ENHANCE PLACE MINE

2021
ANNUAL ENVIRONMENTAL MANAGEMENT REPORT

(Small Mine Version)

TITLE BLOCK

Name of Mine	Enhance Place Mine		
Mining Titles/Leases	ML 1458	**Expiry Date**	28/11/2020
Mining Titles/Leases	ML 1520	**Expiry Date**	28/08/2023
Historical Mining Titles/Leases	ML 1422	**Expiry Date**	3/12/2018
Name of Leaseholder	Enhance Place Pty Ltd		
Name of Mine Operator	As above		
Postal Address	Enhance Place Pty Ltd		
	350 Boulder Road		
	Portland, N.S.W, 2847		
Telephone	(02) 6354 8111		
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Signature		**Signature**	
Name	Graham Goodwin	**Name**	Ben Eastwood
Position	Mining Engineering Manager		Environmental Officer
Date	18.02.2021	**Date**	18.02.2021

Contents

1 INTRODUCTION

1.1 BACKGROUND

Enhance Place Pty Ltd (Enhance Place) was established in 1997 using open cut mining methods to recover remnant coal from areas that had been previously mined in the 1950's. A principal objective of Enhance Place was to provide the means to improve the appearance and general amenity of the land through the rehabilitation of land previously impacted by mining.

Enhance Place operated the Enhance Place Open Cut Coal Mine (Enhance Place Mine) from 1997 until its closure in June 2005 following the extraction of all economically feasible coal reserves.

The Enhance Place Mine is located in the Western Coalfields of NSW at Blackmans Flat, 15km northwest of Lithgow on the southern side of the Castlereagh Highway. The site is approximately 3km southeast of Mount Piper Power Station (Plans **1** & **1a**, **Appendix A**).

The Enhance Place Mine extracted coal over the abandoned Eastern Main Underground Mine workings (Eastern Main Mine). The Eastern Main Mine operated as a Bord and Pillar mine until 1975. Mining activities at the Enhance Place Mine were undertaken by six (6) employees, being augmented for short periods by secondment of maintenance, operating or rehabilitation personnel from other areas of the contractor's operations as required.

Since the cessation of open cut operations in June 2005, activities at the Enhance Place Mine have included surface water control, rehabilitation of land-form with seeding and fertilisation, feral animal and weed control programmes have been implemented with final rehabilitation completed.

Weed spraying was scheduled to be undertaken during the 2021 reporting period. However, due to a change in ownership of the property, no weed spraying was carried out.

1.2 LANDOWNERSHIP AND LAND USE BOUNDARIES

Land ownership of the Enhance Place Mine consists of private freehold and crown land. The current status of land ownership, tenure and pre-mining land use at the Enhance Place Mine is summarised in **Table 1**. The landowner and the respective boundaries are shown in **Plan 2**, **Appendix A**.

Table 1 *Land Ownership*

Landowner/Occupier	Lot/DP	Tenure (freehold leasehold)	Pre-mining land use
Mr & Mrs J. Cherry	301/751636	Freehold	Grazing
Mrs J. Cope	302/751636 303/751636	Perpetual Lease	Grazing
D & J Hunt	370/751651	Freehold	Grazing
State of NSW - Glen Davis Recreation Area (R. 59960)	304/751636 305/751636	Crown Land	Grazing
State of NSW	7004/1026541	Crown Land	Bush/grazing
M & L Morris up until approximately August 2021, property purchased by A.M.D. Thompson.	101/1145705	Freehold	Grazing

1.3 MINE PRODUCTION, PRODUCT AND MARKET

The mine ceased production at the end of June 2005 when all coal reserves had been extracted. There was no coal production or active mining operations undertaken at Enhance Place during the 2021 reporting period (refer **Section 4**).

Details of production history are detailed in **Table 2**.

Table 2 *Production History*

Year	Production Total (Tonnes)
1998	73,632
1999	86,007
2000	77,804
2001	77,579
2002	77,109
2003	101,851
2004	89,000
2005	27,228
Total	**609,940**

2 CONSENTS AND LICENCES

The following consents and licences apply to Enhance Place Mine.

Local Council Area:	Lithgow City Council Development Consent 36/99	
Development Consent:	Granted	[✓]
	Required but not granted	[ ]
	Not required	[ ]

Do licences granted by other agencies apply to the mine activities? Yes [✓] No [ ]

EPL No.6312 surrendered 28/09/2005 after cessation of mining.

National Parks and Wildlife Services	[N/A]
Dam Safety	[N/A]
Other	[N/A]

2.1 MINING OPERATIONS PLAN (MOP) AND ANNUAL ENVIRONMENTAL MANAGEMENT REPORT (AEMR) PERIOD

MOP Commencement Date	31 May 2013	**Completion Date**	16 January 2024
AEMR Start Date	1 January 2021	**End Date**	31 December 2021

There have been no amendments made to the Enhance Place Care and Maintenance Mining Operations Plan (MOP, Ref [1]) during the 2021 AEMR period.

A report, required under the Enhance Place Mine Consent, that presented options on the final land use and ownership of the Glen Davis Recreation Trust area at the Enhance Place Mine has been presented (in 2015) to the Lithgow City Council and other relevant stakeholders. This Consent Condition is now satisfied, and the final decision on land use rests with the relevant authorities.

3 ACTIONS REQUIRED FROM PREVIOUS AEMR

There were no actions noted during the review of the 2020 Enhance Place AEMR.

4 MINING OPERATIONS DURING THE REPORTING PERIOD

There were no mining activities undertaken at the Enhance Place Mine during the reporting period as mining ceased on the 29 June 2005. The production and waste summary for 2021 is presented in **Table 3**.

Table 3 *Production and Waste Summary*

	Production and Waste (cubic metres)		
	Start of Current Reporting Period (Actual)	**At end of Current Reporting Period (Actual)**	**End of Next Reporting Period (Estimated)**
Topsoil stripped	Nil	Nil	Nil
Topsoil used/spread	Nil	Nil	Nil
Waste Rock	Nil	Nil	Nil
Ore	Nil	Nil	Nil
Processing Waste	Nil	Nil	Nil
Product	Nil	Nil	Nil

5 REHABILITATION

The primary domain at the Enhance Place Mine is the Overburden Emplacement Area, which is subdivided into two (2) secondary domains consisting of rehabilitated pasture areas and rehabilitated woodland (treed) areas. The locations of rehabilitation domains are shown in **Plan 3**, **Appendix A**.

Development of quantitative rehabilitation completion criteria and provision of advice and recommendations for pasture improvement strategies was undertaken in 2014 (Ref [2]), including the addition of soil ameliorants for each of the rehabilitation domains at Enhance Place. Rehabilitation Completion Criteria were then derived and incorporated within the MOP (Ref [1]).

A rehabilitation status survey is undertaken annually, and the monitoring report provides an overview of the rehabilitation status at the Enhance Place Mine and recommendations for the improvement of rehabilitation outcomes in reference to the approved completion criteria (Ref [1]). The survey comprises inspection of four (4) previously established quadrats and two (2) transects representing rehabilitated pasture and treed areas transects. An additional two (2) transects exist as analogue sites in grazed pasture and undisturbed naturally vegetative areas to provide benchmarks against the pasture and treed rehabilitation areas.

Rehabilitation activities are conducted in accordance with best practice management to ensure the rehabilitation completion criteria, as detailed in the Enhance Place Mine Care and Maintenance MOP (Ref [1]), are achieved and to take into account the recommendations of the annual rehabilitation monitoring reports.

5.1 SUMMARY OF WORKS UNDERTAKEN TO COMMENCEMENT OF REPORTING PERIOD

Since mining ceased in June 2005 Rehabilitation works at Enhance Place Mine have included:

- Construction of final landform, water management and erosion/sediment control structures.
- Reseeding of 21 ha to pasture and 1.2 ha planted to trees and shrubs. Pasture was sown with *Coxs River Mix*, comprising:
    - 40% Fescue.
    - 25% Cocksfoot.
    - 20% Subterranean clover.
    - 6% Perennial rye grass.
    - 5% White clover.
    - 4% Phalaris.
- Amelioration of pasture and treed areas with compost, lime and gypsum in accordance with recommendations of the 2014 SLR report (Ref [2]).
- Development and implementation of a stock management plan with landowners (presented in **Appendix B**).
- Erosion management, soil stabilisation, surface drainage structure maintenance, pasture improvement, treed area improvement, weed management and stock management; and
- Ongoing feral animal and weed control programs.

These works have improved soil nutrient parameters, ground cover and pasture composition within the rehabilitation areas, whilst also reducing erosion and weed presence.

A summary of the key findings and recommendations detailed in the previous Enhance Place Mine Rehabilitation Monitoring Reports (Ref [3-7]) are presented in **Table 4** along with the completed actions during each AEMR period up until 2020.

Rehabilitation monitoring was undertaken in late November 2021.

Table 4 *Rehabilitation Works Completed 2016 – 2020 (Ref [3-7])*

EP Commitments as per MOP (Ref [1])	Year	Enhance Place Rehabilitation Monitoring Report Recommendations	Rehabilitation Works Completed
		Pasture Areas	
Erosion Management; Soil Stabilisation; Weed Management; & Pasture Improvement.	**2016**	• Re-sow waterlogged areas and exposed soils in depressions with rye grass.	• Waterlogged areas and depressions did not require re-sowing as water infiltrated quickly and existing pasture was still viable.
		• Increase and maintain groundcover in pasture rehabilitation areas to at least 95% to mitigate the potential for soil erosion and to ensure that groundcover is comparable to cover at the pasture analogue site.	• Fertiliser (lime & gypsum) applied over pasture areas- success is subject to horse grazing management. Pasture rehabilitation is currently between 75-90%, which satisfies the MOP (Ref [1]) completion criteria.
		• Continue to monitor stocking rates in accordance with the Stock Management Plan (Ref [8], **Appendix B**).	• SMP implemented - paddock 1 exclusion Sep to Dec 2016. • Monitoring and Evaluation of pasture rehabilitation (January 2017) indicated successful rehabilitation of pasture in paddock 1.
	2017	• Continue to monitor percentage groundcover.	• Field surveys to determine percentage groundcover conducted in March and August 2017
		• Continue to monitor stocking rates in accordance with the Stock Management Plan (Ref [8], **Appendix B**).	• Stocking rates were recorded during field surveys in March and August 2017.
	2018	• Continue to monitor percentage groundcover.	• Field surveys to determine percentage groundcover conducted in September 2018.
		• Continue to monitor stocking rates in accordance with the Stock Management Plan (Ref [8], **Appendix B**).	• Stocking rates were recorded during the field survey in September 2018.
	2019	• Continue to monitor percentage groundcover.	• Field surveys to determine percentage groundcover conducted in September 2019
		• Continue to monitor stocking rates in accordance with the Stock Management Plan (Ref [8], **Appendix B**).	• Stocking rates were recorded during the field survey in September 2019.
	2020	• Continue to monitor percentage groundcover, species composition and erosion.	• Field surveys of pasture area conducted in September 2020.
		• Continue to monitor stocking rates in accordance with the Stock Management Plan (Ref [8], **Appendix B**).	• Stocking rates were recorded during the field survey in September 2020
	2021	• Continue to monitor percentage groundcover, species composition and erosion.	• Field surveys of pasture area conducted in November 2021.
		• Reassess pasture capability and stocking rates in 2022	• The 2021 survey recorded no stock were present and anecdotal evidence suggested that no grazing had occurred in the two months preceding the survey. The new owner of the property had not stocked the land as at the time of the survey

EP Commitments as per MOP (Ref [1])	Year	Enhance Place Rehabilitation Monitoring Report Recommendations	Rehabilitation Works Completed
		Treed Areas	
Erosion Management; Soil Stabilisation; Weed Management; & Treed area Improvement.	**2016**	• Increase groundcover of grasses and broadleaf herbs at treed rehabilitation areas to >95% to mitigate the potential for soil erosion and to ensure that groundcover is comparable to cover at the treed analogue site.	• Application of organic mulch and seed mix applied. Hydro mulch and seed mix of fast-growing groundcover herbs and grasses then applied to the treed area.
		• Consider planting tree seedlings where soils are exposed (2016).	• Planting of deep-rooted native tube stock undertaken.
		• Place additional coarse woody debris along contours above rills to reduce rate and volume of runoff.	• Woody debris and organic matter sprayed over contours of treed area.
	2017	• Continue to monitor vegetation health.	• Field surveys conducted in March and August 2017. Replanting / replacement of dead Tube stock in January and March.
		• Continue to monitor groundcover of grasses and broadleaf herbs.	• Field surveys conducted in March and August 2017
	2018	• Continue to monitor vegetation health.	• Field surveys conducted in September 2018. Replanting / replacement of dead Tube stock in March 2018.
	2019	• Continue to monitor vegetation health.	• Field survey conducted in September 2019. Watering of trees undertaken.
	2020	• Continue to monitor vegetation health.	• Field survey conducted in September 2020.
	2021	• Continue to monitor vegetation health.	• Field survey conducted in November 2021.
		All Areas	
Erosion Management; Soil Stabilisation; & Weed Management	**2016**	• Continue to spot-spray outbreaks of African lovegrass. Hand pull Wild Radish plants.	• Weed control undertaken as per Weed Maintenance Schedule (**Appendix B**).
		• Revegetate exposed sediment retention basin walls.	• Roll-over drain constructed and maintained to prevent rill erosion.
		• Construct a roll-over drain above existing rill erosion on sloping trails to divert water off trail surface more effectively.	• No areas of cracking greater than 20cm in depth were observed during 2016.
		• Address soil cracking / movement as it occurs.	• Soil movement (settling hole) re-filled.
		• Monitor pest animal numbers.	• Pest monitoring not required as numbers are considered low with no adverse impact on rehabilitation and final land use.
	2017	• Address soil cracking / movement as it occurs.	• Maintenance of minor cracking occurring in Pasture areas undertaken in May 2017. Grading of access trail to facilitate surface water runoff (August 2017).
		• Monitor pest animal numbers.	• Pest numbers noted during field surveys in March & August 2017
		• Spot-spray outbreaks of African lovegrass (Sept thru to Feb).	• Weed control undertaken as per Weed Maintenance Schedule (**Appendix B**).
	2018	• Monitor pest animal numbers.	• Pest numbers noted during field surveys in September 2018.
		• Spot-spray outbreaks of African lovegrass (Sept thru to Feb).	• Weed control undertaken as per Weed Maintenance Schedule (**Appendix B**).
	2019	• Monitor pest animal numbers.	• Pest numbers noted during field surveys in September 2019.
		• Spot-spray outbreaks of African lovegrass (Sept thru to Feb).	• Weed control undertaken as per Weed Maintenance Schedule (**Appendix B**).
	2020	• Monitor pest animal numbers.	• Pest numbers considered low and satisfactory September 2020 survey.
		• Spot-spray outbreaks of African lovegrass (Sept thru to Feb).	• Weed spraying undertaken January 2020.
	2021	• Monitor pest animal numbers.	• Pest numbers considered low and satisfactory November 2021 survey.
		• Spot-spray outbreaks of African lovegrass, St Johns Wort, Serrated tussock and Blackberry	• No weed spraying undertaken throughout 2021.

5.2 REHABILITATION MONITORING UNDERTAKEN IN 2021

The rehabilitation activities undertaken during the 2021 AEMR reporting period included weed management and stock monitoring in accordance with the recommendations outlined in the Enhance Place Mine Rehabilitation Monitoring Report 2020 (Ref [7]). Further details are provided in **Section 6**.

The Enhance Place Mine Rehabilitation Monitoring Report 2021 (Ref [9]) is attached in **Appendix C** and Figure 1 of that report shows the location of the quadrats and transects along with the results of the survey and comparative photographs. An assessment of the current status of the site conditions compared to the completion criteria (Ref [1]) is included within the Report (Ref [9], **Appendix C**). It is noted that analogue sites (situated outside of the boundary of Enhance Place Mine) could not be surveyed in 2021 due to the presence of livestock in the former area and due to accessibility issues associated with the late 2019 / early 2020 bushfire in the latter area.

The Enhance Place Mine Rehabilitation Monitoring Report 2021 (Ref [9]) made the following observations:

- Free water was observed on the ground surface of internal trails and in isolated locations within the pastures. It was noted that rainfall preceding the November site inspection was higher than the mean annual rainfall for the area.
- Pastures had not been grazed for two (2) months prior to the inspection and there were increases in the % of annual and total living cover in all quadrats.
- Landform stability and concentration of soil cracking is satisfactory.
- Rural land capabilities of pastures are satisfactory.
- Specifies composition and ground cover within pastures are satisfactory.
- Annual living cover and total living cover increased at transects 7 and 8.
- African lovegrass is present within the pasture areas.
- Vegetation health and ground cover in treed areas are satisfactory.
- Isolated, juvenile blackberry plants are present in quadrats 1, 2 and 3.
- St John's Wort was observed in quadrats 1, 2 and 4.
- Serrated Tussock was observed in the south-eastern corner of quadrat 3.
- There is no evidence of second-generation establishment ('recruitment') within the treed rehabilitation areas.
- The presence of rabbits (European rabbit *Oryctolagus cuniculus*) was observed however no holes, burrows or dens were identified. Rabbit numbers were considered low. There is no mention of the presence of foxes or any other feral species.

The following recommendations were made:

- Continue to spot-spray outbreaks of African Lovegrass.
- Control outbreaks of Blackberry in quadrats 1, 2 and 3.
- Control St John's Wort in quadrats 1, 2 and 4.
- Control Serrated Tussock in the south-eastern corner of quadrat 3.

- Continue to monitor performance indicators.
- Re-assess pasture capability and stocking rates in 2022.

These recommendations will be implemented within the 2022 Reporting Period.

Monitoring and maintenance of the final landform and stability of the site will continue while Enhance Place hold relevant mining authorities over the area; however, Enhance Place intend to confirm that rehabilitation has been successfully completed to the satisfaction of the Department and relinquish these areas (refer **Section 7**). If confirmed the maintenance requirements will revert to the private owners (refer **Table 1**).

5.3 REHABILITATION STATUS SUMMARY

Disturbed and rehabilitated areas at the Enhance Place Mine is summarised in **Table 5**.

Table 5 *Rehabilitation Status Summary*

		Area Affected / Rehabilitated (hectares)		
		To Date (Actual)	**Last Report: 2021 (Actual)**	**Next Report: 2022 (estimated)[a]**
A: Mine Lease Area				
A1	ML 1422 (expired: 3/12/2018) ML 1458 (expired: 28/11/2020) ML 1520	7.0 14.0 9.6	7.0 14.0 9.6	0.0 0.0 0.0
	Total Mine Lease(s) area[a]	30.6	30.6	0.0
B: Disturbed Areas				
B1	Infrastructure Area	Nil	Nil	Nil
B2	Active Mining Area	Nil	Nil	Nil
B3	Waste Emplacements	Nil	Nil	Nil
B4	Tailings Emplacements	n/a	n/a	n/a
B5	Shaped Waste Emplacement	Nil	Nil	Nil
All Disturbed Areas		**Nil**	**Nil**	**Nil**
C: Rehabilitation Progress				
C1	Total Rehabilitated Area	24.2	24.2	24.2
D: Rehabilitation on Slopes				
D1	10 to 18 Degrees	1.2	1.2	1.2
D2	Greater than 18 Degrees	0.5	0.5	0.5
E: Surface of Rehabilitated Land				
E1	Pasture and Grasses	21.0	21.0	21.0
E2	Native Forest / Eucalypt	1.2	1.2	1.2
E3	Plantations and Crops	Nil	Nil	Nil
E4	Other	2.0	2.0	2.0

[a] This includes expired mine lease areas as the rehabilitation area encompasses ML 1422, ML 1458 and ML 1520.

6 ENVIRONMENTAL PERFORMANCE

As the majority of land within the leases of Enhance Place Mine is privately owned (refer **Table 1**) landowner permission is required to access the site: this has been restricted by locked gates to the portion of land owned Lot 101, DP1145705 which was owned by, at the commencement of the 2021, Mr. Morris (refer **Plan 3**, **Appendix A**). It is noted that the property, formerly owned by Mr. Morris, was listed for sale in around April/May 2021 and the property was henceforth sold in August 2021. The new owners, A.M.D. Thompson, had not (at the end of the reporting period) responded to correspondence regarding potential access to the property. This has resulted in some limitation to works planned and/or undertaken at the site during the reporting period.

There were no environmental incidents reported during the 2021 reporting period.

6.1 EROSION MANAGEMENT

All landform shaping and drainage control structures as outlined in the MOP (Ref [1]) have previously been completed at Enhance Place Mine (refer **Plan 2**, **Appendix A**) and the potential for major erosion (gully or tunnel erosion; mass movement) is considered to have been mitigated as there is no evidence of significant erosion occurring. However, surface erosion may occur in areas where rehabilitation has not been successful, or as a result of overgrazing or other events (such as severe drought / bushfire / flooding).

The Enhance Place Mine Rehabilitation Monitoring Report 2020 (Ref [7]) identified minor surface erosion in the pasture rehabilitation areas, with the combined bare surfaces observed to be less than 20m^2 per hectare, which was determined to be satisfactory. It was further observed that exposed soils within the treed rehabilitation areas were also subject to wind and minor rill erosion however there were no recommendations to undertake any repairs to erosion or drainage control structures during the 2021 reporting period. The Enhance Place Mine Rehabilitation Monitoring Report 2021 (Ref [9]) noted no significant erosion features that compromise landform stability or public safety during the November 2021 survey. However, there was evidence of minor surface erosion consistent with the 2020 survey results.

The land shaping areas and drainage control structures were inspected generally on a monthly basis throughout 2021 by the Mining Engineering Manager; no activities for erosion control were undertaken within the 2021 Reporting Period.

Based on the status as reported by the Enhance Place Mine Rehabilitation Monitoring Report 2021 (Ref [9], refer **Section 5.2**), it is considered that erosion management has been satisfactory.

6.2 SOIL STABILISATION

Cracking soils and waterlogging may occur in areas of overgrazing; where rehabilitation has not been successful; or adjacent to the highwall as a result of subsidence and soil movement.

The Enhance Place Mine Rehabilitation Monitoring Report 2020 (Ref [7]) did not identify any soil cracking and there were no recommendations for repair works during the 2021 reporting period.

No activities with regards to soil stabilisation were undertaken in the 2021 Reporting Period.

Based on the status as reported by the Enhance Place Mine Rehabilitation Monitoring Report 2021 (Ref [9], **Appendix C**), it is considered that soil stabilisation management has been satisfactory.

6.3 SURFACE DRAINAGE AND STRUCTURE MANAGEMENT

Surface water pooling may occur as a result of inappropriate or inadequate drainage structures. Sediment ponds and contour drains have previously been constructed where appropriate and there is no evidence of failure to date.

The Enhance Place Mine Rehabilitation Monitoring Report 2020 (Ref [7]) noted that sediment ponds and contour drains were in good operational condition and that there were no impediments within drainage structures nor was there evidence of erosion or sedimentation associated with drainage structures generally. Furthermore, there was little evidence of surface water flow occurring outside of established contour drainage lines. There were no recommendations for repair works during the 2021 reporting period.

No activities with regards to surface drainage and structures were undertaken in the 2021 Reporting Period.

Based on the status as reported by the Enhance Place Mine Rehabilitation Monitoring Report 2021 (Ref [9], **Appendix C**), it is considered that management of surface drainage and structures has been satisfactory.

6.4 STOCK MANAGEMENT

A Stock Management Plan (Ref [8], **Appendix B**) was commissioned for the Enhance Place Mine to aid in the management of the rehabilitated pasture areas which were affected by compaction and overgrazing by the landowner's stock. Enhance Place had previously installed fencing to create three (3) fenced and watered paddocks and the Plan (Ref [8]) included this layout to assist with time control and/or rotational grazing. Appropriate stocking rates for each paddock were determined in accordance with the carrying capacity of the pasture conditions.

A collaboration between Enhance Place Mine Pty Ltd and the then landowners (Morris), led to the exclusion of grazing stock from various paddock areas in late 2016 and into 2017 in an effort to improve pasture conditions (refer **Section 6.5**).

The Enhance Place Mine Rehabilitation Monitoring Report 2020 (Ref [7]) stated that the rehabilitation area had successfully supported stock and/or horses for > 12 months at modest rates and there were no recommendations for pasture improvement during the 2021 reporting period.

Stock management was the responsibility of the landowner throughout the 2021 Reporting Period. At time of writing there are no stock situated within the rehabilitation area, and has not been since approximately September 2021 and it is unknown what the intentions of the new landowner are with regards to stocking rates on the property. Efforts to engage in meaningful discussion regarding the management of the portion of land are ongoing.

The Enhance Place Mine Rehabilitation Monitoring Report 2021 (Ref [9], **Appendix C**), did not provide any conclusions about stock management, presumably due to the absence of stock on site during the inspection and the two (2) preceding months due to the sale of the property.

6.5 PASTURE IMPROVEMENT

Enhance Place Mine provides assistance with regards to pasture improvement within the rehabilitation assessment area beyond the management of stock by intermittent application of fertiliser and assistance with weed / feral animal control.

The stock exclusion from late 2016 and into 2017 (refer **Section 6.4**) was beneficial for the pasture rehabilitation such that pasture conditions during 2017 (Ref [4]) were considered to be consistent with the species within the analogue pasture site.

The Enhance Place Mine Rehabilitation Monitoring Report 2020 (Ref [7]) stated that rural land capability, species composition, presence of pest / weed and groundcover were satisfactory and there were no recommendations for pasture improvement during the 2021 reporting period.

No activities with regards to pasture improvement were undertaken in the 2021 Reporting Period.

Based on the status as reported by the Enhance Place Mine Rehabilitation Monitoring Report 2021 (Ref [9], **Appendix C**) it is considered that pasture management has been satisfactory.

6.6 TREED AREA IMPROVEMENT

Improvement of the treed rehabilitation area generally comprises the removal of weeds and plastic guards surrounding trees / shrubs which have historically been directed planted by Enhance Place as part of rehabilitation activities. Watering of planted trees has also been undertaken historically in times of low rainfall.

The Enhance Place Mine Rehabilitation Monitoring Report 2020 (Ref [7]) stated that vegetation establishment was good with >80% of native forest indicator species present. Canopy cover was observed to be developing along with a sparse understorey. While there was no evidence of second-generation establishment, the condition of the treed rehabilitation areas was satisfactory and were no recommendations for pasture improvement during the 2021 reporting period.

Activities with regards to treed area improvement were limited to inspections to check the condition of trees and for the manual removal of weeds from trees and surrounding tree guards. No watering occurred during the 2021 reporting period due to the high rainfall over the reporting period (refer **Section 8**).

Based on the status as reported by the Enhance Place Mine Rehabilitation Monitoring Report 2021 (Ref [9], refer **Section 5.2**) it is considered that management of the treed improvement area has been satisfactory.

6.7 WEED AND FERAL ANIMAL MANAGEMENT

Management of noxious / priority weeds at the Enhance Place Mine are controlled in accordance with the Weed Management Plan included as part of the Stock Management Plan (Ref [8]).

Management of feral animals is undertaken in accordance with the objectives of the Enhance Place Mine MOP (Ref [1]) and is implemented in a manner specific to the species being targeted. Historically rabbits and foxes have been identified at the Enhance Place Mine rehabilitation area.

The Enhance Place Mine Rehabilitation Monitoring Report 2020 (Ref [7]) stated that the only priority weed observed was African lovegrass which was limited to <10% of the pasture area. The outbreak was not observed to be growing or producing seed. The Report (Ref [7]) stated that the only observations of pests related to the European rabbit for which no holes, burrows or dens were identified, and numbers were considered low. Recommendations were limited to the continued spot spraying of African lovegrass.

Weed spraying was scheduled to be undertaken during the 2021 reporting period. However, due to a change in ownership of the property subject to the weed spraying activities and the inability to correspond with the new landowner, no weed spraying was carried out within the optimum seasons as presented in the Weed Management Plan (included within Ref [8]).

No feral animal control was undertaken by Enhance Place during the 2021 reporting period.

Based on the status as reported by the Enhance Place Mine Rehabilitation Monitoring Report 2021 (Ref [9], refer **Section 5.2**) it is considered that management of the weed and feral animals has been satisfactory, noting that there has been a reoccurrence of some priority weeds that will requirement management in the 2022 reporting period.

6.8 COMPLAINTS AND LIAISON

There were no environmental complaints recorded during the reporting period from the general public or near neighbours.

Discussions with key landholders were ongoing during the reporting period to ensure dialogue was maintained regarding land management matters. As noted in **Section 6.4**, Enhance Place had been unable to contact the new land owner who recently purchased Lot 101, DP 1145705 within the 2021 reporting period. Enhance Place will continue its attempts to correspond with the new landowner throughout 2022.

7 RELINQUISHMENT OF REHABILITATED LAND

A detailed inspection and assessment of the rehabilitation areas, including the collection of soil samples and analysis for pH, electrical conductivity, major cations, sulphur and nitrate was undertaken in March 2018. The subsequent Rehabilitation and Completion Assessment Report (Ref [10], **Appendix D**) indicated soil nutrient levels that satisfied the completion target measures and that the approved rehabilitation objectives and completion criteria specified in the MOP (Ref [1]) have been achieved.

During December 2020, Inspectorate Officers from the NSW Resources Regulator inspected the rehabilitation area at Enhance Place. The inspection was carried out in anticipation of an application to relinquish mining leases (ML 1422[1], ML 1458[2] and 1520). On the 16 March 2021, Enhance Place received feedback from that inspection, with the Inspectors noting that:

- There were still areas of the site with patchy vegetation cover and some bare areas.
- There were no stability or erosion concerns.
- Some remedial work may be appropriate in the eastern portions of the site.

It is noted that the inspection took place whilst there was a high stocking rate grazing the area (28 animals in total, the highest recorded since monitoring commenced). Based on the advice of the NSW Resources Regulator, Enhance Place did not submit an application to relinquish the mining leases in 2021.

As such, Enhance Place intends to lodge an application to the NSW Resources Regulator to relinquish the above mentioned mining leases covering the pasture and treed rehabilitation areas in 2022. Since Lot 101, DP 1145705 has been sold, there has been no grazing activity. Consequently, it is anticipated that there will be vegetation recovery as a result.

The relinquishment will be subject to approval from the NSW Resources Regulator.

[1] ML 1422 expired on 3rd December 2018

[2] ML 1458 expired on 28th November 2020.

It is noted that rehabilitation monitoring has been undertaken each year since 2018; the three (3) reports (Ref [5-7]) since that time have concluded that rehabilitation objectives and completion criteria are complete or satisfactory. The Enhance Place Mine Rehabilitation Monitoring Report 2021 (Ref [9], **Appendix C**) made similar findings with the exception of suitable stocking rates. Based on the comparative photographs provided in the report (Ref [9], **Appendix C**) the ongoing nature of this objective in the latest report is considered to relate to the absence of stock at time of, and for some time preceding, the inspection and not representative of any degradation of the pasture status.

8 METEOROLOGICAL DATA

An automatic weather station was installed at the Pine Dale Open Cut Mine project site in 2006 (located less than 1km to the north of Enhance Place Mine, refer **Plan 1**, **Appendix A**). The data was downloaded and reported by the appointed environmental consultant for the majority of the 2021 Reporting Period, RCA Australia.

A second weather station is located at Mt Piper Power Station, located approximately 3km to the northwest of Enhance Place Mine. Data from this weather station was utilised in the event of a data failure at Pine Dale and following an amendment to EPL 4911, the licenced location of the Pine Dale weather station was relocated to the Mt Piper Power Station.

Meteorological monitoring parameters recorded include wind speed, wind direction, temperature at 10m height, temperature at 2m height, rainfall, humidity, solar radiation, sigma theta and evapotranspiration. Details of weather data relevant for Enhance Place Mine recorded for the period January to December 2021 are summarised in **Table 6**.

The Bureau of Meteorology (BoM) weather station located at Lithgow[3] (Birdwood Street) (approximately 16km from PDM), reported a long-term median[4] annual rainfall total (years 1889 – 2006) of 858.6mm and an average annual rainfall total of 861.8mm.

Rainfall during the 2021 period (835mm) was observed to be greater than the rainfall recorded during 2019 (350mm), 2018 (660mm) and 2017 (577mm), although less than the rainfall recorded during 2016 (1168mm). The annual rainfall recorded at the Pine Dale Mine meteorological monitoring station for the period 2006 – 2021 is shown in **Figure 1**. The monthly rainfall and evapotranspiration for the 2021 period is shown in **Figure 2**.

[3] Data for the Cooerwull Station (14km from PDM) was not available at date of access (26/1/2022)

[4] The use of median value is specified as the preferred measure for 'typical' rainfall from a meteorological perspective as it reduces bias from extreme rainfall events.

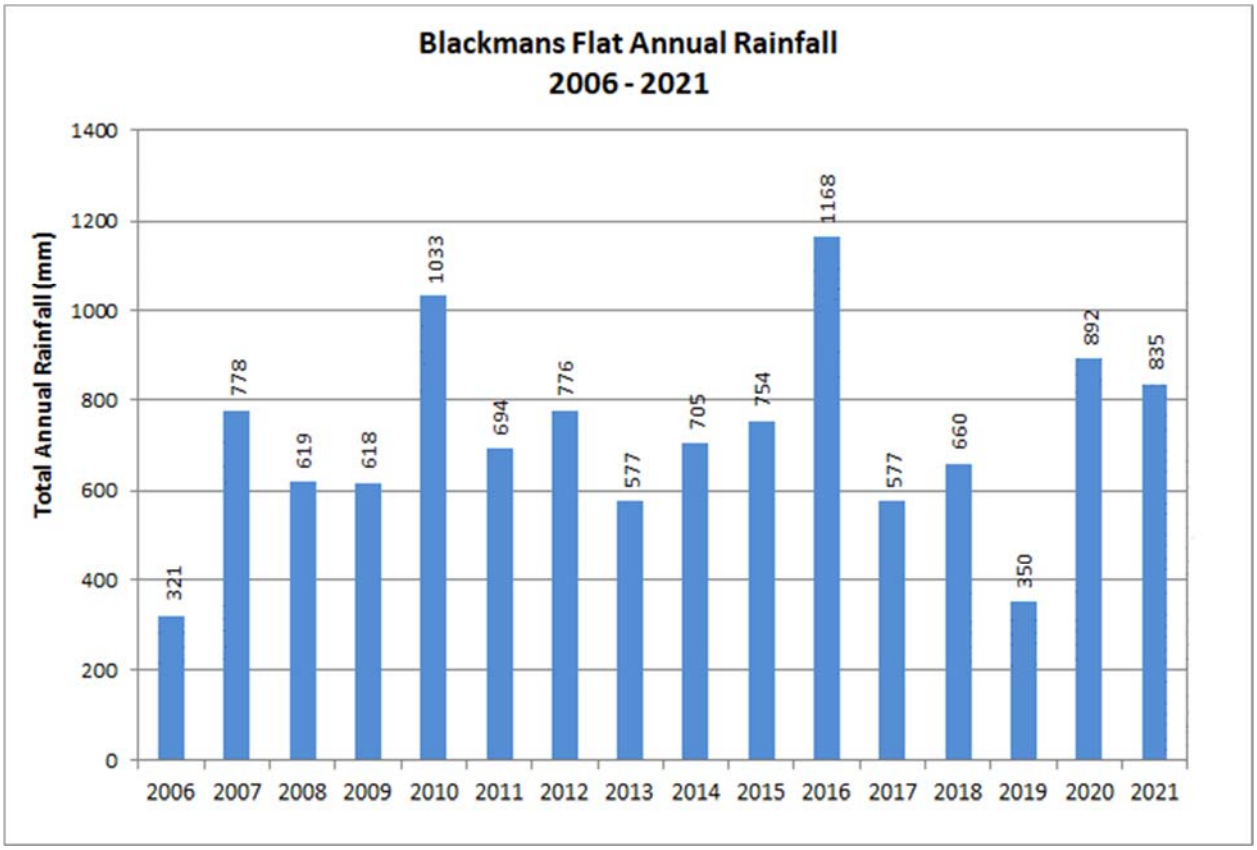


Figure 1 *Blackmans Flat Annual Rainfall: 2006 – 2021*

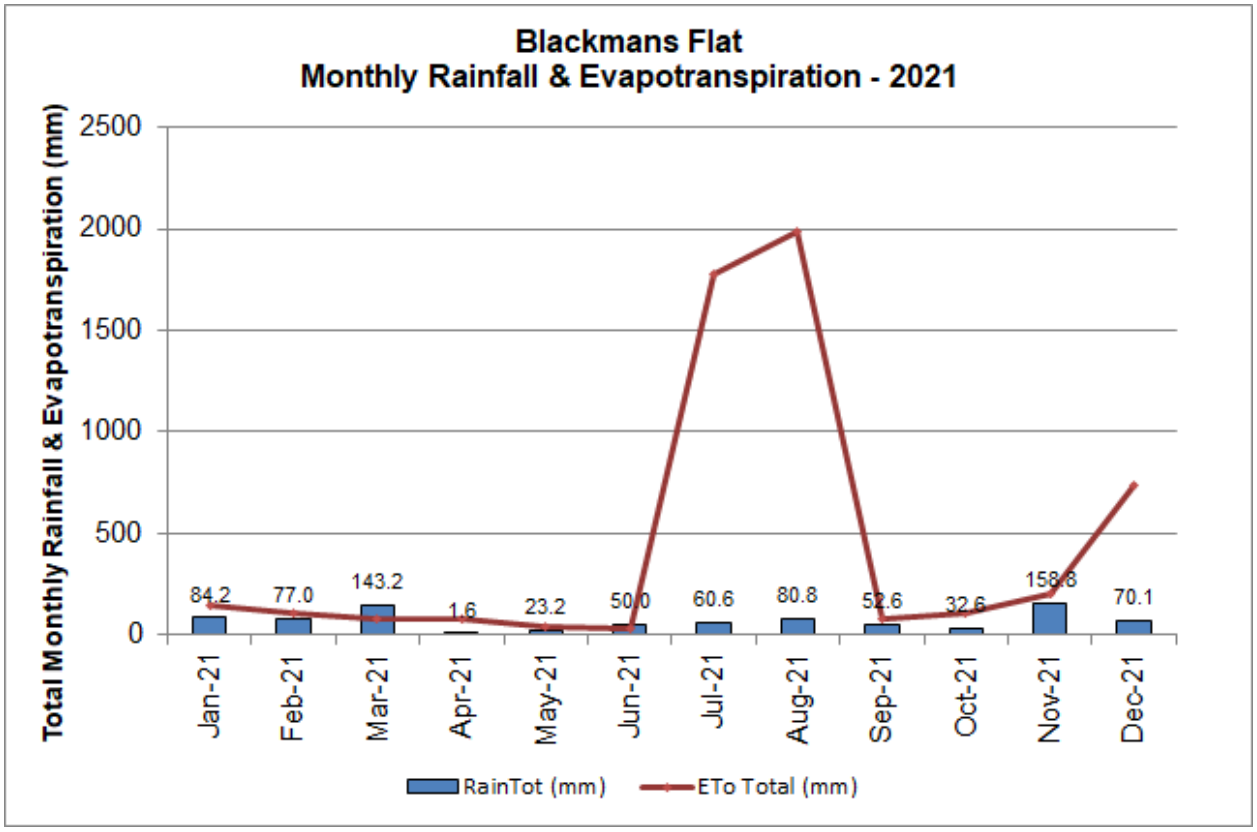


Figure 2 *Blackmans Flat Monthly rainfall and evapotranspiration: 2021*

The maximum temperatures recorded during the reporting period were 35.8°C at the 2m sensor and 34.4°C at the 10m sensor, during January 2021. The lowest temperatures occurred in July at 2m (-6.8^{o}C) and in May at10m (-5.8^{o}C). A summary of monthly temperatures for 2020 is included in **Table 6**.

The predominant wind direction during 2021 were observed to be from the north-westerly quadrant. Wind directions were also observed from an easterly / south easterly direction during the February – May and from the south-west quadrant in July – August and December 2021.

The maximum wind speed measured at the site was 18.5m/s during December 2021 from a west-south-west direction. Sigma theta data was measured continuously throughout the entire 2021 monitoring period. A summary of monthly wind speed, predominant directions and sigma theta recordings in 2021 is included in **Table 6**.

Table 6 *Meteorological Monitoring Summary: 2021*

Month	Rainfall (mm)	Cumulative Rainfall (mm)	No of Rain Days/ Month	Air Temp. @ 2m (°C)			Air Temp. @ 10m (°C)			Sigma theta (º)			Relative Humidity (%)			Wind Speed (m/s)			Modal Wind Direction
				Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	
Jan	84.2	84.2	11	18.3	6.9	35.8	17.8	7.1	34.4	38.5	3.4	103	73.2	15.1	101.9	1.6	0.0	16.1	WNW
Feb	77	161.2	17	17.7	7.3	30.5	17.2	7.5	28.6	38.3	4.6	100.5	81.1	25.1	101.9	1.6	0.0	12.1	ESE
Mar	143.2	304.4	16	15.7	2.9	30.1	15.4	2.9	28.6	41.2	6.8	103.3	81.6	15.4	101.9	1.6	0.0	12.0	E
April	1.6	306	7	10.9	-2.8	29.7	10.8	-2.8	28.6	40.5	2.2	102.1	76.1	18.6	101.9	1.3	0.0	12.3	E
May	23.2	329.2	12	8.2	-5.8	22.3	8.1	-5.8	21.4	38.5	2.6	103	83.8	22.1	101.9	1.3	0.0	14.9	SE
June	50	379.2	14	5.8	-4.9	18.6	5.8	-4.9	17.6	34.2	5.1	102.1	87.1	23.5	101.9	1.8	0.0	12.5	W
July*	60.6	439.8	22	5.1	-6.8	17	5.2	-4.8	16.7	23.9	0.0	100	82.6	5.8	99.9	2.2	0.0	15.1	WSW
Aug*	80.8	520.6	22	5.1	-4.5	20	5.2	-2.7	19.6	20.3	0.0	100	82.6	3.6	99.8	2.3	0.0	11.2	SW
Sept	52.6	573.2	7	9.0	-4.5	23.5	8.9	-4.4	22	33.7	1.0	102.5	73.1	6.8	101.9	2.0	0.0	17.0	WNW
Oct	32.6	605.8	12	12.0	-0.4	29.7	11.6	-0.6	28.2	36.2	4.6	102.1	74.3	11.7	101.9	1.9	0.0	16.2	WNW
Nov	158.8	764.6	18	14.0	2.4	26.4	13.5	2.4	24.1	35.9	6.6	103.8	81.9	27.7	101.9	1.9	0.0	15.3	WNW
Dec*	70.1	834.7	15	16.5	4.1	29.9	16.7	5	29	24.2	0.0	100	73.7	0	101.4	1.9	0.0	18.5	SW
TOTAL	834.7		173	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	1.6		7	-	*-6.8*	-	-	*-5.8*	-	-	*0.0*	-	-	*0*	-	-	*0.0*	-	-
Maximum	158.8		22	-	-	*35.8*	-	-	*34.4*	-	-	*103.8*	-	-	*101.9*	-	-	*18.5*	-

Note that data was missing for approximately twelve (12) hours on 16th April

Note that June rainfall was recorded as 1911mL however considered to be a weather station malfunction. The 50mm assigned based on manual review of data and Lithgow BOM records

* July and August data from Mt Piper Power Station records due to Pine Dale weather station malfunction

*December data from Mt Piper Power Station records following EPL amendment. Negative humidity numbers were presented however are not considered viable data and have been ascribed a value of 0

REFERENCE

[1] Enhance Place Pty Limited, *Enhance Place Mine Care and Maintenance Mining Operations Plan,* December 2016.

[2] SLR, *Soil Assessment and Recommendations for Rehabilitated Areas: Pine Dale Mine and Enhance Place*, November 2014.

[3] FirstField Environmental, *Enhance Place Mine Rehabilitation Monitoring Report 2016,* 10 November 2016.

[4] FirstField Environmental, *Enhance Place Mine Rehabilitation Monitoring Report 2017,* 15 September 2017.

[5] FirstField Environmental, *Enhance Place Mine Rehabilitation Monitoring Report 2018,* 23 October 2018.

[6] FirstField Environmental, *Enhance Place Mine Rehabilitation Monitoring Report 2019,* 30 October 2019.

[7] FirstField Environmental, *Enhance Place Mine Rehabilitation Monitoring Report 2020,* 9 November 2020.

[8] FirstField Environmental, *Enhance Place Mine Stock Management Plan,* April 2016.

[9] FirstField Environmental, *Enhance Place Mine, Rehabilitation Monitoring Report 2021,* 19 January 2022.

[10] SLR, *Pine Dale Mine Rehabilitation Completion Assessment*, SLR ref 630.12362-R01, 2018.

Appendix A

Enhance Place Mine Plans

Locality Plan (NSW)

LEGEND

Enhance Place Mine

Pine Dale Mine

Note: Aerial taken from ArcGis Base Map, September 10 2018
Coordinate System MGA Zone 56

0 162.5 325 650 975 1,300
metres

N

EnergyAustralia
LIGHT THE WAY

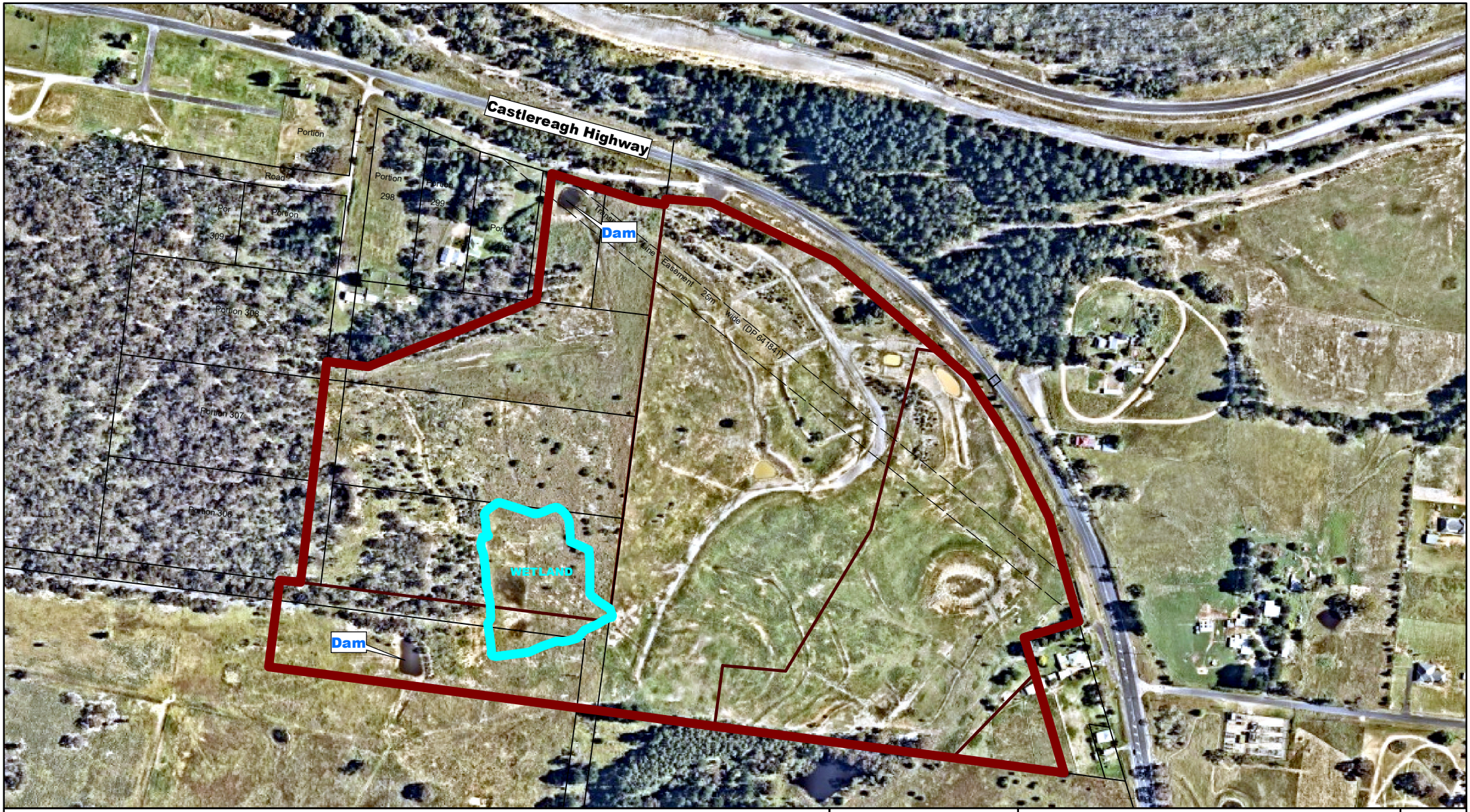
ENHANCE PLACE MINE
REGIONAL LOCALITY PLAN

PLAN: 1

DRAWN BY : F.Brooker

SCALE: 1:24,000 (A3)

DATE: 17/02/2022



LEGEND

Enhance Place Mine boundary

Natural features

NOTE: Aerial image taken from Nearmap,14 January 2021
(used in accordance with commercial licence)
Drawing adapted from plan supplied by Enhance Place Mine
Drawn by Craven, Elliston & Hayes (Lithgow) Pty Ltd
Dwg No. ENH-REH, Plan 3, 18-12-13

0 35 70 140 210 280
metres

N

EnergyAustralia
LIGHT THE WAY

PRE MINING ENVIRONMENT
ENHANCE PLACE MINE
BLACKMANS FLAT

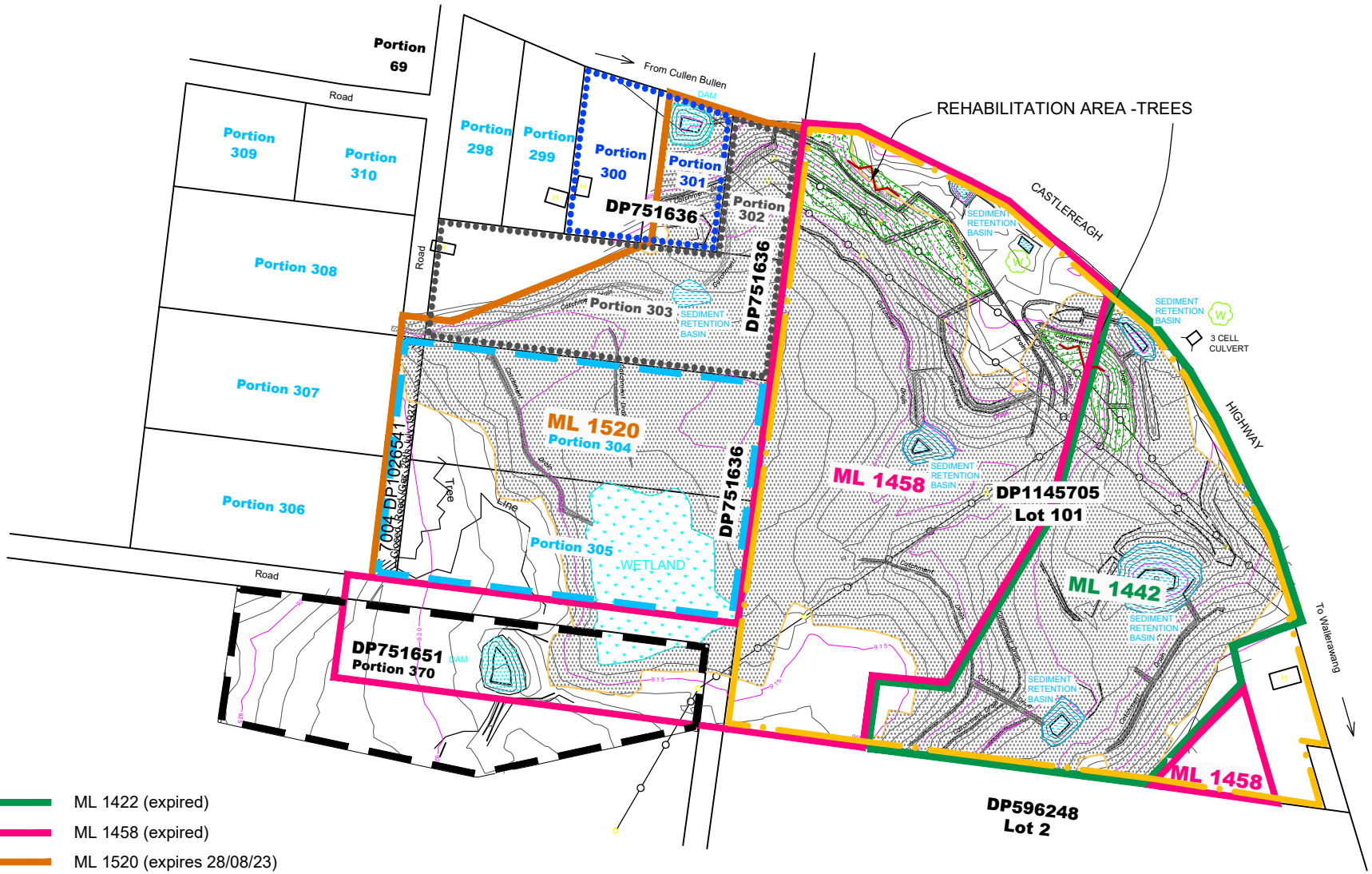
PLAN: 1a

DRAWN BY : F. Brooker

SCALE: 1:5,000 (A4)

DATE: 17/02/2022

CDT–DWG–A4H–001/1



LEGEND

- ML 1422 (expired)
- ML 1458 (expired)
- ML 1520 (expires 28/08/23)
- J.M.Cope
- D.J. Hunt
- A.J. Cherry
- A.M.D Thompson
- State of NSW
- Rehabilitation area - trees
- Rehabilitation area - pasture
- Existing dams

NOTE: Drawing adapted by RCA from plan supplied by Enhance Place Mine
Drawn by Craven, Elliston & Hayes (Lithgow) Pty Ltd
Dwg No. ENH-REH, Plan 3, 18-12-13

0 50 100 150 200 250
metres

EnergyAustralia
LIGHT THE WAY

FINAL REHABILITATION AND POST MINING LAND USE
ENHANCE PLACE MINE
BLACKMANS FLAT

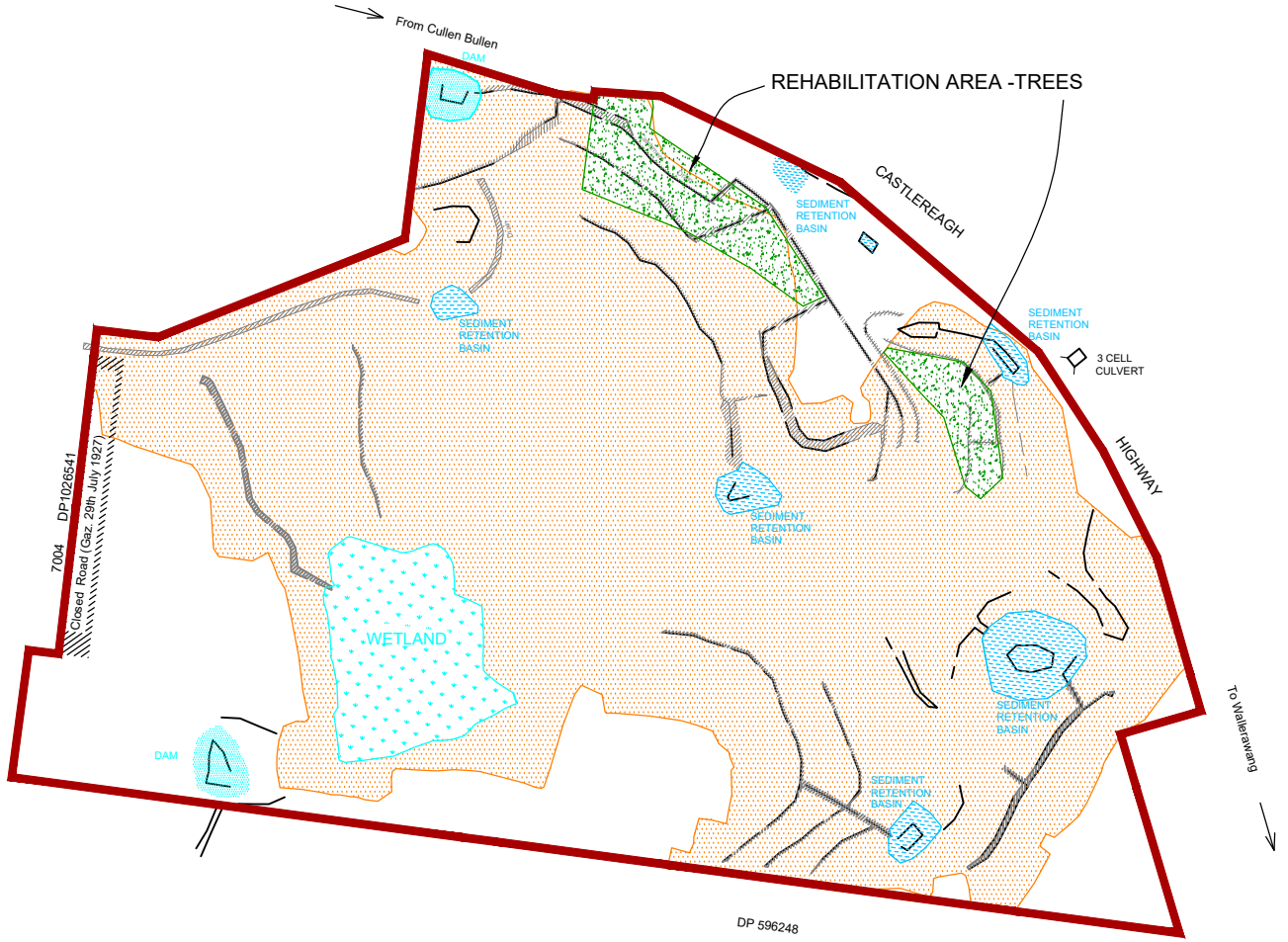
PLAN: 2

DRAWN BY : F.Brooker

SCALE: 1 : 5000 (A4)

DATE: 17/02/2022

CDT-DWG-A4H-001/1



LEGEND

- Enhance Place Mine boundary
- Rehabilitation Area - Pasture
- Rehabilitation Area - Treed Area
- Existing dams

NOTE: Drawing adapted by plan supplied by Enhance Place Mine
Drawn by Craven, Elliston & Hayes (Lithgow) Pty Ltd
Dwg No. ENH-REH, Plan 3, 18-12-13

0 50 100 150 200 250
metres

N

EnergyAustralia
LIGHT THE WAY

MINE DOMAINS AT COMMENCEMENT OF MOP
ENHANCE PLACE MINE
BLACKMANS FLAT

PLAN: 3

DRAWN BY : F.Brooker

SCALE: 1 : 5000 (A3)

DATE: 17/02/2022

Appendix B

Stock Management Plan (Ref [8])

Enhance Place Mine
Stock Management Plan

1449 Castlereagh Highway
Blackmans Flat NSW 2790

Report prepared for Mr & Mrs Morris
by First Field Environmental
on behalf of Enhance Place Mine Pty Ltd

April 2016

Revision history			
Version	**Date**	**Author**	**Authorised by**
Draft	10 February 2016	Michelle Evans /Anna Douglas Morris	
Draft revision	29 February 2016	Michelle Evans	
Final	18 April 2016	Michelle Evans	Michelle Evans

This report has been prepared by First Field Environmental for Enhance Place Mine Pty Ltd. The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report.

First Field Environmental

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Contents

Appendices

Figures

Tables

Introduction

This Stock Management Plan has been developed by First Field Environmental, on behalf of Enhance Place Mine Pty Ltd, to provide guidance in relation to stock management on the Morris property.

The Morris property is located on land formerly comprising Enhance Place Mine. The property is within Blackman's Flat on the southern side of Castlereagh Highway at Blackmans Flat, 15km north of Lithgow. The land to which this report relates is shown on Figure 1 and Figure 2 and covers an area of approximately 16.2 ha.

Enhance Place Mine operated as an open cut coal mine from 1997 until its closure in June 2005. Rehabilitation of the former Enhance Place Mine has included the importation of soil and creation of a landform similar to that of the surrounding area. Catchment drains and sediment retention basins have been installed. The land has been revegetated to pasture, internal trails have been constructed and the land is fenced and gated. The pasture area is part of a larger area which includes treed rehabilitation areas on steeper slopes of the landscape. These areas are adjacent to the pasture area but do not form part of the Stock Management Plan.

Although still under mining license to Enhance Place Mine, the land is utilised by Mr and Mrs Morris of 1449 Castlereagh Highway, Blackmans Flat. The land is currently grazed by miniature horses, horses, ponies and cows.

This report aims to provide Mr and Mrs Morris with a plan for maintaining the land as pasture for grazing and to promote appropriate stocking rates in accordance with land capability. The preliminary report will be provided to Enhance Place Mine and Mr and Mrs Morris and will facilitate discussion regarding the feasibility of land management practices in terms of desired land use. The preparation of a final Stock Management Plan will be informed by the outcomes of these discussions.

How to use this document

This document has been prepared for use in ongoing stock and grazing management for the property. **Section one** contains information about the property, including landuse and property characteristics, and provides background information related to the condition of the pasture areas.

Section two provides recommendations for achieving appropriate landuse and includes a trigger action response plan for addressing issues as they are observed. The land management schedule recommends the completion of specific activities on a regular basis. It is intended that the trigger action response plan be checked regularly and that the land management schedule be used for forward planning.

Detailed information relating to stocking rates, fertiliser application and weed control is provided in the Appendices.

1. Property information

1.1 Previous landuse

Enhance Place Mine was established in 1997 to recover remnant coal from areas previously open cut mined in the 1950's. Open cut operations ceased in June 2005 when economically feasible coal reserves were exhausted.

Rehabilitation of the land by Enhance Place Mine Pty Ltd has been conducted in accordance with completion criteria contained within the Care and Maintenance Mining Operations Plan (Enhance Place Mine 2014) and has included:

- Land forming;
- Erosion management;
- Pasture establishment;
- Soil stabilisation; and
- Weed management.

Rehabilitation of the land by Enhance Place Mine Pty Ltd is ongoing. The most recent assessment of rehabilitation completion criteria (Enhance Place Mine 2014) determined the following:

Land forming - The final landform shaping and drainage control structures have been completed. The rehabilitated landform is considered to have no greater management requirements than the surrounding landforms and land uses.

Erosion management –The potential for major erosion (gully or tunnel erosion or mass movement) is considered to have been mitigated as there is no evidence of significant erosion occurring at the site. Surface erosion may occur in areas where vegetation rehabilitation has not been successful, or as a result of overgrazing.

Pasture establishment – The current proportion of annual legume and perennial grass species within the pasture areas is representative of species composition in adjoining unmined land. Ground cover in pasture rehabilitation areas is >70% however areas of sparse to no ground cover do exist.

Soil stabilisation – Cracking soils and waterlogging may occur in areas of overgrazing or where rehabilitation has not been successful.

Weed management – Noxious weeds have been controlled in accordance with the principles of an integrated weed management plan.

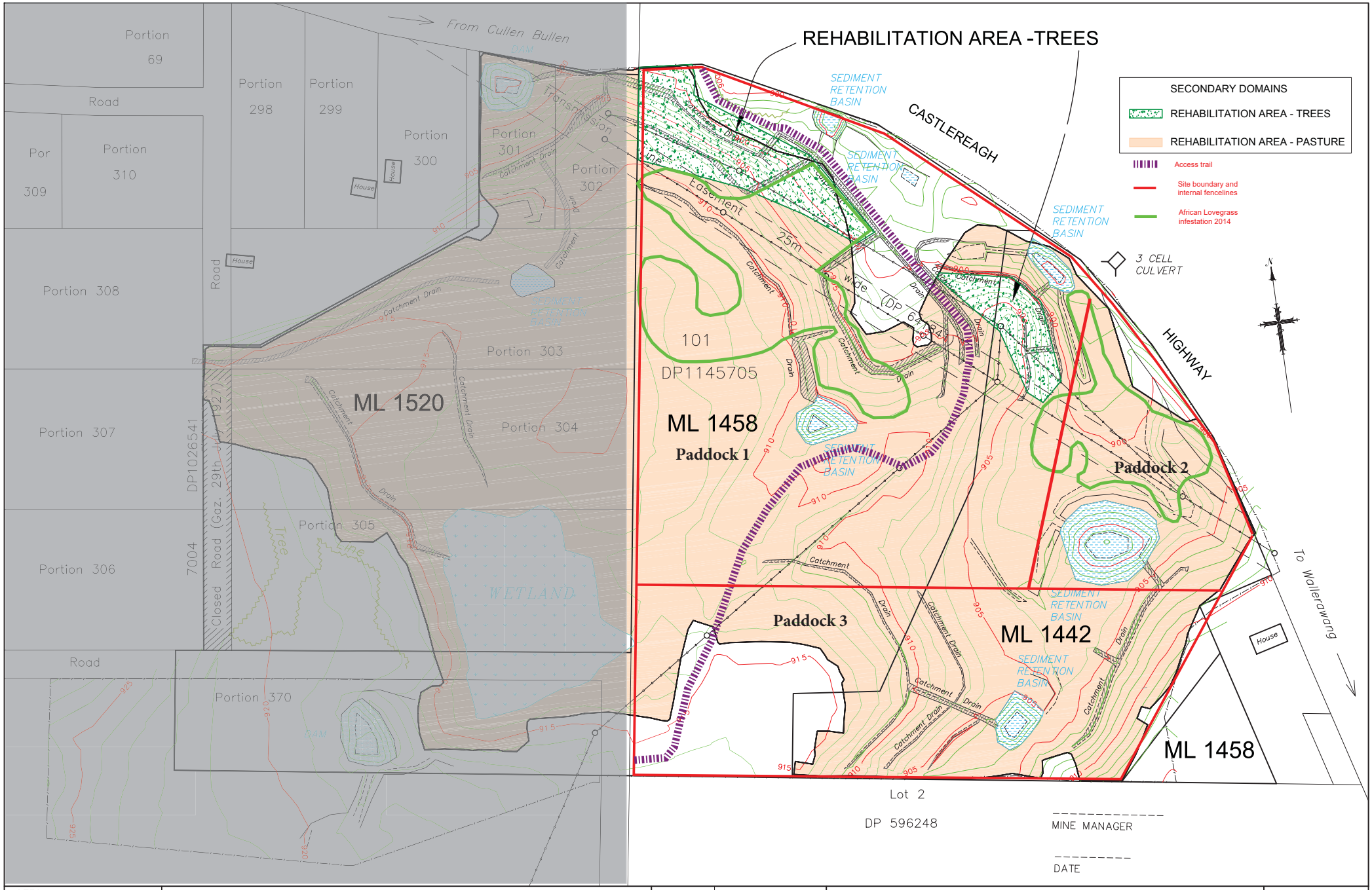
1.2 Current and future landuse

The land is currently utilised by Mr and Mrs Morris for grazing and generally supports combinations of the following livestock:

- Miniature horses;
- Horses;
- Ponies; and
- Cows.

Livestock grazing is a common activity in the Blackmans Flat region and it is the intention of Mr and Mrs Morris to continue to graze these animals in the future.

Figure 1 Rehabilitated pastures of the Morris Property



NOTES:

CRAVEN, ELLISTON & HAYES (LITHGOW) PTY.LTD.
CONSULTING LAND, ENGINEERING AND MINING SURVEYORS
ACN 056 544 551
"ASTROLABE" RUTHERFORD LANE, LITHGOW, 2790 PH: (02) 6351 2281, FAX: (02) 6352 1339
EMAIL : survey@ceh.com.au

DATE	18–12–13
AMENDED	
SURVEYOR	T.H./T.E
DRAWN	K.L.F./D.M.
CHECKED	

ENHANCE PLACE MINE
FINAL REHABILITATION AND POST MINING LAND USE

SCALE - 1 : 1250 (A1 SHEET)

DWG No

ENH-REH
PLAN 3

1.3 Property characteristics

1.3.1 Climate

Blackman's Flat is located within the central tablelands of NSW, a region with a temperate cool-season wet climate (Stokes & Howden 2010). The area is characterised by warm summers, cool to cold winters and generally consistent rainfall.

Mean maximum temperatures of around 23°C are experienced from November to March. Mean minimum temperatures of below 5°C are experienced from May to September.

The area received a mean annual rainfall of 700 mm in 2015. January and April received the highest monthly rainfall of approximately 157 mm per month, while September had the lowest monthly rainfall of approximately 9 mm (Bureau of Meteorology 2016).

Mean monthly temperature and rainfall statistics indicate strong seasonality in average temperatures and rainfall patterns throughout the year.

The following average rainfall and temperature data (Figure 3) has been sourced from Bureau of Meteorology records for Mount Boyce Automatic Weather Station and is considered generally indicative of conditions experienced on the property.

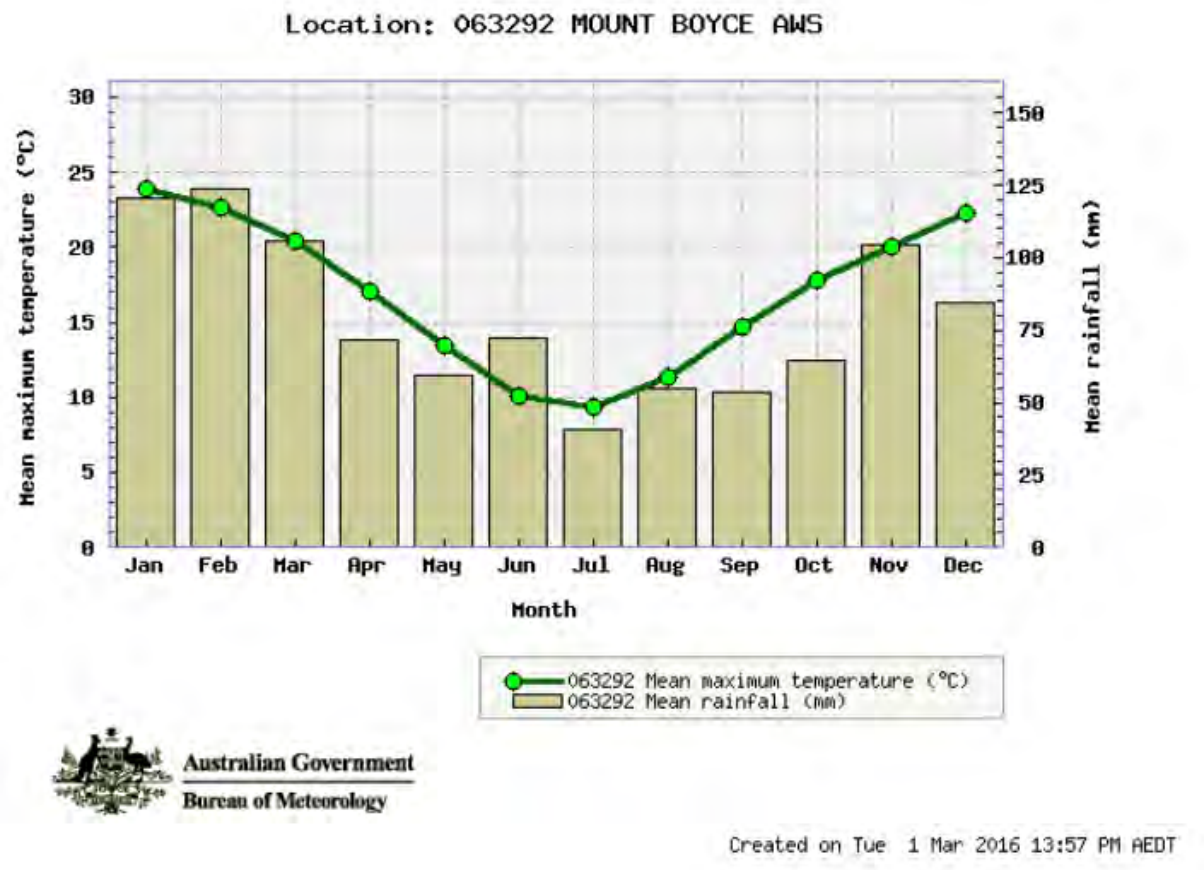


Figure 3 Mean maximum temperature and rainfall

1.3.2 Topography

Blackman's Flat is located on the western side of the Blue Mountains and is at 900 m (Australian Height Datum). The landscape is characterised by rolling hills. Slopes vary between 10% and 25% with a local relief of less than 50m. The study area was filled and contoured prior to 2014 and the shape and form of the landscape is considered to be visually similar to the adjacent landscape.

1.3.3 Soils

Soils on the property are highly disturbed, resulting from rehabilitation activities including filling of the open cut coal mine, soil importation and land forming. As a result; soil physical and chemical characteristics are not consistent with unmined soils of the region.

Unmined soils adjacent to the property are generally mapped as Cullen Bullen soil landscape (*Soil landscapes of the Wallerawang 1:100,000 sheet* King 1993).

Soil characteristics

Various soil components have been surveyed as part of rehabilitation monitoring undertaken by First Field Environmental. Soil samples to a depth of 10 cm were taken randomly from ten points throughout the pasture area, and physical characteristics including soil structure, ped shape and ped surface characteristics were assessed in accordance with the *Australian soil and land survey field handbook* (CSIRO 2009). The results of field tests have been used to determine land and soil capability (see Section 1.3.6).

SLR Global Environmental Solutions conducted soil nutrient analysis of topsoil samples (0-10cm depth) from two locations on the property in 2014. A summary of test results is provided in Table 1. Soil nutrient levels found at the test sites are compared with target levels. These target levels are a product of ideal soil nutrient ranges for pastures and actual soil nutrient levels found in unmined local pastures.

Complete test results are provided in Appendix A.

Table 1 Summary of soil test results

Soil element	Measure and test	Target Measure	Soil test location average	Target Met
pH	1:5 $CaCl_2$	>4.9	6.9	Yes
Potassium (K)	% of total CEC	>2%	2.72%	Yes
Sodium (Na)		<3%	2.75%	Yes
Aluminium (Al)		<5%	0.00%	Yes
Sulfur (S)	mg/kg KCl 40 S	>8mg/kg	6.45 mg/kg	Yes*
Nitrogen (N)	mg/kg water extract	>10mg/kg	2.30 mg/kg	No (see land management schedule (Section 2.8) for mitigation measures)
Zinc (Zn)	mg/kg DTPA	>1mg/kg	0.80 mg/kg	
Calcium (Ca)	Ca:Mg	>3	2.16	

*Sulfur levels of 6.5 mg/kg are optimal for moderately-grazed pastures (DSE 7-12 DSE/ha).

1.3.4 Drainage

Contour drains and sediment retention basins were established prior to 2014 and generally remain in good operational condition with little evidence of surface water flow occurring outside of established contour drainage lines.

Isolated areas accounting for less than 1% of the rehabilitated pasture area show evidence of seasonal waterlogging.

1.3.5 Erosion and sedimentation

There are no significant erosion features that compromise landform stability within the rehabilitation areas. The landform is considered to be stable and is suitable for grazing horses.

There is some evidence of active, minor to moderate wind erosion where pastures are poorly established or absent (see Figure 4 and Figure 5). Minor rilling is occurring on exposed soils of the sediment retention basins and can be seen in Figure 6.

Figure 4 Patchy exposed soils in south-western corner of pasture area

Figure 5 Exposed soils in southern portion of pasture area

Figure 6 Minor erosion of sediment retention basin wall

Surface cracking to 20 cm is evident along slope crests in the northern extent of the pasture area (see Figure 7). Soil samples taken to a depth of 20 cm indicate that soils are not prone to cracking through swelling and shrinking and suggest that cracking is indicative of soil settling.

Figure 7 Example of soil cracking on slope crests

1.3.6 Land and soil capability

Land capability refers to the suitability of land for particular agricultural activities and is determined by the relationship between the physical and chemical properties of soils. An assessment of these properties conducted in accordance with the *Land and Soil Capability Assessment Scheme* (NSW Office of Environment and Heritage, 2012) is summarised in Table 2.

The resulting classification indicates that the pastures are consistent with **Land and Soil Capability Class V** and are suitable for grazing.

Class V land has severe limitations for high impact land management uses such as cropping, and is generally more suitable for grazing with some limitations or very occasional cultivation for pasture establishment. It is important to minimise soil disturbance, maintain cover and maintain good organic matter levels. The limiting factors for land use are generally related to wind erosion hazard.

Table 2 Land and soil capability assessment

Class	Description
Water erosion hazard class	3 3 - <10% slope
Wind erosion hazard class	5 Moderate wind erodibility class of surface soil, high winds erosive power, high exposure to wind, average annual rainfall >500mm
Soil structural decline class	4 Fragile light textured soil - hardsetting
Soil acidification hazard class	4 Very low texture /buffering capacity, pH 5.38 – 7.17 ($CaCl_2$)
Salinity hazard class	1 Moderate to high recharge potential, low discharge potential, low salt store
Waterlogging hazard class	2 0 – 0.25 months typical waterlogging duration, moderately well drained soils
Shallow soils and rockiness hazard class	1 Nil rocky outcrop, soil depth >100 cm
Mass movement hazard class	1 No mass movement present

1.3.7 Pasture species

Pastures were established with Cox's River seed mix prior to 2014 and are representative of species composition of grazing pastures on adjacent, unmined soils.

Cox's River seed mix consists of 70% perennial grasses and 20% annual legumes, sown at the following rates:

- 40% Fescue
- 25% Cocksfoot
- 20% Subterranean clover
- 6% Perennial rye grass
- 5% White clover
- 4% Phalaris

Within this region, cold temperatures (especially in July and August) restrict pasture growth and areas are prone to severe frosts, with the frost-free period varying from 150 to 240 days per year.

In summer, evaporation exceeds rainfall, reducing pasture growth. Winter rainfall exceeds evaporation, but cooler temperatures slow pasture growth. Heavy summer rains face higher evaporation rates than rain falling mid-autumn when evaporation rates are lower.

Appendix B describes the phases of pasture growth.

1.3.8 Weeds

Weeds with the potential to occur in the region are defined as those listed under the Noxious Weeds Act 1993; Weeds of National Significance; and Environmental Weeds. Also included in this report are species harmful to horses.

The following weed species meeting this definition and observed on the property during previous surveys:

- African Lovegrass (*Eragrostis curvula*);
- Blackberry (*Rubus fruticosus* aggregate);
- St John's Wort (*Hypericum perforatum*);
- Sweet Briar (*Rosa rubiginosa*);
- Crofton Weed (*Ageratina adenophora*);
- Fireweed (*Senecio madagascariensis*);
- Wild Radish (*Raphanus raphanistrum*);
- Flatweed (*Hypochaeris radicata*); and
- Paterson's Curse (*Echium plantagineum*).

African Lovegrass infestations (shown on Figure 2) were treated in late 2015 in accordance with control methods listed in Appendix C and are currently not observed to be growing or producing seed.

Appendix D provides a full list of noxious weeds declared in the Upper Macquarie County.

1.3.9 Fencing and access

Figure 2 shows the location and extent of current fencing and access trails. All fences and gates appear to be in good condition.

Access trails within the study area are generally in good condition although minor wind and water erosion is evident in steeper areas of trails.

2. Property management

2.1 Stocking rates

The grazing area (see Figure 2) within the property is comprised of three fenced paddocks with a combined area of ~16.2 ha:

- Paddock 1 (~9.4 ha);
- Paddock 2 (~1.9 ha); and
- Paddock 3 (~4.9 ha).

The success of pastures in supporting current stocking rates has been determined in relation to the pasture and soil condition at the time the field survey was conducted (11th September 2015).

Carrying capacity refers to the 'dry sheep equivalent' (DSE) per hectare supported by the class of pasture. DSE is a standard unit used to measure the feed requirements of different animal classes. Table 3 shows the DSE ratings of different stock classes.

The paddocks have been classified as 'top-dressed pasture with some clover', which according to the NSW Department of Primary Industries (2005) has a DSE rating of 7-10.

The carrying capacity is the number of hectares required for a particular animal on a pasture type and is determined as the livestock DSE divided by the pasture DSE:

Horse – light horse in current top-dressed pastures with some clover = 10.0/(7-10) = 1.42 – 1.0

A light horse therefore requires 1.42-1.0 hectares of top-dressed pasture with some clover to survive. The current capacity of each fenced pasture area on the property is provided in Appendix E.

Table 3 DSE ratings and current carrying capacity of pasture in present and improved conditions

Livestock (DSE rating)	Number of hectares required	Fenced area 1 (9.4 ha)	Fenced area 2 (1.9 ha)	Fenced area 3 (4.9 ha)
Top-dressed pasture with some clover (present state of pasture) (average DSE /ha = 7-10)				
Horses – light horse (DSE = 10)	1.43-1.0	6-9	1-2	3-5

2.2 Grazing management

Grazing management is a cost-effective tool to obtain the most from a pasture (NSW Agriculture 2003). Benefits of good grazing management include:

- Optimisation of pasture growth;
- Maximisation of feed quality; and
- Maintenance of adequate ground cover that in turn prevents erosion and resists weed invasion.

Recent monitoring by First Field Environmental revealed an average total living ground cover of 87.5% within the established quadrats of pasture rehabilitation area. Establishing and maintaining near 100% ground cover across the paddocks can ensure that optimal rainfall is retained in the landscape and concurrently sediments (potential resources) are trapped within the farm-scape, rather than lost through erosive processes (Gleeson & Gleeson 2012).

The establishment and persistence of good ground cover will reduce various forms of soil degradation, including soil acidification, rising water tables and dryland salinisation, as well as increasing beneficial soil micro-organisms and improving soil structure, pasture composition and fertility (NSW Agriculture 2003).

2.3 Pasture management

The pastures currently support a mix of summer and winter-growing species palatable to horses and cattle. Re-sowing is required when favourable pasture cover decreases to <70%, and is addressed by both the trigger action response plan (see Section 2.7) and the land management schedule (Section 2.8). A list of summer and winter-growing pasture species is provided in Appendix F and includes the method, rate and optimal timing for sowing each species.

2.4 Nutrient availability

Soils currently exhibit a pH of 6.7-7.9. While this is within the range of adjacent, unmined soils, a decrease in availability of certain nutrients in slightly acid soils may be mitigated through appropriate fertiliser application. Other nutrients may decline as a result of the removal of biomass through grazing and may require regular application.

Soil tests indicate that the following nutrients are deficient for optimal pasture growth:

- Sulfur (S);
- Nitrogen (N); and
- Calcium (Ca).

These deficiencies may be addressed through scheduled paddock rehabilitation and stock rotation (see land management schedule, Section 2.8). Application rate, method and optimal timing relevant to the property is provided in Appendix G.

2.5 Paddock rotation

The temporary exclusion of livestock from paddocks is required in order to conduct sediment and erosion control works, re-sowing and weed treatment. Livestock may be excluded from one of three fenced paddocks in the pasture area and may also be housed temporarily in the home paddock or stables. Activities requiring the exclusion of livestock are addressed in the trigger action response plan (see Section 2.7). Regular paddock rotation is addressed in the land management schedule (Section 2.8).

2.6 Weed management

The identification and management of noxious weeds is addressed in the trigger action response plan (see Section 2.7), while the land management schedule (Section 2.8) provides for regular and long term strategies for weed management. Best practice integrated weed control methods are described in Appendix C.

2.7 Trigger action response plan

Table 4 summarises the actions required when certain triggers are observed. Whilst some of these actions need to be conducted at specific times, others can be implemented as needed. A schedule of land management actions to be conducted at regular intervals is provided in the following section.

Table 4 Trigger action response plan

Goal	Trigger	Action	Optimal timing
Appropriate stock rate	The number of stock grazing in pastures should be in accordance with the grazing capability of each pasture.	Refer to Section 2.1 for appropriate stocking rates. Match number of stock to specific paddock recommendations provided in Table 3.	Ongoing.
Weeds including African Lovegrass to comprise <10% of the pasture sward with no significant infestations.	More than 10% of the pasture sward composed of weeds. Weeds outcompeting preferred species.	Identify and map the location of noxious weeds, weeds hazardous to horses and weeds of national significance (see Appendices C and D). Treat weeds in accordance with Appendices C and D. Install temporary fencing around outbreaks to restrict grazing pressure during weed treatment and regrowth of preferred species.	As required. Determine optimal timing of weed control in accordance with Appendix C. Spray weeds during target species' growth period and when the desirable species are dormant (refer to Appendices B and C).
Maintenance of ground cover (vegetation, leaf litter, mulch, cryptograms) at or above 70%.	Less than 70% ground cover.	Rip along contours of poorly established pasture rehabilitation areas and re-sow pasture mix and fertiliser. Increase and maintain groundcover in pasture rehabilitation areas to at least 95% to minimise run-off and loss of nutrients and soil, and limit erosion.	As required. Select appropriate seasonal species for re-sowing (refer to Appendix F).
No loss of topsoil.	Presence of active surface erosion. Combined bare surfaces of more than 20 m^2 per hectare.	Remove livestock and install temporary fencing to restrict grazing pressure during regrowth. Sow a cover crop of oats or short-term rye grasses to protect the soil surface (sub-surface root system remains even after grass has died off).	As required.
Limited areas of high concentration	Broad areas of cracking soils	Mechanically improve the soil surface in areas where cracking is more than 20 cm in depth.	As required.

Goal	Trigger	Action	Optimal timing
of soil cracking due to soil settling.	associated with soil settling.		
Minimal waterlogging and ponding in pastures.	Presence of surface water pooling more than 48 hours after rainfall. Yellowing of pasture. When holes are dug 20-30 cm below the surface, water flows into them.	Intercept water upslope with earthworks and redirect into farm dams. Clear impediments from contour drains. Install temporary fencing to restrict grazing pressure and prevent damage to pasture and soil. Plant deep-rooted temperate perennial grass species in areas prone to waterlogging. Graze taller pastures (>10 cm) as it enables animals to eat their allocation quicker and will prevent the need for stock to walk in search of food.	As required. Install drains when soils are moist e.g. after summer or autumn rains.
Stable sediment retention basins.	Active erosion of sediment retention basins.	Revegetate exposed sediment retention basin walls with perennial species.	As required. Select appropriate seasonal species for re-sowing (refer to Appendix F).
Stable trail surfaces.	Water ponding, active erosion and minor rilling on trail surfaces.	Construct a roll-over drain above existing rill erosion on sloping trails to divert water off trail surface more effectively.	Install drains when soils are moist e.g. after summer or autumn rains.
No symptoms of overgrazing are evident.	Symptoms of overgrazing evident e.g. pasture grazed lower than 3 cm; ground cover below 70%.	Locate water points and fences to manipulate grazing distribution, ensure even pasture utilisation and reduce selective grazing. Keep paddock records of stock numbers and use in conjunction with land condition monitoring to help determine suitable stocking rates.	Assess available feed and adjust stocking rates at the end of the growing season (refer to Appendix E).

2.8 Land management schedule

Table 5 Land management schedule

Goal	Description	Activity	Timing	Summer			Autumn			Winter			Spring		
				December	January	February	March	April	May	June	July	August	September	October	November
Appropriate soil nutrient levels and pH range	Soils should be within a pH range of >5.0 and <8.5 to facilitate availability of soil nutrients consistent with soils on adjacent, unmined properties. Soil nutrients deficiencies (as determined by agricultural soil testing) should be balanced to within appropriate ranges as indicated in Section 2.4.	• Apply gypsum at a rate of 3t/ha. • Apply DAP at a rate of 0.20t/ha. • Apply MAP at a rate of 0.25t/ha. • Re-sow exposed soils with a seasonally appropriate pasture mix (see Appendix F). • Fence area to exclude grazing until the pasture is established and then only lightly graze the pasture in the first growing season.	As part of initial pasture regeneration activities. Note: see Appendix G for appropriate timing of gypsum and fertiliser application.												
Erosion control	Less than 20% of the pasture area should have exposed soils.	• Identify and map areas of active surface soil erosion. • Re-sow exposed soils with a seasonally appropriate pasture mix (see Appendix F). • Fence area to exclude grazing until the pasture is established and then only lightly graze the pasture in the first growing season. • Plant trees where mid-slope soils are exposed and fence area to exclude grazing until trees are established.	As part of pasture regeneration activities.												

Goal	Description	Activity	Timing	Summer			Autumn			Winter			Spring		
				December	January	February	March	April	May	June	July	August	September	October	November
Seasonally appropriate pasture growth	More than 70% favourable species in winter pastures. More than 70% favourable species in summer pastures.	• Determine % species presence in pastures (see Appendix F). • Move stock to prevent overgrazing and decline of desirable pasture species.	Seasonally.				Winter pasture species						Summer pasture species		
Weed control	No noxious weeds. No weeds hazardous to horses. No weeds of national significance. Less than 10% of pasture supporting African Lovegrass.	• Identify and map the location of noxious weeds, weeds hazardous to horses and weeds of national significance (see Appendices C and D). • Treat weeds in accordance with Appendices C and D. • Heavily graze annual weeds to remove seed heads and reduce seed set.	During seasonal periods of weed establishment (see Appendix B). As part of pasture regeneration activities. See Appendix C for appropriate timing of weed treatment. See Appendix B to determine optimal timing for grazing during seed production and set.												

Goal	Description	Activity	Timing	Summer			Autumn			Winter			Spring		
				December	January	February	March	April	May	June	July	August	September	October	November
Pasture regeneration	Maintenance of pasture comprising approximately 70% perennial grass and 20% annual legumes.	• Identify priority pasture areas for regeneration. • Exclude stock from regenerating pasture, while ensuring that stocking rates in remaining pasture areas are consistent with Section 2.1. • Only lightly graze newly sown pasture areas in the first season. • Rest pastures for seed set and re-establishment e.g. delay grazing of sub-clover in autumn until the 2-3 leaf stage where feasible.	For pasture regeneration, spelling must occur after effective rainfall has fallen, when the plants are actively growing and restoring their root reserves.												

3. Project outcomes

The project commenced in December 2015 and included a number of visits to the property. Stakeholders were identified as Mr. and Mrs. Morris who are the current landholders and Graham Goodwin, the representative of Enhance Place Mine. Consultation has incorporated a number of phone calls from Michelle Evans to each of the stakeholders, as well as two face-to-face meetings at the Morris property.

An initial meeting at the Morris property was conducted in December 2016 between Michelle Evans and Mr. and Mrs. Morris. This meeting introduced the project aims and identified a number of concerns held by the landholders. A summary of this meeting is provided in Appendix H.

Key points from the initial meeting were discussed with Graham Goodwin and subsequently informed the development of the Draft Stock Management Plan.

The second stakeholder meeting was held at the Morris property in March 2016 and was attended by each of the stakeholders. This meeting provided an opportunity to present the Draft Stock Management Plan and describe how the document may assist in determining appropriate stocking rates and ongoing land management activities. A summary of this meeting is included in Appendix H.

3.1 Ongoing activities

Many of the initial stakeholder concerns listed in Appendix H are addressed in the Stock Management Plan and have been communicated to each of the stakeholders. Those concerns not immediately addressed in the Stock Management Plan are the subject of ongoing activities and focus on two issues: the number of water-holding dams and the need to manage stocking numbers in areas undergoing rehabilitation.

Mr. and Mrs. Morris have supplied a copy of the real estate listing for the property (attached). Enhance Place Mine is currently examining the number and condition of dams on the property.

Appropriate stocking numbers have been determined in the Stock Management Plan and communicated to the landholders. There is agreement between stakeholders to exclude stock from a selected paddock to allow further rehabilitation activities to be undertaken.

3.2 Recommendations

- Assess the current condition of pastures against the land management goals in Table 4 (Section 2.7).
- Exclude stock from a selected paddock to enable further rehabilitation activities. Refer to appropriate stocking numbers provided in Appendix E for remaining paddocks.
- Conduct rehabilitation of selected paddock having regard to the property management guidelines described in Section 2.
- Monitor the success of rehabilitation activities against the land management goals of Section 2.7.
- Reopen the successfully rehabilitated paddock to grazing at appropriate rates.

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Appendix A Soil test results

SOILTEC

SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66251411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s14-0897 (14)

Client: SLR
Account: EP3

Sample Received: 3.10.2014 Report Reply: 9.10.2014
SAMPLE I.D: 0-10cm **INTENDED USE:**
TEXTURE

		RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)		0.09	<0.15
pH	(1:5 $CaCl_2$)	6.80	5.2-5.5
Exchangeable Cations: (Measured)			
Calcium	(Ca)(meq/100g)	8.44	See Percentage
Magnesium:	(Mg)(meq/100g)	5.21	See Percentage
Potassium:	(K)(meq/100g)	0.35	0.5-1.0
Sodium:	(Na)(meq/100g)	0.54	Zero
Aluminium:	(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):		**14.54**	
Exchangeable Cations (as a % of Total)			
Calcium:		58.05	65-80%
Magnesium:		35.83	15-20%
Potassium:		2.41	3-5%
Sodium:		3.71	<3%
Aluminium:		0.00	<5%
Phosphorus:	(mg/kg) (Bray-1)	21.0	
Sulphur	(mg/kg) (KCl 40 S)	5.9	8-10
Nitrate Nitrogen	(mg/kg) (water extract)	2.3	At least 10
Organic Carbon	(%) (Walkely & Black)	2.8	2% or more
Trace Elements			
Copper	(mg/kg) (DTPA)	0.8	
Zinc	(mg/kg) (DTPA)	0.8	
Manganese	(mg/kg) (DTPA)	25.1	
Iron	(mg/kg) (DTPA)	26.8	
Boron	(mg/kg) (Hot CaCl)	0.7	
Calculations:			
Lime Requirement (Cregan)		0.00	(see notes on page 2)
Calcium/Magnesium Ratio:		1.62	3-5

~ASPAC~
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1 of 2

SOILTEC

SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL: chemist@soiltec.com.au

Soil Test Report #s14-0897 (10)

Client: *SLR*
Account: **EP1**

Sample Received: 3.10.2014 Report Reply: 9.10.2014
SAMPLE I.D: 0-10cm **INTENDED USE:**
TEXTURE

			RESULT	*OPTIMAL*
Conductivity (dS/m)(1:5 water)			0.07	<0.15
pH	(1:5 $CaCl_2$)		7.17	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium:		(Ca)(meq/100g)	6.18	See Percentage
Magnesium:		(Mg)(meq/100g)	2.39	See Percentage
Potassium:		(K)(meq/100g)	0.27	0.5-1.0
Sodium:		(Na)(meq/100g)	0.16	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			8.99	
Exchangeable Cations (as a % of Total)				
Calcium:			69.44	65-80%
Magnesium:			25.73	15-20%
Potassium:			3.03	2-8%
Sodium:			1.80	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	14.9	
Sulphur	(mg/kg)	(KCl 40 S)	7.0	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	2.3	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.2	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	0.8	
Zinc		(mg/kg) (DTPA)	0.8	
Manganese		(mg/kg) (DTPA)	24.7	
Iron		(mg/kg) (DTPA)	26.4	
Boron		(mg/kg) (Hot CaCl)	0.9	
Calculations:				
Lime Requirement (Crogan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio			2.70	3-5

~ASPAC~

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Appendix B Phases of pasture growth

Phases of pasture growth	Characteristics
Phase 1 – Early growing season	• Short, leafy growth • Moderate pasture growth rate • High forage quality but low yield • High sensitivity to grazing pressure
Phase 2 – Mid growing season	• Well-developed leafy-tussock phase • High pasture growth rate • Good forage quality with moderate to increasing yield • Moderate sensitivity to grazing pressure
Phase 3 – Mid to late growing season	• Reproductive phase • Low pasture growth rate • Moderate to low forage quality and maximum yield has been reached • Low to moderate sensitivity to grazing pressure
Phase 4 – Beyond the growing season	• Dormant phase • Little or no growth • Low to very low forage quality and plants have withdrawn protein into their roots • Low sensitivity to grazing pressure

Source: QLD Department of Agriculture, Fisheries and Forestry (2013)

Appendix C Weed management plan

This Plan has been prepared to meet the requirements for noxious weed control in the Upper Macquarie County Council area.

Legal requirements

Individuals, landholders and Government have a responsibility to control noxious weeds on their land under the *Noxious Weeds Act* 1993, which is regulated in the area by the Upper Macquarie County Council. Weeds under this Act include Weeds of National Significance (WoNS) and Environmental Alert Weeds (EAW).

The following legislation and strategies may require consideration when undertaking various weed management activities.

Legislation relevant to weed control

Legislation	Summary
Noxious Weeds Act 1993	The *Noxious Weeds Act* 1993 defines the roles of government, councils, private landholders and public authorities in the management of noxious weeds. The Act sets up categorisation and control actions for the various noxious weeds, according to their potential to cause harm to the environment. Landowners or occupiers of land are required to control noxious weeds on the property and to prevent the spread of noxious weeds to adjoining land.
Pesticides Act 1999	The NSW Department of Environment and Conservation restricts the application of certain pesticides near or within waterways.
Work Health and Safety Act 2011	The Act is administered by Workcover NSW. There are specific requirements relating to use of pesticides and certification of pesticide operators.
Australian Weeds Strategy – A national strategy for weed management in Australia (Department of the Environment and Water Resources 2006)	The Strategy provides a national framework to complement state, territory, regional and local government strategies and industry initiatives and legislative controls; and identifies the Weeds of National Significance (WONS) for priority weed management efforts.
Threat Abatement Plans	Statutory plans under the NSW *Threatened Species Conservation Act* 1995 for control of Key Threatening Processes, which includes some weed species.

Weeds to which this Plan applies

This Plan has been developed for the control and management of Class 4 noxious weeds listed for the Upper Macquarie County Council area (Appendix D).

In addition, this Plan identifies noxious weeds for which there are specific control and notification requirements:

- Control Class 1 and 2 – Plants which must be eradicated from the land and whose presence must be notified to the local control authority;
- Control Class 3 – Plants which must be fully and continuously suppressed and destroyed; and
- Control Class 5 – Outbreaks of which must be reported to the local control authority within three days of discovery.

Weeds listed as WoNS have been determined by the Australian Government based on their invasiveness, potential for spread, and their environmental, social and economic impacts. Listed WoNS have been and continue to be responsible for significant agricultural, forestry and environmental damage.

The EAW list has been compiled by the Australian Government Department of Environment and Heritage in conjunction with other experts and complements the WONS list. Weeds that have been placed on the National Environmental Alert List have been identified as having the potential to become a significant threat to biodiversity if they are not managed in the early stages of establishment.

Weed control

Weed control on the site will include:

- Identification of noxious weeds across the property;
- Determination of control class of noxious weeds observed on the property;
- Weed management scheduling in accordance with the aims of integrated weed management; and
- Monitoring the occurrence and extent of noxious weeds.

Note: Scheduled weed treatment may be determined in accordance with:

- *Weed control in pastures and lucerne 2010* (NSW Industry and Investment, 2010)
- *Noxious and environmental weed control handbook: a guide to weed control in non-crop, aquatic and bushland situations* (NSW DPI, 2011);
- *Calendar of growth cycle and control times for weeds of the Southern* Tablelands (NSW DPI, n.d); and
- *Weed Alerts* (NSW DPI, n.d.).

Integrated weed management

Weed competition is a major cause of pasture establishment failure and may lead to a loss of pasture production. Cultivation, cropping, slashing, herbicides and pasture manipulation can all be effectively used to control weeds (NSW Agriculture 2003). When using herbicides, it is important to remember that selection and correct use of herbicide is crucial.

Grazing by livestock may also be used as a form of weed control, by helping to suppress and reduce weed growth and seed production and/or prevent weed domination (Gleeson & Gleeson 2012).

However this technique varies in effectiveness depending on the palatability of the weed species. A combination of grazing and weed control (through the use of a herbicide application or other techniques to remove unpalatable weeds) can be an effective solution.

Integrated weed management control methods have been sourced from the *Noxious and environmental weed control handbook: A guide to weed control in non-crop, aquatic and bushland situations* (NSW DPI 2011). Chemical control methods may differ between life stages and application method for each species.

Integrated weed management of Control Class 4 noxious weeds

Note: species in **bold** have been recorded on the property

Common name ***Scientific name***	**Physical**	**Biological**	**Cultural**	**Chemical**
African boxthorn *Lycium ferocissimum*	Mechanically remove the top growth and as many of the roots as possible when soil is wet (winter) and burn the removed material.			A number of herbicides may be used for treatment. Regrowth should be sprayed.
African lovegrass ***Eragrostis curvula***			Pasture improvement and grazing management will reduce re-establishment. Main control principle is to ensure it is replaced by better species.	
Arrowhead *Sagittaria montevidensis*	Excavation with machinery or manual digging by hand from waterways. Steam application.		Maintain good hygiene and containment during physical control.	Use of a herbicide registered to control arrowhead. Herbicide treatment will often only suppress infestations and regeneration will occur.

Common name *Scientific name*	Physical	Biological	Cultural	Chemical
Asparagus weeds *Asparagus* species	Carefully dig out the entire crown of *A. aethiopicus*, leaving the roots and tubers in situ; the crown and any fruiting stems should be bagged and burnt. The entire plant (including root system) of *A. declinatus* can be dug out in small to medium sized infestations. Sheep grazing may be effective on *A. asparagoides.*	Biological control agents are available for *Asparagus asparagoides.*		A number of herbicide options are available, most of which require a permit for use.
Bathurst/Noogoora/ Hunter/ South American/ Californian/ Cockle burr *Xanthium* species	Hoe, chip or slash before flowering or seed set.	Biological control agents are available.	Maintaining ground cover in pastures to reduce burr germination and seedling survival. Prevent overgrazing of pastures in spring and summer. Seedling form is toxic to livestock.	A range of foliar and residual herbicide options are available.
Blackberry ***Rubus fruticosus* species *aggregate***	Slashing of juvenile bushes and use of goats (and potentially sheep depending on availability of other feed) will give some control, however these techniques are best used in a combination with herbicides (due to the root structure of the blackberry).	Biological control agents are available.	Improve pastures with a vigorous perennial species. Strong, actively growing pasture will help prevent invasion from weeds.	Herbicides are the most reliable method for achieving local eradication of blackberry, and a number of herbicides are registered for use on this weed.

Common name *Scientific name*	Physical	Biological	Cultural	Chemical
Chilean needle grass *Nassella neesiana*			Good grazing management combined with a pasture improvement program to reduce the soil seed bank.	Herbicide application may be used in combination with other management techniques.
Lippia *Phyla canescens*		The *National Lippia Working Group* is currently investigating biological control options.	Requires an integrated approach of suppression, pasture improvement and pasture maintenance.	Herbicide application should be used in conjunction with cropping, pasture improvement and grazing management where appropriate.
Long-leaf willow primrose *Ludwigia longifolia*	Small plants may be manually removed, taking care not to spread seed.			
Nodding thistle *Carduus nutans* subsp. *nutans*	Grubbing on scattered plants. Remove at least the top 10 cm of the root system and invert the sod to expose the plant roots and prevent regrowth.	Biological control agents are available.	Good perennial pastures with sound grazing management to prevent invasion.	Herbicide application at the early seedling stage or when passing from the seedling to the rosette stage.
Pampas grass *Cortaderia* species	Mechanical removal where possible. Remove the seed heads of large plants and slash before grubbing.	Readily grazed by stock when it is young (which prevents the development of flowers and seed set), before it becomes too abrasive.		May be treated with a Glyphosate-based herbicide such as Roundup.

Common name *Scientific name*	Physical	Biological	Cultural	Chemical
Prickly pear *Opuntia* species		*Cochineal* and *Cactoblastis* biological control agents are available.		
Prickly pear *Cylindropuntia* species	Small plants can be carefully mechanically removed.			
Sagittaria *Sagittaria platyphylla*	Isolated plants can be manually removed.			
Scotch broom *Cytisus scoparius*		Biological control agents may be available.	Use of goats as grazing management tool.	
Scotch, Stemless, Illyrian and Taurian thistles *Onopordum* species	Grub out single plants, removing at least 50 mm of root.	Biological control agents are available.	Establish a strong, perennial, grass-based pasture.	
Serrated tussock *Nassella trichotoma*	Grub out single plants.		Establish perennial pasture with good grazing management.	
Silverleaf nightshade *Solanum elaeagnifolium*			Use strong, competitive crops or pasture.	Seedlings are readily controlled by all registered

Common name *Scientific name*	Physical	Biological	Cultural	Chemical
			Quarantine infestation and prevent seeding. Do not cultivate.	herbicides.
Spiny burrgrass *Cenchrus incertus* */Cenchrus longispinus*			Establish a strong, competitive summer pasture. Ensure equipment hygiene is used to prevent seed dispersal. Quarantine infestations.	Herbicides are best used in a strategy incorporating cultivation, crop rotation and pasture improvement.
St. John's wort ***Hypericum perforatum***		Biological control agents are available.	Prevent invasion. Establish perennial pasture with good grazing management.	Spot-spraying using a registered herbicide can be used on isolated infestations.
Star thistle *Centaurea calcitrapa*	Hoe or chip individual plants or small infestations, removing at least 50 mm of the root.		Improve pasture stand.	Foliar application of a registered herbicide at seedling or rosette stage for best results.
Sweet briar ***Rosa rubiginosa***	Remove mechanically or grub out established plants. Graze with goats. Young seedlings may be grazed with sheep to help prevent establishment.		Vigorous perennial pastures provide competition to reduce invasion.	Registered herbicide may be applied by foliar spray, basal bark treatment, cut stump treatment or root application.

Common name *Scientific name*	Physical	Biological	Cultural	Chemical
Wild radish ***Raphanus raphanistrum***	Young plants may be easily removed by hand. Older plants develop a taproot that makes physical removal difficult. Slashing may reduce seed production but won't destroy the plant.	Biological control is risky as the plant is closely related to many agricultural and horticultural species.	Maintain a well-balanced pasture with good grazing management. Stock should be removed from Wild Radish infested areas.	Herbicide treatment may be used, however some populations have developed herbicide resistance.
Willows *Salix* species	Seedlings may be pulled by hand.			Registered herbicides may be applied by foliar spray, cut stump application or stem injection.

Chemical weed control methods

Species	Weed type /Noxious weed control class	Control method	Effect on grazing	Summer			Autumn			Winter			Spring		
				December	January	February	March	April	May	June	July	August	September	October	November
African Lovegrass *Eragrostis curvula*	4	Flupropanate 745 g/L **(*Taskforce*)** 300 mL per 100 L of water. **Non-chemical options:** appropriate grazing management.	4 month stock withholding period for boom spraying. 14 day stock withholding period for spot spraying.	✓	✓	✓							✓	✓	✓
Blackberry *Rubus fruticosus* aggregate species	4	Triclpyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L **(*Grazon Extra*)** 350 or 500 mL per 100 L water. **Non-chemical options:** slashing of young bushes and use of biological control agents.	No stock withholding period required.	✓	✓	✓	✓								
Crofton Weed *Ageratina adenophora*	Weed of horse pastures	MCPA 340 g/L + Dicamba 80 g/L **(Banvel M, Kamba M)** 2.8 L or 4 L per 100 L water. **Non-chemical options:** small plants can be dug out with mattock, slashing, and biological control agents.	7 days stock withholding period. The slashed and dried plant is still attractive and toxic to horses. Keep horses away until the plant has been completely removed from the paddock.	✓	✓	✓	✓						✓	✓	✓
Fireweed *Senecio madagascariensis*	Weed of horse pastures	Bromoxynil 200 g/L **(Various trade names)** 1.4 L or 2.8 L per 100 L water.	Bromoxynil has 14 days stock withholding period.				✓	✓	✓						

Species	Weed type /Noxious weed control class	Control method	Effect on grazing	Summer			Autumn			Winter			Spring		
				December	January	February	March	April	May	June	July	August	September	October	November
		Diflufenican g/L + Bromoxynil 250 g/L **(Jaguar, Barracuda)** 500 mL per 100 L water. Paraquat 250 g/L **(Gramoxone 250, Paraquat 250, Nuquat 250)** 1.2 L per 100 L water. Paraquat 135 g/L + Diquat 115 g/L **(Spray Seed 250)** 1.6 or 2.4 L per 100 L water. MCPA 250 g/L + Diflufenican 25 g/L **(Tigrex, Nugrex)** 1 L per 100 L water. Triclopyr 300 g/L + picloram 100 g/L **(Grazon Extra)** 350 mL per 100 L water. **Non-chemical options:** slashing, hand weeding, and biological control agents.	Diflufenican + Bromoxynil has 56 days stock withholding period. Paraquat has 7 days stock withholding period for horses. MCPA + Diflufenican has 7 days stock withholding period. No stock withholding period required for Triclopyr + picloram.												
Flatweed *Hypochaeris radicata*	Weed of horse pastures	Bromoxynil 200 g/L **(Various trade names)** 1.4 L or 2 L per 100 L water. Paraquat 250 g/L **(Gramoxone, Paraquat, Nuquat)** 1.2 L. Paraquat 135 g/L + Diquat 115 g/L **(Spray Seed)** 1.6 L to 2.4 L.	Bromoxynil has 14 days stock withholding period. Paraquat has 7 days stock withholding period for horses.										✓	✓	✓

Species	Weed type /Noxious weed control class	Control method	Effect on grazing	Summer			Autumn			Winter			Spring		
				December	January	February	March	April	May	June	July	August	September	October	November
Paterson's Curse *Echium plantagineum*	Weed of horse pastures	2,4-D dma amine 625 g/L **(Amicide 625, Amicide Lo-625A)** 1.1 L or 1.7 L per 100 L water. Glyphosate 450g/l **(Glyphosate ct, Roundup ct)** 800 mL or 1.6 L per 100 L water. Glyphosate 540 g/L **(Roundup Power Max)** 630 mL or 1.37 L per 100 L water. Glyphosate 500 g/L **(Touchdown, Hitech)** 660 mL or 1.32 L per 100 L water. Paraquat 250 g/L **(Gramoxone, Paraquat, Nuquat)** 1.2 L. Paraquat 135 g/L + Diquat 115 g/L **(Spray Seed)** 1.6 L to 2.4 L. Bromoxynil 200 g/L **(Various trade names)** 2 L per 100 L water *(Add 1.5–2.0 L/ha 2,4-DB (500 g/L)* Flumetsulam 800 g/L **(Broadstrike)** 25 g *(Add 0.7 L/ha bromoxynil (200 g/L); Add wetter + 0.1 L/ha diuron (500 g/L); Add 0.3 L/ha terbutryn (500 g/L) + wetter).* 2,4-DB 500 g/L trifolamine **(Buttress)** 1 L or 3.2 L per 100 L water.	2,4-D dma amine has 7 days stock withholding period. No stock withholding period required for Glyphosate. Paraquat has 7 days stock withholding period for horses. Bromoxynil has 14 days stock withholding period. Flumetsulam has 3 days stock withholding period. 2,4-DB has 7 days stock withholding period. Diflufenican + Bromoxynil has 14 days stock withholding period. Imazethapyr has 14 days stock withholding period.				✓	✓	✓						

Species	Weed type /Noxious weed control class	Control method	Effect on grazing	Summer			Autumn			Winter			Spring		
				December	January	February	March	April	May	June	July	August	September	October	November
		Diflufenican g/L + Bromoxynil 250 g/L **(Jaguar, Barracuda)** 500 mL or 750 mL per 100 L water. Imazethapyr 700 g/kg **(Spinnaker, WDG)** 70 g or 140 g. **Non-chemical options:** slashing and hand weeding, burning, grazing management, and biological control agents.													
St. John's Wort *Hypericum perforatum*	4	Triclpyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L **(*Grazon Extra*)** 500 mL per 100 L of water. **Non-chemical options:** appropriate grazing management and use of biological agents.	No stock withholding period required.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
				Twiggy flowering growth stage.			Spindly stem growth stage.						Twiggy flowering growth stage.		
Sweet Briar *Rosa rubiginosa*	4	Triclpyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L **(*Grazon Extra*)** 500 mL per 100 L of water. **Non-chemical options:** mechanical removal or grubbing.	No stock withholding period required.	✓	✓	✓							✓	✓	✓

Source: NSW WeedWise, NSW Dept. Primary Industries, <http://weeds.dpi.nsw.gov.au/>

Appendix D Noxious Weeds declared in the Upper Macquarie County Council

Class 4 noxious weeds

Note: Species in **bold** have been recorded within the property.

Common Name	Scientific Name	Control Class
African boxthorn	*Lycium ferocissimum*	4; WoNS
African lovegrass	***Eragrostis curvula***	**4**
Arrowhead	*Sagittaria calycina* var. *calycina*	4
Asparagus - climbing asparagus fern	*Asparagus plumosus*	4
Asparagus - ground asparagus	*Asparagus aethiopicus*	4
Asparagus weeds	*Asparagus* species	4
Blackberry	***Rubus fruticosus* species aggregate**	**4; WoNS**
Bridal creeper	*Asparagus asparagoides*	4; WoNS
Burr - Bathurst burr	*Xanthium spinosum*	4
Burr - Californian burr	*Xanthium orientale*	4
Burr - Italian cockleburr	*Xanthium italicum*	4
Burr - Noogoora burr	*Xanthium occidentale*	4
Burr - South American burr	*Xanthium cavanillesii*	4
Chilean needle grass	*Nassella neesiana*	4; WoNS
Columbus grass	*Sorghum x almum*	4
Fireweed	***Senecio madagascariensis***	**4**
Flax-leaf broom	*Genista linifolia*	4

Common Name	Scientific Name	Control Class
Giant reed	*Arundo donax*	4
Golden dodder	*Cuscuta campestris*	4
Harrisia cactus	*Harrisia* species	4
Illyrian thistle	*Onopordum illyricum*	4
Johnson grass	*Sorghum halepense*	4
Leafy elodea	*Egeria densa*	4
Lippia	*Phyla canescens*	4
Mother-of-millions	*Bryophyllum* species	4
Nodding thistle	*Carduus nutans* subsp. *nutans*	4
Pampas grass	*Cortaderia* species	4
Prickly pear - common pear	*Opuntia stricta*	4; WoNS
Prickly pear - Hudson pear	*Cylindropuntia rosea*	4; WoNS
Prickly pear - smooth tree pear	*Opuntia monacantha*	4; WoNS
Prickly pear - tiger pear	*Opuntia aurantiaca*	4; WoNS
Prickly pear - velvety tree pear	*Opuntia tomentosa*	4; WoNS
Privet - broad-leaf	*Ligustrum lucidum*	4
Privet - narrow-leaf	*Ligustrum sinense*	4
Rhus tree	*Toxicodendron succedaneum*	4
Sagittaria	*Sagittaria platyphylla*	4; WoNS
Scotch broom	*Cytisus scoparius* subsp. *scoparius*	4

Common Name	Scientific Name	Control Class
Scotch thistle	*Onopordum acanthium*	4
Serrated tussock	*Nassella trichotoma*	4; WoNS
Silverleaf nightshade	*Solanum elaeagnifolium*	4; WoNS
Spiny burrgrass - longispinus	*Cenchrus longispinus*	4
Spiny burrgrass - spinifex	*Cenchrus spinifex*	4
St. John's wort	***Hypericum perforatum***	**4**
Star thistle	*Centaurea calcitrapa*	4
Stemless thistle	*Onopurdum acaulon*	4
Sweet briar	***Rosa rubiginosa***	**4**
Taurian thistle	*Onopurdum tauricum*	4
Tree-of-heaven	*Ailanthus altissima*	4
Wild radish	***Raphanus raphanistrum***	**4**
Willows	*Salix* species	4; WoNS

Plants requiring eradication

Note: Species in **bold** have been recorded within the property

Common Name	Scientific Name	Control Class
Alligator weed	*Alternanthera philoxeroides*	2; WoNS
Anchored water hyacinth	*Eichhornia azurea*	1
Black knapweed	*Centaurea X moncktonii*	1
Black willow	*Salix nigra*	2
Boneseed	*Chrysanthemoides monilifera* subsp. *monilifera*	1; WoNS
Bridal veil creeper	*Asparagus declinatus*	1
Broomrapes	*Orobanche* species	1
Cat's claw creeper	*Dolichandra unguis-cati*	2
Chinese violet	*Asystasia gangetica* subsp. *micrantha*	1
Eurasian water milfoil	*Myriophyllum spicatum*	1
Frogbit	*Limnobium laevigatum*	1
Grey sallow	*Salix cinerea*	2
Hawkweeds	*Hieracium* species	1
Horsetails	*Equisetum* species	1; EAW
Hydrocotyl	*Hydrocotyle ranunculoides*	1
Hymenachne	*Hymenachne amplexicaulis* and hybrids	1; WoNS
Karroo thorn	*Vachellia karroo*	1
Kidney-leaf mud plantain	*Heteranthera reniformis*	1

Common Name	Scientific Name	Control Class
Kochia	*Bassia scoparia*	1
Koster's curse	*Clidemia hirta*	1
Lagarosiphon	*Lagarosiphon major*	1
Mesquite	*Prosopis species*	2; WoNS
Mexican feather grass	*Nassella tenuissima*	1
Miconia	*Miconia* species	1
Mikania vine	*Mikania micrantha*	1
Mimosa	*Mimosa pigra*	1; WoNS
Parkinsonia	*Parkinsonia aculeata*	2; WoNS
Parthenium weed	*Parthenium hysterophorus*	1; WoNS
Pond apple	*Annona glabra*	1; WoNS
Prickly acacia	*Vachellia nilotica*	1; WoNS
Rubber vine	*Cryptostegia grandiflora*	1; WoNS
Salvinia	*Salvinia molesta*	2; WoNS
Senegal tea plant	*Gymnocoronis spilanthoides*	1; EAW
Siam weed	*Chromolaena odorata*	1
Spongeplant	*Limnobium spongia*	1
Spotted knapweed	*Centaurea stoebe* subsp. *micranthos*	1
Tropical soda apple	*Solanum viarum*	1
Water caltrop	*Trapa* species	1

Common Name	Scientific Name	Control Class
Water hyacinth	*Eichhornia crassipes*	2
Water lettuce	*Pistia stratiotes*	1
Water soldier	*Stratiotes aloides*	1
Witchweeds	*Striga* species	1
Yellow burrhead	*Limnocharis flava*	1

Plants requiring full and continuous suppression

Common Name	Scientific Name	Control Class
Cape broom	*Genista monspessulana*	3
Gorse	*Ulex europaeus*	3; WoNS
Green cestrum	*Cestrum parqui*	3
Long-leaf willow primrose	*Ludwigia longifolia*	3

Plants requiring full and continuous suppression

Common Name	Scientific Name	Control Class
Athel pine	*Tamarix aphylla*	5; WoNS
Cabomba	*Cabomba caroliniana*	5; WoNS
African feather grass	*Cenchrus macrourus*	5
African turnip weed - eastern	*Sisymbrium thellungii*	5
African turnip weed - western	*Sisymbrium runcinatum*	5
Annual ragweed	*Ambrosia artemisiifolia*	5
Artichoke thistle	*Cynara cardunculus*	5
Bear-skin fescue	*Festuca gautieri*	5
Burr ragweed	*Ambrosia confertiflora*	5
Cayenne snakeweed	*Stachytarpheta cayennensis*	5
Clockweed	*Oenothera curtiflora*	5
Corn sowthistle	*Sonchus arvensis*	5
Dodder	*Cuscuta* species	5
Espartillo - broad kernel	*Amelichloa caudata*	5
Espartillo - narrow kernel	*Amelichloa brachychaeta*	5
Fine-bristled burr grass	*Cenchrus brownii*	5
Fountain grass	*Cenchrus setaceus*	5
Gallon's curse	*Cenchrus biflorus*	5
Gamba grass	*Andropogon gayanus*	5

Common Name	Scientific Name	Control Class
Glaucous starthistle	*Carthamus leucocaulos*	5
Golden thistle	*Scolymus hispanicus*	5
Mexican poppy	*Argemone mexicana*	5
Mossman River grass	*Cenchrus echinatus*	5
Red rice	*Oryza rufipogon*	5
Smooth-stemmed turnip	*Brassica barrelieri* subsp. *oxyrrhina*	5
Soldier thistle	*Picnomon acarna*	5
Texas blueweed	*Helianthus ciliaris*	5
Yellow nutgrass	*Cyperus esculentus*	5

Control requirements

Control Class	Legal requirements	Notifiable
1	The plant must be eradicated from the land and the land must be kept free of the plant	All outbreaks must be reported to the local control authority and NSW DPI (phone 1800 680244) within three days of discovery
2		
3	The plant must be fully and continuously suppressed and destroyed	Not notifiable
4	The growth of the plant must be managed in a manner that reduces its numbers, spread and incidence and continually inhibits its reproduction	
5	The requirements in the *Noxious Weeds Act* 1993 for a notifiable weed must be complied with	All outbreaks must be reported to the local control authority and NSW DPI (phone 1800 680 244) within three days of discovery

Appendix E Recommended stocking rates

Livestock (DSE rating)	Number of hectares required	Fenced area 1 (9.4 ha)	Fenced area 2 (1.9 ha)	Fenced area 3 (4.9 ha)
Top-dressed pasture with some clover (present state of pasture) (average DSE /ha = 7-10)				
Horses – light horse (DSE = 10)	1.43-1.0	6-9	1-2	3-5
Horse – under light work (DSE = 13.5)	1.93-1.35	5-7	1	2-4
Pony (DSE = 6)	0.86-0.6	11-15	2-3	5-8
Miniature horse (DSE = 3.5)	0.5-0.35	19-27	4-5	10-14
Cow – dry stock (450 kg) (DSE = 6)	0.86-0.6	11-15	2-3	5-8
Cow – bull (800 kg) (DSE = 10)	1.43-1.0	6-9	1-2	3-5
Alpaca – wether (DSE = 1)	0.14-0.1	67-94	13-19	35-49
Alpaca – pregnant (DSE = 1.5)	0.21-0.15	44-62	9-12	23-32
Alpaca lactating (DSE = 2)	0.29-0.2	32-47	6-9	17-24
Improved pasture, paspalum, kikuyu and clover on good fertility soils + fertiliser (average DSE /ha = 14-24)				
Horses – light horse (DSE = 10)	0.71-0.42	13-22	3-4	7-11
Horse – under light work (DSE = 13.5)	0.96-0.56	10-17	2-3	5-9
Pony (DSE = 6)	0.43-0.25	22-37	4-7	11-21

Livestock (DSE rating)	Number of hectares required	Fenced area 1 (9.4 ha)	Fenced area 2 (1.9 ha)	Fenced area 3 (4.9 ha)
Miniature horse (DSE = 3.5)	0.25-0.15	37-62	7-12	21-32
Cow – dry stock (450 kg) (DSE = 6)	0.43-0.25	22-37	4-7	11-21
Cow – bull (800 kg) (DSE = 10)	0.71-0.42	13-22	3-4	7-11
Alpaca – wether (DSE = 1)	0.07-0.04	134-235	27-47	70-122
Alpaca – pregnant (DSE = 1.5)	0.1-0.06	94-156	19-31	3-81
Alpaca lactating (DSE = 2)	0.14-0.08	67-117	13-24	35-61

Appendix F Pasture sowing guide

Summer pasture species	Winter fodder species	Sowing method[1]	Sowing rate[2]	Sowing period											
				Summer			Autumn			Winter			Spring		
				December	January	February	March	April	May	June	July	August	September	October	November
Fescue		Sow 5–15 mm deep. Broadcast and harrow or drill into a clean, firm seedbed.	4-5 kg/ha										✓	✓	✓
Cocksfoot (European type)	Cocksfoot (Mediterranean type)	Sow into a clean seedbed, no more than 2 cm deep.	1-3 kg/ha				✓	✓	✓				✓	✓	✓
	Subterranean clover	Sow in the better drained parts of the paddock (sow white clover separately in wetter areas to reduce competition).	4 kg/ha				✓	✓	✓						

[1] From Rejuvenating Perennial Pastures (NSW Department of Primary Industries 2009)
[2] From Graziers' Guide to Pastures (NSW Agriculture 2003)

Summer pasture species	Winter fodder species	Sowing method[1]	Sowing rate[2]	Sowing period											
				Summer			Autumn			Winter			Spring		
				December	January	February	March	April	May	June	July	August	September	October	November
	Perennial ryegrass	Direct-drill after suppression of existing growth by herbicide. Drill or broadcast following mulching or into a clean seedbed (NSW Agriculture 1997).	3-20 kg/ha. Restrict sowing rate of annual ryegrass to no more than 7 kg/ha when sown with perennial ryegrass										✓	✓	✓
	Annual ryegrass	Broadcast or drill into clean seedbeds. Direct-drill into clean seedbeds or after suppression of summer pasture growth with herbicides.	15 kg/ha when sown alone or 5-10 kg/ha in mixture				✓								

Summer pasture species	Winter fodder species	Sowing method[1]	Sowing rate[2]	Sowing period											
				Summer			Autumn			Winter			Spring		
				December	January	February	March	April	May	June	July	August	September	October	November
	White clover	Sow on the surface, cover and roll. Avoid sowing too deep Sow in wetter areas of the paddock (sow sub clover in the better drained parts to reduce competition).	0.5-1 kg/ha										✓	✓	✓
	Phalaris		2 kg/ha				✓	✓	✓				✓		
Japanese Millet		Sow into clean seedbed.	8-10 kg/ha	✓	✓									✓	✓
	Cereal Rye										✓	✓	✓	✓	
Red Clover			1-4 kg/ha				✓	✓	✓				✓	✓	✓

Summer pasture species	Winter fodder species	Sowing method[1]	Sowing rate[2]	Sowing period											
				Summer			Autumn			Winter			Spring		
				December	January	February	March	April	May	June	July	August	September	October	November
Rhodes Grass		Sow into a clean seed bed.	1-4 kg/ha			✓	✓						✓	✓	✓
	Oats	Drill or broadcast into a clean seedbed. Direct-drill early sowings after suppression of summer pasture with herbicides.	80-120 kg/ha; reduce rate when sowing with Annual ryegrass			✓	✓	✓							
	Triticale		100-120 kg/ha				✓	✓	✓						
	Barley	Ideal depth is 3-6 cm. Seed should always be sown into moist soil.	Up to 100 kg/ha or reduced rates in a mix with forage legumes.					✓	✓	✓					

Appendix G Fertiliser application

Fertiliser (including lime)	Application rate	Application method	Summer			Autumn			Winter			Spring		
			December	January	February	March	April	May	June	July	August	September	October	November
SULFUR (S)														
Superphosphate	An application of 91 kg of superphosphate per hectare is required to achieve a rate of 10 kg of sulfur per hectare and will include 8 kg of phosphorus and 18 kg of calcium.	Apply when pastures are actively growing. Avoid applying in autumn if pastures are not actively growing.			✓	✓	✓							
Gypsum (calcium sulfate)	An application of 69 kg of gypsum per hectare is required to achieve a rate of 10 kg of sulfur per hectare and will include 69 kg of phosphorus and 13 kg of calcium.				✓	✓	✓							
Note: S-deficient plants accumulate N which may cause N poisoning in livestock.														
CALCIUM (Ca)														
Agricultural lime (calcium carbonate)	An application of 25-29 kg of agricultural lime per hectare is required to achieve a rate of 10 kg of calcium per hectare.	Surface spread or incorporate into the soil to a depth of 10 cm. Incorporate into seed bed when sowing a new pasture or forage crop.	Apply approximately once every ten years. Can be applied at any time of year.											

Fertiliser (including lime)	Application rate	Application method	Summer			Autumn			Winter			Spring		
			December	January	February	March	April	May	June	July	August	September	October	November
Note: Blanket applications of nitrogen fertiliser every 6–8 weeks for perennial ryegrass – clover pastures are not recommended as they will alter the balance between grasses and clovers. **Do not apply lime and nitrogen fertilisers at the same time (the lime will cause freshly applied nitrogen to be lost as gas).**														
POTASSIUM (K)														
Potassium chloride (KCl) (MOP - muriate of potash)	Apply 15 kg of potassium per hectare annually (for dry pasture with 0.2-0.3 meq/100g). An application of 40 kg of potassium chloride (muriate of potash) is required to achieve a rate of 20 kg of potassium.	Apply to moist soils.			✓	✓	✓							
Note: Do not graze pastures within 28 days of potassium application.														
NITROGEN (N)														
Urea	Apply up to 400 kg of nitrogen per hectare per year. An application of 88 kg of urea per hectare is required to achieve 40 kg of nitrogen per hectare.	Best applied within 3 days of last grazing or slashing. Apply to actively growing pasture. Soils must be moist - coincide application with rain or irrigation.								✓	✓	✓		

Fertiliser (including lime)	Application rate	Application method	Summer			Autumn			Winter			Spring		
			December	January	February	March	April	May	June	July	August	September	October	November
	A subsequent application of 72 kg per hectare of lime is required to reduce soil acidity.	Avoid applying when soils are either waterlogged or dry, or if substantial rain is predicted.												
Notes: Urea will only last 6 weeks in the soil. **Do not graze pastures between for 14 days after nitrogen application.** **Increasing the cover and abundance of legumes (clovers, medics) which fix nitrogen from the air is another means to supply the pasture with nitrogen.**														
PHOSPHOROUS (P) (including mixed nutrients)														
Mono ammonium phosphate (MAP)	An application of 364 kg of MAP per hectare is required to achieve a rate of 40 kg of nitrogen per hectare and will include 80 kg of phosphorus. A subsequent application of 216 kg per hectare of lime is required to reduce soil acidity.	Phosphorus can be applied to dry soil. Avoid applying if substantial rain is predicted.			✓	✓	✓							
Di ammonium phosphate (DAP)	An application of 224 kg of DAP per hectare is required to achieve a rate of 40 kg of nitrogen per hectare and will include 44 kg of phosphorous.				✓	✓	✓							

Fertiliser (including lime)	Application rate	Application method	Summer			Autumn			Winter			Spring		
			December	January	February	March	April	May	June	July	August	September	October	November
	A subsequent application of 144 kg per hectare of lime is required to neutralise acidity.													
Do not apply phosphorous fertilisers to holding yards or effluent treated paddocks.														
Mushroom compost	An application of 1000 kg of mushroom compost per hectare is required to achieve a rate of 18 kg of nitrogen per hectare and will include 8 kg of phosphorous and 16 kg of potassium. Also includes manganese, copper and zinc. pH neutral.	Incorporate into top 10-30cm of soil before rain.	Apply approximately once every three to five years. Can be applied at any time of year.											

Appendix H Record of stakeholder liaison

December 5, 2015

Present: Mr. Michael Morris, Mrs. Lorraine Morris and Michelle Evans

1. Background

Michelle Evans of First Field Environmental has been engaged by Enhance Place Mine Pty Ltd (EPM) to facilitate liaison between EPM and the landholders of rehabilitated land under mining lease to EPM. The land is currently used for grazing and it is the intention of EPM that a Stock Management Plan be prepared by First Field Environmental and provided to Mr. and Mrs. Morris (the landholders) and EPM. This document is a summary of initial conversations between Michelle Evans and Mr. and Mrs. Morris, conducted on 5 December 2015 at the property.

2. Discussion

a. Mr. and Mrs. Morris were concerned with the lack of topsoil and subsequent effects on vegetation establishment and sustainability. Surface soil erosion has been ongoing and has been particularly noticeable during extended dry periods. It has not been uncommon to find general waste such as household garbage held within exposed soils.

b. A number of holes have opened up in the rehabilitated area, including cracks associated with slope crests. Mr. and Mrs. Morris reported that one of their horses recently became injured due a hole in the grazing area, and that veterinary care was required.

c. Vegetation damage and surface soil loss is evident at a number of mid-slope locations throughout the grazing area. Mr. and Mrs. Morris and Michelle Evans shared the opinion that this damage is the result of slope and poor vegetation establishment and not overgrazing, as stock will preferentially graze flat areas before slopes of this degree. Mr. and Mrs. Morris suggested that trees could be planted mid-slope to mitigate the effects of soil slippage, loss of surface vegetation and surface soils. Mr. and Mrs. Morris have observed stock congregating beneath existing tree plantings and believe that additional planting would increase available shade and decrease potential soil damage under existing trees.

d. Mr. and Mrs. Morris indicated that there is an obvious difference in pasture health and resilience between the rehabilitated area and pastures adjacent to their property and that they would like their land rehabilitated to resemble adjacent land capability.

e. When suggested, Mr. and Mrs. Morris agreed that areas of grazing land can be closed to exclude grazing and allow for further rehabilitation works to be undertaken by EPM.

f. Mr. Morris identified a number of newly established weeds within the rehabilitated area, namely St John's Wort, Blackberry, Patterson's Curse and Wild Radish. Both Mr. and Mrs. Morris agreed that Scotch Thistle occurs occasionally and that African Lovegrass is present but well controlled as a result of recent chemical application by EMP.

g. There appears to be confusion regarding the number of dams initially prescribed for the property and the actual number of dams present. Mr. and Mrs. Morris believe that a description of the property given to them around the time of purchase stated that there were five dams on their portion of the property. Previous conversations between the landholders and a representative of EPM (no longer involved with the property) indicated to Mr. and Mrs. Morris that the two sediment retention basins would be relined for use as water storage dams.

h. It was ascertained from Mr. and Mrs. Morris that the property currently supports:

- 5 x cows;
- 8 x miniature horses;
- 7 x miniature ponies;
- 2 x horses; and
- 1 x alpaca.

A number of these animals are contained outside of the rehabilitated pasture area and are either stabled or kept in the home paddock. The rehabilitated grazing area generally supports:

- 5 x cows;
- 1 x miniature horse;
- 3 x miniature ponies; and
- 2 x horses.

i. During these conversations Mr. and Mrs. Morris indicated that the development of a Stock Management Plan would be beneficial in providing clarity regarding planned rehabilitation works, pasture and stock management.

3. Actions required

- Provide Mr. and Mrs. Morris with aerial imagery on which they can confirm the location of current fence lines and gates.
- Clarify EPMs position regarding the sediment basins against Mr. and Mrs. Morris's understanding that there be five dams on the property. Mr. and Mrs. Morris to provide original agreement.
- Schedule a meeting between Mr. and Mrs. Morris, Graham Goodwin (EPM representative) and Michelle Evans to agree on optimal outcomes of a Stock Management Plan for the property.

March 20, 2016

Present: Mr. Michael Morris, Mrs. Lorraine Morris, Graham Goodwin and Michelle Evans

1. Background

These records summarise conversations between Michelle Evans, Mr. and Mrs. Morris, and Graham Goodwin conducted on 20 March 2016 at the property.

2. Discussion

a. Michelle Evans presented Mr. and Mrs. Morris with a hard copy of the Draft Stock Management Plan. Discussion included the suggested use and layout of the Plan.

b. Mr. and Mrs. Morris and Graham Goodwin have agreed on the optimal outcomes for the property as reflected in the Draft Stock Management Plan.

c. Information sources for Section 1 of the Plan were discussed and the resulting characteristics of the property as described in the Plan were confirmed.

d. Specific land management goals in Section 2 of the Plan were identified along with methods for addressing potential immediate and long term land management issues.

e. Mr. and Mrs. Morris were provided with aerial imagery on which they confirmed the location of current fence-lines and gates.

f. It was explained to Mr. and Mrs. Morris that the current land capability of the study area is consistent with the land capability class of surrounding agricultural land.

g. Agreement was reached that rehabilitation work may commence immediately and that the closure of one paddock and subsequent exclusion of stock would be acceptable.

h. Mr. and Mrs. Morris provided a copy of the real estate listing for the property (attached below) which stated that the property contained five dams.

3. Actions required

- Clarify EPMs position regarding the sediment basins against Mr. and Mrs. Morris's understanding that there be five dams on the property.
- Undertake an assessment of the site to identify a suitable paddock for rehabilitation activities.
- Exclude grazing from the selected paddock for at least six months to allow rehabilitation works and pasture reestablishment.
- Commence rehabilitation activities as consistent with this Stock Management Plan.
- Audit rehabilitation effectiveness in mid Spring 2016.

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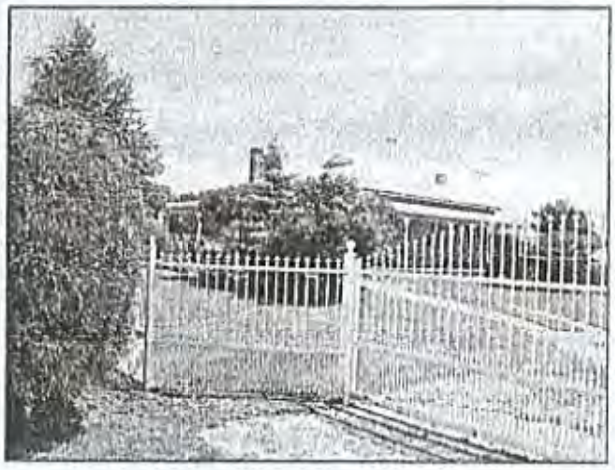

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Appendix C

Rehabilitation Monitoring Report 2021 (Ref [9])

Enhance Place Mine

Rehabilitation Monitoring Report 2021

Report prepared by First Field Environmental
on behalf of EnergyAustralia
19 January 2022

Revision history		
Version	Date	Author
Draft	10 January 2022	Myrna Calumpong Michelle Evans
Final	19 January 2022	Michelle Evans

Cover image: Treed rehabilitation area

This report has been prepared by First Field Environmental for EnergyAustralia. The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report.

First Field Environmental

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1. Introduction

Enhance Place Coal Mine is located in the Western Coalfields of NSW at Blackmans Flat, 15 km north of Lithgow on the southern side of Castlereagh Highway. The site is approximately 3 km south west of Mount Piper Power Station and adjacent to Springvale Coal Handling Facility.

Enhance Place Mine is managed in accordance with Mining Lease (ML) 1520, and ML 1458. The draft *Care and Maintenance Mining Operations Plan* dated 2016 has been prepared in accordance with ESG3: Mining Operations Plan Guidelines (2013) and describes the following rehabilitation objectives:

- *"Create a low maintenance, geotechnically stable and safe landform;*
- *Stabilise all earthworks, drainage lines and disturbed areas associated with both past and future activities in order to minimise erosion and the associated generation of sediment-laden water;*
- *Reduce the visual impact from both local or distant vantage points by means of final rehabilitation of areas of disturbance;*
- *Blend the created landform with the surrounding land fabric; and*
- *As appropriate, revegetate with native tree and shrub species and/or pasture species comparable with those on surrounding lands or which occurred in each area prior to agriculture of mining-related disturbance."*

This report aims to identify successes and failures in rehabilitation to agreed performance indicators and completion criteria. Recommendations are made in areas that could be improved.

2. Performance indicators

Table 1 identifies the performance indicators and completion criteria for Enhance Place Mine as determined by the *Enhance Place Mine Care and Maintenance Mining Operations Plan* (Enhance Place Pty Ltd, 2016).

Table 1 Performance indicators and completion criteria

Objective	Performance indicator	Completion criteria
Rehabilitation area - Pasture		
Stable and safe landform	Erosion	Stable landform, suitable for grazing and horses
		No exposed highwalls and adits to underground mine workings
Minimal cracking of soils from soil settling	Surface cracks	Limited areas of high concentration with cracking due to soil settling
Final landform is commensurate with surrounding landscape	Landform	Shape and form is visually similar to adjacent land
Landscape is free draining	Ponding of water	Sediment ponds constructed
		Contour drains constructed

		Relief ensures water flows as designed and directs water off site
Site is accessible and stock management controls in place	Access tracks, fences & gates	Site access tracks constructed
		Fences erected
		Gates installed
Pasture areas can support cattle and horse grazing	Rural Land Capability	Pasture Rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing)
	Cattle and horses	Area has successfully supported stock and/or horses for >12 months at modest rates
Pasture rehabilitation areas will be established comparable to surrounding undisturbed pasture lands	Species composition	Establishment of pasture comprising approximately 70% perennial grass and 20% annual legume, representative of species at analogue sites.
	Weed presence	Weeds including African Lovegrass to comprise <10% of the pasture sward
Soil profile of pasture areas developing appropriately for the intended post mining land use	Ground cover	Ground cover (vegetation, leaf litter, mulch) >70%
Rehabilitation area - Woodland		
Stable and safe landform	Erosion	Stable landform, suitable for grazing and horses
		No exposed highwalls and adits to underground mine workings
Minimal cracking of soils from soil settling	Surface cracks	Limited areas of high concentration with cracking due to soil settling
Final landform is commensurate with surrounding landscape	Landform	Shape and form is visually similar to adjacent land
Landscape is free draining	Ponding of water	Sediment ponds constructed
		Contour drains constructed
		Relief ensures water flows as designed and directs water off site

Site is accessible and stock management controls in place	Access tracks, fences & gates	Site access tracks constructed
		Fences erected
		Gates installed
Tree rehabilitation areas will be established and compatible with surrounding treed vegetation	Species composition	Vegetation is established in accordance with the approved species mix
	Vegetation health	More than 75% of planted species are assessed to be healthy and growing.
	Vegetation distribution	Native trees planted in designated areas as generally shown in MOP Plan 3.
	Ground cover	Ground cover (vegetation, leaf litter, mulch) >70% at year 5.
Reduced visual impact	Visual amenity	Completion of bulk earthworks to create final landform
		Completion of seeding and tree plantings

Source: Care and Maintenance Mining Operations Plan for Enhance Place Mine (Enhance Place Pty Ltd, 2016)

3. Weather conditions

The three months leading up to the survey were consistent with average temperatures (over a 15-year period of observations). The area received significantly higher than average rainfall in the three months leading up to the survey with winter rainfall of 220.6 mm compared with the average of 162.5 mm in the months of June – August (Bureau of Meteorology 2020). Table 2 presents regional rainfall data for the period commencing 2013.

Table 2 Rainfall (in mm) recorded January 2013 - September 2021

Year	Average	2013	2014	2015	2016	2017	2018	2019	2020	2021
January	85.0	87.4	9.2	156.2	142.0	37.2	49.0	154.6	46.8	82.8
February	63.2	149	85	21.2	28.8	12.2	65.2	21.4	131.6	87.4
March	91.9	43.2	155	39.4	69.6	141.4	56.6	84.2	115.0	154.0
April	42.9	26.8	63	158.2	6.2	21.2	13.6	1.0	93.6	0.6
May	22.6	23.6	14	25.2	26.0	32.6	12.6	37.2	47.8	25.2
June	62.4	87	43.2	24.8	173.4	19.6	34.6	16.2	39.0	51.8
July	35.3	19.6	25.6	44.6	91.4	6.6	5.4	10.8	77.8	60.6
August	46.7	22.4	56.4	43.8	52.2	41.8	38.0	18.0	103.8	81.4
September	42.4	44	35.2	9.8	118.6	4.2	67.6	52.0	57.0	43.2
October	60.6	20.8	51.6	58.0	71.4	106.0	79.8	9.4	68.6	53.2
November	64.6	68.6	36.8	63.6	58.4	28.8	124.6	35.8	76.4	172.4
December	83.8	38.4	160.4	58.6	86.4	75.2	80.6	2.8	125.0	-
Annual	**696.77**	**630.8**	**735.4**	**703.4**	**924.4**	**526.8**	**627.6**	**443.4**	**982.4**	-

Source: Bureau of Meteorology (2021)

4. Survey methodology

4.1 Rehabilitation monitoring

Monitoring locations - Previous studies have seen the establishment of four monitoring quadrats located within rehabilitated pastures, two transects within treed rehabilitation areas and 3 transects across areas of African lovegrass infestation. Additional transects exist as analogue sites in grazed pasture and an undisturbed naturally vegetated area of Pine Dale Mine to provide benchmarks against which the pasture and treed rehabilitation areas of Enhance Place Mine are assessed. Monitoring locations are shown in Figure 1.

Photopoint monitoring - Coordinates for each quadrat, transect and analogue site are provided in Appendix A. Each quadrat and transect area contains previously established photo monitoring points. Photos were taken from the northwest corner of each quadrat and along transects within treed rehabilitation areas. Photos taken from these points enable a visual comparison to photos from previous surveys and are provided in Appendix D.

4.2 Erosion and sedimentation

Erosion and sedimentation - Evidence of erosion and sedimentation within each quadrat and in the vicinity of each transect has been determined in accordance with *Best Practice Erosion and Sediment Control* (IECA 2006).

Drainage impediments - Drainage structures within the rehabilitation areas were identified in the field and assessed for visible impediments and evidence of erosion and sedimentation.

Cracking soils - Soil surfaces within the rehabilitation areas were observed for surface cracking. Soil samples to a depth of 20 cm were taken randomly from ten points within each pasture transect area. Soil structure, ped shape and ped surface characteristics were examined to determine whether soils are prone to cracking. Soil physical characteristics are assessed in accordance with the *Australian Soil and Land Survey Field Handbook* (CSIRO, 2009).

4.3 Vegetation assessment

Pasture rehabilitation areas – Approximately 20 ha of the study area was sown with Cox's River seed mix prior to 2013 at the following rates:

- 40% Fescue *(Festuca spp.)*
- 25% Cocksfoot *(Dactylis glomerata)*
- 20% Subterranean clover *(Trifolium subterranean)*
- 6% Perennial rye grass *(Lolium perene)*
- 5% White clover *(Trifolium repens)*
- 4% Phalaris *(Phalaris aquatica)*

The proportion of perennial grasses and annual legumes currently in evidence at pasture quadrats and transects has been recorded and compared with the proportion at which these species were initially sown.

Tree rehabilitation areas – Approximately 6 ha of the study area was revegetated with trees, shrubs and herbaceous groundcover prior to 2013. Vegetation health, natural regeneration, structure and species composition have been determined in accordance with the *Australian Soil and Land Survey Field Handbook* (CSIRO 2009).

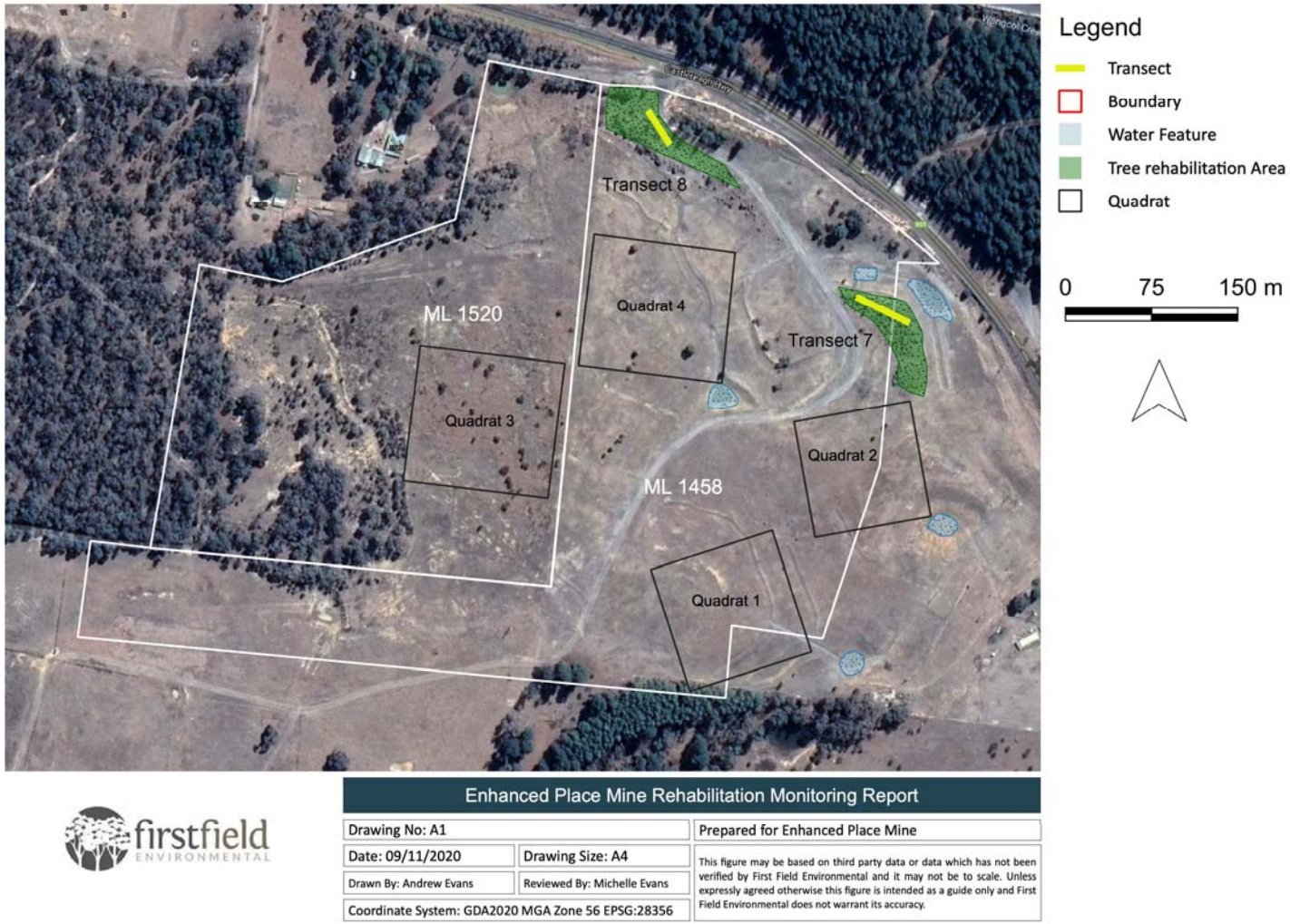

Figure 1 Monitoring locationsPest animal and weed survey

Pest animal presence - Evidence of feral animal presence across the rehabilitation areas has been determined through scat and trail identification.

Priority weeds - The location and extent of priority weeds as declared for the Central Tablelands Region (Central Tablelands Local Land Services, 2019) have been recorded. Target weed species, particularly African lovegrass were identified in accordance with field guides and botanical keys.

4.4 Rural land capability assessment

Pasture rehabilitation areas have been assessed in accordance with the *Land and Soil Capability Assessment* (OEH 2007) and against *Pastures for Horses* (NSW DPI 2007). The physical effects of current grazing practices are contrasted with optimum horse stocking rates.

4.5 Stocking rates

Appropriate stocking rates have been determined in accordance with the carrying capacity of current and improved pasture conditions. Optimum stocking rates are provided in Appendix E of the *Stock Management Plan* (First Field Environmental 2016).

4.6 Access and fencing

Establishment of gates and fencing was completed prior to 2013. The condition of internal trails, fences and gates has been recorded.

5. Field survey results

Field survey was conducted on 29 November 2021 by a qualified ecologist. The survey revisited the four quadrats and two transects representing rehabilitated pasture and treed areas. Pasture and treed analogue sites located at Pine Dale Mine were not visited due to the presence of livestock in the pasture and vehicular access difficulties. Quadrat and transect data is instead compared to analogue site data from previous years.

5.1 Erosion and sedimentation

There are no significant erosion features that compromise landform stability or public safety within the rehabilitation areas. The landform is considered stable and is suitable for grazing. No highwalls or adits to underground mine workings are exposed.

Pasture rehabilitation areas - Visual assessment found evidence of minor surface erosion however overall combined bare surfaces do not exceed 20 m^2 per hectare in any of the three fenced paddocks.

Treed rehabilitation areas – Exposed soils within the treed rehabilitation areas have been subject to minor rill erosion.

Analogue sites – No active erosion was evident at the pasture analogue site (Pine Dale Mine) in 2020. The 2020 fire in the treed analogue site (Pine Dale Mine) resulted in patches of bare ground. Minor surface erosion related to wind and surface water flow was evident in 2020.

Surface cracking – No soil cracking was observed on the property.

Landform – The study area was filled and contoured prior to 2013 and the shape and form of the landscape is visually similar to the adjacent landscape.

Ponding of water – Sediment ponds and contour drains were established prior to 2013 and generally remain in good operational condition.

No impediments were observed within drainage structures and there is no evidence of erosion or sedimentation associated with drainage structures. There is little evidence of surface water flow occurring outside of established contour drainage lines.

5.2 Vegetation assessment

Flora species identified within the quadrats and transects are listed in Appendix C.

Species composition at pasture rehabilitation areas – Pasture rehabilitation areas are established with a mix of perennial grasses and annual legumes and are representative of species composition recorded at the analogue pasture site in previous years.

Figure 2 Pasture composition at the pasture analogue site in 2020

Figure 3 Typical pasture composition at Quadrat 1

Total living cover at pasture rehabilitation areas – Percentage and type of groundcover is recorded in Appendix A.

Total living cover in all quadrats has increased from 90% to more than 90% since 2020. The percentage of annual living cover appears to have increased from 10%-30% in quadrats 1, 2 and 3 and from 15%-30% in quadrat 4.

The area of bare surface has generally decreased at each quadrat.

Photopoint monitoring provides a comparison of cover between 2014 and 2021 (see Appendix D).

Species composition at treed rehabilitation areas – Treed rehabilitation areas are established in accordance with an approved species mix representing local native species.

The areas of transects 7 and 8 support scattered juvenile trees and sparse mixed native shrub layers. The ground layers are dominated by mixed exotic grasses and herbs.

Canopy cover at treed rehabilitation areas - Canopy cover is developing in treed rehabilitation areas. A sparse mid-storey of isolated juvenile trees to 5 m height and shrubs to 1.5 m height exist over a sparse, low, shrubby understorey.

Groundcover at treed rehabilitation areas – Groundcover is a sparse mix of broadleaf herbs and grasses and remains at 90% coverage across both transects.

Difficulties in vehicle access meant that the treed analogue site at Pine Dale Mine was not accessible during the 2021 survey.

In 2019 the treed analogue site was characterised by a canopy to 14 m height with 20% canopy cover over a sparse shrubby mid-storey to 3 m height and isolated shrubs to 1.5 m height in the understorey. Groundcover consisted of grasses and herbs with a cover of >95% (Figure 4).

Figure 5 Vegetation structure of treed analogue site (Pine Dale Mine) 2020 shows the vegetation structure at the treed analogue site in 2020. Many of the standing trees were showing evidence of new growth however the presence of epicormic growth is not an indicator of long-term survival of the tree. Recently fallen timber was contributing to ground cover. The trees provided no appreciable canopy cover. The shrub layer was very sparse. Ground cover was actively growing and regeneration of woody plants was occurring across the site.

Figure 4 Vegetation structure of treed analogue site (Transect 7) in 2019

Figure 5 Vegetation structure of treed analogue site (Pine Dale Mine) 2020

Vegetation health at treed rehabilitation areas – Native forest indicator species are those that occur both in treed rehabilitation areas and the treed analogue site and provide an opportunity for comparison of growth between natural and rehabilitation conditions. Indicator species include native trees, shrubs and groundcovers.

Establishment of vegetation on treed rehabilitation areas is good and >75% of forest indicator plants were observed to be healthy and growing.

It is not yet possible to determine whether native forest indicator tree species on treed rehabilitation areas are within the height and girth measurements of trees on the treed analogue site. While there is evidence of recruitment on the treed analogue site it is not possible to determine the whether the age of juvenile trees is comparable to those establishing on the treed rehabilitation areas.

5.3 Feral animals and weeds

The presence or evidence of pests and weeds within each quadrat and in the vicinity of each transect is recorded in Appendix A.

Pest animal presence – Rabbit scats were observed across the property. No holes, burrows or dens were observed. Rabbit numbers are considered low and do not require population reduction measures.

Priority and targeted weed species – Priority weeds observed during field survey are listed in Table 3.

Priority weed species – The presence of African lovegrass was noted at all locations and occurred across less than 10% of the pasture area. These outbreaks have been subjected to ongoing chemical control.

Table 3 Feral animal and priority weed presence

Common name *Species name*	Location	Treatment
European rabbit *Oryctolagus cuniculus*	All locations	Landholders are obliged to control populations on their land
African lovegrass *Eragrostis curvula*	All locations	All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.
St John's Wort *Hypericum perforatum*	Quadrats 1, 2 and 4	Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. The plant should not be bought, sold, grown, carried or released into the environment. Protect grazing land that is free of St. John's Wort.
Blackberry *Rubus fruticosus* sp. aggregate	Quadrats 1, 2 and 3	Must not be imported into the state, sold, bartered, exchanged or offered for sale.
Serrated Tussock *Nasella trichotoma*	Quadrat 3 (south-eastern corner of quadrat)	Must not be imported into the state, sold, bartered, exchanged or offered for sale.

5.4 Rural land capability assessment

Pasture rehabilitation areas are assessed as being better than Class VI Land and Soil Capability (and suitable for grazing). The limiting factors for land use are generally related to wind erosion hazard (Table 4).

Table 4 Rural land capability assessment of pasture areas

Class	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Water erosion hazard class	3 3 - <10% slope	3 3 - <10% slope	2 1 - 3% slope	3 3 - <10% slope
Wind erosion hazard class	5 Moderate wind erodibility class of surface soil, high winds erosive power, high exposure to wind, average annual rainfall >500 mm			
Soil structural decline class	4 Fragile light textured soil - hardsetting			
Soil acidification hazard class	4 Very low texture /buffering capacity, pH 6.7 – 7.5 ($CaCl_2$)			
Salinity hazard class	1 Moderate to high recharge potential, low discharge potential, low salt store			
Waterlogging hazard class	2 0 – 0.25 months typical waterlogging duration, moderately well drained soils			

Class	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Shallow soils and rockiness hazard class	1 Nil rocky outcrop, soil depth >100 cm			
Mass movement hazard class	1 No mass movement present			

5.5 Stocking rates

Paddocks 1, 2, and 3 are available as pasture. At the time of survey no stock were present and anecdotal evidence suggests that no grazing had occurred in the two months preceding survey.

Table 5 Past and current stocking rates

Date	Cows	Full-size horses	Miniature horses	Miniature ponies	Alpacas	Donkeys	Sheep
September 2015	5	3	8	-	1	-	-
December 2015*	5	2	8	7	1	-	-
September 2016	1	3	-	5	1	-	-
March 2017	1	2	-	16	1	-	-
August 2017	1	5	-	14	1	-	-
September 2018	1	1	2	8	-	-	-
September 2019	1	1	4	10	-	3	3
September 2020	-	1	3	11	-	4	9
November 2021	-	-	-	-	-	-	-

* A number of these animals had been contained outside of the rehabilitated pasture area, either in stables or in the home paddock.

5.6 Access and fencing

Site access trails have been constructed, gates have been installed and fences have been erected.

6. Rehabilitation status

The status of performance indicators and completion criteria are summarised in Table 6.

Table 6 Status of completion criteria

Objective	Performance indicator	Completion criteria	Progress
Rehabilitation area - Pasture			
Stable and safe landform	Erosion	Stable landform, suitable for grazing and horses	**Satisfactory – Continue to monitor**
		No exposed highwalls and adits to underground mine workings	**Complete**
Minimal cracking of soils from soil settling	Surface cracks	Limited areas of high concentration with cracking due to soil settling	**Satisfactory – Continue to monitor**
Final landform is commensurate with surrounding landscape	Landform	Shape and form is visually similar to adjacent land	**Complete**
Landscape is free draining	Ponding of water	Sediment ponds constructed	**Complete**
		Contour drains constructed	**Complete**
		Relief ensures water flows as designed and directs water off site	**Complete**
Site is accessible and stock management controls in place	Access tracks, fences & gates	Site access tracks constructed	**Complete**
		Fences erected	**Complete**
		Gates installed	**Complete**
Pasture areas can support cattle and horse grazing	Rural Land Capability	Pasture Rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing)	**Satisfactory – Continue to monitor**
	Cattle and horses	Area has successfully supported stock and/or horses for >12 months at modest rates	**Ongoing – re-assess in 12 months**

Pasture rehabilitation areas will be established comparable to surrounding undisturbed pasture lands	Species composition	Establishment of pasture comprising approximately 70% perennial grass and 20% annual legume, representative of species at analogue sites.	**Satisfactory – Continue to monitor**
	Weed presence	Weeds including African Lovegrass to comprise <10% of the pasture sward	**Satisfactory – Continue to monitor**
Soil profile of pasture areas developing appropriately for the intended post mining land use	Ground cover	Ground cover (vegetation, leaf litter, mulch) >70%	**Satisfactory – Continue to monitor**
Rehabilitation area - Woodland			
Stable and safe landform	Erosion	Stable landform, suitable for grazing and horses	**Satisfactory – Continue to monitor**
		No exposed highwalls and adits to underground mine workings	**Complete**
Minimal cracking of soils from soil settling	Surface cracks	Limited areas of high concentration with cracking due to soil settling	**Complete**
Final landform is commensurate with surrounding landscape	Landform	Shape and form is visually similar to adjacent land	**Complete**
Landscape is free draining	Ponding of water	Sediment ponds constructed	**Complete**
		Contour drains constructed	**Complete**
		Relief ensures water flows as designed and directs water off site	**Complete**
Site is accessible and stock management controls in place	Access tracks, fences & gates	Site access tracks constructed	**Complete**
		Fences erected	**Complete**
		Gates installed	**Complete**
Tree rehabilitation areas will be established and	Species composition	Vegetation is established in accordance with the approved species mix	**Complete**

compatible with surrounding treed vegetation	Vegetation health	More than 75% of planted species are assessed to be healthy and growing.	**Satisfactory – Continue to monitor**
	Vegetation distribution	Native trees planted in designated areas as generally shown in MOP Plan 3.	**Complete**
	Ground cover	Ground cover (vegetation, leaf litter, mulch) >70% at year 5.	**Satisfactory – Continue to monitor**
Reduced visual impact	Visual amenity	Completion of bulk earthworks to create final landform	**Complete**
		Completion of seeding and tree plantings	**Complete**

7. Key findings

- Rainfall preceding the November survey was higher than the mean annual rainfall for the area and free water was observed on the surface of internal trails and in isolated patches across the pastures.
- Grazing of pastures had not occurred in the two months prior to survey and increases in % annual cover and total living cover have occurred across all quadrats.
- Landform stability and concentration of soil cracking is satisfactory and is to continue to be monitored to ensure that the criteria remain satisfactorily met prior to completion of rehabilitation requirements.
- Rural land capability is satisfactory and is currently considered satisfactory for supporting stock /horses at modest rates. Previous grazing had occurred within the past 12 months in excess of pasture capability. Pasture capability is to be re-assessed once 12 months has passed.
- Species composition and ground cover in pastures are currently satisfactory and are to be monitored to ensure that the criteria remain satisfactorily met prior to completion of rehabilitation requirements.
- African Lovegrass is present. The extent of establishment is to be monitored and the species is to be controlled to within less than 10% of the pasture sward.
- Vegetation health and ground cover in treed areas are satisfactory and are to continue to be monitored to ensure that the criteria remain satisfactorily met prior to completion of rehabilitation requirements.
- Annual living cover and total living cover increased at transects 7 and 8.
- Isolated, juvenile blackberry plants are present in quadrats 1, 2 and 3.
- St John's Wort was observed in quadrats 1, 2 and 4.
- Serrated Tussock was observed in the south-eastern corner of quadrat 3.
- The pasture analogue site was not accessible during the 2021 survey due to the presence of livestock. 2020 survey data was utilised as a comparison to 2021 quadrat conditions.
- The treed analogue area located near Pine Dale Mine was affected by bushfire in 2020. The treed analogue area was not accessible during the 2021 survey due to hazardous conditions. 2019 survey data was utilised as a comparison to 2021 treed rehabilitation conditions.

8. Recommendations

Continue to monitor the site for the term of the *Enhance Place Mine Care and Maintenance Mining Operations Plan* (Enhance Place Pty Ltd 2016).

- Continue to spot-spray outbreaks of African Lovegrass;
- Control outbreaks of Blackberry in quadrats 1, 2 and 3;
- Control St John's Wort in quadrats 1, 2 and 4;
- Control Serrated Tussock in the south-eastern corner of quadrat 3;
- Continue to monitor performance indicators; and
- Re-assess pasture capability and stocking rates in 2022.

9. References

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Appendix A
Survey data 2021

Pasture analogue site (Pine Dale Mine) 2020	
Easting	Northing
228300	6304880
228317	6304925
Landform and soils	
Slope	1 - <3% slope inclining to the northwest.
Erosion	Not observed.
Cracking soils	Not observed.
Surface drainage impediments	No significant drainage impediments.
Vegetation	
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.
Species richness	>30 herb and 15 grass species identified.
Cover classification	
Total living cover	90%
Annual living cover	20%
Perennial living cover	70%
Litter cover	-
Bare surface	10%

Quadrat 1 Pasture rehabilitation area										
Corner peg	Easting	Northing								
Northwest	227099	6303904								
Southwest	227099	6303904								
Southeast	227199	6303904								
Northeast	227199	6303904								
Landform and soils										
Slope	Upper slope gently inclining (4-10%) to the southwest.									
Erosion	Minor wind erosion present on exposed soils.									
Cracking soils	Not observed.									
Surface drainage impediments	No significant drainage impediments. No surface water ponding observed.									
Vegetation										
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.									
Species diversity	44 species identified, mostly exotics.									
Cover classification	% cover at each observation									
	September 2011	November 2012	April 2014	September 2015	September 2016	August 2017	September 2018	September 2019	September 2020	November 2021
Total living cover	90%	94%	90%	90%	90%	90%	90%	85%	90%	>90%
Annual living cover	22.75%	14.5%	-	-	20%	20%	20%	10%	10%	30%
Perennial living cover	67.25%	79.5%	-	70%	70%	70%	70%	75%	80%	60%
Litter cover	7%	6%	10%	-	-	-	-	-	-	-

Bare surface	3%	-	-	10%	10%	<10%	<10%	<15%	<10%	<10%
Weed presence	% cover 2014	% cover 2015	% cover 2016	% cover 2017	% cover 2018	% cover 2019	% cover 2020	% cover 2021		
Eragrostis curvula	25%	25%	<10%	<10%	<10%	<10%	<10%	<10%		
Hypericum perforatum	Present	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Present		
Rubus fruiticosus sp. *agg.*	Present	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Present		

Quadrat 2 Pasture rehabilitation area										
Corner peg	Easting	Northing								
Northwest	227264	6303966								
Southwest	227264	6303966								
Southeast	227264	6303966								
Northeast	227264	6303966								
Landform and soils										
Slope	Upper slope gently inclining (4-10%) to the southwest.									
Erosion	Minor wind erosion present on exposed soils.									
Cracking soils	Not observed.									
Surface drainage impediments	No significant drainage impediments. No surface water ponding observed.									
Vegetation										
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.									
Species diversity	44 species identified, mostly exotics.									
Cover classification	% cover at each observation									
	September 2011	November 2012	April 2014	September 2015	September 2016	August 2017	September 2018	September 2019	September 2020	November 2021
Total living cover	90%	94%	90%	90%	90%	90%	90%	85%	90%	>90%
Annual living cover	22.75%	14.5%	-	-	20%	20%	20%	10%	10%	30%
Perennial living cover	67.25%	79.5%	-	70%	70%	70%	70%	75%	80%	60%
Litter cover	7%	6%	10%	-	-	-	-	-	-	-

Bare surface	3%	-	-	10%	10%	<10%	<15%	<10%	<10%
Weed presence	% cover 2014	% cover 2015	% cover 2016	% cover 2017	% cover 2018	% cover 2019	% cover 2020	% cover 2021	
Eragrostis curvula	25%	25%	<10%	<10%	<10%	<10%	<10%	<10%	
Hypericum perforatum	Present	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Present	
Rubus fruiticosus sp. *agg.*	Present	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Present	

Quadrat 3 Pasture rehabilitation area										
Corner peg	Easting	Northing								
Northwest	226973	6304068								
Southwest	226960	6303971								
Southeast	227060	6303962								
Northeast	227083	6304052								
Landform and soils										
Slope	Relatively flat.									
Erosion	Minor wind erosion present on exposed soils.									
Cracking soils	Not observed.									
Surface drainage impediments	No significant drainage impediments. No surface water ponding observed.									
Vegetation										
Vegetation structure	Sparse trees and shrubs. Groundcover of mixed native and exotic grasses and broadleaf herbs.									
Species diversity	3 native tree species identified. 39 groundcover species identified, mostly exotics.									
Cover classification	% cover at each observation									
	September 2011	November 2012	April 2014	September 2015	September 2016	August 2017	September 2018	September 2019	September 2020	November 2021
Total living cover	90%	94%	90%	80%	75%	90%	85%	85%	90%	>90%
Annual living cover	22.75%	14.5%	-	20%	10%	20%	20%	15%	10%	30%
Perennial living cover	67.25%	79.5%	-	60%	60%	70%	65%	70%	80%	60%
Litter cover	7%	6%	10%	-	5%	-	-	-	-	-

Bare surface	3%	-	-	20%	25%	<10%	15%	,<15%	<10%	<10%
Weed presence	% cover 2014	% cover 2015	% cover 2016	% cover 2017	% cover 2018	% cover 2019	% cover 2020	% cover 2021		
Eragrostis curvula	25%	50% (dead)	<10%	<10%	<10%	<10%	<10%	<10%		
Hypericum perforatum	Present	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed		
Nassella trichotoma	-	-	-	-	-	-	-	Present		
Rubus fruiticosus sp. *aggregate*	Present	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Present		

Quadrat 4 Pasture rehabilitation area										
Corner peg	Easting	Northing								
Northwest	227102	6304154								
Southwest	227088	6304054								
Southeast	227188	6304054								
Northeast	227202	6304154								
Landform and soils										
Slope	Upper slope gently inclining (4-10%) to the southwest.									
Erosion	Minor wind erosion present on exposed soils.									
Cracking soils	Not observed.									
Surface drainage impediments	No significant drainage impediments. No surface water ponding observed.									
Vegetation										
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.									
Species diversity	44 herbs and grasses identified, mostly exotics.									
Cover classification	% cover at each observation									
	September 2011	November 2012	April 2014	September 2015	September 2016	August 2017	September 2018	September 2019	September 2020	November 2021
Total living cover	90%	94%	90%	90%	90%	90%	90%	85%	90%	>90%
Annual living cover	22.75%	14.5%	-	30%	30%	20%	20%	10%	15%	30%
Perennial living cover	67.25%	79.5%	-	60%	60%	80%	80%	75%	75%	60%
Litter cover	7%	6%	10%	-	-	-	-	-	-	-

Bare surface	3%	-	-	10%	10%	<10%	<15%	<10%	<10%
Weed presence	% cover 2014	% cover 2015	% cover 2016	% cover 2017	% cover 2018	% cover 2019	% cover 2020	% cover 2021	
Eragrostis curvula	75%	10-20% (dead)	<10%	<10%	<10%	<10%	<10%	<10%	
Hypericum perforatum	Present	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Present	
Rubus fruiticosus sp. *agg.*	Present	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	

Transect 7 Treed rehabilitation area										
Easting	Northing									
227325	6304082									
227362	6304060									
Landform and soils										
Slope	Transect located along contour of mid slope, moderately inclining (~30%) to the southwest.									
Erosion	Minor wind erosion present on exposed soils.									
Cracking soils	Not observed.									
Surface drainage impediments	No significant drainage impediments.									
Vegetation										
Vegetation structure	• 10% tree cover to 5 m height • 30% shrub cover, mixed juvenile native trees to 1.5 m height • 50% groundcover dominated by mixed native and exotic broadleaf herbs and grasses									
Species diversity	• 4 native tree species • 3 native and exotic shrub species • Groundcover of 28 native and exotic broadleaf and grass species									
Cover classification	% cover at each observation									
	September 2011	November 2012	April 2014	September 2015	September 2016	August 2017	September 2018	September 2019	September 2020	November 2021
Total living cover	90%	94%	90%	90%	90%	90%	90%	80%	80%	90%
Annual living cover	22.75%	14.5%	-	20%	15%	20%	20%	20%	10%	25%
Perennial living cover	67.25%	79.5%	-	70%	70%	70%	70%	60%	70%	75%

Litter cover	7%	6%	10%	5%	5%	5%	10%	5%	5%	10%
Bare surface	3%	-	-	5%	5%	<10%	<10%	<15%	15%	<10%
Weed presence	% cover 2014	% cover 2015	% cover 2016	% cover 2017	% cover 2018	% cover 2019	% cover 2020	% cover 2021		
Eragrostis curvula	Present	<5%	<5%	5%	<5%	<5%	<10%	<5%		
Raphanus raphanistrum	Not observed	Not observed	Present	Not observed	Not observed	Not observed	Not observed	Not observed		

Transect 8 Treed rehabilitation area								
Easting	Northing							
227150	6304234							
227192	6304205							
Landform and soils								
Slope	Transect located along contour of mid slope, moderately inclining (~30%) to the southwest.							
Erosion	Minor wind erosion present on exposed soils.							
Cracking soils	Not observed.							
Surface drainage impediments	No significant drainage impediments.							
Vegetation								
Vegetation structure	• 10% tree cover to 5 m height • 50% shrub cover, mixed juvenile native trees to 1.5 m height • 30% groundcover dominated by mixed native and exotic broadleaf herbs and grasses							
Species diversity	• 4 native tree species • 1 native shrub species • Groundcover of 28 native and exotic broadleaf and grass species							
Cover classification	% cover at each observation							
	April 2014	September 2015	September 2016	August 2017	September 2018	September 2019	September 2020	November 2021
Total living cover	90%	60%	60%	90%	90%	80%	90%	90%
Annual living cover	-	-	15%	20%	20%	20%	10%	25%
Perennial living cover	-	60%	35%	70%	70%	60%	80%	75%
Litter cover	10%	-	10%	5%	5%	5%	10%	10%

Bare surface	-	40%	40%	<10%	<10%	<15%	<10%	<10%
Weed presence	% cover 2014	% cover 2015	% cover 2016	% cover 2017	% cover 2018	% cover 2019	% cover 2020	% cover 2021
Eragrostis curvula	Present	<5%	<5%	<5%	<5%	<5%	<10%	<5%
Raphanus raphanistrum	Not observed	Not observed	Present	Not observed	Not observed	Not observed	Not observed	Not observed

Appendix B
Vegetation assessment of treed areas

Treed analogue site (transect 7) 2020	
Easting	Northing
226801	6305097
226838	6305039
Landform and soils	
Slope	Transect located along contour of mid slope gently inclining to the north.
Erosion	Minor wind and rill erosion observed on exposed soils.
Cracking soils	Not observed.
Surface drainage impediments	No drainage impediments.
Vegetation	
Vegetation structure	Eucalyptus dominated canopy to 14 m high. No appreciable canopy cover due to recent fire. Very sparse shrub layer to 3 m height. 70% groundcover to 0.5 m height, dominated by native grasses with mixed native herbs.
Species richness	More than 10 tree species, dominated by *Eucalyptus* spp. Shrub layer of >14 native species. Diverse groundcover dominated by *Poa* spp. with mixed native herbs.
Cover classification	
Total living cover	70%
Annual living cover	10%
Perennial living cover	60%
Litter cover	20%
Bare surface	10%
Target weed presence	
None observed.	

Vegetation assessment treed areas 2021

Transect	Treed rehabilitation area (transect 7)	Treed rehabilitation area (transect 8)	Treed analogue site Pine Dale Mine (transect 7) 2020
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	<10	<10	>25
Trees	>5 species, ~5 m height. Canopy cover is establishing as trees near maturity.	>5 species, ~5 m height. Canopy cover is establishing as trees near maturity.	>5 species, 12-14 m height. No significant canopy cover due to 2020 fire.
Understorey	Sparse. >5 species identified.	Sparse. <5 species identified.	Sparse. <10 species, 1-3 m height, No significant cover due to 2020 fire.
Groundcover	Dominated by exotic broadleaf and grass species. 90% cover.	Dominated by exotic broadleaf and grass species. 90% cover.	70% cover. Mixed native herbs and grasses.
Non-native species	>30	>30	<5
Recruitment	Not observed	Not observed	Regeneration observed.
Organic litter	<10 mm depth. Patchy.	<10 mm depth. Patchy.	Thin, sparse.
Logs	Present	Present	Sparse fallen timber from burned trees.

Vegetation assessment treed areas 2020

Transect	Treed rehabilitation area (transect 7)	Treed rehabilitation area (transect 8)	Treed analogue site Pine Dale Mine (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>35	>30	>25
Trees	5 species, ~5 m height. Canopy cover is establishing as trees near maturity.	5 species, ~5 m height. Canopy cover is establishing as trees near maturity.	>5 species, 12-14 m height. No significant canopy cover not assessable due to recent fire.
Understorey	>5 species identified.	Sparse. <5 species identified.	Sparse. <10 species, 1-3 m height, No significant cover due to recent fire.
Groundcover	Dominated by exotic broadleaf and grass species. 80% cover.	Dominated by exotic broadleaf and grass species. 90% cover.	70% cover. Mixed native herbs and grasses.
Non-native species	>30	>30	<5
Recruitment	Not observed	Not observed	Regeneration observed.
Organic litter	<10 mm depth. Patchy.	<10 mm depth. Patchy.	Thin, sparse.
Logs	Present	Present	Sparse fallen timber from burned trees.

Vegetation assessment treed areas 2019

Transect	Treed rehabilitation area (transect 7)	Treed rehabilitation area (transect 8)	Treed analogue site Pine Dale Mine (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	28	27	>25
Trees	5	5	>10 species, 12-14 m height. 20% canopy cover.
Understorey	3	1	>14 species, 1-3 m height, 10% cover
Groundcover	Dominated by native and exotic broadleaf and grass species. 80% cover.	Dominated by native and exotic broadleaf and grass species. 80% cover.	Dominated by *Poa* spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	>20	>20	<5
Recruitment	Not observed	Not observed	Observed.
Organic litter	<10 mm depth. Patchy.	<10 mm depth. Patchy.	Well-developed to 2 cm depth.
Logs	Present	Present	>10 fallen logs of >20 cm diameter present along transect.

Vegetation assessment treed areas 2018

Transect	Treed rehabilitation area (transect 7)	Treed rehabilitation area (transect 8)	Treed analogue site Pine Dale Mine (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>20	>10	>50
Trees	>6	>5	>10 species, 12-14 m height. 20% canopy cover.
Understorey	>5	<5	>14 species, 1-3 m height, 10% cover
Groundcover	Dominated by native and exotic broadleaf and grass species. 90% cover.	Dominated by native and exotic broadleaf and grass species. 90% cover.	Dominated by *Poa* spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	>20	>20	<5
Recruitment	Not observed	Not observed	Observed.
Organic litter	10%	5%	Well-developed to 2 cm depth.
Logs	Present	Present	>10 fallen logs of >20 cm diameter present along transect.

Vegetation assessment treed areas 2017

Transect	Treed rehabilitation area (transect 7)	Treed rehabilitation area (transect 8)	Treed analogue site Pine Dale Mine (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>7	>6	>50
Trees	>5	>5	>5 species, 12-14 m height. 40% canopy cover.
Understorey	>5	<5	>14 species, 1-2 m height, 10% cover
Groundcover	Dominated by native and exotic broadleaf and grass species. 80% cover.	Dominated by native and exotic broadleaf and grass species. 70% cover.	Dominated by *Poa* spp. >90% cover. Mixed herbs and grasses also present.
Non-native species	>20	>20	<10
Recruitment	Not observed	Not observed	Present
Organic litter	5%	5%	Well-developed to 2 cm depth.
Logs	Present	Present	>10 fallen logs of >20 cm diameter present along transect.

Vegetation assessment treed areas 2016

Transect	Treed rehabilitation area (transect 7)	Treed rehabilitation area (transect 8)	Treed analogue site Pine Dale Mine (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	11	8	>50
Trees	6	5	>5 species, 12-14 m height. 40% canopy cover.
Understorey	<5	<5	>7 species, 1-2 m height, 10% cover
Groundcover	Dominated by native and exotic broadleaf and grass species. 90% cover.	Dominated by native and exotic broadleaf and grass species. 60% cover.	Dominated by *Poa* spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	33	34	<10
Recruitment	Not observed	Not observed	Present
Organic litter	5%	10%	Well-developed to 2 cm depth.
Logs	Present	Present	8 fallen logs of >20 cm diameter present along transect.

Vegetation assessment treed areas 2015

Transect	Treed rehabilitation area (transect 7)	Treed rehabilitation area (transect 8)	Treed analogue site Pine Dale Mine (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	45	40	>50
Trees	4	3	>5 species, 12-14 m height. 40% canopy cover.
Understorey	8	8	>7 species, 1-2 m height, 10% cover
Groundcover	Dominated by native and exotic broadleaf and grass species. 90% cover.	Dominated by native and exotic broadleaf and grass species. 60% cover.	Dominated by *Poa* spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	<10	<10	<10
Recruitment	Not observed	Not observed	Present
Organic litter	5%	Not observed	Well-developed to 2 cm depth.
Logs	Present	Present	8 fallen logs of >20 cm diameter present along transect.

Vegetation assessment treed areas 2014

Transect	Treed rehabilitation area (transect 7)	Treed rehabilitation area (transect 8)	Treed analogue site Pine Dale Mine (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	45	45	>50
Trees	4	3	>5 species, 12-14 m height. 40% canopy cover.
Understorey	8	8	>7 species, 1.5 - 3 m height, 35% cover
Groundcover	95%	90%	70% cover. Dominated by *Poa* spp. with mixed native herbs.
Non-native species	<10	<10	<10
Recruitment	Not observed	Not observed	Present
Organic litter	5%	Not observed	Well-developed to >2cm depth.
Logs	Present	Present	8 fallen logs of >20 cm diameter present along transect.

Appendix C
Species list

Scientific name	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Transect 7	Transect 8	Treed analogue site (Pine Dale Mine transect 7)
Acacia dealbata subsp. *dealbata*			✓		✓	✓	✓
Acacia rubida					✓	✓	✓
Acacia sp.			✓		✓	✓	✓
Acacia ulcifolia							✓
Acaena novae-hollandiae			✓				✓
Agrostis sp.						✓	
Brassica spp.	✓	✓	✓	✓	✓	✓	
Bromus catharticus	✓	✓	✓	✓			
Bromus molliformis	✓	✓	✓	✓			
Bursaria spinosa subsp. *lasiophylla*							✓
Cassinia laevis			✓		✓	✓	
Chloris truncata	✓	✓	✓	✓			
Cirsium vulgare	✓	✓	✓	✓			
Conyza bonariensis	✓	✓	✓	✓	✓	✓	
Cymbonotus sp.					✓	✓	
Cyperus eragrostis	✓	✓	✓	✓			
Dactylis glomerata	✓	✓	✓	✓	✓	✓	
Eragrostis curvula	✓	✓	✓	✓	✓	✓	
Erodium sp.	✓	✓	✓	✓			
Eucalyptus bensonii							✓
Eucalyptus dalrympleana subsp. *dalrympleana*							✓
Eucalyptus dives							✓
Eucalyptus macrorhyncha subsp. *cannonii*							✓
Eucalyptus mannifera subsp. *mannifera*							✓

Scientific name	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Transect 7	Transect 8	Treed analogue site (Pine Dale Mine transect 7)
Eucalyptus radiata subsp. *radiata*							✓
Eucalyptus rubida subsp. *rubida*							✓
Eucalyptus sp.			✓		✓	✓	✓
Euphorbia sp.	✓	✓		✓	✓	✓	
Exocarpos cuppressiformis							✓
Festuca sp.	✓	✓	✓	✓	✓	✓	
Gamochaeta sp.	✓	✓	✓	✓	✓	✓	
Geranium mole var. *molle*	✓	✓	✓	✓	✓	✓	
Gnaphalium sphaericum	✓	✓	✓	✓	✓	✓	
Hypericum perforatum	✓	✓		✓			
Hypochaeris radicata	✓	✓	✓	✓	✓	✓	
Juncus spp.			✓	✓			
Lepidium bonariense	✓	✓	✓	✓	✓	✓	
Leucopogon sp.							✓
Lissanthe strigosa subsp. *subulata*							✓
Lolium perenne	✓	✓		✓	✓	✓	
Lysimachia arvensis							✓
Marruboum vulgare							✓
Malva neglecta	✓	✓	✓	✓	✓	✓	
Malva sp.	✓	✓	✓	✓	✓	✓	
Medicago sp.	✓	✓		✓	✓	✓	
Modiola carolina	✓	✓	✓	✓			
Nasella trichtoma			✓				
Oxalis corniculata	✓	✓	✓	✓	✓	✓	
Oxalis sp.	✓	✓	✓	✓			

Scientific name	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Transect 7	Transect 8	Treed analogue site (Pine Dale Mine transect 7)
Paspalum sp.	✓	✓	✓	✓	✓	✓	
Pattersonia sp.	✓	✓	✓	✓			
Persoonia laurina					✓		✓
Persoonia mollis							✓
Persoonia oblongata					✓		
Persoonia sp.							✓
Phalaris sp.	✓	✓	✓	✓	✓	✓	
Pinus sp.					✓	✓	
Plantago lanceolata	✓	✓	✓	✓	✓	✓	
Poa annua	✓	✓	✓	✓	✓	✓	
Poa labillardierei							✓
Poa spp.	✓	✓	✓	✓	✓	✓	✓
Portulaca oleracea	✓	✓	✓	✓	✓	✓	
Rorippa sp.	✓	✓		✓			
Rubus fruticosus sp. aggregate	✓	✓	✓				
Rumex acetosella	✓	✓		✓	✓	✓	
Secale sp.	✓	✓	✓	✓			
Solanum sp.	✓	✓		✓	✓		
Sonchus asper	✓	✓	✓	✓			
Stellaria media	✓	✓		✓			
Themeda australis							✓
Trifolium arvense	✓	✓		✓			
Trifolium campestre	✓	✓	✓	✓	✓	✓	
Trifolium repens	✓	✓	✓	✓	✓	✓	
Trifolium subterraneum	✓	✓	✓	✓	✓	✓	

Scientific name	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Transect 7	Transect 8	Treed analogue site (Pine Dale Mine transect 7)
Vulpia muralis	✓	✓		✓			

Appendix D
Photopoint monitoring to 2021

Quadrat 1 from southwest looking northeast 2012

Quadrat 1 from southwest looking northeast 2014

Quadrat 1 from southwest looking northeast 2015

Quadrat 1 from southwest looking northeast 2016

Quadrat 1 from southwest looking northeast 2017

Quadrat 1 from southwest looking northeast 2018

Quadrat 1 from southwest looking northeast 2019

Quadrat 1 from southwest looking northeast 2020

Quadrat 1 from southwest looking northeast 2021

Quadrat 2 from southwest looking northeast 2012

Quadrat 2 from southwest looking northeast 2014

Quadrat 2 from southwest looking northeast 2015

Quadrat 2 from southwest looking northeast 2016

Quadrat 2 from southwest looking northeast 2017

Quadrat 2 from southwest looking northeast 2018 (image taken from adjacent paddock due to presence of livestock next to the monitoring point)

Quadrat 2 from southwest looking northeast 2019

Quadrat 2 from southwest looking northeast 2020

Quadrat 2 from southwest looking northeast 2021

Quadrat 3 from southwest looking northeast 2012

Quadrat 3 from southwest looking northeast 2014

Quadrat 3 from southwest looking northeast 2015

Quadrat 3 from southwest looking northeast 2016

Quadrat 3 from southwest looking northeast 2017

Quadrat 3 from southwest looking northeast 2018

Quadrat 3 from southwest looking northeast 2019

Quadrat 3 from southwest looking northeast 2020

Quadrat 3 from southwest looking northeast 2021

Quadrat 4 from southwest looking northeast 2012

Quadrat 4 from southwest looking northeast 2014

Quadrat 4 from southwest looking northeast 2015

Quadrat 4 from southwest looking northeast 2016

Quadrat 4 from southwest looking northeast 2017

Quadrat 4 from southwest looking northeast 2018

Quadrat 4 from southwest looking northeast 2019

Quadrat 4 from southwest looking northeast 2020

Quadrat 4 from southwest looking northeast 2021

Appendix D

Rehabilitation and Completion Assessment Report (Ref [10])

ENHANCE PLACE MINE

Rehabilitation and Completion Assessment

Prepared for:

Enhance Place Pty Ltd
PO Box 202
Wallerawang NSW 2790

SLR Ref: 630.12362-R02
Version No: -v1.0
December 2018

PREPARED BY

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Enhance Place Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.12362-R02-v1.0	20 December 2018	Nathan Archer	Murray Fraser	Nathan Archer

EXECUTIVE SUMMARY

Energy Australia (EA) owns Enhance Place Pty Limited (Enhance Place) which owns and operates the Pine Dale Mine and Enhance Place Mine near Lithgow in the Western Coalfields of New South Wales (NSW).

The Enhance Place Mine has been under care and maintenance since 2005, and rehabilitation activities have been undertaken on former disturbance areas since this time. Extensive work has been undertaken to rehabilitate the degraded former mining areas back to an approved final land use which is commensurate with the surrounding area. The Enhance Place Mine has been rehabilitated back to pasture for agricultural purposes with some treed areas. Enhance Place has undertaken a strategic approach to the rehabilitation of the Enhance Place Mine, consistent with NSW Government recommendations and best practice environmental management.

In 2014, Enhance Place engaged SLR to undertake an assessment of the status of rehabilitated pasture areas to identify measures required to improve the productivity of pasture areas. The assessment identified appropriate soil amelioration and management measures would improve soil quality and rehabilitation performance over the long term. Based on the findings and recommendations of the assessment Enhance Place developed and implemented a targeted rehabilitation works and monitoring program which was incorporated into the *Enhance Place Mine Care and Maintenance Mining Operations Plan* (MOP) (Enhance Place, 2016).

In addition, Enhance Place has engaged FirstField Environmental to undertake annual rehabilitation monitoring and to make further recommendations for improving rehabilitation performance. The results of the rehabilitation monitoring have been reported in the Annual Review for the site with an ongoing works program being implemented by Enhance Place to incorporate the additional recommendations.

Rehabilitation works undertaken at the Enhance Place Mine have included:

- Construction of final landform and water management / erosion and sediment control structures;
- Reseeding of 21 ha to pasture and 1.2 ha planted with trees and shrubs;
- Amelioration of pasture and treed areas with compost, lime and gypsum in accordance with recommendations of 2014 Rehabilitation Assessment;
- Development and implementation of Stock Management Plan with landowners;
- Erosion management, soil stabilisation, surface drainage structure maintenance, pasture improvement, treed area improvement, weed management, and stock management; and
- Ongoing feral animal and weed control programs.

These works have improved soil nutrient parameters, ground cover and pasture composition within the rehabilitation areas whilst also reducing erosion and weed presence. Rehabilitation monitoring results and soil nutrient analysis have shown that the rehabilitation within all the areas has now been completed to a standard where the approved rehabilitation objectives and completion criteria specified in the MOP have been achieved. As such, Enhance Place is seeking to partially relinquish the relevant mining leases covering these areas and seeks confirmation that rehabilitation has been successfully completed to the satisfaction of the Department.

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1 Introduction

Energy Australia (EA) owns Enhance Place Pty Limited (Enhance Place) which owns and operates the Pine Dale Mine and Enhance Place Mine near Lithgow in the Western Coalfields of New South Wales (NSW).

The Enhance Place Mine has been under care and maintenance since 2005, and rehabilitation activities have been undertaken on former disturbance areas since this time. Extensive work has been undertaken to rehabilitate the degraded former mining areas back to an approved final land use which is commensurate with the surrounding area. Works undertaken at Enhance Place Mine have improved soil nutrient parameters, ground cover and pasture composition within the rehabilitation areas whilst also reducing erosion and weed presence. Rehabilitation has been completed to a standard where the completion criteria approved within the *Enhance Place Mine Care and Maintenance Mining Operations Plan* (MOP) (Enhance Place, 2016) have been met and rehabilitation is considered complete. As such Enhance Place is seeking to relinquish the mining leases covering these areas.

This report has been prepared to support an application to the Department of Planning and Environment – Resource Regulator (DPE-RR) for the relinquishment of Mining Lease (ML) 1520, ML 1458 and ML 1422. This report confirms that the rehabilitation objectives approved under the MOP have been achieved. Enhance Place therefore seek confirmation that rehabilitation has been successfully completed to the satisfaction of the Department.

The report has been prepared in accordance with the requirements of *Form ESF2: Rehabilitation Completion and/or Review of Rehabilitation Cost Estimate* (DRE 2017). It includes a description of the rehabilitation activities undertaken and evidence of meeting the approved rehabilitation objectives and completion criteria specified in the MOP.

2 Background

Enhance Place Mine was established in 1997 to recover remnant coal from areas previously open cut mined in the 1950's. Open cut mining operations ceased in June 2005 when economically feasible coal reserves were exhausted.

Enhance Place operated Enhance Place Mine from 1997 until its closure in June 2005 following the extraction of all economically feasible coal reserves. Since the cessation of mining, surface water control, rehabilitation of the landform, seeding and fertilisation, feral animal and weed control programs have been implemented. Rehabilitation and care and maintenance activities have been undertaken in accordance with the approved MOP (Enhance Place, 2016).

Rehabilitation activities have been undertaken with the intention of improving rehabilitation areas to an appropriate standard for relinquishment. Enhance Place has undertaken a strategic approach to the rehabilitation of the Enhance Place Mine, consistent with NSW Government recommendations and best practice environmental management.

In 2014, an assessment of the status of rehabilitation was undertaken by SLR to identify measures improve the productivity of pasture areas and to progress towards the desired objective of establishing sustainable grazing to a standard appropriate to relinquish the mining leases. The assessment identified appropriate soil amelioration and management measures would improve soil quality and rehabilitation performance over the long term. Additionally the assessment established soil performance indicators using site specific characteristics and baseline data from undisturbed analogue sites.

The results and recommendations of the assessment were presented in the *Soil Assessment and Recommendations for Rehabilitated Areas – Pine Dale Mine and Enhance Place Mine* (SLR, 2014). Based on the findings and recommendations of the assessment Enhance Place developed and implemented a targeted rehabilitation works and monitoring program which was incorporated into the MOP (Enhance Place, 2016).

Enhance Place has also developed and implemented a Stock Management Plan in consultation with the landowners. This has included utilisation of fenced areas to assist with time control and rotational grazing to improve pasture.

Enhance Place engaged FirstField Environmental to undertake annual monitoring of the progress of rehabilitation and to make further recommendations for improving rehabilitation performance. The results of the rehabilitation monitoring have been reported in the Annual Review for the site with an ongoing works program being implemented by Enhance Place to incorporate any additional recommendations. The findings of the 2017 Annual Rehabilitation Monitoring Report (FirstField Environmental, 2017) are included as **Appendix A** and are summarised in **Section 8.1** of this report.

A further rehabilitation assessment and soil sampling program was undertaken by SLR in March 2018 to determine if the site had progressed to a relinquishable standard. The findings of the inspection are presented in *Assessment of Rehabilitated Areas – Pine Dale and Enhance Place Mine,* (SLR 2018) (**Appendix B**) and are summarised in **Section 8.2** of this report. The inspection showed that works undertaken have improved soil nutrient parameters, ground cover and pasture composition within the rehabilitation areas whilst also reducing erosion and weed presence.

As presented in this report, through the implementation of all appropriate recommendations, Enhance Place has rehabilitated the Enhance Place Mine back to pasture for agricultural purposes, including grazing with some treed areas. Rehabilitation monitoring results and soil nutrient analysis has shown that the rehabilitation within all the areas has met or exceeded the approved rehabilitation objectives and completion criteria specified in the MOP.

3 Reference Documents

The following documents have been referred to in the preparation of this report:

- Enhance Place Mine Care and Maintenance MOP (Enhance Place 2016);
- Enhance Place Mine Rehabilitation Monitoring Reports (FirstField Environmental 2014 to 2017);
- Enhance Place Annual Environmental Management Review / Annual Reviews (2011 to 2017);
- Soil Assessment and Recommendations for Rehabilitated Areas – Pine Dale Mine and Enhance Place Mine (SLR, 2014); and
- Assessment of Rehabilitated Areas – Pine Dale Mine and Enhance Place Mine (SLR, 2018).

4 Regulatory Requirements and Rehabilitation Objectives

Enhance Place Mine rehabilitation has been undertaken in accordance with the relevant planning approval and the conditions of ML 1520, ML 1458 and ML 1422. A summary of regulatory requirements is included in **Table 1.**

Table 1 Rehabilitation Regulatory Requirements

Reference	Condition
ML1458 Schedule 21 ML1520 Schedule 21 ML1422 Schedule 11	If so directed by the Minister the lease holder shall rehabilitate to the satisfaction of the Minister any lands within the subject area which may have been disturbed by the lease holder.
ML1458 Schedule 23 ML1520 Schedule 23 ML1422 Schedule 13	If so directed by the Minister the lease holder shall rehabilitate to the satisfaction of the Minister and within such time as may be allowed by the Minister any lands within the subject area which may have been disturbed by mining or prospecting operations whether such operations were or were not carried out by the lease holder.
ML1458 Schedule 25 ML1520 Schedule 25 ML1422 Schedule 15	The lease holder shall provide and maintain to the satisfaction of the Minister efficient means to prevent contamination, pollution, erosion or siltation or any river, stream, creek, tributary, lake, dam, reservoir, watercourse or catchment area or any undue interference to fish or their environment and shall observe any instruction given or which may be given by the Minister with a view to preventing or minimising the contamination, pollution, erosion or siltation of any river, stream, creek, tributary, lake, dam, reservoir, watercourse or catchment area or any undue interference to fish or their environment.
ML1458 Schedule 35	The lease holder shall: (j) Complete work in relation to rehabilitation within the Warragamba Outer Catchment Area before termination of the authority to the satisfaction of the Corporation.
ML1520 Schedule 64	The lease holder shall consider the type of rehabilitation vegetation to reflect the locally indigenous flora of the area in the vicinity of the Enhance Place Colliery.

The MOP was prepared in accordance with the relevant regulatory requirements with the approved rehabilitation objectives for the site as follows:

- Create a low maintenance, geotechnically stable and safe landform;
- Stabilise all earthworks, drainage lines and disturbed areas associated with both past and future activities in order to minimise erosion and the associated generation of sediment laden water;
- Reduce the visual impact form both local or distant vantage points by means of final rehabilitation of areas of disturbance;
- Blend the created landform with the surrounding land fabric; and
- As appropriate, revegetate with native tree and shrub species and/or pasture species comparable with those on surrounding lands or which occurred in each area prior to agriculture or mining related disturbance.

5 Rehabilitation Areas and Post Mining Land Use Goal

The post mining land use goal for the Enhance Place Mine is to rehabilitate the site to pasture and some treed areas suitable for stock including cattle grazing and horses. Enhance Place predominantly comprises privately owned land with a block of Crown Land in the west of the site. The location of the site and landownership is shown in **Figure 1** along with the post mining land use.

Enhance Place seeks to relinquish the mining leases associated with the Enhance Place Mine as they are considered to have met the nominated rehabilitation objectives. The following sections presents a summary of the rehabilitation completed at Enhance Place Mine along with rehabilitation monitoring results which demonstrates the successful achievement of the approved rehabilitation completion criteria specified in the MOP.

Scale: 1:5,000
GDA 1994 MGA Zone 56

17-Aug-2018
630.12362

Sheet Size : A4

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Enhance Place Rehabilitation Areas

Figure 1

6 Rehabilitation Activities Completed

Rehabilitation at Enhance Place covers an area of 21 ha that has been rehabilitated to pasture with an additional 1.2 ha planted with trees and shrubs.

Pasture areas were established with a pasture mixture known as '*Cox's River Mix*' prior to 2014 and are representative of species composition of grazing pastures on adjacent, unmined soils.

'*Cox's River Mix*' comprises of:

- 40% Fescue (*Festuca spp.*);
- 25% Cocksfoot (*Dactylis glomerata*);
- 20% Subterranean Clover (*Trifolium subterranean*);
- 6% Perennial Ryegrass (*Lolium perenne*);
- 5% White Clover (*Trifolium repens*); and
- 4% Phalaris (*Phalaris aquatica*).

1.2 ha was planted with trees and shrubs in 2011. The planting program consisted of:

- 400 Wattle, Eucalypts and mixed shrub and tree species;
- Install tree guards to all plantings; and
- Supply and spread approximately 240kg Japanese Millet seed.

A timeline of the rehabilitation activities undertaken at the Enhance Place Mine prior to 2011 is presented in the 2011 Annual Environmental Management Review (AEMR) and included the following key milestones:

- **1998 - 2004** – continued construction of the final landform behind mining through the replacement and shaping of overburden. Some clay and topsoil was spread over reshaped areas with some pasture seeding and fertilisation.
- **2005** – Mining ceased at the end of June 2005. From June to December the mine underwent substantial rehabilitation. The final mining void and the pump sump were back filled and the surrounding slopes shaped and profiled. Hunt's dam, originally destroyed during the mining process and located just to the west of the final mining void, was rebuilt. Topsoil and clay was spread over reshaped and profiled areas of the mining lease. A wetland was established to the west of the property (northeast of Hunt's dam). The purpose of the wetland was to serve as a decelerator to the 100/500 year storms that cause huge water volume runoff on the property. The wetland also serves as a wildlife refuge for native frogs, ducks, ibis and other birds. The property was then seeded and fertilised. Grasses planted were: rye corn, kangaroo grass, millet, clovers, sub-clovers, cocksfoot, fescue and rye. Native tree seed sown were: wattle, stringy bark, she-oak, brittle jack and peppermint gum.
- **2006** – Contour and dropdown drains lined with "terra firma" and gabion rock were constructed across the mine property. Wood ash was stockpiled on the property and was spread through 2007. All areas were deeply ripped and silt fencing placed on steep slopes. Sediment Retention Basin spillways were fortified with large diameter rock.
- **2007** – All broad surface treatment was completed. Scrap steel was completely removed. Trees were planted.

- **2008** – Reseeding of limited areas took place along with improved landform to properties owned by Mr & Mrs. Cherry.
- **2009** – Fencing of the various properties completed after satisfactory pasture establishment occurred. Final rock picking and slashing program completed for the taller grasses during autumn 2009.
- **2010** – Completed sediment dam structure stabilising. Completed fencing of entire area, inclusive of monitoring points and treed area.
- **2011** – Spraying of blackberry where it presented. Slashing program completed of the taller grasses during autumn 2011.

During 2015 significant rehabilitation maintenance activities were undertaken on the rehabilitated areas including:

- Erosion control works on existing erosion channels within treed rehabilitation area;
- Installation of jute mesh sown with fast growing grass seeds (ryegrass);
- Erosion control works undertaken on cracking occurring on crests of slopes adjacent to the treed rehabilitation area; and slope adjacent to the Castlereagh Highway;
- Repair of sediment basin wall subject to erosion;
- Re-shaping of slopes and re-stacking using existing rock structures was undertaken;
- Application of hydromulch containing fertilizer to bare earth areas within the treed rehabilitation area; and
- Planting of 600 native grass species tube stock within treed rehabilitation area.

During 2016 and 2017, the rehabilitation activities undertaken at Enhance Place included erosion management, soil stabilisation, surface drainage structure maintenance, pasture improvement, treed area improvement, weed management, and stock management. Rehabilitation maintenance implemented recommendations from the previous *Enhance Place Mine Rehabilitation Monitoring Reports* (First Field Environmental, 2015 to 2017) and the *Soil Assessment and Recommendations for Rehabilitated Areas – Pine Dale Mine and Enhance Place Mine* (SLR, 2014) in order to achieve the required completion criteria. A summary of the rehabilitation actions undertaken during the 2016 and 2017 periods are presented in **Table 2** and **Table 3**.

Table 2 Rehabilitation Activities undertaken during 2016

EP Commitments as per EP MOP 2015	Enhance Place Rehabilitation Monitoring Report Recommendations for 2015 and 2016	Rehabilitation Works Completed During 2016
Pasture Areas		
Erosion Management: Soil Stabilisation; Weed Management & Pasture Improvement. Erosion management (surface) – treated through planting, installation of fencing, improvement of surface drainage structures. Crack mechanically improvement and replanted. Pasture improvement – Stock Management Plan	Rip along contours of poorly established pasture rehabilitation areas and re-sow pasture mix and fertiliser. Cover with a mixture of lime and gypsum as per the recommendations of SLR 2014 report (2015) Re-sow water logged areas and exposed soils in depressions with rye grass (2016	Lime and gypsum was applied across all pasture areas at the recommended rate. Waterlogged areas and depressions did not require re-sowing as water infiltrated quickly and existing pasture was still viable.
	Increase and maintain groundcover in pasture rehabilitation areas to at least 95% to mitigate the potential for soil erosion and to ensure that groundcover is comparable to cover at the pasture analogue site (2015 and 2016).	Fertiliser (lime and gypsum) applied over pasture areas – success is subject to horse grazing management. Pasture rehabilitation is currently between 75-90% which satisfies the MOP completion criteria.
	Address overgrazing through the development of a Stock Management Plan (2015 Continue to monitor stocking rates in accordance with SMP (2016).	Stock Management Plan (SMP) developed. SMP implemented – paddock 1 exclusion Sep to Dec 2016 Monitoring and Evaluation of SMP pasture rehabilitation (January 2017) indicated successful rehabilitation of pasture in paddock 1.
Treed Areas		
Erosion Management; Soil Stabilisation; Weed Management & Treed area improvement. Treed area improvement by planting additional tube stock, weed management, fertiliser and mulch application.	Re-apply a mixture of mushroom compost, lime and gypsum to treed rehabilitation areas as per the recommendations of SLR 2014 report (2015)	Compost, lime and gypsum applied across treed areas at recommended rate.
	Increase groundcover of grasses and broadleaf herbs at treed rehabilitation areas to >95% to mitigate the potential for soil erosion and to ensure that groundcover is comparable to cover at the treed analogue site (2015 and 2016).	Application of organic mulch and seed mix applied. Hydromulch and seed mix of fast growing groundcover herbs and grasses then applied to the treed area.
	Consider planting tree seedlings where soils are exposed (2016).	Planting of deep rooted native tube stock undertaken.
	Place additional coarse woody debris along contours above rills to reduce rate and volume of runoff (2016	Wood debris and organic matter sprayed over contours of treed area.

EP Commitments as per EP MOP 2015	Enhance Place Rehabilitation Monitoring Report Recommendations for 2015 and 2016	Rehabilitation Works Completed During 2016
All Areas		
Erosion Management: Soil Stabilisation & Weed Management	Continue to spot-spray outbreaks of African lovegrass (2015). Hand pull Wild Radish Plants (2016) Revegetate exposed sediment retention basin walls (2015 & 2016) Construct a roll over drain above existing rill erosion on sloping trails to divert water off trial surface more effectively (2015 & 2016) Mechanically improve the soil surface in areas where cracking is more than 20 cm in depth (2015). Address soil cracking / movement as it occurs (2016) Monitor pest animal numbers (2016	Weed management undertaken as per Table 8 Roll-over drain constructed and maintained to prevent rill erosion. No areas of cracking greater than 20 cm in depth were observed during 2016. Soil movement (settling hole) re-filled. Pest monitoring not required as numbers are considered low with no adverse impact on rehabilitation and final land use.

Table 3 Rehabilitation Activities undertaken in 2017

EP Commitments as per EP MOP 2015	Year	Enhance Place Rehabilitation Monitoring Report Recommendations	Rehabilitation Works Completed during 2017
Pasture Areas			
Erosion Management; Soil Stabilisation; Weed Management & Pasture Improvement Erosion Management (surface) – treated through planting, installation of fencing, improvement of surface drainage structures. Cracks mechanically improved and replanted. Pasture improvement – Stock Management Plan.	2016	Re-sow water logged areas and exposed soils in depressions with rye grass	Waterlogged areas and depressions did not require re-sowing as water infiltrated quickly and existing pasture was still viable.
		Increase and maintain groundcover in pasture rehabilitation areas to at least 95% to mitigate the potential for soil erosion and to ensure that groundcover is comparable to cover at the pasture analogue site.	Fertiliser (lime and gypsum) applied over pasture areas – success is subject to horse grazing management. Pasture rehabilitation is currently between 75-90%, which satisfies the MOP completion criteria.
		Continue to monitor stocking rates in accordance with the Stock Management Plan.	SMP implemented paddock 1 exclusion Sep to Dec 2016 Monitoring and Evaluation of SMP pasture rehabilitation (January 2017) indicated successful rehabilitation pasture in paddock 1.
	2017	Continue to monitor percentage groundcover	Field Surveys to determine percentage groundcover conducted in March and August 2017
		Continue to monitor stocking rates in accordance with the Stock Management Plan.	Stocking rates were recorded during field surveys in March and August 2017
Treed Areas			
Erosion Management; Soil Stabilisation; Weed Management & Treed area improvement. Treed area improvement by planting additional tube	2016	Increase groundcover of grasses and broadleaf herbs at treed rehabilitation areas to >95% to mitigate the potential for soil erosion and to ensure that groundcover is comparable to cover at the treed analogue site.	Application of organic mulch and seed mix applied. Hydromulch and seed mix of fast growing groundcover herbs and grasses then applied to the treed area.

EP Commitments as per EP MOP 2015	Year	Enhance Place Rehabilitation Monitoring Report Recommendations	Rehabilitation Works Completed during 2017
stock, weed management, fertiliser and mulch application.		Consider planting tree seedlings where soils are exposed (2016).	Planting of deep rooted native tube stock undertaken.
		Place additional course woody debris along contours above rills to reduce rate and volume of runoff.	Woody debris and organic matter sprayed over contours of treed area.
	2017	Continue to monitor vegetation health	Field surveys conducted in March and August 2017. Replanting / replacement of dead Tubestock in January and March.
		Continue to monitor groundcover of grasses and broadleaf herbs.	Field Surveys conducted in March and August 2017.
All areas			
Erosion Management; Soil Stabilisation and Weed Management	2016	Continue to spot-spray outbreaks of African lovegrass. Hand pull Wild Radish plants.	Weed control undertaken as per Weed Maintenance Schedule (Table 7)
		Revegetate exposed sediment retention basin walls	Roll-over drain constructed and maintained to prevent rill erosion.
		Construct a roll-over drain above existing rill erosion on sloping trails to divert water off trail surface more effectively.	No areas of cracking greater than 20 cm in depth were observed during 2016.
		Address soil cracking / movement as it occurs.	Soil movement (settling hole) re-filled.
		Monitor pest animal numbers.	Pest monitoring not required as numbers are considered low with no adverse impact on rehabilitation and final land use.
	2017	Address soil cracking/movement as it occurs	Maintenance of minor cracking occurring in Pasture areas undertaken in May 2017. Grading of access trail to facilitate surface water runoff (August 2017)
		Monitor pest animal numbers	Pest numbers noted during field surveys in March and August 2017
		Spot-spray outbreaks of African lovegrass (Sept thru to Feb).	Weed control undertaken as per Weed Maintenance Schedule (Table 7).

7 Completion Criteria

Table 4 presents the approved rehabilitation completion criteria relevant to the Enhance Place Mine. The rehabilitation completion criteria were developed in accordance with *ESG3: Mining Operations Plan (MOP) Guidelines* dated September 2013 and were approved by the DPE on 10 March 2017. **Table 4** also presents the completion status of each of the criteria as well as the section of this report where further evidence is provided. **Table 5** presents the specific soil nutrient completion targets required to meet the desired objective of establishing sustainable grazing pasture that will require ongoing management inputs that are consistent with comparable pasture and grazing practices.

Table 4 Enhance Place Mine Performance Indicators and Completion / Relinquishment Criteria

Objective	Performance Indicator	Completion Criteria	Justification / Source	Complete (Yes / No)	Evidence / Section of report addressed
Phase – Ecosystem and land use sustainability					
Domain - Rehabilitation area - Pasture					
Stable and safe landform	Erosion	Stable landform, suitable for grazing and horses. No exposed highwalls and adits to underground mine workings.	*Statement of Environmental Effects (1997),* *Best Practice Erosion and Sediment Control (IECA 2006)*	Yes	Section 6; Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
Minimal cracking of soils from soil settling	Surface cracks	Limited areas of high concentration with cracking due to soil settling.	*Statement of Environmental Effects (1997;* *Australian Soil and Land Survey Field Handbook (CSIRO, 2009)*	Yes	Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
Final landform is commensurate with surrounding landscape	Landform	Shape and form is visually similar to adjacent land.	*Statement of Environmental Effects (1997);* *Australian Soil and Land Survey Field Handbook (CSIRO, 2009)*	Yes	Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
Landscape is free draining	Ponding of water	Sediment ponds constructed. Contour drains constructed. Relief ensures water flows are designed and directs water off site.	*Statement of Environmental Effects (1997)*	Yes	Section 6; Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
Site is accessible and stock management controls in	Access tracks, fences & gates	Sites access tracks constructed. Fences erected.	*Statement of Environmental Effects (1997)*	Yes	Section 6; Section 8.1; and

Objective	Performance Indicator	Completion Criteria	Justification / Source	Complete (Yes / No)	Evidence / Section of report addressed
place		Gates installed.			2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
Pasture areas can support cattle and horse grazing	Rural land capability	Pasture Rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing).	*Land and Soil Capability Assessment (OEH 2007); Pastures for Horses (NSW DPI 2007)*	Yes	Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
	Cattle and horses	Area has successfully supported stock and/or horses for >12 months at modest rates.	*Statement of Environmental Effects (1997);* *Stock Management Plan (First Field Environmental 2016)*	Yes	Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
Pasture rehabilitation areas will be established comparable to surrounding undisturbed pasture lands	Species composition	Establishment of pasture comprising approximately 70% perennial grass and 20% annual legume, representative of species at analogue sites.	*Soil Assessment and Recommendations for Rehabilitation Areas (SLR 2014)*	Yes	Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
	Weed presence	Weeds including African Lovegrass to comprise <10% of the pasture sward.	*Soil Assessment and Recommendations for Rehabilitation Areas (SLR 2014)*	Yes	Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
Soil profile of pasture areas developing appropriately for the intended post mining land use	Soil quality	Soil chemical characteristic including: pH, EC, major cations (K, Na, Al, Ca, Zn) sulfur and nitrate are comparable with analogue site (PD3).	*Soil Assessment and Recommendations for Rehabilitation Areas (SLR 2014)*	Yes	Section 8.2; and *Assessment of Rehabilitated Areas – Pine Dale Mine and Enhance Place Mine* (SLR, 2018) (**Appendix B**)

Objective	Performance Indicator	Completion Criteria	Justification / Source	Complete (Yes / No)	Evidence / Section of report addressed
	Ground cover	Ground cover (vegetation, leaf litter, mulch) >70%.	*Soil Assessment and Recommendations for Rehabilitation Areas (SLR 2014)*	Yes	Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
Phase – Ecosystem and land use sustainability					
Domain - Rehabilitation area – Woodland					
Stable and safe landform	Erosion	Stable landform, suitable for grazing and horses No exposed highwalls and adits to underground mine workings.	*Statement of Environmental Effects (1997),* *Best Practice Erosion and Sediment Control (IECA 2006)*	Yes	Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
Minimal cracking of soils from soil settling	Surface cracks	Limited areas of high concentration with cracking due to soil settling.	*Statement of Environmental Effects (1997;* *Australian Soil and Land Survey Field Handbook (CSIRO, 2009)*	Yes	Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
Final landform is commensurate with surrounding landscape	Landform	Shape and form is visually similar to adjacent land.	*Statement of Environmental Effects (1997);* *Australian Soil and Land Survey Field Handbook (CSIRO, 2009)*	Yes	Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
Landscape is free draining	Ponding of water	Sediment ponds constructed. Contour drains constructed. Relief ensures water flows as designed and directs water off site.	*Statement of Environmental Effects (1997)*	Yes	Section 6; Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)

Objective	Performance Indicator	Completion Criteria	Justification / Source	Complete (Yes / No)	Evidence / Section of report addressed
Site is accessible and stock management controls in place	Access tracks, fences & gates	Site access tracks constructed. Fences erected. Gates installed.	*Statement of Environmental Effects (1997)*	Yes	Section 6; Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
Tree rehabilitation areas will be established and compatible with surrounding treed vegetation	Species composition	Vegetation is established in accordance with the approved species mix.	*Statement of Environmental Effects (1997)*	Yes	Section 6; Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
	Vegetation health	More than 75% of planted species are assessed to be healthy and growing.	*Ecosystem function Analysis (CSIRO 2008)*	Yes	Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
	Vegetation distribution	Native trees planted in designated areas as generally shown in MOP Plan 3.	*Statement of Environmental Effects (1997)*	Yes	Section 6; Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
	Groundcover	Ground cover (vegetation, leaf litter, mulch) >70% at year5.	*Statement of Environmental Effects (1997);* *Ecosystem function Analysis (CSIRO 2008)*	Yes	Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)
Reduced visual impact	Visual amenity	Completion of bulk earthworks to create final landform. Completion of seeding and tree plantings.	*Statement of Environmental Effects (1997)*	Yes	Section 6; Section 8.1; and 2017 Annual Rehabilitation Monitoring Report (**Appendix A**)

Table 5 Soil Nutrient Level Completion Targets

Soil Element	Measure & Test	Site PD3 Soil Test	Ideal Soil Element Range[1]	Completion Target Measure
pH	1:5 $CaCl_2$	4.94	Between 5.2 – 8.0	Greater than 4.9
Potassium	% of Total CEC	3.17	Greater than 2%	Greater than 2%
Sodium	% of Total CEC	1.90	Less than 3%	Less than 3%
Aluminium	% of Total CEC	0.53	Less than 5%	Less than 5%
Sulfur	mg/kg KCl 40 S	6.8	Greater than 8	Greater than 5.4[2]
Nitrogen	mg/kg Water Extract	4.6	Greater than 10	Greater than 4.6
Zinc	mg/kg DTPA	0.7	Greater than 1	Greater than 0.7
Calcium	Calcium to Magnesium Ratio	2.14	Greater than 3	Greater than 2.1

1 - Ideal soil element ranges were derived from Lines-Kelly R (1994) *Soil Sense: Soil Management for North Coast Farmers* and Peverill K.I. Sparrow L.A. Reuter D.J. (1999) *Soil Analysis: An Interpretation Manual*

2 - Upon analysis of soil samples taken from analogue sites in March 2018, the sulfur levels at PD3 in September 2014 appear to be unusually high, with all analogue sites (including PD3) having sulfur levels significantly lower than 6.8, with an average across the five analogue sites of 5.4,. Considering these results a sulfur completion target measure of greater than 5.4 is considered a more realistic representation of baseline conditions.

8 Rehabilitation Monitoring

Annual rehabilitation monitoring is undertaken by FirstField Environmental and is reported in the Enhance Place Mine Annual Review, available on the Enhance Place website. Rehabilitation monitoring has assessed the status of the rehabilitation against the *ecosystem and land use establishment* and *ecosystem and land use sustainability* completion criteria presented in **Table 4**.

The findings of the *2017 Annual Rehabilitation Monitoring Report* (FirstField Environmental, 2017) (**Attachment A**) showing the assessed status of the rehabilitation at Enhance Place Mine are summarised in **Table 6**.

Table 6 2017 Rehabilitation Monitoring Results

Performance Indicator	Completion Criteria	2017 Annual Rehabilitation Monitoring Findings	Status of Completion Criteria
Phase – Ecosystem and land use sustainability			
Domain - Rehabilitation area - Pasture			
Erosion	Stable landform, suitable for grazing and horses.	There are no significant erosion features that compromise landform stability or public safety within the rehabilitation areas. The landform is considered to be stable and is suitable for grazing.	**Satisfactory**
	No exposed highwalls and adits to underground mine workings.	No highwalls or adits to the underground workings are exposed.	**Complete**
Surface cracks	Limited areas of high concentration with cracking due to soil settling.	No soil cracking was observed on the property.	**Satisfactory**
Landform	Shape and form is visually similar to adjacent land.	The rehabilitation area was filled and contoured prior to 2013 and the shape and form of the landscape is very similar to the surrounding landscape.	**Complete**
Ponding of water	Sediment ponds constructed.	Sediment ponds and contour drains were established prior to 2013 and generally remain in good operating condition. Field inspections carried out following days of intermittent rain showed no signs of waterlogging or significant ponding. Seasonal waterlogging accounts for less than 1% if the rehabilitated area. No impediments were observed within the drainage structures and there is no evidence of erosion or sedimentation associated with them. There is little evidence of surface water flow outside of the established contour drain lines.	**Complete**
	Contour drains constructed.		**Complete**
	Relief ensures water flows are designed and directs water off site.		**Complete**
Access tracks, fences & gates	Sites access tracks constructed.	Access tracks, fences and gates have all been constructed and are in good condition.	**Complete**
	Fences erected.		**Complete**
	Gates installed.		**Complete**
Rural land capability	Pasture Rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing).	Pasture rehabilitation areas are assessed as being Class V and are suitable for grazing.	**Complete**

Performance Indicator	Completion Criteria	2017 Annual Rehabilitation Monitoring Findings	Status of Completion Criteria
Cattle and horses	Area has successfully supported stock and/or horses for >12 months at modest rates.	The area has successfully supported livestock and horses for greater than 12 months modest rates.	**Complete**
Species composition	Establishment of pasture comprising approximately 70% perennial grass and 20% annual legume, representative of species at analogue sites.	Pasture rehabilitation areas area established with a mix of 70% perennial grasses and 20% annual legumes and are representative of the pasture analogue site (located at Pine Dale).	**Complete**
Weed presence	Weeds including African Lovegrass to comprise <10% of the pasture sward.	Isolated patches of African Lovegrass were observed across the rehabilitated area; however, ongoing weed treatment appears to have successfully controlled these outbreaks. No weeds hazardous to horses were observed on the property. No weeds of national significance were observed on the property.	**Satisfactory**
Soil quality	Soil chemical characteristic including: pH, EC, major cations (K,Na, Al, Ca, Zn) Sulfur and nitrate are comparable with analogue site (PD3).	Not assessed by FirstField Environmental (refer **Section 8**)	Refer **Section 8**
Ground cover	Ground cover (vegetation, leaf litter, mulch) >70%.	Ground cover in all pasture rehabilitation monitoring transects was ≥90% during the 2017 monitoring. Ground cover in all areas has been consistently >75% since 2014.	**Satisfactory**
Phase – Ecosystem and land use sustainability			
Domain - Rehabilitation area - Woodland			
Erosion	Stable landform, suitable for grazing and horses	As *Domain – Rehabilitated Area – Pasture* above.	**Satisfactory**
	No exposed highwalls and adits to underground mine workings.		**Complete**
Surface cracks	Limited areas of high concentration with cracking due to soil settling.		**Satisfactory**

Performance Indicator	Completion Criteria	2017 Annual Rehabilitation Monitoring Findings	Status of Completion Criteria
Landform	Shape and form is visually similar to adjacent land.		**Complete**
Ponding of water	Sediment ponds constructed.		**Complete**
	Contour drains constructed.		**Complete**
	Relief ensures water flows as designed and directs water off site.		**Complete**
Access tracks, fences & gates	Site access tracks constructed.		**Complete**
	Fences erected.		**Complete**
	Gates installed.		**Complete**
Species composition	Vegetation is established in accordance with the approved species mix.	Native trees have been planted and treed rehabilitation areas are established in accordance with the approved species mix representative of local native species.	**Complete**
Vegetation health	More than 75% of planted species are assessed to be healthy and growing.	Establishment of vegetation on treed rehabilitation areas is good and more than 80% of native forest indicator species are considered to be healthy and growing.	**Satisfactory**
Vegetation distribution	Native trees planted in designated areas as generally shown in MOP Plan 3.	Native trees have been planted in the appropriate areas.	**Complete**
Groundcover	Ground cover (vegetation, leaf litter, mulch) >70% at year5.	Ground cover in the two rehabilitation monitoring transects is 90% at transect 7 and 70% at transect 8.	**Satisfactory**
Visual amenity	Completion of bulk earthworks to create final landform.	The rehabilitation area was filled and contoured prior to 2013 and the shape and form of the landscape is very similar to the surrounding landscape.	**Complete**
	Completion of seeding and tree plantings	Native trees have been planted and treed rehabilitation areas are established in accordance with the approved species mix representative of local native species.	**Complete**

As presented in **Table 6,** the status of all completion criteria was determined to be complete or satisfactory during the 2017 Annual Rehabilitation Monitoring period.

9 Assessment of Rehabilitated Areas

In March 2018 a detailed walk through inspection undertaken by SLR to assess the current status of rehabilitation and to determine whether rehabilitation objectives had been met. During the inspection soil samples were taken from the topsoil (0-10 cm) at each inspection site and analysed for soil chemical characteristics including pH, EC, major cations (K, Na, Al, Ca, Zn), sulfur and nitrate for comparison with the analogue site and the completion criteria presented in **Table 5**.

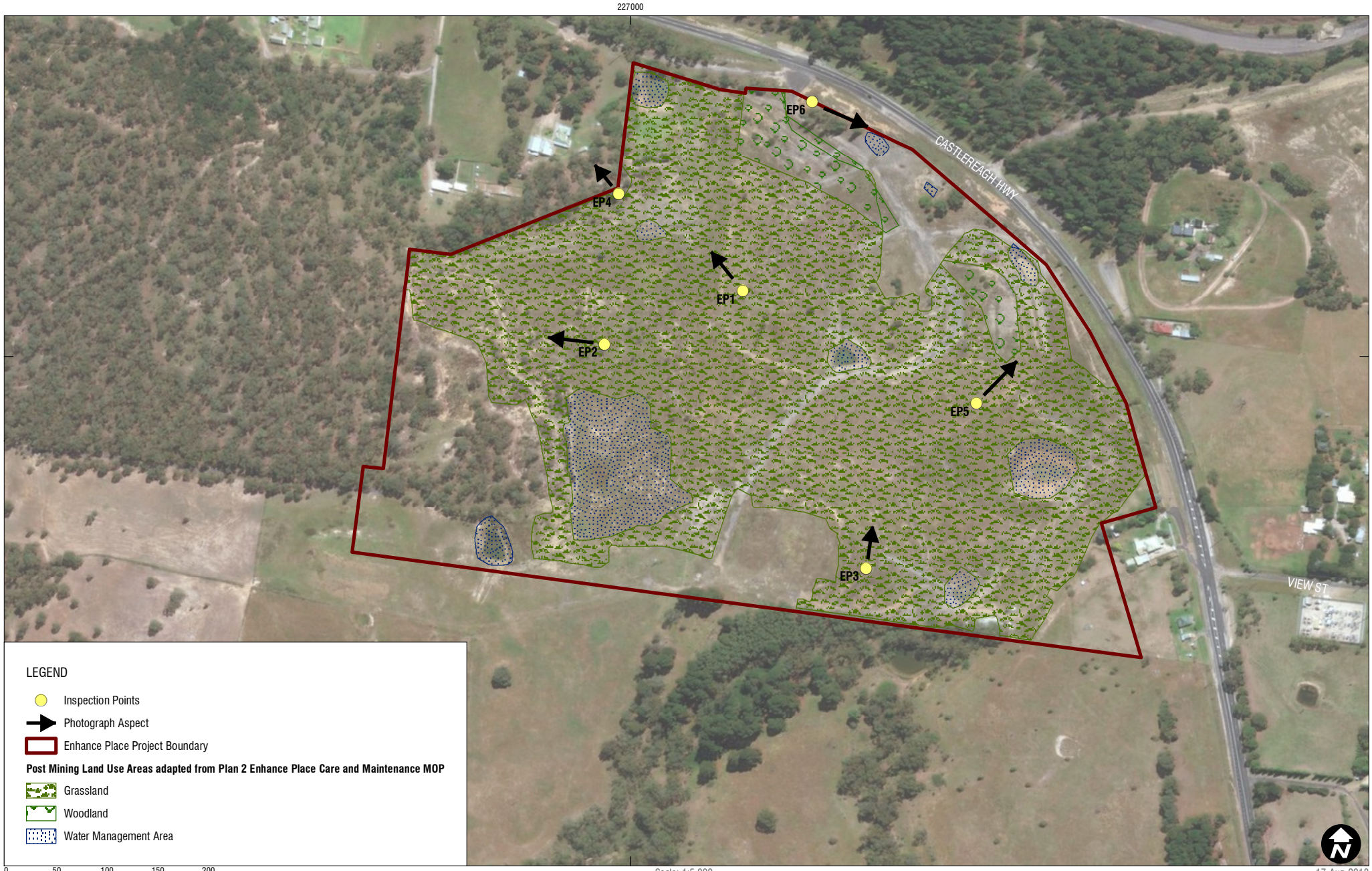
The findings of the inspection are presented in *Assessment of Rehabilitated Areas – Pine Dale and Enhance Place Mine,* (SLR 2018) (**Attachment B**) and are summarised below.

Results are summarised for each of the sites inspected at Enhance Place Mine in 2018 alongside comparisons made with 2014 inspection results. It is intended to show the general condition of each site at the time of the inspection as well as document any further identified constraints which may be limiting desirable plant establishment and growth. A traffic light risk rating was used to describe any soil nutrient deficiencies/toxicities which may be limiting plant establishment and production as outlined in **Table 7**.

Table 7 Soil Nutrients Descriptors

Rating	Descriptor
	Soil nutrient is present in levels that are deficient /toxic and are highly likely to be impacting optimum plant growth.
	Soil nutrient is present in levels that are marginally deficient /toxic and may be impacting optimum plant growth.
	Soil nutrient is present in levels which are ideal for optimum plant growth.

The location of each inspection site is shown in **Figure 2** along with the location and aspect of all photographs provided in the discussion below.



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Enhance Place
Inspection Points and Photo Locations

Figure 2

9.1 Privately Owned Land

9.1.1 Analogue Sites

9.1.1.1.1 Analogue Site EP4

Table 8 below shows soil nutrient levels at Site EP4 from the 2018 inspection. Site EP4 was chosen as an analogue site for the Morris Property as it is undisturbed by mining did not receive any of the Morris Property treatment, being located between eucalypt trees and not accessed by fertiliser spreading equipment. **Photo 1** shows the general landscape setting for analogue Site EP4.

Table 8 Soil Nutrient Levels Site EP4 (Analogue Site)

Soil Element	Measure & Test	Site EP4 2014	Completion Target	Site EP4 2018
pH	1:5 $CaCl_2$	New Analogue Site Not Tested 2014	Greater than 4.9	4.8
Potassium	% of Total CEC		Greater than 2%	3.7
Sodium	% of Total CEC		Less than 3%	0.2
Aluminium	% of Total CEC		Less than 5%	2.0
Sulfur	mg/kg KCl 40 S		Greater than 5.4	6.0
Nitrogen	mg/kg Water Extract		Greater than 4.6	4.6
Zinc	mg/kg DTPA		Greater than 0.7	0.8
Calcium	Calcium:Magnesium Ratio		Greater than 2.1	2.6

9.1.1.1.2 Analogue Site EP6

Table 9 below shows soil nutrient levels at Site EP6 from the 2018 inspection. Site EP6 was chosen as an analogue site for the Morris Property as it is undisturbed by mining and also located in a roadside reserve and not accessed by fertiliser spreading equipment. **Photo 2** shows the general landscape setting for analogue Site EP6.

Table 9 Soil Nutrient Levels Site EP6 (Analogue Site)

Soil Element	Measure & Test	Site EP6 2014	Completion Target	Site EP6 2018
pH	1:5 $CaCl_2$	New Analogue Site Not Tested 2014	Greater than 4.9	4.6
Potassium	% of Total CEC		Greater than 2%	4.0
Sodium	% of Total CEC		Less than 3%	1.3
Aluminium	% of Total CEC		Less than 5%	6.2
Sulfur	mg/kg KCl 40 S		Greater than 5.4	5.7
Nitrogen	mg/kg Water Extract		Greater than 4.6	4.6
Zinc	mg/kg DTPA		Greater than 0.7	0.7
Calcium	Calcium:Magnesium Ratio		Greater than 2.1	1.8

Photo 1 Analogue Site EP4 March 2018

Photo 2 Analogue Site EP6 March 2018

9.1.2 Rehabilitated Sites

9.1.2.1.1 Rehabilitated Site EP1

Table 10 below shows a comparison of soil nutrient levels at Site EP1 from the 2014 and 2018 inspections. Grazing completion targets were met for all soil elements.

Table 10 Soil Nutrient Levels EP1 (Rehabilitated Site)

Soil Element	Measure & Test	Site EP1 2014	Completion Target	Site EP1 2018
pH	1:5 $CaCl_2$	7.2	Greater than 4.9	5.1
Potassium	% of Total CEC	3.0	Greater than 2%	5.2
Sodium	% of Total CEC	1.8	Less than 3%	0.4
Aluminium	% of Total CEC	0.0	Less than 5%	0.0
Sulfur	mg/kg KCl 40 S	7.0	Greater than 5.4	6.2
Nitrogen	mg/kg Water Extract	2.3	Greater than 4.6	46.0
Zinc	mg/kg DTPA	0.8	Greater than 0.7	0.8
Calcium	Calcium:Magnesium Ratio	2.7	Greater than 2.1	3.3

Photo 3 and **Photo 4** show the general landscape setting for Site EP1 within the Morris Property at Enhance Place Mine during the 2014 and 2018 inspections.

Pasture at Site EP1 is dominated by perennial grasses phalaris and cocksfoot, the herb plantain with some medic present in the sward, and greater than 80% groundcover. Significant increase in perennial grass groundcover can be seen between the two inspection periods.

Overgrazing is still a major land management issue here, however increase in perennial grass pasture density have been achieved nonetheless.

Photo 3 Rehabilitated Site EP1 September 2014

Photo 4 Rehabilitated Site EP1 March 2018

9.1.2.1.2 Rehabilitated Site EP3

Table 11 below shows a comparison of soil nutrient levels at Site EP3 from the 2014 and 2018 inspections. Grazing completion targets were met for all soil elements.

Table 11 Soil Nutrient Levels Site EP3 (Rehabilitation Site)

Soil Element	Measure & Test	Site EP3 2014	Completion Target	Site EP3 2018
pH	1:5 $CaCl_2$	6.8	Greater than 4.9	5.3
Potassium	% of Total CEC	2.4	Greater than 2%	3.5
Sodium	% of Total CEC	3.7	Less than 3%	0.3
Aluminium	% of Total CEC	0.0	Less than 5%	0.0
Sulfur	mg/kg KCl 40 S	5.9	Greater than 5.4	7.8
Nitrogen	mg/kg Water Extract	2.3	Greater than 4.6	115.0
Zinc	mg/kg DTPA	0.8	Greater than 0.7	0.9
Calcium	Calcium:Magnesium Ratio	1.6	Greater than 2.1	2.3

Photo 5 and **Photo 6** show the general landscape setting for Site EP3 within the Morris Property at Enhance Place Mine during the 2014 and 2018 inspections.

Pasture at Site EP3 is dominated by perennial grasses fescue and cocksfoot, the herb plantain with some medic present in the sward, and greater than 80% groundcover. Significant increase in perennial grass groundcover can be seen between the two inspection periods. There are areas of *Brassica* weed species which are being grazed by horses and cattle.

Overgrazing is still a major land management issue here, however increase in perennial grass pasture density have been achieved nonetheless.

Photo 5 Rehabilitated Site EP3 September 2014

Photo 6 Rehabilitated Site EP3 March 2018

9.1.2.1.3 Rehabilitated Site EP5

Table 12 below shows soil nutrient levels at Site EP5 from the 2018 inspection. Grazing completion targets were met for all soil elements.

Table 12 Soil Nutrient Levels Site EP5 (Rehabilitation Site)

Soil Element	Measure & Test	Site EP5 2014	Completion Target	Site EP5 2018
pH	1:5 $CaCl_2$	New Site Not Tested 2014	Greater than 4.9	6.1
Potassium	% of Total CEC		Greater than 2%	4.3
Sodium	% of Total CEC		Less than 3%	0.3
Aluminium	% of Total CEC		Less than 5%	0.0
Sulfur	mg/kg KCl 40 S		Greater than 5.4	7.5
Nitrogen	mg/kg Water Extract		Greater than 4.6	73.6
Zinc	mg/kg DTPA		Greater than 0.7	0.8
Calcium	Calcium:Magnesium Ratio		Greater than 2.1	3.1

Photo 7 shows the general landscape setting for Site EP5 within the Morris Property at Enhance Place Mine during the 2018 inspections. Pasture at Site EP5 is dominated by perennial grasses fescue and phalaris, the herb plantain with some medic present in the sward, and greater than 90% groundcover.

Photo 7 Rehabilitated Site EP5 March 2018

9.1.3 Crown Land Block

Table 13 below shows a comparison of soil nutrient levels at Site EP3 from the 2014 and 2018 inspections. Grazing completion targets were met for all soil elements.

Table 13 Soil Nutrient Levels Site EP2 (Rehabilitation Site)

Soil Element	Measure & Test	Site EP2 2014	Completion Target	Site EP2 2018
pH	1:5 $CaCl_2$	7.1	Greater than 4.9	6.3
Potassium	% of Total CEC	4.0	Greater than 2%	4.1
Sodium	% of Total CEC	2.1	Less than 3%	0.4
Aluminium	% of Total CEC	0.0	Less than 5%	0.0
Sulfur	mg/kg KCl 40 S	6.5	Greater than 5.4	5.4
Nitrogen	mg/kg Water Extract	4.6	Greater than 4.6	13.8
Zinc	mg/kg DTPA	0.7	Greater than 0.7	0.7
Calcium	Calcium:Magnesium Ratio	2.1	Greater than 2.1	2.9

The Crown Land Block adjacent to the Morris property is grazed only by kangaroos with domestic stock being excluded. In 2014 EP2 had sufficient groundcover and a desirable pasture species composition with no further remediation work recommended.

Photo 8 and **Photo 9** show the general landscape setting for Site EP2 within the Crown Land at Enhance Place Mine during the 2014 and 2018 inspections, with greater than 80% groundcover.

Photo 8 Rehabilitated Site EP2 September 2014

Photo 9 Rehabilitated Site EP2 March 2018

APPENDIX A

2017 Annual Rehabilitation Monitoring Report

Enhance Place Mine

Rehabilitation Monitoring Report 2017

Report prepared by First Field Environmental
on behalf of EnergyAustralia

15 September 2017

Revision history		
Version	Date	Author
Draft	13 September 2017	Michelle Evans
Final	15 September 2017	Michelle Evans

This report has been prepared by First Field Environmental for EnergyAustralia. The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report.

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Contents

Appendices

Figures

Tables

1. Introduction

Enhance Place Coal Mine is located in the Western Coalfields of NSW at Blackmans Flat, 15km north of Lithgow on the southern side of Castlereagh Highway. The site is approximately 3km south west of Mount Piper Power Station and adjacent to the Springvale Coal Handling Facility.

Enhance Place Mine is managed in accordance with Mining Lease (ML) 1520, ML 1458 and ML 1422. The draft *Care and Maintenance Mining Operations Plan* dated 2014 has been prepared in accordance with ESG3: Mining Operations Plan Guidelines (2013) and describes the following rehabilitation objectives:

- *"Create a low maintenance, geotechnically stable and safe landform;*
- *Stabilise all earthworks, drainage lines and disturbed areas associated with both past and future activities in order to minimise erosion and the associated generation of sediment-laden water;*
- *Reduce the visual impact from both local or distant vantage points by means of final rehabilitation of areas of disturbance;*
- *Blend the created landform with the surrounding land fabric; and*
- *As appropriate, revegetate with native tree and shrub species and/or pasture species comparable with those on surrounding lands or which occurred in each area prior to agriculture of mining-related disturbance."*

This report aims to identify successes and failures in rehabilitation to agreed performance indicators and completion criteria. Recommendations are made in areas that could be improved.

2. Performance indicators

Table 1 identifies the performance indicators and completion criteria for Enhance Place Mine as determined by the *Enhance Place Mine Care and Maintenance Mining Operations Plan* (Enhance Place Pty Ltd, 2014).

Table 1 Performance indicators and completion criteria

Performance indicator	Completion criteria
Vegetation health	• More than 75% of native forest indicator species are assessed to be healthy and growing at year 5.
Erosion	• Stable landform, suitable for grazing and horses. • No exposed highwalls and adits to underground mine workings.
Surface cracks	• Limited areas of high concentration with cracking due to soil settling.
Landform	• Shape and form is visually similar to adjacent land.
Ponding of water	• Sediment ponds constructed. • Contour drains constructed. • Relief ensures water flows as designed and directs water off site.
Access tracks, fences and gates	• Site access tracks constructed. • Fences erected. • Gates installed.
Rural land capability	• Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing).

Performance indicator	Completion criteria
Cattle and horses	• Area has successfully supported stock and/or horses for > 12 months at modest rates.
Species composition	• Establishment of pasture comprising approximately 70% perennial grass and 20% annual legume, representative of species at analogue sites. • Vegetation within the treed rehabilitation areas are established in accordance with the approved species mix.
Weed presence	• Weeds including African Lovegrass to comprise <10% of the pasture sward.
Vegetation distribution	• Native trees planted in designated areas as generally shown in MOP Plan 3 (ENH-REH Plan 3).
Groundcover	• Groundcover (vegetation, leaf litter, mulch) >70% at year 5.
Visual amenity	• Completion of bulk earthworks to create final landform. • Completion of seeding and tree plantings.

Source: Care and Maintenance Mining Operations Plan for Enhance Place Mine (Enhance Place Pty Ltd, 2014).

3. Weather conditions

Winter of 2017 was characterised by sustained warmer weather. Average monthly rainfall leading up to the survey was variable, with June and July being unusually dry receiving significantly lower rainfall than the statistical average for that month.

Table 2 presents regional rainfall data for the period commencing 2010.

The area received light rain (between 2 and 6 mm per day) during the week leading up to the survey work on the 25th of August (Bureau of Meteorology 2017).

Table 2 Rainfall (in mm) recorded at Lidsdale (Maddox Lane) January 2011 - August 2017

Year	Average	2011	2012	2013	2014	2015	2016	2017
Month								
January	77.6	63	48.2	87.4	9.2	156.2	142.0	37.2
February	76.8	68.2	173.8	149	85	21.2	28.8	12.2
March	101.9	78	187	43.2	155	39.4	69.6	141.4
April	47.2	23.8	31.6	26.8	63	158.2	6.2	21.2
May	29.2	42.4	40.6	23.6	14	25.2	26.0	32.6
June	65.6	41.2	70.6	87	43.2	24.8	173.4	19.6
July	36.4	18.2	48.8	19.6	25.6	44.6	91.4	6.6
August	42.0	54.8	23.2	22.4	56.4	43.8	52.2	41.8
September	52.2	65.4	40.4	44	35.2	9.8	118.6	-
October	42.5	36.8	16.6	20.8	51.6	58.0	71.4	-
November	70.7	158	39	68.6	36.8	63.6	58.4	-

Year	Average	2011	2012	2013	2014	2015	2016	2017
December	81.8	86	61.2	38.4	160.4	58.6	86.4	-
Annual	**762.1**	**735.8**	**781**	**630.8**	**735.4**	**703.4**	**924.4**	**-**

Source: Bureau of Meteorology (2016)

4. Survey methodology

4.1 Rehabilitation monitoring

Monitoring locations - Previous studies have seen the establishment of four monitoring quadrats located within rehabilitated pastures, two transects within treed rehabilitation areas and 3 transects across areas of African lovegrass infestation. Additional transects exist as analogue sites in grazed pasture and an undisturbed naturally vegetated area of Pine Dale Mine to provide benchmarks against which the pasture and treed rehabilitation areas of Enhance Place Mine are assessed. Monitoring locations are shown in Figure 1.

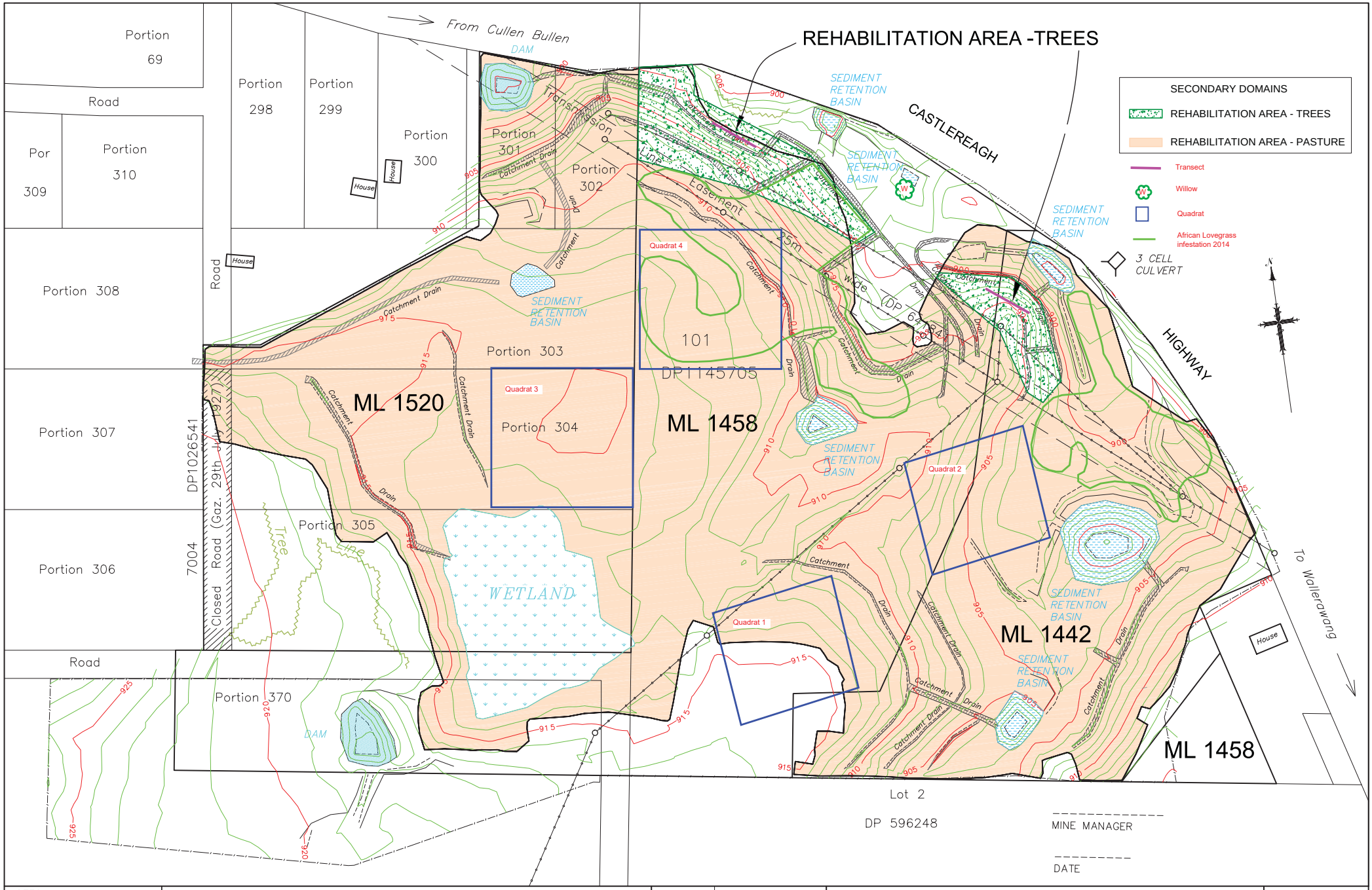
Photopoint monitoring - Coordinates for each quadrat, transect and analogue site are provided in Appendix A. Each quadrat and transect area contains previously established photo monitoring points. Photos were taken from the northwest corner of each quadrat, along transects within treed rehabilitation areas and where African lovegrass presence and density was considered significant. Photos taken from these points enable a visual comparison to photos from previous surveys and are provided in Appendix D.

4.2 Erosion and sedimentation

Erosion and sedimentation - Evidence of erosion and sedimentation within each quadrat and in the vicinity of each transect has been determined in accordance with *Best Practice Erosion and Sediment Control* (IECA 2006).

Drainage impediments - Drainage structures within the rehabilitation areas were identified in the field and assessed for visible impediments and evidence of erosion and sedimentation.

Cracking soils - Soil surfaces within the rehabilitation areas were observed for surface cracking. Soil samples to a depth of 20cm were taken randomly from ten points within each pasture transect area. Soil structure, ped shape and ped surface characteristics were examined to determine whether soils are prone to cracking. Soil physical characteristics are assessed in accordance with the *Australian Soil and Land Survey Field Handbook* (CSIRO, 2009).



NOTES:

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CONSULTING LAND, ENGINEERING AND MINING SURVEYORS
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EMAIL : survey@ceh.com.au

DATE	18–12–13
AMENDED	
SURVEYOR	T.H./T.E
DRAWN	K.L.F./D.M.
CHECKED	

ENHANCE PLACE MINE
FINAL REHABILITATION AND POST MINING LAND USE

SCALE - 1 : 1250 (A1 SHEET)

DWG No

ENH-REH
PLAN 3

4.3 Vegetation assessment

Pasture rehabilitation areas – Approximately 20 ha of the study area was sown with Cox's River seed mix prior to 2013 at the following rates:

- 40% Fescue *(Festuca spp.)*
- 25% Cocksfoot *(Dactylis glomerata)*
- 20% Subterranean clover *(Trifolium subterranean)*
- 6% Perennial rye grass *(Lolium perene)*
- 5% White clover *(Trifolium repens)*
- 4% Phalaris *(Phalaris aquatica)*

The proportion of perennial grasses and annual legumes currently in evidence at pasture quadrats and transects has been recorded and compared with the proportion at which these species were initially sown.

Tree rehabilitation areas – Approximately 6 ha of the study area was revegetated with trees, shrubs and herbaceous groundcover prior to 2013. Vegetation health, natural regeneration, structure and species composition have been determined in accordance with the *Australian Soil and Land Survey Field Handbook* (CSIRO 2009).

4.4 Pest animal and weed survey

Pest animal presence - Evidence of feral animal presence across the rehabilitation areas has been determined through scat and trail identification.

Noxious weeds - The location and extent of noxious weeds (as declared for the Upper Macquarie County Council area (NSW DPI, 2017) have been recorded. Target weed species, particularly African Lovegrass were identified in accordance with field guides and botanical keys.

4.5 Rural land capability assessment

Pasture rehabilitation areas have been assessed in accordance with the *Land and Soil Capability Assessment* (OEH 2007) and against *Pastures for Horses* (NSW DPI 2007). The physical effects of current grazing practices are contrasted with optimum horse stocking rates.

4.6 Stocking rates

Appropriate stocking rates have been determined in accordance with the carrying capacity of current and improved pasture conditions. Optimum stocking rates are provided in Appendix E of the *Stock Management Plan* (First Field Environmental 2016).

4.7 Access and fencing

Establishment of gates and fencing was completed prior to 2013. The condition of internal trails, fences and gates has been recorded.

5. Field survey results

Field survey was conducted on 25th August 2017 by a qualified ecologist. The survey revisited four quadrats and two transects representing rehabilitated pasture and treed areas, as well as pasture and treed analogue sites located at Pine Dale Mine.

5.1 Erosion and sedimentation

There are no significant erosion features that compromise landform stability or public safety within the rehabilitation areas. The landform is considered to be stable and is suitable for grazing. No highwalls or adits to underground mine workings are exposed.

Pasture rehabilitation areas - Visual assessment found evidence of minor surface erosion however overall combined bare surfaces do not exceed 20m^2 per hectare in any of the three fenced paddocks.

Treed rehabilitation areas – Exposed soils within the treed rehabilitation areas have been subject to wind and minor rill erosion.

Analogue sites – No active erosion is evident at the pasture and treed analogue sites.

Surface cracking – No soil cracking was observed on the property.

Landform – The study area was filled and contoured prior to 2013 and the shape and form of the landscape is visually similar to the adjacent landscape.

Ponding of water – Sediment ponds and contour drains were established prior to 2013 and generally remain in good operational condition. Figure 2 shows the condition of sloping retention basin walls.

Figure 2 Indicative condition of sediment retention basins

Field inspection was conducted following days of intermittent rain. Soils showed no signs of waterlogging or significant ponding. Seasonal waterlogging accounts for less than 1% of the rehabilitated pasture area.

No impediments were observed within drainage structures and there is no evidence of erosion or sedimentation associated with drainage structures. There is little evidence of surface water flow occurring outside of established contour drainage lines.

5.2 Vegetation assessment

Flora species identified within the quadrats and transects are listed in Appendix C.

Species composition at pasture rehabilitation areas – Pasture rehabilitation areas are established with a mix of 70% perennial grasses and 20% annual legumes and are representative of species composition at the analogue pasture site. An example of rehabilitated pasture is shown in Figure 3.

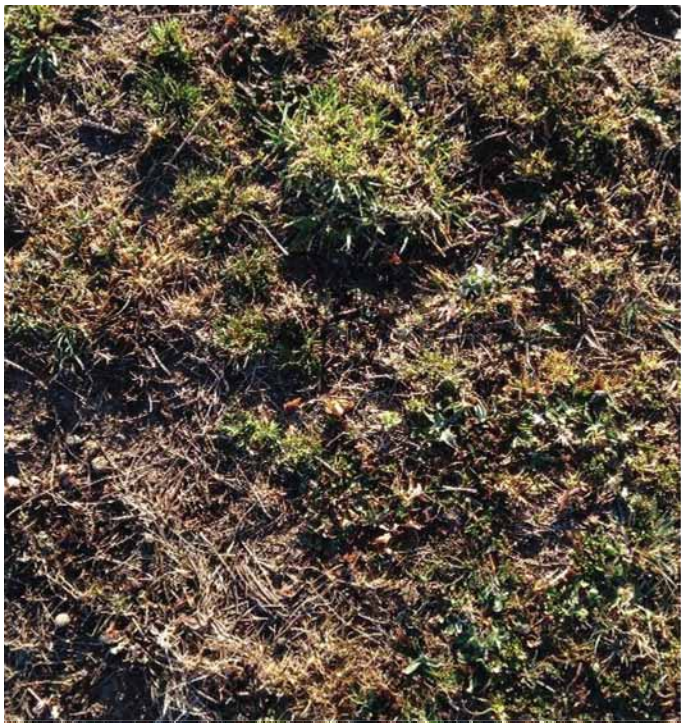

Figure 3 Pasture composition representative of rehabilitated pasture areas

Groundcover at pasture rehabilitation areas – Pasture rehabilitation areas are established with a mix of 70% perennial grasses and 20% annual legumes and are representative of species composition at the pasture analogue site (located at Pine Dale Mine). Percentage and type of groundcover is recorded in Appendix A.

Groundcover in quadrats 1 and 2 have remained stable, with 90% total living groundcover recorded in 2014, 2015 and 2016 surveys.

Groundcover in quadrat 3 has fluctuated across the years, from 94% cover recorded in 2012 to 75% IN 2016. Groundcover has significantly increased from 75% in 2016 to 90% in 2017.

Quadrat 4 has retained the 90% groundcover first achieved in 2015.

Photopoint monitoring provides a comparison of cover between 2014, 2015, 2016 and 2017 (see Appendix D).

Species composition at treed rehabilitation areas – Treed rehabilitation areas are established in accordance with an approved species mix representing local native species.

The areas of transects 7 and 8 (represented in Figure 4 and 11) support scattered juvenile trees and sparse mixed native shrub layers. The ground layers are dominated by mixed native grasses.

Groundcover at treed rehabilitation areas – Transect 7 supports groundcover of 90%. Transect 8 supports groundcover of 70%.

Figure 4 Vegetation structure and groundcover at transect 7

Figure 5 Vegetation structure and groundcover at transect 8

The treed analogue site is characterised by a canopy to 12m height with 40% canopy cover over a sparse shrubby mid-storey to 3m height and isolated shrubs to 1.5m height in the understorey. Groundcover consists of grasses and herbs with a cover of >90% (Figure 6).

Figure 6 Vegetation structure of treed analogue site (Pine Dale Mine)

Canopy cover is absent in treed rehabilitation areas. A sparse mid-storey of isolated juvenile trees and shrubs exists over a sparse, low, shrubby understorey (seen in Figure 4 and Figure 5). Groundcover is a sparse mix of broadleaf herbs and grasses. Changes in vegetation structure over time (as shown in Appendix B) are not considered significant.

Vegetation health at treed rehabilitation areas – Native forest indicator species are those that occur both in treed rehabilitation areas and the treed analogue site and provide an opportunity for comparison of growth between natural and rehabilitation conditions. Indicator species include native trees, shrubs and groundcovers.

Establishment of vegetation on treed rehabilitation areas is good and more than 80% of native forest indicator species considered to be healthy and growing.

It is difficult to determine whether native forest indicator tree species on treed rehabilitation areas are within the height and girth measurements of trees on the treed analogue site. While there is evidence of recruitment on the treed analogue site it is not possible to determine the whether the age of juvenile trees is comparable to those establishing on the treed rehabilitation areas.

5.3 Pest animal and weed survey

The presence or evidence of pests and weeds within each quadrat and in the vicinity of each transect is recorded in Appendix A.

Pest animal presence – Rabbit and fox scats were observed across the property. Rabbit and fox numbers are considered low and do not require population reduction measures.

More than 20 kangaroos were observed grazing in paddock 3 during field survey.

The European rabbit and European red fox are declared pests under the Local Land Services Act 2013. Rabbit and fox density is considered low, with some evidence of shallow soil scraping and scats across each of the monitoring locations. No holes, burrows or dens were observed.

Noxious and targeted weed species – Noxious weeds observed during field survey are listed in Table 3.

Table 3 Feral animal and noxious weed presence

Common name *Species name*	Location	Treatment
European Red Fox *Vulpes vulpes*	All locations	Landholders are obliged to control populations on their land.
European rabbit Oryctolagus cuniculus		
African Lovegrass *Eragrostis curvula*	Quadrats 1, 2, 3 and 4	The growth of the plant must be managed in a manner that reduces its numbers, spread and incidence and continually inhibits its reproduction. Not notifiable.

Noxious weed species – Isolated patches of African Lovegrass were observed across the rehabilitated areas; however, ongoing weed treatment appears to have successfully controlled these outbreaks.

Weeds hazardous to horses – No weeds hazardous to horses were observed on the property.

Weeds of national significance - No weeds of national significance were observed on the property.

5.4 Rural land capability assessment

Pasture rehabilitation areas are assessed as being better than Class VI Land and Soil Capability (and suitable for grazing). The pasture rehabilitation areas are assessed as being Class V and are suitable for grazing. The limiting factors for land use are generally related to wind erosion hazard (Table 4).

Table 4 Rural land capability assessment of pasture areas

Class	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Water erosion hazard class	3 3 - <10% slope	3 3 - <10% slope	2 1 - 3% slope	3 3 - <10% slope
Wind erosion hazard class	5 Moderate wind erodibility class of surface soil, high winds erosive power, high exposure to wind, average annual rainfall >500mm			
Soil structural decline class	4 Fragile light textured soil - hardsetting			

Class	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Soil acidification hazard class	4 Very low texture /buffering capacity, pH 6.7 – 7.5 ($CaCl_2$)			
Salinity hazard class	1 Moderate to high recharge potential, low discharge potential, low salt store			
Waterlogging hazard class	2 0 – 0.25 months typical waterlogging duration, moderately well drained soils			
Shallow soils and rockiness hazard class	1 Nil rocky outcrop, soil depth >100cm			
Mass movement hazard class	1 No mass movement present			

5.5 Stocking rates

Paddocks 1, 2 and 3 contain the stock numbers as listed in Table 5 below. With a combined area of approximately 16.2 ha, the number of stock grazing the property is equivalent to 110 DSE and is in accordance with grazing capability.

Table 5 Past and current stocking rates

Date	Cows	Full-size horses	Miniature horses	Miniature ponies	Alpacas
September 2015	5	3	8	-	1
December 2015*	5	2	8	7	1
September 2016	1	3	-	5	1
March 2017	1	2	-	16	1
August 2017	1	5	-	14	1

* A number of these animals had been contained outside of the rehabilitated pasture area, either in stables or in the home paddock.

5.6 Access and fencing

Site access trails have been constructed, gates have been installed and fences have been erected. Recent trail work has improved trail surfaces, grade and surface water drainage (see Figure 7).

Figure 7 Recently graded trail

6. Rehabilitation status

The status of performance indicators and completion criteria are summarised in Table 6.

Table 6 Status of completion criteria

Performance indicator	Completion criteria	Status
Vegetation health	• More than 75% of native forest indicator species are assessed to be healthy and growing at year 5.	• **Satisfactory** – Continue to monitor vegetation health to year 5.
Erosion	• Stable landform, suitable for grazing and horses. • No exposed highwalls and adits to underground mine workings.	• **Satisfactory** – Continue to monitor for evidence of landform instability to year 5. • **Complete** – No highwalls or adits exposed.
Surface cracks	• Limited areas of high concentration with cracking due to soil settling.	• **Satisfactory –** Continue to monitor incidents of soil cracking to year 5.
Landform	• Shape and form is visually similar to adjacent land.	• **Complete –** Shape and form is consistent with surrounding landscape.
Ponding of water	• Sediment ponds constructed. • Contour drains constructed. • Relief ensures water flows as designed and directs water off site.	• **Complete –** Sediment ponds and contour drains have been constructed. • **Complete –** Relief ensures water flows as designed.
Access tracks, fences and gates	• Site access tracks constructed. • Fences erected.	• **Complete** – Site access trails in good condition. • **Complete** – Fences and gates installed.

Performance indicator	Completion criteria	Status
	• Gates installed.	
Rural land capability	• Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing).	• **Complete** – Pasture areas have a Rural Land Capability Class of VI or better.
Cattle and horses	• Area has successfully supported stock and/or horses for > 12 months at modest rates.	• **Complete** – modest stocking rates have been supported for more than 12 months.
Species composition	• Establishment of pasture comprising approximately 70% perennial grass and 20% annual legume, representative of species at analogue sites. • Vegetation within the treed rehabilitation areas is established in accordance with the approved species mix.	• **Complete** – Pasture composition is representative of analogue sites. • **Complete –** Native trees have been planted in accordance with approved species mix.
Pest and weed presence	• Weeds including African Lovegrass to comprise <10% of the pasture sward.	• **Satisfactory –** Continue to monitor presence of noxious weeds and pests to year 5.
Vegetation distribution	• Native trees planted in designated areas as generally shown in MOP Plan 3 (ENH-REH Plan 3).	• **Complete –** Native trees are planted in appropriate areas.
Groundcover	• Groundcover (vegetation, leaf litter, mulch) >70% at year 5.	• **Satisfactory –** Continue to monitor percentage groundcover to year 5.
Visual amenity	• Completion of bulk earthworks to create final landform. • Completion of seeding and tree plantings.	• **Complete –** Final landform is appropriate. • **Complete** – Seeding and tree plantings are consistent with analogue areas.

7. Key findings

- Vegetation health appears to be stable, with 80% of species in the treed rehabilitation areas assessed to be healthy.
- The landform appears to be stable and suitable for grazing horses.
- Levels of rabbit and fox activity at each of the rehabilitation and analogue sites are low and are not considered to adversely impact the intended final land use.
- While isolated patches of African lovegrass are present at each of the pasture and treed rehabilitation areas, ongoing weed treatment appears to have successfully controlled these outbreaks.
- Groundcover in pasture rehabilitation areas is >70%.

8. Recommendations

The following recommendations for mitigation and management are consistent with intervention and adaptive management measures contained within the *Enhance Place Mine Care and Maintenance Mining Operations Plan* (Enhance Place Pty Ltd 2014).

General

- Continue to address incidents of soil cracking and movement as they occur.
- Monitor pest animal numbers.
- Continue to spot-spray outbreaks of African lovegrass from September through to February.

Pasture rehabilitation areas

- Continue to monitor percentage groundcover.
- Continue to monitor stocking rates in accordance with the *Enhance Place Mine Draft Stock Management Plan* (First Field Environmental 2016).

Treed rehabilitation areas

- Continue to monitor vegetation health in treed rehabilitation areas.
- Continue to monitor groundcover of grasses and broadleaf herbs at treed rehabilitation areas.

9. References

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Appendix A
Survey data 2017

Pasture analogue site (Pine Dale Mine)	
Easting	Northing
228300	6304880
228317	6304925
Landform and soils	
Slope	1 - <3% slope inclining to the northwest.
Erosion	Not observed.
Cracking soils	Not observed.
Surface drainage impediments	No significant drainage impediments.
Vegetation	
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.
Species richness	>30 herb and 15 grass species identified.
Cover classification 2015	
Total living cover	>90%
Annual living cover	40%
Perennial living cover	50%
Litter cover	<10%
Bare surface	-

Quadrat 1 Pasture rehabilitation area						
Corner peg	Easting			Northing		
Northwest	227099			6303904		
Southwest	227099			6303804		
Southeast	227199			6303804		
Northeast	227199			6303904		
Landform and soils						
Slope	Upper slope gently inclining (4-10%) to the southwest.					
Erosion	Minor wind erosion present on exposed soils.					
Cracking soils	Not observed.					
Surface drainage impediments	No significant drainage impediments. No surface water ponding observed.					
Vegetation						
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.					
Species diversity	>20 species identified, mostly exotics.					
Cover classification	% cover at each observation					
	September 2011	November 2012	April 2014	September 2015	September 2016	August 2017
Total living cover	90%	94%	90%	90%	90%	90%
Annual living cover	22.75%	14.5%	-	-	20%	20%
Perennial living cover	67.25%	79.5%	-	70%	70%	70%
Litter cover	7%	6%	10%	-	-	-
Bare surface	3%	-	-	10%	10%	<10%
Noxious weed presence	2014		2015	2016		2017
Eragrostis curvula	25%		25%	<10%		<10%
Hypericum perforatum	Present		Not observed	Not observed		Not observed
Rubus fruiticosus sp. agg.	Present		Not observed	Not observed		Not observed
Raphanus raphanistrum	Not observed		Not observed	Present		Not observed

Quadrat 2 Pasture rehabilitation area						
Corner peg	Easting			Northing		
Northwest	227264			6303966		
Southwest	227264			6303866		
Southeast	227364			6303866		
Northeast	227364			6303966		
Landform and soils						
Slope	Upper slope gently inclining (4-10%) to the southwest.					
Erosion	Minor wind erosion present on exposed soils.					
Cracking soils	Not observed.					
Surface drainage impediments	No significant drainage impediments. No surface water ponding observed.					
Vegetation						
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.					
Species diversity	>20 species identified, mostly exotics.					
Cover classification	% cover at each observation					
	September 2011	November 2012	April 2014	September 2015	September 2016	August 2017
Total living cover	90%	94%	90%	90%	90%	90%
Annual living cover	22.75%	14.5%	-	-	20%	20%
Perennial living cover	67.25%	79.5%	-	70%	70%	70%
Litter cover	7%	6%	10%	-	-	-
Bare surface	3%	-	-	10%	10%	<10%
Noxious weed presence	2014		2015	2016		2017
Eragrostis curvula	25%		25%	<10%		<10%
Hypericum perforatum	Present		Not observed	Not observed		Not observed
Rubus fruiticosus sp. agg.	Present		Not observed	Not observed		Not observed
Raphanus raphanistrum	Not observed		Not observed	Present		Not observed

Quadrat 3 Pasture rehabilitation area						
Corner peg	Easting			Northing		
Northwest	226973			6304068		
Southwest	226960			6303971		
Southeast	227060			6303962		
Northeast	227083			6304052		
Landform and soils						
Slope	Relatively flat.					
Erosion	Minor wind erosion present on exposed soils.					
Cracking soils	Not observed.					
Surface drainage impediments	No significant drainage impediments. No surface water ponding observed.					
Vegetation						
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.					
Species diversity	>20 species identified, mostly exotics.					
Cover classification	% cover at each observation					
	September 2011	November 2012	April 2014	September 2015	September 2016	August 2017
Total living cover	90%	94%	90%	80%	75%	90%
Annual living cover	22.75%	14.5%	-	20%	10%	20%
Perennial living cover	67.25%	79.5%	-	60%	60%	70%
Litter cover	7%	6%	10%	-	5%	-
Bare surface	3%	-	-	20%	25%	<10%
Noxious weed presence	2014		2015	2016	2017	
Eragrostis curvula	25%		50% (dead)	<10%	<10%	
Hypericum perforatum	Present		Not observed	Not observed	Not observed	
Rubus fruiticosus sp. agg.	Present		Not observed	Not observed	Not observed	
Raphanus raphanistrum	Not observed		Not observed	Present	Not observed	

Quadrat 4 Pasture rehabilitation area						
Corner peg	Easting			Northing		
Northwest	227102			6304154		
Southwest	227088			6304054		
Southeast	227188			6304054		
Northeast	227202			6304154		
Landform and soils						
Slope	Upper slope gently inclining (4-10%) to the southwest.					
Erosion	Minor wind erosion present on exposed soils.					
Cracking soils	Observed along slope crest in north eastern corner of quadrat and adjacent to treed rehabilitation area.					
Surface drainage impediments	No significant drainage impediments. No surface water ponding observed.					
Vegetation						
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.					
Species diversity	>20 herbs and grasses identified, mostly exotics.					
Cover classification	% cover at each observation					
	September 2011	November 2012	April 2014	September 2015	September 2016	August 2017
Total living cover	90%	94%	90%	90%	90%	90%
Annual living cover	22.75%	14.5%	-	30%	30%	20%
Perennial living cover	67.25%	79.5%	-	60%	60%	80%
Litter cover	7%	6%	10%	-	-	-
Bare surface	3%	-	-	10%	10%	<10%
Noxious weed presence	2014		2015	2016		2017
Eragrostis curvula	75%		10-20% (dead)	<10%		<10%
Hypericum perforatum	Present		Not observed	Not observed		Not observed
Rubus fruiticosus sp. agg.	Present		Not observed	Not observed		Not observed
Raphanus raphanistrum	Not observed		Not observed	Present		Not observed

Transect 7 Treed rehabilitation area						
Easting			Northing			
227325			6304082			
227362			6304060			
Landform and soils						
Slope	Transect located along contour of mid slope, moderately inclining (~30%) to the southwest.					
Erosion	Minor wind erosion present on exposed soils.					
Cracking soils	Not observed.					
Surface drainage impediments	No significant drainage impediments.					
Vegetation						
Vegetation structure	• <5% tree cover, to 4-8 m height • 15% shrub cover, mixed juvenile native trees to 1.5 m height • 80% groundcover dominated by mixed native and exotic broadleaf herbs and grasses					
Species diversity	• >6 native tree species • >5 native and exotic shrub species • Groundcover of >20 native and exotic broadleaf and grass species					
Cover classification	% cover at each observation					
	September 2011	November 2012	April 2014	September 2015	September 2016	August 2017
Total living cover	90%	94%	90%	90%	90%	90%
Annual living cover	22.75%	14.5%	-	20%	15%	20%
Perennial living cover	67.25%	79.5%	-	70%	70%	70%
Litter cover	7%	6%	10%	5%	5%	5%
Bare surface	3%	-	-	5%	5%	<10%
Noxious weed presence	% cover 2014		% cover 2015		% cover 2016	% cover 2017
Eragrostis curvula	Present		<5%		<5%	5%
Raphanus raphanistrum	Not observed		Not observed		Present	Not observed

Transect 8 Treed rehabilitation area				
Easting	Northing			
227150	6304234			
227192	6304205			
Landform and soils				
Slope	Transect located along contour of mid slope, moderately inclining (~30%) to the southwest.			
Erosion	Minor wind erosion present on exposed soils.			
Cracking soils	Not observed.			
Surface drainage impediments	No significant drainage impediments.			
Vegetation				
Vegetation structure	• <5% tree cover to 5 m height • <10% shrub cover, mixed juvenile native trees to 1 m height • 80% groundcover dominated by mixed native and exotic broadleaf herbs and grasses			
Species diversity	• >5 native tree species • >4 native shrub species • Groundcover of >20 native and exotic broadleaf and grass species			
Cover classification	% cover at each observation			
	April 2014	September 2015	September 2016	August 2017
Total living cover	90%	60%	60%	90%
Annual living cover	-	-	15%	20%
Perennial living cover	-	60%	35%	70%
Litter cover	10%	-	10%	5%
Bare surface	-	40%	40%	<10%
Noxious weed presence	% cover 2014	% cover 2015	% cover 2016	% cover 2017
Eragrostis curvula	Present	<5%	<5%	<5%
Raphanus raphanistrum	Not observed	Not observed	Present	Not observed

Treed analogue site (transect 7, Pine Dale Mine)	
Easting	Northing
226801	6305097
226838	6305039
Landform and soils	
Slope	Transect located along contour of mid slope gently inclining to the north.
Erosion	No erosion observed.
Cracking soils	Not observed.
Surface drainage impediments	No drainage impediments.
Vegetation	
Vegetation structure	Eucalyptus dominated canopy to 12m high with a canopy cover of 40%. Sparser shrub layer to 3m height with isolated shrubs to 1.5m height. >95% groundcover to 0.5m height, dominated by native grasses with mixed native herbs.
Species richness	More than 10 tree species, dominated by *Eucalyptus* spp. Shrub layer of >9 native species. Diverse groundcover dominated by *Poa* spp. with mixed native herbs.
Cover classification	
Total living cover	90%
Annual living cover	10%
Perennial living cover	80%
Litter cover	10%
Bare surface	-
Target weed presence	
None observed.	

Appendix B
Vegetation assessment of treed areas

Vegetation assessment treed areas 2017

Transect	Treed rehabilitation area (transect 7)	Treed rehabilitation area (transect 8)	Treed analogue site Pine Dale Mine (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>7	>6	>50
Trees	>5	>5	>5 species, 12-14 m height. 20% canopy cover.
Understorey	>5	<5	>14 species, 1-2 m height, 10% cover
Groundcover	Dominated by native and exotic broadleaf and grass species. 80% cover.	Dominated by native and exotic broadleaf and grass species. 70% cover.	Dominated by *Poa* spp. >90% cover. Mixed herbs and grasses also present.
Non-native species	>20	>20	<10
Recruitment	Not observed	Not observed	Present
Organic litter	5%	5%	Well-developed to 2 cm depth.
Logs	Present	Present	>10 fallen logs of >20 cm diameter present along transect.

Vegetation assessment treed areas 2016

Transect	Treed rehabilitation area (transect 7)	Treed rehabilitation area (transect 8)	Treed analogue site Pine Dale Mine (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	11	8	>50
Trees	6	5	>5 species, 12-14 m height. 20% canopy cover.
Understorey	<5	<5	>7 species, 1-2 m height, 10% cover
Groundcover	Dominated by native and exotic broadleaf and grass species. 90% cover.	Dominated by native and exotic broadleaf and grass species. 60% cover.	Dominated by *Poa* spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	33	34	<10
Recruitment	Not observed	Not observed	Present
Organic litter	5%	10%	Well-developed to 2 cm depth.
Logs	Present	Present	8 fallen logs of >20 cm diameter present along transect.

Vegetation assessment treed areas 2015

Transect	Treed rehabilitation area (transect 7)	Treed rehabilitation area (transect 8)	Treed analogue site Pine Dale Mine (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	45	40	>50
Trees	4	3	>5 species, 12-14 m height. 20% canopy cover.
Understorey	8	8	>7 species, 1-2 m height, 10% cover
Groundcover	Dominated by native and exotic broadleaf and grass species. 90% cover.	Dominated by native and exotic broadleaf and grass species. 60% cover.	Dominated by *Poa* spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	<10	<10	<10
Recruitment	Not observed	Not observed	Present
Organic litter	5%	Not observed	Well-developed to 2 cm depth.
Logs	Present	Present	8 fallen logs of >20 cm diameter present along transect.

Vegetation assessment treed areas 2014

Transect	Treed rehabilitation area (transect 7)	Treed rehabilitation area (transect 8)	Treed analogue site Pine Dale Mine (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	45	45	>50
Trees	4	3	>5 species, 12-14 m height. 40% canopy cover.
Understorey	8	8	>7 species, 1.5 - 3 m height, 35% cover
Groundcover	95%	90%	70% cover. Dominated by *Poa* spp. with mixed native herbs.
Non-native species	<10	<10	<10
Recruitment	Not observed	Not observed	Present
Organic litter	5%	Not observed	Well-developed to >2cm depth.
Logs	Present	Present	8 fallen logs of >20 cm diameter present along transect.

Appendix C
Species list

Scientific name	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Transect 7	Transect 8	Treed analogue site (Pine Dale Mine transect 7)
Acacia dealbata subsp. *dealbata*					X	X	X
Acacia rubida					X	X	X
Acacia sp.					X	X	X
Acacia ulcifolia							X
Agrostis sp.						X	
Ajuga australis							X
Brassica spp.	X	X	X	X			
Bursaria spinosa subsp. *lasiophylla*							X
Calandrinia calyptrata							X
Cassinia sp.					X	X	
Conyza bonariensis					X	X	
Cymbonotus sp.	X	X	X	X	X	X	
Dactylis glomerata	X	X	X	X	X	X	
Desmodium varians							X
Dillwynia phylicoides							X
Eragrostis curvula	X	X	X	X	X	X	
Erodium cicutarium					X	X	
Erodium sp.	X	X	X	X	X	X	
Eucalyptus dalrympleana subsp. *dalrympleana*							X
Eucalyptus dives							X
Eucalyptus mannifera subsp. *mannifera*							X
Eucalyptus rubida subsp. *rubida*							X
Eucalyptus sp.					X	X	

Scientific name	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Transect 7	Transect 8	Treed analogue site (Pine Dale Mine transect 7)
Festuca arundinacea	X	X	X	X	X	X	
Gamochaeta sp.	X	X	X	X	X	X	
Geranium sp.							X
Gompholobium huegelii							X
Goodenia hederacea							X
Hibbertia aspera subsp. *aspera*							X
Hibbertia obtusifolia							X
Hypochaeris radicata	X	X	X	X	X	X	
Juncus spp.			X	X			
Leucopogon sp.							X
Lissanthe strigosa subsp. *subulata*							X
Lolium perenne	X	X	X	X	X	X	
Lomandra filiformis							X
Malva neglecta	X	X	X	X	X	X	
Paspalum sp.	X	X	X	X	X	X	
Persoonia sp.							X
Persoonia laurina					X		
Persoonia oblongata					X		
Phalaris aquatica	X	X	X	X	X	X	
Pinus sp.					X	X	X
Plantago lanceolata	X	X	X	X	X	X	
Poa annua	X	X	X	X	X	X	X
Poa labillardierei							X
Poa spp.	X	X	X	X	X	X	X

Scientific name	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Transect 7	Transect 8	Treed analogue site (Pine Dale Mine transect 7)
Portulaca oleracea	X	X	X	X	X	X	
Ranunculus sp.							X
Rumex acetosella (synonym *Acetosella vulgaris*)	X	X	X	X	X	X	
Stellaria media	X	X	X	X	X	X	
Themeda australis							X
Trifolium campestre	X	X	X	X	X	X	
Trifolium repens	X	X	X	X	X	X	
Trifolium subterraneum	X	X	X	X	X	X	
Veronica calycina							X

Appendix D
Photopoint monitoring to 2017

Quadrat 1 from southwest looking northeast 2012

Quadrat 1 from southwest looking northeast 2014

Quadrat 1 from southwest looking northeast 2015

Quadrat 1 from southwest looking northeast 2016

Quadrat 1 from southwest looking northeast 2017

Quadrat 2 from southwest looking northeast 2012

Quadrat 2 from southwest looking northeast 2014

Quadrat 2 from southwest looking northeast 2015

Quadrat 2 from southwest looking northeast 2016

Quadrat 2 from southwest looking northeast 2017

Quadrat 3 from southwest looking northeast 2012

Quadrat 3 from southwest looking northeast 2014

Quadrat 3 from southwest looking northeast 2015

Quadrat 3 from southwest looking northeast 2016

Quadrat 3 from southwest looking northeast 2017

Quadrat 4 from southwest looking northeast 2012

Quadrat 4 from southwest looking northeast 2014

Quadrat 4 from southwest looking northeast 2015

Quadrat 4 from southwest looking northeast 2016

Quadrat 4 from southwest looking northeast 2017

APPENDIX B

Assessment of Rehabilitated Areas – Pine Dale Mine and Enhance Place Mine

global environmental solutions

Assessment of Rehabilitated Areas

Pine Dale Mine and Enhance Place Mine

Report Number 630.12362

July 2018

for Enhance Place Pty Ltd

Version: Final Draft

Assessment of Rehabilitated Areas

Pine Dale Mine and Enhance Place Mine

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
630.12362	Final Draft	July 2018	Murray Fraser	Andrew Hutton	Andrew Hutton

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TABLES

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1 INTRODUCTION

Enhance Place Pty Ltd (Enhance Place) owns and operates the Pine Dale Mine and Enhance Place Mine in accordance with Project Approval (PA) 10_0041 and PA 451_01 respectively, granted by the Minister for the Department of Planning and Environment.

SLR was engaged by Enhance Place to conduct an assessment of rehabilitated areas of Pine Dale Mine and Enhance Place for possible relinquishment of the mining lease, having met rehabilitation commitments and completion criteria.

Previously (September, 2014) SLR was engaged by Enhance Place to:

- Undertake soil analysis and any other assessment as required, to inform development of quantitative rehabilitation completion criteria for Growth Media Development phase of rehabilitation; and
- Provide advice and recommendations for pasture improvement strategies required to achieve the agreed rehabilitation completion criteria as described in the relevant Mining Operations Plan.

In total, five sites have been rehabilitated between Pine Dale Mine and Enhance Place Mine. These sites are shown in **Figure 1** and **Figure 2** and are identified as the following:

Pine Dale Mine

- Area A;
- Area C (Jenkins Property); and
- Area 8.

Enhance Place

- Morris Property; and
- Crown Land block.

2 METHODOLOGY

A detailed walk-through inspection of these five areas was undertaken by Murray Fraser (SLR Associate Agronomist) and Graham Goodwin (Manager Mining Engineering) on 12th March 2018. The objective of this inspection was to assess the current condition of these rehabilitated areas, particularly the extent African lovegrass (*Eragrostis curvula*), to determine whether rehabilitation objectives have been met.

Soil samples were taken from the topsoil (0-10 cm) at each inspection site and sent to Soiltec Laboratories for nutrient testing and further analysis.

A traffic light risk rating has been used to describe any soil nutrient deficiencies/toxicities which may be limiting plant establishment and production in the rehabilitation areas at each of the sites. **Table 1** below outlines the meaning of each rating as per the traffic light methodology. Detailed soil test results are contained in **Appendix A**.

Table 2 Soil Nutrient Descriptors

Rating	Descriptor
	Soil nutrient is present in levels that are deficient /toxic and are highly likely to be impacting optimum plant growth.
	Soil nutrient is present in levels that are marginally deficient /toxic and may be impacting optimum plant growth.
	Soil nutrient is present in levels which are ideal for optimum plant growth.

2.1 Grazing Pasture Completion Criteria

Enhance Place proposed the following completion criteria for the grazing areas at Enhance Place Mine and Pine Dale Mine to be achieved within five years:

- Establishment of a vigorous perennial grass and annual legume pasture, comprising approximately 70% perennial grass and 20% annual legume.
- Obtain a year round pasture groundcover of greater than 70%.
- African lovegrass to comprise less than 10% of the pasture sward.
- Soil nutrient levels tested to meet the minimum completion targets shown in **Table 2**.

Soil element completion target measures were developed using a combination of the ideal range for soil elements and those measured at the undisturbed (analogue) Site PD3 in Area C (**Appendix B**) during the 2014 inspections, where there was a vigorous perennial grass and annual clover based pasture established.

Rainfall data obtained from the Lidsdale Bureau of Meteorology Station (063132) show that for the three months preceding the 2014 (153.2 millimetres) and the 2018 (210.8 millimetres) inspections cumulative rainfall was 30% less than the long term average, giving similar climatic conditions to make a comparable comparison in nutrient levels and pasture groundcover between these years.

Table 2 Soil Nutrient Level Completion Targets

Soil Element	Measure & Test	Site PD3 Soil Test	Ideal Soil Element Range	Completion Target Measure
pH	1:5 $CaCl_2$	4.94	Between 5.2 – 8.0	Greater than 4.9
Potassium	% of Total CEC	3.17	Greater than 2%	Greater than 2%
Sodium	% of Total CEC	1.90	Less than 3%	Less than 3%
Aluminium	% of Total CEC	0.53	Less than 5%	Less than 5%
Sulfur	mg/kg KCl 40 S	6.8	Greater than 8	Greater than 6.8
Nitrogen	mg/kg Water Extract	4.6	Greater than 10	Greater than 4.6
Zinc	mg/kg DTPA	0.7	Greater than 1	Greater than 0.7
Calcium	Calcium to Magnesium Ratio	2.14	Greater than 3	Greater than 2.1

Upon analysis of soil samples taken from analogue sites in March 2018, the sulfur levels at PD3 in September 2014 appear to be unusually high, with all analogue sites (including PD3) having sulfur levels significantly lower than 6.8, with an average across the five analogue sites of 5.4, as shown in **Table 3** below. Considering these results, a sulfur completion target measure of greater than 5.4 is considered a more realistic representation of baseline conditions.

Table 3 Analogue Site 2018 Sulfur Levels

Soil Element	PD3	PD6	PD8	EP4	EP6	Average
Sulfur	5.3	5.2	5.0	6.0	5.7	**5.4**

2.2 Recommended Agronomic Treatments 2014

The following agronomic recommendations were made by SLR in November 2014 in order for Pine Dale Mine and Enhance Place Mine to achieve the nominated rehabilitation criteria.

Pine Dale Mine – Area A

Table 4 Area A Fertiliser Application

Site	Fertiliser Requirement	Tonnes/ha	Total tonnes
Area A Approx. 7 hectares	MOP	0.25	1.75
	Mushroom compost	10	70
	Lime	3	21
	Gypsum	2	14

Pine Dale Mine – Area C (Jenkins Property)

Area C requires a boom spray application of *Taskforce* for the control of African Lovegrass prior to any pasture establishment works being undertaken.

Table 5 Area C Fertiliser Application

Site	Fertiliser Requirement	Tonnes/ha	Total tonnes
Area C Approx. 14 hectares	MOP	0.25	3.5
	DAP	0.20	2.8
	Mushroom compost	10	140
	Lime	4	56
	Gypsum	1	14

Pine Dale Mine – Area 8

Area 8 requires a boom spray application of *Taskforce* for the control of African Lovegrass prior to any pasture establishment works being undertaken.

Table 6 Area 8 Fertiliser Application

Site	Fertiliser Requirement	Tonnes/ha	Total tonnes
Area 8 Approx. 7 hectares	DAP	0.20	1.4
	Mushroom compost	10	70
	Lime	1	7
	Gypsum	3	21

Enhance Place Mine – Morris Property

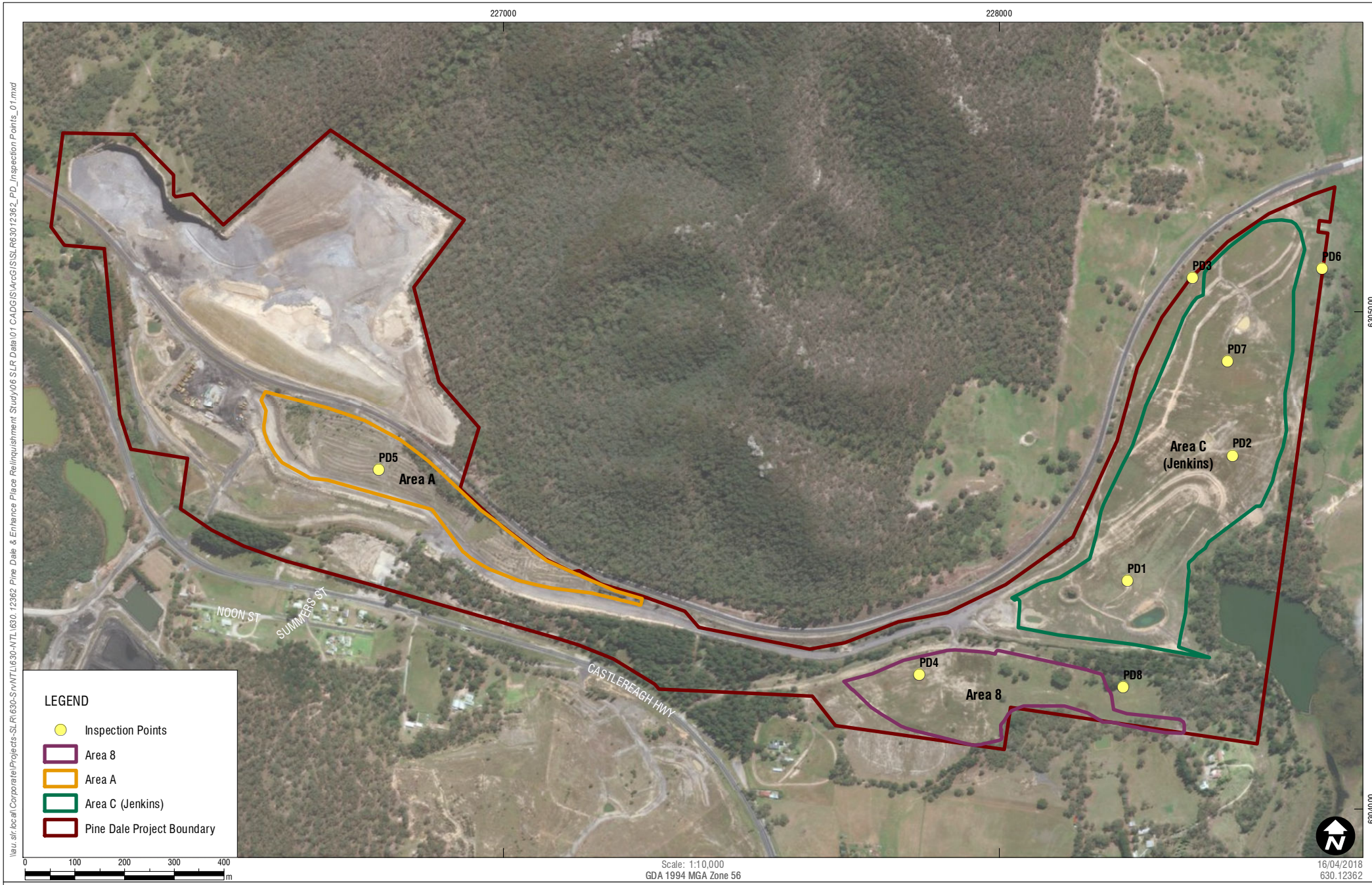
The Morris property requires a boom spray application of *Taskforce* to control African lovegrass and also broadleaf weed control prior to any pasture renovation being undertaken.

Table 7 Morris Property Fertiliser Application

Site	Fertiliser Requirement	Tonnes/ha	Total tonnes
Morris Property Approx. 23 hectares	DAP	0.20	4.6
	MOP	0.25	5.75
	Gypsum	3	69

Enhance Place Mine – Crown Land

The Crown Land (EP 2) Block does not require any remedial action as it has satisfactory pasture groundcover and appears to be only grazed by kangaroos. It is recommended that this area continues to be monitored against agreed rehabilitation completion criteria



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Pine Dale
Inspection Points

FIGURE 1

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Enhance Place
Inspection Points

FIGURE 2

3 INSPECTION RESULTS

The following section summarises the results for each of the sites inspected at both Pine Dale Mine and Enhance Place Mine in 2018 alongside comparisons made with 2014 inspection results. It is intended to show the general condition of each site at the time of the inspection as well as document any further identified constraints which may be limiting desirable plant establishment and growth.

3.1 Pine Dale Mine

3.1.1 Area A

Rehabilitated Site PD5

The rehabilitation objective for Area A, incorporating Site PD5 is return to a native woodland vegetation community. **Table 8** below shows a comparison of soil nutrient levels between the 2014 and 2018 inspections. All completion targets have been achieved at Site PD5.

Table 8 Soil Nutrient Levels Site PD5 (Rehabilitated Site)

Soil Element	Measure & Test	Site PD5 2014	Completion Target	Site PD5 2018
pH	1:5 $CaCl_2$	4.1	Greater than 4.9	6.6
Potassium	% of Total CEC	2.7	Greater than 2%	3.1
Sodium	% of Total CEC	7.1	Less than 3%	0.1
Aluminium	% of Total CEC	6.2	Less than 5%	0.0
Sulfur	mg/kg KCl 40 S	6.3	Greater than 5.4	9.0
Nitrogen	mg/kg Water Extract	6.9	Greater than 4.6	13.8
Zinc	mg/kg DTPA	0.9	Greater than 0.7	1.0
Calcium	Calcium:Magnesium Ratio	1.6	Greater than 2.1	2.3

Plate 1 and **Plate 2** show the general landscape setting for site PD5 within Area A at Pine Dale Mine during the 2014 and 2018 inspections. The rehabilitation objective for PD5 is a native woodland vegetation community.

Increased growth of eucalypts can clearly be seen while groundcover consists of couch, phalaris and fescue perennial grasses with greater than 80% groundcover.

Plate 1: Rehabilitated Site PD5 September 2014

Plate 2: Rehabilitated Site PD5 March 2018

3.1.2 Area C (Jenkins Property)

Analogue Site PD3

Table 9 below shows a comparison of soil nutrient levels at Site PD3 from the 2014 and 2018 inspections. Grazing completion targets were developed from the 2014 results at Site PD3. Sulfur has dropped from 6.8 mg/kg to 5.3 mg/kg, an unexpected change which also occurred at several of the analogue sites.

Site PD3 underwent the same treatments as other rehabilitated sites within Area C.

Table 9 Soil Nutrient Levels Site PD3 (Analogue Site)

Soil Element	Measure & Test	Site PD3 2014	Completion Target	Site PD3 2018
pH	1:5 $CaCl_2$	4.9	Greater than 4.9	6.6
Potassium	% of Total CEC	3.8	Greater than 2%	4.4
Sodium	% of Total CEC	1.9	Less than 3%	0.2
Aluminium	% of Total CEC	0.5	Less than 5%	0.0
Sulfur	mg/kg KCl 40 S	6.8	Greater than 5.4	5.3
Nitrogen	mg/kg Water Extract	4.6	Greater than 4.6	9.2
Zinc	mg/kg DTPA	0.7	Greater than 0.7	0.7
Calcium	Calcium:Magnesium Ratio	2.1	Greater than 2.1	2.8

Plate 3 and **Plate 4** show the general landscape setting for site PD3 within Area C at Pine Dale Mine during the 2014 and 2018 inspections.

Site PD3 has not been disturbed by mining activity and has not been rehabilitated. Site PD3 is considered to be representative of pre-mining grazing land use conditions in regards to soil profile and vegetation cover for this area. It is considered an analogue site for Area C.

Topsoil consists of a sandy clay loam over a medium clay subsoil. This area supports a perennial grass and clover pasture, including cocksfoot, tall fescue, phalaris, sub clover, with some annual ryegrass. These pasture species have a winter and spring growth habit, with the difference in pasture mass clearly evident between the 2014 (September) and 2018 (March) inspections.

Plate 3: Analogue Site PD3 September 2014

Plate 4: Analogue Site PD3 March 2018

Rehabilitated Site PD1

Table 10 below shows a comparison of soil nutrient levels at Site PD1 from the 2014 and 2018 inspections. Grazing completion targets were met for all soil elements.

Table 10 Soil Nutrient Levels Site PD1 (Rehabilitated Site)

Soil Element	Measure & Test	Site PD1 2014	Completion Target	Site PD1 2018
pH	1:5 $CaCl_2$	6.6	Greater than 4.9	6.5
Potassium	% of Total CEC	1.7	Greater than 2%	3.5
Sodium	% of Total CEC	2.5	Less than 3%	0.2
Aluminium	% of Total CEC	0.0	Less than 5%	0.0
Sulfur	mg/kg KCl 40 S	5.4	Greater than 5.4	6.3
Nitrogen	mg/kg Water Extract	6.9	Greater than 4.6	27.6
Zinc	mg/kg DTPA	0.7	Greater than 0.7	1.0
Calcium	Calcium:Magnesium Ratio	1.6	Greater than 2.1	2.7

Plate 5 and **Plate 6** show the general landscape setting for Site PD1 within Area C at Pine Dale Mine during the 2014 and 2018 inspections.

Pasture at Site PD1 is dominated by perennial cocksfoot and paspalum grass pasture with some sub clover and arrowleaf clover present in the sward, with greater than 90% groundcover. There is no African lovegrass present. Again the difference in pasture growth between autumn and spring can clearly be seen.

Plate 5: Rehabilitated Site PD1 September 2014

Plate 6: Rehabilitated Site PD1 March 2018

Rehabilitated Site PD2

Table 11 below shows a comparison of soil nutrient levels at Site PD2 from the 2014 and 2018 inspections. Grazing completion targets were met for all soil elements.

Table 11 Soil Nutrient Levels Site PD2 (Rehabilitated Site)

Soil Element	Measure & Test	Site PD2 2014	Completion Target	Site PD2 2018
pH	1:5 $CaCl_2$	4.6	Greater than 4.9	5.9
Potassium	% of Total CEC	1.7	Greater than 2%	4.4
Sodium	% of Total CEC	2.3	Less than 3%	0.3
Aluminium	% of Total CEC	4.5	Less than 5%	0.0
Sulfur	mg/kg KCl 40 S	6.0	Greater than 5.4	7.7
Nitrogen	mg/kg Water Extract	4.6	Greater than 4.6	46.0
Zinc	mg/kg DTPA	0.8	Greater than 0.7	0.8
Calcium	Calcium:Magnesium Ratio	1.8	Greater than 2.1	2.3

Plate 7 and **Plate 8** show the general landscape setting for Site PD2 within Area C at Pine Dale Mine during the 2014 and 2018 inspections.

Pasture at Site PD2 is dominated by perennial cocksfoot and paspalum grass pasture with the herb plantain and some arrowleaf clover present in the sward, with greater than 80% groundcover. There are isolated African lovegrass tussocks present which comprise less than 5% of the pasture sward. Significant increase in perennial grass groundcover can be seen between the two inspection periods.

Plate 7: Rehabilitated Site PD2 September 2014

Plate 8: Rehabilitated Site PD2 March 2018

Analogue Site PD6

Table 12 below shows soil nutrient levels at Site PD6 from the 2018 inspection. Site PD6 was chosen as an additional analogue site for Area C.

Table 12 Soil Nutrient Levels Site PD6 (Analogue Site)

Soil Element	Measure & Test	Site PD6 2014	Completion Target	Site PD6 2018
pH	1:5 $CaCl_2$	New Site Not Tested 2014	Greater than 4.9	5.2
Potassium	% of Total CEC		Greater than 2%	3.2
Sodium	% of Total CEC		Less than 3%	0.2
Aluminium	% of Total CEC		Less than 5%	0.0
Sulfur	mg/kg KCl 40 S		Greater than 5.4	5.2
Nitrogen	mg/kg Water Extract		Greater than 4.6	18.4
Zinc	mg/kg DTPA		Greater than 0.7	1.0
Calcium	Calcium:Magnesium Ratio		Greater than 2.1	2.5

Plate 9 shows the general landscape setting for Site PD6 within Area C at Pine Dale Mine during the 2018 inspection. Pasture at Site PD6 is dominated by the perennial grasses phalaris and fescue

Rehabilitated Site PD7

Table 13 below shows nutrient levels at Site PD7 from the 2018 inspection. Site PD7 was chosen as an additional rehabilitation site for Area C. Grazing completion targets were met for all soil elements.

Table 13 Soil Nutrient Levels Site PD7 (Rehabilitated Site)

Soil Element	Measure & Test	Site PD7 2014	Completion Target	Site PD7 2018
pH	1:5 $CaCl_2$	New Site Not Tested 2014	Greater than 4.9	5.3
Potassium	% of Total CEC		Greater than 2%	5.2
Sodium	% of Total CEC		Less than 3%	0.3
Aluminium	% of Total CEC		Less than 5%	0.0
Sulfur	mg/kg KCl 40 S		Greater than 5.4	5.5
Nitrogen	mg/kg Water Extract		Greater than 4.6	9.2
Zinc	mg/kg DTPA		Greater than 0.7	0.7
Calcium	Calcium:Magnesium Ratio		Greater than 2.1	2.7

Plate 10 shows the general landscape setting for Site PD7 within Area C at Pine Dale Mine during the 2018 inspection. Pasture at Site PD6 is dominated by perennial grasses phalaris, fescue and paspalum along with the herb plantain and arrowleaf clover. There is greater than 90% groundcover with only isolated tussocks of African lovegrass, which comprises less than 5% of the pasture sward.

Plate 9: Analogue Site PD6 March 2018

Plate 10: Rehabilitated Site PD7 March 2018

3.1.3 Area 8

Rehabilitated Site PD4

Table 14 below shows a comparison of soil nutrient levels at Site PD4 from the 2014 and 2018 inspections. Grazing completion targets were met for all soil elements.

Table 14 Soil Nutrient Levels Site PD4 (Rehabilitated Site)

Soil Element	Measure & Test	Site PD4 2014	Completion Target	Site PD4 2018
pH	1:5 $CaCl_2$	5.7	Greater than 4.9	6.1
Potassium	% of Total CEC	3.5	Greater than 2%	4.4
Sodium	% of Total CEC	1.4	Less than 3%	0.3
Aluminium	% of Total CEC	0.0	Less than 5%	0.0
Sulfur	mg/kg KCl 40 S	7.4	Greater than 5.4	8.9
Nitrogen	mg/kg Water Extract	4.6	Greater than 4.6	36.8
Zinc	mg/kg DTPA	0.8	Greater than 0.7	0.7
Calcium	Calcium:Magnesium Ratio	2.7	Greater than 2.1	3.7

Plate 11 and **Plate 12** show the general landscape setting for Site PD4 within Area 8 at Pine Dale Mine during the 2014 and 2018 inspections.

Pasture at Site PD4 is dominated by perennial grasses cocksfoot, fescue and paspalum with some arrowleaf clover present in the sward, and greater than 90% groundcover. There are isolated African lovegrass tussocks present which comprise less than 5% of the pasture sward. Significant increase in perennial grass groundcover can be seen between the two inspection periods.

Plate 11: Rehabilitated Site PD4 September 2014

Plate 12: Rehabilitated Site PD4 March 2018

Analogue Site PD8

Table 15 below shows soil nutrient levels at Site PD8 from the 2018 inspection. Site PD8 was chosen as an analogue site for Area 8 as it is undisturbed by mining and did not receive any of the Area 8 treatment, being located between pine trees and not accessed by fertiliser spreading equipment.

Table 15 Soil Nutrient Levels Site PD8 (Analogue Site)

Soil Element	Measure & Test	Site PD8 2014	Completion Target	Site PD8 2018
pH	1:5 $CaCl_2$	New Analogue Site Not Tested 2014	Greater than 4.9	5.0
Potassium	% of Total CEC		Greater than 2%	2.5
Sodium	% of Total CEC		Less than 3%	0.9
Aluminium	% of Total CEC		Less than 5%	2.0
Sulfur	mg/kg KCl 40 S		Greater than 5.4	5.0
Nitrogen	mg/kg Water Extract		Greater than 4.6	2.3
Zinc	mg/kg DTPA		Greater than 0.7	0.8
Calcium	Calcium:Magnesium Ratio		Greater than 2.1	1.7

Plate 13 shows the general landscape setting for Site PD8 within Area 8 at Pine Dale Mine during the 2018 inspection. Pasture at Site PD8 is dominated by perennial phalaris and fescue with some arrowleaf clover present in the sward, with greater than 90% groundcover. There are isolated African lovegrass tussocks present which comprise less than 5% of the pasture sward.

Plate 13: Analogue Site PD8 March 2018

3.2 Enhance Place Mine

3.2.1 Morris Property

Analogue Site EP4

Table 16 below shows soil nutrient levels at Site EP4 from the 2018 inspection. Site EP4 was chosen as an analogue site for the Morris Property as it is undisturbed by mining did not receive any of the Morris Property treatment, being located between eucalypt trees and not accessed by fertiliser spreading equipment. **Plate 14** shows the general landscape setting for analogue Site EP4

Table 16 Soil Nutrient Levels Site EP4 (Analogue Site)

Soil Element	Measure & Test	Site EP4 2014	Completion Target	Site EP4 2018
pH	1:5 $CaCl_2$	New Analogue Site Not Tested 2014	Greater than 4.9	4.8
Potassium	% of Total CEC		Greater than 2%	3.7
Sodium	% of Total CEC		Less than 3%	0.2
Aluminium	% of Total CEC		Less than 5%	2.0
Sulfur	mg/kg KCl 40 S		Greater than 5.4	6.0
Nitrogen	mg/kg Water Extract		Greater than 4.6	4.6
Zinc	mg/kg DTPA		Greater than 0.7	0.8
Calcium	Calcium:Magnesium Ratio		Greater than 2.1	2.6

Analogue Site EP6

Table 17 below shows soil nutrient levels at Site EP6 from the 2018 inspection. Site EP6 was chosen as an analogue site for the Morris Property as it is undisturbed by mining and also located in a roadside reserve and not accessed by fertiliser spreading equipment. **Plate 15** shows the general landscape setting for analogue Site EP6.

Table 17 Soil Nutrient Levels Site EP6 (Analogue Site)

Soil Element	Measure & Test	Site EP6 2014	Completion Target	Site EP6 2018
pH	1:5 $CaCl_2$	New Analogue Site Not Tested 2014	Greater than 4.9	4.6
Potassium	% of Total CEC		Greater than 2%	4.0
Sodium	% of Total CEC		Less than 3%	1.3
Aluminium	% of Total CEC		Less than 5%	6.2
Sulfur	mg/kg KCl 40 S		Greater than 5.4	5.7
Nitrogen	mg/kg Water Extract		Greater than 4.6	4.6
Zinc	mg/kg DTPA		Greater than 0.7	0.7
Calcium	Calcium:Magnesium Ratio		Greater than 2.1	1.8

Plate 14: Analogue Site EP4 March 2018

Plate 15: Analogue Site EP6 March 2018

Rehabilitated Site EP1

Table 18 below shows a comparison of soil nutrient levels at Site EP1 from the 2014 and 2018 inspections. Grazing completion targets were met for all soil elements.

Table 18 Soil Nutrient Levels Site EP1 (Rehabilitated Site)

Soil Element	Measure & Test	Site EP1 2014	Completion Target	Site EP1 2018
pH	1:5 $CaCl_2$	7.2	Greater than 4.9	5.1
Potassium	% of Total CEC	3.0	Greater than 2%	5.2
Sodium	% of Total CEC	1.8	Less than 3%	0.4
Aluminium	% of Total CEC	0.0	Less than 5%	0.0
Sulfur	mg/kg KCl 40 S	7.0	Greater than 5.4	6.2
Nitrogen	mg/kg Water Extract	2.3	Greater than 4.6	46.0
Zinc	mg/kg DTPA	0.8	Greater than 0.7	0.8
Calcium	Calcium:Magnesium Ratio	2.7	Greater than 2.1	3.3

Plate 16 and **Plate 17** show the general landscape setting for Site EP1 within the Morris Property at Enhance Place Mine during the 2014 and 2018 inspections.

Pasture at Site EP1 is dominated by perennial grasses phalaris and cocksfoot, the herb plantain with some medic present in the sward, and greater than 80% groundcover. Significant increase in perennial grass groundcover can be seen between the two inspection periods.

Overgrazing is still a major land management issue here, however increase in perennial grass pasture density have been achieved nonetheless.

Plate 16: Rehabilitated Site EP1 September 2014

Plate 17: Rehabilitated Site EP1 March 2018

Rehabilitated Site EP3

Table 19 below shows a comparison of soil nutrient levels at Site EP3 from the 2014 and 2018 inspections. Grazing completion targets were met for all soil elements.

Table 19 Soil Nutrient Levels Site EP3 (Rehabilitated Site)

Soil Element	Measure & Test	Site EP3 2014	Completion Target	Site EP3 2018
pH	1:5 $CaCl_2$	6.8	Greater than 4.9	5.3
Potassium	% of Total CEC	2.4	Greater than 2%	3.5
Sodium	% of Total CEC	3.7	Less than 3%	0.3
Aluminium	% of Total CEC	0.0	Less than 5%	0.0
Sulfur	mg/kg KCl 40 S	5.9	Greater than 5.4	7.8
Nitrogen	mg/kg Water Extract	2.3	Greater than 4.6	115.0
Zinc	mg/kg DTPA	0.8	Greater than 0.7	0.9
Calcium	Calcium:Magnesium Ratio	1.6	Greater than 2.1	2.3

Plate 18 and **Plate 19** show the general landscape setting for Site EP3 within the Morris Property at Enhance Place Mine during the 2014 and 2018 inspections.

Pasture at Site EP3 is dominated by perennial grasses fescue and cocksfoot, the herb plantain with some medic present in the sward, and greater than 80% groundcover. Significant increase in perennial grass groundcover can be seen between the two inspection periods. There are areas of *Brassica* weed species which are being grazed by horses and cattle.

Overgrazing is still a major land management issue here, however increase in perennial grass pasture density have been achieved nonetheless.

Plate 18: Rehabilitated Site EP3 September 2014

Plate 19: Rehabilitated Site EP3 March 2018

Rehabilitated Site EP5

Table 20 below shows soil nutrient levels at Site EP5 from the 2018 inspection. Grazing completion targets were met for all soil elements.

Table 20 Soil Nutrient Levels Site EP5 (Rehabilitated Site)

Soil Element	Measure & Test	Site EP5 2014	Completion Target	Site EP5 2018
pH	1:5 $CaCl_2$	New Site Not Tested 2014	Greater than 4.9	6.1
Potassium	% of Total CEC		Greater than 2%	4.3
Sodium	% of Total CEC		Less than 3%	0.3
Aluminium	% of Total CEC		Less than 5%	0.0
Sulfur	mg/kg KCl 40 S		Greater than 5.4	7.5
Nitrogen	mg/kg Water Extract		Greater than 4.6	73.6
Zinc	mg/kg DTPA		Greater than 0.7	0.8
Calcium	Calcium:Magnesium Ratio		Greater than 2.1	3.1

Plate 20 shows the general landscape setting for Site EP5 within the Morris Property at Enhance Place Mine during the 2018 inspections. Pasture at Site EP5 is dominated by perennial grasses fescue and phalaris, the herb plantain with some medic present in the sward, and greater than 90% groundcover.

Plate 20: Rehabilitated Site EP5 March 2018

3.2.2 Crown Land Block

Rehabilitated Site EP2

Table 21 below shows a comparison of soil nutrient levels at Site EP3 from the 2014 and 2018 inspections. Grazing completion targets were met for all soil elements.

Table 21 Soil Nutrient Levels Site EP2 (Rehabilitated Site)

Soil Element	Measure & Test	Site EP2 2014	Completion Target	Site EP2 2018
pH	1:5 $CaCl_2$	7.1	Greater than 4.9	6.3
Potassium	% of Total CEC	4.0	Greater than 2%	4.1
Sodium	% of Total CEC	2.1	Less than 3%	0.4
Aluminium	% of Total CEC	0.0	Less than 5%	0.0
Sulfur	mg/kg KCl 40 S	6.5	Greater than 5.4	5.4
Nitrogen	mg/kg Water Extract	4.6	Greater than 4.6	13.8
Zinc	mg/kg DTPA	0.7	Greater than 0.7	0.7
Calcium	Calcium:Magnesium Ratio	2.1	Greater than 2.1	2.9

The Crown Land Block adjacent to the Morris property is grazed only by kangaroos with domestic stock being excluded. In 2014 EP2 had sufficient groundcover and a desirable pasture species composition with no further remediation work recommended.

Plate 21 and **Plate 22** show the general landscape setting for Site EP2 within the Morris Property at Enhance Place Mine during the 2014 and 2018 inspections, with greater than 80% groundcover.

Plate 21: Rehabilitated Site EP2 September 2014

Plate 22: Rehabilitated Site EP2 March 2018

4 SUMMARY

All rehabilitated sites at Pine Dale Mine and Enhance Place Mine showed improved levels of soil fertility from 2014. Additionally, desirable perennial pasture content had increased and African lovegrass populations had significantly decreased.

SLR is of the opinion that Enhance Place Pty Ltd. has met (and exceeded) the Grazing Pasture Completion Criteria stated in **Section 2.1** at the Pine Dale Mine and Enhance Place sites.

Appendix A

2018 All Sites Laboratory Soil Test Results

SOILTEC

SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s18-0307 (8)

Client: ***SLR***
Account: **PD1**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.12	<0.15
pH	(1:5 $CaCl_2$)		6.50	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	11.27	See Percentage
Magnesium:		(Mg)(meq/100g)	4.11	See Percentage
Potassium:		(K)(meq/100g)	0.56	0.5-1.0
Sodium:		(Na)(meq/100g)	0.03	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**15.97**	
Exchangeable Cations (as a % of Total)				
Calcium:			70.57	65-80%
Magnesium:			25.74	15-20%
Potassium:			3.51	2-5%
Sodium:			0.19	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	15.7	
Sulphur	(mg/kg)	(KCl 40 S)	6.3	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	27.6	At least 10
Organic Carbon	(%)	(Walkely & Black)	4.0	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	1.3	
Zinc		(mg/kg) (DTPA)	1.0	
Manganese		(mg/kg) (DTPA)	56.3	
Iron		(mg/kg) (DTPA)	60.3	
Boron		(mg/kg) (Hot CaCl)	1.0	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			2.74	3-5

SOILTEC

SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s18-0307 (9)

Client: ***SLR***
Account: **PD2**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.10	<0.15
pH	(1:5 $CaCl_2$)		5.85	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	6.59	See Percentage
Magnesium:		(Mg)(meq/100g)	2.93	See Percentage
Potassium:		(K)(meq/100g)	0.44	0.5-1.0
Sodium:		(Na)(meq/100g)	0.03	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**9.99**	
Exchangeable Cations (as a % of Total)				
Calcium:			65.97	65-80%
Magnesium:			29.33	15-20%
Potassium:			4.40	2-5%
Sodium:			0.30	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	35.9	
Sulphur	(mg/kg)	(KCl 40 S)	7.7	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	46.0	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.9	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	1.0	
Zinc		(mg/kg) (DTPA)	0.8	
Manganese		(mg/kg) (DTPA)	40.3	
Iron		(mg/kg) (DTPA)	46.9	
Boron		(mg/kg) (Hot CaCl)	0.7	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			2.25	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s18-0307 (10)

Client: ***SLR***
Account: **PD3**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.08	<0.15
pH	(1:5 $CaCl_2$)		6.60	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	7.54	See Percentage
Magnesium:		(Mg)(meq/100g)	2.67	See Percentage
Potassium:		(K)(meq/100g)	0.47	0.5-1.0
Sodium:		(Na)(meq/100g)	0.02	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**10.70**	
Exchangeable Cations (as a % of Total)				
Calcium:			70.47	65-80%
Magnesium:			24.95	15-20%
Potassium:			4.39	2-5%
Sodium:			0.19	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	13.6	
Sulphur	(mg/kg)	(KCl 40 S)	5.3	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	9.2	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.4	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	1.2	
Zinc		(mg/kg) (DTPA)	0.7	
Manganese		(mg/kg) (DTPA)	44.3	
Iron		(mg/kg) (DTPA)	48.2	
Boron		(mg/kg) (Hot CaCl)	0.8	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	2.82	3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s18-0307 (11)

Client: ***SLR***
Account: **PD4**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.29	<0.15
pH	(1:5 $CaCl_2$)		6.11	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	6.53	See Percentage
Magnesium:		(Mg)(meq/100g)	1.79	See Percentage
Potassium:		(K)(meq/100g)	0.38	0.5-1.0
Sodium:		(Na)(meq/100g)	0.03	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**8.73**	
Exchangeable Cations (as a % of Total)				
Calcium:			74.80	65-80%
Magnesium:			20.50	15-20%
Potassium:			4.35	2-5%
Sodium:			0.34	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	46.0	
Sulphur	(mg/kg)	(KCl 40 S)	8.9	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	36.8	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.6	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	1.0	
Zinc		(mg/kg) (DTPA)	0.7	
Manganese		(mg/kg) (DTPA)	43.7	
Iron		(mg/kg) (DTPA)	40.3	
Boron		(mg/kg) (Hot CaCl)	0.7	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			3.65	3-5

~ASPAC~

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s18-0307 (12)

Client: ***SLR***
Account: **PD5**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.21	<0.15
pH	(1:5 $CaCl_2$)		6.55	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	12.21	See Percentage
Magnesium:		(Mg)(meq/100g)	5.26	See Percentage
Potassium:		(K)(meq/100g)	0.56	0.5-1.0
Sodium:		(Na)(meq/100g)	0.02	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**18.05**	
Exchangeable Cations (as a % of Total)				
Calcium:			67.65	65-80%
Magnesium:			29.14	15-20%
Potassium:			3.10	2-5%
Sodium:			0.11	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	45.2	
Sulphur	(mg/kg)	(KCl 40 S)	9.0	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	13.8	At least 10
Organic Carbon	(%)	(Walkely & Black)	6.1	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	1.2	
Zinc		(mg/kg) (DTPA)	1.0	
Manganese		(mg/kg) (DTPA)	58.8	
Iron		(mg/kg) (DTPA)	72.4	
Boron		(mg/kg) (Hot CaCl)	1.1	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	2.32	3-5

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2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s18-0307 (13)

Client: ***SLR***
Account: **PD6**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.08	<0.15
pH	(1:5 $CaCl_2$)		5.16	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		8.53	See Percentage
Magnesium:	(Mg)(meq/100g)		3.37	See Percentage
Potassium:	(K)(meq/100g)		0.40	0.5-1.0
Sodium:	(Na)(meq/100g)		0.03	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**12.33**	
Exchangeable Cations (as a % of Total)				
Calcium:			69.18	65-80%
Magnesium:			27.33	15-20%
Potassium:			3.24	2-5%
Sodium:			0.24	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	10.0	
Sulphur	(mg/kg)	(KCl 40 S)	5.2	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	18.4	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.7	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	1.1	
Zinc	(mg/kg)	(DTPA)	1.0	
Manganese	(mg/kg)	(DTPA)	43.9	
Iron	(mg/kg)	(DTPA)	63.1	
Boron	(mg/kg)	(Hot CaCl)	0.7	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	2.53	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s18-0307 (14)

Client: ***SLR***
Account: **PD7**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.03	<0.15
pH	(1:5 $CaCl_2$)		5.29	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	4.67	See Percentage
Magnesium:		(Mg)(meq/100g)	1.74	See Percentage
Potassium:		(K)(meq/100g)	0.35	0.5-1.0
Sodium:		(Na)(meq/100g)	0.02	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**6.78**	
Exchangeable Cations (as a % of Total)				
Calcium:			68.88	65-80%
Magnesium:			25.66	15-20%
Potassium:			5.16	2-5%
Sodium:			0.29	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	11.2	
Sulphur	(mg/kg)	(KCl 40 S)	5.5	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	9.2	At least 10
Organic Carbon	(%)	(Walkely & Black)	2.3	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	0.9	
Zinc		(mg/kg) (DTPA)	0.7	
Manganese		(mg/kg) (DTPA)	36.2	
Iron		(mg/kg) (DTPA)	45.8	
Boron		(mg/kg) (Hot CaCl)	0.6	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	2.68	3-5

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2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s18-0307 (15)

Client: ***SLR***
Account: **PD8**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.03	<0.15
pH	(1:5 $CaCl_2$)		4.95	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	7.05	See Percentage
Magnesium:		(Mg)(meq/100g)	4.21	See Percentage
Potassium:		(K)(meq/100g)	0.30	0.5-1.0
Sodium:		(Na)(meq/100g)	0.11	Zero
Aluminium:		(Al)(meq/100g)	0.24	Zero
Total Cation Exchange Capacity (CEC):			**11.91**	
Exchangeable Cations (as a % of Total)				
Calcium:			59.19	65-80%
Magnesium:			35.35	15-20%
Potassium:			2.52	2-5%
Sodium:			0.92	<3%
Aluminium:			2.02	<5%
Phosphorus:	(mg/kg)	(Bray-1)	6.9	
Sulphur	(mg/kg)	(KCl 40 S)	5.0	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	2.3	At least 10
Organic Carbon	(%)	(Walkely & Black)	1.9	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	1.0	
Zinc		(mg/kg) (DTPA)	0.8	
Manganese		(mg/kg) (DTPA)	46.6	
Iron		(mg/kg) (DTPA)	49.7	
Boron		(mg/kg) (Hot CaCl)	0.7	

Calculations:

Lime Requirement (Cregan)	0.31	(see notes on page 2)
Calcium/Magnesium Ratio:	1.67	3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s18-0307 (1)

Client: ***SLR***
Account: **EP1**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.14	<0.15
pH	(1:5 $CaCl_2$)		5.11	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		5.93	See Percentage
Magnesium:	(Mg)(meq/100g)		1.78	See Percentage
Potassium:	(K)(meq/100g)		0.42	0.5-1.0
Sodium:	(Na)(meq/100g)		0.03	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**8.16**	
Exchangeable Cations (as a % of Total)				
Calcium:			72.67	65-80%
Magnesium:			21.81	15-20%
Potassium:			5.15	2-5%
Sodium:			0.37	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	15.8	
Sulphur	(mg/kg)	(KCl 40 S)	6.2	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	46.0	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.4	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.8	
Zinc	(mg/kg)	(DTPA)	0.8	
Manganese	(mg/kg)	(DTPA)	35.6	
Iron	(mg/kg)	(DTPA)	51.2	
Boron	(mg/kg)	(Hot CaCl)	0.7	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			3.33	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s18-0307 (2)

Client: ***SLR***
Account: **EP2**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.06	<0.15
pH	(1:5 $CaCl_2$)		6.34	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		6.68	See Percentage
Magnesium:	(Mg)(meq/100g)		2.34	See Percentage
Potassium:	(K)(meq/100g)		0.39	0.5-1.0
Sodium:	(Na)(meq/100g)		0.04	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**9.45**	
Exchangeable Cations (as a % of Total)				
Calcium:			70.69	65-80%
Magnesium:			24.76	15-20%
Potassium:			4.13	2-5%
Sodium:			0.42	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	6.8	
Sulphur	(mg/kg)	(KCl 40 S)	5.4	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	13.8	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.1	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.9	
Zinc	(mg/kg)	(DTPA)	0.7	
Manganese	(mg/kg)	(DTPA)	39.3	
Iron	(mg/kg)	(DTPA)	53.8	
Boron	(mg/kg)	(Hot CaCl)	0.72	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	2.85	3-5

SOILTEC

SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s18-0307 (3)

Client: ***SLR***
Account: **EP3**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.32	<0.15
pH	(1:5 $CaCl_2$)		5.32	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		8.92	See Percentage
Magnesium:	(Mg)(meq/100g)		3.88	See Percentage
Potassium:	(K)(meq/100g)		0.47	0.5-1.0
Sodium:	(Na)(meq/100g)		0.04	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**13.31**	
Exchangeable Cations (as a % of Total)				
Calcium:			67.02	65-80%
Magnesium:			29.15	15-20%
Potassium:			3.53	2-5%
Sodium:			0.30	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	50.0	
Sulphur	(mg/kg)	(KCl 40 S)	7.8	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	115.0	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.8	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	1.1	
Zinc	(mg/kg)	(DTPA)	0.9	
Manganese	(mg/kg)	(DTPA)	45.4	
Iron	(mg/kg)	(DTPA)	63.2	
Boron	(mg/kg)	(Hot CaCl)	0.79	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	2.30	3-5

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Soil Test Report #s18-0307 (4)

Client: ***SLR***
Account: **EP4**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.06	<0.15
pH	(1:5 $CaCl_2$)		4.84	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		7.54	See Percentage
Magnesium:	(Mg)(meq/100g)		2.86	See Percentage
Potassium:	(K)(meq/100g)		0.41	0.5-1.0
Sodium:	(Na)(meq/100g)		0.02	Zero
Aluminium:	(Al)(meq/100g)		0.22	Zero
Total Cation Exchange Capacity (CEC):			**11.05**	
Exchangeable Cations (as a % of Total)				
Calcium:			68.24	65-80%
Magnesium:			25.88	15-20%
Potassium:			3.71	2-5%
Sodium:			0.18	<3%
Aluminium:			1.99	<5%
Phosphorus:	(mg/kg)	(Bray-1)	15.0	
Sulphur	(mg/kg)	(KCl 40 S)	6.0	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	4.6	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.6	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	1.0	
Zinc	(mg/kg)	(DTPA)	0.8	
Manganese	(mg/kg)	(DTPA)	42.1	
Iron	(mg/kg)	(DTPA)	60.8	
Boron	(mg/kg)	(Hot CaCl)	0.74	
Calculations:				
Lime Requirement (Cregan)			0.29	(see notes on page 2)
Calcium/Magnesium Ratio:			2.64	3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
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Soil Test Report #s18-0307 (5)

Client: ***SLR***
Account: **EP5**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.26	<0.15
pH	(1:5 $CaCl_2$)		6.11	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		6.37	See Percentage
Magnesium:	(Mg)(meq/100g)		2.04	See Percentage
Potassium:	(K)(meq/100g)		0.38	0.5-1.0
Sodium:	(Na)(meq/100g)		0.03	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**8.82**	
Exchangeable Cations (as a % of Total)				
Calcium:			72.22	65-80%
Magnesium:			23.13	15-20%
Potassium:			4.31	2-5%
Sodium:			0.34	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	47.2	
Sulphur	(mg/kg)	(KCl 40 S)	7.5	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	73.6	At least 10
Organic Carbon	(%)	(Walkely & Black)	5.1	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.9	
Zinc	(mg/kg)	(DTPA)	0.8	
Manganese	(mg/kg)	(DTPA)	38.7	
Iron	(mg/kg)	(DTPA)	54.6	
Boron	(mg/kg)	(Hot CaCl)	0.77	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			3.12	3-5

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2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s18-0307 (6)

Client: ***SLR***
Account: **EP6**
10 Kings rd
New lambton NSW

Sample Received: 16.4.2018 Report Reply: 24.4.2018
SAMPLE I.D: 0-10cm **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.04	<0.15
pH	(1:5 $CaCl_2$)		4.56	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		3.96	See Percentage
Magnesium:	(Mg)(meq/100g)		2.17	See Percentage
Potassium:	(K)(meq/100g)		0.28	0.5-1.0
Sodium:	(Na)(meq/100g)		0.09	Zero
Aluminium:	(Al)(meq/100g)		0.43	Zero
Total Cation Exchange Capacity (CEC):			**6.93**	
Exchangeable Cations (as a % of Total)				
Calcium:			57.14	65-80%
Magnesium:			31.31	15-20%
Potassium:			4.04	2-5%
Sodium:			1.30	<3%
Aluminium:			6.20	<5%
Phosphorus:	(mg/kg)	(Bray-1)	14.1	
Sulphur	(mg/kg)	(KCl 40 S)	5.7	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	4.6	At least 10
Organic Carbon	(%)	(Walkely & Black)	2.0	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.9	
Zinc	(mg/kg)	(DTPA)	0.7	
Manganese	(mg/kg)	(DTPA)	33.6	
Iron	(mg/kg)	(DTPA)	40.3	
Boron	(mg/kg)	(Hot CaCl)	0.6	

Calculations:

Lime Requirement (Cregan)	0.56	(see notes on page 2)
Calcium/Magnesium Ratio:	1.82	3-5

Appendix B

2014 EP3 Analogue Laboratory Soil Test Results

SOILTEC

SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s14-0897 (6)

Client: ***SLR***
Account: **Pdk 3**

Sample Received: 3.10.2014 Report Reply: 9.10.2014
SAMPLE I.D: 0-10cm **INTENDED USE:**
TEXTURE

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.06	<0.15
pH	(1:5 $CaCl_2$)		4.94	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	6.08	See Percentage
Magnesium:		(Mg)(meq/100g)	2.84	See Percentage
Potassium:		(K)(meq/100g)	0.30	0.5-1.0
Sodium:		(Na)(meq/100g)	0.18	Zero
Aluminium:		(Al)(meq/100g)	0.05	Zero
Total Cation Exchange Capacity (CEC):			**9.45**	
Exchangeable Cations (as a % of Total)				
Calcium:			64.34	65-80%
Magnesium:			30.05	15-20%
Potassium:			3.17	2-5%
Sodium:			1.90	<3%
Aluminium:			0.53	<5%
Phosphorus:	(mg/kg)	(Bray-1)	14.7	
Sulphur	(mg/kg)	(KCl 40 S)	6.8	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	4.6	At least 10
Organic Carbon	(%)	(Walkely & Black)	1.5	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	0.8	
Zinc		(mg/kg) (DTPA)	0.7	
Manganese		(mg/kg) (DTPA)	19.3	
Iron		(mg/kg) (DTPA)	30.8	
Boron		(mg/kg) (Hot CaCl)	0.8	
Calculations:				
Lime Requirement (Cregan)			0.07	(see notes on page 2)
Calcium/Magnesium Ratio:			2.14	3-5

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