COBBORA COAL PROJECT

Supplementary Information

Prepared for Cobbora Holding Company Pty Limited
February to May 2013

Cobbora Holding Company Pty Limited

EMM
EMGA Mitchell McLennan

Supplementary information — February to May 2013

Cobbora Coal Project

Prepared for Cobbora Holding Company Pty Limited | 16 May 2013

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Supplementary information — February to May 2013

Draft Report

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1 Introduction

EMGA Mitchell McLennan Pty Limited (EMM) has been engaged by the Cobbora Holding Company Pty Limited (CHC) to prepare the environmental assessment for the Cobbora Coal Project.

This document collates (Table 1.1) the supplementary information provided in response to:

- comments received from agencies in submissions on the Cobbora Coal Project Preferred Project Report and Response to Submissions (PPR&RTS) (February 2013);
- questions from the Department of Planning and Infrastructure (DP&I) between February and May 2013; and
- additional information requested by DP&I in April 2013 to be provided along with responses to the PAC Review Report (Appendices A to D).

Table 1.1 Supplementary information provided to DP&I

Appendix	Title	Date provided to DP&I
A	Environment Protection Authority — responses to comments	15 May 2013
B	Department of Primary Industries — responses to comments	15 May 2013
C	Acid and metalliferous drainage update assessment	15 May 2013
D	Preliminary responses to Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development advice	15 May 2013
E	Biodiversity offset update	11 April 2013
F	Preliminary responses to OEH and SEWPaC comments on the Preferred Project Report and Response to Submissions — biodiversity	26 March 2013
G	Update on VPA	21 March 2013
H	Land use management strategy	20 March 2013
I	Clarification of tailings information	19 March 2013
J	Water balance and surface Water management system — addendum	18 March 2013
K	Surface water assessment — responses to initial comments from DP&I	7 March 2013
L	Pre-construction air quality monitoring plan	6 March 2013
M	Offsite rail noise impacts	6 March 2013
N	B OOP E waste rock emplacement of height change on noise levels	6 March 2013
O	Implications of changes to the Cobbora Coal Project on the air quality and greenhouse gas assessment	5 March 2013

Appendix A

Environment Protection Authority — responses to comments (15 May 2013)

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
1	***Water — general***	
	The EPA notes that if consent is granted by the Department of Planning and Infrastructure, the EPA will be unable to issue a Scheduled Development or Scheduled Activity Licence until the relevant plans are prepared in consultation with the EPA and approved.	**Accepted in part.** CHC will prepare water management plans for the Project in consultation with Environment Protection Authority (EPA) and NSW Office for Water (NOW) and to the satisfaction of the Director-General of the Department of Planning and Infrastructure (DP&I). It is noted that the Project is a 'transitional Part 3A project' and determination is sought under the former provisions of Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Therefore Section 75V of the Act applies which identifies authorisations that the relevant determining authority must not refuse and, when granted, that must be substantially consistent with the terms of a project approval. This includes the issuing of an Environment Protection Licence (EPL) under the NSW *Protection of the Environment Operations Act 1997*. Specific responses are provided below regarding the issue of Scheduled Development and Scheduled Activity licences (or EPLs).
2	***Review of sediment basin water quality discharge limits***	
	Consequently following adoption of the interim discharge limits recommended in the EPA's previous advice, the EPA would like to advise that it is the EPA's intention to add a condition to the Environment Protection Licence via a Pollution Reduction Program (if issued) requiring that the proponent review the interim discharge limits in 2 years, using the framework established in Chapter 3 ANZECC (2000) for setting ambient water quality triggers.	**Accepted.**
	Section 3.1.4 of ANZECC (2000) provides guidance on defining a reference condition for undertaking an assessment of likely impact against a water quality objective. Consistent with the policy position described above, the reference condition should reflect a slightly modified ecosystem. The review of the interim discharge limits will involve the proponent either: i. modelling the impact of the discharge at the edge of the near-field mixing zone against ANZECC default trigger values for a slightly modified system; or ii. justifying the reference sites using the framework established in Chapter 3 ANZECC (2000); or iii. where the proponent is not able to adequately justify the reference sites used in the environmental assessment, identifying appropriate reference sites that represent a slightly modified system and obtaining adequate water quality data over the next 2 years to support setting of site specific ambient trigger levels, and modelling the impact of the discharge at the edge of the near-field mixing zone against those site specific trigger levels.	**Accepted.**

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
	The proponent should consider the alternate approaches above and consider the need to identify alternate reference sites if required and commence monitoring as required to support the preferred approach to the review.	
3	***Flocculants***	
	Flocculants used on the site will be of low ecotoxicity. The proponent will maintain records of the flocculants used on the site including product ecotoxicity information and application rates.	**Accepted.** CHC commit to using flocculants that have low ecotoxicity and to keeping records of the flocculants used on the site, product ecotoxicity information and application rates.
4	***Waste rock emplacement***	
	The EPA recommends that the proponent be required to provide the additional information referred to above, including: • as the out-of-pit waste rock emplacement areas may affect water quality discharged from the sediment basins, the proponent should confirm the additional analyses of acid forming potential include the Whaka seam, and the additional seams listed in section 5.2.2 of the PPR'; and • assessment of the acid mine drainage potential of waste rock associated with the Whaka seam and the additional seams listed in section 5.2.2 of the PPR and identification of the need for separate specific management plans for this material if determined to be potentially acid forming material. The EPA requests that a further opportunity be provided to the EPA to review this new information before the project proceeds to the determination stage to ensure impacts have been adequately assessed.	**Accepted.** Additional (Phase 2) geochemical testwork has been undertaken and is reported in Geoterra *Cobbora Coal Project - Acid & Metalliferous Drainage Update Assessment*, May 2013. The key findings are: • no specific overburden or tailings waste management handling, storage or testing procedures are considered to be required in regard to acid and metalliferous drainage (AMD)management; • ongoing AMD testing during mining will confirm (or modify) this conclusion in relation to the uneconomic coal seams and associated lithologies; and • elevated metal concentrations were measures in waste rock and overburden leachate samples and routine site water quality monitoring programs should monitor these parameters. While the risk of AMD occurring has been determined to be low, CHC will prepare a Waste Rock Management Plan (see below). The Phase 2 report identifies higher metal concentrations in waste rock and tailings leachate. This is based on the analysis of extracts from crushed (to 4 mm, or where not available, supplied material), waste rock and tailings samples in deionised water using a 1:2 solid:water ratio. Concentrations in waste rock and tailings leachate in the field are expected to be much lower given that dilution ratios will be much higher and, for waste rock, particle size will be much larger and hence the surface area and potential for leaching much smaller.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
	The Proponent shall prepare and implement a Waste Rock Management Plan prior to commencement of mining operations and to the satisfaction of the Director General. The plan must: a) be developed in consultation with the EPA and NOW; b) include a detailed description of the procedures to be implemented to monitor and manage potential acid forming material; c) detail groundwater and surface water monitoring programs to monitor potentially acid-forming waste rock and any leachate generated, including appropriately designed detection and response systems for acid generation (covering monitoring methods, trigger levels and proposed management actions); d) ensure effective isolation of potential acid forming material in rock dumps; e) include procedures for appropriate testing of potentially acid forming waste rock prior to it being bought to the surface; f) include procedures for prioritising the relocation of potential acid forming material to a suitable underground locations prior to oxidation; g) include procedures to ensure that material relocated underground does not, to the extent reasonable and feasible, further oxidise or cause impact to groundwater; h) notwithstanding (f) above, trigger levels for any material that has oxidised to the extent that it cannot be placed underground without impacting groundwater quality and procedures for adequate capping and sealing of such material at the surface; i) detail proposed neutralising options to be implemented for oxidising material stored or encapsulated aboveground; j) where there is likely to be an extended time between placement of potential acid forming material underground, details of proposed methods to prevent oxidation of the material underground or to otherwise manage acid drainage to prevent impacts on groundwater; and k) include contingencies for management of acid forming material should this present a larger issue than first expected.	**Accepted.** A Waste Rock Management Plan will be prepared to address these items. The groundwater and surface water monitoring programs will be provided in the groundwater and surface water plans rather than in the Waste Rock Management Plan. These programs will include sampling locations and parameters to detect any AMD. These plans will be prepared in consultation with EPA and NOW and to the satisfaction of the Director-General of DP&I.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
	The EPA notes the Waste Rock Management Plan must be prepared in consultation with the EPA and approved prior to issue of an Environment Protection Licence.	**Not accepted.** Given that the Waste Rock Management Plan will need to be approved and regulated by Director-General of DP&I, it is should not be a condition of issuing of a Scheduled Development or Scheduled Activity (ie EPL) but rather a Project Approval condition. It is proposed that CHC submit a draft Waste Rock Management Plan to DP&I three months prior to the start of the initial mine box cut and that this plan will be finalised as soon as possible based on the comments received from DP&I, EPA and NOW.
5	***Liners for contaminated water storages***	
	The EPA's submission on the Exhibited EA dated 16 November 2012 identified that the EA also does not appear to provide detail on whether contaminated water storage structures will be lined and if so details of proposed liners to ensure pollution of surface water and ground water does not occur. This was also identified at adequacy stage, The EPA's submission on the Exhibited EA provided the following recommendations:	See below.
	• Further information regarding the construction of the clay liners (or alternate geosynthetic liners) for all contaminated water storage structures onsite is required. This includes the location of liners (e.g. floor and walls), overall thickness of liners, thickness of successive layers, gradients of sides of structures of clay liners etc for all structures. Alternatively impermeable geosynthetic liners could be considered. • Further information is required to demonstrate how the EPA's clay liner requirements for contaminated water storage structures (outlined below) will be met to ensure impacts do not occur. • The EPA's standard requirement for these types of liners (i.e. contaminated water storage structures) is to achieve a permeability of 1 x 10^{-9} m/s or less, with a re-compacted clay liner of at least 90 centimetres (cm) in thickness (or alternative geosynthetic liner of equivalence). Where the proposed liner will not meet this thickness and the natural geology of the site in conjunction with constructed clay liners is considered sufficient in meeting this requirement, sufficient evidence must be provided in support of this to demonstrate the construction will be adequate to prevent pollution of groundwater (eg geological evidence, appropriate groundwater modelling etc).	**Accepted.** The following contaminated water storages will be lined to achieve a permeability of 1 x 10^{-9} m/s or less: • the out-of-pit tailings storage facility; and • mine water dams. The following water storages will not necessarily be lined to achieve a permeability of 1 x 10^{-9} m/s or less: • the raw water dam; • sedimentation dams; and • clean water dams. The in-pit tailings storage facilities are not considered to be water storage facilities and will not be lined. An application to undertake geotechnical drilling in the out-of-pit tailing emplacement area was submitted to the Division of Resources and Energy on 7 May 2013. Once approved, the investigation program will include determining the quantity and suitability of existing clay for lining the contaminated water storages.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
		An assessment of the clay and its suitability for the contaminated water storages liners (ie to achieve the permeability criteria) will be prepared by a suitably qualified expert based on the results of the test work underway. If there is not suitable clay available, the liners assessment will assess alternative liners and will provide an alternative liner proposal.
	• Even where the EPA's permeability requirements for contaminated water storage outlined above are met, any contaminants contained in contaminated water storages still have potential to permeate below clay linings albeit over a long period of time. Hence an assessment also needs to be provided including: • an assessment of the long term fate of contaminants in contaminated water storages; • an assessment of potential impacts on groundwater quality in the longer term, against ANZECC 2000 criteria for any beneficial uses likely to be impacted as well as the preservation of aquatic ecosystems; and • longer term arrangements for management, monitoring and response to any such impacts beyond the operational life of the proposed mine. The EPA recommends that the proponent be required to provide the additional information referred to above, including: • detailed information on how all contaminated water storages will be lined (i.e. to what permeability standard and depth of liners for walls and floors of all facilities); and • assess potential impacts on surface water and groundwater due to potential seepage from structures referred to above (refer to the EPA's comments dated 16 November 2012 for further information on impact assessment requirements).	**Accepted.** A further assessment of the potential for seepage from contaminated water storages and from in-pit tailings storage facilities to contaminate groundwater will be undertaken by a suitably qualified expert based on the results of the water storages liners assessment. As a minimum, this assessment will include single-dimension contaminant fate modelling. Additional more detailed modelling will be undertaken if this modelling identifies that there is a moderate or high risk that ANZECC/ARMCANZ (2000) water quality trigger values for slight-moderately disturbed ecosystems will be exceeded in groundwater. This modelling will be undertaken based on the highest metal concentrations measured in 1:2 water:tailings leachate in the Phase 2 geochemical testwork program (Geoterra, *Cobbora Coal Project - Acid & Metalliferous Drainage Update Assessment*, May 2013). Additional geochemical testwork work will be undertaken to investigate the differences in the Phase 1 and Phase 2 tailings leachate results if modelling indicates there is a risk of groundwater contamination. The operations groundwater management plan will detail a monitoring program to determine if any contamination of groundwater from seepage is occurring. It will present potential contingency measures that will be implemented if impacts to groundwater or surface water are predicted to occur.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
	The proponent has not provided a response to this request aside from indicating that it is now proposed to construct mine water dams with low permeability floor and walls (with no further detail) and subsequently it is uncertain whether contaminated water storages onsite will be adequately lined to prevent leakage and impact to surface water and/or groundwater. The EPA requests that a further opportunity be provided to the EPA to review this new information before the project proceeds to the determination stage to ensure impacts have been adequately assessed.	**Accepted in part.** Lining earth fill water storages with compacted clay or geosynthetic material aids the loss of water to seepage, but does not entirely prevent seepage. By providing a required liner permeability of 1 x 10^{-9} m/s or less, EPA acknowledge that some leakage may occur. CHC commit to clay lining dams to achieve the required permeability and to prevent impact to surface water and/or groundwater. There is a low risk that groundwater contamination will occur (see EA Section 7.5.4), CHC has committed to line contaminated water storages, and there are multiple alternatives to achieve the required liner permeability. It is unreasonable that the determination of the Project application is delayed while detailed design of the dam linings is completed and a further assessment of the low risk of groundwater contamination is complete. Therefore, it is proposed that the dam liner assessments will be completed in consultation with the EPA and to the satisfaction of the Director-General of the DP&I prior to the start of construction of the contaminated water storages.
	If the information outlined above is not provided to the satisfaction of the EPA, the EPA will be recommending that the Department of Planning and Infrastructure incorporate the following conditions of consent in relation to lining of contaminated water storages to prevent seepage and impact on surface water and groundwater. <u>Recommended consent condition</u> All contaminated water storages must have a basal or impermeable liner with an equivalent permeability of 1 x 10^{-9} metres per second over a minimum thickness of 900 mm or other liner approved by the EPA. The licensee must obtain and retain documentation from an appropriately qualified person to demonstrate the liners for all structures referred to above meet the permeability requirements specified above.	**Accepted.**
6	***Surface water and groundwater protection measures***	
	The proponent has provided a comparison of options of tailings dewatering (Appendix C of Preferred Project Report and Response to Submissions (PPR)). The report recommends the Cobbora project adopt the base thickening design with high rate thickening and discharge to tailings emplacement as the economic alternative. However as indicated on page 6, the report does not consider any effects on freshwater, groundwater or surface water from the proposed or alternate systems. That is, the proposed method of tailings emplacement is based on economic decisions only.	**Accepted.** See responses to Recommendation 5.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
	The EPA notes Tailings Storage Facilities (TSF) are proposed to be placed in mined areas A and B, which is below the current watertable 110 metres below surface and groundwater inflow is likely to occur during placement and following completion of filling. As indicated on page 123 of the Groundwater Assessment in Appendix C groundwater interacting with and flowing through the tailings emplacements is likely to undergo changes in quality as groundwater interacts with this material. The tailings to be generated onsite contain potentially acid forming material amongst other potential contaminants. Page 141 of the EA indicates that most Potentially Acid Forming material (PAF) will be placed in the Tailings Storage Facility (TSF) and that PAF may generate and mobilise heavy metals. Page 175 of the EA indicates tailings TCLP results indicate exceedances of ANZECC criteria in terms of pH, nickel and zinc limits. The PPR does not provide any further information/clarification/assessment regarding potential impacts on surface water and groundwater due to potential seepage from the TSF's or proposed measures to protect surface water and groundwater from pollution aside from stating that the TSF's and associated seepage collection ponds will be lined material of low permeability, however no further detail is provided as to how they will be lined. There is no additional information on monitoring of groundwater and surface water surrounding and underlying TSF's. The PPR does not address issues identified by the EPA in its comments on the exhibited EA dated 16 November 2012 in terms of further details of the expected quality of tailings and seepage generated from stored tailings and assessing and mitigating potential impacts on surface water and groundwater from the storage of tailings material. Seepage from tailings must be managed in a manner that prevents impacts to surface water and groundwater to ensure compliance with section 120 of the Protection of the Environment Operations Act 1997.	
	The EPA recommends that the proponent be required to provide the additional information referred to above, including: • detailed information on how the Tailings Storage Facilities will be lined (i.e.to what permeability standard and depth of liners for walls and floors of all facilities); • detailed information on the expected quality of tailings and seepage generated from stored tailings; and • assess potential impacts on surface water and groundwater due to potential seepage from the TSF's (refer to the EPA's comments dated 16 November 2011 for further information on impact assessment requirements)	**Accepted.** See responses to Recommendation 5.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
	EPA requests that a further opportunity be provided to the EPA to review this new information before the project proceeds to the determination stage to ensure impacts have been adequately assessed.	**Accepted in part.** It is unreasonable that the determination of the Project application is delayed while the further information committed to is reviewed by the EPA. Therefore, it is proposed that the additional information referred to above will be completed in consultation with the EPA and to the satisfaction of the Director-General of the DP&I prior to the start of construction of the contaminated water storages and TSFs. See responses to Recommendation 5.
	If the information outlined above is not provided to the satisfaction of the EPA, the EPA will be recommending that the Department of Planning and Infrastructure incorporate the following conditions of consent in relation to lining of Tailings Storage Facilities to prevent seepage and impact on surface water and groundwater. Recommended consent condition All Tailings Storage Facilities must have a basal or impermeable liner with an equivalent permeability of 1 x 10^{-9} metres per second over a minimum thickness of 900 mm or other liner approved by the EPA. The licensee must obtain and retain documentation from an appropriately qualified person to demonstrate the liners for all structures referred to above meet the permeability requirements specified above. The EPA notes alternative liners could be considered if alternative dewatering methods are reconsidered to minimise seepage generated from tailings. This may also minimise the need for heavy reliance on monitoring to detect any seepage.	**Accepted in part.** See responses to Recommendation 5. It is noted that lining water storage facilities is much more expensive than even an intensive and ongoing monitoring program.
	If consent is granted by the Department of Planning and Infrastructure the EPA will be unable to issue a Scheduled Development or Scheduled Activity Licence until the issues outlined above are addressed.	**Accepted in part.** As discussed above, it is proposed that the dam liner assessments are completed in consultation with the EPA and to the satisfaction of the Director-General of the DP&I prior to the start of construction of the contaminated water storages. A Scheduled Development Licence will be sought to construct the Project. This will not include discharging tailings to the tailings emplacement areas. It is not accepted that is reasonable to delay the granting of this licence for an activity that it would not permit. CHC will consult with EPA and DP&I (as described in the Response to Recommendation 5) to ensure that contaminated water storage facilities assessments are completed prior to the start of dam construction. A Scheduled Activity Licence will be sought for the operation of the Project, including the contaminated water storages.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
		As previously noted, the Project is a 'transitional Part 3A project' and determination is sought under the former provisions of Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Therefore Section 75V of the Act applies which identifies authorisations that the relevant determining authority must not refuse and, when granted, that must be substantially consistent with the terms of a project approval. This includes the issuing of an EPL under the *Protection of the Environment Operations Act 1997*.
7	***Site contamination***	
	Contaminated site assessments must be undertaken for both "Yallambee" and "Danabar" piggeries in accordance with guidelines such as the National Environment Protection (Assessment of Site Contamination) Measure 1999 and other relevant EPA Guidelines to inform management decisions prior to commencement of development works.	**Accepted in part.** Contaminated site assessments will be undertaken for the previous piggeries at "Yallambee" and "Danabar". Works are not expected to occur in these areas during construction. Therefore, nothing will be gained from preventing the development works from starting prior to these assessments to being completed. CHC commit to completing contaminated site assessments at these sites prior to disturbing the sites or within 2 years of the start of operations (defined by product coal leaving the site), whichever is sooner.
8	***Noise limit conditions***	
	[L6.1] Noise generated at the premises must not exceed the noise limits in Table A.2.	**Accepted in part.** Noise criteria should only be applied at non-mine owned residences. This should be reflected in the table heading. "Noise generated at the premises must not exceed those listed below unless owned by the mine operator". The EPA recommended criteria for receivers along the rail spur have been based on rail noise impacts modelled for the superseded rail alignment and industrial noise policy (INP) goals, as presented in the EA. The PPR&RTS included updated noise impacts based on modelling of whole of period (day and night) for the proposed *Rail Infrastructure Noise Guidelines* (RING) and impact modelling based on the new alignment. Noise control options were also investigated for receivers based on meeting the RING goals. It is anticipated that the RING criteria will be applied to the Project if they are approved prior to the project determination. The L_{Aeq}(15-min) noise levels and INP criteria for the revised rail alignment are presented in Appendix D of the *Planning Assessment Commission Review — Responses to Recommendations*.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
	[L6.2] For the purpose of condition L6.1; • Day is defined as the period from 7 am to 6 pm Monday to Saturday and 8 am to 6 pm Sunday and Public Holidays. • Evening is defined as the period 6 pm to 10 pm. • Night is defined as the period from 10 pm to 7 am Monday to Saturday and 10 pm to 8 am Sunday and Public Holidays.	**Accepted.**
	[L6.3] To determine compliance: a) with the Leq (15 minute) noise limits in condition L6.1, the noise measurement equipment must be located: i) approximately on the property boundary, where any dwelling is situated 30 m or less from the property boundary closest to the premises; or ii) within 30 metres of a dwelling facade, but not closer than 3m, where any dwelling on the property is situated more than 30 metres from the property boundary closest to the premises; or, where applicable iii) within approximately 50 metres of the boundary of a National Park or a Nature Reserve. b) with the LA1 (1 minute) noise limits in condition L6.1, the noise measurement equipment must be located within 1 metre of a dwelling facade. c) with the noise limits in condition L6.1, the noise measurement equipment must be located: i) at the most affected point at a location where there is no dwelling at the location; or ii) at the most affected point within an area at a location prescribed by conditions L6.3(a) or L6.3(b).	**Accepted in part.** The INP amenity criteria for passive recreational areas such as National Parks is 50 dB(A)Leq. The INP is clear that the criteria is to apply "at the receiver location" for passive recreation receivers. The criteria should be applied at the boundary of a passive recreation area.
	[L6.4] A non-compliance of condition L6.1 will still occur where noise generated from the premises in excess of the appropriate limit is measured: • at a location other than an area prescribed by conditions L6.3(a) and L6.3(b); and/or • at a point other than the most affected point at a location.	**Not accepted.** This appears to contradict L6.3 in determining compliance, given that the assessment location has to be representative of a receiver, especially for sleep disturbance. This is ambiguous and open to multiple interpretations especially for compliance officers.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
	[L6.5] The noise limits set out in .condition L6.1 apply under all meteorological conditions except for the following: d) wind speeds greater than 3 metres/second at 10 metres above ground level; or e) stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level.	**Accepted.**
	[L6.6] For the purposes of condition L6.5: a) data recorded by a meteorological station to be located onsite must be used to determine meteorological conditions; and b) temperature inversion conditions (stability category) are to be determined by the sigma-theta method referred to in Part E4 of Appendix E to the NSW Industrial Noise Policy.	**Accepted.** It is noted that the stability class can only be 'estimated' rather than 'determined'.
	[L6.7] For the purposes of determining the noise generated at the premises - the modification factors in Section 4 of the NSW Industrial Noise Policy must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.	**Accepted.**
	[L6.8] Heavy vehicle movements to and from the site are restricted to between the hours of 7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday and at no time on Sundays and public holidays.	**Accepted in part.** See response to PAC Review Recommendation 15 in *Planning Assessment Commission Review — Responses to Recommendations*.
9	***Construction noise***	
	[L6.9] All construction work at the premises must be conducted between 7 am and 6 pm Monday to Friday and between 8 am and 1 pm Saturdays and at no time on Sundays and public holidays. This condition does not apply in the event of a direction from police or other relevant authority for safety or emergency reasons. Note: 'safety or emergency reasons' refers to emergency works which may need to be undertaken to avoid loss of life, property loss and/or to prevent environmental harm.	**Not accepted.** The construction program is proposed for seven days per week and up to 12 hours per day allowing for works to be expedited. This will reduce the construction noise duration. Additionally, several out of hours activities are critical to the delivery and integrity of the infrastructure for the project. Noise associated with standard hours and out of hours construction programs have been assessed in two separate quantitative reports (*Noise and vibration assessment for out of hours construction* (Appendix I of the PPR&RTS) and the draft *Noise and vibration management plan – construction*). The quantitative assessments were in accordance with the *Interim Construction Noise Guideline* (ICNG) and provide reasonable and feasible mitigation controls and management measures to reduce potential impacts on the community. CHC are seeking approval for both the standard and out of hours construction programs.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
10	***Train noise performance***	
	L6.10. The Proponent shall take all necessary actions to ensure that trains operated on the Site have received an 'approval to operate on the NSW rail network' in accordance with the noise performance criteria established under conditions L6.1 to L6.4 in Environment Protection Licences or a Pollution Control Approval issued pursuant to the former Pollution Control Act 1970.	**Accepted in part.** See response to PAC Review Recommendation 12 in *Planning Assessment Commission Review — Responses to Recommendations*.
11	***M8 requirement to monitor noise***	
	[M8.1] To assess compliance with Condition L6.1, attended noise monitoring must be undertaken in accordance with Conditions L6.3 and: a) at each one or at a location representative of the most affected location of the locations listed in Condition L6.1; b) occur annually in a reporting period; c) occur during each day, evening and night period as defined in the NSW Industrial Noise Policy for a minimum of: i) 1.5 hours during the day; ii) 30 minutes during the evening; and iii) 1 hour during the night; and d) occur for three consecutive operating days.	**Accepted.**
12	***Reporting conditions — R4 Noise Monitoring Report***	
	A noise compliance assessment report must be submitted to the EPA within 30 days of the completion of the yearly monitoring. The assessment must be prepared by a suitably qualified and experienced person and include: a) an assessment of compliance with noise limits presented in Condition L6.1; and b) an outline of any management actions taken within the monitoring period to address any exceedences of the limits contained in Condition L6.1.	**Accepted.**

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
13	***Coal mine particulate matter control best practice***	
	The proponent must conduct a site specific Best Management Practice (BMP) determination to identify the most practicable means to reduce particle emissions.	**Accepted.** A Best Management Practice Review is provided in Section 6.4.2 of the *Air quality and greenhouse gas assessment* (EA Appendix M). This will be expanded to form a Best Management Practice (BMP) plan for the Project. The mine plan has been revised taking into account the recommendations of the PAC Review. As identified in the Best Management Practice Review, wheel generated emissions from unpaved roads are the highest ranked sources of particulate matter emissions. The revised mine plan has less haul trucks travelling less in total. This is described further in the *Planning Assessment Commission Review — Responses to Recommendations.*
	[1.1] The proponent must prepare a report which includes, but is not necessarily limited to, the following: • identification, quantification and justification of best practice measures that could be used to minimise particle emissions; • evaluation of the practicability of implementing these best practice measures; and • a proposed timeframe for implementing all practicable best practice measures.	**Accepted.**
	[1.2] In preparing the report, the proponent must utilise the document entitled Coal Mine Particulate Matter Control Best Practice — Site Specific Determination Guideline — August 2011 (http://www.environment.nsw.qov.au/resources/air/20110813coalmineparliculate.pdf) .	**Accepted.**
	[1.3] All cost related information is to be included as Appendix 1 of the Report required by condition 1.2 above.	**Accepted.**
	[1.4] The report required by condition 1.2 must be submitted by the proponent to the Environment Protection Authority's Head of Operations Dubbo, at PO Box 2111 Dubbo NSW 2830 prior to an application for an environment protection licence for the project.	**Not accepted.** Across NSW, the majority of Best Management Practice Plans have been prepared for existing operations. This allows the plan to be specific to the operation of the site taking into account site-specific conditions, equipment types and numbers, and operational arrangements. Given that the actual equipment and operational arrangements will be determined by the mining contractor (which has yet to be selected), the EA air quality assessment was based on a range of conservative assumptions. The Best Management Practice Plan will be most effective if based on as many project-specific details as possible. These will be determined based on the selection of the mining contractor and will be further informed by the site-specific conditions encountered during construction.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
		It is proposed that the Best Management Practice is prepared three months prior to the start of operations (defined by product coal leaving the site).
	[1.5] The report required by condition 1.2 above, except for cost related information contained in Appendix 1 of the Report, must be made publicly available by the proponent on the proponent's website by <date>.	**Accepted in part.** As discussed above, as this is not an existing operation, it is proposed that the timing is tied to the start of operations rather than a calendar date.
14	***Air quality management plan***	
	Based on the information contained in the site specific BMP (refer to condition 1 above) and the project EA, the proponent must develop and implement an air quality management plan for the project in consultation with the EPA. As a minimum the air quality management plan must include the following information for each emission source: • key performance indicator(s); • monitoring method; • location, frequency and duration of monitoring; • record keeping; • response mechanisms; and • compliance reporting.	**Accepted.**
	If consent is granted by the Department of Planning and Infrastructure the EPA will be unable to issue a Scheduled Development or Scheduled Activity Licence until the documentation referred to above is prepared and approved.	**Not accepted.** Given that it is proposed to prepare the Best Management Practice Plan at a stage where it best meets its objectives (see above), it is proposed to prepare the air quality management plan in two stages: construction and operations. The construction air quality management plan will be prepared in consultation with EPA and to the satisfaction of the Director-General of DP&I prior to the start of construction. The operations air quality management plan will be prepared in consultation with EPA and to the satisfaction of the Director-General of DP&I prior to the start of the initial box-cut.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
15	***Water — site water management plan***	
	The EPA recommends that the Department of Planning and Infrastructure incorporate a condition of consent requiring that the Site Water Management Plan be prepared prior to commencement of site construction in consultation with the EPA. The Site Water Management Plan must address:	**Accepted.** The groundwater and surface water plans will address the listed items. It is proposed to prepare these management plans in two stages: construction and operations. The construction management plans will be prepared in consultation with EPA and to the satisfaction of the Director-General of DP&I prior to the start of construction. The operations plans will be prepared in consultation with EPA and to the satisfaction of the Director-General of DP&I prior to the start of the initial box-cut.
	• measures to ensure that pit water, coal washery wastewater, groundwater seepage and process water are retained within the pit, infrastructure and process water systems (as committed to in the EA);	**Accepted.**
	• measures to ensure that water from overburden emplacements, topsoil stockpiles and other disturbed areas are directed to sediment basins designed, constructed and operated in accordance with: - Managing Urban Stormwater: Soils and Construction Volume 1; - Managing Urban Stormwater: Soil and Construction: Volume 2E Mines and Quarries (DECC, 2008); - Managing Urban Stormwater: Soils and Construction: Volume 2C Unsealed Roads (DECC, 2008) for erosion and sediment control of onsite roads and waterway crossings (guidance is also provided in the field guide Erosion and sediment control on unsealed roads available on the Office of Environment and Heritage stormwater website); and • Managing Urban Stormwater: Soils and Construction: Volume 2A Installation of Services (DECC 2008) for erosion and sediment control during the installation of the water pipeline and any other reticulated services.	**Accepted in part.** Sedimentation basins will be designed, constructed and operated in accordance with only the following guidelines: • Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004) ; and • Managing Urban Stormwater: Soil and Construction: Volume 2E Mines and Quarries (DECC 2008).
	• the development of sediment basin salinity, acidity and metal trigger values that prompt investigations of the causes of elevated salinity, acid or metal levels and the implementation of mitigation measures	**Accepted.**

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
	• a surface and groundwater quality monitoring program that sets out: - the duration (pre, during, and post mining), sites to be sampled; - frequency of sampling; - the parameters to be measured, for each water system including for water reuse in land application, management of the process water, groundwater and inflow to sediment basins from stockpiles; - the trigger values for investigation derived from assessment against WQOs determined using either ANZECC (2000) default trigger values or site specific WQOs determined in accordance with ANZECC (2000) and DEC (2006) procedures; - mitigation actions when trigger values are exceeded; and - monitoring of discharges from the sediment basins and ambient monitoring for the purpose of confirming or amending ,discharge limits.	**Accepted.**
	• a framework for post-mining monitoring, with a commitment for a detailed post-mining monitoring program to be prepared two years prior to the cessation of mining operations;	**Accepted.**
	• a program for reporting on the effectiveness of the water management systems; and	**Accepted.**
	• Groundwater Management Plan with Groundwater Reuse Procedures.	**Accepted.**
16	***Water — site water management plan***	
	The EA lists some groundwater quality monitoring parameters in section 7.6.1 (pg 144), but provides no proposed surface water quality monitoring parameters. Sediment basin monitoring will need to include TSS/NTU, oil and grease, and pH. Sediment basin monitoring should also assess other potential risk factors in the runoff from the overburden stockpiles including a suite of metals, EC/TDS, and sulphate.	**Accepted.** Water quality monitoring of sedimentation basins will include: • total suspended solids (TSS)/turbidty (measured in nephelometric turbidity units (NTU)), oil and grease and pH; and • a suite of metals, electrical conductivity/total dissolved solids, and sulphate until such time as these parameters are demonstrated not to be an issue for the Project.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
	Groundwater reused for land application (rehabilitation and dust suppression) and water that may be stored within the mine workings and basins that could affect local ground waters should also be monitored for: • a full suite of metals; • volatile organics; • total petroleum hydrocarbons (C6–C9 and C10–C36); • semivolatile organic compounds including polycyclic aromatic hydrocarbons and phenols; • polychlorinated biphenyls (PCBs); • alkalinity, hardness, pH , conductivity/salinity, major ions (including: sodium, chloride, bicarbonate, potassium, magnesium, carbonate, fluoride, hydroxide, sulfate, calcium); • non-metallic inorganics — cyanide; and • radionuclides. The issues outlined above should be addressed in the Site Water Management Plan.	**Accepted in part.** It is proposed that groundwater is reused for land application (rehabilitation and dust suppression). Water that may be stored within the mine workings and basins that could affect local groundwaters will be monitored for: • a full suite of metals; • volatile organics; • total petroleum hydrocarbons (C6–C9 and C10–C36); and • alkalinity, hardness, pH , conductivity/salinity, major ions (including: sodium, chloride, bicarbonate, potassium, magnesium, carbonate, fluoride, hydroxide, sulfate, calcium). Potential sources of the following analytes at levels that may impact the environment have not be identified and it is not proposed to include them in the monitoring suite: • semivolatile organic compounds including polycyclic aromatic hydrocarbons and phenols; • polychlorinated biphenyls (PCBs); • non-metallic inorganics — cyanide; • the ions fluoride, hydroxide; and • radionuclides.
	If consent is granted by the Department of Planning and Infrastructure the EPA will be unable to issue a Scheduled Development or Scheduled Activity Licence until the Site Water Management Plan is prepared and approved.	**Not accepted.** As described above, it is proposed to prepare: • A construction surface water management plan and a construction groundwater water management plan in consultation with EPA and to the satisfaction of the Director-General of DP&I prior to the start of construction. • An operations surface water management plan and an operations groundwater water management plan in consultation with EPA and to the satisfaction of the Director-General of DP&I prior to the start of the initial box-cut. It is understood that the components of these plans that will form part of the environment protection licences (eg discharge limits and the monitoring program). It is proposed that these are resolved in parallel to preparing of the water management plans but that the plans should not need to be approved by the Director-General of DP&I before EPLs can be approved.

Table A.1 Environment Protection Authority — Responses to Comments

No.	Recommendation	CHC response
17	***Hazardous chemical and waste management***	
	Dangerous Goods must be transported in accordance with the requirements of the "Australian Code for the Transport of Dangerous Goods by Road and Rail — Current Edition".	**Accepted.**
	All hydrocarbon and chemical products must be stored within a bunded area complying with the relevant Australian Standard.	**Accepted.**
	Toxic Chemicals must be stored in accordance with the requirements of ASINZS 4452: The Storage and Handling of Toxic Substances.	**Accepted.**
	All wastes onsite must be classified as waste in accordance with the document "Waste Classification Guidelines Part 1: Classifying Waste" (DECCW 2009) and subsequently disposed at landfill facilities that can lawfully accept the waste following classification.	**Accepted.**
18	***Lighting impacts***	
	The proponent must engage an appropriately qualified expert to prepare and implement a light management plan for all aspects of the project.	**Accepted.**

Table A.2 L6.1 Noise generated at the premises must not exceed those listed below unless owned by the mine operator

Locality	Noise limits dB(A)			
	Day	Evening	Night	
	L_{Aeq} (15 minute)	L_{Aeq} (15 minute)	L_{Aeq} (15 minute)	L_{A1} (1 minute)
1101–1172, 1178, 1185–3020, 3029, 3044–3052, 3062–3086, 3218–3236, 5003–5022, 5025	35	35	35	45
1178, 3041	36	36	36	48
3021, 3022, 3043	39	39	39	50
3024, 5023	38	38	38	49
3035	37	37	37	46

Appendix B

Department of Primary Industries — Responses to Comments

Table B.1 Department of Primary Industries — Responses to Comments

No.	Recommendation	CHC response
1	***Improved information on the impacts of changes in gross margins and agricultural productivity***	
	The economic assessment of the agricultural land removed for mining is based on current average gross margins available from NSW Trade and Investment (AIS [Agricultural Impact Statement], Section 6.1.2). The range of gross margins available for each enterprise evaluated is not used. In addition, the assessment does not consider potential changes in agricultural productivity over time, which could result in higher gross margins. Taking no account of productivity changes has the potential to underestimate the value of agricultural land removed for mining.	**Not accepted.** As stated in EA Section 9.5.6: • the direct annual output of the Project is estimated to be $535 million; and • the direct annual output from the displaced agriculture is estimated to be $5.6 million. The difference between the output benefit of the Project compared to the displaced agriculture is therefore $529 million. This is relatively insensitive to the assumed average gross margins for agricultural activities. For example, if these agricultural activities were assumed to have double the output benefit due to increased margins or changed productivity, the difference between the output benefit of the Project compared to the displaced agriculture is would be $524 million (1% lower). A detailed sensitivity analysis was not undertaken as it would not provide additional information to allow a project determination to be made.
2	***A mix of alternative post-mining land uses for rehabilitated land should be considered***	
	In the assessment, the post-mining land uses considered for rehabilitated land are cropping, grazing and woodlands (AIS, Section 6.1.3). Each of these are considered as stand alone options depending on the land capability class. Given it may not be possible to implement these limited land-use changes for the particular land class, the assessment should be more flexible and consider a mix of land uses as a risk-management strategy.	**Accepted.** The updated Mine Rehabilitation Strategy (PPR&RTS Appendix H) updates the proposed final land use map. This demonstrates that the landform and resource availability is sufficient to return the land to a mix of agricultural land and woodland. Within the limits of the Project Approval, it is anticipated that the final land use will be optimised as rehabilitation progresses within the life of the mine.
3	***Improved information on the value of water***	
	In the assessment, "the downstream flow impacts of the Project on the Talbragar River has been assessed as being minimal", but no detailed information supporting this conclusion has been provided (AIS, Section 6.2).	**Not accepted.** The surface water assessment report (EA Appendix E) and updated surface water assessment report (PPR&RTS Appendix F) contain extensive detailed information regarding the assessment of impacts to the Talbragar River. Further information is presented in the *Planning Assessment Commission Review — Responses to Recommendations* (May 2013).

Table B.1 Department of Primary Industries — Responses to Comments

No.	Recommendation	CHC response
	In addition, the value of water purchased from agricultural producers for the mine has been evaluated based on current average gross margins for irrigated lucerne and dryland cropping. As highlighted in point 1 above, the range of gross margins available for these enterprises, and the impact of agricultural productivity changes over time on these gross margins, should be considered in evaluating the value of water removed from agriculture.	**Not accepted.** See response to Recommendation 1.
4	***Improved information on agricultural land rehabilitation monitoring***	
	There remains concern about the proponent's ability to rehabilitate such significant areas of agricultural land, in particular, Class III capability land. The progression of this rehabilitation should be closely monitored. Agricultural land rehabilitation monitoring currently proposes a 100 m transect be established across a typical section of pasture rehabilitation every 20–40 ha with no mention of monitoring crop rehabilitation. It is considered this is insufficient. In order to address this insufficient monitoring proposal, the following conditions of consent are recommended: • that 100 m transects every 20–40ha across all land rehabilitated to both crop and pasture. Twenty 1 m x 1 m quadrats should be assessed along each transect for pasture species, weed species and groundcover percentage annually, in spring; • every five years, bulk soil samples across each transect should be taken at 0–10 and 10–30 cm and assessed for major nutrients, cations, pH, EC and organic carbon; • both crop and pasture rehabilitated land should be assessed as complete when crop and pasture yields are consistent with average district yields of comparable land in that class. Soil chemistry must also return to a comparable state to that of soils in the surrounding locality of that particular class; • while section 9.6 specifies soil structure as a criterion for successful rehabilitation of both Class III and Class IV-VIII, no methods for monitoring this have been provided. As part of any conditions of consent. It is recommended that soil structure monitoring must also take place; and • that the reference sites specified in section 6.1 of Appendix G should be sourced in collaboration with a local landholder reference group containing farmers and graziers from surrounding properties.	**Accepted.** The mine rehabilitation management plan monitoring program will include these items. Soil structure related parameters will be incorporated into the soil monitoring program. Monitored parameters will include organic carbon, Emerson Aggregate Test, available water capacity and bulk density.

Table B.1 Department of Primary Industries — Responses to Comments

No.	Recommendation	CHC response
5	***Rehabilitation***	
	With the results provided, it was not possible to determine the quality of the topsoils described. While a detailed assessment of resources is described in Appendix G sub Appendix 1 Section 4, the soil test results provided in Attachment 1 of the same document could not be related to Section 4. This information should be provided to enable a proper assessment.	**Accepted.** This information will be provided in the Mine Rehabilitation Management Plan.
	Table 5.6 in Appendix G provides an example of pasture mix. This mix is unlikely to be successful and contains species such as Rhodes Grass which are no longer regarded as favourable pasture species. Pasture mixes should be aligned with the soil physical and chemical properties along with the local climatic conditions. Table 5.6 should be amended to reflect this. There are a number of areas that will be impacted and require further attention should the development be approved. The following comments provide suggested conditions that deal with the following issues:	**Accepted.** An amended version of Table 5.6 is provided in Table B.2 below.
6	***Change in water use (mitigating potential third-party impacts)***	
	The Cobbora Project will become a substantive high-security water entitlement holder and user in the catchment. To mitigate against any unintended third-party impacts, it is recommended that a collaborative water-management strategy be developed which includes not only the proponent and State Water (the water supplier) but also representatives of water users in the catchment. This expands upon the commitment that is already made in Section 31 (Cobbora Coal Project EA - Part E Commitments and Justification) and Chapter 23 (Statement of Commitments, p.495, Table 23.1).	**Not accepted.** The supply of water through the high-security water entitlements is managed by the State Water Corporation (State Water) and not by individual water users. A water extraction agreement has been reached with State Water that will allow State Water to more effectively and efficiently delivery water from the Cudgegong River. This matter should be discussed directly with State Water.
7	***Agricultural community social impacts***	
	To mitigate against third-party agricultural community impacts, it is recommended that a social-impact mitigation strategy be developed. This strategy should detail an ongoing monitoring strategy and provide triggers for actions consistent with AIS requirements.	**Accepted.** These matters will generally be addressed in the Integrated Land Management Plan that will be prepared in response to PAC Review Recommendation 1.

Table B.2 Amended Table 5.6 in Appendix G of agricultural impact assessment

Pasture species	Application rate (kg/ha)
Autumn sowing	
Oats	10
Cocksfoot	3
Perennial ryegrass	6
Phalaris	3
Sub clover*	4
Red clover*	2
Spring sowing	
Japanese millet	10
Phalaris	5
Paspalum	5
White clover*	2
Lucerne*	3

**Inoculate with appropriate rhizobia and lime pelleted.*

Appendix C

Acid and metalliferous drainage update assessment (15 May 2013)

GeoTerra

COBBORA HOLDING COMPANY PTY LIMITED

COBBORA COAL PROJECT
ACID & METALLIFEROUS DRAINAGE
UPDATE ASSESSMENT

Dunedoo, NSW

COB1-R2B
14 May 2013

GeoTerra PTY LTD **ABN 82 117 674 941**

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COB1-R2B (14 May 2013)

Cobbora Holding Company Pty Ltd
C/- EMGA Mitchell McLennan
PO BOX 21
ST LEONARDS NSW 1590

Attention: Philip Towler

Philip,

RE: Cobbora Coal Project Acid & Metalliferous Drainage Update Assessment

Please find enclosed a copy of the above mentioned report.

Yours faithfully

GeoTerra Pty Ltd

Andrew Dawkins (AuSIMM CP-Env)

Managing Geoscientist

Distribution: Original GeoTerra Pty Ltd
1 electronic copy EMGA Mitchell McLennan
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Authorised on behalf of Geoterra Pty Ltd:	
Name:	Andrew Dawkins
Signature:	
Position:	Managing Geoscientist

Date	Rev	Comments
11.03.2012		Initial Draft
10.04.2013	A	Incorporate reviewers comments
14.05.2013	B	Incorporate reviewers comments

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GLOSSARY OF TERMS

ABCC	Acid buffering characteristic curve measures the readily available portion of the inherent acid neutralising capacity (ANC) of a sample by slow acid titration to a set end-point and then calculation of the amount of acid consumed and evaluation of the resultant titration curve.
Acid	A measure of hydrogen ion (H^+) concentration; generally expressed as pH
Acid Base Account	Evaluation of the balance between acid generation and acid neutralisation processes. Generally determines the maximum potential acidity (MPA) and the inherent acid neutralising capacity (ANC), as defined below.
AMD	Acid and metalliferous drainage caused by exposure of sulfide minerals in mine waste materials to oxygen and water. Typically characterised by low pH and elevated concentrations of salts, sulfate and metals.
ANC	Acid neutralising capacity of a sample as kg H_2SO_4 per tonne of sample.
ANC/MPA Ratio	Ratio of the acid neutralising capacity and maximum potential acidity of a sample. Used to assess the risk of a sample generating acid conditions.
CHPP	Coal handling and preparation plant.
EC	Electrical conductivity, expressed as µS/cm.
CEC	Cation exchange capacity provides a measure of the amount of exchangeable cations (Ca, Mg, Na and K) in a sample.
ESP	Exchangeable sodium percentage provides a measure of the sodicity of a materials and propensity to erode.
Interburden	Waste rock material that lies within a coal seam.
KLC test	Kinetic leach column tests are procedures used to measure the geochemical/ weathering behaviour of a sample of mine material overtime.
MPA	Maximum potential acidity calculated by multiplying the total sulfur content of a sample by 30.6 (stoichiometric factor) and expressed as kg H_2SO_4 per tonne.
NAF	Non-acid forming. Geochemical classification criterion for a sample that will not generate acid conditions.
NAG test	Net acid generation test. Hydrogen peroxide solution is used to oxidise sulfides in a sample, then any acid generated through oxidation may be consumed by neutralising components in the sample. Any remaining acidity is expressed as kg H_2SO_4 per tonne.
NAPP	Net acid producing potential expressed as kg H_2SO_4 per tonne. Calculated by subtracting the ANC from the MPA.
Overburden	Material that overlies a coal resource and must be removed to mine the coal.
PAF	Potentially acid forming. Geochemical classification criterion for a sample that has the potential to generate acid conditions.
(Coal) Reject	Mixture of coarse and finely ground materials from which the desired mineral (coal) values have been largely extracted.
Static test	Procedure for characterising the geochemical nature of a sample at one point in time. Static tests may include measurements of mineral and chemical composition of a sample and the Acid Base Account.
(Coal) Tailing	Finely ground materials from which the desired mineral (coal) values have been largely extracted.
TSF	Tailing storage facility designed for the storage of tailing (fine reject) materials produced during coal processing at the CHPP. Supernatant water may be recycled back to the CHPP from a decant pond.
Total Sulfur	Total sulfur content of a sample generally measured using a 'Leco' analyser expressed as % sulfur.
Uncertain	Geochemical classification criterion for a sample where the potential to generate acid conditions remains uncertain and may require further analysis.
Underburden	Waste rock material that lies beneath a coal seam.

1. INTRODUCTION

Geoterra Pty Ltd (Geoterra) were commissioned by Cobbora Management Company Pty Limited (CMC) to conduct a “Phase Two” laboratory assessment and interpretation of the acid and metalliferous drainage (AMD) potential of the proposed Cobbora Coal Project.

The Cobbora Coal Project is located five kilometres from the village of Cobbora and twenty two kilometres south west of Dunedoo in the Western Coalfield of New South Wales.

The Cobbora Coal Project is a proposed multi-seamed open cut coal mine which consists of Mining Areas A, B and C. Mining is proposed by the conventional truck and excavator method to a maximum depth of 110m.

The potential sources of AMD from the operation include:

- overburden waste rock;
- open pit floors;
- tailings; and
- raw coal and product coal stockpiles.

A “Phase One” investigation was performed in 2010 /11 to assess the AMD potential of the overburden, coal, floor rock and tailings wastes anticipated to be produced from development of the project.

The results, discussion and conclusions relating to this work are presented in Geoterra (2012).

The “Phase One” investigation incorporated sampling, laboratory assessment and interpretation of 59 selected core intervals from overburden, coal seam, seam roof or seam floor material. An additional 11 samples were assessed from tailings sourced from the following drillholes and locations as shown in **Table 1**.

The initial group of samples were tested for AMD parameters, supported by inspection and sampling of drill cores from bores DDH47, DDH49, DDH51 and DDH97 for assessment of the potential overburden AMD, whilst coal intercepts from open hole hammer bores FEH001 and FEH002 were used to assess the potential tailings AMD.

Table 1 Phase One Drill Hole Locations

Hole	Mining Area	Easting	Northing	Total Depth (m)
Overburden				
DDH47	B	710712	6437026	88.0
DDH49	B	713727	6435033	69.3
DDH51	1400m SE of B	715624	6432527	69.5
DDH97	1060m west of A	706882	6443727	123.7
Tailings				
FEH001	A	708662	6441954	Flyblowers / Ulan Seams
FEH002	665m SE of B	714962	6433027	Flyblowers / Ulan Seams

Review of the Phase One study by the NSW Environment Protection Authority (EPA) and the NSW Department of Planning and Infrastructure (DP&I) indicated that as there was some uncertainty in the Phase 1 assessment, additional laboratory analyses would assist in clarifying the prediction, nature and management of AMD at the site.

The Phase Two study involved assessment of an additional 83 overburden and 10 tailings samples.

The Phase One and Phase Two studues are discussed in this report.

1.1 Objectives

The objective of the Phase Two study is to more definitively understand the AMD potential of overburden, coal, floor rock and tailings waste materials that could potentially be produced from the project.

2. PROPOSED MINE PLAN AND SAMPLING LOCATIONS

Multiple open cut mining pits will be developed within the three mining areas shown in **Figure 1**. They are:

- Area A north west of the infrastructure area to 70m deep;
- Area B south west of the infrastructure area to 110m deep; and
- Area C north-east of the infrastructure area to 70m deep.

There will be three out-of-pit waste rock emplacements:

- AC-OOP between mining areas A and C;
- B-OOP E adjacent to Mining Area B on the east side of Laheys Creek; and
- B-OOP W adjacent to Mining Area B on the west side of Laheys Creek.

Further details are contained in Geoterra (2012)

Locations of the proposed workings and sampled drill holes are shown in **Figure 1**.

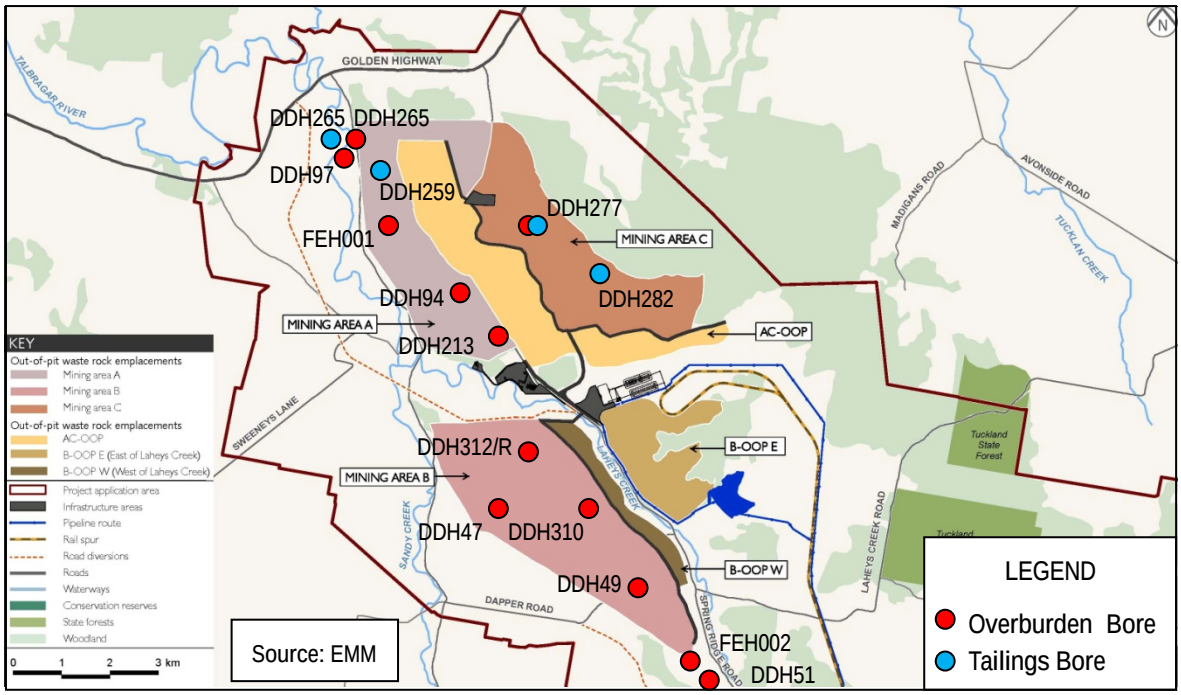


Figure 1 Proposed Mine Layout and Drill Hole Locations

3. GEOLOGY

For details of local geology, see Geoterra (2012).

4. PHASE TWO SAMPLE SELECTION, PREPARATION AND ANALYSIS

Eighty three overburden and ten tailings samples were sourced from from recent exploration drillholes as shown in **Table 2**.

It should be noted that due to core loss during drilling of DDH312, DDH312R was redrilled approximately 10m from DDH312.The core from these two holes was combined in this assessment to represent a “complete” DDH312.

In most cases, the product coal (principally from the Flyblowers and Ulan Seams) and the immediate roof and floor had been removed for metallurgical / washability analysis prior to the AMD sampling process. As such, the presence or absence of pyrite in those seams and adjoing lithologies could not be assessed.

A more detailed assessessment of the overburden and remnant pit walls (wallrock) AMD potential was undertaken in the Phase Two work with samples selected from bores DDH94, 213, 277, 310 312 (and the redrilled hole 312R) .

In addition, 10 samples from four bores remaining after the laboratory coal washability testwork on the Flyblowers, Ulan Upper and Ulan Lower Seams were used to further define the AMD potential of the tailings. The tailings samples represent material that will be a waste stream from the Coal Handling and Preparation Plant (CHPP).

Table 2 Phase Two Drill Hole Locations

Hole (DDH)	Mining Area	Easting	Northing	Total Depth (m)
Overburden				
94	A	709536	6441424	60.5
213	A	710312	6439973	54.0
277	C	711030	6442575	50.8
310	B	712250	6436751	70.3
312	B	711750	6437748	57.3
312R	B	711752	6437748	39.4
Tailings				
259	A	708004	6442999	Flyblowers / Ulan Seams
265	350 west of A	707502	6443998	Flyblowers / Ulan Seams
277	C	711030	6442575	Flyblowers / Ulan Seams
282	C	712980	6441530	Flyblowers / Ulan Seams

The core samples were sent to Sydeny Environmental Soil Laboratory (SESL) for sample crushing and splitting into -75µm and -4mm splits, then despatched to Sydney Analytical Laboratories and MPL Laboratories for sample analysis. Spare splits of each sample were retained in case follow up testing was required.

The nominal four millimetre grain size overburden and tailings samples were tested for $pH_{1:2}$ and electrical conductivity ($EC_{1:2}$) with de-ionised water extracts using a one solid to two part water ratio (weight/weight).

The crushed four millimetre sample de-ionised water overburden and tailings leachate samples were analysed for pH, total dissolved solids (TDS), sulfate and selected metals.

The overburden and tailings samples were analysed for:

- total sulfur (TS) by the Leco method;
- chromium reducible sulfur (CrS) where total sulfur >0.05%, to differentiate between pyritic acid forming sulfur and non-acid forming sulfate species, and;
- acid neutralising capacity (ANC).

The net acid production potential (NAPP) was then calculated using the ANC / TS and the ANC / CrS, and based on the above results, selected samples were subsequently analysed for:

- extended boil Net Acid Generation (NAG), and;
- calculated NAG assessment through analysis of sulfur, calcium, magnesium, sodium, potassium and chloride in the NAG leachate.

As discussed in **Section 5.2.4**, the ten tailings samples were subsequently combined into the Ulan Upper / Ulan Lower (UU/UL), Ulan Upper (UU), Ulan Lower (UL) and Flyblowers (FB) composite samples to facilitate analysis of Net Acid Generation (NAG) - Extended Boil and Calculated NAG tests.

The $pH_{1:2}$ and $EC_{1:2}$ leachate preparation and pH / electrical conductivity (EC) analysis was conducted by Geoterra.

Sydney Analytical Laboratories conducted the Leco total sulfur on the crushed solids, along with the dissolved solids (TDS), sulfate, total and filtered iron and manganese and filtered selected metals on the overburden and tailings one to two ratio leachates.

The chromium reducible sulfur, extended boil NAG and calculated NAG analyses were conducted by MPL Laboratories.

Chromium reducible sulfur analysis was conducted by Envirolab Pty Ltd.

All laboratory work and data analysis was conducted according to procedures outlined in the Australian Coal Association Research Project C15034 (Environmental Geochemistry International et al, 2008) as well as (AMIRA, 2002) and (Price, W.A, 2009).

The laboratory and data interpreation procedures used in this assessment are outlined in Geoterra (2012).

5. PHASE TWO OVERBURDEN ASSESSMENT

A total of 83 overburden samples were assayed for $pH_{1:2}$, $EC_{1:2}$, total sulfur, ANC and NAPP.

Of the 83, 59 samples, 11 of which contained at least 0.05% total sulfur, were tested for ANC, NAPP and single addition NAG.

Of the 83 samples, 48 were subsequently tested for chromium reducible sulfur.

Of the 48 samples, 10 that exceeded 0.05% CrS were subsequently analysed for Extended Boil NAG and calculated NAG assessment as shown in **Table 3**, as well as in **Appendix A**, which contains the laboratory analysis results.

Table 3 Overburden Laboratory Testwork

Hole (DDH)	Total Sulfur Tests	Cr Reducible Sulfur Tests	Extended Boil NAG Tests	Calculated NAG Tests
94	12	4	1	1
213	16	9	3	3
277	10	2	0	0
310	18	12	3	3
312 / 312R	27	21	3	3
TOTAL	**83**	**48**	**10**	**10**

A flow chart of the initial assessment process is shown in **Figure 2**, whilst the NAG assessment process is shown in **Figure 3**.

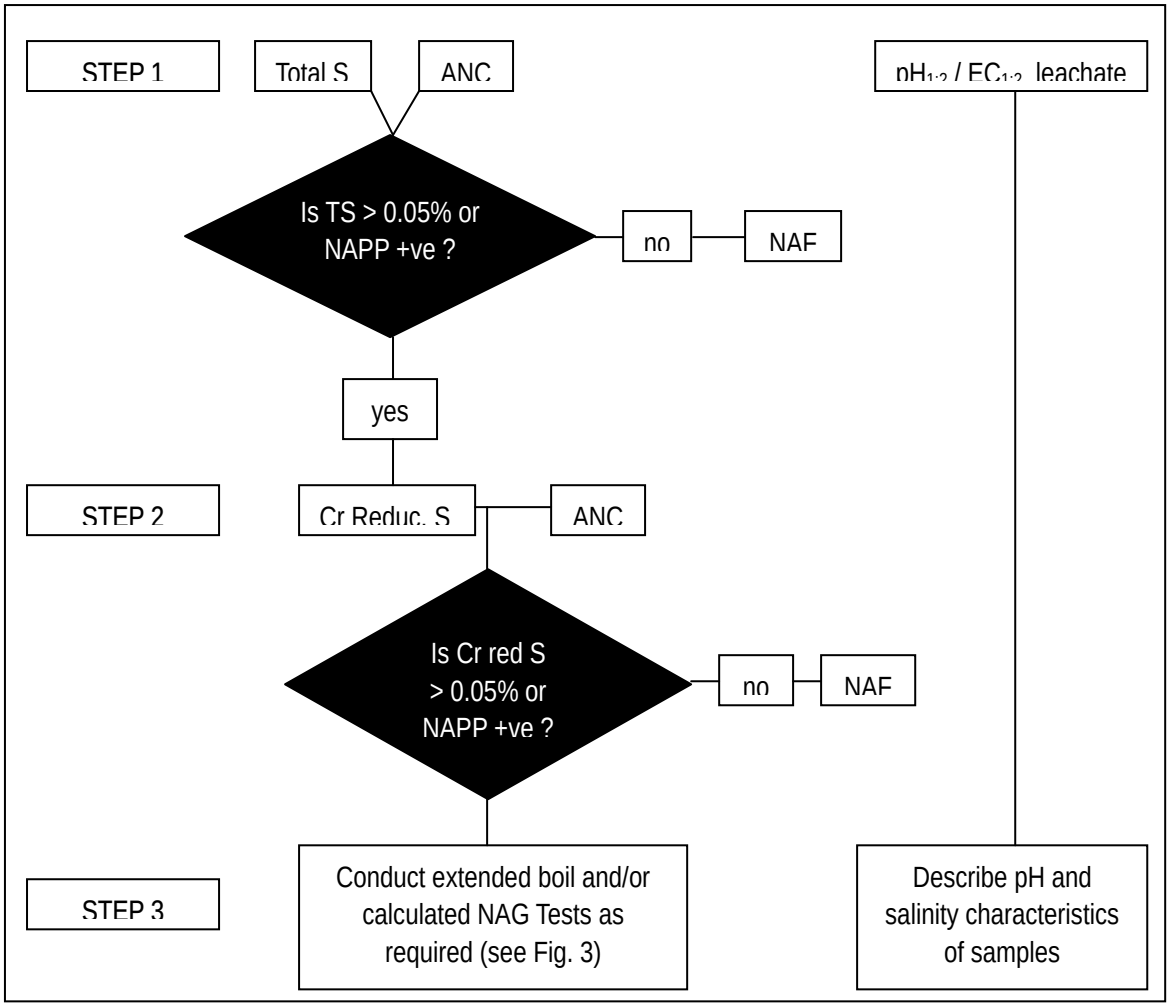


Figure 2 Initial Screening Test Protocol

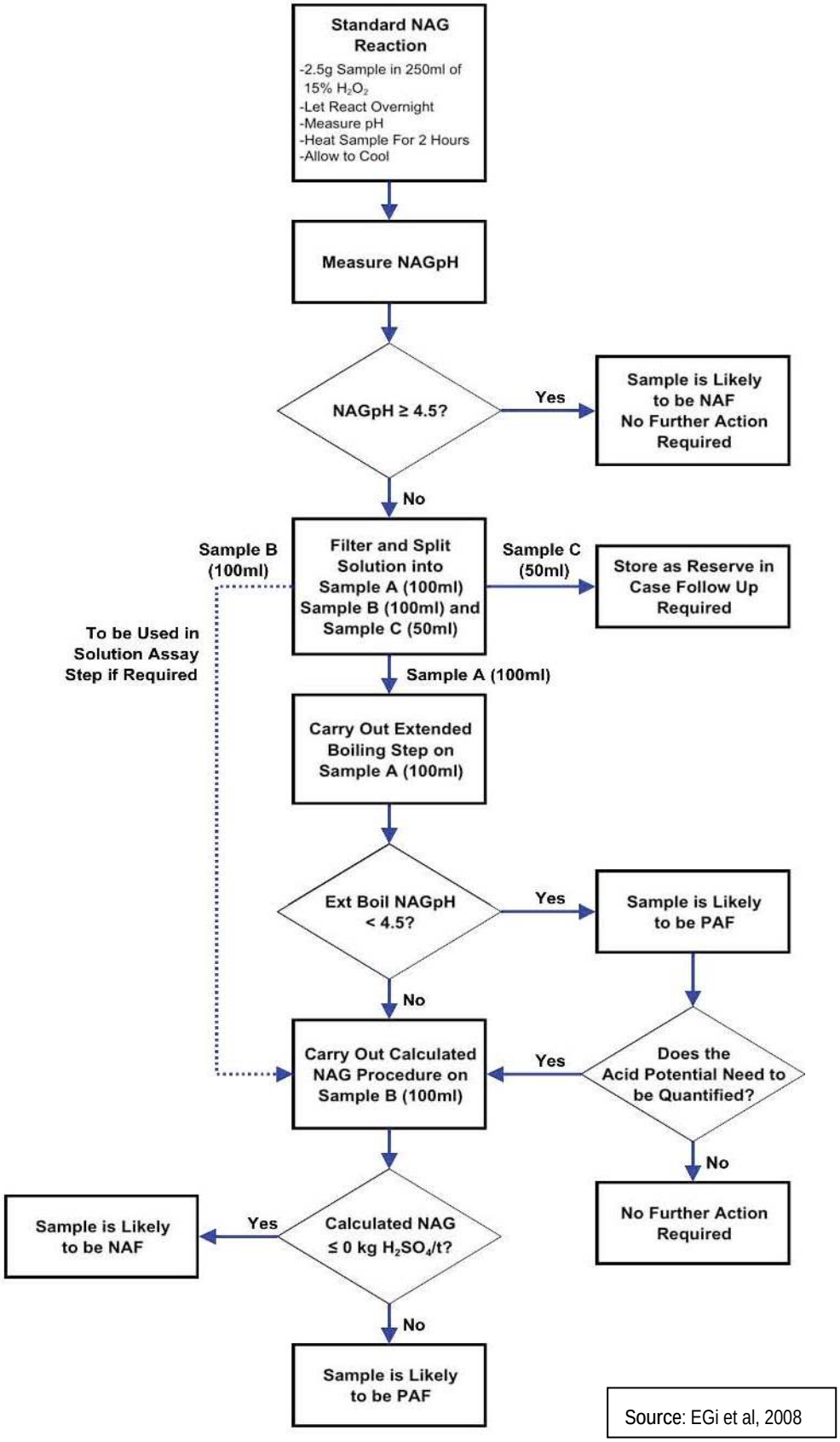


Figure 3 Extended Boil and Calculated NAG Test Protocol

The 83 $pH_{1:2}$ and $EC_{1:2}$ tests were conducted by equilibrating the sample in deionised water for a minimum of 1 month at a solid to water ratio of one:two (w/w) to provide an indication of the potential leachate acidity and salinity.

5.1 Leachate pH and Salinity

The $pH_{1:2}$ of the composite bore leachates ranged from 2.58 – 6.38, the medians ranging from 3.80 – 5.95, indicating some potential acidity. The samples with the lowermost pH were associated with coal, carbonaceous lithologies, conglomerate and tuff.

The results indicated that the overburden, as represented by the samples, could generate acidic leachate. However further assessment was undertaken to further quantify this potential as discussed in the Extended Boil and Calculated NAG tests in Section 5.2.4.

The $EC_{1:2}$ values ranged from 176 - 2420µS/m with bore composite medians ranging from 353 - 503µS/m.

The results indicate the overburden as represented by the samples generally contains low to moderate salinity.

This assessment was conducted using a sample to water ratio of one to two, however the tests have also been conducted by other researchers using a ratio of one to five. In this instance, the one to two ratio ratio would provide a “worst case” scenario, as the actual overburden emplacements final seepage water quality will be affected by an undefined and ongoing rainwater or seepage dilution rate.

Table 4 Overburden Leachate Summary

Hole (DDH)	pH	EC µS/cm
94	3.25 – 5.21 (median 4.10)	176 – 1336 (median 392)
213	2.58 – 5.14 (median 3.80)	242 – 2420 (median 503)
277	4.13 – 6.00 (median 4.60)	292 – 691 (median 370)
310	3.29 – 6.38 (median 5.95)	280 – 905 (median 423)
312 / 312R	3.19 – 6.05 (median 4.67)	225 – 772 (median 353)

5.2 Acid Neutralisation, Sulfur and Net Acid Production Potential

5.2.1 Acid Neutralisation Capacity

The acid neutralisation capacity (ANC) of the 83 tested samples ranged up to a low value of 0.59% $CaCO_3$ (which is equivalent to 5.9kg H_2SO_4/t).

5.2.2 Sulfur

Total sulfur in the 83 overburden samples ranged up to 1.6% total sulfur (TS).

Of the 48 total sulfur samples that exceeded 0.05%TS, the maximum chromium reducible sulfur (CrS) concentration, which represesents sulfide sulfur (i.e. excluding sulfate and organic sulfur), ranged up to 0.57%.

As shown in **Appendix A**, total sulfur and chromium reducible sulfur is highest in samples dominated by coal, followed by carbonaceous shale then shale and sandstone lithologies.

Note that the pyritic sulfide sulfur value should be treated as a guide to the pyrite content in a sample due to issues with variability in the chromium reducible sulfur method.

In general, the total sulfur values include sulfur species present as low risk organic and non-acid sulfate sulfur.

Table 5 Overburden ANC and Sulfur Maximum Values

Hole (DDH)	ANC (as $CaCO_3$)	Total Sulfur %	Chromium Reducible Sulfur %
94	0.01	0.12	0.05
213	0.55	0.59	0.12
277	0.21	0.18	0.01
310	0.59	0.48	0.22
312 / 312R	0.31	1.6	0.57

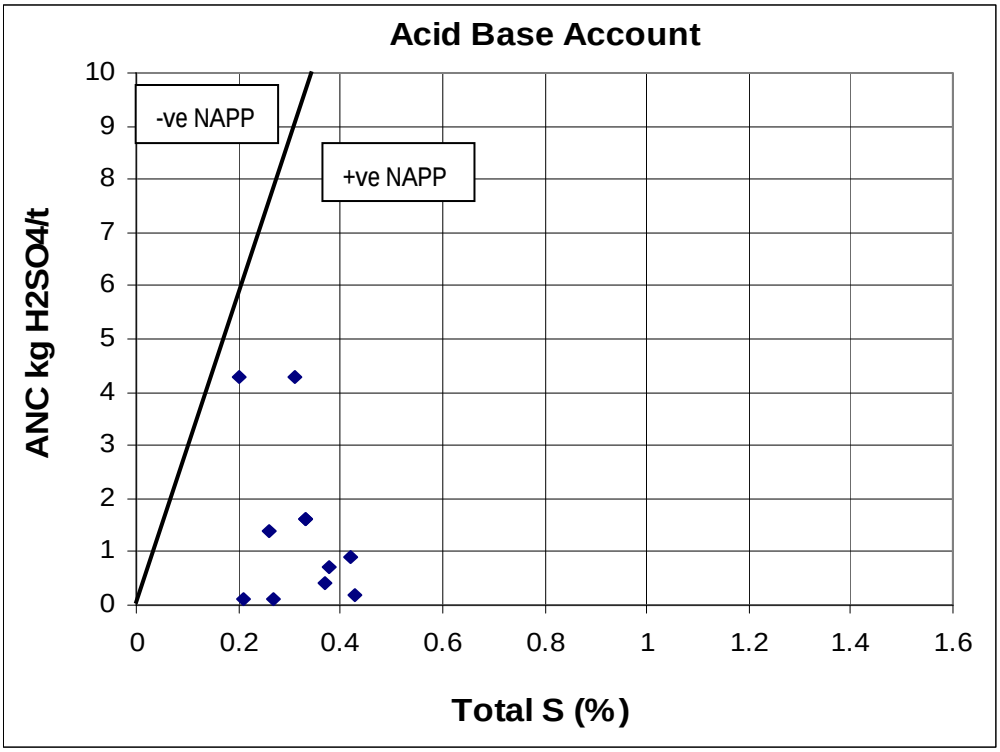
5.2.3 Net Acid Production Potential

A plot of the samples tested for total sulfur / ANC as well as CrS / ANC indicates the samples have a low, although positive potential for acid drainage as shown in **Figure 4** and 5.

The net acid producing potential (NAPP) acid-base account plot of total sulfur and ANC in **Figures 4** and 5 represents the balance between MPA and the ANC.

Appendix A includes a re-calculated NAPP based on the proportion of acid generating chromium reducible sulfur and ANC. Results using the chromium reducible sulfur (sulfide) values indicate the NAPP is lower in all five cases that were re-tested.

Results show that plots of the sulfide sulfur (as opposed to total sulfur) against ANC, all have a lower potential NAPP.



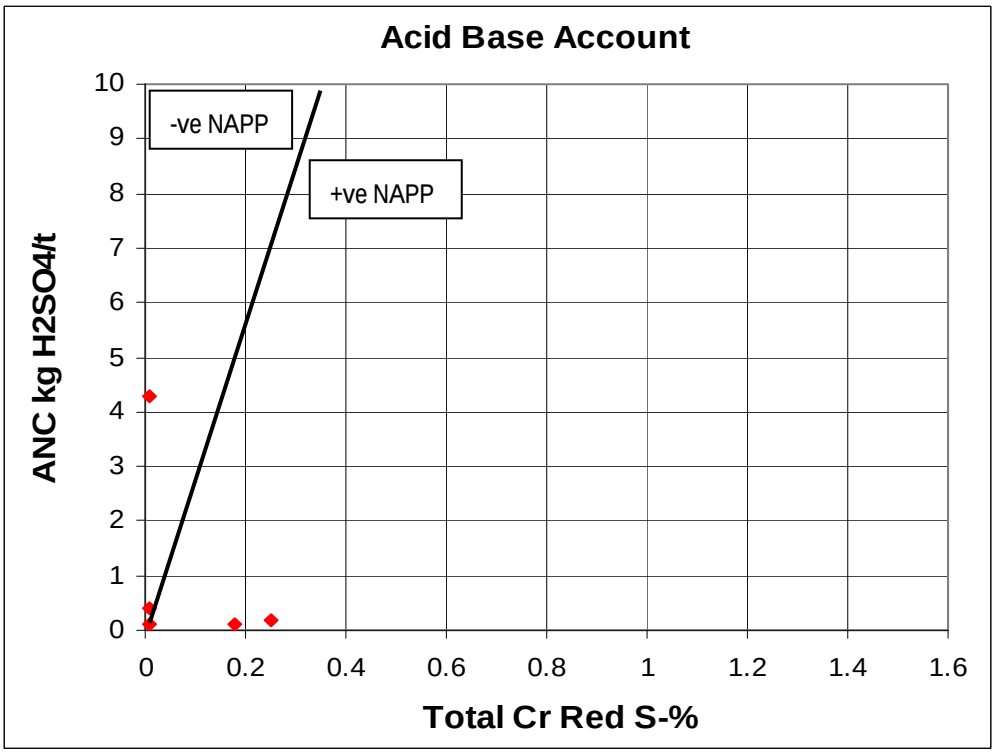
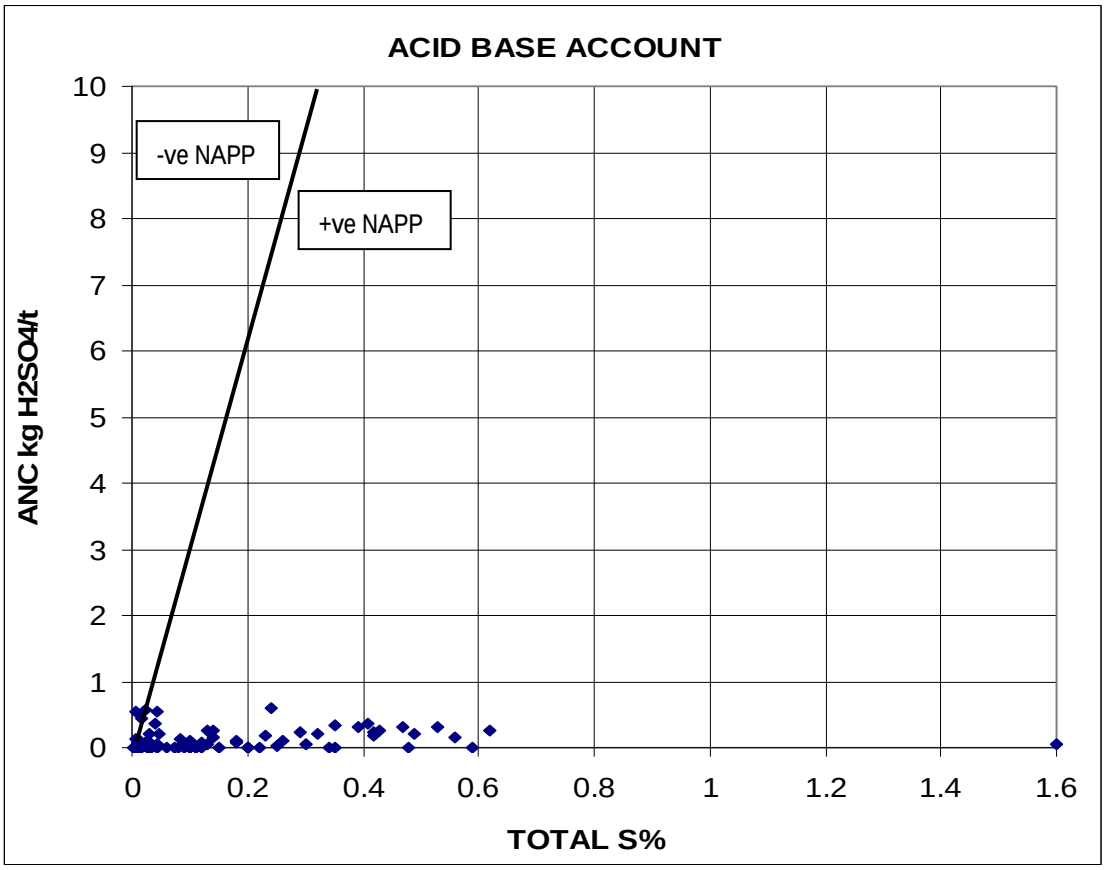


Figure 4 Phase One Overburden Acid Base Account



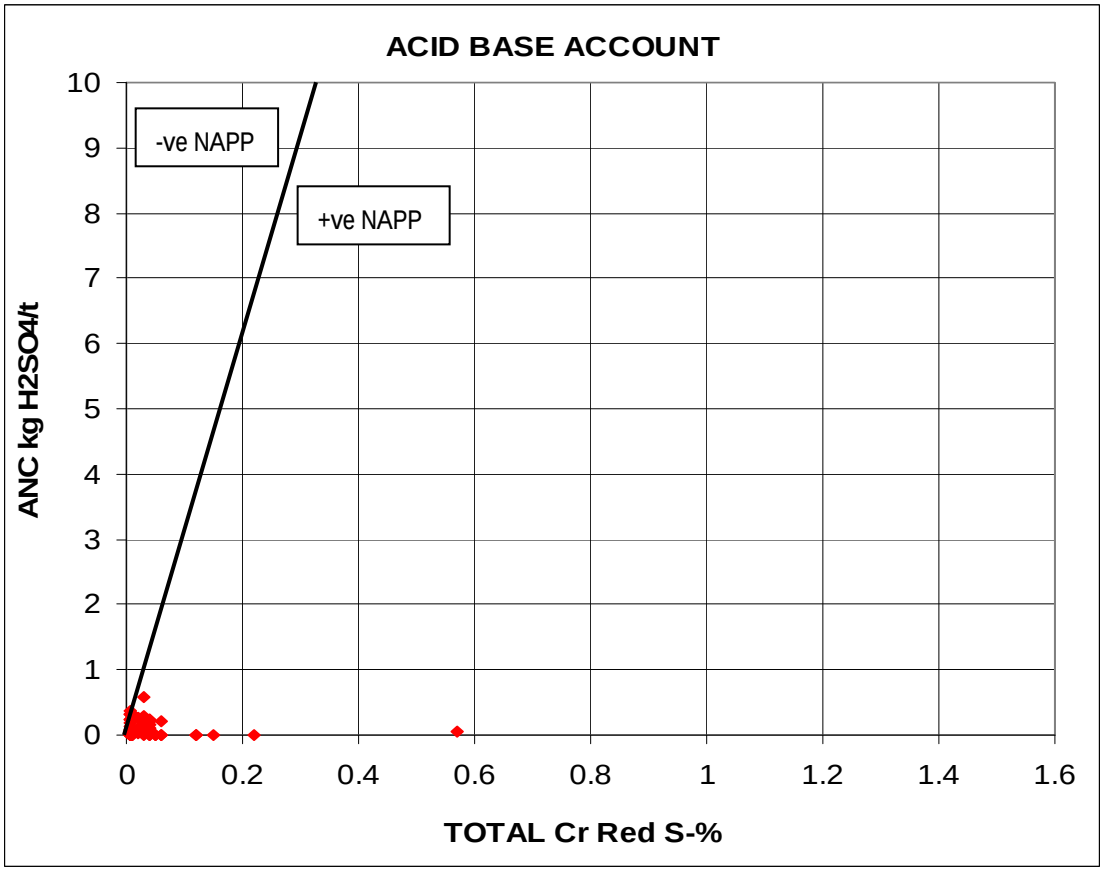


Figure 5 Phase Two Overburden Acid Base Account

5.2.4 Extended Boil NAG

Four tests were conducted on the tailings composite samples UU/UL, FB, UU and UL by conducting both the single step NAG test and the extended Boil NAG tests as shown in **Table 6.**

Table 6 Single Step and Extended Boil Tailings NAG Tests

Sample	Single Step pH	Extended Boil pH
UU / UL	2.4	5.3
FB	2.9	5.4
UU	2.7	5.5
UL	2.3	5.7

The single step test indicates a NAG acidity after oxidation of the samples with hydrogen peroxide of pH 2.3 – 2.9.

The extended boil step, which is conducted on the single step NAG liquor, indicates a final pH of between 5.3 and 5.7. The higher pH observed after extended boiling is due to the organic acids remaining after the single step liquor breaking down on boiling the liquor.

The organic acids are generated from the strong oxidation of the carbonaceous components of the sample by hydrogen peroxide and therefore the low “single step” pH result is due to both sulfuric acid and organic acid effects in the laboratory testing.

The extended boil results therefore represent the more likely pH that will occur in reality due to oxidation of sulfide minerals in the waste.

Extended boil NAG tests were conducted on the 10 overburden samples which exceeded or equalled both 0.05% TS and CrS.

The results are shown in **Table 7.** The results indicate that, of the ten highest sulfide containing samples in the total suite of 83 overburden samples, 6 samples generated a pH of below 4.5 (7%). In other words, 77 of the 83 samples would produce a pH on oxidation of above 4.5, which is deemed to be the discriminator between acid generating and no acid generating samples as outlined in **Appendix A** of Geoterra (2012).

It should be noted however that the procedure notes associated with the Extended Boil NAG test methodology Geoterra (2012) can be used to confirm samples are PAF, but does not necessarily mean that samples with pH greater than 4.5 are NAF due to some potential loss of free acid during the extended boiling procedure.

Table 7 Overburden Extended Boil NAG Results

Sample	Depth (m)	Extended Boil NAG pH	Lithology
DDH94	45.09 – 45.36	6.6	claystone / coal
DDH213	22.17 – 22.46	3	tuff, claystone, carb. siltstone
DDH213	23.59 – 23.81	3.1	tuff, claystone, carb. claystone
DDH213	43.44 – 43.8	4.8	coal, claystone
DDH310	18.57 – 18.74	3.0	conglomerate
DDH310	38.47 – 38.67	6.5	coal, sandstone
DDH310	55.63 – 55.82	3.4	conglomerate
DDH312	12.18 – 12.43	4.2	coal, claystone
DDH312	22.82 – 23.04	2.6	carb. mudstone, claystone, coal
DDH312	24.17 – 24.37	7.6	coal, carb. mudstone, claystone

5.3 Calculated NAG Tests

To address the uncertainty discussed in the previous sections, a potential NAG value was calculated from concentrations of S, Ca, Mg, Na, K and Cl ions in the Extended Boil NAG leachate for the ten tested samples as shown in **Table 8**.

Table 8 Overburden Calculated NAG

Sample	Depth (m)	Calculated NAG kg H_2SO_4/t	Lithology
DDH94	45.09 – 45.36	2	claystone / coal
DDH213	22.17 – 22.46	11	tuff, claystone, carb. siltstone
DDH213	23.59 – 23.81	11	tuff, claystone, carb. claystone
DDH213	43.44 – 43.8	3	coal, claystone
DDH310	18.57 – 18.74	18	conglomerate
DDH310	38.47 – 38.67	2	coal, sandstone
DDH310	55.63 – 55.82	6	conglomerate
DDH312	12.18 – 12.43	4	coal, claystone
DDH312	22.82 – 23.04	40	carb. mudstone, claystone, coal
DDH312	24.17 – 24.37	0	coal, carb. mudstone, claystone

A calculated NAG less than or equal to 0.0kg H_2SO_4/t indicates the sample is potentially NAF, whilst greater than 0.0kg H_2SO_4/t indicates it may be PAF.

The results therefore indicate that of the ten “worst” samples in the total suite of 83 samples, four of the 83 samples (5%) could produce a moderate degree of AMD.

5.4 Overburden AMD Classification

The potential AMD classifications are provided in **Appendix A** based on results and discussions outlined in the previous sections.

All samples with less than or equal to 0.05% TS and 0.05% CrS were classified NAF due to the negligible risk of acid formation.

Further clarification of the AMD status for samples exceeding 0.05% TS was then conducted with reference to the Extended Boil NAG, calculated NAG and one to two ratio leachate tests.

A summary of the overburden AMD classification is shown in **Table 9**, which is based on the sequential test results shown in **Appendix A**.

Table 9 Overburden AMD Classification Summary

Category	Number of Samples	% of Total Samples
Non-acid Forming (NAF)	74	89
Potentially Acid Forming – Low Capacity (PAF-LC)	8	9.8
Potentially Acid Forming	1	1.2

There is a close association of PAF–LC and PAF samples implied by ‘association’ as opposed to a more definative relationship, eg ‘all’ with coal and carbonaceoues lithologies, generally immediately adjacent to or within the Trinkey, Whaka, Ulan Upper and Ulan Lower seams.

The available data from both Phase One and Phase Two testing indicates the potentially acid forming materials are associated within or adjacent to the coal seams, with no particular seam being more prevalent to generate AMD than the others. However, the highest recorded AMD potential was from the Whaka Four seam in DDH312 between 22.82 – 23.04 mbgl in a carbonaceous mudstone, claystone and coal interval.

The economic Ulan and Flyblowers coal seams and their associated carbonaceous lithologies with the higher total sulfur content will predominantly be extracted, washed in the CHPP and exported offsite as product coal, with the washery waste (also known as tailings) placed in a tailings storage facility.

The overburden, which is to be placed in the waste rock emplacements, has TS concentrations ranging from 0.002 – 1.6% for the suite of 83 samples in the Phase Two testwork, and a chromium reducible sulfur (i.e. sulfidic sulfur) range of 0.005 - 0.57% for the 48 sample sub-set, which indicates a non-acid forming (NAF) to low overall “bulk” risk of AMD generation.

Although 8% of samples are PAF-LC and 1% is PAF, it is unlikely that the overall bulk waste overburden material would result in AMD due to operational mixing with the NAF overburden, even though the ANC of the overburden is low (ie, less than 5.9kg H_2SO_4/t and median range of 0.01 – 0.26kg H_2SO_4/t).

Overall, the coal seams and their shale dominated, carbonaceous roof and floor lithologies appear to contain relatively low pyritic sulfur, which means they have a low AMD potential.

Due to the low acid neutralisation capacity (ANC) values, and, as a result, their low buffering potential, acid buffering characteristic curve (ABCC) testing was not conducted on the samples.

Although there is not a signifcant excess of ANC compared to MPA (calculated from total S), due to the low potential acid production potential of the positive NAPP results, it is considered there is a low likelihood of AMD conditions developing from overburden waste represented by these samples.

5.5 Overburden Leachate Results

Laboratory analysis for composites of the one:two ratio solid:water “Phase Two” overburden samples are shown in **Table 10**.

The data is compared to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000). The ANZECC/ARMCANZ (2000) freshwater trigger values (95% level of protection) were selected as the area is moderately disturbed, whilst the ANZECC/ARMCANZ (2000) guidelines for upland rivers in south-east Australia are also referenced as the site is above 150m altitude.

As shown in **Table 10**, the parameters that exceeded trigger values for freshwater upland streams and protection of 95% of aquatic species were: Al, Cd, Cu, Pb, Ni and Zn.

As the results are derived from pulverised samples, where the surface area in contact with water is much greater than in a typical overburden emplacement area, and that further dilution is likely in the field due to mixing with rainfall and clean surface runoff, the laboratory based results are likely to represent a potential ‘worst case' scenario.

It should be noted that the discharge water quality from the waste emplacement/s will be represented by a combination of the individual bore analyses, as opposed to a single bore water quality leachate result. For example, although notably elevated results for copper, lead and zinc are present in Bore DDH213, the combined water quality leachate will be notably lower than the individual bore peak value.

On this basis, the risk of metalliferous runoff and seepage above the ANZECC 2000 criteria from the overburden and wallrock is anticipated to be low to moderate.

Table 10 Overburden and Wallrock Composite Drillhole Leachates (mg/L)

	ANZECC/ARMCANZ 2000	DDH94	DDH213	DDH277	DDH310	DDH312/R	Wall
pH	6.5 – 7.5	3.6	3.2	5.6	6.7	4.3	6.2
TDS	350	280	250	260	290	235	220
SO4	_	145	170	110	100	100	80
Al	0.055 (for pH>6.5)	6.5	32	0.04	0.01	0.55	0.02
As	0.024 (As III)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cd	0.0002	**0.0036**	**0.037**	<0.0002	<0.0002	**0.0014**	<0.0002
Co	_	1.0	2.8	0.06	0.16	0.08	0.16
Cu	0.0014	**0.016**	**0.72**	0.009	**0.036**	**0.015**	**0.045**
Fe	_	52	23	14	56	7.5	92
Fe (filt)	_	0.08	5.9	0.02	0.01	0.14	0.04
Pb (filt)	0.0034	**0.041**	**0.78**	**0.004**	<0.001	**0.009**	0.003
Mn	1.9	0.39	0.59	0.27	1.2	0.47	**2.7**
Mn (filt)	1.9	0.36	0.55	0.26	0.41	0.43	0.67
Ni (filt)	0.011	**0.97**	**4.0**	**0.08**	**0.33**	**0.11**	**0.15**
Se (filt)	0.011	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sr (filt)	_	0.067	0.046	0.039	0.088	0.044	0.047
$Sn_{organic}$ (filt)	_	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zn (filt)	0.008	**3.2**	**10.0**	**0.11**	**0.069**	**0.32**	**1.1**

NOTE: ANZECC/ARMCANZ (2000) provides trigger values for protection of 95% of aquatic freshwater species and trigger values for physical and chemical stressors for upland streams in NSW

_ no outlined criteria

6. PHASE TWO TAILINGS ASESSMENT

Ten samples of potential tailings from coal preparation laboratory trials were obtained from four crushed drill core samples (DDH259, 265, 277 and 282) from the Flyblowers, Ulan Upper and Ulan Lower Seams within the proposed Mining Areas A and C, as outlined in **Table 2**.

The acid forming characteristics of the 10 coal preparation laboratory trial reject samples are presented in **Appendix A**, with the samples analysed for total S, chromium reducible sulfur ANC, Total sulfur and sulfide sulfur NAPP, as well as $pH_{1:2}$ and $EC_{1:2}$ leachate tests.

Composites of the four tailings samples for each seam were subsequently combined to form a seam specific composite samples that was tested for the NAG and Extended Boil NAG test as well as calculated NAG.

6.1 Leachate pH and Salinity

The $pH_{1:2}$ ranged from 3.47 – 5.8, with a median of 5.04 for the ten tailings samples, which indicates there is minor potential bulk acidity in the tailings, whilst $EC_{1:2}$ ranged from 286 - 1128µS/cm, with a median of 411µS/cm, as shown in **Appendix A**.

As the salinity results are derived from pulverised samples, where the surface area in contact with water is much greater than at a typical coal tailings emplacement area, and anticipating that further dilution is likely in the field, this laboratory based result is likely to represent a “worst case” scenario.

This assessment was conducted using a sample to water ratio of one to two ratio, however the tests have also been conducted by other researchers using a one to five ratio. In this instance, the one to two ratio would provide a “worst case” scenario, as the actual tailings final seepage water quality will also be affected by an as yet undefined and ongoing rainwater runoff and seepage dilution rate.

On this basis, the risk of saline runoff and seepage from the tailings is anticipated to be low.

6.2 Acid Neutralisation, Sulfur and Net Acid Production Potential

6.2.1 Acid Neutralisation Capacity

The acid neutralisation capacity (ANC) of the 10 tested samples ranged up to a relatively low value of 0.56% $CaCO_3$ (which is equivalent to 5.6kg H_2SO_4/t).

6.2.2 Sulfur

Total sulfur in the tailings samples ranged from 0.10 - 0.55%, with a median of 0.28%.

Of the 10 samples, all exceeded 0.05% total sulfur.

For the sulfide sulfur tests, as represented by chromium reducible sulfur analysis, the sulfur content ranged from 0.01 – 0.32%, with a median of 0.03%.

A plot of total and sulfide sulfur against ANC indicates the samples have a generally low, although potentially acid forming – low capacity (PAF-LC) capacity for acid drainage as shown in **Figures 6** and **7**.

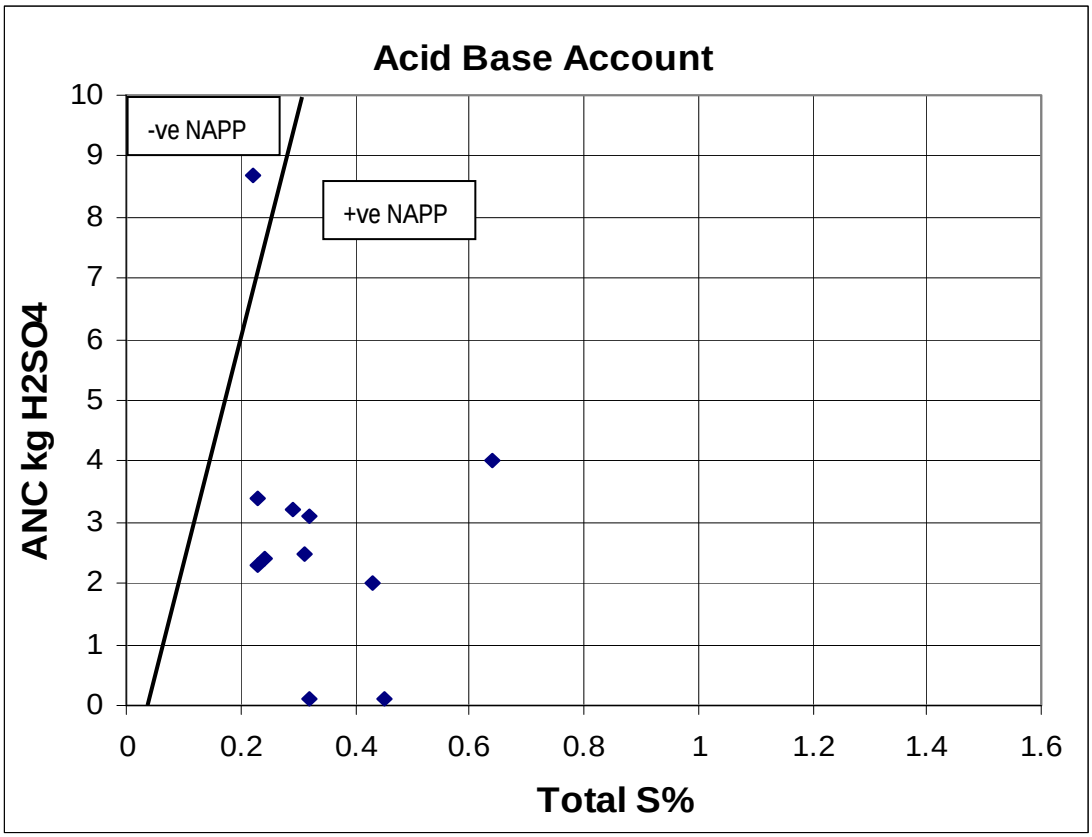
Total sulfur is highest in samples from the Flyblower and Ulan Upper seams, followed by the Ulan Lower Seam.

Results show that by plotting the chromium reducible (sulfide) sulfur, as opposed to total sulfur, against ANC, all of the samples have a lower potential NAPP, and are now all potentially non-acid forming, although two samples in the Flyblowers and 1 in the Ulan Upper Seam may be marginally PAF-LC.

The sulfide sulfur assessment is a better representative of what sulfuric acid based runoff could occur from the tailings, as the total sulfur based values also include the oxidised sulfate and organic forms of sulfur, which do not form sulfuric acid.

The highest NAPP using total sulfur was 16.6kg H_2SO_4/t in the Flyblowers Seam which reduced using chromium reducible sulfide sulfur to 3.1kg H_2SO_4/t.

The majority of samples occur in the Non Acid Forming (NAF) category.



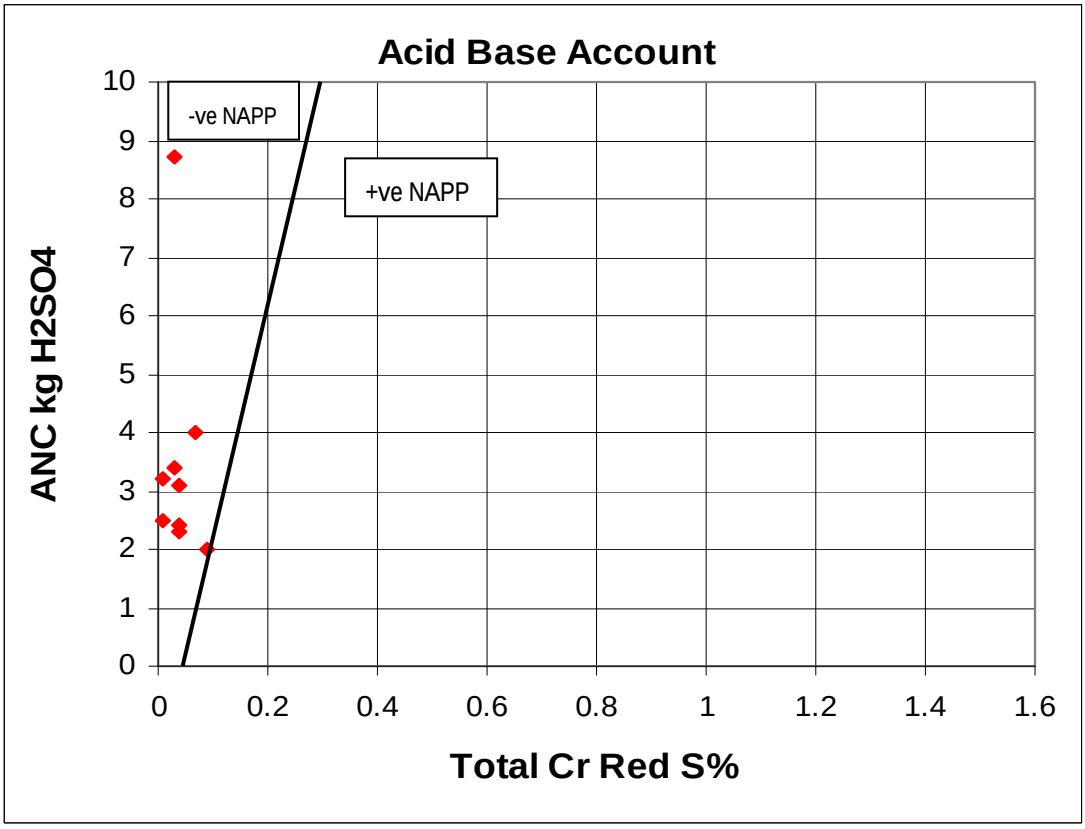
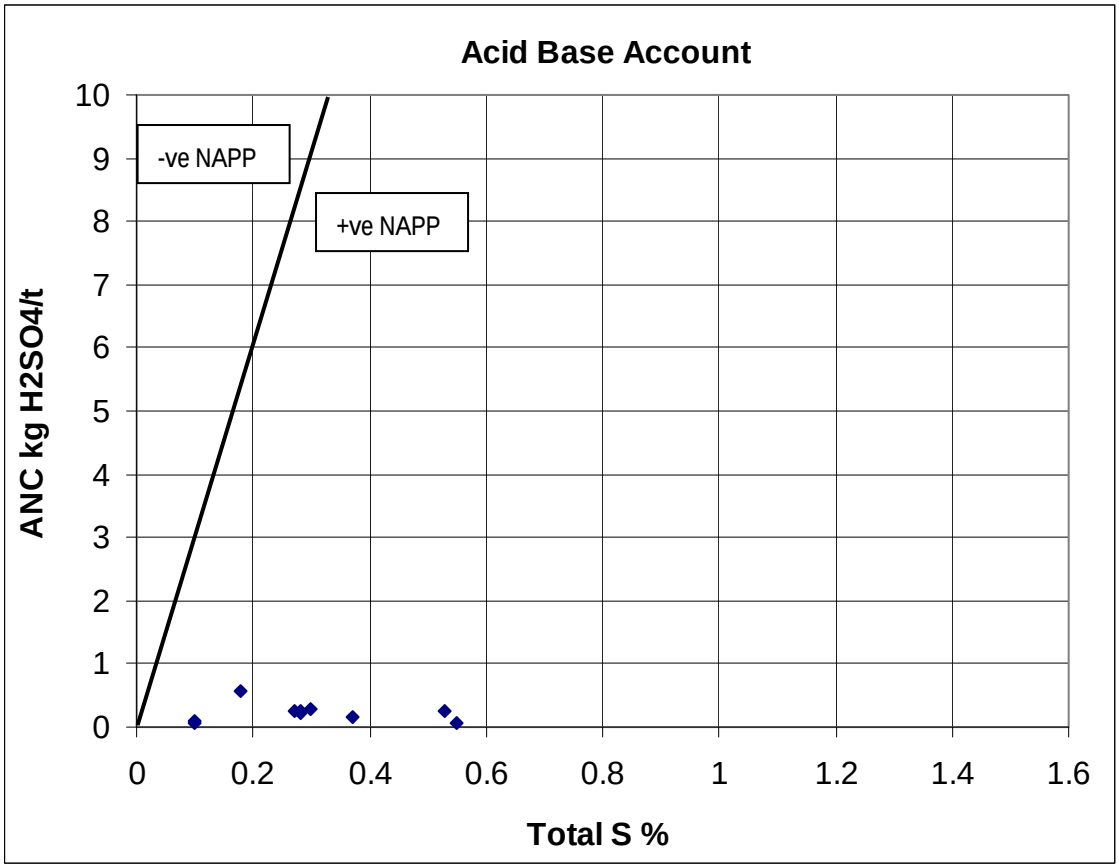


Figure 6 Phase One Tailings Acid Base Account



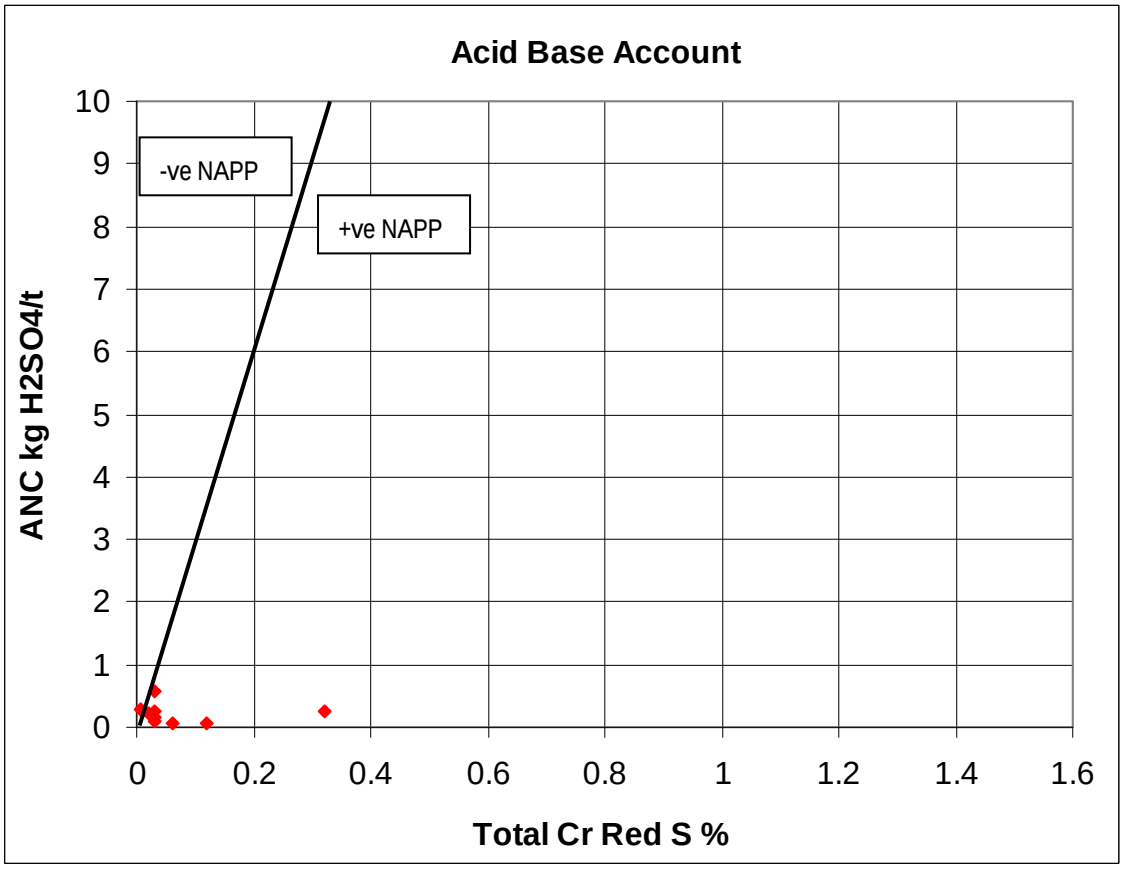


Figure 7 Phase Two Tailings Acid Base Account

6.2.3 Extended Boil NAG

Further investigation was conducted to determine the acid production potential of the coal seam composite tailings samples using an Extended Boil NAG test.

The initial single step NAG results ranged from pH 2.3 – 2.7, however after the Extended Boil step, which is used to reduce the effects of organic, rather than sulfuric acids on the final result, had pH between 5.3 and 5.7. This indicates the composite (albeit seam specific) samples are Non Acid Forming (NAF).

6.3 Calculated NAG

A potential NAG value was calculated from concentrations of S, Ca, Mg, Na, K and Cl ions in the NAG leachate for the four, seam specific, composite samples.

The flyblowers composite had a calculated NAG of 10kg H_2SO_4/t, indicating it has a low potential for acid production, whilst the other three samples generated 4kg H_2SO_4/t, indicating a very low acid production potential.

6.4 Tailings AMD Classification

The potential acid and metalliferous drainage (AMD) classifications of tailings are provided in **Appendix A** based on results and discussions outlined in the previous sections.

No tailings samples contained below 0.05% total S as shown in **Appendix A**, which means that on a first pass basis, there is potential for the samples to potentially produce AMD, and that further testwork was required to characterise the AMD potential as outlined in previous sections.

A summary of the tailings AMD classification is shown in **Table 11**.

Table 11 Tailings AMD Classification Summary

Category	% of 10 individual samples	% of 4 composite seam samples
Non-acid Forming (NAF)	30	75
Potentially Acid Forming – Low Capacity (PAF-LC)	70	25

Overall, the results indicate that the tailings should be non-acid forming to potentially acid forming (low capacity) due to the very low to low chromium reducible sulfur levels (ie low pyrite), with the highest sulfur (maximum 0.32% chromium reducible S) contained in the Flyblower Seam in borehole DDH265.

The PAF-LC tailings has potentially low overall acid production capacity, with less than 7.2kg H_2SO_4/t when only pyritic sulfur data is used.

It is unlikely that these materials would result in AMD due to operational mixing with surrounding higher NAF tailings, even though the ANC is not high, with less than 5.6kg H_2SO_4/t (median 2.4kg H_2SO_4/t).

Due to the low acid neutralisation capacity (ANC) values, and, as a result, their low buffering potential, acid buffering characteristic curve (ABCC) testing was not conducted on the samples.

Although there is not a signifcant excess of ANC compared to MPA (calculated from chromium reducible sulfur), due to the low potential acid production potential of the positive NAPP results, it is considered there is a low likelihood of AMD developing from tailings represented by these samples.

6.5 Tailings Leachate Results

The ten Phase Two individual drill core based leachate samples from four drill holes were combined into one composite sample that was analysed for TDS, sulfate and pH, as well as major metals as shown in **Table 12**. The initial “Phase One” results from the previous study Geoterra (2012) are also shown for comparison.

The tested lithologies exceeding the ANZECC/ARMCANZ (2000) trigger values for freshwater upland streams and protection of 95% of aquatic species as summarised in **Table 12**, with the parameters exceeding the trigger values pH, Ni, Cd, Cu, Pb and Zn, in the Phase Two composite.

Table 12 Tailings Leachate Analyses (mg/L)

Seam	ANZECC / ARMCANZ 2000	Phase 2 Combined Seams	Phase 1 Trinkey	Phase 1 Whaka	Phase 1 Flyblowers	Phase 1 Ulan Upper	Phase 1 Ulan Lower
pH	6.5 – 7.5	**4.6**	6.9	**7.9**	**7.9**	7.2	7.2
TDS	350	265	250	320	230	190	160
SO4	_	110	48	51	43	24	390
Al (filt)	0.055 (for pH>6.5)	1.2	0.02	0.01	<0.01	<0.01	<0.01
As (filt)	0.024 (As III)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cd (filt)	0.0002	**0.0082**	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Cr (filt)	0.001 (CrVI)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Co (filt)	_	0.75	0.057	<0.001	<0.001	<0.001	<0.001
Cu (filt)	0.0014	**0.069**	0.001	<0.001	0.001	0.001	0.001
Fe (total)	_	28	_	_	_	_	_
Fe (filt)	_	0.81	0.01	<0.01	<0.01	<0.01	<0.01
Pb (filt)	0.0034	**0.082**	<0.001	<0.001	<0.001	<0.001	<0.001
Mn (total)	1.9	1.4	_	_	_	_	_
Mn (filt)	1.9	1.3	0.16	0.17	0.16	0.13	0.18
Ni (filt)	0.001	**0.64**	**0.07**	<0.01	<0.01	<0.01	<0.01
Se (filt)	0.011	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sr (filt)	_	0.12	0.089	0.22	0.270	0.051	0.070
$Sn_{organic}$ (filt)	_	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zn (filt)	0.008	**1.4**	**0.081**	0.001	0.002	0.003	0.007

NOTE:

ANZECC/ARMCANZ (2000) trigger values For Protection of 95% of Aquatic Freshwater Species and Trigger Values For Physical and Chemical Stressors for SE Australian Upland Streams

7. FINDINGS SUMMARY

Combination of the Phase One and Phase Two assessments work indicates the following;

7.1 Overburden

The results indicate that:

- 89% of the overburden samples tested are non-acid forming,
- <10% are potentially acid forming – low capacity, and;
- <1% are potentially acid forming

The majority of potentially acid forming materials are associated with the coal seams and associated overburden, interburden and underburden carbonaceous materials, with no particular bias toward any one seam. The highest individual analysis of chromium reducible (sulfide) sulfur was encountered in the Whaka Seam (sub unit four) with a concentration of 0.57%.

The economic coal seams and their associated carbonaceous lithologies with the higher total sulfur content will predominantly be extracted, washed in the CHPP and sold as product coal, with the waste material placed in tailings dams or in approved coarse reject waste emplacement areas.

The remainder of the uneconomic coal and carbonaceous units, such as the Whaka and Trinkey seams and their interburden will be placed on the waste rock emplacements.

Results to date indicate the Whaka and Trinkey Seam waste has a median (sulfide) sulfur level of 0.01 - 0.03%, with an overall low risk of AMD generation (which incorporates the individual analysis of 0.57%).

Due to the limitation of the lower number of samples tested in the Phase One study for chromium reducible sulfur, and the biased sampling toward high (sulfide) sulfur samples in that study based on samples selected from the total sulfur results, the (sulfide) sulfur Phase One results are not discussed further.

Overall, the overburden and pit floor materials from the proposed Cobbora Open Cut coal mine are likely to be non-acid forming (NAF).

Preliminary investigation of the Whaka and Trinkey Seam potential overburden waste material indicate they have a low potential for acid generation.

Potential coarse reject from the CHPP that may be sent to the waste emplacement from the Flyblower, Ulan Upper and Ulan Lower could not be tested as part of this study as no samples were available after the laboratory product coal washability trials.

It is anticipated that although limited sulfuric acid drainage from oxidation of pyritic material may occur, it is likely to be predominantly from the uneconomic coal seams and associated overburden (waste rock above the Flyblower Seam), interburden (waste rock between the economic coal seams) and underburden (beneath the Ulan Lower Seam).

Although current data indicates the remaining waste has low ANC, mixing of mined waste material should limit any isolated AMD that may be generated primarily from the uneconomic coal and carbonaceous wastes.

Salinity is low for the overburden waste, with the more elevated leachates generally sourced from the weathered overburden or carbonaceous samples. Overall, the median leachate generated from the overburden was 238µS/cm in the Phase One suite and 407µS/cm for Phase Two, whilst the highest individual sample returned a salinity of

1161µS/cm in Phase One and 2420µS/cm in the Phase Two testwork.

The potential overburden leachate pH for the selected samples for the Phase One tests ranged from 3.04 - 8.08, and from 2.58 – 6.38 for Phase Two. The median pH value of 6.26 for Phase One and 4.58 for Phase Two indicates the leachate pH could potentially be slightly acidic.

TDS, Al, Cu, Pb, Ni and Zn were present in isolated, individual samples that exceed, or, in the case of pH, were outside the ANZECC/ARMCANZ (2000) upland stream or 95% protection of aquatic species trigger values. However, the available analyses indicates that, on bulk, the overburden emplacements are not anticipated to generate leachate water quality in excess of the relevant criteria.

This interpretation is derived on the basis that the 1:2 leachate test potentially over-estimates the in-situ waste dump leachate quality as the laboratory test utilises a smaller grain size than would be present in the actual dump, and doesn't factor in dilution by rainfall and runoff.

The laboratory tests represent pore water chemistry from pulverised samples, whilst the coarse rock waste emplacement will contain grain sizes up to large rocks, with a reultant lesser interaction with leachate passing through the material.

On this basis, leachate discharging from the overburden is likely to contain low concentrations of dissolved metals at the predominantly slightly low pH.

Past experience with similar waste emplacements and similar AMD characteristics indicates that dilution from rainfall infiltration and surface runoff mixing are likely to occur in the field, and as a result, the "field" dissolved metal concentration (as opposed to laboratory test results) in discharge from the overburden are unlikely to present significant bulk discharge surface water quality environmental issues.

7.2 Tailings

The potential tailings from the proposed Cobbora Open Cut coal mine are likely to be non-acid forming (NAF) and should not require any special handling for AMD control.

It is anticipated that minor sulfuric acid drainage from oxidation of pyritic material may occur and that these leachates are likely to be isolated. Current data indicates the tailings have low ANC.

Mixing of the tailings should limit any isolated AMD that may be generated.

Median leachate generated from the tailings has low salinity of approximately 206µS/cm for the Phase One results and 412µS/cm in Phase Two.

The potential overburden leachate $pH_{1:2}$ ranges from 3.47 to 6.91 for Phase One and 3.47 to 5.80 in Phase Two. The Phase One median was 6.39 and the Phase Two median was 6.39.

Based on the combined Phase One and Phase Two analyses, although nickel and zinc, and to a lesser degree, lead, were present in isolated tailings samples that exceeded the metals trigger values, and/or were outside pH range specified in the ANZECC/ARMCANZ (2000) upland stream or 95% protection of aquatic species, the combined bulk leachate from the tailings is not anticipated to generate significant exceedance of the ANZECC/ARMCANZ (2000) water quality trigger values.

The leachate tests were conducted on pulverised samples which could therefore overestimate, or represent a “worst case” scenario, of the actual tailings emplacement leachate.

Dilution effects from rainfall and natural attenuation are likely to occur in the field, the dissolved metal concentrations in runoff or seepage from the tailings are unlikely to present any significant environmental issues in terms of the potential bulk discharging surface water quality from the tailings emplacements in relation to the ANZECC/ARMCANZ (2000) upland stream or 95% protection of aquatic species trigger values.

As some PAF-LC material was recognised in the Phase Two study from the Flyblowers and Ulan Upper seams, there is a potential for dissolved metals to be contained in surface runoff and seepage, and as a result, these materials should be blended and well managed on site.

Past experience with similar tailings emplacements and similar AMD characteristics indicates that dilution from rainfall infiltration and surface water mixing are likely to occur in the field, and as a result, the “field” dissolved metal concentration (as opposed to laboratory test results) in discharge from the tailings are unlikely to present significant bulk discharge surface water quality environmental issues.

8. CONCLUSIONS

Based on the existing data from both studies, no specific overburden or tailings waste management handling, storage or testing procedures are considered to be required in regard to AMD management, although additional ongoing AMD testing during the mining process would confirm (or modify) this conclusion in relation to the uneconomic coal seams and associated lithologies.

Up to eighty nine percent of the tested samples are NAF, indicating that the overburden is not anticipated to require special “bulk” handling for AMD control, although the NAF material may be required to assist with management of the limited potential PAF-LC, and the infrequent to rare PAF material, if they are encountered during mining.

If required, and if ongoing AMD test work is inconsistent with the current findings, possible management strategies for PAF-LC tailings or overburden could include:

- placement of PAF-LC materials below the water table to allow inundation and prevent further exposure to atmospheric oxidation; or
- construction of a NAF cover zone designed to limit oxygen diffusion and infiltration into PAF-LC materials.

The run of mine and product coal stockpiles are not anticipated to generate AMD assuming typical residence times and reaction rates, and therefore, provision for capture of runoff/leachate, monitoring and lime treatment associated with the ROM stockpiles is not an anticipated requirement.

A program of routine sampling and testing of tailings and overburden/interburden materials should be implemented during active placement to monitor any variation in acid potential and to better define the low potential AMD in the overburden.

To assess the performance of any management strategies that may be required, and to determine the need and/or refinement of AMD management / treatment requirements, water quality monitoring of seepage and runoff from pit walls and floors, waste rock emplacements, ROM stockpiles and tailings disposal areas should be conducted.

Routine site water quality monitoring programmes should include pH, EC, acidity/alkalinity, sulfate, Al, As, Co, Cu, Fe, Mn, Ni and Zn to monitor for any effects of pyrite oxidation and AMD generation.

9. RECOMMENDATIONS

The results to date indicate the uneconomic coal seams have a higher potential for AMD, and that these lithologies may require ongoing AMD assessment. If they are subsequently assessed to be potentially acid generating on a larger scale during ongoing testing during operation of the mine, specific waste management measures may be required.

Water quality monitoring of key seepage, pit water and drainage from the overburden and tailings should be routinely carried out for indicators of AMD as well as salinity and pH to confirm the expected benign nature of these materials, and to provide advance warning of any anomalous pyritic materials contained within the waste. These procedures should be outlined in a relevant management plan.

Additional chromium reducible sulfur, ANC, NAPP (using both total and sulfide sulfur) and Extended Boil NAG diagnostic tests could be conducted on selected bulk samples during mining, prior to final rehabilitation in the waste emplacements to obtain an ongoing

assessment of the potential acid generation and buffering capacity of the waste as it is extracted from the pits. Notwithstanding that more analyses could be conducted, it is our assessment that this does not invalidate the overall conclusion of the report, in that AMD is not anticipated to be an issue of concern at the Project Site.

On-going monitoring of the leachate generated from the waste emplacements should include pH, salinity (EC), sulfate and acidity/alkalinity, with follow up multi-element testing if any low pH conditions are detected to ensure that key water quality parameters remain within appropriate criteria.

For the management of tailiings, it is recommended that the Proponent considers:

- Placement of NAF coal reject materials in the open pit and/or co-disposal with overburden;
- In-pit burial of any blended coal reject materials identified as PAF-LC. Where this is not possible, and out-of-pit disposal of PAF-LC rejects in overburden encapsulated cells may need to be considered until sufficient capacity in the open pit becomes available. Further ongoing testing during mining would be required to clarify this possibility;
- Deep (in-pit) burial of any PAF-LC roof and floor materials that do not report as waste in the CHPP. Out-of-pit disposal of PAF-LC roof and floor materials in overburden encapsulated cells may need to be considered until sufficient capacity in the open pit becomes available;
- Covering of PAF-LC coal reject and PAF-LC roof and floor material as soon as practical with at least 5 metres of overburden to minimise the length /availability of exposure to oxidising conditions and to minimise the potential for AMD generation;
- For any co-disposal that may be conducted, placement of NAF coal reject material in a manner that limits the risk of erosion; and;
- Verifying the geochemical characteristics of blended coal reject materials using standard static geochemical tests when bulk samples become available from the CHPP or similar process.

Surface water runoff and seepage from coal tailings material should be monitored to ensure that key water quality parameters remain within appropriate criteria. It is therefore recommended that the Proponent monitors standard runoff/seepage from coal reject emplacement areas (pH, EC and TSS) and also dissolved metals, as required.

If required, possible management strategies for PAF-LC tailings or overburden/interburden could include:

- limestone treatment and interim compaction of PAF-LC materials to increase lag times before onset of acid conditions to manage AMD during operations or until implementation of closure strategies;
- When sufficient in-pit storage is available, PAF-LC materials are placed below the water table to allow inundation and prevent further exposure to atmospheric oxidation; or
- construction of a NAF clay-based cover zone designed to limit oxygen diffusion and infiltration into PAF-LC materials (where water and oxygen flux modelling will be required to determine the best approach under the local climatic conditions).

10. REFERENCES

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ANZECC/ARMCANZ, 2000. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand. Canberra, ACT.

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LIMITATIONS

APPENDIX A
LABORATORY RESULTS

TAILINGS LABORATORY RESULTS AND AMD CLASSIFICATION

	pH	uS/cm	%	%	CaCO3	kg H2SO4/t	kg H2SO4/t	AMD
Sample	**1:2 leachate**	**1:2 leachate**	**TS**	**S-**	**ANC**	**NAPP**	**NAPP S-**	**Classification**
259 FB	5.44	283	0.37	0.03	0.15	10.1	-0.6	**NAF**
265 FB	5.8	612	0.53	0.32	0.26	14	7.2	**PAF-LC**
277 FB	3.47	1128	0.55	0.12	0.06	16.6	3.1	**PAF-LC**
282 FB	5.39	286	0.3	0.007	0.28	6.6	-2.6	**NAF**
259 UU/UL	5.58	360	0.28	0.02	0.23	6.5	-1.7	**NAF**
265 UU	5.55	395	0.18	0.03	0.56	0	-4.7	**NAF**
277 UU	4.44	532	0.1	0.06	0.05	2.6	1.3	**PAF-LC**
282 UU	4.69	432	0.1	0.03	0.1	2.1	-0.1	**NAF**
277 UL	4.32	384	0.27	0.01	0.25	6	-2.2	**NAF**
282 UL	4.61	428	0.28	0.03	0.24	6.4	-1.5	**NAF**

ST Dev	0.74	247.69	0.16	0.10	0.15	5.22	3.36
Max	5.80	1128.00	0.55	0.32	0.56	16.60	7.19
Min	3.47	283.00	0.10	0.01	0.05	0.00	-4.68
Median	5.04	411.50	0.28	0.03	0.24	6.45	-1.03

	pH	pH	kg H2SO4/t	kg H2SO4/t	kg H2SO4/t	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	AMD
COMPOSITE	**NAG**	**Xtnd Boil NAG**	**NAGpH4.5**	**NAGpH7.0**	**Calc Xtnd Boil NAG**	**S**	**Ca**	**Mg**	**Na**	**K**	**Cl**	**Classification**
Flyblowers	2.9	5.3	32	60	10	41	1.9	2	7.9	2.7	7	**PAF-LC**
UU/UL	2.4	5.4	94	140	4	20	1.5	1.2	7.4	2.6	3	**NAF**
Ulan Upper	2.7	5.5	44	72	4	19	1	1.4	8.1	1.7	4	**NAF**
Ulan Lower	2.3	5.7	110	160	4	19	0.9	0.5	6.5	1.3	3	**NAF**

OVERBURDEN LABORATORY RESULTS AND AMD CLASSIFICATION

DDH94

m	m	m	pH	pH	uS/cm	CaCO3	%	%	kg H2SO4/t	kg H2SO4/t	kg H2SO4/t		AMD
top	bottom	thickness	1:2 leachate	Xtnd Boil NAG	1:2 leachate	ANC	TS	S-	NAPP	NAPP S-	Calc NAG	Seam	Classification
12.21	12.53	0.32	3.95	_	441	0.01	0.03	_	0.9	_	_	Whaka 1	NAF
12.69	13.2	0.51	4.08	_	376	0.01	0.017	_	0.5	_	_	Whaka 1	NAF
19.26	21.09	1.83	3.35	_	839	0.01	0.12	0.005	3.8	0.1	_	Whaka 6	NAF
29.95	30.14	0.19	3.67	_	582	0.01	0.092	0.01	2.9	0.2	_	Flyblower 7	NAF
31.48	31.85	0.37	4.38	_	284	0.01	0.014	_	0.4	_	_	_	NAF
32.62	33.06	0.44	4.42	_	228	0.01	0.006	_	0.2	_	_	_	NAF
34.3	34.54	0.24	4.58	_	213	0.01	0.003	_	0.1	_	_	_	NAF
36.2	36.37	0.17	5.21	_	176	0.01	0.005	_	0.2	_	_	_	NAF
37.5	37.75	0.25	4.12	_	408	0.01	0.026	_	0.8	_	_	_	NAF
38.69	38.85	0.16	4.35	_	362	0.01	0.002	_	0	_	_	_	NAF
44.51	44.88	0.37	3.86	_	708	0.01	0.1	0.04	3.1	1.1	_	CMK	PAF-LC
45.09	45.36	0.27	3.25	6.6	1336	0.01	0.11	0.05	3.4	1.4	2.0	Ulan Lower 1	PAF-LC

ST Dev	0.46	0.54		332.75	0.00	0.05	0.02	1.47	0.68
Max	1.83	5.21		1336.00	0.01	0.12	0.05	3.80	1.43
Min	0.16	3.25		176.00	0.01	0.00	0.01	0.00	0.05
Median	0.29	4.10		392.00	0.01	0.02	0.03	0.65	0.67

DDH213

top	bottom	thickness	1:2 Leachate	Xtnd Boil NAG	1:2 Leachate	ANC	TS	S-	NAPP	NAPP S-	Calc NAG	Seam	Classification
10.74	11.01	0.27	4.07	_	325	0.01	0.032	_	1	_	_	_	NAF
12.28	12.47	0.19	4.05	_	297	0.01	0.011	_	0.3	_	_	_	NAF
14.85	14.94	0.09	4.26	_	242	0.01	0.013	_	0.4	_	_	Trinkey	NAF
14.94	15.09	0.15	3.73	_	476	0.01	0.59	0.005	18.5	0.1	_	Trinkey	NAF
15.09	15.41	0.32	3.54	_	574	0.1	0.26	0.01	7.1	-0.7	_	Trinkey	NAF
15.41	15.77	0.36	3.57	_	521	0.33	0.35	0.005	7.7	-3.1	_	_	NAF
15.84	15.96	0.12	3.87	_	519	0.01	0.22	0.005	6.9	0.1	_	_	NAF
17.75	17.86	0.11	3.05	_	1207	0.01	0.2	0.04	6.3	1.1	_	_	NAF
22.17	22.46	0.29	2.7	3	1848	0.01	0.34	0.12	10.6	3.6	11	Whaka	PAF-LC
23.59	23.81	0.22	2.58	3.1	2420	0.01	0.35	0.12	11	3.6	11	Whaka	PAF-LC
26.17	26.29	0.12	4.88	_	350	0.2	0.047	_	-0.5	_	_	_	NAF
27.1	27.26	0.16	5.14	_	407	0.55	0.043	_	-4.2	_	_	_	NAF
37.65	37.85	0.2	3.94	_	465	0.02	0.022	_	0.5	_	_	Ulan Upper	NAF
42.49	42.68	0.19	3.22	_	888	0.01	0.072	0.03	2.3	0.8	_	_	NAF
43.44	43.8	0.36	2.98	4.8	1302	0.01	0.1	0.06	3.1	1.7	3	Ulan Lower	PAF-LC
48.9	49.1	0.2	4.07	_	486	0.01	0.044	_	1.4	_	_	_	NAF

ST Dev	0.09	0.72	1.01	622.08	0.15	0.17	0.05	5.66	2.10
Max	0.36	5.14	4.80	2420.00	0.55	0.59	0.12	18.50	3.57
Min	0.09	2.58	3.00	242.00	0.01	0.01	0.01	-4.20	-3.15
Median	0.20	3.80	3.10	502.50	0.01	0.09	0.03	2.70	0.82

DDH277

m	m	m	pH	pH	uS/cm	CaCO3	%	%	kg H2SO4/t	kg H2SO4/t		AMD
top	bottom	thickness	1:2 Leachate	Xtnd Boil NAG	EC 22 Jan	ANC	TS	S-	NAPP	NAPP S-	Seam	Classification
27.35	27.65	0.3	6	_	505	0.21	0.03	_	-1.2	_	_	**NAF**
28.2	28.42	0.22	4.3	_	691	0.01	0.042	_	1.3	_	_	**NAF**
34.12	34.49	0.37	4.53	_	390	0.03	0.046	_	1.1	_	_	**NAF**
35.66	35.82	0.16	4.82	_	292	0.03	0.019	_	0.3	_	_	**NAF**
38.04	38.25	0.21	4.13	_	415	0.01	0.012	_	0.4	_	_	**NAF**
38.25	38.48	0.23	4.43	_	344	0.02	0.021	_	0.5	_	_	**NAF**
38.83	39.1	0.27	4.58	_	295	0.01	0.014	_	0.3	_	_	**NAF**
47.64	47.82	0.18	4.74	_	350	0.01	0.11	0.005	3.4	0.1	_	**NAF**
48.43	48.77	0.34	4.62	_	343	0.09	0.18	0.005	4.7	-0.7	wallrock	**NAF**
49.16	49.55	0.39	4.75	_	396	0.05	0.035	_	0.6	_	wallrock	**NAF**

ST Dev	0.08	0.51	#DIV/0!	119.06	0.06	0.05	0.00	1.70	0.57
Max	0.39	6.00	0.00	691.00	0.21	0.18	0.01	4.70	0.05
Min	0.16	4.13	0.00	292.00	0.01	0.01	0.01	-1.20	-0.75
Median	0.25	4.60	#NUM!	370.00	0.03	0.03	0.01	0.55	-0.35

DDH310

m	m	m	pH	pH	uS/cm	CaCO3	%	%	kg H2SO4/t	kg H2SO4/t	kg H2SO4/t		AMD
top	bottom	thickness	1:2 Leachate	Xtnd Boil NAG	1:2 Leachate	ANC	TS	S-	NAPP	NAPP S-	Calc NAG	Seam	Classification
18.57	18.74	0.17	3.53	3	728	0.01	0.48	0.22	15	6.6	18	Trinkey 2	**PAF-LC**
20.87	20.99	0.12	5.27	_	328	0.04	0.044	_	1	_	_	_	**NAF**
35.36	35.51	0.15	5.29	_	408	0.06	0.13	0.02	3.5	0.0	_	Whaka 1	**NAF**
35.87	36.1	0.23	5.75	_	329	0.23	0.42	0.006	10.8	-2.1	_	Whaka 2	**NAF**
36.73	36.98	0.25	6.38	_	634	0.26	0.13	0.02	1.5	-2.0	_	Whaka 2	**NAF**
37.52	37.85	0.33	6.33	_	280	0.26	0.43	0.02	10.9	-2.0	_	Whaka 2	**NAF**
38.47	38.67	0.2	6.31	6.5	524	0.21	0.32	0.06	7.9	-0.3	2	Whaka 3	**NAF**
39.75	40.04	0.29	6.13	_	425	0.27	0.14	0.03	1.7	-1.8	_	Whaka 4	**NAF**
40.65	40.94	0.29	5.83	_	297	0.31	0.39	0.009	9.1	-2.8	_	Whaka 4	**NAF**
41.2	41.48	0.28	5.93	_	449	0.44	0.016	_	-3.9	_	_	Whaka 5	**NAF**
41.88	42.09	0.21	6.14	_	513	0.59	0.24	0.03	1.6	-5.0	_	Whaka 5	**NAF**
43.83	44.07	0.24	6.17	_	334	0.37	0.41	0.005	9.1	-3.5	_	_	**NAF**
44.07	44.29	0.22	6.33	_	528	0.54	0.007	_	-5.2	_	_	_	**NAF**
45.27	45.53	0.26	5.96	_	390	0.1	0.026	_	-0.2	_	_	Flyblower 2	**NAF**
52.37	52.59	0.22	6.26	_	433	0.36	0.04	_	-2.3	_	_	_	**NAF**
55.63	55.82	0.19	3.29	3.4	905	0.01	0.2	0.15	6.3	4.5	6	Ulan Upper 1	**PAF-LC**
67.82	68.05	0.23	5.8	_	295	0.14	0.084	0.005	1.2	-1.2	_	wallrock	**NAF**
68.32	68.48	0.16	5.86	_	428	0.56	0.025	_	-4.8	_	_	wallrock	**NAF**

ST Dev	0.05	0.89	1.92	164.29	0.19	0.17	0.07	5.94	3.29	8.33
Max	0.33	6.38	6.50	905.00	0.59	0.48	0.22	15.00	6.63	18.00
Min	0.12	3.29	3.00	280.00	0.01	0.01	0.01	-5.20	-4.98	2.00
Median	0.23	5.95	3.40	426.50	0.26	0.14	0.02	1.65	-1.89	6.00

DDH312 (a)

m	m	m	pH	pH	uS/cm	CaCO3	%	%	kg H2SO4	kg H2SO4	kg H2SO4		AMD
top	bottom	thickness	1:2 Leachate	Xtnd Boil NAG	EC 22 Jan	ANC	TS	S-	NAPP	NAPP S-	Calc NAG	Seam	Classification
9.66	9.86	0.2	4.73	_	414	0.01	0.002	_	0	_	_	_	NAF
10.43	10.8	0.37	4.67	_	241	0.01	0.002	_	0	_	_	_	NAF
10.94	11.26	0.32	4.12	_	608	0.01	0.15	0.005	4.7	0.1	_	Trinkey 1	NAF
12.18	12.43	0.25	3.19	4.2	772	0.01	0.1	0.06	3.1	1.7	4	Trinkey 1	PAF-LC
12.43	12.79	0.36	3.59	_	420	0.19	0.23	0.005	5.3	-1.7	_	Trinkey 2	NAF
12.98	13.47	0.49	3.81	_	441	0.03	0.25	0.02	7.5	0.3	_	Trinkey 2, 3	NAF
17.22	17.44	0.22	4.47	_	244	0.01	0.082	0.005	2.5	0.1	_	_	NAF
18.8	19.19	0.39	4.65	_	225	0.01	0.2	0.009	6.3	0.2	_	Whaka 1	NAF
20.29	20.68	0.39	4.68	_	250	0.25	0.62	0.04	16.9	-1.3	_	Whaka 2	NAF
21.45	21.74	0.29	4.66	_	286	0.3	0.53	0.03	13.6	-2.1	_	Whaka 3	NAF
22.82	23.04	0.22	3.35	2.6	759	0.05	1.6	0.57	49.6	16.9	40	Whaka 4	PAF
23.79	23.97	0.18	4.33	_	350	0.31	0.47	0.006	11.6	-2.9	_	Whaka 4	NAF
24.17	24.37	0.2	3.87	7.6	585	0.01	0.061	0.05	1.9	1.4	0	Whaka 4	PAF-LC
25.03	25.28	0.25	5.02	_	236	0.23	0.29	0.005	6.8	-2.1	_	Whaka 5	NAF
26.28	26.54	0.26	4.31	_	387	0.18	0.42	0.03	11.3	-0.9	_	Whaka 5	NAF

DDH312 (B)

m	m	m	pH	pH	uS/cm	CaCO3	%	%	kg H2SO4	kg H2SO4	kg H2SO4		AMD
top	bottom	thickness	1:2 Leachate	Xtnd Boil NAG	EC 22 Jan	ANC	TS	S-	NAPP	NAPP S-	Calc NAG	Seam	Classification
27.23	27.54	0.31	4.39	_	411	0.06	0.3	0.03	8.8	0.3	_	Whaka 5	NAF
27.54	28.07	0.53	4.78	_	260	0.2	0.49	0.04	13.3	-0.8	_	Whaka 6	NAF
28.07	28.46	0.39	4.66	_	325	0.15	0.56	0.03	16	-0.6	_	Whaka 6	NAF
29.03	29.27	0.24	5.18	_	353	0.03	0.095	0.005	2.7	-0.1	_	_	NAF
35.67	35.79	0.12	6.05	_	412	0.15	0.14	0.04	2.9	-0.3	_	_	NAF
35.79	36	0.21	5.98	_	323	0.05	0.03	_	0.4	_	_	_	NAF
38.68	38.88	0.2	5.18	_	413	0.07	0.12	0.005	3.1	-0.5	_	_	NAF
39.36	39.58	0.22	5.95	_	400	0.1	0.1	0.04	2.1	0.2	_	_	NAF
41.34	41.63	0.29	5.67	_	361	0.1	0.012	_	-0.6	_	_	_	NAF
42.9	43.15	0.25	5.93	_	346	0.13	0.008	_	-1	_	_	_	NAF
48.57	48.86	0.29	5.75	_	311	0.11	0.18	0.02	4.5	-0.5	_	Ulan Upper 4	NAF
52.75	52.91	0.16	5.93	_	338	0.05	0.015	_	0	_	_	wallrock	NAF

27.23 DDH312R sample

ST Dev	0.10	0.83	2.55	143.89	0.09	0.33	0.12	9.97	3.96
Max	0.53	6.05	7.60	772.00	0.31	1.60	0.57	49.60	16.94
Min	0.12	3.19	2.60	225.00	0.01	0.00	0.01	-1.00	-2.92
Median	0.25	4.67	4.20	353.00	0.07	0.15	0.03	4.50	-0.28

CALCULATED NAG RESULTS

TAILINGS

	pH	pH	kg H2SO4/t	kg H2SO4/t	kg H2SO4/t	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	AMD
COMPOSITE	**NAG**	**Xtnd Boil NAG**	**NAGpH4.5**	**NAGpH7.0**	**Calc Xtnd Boil NAG**	**S**	**Ca**	**Mg**	**Na**	**K**	**Cl**	**Classification**
Flyblowers	2.9	5.3	32	60	10	41	1.9	2	7.9	2.7	7	**PAF-LC**
UU/UL	2.4	5.4	94	140	4	20	1.5	1.2	7.4	2.6	3	**NAF**
Ulan Upper	2.7	5.5	44	72	4	19	1	1.4	8.1	1.7	4	**NAF**
Ulan Lower	2.3	5.7	110	160	4	19	0.9	0.5	6.5	1.3	3	**NAF**

OVERBURDEN

DDH	m	m	m	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	top	**bottom**	**thickness**	**S**	**Ca**	**Mg**	**Na**	**K**	**Cl**
94	45.09	45.36	0.27	14	1.3	1.5	7.1	4.1	7
213	22.17	22.46	0.29	38	<0.5	<0.5	4	3.9	2.4
213	23.59	23.81	0.22	40	<0.5	<0.5	4	4.1	3.1
213	43.44	43.8	0.36	12	<0.5	<0.5	7	4.5	1.2
310	18.57	18.74	0.17	62	0.6	0.7	4.2	1.9	3
310	38.47	38.67	0.2	19	3.9	6.5	9.3	2.8	13
310	55.63	55.82	0.19	25	1.6	1.3	4.8	3.3	6
312	12.18	12.43	0.25	16	<0.5	<0.5	4.8	1.3	4
312	22.82	23.04	0.22	130	1	1.4	4.6	1.4	4
312	24.17	24.37	0.2	9.9	1	2	9.1	5.6	6

Appendix D

Preliminary responses to Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development advice (15 May 2013)

Parsons Brinckerhoff Australia Pty Limited

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Memo

Date 9 May 2013

To Andrew Krause, Trish McDonald, CHC
Phil Towler, EMM

From Rob Leslie

Ref 2162570C-DMS-WAT-008 RevA

Subject Cobbora Coal Project - Surface Water Assessment - Responses to comments from the Independent Expert Scientific Committee

Dear Andrew and Trish

1. Introduction

This memo provides PB's responses to comments on the Cobbora Coal Project Surface Water and Groundwater Assessments provided in the Independent Expert Scientific Committee (IESC) advice dated 8th April 2103.

2. Responses to IESC advice comments

The IESC advice provides numbered comments which are repeated in this section with PB's responses below.

1. There is insufficient information to reasonably understand the potential impacts of the proposed project, without a regional water balance, without a comprehensive cumulative impact assessment and without potential downstream water quality impact assessments, particularly in relation to salinity.

PB response:

The groundwater modelling demonstrates that drawdown and depressurisation impacts are limited to an area of approximately 280km^2 centred on the mining area. The area of potential impact sits well within the boundaries of the model and the model is considered to provide reasonable estimates of groundwater components of the water balance. There are no impacts on the aquifers outside of this impacted area. Furthermore, the proposed Cobbora Project lies some 40 km to the west of the active Ulan Mine. Groundwater impacts from the Ulan mine are highly unlikely to extend to the Cobbora project and therefore a cumulative groundwater impact assessment in regard to that project is not required.

The surface water modelling demonstrates that the main impacts on downstream flows will be experienced in the following reaches:

- Lower 3km of Blackheath Creek adjacent to mining area C
- Lower 8km of Laheys Creek adjacent to mining area B
- Lower 11km of Sandy Creek adjacent to mining areas B and A

The flow impacts will also extend further downstream into the Talbragar River below its confluence with Sandy Creek; however, the impacts will be greatly diminished due to the influence of the larger Talbragar catchment. These impacts would also diminish further downstream as the contributing catchment of the Talbragar increases. The Sandy Creek sub-catchment is approximately 8% of the Talbragar River catchment to the Sandy Creek and Talbragar River confluence; and approximately 1% of the Macquarie River catchment to the Talbragar River and Macquarie River confluence. Therefore, the Sandy Creek sub-catchment is a very small portion of the broader Macquarie River catchment system. The Surface Water Assessment identified that the mean daily flow in Sandy Creek is approximately 11% of the mean daily flow in the Talbragar River at Elong Elong, 0.9% of the mean daily flow in the Macquarie River at Warren Weir and 2% of the mean daily flow in the Macquarie River at Oxley Station. Therefore, there are no significant regional impacts of the Project on downstream flow regimes beyond the confluence of Sandy Creek and the Talbragar.

2. The increased risk of salinity as a result of surface discharge and groundwater drawdown resulting from the proposed project may have significant ramifications for downstream users and ecosystems. In this regard the Committee notes the following:

    a. The proponent has not identified all the potential risks associated with salinity in the Sandy Creek sub-catchment (and the Talbragar River catchment) and should undertake a risk assessment to ensure that an appropriate mitigation plan is in place to manage the potential impacts from increased regional salinity;

PB response:

The water quality modelling indicates that the main impact on salinity is in the Sandy Creek system, with TDS concentrations increased by up to 52% during mining. The impact on the Talbragar system is much lower with TDS concentrations increased by up to 5%. The elevated TDS concentrations in the Talbragar remain well below the customised water quality objective. As for the flow impact assessment, there are no significant regional impacts of the Project on downstream water quality beyond the confluence of Sandy Creek and the Talbragar.

b. The Jurassic Purlawaugh Beds are a major source of salt in the Sandy Creek sub-catchment and the Talbragar River catchment. The Jurassic Purlawaugh Beds and the Pilliga Sandstone, should be included in the geological conceptual model and then translated into the numerical groundwater model; and

PB response:

The Jurassic Purlawaugh Formation and Pilliga Sandstone were considered in the Groundwater Assessment, and were included as a distinct layer in the groundwater model. It was found that groundwater flow from the Jurassic beds was insignificant compared with the Triassic strata. Regional groundwater quality monitoring (Figure 5.12 of the Groundwater Assessment) does not support a high source of salinity from the Purlawaugh Formation. Sampling indicates that groundwater within and immediately down-gradient of the Purlawaugh Formation is of a similar or lower salinity (e.g. bore GW18; 2306 µS/cm) to samples collected from the Triassic rocks in recharge areas such as the ridges within the Project area (e.g. bore GW24; 2970 µS/cm). This implies that the risk of adverse salinity impact from enhanced recharge via the Purlawaugh Formation is negligible.

c. The proposed transfer of 3,311 ML per year of water from the Cudgegong River catchment into the Sandy Creek sub-catchment has the potential to exacerbate the issues surrounding salinity in the already highly saline Sandy Creek sub-catchment.

PB response:

While the full entitlement from the Cudgegong is 3,311 ML per year, the actual transfer of water under most climate conditions will be far less. Cudgegong water that is used in the mine for activities such as dust suppression and then captured in sedimentation dams and released to the Sandy Creek system will form a relatively small portion of the flow in the downstream system, e.g. for the reference dry year the releases from the sedimentation dams forms a maximum of approximately 18% of the flow in Sandy Creek. This water will also be subject to performance criteria for a range of water quality parameters, including TDS, before release. The water quality assessment shows that salinity in the Sandy Creek system is increased; however, the TDS concentrations remain at or just over the customised water quality objective.

3. A risk assessment is needed to determine the potential impacts on recharge into the Great Artesian Basin and downstream irrigation areas. In relation to the Great Artesian Basin, the Sandy Creek sub-catchment geology includes Jurassic sediments which may connect to the southern recharge zone of the basin. Further work is required to ensure that the drawdown in the proposal will not affect recharge to the Great Artesian Basin as the Southern Groundwater Recharge Source extends to the northern edge of the Talbragar River in this area.

PB response:

The maximum predicted drawdown extends just to the margin of the Great Artesian Basin water source but does not propagate significantly into it, implying negligible impact to the GAB recharge areas. Drawdown may extend to three Jurassic outliers to the west of the project area, but these are disconnected outliers from the GAB and similarly imply no additional impact to the GAB recharge areas (See figures 6.7 and 8.1a of the Groundwater Assessment). Drawdown impacts to the GAB have therefore been considered in the current model, the results of which imply a negligible risk to that water source. We suggest that additional modelling would not change this assessment.

4. The proponent has not considered the potential impacts on the surrounding creeks and water quality as a result of uncontrolled discharge from the mine water dams. The sedimentation dams are currently designed to contain 95 per cent of a 5 day storm event (63.3 mm), which means that they have the potential to overflow approximately 1 to 2 times per year. Consideration should be given to sedimentation dams being redesigned to contain a larger storm event (1 in 1000 year average recurrence interval) to minimise the potential for downstream water quality and ecological impacts.

PB response:

Sedimentation dams have been designed in accordance with the Blue Book, and increasing the storage capacity beyond guideline values to retain larger storm events without controlled release or spilling would have impacts on the flow regime downstream. The mine water system has been designed to harvest sedimentation dam water up to a point, but balanced so as to avoid significant impacts on the flow regime in the creeks downstream. A range of rules were tested during development of the water balance model for harvesting from sedimentation dams; (1) no sedimentation dam water harvesting; (2) pump from sedimentation dams to mine water dams when mine water dams fall below 25% full; and (3) pump from sedimentation dams to mine water dams when mine water dams fall below 50% full. The results of these early tests are summarised below for mining year 20 in Table 1:

Table 1 – Annual flow impacts at Sandy Creek outlet

Climate condition	Impact on creek flow – mining year 20		
	0% rule	25% rule	50% rule
10%ile (dry) year	+11%	-5%	-5%
50%ile (median) year	+12%	+5%	+3%
90%ile (wet) year	+2%	+2%	+1%

The 25% rule was chosen as the preferred operating procedure as it was found to provide a significant volume of water to reduce reliance on the Cudgegong entitlement while not significantly impacting the downstream flow regime.

5. The proposed project identifies mitigation measures, including creation of permanent water sources to offset the impact of dry years on the riparian vegetation due to the reduction of catchment runoff along creek channels. Insufficient information has been provided as to the adequacy of these water sources to recharge the shallow alluvial aquifers that support the existing riparian vegetation.

PB response:

Groundwater monitoring carried out in the Groundwater Assessment indicates that groundwater in the vicinity of the lower reaches of Laheys Creek and Sandy Creek is shallow and sits within the alluvium of those creeks. It is likely that vegetation and some refuge pools are partially reliant on groundwater within the alluvium. In addition, test pumping and isotopic analysis in the Groundwater Assessment showed that the alluvium is only weakly connected to the underlying Permian Coal Measures and recharges rapidly during high rainfall events (the alluvial groundwater is relatively “young” and rainfall derived). Therefore it is likely that the alluvium and the pools will recharge rapidly during recharge events and be sustained for several months after the rainfall event due to storage in the alluvium, even with mining impacts. This also implies that any releases to the creeks would be effective in recharging shallow groundwater, provided the releases were large.

6. The Committee made a number of observations about the proposal's potential impacts on surface water and groundwater resources and groundwater dependent ecosystems:

    a. The predicted drawdown levels of 90 m in mining area B and 60 m in area A have the potential to impact groundwater dependent ecosystems and surface water including refuge pools;

PB response:

It should be noted that the drawdown predicted by the groundwater model at the pool locations is in the range 1 to 18m.

    b. The regional 1 m drawdown is predicted to extend 5 km to the south, 4 km to the west and 3 km to the north and east of the mining area highlighting the need to determine the potential regional impacts on water; and

PB response:

The model adequately shows the potential water table drawdown extents in relation to groundwater users and surface water sources. The impacts on vegetation and irrigation areas located away from the major creek lines will be negligible because the depth to groundwater increases from <3 m near the creeks to >15 m beneath the interfluves and ridges.

c. There is insufficient information on hydraulic connectivity across the proposed project area and regionally to understand the impacts of drawdown on surface water systems and groundwater dependent ecosystems.

PB response:

Connectivity has been defined in the Groundwater Assessment and incorporated into the model. The hydraulic conductivity for all relevant units has been determined using appropriate hydraulic tests (See Section 4 of the Groundwater Assessment). Further, the connectivity between the Permian Coal Measures and the alluvium which contains the potential groundwater dependent vegetation was determined by long duration pump testing. These attributes were used to parameterise the numerical model and therefore we consider that the hydraulic connectivity is well represented in the model. Potential drawdown beneath all surface water courses and refuge pools has been predicted with the model and presented in the Groundwater Assessment (Section 6). The absolute impact on individual pools and species is subject to several sources of uncertainty, including the detailed hydrology and soil characteristics of each pool and plant environment. However the relative drawdown predicted by the model provides an adequate basis for risk assessment.

8. The Committee, while noting that field investigations have been undertaken, recommends that further information be provided to improve the reliability of the groundwater model, particularly in regard to:

   a. Formation-scale hydraulic properties such as vertical permeability and hydraulic conductivity for relevant geologic units, which are required to assess aquifer connectivity;

.

PB response:

The groundwater model has been conceptualised appropriately and peer reviewed by two independent reviewers. While it is acknowledged that there is uncertainty with these parameters, that has been addressed through the uncertainty analysis (Section 5.3 of the Groundwater Modelling Technical Report) and the model is considered to be adequate in determining localised and regional impacts. The adopted regional vertical and horizontal permeability values are considered to be in line with field testing and consistent with ranges in published data from elsewhere (including many studies in the Hunter Valley).

b. Geological conceptualisation model, including faulting and the Jurassic formations to reduce the uncertainty in regards to regional salinity impacts;

PB response:

Jurassic Formations were included in the numerical model, however they were not found to be sensitive parameters with respect to mine inflow or drawdown impacts. Faults are known to occur within the project area. However faults can influence groundwater in a variety of ways, in some cases acting as hydraulic conduits and in some cases as barriers to flow (or any gradation between). Given this high degree of variability in behaviour and the likely occurrence of unknown faults, the most appropriate and conservative approach is to exclude them from models unless there is strong evidence for their influence on groundwater flow. No such evidence was encountered during the field investigations.

c. Evapotranspiration;

PB response:

Evapotranspiration has been allowed for in the groundwater model. It is represented using the EVT package in MODFLOW Surfact and shown to be a significant component of the regional groundwater budget (See Table 4.3 of the Groundwater Modelling Technical Report).

d. Ongoing review and validation of the model during the life of the project, including data on the impacts of the proposed voids; and

PB response:

It is agreed that the model should be subject to ongoing review and validation.

e. Uncertainty analysis of the outputs from the groundwater model, which is consider to be best practice.

PB response:

An uncertainty analysis has been done – See Section 5.3 of the Groundwater Modelling Technical Report. Additional sensitivity runs were carried out in response to comments from the PAC technical reviewer (Dr Frans Kalf) to assess the role of the ephemeral streams in recharging the aquifers and mitigating drawdown impacts. Water balance modelling of the final void was carried out in a stochastic manner using ranges for groundwater inflow to reflect the likely uncertainty in those estimates (derived from the groundwater uncertainty analysis).

Yours sincerely

Rob Leslie
Team Manager, Water Resources NSW
Parsons Brinckerhoff

Appendix E

Biodiversity offset update (11 April 2013)

Offset Update - April 2013
Cobbora Coal Project

Prepared for Cobbora Holding Company Pty Limited | 11 April 2013

Planning + Environment + Acoustics

April 2013 Offset Update – April 2013

Final

Report J11030RP1 | Prepared for Limited| 11 April 2013

Prepared by	**C. Thompson**	Approved by	**P. Towler**
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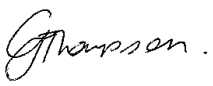
Signature		Signature	
Date	11 April 2013	Date	11 April 2013

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1 Introduction

1.1 Background

The Cobbora Coal Project (the Project) is an open cut coal mine proposed by the Cobbora Holding Company Pty Limited (CHC). An Environmental Assessment (EA) report has been prepared to support an application for the Project under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

A draft biodiversity offset strategy was provided as part of the EA for the Project. It provided a framework for determining the appropriate level and scale of offsets required to compensate for Project impacts. An Updated Biodiversity Offset Strategy (EMM 2013) was provided with the Preferred Project Report and Response to Submissions report (PPR&RTS), which provided further information of additional offset investigations and offset commitments.

Additional surveys of proposed offset sites have been undertaken since the PPR&RTS Updated Biodiversity Offset Strategy was completed in January 2013 (see Section 2.4). This April 2013 offset update provides details of the proposed offset package based on these surveys. It also provides an assessment of the proposed package against the offset strategy requirements, the OEH Interim Offset Policy and the Commonwealth EPBC Act Environmental Offset Policy. This offset update provides information to the Department of Planning and Infrastructure (DP&I), the Office of Environment and Heritage (OEH) and the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) for upcoming offset package discussions.

1.2 Residual impacts to be offset

1.2.1 Loss of vegetation

Vegetation will be cleared gradually within the Project area over the life of the mine. Twelve vegetation communities have been identified and mapped within the disturbance footprint with a total of 2,039 ha of native woodland vegetation (including regenerating vegetation) to be directly impacted**.** Proposed offsets have only compensated for direct Project impacts, in line with recent existing approved open-cut mine projects in NSW.

A total of 232 ha of TSC Act-listed threatened ecological communities (TECs) will be directly impacted comprising:

- 43 hectares (ha) of Inland Grey Box Woodland (Grey Box Woodland) endangered ecological community (EEC) and 34 ha of Grey Box Woodland EEC derived native grassland (DNG);
- 22 ha of White Box Yellow Box Blakely's Red Gum Woodland (Box Gum Woodland) EEC and 105 ha of Box Gum Woodland EEC DNG; and
- 14 ha of Fuzzy Box Woodland on alluvial soils EEC and 14 ha of Fuzzy Box Woodland EEC DNG.

A total of 65 ha of these communities are also listed under the EPBC Act as threatened: 43 ha of Grey Box Grassy Woodland and Derived Native Grasslands of South-eastern Australia EEC; and 22 ha of White Box Yellow Box Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands critically endangered ecological community (CEEC).

1.2.2 Loss of threatened species and their habitat

Assessments were undertaken to determine the significance of Project impacts on threatened species recorded or considered likely to occur in the Project footprint (see the Cobbora Coal Project Terrestrial Ecology Assessment (EMM 2012)). Significant impacts were considered likely to three flora species and 11 fauna species. A summary of the findings of the assessments is provided in Table 1.1. The offset strategy is focused on the species expected to be significantly impacted by the Project (EMM 2013).

Table 1.1 Impact assessment results for recorded threatened species

Species or community	Status		Recorded within the study area?	Impact description	Significant impact?
	TSC Act	EPBC Act			
Homoranthus darwinioides	V	V	Yes	Removal of 227 individuals from 1 sub-population	Yes
Ingram's Zieria	E	E	Yes	Removal of 727 individuals within 8 sub-populations	Yes
Tylophora linearis	V	E	Yes	Removal of 9 individuals, representing the local known population (within the study area)	Yes
Acacia ausfeldii	V	-	Yes	Removal of 200 individuals in one sub-population	No
Barking Owl	V	-	Yes	Removal of 1,954 ha of foraging and breeding habitat	No
Brown Treecreeper	V	-	Yes	Removal of 1,954 ha of foraging and breeding woodland habitat	Yes
Diamond Firetail	V	-	Yes	Removal of 1,954 ha of foraging and breeding woodland habitat	Yes
Glossy Black-Cockatoo	V	-	Yes	Removal of 1,954 ha of woodland habitat	Yes
Grey-crowned Babbler	V	-	Yes	Removal of 1,954 ha of woodland habitat	Yes
Hooded Robin	V	-	Yes	Removal of 1,954 ha of woodland habitat	Yes
Large-eared Pied Bat	V	V	Yes	Removal of 1,954 ha of foraging and 16.7 km of cliff line (roosting and potential breeding habitat)	Yes
Little Pied Bat	V	-	Yes	Removal of 1,954 ha of foraging habitat and 16.7 km of cliff line habitat	Yes
Masked Owl	V	-	Yes	Removal of 1,954 ha of foraging and breeding habitat	No
Powerful Owl	V	-	Yes	Removal of 1,954 ha of foraging and breeding habitat	No
Southern Long-eared Bat	V	V	Yes	Removal of 1,954 ha of foraging and breeding habitat	Yes
Speckled Warbler	V	-	Yes	Removal of 1,954 ha of foraging and breeding habitat	Yes
Varied Sittella	V	-	Yes	Removal of 1,954 ha of foraging and breeding habitat	Yes
Yellow-Bellied Sheathtail Bat	V	-	Yes	Removal of 1,954 ha of woodland habitat	Yes

Notes: Significantly impacted species are shaded.

OEH and SEWPaC consider a number of additional fauna species should be included in the offsets. These are:

- Eastern Cave Bat (*Vespadelus troughtoni*);
- Koala (*Phascolarctos cinereus*);
- Pale-headed Snake (*Holocephalus bitorquatus*);
- Regent Honeyeater (*Xanthomyza phrygia*);
- Sloane's Froglet (*Crinia sloanei*);
- Spotted-tailed Quoll (*Dasyurus maculatus*);
- Squirrel Glider (*Petaurus norfolcensis*); and
- Swift Parrot (*Lathamus discolor*).

These species were not recorded at the Project site, however suitable habitat is present and a moderate to high likelihood for occurrence was identified. These species have been considered on this basis.

2 Land-based offset updates

2.1 Secured offset sites

A total of 3,725 ha of offset sites have been secured in areas surrounding the Project area (Figure 2.1). These have been chosen for their biodiversity values and also their proximity to the local reserve network.

All secured offset sites are located in areas that have no or low potential coal resources, or areas that would be unviable to mine, such as those close to NPWS estate or with long haul distances to mining infrastructure areas. In addition, the offset sites have been discussed with the Division of Resources and Energy and no objections have been raised (letter received October 2012).

Details of the secured offset sites are provided in the PPR&RTS. Note that the proposed Dapper Nature Reserve (NR) additions are no longer being included in the offset strategy, as this area has not been identified as a priority for addition to the NPWS Estate. In addition, this area is mainly cleared and would require extensive rehabilitation and revegetation work.

CHC is actively managing the secured offset sites for conservation. The secured offset areas are no longer subject to key threatening processes such as wood collection and the removal of native vegetation. Some light grazing is still being undertaken in grassland offset areas, however weed and feral animal control is also being undertaken. Stock has been removed and excluded from areas identified as containing threatened plants in both the Project area, to ensure that seed and cuttings can been collected for the translocation program, and in the offset areas.

2.2 Additional offsets

2.2.1 Consultation

Consultation has been ongoing over the last year with NSW National Parks and Wildlife Service (NPWS) representatives in Mudgee and Dubbo. The aim of the consultation was to determine priority areas for addition into the NPWS Estate. Dedicated offset meetings were held in Mudgee and Dubbo to guide the proposed offset additions to priority areas, and to discuss their acquisition and the process for dedication to NPWS Estate. These offset discussions formed the basis of additional offset identification work, including subsequent fieldwork undertaken throughout February and March 2013, and discussions with landholders.

Site reconnaissance was completed for a number of proposed NPWS Estate additions that were identified in the offset package in February 2013 with Andy McQuie (Conservation Assessment Officer, Reserve Acquisitions). Consultation with NPWS is ongoing. Further consultation has also been undertaken with OEH to determine if additionality applies to the proposed offset areas.

2.2.2 Additional offsets identified

Three main additional offset areas have been identified since the PPR&RTS, with an additional area of 6,018 ha (Figure 2.1). These sites are all to the north of the Project area and are adjacent to existing conservation areas. Discussions commenced with landholders in March 2013 and are ongoing.

Initial broad vegetation mapping has been undertaken at these sites and future detailed surveys are described in Section 2.3.

2.3 Project offset package

The proposed offset package considered in this update includes the secured offsets described in the PPR&RTS and the new offset sites. The ownership of each of the offset areas is provided in Table 2.1.

As discussed with NPWS, it is planned that the majority of the offset areas will be protected in perpetuity through the reservation to NPWS Estate under the *National Parks and Wildlife Act 1974*. This includes the areas identified as the Southern NPWS additions, Cobbora additions, Adelyne additions and Goonoo additions which occur adjacent to NPWS Estate. Other areas will be protected through one of the following mechanisms:

- the establishment of Biobanking sites with Biobanking Agreements under the TSC Act;
- entering into a conservation agreement pursuant to s69B of the NPW Act; or
- registered under a public positive covenant and/or restriction on the use of the land against the title.

Table 2.1 Offset area ownership

Property/offset area	Size (ha)	Status
Southern NPWS additions		
Lot 2 and 3-839623, and Lot 3-1112933	57.1	Owned by Cobbora Holding Company
Lot 2-1112933	112.1	Owned by Cobbora Holding Company
Lot 3-802679 and Lot 88-750780	161.7	Owned by Cobbora Holding Company
Lot 1-802679	41.4	Owned by Cobbora Holding Company
Lot 1-1072945 and Lots 78 and 79-750751	168.0	Owned by Cobbora Holding Company
Lot 46, 48 and 49-754329	194.1	Owned by Cobbora Holding Company
Lot 2-1072945	356.4	Owned by Cobbora Holding Company
Lot 45-754329	214.4	Owned by Cobbora Holding Company
Part Lot 115-721236, part Lots 16,17, 25,26-754329	928.0	Owned by Cobbora Holding Company
Eastern link areas		
Lot 20, 21 and 23-754329, and Lot 9-130575	188.9	Owned by Cobbora Holding Company
Part Lot 31-754329	185.5	Owned by Cobbora Holding Company
Lot 102-754334	198.7	Owned by Cobbora Holding Company
Part Lot 30-754329, and part Lot 2 and part 3-586911	195.2	Owned by Cobbora Holding Company
Part Lot 141-721256	162.7	Owned by Cobbora Holding Company
Zieria patch		
Part Lot 36-754289 and part Lot 44-754289	43.2	Owned by Cobbora Holding Company
Cobbora additions		
Lot 45-720311	1,571.1	Private ownership - negotiations with landholder ongoing
Lot 42-257240 and Lot 18-754312	1,057.8	Owned by Cobbora Holding Company
Adelyne additions		
Lot 54-754326	183.5	Private ownership - negotiations with landholder ongoing

Table 2.1 Offset area ownership

Property/offset area	Size (ha)	Status
Lot 35-754326	412.9	Private ownership - negotiations with landholder ongoing
Goonoo additions		
Lot 3-754325	393.2	Private ownership - negotiations with landholder ongoing
Lot 39-754330	383.4	Private ownership - negotiations with landholder ongoing
Lot 36-754330	992.1	Private ownership - negotiations with landholder ongoing
Lot 9-721223	305.8	Private ownership - negotiations with landholder ongoing
Lot 17-754293	1,236.0	Private ownership - negotiations with landholder ongoing
Total	**9,743.2**	

2.4 Offset surveys

Ecological surveys have been completed in and surrounding the proposed offset areas over the last two years. This has included detailed surveys as part of the main ecological assessment for the Project, offset verification and ground-truthing and subsequent targeted offset investigations (Table 2.1).

Additional surveys to identify further populations of *T. linearis* and *H. darwinioides* are planned in April and May (see Section 2.5.1 and 3.3). Detailed surveys will be undertaken following approval of the offset package. These surveys will confirm the vegetation types and include plot-based assessments, classification of grassland areas and threatened species searches. Additional equivalent offsets will be secured if there are smaller areas of targeted vegetation types identified in the detailed surveys compared to the broad vegetation mapping.

Table 2.2 Overview of offset surveys

Offset area	Vegetation mapping and flora surveys	Targeted fauna surveys	Estimated survey effort (person hours)
Eastern link areas	Plot-based surveys, rapid assessments and vegetation mapping. Targeted searches for threatened flora species.	Call detection for microbats, harp trapping, habitat searches, bird surveys, spotlighting, infrared cameras and hair tubes.	250
Southern NPWS additions	Plot-based surveys, rapid assessments and vegetation mapping. Targeted searches for threatened flora species.	Call detection for microbats, harp trapping, habitat searches, bird surveys, spotlighting, infrared cameras and hair tubes.	200
Zieria patch	Plot-based surveys, rapid assessments and vegetation mapping. Targeted searches for threatened flora species.	Habitat searches and bird surveys.	50
Cobbora additions	Rapid assessments and vegetation mapping. Some targeted surveys for threatened flora species.	Call detection for microbats, harp trapping, habitat searches, bird surveys, spotlighting, infrared cameras, hair tubes and spotlighting.	100
Adelyne additions	Rapid assessments and vegetation mapping	Habitat searches, call detection for microbats and opportunistic bird surveys.	110
Goonoo additions	Rapid assessments and vegetation mapping	Habitat searches and opportunistic bird surveys.	110

Table 2.2 Overview of offset surveys

Offset area	Vegetation mapping and flora surveys	Targeted fauna surveys	Estimated survey effort (person hours)
Total			**820 person hours**

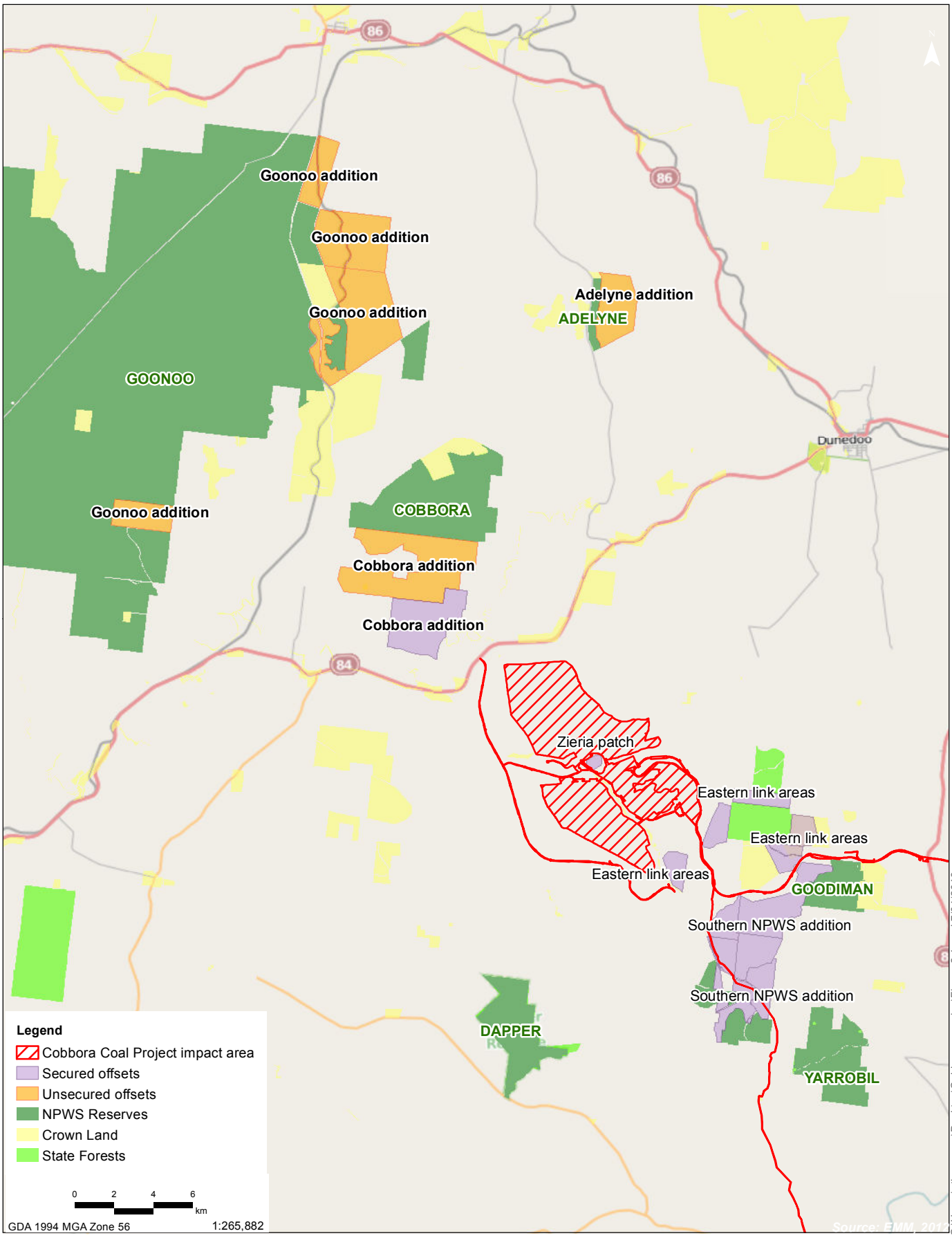
2.5 Offset vegetation types

Five offset areas have been identified (Figures 2.2 to 2.6). A total of 16 vegetation types, according to the Biometric vegetation types (BVT) database, have been identified in the proposed offset areas. In addition to these woodland areas, patches of native grasslands have been identified, some of which may constitute derived native grasslands (DNG) for TECs. Detailed surveys will confirm if grassland areas are DNG.

A total of 8,277 ha of woodland vegetation was recorded in the offset areas (Table 2.2). This included 1,457 ha of TECs, compromising approximately 1,207 ha of Box Gum Woodland, 45 ha of Fuzzy Box Woodland and 205 ha of Grey Box Woodland. Detailed surveys (see Section 2.3) will confirm the vegetation types meet the 'like for like' criterion. In particular, detailed quantitative surveys will compare TEC areas to listing criteria under the TSC Act and EPBC Act.

Table 2.3 Vegetation types by offset area

	Offset areas (ha)					
Vegetation type	**Eastern link areas**	**Zieria patch**	**Cobbora SCA and NPWS Sth additions**	**Goonoo additions**	**Adelyne additions**	**Total**
Black Cypress Pine Woodland	76		372	62		510
Blakely's Red Gum Rough-barked Apple Flats Woodland	124		339	330	44	837
Blakely's Red Gum - Yellow Box Grassy Woodland	1		203	149		353
Blue-leaved Ironbark Woodland	323	39	295	1,499	253	2,409
Blue-leaved Ironbark Woodland - regrowth			1,390	90	23	1,503
Dwyer's Red Gum Woodland	12	4	229	326	54	625
Fuzzy Box Woodland				45		45
Inland Grey Box Tall Grassy Woodland	35		63	40	67	205
Mugga Ironbark - Inland Grey Box - Pine Tall Woodland	38		42	0		80
Mugga Ironbark - Inland Grey Box Shrubby Woodland	2		30	267		299
Narrow-leaved Ironbark Shrubby Woodland				297		297
Scribbly Gum Woodland			48	0	9	57
Red Stringybark Woodland	145		481	208	26	860
Slaty Gum Woodland	115		51	0		166
Tumbledown Red Gum Woodland			14	0		14
White Box - White Cypress Pine - Inland Grey Box Woodland			17	0		17
Total	**871**	**43**	**3,574**	**3,313**	**476**	**8,277**



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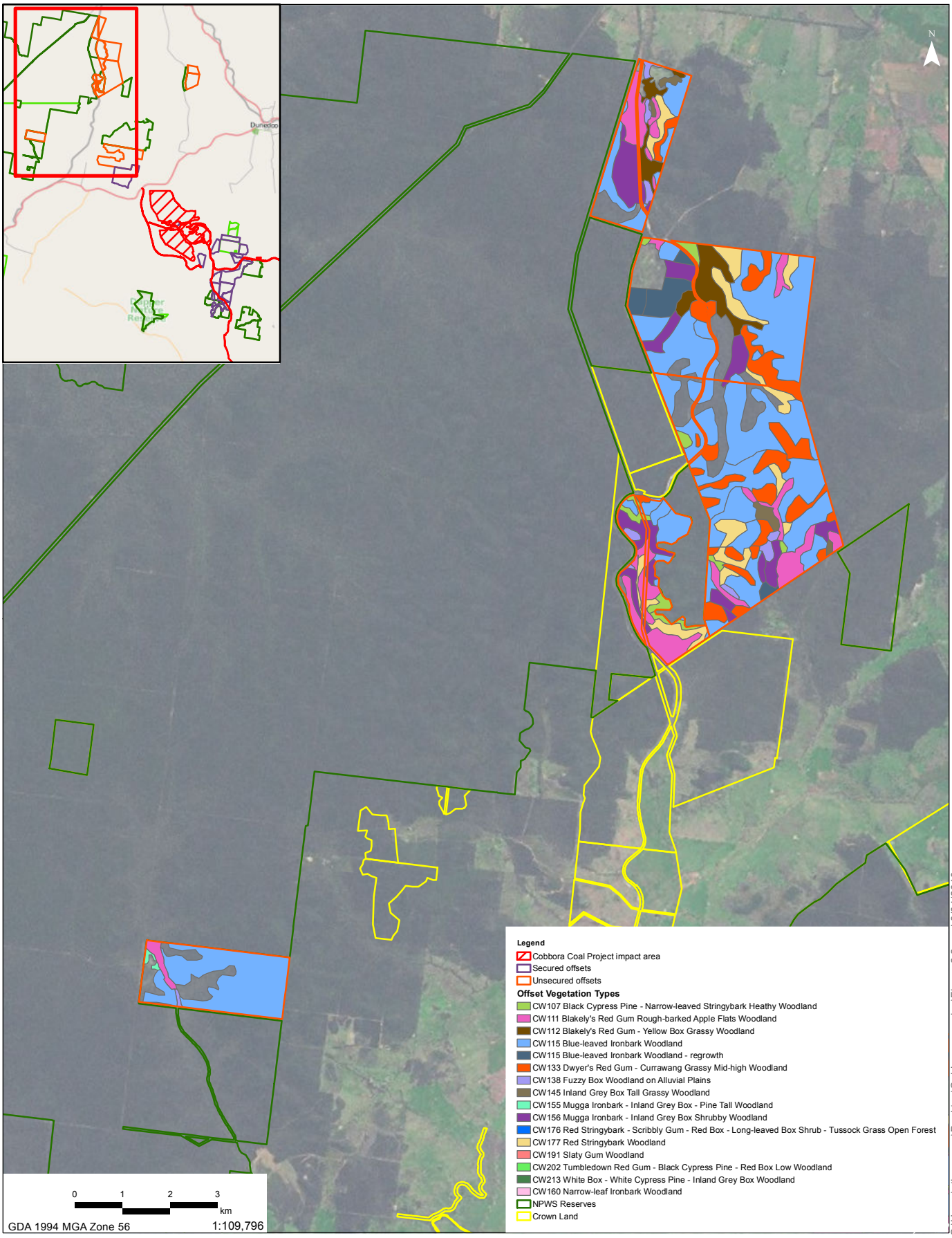
Proposed offset areas

Cobbora Coal Project - offset update

Figure 2.1



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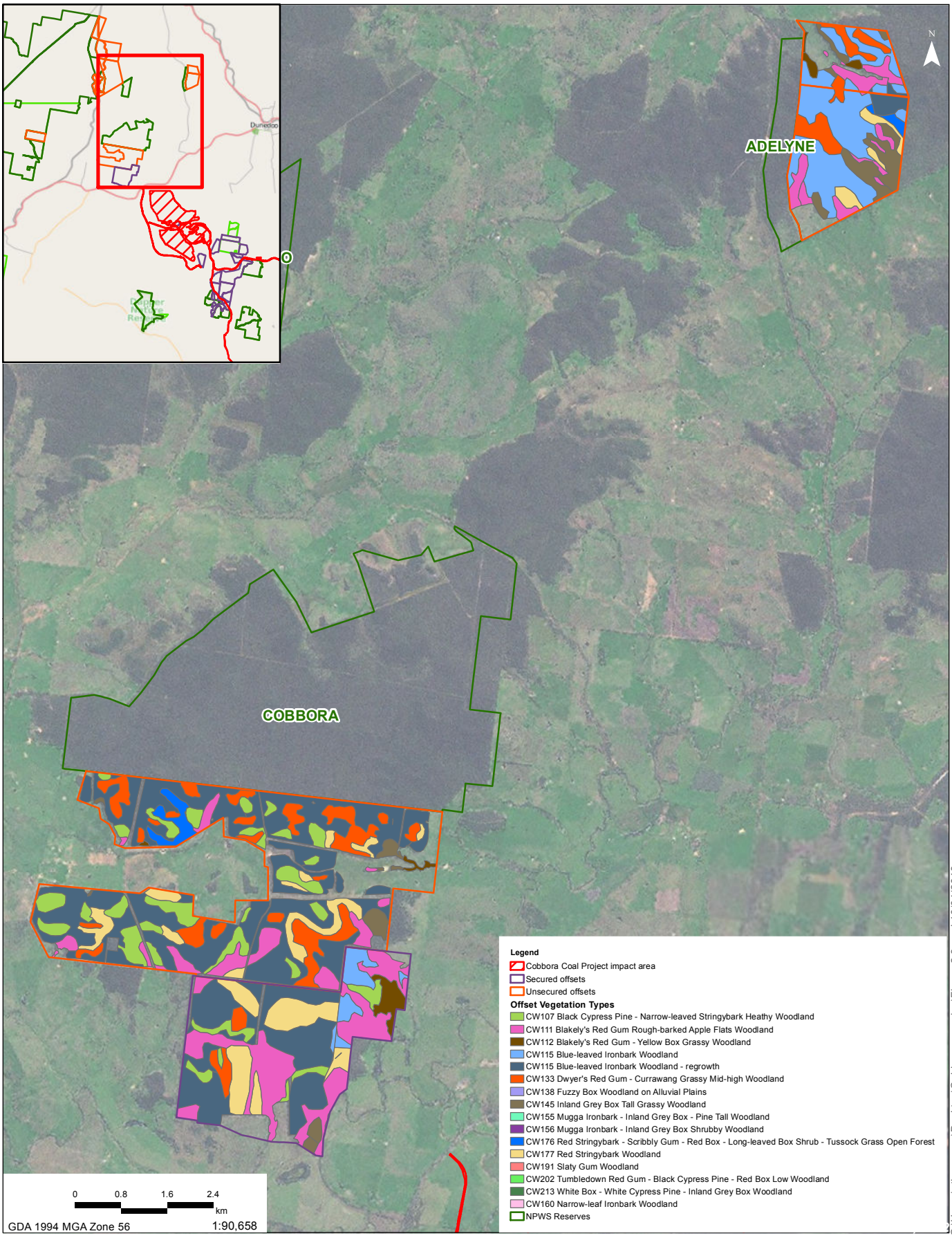
Cobbora offsets - Goonoo additions

Cobbora Coal Project - offset update

Figure 2.2



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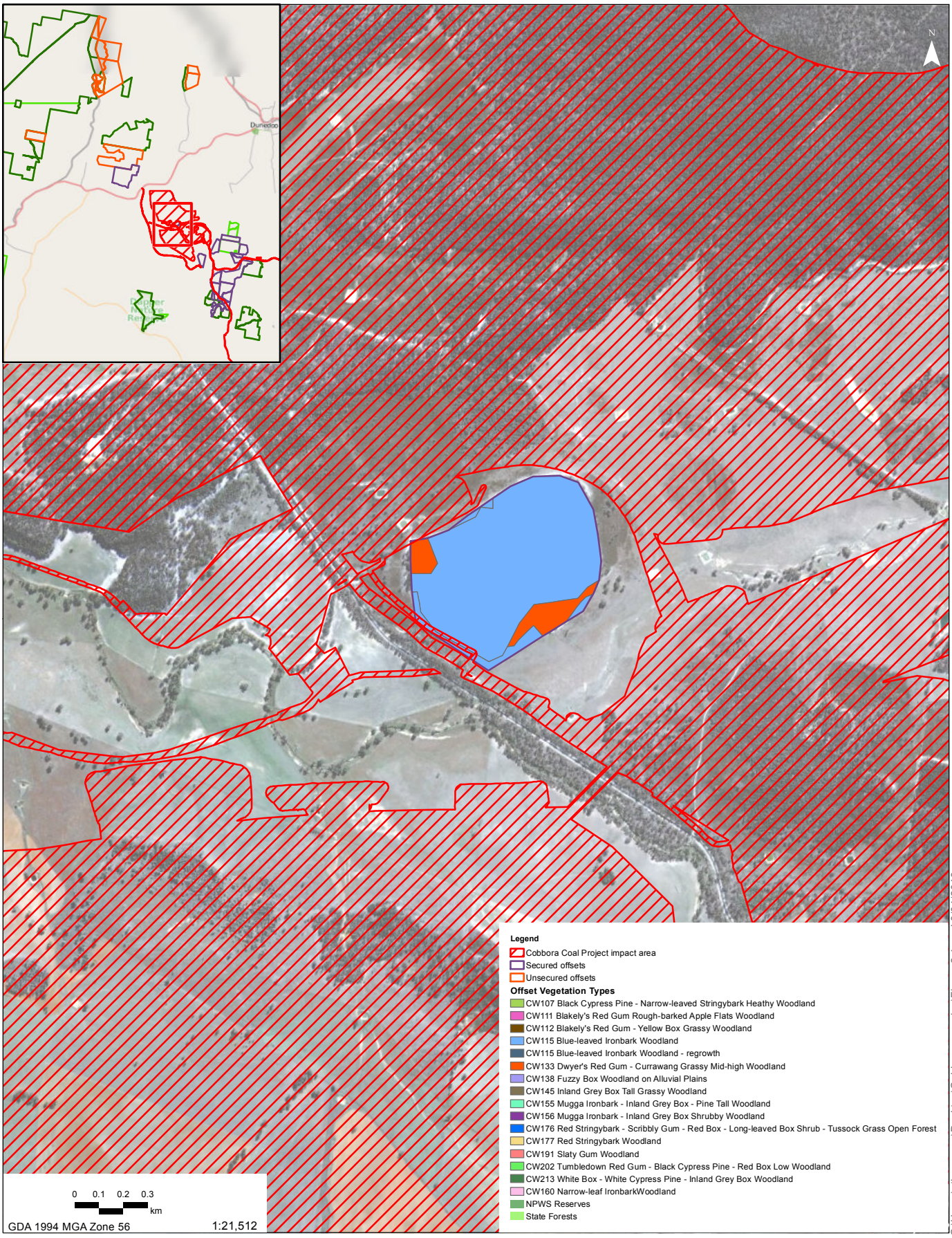
Cobbora offsets - Adelyne and Cobbora additions

Cobbora Coal Project - offset update

Figure 2.3



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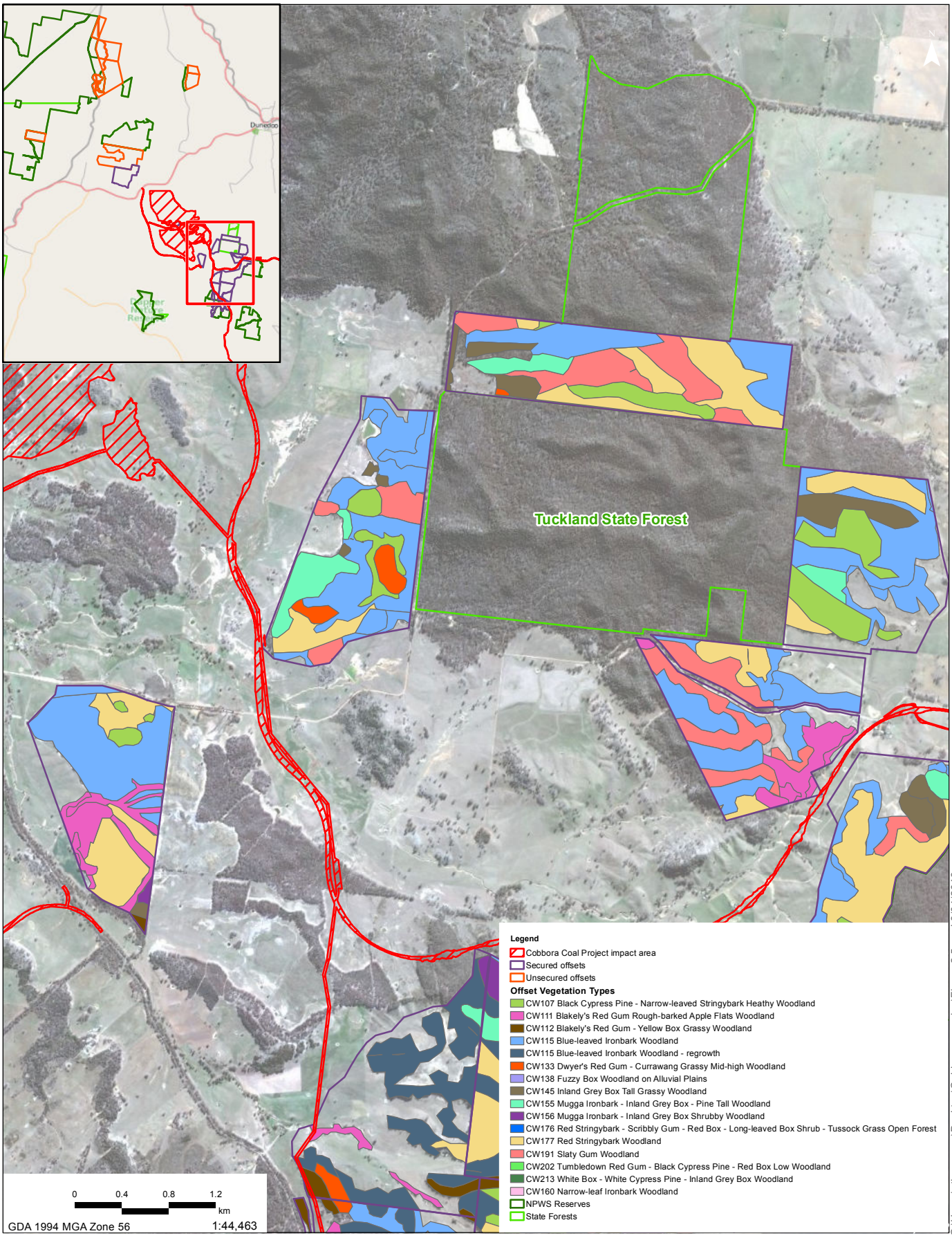
Cobbora offsets - Zieria Patch

Cobbora Coal Project - offset update

Figure 2.4



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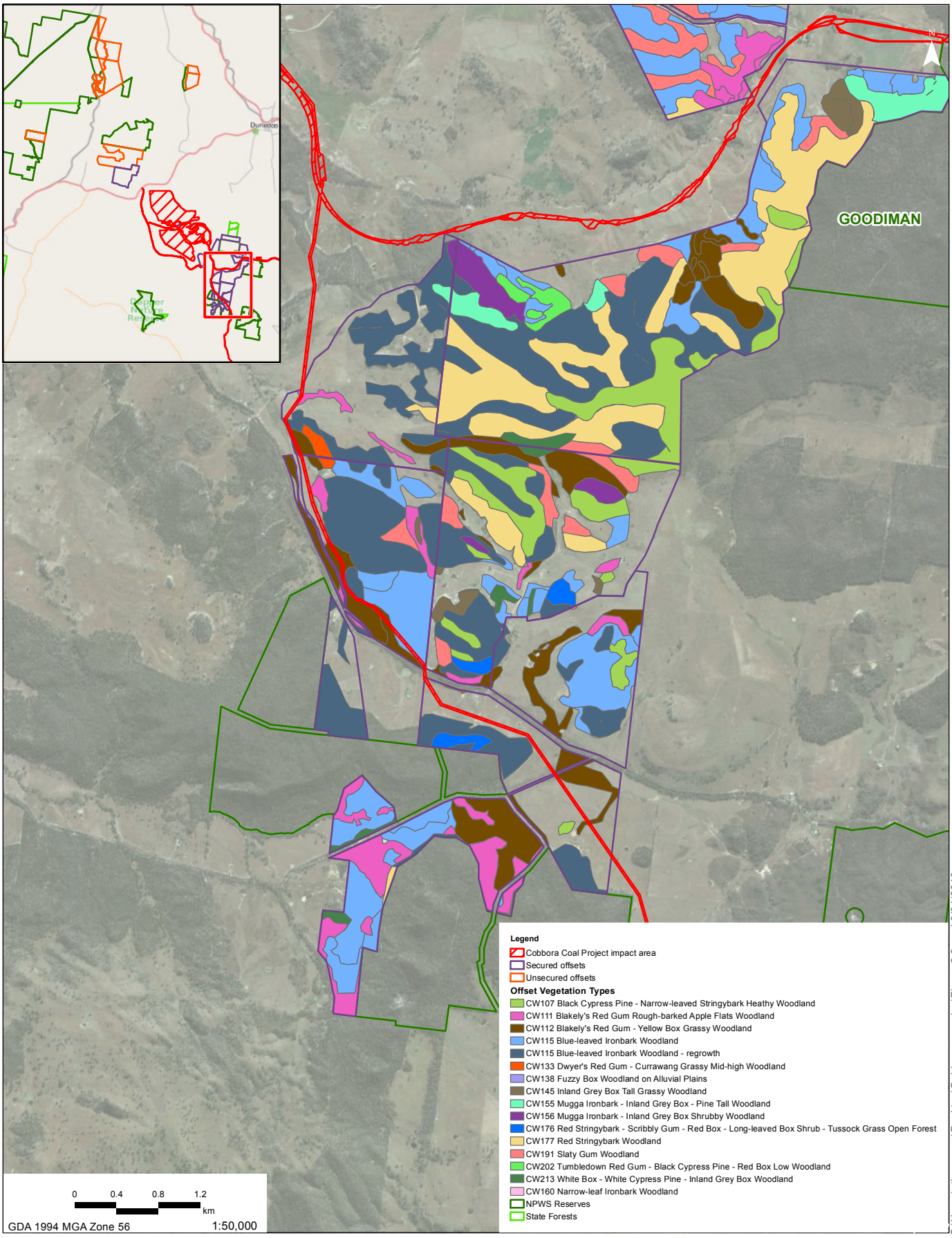
Cobbora offsets - Eastern Link Areas

Cobbora Coal Project - offset update

Figure 2.5



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Cobbora offsets - Southern NPWS additions

Cobbora Coal Project - offset update

Figure 2.6

2.5.1 Threatened flora in offset areas

i Ausfeld's Wattle

A large sub-population of Ausfeld's Wattle was recorded adjacent to Goodiman SCA in the Eastern link offset area in regrowth vegetation, where it was the dominant species. The sub-population in this area was estimated as 55,000 individuals, based on 10 m by 10 m plots recording approximately 100 plants (Figure 2.7). A smaller population occurs to the west of this population in regrowth (approximately 200 individuals) and another occurs adjacent to Yarrobil National Park (approximately 1,000 individuals).

ii Ingram's Zieria

Eight sub-populations of this Ingram's Zieria were identified in the offset areas (Table 2.4). A total of 1,435 plants have been recorded in these areas (see Table 2.4) (Figure 2.7 & 2.8). As described in Section 2.3, detailed targeted surveys are planned in the new offset areas, however three populations have already been identified in these areas opportunistically. Suitable habitat occurs throughout the new offsets for Ingram's Zieria, and known populations occur in adjacent NPWS Estate.

Table 2.4 Ingram's Zieria populations in the offset areas

Population number	Number of Individuals	Offset area	Description of sub-population	Vegetation community
3	340	Zieria patch	Located on a small grassy hill surrounded by paddocks. Small rock outcrops occur throughout with the plants generally below these areas on flatter ground. The sub-population ranges from north-facing slopes to south-east facing slopes and flat ground. Open woodland with a high percentage of bare ground. Individuals had set seed in November 2011 in this area.	Blue-leaved Ironbark Woodland and Dwyer's Red Gum Woodland
11	28	Eastern link area	On an eastern-facing slope in open woodland.	Blue-leaved Ironbark Woodland, Dwyer's Red Gum Woodland and Cypress Pine Woodland
12	70	Eastern link area	On a flat to north-facing gentle slope. Adjacent to a population of *Homoranthus darwinioides*. It occurs in a rocky area where there is a low percent canopy cover and a high proportion of open ground. The sub-population contained seedlings and some older plants.	Blue-leaved Ironbark Woodland and Cypress Pine Woodland
13	25	Eastern link area	Plants were predominantly located on the midslope with some plants recorded at the base of gentle slopes.	Blue-leaved Ironbark Woodland
14	23	Eastern link area	Plants recorded on the upper parts of south to south-east facing slopes. The sub-population contained seedlings and some older plants in open woodland with a low sparse shrub layer and scattered grass tussocks.	Blue-leaved Ironbark Woodland
15	216	Cobbora additions	Plants were recorded on a number of rocky knolls.	Dwyer's Red Gum amongst Blue-leaf

Table 2.4 Ingram's Zieria populations in the offset areas

Population number	Number of Individuals	Offset area	Description of sub-population	Vegetation community
				Ironbark and near patches of Red Stringybark Woodland.
16	5	Goonoo addition	Plants were recorded in two areas on a slight slope.	Dwyer's Red Gum amongst Blue-leaf Ironbark and near patches of Red Stringybark Woodland.
17	728	Goonoo addition	Plants were recorded on a cleared track and in adjacent bushland on a hillslope.	Dwyer's Red Gum amongst Blue-leaf Ironbark.
Total	**1,435**			

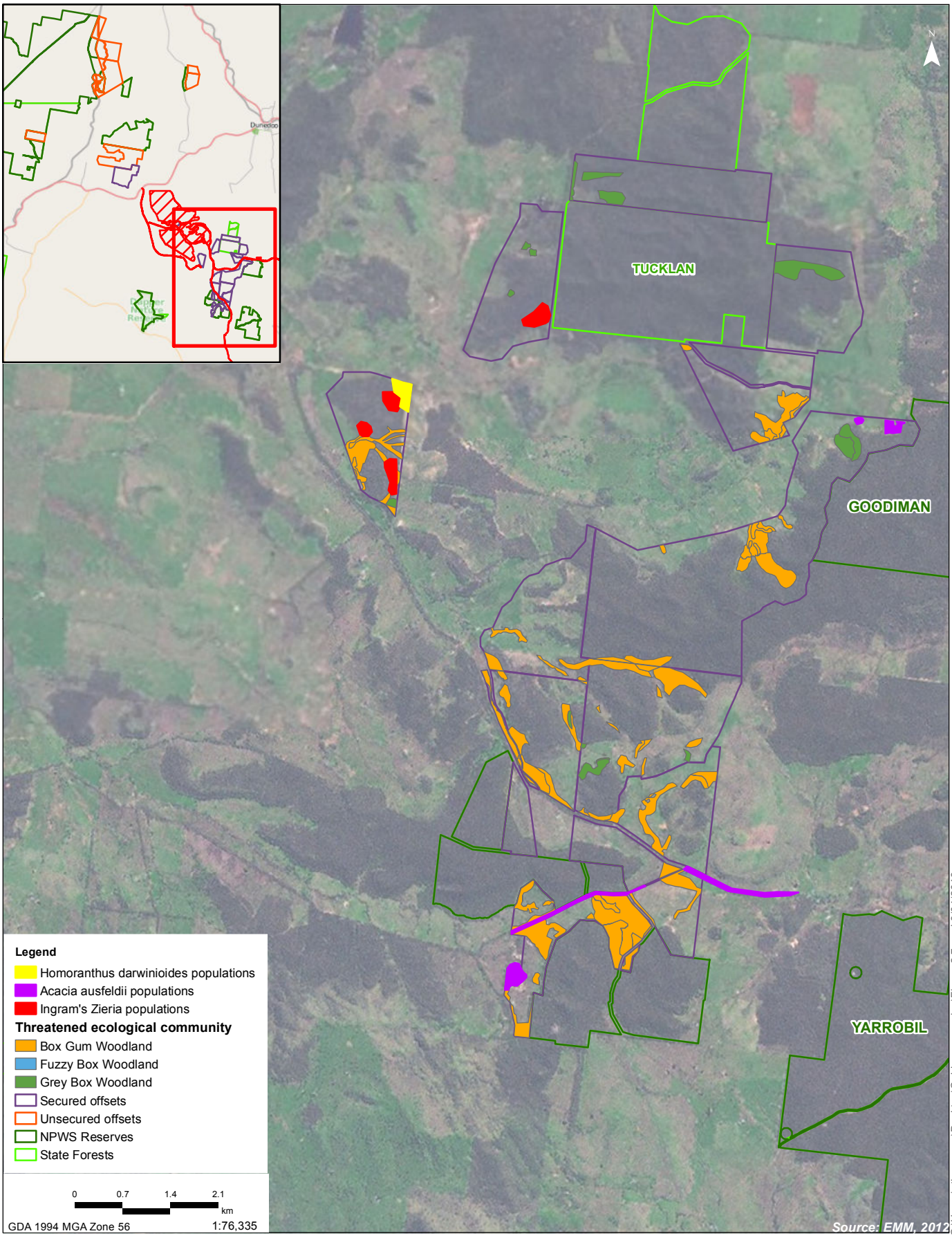
iii Homoranthus darwinioides

One of the two sub-populations of this species is within the eastern link offset area. This sub-population was estimated at greater than 200 individuals (Figure 2.7). This sub-population is located in Blue-leaved Ironbark Woodland. The dominant shrub species was Common Fringe-myrtle. Other species recorded included Silver-leaved Ironbark (*E. melanophloia*), Black Cypress Pine, *Allocasuarina gymanthera, Acacia triptera, Philotheca ciliata, Lomandra filiformis filiformis* and *Platysace linearifolia*.

No additional populations have been identified in the new offsets, however additional surveys (see Section 2.3) will target this species. Suitable habitat occurs in the new offsets and records occur in adjacent NPWS Estate.

iv Tylophora linearis

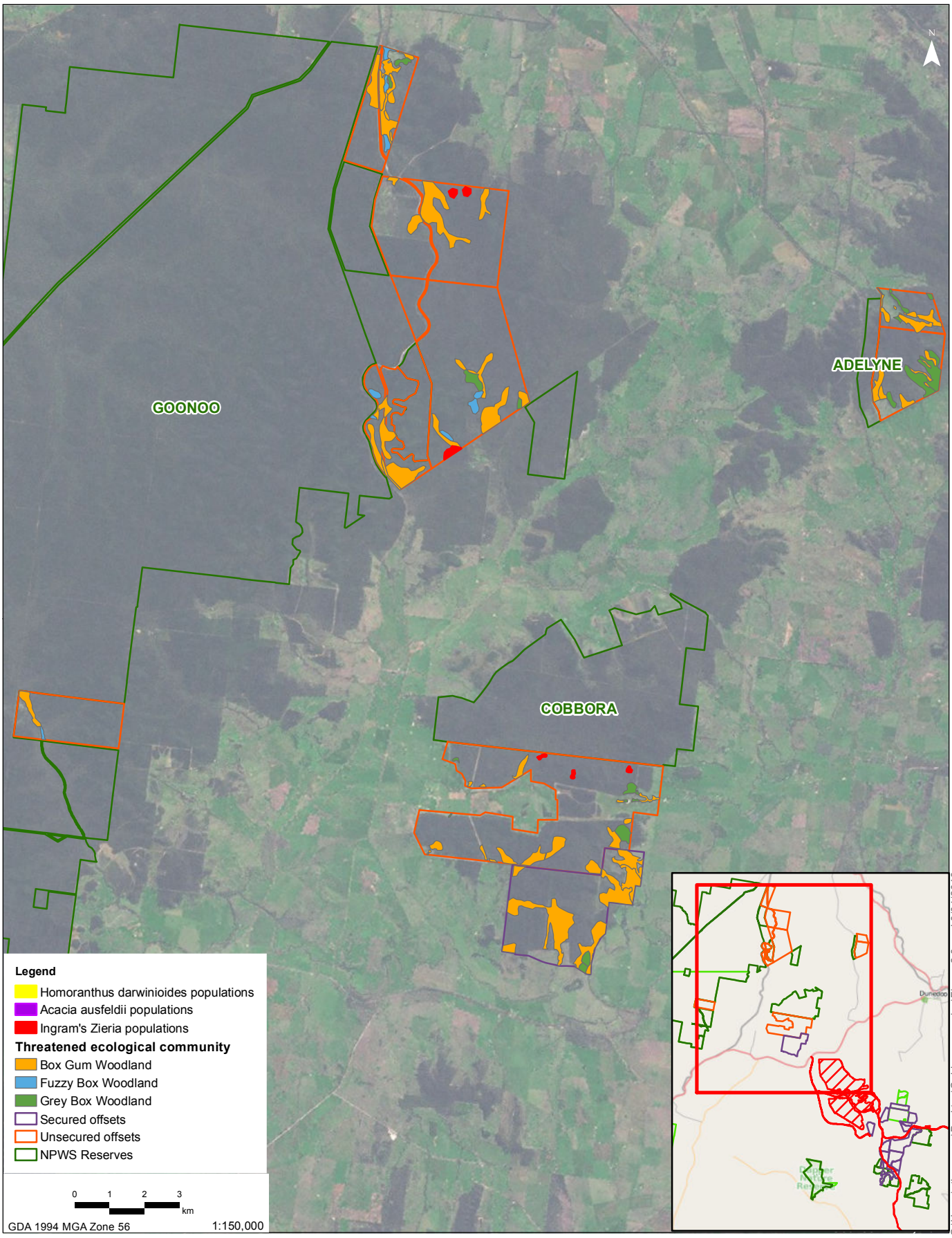
No additional populations of *Tylophora linearis* have been identified in the offsets to date, however additional surveys (see Section 2.3) will target this species. This is a cryptic species and surveys need to coincide with known flowering periods (November or May – flowered in the Project area in April). Suitable habitat occurs in these areas and records occur in the adjacent NPWS Estate.



Cobbora offsets - Threatened flora and TECs - Southern offsets

Cobbora Coal Project - offset update

Figure 2.7



Cobbora offsets - Threatened flora and TECs - Northern offsets

Cobbora Coal Project - offset update

Figure 2.8

2.5.2 Threatened fauna in offsets

The proposed offset areas provide habitat for the range of threatened species identified in the Project area. Important habitat features for threatened species include:

- approximately 35 km of cliff lines providing habitat for cave-roosting bats;
- hollow-bearing trees;
- known feeding resources such as large patches of *Allocasuarina* spp for the Glossy Black Cockatoo;
- fallen timber;
- dams and ephemeral creeks; and
- shrubby and regenerating areas.

Table 3.3 provides an overview of the threatened fauna recorded in the offset areas and the presence of suitable habitat for species recorded in the Project area. The Eastern Cave Bat was recorded in a number of the offset areas, but was not recorded in the Project footprint or surrounds during the Project surveys.

Table 2.5 Threatened fauna records and habitat in secured offset areas

	Offset area				
Common name	**Eastern link areas and NPWS additions Sth**	**Zieria patch**	**Cobbora SCA additions**	**Adelyne additions**	**Goonoo additions**
Birds					
Australasian Bittern	FH	-	-	FH	-
Barking Owl	FH, BH	-	FH, BH	FH, BH	FH, BH
Brown Treecreeper	R, FH, BH	FH	FH, BH	FH, BH	FH, BH
Diamond Firetail	R, FH, BH	FH	FH, BH	FH, BH	FH, BH
Glossy Black-Cockatoo	R, FH, BH	-	FH, BH	R, FH, BH	R, FH, BH
Grey-crowned Babbler	R, FH, BH	-	FH, BH	R, FH, BH	R, FH, BH
Hooded Robin	R, FH, BH	-	FH, BH	FH, BH	FH, BH
Little Lorikeet	R, FH, BH	FH	FH, BH	FH, BH	FH, BH
Malleefowl	FH	-	FH	FH	FH
Masked Owl	FH, BH	-	FH, BH	FH, BH	FH, BH
Powerful Owl	FH, BH	-	FH, BH	FH, BH	FH, BH
Regent Honeyeater	FH, BH	FH	FH, BH	FH, BH	FH, BH
Speckled Warbler	R, FH, BH	FH	R, FH, BH	R, FH, BH	R, FH, BH
Superb Parrot	R, FH, BH	FH	FH	FH, BH	FH, BH
Swift Parrot	FH, BH	FH	FH	FH, BH	FH, BH
Turquoise Parrot	FH, BH	-	FH, BH	FH, BH	FH, BH
Varied Sittella	R, FH, BH	-	FH, BH	FH, BH	FH, BH
White-fronted Chat	FH	-	-	FH	FH
Bats					
Eastern Bent-wing Bat	R, FH, BH	-	R, FH	R, FH, BH	FH, BH
Eastern Cave Bat	R, FH, BH	-	R, FH	R, FH, BH	FH, BH

Table 2.5 Threatened fauna records and habitat in secured offset areas

	Offset area				
Common name	**Eastern link areas and NPWS additions Sth**	**Zieria patch**	**Cobbora SCA additions**	**Adelyne additions**	**Goonoo additions**
Large-eared Pied Bat	FH, BH	-	FH	FH, BH	FH, BH
Little Pied Bat	R, FH, BH	-	FH	R, FH, BH	FH, BH
Southern Long-eared Bat	FH, BH	-	FH, BH	FH, BH	FH, BH
Yellow-bellied Sheathtail Bat	FH, BH	-	FH, BH	FH, BH	FH, BH
Reptiles and Frogs					
Pale-headed Snake	FH, BH	-	FH, BH	FH, BH	FH
Sloane's Froglet	FH	-	FH	FH	FH
Mammals					
Koala	FH	FH	FH	FH	FH
Spotted-tailed Quoll	FH, BH	FH	FH, BH	FH, BH	FH, BH
Squirrel Glider	FH, BH	FH	FH, BH	FH, BH	FH, BH

Notes: *1. TSC Act – Threatened Species Conservation Act 1995, EPBC Act – Environment Protection and Biodiversity Conservation Act 1999, Mi - migratory, V - vulnerable, E - endangered.*

2. R – recorded, FH – foraging habitat, BH - breeding habitat.

3 Offset outcomes

This section provides an assessment of the proposed package against the Updated Offset Strategy (EMM 2013) (the 'offset strategy') requirements, the OEH Interim Offset Policy and the Commonwealth EPBC Act Environmental Offset Policy.

3.1 Offset outcomes using ratios

3.1.1 Vegetation outcomes

The Project will protect and enhance four times the amount of woodland vegetation than will be impacted within the proposed offsets (Table 3.1). Offset to impact ratios for woodland TECs under the TSC Act range from 3.2:1 for Fuzzy Box Woodland, 4.8:1 for Grey Box Woodland and 54:1 for Box Gum Woodland. The offset to impact ratio for all other combined vegetation is 3.6:1.

Table 3.1 Vegetation outcomes with the offset package under the OEH Policy

Vegetation type	Impact area (ha)	Area in offset (ha)	Offset to impact ratio	Combined ratio for TECs*	Area required in offset strategy (ha)	Outcome (ha)[1]
Box Gum Woodland	22	1189	54:1	9.4:1	447	742
Box Gum Woodland DNG	105	0	0			
Fuzzy Box Woodland	14	45	3.2:1	1.6:1	126	-81
Fuzzy Box Woodland DNG	14	0	0			
Grey Box Woodland	43	205	4.8:1	2.7:1	360	-155
Grey Box Woodland DNG	34	0	0			
Sub-total TECs	**232**	**1,439**	**6.2:1**	**-**	**-**	**-**
Other native woodland	1,875	6,838	3.6:1	-	5,625	1,213
Total	**2,107**	**8,277**	**3.9:1**	**-**	**6,558**	-

Notes: *1 - negative numbers represent outstanding offset requirements.*
**includes DNG.*

The offset strategy (EMM 2013) aims for offset ratios for woodland TECs of a minimum of 6:1, while other vegetation types and grassland TECs aim for an offset to impact ratio of 3:1. Additional offsets are required to meet the offset strategy requirements for Fuzzy Box Woodland and Grey Box Woodland and associated DNG. More than 1,500 ha of additional grassland areas occur in the offset package areas. As detailed grassland surveys are yet to be conducted in these areas, it is possible that DNG occurs in the offsets, given their proximity to Fuzzy Box Woodland and Grey Box Woodland TEC areas.

3.1.2 Threatened species outcomes

The proposed offset areas contain habitat for all threatened species to be impacted by the Project. The offset to impact ratio for threatened species is generally 4:1 (Table 3.2). The offset strategy recommends a minimum offset to impact ratio of 3:1. The offset strategy requirements have been achieved for all species except for Ingram's Zieria, *H. darwinioides* and *T. linearis* and wetland/dam habitat.

Table 3.2 Threatened species offset outcomes with the offset package under the OEH Policy

Species or community	Status		Units	Impact	Proposed offsets	Outcome (ratio)	Additional measures
	TSC Act	EPBC Act					
Flora							
Homoranthus darwinioides	V	V	plants	227	200	0.9:1	Additional offset surveys during flowering period (March to December) Management and research funding
Ingram's Zieria	E	E	plants	706	1,435	2:1	Additional offset surveys during flowering period (spring) Management and research funding
Tylophora linearis	V	E	plants	9	0	0	Additional offset surveys during flowering period (November or May) Management and research funding
Acacia ausfeldii	V	-	plants	200	56,200	281:1	Offsets significantly exceed impact
Fauna							
Australasian Bittern	E	E	ha	9	21	2.3:1	Additional offset surveys to delineate potential habitat
Barking Owl	V	-	ha	1,954	8,277	4.2:1	-
Brown Treecreeper	V	-	ha	1,954	8,277	4.2:1	-
Diamond Firetail	V	-	ha	1,954	8,277	4.2:1	-
Eastern Bent-wing Bat	V	-	ha	1,954	8,277	4.2:1	-
Eastern Cave Bat	V	-	ha	1,954	8,277	4.2:1	-
Glossy Black-Cockatoo	V	-	ha	1,954	8,277	4.2:1	-
Grey-crowned Babbler	V	-	ha	1,954	8,277	4.2:1	-
Hooded Robin	V	-	ha	1,954	8,277	4.2:1	-
Koala*	V	V	ha	1,954	8,277	4.2:1	-
Large-eared Pied Bat	V	V	ha	1,954	8,277	4.2:1	-
Little Pied Bat	V	-	ha	1,954	8,277	4.2:1	-
Masked Owl	V	-	ha	1,954	8,277	4.2:1	-
Pale-headed Snake*	V	-	ha	1,954	8,277	4.2:1	-
Powerful Owl	V	-	ha	1,954	8,277	4.2:1	-
Regent Honeyeater*			ha	1,954	8,277	4.2:1	-
Sloane's Froglet*	V	-	ha	9	21	2.3:1	Additional offset surveys to delineate potential habitat

Table 3.2 Threatened species offset outcomes with the offset package under the OEH Policy

Species or community	Status		Units	Impact	Proposed offsets	Outcome (ratio)	Additional measures
	TSC Act	EPBC Act					
Southern Long-eared Bat	V	V	ha	1,954	8,277	4.2:1	-
Speckled Warbler	V	-	ha	1,954	8,277	4.2:1	-
Spotted-tailed Quoll*	V	E	ha	1,954	8,277	4.2:1	-
Squirrel Glider*	V	-	ha	1,954	8,277	4.2:1	-
Superb Parrot	V	V	ha	1,954	8,277	4.2:1	-
Swift Parrot*	E	E	ha	1,954	8,277	4.2:1	-
Varied Sittella	V	-	ha	1,954	8,277	4.2:1	-
Yellow-Bellied Sheathtail Bat	V	-	ha	1,954	8,277	4.2:1	-

*Notes: *not recorded in the Project footprint.*

3.1.3 Ratio outcomes

The Project will result in the protection and enhancement of over four times the woodland vegetation to be impacted. The proposed ratios in the offset strategy have been met for all vegetation types except Fuzzy Box Woodland and Grey Box Woodland TEC and associated DNGs. The ratios have also been met for all threatened species, with the exception of Ingram's Zieria, *Homoranthus darwinioides* and *Tylophora linearis.*

Detailed surveys are likely to identify further areas of DNG and threatened plant populations in the offset areas increasing the offset ratio presented in Table 3.2.

3.2 Assessment under the OEH Interim Offset Policy

3.2.1 Vegetation outcomes

Biobanking calculations have not been re-run for this update, rather a preliminary assessment has been completed using credits per hectare as a surrogate for impact and offset calculations, based on the original Biobanking calculations. This has been done to determine the suitability of the proposed offset package against the OEH Interim Offset Policy. The results of the offset estimates will be confirmed using the Biobanking calculator if required, once in-principal agreement is reached regarding the proposed offset package.

Tier 2 outcomes are achieved for the following vegetation types:

- CW111 Blakely's Red Gum Rough-barked Apple Flats Woodland;
- CW155 Mugga Ironbark - Inland Grey Box - Pine Tall Woodland;
- CW156 Mugga Ironbark - Inland Grey Box Shrubby Woodland;
- CW160 Narrow-leaf Ironbark Shrubby Woodland;
- CW176 Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box Shrub - Tussock Grass Open Forest;
- CW177 Red Stringybark Woodland;
- CW202 Tumbledown Red Gum - Black Cypress Pine - Red Box Low Woodland; and
- CW213 White Box - White Cypress Pine - Inland Grey Box Woodland.

Additional credits are required for seven of the vegetation types to result in an overall Tier 2 outcome for the Project under the OEH Interim Offset Policy (Table 3.3). An additional 8,282 ha of these vegetation types would be required to achieve this on a 'like for like' basis, based on an average of 9.5 credits per ha. As discussed in Section 3.2.2, this outcome is not commensurate with a range of recently approved projects. Opportunities for the Project to achieve a Tier 3 outcome for these additional requirements are described in the following section.

Table 3.3 Approximate Biobanking outcomes for the Project

BVT	Impact area (ha)	Credits required for Project impact	Offset area (ha)	Credits generated by offsets per ha	Total credits generated by offset	Outcome (negative numbers are a credit deficit)
CW107 Black Cypress Pine - Narrow-leaved Stringybark heathy woodland of the southern Brigalow Belt South Bioregion	188	12,220	510	10.3	5,233	-6,987
CW111 Blakely's Red Gum Rough-barked Apple Flats Woodland	9	702	836	9.2	7,725	7,023
CW112 Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion	13	910	353	14.4	5,080	-135
CW112 Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion DNG	105	4,305	0	7.8	0	
CW115 Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion	1,043	68,838	2,409	10.7	25,824	-63,169
CW115 Blue-leaved Ironbark woodland on sandy uplands and slopes of the Darling Riverine Plains Bioregion - regrowth	450	29,700	1,503	6.4	9,544	
CW133 Dwyer's Red Gum - Currawang grassy mid-high woodland of central NSW	67	4,355	625	6.2	3,900	-455
CW138 Fuzzy Box Woodland on Alluvial Plains	14	1,064	45	7.1	321	-1,317
CW138 Fuzzy Box Woodland on Alluvial Plains DNG	14	574	0		0	
CW145 Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	43	3,182	205	17.3	3,555	-1,021
CW145 Inland Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions DNG	34	1,394	0	7.4	0	
CW155 Mugga Ironbark - Inland Grey Box - pine tall woodland of the NSW South Western Slopes Bioregion	1	77	80	22.2	1,779	1,702

Table 3.3 Approximate Biobanking outcomes for the Project

BVT	Impact area (ha)	Credits required for Project impact	Offset area (ha)	Credits generated by offsets per ha	Total credits generated by offset	Outcome (negative numbers are a credit deficit)
CW156 Mugga Ironbark - Inland Grey Box shrubby woodland of the Brigalow Belt South Bioregion	0	0	298	13.8	4,124	4,124
CW160 Narrow-leaved Ironbark Shrubby Woodland	0	0	297	9.0	2,673	2,673
CW176 Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	5	380	57	15.4	876	496
CW177 Red Stringybark woodland of the dry slopes of the South Western Slopes Bioregion	20	1,460	860	10.2	8,763	7,303
CW191 Slaty Gum woodland of the slopes of the southern Brigalow Belt South Bioregion	101	6,969	166	8.3	1,374	-5,595
CW202 Tumbledown Red Gum - Black Cypress Pine - Red Box low woodland of hills of the South Western Slopes	0	0	14	8.8	123	123
CW213 White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW	0	0	19	12.7	241	241
Total	**2,107**	**136,130**	**8,277**	**-**	**81,135**	-

i Tier 3 assessment

Under the OEH Offset Policy, considering whether a Tier 3 outcome is appropriate, consideration should be given to:

- whether credits required by the calculator are available on the market;
- whether alternative offset sites (other than credits) are available on the market;
- the overall cost of the offsets and whether these costs are reasonable given the circumstances.

Searches of the Biobanking register have been undertaken, particularly for the presence of TECs. These were outlined in the Updated Biodiversity Offset Strategy (EMM 2013). Searches were unable to locate suitable credits required for the offset package (see Appendix B).

Some properties have been identified through the OEH expression of interest register with potential vegetation communities which may meet the description of outstanding vegetation types. Discussions have been held with owners of these properties. However, given the distance of the properties from the Project area, and therefore reduced potential for 'like for like' offsets, and lack of ecological surveys undertaken to date, a decision was made to focus resources on properties surrounding the Project area.

A Tier 3 outcome, using the variation criteria, is considered to represent a 'mitigated net loss' outcome. Under the OEH Interim Offset Policy, to achieve a Tier 3 'mitigated net loss' standard, the variation criteria may be applied to the Biobanking credit results. The minimum area standard is an offset to clearing ratio of 2:1 under the variation criteria.

In the absence of suitable identified land-based offsets, an assessment of the Tier 3 criteria has been completed, which is provided in the following section for the vegetation types where it is not possible to meet the Tier 2 requirements.

Criterion A: Convert ecosystem credits for one vegetation type to any vegetation type within the same vegetation formation in the same IBRA bioregion.

This variation allows the conversion of ecosystem credits for one vegetation type to another vegetation type within the same vegetation formation in the same IBRA bioregion (Table 3.4).

Using this criterion, a Tier 3 outcome is achieved for the following vegetation types:

- CW112 Blakely's Red Gum - Yellow Box Grassy Woodland;
- CW138 Fuzzy Box Woodland; and
- CW145 Inland Grey Box Tall Grassy Woodland.

Table 3.4 Tier 3 outcomes using variation Criterion A

Vegetation formation	OEH vegetation type	Credits required	Credits generated in offset areas	Outcome (negative numbers are a credit deficit)
Semi-arid Woodlands (Shrubby subformation)	CW133	4,355	3,900	-455
Grassy Woodlands	CW111, CW112, CW138, CW145, CW213	12,575	16,921	4,346
Dry Sclerophyll Forests (Shrubby subformation)	CW107, CW115, CW155, CW191, CW202, CW160	109,939	54,575	-55,364

Based on Criterion A, outstanding credits are required for the following vegetation types:

- CW107 Black Cypress Pine - Narrow-leaved Stringybark Heathy Woodland;
- CW115 Blue-leaved Ironbark Woodland;
- CW133 Dwyer's Red Gum - Currawang Grassy Mid-high Woodland; and
- CW191 Slaty Gum Woodland.

Criterion B: Remove/reduce the need for offsetting.

More than 4 ha of each vegetation type requiring additional offsets is being cleared so this is not applicable to the Project.

Criterion C: Convert ecosystem credits required to hectares and, if necessary, convert hectare figure to an estimate of land value.

This variation allows the calculation of areas and estimates the cost for required offsets where there is insufficient time to secure the offset sites at the time the decision is made. Approximately 76,206 credits are outstanding for the four remaining vegetation types (see Criterion A above) (see Table 3.3). This equates to roughly 8,021 ha of additional land (based on 9.5 ha per offset credit), which at an average of $200 per acre (current cost of offset land in the area), this equates to approximately $1.6 million for the land purchase only. This is a 97% increase to the proposed offset package and would result in an overall offset to impact ratio for the project of 8:1. Given the large offset areas already purchased and under acquisition and the likely additional management costs for these areas, this is significant. Further, it is not required to meet a Tier 3 outcome, as Criterion D can be applied to these outstanding requirements.

Criterion D: Minimum area standard.

Under the Tier 3 outcome, the minimum area standard for offsets is an offset to clearing ratio of 2:1. The offset to clearing ratio for the remaining vegetation types is close to 3:1. Therefore the minimum standard is exceeded with the existing proposed offsets.

3.2.2 Threatened species outcomes

A Tier 2 outcome under the OEH Offset Policy is achieved by the proposed offsets for *Acacia ausfeldii*, Australasian Bittern, Eastern Bentwing Bat, Eastern Cave Bat, Koala, Regent Honeyeater, Sloane's Froglet, Superb Parrot, Swift Parrot and the Large-eared Pied Bat (Table 3.5).

Table 3.5 Threatened species outcomes using the BBAM

Species	Tg value	Units	Impact	Credits required for Project[1]	Offset	Credits achieved by proposed offsets	Outcome[2]	Units still required
Zieria ingramii	0.65	plants	706	10,862	1,258	7,548	-3,314	552
Tylophora linearis	0.125	plants	9	720	0	0	-720	120
Homoranthus darwinioides	0.675	plants	227	3,363	227	1,362	-2,001	333
Acacia ausfeldii	0.125	plants	200	16,000	56,200	337,200	321,200	0
Large-eared Pied Bat (breeding)	0.125	ha	2	160	5	27	-133	22
Large-eared Pied Bat (foraging)	0.75	ha	1954	26,053	8,277	49,662	23,609	0
Australasian Bittern	0.75	ha	9	120	21	126	6	0
Eastern Bent-wing Bat	0.75	ha	1954	26,053	8,277	49,662	23,609	0
Eastern Cave Bat (breeding)	0.125	ha	2	160	5	27	-133	22
Eastern Cave Bat	0.75	ha	1954	26,053	8,277	49,662	23,609	0
Koala	0.825	ha	1954	23,685	8,277	49,662	25,977	0
Pale-headed Snake	0.3	ha	1954	65,133	8,277	49,662	-15,471	2,579
Regent Honeyeater*	0.75	ha	1954	26,053	8,277	49,662	23,609	0
Sloane's Froglet*	0.75	ha	9	120	21	126	6	0
Spotted-tailed Quoll*	0.35	ha	1954	55,829	8,277	49,662	-6,167	2,579
Squirrel Glider*	0.45	ha	1954	43,422	8,277	49,662	6,240	0
Superb Parrot	0.525	ha	1954	37,219	8,277	49,662	12,443	0
Swift Parrot*	0.75	ha	1954	26,053	8,277	49,662	23,609	0

Notes: *1. Using equation 13 of the BBAM.*

2. Using equation 14 of the BBAM, negative number represents credit deficit.

**Species not recorded in the Project footprint.*

Tier 2 credit requirements have not been fully met for Ingram's Zieria, *Tylophora linearis, Homoranthus darwinioides*, Pale-headed Snake, Spotted tailed Quoll and breeding habitat for cave-roosting bats. The variation criteria relevant to species credits have been considered in the following section for these species.

i Tier 3 assessment

Criterion A: Convert one type of species credit to another type of species credit with the same or more endangered conservation status.

Surplus credits are available for *Acacia ausfeldii* which is listed as a vulnerable species under the TSC Act. These credits can be used for the requirements for *Tylophora linearis* and *Homoranthus darwinioides*. In addition, the threatened bat breeding habitat credits (Large-eared Pied Bat and Eastern Cave Bat) can be covered by the other threatened species credits generated for these species for foraging habitat. Therefore a Tier 3 outcome is achieved for these threatened species.

Outstanding credits for vulnerable listed threatened fauna could be compensated by excess credits generated by other vulnerable fauna species. Outstanding requirements for the Spotted-tail Quoll and Ingram's Zieria can also be compensated by the excess credits generated by the Swift Parrot which is listed as an endangered species.

3.2.3 OEH Interim Offset Policy outcomes

Tier 2 outcomes are achieved by the proposed offsets for eight of the vegetation types identified in the Project footprint. An additional 8,282 ha would be required for other vegetation types to meet a Tier 2 outcome. However, the Tier 3 criteria have been applied to these vegetation types and results in three additional vegetation types meeting the Policy requirements, by substituting one vegetation type for another within the same vegetation formation. The remaining four vegetation types meet a Tier 3 outcome by reducing the offset to impact ratio to a minimum of 2:1, with the majority closer to 3:1 recognising the importance of these areas as threatened species habitat.

Tier 2 outcomes have been achieved for eleven of the threatened species credits generated. The variation criteria have been applied and Tier 3 outcomes have been achieved for all threatened species, by converting one type of species credit to another type of species credit.

Therefore, the offset package meets the requirements of a mitigated net loss standard under the OEH Interim Offset Policy for impacts to vegetation and threatened species.

3.3 Commonwealth EPBC Act Environmental Offset Policy

The EPBC Act Environmental Offset Policy was applied to matters of National Environmental Significance (MNES) to determine if the proposed offsets meet the requirements under the EPBC Act. It was applied where residual impacts will occur to MNES. Additional species which have a moderate to high likelihood of occurring in the Project footprint, for which SEWPaC have required offsets, have also been included (Table 3.8).

The proposed offset package will meet requirements for all threatened fauna listed as MNES, but the minimum offset has not been met for *Homoranthus darwinioides*, *Tylophora linearis* or the Australasian Bittern. Details of the calculations are provided in Appendix A.

The proposed offsets for all threatened flora species include translocation, propagation and re-introduction of new plants to supplement existing populations in the proposed offset areas. It also allows for natural recruitment resulting from an improvement in the management of habitat in known population areas. However, the confidence of such results has been assessed by EMM at 50%, which is a combined value for natural and assisted recruitment, as such methods are currently untested for these species.

Detailed surveys of the new offset areas may identify additional populations of *Homoranthus darwinioides* and *Tylophora linearis*, increasing the percent of the impact offset, and meeting the EPBC Act Environmental Offset Policy requirements.

Table 3.6 Summary of offset outcomes for MNES with the offset package

MNES	Impact	Proposed offset[1]	Net present value (adjusted hectares)[2]	Percent of impact offset	Minimum offset met? (90% direct offsets)
Box Gum Woodland	22 ha	1,188 ha	111.99	848.40%	Yes
Grey Box Woodland	43 ha	205 ha	33.11	128.35%	Yes
Homoranthus darwinioides	227 plants	200 plants (plus 200 plant increase over 10 years through management)	147.03	64.77%	No
Ingram's Zieria	706 plants	1,435 plants (plus 1,435 plant increase over 10 years through management)	955.01	135.27%	Yes
Tylophora linearis	9 plants	0 plants (plus 10 plant increase over 10 years through management)	4.44	49.31%	No
Large-eared Pied Bat	1,954 ha	8,277 ha	1,119.63	114.60%	Yes
Southern Long-eared Bat	1,954 ha	8,277 ha	1,119.63	114.60%	Yes
Spotted-tailed Quoll*	1,954 ha	8,277 ha	947,67	121.25%	Yes
Swift Parrot*	1,954 ha	8,277 ha	947,67	121.25%	Yes
Superb Parrot*	1,954 ha	8,277 ha	1,013.79	103.77%	Yes
Australasian Bittern*	9 ha	21 ha	2.4	66.79%	No
Regent Honeyeater*	1,954 ha	8,277 ha	947.67	121.25%	Yes

Notes: *1. As per the EPBC Act Environmental Offset Policy.*

*2. Rounded up to the nearest whole number for calculations. *Species not recorded in the Project footprint.*

3.3.1 EPBC Act Environmental Offset Policy outcomes

The EPBC Act Environmental Offset Policy has been met for all TECs and for all threatened species listed as MNES with the exception of *Homoranthus darwinioides*, *Tylophora linearis* and the Australasian Bittern. Given the presence of available habitat, it is expected that detailed surveys will identify further sub-populations of these flora species and that the proposed management strategies will improve the viability of the identified populations. Additional waterbird habitat could be provided in the offset areas for the Australasian Bittern, but these need to be mapped in detail. In combination, these will increase the offsets achieved for these threatened species.

4 Conclusion

Biodiversity offsets are required to compensate for the post-mitigation biodiversity impacts of the Cobbora Coal Project. Remaining impacts to be compensated include the loss of TECs, threatened flora and threatened fauna and their habitat.

This offset update provides details of the proposed offset package, based on additional offset identification and survey work. It also provides an assessment of the proposed package against the offset strategy requirements, the OEH Interim Offset Policy and the Commonwealth EPBC Act Environmental Offset Policy.

4.1 Current offset package

The offset sites contain populations of threatened flora and fauna species that were identified in the Project area. They also contain areas of vegetation in similar or better condition to that of the Project area, including areas of TECs. The proposed offset package comprises 9,743 ha of offset land, containing 8,277 ha of woodland vegetation. Approximately 3,725 ha of offset areas have been secured by CHC. Negotiations are currently underway to secure the additional 6,018 ha.

More than 820 person-hours have been spent surveying the biodiversity of the offset areas. In addition to this, detailed surveys will be undertaken to identify the full suite of ecological values present, to confirm that vegetation types meet the 'like for like' criterion (through quantitative sampling), and targeting threatened species which are considered likely to occur. Unsurveyed grassland areas occur throughout the offsets. Surveys will also be undertaken to classify these areas and determine if they meet the description of DNG under the TSC Act or EPBC Act.

Offset requirement estimates based on the OEH Interim Offset Policy and the EPBC Act Environmental Offset Policy, show that the proposed offset package generally meets the requirements of these policies. Under the OEH Interim Offset Policy, the project will result in an overall Tier 3 outcome using the variation criteria, however Tier 2 outcomes are achieved for some threatened ecological communities and species.

Under the EPBC Act Environmental Offset Policy, the offset requirements are met for all MNES except *Tylophora linearis, Homoranthus darwinioides* and the Australasian Bittern. Approximately 9 additional *T. linearis* plants, 150 *H. darwinioides* and an additional 9 ha of habitat for the Australasian Bittern are required to meet the policy objectives. The translocation and planting of seedlings and cuttings of threatened plants, into offset areas is identified as a feasible offset measure to increase the viability of offset populations by SEWPaC. Propagation trials are underway with collected threatened plant seed to supplement offset populations. Trials will also be completed using cuttings and translocation when the Project is approved. Additional dams and waterbird habitat could be provided in the offset areas for the Australasian Bittern, but these need to be mapped in detail.

The proposed offsets result in an overall offset to impact ratio for woodland of approximately 4:1. The offset areas contain significant areas of TECs (approximately 18% of the proposed offsets) equating to an offset to impact ratio of more than 6:1. The offsets provide known and potential habitat for a range of threatened flora and fauna species identified in the Project footprint, including consistent vegetation types and habitats.

Based on the offset ratios for equivalent recently approved NSW projects (as described in Section 5.5.1 of the PPR&RTS Updated Biodiversity Offset Strategy), the proposed offsets achieve an offset ratio equivalent or better than these for woodland vegetation and threatened species habitat generally.

However, additional areas containing, or equivalent supplementary planting of known populations of *T. linearis and H. darwinioides* will be required to complete the package. These may be within the current offset areas or may require additional offsets. If these cannot be found and secured in the region, alternative non-land based compensatory measures will be provided in consultation with DP&I, OEH and SEWPaC.

4.2 Finalisation of the offset package

It is proposed that the offset package is finalised in consultation with DP&I, OEH and SEWPaC as follows:

- Prior to Project determination:
  - meet with DP&I, OEH and SEWPaC to confirm the adequacy of the offset package;
  - additional surveys in April and May to identify further populations of *T. linearis* and *H. Darwinioides* and map out additional waterbird habitat in the offset areas;
  - impact and offset site visits with DP&I, OEH and SEWPaC if required; and
  - update DP&I, OEH and SEWPaC based on the outcomes of the surveys.
- Following Project approval:
  - complete detailed surveys for the recently identified offset areas to confirm vegetation types and classify grassland areas. Spring surveys would target cryptic threatened species. Results will be reported to DP&I, OEH and SEWPaC;
  - report results of propagation and translocation trials to DP&I, OEH and SEWPaC;
  - determine if additional offsets are required, based on detailed survey results of vegetation types and threatened species and identify suitable alternatives;
  - finalise land purchase, conservation and management agreements; and
  - prepare and implement the offset management plan.

Appendix A

EPBC Act offset calculations

A.1 Endangered ecological communities

Details on the condition assessments for the Project area and offsets have been completed in accordance with the guidance material for the Commonwealth Offset Calculator and provided below for the EPBC Act listed TECs (Table A.1 and A.2).

In general, the TEC areas comprise woodlands which contained over mature trees and a diverse understorey in most areas. This was the case on both the impact and offset areas. Detailed survey results from the Terrestrial Ecology Assessment were used to determine the condition of the communities against known condition variables in the listing advice and the equivalent benchmarks in the Biometric vegetation types database.

The context of the proposed offset areas was also assessed. The proposed offsets contain large blocks of native vegetation adjacent to large conservation areas, providing connectivity to other TEC sites via riparian drainage lines.

A 10 year time horizon was used for the TECs for both the risk-related time horizon and also the time until ecological benefit. While management actions are likely to continue beyond this timeframe, available scientific data shows that Box Gum Woodland has the ability to regenerate over a relatively short timeframe, particularly when grazing is removed (Maguire & Mulvaney 2011).

The predicted condition of the offsets were determined for the 'future quality without offset' value if no management actions were undertaken and considering the existing land use, zoning and management of the sites. Without conservation in offset areas, TEC areas will be subject to continued wood collection and disturbance and agricultural land uses.

Existing scientific information on the success of such management strategies was incorporated into the decision-making process to determine the 'future quality with offset' value. It is considered likely that the TEC areas will respond quickly to removal of grazing and assisted and natural regeneration (Maguire & Mulvaney 2011). A moderate degree of confidence has been placed on this, as it has been demonstrated on other sites that removal of agricultural activities will provide a positive outcome and improvements in condition.

Table A.1 Quality calculations for Box Gum Woodland

Key considerations	**Score**			
	Project area	**Offsets before**	**Without offset**	**Offsets after**
Structure and condition of the vegetation on the site (2 points)	1.4	1.4	1.2	1.5
Diversity of relevant habitat species present (including both endemic and non-endemic) (2 points)	1.4	1.4	1.1	1.5
Relevant habitat features on the site (2 points)	1.4	1.4	1.1	1.5
Connectivity with other suitable/known habitat or remnants (2 points)	1	1	1	1.5
Importance of the site in relation to the occurrence of the ecological community (1 point)	0.5	0.5	0.5	0.5
Threats on or near the site (1 point)	0.3	0.3	0.1	0.5
Total score	**6**	**6**	**5**	**7**

Table A.2 Quality calculations for Grey Box Woodland

Key considerations	Score			
	Project area	**Offsets before**	**Without offset**	**Offsets after**
Structure and condition of the vegetation on the site (2 points)	1.4	1.4	1.2	1.5
Diversity of relevant habitat species present (including both endemic and non-endemic) (2 points)	1.4	1.4	1.1	1.5
Relevant habitat features on the site (2 points)	1.4	1.4	1.1	1.5
Connectivity with other suitable/known habitat or remnants (2 points)	1	1	1	1.5
Importance of the site in relation to the occurrence of the ecological community (1 point)	0.5	0.5	0.5	0.5
Threats on or near the site (1 point)	0.3	0.3	0.1	0.5
Total score (0-10)	**6**	**6**	**5**	**7**

A.2 Threatened species

Threatened flora numbers were used in the calculations, while threatened fauna species habitat was used in the absence of detailed information on the number of habitat features, birth rate or mortality rate for such species.

It was assumed that the future value of the threatened flora without the offset would be reduced from the current value by 50% as a result of agricultural activities and the potential for future clearing and wood collection in these areas over a ten year period. Continued grazing and agricultural disturbances is likely given the existing management and land use of these areas.

For the future value with the offset, natural and assisted recruitment (seedling propagation and translocation) assumed that there would be a 100% increase over a ten year period in the number of plants on the offset areas. Assisted recruitment will increase the viability of the plant populations and the removal of grazing pressure and agricultural disturbance potential will improve the condition of the habitat present. Moderate confidence at 50% has been used in the calculations, that additional planting, natural regeneration and other management activities will assist in the long-term viability of the population.

The characteristics of each threatened fauna species were considered to determine the appropriate condition of the impact and offset areas. Information for the condition, including important habitat features and condition of these, and the context of the sites including proximity of the area to other habitat areas and movement corridors when considering mobility of species, or pollination opportunities, were assessed to provide an overall habitat condition value (Table A.3 and Table A.4).

The future condition of the offset areas with and without the offsets was assessed in consideration of the proposed management actions and existing land use, zoning and management of the sites. Without the conservation of the offset areas, threatened fauna would be subject to continued wood collection, disturbance and agricultural land uses, which would affect the condition of the habitat present (Table A.5).

Table A.3 Impact area habitat condition for threatened fauna

MNES	Habitat condition	Area/ plants	Context (0 - 10)	Start condition (0 - 10)	Description	Habitat condition
Large-eared Pied Bat	Moderate	1,758	4	5	No significant cave structures evident - just rock crevices and fissures, but suitable foraging habitat, few records across the project site	5
Southern Long-eared Bat	Moderate	1,758	4	5	Only one record at the project site, hollow-bearing trees in the recorded area are minimal, but suitable foraging resources available	5
Spotted-tailed Quoll*	Moderate	1,758	3	4	Not recorded, but suitable habitat present	4
Swift Parrot*	Moderate	1,758	3	4	Not recorded, but suitable habitat present	4
Superb Parrot	Moderate	1,758	3	5	Suitable foraging resources present, recorded in ironbark woodland which is common in the the area	4
Australasian Bittern	Poor	9	4	3	Potential record onsite, marginal forgaing habitat, but no suitable breeding habitat	4
Regent Honeyeater*	Moderate	1,758	3	4	Not recorded, but suitable habitat present	4

Table A.4 Offset area habitat start condition for threatened fauna

MNES	Habitat condition	Area	Context	Start condition (0 - 10)	
Large-eared Pied Bat	Moderate	7,898	Large blocks of native vegetation adjacent to large conservation areas	5	Some cave-like structures and over-hangs present as well as rock crevices and fissures, suitable foraging habitat and records present
Southern Long-eared Bat	Moderate	7,898	Large blocks of native vegetation adjacent to large conservation areas	5	Not recorded but hollow-bearing trees present, suitable foraging resources available
Spotted-tailed Quoll*	Moderate	7,898	Large blocks of native vegetation adjacent to large conservation areas	4	Not recorded, but suitable habitat present
Swift Parrot*	Moderate	7,898	Large blocks of native vegetation adjacent to large	4	Not recorded, but suitable habitat present

Table A.4 Offset area habitat start condition for threatened fauna

MNES	Habitat condition	Area	Context	Start condition (0 - 10)	
			conservation areas		
Superb Parrot	Moderate	7,898	Large blocks of native vegetation adjacent to large conservation areas	5	Suitable foraging resources present, recorded in ironbark woodland at the project site which is common in the area
Australasian Bittern	Poor	15	Large blocks of native vegetation adjacent to large conservation areas	3	Marginal foraging habitat, but no suitable breeding habitat
Regent Honeyeater*	Moderate	7,898	Large blocks of native vegetation adjacent to large conservation areas	4	Not recorded, but suitable habitat present

Table A.5 Future condition of offset

MNES	Future condition without offset (0 - 10)		Future condition with offset (0 - 10)		Ecological benefit confidence		Risk of loss confidence	
Large-eared Pied Bat	4	Continued wood collection, feral animal disturbance and agricultural land uses likely	6	Removal of grazing, feral animal control and improvement in habitat condition will improve the quality of the offsets for this species	85%	High confidence as feral animals are a KTP for this species and the management improvements are known to improve habitat condition	80%	Continued wood collection, feral animal disturbance and agricultural land uses likely
Southern Long-eared Bat	4	Continued wood collection, feral animal disturbance and agricultural land uses likely	6	Removal of grazing, wood collecting, feral animal control and improvement in habitat condition will improve the quality of the offsets for this species	85%	High confidence as the management improvements are known to improve habitat condition	80%	Continued wood collection, feral animal disturbance and agricultural land uses likely
Spotted-tailed Quoll*	3	Continued wood collection, feral animal disturbance and agricultural land uses likely	5	Removal of grazing, wood collecting, feral animal control and improvement in habitat condition will improve the quality of the offsets for this species	85%	High confidence as the management improvements are known to improve habitat condition	80%	Continued wood collection, feral animal disturbance and agricultural land uses likely
Swift Parrot*	3	Continued wood collection, feral	5	Removal of grazing, wood collecting,	85%	High confidence as the management	80%	Continued wood collection, feral

Table A.5 Future condition of offset

MNES	Future condition without offset (0 - 10)		Future condition with offset (0 - 10)		Ecological benefit confidence		Risk of loss confidence	
		animal disturbance and agricultural land uses likely		feral animal control and improvement in habitat condition will improve the quality of the offsets for this species		improvements are known to improve habitat condition		animal disturbance and agricultural land uses likely
Superb Parrot	5	Continued wood collection, feral animal disturbance and agricultural land uses likely	7	Removal of grazing, wood collecting, feral animal control and improvement in habitat condition will improve the quality of the offsets for this species	85%	High confidence as the management improvements are known to improve habitat condition	80%	Continued wood collection, feral animal disturbance and agricultural land uses likely
Australasian Bittern	2	Minimal impact to dams, however potential for fox predation	3	Removal of grazing, feral animal control and improvement in habitat condition will improve the quality of the offsets for this species	75%	Moderate confidence as the management improvements are known to improve habitat condition	80%	Minimal impact to dams, however potential for fox predation
Regent Honeyeater*	3	Continued wood collection, feral animal disturbance and agricultural land uses likely	5	Removal of grazing, wood collecting, feral animal control and improvement in habitat condition will improve the quality of the offsets for this species	85%	High confidence as the management improvements are known to improve habitat condition	80%	Continued wood collection, feral animal disturbance and agricultural land uses likely

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

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Matter of National Environmental Significance	
Name	Box Gum Woodland
EPBC Act status	Critically Endangered
Annual probability of extinction Based on IUCN category definitions	**6.8%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	Yes	Box Gum Woodland	**Area**	22	Hectares	
			Quality	**6**	Scale 0-10	
			Total quantum of impact	13.20	Adjusted hectares	
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)		% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																					
Area of community	Yes	13.20	Adjusted hectares	Unsecured and secured offsets	**Risk-related time horizon (max. 20 years)**	10	**Start area (hectares)**	1188	**Risk of loss (%) without offset**	40%	**Risk of loss (%) with offset**	20%	237.60	70%	166.32	86.15	111.99	848.40%	Yes		
									Future area without offset (adjusted hectares)	712.8	**Future area with offset (adjusted hectares)**	950.4									
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**6**	**Future quality without offset (scale of 0-10)**	**5**	**Future quality with offset (scale of 0-10)**	**7**	2.00	70%	1.40	0.73					
Threatened species habitat																					
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**										
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0									
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**										
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**		**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																				
Condition of habitat Change in habitat condition, but no change in extent	No																				
Threatened species																					
Birth rate e.g. Change in nest success	No																				
Mortality rate e.g Change in number of road kills per year	No																				
Number of individuals e.g. Individual plants/animals	No																				

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	13.2	111.99	848.40%	**Yes**	$0.00	N/A	$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
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Matter of National Environmental Significance	
Name	Grey Box
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	Yes	Grey Box Woodland	**Area**	43	Hectares	
			Quality	**6**	Scale 0-10	
			Total quantum of impact	25.80	Adjusted hectares	
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)		% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																					
Area of community	Yes	25.80	Adjusted hectares	Unsecured and secured offsets	**Risk-related time horizon (max. 20 years)**	10	**Start area (hectares)**	205	**Risk of loss (%) without offset**	40%	**Risk of loss (%) with offset**	20%									
									Future area without offset (adjusted hectares)	123.0	**Future area with offset (adjusted hectares)**	164.0	41.00	70%	28.70	25.47	33.11	128.35%	Yes		
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**6**	**Future quality without offset (scale of 0-10)**	**5**	**Future quality with offset (scale of 0-10)**	**7**	2.00	70%	1.40	1.24					
Threatened species habitat																					
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**										
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0									
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**										
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**		**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																				
Condition of habitat Change in habitat condition, but no change in extent	No																				
Threatened species																					
Birth rate e.g. Change in nest success	No																				
Mortality rate e.g Change in number of road kills per year	No																				
Number of individuals e.g. Individual plants/animals	No																				

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	25.8	33.11	128.35%	**Yes**	$0.00	N/A	$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
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Matter of National Environmental Significance	
Name	Asutralasian Bittern
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Asutralasian Bittern	**Area**	9	Hectares	
			Quality	**4**	Scale 0-10	
			Total quantum of impact	3.60	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	3.60	Adjusted hectares	secured and unsecured offsets	**Time over which loss is averted (max. 20 years)**	10	**Start area (hectares)**	21	**Risk of loss (%) without offset**	30%	**Risk of loss (%) with offset**	15%	3.15	60%	1.89	1.68	2.40	66.79%	No	
									Future area without offset (adjusted hectares)	14.7	**Future area with offset (adjusted hectares)**	17.9								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**4**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**5**	2.00	60%	1.20	1.07				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	3.6	2.40	66.79%	**No**	$0.00	#DIV/0!	#DIV/0!
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Homoranthus darwinioides
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	Yes	Homoranthus darwinioides	227		Count	

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																
Area of community	No				**Risk-related time horizon (max. 20 years)**	**Start area (hectares)**	**Risk of loss (%) without offset**	**Risk of loss (%) with offset**								
							Future area without offset (adjusted hectares) 0.0	**Future area with offset (adjusted hectares)** 0.0								
					Time until ecological benefit	**Start quality (scale of 0-10)**	**Future quality without offset (scale of 0-10)**	**Future quality with offset (scale of 0-10)**								
Threatened species habitat																
Area of habitat	No				**Time over which loss is averted (max. 20 years)**	**Start area (hectares)**	**Risk of loss (%) without offset**	**Risk of loss (%) with offset**								
							Future area without offset (adjusted hectares) 0.0	**Future area with offset (adjusted hectares)** 0.0								
					Time until ecological benefit	**Start quality (scale of 0-10)**	**Future quality without offset (scale of 0-10)**	**Future quality with offset (scale of 0-10)**								
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**	**Start value**	**Future value without offset**	**Future value with offset**	**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No															
Condition of habitat Change in habitat condition, but no change in extent	No															
Threatened species																
Birth rate e.g. Change in nest success	No															
Mortality rate e.g Change in number of road kills per year	No															
Number of individuals e.g. Individual plants/animals	Yes	227	Count	Secures and unsecured offsets	10	200	100	400	300	50%	150.00	147.03	64.77%	No		

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	227	147.03	64.77%	**No**	$0.00	#DIV/0!	#DIV/0!
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Southern Long-eared Bat
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Southern Long-eared Bat	**Area**	1954	Hectares	
			Quality	**5**	Scale 0-10	
			Total quantum of impact	977.00	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	977.00	Adjusted hectares	secured and unsecured offsets	**Time over which loss is averted (max. 20 years)**	10	**Start area (hectares)**	8277	**Risk of loss (%) without offset**	30%	**Risk of loss (%) with offset**	15%	1241.55	60%	744.93	730.19	1119.63	114.60%	Yes	
									Future area without offset (adjusted hectares)	5793.9	**Future area with offset (adjusted hectares)**	7035.5								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**5**	**Future quality without offset (scale of 0-10)**	**4**	**Future quality with offset (scale of 0-10)**	**6**	2.00	60%	1.20	1.18				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	977	1119.63	114.60%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Large-eared Pied Bat
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Large-eared Pied Bat	**Area**	1954	Hectares	
			Quality	**5**	Scale 0-10	
			Total quantum of impact	977.00	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	977.00	Adjusted hectares	secured and unsecured offsets	**Time over which loss is averted (max. 20 years)**	10	**Start area (hectares)**	8277	**Risk of loss (%) without offset**	30%	**Risk of loss (%) with offset**	15%	1241.55	60%	744.93	730.19	1119.63	114.60%	Yes	
									Future area without offset (adjusted hectares)	5793.9	**Future area with offset (adjusted hectares)**	7035.5								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**5**	**Future quality without offset (scale of 0-10)**	**4**	**Future quality with offset (scale of 0-10)**	**6**	2.00	60%	1.20	1.18				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	977	1119.63	114.60%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Spotted-tailed Quoll
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Spotted-tailed Quoll	**Area**	1954	Hectares	
			Quality	**4**	Scale 0-10	
			Total quantum of impact	781.60	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	781.60	Adjusted hectares	secured and unsecured offsets	**Time over which loss is averted (max. 20 years)**	10	**Start area (hectares)**	8277	**Risk of loss (%) without offset**	30%	**Risk of loss (%) with offset**	15%	1241.55	60%	744.93	661.17	947.67	121.25%	Yes	
									Future area without offset (adjusted hectares)	5793.9	**Future area with offset (adjusted hectares)**	7035.5								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**4**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**5**	2.00	60%	1.20	1.07				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	781.6	947.67	121.25%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Regent Honeyeater
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

	Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
	Ecological communities						
Impact calculator	**Area of community**	No		**Area**			
				Quality			
				Total quantum of impact	0.00		
	Threatened species habitat						
	Area of habitat	Yes	Regent Honeyeater	**Area**	1954	Hectares	
				Quality	**4**	Scale 0-10	
				Total quantum of impact	781.60	Adjusted hectares	
	Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
	Number of features e.g. Nest hollows, habitat trees	No					
	Condition of habitat Change in habitat condition, but no change in extent	No					
	Threatened species						
	Birth rate e.g. Change in nest success	No					
	Mortality rate e.g Change in number of road kills per year	No					
	Number of individuals e.g. Individual plants/animals	No					

Offset calculator

	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
	Ecological Communities																				
Offset calculator	**Area of community**	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
										Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
						Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
	Threatened species habitat																				
	Area of habitat	Yes	781.60	Adjusted hectares	secured and unsecured offsets	**Time over which loss is averted (max. 20 years)**	10	**Start area (hectares)**	8277	**Risk of loss (%) without offset**	30%	**Risk of loss (%) with offset**	15%	1241.55	60%	744.93	661.17	947.67	121.25%	Yes	
										Future area without offset (adjusted hectares)	5793.9	**Future area with offset (adjusted hectares)**	7035.5								
						Time until ecological benefit	10	**Start quality (scale of 0-10)**	**4**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**5**	2.00	60%	1.20	1.07				
	Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
	Number of features e.g. Nest hollows, habitat trees	No																			
	Condition of habitat Change in habitat condition, but no change in extent	No																			
	Threatened species																				
	Birth rate e.g. Change in nest success	No																			
	Mortality rate e.g Change in number of road kills per year	No																			
	Number of individuals e.g. Individual plants/animals	No																			

Summary

Summary	Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
						Direct offset ($)	Other compensatory measures ($)	Total ($)
	Birth rate	0				$0.00		$0.00
	Mortality rate	0				$0.00		$0.00
	Number of individuals	0				$0.00		$0.00
	Number of features	0				$0.00		$0.00
	Condition of habitat	0				$0.00		$0.00
	Area of habitat	781.6	947.67	121.25%	**Yes**	$0.00	N/A	$0.00
	Area of community	0				$0.00		$0.00
						$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Superb Parrot
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Swift Parrot	**Area**	1954	Hectares	
			Quality	**5**	Scale 0-10	
			Total quantum of impact	977.00	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	977.00	Adjusted hectares	secured and unsecured offsets	**Time over which loss is averted (max. 20 years)**	10	**Start area (hectares)**	8277	**Risk of loss (%) without offset**	30%	**Risk of loss (%) with offset**	15%	1241.55	60%	744.93	661.17	1013.79	103.77%	Yes	
									Future area without offset (adjusted hectares)	5793.9	**Future area with offset (adjusted hectares)**	7035.5								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**5**	**Future quality without offset (scale of 0-10)**	**4**	**Future quality with offset (scale of 0-10)**	**6**	2.00	60%	1.20	1.07				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	977	1013.79	103.77%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Swift Parrot
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	Swift Parrot	**Area**	1954	Hectares	
			Quality	**4**	Scale 0-10	
			Total quantum of impact	781.60	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	781.60	Adjusted hectares	secured and unsecured offsets	**Time over which loss is averted (max. 20 years)**	10	**Start area (hectares)**	8277	**Risk of loss (%) without offset**	30%	**Risk of loss (%) with offset**	15%	1241.55	60%	744.93	661.17	947.67	121.25%	Yes	
									Future area without offset (adjusted hectares)	5793.9	**Future area with offset (adjusted hectares)**	7035.5								
					Time until ecological benefit	10	**Start quality (scale of 0-10)**	**4**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**5**	2.00	60%	1.20	1.07				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	781.6	947.67	121.25%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Tylophora linearis
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	Yes	Tylophora linearis	9		Count	

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	Yes	9	Count	Secures and unsecured offsets	10		0		0		10		10	50%	5.00	4.44	49.31%	No		

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	9	4.44	49.31%	**No**	$0.00	#DIV/0!	#DIV/0!
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Zieria ingramii
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	Yes	Zieria ingramii	706		Count	

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	Yes	706	Count	Secures and unsecured offsets	10		1435		718		2870		2152	50%	1076.00	955.01	135.27%	Yes		

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	706	955.01	135.27%	**Yes**	$0.00	N/A	$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Appendix B

Biobanking register searches

Search results

Your search for: CMA subregion - Talbragar Valley
Credit status - Issued/Pending

No record for this search is found.

Search again

Search results

Your search for: CMA subregion - Upper Slopes
Credit status - Issued/Pending

No record for this search is found.

Search again

Search results

Your search for: CMA subregion - Pilliga
Credit status - Issued/Pending

No record for this search is found.

Search again

Search results

Your search for: Species scientific name - *Vespadelus troughtoni*
Species common name - Eastern Cave Bat (Breeding)
Credit status - Issued/Pending

No record for this search is found.

Search again

Search results

Your search for: **Species scientific name - *Homoranthus darwinioides***
Species common name - Homoranthus darwinioides
Credit status - Issued/Pending

No record for this search is found.

Search again

Search results

Your search for: **Species scientific name - *Chalinolobus dwyeri***
Species common name - Large-eared Pied Bat (Breeding)
Credit status - Issued/Pending

No record for this search is found.

Search again

Search results

Your search for: **Species scientific name - *Dasyurus maculatus***
Species common name - Spotted-tailed Quoll
Credit status - Issued/Pending

No record for this search is found.

Search again

Search results

Your search for: Species scientific name - *Tylophora linearis*
Species common name - Tylophora linearis
Credit status - Issued/Pending

No record for this search is found.

Search again

Search results

Your search for: **Species scientific name - *Zieria ingramii***
Species common name - Keith's Zieria
Credit status - Issued/Pending

No record for this search is found.

Search again

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