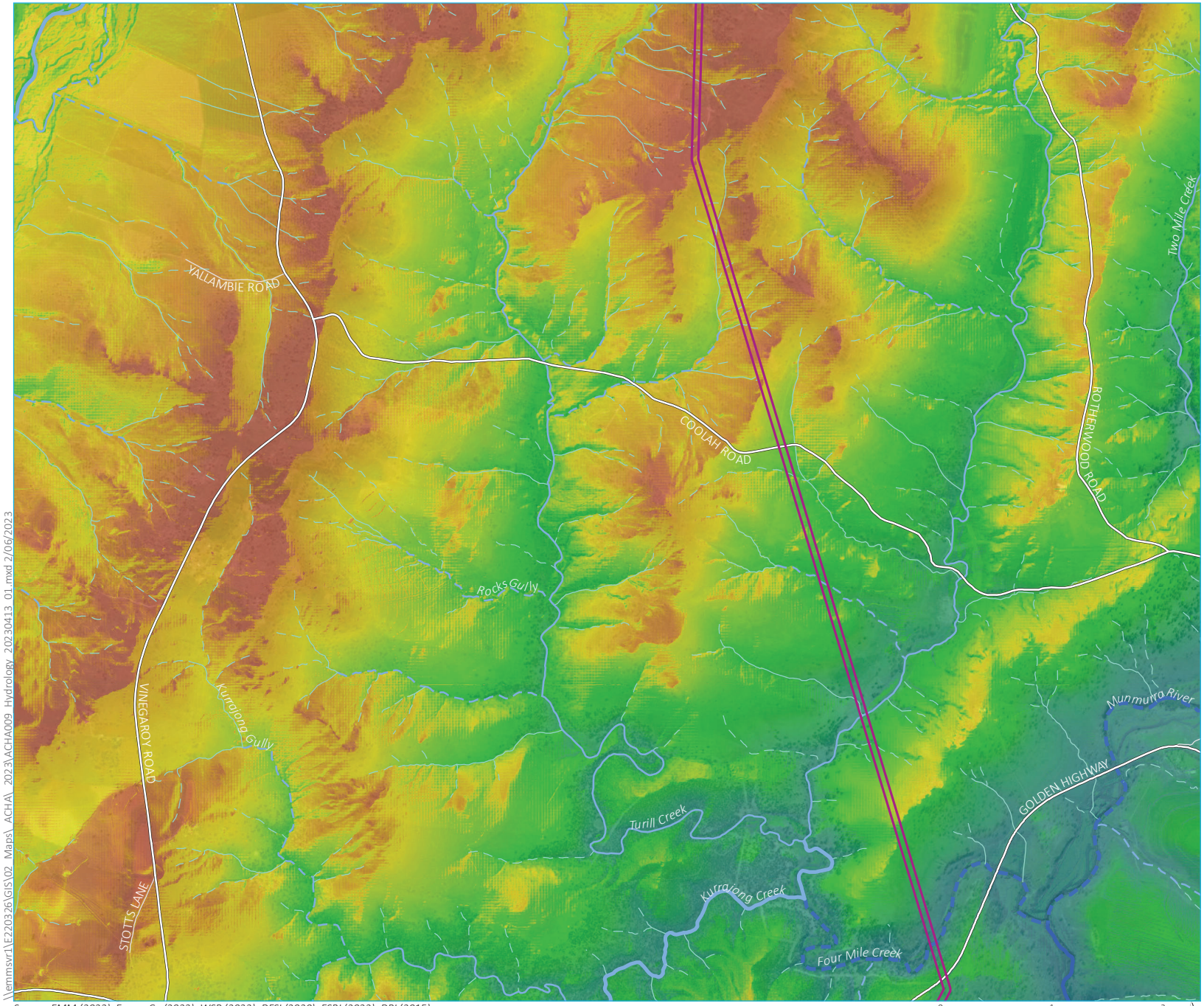
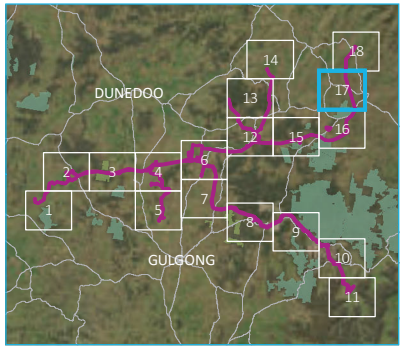
Hydrology of the study area
Map 16 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

Major road

Minor road

Strahler stream order

1st order

2nd order

3rd order

4th order

5th order

6th order

7th order

INSET KEY

Major road

NPWS reserve

State forest

Elevation (m)

787

243

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

GDA2020 MGA Zone 55

N

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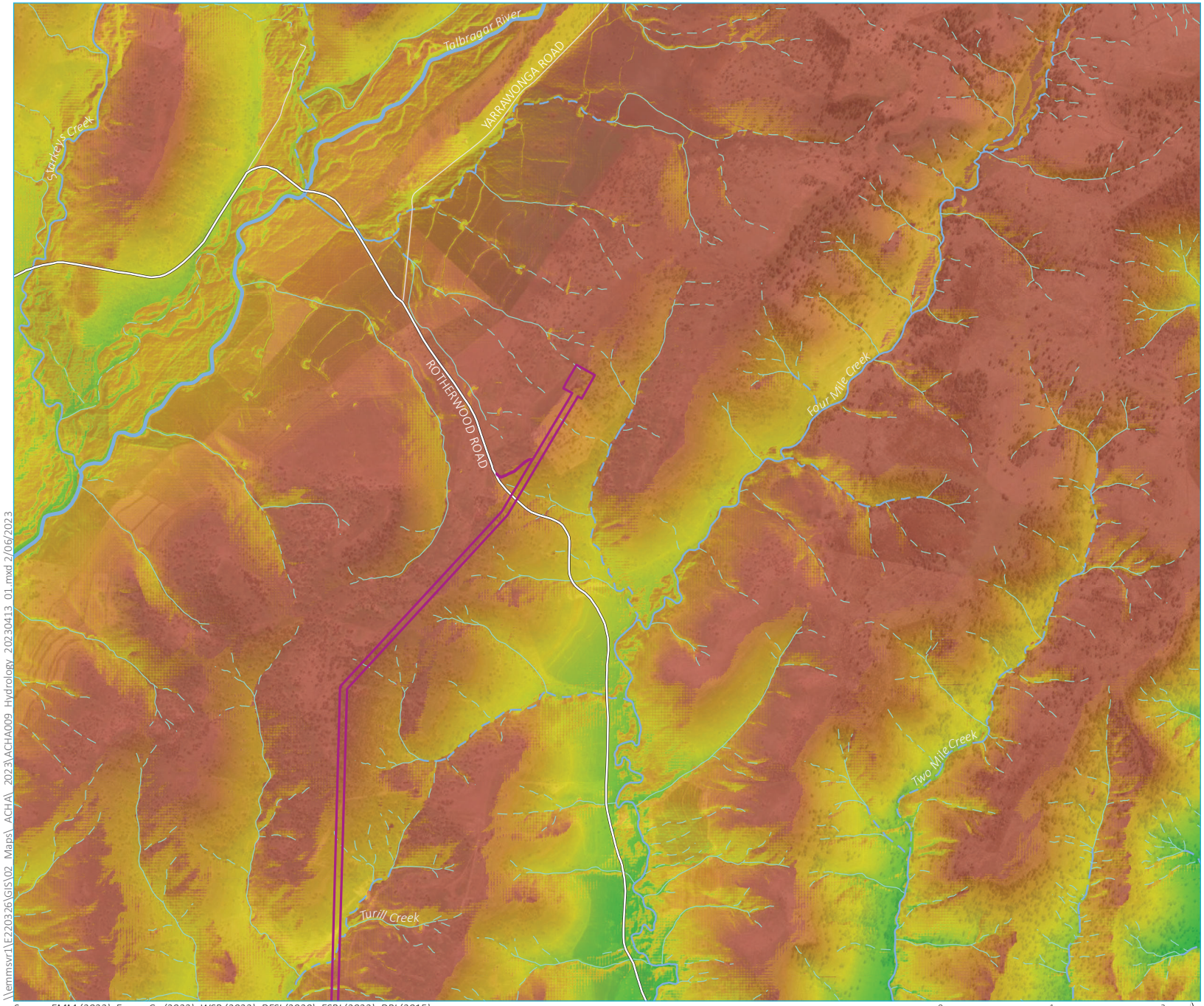
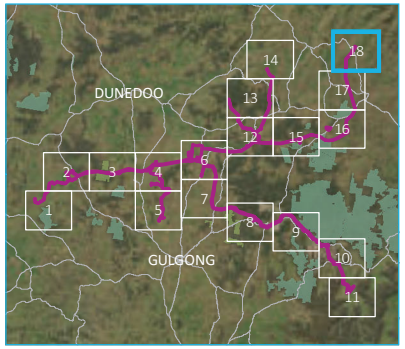
Hydrology of the study area
Map 17 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities





KEY

Construction area

Existing environment

Major road

Minor road

Strahler stream order

1st order

2nd order

3rd order

4th order

5th order

INSET KEY

Major road

NPWS reserve

State forest

Elevation (m)

787

243

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA009_Hydrology_20230413_01.mxd 2/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPI (2015)

0 1 2 km

GDA2020 MGA Zone 55

N

Hydrology of the study area
Map 18 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.4

EMM
creating opportunities

5.5 Flora and fauna

The study area contains four main vegetation communities (Figure 5.5). Crests and exposed slopes are dominated by the Western Slopes Dry Sclerophyll forest, with the Western Slopes Grassy woodland on flats, low slopes in plains and low hills. Flats, hillslopes, hillcrests and gullies comprise the Western Slopes grasslands and footslopes are typically dominated by the Central Gorge Dry Sclerophyll forest. These vegetation communities are characterised by open canopies including a variety of eucalypt species, specifically inland scribbly gum (*Eucalyptus rossii*), grey gum (*Eucalyptus punctata*), stringybark (*E. sparsifolia*), white box (*E. albens)*, ironbark (*E. crebra*) and slaty gum (*E. dawsonii*). Other species include stiff-leaved wattle (*Acacia obtusifolia*), black cypress pine (*Callitris endlicheri*) and the kurrajong (*Brachychiton populneus*) – the latter two present in rocky outcrops – plus grey box (*E. macrocarpa*), yellow box (*E. melliodora*) and rough-barked apple which are prominent on valley floors. River red gums (*E. camaldulensis*) are present along the banks of larger streams and river oak (*Casuarina cunninghamiana*) line the tributaries.

The use of animals, plants and minerals within central New South Wales provided Aboriginal people with essential sources for food, medicine, and materials. Food sources included freshwater aquatic foods, such as fish (codfish was a well-documented species), yabbies, muscle, tortoises and birds, found in rivers, creeks and floodplains (Greenwood 2013). Semi-arid resources included possum fur for clothing, baskets, and bags), quail and other bird species and predominant game animals. Flora such as native grasses were used for woven baskets and bags, sow-thistle was a common green used across semi-arid Australia, the nardoo seeds which were ground for cake and porridge and sugar lerp derived from eucalypt leaves. Aboriginal people adopted useful native flora and fauna into their diets and habits where beneficial to do so.

Remaining vegetation within the construction area is non-native, or generally non-existent due to extensive clearing and agricultural use post-1788 (see Section 1.2). Remnant native vegetation is typical in small pockets where extensive clearing has not occurred.

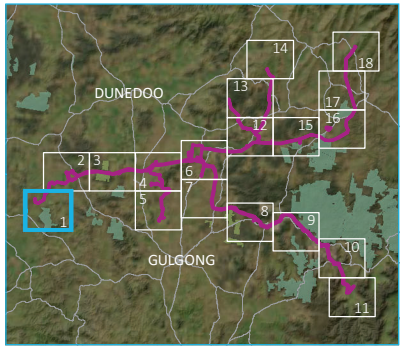
A number of observed vegetation and fauna of value to the Aboriginal community were also identified as part of the cultural mapping investigations of the project footprint (Table 5.5, Section 6.3, Appendix C). Plants provided food and medicine as well as serving other uses. Importantly, a number of the species reflect introduced species, and demonstrate the readiness that Aboriginal people would adopt useful flora and fauna into their diets and habits were beneficial to do so.

Table 5.5 Aboriginal plants and medicines as documented by early ethnographers.

Common names (species)	Wiradjuri name	Recorded Aboriginal use
Blackwood (*Acacia melanoxylon*)	Digu, Mumbil, Munbil	Edible seed and medicinal bark
Bulrush (Typha species)	Baaliyan	Edible rhizome
Emu bush (*Eremophila longifolia*)	Diigawu, Yadhandah	Edible nectar & medicinal foliage
Eucalypts (Eucalyptus species)	Maranggaal (River Red Gum, *E. Camaldulensis*)	Medicinal foliage
False sarsaparilla (*Hardenbergia violacea*)	Ngawang	Medicinal foliage
Fig tree (Ficus species)	Digimdhuna	Edible fruit
Geebung (Persoonia species)	Dyiibang, Bumbadula	Medicinal wood & fruit
Grey grasstree (*Xanthorrhoea glauca*)	Binda, Maybal, Marrady, Babang	Edible young shoots and leaf bases, medicinal foliage
Kangaroo grass (*Themeda triandra*)	Gaymaan	Edible seed

Table 5.5 Aboriginal plants and medicines as documented by early ethnographers.

Common names (species)	Wiradjuri name	Recorded Aboriginal use
Kurrajong (*Brachychiton populneus*)	Yama, Garradyang, Yamagan, Bandhaany	Edible seed
Milk thistle (Sonchus species)	Yulung	Edible foliage
Mistletoe (Amyema and Lysiana species)	Wilburgil	Edible fruit
Nardoo (Marsilea species)	Ngardu	Edible sporocarp
Native cherry (*Exocarpos cupressiformis*)	Mamadya, Mambarra, Wambariga	Edible fruit
Native orange (*Capparis mitchellii*)	Mugilmugil	Edible fruit
Pigface (*Sarcozona praecox*)	Biradur	Edible foliage and thirst quencher foliage
Pituri (*Duboisia hopwoodii*)	Bidyuri	Narcotic foliage
Quandong (*Santalum acuminatum*)	Guwandang	Edible fruit and medicinal kernel oil
Ruby saltbush (*Enchylaena tomentosa*)	Barrinan	Edible fruit
Silver wattle (*Acacia dealbata*)	Giigandul	Edible seed & gum, medicinal gum
Tea-tree (*Leptospermum species*)	Bimbun, Gumarr, Mudha	Medicinal foliage and cones
Weeping myall (*Acacia pendula*)	Burri, Buuri	Edible gum
Wild lemon (*Canthium oleifolium*)	Mugilbang	Edible fruit
Wild onion (*Bulbine bulbosa* and *B. semibarbata*)	Galagang	Edible tubers
Yam daisy (*Microseris lanceolata*)	Murnang, Bading	Edible tubers
Yellow box (*Eucalyptus melliodora*)	Magalang, Baagan, Yurana, Yuwaadhuray	Medicinal foliage



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse
- Not classified vegetation

Plant community type

- 281
- 437
- 468
- 511

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA010_RemnantVegetation_20230807_04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

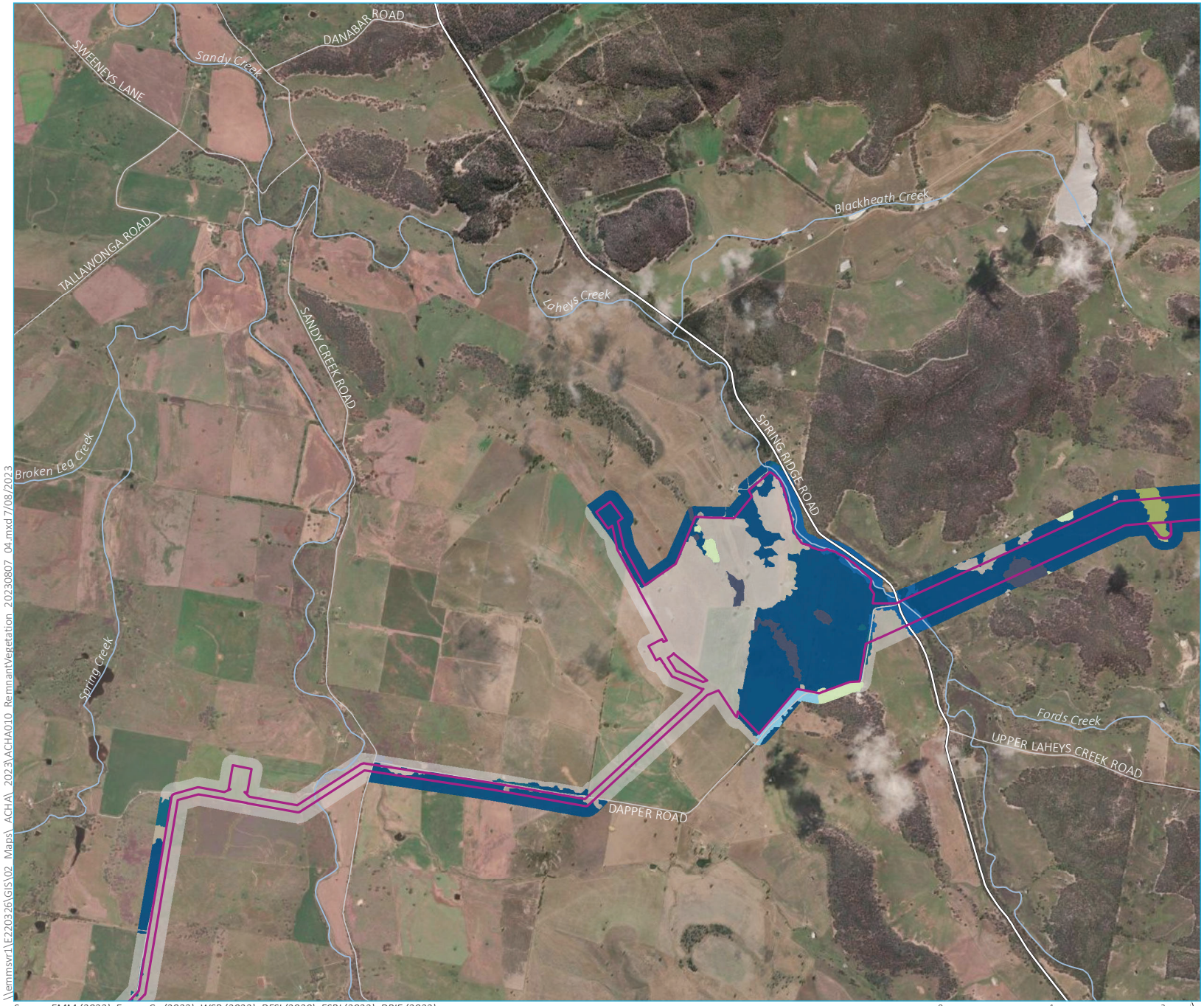
GDA2020 MGA Zone 55

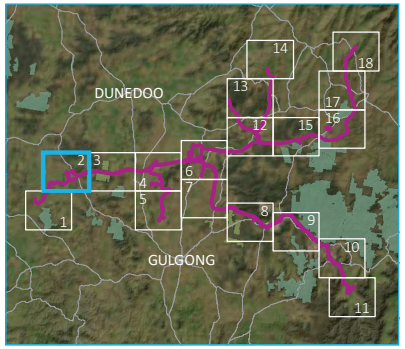
N

Remnant vegetation
Map 1 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse
- Not classified vegetation

Plant community type

- 81
- 202
- 276
- 277
- 281
- 412
- 461
- 467
- 468
- 511
- 599

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA010_RemnantVegetation_20230807_04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

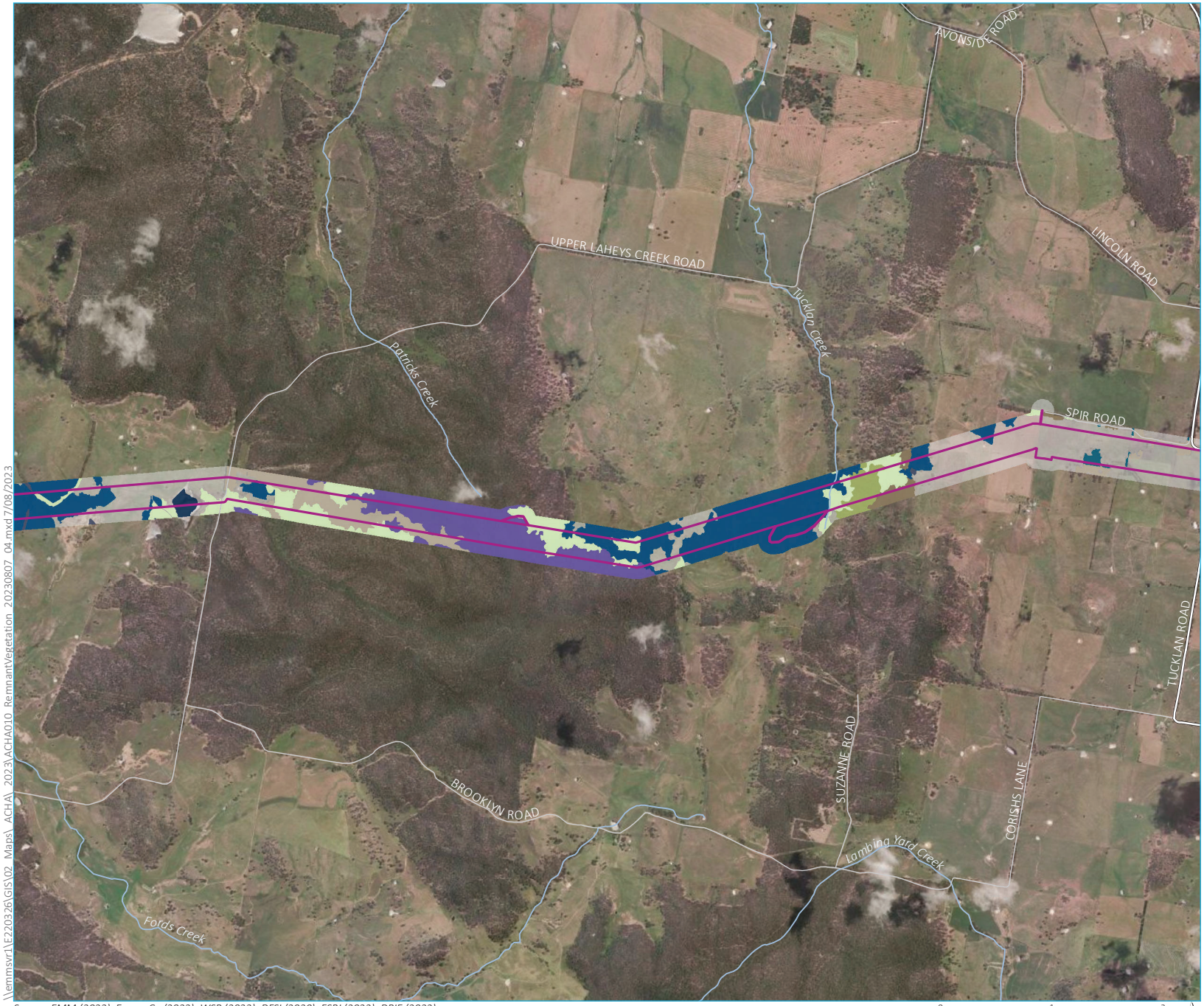
GDA2020 MGA Zone 55

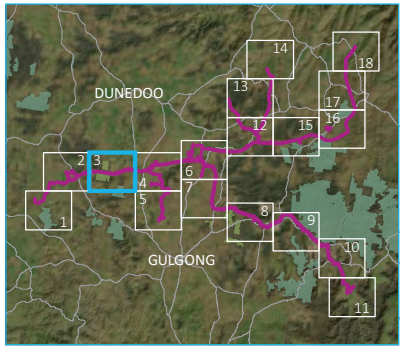
N

Remnant vegetation
Map 2 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse
- Not classified vegetation

Plant community type

- 78
- 81
- 266
- 277
- 281
- 461
- 468
- 478
- 511

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA010 RemnantVegetation 20230807 04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

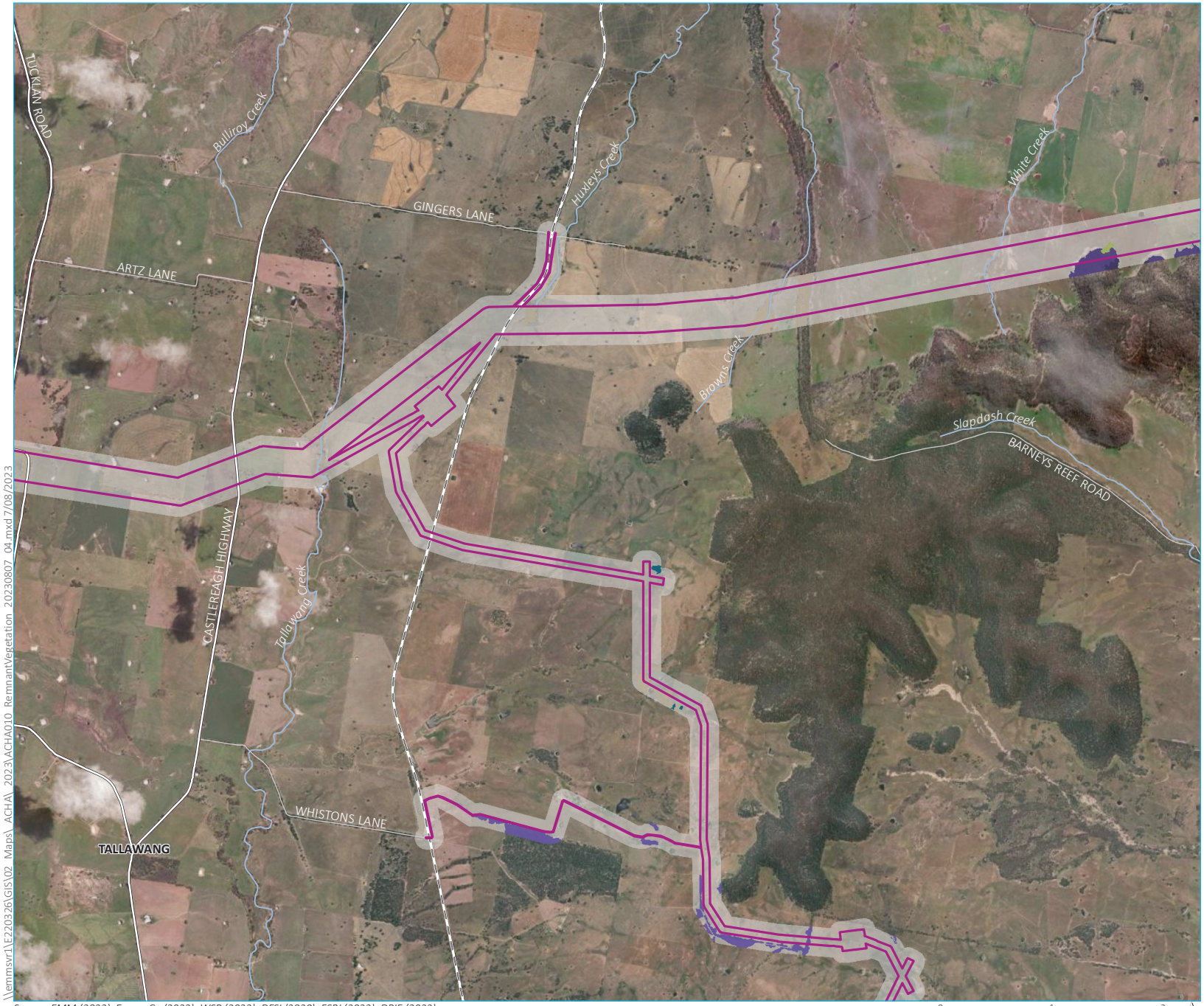
GDA2020 MGA Zone 55

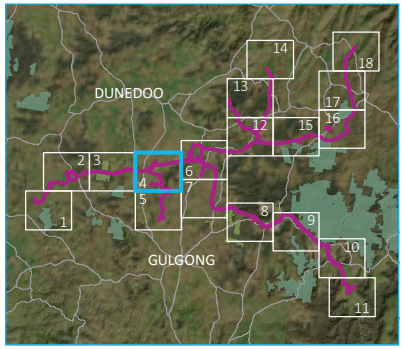
N

Remnant vegetation
Map 3 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse
- Not classified vegetation

Plant community type

- 277
- 281
- 326
- 461
- 476
- 477
- 478

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA010_RemnantVegetation_20230807_04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

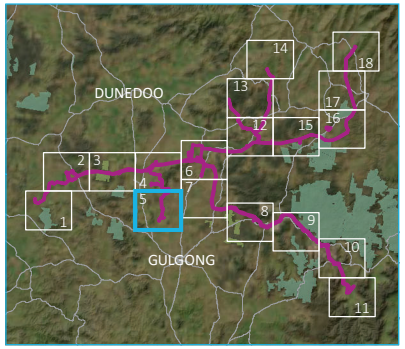
GDA2020 MGA Zone 55

N

Remnant vegetation
Map 4 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse
- Not classified vegetation

Plant community type

- 78
- 201
- 277
- 278
- 281
- 478

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA010 RemnantVegetation 20230807 04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

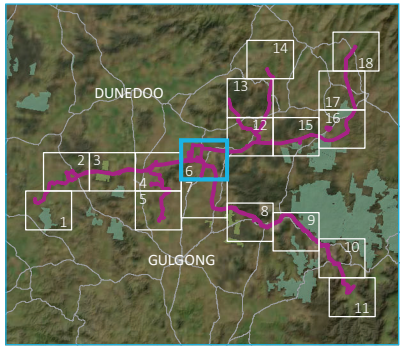
GDA2020 MGA Zone 55

N

Remnant vegetation
Map 5 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse
- Not classified vegetation

Plant community type

- 201
- 276
- 277
- 281
- 461
- 476
- 477
- 478
- 1610
- 1881
- 3396
- 3528
- 3530
- 3532
- 3756
- 3781

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA010_RemnantVegetation_20230807_04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

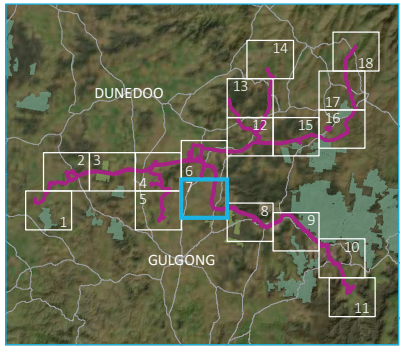
GDA2020 MGA Zone 55

N

Remnant vegetation
Map 6 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse
- Not classified vegetation

Plant community type

- 326
- 461
- 478
- 479

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA010 RemnantVegetation 20230807 04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

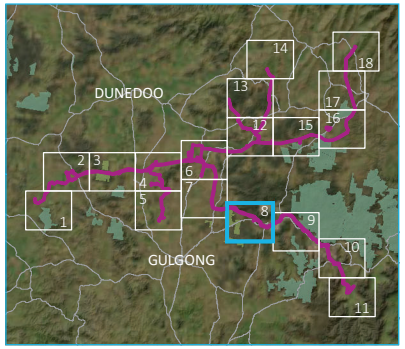
GDA2020 MGA Zone 55

N

Remnant vegetation
Map 7 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse
- Not classified vegetation

Plant community type

- 277
- 281
- 326
- 476
- 477
- 478
- 479
- 1610
- 1675
- 1871
- 1881
- 3388
- 3396
- 3528
- 3530
- 3532
- 3756
- 3781

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA010 RemnantVegetation 20230807 04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

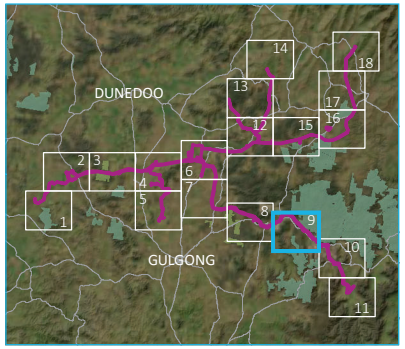
GDA2020 MGA Zone 55

N

Remnant vegetation
Map 8 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse
- Not classified vegetation

Plant community type

- 3396
- 3397
- 3405
- 3528
- 3530
- 3532
- 3760
- 3763
- 3780
- 3781
- 3783

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA010 RemnantVegetation 20230807 04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

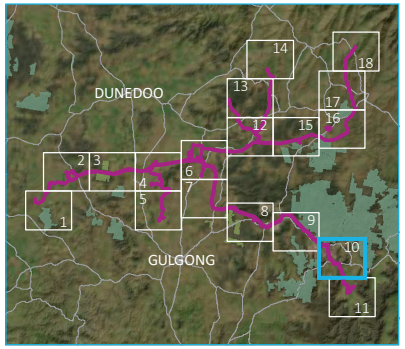
GDA2020 MGA Zone 55

N

Remnant vegetation
Map 9 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse
- Not classified vegetation

Plant community type

- 3388
- 3396
- 3397
- 3405
- 3497
- 3528
- 3529
- 3530
- 3532
- 3780
- 3781
- 3786
- 4064
- 4073

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA010 RemnantVegetation 20230807 04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

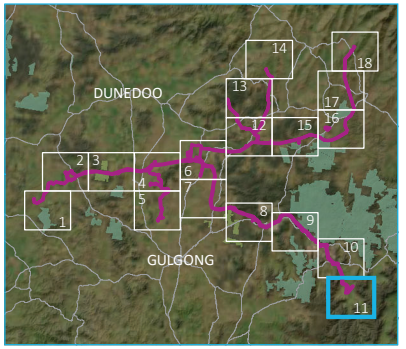
GDA2020 MGA Zone 55

N

Remnant vegetation
Map 10 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Minor road
- Named watercourse
- Not classified vegetation

Plant community type

- 3388
- 3397
- 3528
- 3532
- 3760
- 3786
- 4064

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA010 RemnantVegetation 20230807 04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

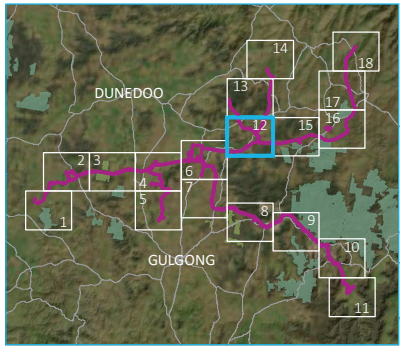
GDA2020 MGA Zone 55

N

Remnant vegetation
Map 11 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse
- Not classified vegetation

Plant community type

- 281
- 440
- 467
- 479
- 484
- 3388
- 3396
- 3528
- 3530
- 3532
- 3756
- 3781

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA010 RemnantVegetation 20230807 04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

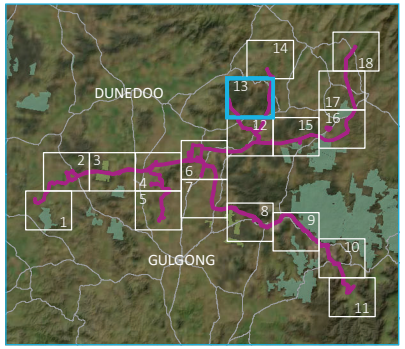
GDA2020 MGA Zone 55

N

Remnant vegetation
Map 12 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse
- Not classified vegetation

Plant community type

- 281
- 403
- 434
- 437
- 440
- 467
- 468
- 477
- 479
- 484
- 3388
- 3396
- 3528
- 3529
- 3532
- 3763
- 3781

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA010 RemnantVegetation 20230807 04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

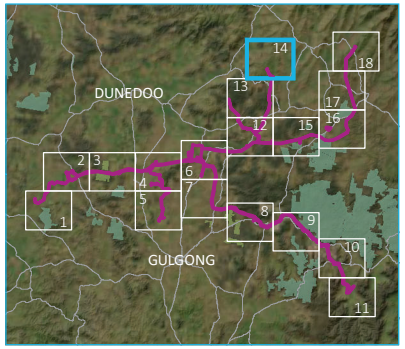
GDA2020 MGA Zone 55

N

Remnant vegetation
Map 13 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse
- Not classified vegetation

Plant community type

- 281
- 381
- 433
- 434

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA010_RemnantVegetation_20230807_04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

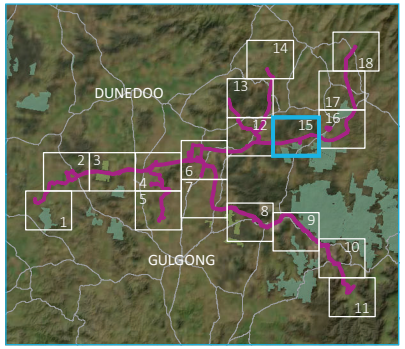
GDA2020 MGA Zone 55

N

Remnant vegetation
Map 14 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse
- Not classified vegetation

Plant community type

- 477
- 484
- 1661
- 1669
- 1675
- 1696
- 1881
- 3396
- 3528
- 3530
- 3532
- 3781

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA010 RemnantVegetation 20230807 04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

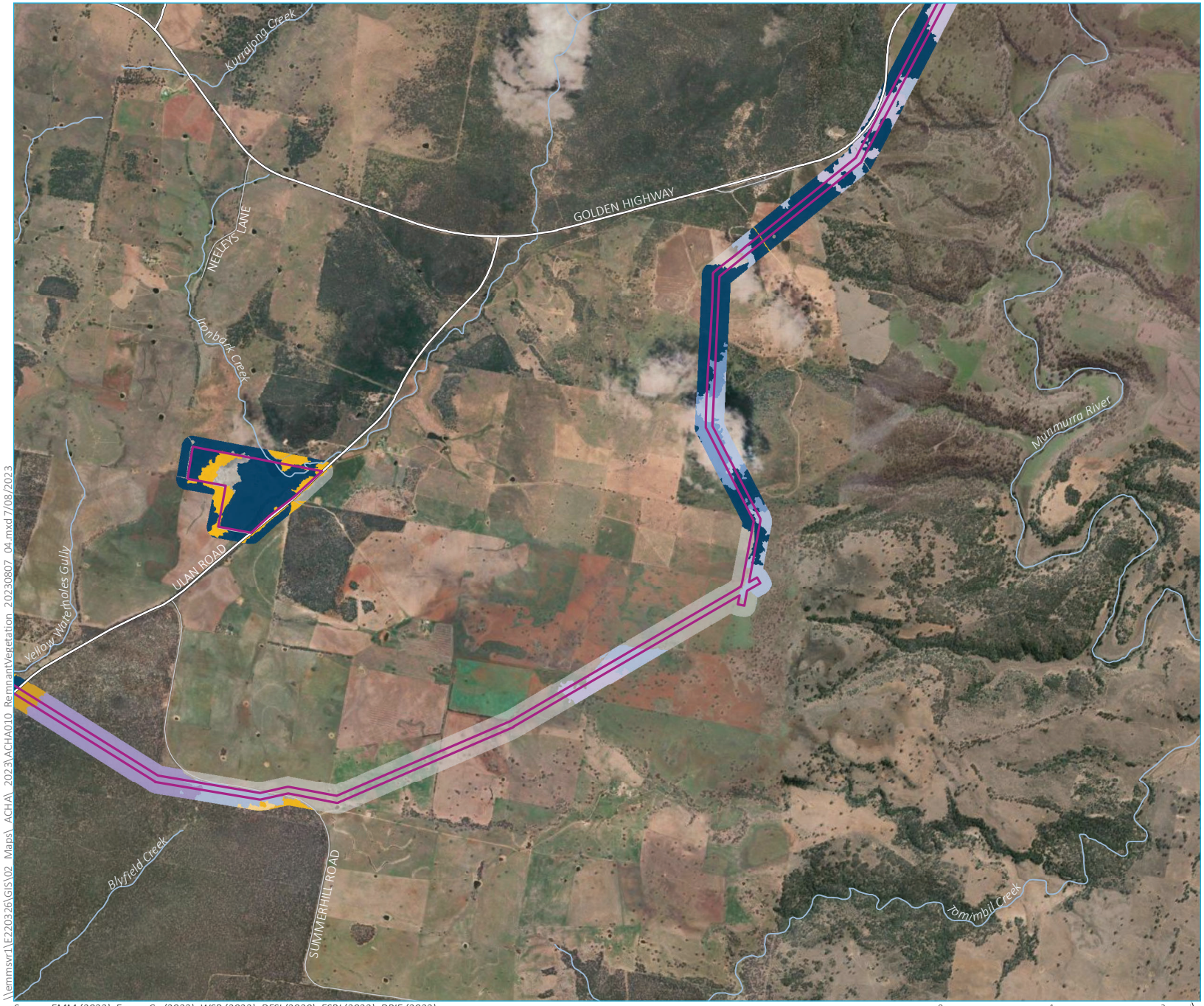
GDA2020 MGA Zone 55

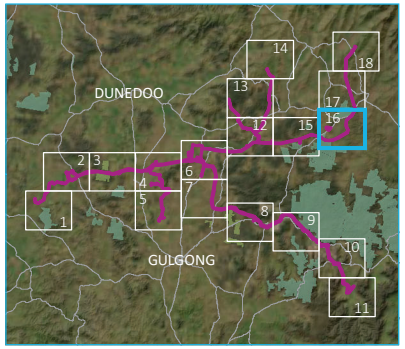
N

Remnant vegetation
Map 15 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities





KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse
- Not classified vegetation

Plant community type

- 482
- 483
- 484
- 1611
- 1661
- 1675
- 1696
- 1881

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA010_RemnantVegetation_20230807_04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

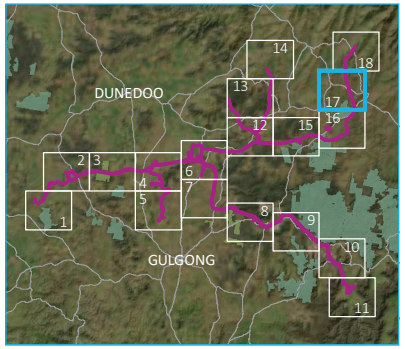
GDA2020 MGA Zone 55

N

Remnant vegetation
Map 16 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse
- Not classified vegetation

Plant community type

- 483
- 484
- 1661
- 1881

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA010 RemnantVegetation 20230807 04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

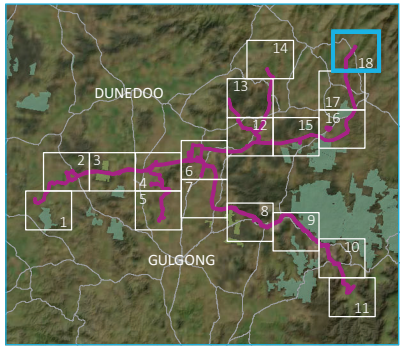
GDA2020 MGA Zone 55

N

Remnant vegetation
Map 17 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities



KEY

- Construction area

Existing environment

- Major road
- Minor road
- Named watercourse
- Not classified vegetation

Plant community type

- 381
- 434
- 483
- 484
- 1881

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA010 RemnantVegetation 20230807 04.mxd 7/08/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

0 1 2 km

GDA2020 MGA Zone 55

N

Remnant vegetation
Map 18 of 18

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities

Plant community

- 78 | River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion
- 81 | Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion
- 201 | Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion
- 202 | Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion
- 266 | White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
- 276 | Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion
- 277 | Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- 278 | Riparian Blakelys Red Gum - box - shrub - sedge - grass tall open forest of the central NSW South Western Slopes Bioregion
- 281 | Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- 326 | Long-leaved Box - Red Box grass-shrub open forest on hillslopes in the Mudgee Region, NSW central western slopes
- 381 | Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion
- 403 | Dapper Mugga Ironbark - Western Grey Box - Blakelys Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion)
- 412 | White Box - Black Cypress Pine shrubby hill woodland in the east Pilliga - Mendooran - Gulgong regions, mainly Brigalow Belt South Bioregion
- 433 | White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion
- 434 | White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion
- 437 | Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion
- 440 | Red Stringybark - Narrow-leaved Ironbark - Black Cypress Pine - hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion
- 461 | Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion
- 467 | Blue-leaved Ironbark - Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo)
- 468 | Narrow-leaved Ironbark - Black Cypress Pine +/- Blakelys Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)
- 476 | Narrow-leaved Wattle low open forest / very tall shrubland on ridges in northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion
- 477 | Inland Scribbly Gum - Red Stringybark - Black Cypress Pine - Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion
- 478 | Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion
- 479 | Narrow-leaved Ironbark-Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion
- 482 | Mugga Ironbark - Black Cypress Pine shrub/grass open forest of the upper Hunter Valley, mainly Sydney Basin Bioregion
- 483 | Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley
- 484 | Derived tall spear grass grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion
- 511 | Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- 599 | Blakelys Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
- 1610 | White Box - Black Cypress Pine shrubby woodland of the Western Slopes
- 1611 | Narrow-leaved Ironbark - Black Cypress Pine shrub - grass woodland upper Hunter and northern Wollemi
- 1661 | Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin
- 1669 | Red Ironbark - Grey Gum - Narrow-leaved Stringybark - Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin
- 1675 | Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin
- 1696 | Blakelys Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter
- 1871 | Western Hunter Dwyers Red Gum-Cypress Woodland
- 1881 | Western Hunter Flats Rough-barked Apple Forest
- 3388 | Central West Valleys White Box Forest
- 3396 | Northwest Flats Box-Blakelys Red Gum Forest
- 3397 | Northwest Flats Yellow Box Woodland
- 3405 | Central West Flats Inland Grey Box Grassy Forest
- 3497 | Western Hunter Escarpment Slaty Gum-Pine Forest
- 3528 | Western Hunter Flats Apple-Gum Shrub Forest
- 3529 | Western Hunter Sandy Colluvial Gully Forest
- 3530 | Western Hunter Sandy Riparian Red Gum Shrub Forest
- 3532 | Western Hunter Ironbark-Box Forest
- 3756 | Gulgong Ranges Stringybark-Ironbark Forest
- 3760 | Munghorn Sandstone Grey Gum-Stringybark Forest
- 3763 | Northwest Wollemi Colluvial Apple Forest
- 3780 | Goulburn River Ironbark-Bloodwood Heathy Forest
- 3781 | Ulan Sandstone Ironbark-Pine Woodland
- 3783 | Western Hunter Rocky Sandstone Ironbark Forest
- 3786 | Western Hunter Scribbly Gum-Pine Woodland
- 4064 | Central Eastern Ranges River Oak Forest
- 4073 | Lower North Hinterland River Oak Forest

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2020); ESRI (2022); DPIE (2022)

Remnant vegetation
PCT descriptions

Central West Orana Renewable Energy Zone transmission
Aboriginal Cultural Heritage Assessment
Figure 5.5

EMM
creating opportunities

5.6 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 construction area is outlined in detail in *Technical Paper 6 - Historical Heritage* (EMM 2023), which has been prepared to support the EIS, and summarised below. Historical aerial photographs of the study area are presented in Appendix B.

5.6.1 Regional history

i Wollar, Wilpinjong, Moolarben and Ulan

The region around Wollar, Wilpinjong, Moolarben and Ulan was first settled in the mid-1820s when William Lee took up the Bylong Run (Niche Environment and Heritage Pty Ltd 2020, p.12). Soon after, prominent emancipist Robert Fitzgerald established Wollar run (Niche Environment and Heritage Pty Ltd 2020, p.12–13). Additional pastoral runs were taken up in the area from 1840. Woollara was taken up by George Bloodsworth in the 1840s, Wilpinjong acquired by John Terry Hughes in the 1840s, John McDonald took up land along Ulan Creek in 1850 and William Robinson purchased a small plot of land around Moolarben and Lagoon Creeks in 1855 (Niche Environment and Heritage Pty Ltd 2020, p.12–13; EMM Consulting Pty Ltd 2013, p.8). Settlement boomed after the *Robinson Land Acts* of 1861 opened the region to free selectors (Niche Environment and Heritage Pty Ltd 2020, p.13). The village of Wollar was established from at least 1867 and was officially declared a village in 1885 and the village of Ulan was gazetted in 1897 (EMM Consulting Pty Ltd 2013, p.8). Dairying became the primary industry of the region in the later decades of the nineteenth century and coal and shale mining began in Wilpinjong from 1899 (Pearson 2004, p.G8). Mining and pastoralism continue to be the prominent industries in the area.

ii Dalkeith, Cassilis and Tangaratta

The town of Cassilis, originally known as Dalkeith, was established c.1834 as a private town to serve the Dalkeith and Cassilis pastoral runs as well as the surrounding area (Arnold Wolthers Architects 1996, 2–4). Dalkeith run began as 1224 acres (495 ha) taken up by Donald Macintyre in 1834 and transferred to Robert Scott in 1835 (Christo Aitken & Associates 2005, 9). Cassilis run was acquired John Turner Clarke in the early 1830s and was purchased by Alexander Busby in 1835 (Christo Aitken & Associates 2005, 8). Landholdings of both stations were heavily expanded over their tenure and from the 1840s the Busby family also held a portion of Dalkeith.

Despite the presence of a courthouse, watchhouse and post office in the town from 1836, occupation was slow due to landholder reluctance to release land, indecision about where to place the Government centre in the region, and the rise of Merriwa as a commercial centre in the mid-nineteenth century (Arnold Wolthers Architects 1996, 2). Nevertheless, Cassilis was a key stop on the transport route between Coonabarabran and Sydney (P.A. Duggan Architect and Heritage Consultant 2019a). It is said that bushranger Captain Thunderbolt (F. W. Ward) robbed the norther mail at Cassilis in 1869 (P.A. Duggan Architect and Heritage Consultant 2019b).

iii Uarbry, Cainbil and Turill

The Uarbry locality had been named by 1833 when Surveyor Robert Dixon stopped in the area to acquire a native guide on the way to Bathurst (P.A. Duggan Architect and Heritage Consultant 2019b). Uarbry village was surveyed in 1868 (P.A. Duggan Architect and Heritage Consultant 2019b). The village was initially constructed on the Talbragar River flood plain but was moved to its current position a few years later (Coolah NSW 2018). By the late nineteenth century Uarbry village was serviced by a pub, post office and schools and the community had established a tennis and cricket club (P.A. Duggan Architect and Heritage Consultant 2019b; Coolah NSW 2018). A school and union church were also established at Turill to the south in the late nineteenth century (NSW Government, n.d.; Churches Australia 2020). The Uarbry region was heavily impacted by fire in 2017 (Zhou 2017).

iv Merotherie, Birriwa and Tucklan

For a brief period in the 1890s Tucklan was a thriving town of 3,000 people (Watts et al. 1993:78). This was due to small finds of gold in the 1890s which sparked a rush of people to the area. Tucklan was serviced by two inns, a blacksmith, a butcher and a bakery. The goldfields were abandoned around 1902 and the town declined. The Lands Department offered former miners 40-acre blocks and encouraged them to stay in the district and build houses on the land (Watts et al. 1993:20). It is unknown how many former miners took up this offer.

v Tallawang, Barneys Reef and Puggoon

The first settlers in the Tallawang region were Henry and George Cox, who established Guntawang run on the Cudgegong River in 1822 (Cremin 2002, p.1). The run was taken over by Edwin and George Rouse on behalf of their father Richard in 1825 and the Rouse family expanded their landholdings claiming various portions of land north of the River in the vicinity of Tallawang (Lenehan 1967; *New South Wales Government Gazette* 6 July 1841, p.903). A W. Mears is also said to have taken up land at Tallawang later selling his property to Mr M. Russell (Kennedy 1913, p.13). Farming families moved into the region after the passing of the 1861 *Robertson Lands Acts* and land was cleared for pastoral as well as wheat growing purposes (Kennedy 1913, p.13). In 1870, payable gold was discovered at Red Hill near Gulgong and then at Tallawang Creek leading to Tallawang, Barneys Reef and Puggoon to be declared part of the Gulgong goldfield (Cremin 2002, p.5; *The Empire* 8 April 1870, p.2). The rush was over by c.1881 and a number of miners decided to establish farms in the area (Kennedy 1913, p.13). Iron-ore mining occurred at Tallawang over the twentieth century and Puggoon became known for its kaolin clay (*Mudgee Guardian and North-Western Representative* 10 January 1952, p.16; 26 October 1939, p.13).

vi Laheys Creek, Dapper and Avondale

Laheys Creek was established by a series of pastoral selections in the late nineteenth century (Cameron and Job 1993:329). It is located along the original Guntawang to Mendooran road which was an important coach, wagon and bullock route. Laheys Creek, named after former convict Michael Lahey, has an interesting connection to the selection of land for the township of Mudgee. Michael Lahey was instrumental in suggesting the present-day location of Mudgee rather than the flood prone land near the Cudgegong first selected by Surveyor Lewis (Cameron and Job 1993:329). Lahey also advised the Rouse brothers to take up land near Guntawang.

5.6.2 Summary

The large extent of the project does not allow for a detailed review of each locale, but a general overview is provided below, and further discussed in subsequent field investigations and findings. Mining, land clearing, and cultivation is a part of the development of the historical landscape in the study area.

George Evans led the first European expedition into the Central Tablelands of New South Wales in 1813 (Former Mudgee Shire Heritage Committee 2004:70). The burgeoning colony was in desperate need of good agricultural land, however, Governor Macquarie kept strict control of the region west of the Blue Mountains, designating it Government land and only releasing grants to select individuals (Former Mudgee Shire Heritage Committee 2004:70). Governor Darling redefined the limits of the colony in 1820 and the Tablelands were open for free settlement (Kass 2003:40). Settlers had reached Mudgee by 1822 and in that year, Henry Lawson led an expedition from Mudgee along the Upper reaches of the Goulburn River (Niche Environment and Heritage Pty Ltd 2015:21). Alan Cunningham surveyed the Upper Goulburn River the following year and noted the richness of the country (Niche Environment and Heritage Pty Ltd 2015:21).

William Lee was the first settler in the Upper Goulburn River region occupying Bylong in the mid-1820s (Niche Environment and Heritage Pty Ltd 2015:21). Squatting runs were taken up over the project study area through the late 1820s and 1830s with initial settlement focusing on reliable water sources (Niche Environment and Heritage Pty Ltd 2015; Kass 2003:40). Around the project study area, squatters cleared the land for grazing with cattle. The climate, rugged landscape, and prevalence of predators in the region made cattle the most cost-effective stock in the region (Kass 2001:8). Cropping was predominant along lower slopes and floodplains of the Talbragar and Coolaburragundy Rivers (OzArk 2022 pp. 15). Original vegetation would have included eucalypt, spotted gum and ironbark species of tree typical of the Tableland Region.

A wool boom in the late 1840s, however, led to the ascendency of sheep farming in the Central Tablelands (Kass 2003:40). Villages were surveyed and were developed within the large squatting runs through the 1840s, and by the 1850s the majority of suitable grazing land had been claimed (Former Mudgee Shire Heritage Committee 2004:71).

During the 1850s, cattle routes began traversing Dubbo and surrounds, causing extensive damage to the landscape in proximity to the construction area. In response, transport infrastructure such as roads and railway lines began their construction during the 1850s and continued into the early 20th century (Kass 2001, 13; Former Mudgee Shire Heritage Committee 2004, 71). Pastoralism and small-scale agriculture continued as the primary industries in the Central Tableland until the coming of the railway in the 1870s and 1880s (Monitor Heritage Consultants 2019:58). A railway line was constructed from Lithgow reaching Bathurst in 1876, Wellington the following year, and arriving in Mudgee in 1884 (Former Mudgee Shire Heritage Committee 2004:71). The line was not extended to smaller townships, such as Gulgong and Dunedoo until c.1910 (Former Mudgee Shire Heritage Committee 2004:71). The coming of the railway not only offered a cheap transport route for famers of the Central Tablelands, but also coincided with the collapse of the wheat industry east of the Great Dividing Range, leaving a gap in the market that needed to be filled (Kass 2001:10). As such, wheat became a primary industry in the region over the late nineteenth century with flour mills and storage silos constructed in villages and townships (Monitor Heritage Consultants 2019:58; Kass 2001:24). Butter companies were also established through western New South Wales from 1888 and dairying was an important industry around the project study area (Pearson 2004:6-8).

The Gold Rush of the 1850s boosted the economic growth of the Central Tablelands as the increased need for beef shifted cattle routes between northern New South Wales and Victoria through Dubbo (Kass 2001:10). Roads were also officially surveyed and constructed during this period (Kass 2001:13). Parts of the study area were subject to this gold rush, including the Merotherie and Tallawang portions of the construction area. Settlement growth in the region, however, was slow until the 1861 introduction of the Robinson Land Acts, which allowed subdivided large squatting runs, permitted any person (free selectors) to purchase up to 320 acres on the condition of payment of a deposit and living on the land for three years (Niche Environment and Heritage Pty Ltd 2015:21).

In the early twentieth century families at Dripstone near Wellington, began producing fruit for the Sydney market (Kass 2001:24). Moreover, coal and shale seams had been discovered in the region at this time. The intermittent mining of coal began in Ulan, to the north, in 1930 and shale deposits were mined on Barigan Station from 1932 (Niche Environment and Heritage Pty Ltd 2015:23). Shale seams were also mined at Wollar/Wilpinjong between 1929 to 1933. Such mining has mostly affected the construction area in the south-east between the Merotherie Energy Hub and Wollar substation. Mining and pastoral pursuits continue to as important industries in the area today.

Overall, the construction area has been subject to a range of past disturbances, generally associated with pastoral activities, and in localised areas from mining. Such activities are likely to have resulted in localised impacts to cultural materials that may be present on site. Most notably, the potential loss of any culturally modified trees, with the potential for pre-Contact vegetation in much of the construction area being limited, and the potential reworking of surface and sub-surface cultural materials from destabilisation and thinning of the soil profiles as a result of these activities.

6 Ethnography and cultural mapping

6.1 Key findings

The following provides a summary of key activities and/or findings of this Chapter:

- Traditionally, the country in which the construction area is primarily located was occupied by people known collectively as the Wiradjuri, who all spoke a related language and shared many cultural attributes, and their descendants are still based in central NSW today. The Wiradjuri linguistic and cultural group represents the largest Aboriginal territory in NSW. The construction area also extends into the southernmost extent of the Gamilaroi country, whose territory extended across a vast area from Singleton in the Hunter Valley through to the Warrumbungle Mountains in the west and up to Nindigully in south-west Queensland.

- The main mythologies of both Wiradjuri and Gamilaroi people during this time involved supreme beings, such as Baiame, Daramulan and Muni Burrebean, with totemic ancestors being of lesser importance. Numerous creation stories and spiritual sites are documented within the region. Burial activities of the Wiradjuri people were observed by early explorers and exhibited complex and highly visibly landscape modifications, including carved trees.

- A review of historical records for the region shows an extensive interaction 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 study area itself. Of note was the Joe and Jimmy Governor, two Aboriginal bushrangers in 1900, who traversed this locale and had associations with the Wollar township.

- Cultural mapping was undertaken by a highly experienced anthropologist and key knowledge-holders for the project (and included in Appendix D). The study provided contextual information on the spiritual, socio-economic and environmental interactions of Wiradjuri and Gomeroi peoples in the study area. Some six places of cultural value were documented, none of which are within the construction area. These are focussed along Cockabutta Creek and the Wilpinjong mining area, and include both tangible (bora grounds, corroboree grounds, rockshelters, burials, etc) and intangible places (travelling routes/nodes, song-lines).

- Additional information from both Aboriginal participants and local landowners highlighted additional cultural sites and places, which either cannot be robustly located or are known to be outside the construction area.

6.2 Documentary ethnography

The study area is primarily associated with Wiradjuri people, but partially encompasses the southern border of the Gamilaroi (also Kamilaroi, Gomeroi and Gamilaraay; Tindale (1974) recorded over 30 spellings) nation. As such, this section discusses both traditional groups. [2]

2 It is important to note that information about the socio-cultural structure of Aboriginal society prior to European contact largely comes from ethno-historical accounts made by colonial settlers. Most ethnographical accounts of Aboriginal life during contact were written in the context of a period of immense change through death and disease, displacement, and a loss of culture, country and knowledge. As a result, this information is often limited and can be contentious.

Territories were marked by natural features in the landscape and Tindale (1974) records Wiradjuri Country covering an area of 127,000 km^2 between the Great Dividing Range and Willandra Lakes region, with the northern boundary extending from beyond Mudgee and the southern boundary marked by the Murray River. The territory of the Gamilaroi to the north is estimated to cover 75,000 km^2 between Singleton to the Warrumbungle mountains, Quirindi and Nindigully in southern Queensland.

6.2.1 The Wiradjuri people

i General overview

As with groups elsewhere in NSW, 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 1906, pp. 941-192). Local waterways and catchment areas delineated the boundaries of these smaller kinship groups (Pearson 1984). Pearson's research also suggests that seasonality influenced social organisation, with people breaking into smaller groups during lean times. 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). These patterns of social organisation mirror those recorded by early colonists in the Sydney region (e.g. see Attenbrow 2010).

Wiradjuri people lived in small family groups of up to 50 individuals and primarily occupied open camp sites comprising either lean-to, mia-mia or gunyahs around a central hearth (Greenwood 2013:12). Groups of the region travelled around country throughout the year, moving to a new area when resources diminished, seasons changed or if there was a death and smaller groups came together for ceremonies and trade ((Niche Environment and Heritage Pty Ltd 2015:20). At the time of European settlement in the NSW Central Tablelands, Wiradjuri groups had established a regional network linking the Blue Mountains to the eastern coastal plains (Extent Heritage Advisors 2017:25). Reports from European observers suggest that the pathways linking Wiradjuri groups socially and economically continued to be used throughout the first fifty years of European colonisation (Extent Heritage Advisors 2017:25).

Pearson's (1981) research into the ethno-history of the Upper Macquarie River Valley identified that the local Aboriginal populations were unlikely to be affected by seasonal change. He suggested that Aboriginal people required limited seasonal movement in the study area, and it is estimated from early accounts that family groups had a territory with a circumference of 40–60 kilometres from which to hunt and procure food resources (Pearson 1984). The hills and grasslands of the study area offered a wealth of terrestrial food and material resources with freshwater aquatic foods, such as fish, yabbies, muscle, tortoises and birds, found in rivers, creeks and floodplains (Greenwood 2013). Tools utilised to hunt or collect food resources included woven nets, Coolamon, digging sticks, grinding stones, and baskets and bags woven of grasses and fur, as well as, canoes, spears, woomeras, boomerangs, Boondi (wooden club), Bullroarer and ground stone axes (Greenwood 2013). Wooden shields were also part of men's material culture and were used in ceremonies and during conflict.

The riverine environments within the region would have provided well for the diet and subsistence needs of the Wiradjuri. The people found an abundance of fish, yabbies and freshwater mussels in the rivers, creek, lakes and waterholes of the region, such as the Macquarie, Talbragar and Cudgegong Rivers. They hunted game such as ducks, snakes, lizards, kangaroos, emus and echidnas as well (Kabaila 1999). Plant foods were also part of the diet including a wide range of berries, seeds, roots, pods, fruits, nuts, bulbs, tubers and greens, gathered from riverbanks and land between the river systems. From archaeological evidence of hundreds of grinding stones on the west of the Great Dividing Range, grinding of these foods was more common in the west (NSW Heritage Office 1996).

Camping is reported to have occurred along river banks. Huts used for shelter were made of grass-thatch and held groups of 50 or 60 people. Huts would be waterproofed over the wet winter months with animal skins or clay coverings (Clayton 1985). (Mathews 1898) reports the layout of camps:

> In all native camps, the young men, and all visitors who have not their wives with them, always camp together a short distance from the camp of the married people and girls.

The government of New South Wales became more active in the management of Aboriginal welfare from the late-19th century (Rowley 1972). After a period of rapid depopulation, this high degree of intrusion into Aboriginal life for the survivors was such that much of the local Aboriginal oral tradition was lost (Tindale 1940). In 1985, a local Aboriginal descendant, James Miller, published a book titled *Koori. A Will to Win*, and he used government records to reconstruct his community's history. Miller (1985) stated that:

> From 1883 onwards I have been able to find much written evidence of my own family, since Kooris of New South Wales in the period were controlled by the infamous Aborigines' Protection Board. This foul government organisation attempted to smash our cultural and family identities, and in so doing it recorded mountains of information on the Kooris they knowingly oppressed.

ii Local beliefs and ceremonial practices

The Central Tablelands region has a high number of ceremonial sites including Bora rings, carved trees, rock art and burial sites. The Wiradjuri and neighbouring groups held common belief in the central importance of Baiamai (also Baiame, Bayme) as the supreme creator of past, present and future (Go Green Services 2002:13). The landscape was transformed, life forms created, and laws and custodianship of the land were given over during *Ballanda,* the creation period (Go Green Services 2002:13; Greenwod 2013:6). Ceremonies connected people to the land and members of their community (Go Green Services 2002:16).

There are gaps in knowledge regarding ceremonies because Aboriginal people were often unwilling to have Europeans present at the ceremonies, therefore, records of the events tend to be disjointed.

Water spirits were prominent in Wiradjuri culture, compared with the 'bunyip' that was widely associated with wetlands, recognised in a 1920 newspaper excerpt from naturalist/explorer, Archibald Meston:

> The bunyip story runs through all Australian history. Back in the convict period of New South Wales some remarkable and mysterious animal was reported in various deep lagoons, and in 1834 a strange animal like a seal was seen in Lake Cowal and Lake George (Holden & Holden 2001, p.84-99).

Ceremonial life involved myths and stories explaining right and wrong forms of behaviours. Religious ceremonies often involved sky gods (Clayton 1985). For the Wiradjuri, Baiame is an important male supreme ancestor, known for transforming two brothers, who had fought all day, into Ivy Rock, located far to the east between Dunedoo and Singleton. Daramulun and Muni Burrebean are two further significant Wiradjuri ancestors akin in status to Baiame. Significant ceremony included the Burbung ceremony, which was associated with male initiation. This ceremony is described in detail by Matthews (1896; 1901) with further detail in Howitt (1904). Aspects of Mathews' (1896) description provide insight into elements of the wider Wiradjuri demography. Mathews relates that the Burbung ceremony involved numerous members of various Wiradjuri tribes. Gathering for the ceremony commenced with the headmen from three tribes deciding to hold the ceremony. Five messengers were dispatched (carrying sacred emblems) to invite neighbouring tribes to participate in the ceremony; these messengers were dispatched in five different directions. The need to dispatch so many messengers suggests the size of the ceremony and the extensive nature of Wiradjuri territory:

> These messengers generally arrived at the camp to which they were dispatched a little before sundown, because at that time of the day all the men have generally returned from hunting, and are to be found in their own quarters (Mathews 1896: 303).

This indicates that tribes were possibly extended family units, each occupying a distinct area, as the messenger knew where to go to find the tribe:

> The next day, or it might be in a few days' time, the message was sent forward to the next tribe, or section of the tribe, either by the headman dispatching one of his own people bearing the sacred emblems, or by the same messenger who had brought the invitation to the camp. In this way the message was sent from tribe to tribe, or to sections of a tribe, until the farthest-off camp of natives was reached (Mathews 1896: 304).

The journey to the appointed place was undertaken by men, women and children in easy stages. Given the descriptions of tribes involved in the Burbung recorded by Mathews, the participating tribes travelled up to 200 km to attend the ceremony. Travelling this distance would have taken at least two weeks and shows that the Wiradjuri had sufficient knowledge of resources to move large numbers of people through their territory.

Mathews (1896: 296) reports that the ceremony commenced at the "end of May" and "the final ceremonies were not concluded till the beginning of July". Two months of ceremony during the late autumn and winter months indicate the ability to procure and provide food and sufficient water for several hundred people.

Art was important as a means of bringing spirit power or influence over everyday activities. Body painting and decoration were used in corroborees and battles (Clayton 1985). Ceremonies involved constructing large elaborate earthen features, decorated with earth carvings; and also constructing 'images' of Dharamoolan (Mathews 1901: 340) and Baiamai (Mathews 1896: 300) from mud, clay and sticks.

Wiradjuri people observed elaborate burial practices. A description of a burial from the Wellington area has been described by Hood (1843), cited in Le Maistre (1993):

> I saw a native grave today. It was heaped up with earth over a deep pit; was of circular form, and covered with trees; a hollow space was scooped out are it, from whence the soil had been taken; and to the south were two semi-circles trodden in the earth, which with the figures cut on to adjoining trees are supposed by these poor people to keep off the debbil debbil, or evil spirit. I understand they will not pass a grave at night and never mention the name of a person after his decease.

This information is mirrored in accounts from Oxley (1820) and Mitchell (1839). They wrote that graves comprised a large, raised central tomb enclosed on top by a bark and timber hut, with tombs frequently surrounded by several raised earthen mounds or ridges. They also wrote that relatives of the deceased person would often keep vigil at the tomb for a period of time.

Today, Wiradjuri people speak of women's and men's sites, and their approximate location is known to most community members in order for them to observe cultural protocols in relation to access (Appendix C).

iii 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 1896: 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: 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 1896: 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 opened up both north and south over the mountains to the coast (Clayton 1985). It has been stated that the Darling River (~450 km west of the construction 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.

6.2.2 The Gamilaroi people

i General overview

The northern portions of the construction area fall within the traditional country of the Gamilaroi (also rendered Kamilaroi; Tindale (1974) recorded over 30 spellings), language group that extends as far west as Lightning Ridge, and with the Tamworth region forming the easternmost border (Tindale 1974).

Tindale (1974) estimates that the territory of the Kamilaroi extended across an area approximately 75,400 km^2 and represents one of the largest tribes in eastern Australia, surpassed only by the Wiradjuri whose territory lies on their southern border (Section 6.2.1). Within the Gamilaroi tribal group, there are two subdivisions; the Corbon Gamilaroi (meaning "the people of the greater country of Gamilaroi") whose territory included the Liverpool Plains and beyond, and the Gammon Gamilaroi (meaning "the people of the lesser country of the Gamilaroi") whose territory included the more southern area from Murrurundi to a very narrow corridor south into the Hunter Valley (Milliss 1980; Telfer & Milliss 1980).

In 1842, it was estimated by Edward Mayne, the first Commissioner of Crown Lands and 'Protector' of Aborigines of Liverpool Plains, that there were 4,000 Aboriginal people living between the Peel, Namoi and Gwydir Rivers (Mayne 1942:169-171). However, this number reflects a population severely impacted by at least two decades of direct European contact, which brought both the loss of resources and the introduction of diseases. Disease in particular decimated Aboriginal populations in the post-contact period; in many instances, diseases spread ahead of the settlement frontier, so that by the time the colonialists settled in the area, the local resistance had already been weakened or destroyed by disease. Indeed, there are reports of a *Gamilaroi* story that testifies to the spread of smallpox ahead of white settlement (Ferry 1978:5, cited in Wilson & McAdam 2000:11).

ii Local beliefs and ceremonial places

The Northern Tablelands have a high number of ceremonial sites including Bora rings, stone pathways, carved trees and rock art. It is commonly known that the area is spiritually linked to Baimai (creator god, discussed below), Birrahgnooloo (his emu-wife), Gooberangalnga (also his wife) and Daramulan (son of Baimai, sometimes a brother) (Flood 2010:238). There are gaps in knowledge regarding information of the use of Bora rings and other ceremonies because Aboriginal people were often unwilling to have Europeans present at the ceremonies, therefore, records of the events tend to be disjointed and mostly speculations.

It is a Gamilaroi tradition that during the Creation (Dreamtime) a god-like male Ancestor, Baiame (Baiamai, Bayme), created rivers, mountains, and the forests on Earth. He also gave Aboriginal people their traditional laws and practices. Baiame made the first initiation site, known as a bora, where teenage boys were made into men. Many of the surrounding groups had the same or related beliefs concerning Baiame (Thomas 1900:166; Wyndam 1889:36-37). For the Gamilaroi, images of Baiame and his wife Gooberangalnga, which were drawn on the ground, bark sheets and on tree trunks, were utilised for the bora ceremony during which male youths were initiated (Howitt 1904:587, 593; Mathews 1907:8, 10). Particular waterholes were reportedly seen as dangerous places. The Gamilaroi believed in the existence of 'a legendary, serpent-like monster called the Kurrea, which is supposed to have its abode in deep lagoons and other sheets of water, and devours human beings who may come within its reach' (Mathews 1907:10). These 'monsters', which were sometimes described as 'crocodile' beings, are related to the Rainbow Serpent (Mathews 1899:20-22; Radcliffe-Brown 1930:343-344).

Male initiation ceremonies were closely linked to Daramulan and Baiami and performed with a Bora ring between August and September due to the celestial phase known as the 'Cosmic Emu' (Fuller et al 2013, p.7). A ceremony at Black Mountain (40 km north of the construction area) described by Charles Blomfield, a student of anthropology and ethnographic study, includes emu tracks being used to mark the track toward the Bora ring (Waters 2015, p.36). Within the Northern Tablelands, ceremonies are reported to have continued until the "early eighties" (probably 1880s) (McBryde 1974, p.41). An 1871 account of the Bora ground mentions a circle of eight to ten yards in diameter surrounded by numerous carved trees (Armidale Express 1871 in McBryde 1974, p.42).

The early ethnographic literature for eastern New South Wales mentioned sites that have specific significance to either men or women. The bora ceremonies were important for the whole community, although specifically directed at the education of young men (Greenway 1901; Mathews 1897:150-173; Small 1898:46). Mathews (1907:5) stated that for the Gamilaroi people:

> The Bora is a great educational institution for the admission of the youths of the tribe to the privileges, duties, and obligations of manhood. The ceremonies are apparently intended to strengthen the authority of the elder men over the younger, and to impress in an indelible manner those rules of conduct which form the moral and civil law of the tribe.

The 'head men', whose duty it was to prepare the bora ground, would invite Aboriginal groups in from the surrounding region 29. Mathews said that 'A suitable camping ground is accordingly selected near some river, creek, or waterhole in a part of the tribe's domain in which there is sufficient game and vegetable products to furnish food for all the people during the continuance of the ceremonies' (Mathews 1907:5).

iii Tools, weapons and apparel

Observations of the local Aboriginal people was made initially by Surveyor-General John Oxley in 1818 during an exploration of the Macquarie River, which resulted in numerous interactions with the Aboriginal people his party encountered along the way. Oxley noted that the groups of Aboriginal people were much more numerous (<25 per group) and different family groups and abandoned campsites much more frequent (<40) than his recent Lachlan expedition. Abandoned campsites were numerous and occurred along the riverbank and elevated land near to the rivers. The men often carried clubs or waddies and banged them together to create noise in an attempt to scare away Oxley's party. The men were carrying spears more like big, jagged lances, clubs, chisels, and several workbags filled with feathers, necklaces of teeth, and nets for the head with thread from the sinew of possum tails (Oxley 1820:236-237), while the characteristic possum cloaks were also observed. During his mapping of the Macquarie River, Oxley noted the presence of many fires in the distance when they camped down at night. They came across a burial at the Lachlan River, encompassing an earthen mound surrounded by carved trees, and somewhat different to the traditions along the east coast.

Ethno-historical information lists an array of tools and weapons and also mentions areas of raw material procurement. Many items are unlikely to have survived as artefacts in the archaeological record because they are susceptible to decomposition. Items made of wood are a primary example. Ethnographic accounts of tools in the Northern Tablelands focus on spears, clubs, waddies (a type of hunting stick) and boomerangs among wooden artefacts and on axes and stone implements such as stone tools (McBryde 1974:13). Rugs and cloaks were made of kangaroo and possum skins with the aid of bone needles and animal sinews for thread. Wood, bark and animal materials were also used to make items like bags, fishing nets and wooden vessels (McBryde 1974:13).

6.2.3 Contact history

The first European explorations of the Central Tablelands occurred from 1813 but the Wiradjuri had already felt the effects of colonisation (Go Green Services 2002:40). Oxley and Cunningham recorded their friendly interactions with Aboriginal groups though the Wellington Valley noting all were familiar with steel hatchets although interactions led the explorers to conclude that only some groups had previous knowledge of white men (OzArk Environmental & Heritage Management 2007:29–30).

Disease and warfare, most notably the massacres between 1824 and 1826 known as the Bathurst War, rapidly depleted Wiradjuri numbers (Former Mudgee Shire Heritage Committee 2004:69; Gapps 2022; Niche Environment and Heritage Pty Ltd 2015:21). Settler/Aboriginal violence, however, was not contained to Bathurst. In early September 1824, William Cox's overseer, two stockmen and an Aboriginal guide killed 16 Aboriginal men at Mudgee, approximately 30 km south of the project study area (Ryan et al. 2022). An Aboriginal Mission Station was established within the decommissioned Wellington convict settlement by the Church Missionary Society in 1831 (Kass 2001:6). Missionaries William Watson and James Gunther, who later established a competing Mission at Nanima Reserve, attempted to convert Wellington Wiradjuri to Christianity focusing on divorcing children from the influence of their parents and elders (Kass 2001:6). Many Wiradjuri exploited the mission for food and tobacco but continued to practice traditional lifeways as long as they were able (Kass 2001:6).

Intensification of settlement throughout the project study area over the 1830s and 1840s further pushed Wiradjuri from their traditional lands restricting access to traditional water and food sources, leading to a reliance on European handouts for survival (Kass 2001:6; 2003:10). By the 1840s, many Wiradjuri family groups and communities had attached themselves to "friendly" stations offering a reliable pool of workers in return for access to Country, which in turn allowed the continuation of traditional lifeways within the European world (Monitor Heritage Consultants 2019:20). In 1869, a correspondent noted the prevalence of Aboriginal workers near Dubbo:

> On the stations to which I am alluding, there is no European—no white man—either as shepherd or stockman. The blacks are employed even at sheep washing. Their food consists only of about two ozs. of tea, a little sugar, and about six lbs of flour weekly. They find their own beef somehow (Empire 1869:2).

The subdivision of large stations and influx of selectors in the 1870s eradicated these camps (Kass 2001:6). From 1883, Wiradjuri camps were broken up by the Aborigines Protection Board and people were forcibly removed from their country to reserves in Eugowra (AR 9386, from 1889, ~150 km south-west of the construction area), Forbes (AR 43462/3, 1909-1915, ~170 km south-west of the construction area), Wellington (AR 45426/7 and AR 87975, from 1910; ~60 km south-west of the construction area), or Spring Flat (AR 80144, 1957-1964, ~40 km south of the construction area) (Extent Heritage Advisors 2017:30). These reserves were segregated on the outskirts of townships (Kass 2003:11). A small community of Aboriginal people, including families of police trackers, were living at the Wollar Police Paddock in 1900 and associated with the events of Jimmy and Joe Governor, and Jacky Underwood (Foster 2019:307) (see Section 6.2.3i).

By the early 1900s, many reports from European observers noted the population of the Wiradjuri had been greatly reduced and traditional activities were no longer practiced (OzArk Environmental & Heritage Management 2007:32; Kass 2003:10; Mudgee Guardian and North-Western Representative 1904:22). Through the early to mid-twentieth century, Wiradjuri children were removed from their families and residents of reserves were under constant government surveillance (Kass 2003:11). After the abandonment of segregationist polices in the 1970s and 1980s, Wiradjuri communities have fuelled a cultural renaissance built on the legacies of the past (Kass 2003:10–11).

i Joe and Jimmy Governor, Australia's last bushranger

Wiradjuri man, Jimmy Governor, was born near Dunedoo in 1875 to parents Tommy and Annie Governor (née Fitzgerald) (Walsh 1983). Tommy Governor hailed from the Naomi River region, working in bark-getting, driving stock, and other bush work. Annie Governor had been raised on the Caigan station, near Mendooran and was the daughter of an Irish stockman, Jack Fitzgerald, and an Aboriginal mother, Polly. The Governors had eight children (five boys and three girls), of whom Jimmy was the eldest (Walsh 1983).

In the mid-1890s, the Governor family moved to an Aboriginal reserve across Wollar Creek near the Wollar township. Jimmy Governor is known to have attended Wollar school with a number of his siblings (Western Mail 1938). During this time, Governor worked on stations and farms within the region and had his first encounter with the law in 1893, convicted of 'horse sweating' (riding a horse without the owner's permission), sentenced to one month in prison (SLNSW n.d.).

In July 1896, Governor enlisted as a tracker with the NSW Police near Cassilis, although this stint only lasted until December 1897 (Walsh 1983). The reasoning behind his departure varies; however, it is clear that Governor had become frustrated by the lack of advancement and maintained dissatisfaction with his colleagues (SLNSW n.d.). At this time, Governor returned to Wollar, cutting wood for Jonathon Starr.

Whilst working for Starr, Governor met 15-year-old Ethel Page in the Gulgong township. Page soon fell pregnant, and the pair were married in 1898 (The Walcha Witness and Vernon County Record 1900). Initially the Governors settled next to Ethel's parents in Gulgong; however, neither her parents nor the Gulgong locals approved of the interracial marriage, and they soon decided to move away from the district (SLNSW n.d.).

Governor secured a fencing contract with John Mawbey in Breelong, and the family moved to an Aboriginal camp nearby. Whilst Jimmy worked on the fences, Ethel worked for the Mawbey's as a domestic servant in return for rations (SLNSW n.d.). Whilst working here, Ethel was subject to harsh ridicule concerning her interracial marriage by the women of the household, particularly Mrs Mawbey, her daughter Grace, and teacher Helen Kerz (Walsh 1983).

A number of further grievances between the two families lead Jimmy Governor to consider bushranging. By this time, Jimmy's brother Joe, friends Jack Underwood and Jack Porter and nephew Peter Governor had joined Jimmy near his camp (Walsh 1983). In 1900, Jimmy and a few of his contemporaries confronted Mrs Mawbey requesting an apology; however, this was met by further goading and insults. Jimmy retaliated, ultimately leading to the deaths of Mrs Mawbey, Helen Kerz and three children Grace and Percy Mawbey and Elise Clarke (SLNSW n.d.).

Whilst Jack Underwood, Jack Porter, Peter Governor and Ethel Governor were taken into custody, Jimmy and Joe Governor spent the next two months on a spree of violence, committing more than 80 crimes, including the murder of Kiernan Fitzpatrick at Wollar (Sunday Times 1900; Plate 6.1). Of relevance to the study area, this included a number of sightings, and crimes committed, in the vicinity of Breelong, Dunedoo, Gulgong, and Wollar, and are presented in Plate 6.1 and Figure 6.1. Following this, the brothers headed north as far as Wee Waa, and then towards the coast in the vicinity of the Manning River catchment. The reward for their capture totalled £2,000, and soon over 2,000 people were hunting the bushrangers.

In October 1900, a shootout took place injuring Jimmy. Jimmy and Joe split up and whilst Joe was shot dead, Jimmy was captured at Bobin Creek and sentenced to hang by January 1901 (SLNSW n.d.)

The last individuals to be identified as 'outlaws' in NSW, over a six-month period, the group gained public attention and committed several more crimes before being captured or killed in late 1900.

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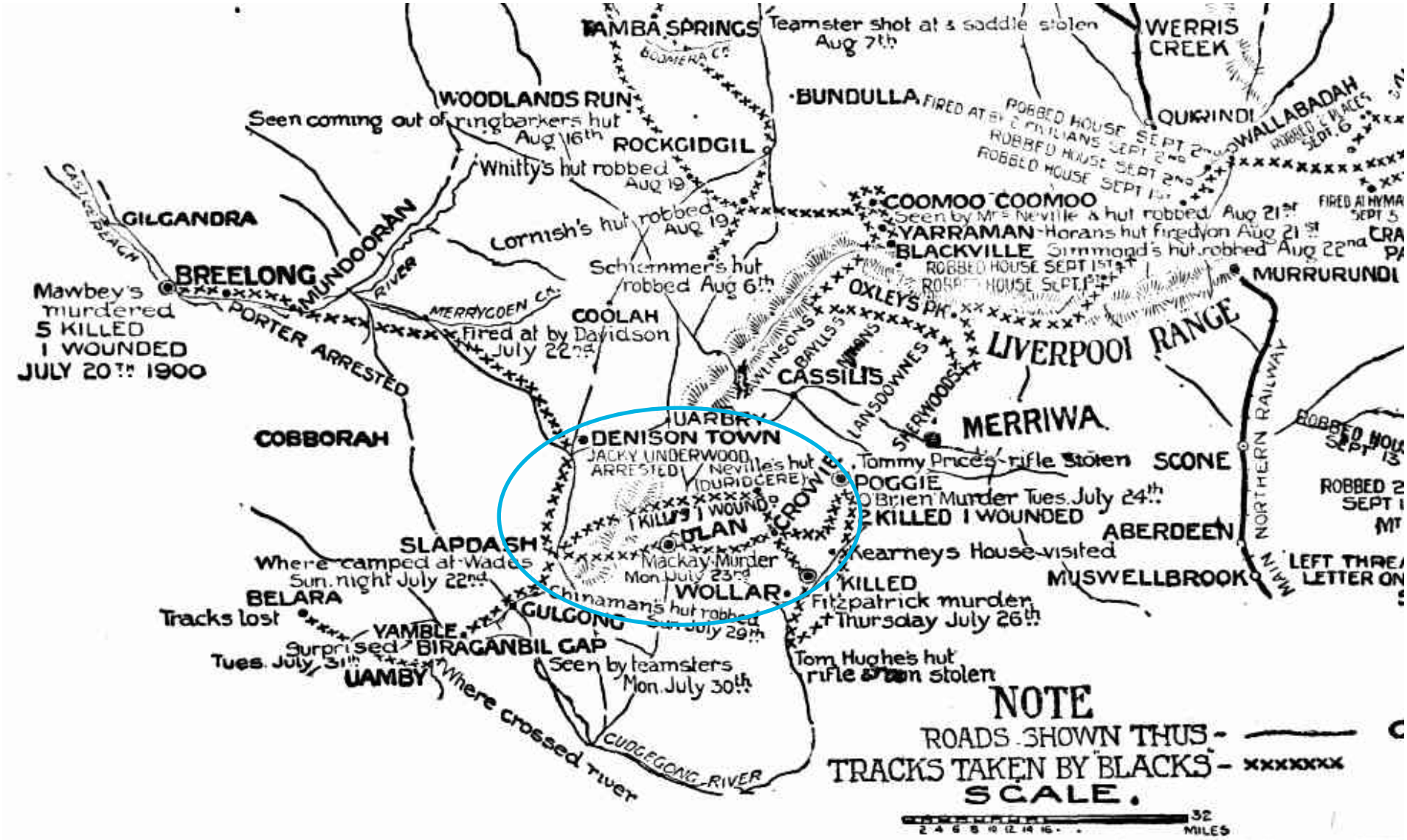
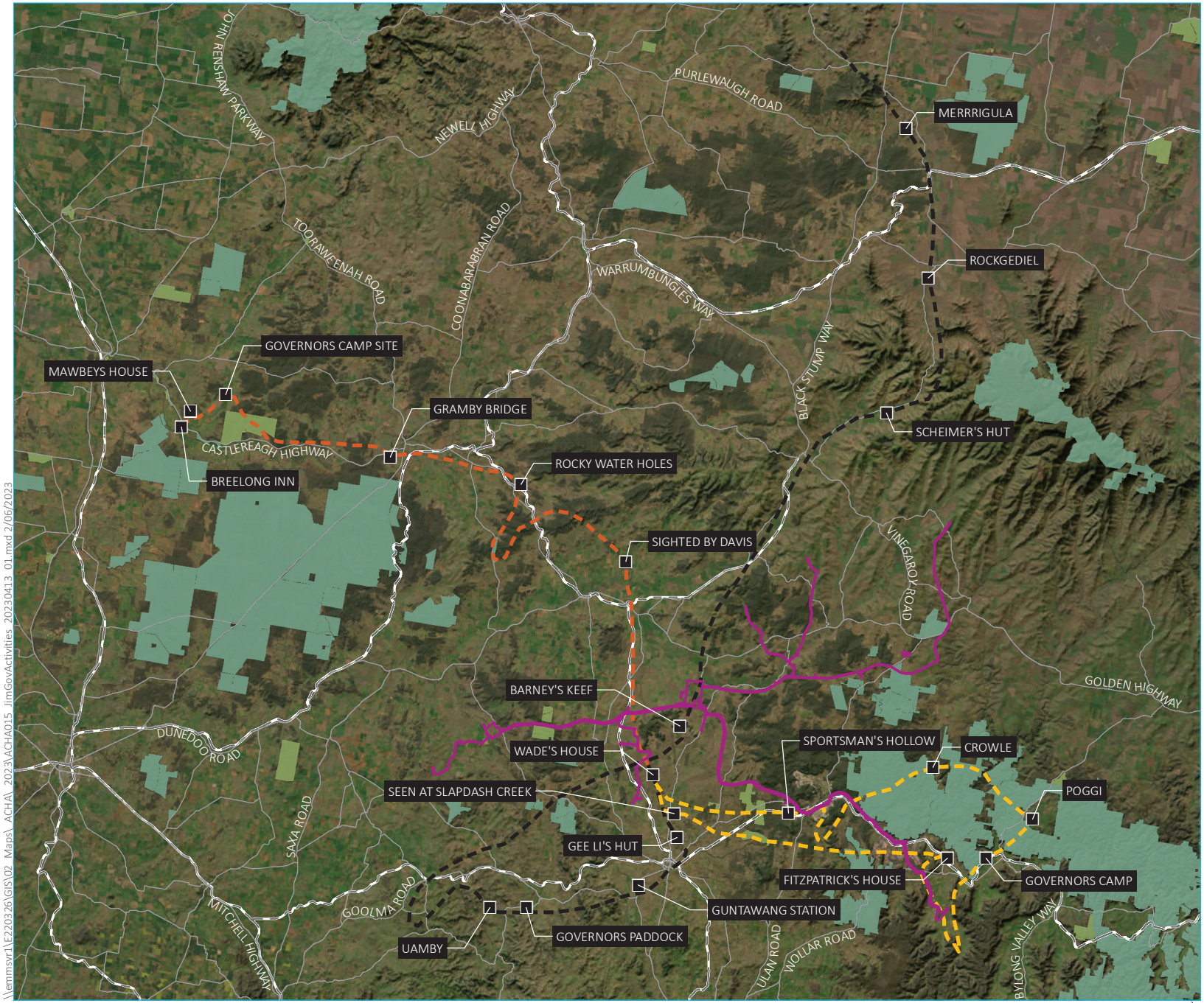


Plate 6.1 Excerpt from 'map showing the wanderings of the Breelong murderers up top the capture of Jimmy Governor at Bobin Creek' (Evening News 1900). The general vicinity of the construction area is shown by the blue circle



KEY

- Construction area
- Activity location

Path taken by Joe and Jimmy Governor

- North to Tambar Springs
- Breelong to Wade's house
- Wades house to Ian, Poggi, Wollar and return

Existing environment

- Major road
- Rail line
- NPWS reserve
- State forest

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); GA (2009)

Locations relevant to the activities of Jimmy Governor

Central-West Orana Renewable Energy Zone Transmission
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Figure 6.1

EMM creating opportunities

6.3 Cultural mapping

6.3.1 Rationale and methods

Cultural mapping is described more fully as cultural resource mapping or cultural landscape mapping, and it refers to an eclectic range of research techniques and scholarly tools that are employed to 'map' the tangible and intangible cultural assets of people within the local landscape. It involves the application of a wide variety of techniques and activities, from community-based participatory data collection and management to the use of sophisticated mapping based on Geographic Information Systems (GIS), in order to come to terms with cultural resources for communities and places. Proponents of cultural mapping as cultural inquiry have claimed that:

> From this perspective, cultural mapping is regarded as a systematic tool to involve communities in the identification and recording of local cultural assets, with the implication that this knowledge will then be used to inform collective strategies, planning processes, or other initiatives. These assets are both tangible, or quantitative (e.g. physical spaces, cultural organizations, public forms of promotion and self-representation, public art, cultural industries, natural and cultural heritage, architecture, people, artifacts, and other material resources) and intangible, or qualitative (e.g., values and norms, beliefs and philosophies, language, community narratives, histories and memories, relationships, rituals, traditions, identities, and shared sense of place). Together, these assets help define communities (and help communities define themselves) in terms of cultural identity, vitality, sense of place, and quality of life (Duxbury et al. 2015, 2).

To apply these concepts and further understand traditional and contemporary cultural values associated with the construction area, cultural mapping was undertaken by Dr Philip Clarke, a highly experienced anthropologist, with the participation of key knowledge holders and/or elders identified by the RAPs. The interviews and fieldwork for this activity was undertaken in April 2023, and included representatives of the Warabinga Wiradjuri #7 native title applicants and Wellington Valley Wiradjuri Aboriginal Corporation, as well as discussions with other Wiradjuri and Gomeroi traditional owners.

A detailed report of the cultural mapping and Dr. Clarke's original field notes are included in Appendix D. The report includes a brief review of existing anthropological and ethnobotanical data for the region with which to compare provided oral histories; and the findings of a number of interviews with the key knowledge holders identifying sites, locations and values across the construction area and surrounds. The method undertaken in the current cultural mapping exercise was to record all places that the Aboriginal participants have declared to have some significance to them, and to determine whether there exists any sense of spatial boundaries. Through documenting the proposed sites an attempt would be made to determine the extent to which the stated importance is based on existing experience and knowledge of the Aboriginal informant, and to ascertain whether this is likely to be a shared opinion with other Aboriginal participants. The cultural mapping determined three types of classification for recording purposes:

- Cultural sites that can reasonably be assumed to have been in existence when Europeans first arrived in the region, or at least shortly afterwards when Aboriginal people were still living in a traditional foraging lifestyle (e.g. specific bora grounds, scarred trees).

- Historical sites and places that typically reflect early interactions (or beyond living memory) between Aboriginal people and Europeans, such as episodes of frontier violence, working on pastoral stations, et cetera.

- Social history places associated with the contemporary local Aboriginal community (e.g. former Aboriginal house sites, gazetted cemeteries and schools). The documentation of these places helps to build a narrative that explains the experiences that members of local Aboriginal communities have had growing up on Country.

6.3.2 Findings

The cultural mapping provided the following summary:

- When Europeans first arrived, the majority of the study area was occupied by people known collectively as the Wiradjuri people in the east and south of the project, with the Gomeroi people in the north-west section. At the time of European colonisation, members of each group all spoke a related language and shared many cultural attributes, and many of their descendants today are still based in central New South Wales and are actively involved in managing the local Aboriginal heritage.

- At the time of European settlement, the study area would have been composed of numerous estates associated with clans as landowning groups within the Wiradjuri and Kamilaroi peoples, although there is only a little information available on their clan identity.

- Upon the breakdown of the clan system in the late-19th century, due to the negative impact of European settlement, Aboriginal people of the study area chiefly lived in settlements and large pastoral properties, where they have built and maintained identities as Wiradjuri and Gomeroi people.

- The main mythologies documented for the Wiradjuri and Gomeroi cultures at the time of European settlement were dominated by supreme beings, such as *Baiame, Daramulan* and *Muni Burrebean*, with totemic ancestors also being of some importance.

- The Aboriginal peoples of central New South Wales had a major involvement in what has been termed the 'Frontier Wars' of the 1820s. While many of the more well-known events took place south of the study area, there were also tragic incidents of frontier conflict that occurred here.

- The ethnographic and historical records relating to the Wiradjuri and Gomeroi peoples are extensive and, while they are incomplete, it can reasonably be expected that any highly significant cultural heritage concerning the study area would have been recorded in them if it had existed.

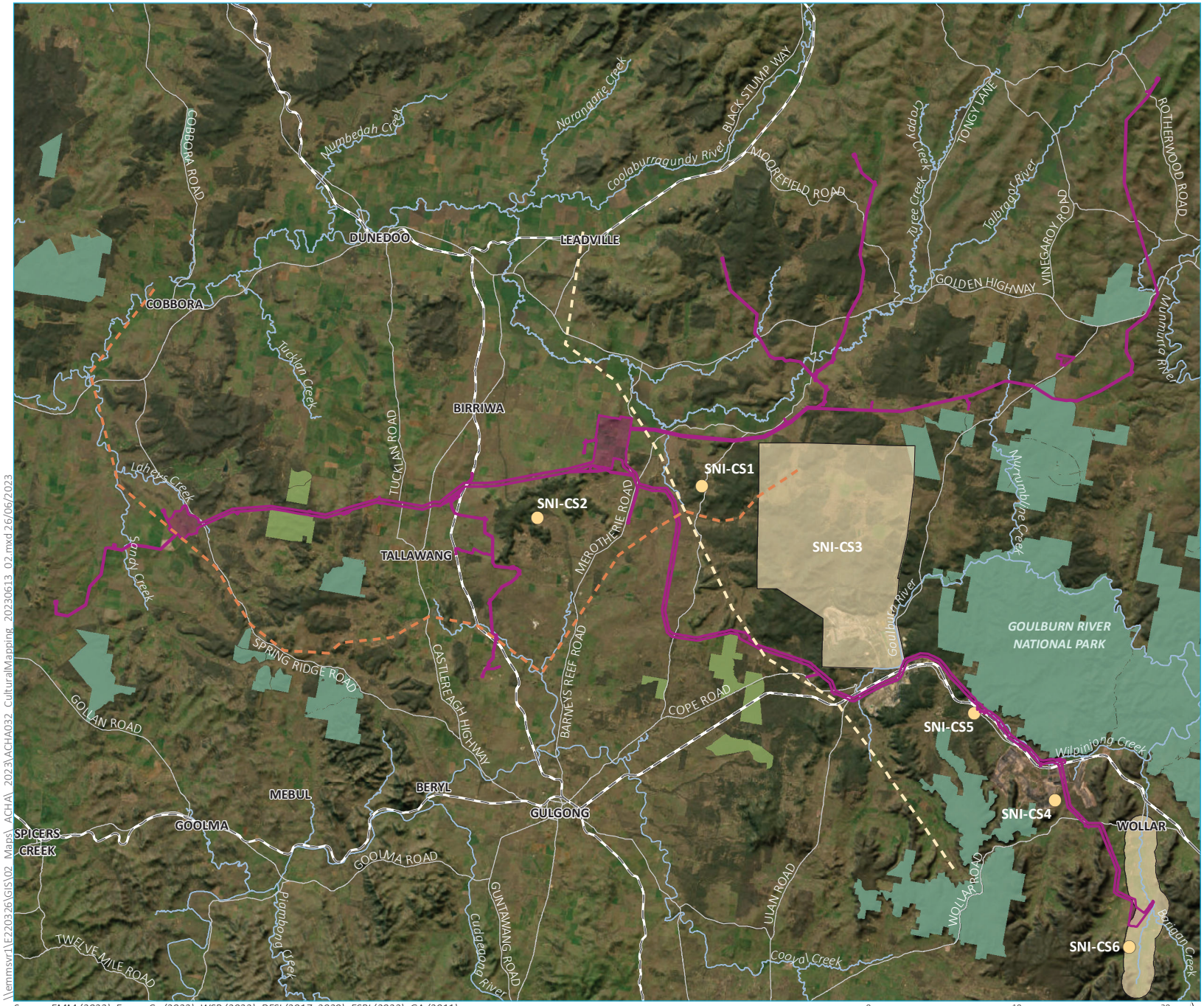
In discussions with participants, the report identified six places of cultural value and two key travelling routes within the study area (Table 6.1; Figure 6.2). They spatially are located along the Cockabutta Creek corridor, disparately extending through the Ulan and Wilpinjong mining areas, and the geological uplifts around Barneys Reef. None are within the construction area, though the travelling routes intersect at a small number of points.

Several of the sites consist of archaeological features and have been documented elsewhere in previous assessments and this ACHA (Chapter 7). These include documented bora and corroboree grounds, specific rockshelters of high value, birthing trees and a burial ground. Several travelling routes, or song-lines, have also been identified, and which reflect main movement corridors of people in the past. While of high cultural value, the participants did not express a specific concern of the project extending across or over these routes, which are already subject to numerous modern activities. Despite this, two of the travelling routes, #1 and #5, were continually discussed in detail with participants as part of the finalisation of the report, and as such these are proposed for specific mitigation measures in Chapter 12. The report also included a wide range of flora and fauna that have historical and contemporary importance to the Aboriginal community, both in terms of their medicinal uses and through totemic relationships (see Section 5.5).

None of the identified places of cultural value would be directly impacted by the project. However, three (SNI-CS4-CS6) would be within visual range of the project, and further interrogation of indirect impacts will be needed once more detailed designs are available. The report did not identify any specific cultural landscapes or connections between the places of cultural value that may be adversely affected by the project. Specific discussions were undertaken with the participants at the AFG #3 meeting in June 2023 in relation to this, and three specific sites and two travelling routes were identified as requiring further visual impact considerations. A mitigation measure to address this visual and inter-connection issues has been included in Chapter 12. The cultural values study makes several other recommendations, all of which are integrated into the broader mitigation measures in Chapter 12.

Table 6.1 Aboriginal sites and places identified through cultural mapping

Site name	Site ID	Description	Site category	Impact
Merotherie Road area (2)	SNI-CS1	Flat area near Cockabutta Creek, reported to contain Aboriginal ancestral burials.	Cultural	None
Barneys Reef (3)	SNI-CS2	Major sandstone uplands, with creek alongside. Artefacts, water wells and grinding grooves; location of documented Aboriginal ancestral burials.	Cultural	None
Ulan coal mine (5)	SNI-CS3	Existing mine lease near Goulbourn River National Park, within which a range of high value and/or significant archaeological features are known, including a bora ground, rockshelters, stone arrangements and occupation sites.	Cultural	None
Castle Rock (6)	SNI-CS4	An impressive rockshelter located immediately south of the existing Wilpinjong mine area, and previously identified as #46-3-0646. Advised that the AHIMS location is erroneous, and the site is situated a few hundred metres further south.	Cultural	Potentially indirect
Wilpinjong coal mine (7)	SNI-CS5	A previously documented bora ground (#36-3-0044) located on the Wilpinjong Creek, and north of the existing mining operations. This was initially recorded by RH Mathews in the late 19th century and is documented as #36-3-0044. The site is reported to extend north of its location (near the construction area), but significant impacts and destruction of parts of the site have occurred through Wollar Road and associated mining infrastructure	Cultural, historical	Potentially indirect
Wollar Creek (8)	SNI-CS6	Wollar Creek between Wollar and south of the Wollar Solar Farm. Increased evidence of past occupation along this river corridor, including occupation sites, grinding grooves and other archaeological material. Specific reference was made to the rockshelters and a 'birthing tree' found as part of the solar farm works (Appendix D.1). The birthing tree may potentially be previously documented as #36-3-3436.	Cultural	Potentially indirect



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Source: EMM (2023); EnergyCo (2023); WSP (2023); DFSI (2017, 2020); ESRI (2022); GA (2011)

Cultural mapping results

Central-West Orana Renewable Energy Zone Transmission
Aboriginal Cultural Heritage Assessment
Figure 6.2

EMM creating opportunities

6.4 Additional Information provided by RAPs

In addition to the information obtained from documentary sources and cultural mapping investigations, additional comments were made by the RAPs during the consultation process that are relevant to this section. These include the following:

- Previous investigations within the Wilpinjong coal mining area have demonstrated that a site known as Rocky Hill or Bird Rock is located ~2.7 km outside the construction area, which was noted for its cultural value. The site is associated with rockshelters containing art (#36-3-2952, #36-3-2954), an ochre quarry (#36-3-2953), scarred tree (#36-3-3740), water hole (#36-3-2804) and numerous artefact sites.

- A landowner, Mr RM and AL Jones, who own a property between Spring Ridge Road and Castlereagh Highway advised of a gender-specific cultural site on Running Creek. They were advised this by a Mr Dominic Nowlan (Local Land Services). Despite repeated attempts, Mr Nowlan never contacted EMM to further discuss the site, and there is no named creek of that name in this locale. As such, the exact location of this site cannot be determined; however, no available data indicates that the site is within the construction area.

- Aaron Talbott (AT Gomilaroi Cultural Consultancy) provided information on the area from Coolah to Gulgong, noting it was Gomeroi and Wadiuru (an alternative spelling for Wiradjuri) country, and the people spoke a unique dialogue that who passed though could understand. He also noted the Cassislis clan, which he noted were a “feared” clan east of the project area, who raided Gunnedah clans to the north; they spoke the Gamilaraay language, though some suggest a Wadiuru language. He noted Urabry, a Gamilaraay word, was the name of a present day township located in Wadiuru country, and that *bry*/*bri* means “a lot” which in the instance of “urabry” here means a place of many yellowbox trees.

- Bradley Bliss (Wellington Valley Wiradjuri Aboriginal Corporation) reaffirmed the importance of Castle Rock rockshelter (SNI-CS4), noting the outlook from the site would be visually impacted by the proposed project. However, as this site was not investigated for this assessment, being a significant distance from the project area, further interrogation of this site is needed before impacts to this site can be considered. This has been included in the management recommendations (Chapter 12, and specifically AH03), and guiding principles for the future investigation and management of this site have been included in the relevant sections of this report.

7 Archaeological context

7.1 Key findings

The following provides a summary of key activities and/or findings of this Chapter:

- Significant parts of the study area have been extensively investigated for over 30 years, initially for several major coal mines in the south-east of the construction area, and more recently for renewable energy projects within and adjacent to the study area. While data remains mostly limited to land within development footprints of other projects, these studies provide a robust model of cultural materials that may be expected across the construction area and the broader study area.

- Based on the regional information, cultural materials are dominated by various stone artefact densities, typically as isolated finds or clusters of <20, which is indicative of ongoing but transient use of much of the study area. There are also significant occurrences of culturally modified trees and grinding grooves where remnant vegetation and/or suitable sandstone surfaces, respectively, are encountered. Spatially, these appear to focus on moderately sized creek-lines, such as Laheys, Sandy and Wilpinjong, but are found in a variety of landforms and contexts. Limited to the south-east and eastern sections of the construction area, is an extensive presence of rockshelters and associated features (such as art and deposits), with several hundred documented through Ulan, Wilpinjong and Moolarben. Such sites are constrained to areas of steep sandstone relief, only encountered in this part of the study area. Excavations to date have been limited, but generally find few cultural materials – suggesting field survey is an effective investigative tool for this region – and dominated by shallow duplex soil profiles.

- A review of Heritage NSW's AHIMS database identified 2,809[3] previously documented sites within a search area of ~4,978,538 km^2 centred on the construction area. The most common site types registered included stone artefactual sites (n=2,192, 78.0%); followed by areas of potential archaeological deposit (PAD) (n=186, 6.62%), culturally modified trees (n=144, 5.13%), rockshelters (n=137, 4.88%) and grinding grooves (n=59, 2.10%). Of note are several Aboriginal ceremonial sites, and artefact scatters of very high densities (>1,000), none of which are within the construction area, but reinforce the importance of the region and certain features within it, such as Laheys Creek.

- Of the 2,809 previously documented sites, there are 84 within the construction area. These are dominated by various stone artefact sites (n=73, 86.9%), with lesser occurrences of culturally modified trees (n=5, 5.95%), rockshelters (n=4, 4.76%), an art site (n=1, 1.19%), and a habitation structure (n=1, 1.19%). On further review of each site's data, one of the rockshelters and the art site are mis-identified and are actually various densities of stone artefacts, while the habitation structure is a natural collapsed overhang with no evidence of past use. Seven of these sites have been previously destroyed. These sites are primarily found in the south-east of the construction area, where coal mining activities have resulted in extensive documentation of the archaeological record.

[3] This number has been adjusted to remove duplicates and mis-identified sites. For further discussion, see Section 7.4.

7.2 Regional context

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 ka (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 ka (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 ka (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 ~40–45 ka (Williams et al. 2017). However, it is not until ~35 ka, 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±3 ka) – 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 (~18–8 ka) was characterised 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 ka), Bass Point (~17 ka), and Loggers Shelter in Mangrove Creek (~11 ka) (Bowdler 1970; Lampert 1971; Attenbrow 2004). 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 0.5 ka, 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 4–2 ka, and increasingly turbulent climatic conditions during the Medieval Climatic Anomaly (1.3–1 ka) (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 the 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 formalized exchange networks (WIlliams et al. 2015a).

7.3 Local context

Previous archaeological investigations of the region have been undertaken as part of project development, including for a range of road, telecommunication and electrical infrastructure, coal mining, and more recently solar and wind farms. Some 23 archaeological investigations have been undertaken within and in the vicinity of the construction area. These are presented in Figure 7.1and outlined in detail in Appendix D.1. An overview of their general findings from these investigations is outlined below.

By far the most extensive studies in the study area and in the construction area have occurred at the three operational coal mines in the eastern portion of the study area, Wilpinjong, Moolarben and Ulan. Investigations of Wilpinjong by Navin Officer Heritage Consultants in 2005, surveyed around 2,510 ha, and identified a mixture of stone artefact sites (artefact scatters = 71; isolated objects = 64), rockshelters with various cultural features (n=43), and culturally modified trees (n=49). These were primarily found on the valley floor or adjoining footslopes. Of note, where two sites, including a dense artefact scatter containing over 500 objects (#36-3-0567) and a bora ground (#36-3-0044). Neither of these are in the construction area, although a considerable number do intersect (see Section 7.4). In addition, several waterholes and a place of cultural value, Rocky Hill (Section 6.4), was encountered. Of the 239 sites documented, only 6 were considered of moderate or high significance.

In the case of the Ulan coal mine, Southeast Archaeology (2015), in consultation with numerous Wiradjuri and Wonnarua traditional owners, undertook investigations for a modification. The report makes reference to previous works that have documented some 555 artefact scatters, 347 isolated objects, 568 rockshelters, 14 grinding grooves, and lesser occurrences of ochre sources, culturally modified trees and stone arrangements within the mine site. The additional investigations associated with the modification added a further 22 sites, and highlighted CC37 and 41, which included artefact densities of 40–75 and were considered to be representative of longer term use and occupation.

There have been several assessments of Aboriginal heritage within the Moolarben coal mine – also intersecting with the construction area–- with the most recent by Niche (2021) as part of a modification. These investigations identified a number of rockshelters (n=19) associated with high ridgelines extending through the site, in combination with a large number of low-density artefact scatters and/or isolated Aboriginal objects (n=23) distributed more disparately across the locale. An earlier modification also assessed by Niche (2017) indicates that the mine's internal database has records of 871 previously documented sites and places are within the site's curtilage, and some 326 of these have been previously destroyed. A breakdown of these indicated that 414 of these sites were artefact scatters or isolated Aboriginal objects. Rockshelters and grinding grooves were also listed in lesser numbers (Niche 2017). Some 80% of these sites were found in association with lesser or ephemeral creek lines.

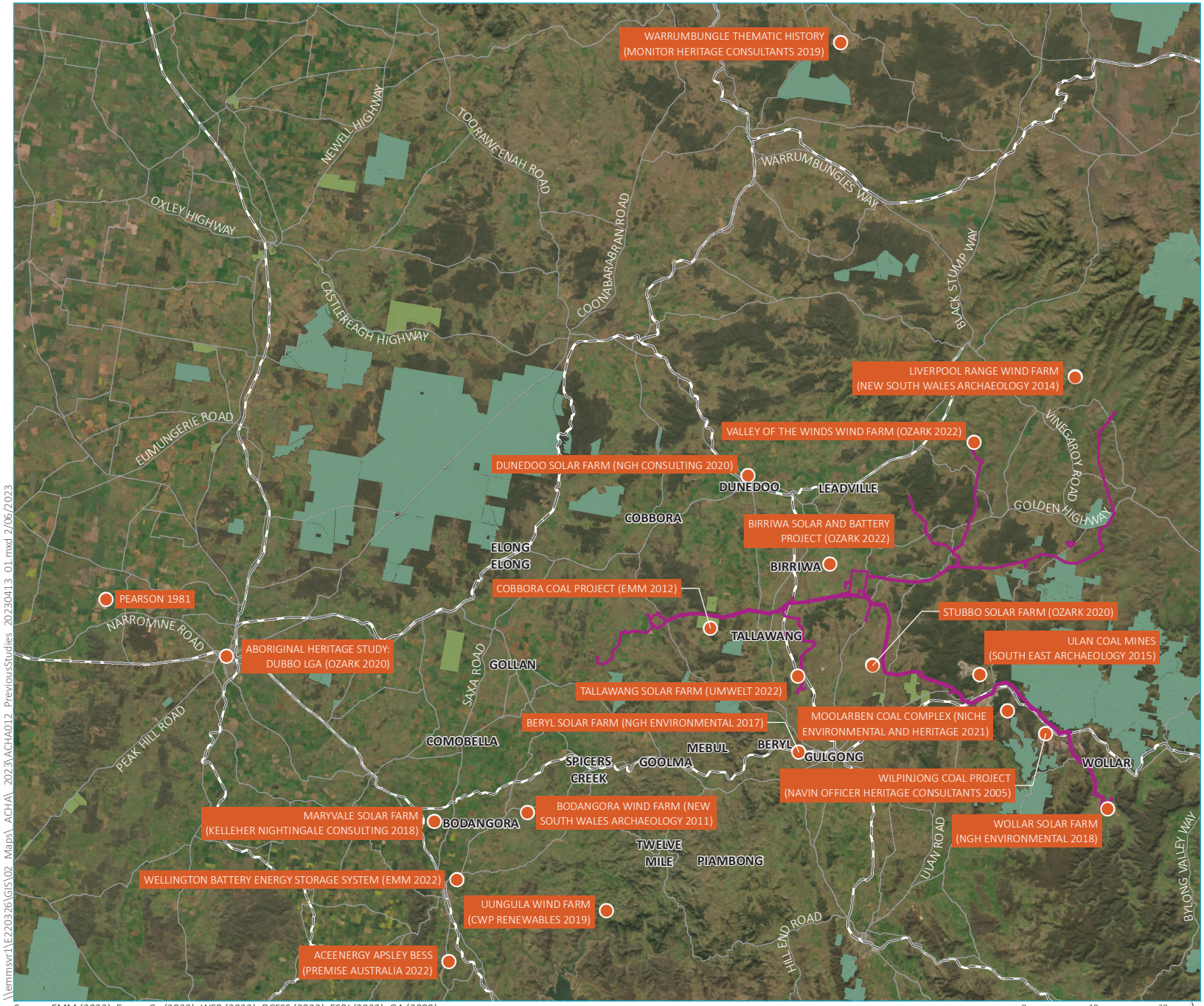
In the vicinity of Elong Elong, the proposed Cobbora Coal Project was assessed in 2012 (EMM 2012) and more recently by OzArk for proposed renewable projects (unpublished). These investigations identified a more diverse archaeological landscape, with some 229 sites recorded across the 276 km^2 application area. Many of these were associated with Sandy Creek and Laheys Creek that run through the study area, and included rockshelters, (n=7), grinding grooves (n=18), culturally modified trees (n=25) and hearths (n=15). The remaining 164 sites consisted of stone artefact sites of varying densities. Fifteen of these sites have been identified as highly significant, and include four stone artefact sites (#36-2-0404, #36-2-0407, #36-2-0413, CBR-OS-05), grinding grooves (#36-2-0171, #36-2-0271) unique or rare objects (#36-2-0196, #36-2-0197, IF 10- Cyclon, #36-2-0234), hearths (#36-2-0209) and archaeological deposits (#36-2-0221, #36-2-0225, #36-2-0226, #36-2-0237).

There are a significant number of recently assessed solar and wind farms within the study area, including Beryl solar farm (NGH Environmental 2017), Bodangora wind farm (NSW Archaeology 2011), Dunedoo solar farm (NGH Environmental 2020), Liverpool Range wind farm (NSW Archaeology 2017), Maryvale solar farm (Kelleher Nightingale Consulting 2018), Stubbo solar farm (OzArk Environment and Heritage 2020), Valley of Winds wind farm (OzArk Environment and Heritage 2022), Spicers Creek wind farm (Umwelt 2022), Ungula wind farm (Austral Archaeology 2020), Barneys Reef wind farm (Umwelt unpublished) and Wollar solar farm (NGH Environmental 2018). Several of these projects intersect completely or partially with the construction area and are highly relevant to the current assessment, including the Liverpool Range wind farm, which encompasses significant portions of the north-east construction area: Cobbora solar farm encompassing the Elong Elong Energy Hub, Sandy Creek, Dapper and Spicers Creek solar farms, which encompass the western end of the construction area, Valley of the Winds wind farm encompassing northern portions of the construction area; and Barneys Reef wind farm encompassing portions of Merotherie and Tallawang (Figure 7.1). Unfortunately, several of these assessments are ongoing and do not have completed, publicly available cultural heritage reports. As a result, data is not readily available from these current investigations before consideration as part of this ACHA.

In the case of Liverpool Range wind farm, NSW Archaeology (2017) surveyed only some ~17 ha of the development area and documented six sites. These were primarily artefactual, as well as a rockshelter and previously documented grinding groove site (#36-3-0105). The latter was considered to be of moderate significance. Recent work at the Sandy Creek solar farm identified 38 Aboriginal sites, all composed of low-density stone artefact scatters or isolated objects, and primarily found within 50 m of water courses (EMM 2023). An archaeological excavation of the site was undertaken – one of the few in the region – recovered a further 118 stone artefacts all within 20 cm of the surface, and ultimately identified six areas of past foci based on artefact densities ranging from >15–40/m^2. A similar finding was made at the Ungula wind farm, which encountered shallow soil profiles, the deepest deposits being <70 cm deep, and few cultural materials encountered (NSW Archaeology 2018).

Overall, these studies provide a clear picture of the nature of the cultural materials within the study area, and which aligns with the broader environmental context as outlined in Chapter 5. Specifically, in the south-east and east of the construction area, the rugged terrain is highly conducive to the presence of rockshelters and associated features. Several hundred of these site types have been documented through the Ulan, Wilpinjong and Moolarben coal mines. In the western portion of the study area, which primarily consists of low-lying and gently undulating hills, site types are primarily surface and shallowly buried stone artefact scatters generally of low density, and usually in close proximity to small or moderate creek lines. In the north and north-east of the study area, previous studies are limited, but suggest a sparser use of the landscape, with few sites being encountered – we hypothesise that this make be as a result of changes in topography to steeper and more exposed country, limiting resources and locations for extended visitation or residence. When considering the density of stone artefacts that may reflect discrete occupation and/or be of greater significance, researchers have typically suggested >50 in a single site or >15/m^2 when presented spatially. Grinding grooves are a common site feature across all the regions and typically occur in a range of in-channel and slope landforms.

Spatially, sites are found in a range of landforms, although minor creek-lines appear to have been a focus. Laheys and Sandy Creek in the west of the construction area have a significant number of sites recorded along their length from previous investigations for renewable energy projects, and Wilpinjong Creek to the east also has a large amount of cultural materials noted, again associated with previous coal projects, including the bora ground known to be present on its western bank. Many previously recorded sites are also documented on slope landforms, but this is in part related to the undulating environment encompassing the study area. When combining the data from several of the above sites that have been subject to extensive investigation and including other major studies such as the Mt Penny Coal Project (ARAS 2012) and Bylong Coal Project (RPS Australia East 2015), it can be considered that ~1 site/8 ha may be expected in this region. Based on the size of the construction area, this may suggest some ~550 sites being present.



\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA012 PreviousStudies 20230413 01.mxd 2/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); GA (2009)

Map of previous studies in the study area

Central-West Orana Renewable Energy Zone Transmission
Aboriginal Cultural Heritage Assessment
Figure 7.1

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7.4 Aboriginal Heritage Information Management System search results

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 resource management. The database identifies any Aboriginal sites or places registered within the study area and aids predictions for the study area, showing the frequency and distribution of Aboriginal site types in the broader landscape.

On 22 April 2022 and 16 August 2022, AHIMS searches were undertaken that encompassed the study area and extended beyond the construction area curtilage. Due to the size of the project and limitations on searches of the AHIMS database (including limits on search extents and the quantity of results within any one search area), this ultimately resulted in the completion of 34 discrete searches being conducted totalling around 4,978,538 km^2 centred on the construction area (Appendix E.2–E.4).

7.4.1 AHIMS search results within the study area

A total of 2,809 Aboriginal heritage objects, sites and places were identified via the AHIMS searches (Table 7.1, Figure 7.2, Appendix D.2–D.4). The results align closely with the previous studies outlined in Section 7.2 and 7.3, and Appendix D. The most common site types registered in AHIMS for the study area are artefactual sites (n=2,192, 78.0%)[4]; followed by areas of potential archaeological deposit (PAD) (n=186[1], 6.62%), culturally modified trees (n=144[1], 5.13%), rockshelters (n=137[1], 4.88%) and grinding grooves (n=59[1], 2.10%). The rockshelter numbers are lower than perhaps expected when reviewing the local context (Section 5.3), but the searches exclude significant portions of Wilpinjong, Ulan and Moolarben coal mines where these sites are primarily documented. The extent of the AHIMS searches in this area were smaller in extent throughout these areas, due to the limitations of AHIMS database results (i.e. 120 sites per search) and associated spatial extent of the searches. The AHIMS search results also included 37 registrations for which details, including location and site type, are restricted. These are typically burials, but may also reflect rare or unique artefacts, such as hand axes. Heritage NSW has confirmed no intersection between these sites and the construction area, and documentation is provided in Appendix D.3.

With respect to site distribution, the registered sites in the region appear to primarily be the result of cultural heritage management assessments, with some evidence of research-based and/or community initiated investigations. In particular, the sites registered in the vicinity of mining operations near Ulan, Moolarben and Wilpinjong certainly add an element of recording bias to the registered sites in the region (see also Section 7.3). This high-density clustering of sites around mining operations is more likely indicative of the level of investigation in this region, rather than any discernible archaeological patterning. There are, however, two notable patterns that can be considered to reflect the past use of the landscape:

1. rockshelter and art sites are generally found in the eastern and south-eastern portion of the study area, where steep relief and sandstone outcropping – a necessity for such sites – is prevalent

2. there are clear clusters of sites along moderate (2–4th order) creek-lines within the study area, most notably Laheys, Sandy and Wilpinjong Creeks, and which suggests these corridors were a focus of past use.

Of note is a site identified as the 'uIan Wilpinjong Creek bora ground' (#36-3-0044), which presumably reflects an important location of past ceremonial activity. It has been validated that the construction area does not encompass this site, and the construction area remains on the opposite (eastern) side of Wilpinjong Creek. Another site, a rockshelter site (#46-3-0646), has been identified by RAPs as of high cultural value (see Section 6.3.2); there is also suggestion that the recorded location is erroneous and it is a few hundred metres south, though worth noting that this location is still outside the construction area.

[4] Note, numerous sites contain multiple attributes, these values therefore may capture the same site multiple times for different features.

Other Aboriginal ceremonial sites include a 'birthing tree' within the development footprint of the Wollar Solar Farm, The Rocks on Cope Road, and WCP 58 and 59 – none of which intersect with the construction area. In addition to these sites, 6 artefact scatters within the AHIMS data exhibit over 1,000 individual artefacts and may be considered to reflect the densest evidence of past occupation. These include AHIMS sites #36-2-0117, #36-2-0118, #36-2-0126 and #36-2-0130, #36-2-0142, and #36-2-0308. None of these sites are located within the construction area; however, AHIMS site #36-2-0118 is located immediately south of the Elong Elong Energy Hub, within the Laheys Creek corridor.

Table 7.1 AHIMS search results within the study area.

AHIMS site type	Number of sites		% of Total	
	Category total	Subcategory total	Category total	Subcategory total
Aboriginal ceremony and dreaming site	6	-	0.21	
Art site	13	-	0.46	
– - with grinding groove	-	2		0.07
– - with undefined artefact site	-	2		0.07
Burial	5	-	0.18	
– with defined artefact site	-	1		0.04
– with culturally modified tree	-	1		0.04
– with hearth	-	1		0.04
Artefact re-burial	1	-	0.04	
Culturally modified tree	144	-	5.13	
Grinding groove	59	-	2.10	
– with art and culturally modified tree	-	1		0.04
– with art and rockshelters	-	1		0.04
– with culturally modified tree	-	1		0.04
– with low density artefact site	-	4		0.04
– with rockshelter	-	1		0.04
– with stone arrangement	-	1		0.04
– with water hole/well	-	1		0.04
– with undefined artefact site	-	7		0.25
Habitation structure	11	-	0.39	
– with moderate artefact site	-	1		0.04
– with undefined artefact site	-	1		0.04
Hearth	21	-	0.75	
– with undefined artefact site	-	6		0.21
High density artefact site (>50 artefacts)	47	-	1.67	
Isolated Aboriginal objects	169	-	6.02	

Table 7.1 AHIMS search results within the study area.

AHIMS site type	Number of sites		% of Total	
	Category total	Subcategory total	Category total	Subcategory total
Low density artefact site (<15 artefacts)	241	-	8.58	
– with undefined stone quarry	-	1		0.04
Midden	1	-	0.04	
Moderate density artefact site (16-49 artefacts)	64	-	2.28	
Ochre quarry	4	-	0.14	
– with low density artefact site	-	1		0.04
– with undefined artefact site	-	1		0.04
Potential archaeological deposit	185	-	6.59	
Rockshelter	138	-	4.88	
– with art	-	27		0.96
– with art and deposit	-	2		0.07
– with deposit	-	104		3.70
– with habitation structure	-	3		0.11
– with habitation structure and deposit	-	2		0.07
Stone arrangement	7	-	0.25	
Stone quarry	6	-	0.21	
– with undefined artefact site	-	1		0.04
Undefined stone artefact site	1,671	-	59.49	
– with PAD	-	77		2.74
– with stone quarry	-	5		0.18
Water hole/well	14	-	0.50	
– with undefined artefact site	-	1		0.04
Total	**2,809**	**-**	**-**	**-**

7.4.2 AHIMS search results with the construction area

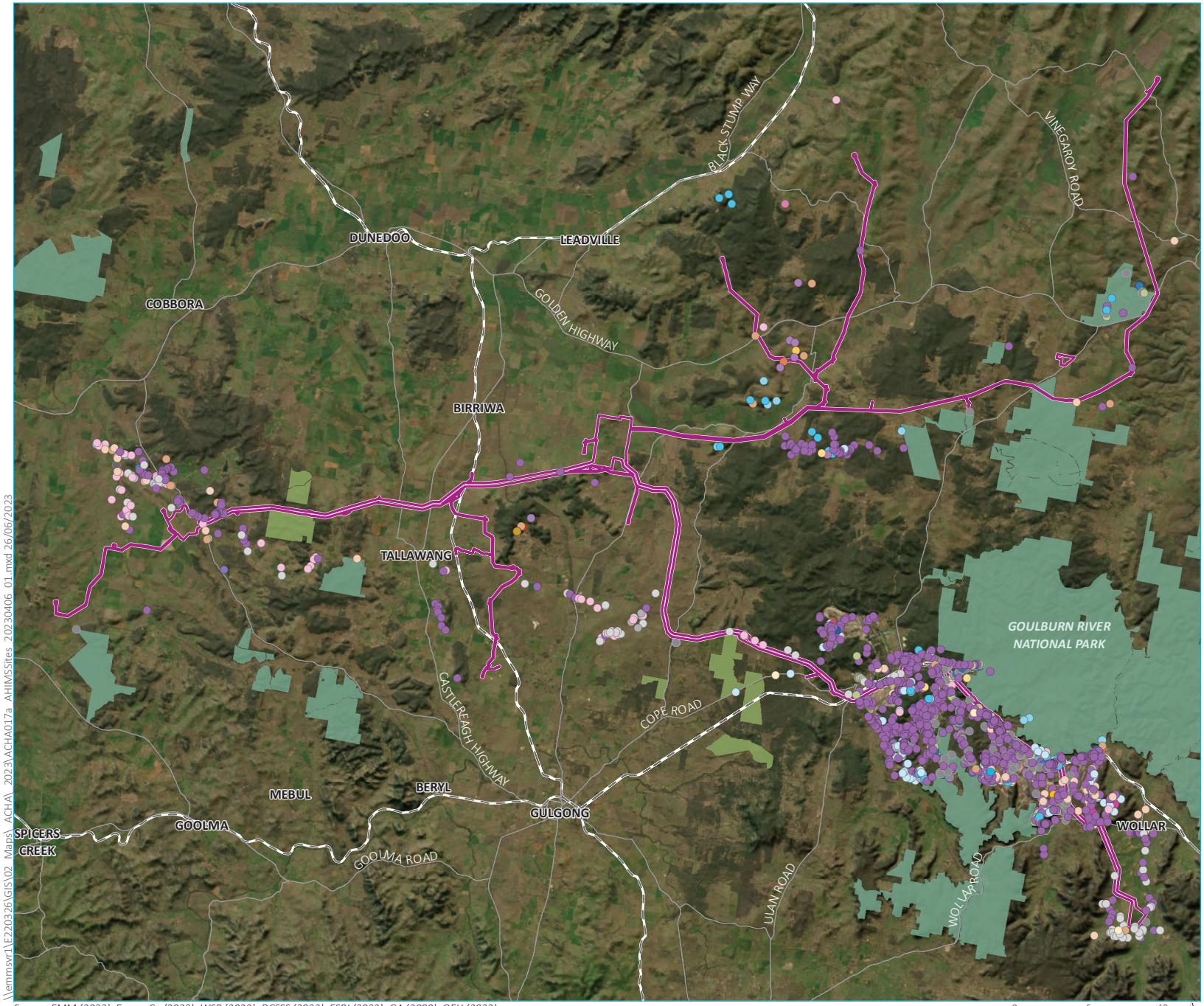
Of the 2,809 previously documented sites identified in the AHIMS searches, 84 are located within the construction area (Table 7.2, Figure 7.2, Appendix D.5). These sites are dominated by various stone artefact sites (n=73, 86.9%), with lesser occurrences of culturally modified trees (n=5, 5.95%), rockshelters (n=4, 4.76%), an art site (n=1, 1.19%), and a habitation structure (n=1, 1.19%).

Of note is the identification of four rockshelters are registered as being located within the construction area, although #36-3-3018 is actually described in the site card as an isolated Aboriginal object on the edge of the active Wilpinjong coal mine and is considered erroneously labelled in the AHIMS database. The remaining three rockshelter sites, AHIMS sites #36-3-0449, #36-3-0570 and #36-3-3790, are all situated on the moderate slopes north of Wilpinjong Creek, within the Wilpinjong (#36-3-0449 and #36-3-0570) and Moolarben (#36-3-3790) coal leases. Similarly, while AHIMS site #36-3-0720 is listed as an art site, the AHIMS site card description refers to it as a moderate-high density stone artefact scatter with 'white clay' listed as an exploitable resource. This site is also in the Moolarben coal lease on a crest overlooking a sharp bend of Wilpinjong Creek. Immediately north within the same lease, AHIMS site #36-3-3794 reflecting a habitation structure, is described on the site card as a collapsed overhang with no cultural materials near the top of a hill. The remaining AHIMS sites reflect a range of various stone artefact sites primarily found along the Wilpinjong creek – where survey has been extensive – but also distributed across other parts of the construction area as a result of recent renewable energy investigations (Figure 7.2).

Seven of the AHIMS sites identified as occurring within the construction area have been previously destroyed based on the AHIMS database, including AHIMS sites #36-3-1046, #36-3-1479, #36-3-1480, #36-3-3123, #36-3-3124, #36-3-3125, and #36-3-3705. A further one, #36-3-0626, is within an active mining area, and considered likely destroyed.

Table 7.2 AHIMS search results within the construction area.

AHIMS site type	Number of sites		% of site type of total sites (Table 7.1)		% of total sites (Table 7.1)	
	Category total	Subcategory total	Category total	Subcategory total	Category total	Subcategory total
Art site	1	-	7.69		0.04	
Culturally modified tree	5	-	3.47		0.18	
Habitation structure	1	-	9.09		0.04	
Isolated Aboriginal objects	5	-	2.96		0.18	
Low density artefact site (<15 artefacts)	7	-	2.90		0.25	
Moderate density artefact site (16-49 artefacts)	3	-	4.69		0.11	
Rockshelter	4	-	2.89		0.14	
– with deposit	-	4		2.89		0.14
Undefined stone artefact site	58	-	3.47		2.06	
– with PAD	-	2		0.12		0.07
Total	**84**	**-**	**-**	**-**	**-**	**-**



KEY

- Construction area

AHIMS (by site type)

- Aboriginal ceremony and dreaming site
- Art site
- Art site, grinding groove
- Art site, unidentified artefact scatter with PAD
- Burial
- Culturally modified tree
- Grinding groove
- Grinding groove, stone arrangement, water hole
- Grinding groove, low density artefact scatter
- Grinding groove, Water hole/Well
- Grinding groove, rockshelter with PAD
- Habitation structure with PAD, unidentified artefact scatter
- Habitation structure
- Habitation structure with moderate density scatter
- Hearth
- Hearth, unidentified artefact scatter, PAD
- High density artefact scatter 50+
- High density artefact scatter 50+ with PAD
- Isolated find
- Isolated find with PAD
- Low density artefact scatter
- Low density artefact scatter with PAD
- Low density artefact scatter, stone quarry
- Moderate density artefact scatter
- Moderate density artefact scatter with PAD
- Ochre quarry, low density artefact scatter
- Ochre quarry, unidentified artefact scatter with PAD
- Potential archaeological deposit
- Rockshelter with art
- Rockshelter with PAD
- Rockshelter, habitation structure
- Rockshelter, habitation structure with PAD
- Stone arrangement
- Unidentified artefact scatter
- Unidentified artefact scatter with PAD
- Unidentified artefact scatter, stone quarry
- Water hole/well

Existing environment

- Major road
- Rail line
- NPWS reserve
- State forest

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); GA (2009); OEH (2023)

Previously documented Aboriginal objects and sites within the AHIMS database

Central-West Orana Renewable Energy Zone Transmission
Aboriginal Cultural Heritage Assessment
Figure 7.2

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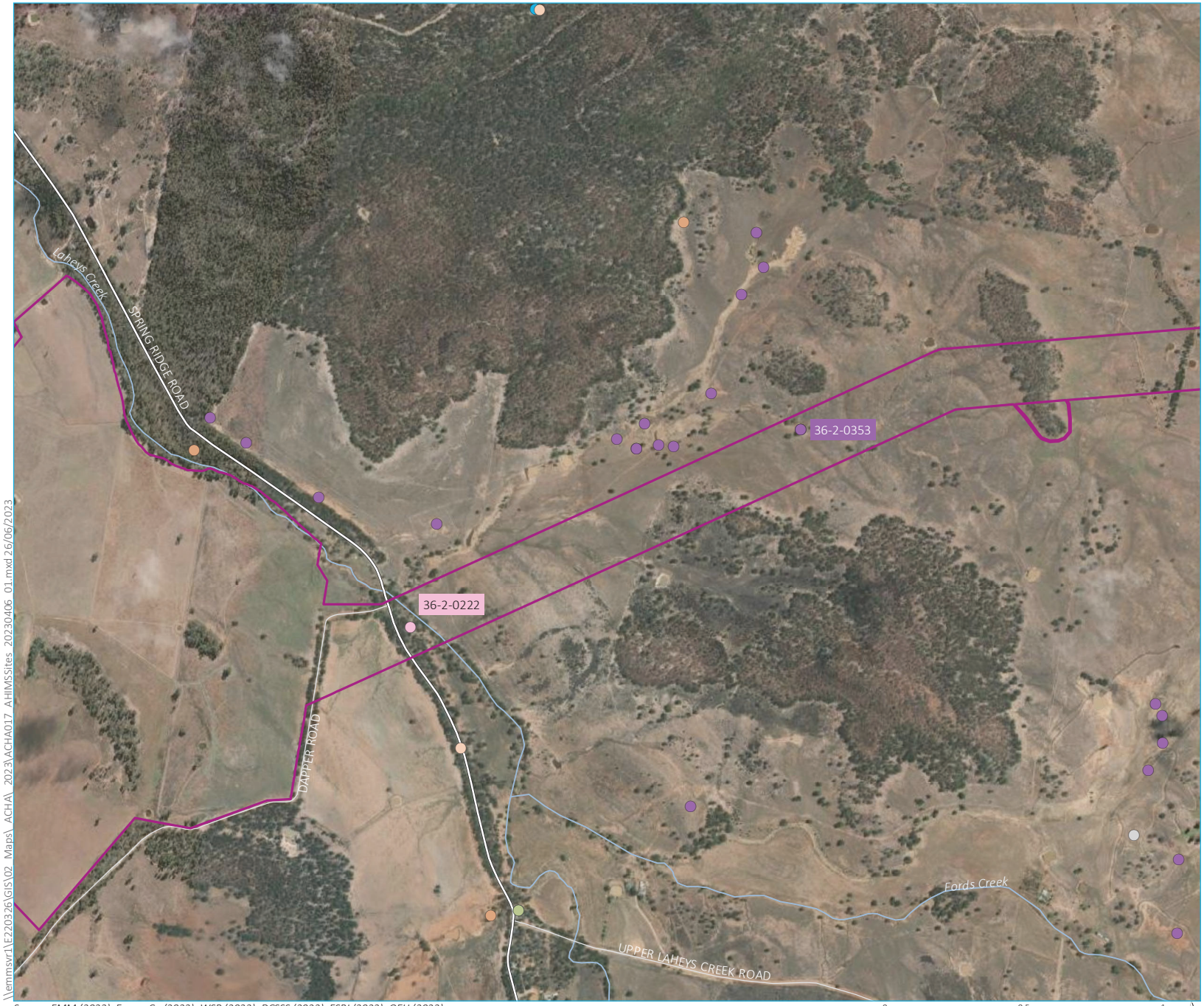

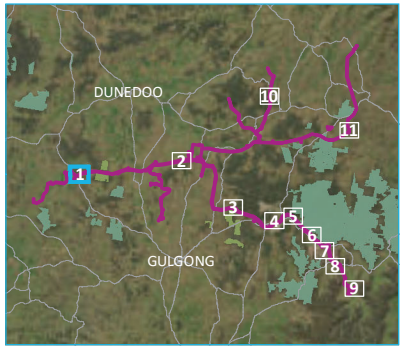

KEY

- Construction area

AHIMS (by site type)

- Culturally modified tree
- Grinding groove
- High density artefact scatter 50+
- Isolated find
- Moderate density artefact scatter
- Rockshelter, habitation structure
- Unidentified artefact scatter
- Unidentified artefact scatter with PAD

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); OEH (2023)

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GDA2020 MGA Zone 55

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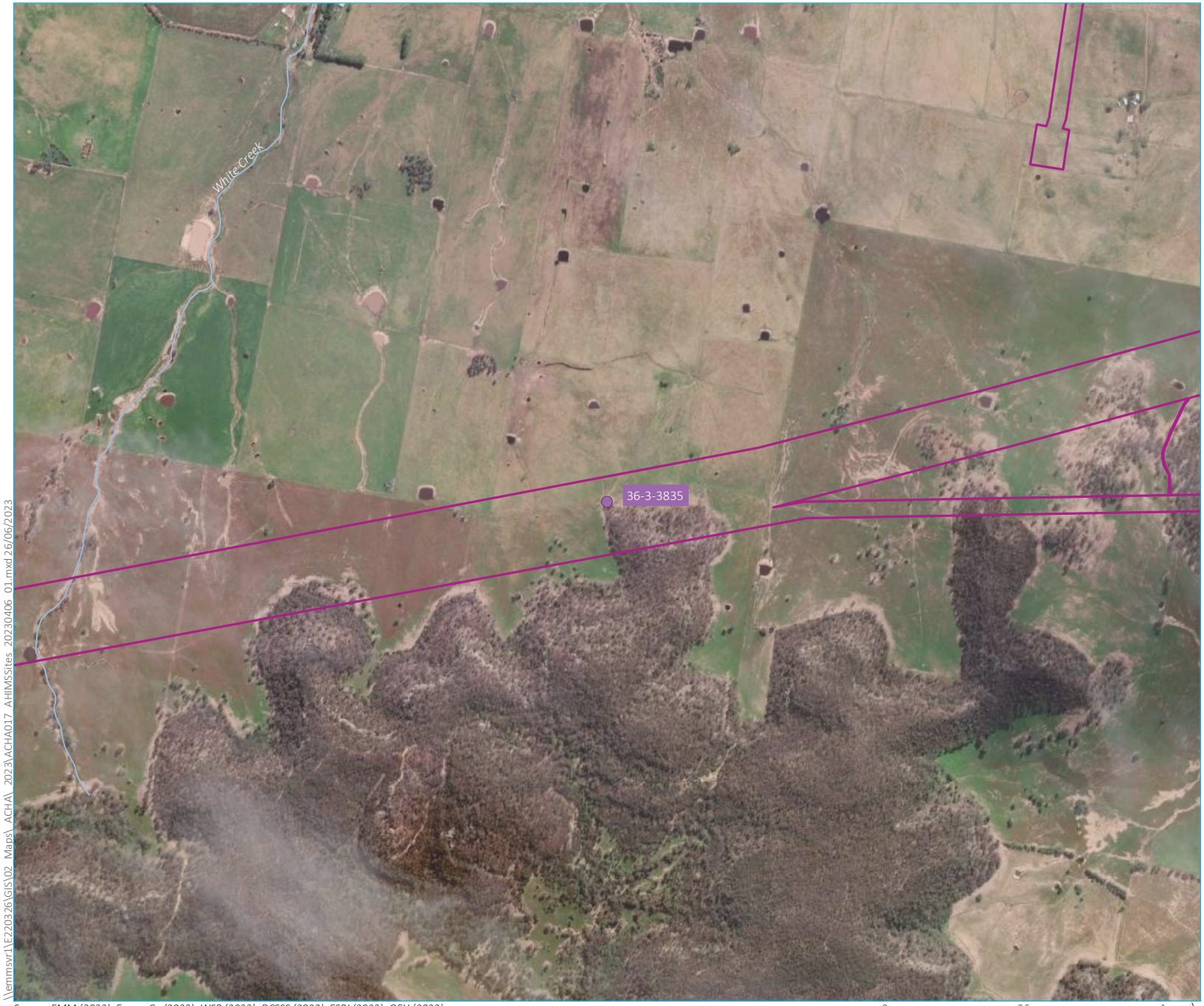
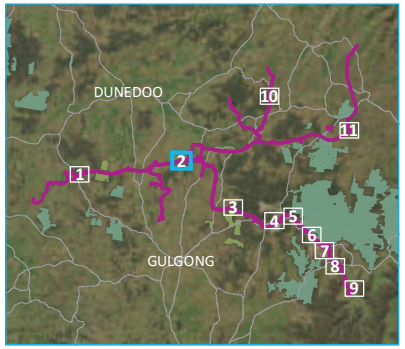
Previously documented Aboriginal objects and sites within the AHIMS database
Map 1 of 11

Central-West Orana Renewable Energy Zone Transmission
Aboriginal Cultural Heritage Assessment
Figure 7.2

EMM
creating opportunities





KEY

Construction area

AHIMS (by site type)

Unidentified artefact scatter

Named watercourse

INSET KEY

Major road

NPWS reserve

State forest

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); OEH (2023)

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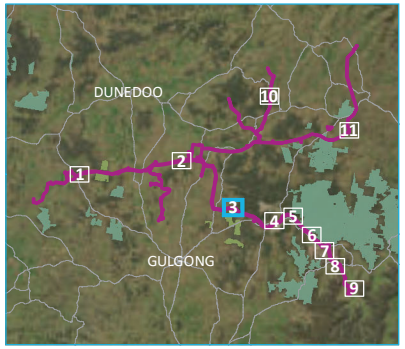
Previously documented Aboriginal objects and sites within the AHIMS database
Map 2 of 11

Central-West Orana Renewable Energy Zone Transmission
Aboriginal Cultural Heritage Assessment
Figure 7.2

EMM
creating opportunities



KEY

- Construction area

AHIMS (by site type)

- Isolated find
- Unidentified artefact scatter with PAD
- Named watercourse
- State forest

INSET KEY

- Major road
- NPWS reserve
- State forest

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); OEH (2023)

0 0.5 1 km

GDA2020 MGA Zone 55

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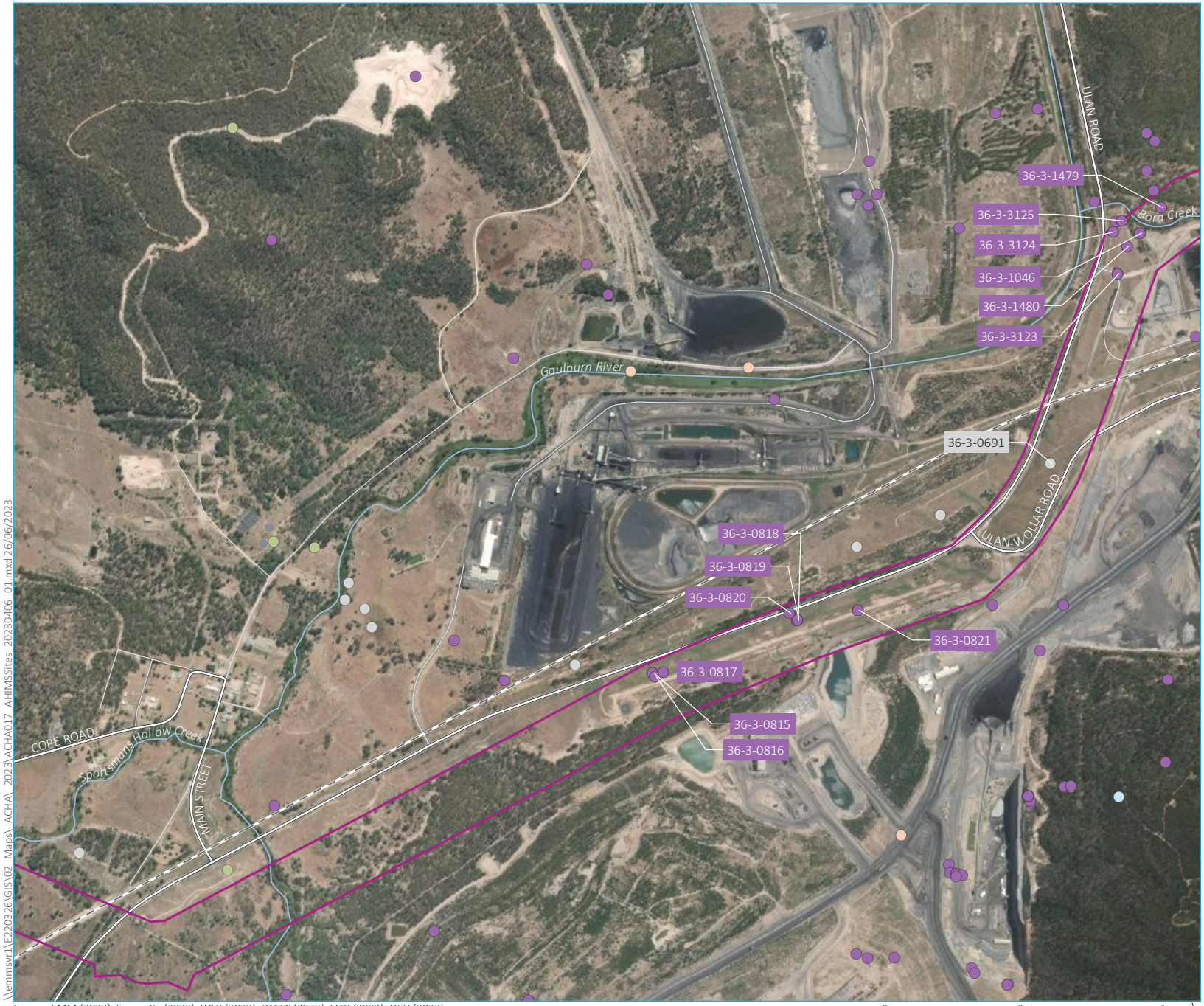
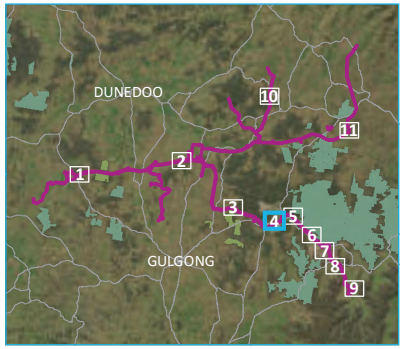
Previously documented Aboriginal objects and sites within the AHIMS database
Map 3 of 11

Central-West Orana Renewable Energy Zone Transmission
Aboriginal Cultural Heritage Assessment
Figure 7.2

EMM creating opportunities





KEY

- Construction area

AHIMS (by site type)

- Culturally modified tree
- Isolated find
- Low density artefact scatter
- Moderate density artefact scatter
- Potential archaeological deposit
- Unidentified artefact scatter

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); OEH (2023)

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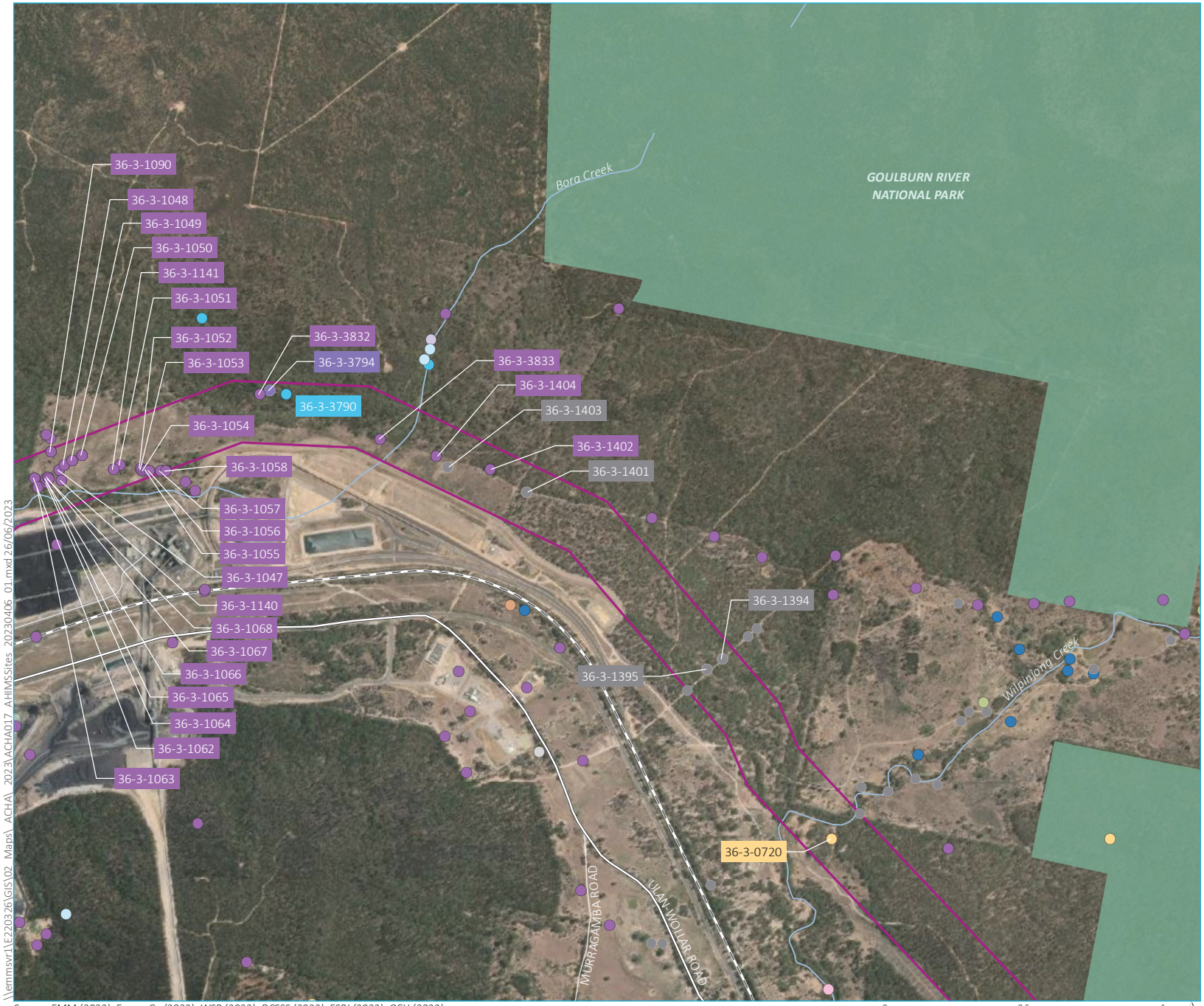
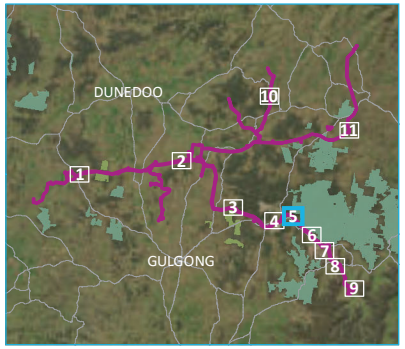
Previously documented Aboriginal objects and sites within the AHIMS database
Map 4 of 11

Central-West Orana Renewable Energy Zone Transmission
Aboriginal Cultural Heritage Assessment
Figure 7.2

EMM
creating opportunities





KEY

- Construction area

AHIMS (by site type)

- Art site
- Grinding groove
- Grinding groove, rockshelter with PAD
- Habitation structure
- High density artefact scatter 50+
- Isolated find
- Low density artefact scatter
- Moderate density artefact scatter
- Potential archaeological deposit
- Rockshelter with PAD
- Unidentified artefact scatter
- Unidentified artefact scatter with PAD

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse
- NPWS reserve

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02_Maps_ACHA_2023\ACHA017_AHIMSSites_20230406_01.mxd 26/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); OEH (2023)

0 0.5 1 km

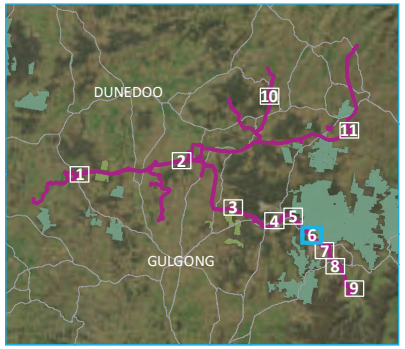
GDA2020 MGA Zone 55

N

Previously documented Aboriginal objects and sites within the AHIMS database
Map 5 of 11

Central-West Orana Renewable Energy Zone Transmission
Aboriginal Cultural Heritage Assessment
Figure 7.2

EMM creating opportunities



KEY

- Construction area

AHIMS (by site type)

- Aboriginal ceremony and dreaming site
- Culturally modified tree
- High density artefact scatter 50+
- Isolated find
- Low density artefact scatter
- Moderate density artefact scatter
- Potential archaeological deposit
- Rockshelter with art
- Unidentified artefact scatter

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse
- NPWS reserve

INSET KEY

- Major road
- NPWS reserve
- State forest

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); OEH (2023)

0 0.5 1 km

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N

Previously documented Aboriginal objects and sites within the AHIMS database
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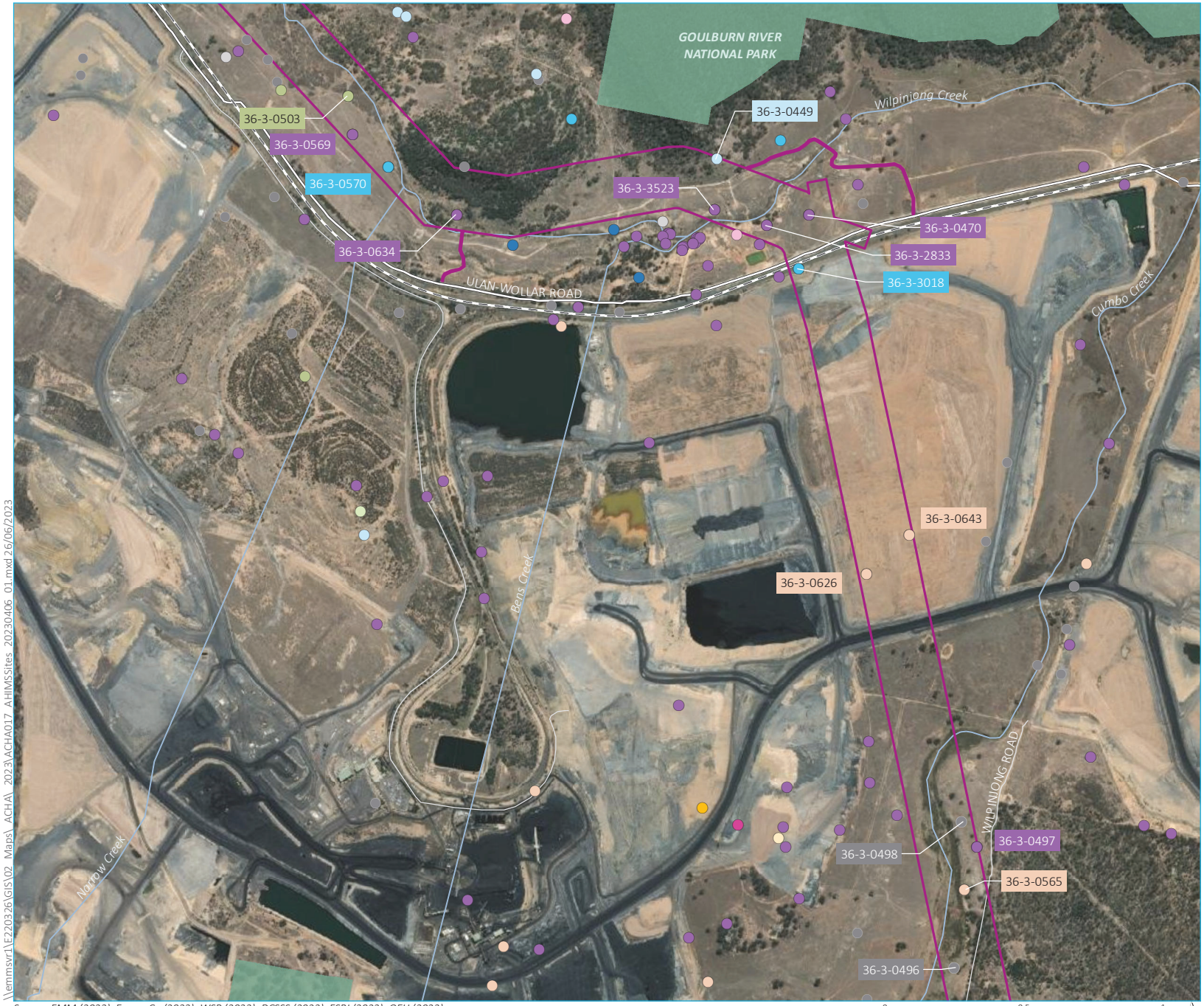
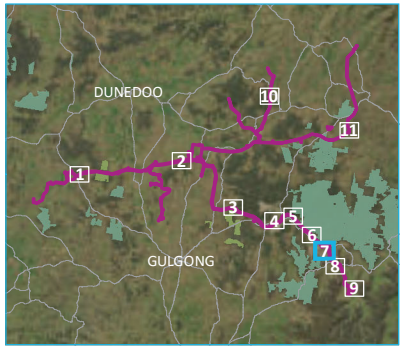
EMM
creating opportunities





KEY

- Construction area

AHIMS (by site type)

- Aboriginal ceremony and dreaming site
- Art site, unidentified artefact scatter with PAD
- Culturally modified tree
- High density artefact scatter 50+
- Isolated find
- Low density artefact scatter
- Low density artefact scatter with PAD
- Low density artefact scatter, stone quarry
- Moderate density artefact scatter
- Potential archaeological deposit
- Rockshelter with PAD
- Unidentified artefact scatter
- Unidentified artefact scatter with PAD
- Water hole/well

Existing environment

- Major road
- Minor road
- Rail line
- Named watercourse
- NPWS reserve

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); OEH (2023)

0 0.5 1 km

GDA2020 MGA Zone 55

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Previously documented Aboriginal objects and sites within the AHIMS database
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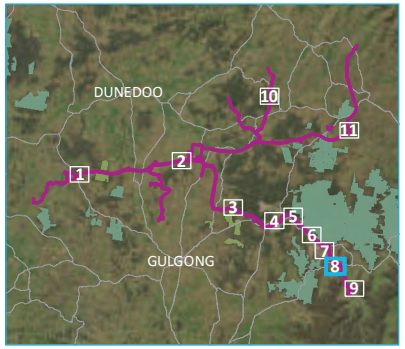
Central-West Orana Renewable Energy Zone Transmission
Aboriginal Cultural Heritage Assessment
Figure 7.2

EMM creating opportunities



KEY

- Construction area

AHIMS (by site type)

- Culturally modified tree
- Low density artefact scatter
- Potential archaeological deposit
- Unidentified artefact scatter
- Unidentified artefact scatter with PAD
- Water hole/well

Existing environment

- Major road
- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); OEH (2023)

0 0.5 1 km

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Previously documented Aboriginal objects and sites within the AHIMS database
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Central-West Orana Renewable Energy Zone Transmission
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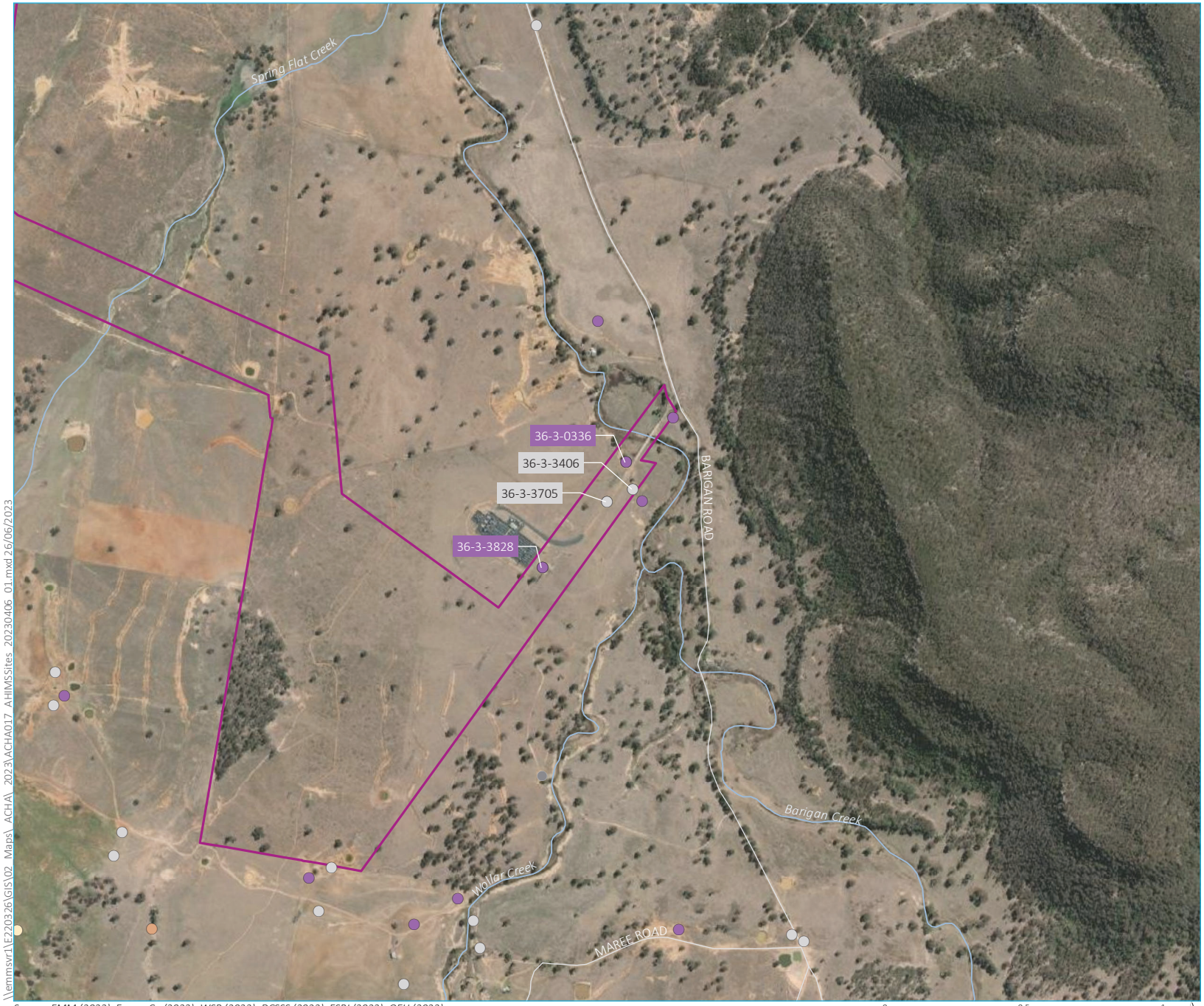

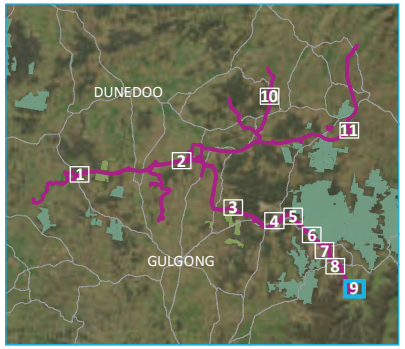

KEY

- Construction area

AHIMS (by site type)

- Aboriginal ceremony and dreaming site
- Grinding groove
- Isolated find
- Low density artefact scatter
- Unidentified artefact scatter

Existing environment

- Minor road
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

\\emmsvr1\E220326\GIS\02 Maps\ ACHA\ 2023\ACHA017 AHIMSSites 20230406 01.mxd 26/06/2023

Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); OEH (2023)

0 0.5 1 km

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Previously documented Aboriginal objects and sites within the AHIMS database
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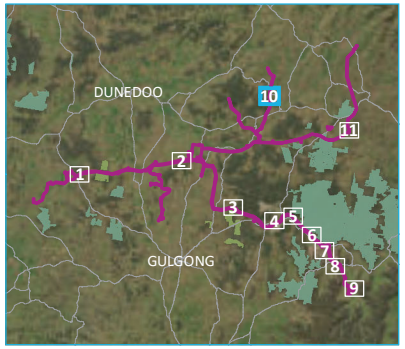
EMM creating opportunities



KEY

Construction area

AHIMS (by site type)

Unidentified artefact scatter

Existing environment

Major road

Named watercourse

INSET KEY

Major road

NPWS reserve

State forest

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); OEH (2023)

0 0.5 1 km

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Previously documented Aboriginal objects and sites within the AHIMS database
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Central-West Orana Renewable Energy Zone Transmission
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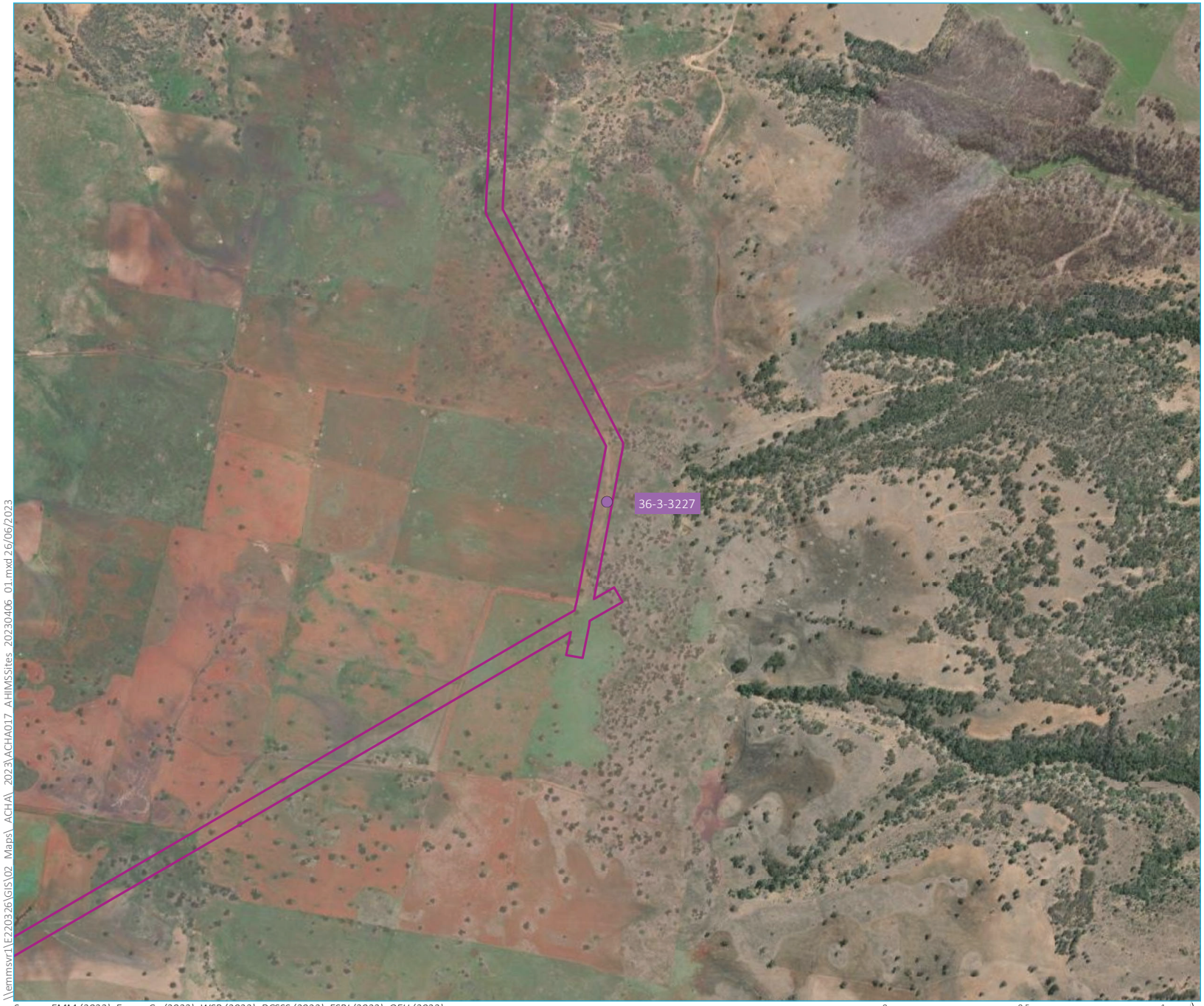
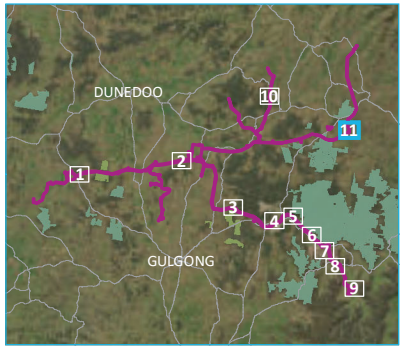
EMM creating opportunities





KEY

Construction area

AHIMS (by site type)

Unidentified artefact scatter

INSET KEY

Major road

NPWS reserve

State forest

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Source: EMM (2023); EnergyCo (2023); WSP (2023); DCSSS (2023); ESRI (2023); OEH (2023)

0 0.5 1 km

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Previously documented Aboriginal objects and sites within the AHIMS database
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Central-West Orana Renewable Energy Zone Transmission
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Figure 7.2

EMM
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7.5 Predictive model

Aboriginal occupation of the construction area and surrounds has been well-documented, in large part due to the extensive archaeological assessments undertaken in association with environmental assessments for the region.

A preliminary Aboriginal heritage assessment was developed by EMM as part of the Scoping Report for the project. This was based on limited data but made several predictions about the potential cultural materials that may be encountered within the construction area and surrounds. Specifically, this report concluded that (EMM 2022: 45-46) the following:

- In the vicinity of Wollar, Wilpinjong and Moolarben, there is high potential for rockshelter site types in areas where sandstone outcropping and steep relief occur. This may also be the case for other parts of the project east of Uarbry.

- To the west encompassing areas around Merotherie, Elong Elong and Uarbry, the archaeological record is dominated by stone artefacts of typically low densities. These are found in a wide range of environments and landforms, although more extensive deposits are found in proximity to major tributaries. Examples of this include Laheys Creek and Maryvale Creek based on previous assessments. Artefacts are typically found on the surface and may also be shallowly buried. Also, within these environments, sites such as grinding grooves and culturally modified trees have also been documented, where environmental conditions are met–- specifically, the presence of exposed sandstone in the vicinity of creek-lines and remnant vegetation.

- Cultural sites are also documented in the region. Currently, these are poorly understood and typically reflect visually dominant features in the landscape, such as hills and ranges. However, other site types, such as the birthing tree at Wollar may also be encountered elsewhere in the region. respectively.

These initial predictions of cultural materials across the construction area remain valid, but additional information within this Chapter enables further refinements. This is most noticeable in the north-east of the construction area, which conforms more closely with the western portion of the project, despite being increasingly close to the Great Dividing Range. Specifically, on the basis of 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 construction area:

- In the west, north and north-east of the construction area, including around Elong Elong, Merotherie, Tallawang:

  - Culturally modified trees, including scarred and carved trees, may occur where native vegetation has been preserved. Extensive vegetation clearance within the construction area reduces the likelihood of this site type, however there are 144 AHIMS records for culturally modified trees within the study area and immediate surrounds. 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.

- To the east and south-east, including Moolarben, Ulan, Wilpinjong and Wollar, as well as localised steep relief in western portions of the construction area:
  - Rockshelters and associated features (including art and cultural deposits) are generally found in the steeper sandstone relief and escarpments in the south and east of the study area. These sites will occur wherever sandstone geology has led to the formation of caves and overhangs that can be used as a shelter. Several hundred have been documented in this region in the last few decades. While patterns are not readily discernible, researchers suggest that they are commonly found in lower and footslope environments in close proximity to creek-lines.
  - These environments are also conducive to isolated finds, open artefact scatters, culturally modified trees and grinding grooves as outlined above can also occur where suitable conditions are encountered.
- Across the construction area:
  - Grinding grooves and to a lesser extent quarry/stone procurement sites are prevalent in the study area. These are frequently constrained to exposed sandstone outcropping in small-moderate creek-lines, but are also found in other landforms where suitable geology is present. No discernible pattern of these sites is evident in the available data, but there is some suggestion that where not within a creek bed, they are found on gentle footslopes associated with the discrete hills and elevations. While these have potential to occur across the construction area, there is evidence to suggest that these may be more prevalent in the western portion of the study 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 sites are concentrated towards the larger creek-lines, typically of 2nd–4th order size, including Laheys, Sandy, and Wilpinjong Creeks. 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 (<20) and are predominantly reflective of transitory movement or short-term camping by small parties. Chronology of the use of the region is not well understood, although rockshelters at Capertee, south of Mudgee do provide a Pleistocene age (>10,000 years ago) for initial visitation. Tool types and raw materials generally documented in the study area suggest the majority of cultural materials will date to the last 5,000 or so years.
  - Burials can occur anywhere in the landscape but are notably more likely on watercourses or under rock ledges; their identification in the landscape is rare, but several are noted in the Ulan area. Generally, they 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 sub-surface 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.