Appendix E

Mandalong

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1 Overview of Operations

Mandalong Mine is an existing underground longwall coal mining operation producing thermal coal that is supplied to domestic and export markets. It is located approximately 35 kilometres south-west of Newcastle near Morisset in New South Wales Mandalong Mine is 100 percent owned and operated by Centennial Mandalong Pty Limited (Centennial Mandalong), a subsidiary of Centennial Coal Company Limited. Centennial Coal Company Limited is a wholly owned subsidiary of Banpu Public Company Limited.

Mandalong Mine operates under Development Consent SSD-5144, which provided for an extension of the underground mining area with a production limit of 6.5 Mtpa. SSD-5144 supersedes DA 97/800, however, Centennial Mandalong are also required to meet the requirements of this consent. DA97/800 was granted in November 1997 and Centennial Mandalong has been granted an extension to surrender DA 97/800 until April 2020. At the time of writing this Biodiversity Management Plan (BMP) conditions in both consents are relevant.

The currently approved Mandalong Mine includes the following surface infrastructure:

- The Mandalong Mine Access Site, encompassing underground workings and associated surface infrastructure near Morisset.
- Delivery of run-of-mine coal from the underground workings to the Cooranbong Entry Site. The Cooranbong Entry Site coal handling and processing facilities are approved under the Northern Coal Logistics Project (SSD-5144). Northern Coal Services operates under a Site Specific Management Plan.
- Delivery of run-of-mine coal from the underground workings to the Delta Entry Site, located near Wyee at the Vales Point Rail Unloader Facility. The coal handling facility is approved under DA35-2-2004.
- Mandalong South Surface Site (MSSS), which is currently being constructed, encompassing ventilation shafts, ventilation fans and underground delivery boreholes located approximately 6 kilometres south-west of the Mandalong Mine Access Site.

1.1 Structure of Mandalong Biodiversity Management Plan

This Mandalong Biodiversity Management Plan (BMP) is a sub-plan to the Northern Region BMP. This BMP has been prepared by RPS Australia East. The Management Plan includes the following Sections:

- Biodiversity Consent Conditions

  The conditions of consent and statement of commitments are reproduced and identified where in the Mandalong BMP they are addressed.

- Baseline Data

  A description of baseline data for terrestrial ecology is presented including ecological communities, threatened ecological communities, habitat values, groundwater dependent ecosystems, flora, threatened flora and threatened fauna.

- Management

Identifies the following management types for management towards biodiversity outcomes: offset areas, operational areas, native vegetation, wetland management areas, areas of biodiversity significance, private lands and rural lands.

Management actions describes for each management area the management action, timing and frequency.

- Site Specific Management Measures

Description of management measures identified within the consent or statement of commitments not required under this management plan and where the requirements are be addressed.

1.2 Biodiversity Consent Conditions

The Project Development Consent conditions for SSD-5144 and DA 97/800 are reproduced below in Table 1 and Table 2 respectively.

Table 1 Mandalong Mine Extension Project Development Consent (SSD-5144)

Condition Reference	Consent Condition	Addressed in Biodiversity Management Plan
Extraction Plan Biodiversity Management Plan		
Schedule 4 Condition 6 (j)	Biodiversity Management Plan which has been prepared in consultation with BCD, which establishes baseline data for existing habitat, including water table depth, vegetation condition, stream morphology and threatened species habitat and provides for the management of potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species, populations and their habitats, endangered ecological communities and water dependent ecosystems.	Extraction Plan Biodiversity Management Plans relate specifically to underground mining and are prepared as independent documents. Refer to the relevant Extraction Plan BMPs prepared for Mandalong.
Land Management Strategy		
Schedule 3 Condition 18	By 30 December 2016, the Applicant must finalise and implement a Land Management Strategy, to compensate for the clearing of 15.6 hectares of Coastal Foothills Spotted Gum – Ironbark Forest. The Land Management Strategy must:	Mandalong Land Management Strategy is included in Appendix F and compensates for 15.6 hectares of Coastal Foothills Spotted Gum – Ironbark Forest.
Schedule 3 Condition 18 (a)	Be finalised in consultation with BCD;	Outcomes of consultation with OEH are included in Appendix F Mandalong Land Management Strategy - Appendix A Consultation.
Schedule 3 Condition 18 (b)	Define conservation areas, habitat restoration areas and riparian protection areas within the three parcels of land shown in red outlined in Figures 1 and 2 of Appendix 7;	Definition of conservation, habitat restoration and riparian protection areas are included in Appendix F Mandalong Land Management Strategy - Figure 3.
Schedule 3 Condition 18 (c)	Make arrangements to manage, protect and provide long-term security for the Land Management Strategy areas; To the satisfaction of the Director General.	The management of the land parcels is described in Appendix F Mandalong Land Management Strategy. The provision of security through a Property

Condition Reference	Consent Condition	Addressed in Biodiversity Management Plan
		Vegetation Plan is described in Appendix F Mandalong Land Management Strategy Section 1.4.1 Property Vegetation Plan. Outcomes of consultation with LLS are included in Appendix F Mandalong Land Management Strategy - Appendix 1 Consultation
Biodiversity Management Plan		
19	The Applicant must prepare and implement a Biodiversity Management Plan for the development to the satisfaction of the Secretary. This plan must be prepared in consultation with BCD and HLLS, and submitted to the Secretary for approval by 31 December 2016;	Appendix A consultation log identifies consultation has been undertaken with OEH and LLS.
19 (a)	Describe the short-term, medium-term, and long-term measures that would be implemented to: • Manage remnant vegetation and habitat at the surface facilities sites. • Implement the Land Management Strategy.	Tables 6-10 of this Appendix describe how remnant vegetation, habitat vegetation and infrastructure areas will be managed. Implementation of the Land Management Strategy is described in Appendix F Mandalong Land Management Strategy - Section 1.6 Management and Performance Measures.
19 (b)	Include detailed performance and completion criteria for the Land Management Strategy	Performance and completion criteria are defined in Appendix F Mandalong Land Management Strategy - Section 1.5 Performance Measures and Section 1.6 Management and Performance Measures.
19 (d)	Include a detailed description of the measures that would be implemented over the next 3 years to: • Enhance the quality of existing vegetation and fauna habitat. • Minimise the impacts to fauna, including undertaking pre-clearance surveys. • Replace cleared hollow-bearing trees with appropriate nest boxes at a ratio of at least 2:1. • Manage salinity.	Measures to manage and enhance the quality of existing vegetation and fauna habitat are addressed in measures to minimise the impact to Fauna are addressed in Northern Biodiversity Management Plan Section 4.3 Surface disturbance activities describes the procedure for all surface disturbance activities, including the completion of the Centennial Coal Land Disturbance Protocol. The replacement of cleared and hollow-bearing trees from the Mandalong South Surface Site is addressed in Appendix F

Condition Reference	Consent Condition	Addressed in Biodiversity Management Plan
	• Control erosion, weeds, feral pests and unauthorised access. • Manage bushfire risk.	Mandalong Land Management Strategy Section 2.4 Installation of Nest Boxes. The ratio of replacement identified is 2:1. The management of salinity is described in Management of this Appendix and will be in accordance with the Mandalong Water Management Plan. The management of erosion, weeds, feral pests, unauthorised access and management of bushfire risk is described in Management Section of this Appendix.
(e)	Include a program to monitor and report on these measures, and progress against the performance and completion criteria.	A monitoring program is described in Monitoring and Tables 11-12 of this Appendix. Reporting of performance is included in the Regional Biodiversity Management Plan Section 5.3 Reporting. Reporting against performance criteria related to subsidence is prepared in accordance with the Extraction Plan Biodiversity Management Plan and Extraction Plan reporting as described in Site Specific Measures of this Appendix. Reporting against performance and completion criteria for the Mandalong Land Management Strategy is described in Appendix F Section 3.2.
The Applicant must implement the approved management plan as approved from time to time by the Secretary.		
Conservation Bond		
20	Within 6 months of the approval of the Biodiversity Management Plan, unless the Secretary agrees otherwise, the Applicant must lodge a Conservation Bond with the Department, to ensure that the Land Management Strategy is implemented in accordance with the performance and completion criteria of the Biodiversity Management Plan.	The Conservation Bond was lodged with the Department of Planning and Environment on 1 February 2018.
20 (a) and (b)	The sum of the value must be determined by: (a) Calculating the full cost of implementing the Land Management Strategy (other than land acquisition costs); and (b) Employing a suitably qualified quantity surveyor to verify the calculated costs.	The Conservation Bond lodged with the Department of Planning and Environment was undertaken by a suitably qualified quantity surveyor calculating the cost of implementing the Land Management Strategy.
20	The Secretary will release the bond if the Land Management Strategy is completed generally in accordance with the completion criteria in the Biodiversity Management Plan. If the Land Management Strategy is not completed generally in accordance with the completion criteria in the Biodiversity Management Plan. If the Land Management	The release of the bond has not yet been triggered. Centennial will request release of the bond when completion criteria identified in Appendix F

<table>
<tr><th>Condition Reference</th><th>Consent Condition</th><th>Addressed in Biodiversity Management Plan</th></tr>
<tr><td></td><td>Strategy is not completed generally in accordance with the completion criteria in the Biodiversity Management Plan, the Secretary will call in all, or part of, the Conservation Bond, and arrange for the satisfactory completion of the relevant works.

Notes:
Alternative funding arrangements for long-term management of the Land Management Strategy, such as provision of capital and management funding as agreed by OEH as a part of the Biobanking Agreement, or transfer to the conservation reserve estate can be used to reduce the liability of the Conservation Bond.
The sum of the bond may be reviewed in conjunction with any revision to the Biodiversity Management Plan.</td><td>Mandalong Land Management Strategy have been addressed.</td></tr>
<tr><td colspan="3">Biodiversity Offset Credit Required</td></tr>
<tr><td>20A</td><td>Within 12 months of the commencement of construction activities for Modification 7, unless otherwise agreed by the Secretary, the Applicant must retire biodiversity credits as set out in Table 5 below. Retirement of these credits must be carried out in accordance with the NSW Biodiversity Offsets Policy for Major Projects (OEH, 2014), to the satisfaction of BCD.
Table 5: Biodiversity credit requirements
<table><tr><th>Credit Type</th><th>Credits Required</th></tr><tr><td>Ecosystem Credits</td><td></td></tr><tr><td>PCT 1568 – Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest</td><td>1</td></tr><tr><td>PCT 1573 – Sydney Blue Gum - Lilly Pilly mesic tall open forest</td><td>9</td></tr><tr><td>PCT 1588 – Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest</td><td>147</td></tr></table>
<table><tr><th>Credit Type</th><th>Credits Required</th></tr><tr><td>PCT 1619 – Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest</td><td>36</td></tr><tr><td>PCT 1638 – Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland</td><td>4</td></tr><tr><td>Species Credits</td><td></td></tr><tr><td>Glossy-Black Cockatoo (Calyptorhynchus lathami)</td><td>229</td></tr><tr><td>Green-Thighed Frog (Litoria brevipalmata)</td><td>9</td></tr></table></td><td>Site Specific Measures of this Appendix identifies how this will be satisfied.</td></tr>
</table>

Table 2 Mandalong Mine Development Consent (DA 97/800)

Condition Reference	Consent Condition	Addressed in Biodiversity Management Plan
74	The Applicant shall prepare and implement Wetlands Management Plans for all wetlands likely to be subject to impacts attributed to mining operations. The Plans shall be prepared in consultation with OEH and affected landowners and to the satisfaction of Council, prior to any mining that may be change the hydrogeological regime of each individual wetland. The Plans shall include, but not be limited to, issues such as weeds management.	A Wetland Management Plan has been prepared - Appendix G Mandalong Wetland Management Plan. The Plan was prepared in consultation with OEH, affected landowners prior to mining. A review was undertaken by OEH in November 2016 identified in Appendix A Consultation Log. The Mandalong Wetland Management Plan in Appendix G requires monitoring for the physical size of the wetland area, hydrology for factors affecting the water regime, water properties for the quality of water, soils for the integrity of soil properties and biota including wetland quantity and quality with weeds.
76A	The Applicant shall rehabilitate 1.25ha of land adjacent to and outside the proposed asset protection zone of the approved gas engines and flares to Redgum-Roughbarked Apple Swamp Forest EEC and Swamp Mahogany Paperbark Forest EEC, as shown generally in Schedule 7. The rehabilitation must: (a) Commence within 1 month of any clearing of Redgum-Roughbarked Apple Swamp Forest EEC for the VAM RAB Unit shown in Schedule 7; (b) Use seeds and propagules from equivalent vegetation communities within the local area; (c) Be monitored on an annual basis for the first five years, by a suitably qualified ecology approved by the Director-General, to ensure successful establishment and development of ecosystem function; (d) Be maintained on an ongoing basis, including but not limited to replacing dead plantings, weed management and feral animal control; to ensure successful establishment and development of ecosystem function. Be to the satisfaction of the Director-General.	The rehabilitation of VAM RAB site commenced within 1 month of any clearing of Redgum-Rough barked Apple Swamp Forest EEC. Seeds and propagules equivalent to local vegetation communities were collected and used. An Offset Rehabilitation Compliance Report (Global Soil Systems 2012) demonstrates the completion of actions. Monitoring and management activities undertaken at the VAM RAB site in accordance with Appendix H VAM-RAB and VAM-RAB Rehabilitation Monitoring plan. Approval has not been sought from the Director-General that monitoring and management activities have been completed. Successfully meeting the requirements of this condition will trigger a request for approval of satisfaction from the Director-General.

The Statement of Commitments for SSD-5144 and DA 97/800 are presented in Table 3 to Table 7.

Table 3 Mandalong Mine Statement of Commitments (SSD-5144)

Reference	Commitment	Addressed in Biodiversity Management Plan
Minimise impacts from construction activities from the Mandalong South Surface Site on the environment and sensitive receivers	Six months prior to the commencement of construction activities at Mandalong South Surface Site (MSSS), Centennial Mandalong will develop a Construction Environmental Management Plan for the construction phase of the Mandalong South Surface Site and access road. The Construction Environmental Management Plan will ensure:	Mandalong South Construction Environmental Management Plan (CEMP) has been prepared for the Mandalong South Surface Site.
	That vegetation to be removed is clearly marked using temporary fencing (flagging tape or similar) to delineate boundaries and minimise the potential for equipment to accidently enter areas to be retained.	Mandalong South CEMP identifies that vegetation to be removed is clearly marked using temporary fencing.
	That vegetation adjacent to the disturbance footprint of the proposed Mandalong South Surface Site and access road is fenced (fauna friendly fencing) prior to construction activities to reduce damage from uncontrolled or accidental access.	Mandalong South CEMP identifies that vegetation adjacent to the disturbance footprint is fenced prior to construction and will be fauna friendly.
	That material stockpiles are established within already disturbed areas and not within areas of retained vegetation.	Mandalong South CEMP identifies that stockpiles will be within already disturbed areas and not within areas of retained vegetation.
	Appropriate topsoil management including: • Topsoil will be maintained in a slightly moist condition during stripping, and material will not be stripped in either and excessively dry or wet condition. • Stripping will be timed to take place in unison with any vegetation clearing activity. If planning to mix groundcover/grass with soil (i.e. not removing groundcover prior to soil stripping) a weed assessment will be undertaken prior to stripping. • Where possible, grading or pushing soil into windrows with graders or dozers for later collection will be undertaken as a preferential less aggressive soil handling systems. • The surface of soil stockpiles will be left coarsely structured (as much as possible) in order to promote infiltration and minimise erosion until vegetation is established, and to prevent anaerobic zones forming. • Topsoil stockpiles will generally be maintained no higher than three metres. • If long-term stockpiling is planned (i.e. greater than three months), the stockpiles will be seeded and fertilised as soon as possible. An annual cover crop species that produces sterile florets or seeds will be sown. A rapid growing and healthy annual pasture sward will provide sufficient competition to minimise the emergence of undesirable weed species. The annual pasture species will not persist in the rehabilitation areas; however will provide sufficient competition for emerging weed species and enhance the desirable micro-organism activity in the soil.	Mandalong South CEMP measures for topsoil management include: • Topsoil will be stripped when not excessively dry or wet. • Topsoil stripping will be timed to coincide with vegetation clearing and if groundcover and grass are mixed a weed assessment will be undertaken. • Windrows will be preferred for grading or pushing soil. • Minimisation of erosion on stockpiles will include construction of the stockpiles coarsely. • Stockpiles will not exceed more than three metres. • Where long term stockpiling will occur the stockpiles will be seeded and fertilised as soon as possible and planted with a cover crop to minimise weed species.

Reference	Commitment	Addressed in Biodiversity Management Plan
	• Prior to re-spreading stockpiled topsoil, an assessment of weed infestation on stockpiles will be undertaken to determine if individual stockpiles require herbicide application and/or 'scalping' of weed species prior to topsoil spreading.	• Prior to re-spreading stockpiled topsoil a weed assessment will be undertaken.
	That clearing activities are timed, where possible, to avoid removal of hollow-bearing trees during breeding season of threatened species.	Mandalong South CEMP identifies that clearing activities will be timed, where possible, to avoid removal of hollow-bearing trees during breeding season of threatened species.
	That a specialist ecologist is engaged to supervise vegetation clearing and ensure vegetation clearing, particularly the removal of hollow-bearing trees, is undertaken as outlined in the EIS.	Mandalong South CEMP identifies that a specialist ecologist will be engaged to supervise vegetation clearing. Requirements include the removal of hollow-bearing trees as outlined in the EIS.
Enable Centennial Mandalong to conduct exploration activities in an environmentally responsible manner with due consideration to the community	Due-diligence field inspections and targeted surveys of proposed drill sites and access tracks will be undertaken by a qualified ecologist prior to commencement of works to ensure the potential for localised issues are minimised and, where necessary, appropriately managed.	The requirement for due diligence field inspections and targeted surveys of proposed surface disturbance activities by a qualified ecologist prior to any surface works is described in the Northern Region Biodiversity Management Plan Figure 4.4.
Minimise impacts to ecology within the Southern Extension Area	As part of the detailed design phase for the Mandalong South Surface Site, Centennial Mandalong will ensure that the proposed access road is aligned to minimise disturbance and avoid removal of any *M. biconvexa* specimens.	Alignment of the surface site was undertaken in consideration of the threatened species including individual *Melaleuca biconvexa.* The process for minimisation of the disturbance footprint size and impact on threatened species is described in the Mandalong Extension Project EIS.
	Centennial Mandalong will implement a vegetation condition monitoring programme 2 years before, during and 2 years after completion of mining in the adjacent longwall panel in sensitive environments (which will include floodplains and groundwater dependant ecosystems).	Monitoring for longwall panels is undertaken in accordance with the Extraction Plan Biodiversity Management Plan. A summary of requirements under the Extraction Plan for biodiversity are presented in the Site Specific Measures of this Appendix.
	As part of the construction activities at Mandalong South Surface Site, a wheel wash will be installed to help prevent soil-borne disease (Phytophthora), pathogenic fungus (Myrtle Rust) transmission and weed seed dispersal.	The requirement for a wheel wash to be installed at the Mandalong Surface Site prior to construction is described in the CEMP.
	Centennial Mandalong will develop a Biodiversity Management Plan that includes: • Identification of weed management, monitoring and control practices to minimise the spread of exotic species.	Identification of weed management, monitoring and control practices to prevent the spread of weeds is identified in Management Actions of this Appendix.

Reference	Commitment	Addressed in Biodiversity Management Plan
	• Incorporation of the existing Wetland management Plan. • Trigger Action Response Plan.	The Mandalong Wetland Management Plan is included in Appendix G. A trigger action response plan is developed for each Extraction Plan area under the Extraction Plan Biodiversity Management Plan in accordance with DRE requirements as described in Site Specific Measures of this Appendix.
Offset the ecological impacts of the Project	Centennial Mandalong will install nest boxes to compensate for the loss of 9 hollow bearing trees containing 18 habitat hollows as a result of the construction of the MSSS. • Nest boxes will be installed at a ratio of 1:1 (i.e. one nest box for every habitat hollow removed). • A mixture of nest box types are used to compensate for the variety of hollows being removed. • Nest box sizes will target microbats, gliders and possums. • All nest boxes will be rear entry. • The majority of nest boxes will be placed at a westerly aspect to maximise chances of colonization. Standard nest box design (i.e. single walled nest boxes) will be used rather than double walled nest boxes as previous monitoring has identified a sharper uptake of animals in single-walled nest boxes.	A nest box ratio of 2 nest boxes for every hollow bearing tree removed is described in Appendix F Mandalong Land Management Strategy.

Table 4 Mandalong Mine Statement of Commitments (SSD-5144) MOD 1 – Mandalong Mine Transmission Line TL24 Relocation Project

Reference	Commitment	Addressed in Biodiversity Management Plan
Ecology	A Flora and Fauna Management Plan will form an Appendix to the CEMP. This plan will include:	Mandalong Mine TL 24 Construction Environmental Management Plan sub-plan Flora and fauna Management Plan Section 2.3 requires: • Vegetation to be cleared will be marked by flagging tape to delineate the limit of work; • A contractor induction will include the designated work areas and vehicles machinery will use designated tracks and be restricted to a speed limit of 40km / hour; • Nest box sizes will target microbats, gliders and possums.
	Unnecessary vegetation clearing will be avoided by marking the clearing limit with flagging tape;	
	All contractors will be advised of the designated work area through a site induction process;	
	Vehicles/machinery will use designated access tracks. Speeds will be limited to 40 kilometres per hour to reduce the potential of fauna strike and to reduce dust generation;	
	Measures will be implemented as required to prevent the spread of weeds and potential importation of Phytophthora;	
	Where possible, clearing activities should be timed to avoid removal of hollow-bearing trees during breeding season of threatened species (avoiding winter and spring); and	

Reference	Commitment	Addressed in Biodiversity Management Plan
	A suitably qualified person is to be present to supervise hollow-bearing tree clearing within the impact area.	
	Lot 152 DP 755238 will be included in the Mandalong Mine Land Management Strategy to offset the impacts of vegetation clearing for the Project.	Mandalong Mine Land Management Strategy was approved by DPIE in 2018 and incorporates Lot 152 DP 755238.

Table 5 Mandalong Mine Statement of Commitments (SSD-5144) MOD 6 MSSS Discharge

Reference	Commitment	Addressed in Biodiversity Management Plan
Biodiversity Offsets	Any identified impacts to threatened flora or fauna will be quantified and offset in accordance with the NSW Biodiversity Offset Policy for Major Projects. Biodiversity monitoring will be undertaken in accordance with Section 4.2 of the Centennial Coal's Northern Region Biodiversity Management Plan (NRBMP) with any biodiversity offsets implemented in accordance with Section 4.6 of the NRBMP.	Biodiversity monitoring is being undertaken in accordance with this commitment. Aquatic ecology monitoring and frog surveys being completed are listed in the site specific measures of this appendix.

Table 6 Mandalong Mine Statement of Commitments (SSD-5144) MOD 7 Construction of a 33kV powerline

Reference	Commitment	Addressed in Biodiversity Management Plan
Biodiversity in the CEMP	The following mitigation measures will be implemented during construction of the Project to avoid and minimise impacts on native vegetation and habitat. These will be documented in the CEMP for the Project:	
	Impacts on Fauna and their Habitat: • Retain habitat trees and significant tree limbs (where possible); • Confirm habitat tree numbers and distribution; • Mark habitat trees and estimate height; • Identify limbs of habitat value with enough clearance below power lines for retention; and • Clearly mark out a buffer area to prevent damage during construction;	Mandalong 33kV CEMP Sub-Plan Flora and Fauna Section 2.3.1 provides the vegetation clearing protocol requiring the actions listed to be completed: • Retain habitat trees and significant tree limbs (where possible); • Confirm habitat tree numbers and distribution; • Mark habitat trees and estimate height; • Identify limbs of habitat value with enough clearance below power lines for retention; • Clearly mark out a buffer area to prevent damage during construction; • Habitat trees to be impacted by the proposed works are to be quantified and offset adjacent to the site; • Pre-clearance surveys by qualified ecologist prior to tree removal;
	Install substitute habitat: • Habitat trees to be impacted by the proposed works are to be quantified and offset adjacent to the site; and • Hollow bearing trees are to be replaced by nest boxes at a ratio of at least 1:1;	
	Fauna protection protocols: • Pre-clearance surveys by qualified ecologist prior to tree removal; and • Apply procedures to safely fell habitat trees and release areas for any rescued fauna;	

Reference	Commitment	Addressed in Biodiversity Management Plan
	Retain other habitat attributes: • Hollow logs and rock habitat within the clearance areas will be retained and carefully placed into the adjacent bushland;	• Implement the procedure within the CEMP to safely fell habitat trees and release areas for any rescued fauna; and • Hollow logs and rock habitat within the clearance areas will be retained and carefully placed into the adjacent bushland. Mandalong 33kV CEMP Sub-Plan Flora and Fauna Section 2.3.1 states the installation of compensatory nest boxes will be installed at a ratio of at least 1 nest box for 1 habitat hollow using a mixture of box type to compensate for the variety of hollows being removed targeting microbats, gliders and possums.
	Maintain upper catchment hydrology (maintain ephemerality): • Erosion and sediment controls will be designed to prevent permanent or semi-permanent ponding of water where possible;	Mandalong 33kV CEMP Sub-Plan Flora and Fauna Section 2.3.5 requires the implementation and maintenance of erosion and sediment control measures to reduce sediment moving offsite and sediment laden water entering into an watercourse. The further detail for implementation of the measures is within the CEMP Appendix E, Construction Erosion and Sediment Control Management Sub-Plan.
	Protect adjacent habitat or vegetation: • Boundaries for vegetation removal clearly established prior to clearing using tape/rope; • All vehicles and equipment accessing site must use established access tracks only; and • Restrict load/equipment set down areas to well within the designated impact area;	Mandalong 33kV CEMP Sub-Plan Flora and Fauna Section 2.3.1 provides the vegetation clearing protocol and site management actions, requiring the actions listed to be completed: • Boundaries for vegetation removal clearly established prior to clearing using tape/rope; • All vehicles and equipment accessing site must use established access tracks only; and • Restrict load/equipment set down areas to well within the designated impact area;
	Minimise noise and light spill: • Avoid night work; • Take measures to reduce noise.	Mandalong 33kV CEMP Sub-Plan Flora and Fauna Section 2.3.8 Noise and Light spill states construction will be undertaken between standard working hours with exceptions of works or deliveries as requested by authorities for safety reasons and the contractor is required to manage noise levels as required by CEMP Section 7.
	Dust management: • Visual monitoring of dust generated during earthworks, suspending work if dust is blown into adjacent bushland and use of water carts;	Mandalong 33kV CEMP Sub-Plan Flora and Fauna Section 2.3.7 requires the contractor to undertake visual monitoring of dust generated during earthworks. The work must be suspended if dust is blown adjacent bushland and water carts are to be used for dust suppression. The further detail for implementation of the measures is within

Reference	Commitment	Addressed in Biodiversity Management Plan
		the CEMP Section 6 Environmental Management – Air Quality.
	Weed and pathogen management: • Good hygiene practices are to be used to reduce the risk of spreading weeds and pathogens, including ensuring that all machinery, materials and personnel are clean of any weed seed to entering the site Priority Weeds listed under *Biosecurity Act 2015* to be actively managed on site to limit the spread of weeds into the adjacent forested areas; • Weeds removed from the subject site are to be disposed of appropriately at an approved waste facility; o Occurrences of pathogens (e.g. Myrtle Rust and Phytophthora) will be reported, treated and monitored; and o Quarantine controls will be applied to prevent introduction of Chytrid disease;	Mandalong 33kV CEMP Sub-Plan Flora and Fauna Section 2..3.2 Pathogen management requires: • Priority weeds *Biosecurity Act 2015* are actively managed on site to limit spread on site and into adjacent forest land; • Weeds removed from the site will be disposed of appropriately at an approved waste facility; • Major pathogens will be reported, treated and monitored; • The contractor will maintain hygiene practice to reduce the risk of spreading weeds and pathogens including ensuring all machinery, materials and personnel are clean of any weed seed; • Quarantine controls will be applied to prevent Chytrid disease.
	Partitioning off threatened flora species: • Patches of threatened plants are to be identified and marked out to minimise indirect impacts of clearing/construction activities; and • A qualified ecologist is present during initial vegetation removal to identify these environmentally sensitive areas;	Mandalong 33kV CEMP Sub-Plan Flora and Fauna Section 2.3.1 provides the vegetation clearing protocol requiring the actions listed to be completed: • Patches of threatened plants are to be identified and marked out to minimise indirect impacts; and • A qualified ecologist is present during initial vegetation removal to identify these environmentally sensitive areas.
	CEMP: The Project CEMP will include the safeguards included in the BDAR and detail unexpected threatened species finds procedure and rehabilitation following construction;	Mandalong 33kV CEMP Sub-Plan Flora and Fauna implements the requirements of the BDAR and includes an unexpected threatened species finds procedure.
	• Staff and contractor training and site briefing to educate contractors on biodiversity management measures;	Mandalong 33kV CEMP Sub-Plan Flora and Fauna commits that contractors will be made aware of biodiversity management measures through toolbox talks and review of the CEMP.
	Sediment and erosion controls: • Erosion and sediment control measures are to be implemented and maintained to reduce sediment moving offsite, and sediment laden water entering any watercourse; • Erosion controls are to be regularly inspected for their functionality and maintained if required, especially after rainfall; • Excavated material should be stockpiled well away from areas where native vegetation is to be retained and waterways; and	Mandalong 33kV CEMP Sub-Plan Flora and Fauna Section 2.3.5 describes erosion and sediment controls that will be implemented, including the below which are further provided in the 33kV CEMP Sub-Plan Construction Erosion and Sediment Control: • Erosion and sediment control measures are implemented, maintained, regularly inspection for the functionality; • Designed to prevent permanent or semi-permanent pounding;

Reference	Commitment	Addressed in Biodiversity Management Plan
	• Work areas stabilised progressively during works;	• Excavated materials stockpiled aware from areas where native vegetation is be retained and waterways; and • Work areas are stabilised progressively during works.
	Prevent Water Pollution: • No release of dirty water into drainage lines/waterways. Water will be released from the easement during construction via sediment controls; • All fuel/chemicals are to be stored in either self-bunded containers or in a bunded facility; • An emergency spill kit is always to be kept on sites where equipment is being used; • An emergency spill response plan will be appended to the CEMP; and • Regular inspection of equipment and vehicles for fuel or oil leaks;	Mandalong 33kV CEMP Sub-Plan Flora and Fauna Section 2.3.6 Prevent Water Pollution specifies the following requirements, which are also provided in the Mandalong 33kV CEMP Sub-Plan Appendix F Emergency Spill Response Plan: • Water will be released via determined control and no release of dirty water into drainage lines or waterways; • Regulator inspections of vehicles are to be undertaken; • All fuels/chemicals to be stored in self-bunds containers or in a bunded facility; • Emergency spill kit to be kept on sites where equipment is being used; • Contractor is to provide and maintain the spill kits.
	Avoid vehicle strike: • Vehicles will adhere to a 40 km/hr speed limit on dirt tracks.	Mandalong 33kV CEMP Sub-Plan Flora and Fauna Section 2.3.1.9 states vehicles will adhere to a 30km/hr speed limit on dirt access tracks to the work site to protect fauna from a vehicle strike.

Table 7 Mandalong Mine Statement of Commitments (DA 97/800

Condition Reference	Consent Condition	Addressed in Biodiversity Management Plan
Flora and Fauna		
	Approximately 1.25 ha of degraded areas within the project site will be rehabilitated. 0.9 ha of MU38 Redgum – Roughbark Apple Swamp Forest EEC will be established in the areas currently mapped as 'disturbed/rehabilitated vegetation; in the project site, and 0.3ha of MU 37 Swamp Mahogany – Paperbark Forest EEC will be established in the area currently mapped as MU46 on the eastern side of the approved gas engines and flares (illustrated in Figure 6). The species to be established as part of the remediation will be sourced from local provenance to avoid genetic conflicts between local and imported species. Redgums will be Eucalyptus amplifolia grown from seed collected from trees in the Mandalong floodplain. Weed management activities will also be undertaken in the rehabilitated areas to ensure improved remediation outcomes.	The Offsetting of 1.25 ha of degraded areas within the site to be rehabilitated is identified in the VAMRAB Offset Rehabilitation – Compliance Report (Global Soil Systems 2012) and Appendix H VAM RAB. Rehabilitation, monitoring and completion of management actions at the VAM RAB Offset site commenced in January 2012. Species used in the remediation were sourced locally.

Condition Reference	Consent Condition	Addressed in Biodiversity Management Plan
	A bushfire risk assessment will be undertaken prior to the remediation taking place to determine the width of the APZ to be maintained around the gas flares and engines. In this zone the species the species to be used in the remediation will be tailored to suit the APZ requirements.	A bushfire risk assessment has been completed. An APZ is maintained around the gas flares and engines.

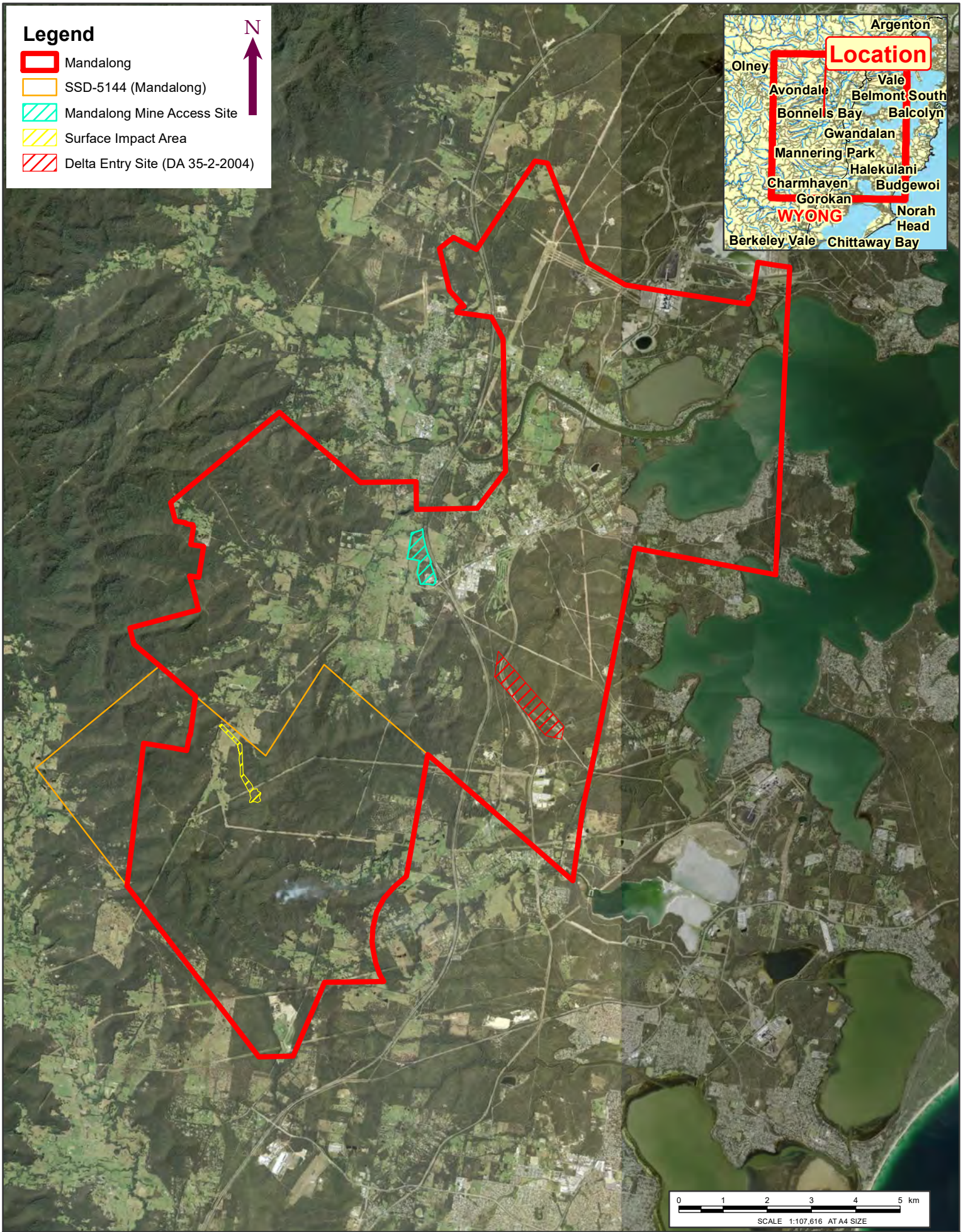

Figure 1: Location Plan

LOCATION: MANDALONG	Coordinate System: GDA 1994 MGA Zone 56 Datum: GDA 1994
JOB NO.: **PR 145829** PURPOSE: BMP Technician: Shawn.Ryan Date: 22/11/2019	Data Sources: RPS, Client Land and Property 2017

CLIENT: CENTENNIAL

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Path: S:\Centennial\All Jobs\145829 Mandalong BMP Updates\10 - Drafting\Arcgis Map Documents\Eco\145829_Figure 1 Location Plan A A4 20191118.mxd

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2 Baseline Data - Terrestrial Ecology

2.1 Habitat

Vegetation within Mandalong Mine is classified into six broad fauna habitat types including:

- Dry Sclerophyll Forest;
- Wet Sclerophyll Forest;
- Rainforest;
- Temperate Woodland;
- Swamp (Floodplain) Forest and woodland; and
- Cleared/disturbed areas.

These habitat types are characterized by habitat features such as open or closed forests, hollow bearing trees, exposed rocky outcrops, aquatic habitats, ground timber, flowering/fruiting vegetation and vegetation structures for shelter or foraging (e.g. groundcover and leaf litter).

2.2 Ecological Communities

There are 22 ecological communities at Mandalong Mine, as listed in Table 8 below and presented in Figure 2.

Table 8 Ecological Communities at Mandalong Mine

LHCCREMS Vegetation Map Unit Number (MU)	PCT	(ha)
MU 1: Coastal Wet Gully Forest	1573	104.89
MU 5: Alluvial Tall Moist Forest & MU 9: Coastal Ranges Open Forest	1568	719.06
MU 6: Coastal Narrabeen Moist Forest	1580	148.88
MU 11: Coastal Sheltered Apple – Peppermint Forest	1627	51.83
MU 15: Coastal Foothills Spotted Gum – Ironbark Forest	1588	3656.96
MU17a: Lower Hunter Spotted Gum – Ironbark Forest	1590	21.46
MU 22: Coastal Narrabeen Shrub Forest	1579	3.77
MU 30: Coastal Plains Smooth-barked Apple Woodland	1619	661.05
MU 31: Coastal Plains Scribbly Gum Woodland	1636	1985.38
MU 37: Swamp Mahogany – Paperbark Forest & MU 42a: Melaleuca Scrub	1718	198.93
MU 38: Redgum – Rough-barked Apple Forest	1598	164.35
MU 40: Swamp Oak – Rushland Forest	1727	104.54
MU 42: Riparian Melaleuca Swamp Woodland	1649	487.96
MU 43: Wyong Paperbark Swamp Forest	1716	57.82
MU 44: Coastal Wet Sand Cyperoid Heath	1707	20.45
MU 46: Freshwater Wetland Complex	1736	17.93
MU 47: Mangrove-Estuarine Complex	1747	21.19
MU 47a: Saltmarsh	1126	14.77
Cleared/Disturbed	-	858.56
Total		**9902.77**

Ten vegetation types have been identified as being commensurate with listed threatened ecological communities under the *Biodiversity Conservation Act 2016* (BC Act) and *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) are listed in Table 9.

Table 9 Threatened Ecological Communities Mandalong Mine

LHCCREMS Vegetation Map Unit Number (MU)	PCT	Listed EEC (BC ACT)
MU 1: Coastal Wet Gully Forest	1573	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions EEC
MU17a: Lower Hunter Spotted Gum – Ironbark Forest	1590	Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion EEC
MU 37: Swamp mahogany Paperbark Forest	1718	Swamp Sclerophyll Forest on Coastal Floodplains
MU 38: Redgum – Rough-barked Apple Forest	1598	River-Flat Eucalypt Forest on Coastal Floodplains
MU 40: Swamp Oak – Rushland Forest	1727	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions EEC
MU 41: Swamp Oak Sedge Forest	1727	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions EEC
MU 42: Riparian Melaleuca Swamp Woodland	1649	Swamp Sclerophyll Forest of the Floodplains of the North Coast, Sydney Basin and Southeast Corner Bioregions EEC
MU 42a: Melaleuca Scrub	1718	Swamp Sclerophyll Forest of the Floodplains of the North Coast, Sydney Basin and Southeast Corner Bioregions EEC
MU 43: Wyong Paperbark Swamp Forest	1716	Swamp Sclerophyll Forest of the Floodplains of the North Coast, Sydney Basin and Southeast Corner Bioregions EEC
MU 46: Freshwater Wetland Complex	1736	Freshwater Wetlands on Coastal Floodplains
MU 47a: Saltmarsh	1126	Coastal Saltmarsh

2.3 Groundwater Dependent Ecosystems

Five vegetation communities have been identified as all or in part to be commensurate with the definition of a Groundwater Dependent Ecosystem at Mandalong Mine and are presented in Figure 2 and listed in Table 9:

- MU-5: Alluvial Tall Moist Forest (PCT 1568);
- MU-6: Coastal Narrabeen Moist Forest (PCT 1580);
- MU-41: Swamp Oak Sedge Forest (PCT 1727) (also a listed EEC – see Table 9);
- MU-42: Riparian Melaleuca SwampWoodland (PCT 1649) (also a listed EEC – see Table 9);
- MU 42a: Melaleuca Scrub (PCT 1718) (also a listed EEC – see Table 9); and
- MU-43: Wyong Paperbark Swamp Forest (PCT 1716) (also a listed EEC – see Table 9).

2.4 Threatened Flora

Nine threatened flora species occur within Mandalong Mine (RPS 2013, RPS 2017, RPS 2019) as listed in Table 10 (also see Figure 3a and b). Previous records of threatened flora in the area are also provided (Figure 3a and b).

Table 10 Threatened Flora Species at Mandalong Mine

Common Name	Scientific Name	BC Act	EPBC Act
Small – Flower Grevillea	*Grevillea parviflora* subsp. *parviflora*	Vulnerable	Vulnerable
Biconvex Paperbark	*Melaleuca biconvexa*	Vulnerable	Vulnerable
Black – eyed Susan	*Tetratheca juncea*	Vulnerable	Vulnerable
	Maundia triglochinoides	Vulnerable	-
Charmhaven Apple	*Angophora inopina*	Vulnerable	Vulnerable
Magenta Lilly Pilly	*Syzygium paniculatum*	Endangered	Vulnerable
Red Helmet Orchid	*Corybas dowlingii*	Endangered	-
Scrub Turpentine*	*Rhodamnia rubescens*	Critically Endangered	-
Variable Midge Orchid	*Genoplesium insigne*	Critically Endangered	Critically Endangered

*Note: Threatened species which were listed after the receipt of the Mandalong South Project Development Consent (SSD_5144) on 12th October 2015, need only be considered for areas which were the subject of subsequent biodiversity related modifications.

2.5 Threatened Fauna

Twenty two threatened fauna species occur within Mandalong Mine (RPS 2013, RPS 2017, RPS 2019) as listed in Table 11 (also see Figure 3a and b). Previous records of threatened fauna in the area are also provided (Figure 3a and b).

Table 11 Threatened Fauna Species at Mandalong Mine

Common Name	Scientific Name	BC Act	EPBC Act
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Vulnerable	-
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	Vulnerable	-
Little Lorikeet	*Glossopsitta pusilla*	Vulnerable	-
Powerful Owl	*Ninox strenua*	Vulnerable	-
Sooty Owl	*Tyto tenebricosa*	Vulnerable	-
Varied Sittella	*Daphoenositta chrysoptera*	Vulnerable	-
Square-tailed Kite	*Lophoictinia isura*	Vulnerable	-
Scarlet Robin	*Petroica boodang*	Vulnerable	-
Flame Robin	*Petroica phoenicea*	Vulnerable	-
Grey-headed Flying-Fox	*Pteropus poliocephalus*	Vulnerable	Vulnerable
Yellow – bellied Glider	*Petaurus australis*	Vulnerable	-
Little Bentwing-bat	*Miniopterus australis*	Vulnerable	-
Golden-tipped Bat	*Phoniscus papuensis*	Vulnerable	-
Yellow-bellied Sheath Bat	*Saccolaimus flaviventris*	Vulnerable	-
Southern Myotis	*Myotis aelleni*	Vulnerable	-

Common Name	Scientific Name	BC Act	EPBC Act
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	Vulnerable	-
Large-eared Pied Bat	*Chalinolobus dwyeri*	Vulnerable	Vulnerable
Eastern Bentwing-Bat	*Miniopterus orianae oceanensis*	Vulnerable	-
Eastern Chestnut Mouse	*Pseudomys gracilicaudatus*	Vulnerable	-
Dusky Woodswallow	*Artamus cyanopterus*	Vulnerable	-
Greater Glider*	*Petauroides Volans*	-	Vulnerable
Brown Treecreeper	*Climacteris picumnus*	Vulnerable	-

*Note: Threatened species which were listed after the receipt of the Mandalong South Project Development Consent (SSD_5144) on 12th October 2015, need only be considered for areas which were the subject of subsequent biodiversity related modifications.

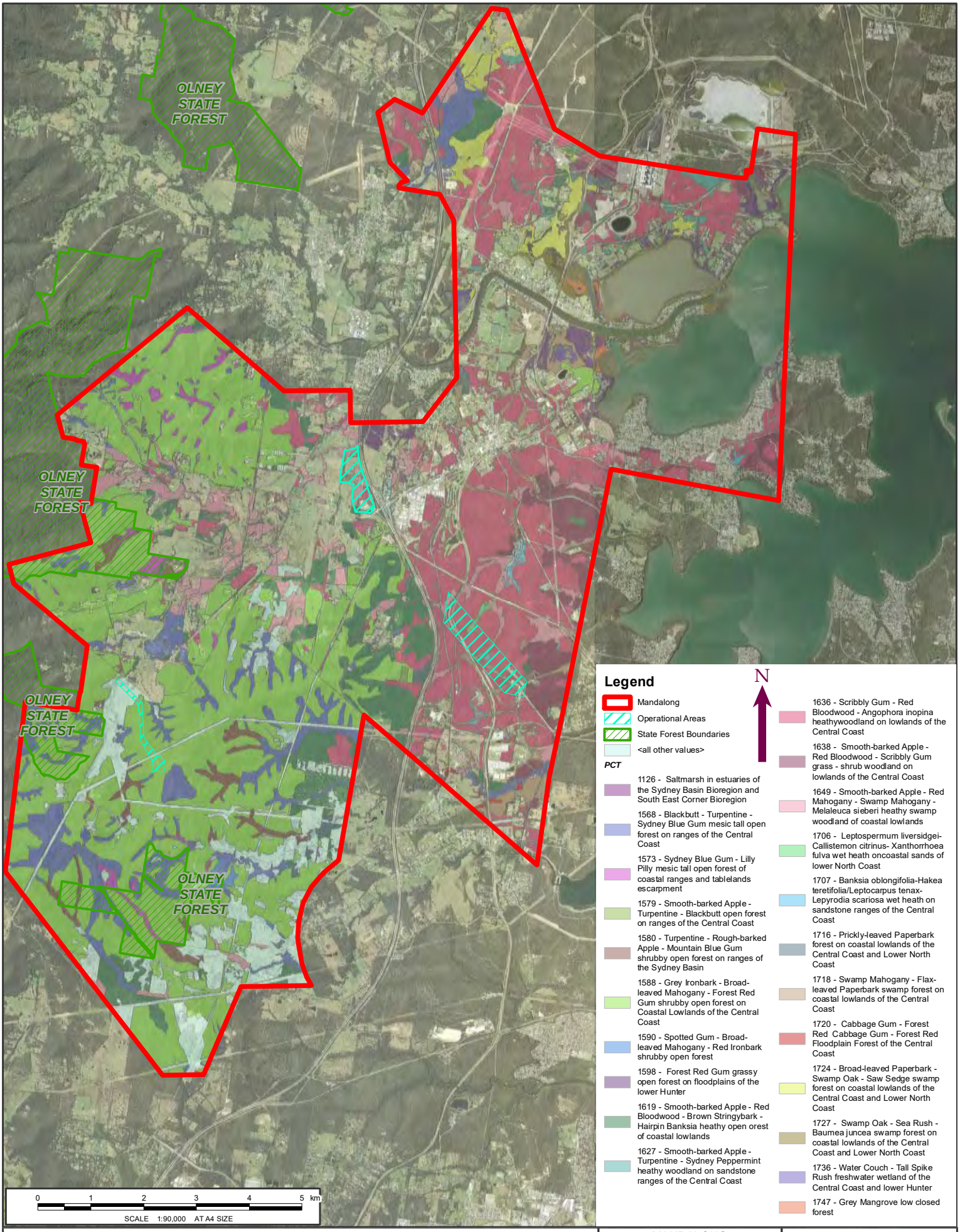

Figure 2: Vegetation Communities

LOCATION: MANDALONG

Coordinate System: GDA 1994 MGA Zone 56
Datum: GDA 1994

JOB NO.: **PR 145829**
PURPOSE: BMP
Technician: Natalie.Wood Date: 25/11/2019

Data Sources:
RPS, Client
Land and Property 2017

CLIENT: CENTENNIAL

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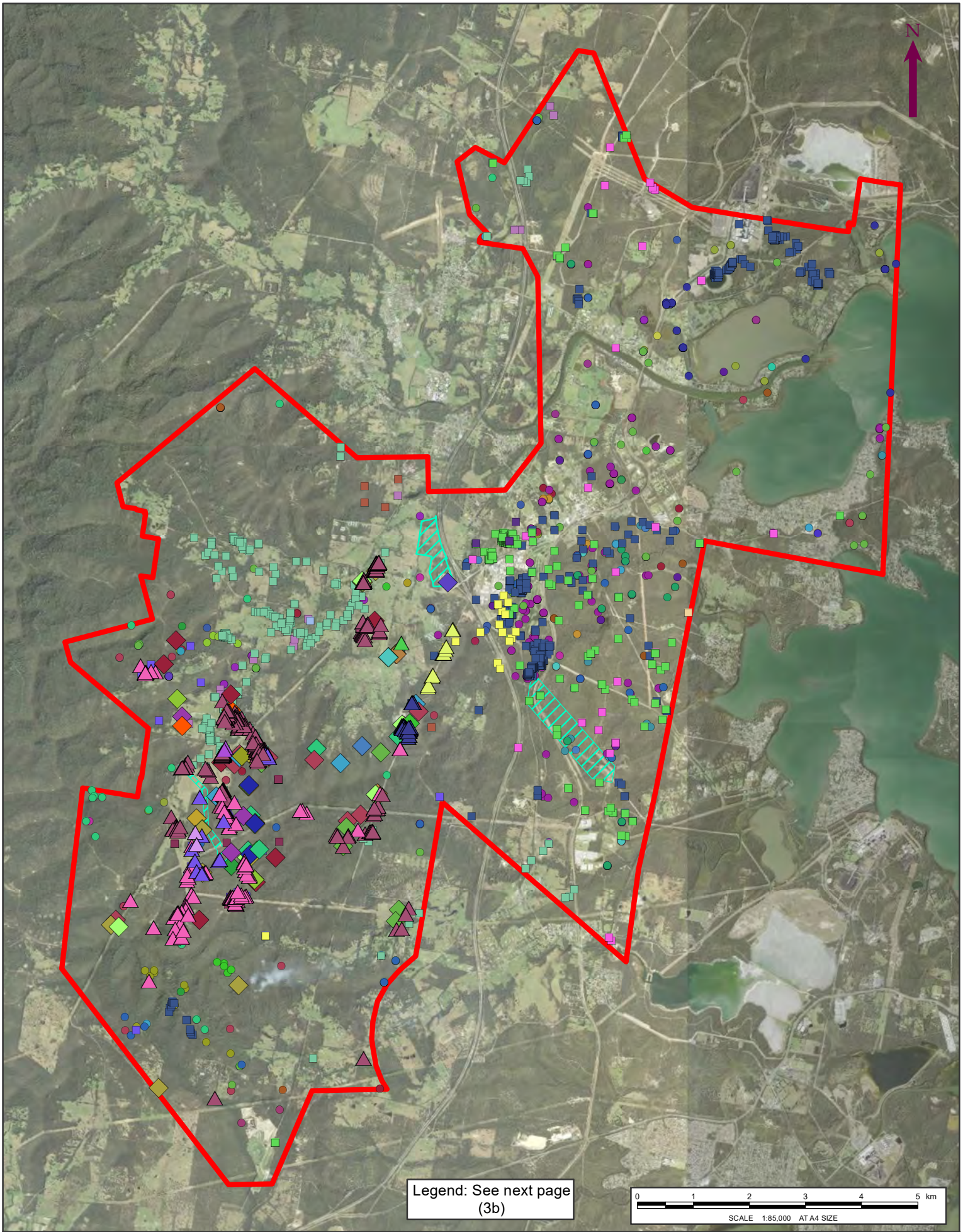

Figure 3a: Threatened Flora and Fauna Locations

LOCATION: MANDALONG

Coordinate System: GDA 1994 MGA Zone 56
Datum: GDA 1994

JOB NO.: **PR 145829**
PURPOSE: BMP
Technician: Shawn.Ryan Date: 22/11/2019

Data Sources:
RPS, Client
Land and Property 2017

CLIENT: CENTENNIAL

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Legend

- Mandalong
- Operational Areas

Threatened Fauna (RPS Survey)

- Brown Treecreeper
- Dusky Woodswallow
- Eastern Bentwing-Bat
- Flame Robin
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Golden-tipped Bat
- Greater Glider
- Grey-headed Flying Fox
- Large-eared Pied Bat
- Little Bentwing-Bat
- Little Lorikeet
- Powerful Owl
- Scarlet Robin
- Sooty Owl
- Southern Myotis
- Square-tailed Kite
- Varied Sitella
- Yellow-bellied Glider
- Yellow-bellied Sheath-tailed Bat

Threatened Flora (RPS Survey)

- Angophora inopina
- Corybas dowlingii
- Genoplesium insignis
- Grevillea parviflora subsp. parviflora
- Melaleuca biconvexa
- Rhodamnia rubescens
- Syzygium paniculatum
- Tetratheca juncea

Threatened Flora (Atlas)

- Acacia bynoeana
- Angophora inopina
- Callistemon linearifolius
- Corybas dowlingii
- Eucalyptus parramattensis subsp. parramattensis
- Grevillea parviflora subsp. parviflora
- Isotoma fluviatilis subsp. fluviatilis
- Maundia triglochinoides
- Melaleuca biconvexa
- Persicaria elatior
- Rhodamnia rubescens
- Rutidosis heterogama
- Tetratheca juncea

Threatened Fauna (Atlas)

- Black-necked Stork
- Blue-billed Duck
- Brown Treecreeper (eastern subspecies)
- Brush-tailed Rock-wallaby
- Bush Stone-curlew
- Dusky Woodswallow
- Eastern Cave Bat
- Eastern Chestnut Mouse
- Eastern Coastal Free-tailed Bat
- Eastern False Pipistrelle
- Eastern Osprey
- Freckled Duck
- Gang-gang Cockatoo
- Giant Barred Frog
- Glossy Black-Cockatoo
- Golden-tipped Bat
- Greater Broad-nosed Bat
- Greater Glider
- Green Turtle
- Green and Golden Bell Frog
- Green-thighed Frog
- Grey-headed Flying-fox
- Koala
- Large Bent-winged Bat
- Large-eared Pied Bat
- Little Bent-winged Bat
- Little Eagle
- Little Lorikeet
- Loggerhead Turtle
- Masked Owl
- New Holland Mouse
- Powerful Owl
- Regent Honeyeater
- Scarlet Robin
- Sooty Owl
- Southern Myotis
- Spotted-tailed Quoll
- Square-tailed Kite
- Squirrel Glider
- Stuttering Frog
- Swift Parrot
- Varied Sittella
- Wallum Froglet
- White-bellied Sea-Eagle
- Yellow-bellied Glider
- Yellow-bellied Sheathtail-bat

Figure 3b: Threatened Flora and Fauna Legend

LOCATION: MANDALONG

Coordinate System: GDA 1994 MGA Zone 56
Datum: GDA 1994

JOB NO.: **PR 145829**
PURPOSE: BMP
Technician: Natalie.Wood Date: 22/11/2019

Data Sources:
RPS, Client
Land and Property 2017

CLIENT: CENTENNIAL

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3 Management

3.1 Management Areas

Management areas are based operational activities, vegetation type and proposed management objectives. Management areas are summarised below and are shown in Figure 4, with a description of the activities defined in the following sections and detailed actions presented in Tables 12 to 16.

3.1.1 Offset Areas

The objective of management within offset areas is to maintain or improve the biodiversity values. Offset areas include Mandalong Road, Chapman Road (Appendix F Mandalong Land Management Strategy) and VAM RAB (Appendix H). The following management measures may apply to all or some of the management areas as identified in Appendix G and Appendix H:

- Revegetation;
- Grazing activities with biodiversity inputs;
- Weed management;
- Pest species management;
- Access management;
- Bushfire management; and
- Riparian improvements.

Monitoring reports include recommendations that describe the outcomes of monitoring and recommendations for enhancing biodiversity values.

3.1.2 Operational Areas

The objective of management within operational areas is to manage environmental values to maintain or improve environmental biodiversity values within the area. Operational areas include the Mandalong Mine Access Site, Delta Entry Site, Cooranbong Entry Site and Mandalong South Surface Site. Biodiversity management within operational areas is restricted due to the absence of vegetation. Management measures include:

- Bushfire management;
- Weed management;
- Manage salinity;
- Manage erosion;
- Surface water management; and
- Access management.

Once active operations in an operational area have ceased, rehabilitation measures can be implemented to restore the biodiversity values in this area as part of final land form post mining closure in accordance with the Mining Operations Plan or Rehabilitation Management Plan.

Monitoring reports will include recommendations that describe the outcomes of monitoring and recommendations for enhancing biodiversity values.

3.1.3 Native Vegetation

The objective of management within areas of native vegetation is to manage environmental values to maintain or improve environmental biodiversity values within the area. This area applies to areas of native vegetation and habitat within Centennial owned lands that do not constitute areas of biodiversity significance. To enhance areas of existing remnant vegetation the following management measures are required:

- Weed management;
- Pest management;
- Manage Salinity;
- Manage erosion;
- Bushfire management; and
- Access restrictions.

3.1.4 Wetland Management Areas

The objective of the wetland monitoring program is to monitor for change in biodiversity values for a period of two years following the cessation of mining. Eight wetlands within Mandalong Mine are monitored biannually, including impact and reference sites. Management actions outlined in the Wetland Monitoring and Management Plan include:

- Investigate the occurrence of new areas of surface ponding; and
- Recommendations for management of biodiversity values are made following biannual monitoring.

Monitoring reports include recommendations that describe the outcomes of monitoring and recommendations for enhancing biodiversity values.

3.1.5 Areas of Biodiversity Significance

This management area encompasses areas of biodiversity significance such as threatened flora, threatened fauna habitat, EECs and GDEs situated within Centennial owned lands, including:

- *Melaleuca biconvexa* (Biconvex Paperbark);
- *Rhodamnia rubescens* (Scrub Turpentine)
- *Tetratheca juncea* (Black-eyed Susan);
- *Acacia bynoeana* (Bynoe's Wattle);
- *Angophora inopina* (Charmhaven Apple)
- *Syzygium paniculatum* (Magenta Lilly Pilly)
- *Corybas dowlingii* (Red Helmet Orchid)

- *Genoplesium insigne* (Variable Midge Orchid)

Squirrel Glider habitat such as per Lake Macquarie guidelines (LMCC 2015)

  - MU 11: Coastal Sheltered Apple – Peppermint Forest (PCT 1627)
  - MU 15: Coastal Foothills Spotted Gum – Ironbark Forest (PCT 1588)
  - MU 30: Coastal Plains Smooth-barked Apple Woodland (PCT 1619)
  - MU 31: Coastal Plains Scribbly Gum Woodland (PCT 1636)
  - MU 37: Swamp Mahogany – Paperbark Forest (PCT 1725)

- Threatened Ecological Communities including:
  - *Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions EEC;*
  - *Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion EEC;*
  - *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions EEC;*
  - *Swamp Sclerophyll Forest of the Floodplains of the North Coast, Sydney Basin and Southeast Corner Bioregions EEC*; and

- Groundwater Dependant Ecosystems including:
  - MU-5: Alluvial Tall Moist Forest (GDE) (PCT 1568);
  - MU-6: Coastal Narrabeen Moist Forest (GDE);
  - MU-41: Swamp Oak Sedge Forest (GDE);
  - MU-42: Riparian Melaleuca SwampScrub Woodland (GDE) (PCT 1649; and
  - MU-43a: Wyong Paperbark Swamp Forest (GDE) (PCT 1716).

*Note: Threatened species which were listed after the receipt of the Mandalong South Project Development Consent (SSD_5144) on 12th October 2015, need only be considered for areas which were the subject of subsequent biodiversity related modifications.

The objective of management within areas of biodiversity significance is to undertake management as required at a minimum under the Development Consent and maintain or improve biodiversity values at the locations. To meet these objectives these areas will require the following management measures:

- Weed management;
- Bushfire management; and
- Pest management.

Monitoring reports include recommendations that describe the outcomes of monitoring and recommendations for enhancing biodiversity values.

3.1.6 Private Lands/Centennial Leased Lands

Private lands or lands that are privately owned and leased to Centennial Coal are land parcels that fall within the Mandalong mine boundary that are not owned by Centennial Mandalong. These lands are

not directly managed by Centennial Mandalong and as such Centennial Mandalong has no authority to implement management activities on these lands. Notwithstanding these land tenure impediments, Centennial Mandalong will support management of native vegetation and areas of biodiversity significance within this management area through ongoing consultation with individual land owners.

3.1.7 Rural Lands

Supplementary management actions will occur where possible on rural lands owned by Centennial Mandalong. Management actions will aim to enhance remnant areas of vegetation that results in an increase in overall native vegetation area and/or contribution to larger vegetation corridors across the landscape.

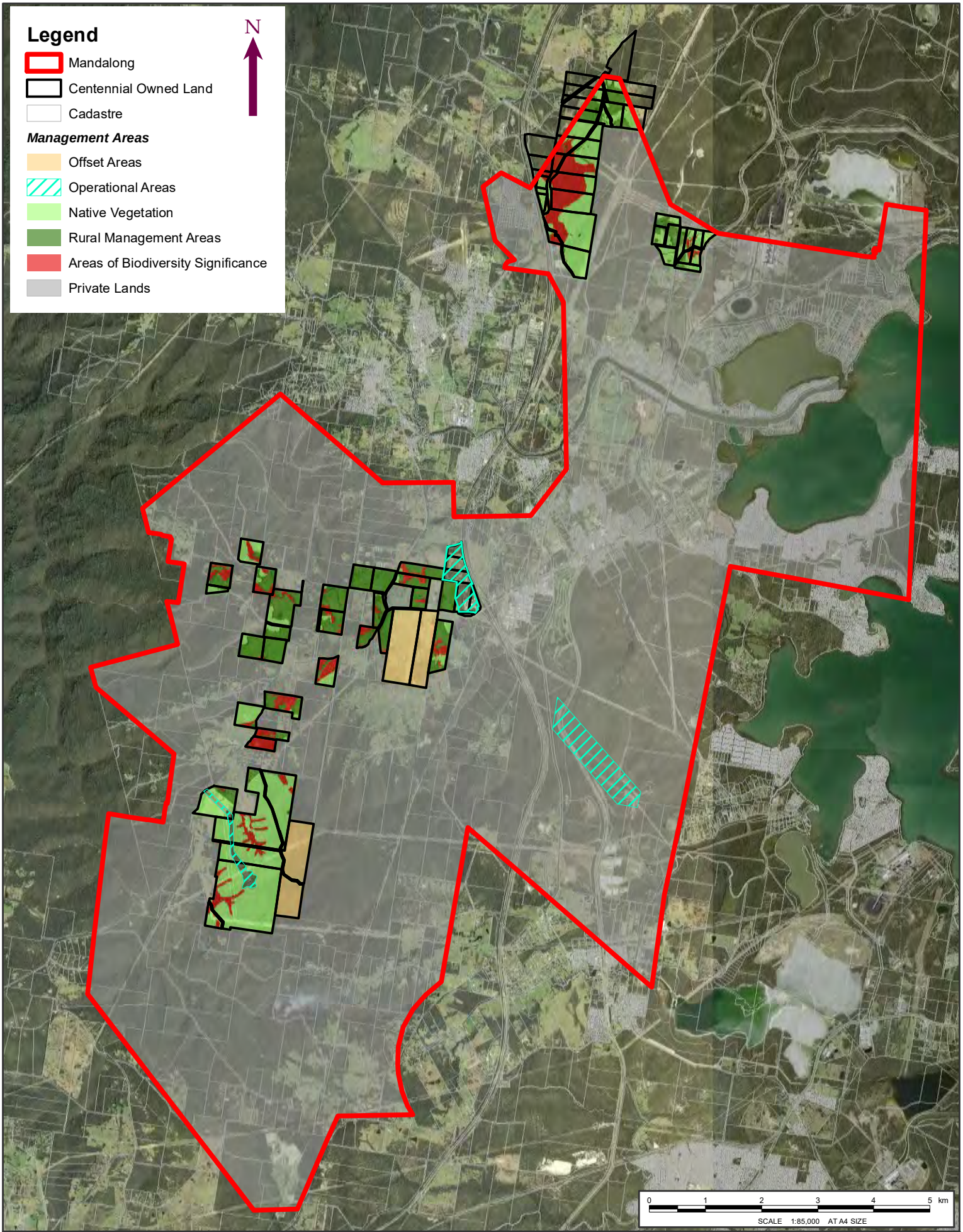

Figure 4: Mandalong Management Areas

LOCATION: MANDALONG

Coordinate System: GDA 1994 MGA Zone 56
Datum: GDA 1994

JOB NO.: **PR 145829**
PURPOSE: BMP
Technician: Natalie.Wood Date: 25/11/2019

Data Sources:
RPS, Client
Land and Property 2017

CLIENT: CENTENNIAL

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3.2 Management Actions

Land management activities are presented in Tables 12 to 16 with identified management areas for Mandalong Mine in Figure 4. The land management activities will be implemented by the Site Environment and Community Coordinator and undertaken in consultation with, but not limited to relevant specialists or contractors including Bush Regenerators, Weed and Pest Management, qualified Ecologists, Local Land Services and the Rural Fire Service. Management actions outlined below incorporate short, medium and long term goals for the duration of each required measure.

The frequency for management activities identifies the time period for which activities will continue to be undertaken. Activities required for the period of the operation or in perpetuity are identified. Where future actions are dependent on the success of current activities a 3 year time period has been provided. This document will be reviewed annually for the Annual Review and three yearly to identify the success of measures implemented for the upcoming three year period, as identified in Section 5.4 of the Northern Region BMP.

Table 12 Offset Area Management Actions

OffsetSite	Management Actions	Timing	Frequency
Mandalong Land Management Strategy	As outlined in the Mandalong Land Management Strategy (Appendix F)	Refer to Land Management Strategy in Appendix F	Refer to Land Management Strategy in Appendix F
VAM RAB Offset Area	Fencing of all rehabilitation areas to exclude stock and large herbivores	Completed	Completed
	Revegetation of rehabilitation areas	Completed in 2012	Completed
	Monitoring and ongoing management actions	Annually	Annually (commenced in 2013) for a minimum of five years perio from issue of DA97/800 modification
	Plant and machinery will be cleaned of any foreign soil and propagative material prior to being transported to the site to prevent the spread of weeds and potential importation of Phytopthora and Chytrid Fungus.	Prior to any vehicles entering offset sites	On entry

Table 13 Operational Areas Management Activities

Management Actions	Timing	Frequency
Access management – signage and gates at areas of threatened species, populations or communities located near operation areas, if any	to be installed after first ecological monitoring event	To be installed once and maintained accordingly
Bushfire Management - Liaison with RFS to ensure an Asset Protection Zone is maintained around the operations area. Annual reporting within Annual Review of changes	Ongoing	Outlined in the Mandalong Bushfire Management Plan
Erosion to be controlled in line with the site erosion control procedures in the Water Management Plan	As per Mandalong Water Management Plan	As per Mandalong Water Management Plan
Manage salinity in accordance with the Water Management Plan	As per Mandalong Water Management Plan	As per Mandalong Water Management Plan
Surface water management in accordance with the Water Management Plan	As per Mandalong Water Management Plan	As per Mandalong Water Management Plan
Pre-clearance surveys (Section 4.3 Northern Region BMP)	Prior to vegetation removal	Prior to all clearing activities commencing

Table 13 Native Vegetation Management Actions

Management Actions	Timing	Frequency
Removal of weeds, particularly WoNS/ noxious weed infestations, identified through ongoing monitoring – Treatment in accordance with Section 4.4.2 of the RBMP	Spring and Summer in consultation with Local Land Services	As per the Weed Action Plan (WAP)
Pest management - Treatment in accordance with Section 4.5.2 of the RBMP	Annually	Every year for the duration of Operations
Monitoring of habitat health and vegetation condition at locations yet to be determined	Prior to December 2019	Every 5 years for the duration of Operations
Management of weeds - Treatment in accordance with Section 4.4.2 of the RBMP	Spring and Summer annually	As per the Weed Action Plan (WAP)

Management Actions	Timing	Frequency
Bushfire Management - Bushfire Management - Engage with a qualified Bushfire Practitioner to develop a strategy for integrating safe burning regimes with positive biodiversity outcomes, through the implementation of a Fire Management Plan as reported to the Central Coast Bush Fire Management Committee, to the satisfaction of the LMCC	Prior to December 2019	Engagement to occur once

Table 14 Wetland Management Actions

Management Actions	Timing	Frequency
Removal of weeds, particularly WoNS/ noxious weed infestations, identified through ongoing monitoring – Treatment in accordance with Section 4.4.2 of the RBMP. Actions are identified from monitoring reports required under the Wetland Management Plan.	Spring and Summer annually	As per Wetland Management Report recommendations, minimum of 2 years following cessation of mining under wetlands

Table 156 Areas of Biodiversity Significance Management Actions

Management Actions	Timing	Frequency
Removal of weeds, particularly WoNS/ noxious weed infestations, identified through ongoing monitoring – Treatment in accordance with Section 4.4.2 of the RBMP	Spring and Summer annually	Twice annually for the life of the Operation
Monitoring of habitat health and vegetation condition at locations yet to be determined	Prior to December 2019	Every 5 years for the duration of Operations
Bushfire Management - Engage with a qualified Bushfire Practitioner to develop a strategy for integrating safe burning regimes with positive biodiversity outcomes, through the implementation of a Fire Management Plan as reported to the Central Coast Bush Fire Management Committee, to the satisfaction of the LMCC	Prior to December 2019	Engagement to occur once

Note: Annual consultation with Local Land Services will be required. Consultation will include, at a minimum, the previous years' land management monitoring results. Monitoring locations not yet established for monitoring of management measures will be completed prior to 2019 through a pilot monitoring program.

3.3 Site Specific Management Measures – Mandalong Mine

3.3.1 Land Management Strategy

The Mandalong Land Management Strategy has been drafted to address SSD-5144 Conditions of Consent. The Strategy includes the placement of land located off Mandalong Road and Chapman Road to be placed under a Property Vegetation Plan. The Strategy will include the management and monitoring of the land parcels in accordance with their management type: habitat enhancement, grazing/habitat management zones and riparian conservation areas.

3.3.2 VAM RAB

The VAM-RAB Offset area (Appendix H) is a requirement of Development Consent DA 97/800. Vegetation occurring on the site includes:

- MU31 Coastal Plains Scribbly Gum Woodland;
- MU37 Swamp Mahogany Paperbark Forest;
- MU38 Redgum – Rough-barked Apple Swamp Forest; and
- MU46 Freshwater Wetlands.

The site commenced active regeneration of vegetation in 2012 which has since been monitored by a qualified ecologist. Baseline monitoring of the site was undertaken in 2012 and monitoring is required for a further five years. Management measures are identified each year within monitoring reports and are actioned to increase the success of remediation undertaken. To date actions have included targeted pest and weed management, an annual planting program replacing losses and fencing herbivore prone areas. An improvement in habitat has been identified since 2012 through the monitoring program by an increasing presence of habitat selective species; however a period of longer than five years will be required to demonstrate successful remediation.

3.3.3 Wetland Management Plan

An approved Wetland Management Plan (Appendix G) addressing Mandalong Consent DA 98/800 consent conditions has been incorporated in this Plan. Management prescriptions and corresponding monitoring activities are described. The Wetland Management Plan identifies eight wetlands (three monitored wetlands are controls) monitored bi-annually using a transect starting on dry land extending into the wetland. Floristic content and abundance are collected and analysed. A Trigger Action Response Plan has been included in the Wetland Management Plan. An annual report is provided and includes management guidance for matters such as weeds.

3.3.4 Extraction Plan Biodiversity Management Plan

Mandalong Mine must complete an Extraction Plan BMP for all areas of secondary extraction of underground mining under Schedule 4 of SSD-5144. The BMP for individual Extraction Plans will be prepared in consultation with OEH and will define:

- Baseline data for existing habitat, including water table depth, vegetation condition, stream morphology and threatened species habitat;

- Provide for the management of potential impacts and/or environmental consequences of the proposed second workings on aquatic habitats with a specific focus on aquatic and terrestrial flora and fauna, with a specific focus on threatened species, populations and their habitats: endangered ecological communities and water dependent ecosystems;
- Performance measures of negligible consequences for threatened species, threatened populations and endangered ecological communities.
- A Trigger Action Response Plan; and
- A contingency plan.

A monitoring program for the Mandalong Lease area for the purpose of complying with the Development Conditions will be developed in early 2017. A pilot monitoring event will be undertaken in 2019 and the first monitoring event will be undertaken in Spring 2019. Following the completion of the monitoring event this Mandalong BMP will be updated to include a monitoring program following the first monitoring event. Monitoring for the components that currently exist, including Wetland monitoring and Biodiversity Offset monitoring, is outlined in Tables 14-15.

3.3.5 Bushfire Management Plan

The Bushfire Management Plan shall be reviewed to ensure the recommended bushfire mitigation measures support the objectives of the BMP. The Bushfire Management Plan is to provide a document that can provide certainty to the approval authorities and the operators in regards to fire risks and hazards, and recommends fire mitigation measures for the site with positive biodiversity outcomes.

The broad strategies to manage fire risk include:

- Eliminate the fire risk.
- Manage all fuel and infrastructure to reduce the rate of spread and intensity of fires- including structural risks.
- Manage fire regimes to enhance areas of biodiversity significance and areas of native vegetation.
- Engineering controls to effectively contain fires.
- Administration and organisation.

The Bushfire Management Plan will be consistent with the RFS Bushfire Environmental Assessment Code and the Rules and Notes for the Implementation of the Threatened Species Hazard Reduction List which outlines species specific conditions relating to the use of fire and mechanical forms of hazard reduction.

3.3.6 Mandalong South Surface Site Monitoring MOD 6

A commitment was made for any biodiversity impact to threatened flora or fauna of the Mandalong South Surface Site from the controlled release of surface water following significant rainfall event to be offset. The control release of surface water is a short term option until the water is diverted to underground mine workings.

The following biodiversity monitoring is being prepared to commence in 2019:

- Targeted frog species program mapping the habitat of species on Morans Creek.
- Ongoing aquatic ecology monitoring for macroinvertebrates.

The detailed monitoring program will be updated in a future revision of this Management Plan.

3.3.7 Retirement of Biodiversity Credits MOD 7

The requirement for retirement of biodiversity credits required within 12 months of the commencement of construction of Modification 7 (33kV powerline) will be made in accordance with the NSW Biodiversity Offset Policy for Major Projects (OEH, 2014).

The credits required to be retired are listed below:

Ecosystem*:*

- PCT 1619 – Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest – 35 credits;
- PCT 1573 – Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment – 9 credits;
- PCT 1588 – Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast – 147 credits;
- PCT 1619 – Smooth-barked Apple - Red Bloodwood - Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands – 36 credits; and
- PCT 1638 – Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass – shrub woodland on lowlands of the Central Coast – 4 credits.

Species Credits

- Glossy-Black Cockatoo (*Calyptorhynchus lathami*) – 229 credits;
- Green-Thighed Frog (*Litoria brevipalmata*) – 9 credits.

Correspondence will be submitted to BCD following the satisfaction of the biodiversity credit requirement to satisfy condition 20A of Schedule 3 of SSD-5144. Where BCD written correspondence is not received from BCD, Mandalong will notify DPIE of the actions undertaken to satisfy this condition.

4 Terrestrial Ecology Monitoring

The terrestrial ecology monitoring program is divided into management areas as shown in Tables 17-18. All monitoring locations are presented in Figure 5 and 6.

Table 16 Offset Area Monitoring Requirements

Offset Site	Type	Purpose	GPS Location	Monitoring Design	Monitoring Methodology	Data Analysis	Monitoring Frequency	Reporting Frequency
VAM RAB	Vegetation (existing vegetation and rehabilitation areas)	Collect data that enables a quantitative comparison between target communities and rehab areas	Plot 1 – SSF Control 356,509'E 6,334,805 'N 356,513'E 6,334,825' N 356,533'E 6,334,821' N 356,529'E 6,334,801' N Plot 2 – SSF Control 356,486'E 6,334,905' N 356,482'E 6,334,925' N 356,502'E 6,334,928' N 356,506'E 6,334,908' N Plot 3 – SSF Rehab 356,519'E 6,334,957' N 356,522'E 6,334,977' N 356,541'E 6,334,974' N 356,539'E 6,334,955' N Plot 4 – SSF Rehab 356,516'E 6,335,013' N 356,517'E 6,335,039' N 356,532'E 6,335,038' N 356,531'E 6,335,012' N Plot 5 – RFEF Rehab 356,496'E 6,335,071' N 356,493'E 6,335,111' N 356,503'E 6,335,112' N 356,506'E 6,335,072' N Plot 6 – RFEF Rehab 356,469'E 6,335,067' N 356,466'E 6,335,087' N 356,486'E 6,335,090' N 356,489'E 6,335,070' N Plot 7 – RFEF Control 356,468'E 6,335,148' N 356,454'E 6,335,162' N 356,468'E 6,335,176' N 356,482'E 6,335,162' N Plot 8 – RFEF Control 356,419'E 6,335,096' N 356,426'E 6,335,115' N	Comparison of data collected from permanent monitoring sites (i.e. repeated measures data analysis)	Permanent 20 m x 20 m floristic plots – nine in total Braun-blanquet	Agglomerative hierarchical clustering with the SIMROF option	Annually for five years (since 2012)	Annually for five years (since 2012)

Offset Site	Type	Purpose	GPS Location	Monitoring Design	Monitoring Methodology	Data Analysis	Monitoring Frequency	Reporting Frequency
			356,445'E 6,335,109' N 356,438'E 6,335,090' N Plot 9 – SSF Rehab 356,282'E 6,335,275' N 356,242'E 6,335,281' N 356,244'E 6,335,291' N 356,284'E 6,335,285' N					
Chapman Road Mandalong Road	Flora and Fauna	Baseline Monitoring and status of area following implementation of Management Measures	To be confirmed at commencement of program	Before After Control Impact (BACI) design (see note)	Biometric Plots	To be determined after the establishment of the BACI design.	Annually for the first three monitoring events following collection of the initial (baseline) dataset Every three years for the following five monitoring events Five yearly for every monitoring event thereafter	Annually Every three years Every five years
	Threatened Flora	Monitor threatened flora in Offset sites	To be confirmed at commencement of program	BACI design (see note)	Individual counts and age classing to identify recruited individuals	To be determined after the establishment of the BACI design.	Annually for the first three monitoring events. Every three years for the following five monitoring events. Five yearly for every monitoring event thereafter.	Annually

Note: **Control sites will be off tenement to ensure the BACI design is valid. A power analysis should be performed to determine if the BACI monitoring design is sufficiently robust enough to minimise the incidence of a false negative/ positive result.**

Table 17 Wetland Monitoring Requirements

Type	Purpose	GPS Location	Monitoring Method	Data Analysis	Monitoring Frequency	Reporting Frequency
This table provides a summary of Appendix G Wetland Management Plan	Monitor floristic abundance and condition in relation to potential mining related impacts	End points of transect Wetland 2: 356,287.5510'E 6,335,231.0810'N 356,300.8860'E 6,335,213.8790'N Wetland 3: 351,965.9270'E 6,331,216.2200'N 351,949.0000'E 6,331,231.0000'N Wetland 4: 353,167.6090'E 6,333,119.5730'N 353,205.1390'E 6,333,120.1080'N Wetland 5: 353,085.1980'E 6,333,160.2510'N 353,062.3850'E 6,333,183.3800'N Wetland 7: 353,027.1000'E 6,334,660.7160'N 353,024.2120'E 6,334,679.4580'N Wetland 8: 354,392.4350'E 6,334,761.6840'N 354,377.4510'E 6,334,770.1960'N Wetland 9: 354,666.9670'E 6,334,234.6070'N 354,683.2800'E 6,334,259.4290'N	Collect and analyse floristic data from transects at each monitored wetland at six-monthly intervals; Conduct chemical analysis on water samples collected at the same time as floristic data are collected; Monthly rainfall data Standardised Photography Flow alterations Water properties Extent and nature of soils 1 m x 1 m quadrats long permanent transects for floristics	Split moving window analysis Shannon-Weiner index	Biannually (April and November) for a period of ten years post mining.	Annually

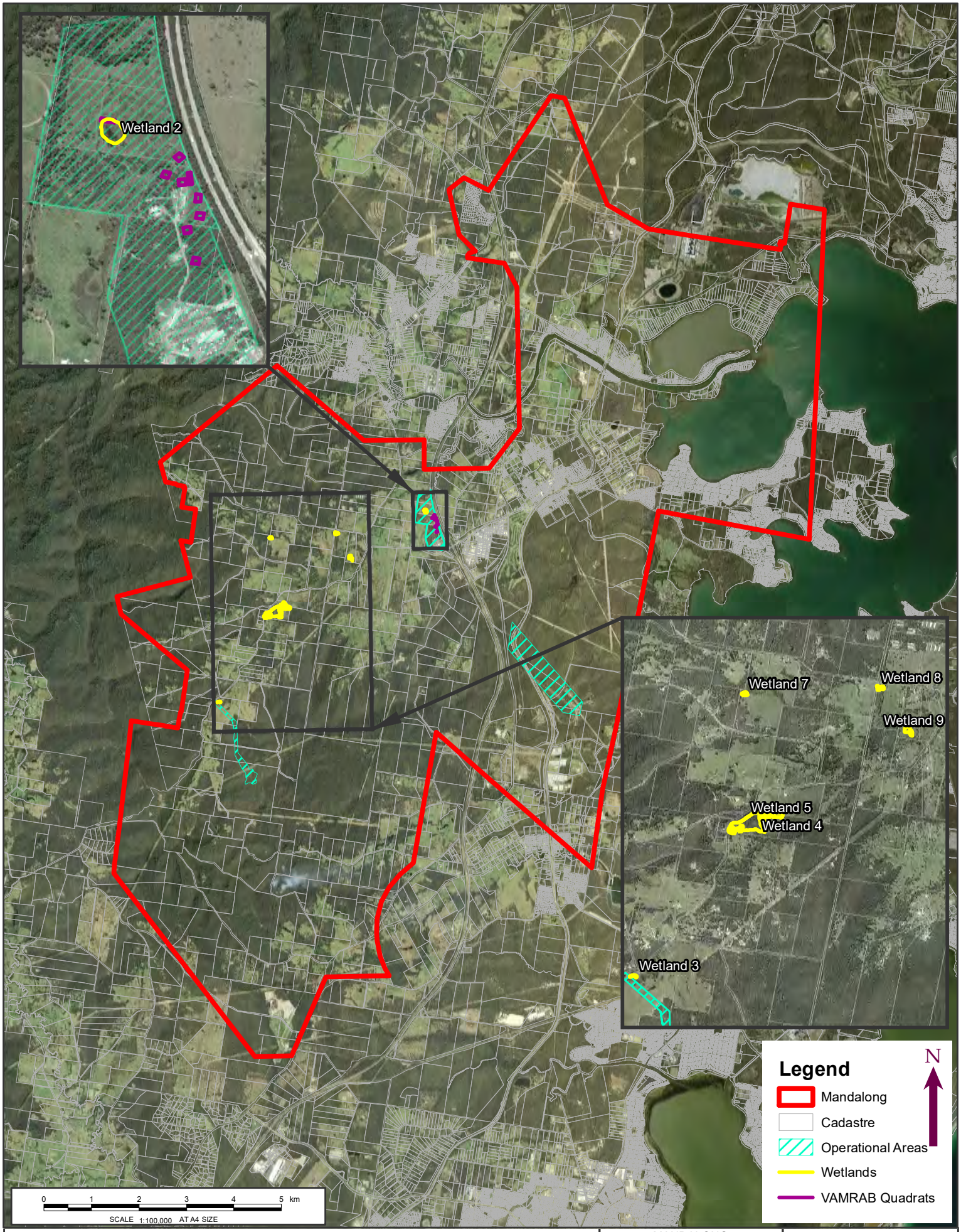


Figure 5: Mandalong Monitoring Locations (Colin Driscoll)

LOCATION: MANDALONG

JOB NO.: **PR 145829**

PURPOSE: BMP

Technician: Natalie.Wood Date: 22/11/2019

Coordinate System: GDA 1994 MGA Zone 56
Datum: GDA 1994

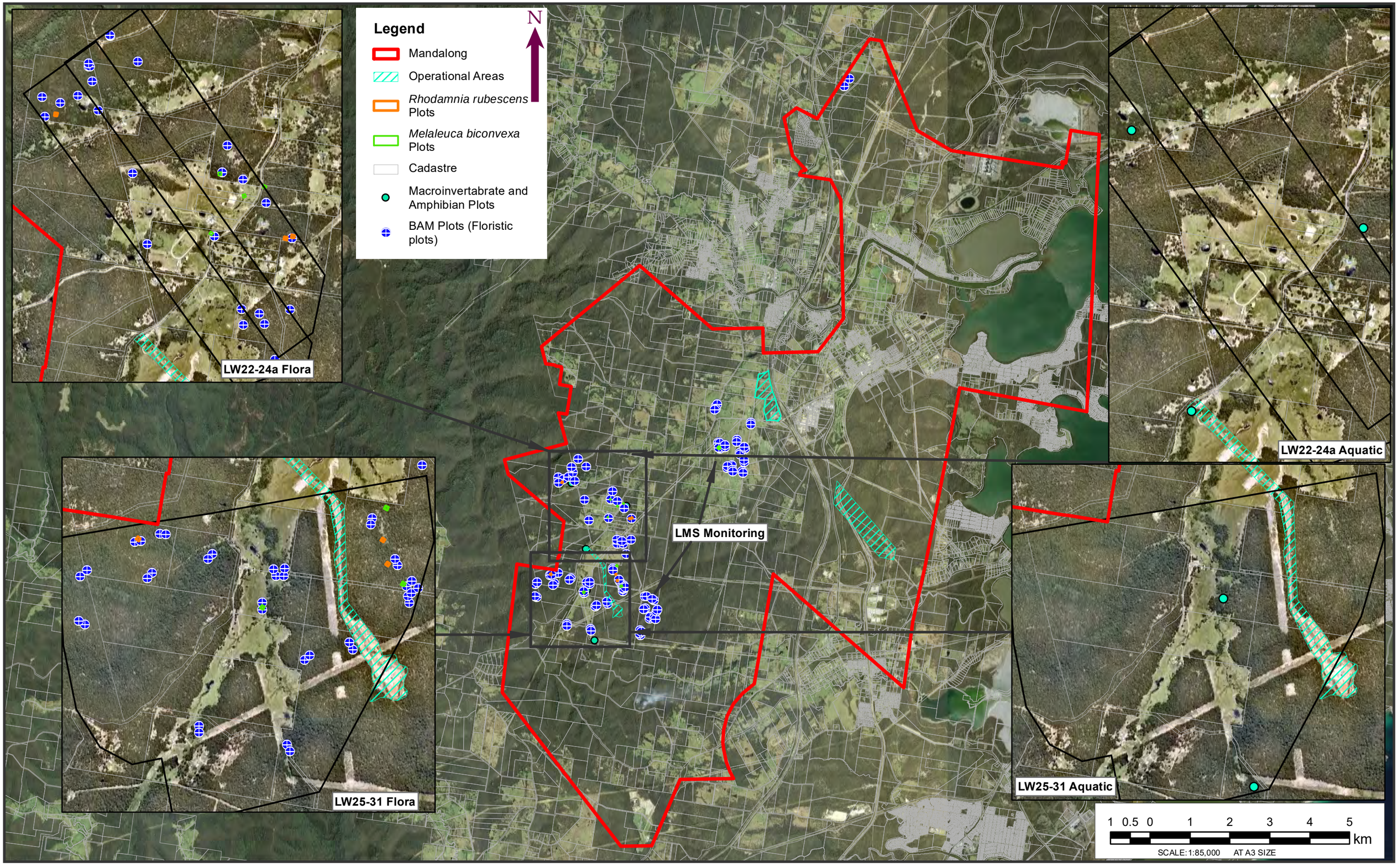
Data Sources:
RPS, Client
Land and Property 2017

CLIENT: CENTENNIAL

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
Unit 2A, 45 Fitzroy Street, Carrington, NSW, Australia, 2294 P.O Box 120, Carrington, NSW, 2294
T: 02 4940 4200 F: 02 4940 4299 www.rpsgroup.com.au

Path: S:\Centennial\All Jobs\145829 Mandalong BMP Updates\10 - Drafting\Arcgis Map Documents\Eco\145829_Figure 5 Monitoring Locations by Others A A4 20191122.mxd

NEW_A4_Portrait 2018 Rev:B Produced:NW Reviewed:NW Date: 10/05/2018



TITLE : FIGURE 6: MANDALONG MONITORING LOCATIONS (RPS)

LOCATION : MANDALONG

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **25/11/2019**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): A A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\145829 Mandalong BMP Updates\10 - Drafting\Arcgis Map Documents\Eco\145829_Figure 6 Monitoring Locations by RPS A A3 20191122.mxd

CLIENT: **CENTENNIAL**

JOB REF: **PR145829**

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