Our ref: DOC19/608527-1
Your ref: SSD 8642

Ms Genevieve Seed

5 September 2019

Senior Environmental Assessment Officer Planning Services
Resource Assessments Compliance Division
genevieve.seed@planning.nsw.gov.au

Dear Ms Seed

Mangoola Coal Continued operations Project (SSD 8642)

I refer to your e-mail dated 15 July 2019 requesting advice from the Biodiversity and Conservation Division (BCD) of the Department of Planning, Industry and Environment on the proposed Mangoola Coal Continued Operations Project (SSD 8642). We have reviewed the Environmental Impact Statement and relevant appendices for the project in relation to Aboriginal cultural heritage, flood risk and biodiversity issues in the proposed development footprint.

We have not reviewed the proposed biodiversity offset package for this project. The Environmental Impact Assessment (EIS) includes a calculation of the biodiversity offset requirement for this mine, and under the 'NSW Biodiversity Offsets Policy for Major Projects' the proponent has the flexibility to meet their offset obligation by a number of means. While the proponent has provided some information on possible offsetting options, they have not committed to those options.

Recommendations are provided in **Attachment A** and detailed comments are provided in **Attachment B**. If you require any further information regarding this matter, please contact Steven Cox, Senior Team Leader Planning, on 4927 3140 or via email at rog.hcc@environment.nsw.gov.au

Yours sincerely

SONYA ERRINGTON
Director Hunter Central Coast Branch
Biodiversity and Conservation Division

Enclosure: Attachments A and B

Mangoola Coal Continued Operations Project (SSD 8642)

Biodiversity – Biodiversity Assessment Report

The Biodiversity and Conservation Division recommends:

1. The proponent provides the information listed in point 1 of **Attachment B** to complete the Biodiversity Assessment Report.

2. Three of the year 7 performance indicators and one of the completion criteria for post-mine rehabilitation are reworded to make them measurable and targeted, to improve the stage that the rehabilitation would be at by Year 7.

3. The planted River Red Gum (*Eucalyptus camaldulensis*) and Weeping Myall (*Acacia pendula*) plants in the development footprint are shown on a map and assessed using the BioBanking Major Project credit calculator.

4. The BioBanking Major Project credit calculator is re-run, using Central Hunter Foothills as the selected Mitchell Landscape.

5. That any clearing of the existing Big Flat Creek Conservation Area offset for the Mangoola Mine is replaced by a new offset that meets the Mangoola Mine consent condition requirements and that the impact for the Mangoola Continued Operations Project is also offset.

Biodiversity – Orchid Expert Report

The Biodiversity and Conservation Division recommends:

6. The suitability of the 10 vegetation communities identified as orchid habitat by the Expert is reassessed and that the subsequent estimated number of orchids across the offset areas is reviewed.

7. A consent condition is created that requires targeted surveys for *Diuris tricolor* and *Prasophyllum petilum* in the Mangoola Offset after two consecutive winters of at least average rainfall. If the surveys fail to identify enough orchids of each species to meet the projects offsetting requirements, the consent condition should require the shortfall of orchid credits to be offset in accordance with the offset policy in force at that time.

8. Further information is provided on the cultivation history of the seven polygons in Figure 2 of the Expert Report that were determined to be 'moderate quality habitat' or 'low quality habitat' and justification for why they are not considered to be unsuitable habitat. House paddocks and waterbodies should also to be excluded from the estimation of orchid habitat areas in the offset lands.

9. The identified inconsistencies listed in point 9 of **Attachment B** are rectified and that the listed further analysis or data are provided.

Aboriginal cultural heritage

The Biodiversity and Conservation Division recommends:

10. Salvage of the 26 Aboriginal sites be undertaken in consultation with the Registered Aboriginal Parties and in accordance with the protocols outlined in the existing approved Aboriginal Cultural Heritage Management Plan.

11. Test excavations are not undertaken at rock shelters that occur outside of the development footprint. References in the Aboriginal Cultural Heritage Management Plan to undertaking test excavations at rock shelters should be removed.

12. The Aboriginal cultural values identified in the *Mangoola Aboriginal Cultural Values Assessment Report* should be included in the Aboriginal cultural heritage management plan. They should be included in the formation of management actions to manage and mitigate harm to Aboriginal cultural values in the Mangoola Coal Continued Operations project area.

13. If approval is granted for the Mangoola Coal Continued Operations Project, provision should be made for the Aboriginal objects salvaged in the development footprint to be included in the current approved Mangoola Care Agreement C0003885.

Flooding and flood risk

The Biodiversity and Conservation Division recommends:

14. A peer review of the flood model and mapping is undertaken, and flood maps are provided at a scale that provides for better visibility of impacts (for example, using A3 sizing).

15. The flood impact assessment should analyse the differences in flooding for each mining stage and, at a minimum, compare pre-mining conditions with the stage that has the greatest flood impact.

16. The flood study and EIS should be updated to use the correct terms to describe flood frequency in accordance with ARR2016 requirements.

17. The surface water assessment should consider potential flooding impacts associated with the diversion of water towards and below Wybong Post Office Road. This should include the likelihood and impact of blockage of proposed culverts under the road.

18. The flood behaviour along Wybong Road under the proposed overpass should be reviewed to ensure that safety of the roadway is not compromised by the bund wall and overpass embankment.

19. Further information regarding flood depth and velocity on the roadway for the with and without project scenarios should be provided so that changes in the trafficability of Wybong Road can be accurately determined.

20. Flood mapping should be provided for the 1:10 event with the project. Values of depth and velocity should be extracted from the model so that potential impacts to the trafficability and frequency of inundation of Wybong Road can be accurately assessed.

Attachment B

Biodiversity and Conservation Division's detailed comments

Mangoola Coal Continued Operations Project (SSD 8642)

Biodiversity – Biodiversity Assessment Report

1. Several details are missing from the Biodiversity Assessment Report

The biodiversity assessment for the Mangoola Continued Operations Project has been prepared under the Framework for Biodiversity Assessment (FBA). The FBA requires the generation of a Biodiversity Assessment Report (BAR), which is presented in Appendix 13 of the Environmental Impact Statement (EIS). The BAR was reviewed against the requirements of the FBA. Copies of vegetation survey sheets and shapefiles from the Bar were provided on 9 August 2019 and a site inspection of the development footprint was conducted on 20 August 2019. Several details required for the BAR have not been provided and should be provided in the Response to Submissions Report:

a. an estimate of the percent cleared of each plant community type identified in the EIS (as per section 5.2.1.10 of the FBA)

b. details of the weather conditions during surveys (as per Table 20 of the FBA)

c. the landscape Tg value assigned to each vegetation zone, and indications of where this value may have changed due to species exclusion (as per table 20 of the FBA)

d. identification of whether any of the threatened species considered in the assessment is a species that cannot withstand any further loss (as per section 6.1.1.1 of the FBA)

e. a table of measures to be implemented before, during and after construction to avoid and minimise the impacts of the project, including action, outcome, timing and responsibility (as per Table 21 of the FBA); and

f. maps demonstrating indirect impact zones, or text in the BAR demonstrating how such maps are not applicable (as per Table 21 of the FBA).

Recommendation 1

The proponent provides the information listed in point 1 of **Attachment B** to complete the Biodiversity Assessment Report.

2. The Preliminary Performance Indicators and Completion Criteria for post-mine rehabilitation are too ambiguous

Table 7.5 in the EIS describes preliminary Performance Indicators and Completion Criteria for mine rehabilitation for each plant community type. The performance indicators for partial success, by Year 7, and the completion criteria, for when rehabilitation will generate credits for the biodiversity offset strategy are based on four aspects (site condition, vegetation composition, vegetation function and ecosystem function). They have been prepared for the three plant community types.

These performance indicators and completion criteria are tied to the Mine Operation Plan (MOP) to be developed for the project and many are currently not-measurable. They will be refined during the MOP review stage. We recommend that the following performance indicators and completion criteria are reworded to provide a higher measure of success:

- Site condition: the year 7 performance indicator requires that a '[n]umber of trees with hollows (i.e. natural hollows or stags salvaged from other areas and placed into rehabilitation) occur in the rehabilitation' but it does not specify a density. This performance measure could be met by placing a single salvaged stag with a hollow in the entire rehabilitated area of any of the three plant community types. The year 7 performance criteria should be set to >10% of benchmark values.
- Vegetation condition: the year 7 performance indicator requires that '[t]argeted planting of flora species characteristic or diagnostic of [a specified plant community type] is undertaken.' We recommend that this is reworded to 'rehabilitation has commenced and contains at least 25% of the species characteristic or diagnostic of [a specified plant community type] as outlined in the VIS (or equivalent) or in suitable reference sites.' This would ensure that rehabilitation has commenced by Year 7 and that it already includes a minimum of 25% of characteristic species; and
- Ecosystem function: the year 7 performance indicator states that '[h]igh threat weeds (OEH 2018bd) do not comprise more than 20% cover of any stratum' and that for the completion criteria that '[h]igh threat weeds (OEH 2018bd) do not comprise more than 10% cover of any stratum'. For ecosystem-altering species such as *Acacia saligna*, *Olea europaea* subsp. *cuspidata* and *Chloris gayana,* we recommend that their combined maximum allowed abundance for the year 7 performance criteria is not more than 5%, and that for the completion criteria they form no more than 1% of the total cover.

Recommendation 2

Three of the year 7 performance indicators and one of the completion criteria for post-mine rehabilitation be reworded to make them measurable and targeted, to improve the stage that the rehabilitation would be at by Year 7.

3. Planted Weeping Myall and River Red Gum plants generate species credits

Section 3.3.2 of the Biodiversity Assessment Report suggests that planted Weeping Myall (*Acacia pendula*) and River Red Gum (*Eucalyptus camaldulensis*) in the development footprint do not form part of either of the Hunter Valley endangered populations of both species and do not generate species credits. The proponent has stated that because the River Red Gum plants, are of unknown provenance they may contaminate the genetics of the local endangered population, and they do not occur on a flood plain. The proponent suggests that the 40 Weeping Myall plants do not form part of the local endangered population because they are planted and appear to be sterile.

The NSW Scientific Committee Final Determinations for both endangered populations in the Hunter Valley are silent on planted examples of both species. Planted examples of both species could be considered to be part of the endangered population, regardless of provenance. Record of these species need to be shown on a map. Both species should be assessed using the BioBanking Major Projects credit calculator to generate credits to be offset for this development.

Recommendation 3

The planted River Red Gum (*Eucalyptus camaldulensis*) and Weeping Myall (*Acacia pendula*) plants in the development footprint are shown on a map and assessed using the BioBanking Major Project credit calculator.

4. The Mitchell Landscape should be changed in the credit calculator

The proposed mine site straddles the Central Hunter Foothills Mitchell Landscape (540.43 out of 634.53 hectares (85.2%)) and the Lees Pinch Mitchell Landscape (94.1 out of 634.53 hectares (14.8%)). When running a BioBanking credit calculation on areas covering two or more Mitchell Landscapes the Mitchell Landscape that forms most of the site is used. Sections 1.3.1 and 3.1.2 of the BAR identified the Central Hunter Foothills Mitchell Landscape as the Mitchell Landscape to use in the calculation. However, the Lees Pinch Mitchell Landscape was used in the credit calculation. The BioBanking Major Project credit calculator be re-run with Central Hunter Foothills Mitchell landscape selected.

Recommendation 4

The BioBanking Major Project credit calculator is re-run using Central Hunter Foothills as the selected Mitchell Landscape.

5. Loss of any existing offset land for the Mangoola Mine should be offset

The development footprint of the Mangoola Continued Operations Project extends south of Wybong Road to connect the proposed new mine to the workshops and coal handling and processing plant of the existing Mangoola Mine (MP 06_0014 MOD 8). This would result in the clearing of about 4 hectares of the Big Flat Creek Conservation Area offset for the Mangoola Mine. Any loss of an existing offset should be replaced in accordance with the Mangoola Mine consent condition requirements and that the impact for the Mangoola Continued Operations Project is also offset.

Recommendation 5

Any clearing of the existing Big Flat Creek Conservation Area offset for the Mangoola Mine be replaced by a new offset that meets the Mangoola Mine consent condition requirements and that the impact for the Mangoola Continued Operations Project is also offset.

Biodiversity – Orchid Expert Report

The Division reviewed a draft version of the report titled *Expert Report: Expected Presence of Threatened Terrestrial Orchids (Diuris tricolor & Prasophyllum petilum): Mangoola Coal Continued Operations Project* (the Expert Report, dated October 2018) and provided advice in a letter dated 18 April 2019 which included six recommend changes to the report. On 29 April 2019, the Department met with Dr. Stephen Bell (the author of the Expert Report), Umwelt (Australia) Pty Limited, and Mangoola Coal Operations Pty Limited, to discuss the Department's advice. Following this review, Dr. Bell provided further comments in an e-mail dated 29 April 2019 and an updated version of the Expert Report (dated June 2019) was provided with the EIS. The following comments refer to the Expert Report in the EIS.

6. The identification of vegetation communities that are orchid habitat should be reassessed

The Expert has identified ten of 14 vegetation communities in the proposed development footprint and Mangoola offset that have the potential to provide habitat for *Diuris tricolor* and *Prasophyllum petilum* (Table 3 in the Expert Report). The Expert identified the 14 vegetation communities from his analysis of the vegetation across the site and then applied his expert knowledge of the two species to nominate 10 of the 14 vegetation communities as orchid habitat. However, when the location of vegetation quadrats of deemed suitable orchid habitat (Figure 18 in the Expert Report) is superimposed over a map of orchid records (Figure 9 in the Expert Report: See **Figure 1** (below)) there is a large number of quadrats where orchids have not been recorded that are identified as orchid habitat.

The Expert used the 10 vegetation communities of orchid habitat as one of the contributing factors during the identification of low, moderate and high quality orchid habitat areas across

the offset sites. We recommend that the suitability of the 10 vegetation communities as orchid habitat is reassessed and that the subsequent estimated number of orchids across the offset areas is reviewed.

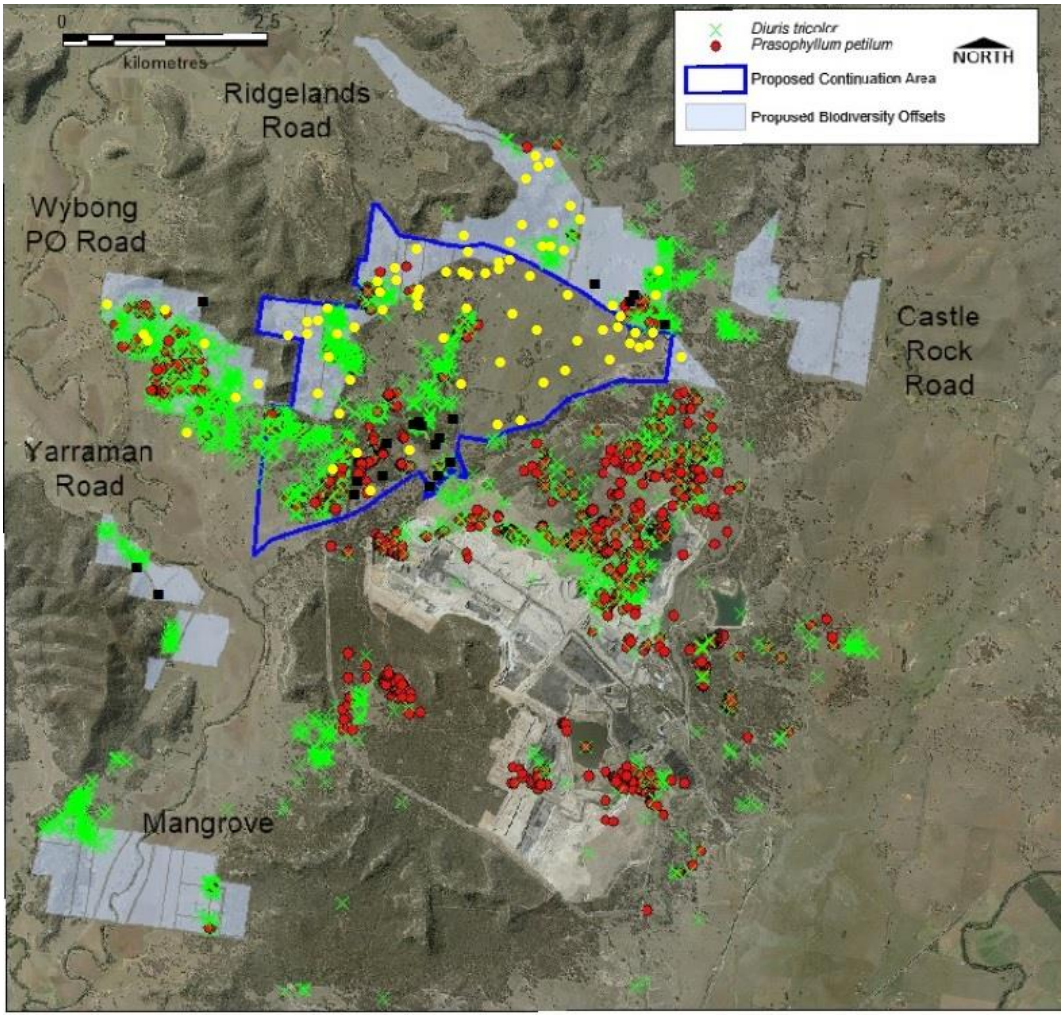

Figure 1. Combination of Figure 9 (*Diuris tricolor* and *Prasophyllum petilum* records) and Figure 18 (quadrats used for orchid habitat analysis: black squares = not orchid habitat, and yellow dots = orchid habitat) from the Expert Report. The correlation between deemed suitable habitat and orchid records does not appear strong in the eastern and northern part of the development footprint.

Recommendation 6

The suitability of the 10 vegetation communities identified as orchid habitat by the Expert be reassessed and that the subsequent estimated number of orchids across the offset areas is reviewed.

7. Orchids should be surveyed in the offset areas after two consecutive good seasons

A consent condition should be created that requires targeted surveys for *Diuris tricolor* and *Prasophyllum petilum* plants in the offset lands to verify orchid numbers estimated in the Expert Report. These surveys are to be conducted after two consecutive years of at least average total winter rainfall to give plants a chance to recover from current drought conditions. If the surveys fail to identify enough orchids of each species to meet the projects offsetting requirements, the consent condition should require the shortfall of orchid credits to be offset in accordance with the offset policy in force at that time.

Recommendation 7

Create a consent condition that requires targeted surveys for *Diuris tricolor* and *Prasophyllum petilum* in the Mangoola Offset after two consecutive winters of at least average rainfall. If the surveys fail to identify enough orchids of each species to meet the projects offsetting requirements, the consent condition should require the shortfall of orchid credits to be offset in accordance with the offset policy in force at that time.

8. Further justification of mapped 'moderate' and 'low' quality habitat with signs of cultivation or heavy grazing is required

It is unclear why seven areas with a history of cultivation were mapped as 'moderate quality habitat' and 'low quality habitat' (Figure 22 in the Expert Report) where targeted surveys (Figure 10 in the Expert Report) did not find any orchids. These areas are shown in **Figure 2** (below) and comprise five green polygons of 'low quality habitat' (labelled 'A' to 'E') and two pale blue polygons of 'medium quality habitat' (labelled '1' and '2').

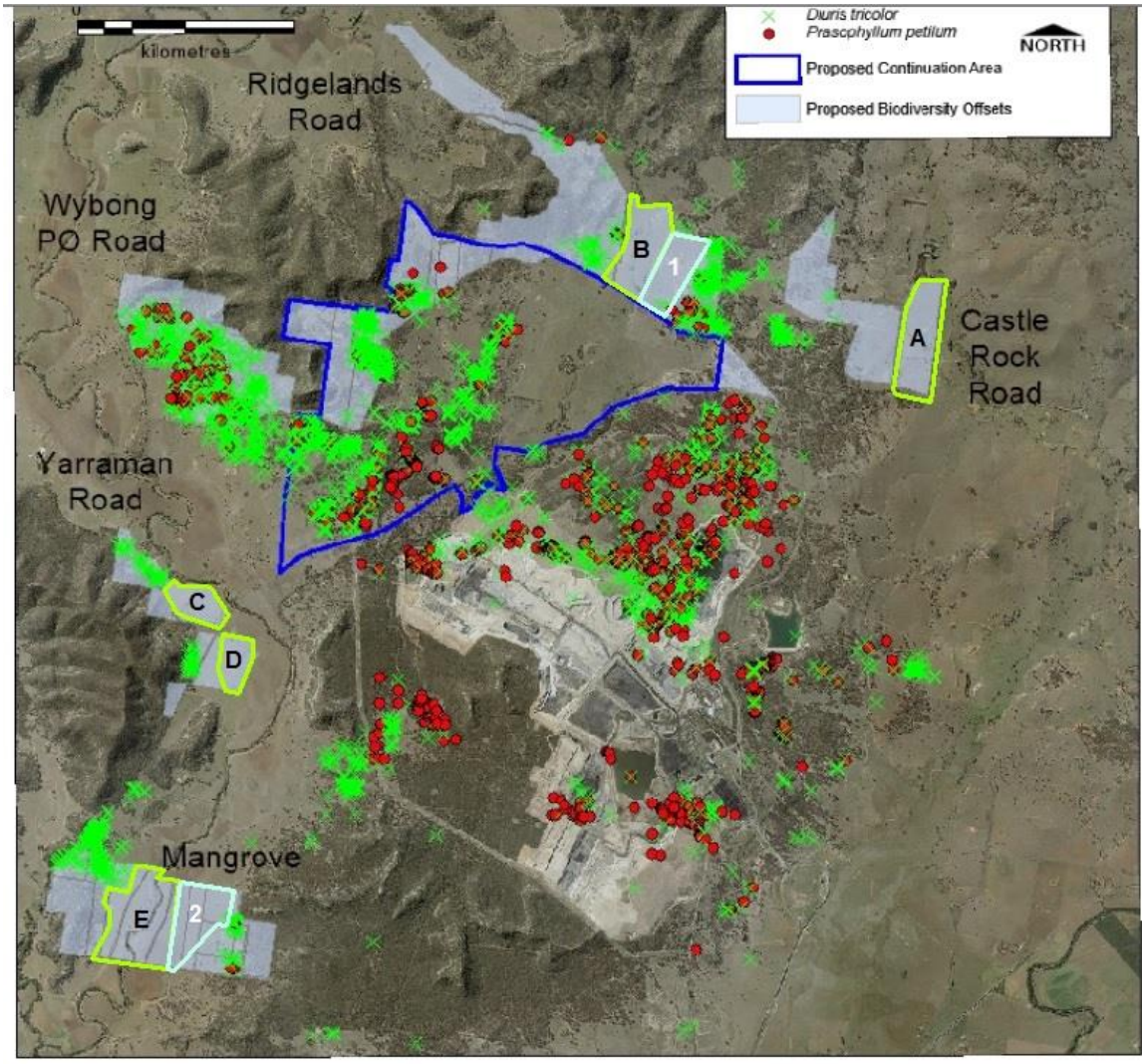

Figure 9 Distribution of *Diuris* and *Prasophyllum* across the proposed offset and continuation areas, 2009 – 2017.

Figure 2. Generalised areas of cultivation or heavy grazing mapped as low-quality habitat (four pale blue polygons) and medium quality habitat (six green polygons) superimposed on a copy of Figure 9 from the Expert Report.

Further information to be provided on how the seven areas shown in Figure 2 of the Expert Report were determined to be 'moderate quality habitat' or 'low quality habitat' and why they are not considered to be unsuitable habitat. The includes demonstrating that those areas have not been cultivated in the past, using historic aerial photos and land management records. A preliminary review of aerial photographs suggests that each of the areas could have some level of cultivation history. Any areas revised as 'no orchid habitat' should be excluded from the estimation of orchid numbers in the offset lands. Areas of house paddocks, dams and other waterbodies should also be excluded from the calculation of orchids across all offset lands.

Recommendation 8

Further information be provided on the cultivation history of the seven polygons in Figure 2 of the Expert Report which were determined to be 'moderate quality habitat' or 'low quality habitat' and justification for why they are not considered to be unsuitable habitat. House paddocks and waterbodies should also to be excluded from the estimation of orchid habitat areas in the offset lands.

9. Several inconsistencies require clarification and further data should be provided

The report contains a number of inconsistencies that should be rectified. In addition, a range of analysis outputs or data should be provided to assist in the interpretation of the expert report.

a. Total known number of threatened orchids in the offset lands varies in the report.
    i. The last paragraph of the summary cites, and paragraph 81 state that 9,914 threatened orchids are known from the offset lands. However, paragraphs 38 and 76 give this total as 9,934 orchids (9,030 *Diuris* and 904 *Prasophyllum*), which is also the sum of orchid records per offset in paragraph 39.
b. Summaries of the number of plots used are confusing and variable.
    i. Paragraph 42 states that between 2014 and 2018 52 plots were sampled in the proposed development footprint and 46 were sampled in the proposed offsets; i.e. 98 plots. But in paragraph 43 the number of plots in the offset lands has increased to 47, making the total of 99 plots.
    ii. Paragraph 55 states that 99 plots were used for an overall analysis of the Mangoola lands. Yet, the paragraph cites 47 plots, 23 plots and 20 plots in Datasets 1, 2 and 3 respectively, giving a total of 90 plots.
c. The number of floristic plots sampled in the proposed offset lands varies
    i. Paragraph 50 states that 20 floristic plots were sampled from the proposed offset lands in early 2018. Yet 28 plots were sampled that year (paragraph 42).
d. The areas named in Table 5 should be shown on a map.
    i. The eight areas of offset land with counts of orchids in Table 5 are not identifiable on any map in the report. A map should be provided.
e. It is not clear how representative the data in Table 5 is for addressing the question of extrapolating orchid numbers on all offset lands?
    i. The total number of *Diuris* (7,054) and *Prasophyllum* (862) in the offset lands in Table 5 do not add up to the total number of *Diuris* (9,030) and *Prasophyllum* (904) plants cited in paragraphs 38 and 76.
    ii. A table with details of all quadrats used in their analysis should be provided. This table should include the name of the quadrat, the date surveyed, location name, location coordinates (easting and northing), vegetation type, and general notes.
f. A data matrix of plant species by quadrat and a total species list should be provided to assist in the interpretation of the analysis in the report (Figures 14, 15 and 16).
g. A copy of the cluster diagram described in paragraph 59 should be provided to show the results of the cluster analysis and supplement the results of the ordination analysis. A cluster diagram would show the overall and relative differences between quadrats,

and how quadrats group around the 14 splits described in paragraph 60 and described in Table 3.

h. Shapefiles for all figures and data used to run the analysis in the report should be provided.

Recommendation 9

The identified inconsistencies listed in point 9 of **Attachment B** are rectified and that the listed further analysis or data are provided.

Aboriginal cultural heritage

10. The Mangoola Coal Continued Operations Project – Environmental Impact Statement

The proposed MCCO Additional Project Area (APA) comprises lands that are within the proposed development footprint and areas outside of the development footprint. There are 72 extant Aboriginal sites in the MCCO APA including 5 rock shelters with potential archaeological deposit (PAD), whilst the remainder of the sites are stone artefact sites and PAD sites. A total of 26 Aboriginal sites (11 isolated finds and 15 artefact scatters) are within the proposed MCCO APA disturbance footprint and will be impacted by the MCCO project. The 5 rock shelters are outside of the development footprint and will not be directly impacted.

Consultation was undertaken with 37 registered Aboriginal stakeholders (RAPs). The MCCO project area is situated in Wonnarua and Gomeroi traditional lands and the RAPs included representatives of four larger groups or families who asked to be consulted with separately.

Recommendation 10

Salvage of the 26 Aboriginal sites be undertaken in consultation with the RAPs and in accordance with the protocols outlined in the existing approved Aboriginal Cultural Heritage Management Plan.

11. Test excavation of rock shelters is not needed

The Aboriginal archaeological impact assessment report recommends test excavations be undertaken at five rock shelters that occur outside of the development footprint in order to determine if the rock shelters were used by Aboriginal people. The testing of areas outside of the development footprint provides unnecessary harm to Aboriginal cultural heritage.

Recommendation 11

Test excavations should not be undertaken at rock shelters that occur outside of the development footprint. References in the Aboriginal Cultural Heritage Management Plan to undertaking test excavations at rock shelters should be removed.

12. Management and mitigation of Aboriginal Cultural Values should be updated in the ACHMP

The *Mangoola Aboriginal Cultural Values Assessment Report* prepared by Tocomwall Pty Ltd (Tocomwall), dated 19 September 2019, was reviewed for the proposed Mangoola Coal Continued Operations Project (MCCO project). The report was prepared by Tocomwall to provide a cultural values assessment of the project from the perspective of the Plains Clans of the Wonnarua Peoples (PCWP) who are one of the registered Native Title Claimants that includes the project area.

The report assesses tangible and intangible Aboriginal cultural values whilst acknowledging scientific evidence in order to inform the protection and management of cultural heritage values

within the project area. This information should be used to ensure the PCWP Aboriginal cultural values are incorporated into the management options for those cultural values and resources in the project area.

Recommendation 12

The Aboriginal cultural values identified in the *Mangoola Aboriginal Cultural Values Assessment Report* should be included in the Aboriginal cultural heritage management plan and included in the formation of management actions to manage and mitigate harm to Aboriginal cultural values in the Mangoola Coal Continued Operations project area.

13. The approved Mangoola Care Agreement should be updated

Aboriginal objects salvaged in the development footprint should be added to the current approved Mangoola Care Agreement C0003885. The Mangoola Care Agreement was lodged on 24 July 2019 as a safe keeping place for previously salvaged Aboriginal objects, retrieved during previously approved Mangoola mine works, until 21 December 2029.

Any Aboriginal objects salvaged within the MCCO development footprint should be transferred for safekeeping to this approved short-term storage location for other Aboriginal objects salvaged from the currently approved Mangoola mine works. The lockable shipping container is located at Mangoola Coal Operations, Wybong Road, Wybong. An application to vary the existing Care Agreement will be required if the proposed Mangoola Coal Continued Operations Project is approved.

Recommendation 13

If approval is granted for the Mangoola Coal Continued Operations Project, provision should be made for the Aboriginal objects salvaged in the development footprint to be included in the current approved Mangoola Care Agreement C0003885.

Flooding and flood risk

14. The surface water assessment should be peer reviewed

A review of the Surface Water Assessment (SWA) prepared by Hydro Engineering & Consulting (dated 7/5/2019) found that flood mapping provided in Appendix 11 of the SWA does not show expected flood behaviour. For example, there appears to be little difference between the extent of floods ranging between 1:10 Annual Exceedance Probability (AEP) and 1:1,000 AEP. Flood mapping usually shows that flood extents follows creek alignments with overbank flooding extending beyond (to the sides of) the mapped creek line. The flood extent will generally be wider for larger floods. The mapped flood extents for this study do not follow the creek line in some areas and the flood extent lines shown appear to cross over the creek line in some locations. Figure B7 and B8 are both labelled 'Predicted Changes to Flood Extend -1:200 AEP' yet they show different impacts.

Recommendation 14

Undertake a peer review of the flood model and mapping, and flood maps are provided at a scale that provides for better visibility of impacts (for example, using A3 sizing).

15. Flood assessment of Big Flat Creek Catchment does not consider all relevant scenarios

The SWA assesses flooding for two scenarios: 1) pre-mining; and, 2) Year 8 (final year of mining). Management of surface water differs throughout the mining period however, and it is not clear if these differences will influence potential flooding impacts. For example, the drain that diverts water around the site is partially removed in Year 8 and a substantial proportion of

the catchment is captured by the mine water system at this point. Flooding impacts to non-mine areas may be worse during earlier years of mining when the mine water system captures and stores less water.

The flooding assessment should model the mine year that has the highest potential to increased flooding impacts. This is likely to be when the diversions are in place and less catchment is directed to the mine water management systems.

Recommendation 15

The flood impact assessment should analyse the differences in flooding for each mining stage and, at a minimum, compare pre-mining conditions with the stage that has the greatest flood impact.

16. The surface water management assessment uses incorrect terminology to describe flood frequency

Australian Rainfall and Runoff 2016 (ARR2016) is used as the basis for current flood assessments and refers to AEP to describe frequency of flooding. The SWA uses a mixture of annual recurrence interval (ARI) and AEP, for example - 1:20 AEP. This should be referred to as 5% AEP. References to AEP should be reviewed throughout the SWA and EIS to ensure they are correct and adjusted where relevant, for example the 10-year recurrence interval is a 9.49% AEP.

Recommendation 16

The flood study and EIS should be updated to use the correct terms to describe flood frequency in accordance with ARR2016 requirements.

17. Potential flooding impacts associated with the relocation of Wybong Post Office Road and the north western diversion drain have not been assessed

The project proposes to divert part of the upslope catchment of Big Flat Creek in a westerly direction towards the relocated Wybong Post Office Road and pipe this water under the roadway to an unnamed tributary to the west. Impacts to flooding associated with this diversion have not be assessed. There is also the potential for blockage of the proposed culvert to increase the likelihood of flooding of Wybong Post Office Road.

Recommendation 17

The surface water assessment should consider potential flooding impacts associated with the diversion of water towards and below Wybong Post Office Road. This should include the likelihood and impact of blockage of proposed culverts under the road.

18. Flood mapping does not appear to accurately show behaviour of flood flows along the roadway below the proposed Wybong Road Overpass

The proposed flood bund runs adjacent and parallel to Wybong Road in the vicinity of the proposed Wybong Road overpass. The bund wall ties into the higher ground of the proposed overpass. Pre-development mapping shows significant overbank flows on the bund wall side of Wybong Road. These will be deflected by the bund wall and embankment for the overpass. Flood mapping provided in the SWA shows a decrease in flooding at the overpass location. This indicates that the surface levels used in the flood model in this location reflect the overpass levels not the roadway levels. An increase in flooding is shown immediately downstream of the overpass.

Recommendation 18

The flood behaviour along Wybong Road under the proposed overpass should be reviewed to ensure that safety of the roadway is not compromised by the bund wall and overpass embankment.

19. Trafficability of Wybong Road has not been correctly assessed

The SWA includes mapping that shows flood depths and velocities along Wybong Road, however; due to the large scale of these maps, the trafficability of Wybong Road cannot be accurately assessed.

The flood model should be interrogated to provide point measurements for flood depth and velocities at points on Wybong Road to ensure trafficability is accurately assessed. The recommended chainages for this are:1400, 1500, Haul road (at road level), 1900, 2100, 2800, 3300, 3600 and 4000. These chainages are consistent with the areas of road shown to flood on Figure 24 in a 1:20 AEP event. The trafficability should be undertaken in accordance with the *Australian Institute for Disaster Resilience's Australian Emergency Management Handbook 7* or an equivalent standard to determine if the combination of increased depth and velocity changes the hazard rating.

Recommendation 19

Further information regarding flood depth and velocity on the roadway for the with and without project scenarios should be provided so that changes in the trafficability of Wybong Road can be accurately determined.

20. The frequency of flooding of Wybong Road may be increased by the project

Table 13 of SWA indicates significant increases in flow in the three test locations in Big Flat Creek when comparing the 'with' and 'without' project scenarios. The 1:10 flows (with the project) are close to and in some cases exceed the 1:20 flows (without the project), particularly upstream of the additional project area.

Flood mapping indicates that flooding of Wybong Road occurs in a number of locations for both scenarios for the 1:20 AEP event, however; it is not clear if the road is currently flooded for the 1:10 event. Figure B1 shows flooding for the 1:10 event, however; the location of Wybong Road is not shown on this figure so flooding of the road cannot be confirmed. No mapping is provided for changes to depth or velocity for the project for the 1:10 event.

Recommendation 20

Flood mapping should be provided for the 1:10 event with the project. Values of depth and velocity should be extracted from the model so that potential impacts to the trafficability and frequency of inundation of Wybong Road can be accurately assessed.