Appendix Q

Rehabilitation performance/completion criteria

Appendix Q — Rehabilitation performance/completion criteria

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Extract from MTW Mining Operations Plan June 2014

MOUNT-THORLEY WARKWORTH	
Mining Operations Plan	
Name of Mine	Mount Thorley Warkworth Operations
MOP Commencement Date	1 June 2014
MOP Completion Date	31 December 2016
Mining Authorisations (Lease / Licence No.)	CL 219, CCL 753, ML 1412, ML 1590
Name of Authorisation / Title Holder(s)	CL 219 Mount Thorley Operations Pty Ltd CCL 753 Warkworth Mining Limited ML 1412 Warkworth Mining Limited ML 1590 Warkworth Mining Limited
Name of Mine Operator (if different)	Coal & Allied Operations Pty Ltd
Name and Contact Details of the Mine Manager (or equivalent)	Mark Rodgers General Manager Mount Thorley Warkworth Operations Coal & Allied Operations Pty Limited PO Box 267 SINGLETON NSW 2330 Ph: 02 6570 1501 Fax: 02 6570 1599 Email: mark.rodgers@riotinto.com
Name and Contact Details of Environmental Representative	Bill Baxter Environmental Specialist Rehabilitation Coal & Allied Operations Pty Limited PO Box 315 SINGLETON NSW 2330 Ph: 02 6570 1717 Fax: 02 6570 1576 Mob: 0488 400958 Email: bill.baxter@rtca.riotinto.com.au
Name of Representative(s) of the Authorisation Holder(s)	David Bennett
Title	Manager - Mine Technical Services Mt Thorley Warkworth
Signature	
Date	

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1.0 Performance Criteria, Measures and Indicators

The performance criteria, measures and associated indicators have been developed in accordance with the range of project related documentation i.e. EA (EMGA Mitchell McLennan, 2013), EIS (ERM, 2002), Director General's Report and the Project Approval. The performance or completion criteria are objective target levels or values that can be measured to quantitatively demonstrate the progress and ultimate success of a biophysical process. These criteria have been developed for each phase of the rehabilitation so that the rehabilitation success can be quantitatively tracked throughout the life of the mine.

The performance measures quantify the rehabilitation and land management program in terms of efficiency or effectiveness and establish the indicative timeframes for completion. The performance indicators are used to define and evaluate the program, typically in terms of making progress towards the development of sustainable ecosystems whilst also providing a framework for the implementation of key activities. These indicators provide the basis for the procedural context of the site work practices. The performance indicators are attributes of the biophysical environment e.g. pH, slope, that can be used to approximate the progression of a biophysical process and can be measured to demonstrate and track the progress of an aspect of rehabilitation towards a desired completion criteria (NSW Trade & Investment September 2013).

The criteria, measures and indicators which provide the framework for this MOP are underpinned by a range of documents which relate to land management. These include industry standards, Rio Tinto Standards and C&A Procedures. The ongoing development of these documents will provide the basis for the review of this MOP with resultant amendments being recorded in documents such as the MTW AEMR.

There is an element of risk attached to the development of completion or performance criteria, in that it is impossible to predict all of the variables that might influence the recovery or otherwise of those lands which are rehabilitated post mining. Many variables operate at catchment or regional scales, such as river flows and pest outbreaks. Other factors that operate at continental or even global scales, such as climatic influences (including droughts or floods brought about by La Niña and El Niño events), could significantly influence the long-term sustainability of the vegetated lands encompassed by Mt Thorley Warkworth. To this end, the performance measures and associated indicators have been designed to provide an appropriate benchmark or guide against which to assess the management of project lands and the resulting improvements.

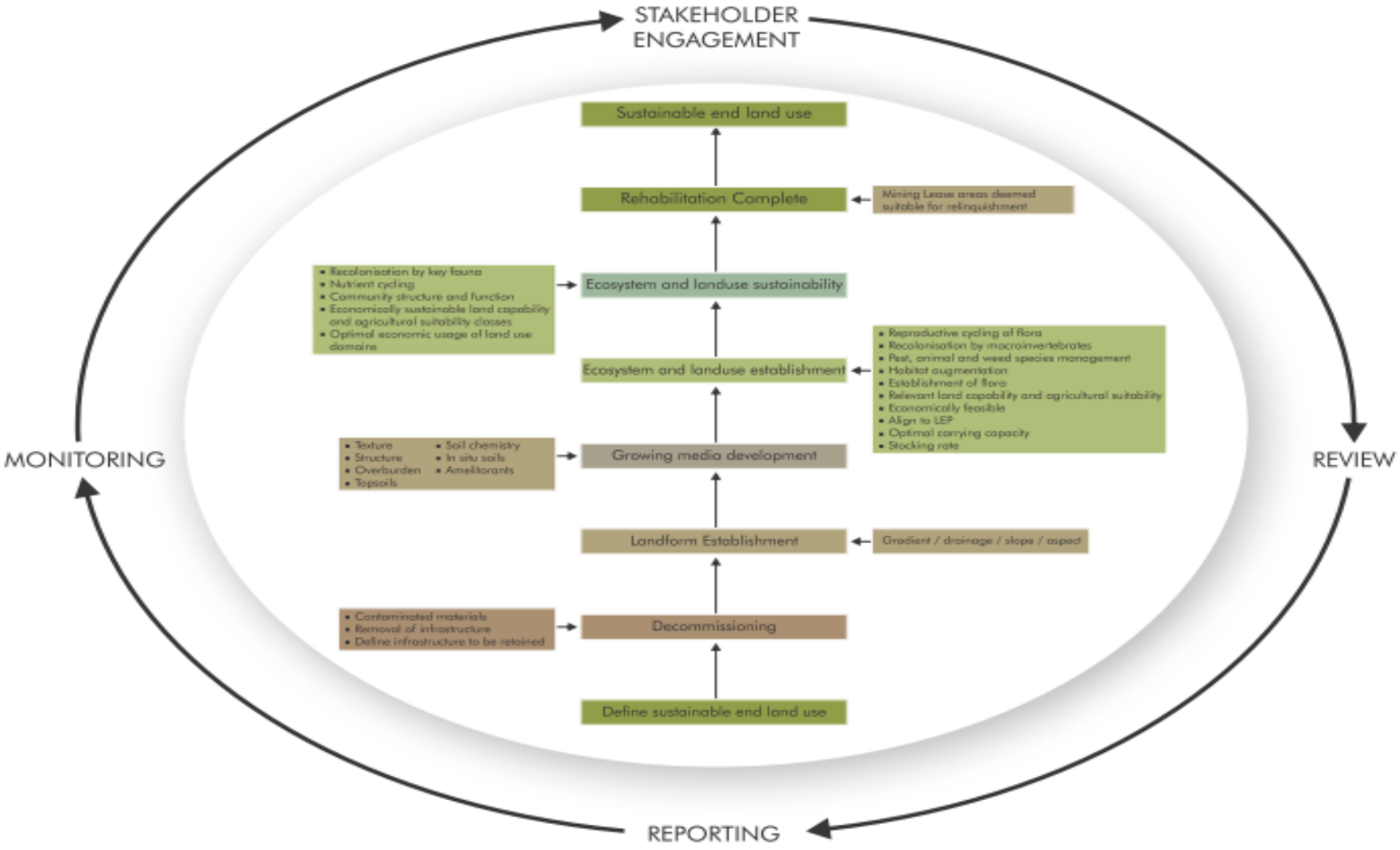
The performance measures and indicators in this MOP are designed to form the basis of the Performance Criteria and provide the ability to track the development of sustainable ecosystems through a series of conceptual stages which are presented in Section 1.1.

1.1 Rehabilitation Phases

The ultimate rehabilitation objective for MTW is the development of sustainable ecosystems across the site and in connection with the surrounding landscape. This will be achieved through a series of conceptual stages which are shown diagrammatically in Figure 1 and described as:

- Stage 1: Decommissioning – removal of hard stand areas, buildings, contaminated materials, hazardous materials;
- Stage 2: Landform Establishment – incorporates gradient, slope, aspect, drainage, substrate material characterisation and morphology;
- Stage 3: Growing Media Development – incorporates physical, chemical and biological components of the growing media and ameliorants that are using to optimise the potential of the media in terms of the preferred vegetative cover;
- Stage 4: Ecosystem and Landuse Establishment – incorporates revegetated lands and habitat augmentation; species selection, species presence and growth together with weed and pest animal control / management and establishment of flora; and
- Stage 5: Ecosystem and Landuse Sustainability – incorporates components of floristic structure, nutrient cycling recruitment and recovery, community structure and function which are the key elements of a sustainable landscape.
- Stage 6 – Rehabilitation Complete – landuse and landscape is deemed as suitable to be relinquished from the Mining Lease.

Figure 1 Conceptual Stages of Sustainable Ecosystem Development



1.2 Decommissioning

In the context of this MOP, decommissioning is the formal process to remove some facet of the mining operation from its active status. The Criteria, Performance Measures and Indicators together with the justification source for this data as it relates to the decommissioning stage are provided in Table 1.

It should be noted that this phase will particularly apply to those domains where the risk of hazardous materials may exist and as such may not apply to some of the domains.

Table 1 Decommissioning

Criteria	Performance Measure	Performance Indicator	Reference / Source
Infrastructure Areas			
The process of decommissioning may occur throughout the life of the mine as infrastructure and facilities progressively become redundant.	Progressive and final decommissioning may include the following: • Disassemble, demolish and remove structures. • Stabilisation of any loose materials on unstable slopes if required. • Installation of interim drainage management if required. • Remove concrete pads and footings. • Reuse or recycle materials (e.g. steel and concrete) where practicable, or dispose of appropriately. • Disconnect and terminate services. • Preparation of Decommissioning Plan.	Certificates for removal and disposal of hazardous materials present.	C&A Environmental Procedure *4.1 – Closure Planning Guidelines* C&A Environmental Procedure *13.1 – Site Contamination Prevention and Control* Rio Tinto Environmental Performance Standard *E5 – Hazardous Material and Contamination Control* Decommissioning Plan[1]
Undertake a hazardous material assessment of infrastructure to identify the potential health and environmental risks associated with demolition of the infrastructure.	Inventory showing location and quantities of: • Asbestos-containing materials (ACMs). • Lead paints. • Synthetic mineral fibre (SMF). • Polychlorinated biphenyls (PCBs). Decommissioning Plan to include hazardous materials management.	Decommissioning Plan to include hazardous materials management. Certificates for removal and disposal of hazardous materials present if required. Detailed investigation if required.	
	Management of hydrocarbon soil contamination.	Onsite treatment at the bioremediation area until the soil can be safely disposed in the spoil dump.	

[1] The decommissioning Plan is to be developed within 5 years of the cessation of mining.

Criteria	Performance Measure	Performance Indicator	Reference / Source
Undertake a contamination assessment to determine the risk of contamination.	Contamination assessment. Identify areas of high risk for further evaluation.	Assessment of contamination and / or remediation requirements if required.	
	Where contamination triggers specific handling and management requirements, develop a remedial action plan to provide a framework for the appropriate management, remediation and validation of contaminated soils if required.	Implementation of Remedial Action Plan. Certificates/audit statements showing remediation of soils.	
Tailing Storage Facility			
Decommissioning of TSF.	Establish a procedure to decommission, inspect and monitor TSF.	Performance of the TSF as per procedure.	Requirements of the Dam Safety Committee
Removal of tailings infrastructure.	Removal of pipelines and pumps and related tailings infrastructure.	Development of Decommissioning Plan.	Rio Tinto Environmental Performance Standard *E7 – Non Mineral Waste Management* C&A Environmental Procedure *6.2 – Coarse Rejects and Tailings Disposal*
Water Management Area			
Management of Water Management Area.	Decommissioning may include: • Removal of infrastructure. • Installation of interim drainage management if required. • Disconnect and terminate services.	Development of Decommissioning Plan.	Rio Tinto Environmental Performance Standard *E10 – Water Use and Quality Control* C&A Environmental Procedure *7.2 – Water Management*
	Where contamination triggers specific handling and management requirements, develop a Remedial Action Plan to provide a framework for the appropriate management, remediation and validation of contaminated soils if required.	Development of Remedial Action Plan. Implementation of Remedial Action Works. Certificates/audit statements showing remediation/ management of soils.	Remedial Action Plan – to be developed

Criteria	Performance Measure	Performance Indicator	Reference / Source
Overburden Emplacement			
Minimise risk of spontaneous combustion.	Undertake a spontaneous combustion assessment of previous stockpile areas where applicable.	If required and where practical monitoring for heat haze, smoke and odour, may include the use of thermal imagery.	C&A Environmental Procedure *8.3 – Spontaneous Combustion*
Final Void			
Management of the final void during mine decommissioning.	Incorporation of void infrastructure and facilities within the Decommissioning Plan.	Development of Decommissioning Plan.	C&A Environmental Procedure *4.1 – Closure Planning Guidelines* C&A Environmental Procedure *13.1 – Site Contamination Prevention and Control* Rio Tinto Environmental Performance Standard *E5 – Hazardous Material and Contamination Control* Decommissioning Plan

1.3 Landform Establishment

In the context of this MOP, Landform Establishment are the processes involved to achieve stable landforms including slopes, erosion controls, and drainage lines with integrated landscape features, which are compatible with surrounding landforms, whilst ensuring also ensuing that the rehabilitated areas of native vegetation link with undisturbed native vegetation.

The Criteria, Performance Measures and Indicators, together with the justification source which describe structures and method for this data, as relate to the Landform Establishment Stage are provided in Table 2 and address:

- Stabilising landforms;
- Minimising erosion;
- Preventing water pollution;
- Preventing access to open pits or other hazardous locations;
- Enhancing visual amenity; and
- Site user, stock and fauna safety.

The final landform and rehabilitation domain types for MTW during the life of the MOP are shown on **Maps 3A** – **3C** inclusive.

Table 2 Landform Establishment

Criteria	Performance Measure	Performance Indicator	Justification / Source
All Domains			
The final landforms, batter slopes, drainage and benching will be designed to ensure the long term stability of the landform.	Design to enable the agreed end landuse (determined as part of the broader mine closure program) to be established.	Absence of slope failure or uncontrolled erosion. Provide an assessment of the number of gullies or rills occurring in a 50m transect and that these are limited and stabilising. Provide an assessment of the extent of soil loss due to gully and rill erosion and that it is limited and/or is stabilising. No areas of active gully erosion. Sediment control features are assessment in accordance with the relevant management plan	C&A Environmental Procedure *10.1 – Visual Management* C&A Environmental Procedure *8.3 – Spontaneous Combustion*
Landforms to be established during rehabilitation will be constructed to match surrounding landforms, as much as possible.	Elements such as drainage paths, contour drains, ridgelines, and emplacements will be shaped, where possible, in undulating informal profiles in keeping with natural landforms of the surrounding environment.	Landform is generally compatible within the context of the local topography. The landform is to be shaped to ensure slopes are 10 degrees or less unless otherwise agreed. Avoidance of straight lines and angular corners in profiles of final landforms. Drainage lines to be self-sustaining and predominantly constructed of natural materials (e.g. minimise concrete).	
Minimisation of constructed slopes greater than 10 degrees – low walls, ramps and drainage structures.	Identify the exceptions where angles of 10 degrees are necessary and are permitted to be constructed. Obtain regulator's approval if greater than 18 degrees.	Approvals in place for slopes >18 degrees.	
Minimise risk of spontaneous combustion.	Exposed coal seams will be covered with benign materials to prevent spontaneous combustion where practical.	Absence of carbonaceous material on the surface of the rehabilitation and no active spontaneous combustion areas.	

Criteria	Performance Measure	Performance Indicator	Justification / Source
		Details on location of spontaneously combustible materials are contained in the AEMR.	
Final Void			
The final landforms, batter slopes, drainage and benching will be designed to ensure the long term stability of the landform.	Exposed coal seams will be covered	Exposed coal seams will be covered with five metres of inert materials to prevent spontaneous combustion where practical.	
	Cover materials	Acceptable cover material for capping.	
Overburden Emplacement			
Encapsulation	Problematic materials will be capped.	Problematic coarse rejects will be disposed amongst non-carbonaceous overburden materials and covered with 5 metres of inert materials.	Rio Tinto Environmental Performance Standard *E3 – Acid Rock Drainage Prediction and Control* Rio Tinto Environmental Performance Standard *E8 – Mineral Waste Management* C&A Environmental Procedure *12.1 – Acid Mine Drainage Prevention and Control* C&A Environmental Procedure *6.2 Coarse Rejects and Tailings Disposal*
		Net acid generating materials will be managed in accordance with the relevant EMS Procedure and / or site specific Standard.	
		Carbonaceous material will be managed in accordance with the relevant EMS Procedure and / or site specific Standard.	
Surface rocks	Rock on rehabilitated lands	Rocks > 200mm are removed from rehabilitated lands.	C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation*

Criteria	Performance Measure	Performance Indicator	Justification / Source
Tailings Storage Facility			
Operation of TSF.		Performance as per procedure.	Rio Tinto Environmental Performance Standard *E7 – Non Mineral Waste Management* C&A Environmental Procedure *6.2 – Coarse Rejects and Tailings Disposal*
The potential subsidence of materials deposited into the TSF will also be taken into account when designing the final landform.	TSF design and management to allow for progressive reshaping of the surface as settlement occurs. TSF design and management to allow for initial overfilling of the covering material to compensate for expected settlement.	Engineering inspection/TSF audit.	
Problematic materials will be capped.	Tailings storage facilities are capped with overburden and rehabilitated after consolidation of tailings.	TSF design documentation.	

1.4 Growing Media Development

In the context of this MOP Growing Media Development incorporates the processes involved to achieve a soil which is capable of supporting a sustainable plant community. It includes consideration of the chemical, physical and biological properties of the media and takes into account issues such as the specialist requirements, e.g. soil ameliorants aligned to the revegetation of the disturbed areas, whilst also incorporating consideration of landuse that may deviate from the traditional post mining landuse.

1.4.1 Overburden characterisation

At MTW, overburden material varies in physical and geochemical properties, in accordance with the geology of the area and the extent of exposure to weathering.

Chemical analyses of MTW spoil materials indicate that, in general, the overburden is slightly sodic and alkaline, but within acceptable ranges for use as a plant growth medium.

1.4.2 Soil types and suitability

Data derived from the EA demonstrates the suitability of the soils of the project area in terms of the suitability of these soils for use as top dressing and the stripping depth. The distribution of each soil type across MTW and the suitability of these soils for use as topsoil dressing and the stripping depth are presented in Section 0.

Industry experience gained from the use of topsoil derived from pasture and returning to native plant communities has demonstrated the potential for these soils to incur land management issues such as erosion and weed incursions. To address these issues the areas returning to native plant communities will, in the main, be based on “enhanced growing media”, the basis being overburden and appropriate ameliorants i.e. organic fertilisers, gypsum and organic matter.

Soil management is fundamental in successful rehabilitation management at MTW. The key objectives for managing the soil landscape (in context of vegetative cover and soil stability) include:

- Minimising bare soil patches, which would be affected by wind and water movement and the introduction and transportation of resources into and out of the system; and
- Favourable nutrient, infiltration and stability characteristics for the nominated vegetation communities.

The Criteria, Performance Measures and Indicators together with the justification source which describe structures and method for this data as relate to the growing media development stage is provided in Table 3.

Table 3 Growing Media Development

Criteria	Performance Measure	Performance Indicator	Justification / Source
Rehabilitation Areas			
Soil properties are suitable for the establishment and maintenance of selected vegetation species	Tests assessing the growing media's physical properties – texture, structure and Emerson Aggregate assessment. Tests assessing the growing media's chemical properties – pH, salinity, nitrogen, potassium and phosphorous. Tests assessing the growing media's biological properties – organic content, presence of an A-horizon.	pH of replaced topsoil to be broadly within the range suitable for targeted species growth. Electrical Conductivity of replaced topsoil to be broadly within the range suitable for plant growth. Runoff water quality to be broadly trending towards less than 1,000µS/cm after 5 years. Soil Phosphorous levels to be trending towards the range suitable for plant growth . Soil Nitrate levels to be trending towards the range suitable for plant growth. Organic carbon levels are typical of that of the surrounding landscape, increasing or fall within desirable ranges provided by the agricultural industry. Cation Exchange Capacity is typical of that of the surrounding landscape or fall within desirable ranges provided by the agricultural industry. Exchangeable Sodium Percentage (a measure of sodicity) is typical of that of the surrounding landscape or fall within desirable ranges provided by the agricultural industry.	Rio Tinto Environmental Performance Standard *E9 – Land Use Stewardship* C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation* C&A Environmental Procedure *7.1 – Water Management* Warkworth Rehabilitation Strategy (2011)

Topsoil spreading	Topsoil is spread appropriately in a way that will ensure optimum ecosystem establishment.	Topsoil is re-spread directly onto reshaped landforms where possible. Topsoil is spread to an average depth of 10cm. The location of areas where topsoil is respread is recorded on the site GIS.	Rio Tinto Environmental Performance Standard *E9 – Land Use Stewardship* C&A Environmental Procedure *10.3 – Ground Disturbance Permit* C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation* Warkworth Rehabilitation Strategy (August 2011) EA (2010)
Soil ameliorants	Where topsoil has been deemed insufficient to sustain plant growth, or if topsoil is not available soil growth media amelioration may be required.	Soil ameliorants such as gypsum, wood and hay mulch, biosolids, municipal waste composts and other organic wastes are utilised based on availability of supply or Waste Regulation 1996 guidelines. Soil ameliorants are incorporated into the growth medium. The location of areas where soil ameliorants are used is recorded on the site GIS Soil data and plant growing requirements provides the premise for ameliorant and fertiliser application rates. All vegetation up to ~0.2 m diameter will be mulched onsite. Resultant mulch product is spread across the soil surface and incorporated during topsoil stripping.	

1.5 Ecosystem and Landuse Establishment

In the context of this MOP, Ecosystem and Landuse Establishment incorporates the requirements for:

- The management and control of fire, weed and vertebrate pest species;
- Correct flora species selection in terms of the revegetation programmes - refer Section 0 for details on species lists;
- Management of the derived grasslands of the Central Hunter Grey Box–Ironbark Woodland and/or Central Hunter Ironbark–Spotted Gum–Grey Box Forest EECs with a view to establishing the defined EEC's;
- Development and implementation of techniques that focus on the re-establishment of the Central Hunter Grey Box-Ironbark Woodland and/or Central Hunter Ironbark-Spotted Gum – Grey Box Forest EECs;
- The development of systems to enhance opportunities for nutrient cycling and the development and enhancement of habitat for key fauna species; and
- The optimal use of onsite resources, e.g. woody debris, rock, mulch.

Table 4 summarises the threatened species, populations and ECCs that are to be managed in accordance with the Project Approval.

Table 4 Threatened species, populations and ECCs recorded or considered likely to occur within MTW extension area

Threatened fauna species	TSC Act	EPBC Act
Brown Treecreeper (*Climacteris picumnus*)	V	-
Grey-crowned Babbler (*Pomatostomus temporalis*)	V	-
Speckled Warbler (*Chthonicola sagittata*)	V	-
Hooded Robin (*Melanodryas cucullata*)	V	-
Diamond Firetail (*Stagonopleura guttata*)	V	-
Glossy Black-cockatoo (*Calyptorhynchus lathami*)	V	-
Regent Honeyeater (*Anthochaera phrygia*)	E	E
Swift Parrot (*Lathamus discolour*)	E	E
Little Lorikeet (*Glossopsitta pusilla*)	V	-
Spotted Harrier (*Circus assimilis*)	V	-
Varied Sittella (*Daphoenositta chrysoptera*)	V	-
Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)	V	-
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	V
Eastern Free-tail Bat (*Mormopterus norfolkensis*)	V	
Little Bent-wing Bat (*Miniopterus australis*)	V	
Large-footed Myotis (*Myotis macropus*)	V	
Squirrel Glider (*Petaurus norfolcensis*)	V	-
Endangered Ecological Communities		
Warkworth Sand Woodlands	E	-
Central Hunter Grey Box–Ironbark Woodlands	E	-
Central Hunter Ironbark–Spotted Gum–Grey Box Forest	E	-

V= Vulnerable; E = Endangered

Additional threatened flora species and ECCs are known to occur within the Warkworth extension area, however none of these species/populations are located within the proposed disturbance area and would therefore not be impacted by mining activities. As such, they have not been included in this assessment.

This information has provided the framework for the development of the Criteria, Performance Measures and Indicators for Ecosystem and Landuse Establishment which are provided in Table 5.

Table 5 Ecosystem and Landuse Establishment

Criteria	Performance Measure	Performance Indicator	Justification/Source
All Domains			
Weed Control	Weeds are controlled to appropriate levels.	The amount of weeds present is comparable to reference sites or baseline survey. Annual inspections of Mine lands are undertaken to identify areas requiring the implementation of weed management measures. Implementation of appropriate weed management measures which may include mechanical removal, application of approved herbicides and biological control. Recording of areas where weed control has been conducted in a GIS database which is regularly maintained. Follow-up inspections to assess the effectiveness of the weed management measures implemented and the requirement for any additional management measures.	Rio Tinto Environmental Performance Standard *E9 – Land Use Stewardship* C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation* *Noxious Weeds Act 1993* Australian and NSW Weed Strategies TSC Act – Key Threatening Processes
Pest animal species	Pest animal control for any declared pest animal species known on the project lands.	Mandatory pest control for any declared pests known to occur on Mine owned land. Use of a range of appropriate pest control measures as determined (e.g. the destruction of habitat, trapping, targeted shooting programs and baiting). Follow-up inspections to assess the effectiveness of control measures implemented and the requirement for any additional control measures.	Rio Tinto Environmental Performance Standard *E9 – Land Use Stewardship* C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation* *Rural Lands Protection Act 1998* TSC Act – Key Threatening Processes
Bushfire preparedness and risk mitigation	Vegetation is managed to control fire.	Implementation of actions as per the Bushfire Management Plan .	Mount Thorley Warkworth Bushfire Management Plan

Criteria	Performance Measure	Performance Indicator	Justification/Source
			Rural Fires Act 1997
Seed collection and utilisation	Data on seed utilisation.	Data on seed utilisation is collated via the use of GIS data including: - Date of seeding - Species mix used. - Viability data – where available.	Rio Tinto Environmental Performance Standard *E9 – Land Use Stewardship* C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation* C&A Environmental Procedure *10.2 – Flora and Fauna* Warkworth Rehabilitation Strategy (August 2011)
Rehabilitation Area			
Establishment and germination of vegetation.	Tube stock planting	Woodland/grassland seed and tubestock supply will preferentially be of local provenance. Seed and tubestock supplied from outside sources will be preferentially of Hunter provenance or from an area within NSW of similar climatic conditions to the Singleton area or as research defines. Tubestock is to be watered the day before and immediately prior to planting. Tubestock is to be planted with water soluble polymer (tree gel). Seedlings are hardened off before they are planted.	C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation* C&A Environmental Procedure *10.2 – Flora and Fauna* Warkworth Rehabilitation Strategy (August 2011) Hunter Ironbark Research Programme CSIRO Methodology for Ecosystem Function Analysis (EFA) (Tongway, 2004).
	Revegetation works aligned to seasonality of rainfall, evaporation and temperature.	Warm season grasses are seeded late spring to autumn. Cool season perennial grasses are planted late autumn-early spring. Tree planting to be undertaken in autumn (between April and August) and after first rains to provide adequate soil moisture.	

Criteria	Performance Measure	Performance Indicator	Justification/Source
	The vegetation is developing in structure and complexity comparable to that of the local remnant vegetation	Based on key physical, biological and chemical characteristics the LFA Stability Index provides an indication of the site's stability and that it is comparable to or trending towards that of analogue sites (%). Based on key physical, biological and chemical characteristics the LFA Infiltration Index provides an indication of the site's infiltration capacity and that it is comparable to or trending towards that of analogue sites (%). Based on key physical, biological and chemical characteristics the LFA Nutrient Recycling Index provides an indication of the site's ability to recycle nutrients and that it is comparable to or trending towards that of analogue sites (%). The Landscape Organisation Index provides a measure of the ability of the site to retain resources and that it is comparable to or trending towards that of analogue sites (%).	
	Predation by herbivores	All plantings at risk of foraging by fauna (rabbits, hares, wallabies and kangaroos) are protected by the pre planting application of deterrent spray, and/or tree guards and/or exclusionary fencing wherever practical.	
Minimise site impact in terms of compaction of soil, the spread of weeds and disturbance to vegetation	No uncontrolled entry of livestock or vehicles.	Vehicle access is restricted to defined access pathways for use by authorised vehicles. The main arterial tracks are maintained in good condition.	C&A Environmental Procedure *10.3 – Ground Disturbance Permit*
	Signage	Key habitat and rehabilitation areas will be fenced or signposted where appropriate to prevent the uncontrolled entry of livestock and to minimise vehicular traffic during the establishment phase.	
Habitat augmentation	Coarse Woody Debris and rocks	Horizontal placement of hollow logs or small piles of timber and rocks are installed across the site creating cavities for habitat for small ground dwelling mammals and reptiles.	C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation* Biodiversity Management
	Drainage depression (frog ponds) creation	Habitat is developed using common native rushes /sedges in unshaded locations, free from predatory fish, nearby grassland and	

Criteria	Performance Measure	Performance Indicator	Justification/Source
	providing riparian and aquatic habitat	sheltering sites of vegetation and rocks.	Plan (2012) Warkworth Rehabilitation Strategy (August 2011)
	Plant species selection.	Plant species are used which create suitable habitat for woodland birds e.g. flaky bark, production of small and large sized woody debris, diversity of flowering time. Plant prickly species (e.g. Native Boxthorn) that provide critical habitat for certain species.	
	Provide diversity of habitats to improve biodiversity.	Create areas of open woodland where trees and shrubs are not planted too densely (create "patchiness") and provide relatively large patches of grassland with scattered trees. Create patchwork of dense thickets of shrubs.	
Rehabilitation Areas – Grassland			
Species Selection	Establishment of 1,129 ha grassland communities with a native component on the residual disturbed mining areas.	1,129ha of grassland established on rehabilitated mine lands. Create an additional north/south wildlife corridor providing connectivity to other habitat.	Rio Tinto Environmental Performance Standard *E9 – Land Use Stewardship* C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation* C&A Environmental Procedure *10.2 – Flora and Fauna* Biodiversity Management Plan (2012) Warkworth Rehabilitation Strategy (August 2011)
	Species used are compatible with agricultural outcomes.	Species sown are based on those recommended species list from (Diversity Native Seeds Scope of Services). The number of grass species comprising the vegetation community is comparable to that of analogue sites (no. species/area).	
Rehabilitation Areas – Woodland Other			

Criteria	Performance Measure	Performance Indicator	Justification/Source
Species Selection	Establishing approximately 2,067 ha of trees over grassland areas, but not necessarily conforming to any particular vegetation community	2,067ha of trees over grassland established on rehabilitated mine lands. The number of tree species comprising the vegetation community is comparable to that of analogue sites (no. species/area). The number of grass species comprising the vegetation community is comparable to that of analogue sites (no. species/area). The density of trees is comparable to that of analogue sites (no./area). Species sown are based on those recommended species list from .	Rio Tinto Environmental Performance Standard *E9 – Land Use Stewardship* C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation* C&A Environmental Procedure *10.2 – Flora and Fauna* Biodiversity Management Plan (2012) Warkworth Rehabilitation Strategy (August 2011)
Rehabilitation Areas – Woodland EEC			
Species Selection	Establishment of 32ha of Central Hunter Grey Box-Ironbark Woodland and / or Central Hunter Ironbark-Spotted Gum-Grey Box Forest on rehabilitated mine lands.	32ha of Central Hunter Grey Box-Ironbark Woodland and / or Central Hunter Ironbark-Spotted Gum-Grey Box Forest established on rehabilitated mine lands. Create an additional north/south wildlife corridor providing connectivity to other habitat. The number of tree species comprising the vegetation community is comparable to that of analogue sites (no. species/area). The number of shrub species comprising the vegetation community is comparable to that of analogue sites (no. species/area). The number of grass species comprising the vegetation community is comparable to that of analogue sites (no. species/area). The number of subshrub species and understorey species (other than grasses) comprising the vegetation community is comparable to that	Rio Tinto Environmental Performance Standard *E9 – Land Use Stewardship* C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation* C&A Environmental Procedure *10.2 – Flora and Fauna* Biodiversity Management Plan (2012) Warkworth Rehabilitation

Criteria	Performance Measure	Performance Indicator	Justification/Source
		of analogue sites (no. species/area). The native plant species richness is within 50-100% or exceeds that of analogue sites (no. species/area). The density of trees is comparable to that of analogue sites (no./area). Species sown are based on those recommended species list from .	Strategy (August 2011)
	Species used are compatible with agricultural or native biodiversity conservation outcomes. Revegetation focusing on reinstating endemic woodland ecological communities utilising flora species which provide a range of canopy, mid and understorey species.	Species sown are based on those recommended species list from industry lead practice and the Hunter Ironbark Research Programme.	

1.6 Ecosystem and Landuse Sustainability

In the context of this MOP, Ecosystem and Landuse Sustainability incorporates the:

- Development of profiles in the growing media aligned to the nominated EECs;
- Sustainable development of the nominated areas of the EECs;
- Vegetation communities capable of withstanding catastrophic events, e.g. bushfire and extensive drought;
- Nutrient cycling;
- Species diversity and abundance for both flora and fauna; and
- Recolonisation of the sites by key indicator species.

The Criteria, Performance Measures and Indicators together with the justification source which describe structures and method for this data as they relate to the Ecosystem and Landuse Sustainability Stage is provided in Table 6.

Table 6 Ecosystem and Landuse Sustainability

Criteria	Performance Measure	Performance Indicator	Justification/Source
Rehabilitation Areas			
Ecosystem resilience	Monitoring of the placement and utilisation of habitat features and artificial roosting/nesting boxes.	Nest boxes will be installed to supplement arboreal habitat. Data on the location and species specificity of each nest box is collected and collated via Geographical Information System (GIS). Record utilisation of nest boxes.	Rio Tinto Environmental Performance Standard *E9 – Land Use Stewardship* C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation* CSIRO Methodology for Ecosystem Function Analysis (Tongway, 2004) Warkworth Rehabilitation Strategy (August 2011) Rehabilitation Management Plan (2012) Biodiversity Management Plan (2012) EA (2010)
Ecosystem Connectivity	Vegetation communities in areas of rehabilitation have been designed to enhance connectivity across the site and to adjoining landscape.	Align vegetation communities on areas of rehabilitation to adjacent landscape. GIS data reflects connectivity of vegetation communities.	
Rehabilitation Area - Grassland			
Ecosystem resilience	Weed management and control	Weed plant cover (calculated as a percentage of total ground cover) is comparable to that of analogue sites. (% Cover)	Rio Tinto Environmental Performance Standard *E9 – Land Use Stewardship* C&A Environmental Procedure *5.1 –*
Ecosystem health	The ecosystem is in a condition comparable to the vegetation of the analogue site.	Total groundcover is the sum of protective ground cover components (dead and live plant material, rocks and logs) and is comparable to that of analogue sites (% Cover).	

Criteria	Performance Measure	Performance Indicator	Justification/Source
Ecosystem health		The abundance of understorey species (non-weed) per square metre, averaged across the site, provides an indication of the heterogeneity of the site and that the number of non-weed species is comparable to analogue sites (no. species/m2).	*Disturbance and Rehabilitation* CSIRO Methodology for Ecosystem Function Analysis (Tongway, 2004) Warkworth Rehabilitation Strategy (August 2011) Rehabilitation Management Plan (2012) Biodiversity Management Plan (2012) EA (2010)
Rehabilitation Area – Woodland Other			
Ecosystem resilience	Weed management and control	Weed plant cover (calculated as a percentage of total ground cover) is comparable to that of analogue sites. (% Cover)	Rio Tinto Environmental Performance Standard *E9 – Land Use Stewardship* C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation* CSIRO Methodology for Ecosystem Function Analysis (Tongway, 2004) Warkworth Rehabilitation Strategy (August 2011) Rehabilitation Management Plan (2012) Biodiversity Management Plan (2012)
Ecosystem health	The ecosystem is in a condition comparable to the vegetation of the analogue site.	Total groundcover is the sum of protective ground cover components (dead and live plant material, rocks and logs) and is comparable to that of analogue sites (% Cover).	
		The diversity of maturing trees and shrubs with a stem diameter greater than 5cm is comparable to that of analogue sites (no./area).	
		The percentage of maturing trees and shrubs with a stem diameter greater than 5cm that are local endemic species is comparable to analogue sites.	
		The density of maturing trees and shrubs with a stem diameter greater than 5cm is comparable to analogue sites (no./area).	
		Average trunk diameter (dbh) of the tree population provides a measure of age and growth rate and that it is trending towards that of analogue sites (cm).	

Criteria	Performance Measure	Performance Indicator	Justification/Source
		The percentage of the tree population which are in healthy condition and that the percentage is comparable to analogue sites.	EA (2010) Biobanking Assessment Methodology (2008)
		The percentage of the tree population which are in a medium health condition and that the percentage is comparable to analogue sites.	
		The percentage of the tree population which are in a state of advance dieback and that the percentage is comparable to analogue sites.	
Ecosystem health	The ecosystem is in a condition comparable to the vegetation of the analogue site.	The presence of reproductive structures such as buds, flowers or fruit on trees and shrubs provides evidence that the ecosystem is maturing, capable of recruitment and can provide habitat resources and that the % population is comparable to that of analogue sites.	
		The proportion of over-storey species occurring as regeneration is within 50-100% or exceeds that of analogue sites.	
Rehabilitation Area – Woodland EEC			
Ecosystem health	The ecosystem is in a condition comparable to the vegetation of the analogue site.	The percentage of native over storey cover is within 50-100% or exceeds that of analogue sites.	Rio Tinto Environmental Performance Standard *E9 – Land Use Stewardship* C&A Environmental Procedure *5.1 – Disturbance and Rehabilitation* CSIRO Methodology for Ecosystem Function Analysis (Tongway, 2004) Warkworth Rehabilitation
		The percentage of native mid storey cover is within 50-100% or exceeds that of analogue sites.	
		The percentage of native ground cover (grasses) is within 50-100% or exceeds that of analogue sites.	
		The percentage of native ground cover (shrubs) is within 50-100% or exceeds that of analogue sites.	
		The percentage of native ground cover (other) is within 50-100% or exceeds that of analogue sites.	

Criteria	Performance Measure	Performance Indicator	Justification/Source
		Exotic plant cover (calculated as a percentage of total ground cover and mid storey cover) is within 5-33% or less than that of analogue sites.	Strategy (August 2011) Rehabilitation Management Plan (2012) Biodiversity Management Plan (2012) EA (2010) Biobanking Assessment Methodology (2008)
		Total groundcover is the sum of protective ground cover components (dead and live plant material, rocks and logs) and is comparable to that of analogue sites (% Cover).	
		The abundance of native understorey species per square metre, averaged across the site, provides an indication of the heterogeneity of the site and that the number of native species is comparable to analogue sites (no. species/m2).	
Ecosystem health	The ecosystem is in a condition comparable to the vegetation of the analogue site.	The diversity of maturing trees and shrubs with a stem diameter greater than 5cm is comparable to that of analogue sites (no./area).	
		The percentage of maturing trees and shrubs with a stem diameter greater than 5cm that are local endemic species is comparable to analogue sites.	
		The density of maturing trees and shrubs with a stem diameter greater than 5cm is comparable to analogue sites (no./area).	
		Average trunk diameter (dbh) of the tree population provides a measure of age and growth rate and that it is trending towards that of analogue sites (cm).	
		The percentage of the tree population which are in healthy condition and that the percentage is comparable to analogue sites.	
		The percentage of the tree population which are in a medium health condition and that the percentage is comparable to analogue sites.	
		The percentage of the tree population which are in a state of advance dieback and that the percentage is comparable to analogue sites.	

Criteria	Performance Measure	Performance Indicator	Justification/Source
		The presence of reproductive structures such as buds, flowers or fruit on trees and shrubs provides evidence that the ecosystem is maturing, capable of recruitment and can provide habitat resources and that the % population is comparable to that of analogue sites.	
		The proportion of over-storey species occurring as regeneration is within 50-100% or exceeds that of analogue sites.	
Ecosystem health	Provide fauna habitat features comparable to that of the analogue site.	The total length of fallen logs is within 50- <100% or exceeds that of analogue sites.	Biobanking Assessment Methodology (2008)
		The number of hollows / nesting sites is within 50- <100% or exceeds that of analogue sites.	