NARRABRI MINE
2021 ANNUAL REVIEW

Table 1: Annual Review Title Block

Name of Operation	Narrabri Mine
Name of Operator	Narrabri Coal Operations Pty Ltd
Development consent / Project Approval #	Project Approval 08_0144
Name of holder of development consent/project approval	Narrabri Coal Operations Pty Ltd
Mining lease #	ML 1609
Name of holder of mining lease	Narrabri Coal Pty Ltd
Water Licence #	Refer to Water Licences in Table 5
Name of holder of water licence	Narrabri Coal Pty Ltd, Narrabri Coal Australia Pty Ltd, Posco International Narrabri Investments Pty Ltd, J-Power Australia Pty Ltd, Kores Narrabri Pty Ltd and Upper Horn Investments (Australia) Pty Ltd
MOP/RMP start date	1 December 2020
MOP/RMP end date	31 December 2023
Annual Review Commencement Date	01 January 2021
Annual Review Completion Date	31 December 2021
I, Gerald Linde, certify that this audit report is a true and accurate record of the compliance status of the Narrabri Mine for the period 01 January 2021 to 31 December 2021, and that I am authorised to make this statement on behalf of Narrabri Coal Operations Pty Ltd. Note. a) The Annual Review is an 'environmental audit' for the purposes of section 122B (2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000. b) The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or $22,000, or both).	
Name of Authorised Reporting Officer	**Gerald Linde**
Title of Authorised Reporting Officer	**General Manager – Narrabri Mine**
Signature	
Date	10/6/22.

Amendment A: updates to address DPE comments

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 STATEMENT OF COMPLIANCE

This Annual Review has been prepared to provide a summary of the environmental performance of the Narrabri Coal Operations (NCO) over the reporting period, 1 January 2021 to 31 December 2021. The compliance status of the mine against relevant approvals was assessed as at the end of the reporting period and is summarised in Table 2.

Table 2: Statement of Compliance

Were all the conditions of the relevant approvals complied with?	Yes/No
Project Approval (PA) 08_0144	Yes
Mining Operations Plan (MOP)	Yes
Mining Lease (ML) 1609	Yes
Subsidence Management Plan (SMP) Approval 10/9000	Yes
90CA811347	Yes
90WA812891	Yes
90CA802130	Yes
90WA822539	Yes
WAL15922	Yes
WAL12833	Yes
WAL12822	Yes
WAL20131	Yes
WAL6762	Yes
WAL2671	Yes
WAL2728	Yes
WAL20152	Yes
WAL29549	Yes
WAL43017	Yes
Groundwater Monitoring Bores: 90BL254481-487, 90BL254658-663, 90BL254701, 90BL254958-967, 90BL255167-173, 90BL255216-218, 90BL255769-772, 90BL256060-064, 90BL256344 and 90BL256346	Yes

Any non-compliances during the reporting period are ranked according to the compliance status key in Table 3 and are described in Table 4. Section 11 of this Annual Review further explains any non-compliances and mitigation measures implemented or proposed for the following reporting period to prevent re-occurrence and potential adverse effects.

Table 3: Compliance Status Key

Risk Level	Colour Code	Description
High	Non-Compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-Compliant	Non-compliance with: • potential for serious environmental consequences, but is unlikely to occur; or • potential for moderate environmental consequences, but is likely to occur
Low	Non-Compliant	Non-compliance with: • potential for moderate environmental consequences, but is unlikely to occur; or • potential for low environmental consequences, but is likely to occur
Administrative non-compliance	Non-Compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions)

Table 4: Non-Compliances

Relevant Approval	Cond. #	Condition Description (Summary)	Compliance Status	Comment	Where addressed in Annual Review

Note: No non-compliances were recorded during the reporting period.

2 INTRODUCTION

This is the fifteenth Annual Review produced for the Narrabri Mine (Figure 1) and has been prepared in accordance with the NSW Department of Planning, Industry and Environment (DPIE) Integrated Mining Policy – Annual Review Guideline, October 2015. This document has been prepared to satisfy the following requirements:

- The Annual Review requirements of the DPIE under Project Approval (PA) 08_0144 (Schedule 6, Condition 6);
- Environmental Management Report requirements of the Resources Regulator under the Narrabri Mine Mining Lease (ML) 1609; and
- The routine reporting expectations of DPIE-Water.

The Annual Review covers the period 1 January 2021 to the 31 December 2021. The Annual Review provides information on historical aspects of the Narrabri Mine, longer term trends in environmental monitoring results and information on proposed activities to be undertaken during the following reporting period.

2.1 PROJECT DESCRIPTION

Narrabri Mine is located within the Narrabri Local Government Area (LGA), approximately 30 km south-southeast of Narrabri, and 10 km north-northwest of Baan Baa (Figure 1). Mining Lease (ML) 1609 was originally approved on the 18th of January 2008 and set to expire 18th January 2029, in accordance with the provisions of Mining Act 1992. The ML encompasses an area of 5,298ha for the predominate purpose of mining for coal.

The current PA 08_0144 Modification 7 will allow the undertaking of mining operations until the 26 July 2031. Modification 5 of PA 08_0144 allows NCO to produce up to 11 Mtpa of ROM coal. The Mining Operations Plan is current from 1 December 2020 to the 31 December 2023.

Narrabri Mine is operated by Narrabri Coal Operations Pty Ltd (NCO). Narrabri Mine is owned by a joint venture between Narrabri Coal Pty Ltd (NCPL), Narrabri Coal Australia Pty Ltd, Upper Horn Investments (Australia) Pty Ltd, J-Power Australia Pty Ltd, Posco International Narrabri Investment Pty Ltd and Kores Narrabri Pty Ltd.

2.2 MINE CONTACTS

The key personnel responsible for operational and environmental management at the Narrabri Mine during the reporting period include:

- *Gerald Linde* – General Manager, retains overall responsibility for all activities and performance at the mine. Contact: (02) 6794 4755.
- *Brent Baker* – Environmental Superintendent, oversees day to day environmental performance across the site. Contact: (02) 6794 4167.

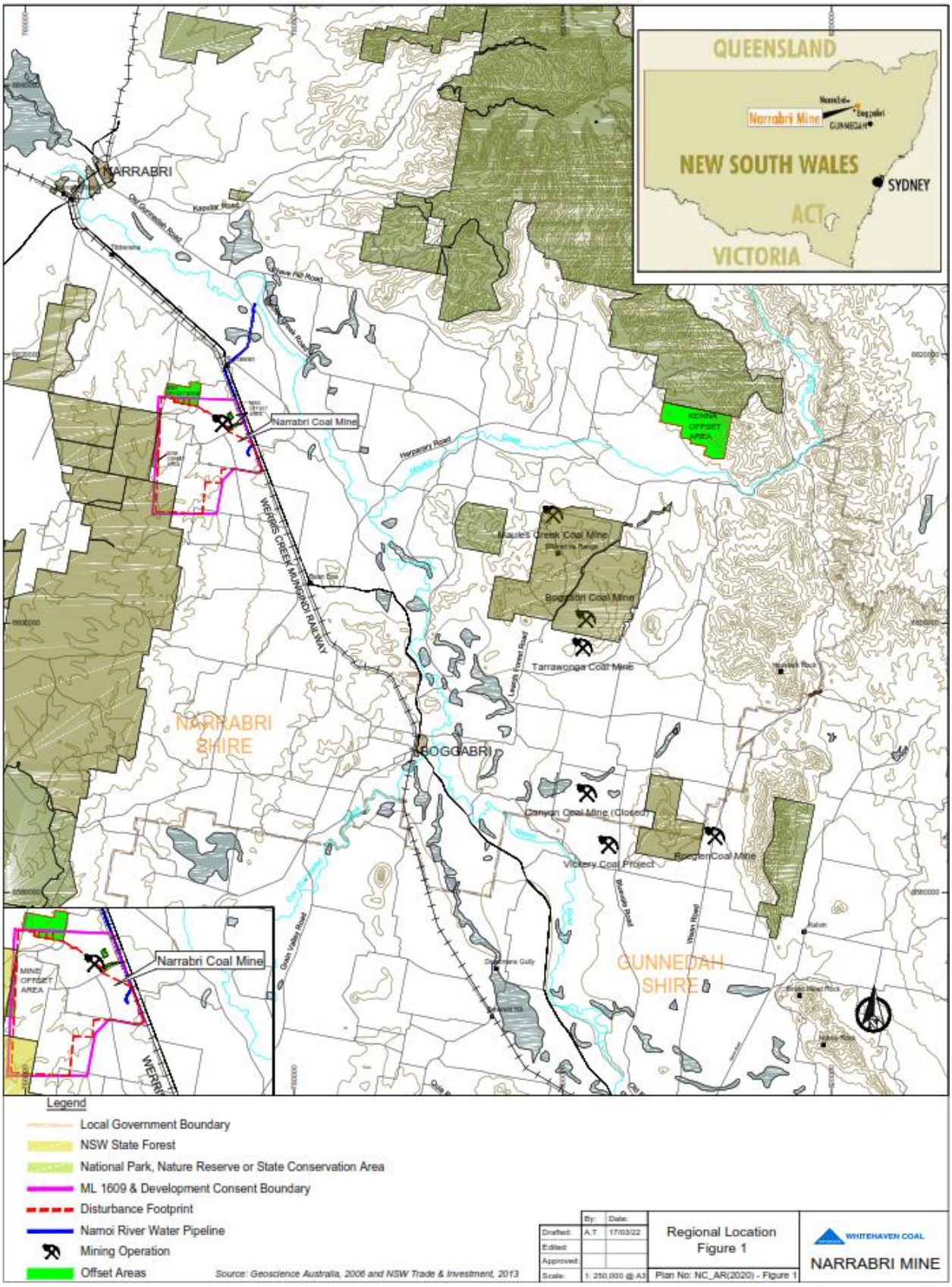

Figure 1: Regional Scale Locality Plan

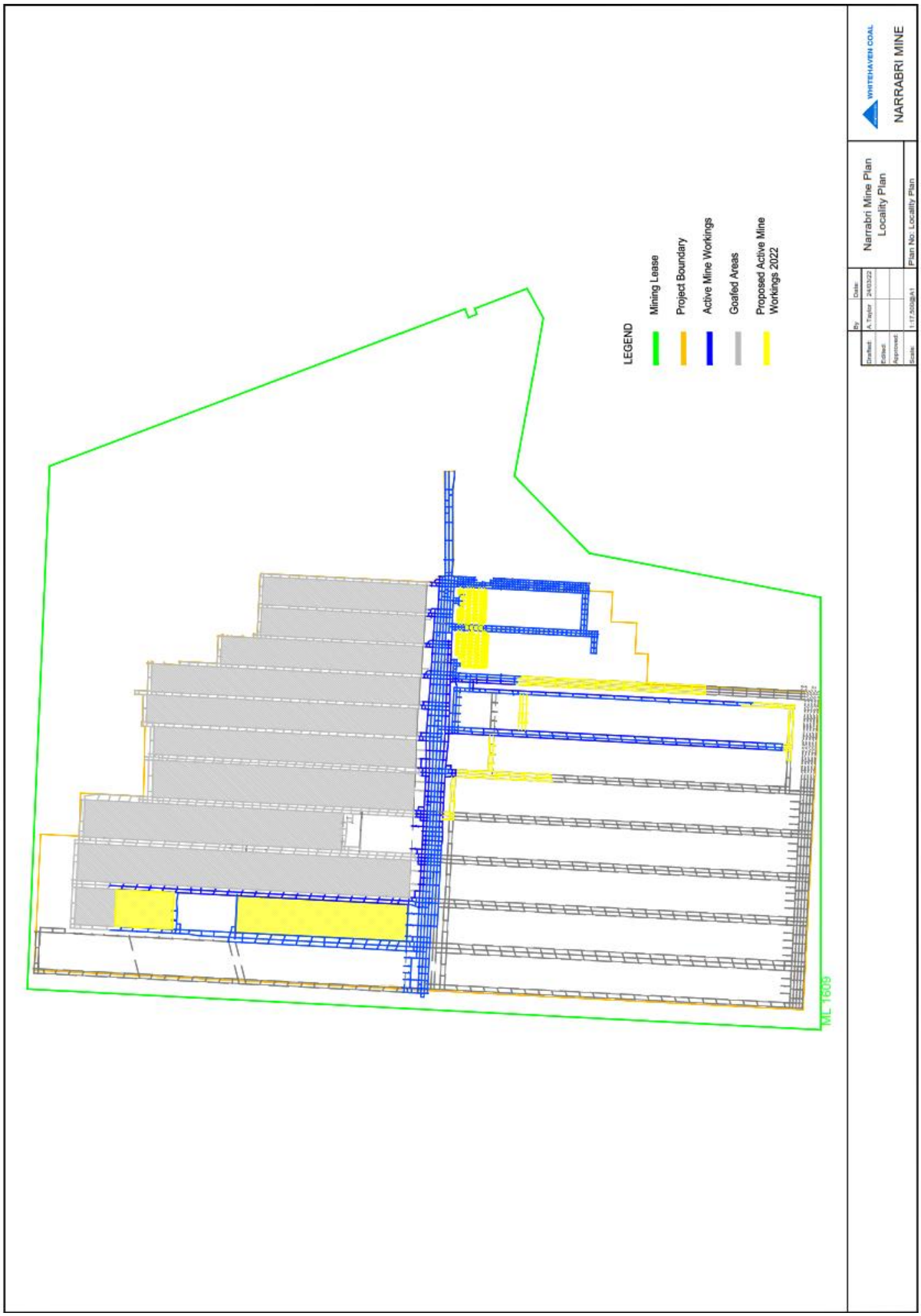

Figure 2: Local Scale Locality Plan

3 APPROVALS

Table 5 provides a summary of the key licences, leases and approvals that have been obtained for the Narrabri Mine to enable the construction and operation of the mine.

Table 5: Licences, Leases and Approvals

Issuing / Responsible Authority	Type of Lease, Licence, Approval	Date of Issue	Expiry	Comments
Resources Regulator	ML 1609	18 January 2008	18 January 2029	**Approval for mining**
Environment Protection Authority (EPA)	Environment Protection Licence (EPL) 12789	20 February 2008	Nil – Anniversary: 20 February	For mining operation >5,000,000 T (handled and produced annually)
Narrabri Shire Council (NSC)	Construction Certificate DP 816020 Inspection Report/Permit to Occupy No 2413	17 October 2008 6 August 2009	N/A	Stage 1 Mine Surface Facilities
Department of Planning, Industry and Environment (DPIE)- Water	90WA822539 / WAL15922 90WA812891 / WAL20131 90WA812891/ WAL12833 90WA812891/WAL12822 90CA802130 / WAL6762 90CA802130 / WAL2671 90CA802130 / WAL2728 90CA802130 / WAL20152 90WA822539 / WAL29549 TBC/WAL43017 90BL254481-254487 90BL254658-254663 90BL254701 90BL254958-254967 90BL255167- 255173 90BL255216-255218 90BL255769-255772 90BL256060-256064 90BL256289 90BL256293 90BL256344 90BL256346 90BL256386 90BL256396-256397 90BL256402 90BL256410	Various	Various	GAB – Water supply (248 units) Upper Namoi Zone 5 groundwater (150 units) Upper Namoi Zone 5 groundwater (67 units) Upper Namoi Zone 5 groundwater (43 units) River – High Security (20 units) River (48 units) River (10 units) River (600 units) Mining – Gunnedah Oxley Basin (818 units) Mining – Gunnedah Oxley Basin (403 units) Groundwater Monitoring Purposes
WorkCover NSW	Notification for explosives use and storage	20 December 2020	20 July 2025	Licence Number – XSTR100215

Issuing / Responsible Authority	Type of Lease, Licence, Approval	Date of Issue	Expiry	Comments
Narrabri Shire Council (NSC)	Construction Certificate DP 816020	23 September 2010	N/A	Stage 2 Mine Surface Facilities
Minister for Planning	PA 08_0144	26 July 2010	26 July 2031	Project Approval for Stage 2
	PA 08_0144 MOD1	30 March 2011	26 July 2031	Notice of modification under Section 75W of the EP&A Act to update the subsidence management conditions.
	PA 08_0144 MOD2	21 December 2011	26 July 2031	Notice of modification under Section 75W of the EP&A Act to allow for a one-off road transport of coal to Tarrawonga Coal Mine.
	PA 08_0144 MOD4	22 September 2015	26 July 2031	Notice of modification under Section 75W of the EP&A Act for an expansion of the coal stockpiles.
	PA 08_0144 MOD5	9 December 2015	26 July 2031	Notice of modification under Section 75W of the EP&A Act to widen the longwall face and increase the annual production limit.
	PA 08_0144 MOD6	13 January 2017	26 July 2031	Notice of modification under Section 75W of the EP&A Act to vary the annual reporting timeframe.
	PA 08_0144 MOD7	23 November 2021	26 July 2031	Notice of modification under Section 75W of the EP&A Act for a change in mining method from longwall to bord and pillar for panels 201 and 202.
Resources Regulator	Mining Operations Plan	1 December 2020	31 December 2023	Details mining and rehabilitation activities during the applicable period.

4 OPERATIONS SUMMARY

During the reporting period longwall mining extracted panel 109. Underground development continued into longwall (LW) panels LW110, LW203 and the 200 Mains. The longwall has previously extracted panels LW101 to LW108A.

Table 6 presents the production summary for the previous and current reporting periods and the forecast production schedule for the next reporting period.

4.1 MINING OPERATIONS

Table 6: Production Summary

Material	Approved limit	Previous reporting period (actual)	This reporting period (actual)	Next Reporting period (forecast)
Waste Rock / Overburden	657,000 m^3 (2010 MOP, Table 3.8)	0	0	0
ROM Coal*	11 Million Tonnes CY (PA 08_0144 Sch. 2, Cond.6) > 5 Million Tonnes produced (EPL 12789)	6.71	3.37	6.04
Reject Material	N/A (Million Tonnes)	0.05	0.15	0.08
Saleable Product**	> 5 Million Tonnes handled (EPL 12789)	6.45	3.43	6.01

* - ROM Coal is total production at the mine site. The difference between ROM Coal and final product is related to changes in stockpile volumes at the mine.
** - Saleable Product is coal railed from site.

4.2 OTHER OPERATIONS

4.2.1 Exploration Activities

Exploration drilling was undertaken during the reporting period to assist mine production planning and define geological structures within ML 1609, with eleven exploration holes drilled within ML 1609.

4.2.2 Construction

A concrete batch plant to provide concrete for drill hole rehabilitation and other site activities was constructed during the reporting period, and is located within existing cleared infrastructure area. The batch plant includes a sealed silo for the dry cement products a hopper for sand and aggregate, water tanks and demountable office building. This plant may be moved during life of mine as required.

Communication cabling (PED cable) was installed above longwall 203 to ensure underground development activities have safe and effective communication ability. The PED cable was buried on the surface to an approximate depth of 600mm. To establish this infrastructure a track the width of a dozer was required for the cable installation.

Underground development works have been described in Section 4.1.

4.2.3 Hours of Operation

The approved hours of operation are provided in Table 7.

Table 7: Hours of Operation

Activity	Hours / Days
Mining Operations	
Pit Bottom Area development	24 hours / 7 days
Underground mining	24 hours / 7 days
Gas drainage	24 hours / 7 days
Ventilation fan operation	24 hours / 7 days
Coal processing and handling	24 hours / 7 days
Rail loading and transportation	24 hours / 7 days
Surface maintenance	24 hours / 7 days
CHPP reject disposal	24 hours / 7 days[1]
Raw materials / supply delivery	7:00am to 10:00pm / 7 days
1: Reject disposal activities will generally be restricted to 7:00am to 10:00pm, 7 days per week. However, it is possible that the proportion of reject material generated by the CHPP may exceed the predicted average 5% level for short periods. To account for these periods of elevated reject production, contingent hours of operation will be 24 hours / 7 days (when inversion conditions do not prevail).	

4.3 NEXT REPORTING PERIOD

4.3.1 Mine Operations

The planned mine production rate for the next reporting period will be 6.04 Mt of ROM coal which is expected to contain approximately 0.08 Mt of coarse reject material. Longwall extraction of LW110A will commence early 2022, followed by LW110B. Development (first workings) will be carried out for LW203, LW204 and 200 Mains.

4.3.2 Exploration

Exploration drilling will continue to be undertaken at the Narrabri Mine. The primary focus of the exploration activities during the next reporting period will be structure/fault definition through the drilling of 12 exploration bore holes on ML 1609.

4.3.3 Construction Activities

Proposed construction activities during the reporting period include:

- Construction of an alternative access track to improve truck access for deliveries to site. The site had been cleared for agricultural purposes prior to the commencement of mining activities and has been included in the approved Mining Operations Plan disturbance area;
- Ongoing expansion of the internal network of access tracks;
- As part of the ongoing development of mine ventilation infrastructure construction of a downcast ventilation shaft at the southern extent of Longwall 205. Construction activities will require clearing of a hardstand area to locate temporary amenities, equipment storage areas, shaft construction plant and equipment, settlement dams, topsoil stockpiles, and a stormwater run-off catch dam to contain all rainwater on the site. Water from the dam will be used in the shaft construction boring process.
- As part of ongoing development of the pit-top water management infrastructure a new HDPE lined Brine Dam has been designed with a capacity of approximately 450ML. The dam will be constructed in a designated area approved under existing PA 08_0144; northwest of the existing pit-top surface water infrastructure and adjacent to the Kamilaroi Highway. Additional surface development associated with the Brine Dam construction would include a sediment dam (SD7) to manage runoff from disturbed construction and operational areas, an access track and services corridors from the existing rail loop dam complex;

- Storage sheds and temporary office facilities within the pit-top infrastructure area; and
- Improvements to the temporary security infrastructure located on the site entrance road.

4.3.4 Mining Fleet Upgrades

Modification 7 to PA 08_0144 was approved on 23 November 2021, and allows the bord and pillar mining of longwall panels 201 and 202. Mining equipment to facilitate the bord and pillar operations that will be introduced to the project during this reporting period include:

- 1 x continuous miner Komatsu Joy 12CM12;
- 1 x shuttle car;
- 2 x underground mining LHD (load haul dump) loaders; and
- 2 x underground personnel transport SMVs.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

The 2021 Annual Review identified the following actions, summarised in Table 8. Correspondence was received from NSW DPIE 8 July 2021 stating that the 2020 Annual Review report had satisfied the reporting requirements of the approval and did not include any additional corrective actions.

Table 8: Actions from the Previous Annual Review (2020)

Action required from Previous Annual Review	Requested By	Action Taken by the Operator	Where discussed in Annual Review
Investigations completed during 2020 have determined that the acoustic attenuators in the main ventilation fan discharge ducts have become compromised over time, potentially resulting in increased noise levels. New acoustic baffles were to be sourced and installed.	Operator	Acoustic baffles were installed to replace the acoustic attenuators on the fan discharge ducts on all main ventilation fans, with completion by July 2021. Sound power level surveys were conducted on the main exhaust ventilation fans following installation. Noise monitoring results have remained within compliance limits at all locations during the reporting period. Action completed.	Section 6.1
In accordance with a Pollution Reduction Study on EPL12789 during the reporting period the mine will undertake further assessment to determine the effectiveness of the current pit top dust suppression systems and identify what, if any, additional mitigation measures can be employed to ensure dust impacts are minimised.	EPA	NCO completed a thorough and robust assessment of pit-top dust management infrastructure and systems. A detailed report was submitted to the EPA on 22/12/2020 to address requirements of condition U3 of EPL12789. Improvements to dust management measures implemented during the reporting period include: installation of atomiser sprays on product coal discharge conveyors, updated Trigger Action Response Plan (TARP). Proposed improvements for next reporting period include upgrade of two stockpile sprays.	Section 6.3
Investigate and implement improvements to the geographical information systems (GIS) for environmental monitoring purposes.	Operator	System review was completed and Scope of Work for system improvements developed. A GIS specialist consultant has been engaged and implementation of improvements is ongoing.	Section 8
Improvements to existing fence installations around Aboriginal cultural heritage sites.	Operator	Fencing standard developed. Aboriginal fencing contractor engaged during the reporting period and fencing upgrades were completed at a number of aboriginal cultural heritage sites. Fence maintenance and upgrades remain ongoing for the 2022 reporting period.	Section 6.7

6 ENVIRONMENTAL PERFORMANCE

The following sub-sections report on the environmental performance achieved during the reporting period and provides a summary of the environmental monitoring data compared to data predictions, trends and management measures. Environmental monitoring locations are illustrated on Figure 3.

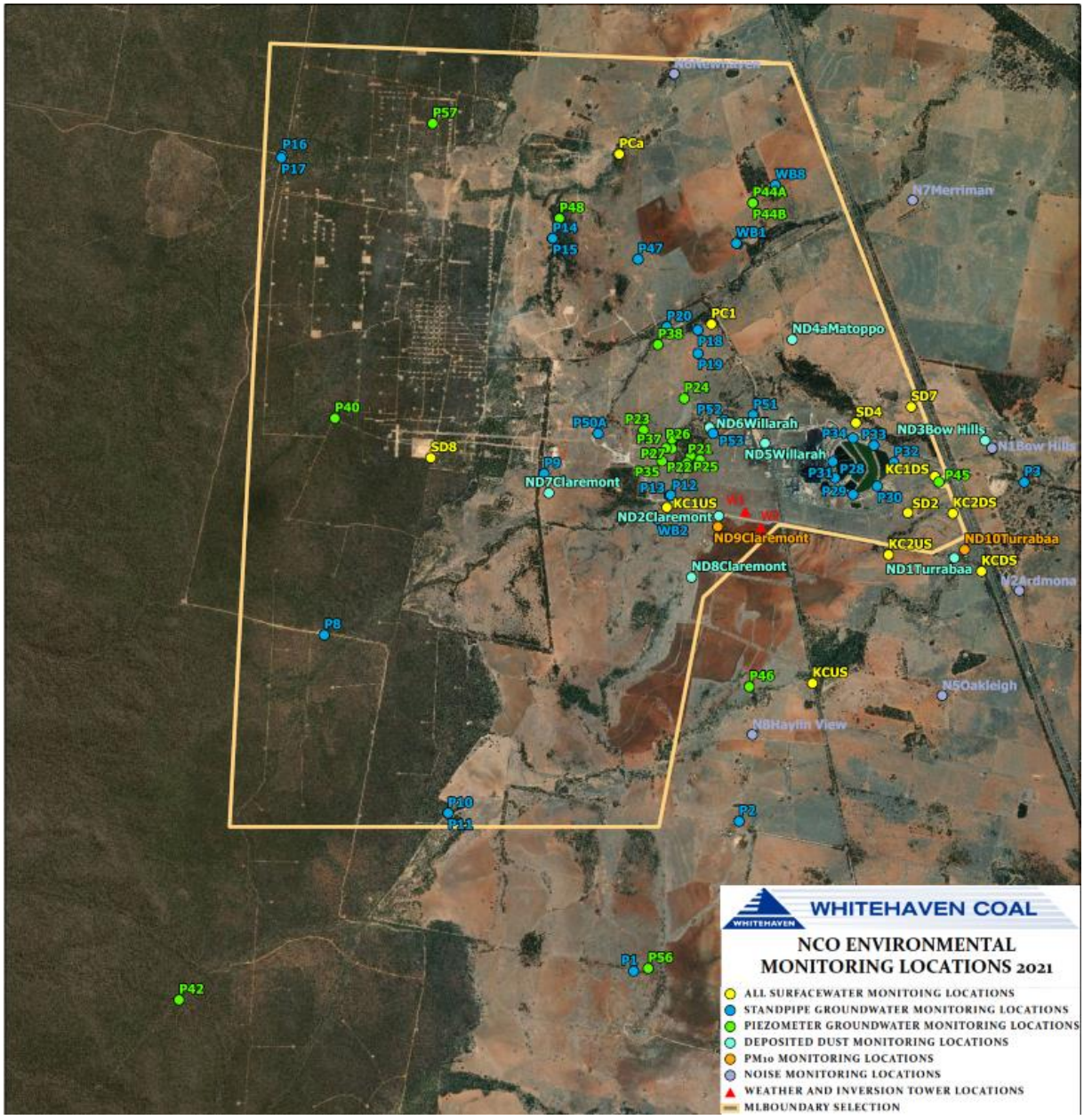

Figure 3: Environmental Monitoring Locations

6.1 NOISE

6.1.1 Environmental Management

Potential noise impacts associated with the Narrabri Mine are managed in accordance with the:

- Noise Criteria and Operating Conditions prescribed under Schedule 4, Conditions 1 to 5 of PA 08_0144;
- EPL 12789 Conditions L4, M7, R4 and E2; and
- NCO has previously prepared the Narrabri Mine Noise Management Plan (NMP) to address the requirements of condition 4, schedule 4 of the PA 08_0144, the NMP was approved by DPIE on the 5 July 2018.

During the reporting period various controls were implemented to manage noise including:

- Progressive replacement of reversing alarms on all existing surface vehicles and machinery to be of the low frequency type;
- An investigation in the previous reporting period determined that the acoustic baffles in the fan discharge ducts had become compromised over time, potentially resulting in increased noise levels from the main ventilation fans. Acoustic baffles were replaced, with design modifications to the fan baffle housings to enable ongoing routine maintenance work on the new baffles.
- Rail track inspections and maintenance activities to mitigate train related noise;
- Maintenance activities along the main entrance road were undertaken to repair potholes and thereby minimise traffic noise;
- The approved hours of operation were adhered to; and
- Monitoring of emitted noise levels is undertaken during mining operations to verify compliance with noise criteria and to assess the need, if any, for additional noise attenuation measures.

The Narrabri Mine noise monitoring network includes:

- Continuous monitoring at three real-time monitoring units for management purposes;
- Temperature Inversion monitoring is undertaken continuously by directly measuring temperature at two elevations 50m apart (10m and 60m from ground level); and
- Quarterly attended monitoring at locations as described in the EPL and Noise Management Plan.

6.1.2 Environmental Performance

Attended Monitoring

Attended noise monitoring is conducted on a quarterly basis during the reporting period by an independent consultant. The attended noise monitoring is used to assess compliance with licence and approval limits for mine contributed noise. A summary of the noise monitoring results are outlined in Table 9 with compliance achieved at all locations for all the monitoring events.

Table 9: Noise Monitoring Summary 2021

Plan	Site ID	Site name	Criteria ($L_{Aeq(15\ minute)}$), dB(A))	Criteria ($L_{A(1\ minute-Night)}$), dB(A))	Quarter 1 22-24 March (Mine Contribution, dB(A))[1]		Quarter 2 21-23 June (Mine Contribution, dB(A))[1]		Quarter 3 08-10 Sept (Mine Contribution, dB(A))[1]		Quarter 4 14-16 Dec (Mine Contribution, dB(A))[1]	
			L_{Aeq} 15min	L_A 1 min Night	L_{Aeq} 15 min	L_A 1 min Night	L_{Aeq} 15 min	L_A 1 min Night	L_{Aeq} 15 min	L_A 1 min Night	L_{Aeq} 15 min	**L_A 1 min Night**
NMP	N3	Ardmona	35	45	<25	27	I/A	I/A	31	25	I/A	I/A
EPL	N5	Oakleigh[2]	35	45	I/A	I/A	35	42	31	I/A	33	28
EPL	N6	Newhaven	35	45	32	30	29	30	34	40	I/A	I/A
EPL	N8	Haylin View / Matilda[2]	35	45	I/A	I/A	32	I33	30	I/A	23	25
EPL	N9	High Range[2]	35	45	27	30	27	I/A	32	39	<25	I/A

I/A = Inaudible
Note 1: Noise levels presented are the highest measured noise level under compliant weather conditions over the monitoring period.
Note 2: Property is owned by Narrabri Coal Operations

Quarterly monitoring is also undertaken at N1; however a private agreement is in place and therefore the results are not included in this AR.

Figure 4 (below) displays attended noise monitoring results for the reporting periods of 2018 to 2021, and shows a decreasing trend in the occurrence of exceedances, with compliance achieved at all locations for the 2021 reporting period. As discussed above, elevated attended noise monitoring results in previous reporting periods triggered investigations and improvements to noise management of the Main Ventilation fans. Exceedances attributed to the fans were recorded at N9 in September 2019 and at N6 in June 2020. Improvement measures consisted of the replacement of acoustic baffles, with design modifications to the fan baffle housings to enable ongoing routine maintenance work on the new baffles.

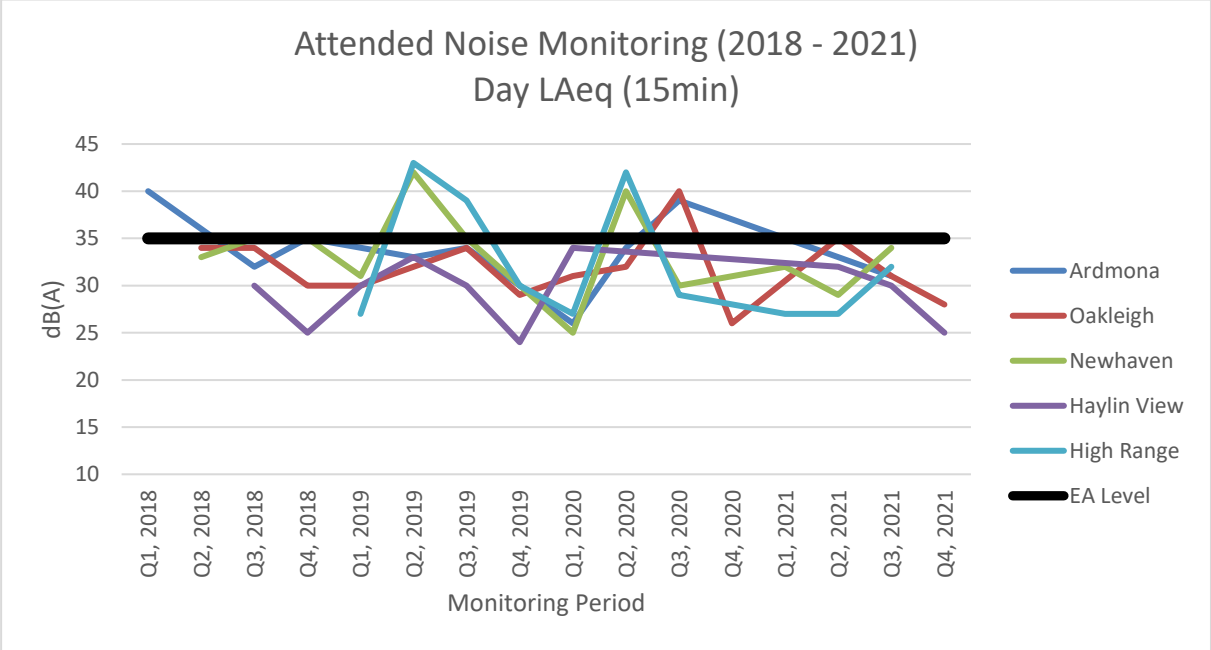

Figure 4: Trended Attended Noise Monitoring (2018 – 2021) Day LAeq (15 min)

Sound Power Testing (SPL)

SPL testing was undertaken on key mobile plant and other fixed equipment during the reporting period, results are summarised in Table 10.

Table 10: SPL Testing Summary

Unit	Equipment Type	Parameter	Modelled SPL (dB)	Result dB
N/A	Main Ventilation Fans	In Service	117	**118**
MEU004	Goaf Drainage Unit	In Service	102	**97**[1]
MEU007	Goaf Drainage Unit	In Service	102	**103**[1]
MEU008	Goaf Drainage Unit	In Service	102	**106**[1]
DOZ004	Komatsu D375A Dozer	Dynamic cycle	118	**113**
DOZ005	Komatsu D475A Dozer	Dynamic cycle	118	**114**
DZ308[3]	Caterpillar D11T Dozer	Dynamic cycle	118	**119**
DZ368[3]	**Caterpillar D11T Dozer**	**Dynamic cycle**	**118**	**117**

Note 1: The reported In Service SWL is not reflective of typical operating conditions.

The reported SPL results for the MEU's (Mobile gas Extraction Units) were not recorded under normal operating conditions. At the time of monitoring underground gas levels did not require extraction via the MEU surface infrastructure. In order to carry out the SPL measurements the MEU equipment had to be configured to run on surface 'fresh air' intakes which results in an increased noise level. Upon resuming normal operations noise measurements will be undertaken to confirm the SPL is <102dB.

6.1.3 Proposed Improvement Measures

The two Caterpillar D11T stockpile dozers DZ308 and DZ368 were purchased in the previous reporting period and as reported in the 2020 Annual Return exhibited lower sound power levels of 113.5dB and 115dB respectively. The reported SPL of these two machines for the current reporting period show an increase, with DZ308 slightly above the modelled level of 118dB. Investigations will be undertaken during the next reporting period into the increased noise from DZ308 and DZ368 and a review of maintenance requirements.

6.2 BLAST

As there has not been any surface or near-surface blasting at the site during the reporting period, no blast monitoring has been required or conducted.

6.3 AIR QUALITY

6.3.1 Environmental Management

Potential air quality impacts associated with the Narrabri Mine are managed in accordance with the:

- Air quality criteria prescribed under Schedule 4, Condition 6 of the PA 08_0144;
- EPL 12789 Conditions O3, P1 and M2; and
- NCO has previously prepared the Narrabri Mine Air Quality Management Plan (AQMP) to address the requirements of condition 7A, schedule 4 of the PA 08_0144; the AQMP was approved by DPIE on the 26 May 2015.

Narrabri Mine employs a range of air pollution control measures including:

- Cleared trees and branches will be retained for use in stabilising disturbed areas until they are rehabilitated are no longer required;
- Trigger Action Response Plans (TARPs) have been developed for the major dust generating activities onsite which currently includes: the coal processing area; surface drilling activities; and surface civil works;
- All conveyers will be fitted with appropriate cleaning and collection devices to minimise the amount of material falling from the return conveyer belts and are partly enclosed to minimise dust lift-off;
- The coal rotary breaker is enclosed;
- The CHPP and stockpile areas have a fully automated water spray systems, including conveyor belt sprays and stockpile sprays;
- Clear definition of all the site roads and the restriction of vehicles and equipment to the roads. All site roads and hardstand areas are routinely watered by a mobile water cart;
- Progressive rehabilitation of areas of disturbance including topsoil and subsoil stockpiles;
- Maintaining a perimeter amenity bund and windbreaks.

The Narrabri Mine air quality monitoring network is illustrated on Figure 3 and includes:

- PM_{10} levels are measured by two High Volume Air Samplers (HVAS) for a twenty-four hour period every six days. Total Suspended Particulate (TSP) matter is inferred at a ratio of 1:2 from the measured PM_{10} data; and
- a network of eight Dust Deposition Gauges (DDGs), measuring deposited dust and particulates collected monthly.

6.3.2 Environmental Performance

Depositional Dust results for the reporting period (Table 11) indicate that all monitoring locations are below the annual average criteria of 4 g/m^2/month Total Insoluble Solids. All dust monitoring locations are located on mine owned properties, with the exception of ND3.

The reporting period average for ND3 was 1.5 g/m^2/month and the long-term average is 1.8 g/m^2/month. The reporting period average is below the annual average criteria.

All depositional dust sites were below the predicted EA levels with the exception of ND8 which is located at the Narrabri Mine's Claremont property. The December 2021 result for this location was 18.1 g/m^2/month which was inconsistent with the previous monthly results for the reporting period. The annual average excluding the December 2021 result is 0.63 g/m^2/month and below the predicted EA levels. A review of prevailing wind direction for the months of November and December 2021 (elevated result monitoring period) indicated ND8 was not downwind of mining operations and therefore the likely cause of this increase was determined to be agricultural activities (harvesting).

Table 11: Deposited Dust Monitoring Data Summary for the Reporting Period

Site	EPL ID No.	Property Name	PA 08_0144 Annual Average Criteria		Modification 5 EA Levels (g/m^2/month)	Annual Mean Total Insoluble Solids (g/m^2/month)
			Max Increase (g/m^2/month)	Max Total (g/m^2/month)		
ND1	-	Turrabaa	2	4	2.2	2.1
ND2	-	Claremont	2	4	1.9	0.9
ND3	3	Bow Hills	2	4	2.0	1.5
ND4A	-	Matoppo	2	4	2.3	2.2
ND5	-	Willarah	2	4	2.9	2.1
ND6	-	Willarah	2	4	2.9	2.6
ND7	-	Claremont	2	4	1.9	1.3
ND8	-	Claremont	2	4	1.9	2.0

Depositional Dust for all sites during the reporting period recorded lower results than previous years (Figure 5), with the exception of monitoring location ND6 (Willarah) which has been impacted from civil works being undertaken during the reporting period but remains below the annual average criteria of 4 g/m2/month Total Insoluble Solids. Lower results within the reporting period may be attributed to higher rainfall recorded than previous years. Previous Annual Reviews also highlighted the occurrence of bush fires and regional dust storms (extraordinary events as per PA08_0144 Schedule 4 Condition 6) as impacting on results during previous reporting periods. This is reflected in the exceedance of the annual average criteria at ND1 and ND6 for the 2018 reporting period. An assessment of the ash content of the sites (at the time of reporting 2018) indicated that these two dusts gauges were impacted by combustible material not indicative of dust sources associated with the mining operation.

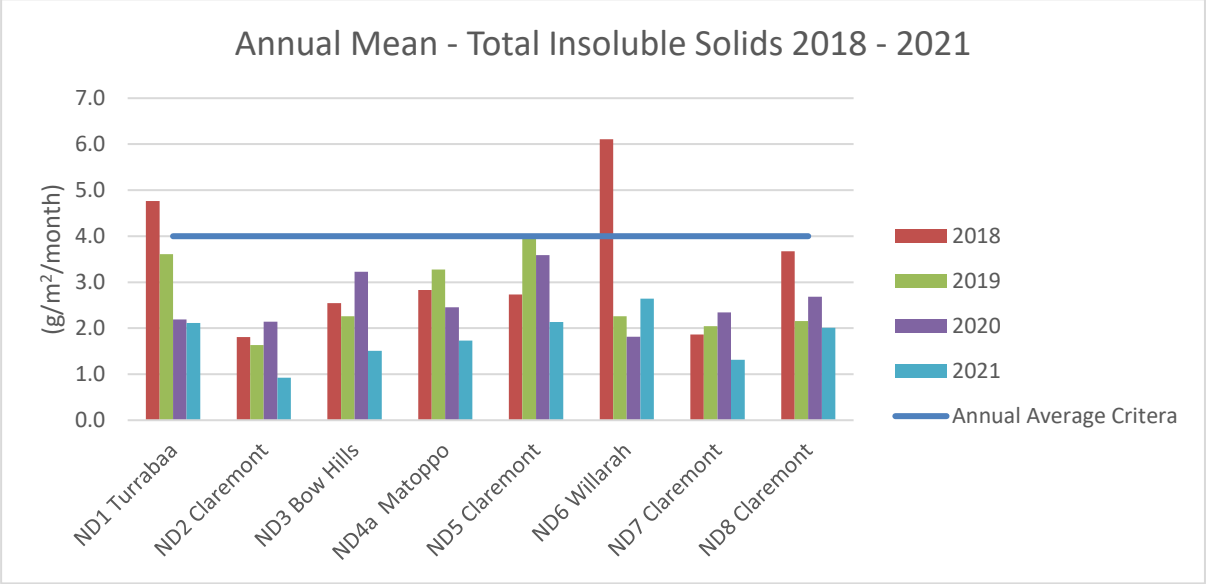

Figure 5 Average Depositional Dust Results 2018 - 2021

The HVAS monitoring conducted (Figure 6 and 7) indicate that the PM_{10} annual average results remain below the applicable criteria of 30 µg/m³ at both monitoring locations; with PM_{10} results of 4.66 µg/m³ at ND9 and 5.69 µg/m³ at ND10. These results were lower than the results from the last reporting period; with PM_{10} results of 10.33 µg/m³ at ND9 and 9.13 µg/m³ at ND10. The results for the PM_{10} monitoring confirm that the TSP criteria for the mine are within the annual average compliance limit. The DPI&E have previously advised that Whitehaven's method for determining TSP concentrations by multiplying PM_{10} concentrations by a factor of 2, is satisfactory. Based on the above, the calculated annual average TSP concentrations of 9.33 µg/m³ at ND9 and 11.38 µg/m³ at ND10 are both below the 90 µg/m³ annual average AQ impact assessment TSP criterion.

During the reporting period exceedances of the 24-hour criterion (50 µg/m³) were reported to DPI&E and summarised below:

- 2 June 2021 the ND10 'Turrabaa' monitoring unit measured PM10 levels of 82 µg/m³. The Turrabaa monitoring unit is located to the South East of the mine pit top area. During the sample period, the dominant wind direction was from the South East, and no coal was being processed or loaded onto trains. There were roadworks occurring on the Kamilaroi Highway, near ND10 monitoring unit. Therefore, the high result is likely related to the roadworks occurring on the

highway, not mining activities. The exceedance was reported to the DPIE who acknowledged that it was unlikely that site activities impacted the data, but required NCO to include the result in annual average calculations as it was not the result of an extraordinary event.

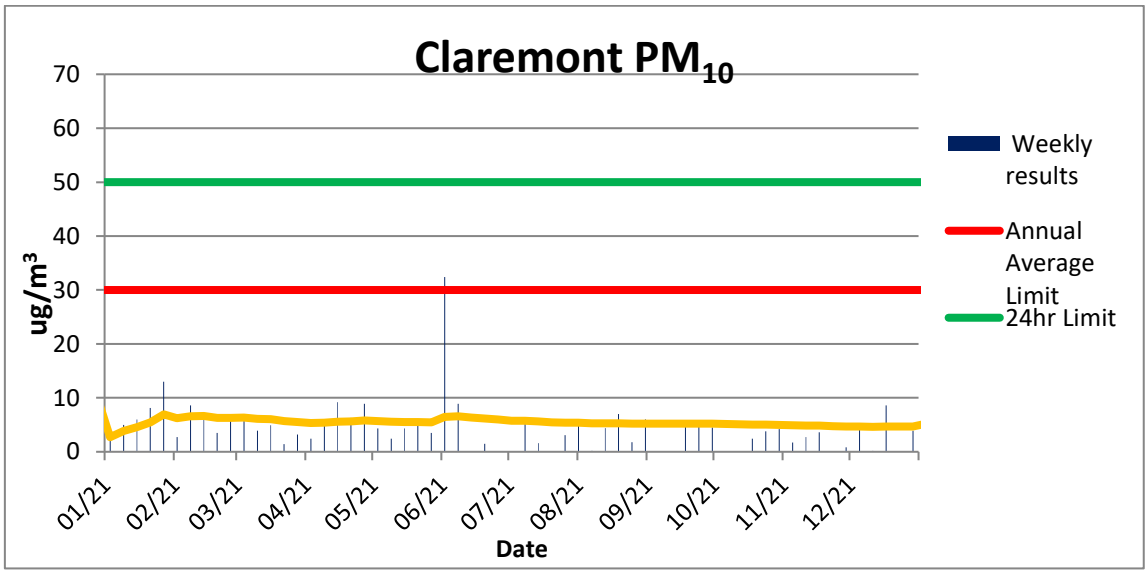

Figure 6: ND9 PM_{10} Results including extraordinary weather events

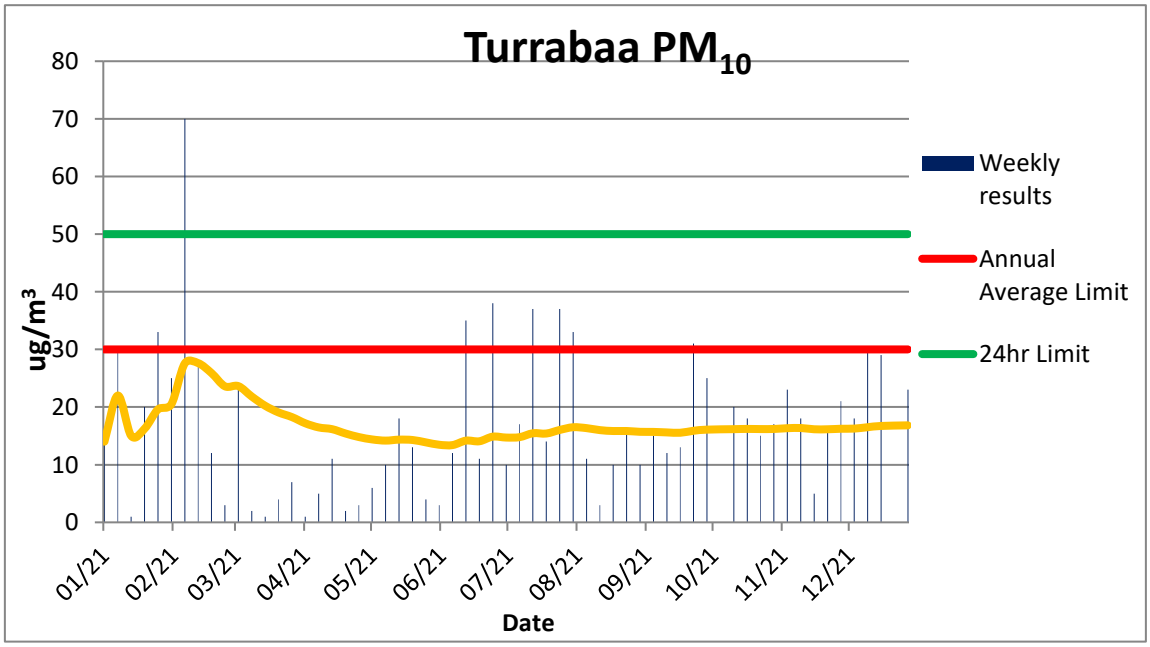

Figure 7: ND10 PM_{10} including extraordinary weather events

Table 12 displays that PM_{10} levels have remained below the annual averaging criteria of 30 µg/m³ across previous years; with the current reporting periods PM_{10} results averaging 4.66 µg/m3 at ND9 and 5.69 µg/m3 at ND10. These results were lower than the results from the previous two reporting periods; with PM10 results of 10.33 µg/m3 at ND9 and 9.13 µg/m3 at ND10. The Stage 2 EA determined that NCOs'

Assumed Ambient background level for annual PM10 Average is 15.8µg/m3. The 2021 results are below this level. As discussed, higher results in previous years can be attributed to low rainfall within the region, particularly for the years 2018 and 2019. This period has also seen the occurrence of regional dust storms as well as bushfires being recorded in the region for 2019, both of which impacted regional air quality. Previous Annual Report commentary suggests that the data for these extraordinary events (as per PA08_0144) has not been excluded from data summaries.

Table 12: PM_{10} Annual Average (2018 – 2021)

Site		2018	2019	2020	2021
ND9	µg/m³	19.38	19.24	10.33	4.66
ND10	µg/m³	18.50	25.10	9.13	5.69

Narrabri Coal Operations Pty Ltd (NCO) was issued a variation to Environmental Protection Licence (EPL) 12789 in the form of a Pollution Reduction Program (EPA Notice Number 1582323) on 3 December 2019 which required a Review of the Pit Top Dust Suppression System. The Pollution Reduction Study addressing Condition U3 was submitted to the NSW Environment Protection Authority (EPA) on 15 June 2020 in a report titled 'Narrabri Coal Pollution Reduction Study – U3 Review of Pit Top Dust Suppression System'. In a letter dated 15 December 2020 (DOC20/967555) EPA requested additional information to determine the effectiveness of the current pit top dust suppression systems and identify what, if any, additional mitigation measures can be employed to ensure dust impacts on the surrounding community are minimised.

NCO have undertaken a thorough and robust assessment of the pit-top dust management infrastructure and management systems and submitted the Pollution Reduction Study report to EPA on 22 December 2021.
Improvements to the site dust suppression system and processes that have been implemented during the reporting period include:

- Installed atomiser sprays at the thermal coal transfer points and from the Crusher to Bypass transfer point. Atomiser sprays provide a broad and consistent application of moisture. As recommended, sprays were installed at the discharge points to achieve effective penetration of the falling product.
- The TARP was amended to include control measures for all surface activities that have the potential to cause dust emissions, and to include specific detail on roles and responsibilities.
- Improved accuracy and reliability of wind anemometers used for measuring wind speeds (which trigger each TARP level through the Citect operating software system).
- Monthly review of Dust TARP triggered events (i.e. CoalTrak records) will be checked against available CCTV images to confirm dust management control measures continue to be effective. This action has been added to the site compliance management software.

6.3.3 Proposed Improvement Measures

Further improvements to the site dust suppression system identified by the Pollution Reduction Study which will be implemented during this reporting period:

- The assessment of the effectiveness of water sprays identified that two SR100 water cannons at locations 3 and 6 installed for product coal stockpile spray coverage are ineffective under TARP levels 3 and 4. These two stockpile sprays will be upgraded to SR150 nozzles, which have been assessed as effective under all TARP level wind conditions.

6.4 METEOROLOGICAL DATA

Meteorological monitoring is conducted onsite in accordance with Schedule 4, Condition 8 of PA 08_0144 at the Narrabri Mine meteorological station. The location of the Narrabri Mine meteorological station is illustrated on Figure 3. Table 13 summarises the monthly meteorological conditions recorded at the Narrabri Mine station for the reporting period.

The total rainfall for the reporting period was recorded at 1001.8 millimetres (mm), which is higher than the historical average of 569.8mm recorded from the Narrabri Airport and higher than the 745.8mm recorded during the 2020 reporting period.

The minimum temperature during the reporting period was -2°C in July 2021 and the maximum temperature was 37.5°C in December 2020. The minimum and maximum temperatures recorded were slightly below historical averages.

The predominant wind direction in the 2021 reporting period was SE, which is comparable to previous reporting periods.

Inversion conditions are calculated from measurements recorded by the site 60m Inversion Tower. Inversions occur during E, F and G stability categories (these categories represent weak, moderate and strong inversion conditions).

Table 13: Summary of Meteorological Conditions 2021

Month	Rain (mm)	Cumulative Rainfall (mm)	Rainfall Days (>1mm)	2m Temperature (˚C)			Wind		Inversion Conditions
				Min	Mean	Max	Av. Speed (m/s)	Predominant Direction	Total E/F Evening & Night %
Jan 2021	32.0	32.0	5	11.5	24.9	37.1	2.6	SE, NW	29.50%
Feb 2021	115.6	147.6	5	14.6	24.4	36.8	3.1	SE	26.00%
Mar 2021	136.8	284.4	7	10.8	21.4	33.6	2.5	SE	32.70%
Apr 2021	13.6	298.0	1	1.8	16.6	29.2	2.2	SE	55.40%
May 2021	37.8	335.8	5	-1.2	13.3	26.1	2.0	SE	59.90%
Jun 2021	114.2	450.0	9	-0.1	10.6	22.7	2.5	SE, NW	53.70%
Jul 2021	63.0	513.0	6	-2.0	10.1	23.3	2.4	SE, NW	49.40%
Aug 2021	31.2	544.2	4	-0.6	12.2	26.9	1.8	NW, S, SE, W	53.60%
Sep 2021	56.4	600.6	4	-0.1	14.5	28.3	2.2	SE, NW	52.10%
Oct 2021	69.0	669.6	6	2.7	18.2	34.3	2.4	SE, NW	39.70%
Nov 2021	252.6	922.2	13	5.5	20.3	32.3	2.5	SE, NW	30.50%
Dec 2021	79.6	1001.8	7	7.1	23.5	37.5	2.5	SE	30.90%

6.5 GREENHOUSE GAS

6.5.1 Environmental Management

Greenhouse Gas (GHG) emissions at the Narrabri Mine are managed in accordance with Schedule 4 Conditions 30 and 32 of PA 08_0144 and the Greenhouse Gas Minimisation Plan (GHGMP). The main sources of GHG emissions considered in the GHGMP are:

- Consumption of diesel fuel – Scope 1;
- Consumption of electricity – Scope 2; and
- Fugitive emissions associated with gas drainage and ventilation – Scope 1.

6.5.2 Environmental Performance

GHG emissions are reported through participation in the National Pollutant Inventory (NPI) and as part of the Whitehaven Group in the National Greenhouse and Energy Reporting Scheme (NGERS). The total of Scope 1 + Scope 2 GHG emissions attributed to the mine reported for the NGERS 2020-2021 reporting year were 455,581 t CO_2-e. The following sections detail the key contributors for the NGERS 2020 - 2021 reporting year.

Scope 1 emissions

Scope 1 greenhouse gas emissions for the 2020 – 2021 NGERS reporting period were 384,304 t CO2-e. This is a decrease from the 2019-2020 Scope 1 emissions of 507,061 t CO2-e. The breakdown of contributors to the Scope 1 emissions total is as follows:

- Fuel combustion (emissions released from combustion of liquid fuels- stationary and transport, and petroleum based oils and greases): approximately 3,554 kL was consumed equating to 8,222 t CO2-e. The fuel usage figures are less than the previous reporting period.
- Fugitive emissions (from extraction of coal):.The reported figure of 376,059 t CO2-e is a decrease from the previous reporting period.
- Industrial processes (emissions of hydrofluorocarbons and sulphur hexafluoride gases): The reported figure of 23 t CO2-e is a decrease from the previous reporting period.

Scope 2 emissions

Approximately 87,996 MWh electricity was purchased by the mine during the 2020 – 2021 reporting period equating to 71,277 t CO_2-e GHG emissions. This is less than the previous reporting period and less than the predicted consumption in the EA MOD5.

6.5.3 Proposed Improvement Measures

As the concentrations of methane in the ventilation and pre-drainage gas streams remain prohibitive for any beneficial use, no additional management measures are to be implemented for fugitive emissions during the next reporting period.

6.6 BIODIVERSITY

6.6.1 Environmental Management

Biodiversity was managed in accordance with:

- Schedule 5, Conditions 1 to 7 of PA 08_0144; and
- the Narrabri Mine Landscape Management Plan (LMP) and Biodiversity Offset Strategy (BOS) prepared to satisfy the requirements of PA 08_0144.

To meet these BOS approval requirements; WHC established Kenna BOA (Kenna offset property) (Figure 9) and the Onsite BOA (includes offset properties: Greylands, Omeo, Rosevale, Greylands Road, Kurrajong Park and West Haven) (Figure 10). These properties are displayed at a regional scale in Figure 8. The Narrabri Coal Mine Stage 1 and 2 Biodiversity Offset Strategy (Eco Logical Australia, 2014 and revised 2019) confirmed the ability of these properties to meet “like for like or better” and “maintain or improve” conservation outcomes’ and outlined that the Narrabri BOA covers an area of native vegetation greater than 1,243ha from the Kenna offset property and greater than 422ha from the Onsite offset properties. Furthermore, up to 1,168 ha of woodland vegetation that was subject to subsidence impacts at NCM, will also be established as the “future” offset, adjoining the Onsite offset properties to be progressed at the end of the mine life, resulting in an overall NCM BOS of 2,833ha. The NCM BOS includes the protection of B. opponens and Superb Parrot habitat within nearly 380 ha of Red Ironbark – Brown Bloodwood shrubby woodland and a further 297 ha of the same vegetation type occupied by B. opponens located within the 1,168 hectares affected by subsidence. The NCM BOS provides an estimated 327,094 plants in the Onsite offset properties with an additional estimated 169,184 plants within the “future” offset for a total of approximately 500,000 plants.

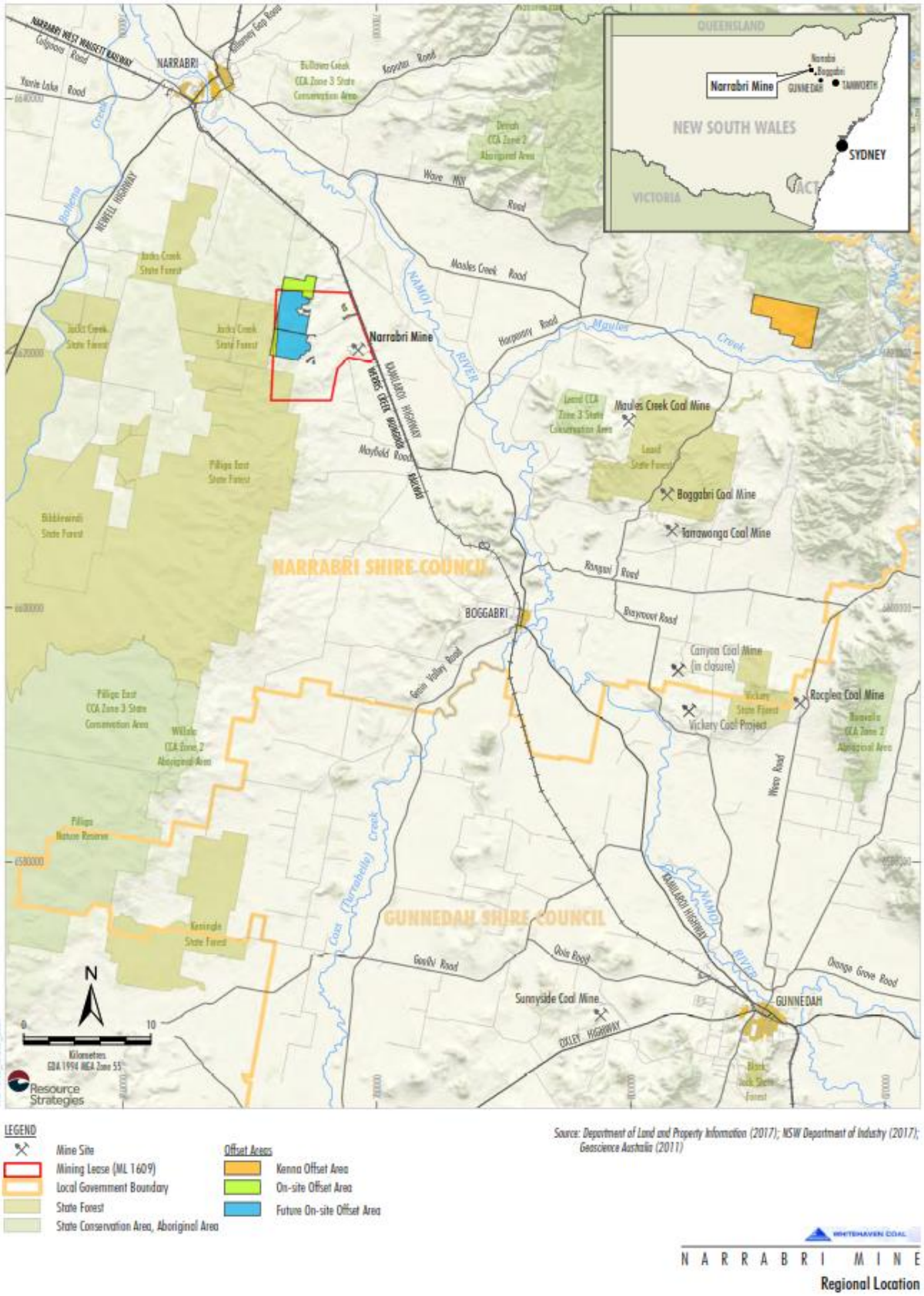

Figure 8: Regional location of Biodiversity Offset Areas

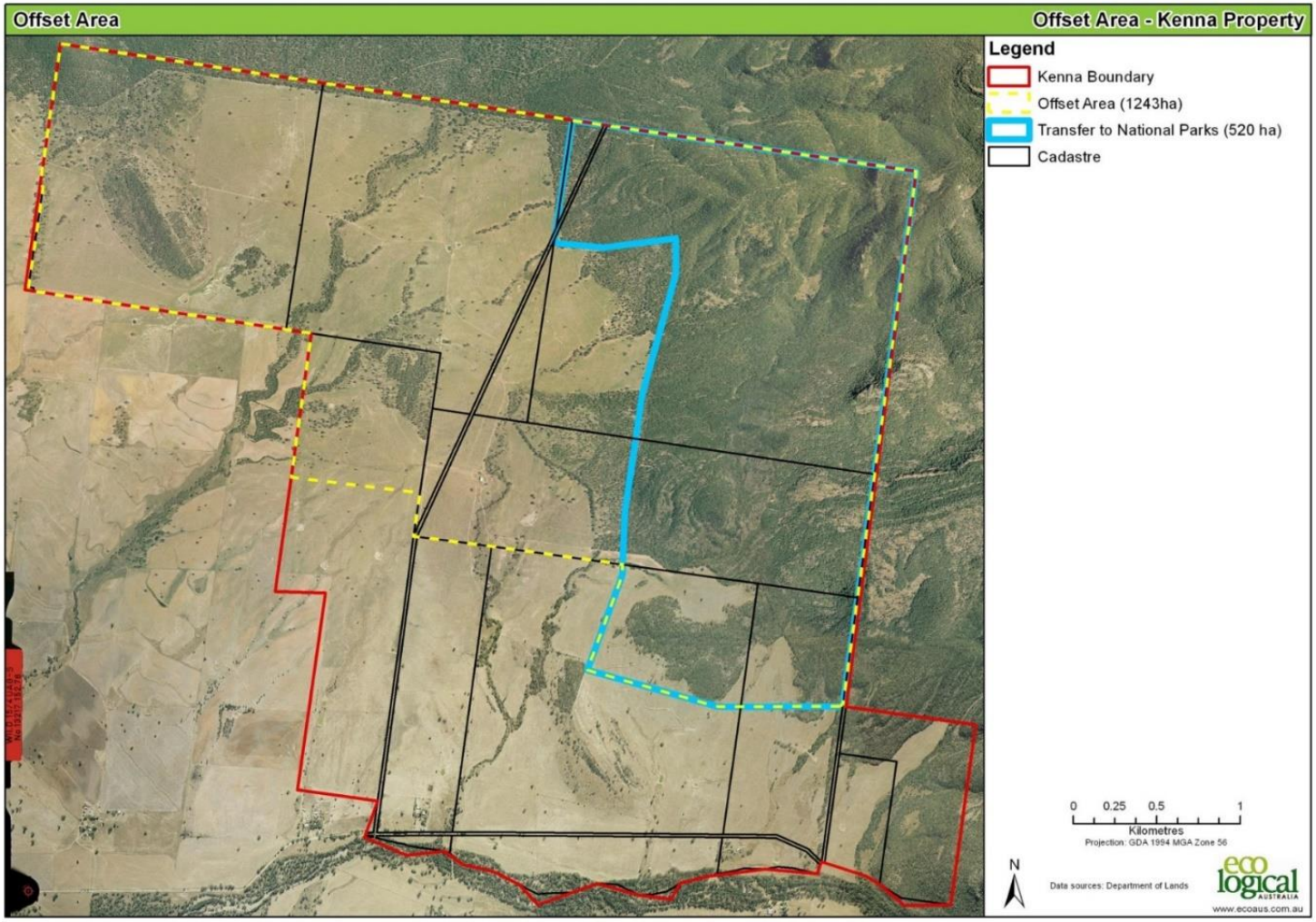

Figure 9: Kenna Biodiversity Offset Area

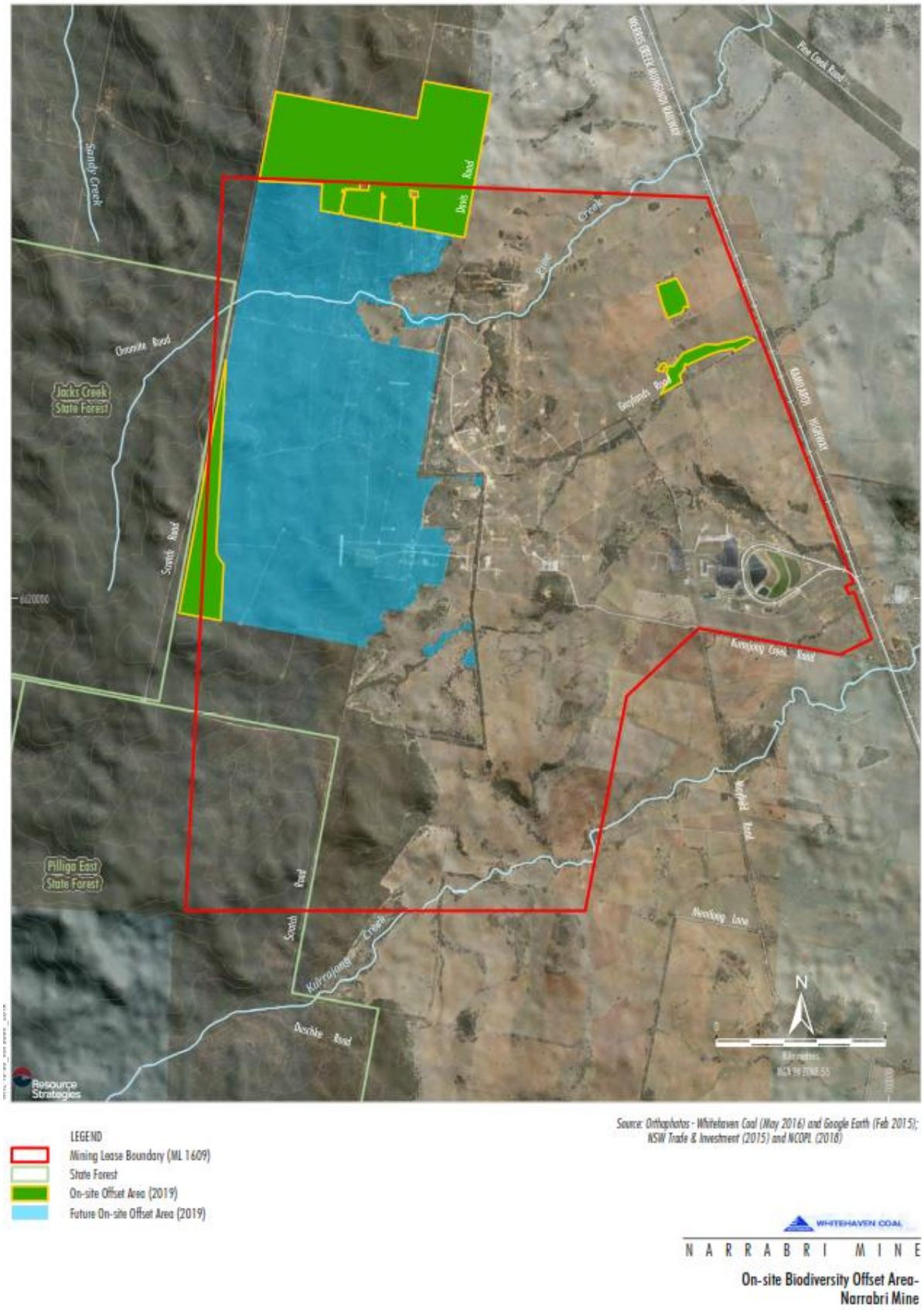

Figure 10: Onsite BOA and proposal future onsite offset areas

Various treatments were implemented during the reporting period to mitigate impacts of the Narrabri Mine including (but not limited to):

- Weed monitoring and inspections;
- Feral animal monitoring, inspections and control;
- Flora and Fauna monitoring.

6.6.2 Environmental Performance and BOMP Implementation

6.6.2.1 Mine Site Environmental Performance

Weed Management

Weed management programs were implemented at NCO during 2021. Weed management consists of spot spraying programs (two-week programs) periodically throughout the year. Locations are based on ecological monitoring reports and locations of listed weed species. Weed control in the pastoral areas is planned to be managed by landholder management and pasture improvement (or as recommended in subsequent monitoring reports). Weeds targeted in the reporting period include African boxthorn, Common pear, Mother of Millions and Bathurst burr.

Feral Animals

A vertebrate animal control programs were undertaken at NCO in Spring 2021, targeting feral pigs. Six Hoggone Bait Trays set up across site, for a four week period. A total of 28 pigs were successfully baited. Motion sensors were used to record the number of wild pigs eating the baits.

As a results of the pig trapping, a 1080 baiting project for foxes was planned, however due to wet weather, it has been delayed until 2022.

Appropriately qualified and experienced feral animal contractors (appropriate feral animal management qualifications, NSW fire arm licence and pesticide accreditation where relevant) were engaged to undertake feral animal control works for WHC.

Annual Extraction Plan Monitoring

The results of annual monitoring undertaken during the reporting period, as required by the Extraction Plan, which includes the LMP, are summarised in Table 14 and Table 15.

Table 14: Biodiversity Management Plan 2021 Monitoring Results

Performance Measures	BMP Performance Criteria	2021 Results
LW101-LW106		
Woodland vegetation (Inland Grey Box EEC) composition and health	Clearing does not exceed the allowable limit of the Project Approval	Performance criteria met - (17. 65 ha of 24. 8 ha)
	Less than 10% change in floristic composition (relative to natural variation found in control areas)	Performance criteria not met – Site 7's floristic composition has been altered by an amount greater than the natural variation + 10% found within the control site. Successive subsidence related ponding events has been identified as the largest influence for this change.

Performance Measures	BMP Performance Criteria	2021 Results
	Less than 10% increase in exotic species numbers and cover	Performance criteria not met – Both exotic species and numbers at Site 7 has increased by more than 10% relative to natural variation found in control site since the baseline survey period. Successive subsidence related ponding events has been identified as the largest influence for this change.
	No increase in feral animal presence	Performance criteria not met – feral species richness and occurrence has remained similar to baseline.
Riparian vegetation composition and health	Clearing does not exceed the allowable limit of the Project Approval	Performance criteria met - (1. 67 ha of 4. 1 ha)
	Less than 10% change in floristic composition (relative to natural variation found in control areas)	Unable to be surveyed due to inundation.
	Less than 10% increase in exotic species numbers and cover	Unable to be surveyed due to inundation.
	No increase in feral animal presence	Performance criteria not met – feral species richness and occurrence has remained similar to baseline.
	Less than 20% increase in length of eroding creek	Refer to creek line assessment outlined in the LMP 2021 monitoring.
Terrestrial fauna habitat for threatened species	Fauna populations do not experience adverse impacts	Performance criteria met – Availability of fauna habitat has remained within the objectives of this BMP
	Fauna records decrease by greater than 10% (relative to natural variation found in control areas)	Performance criteria met – no discernible decrease in fauna records is evident.
Aquatic macro-invertebrate and macrophyte assemblages	No decline in aquatic habitat quality relatively to natural variation in control areas	As per the BMP, ongoing monitoring should be directed at subsidence related ponding along ephemeral creeks. This is addressed within the Subsidence Pond Management Plan (ELA, 2021)
LW107-LW110		

Performance Measures	BMP Performance Criteria	2021 Results
Woodland and riparian vegetation health and habitat value	Areas of NDVI change greater than 1 standard deviation from the mean change and greater than 0.1 ha in area.	Identified decreases in PAB can be attributed mostly the mining infrastructure. Significant decreases identified along watercourses including Pine Creek above LW107 (ID: 1) LW108 (ID: 19 & 20) and LW109 (ID: 5) are potentially related to subsidence ponding.
	Canopy dieback is not substantially greater than that observed during baseline traverses and considered beyond natural seasonal dieback and natural variation due to weather.	Canopy dieback has been more pronounced in some areas of longwalls than others, mainly in the Maximum Subsidence zones. Canopy health has increased in the Pillar and Transition zones. Vegetation plots that have been identified as problem areas have been recommended for further monitoring. LW109 has had no significant decreases in quality of vegetation, or indications of impacts from mining operations have occurred since the pre-mining monitoring period.
	Data does not indicate declining trend in vegetation and habitat conditions.	Pillar and Transition zones have not recorded a decrease vegetation and habitat conditions. A decrease in conditions is more pronounced in maximum subsidence zones of the longwalls. LW109 has had no significant decreases in quality of vegetation, or indications of impacts from mining operations have occurred since the pre-mining monitoring period.
	Less than 10% increase in weed cover in impact quadrats in comparison to control quadrats.	Exotic species percentage cover has historically remained below 1% in all FBS in previous years. This continued in 2021, with no increase in weed coverage being recorded across FBS sites. All High threat weed species, those listed as priority within the North West Regional Strategic Weed Management Plan (LLS 2017-2022) and as noxious weeds listed within the Narrabri mine BMP107-110 (ELA, 2017)) that have been identified in 2021 should be managed across this BMP.

Performance Measures	BMP Performance Criteria	2021 Results
	Clearing does not exceed the estimated area of clearing assessed by the Stage 2 EA and as updated in Modification 5 (Resource Strategies, 2015) for infrastructure above LW107 to LW110.	Clearing amount to date is within the limits as set out in the Stage 2 EA and as updated in Modification 5.
Observance of trapped Delicate Mouse or Pale-headed Snake within surface cracks	Incidence of Delicate Mouse and/or Pale-headed snake becoming trapped in surface cracks.	LW108: Based upon the current capture rates of the Delicate Mouse and Pale-headed Snake, and multiple monitoring periods undertaken above LW108 since undermining was completed, it is recommended that if all major cracks have been ameliorated (as per the BMP), fauna surveys above LW108 can cease. LW109-110: No known incidence of Delicate Mouse or Pale Headed Snakes becoming trapped in surface cracks in 2021 or indication that either species local population is being impacted by surface cracks.

Table 15: Land Management Plan 2021 Monitoring Results

Performance Measures	Performance Criteria	Comment
LW101-LW106		
Surface cracking		
Surface cracking inspection	Permanent cracks (which do not self-close within one month of longwall face passing) are remediated as soon as practicably possible (and safe to do so) Surface cracking is remediated to prevent erosion and slope instability issues within 6 months of each longwall pass.	No evidence of surface cracking has been identified in recent monitoring periods. Additionally, there are no known permanent cracks required to be remediated, as such the performance criteria has been achieved. It is likely that subsidence has stabilised across this LMP. Known subsidence cracks identified within past monitoring reports that occur over LW101 and LW106 have been remediated since undermining was completed.
Topographic form (Lidar)		
Landscape morphology	Subsidence across landscape does not exceed subsidence predictions for LW101-LW106.	LIDAR analysis is undertaken every 3 years and was last undertaken in 2020. Therefore, LIDAR analysis was not undertaken in 2021.
Creeklines	No identifiable change in overall drainage pattern.	LIDAR analysis is undertaken every 3 years and was last undertaken in 2020. Therefore, LIDAR analysis was not undertaken in 2021.

Performance Measures	Performance Criteria	Comment
Multi-spectral image analysis		
Groundcover (multi-spectral images – erosion and pasture cover)	Identified areas of NDVI change (greater than 1 standard deviation from the mean change) investigated in the field to determine the source of the change.	All significant decreases in PAB are derived from mining infrastructure or known subsidence related ponding. Further deterioration of riparian vegetation at the LW104-106 subsidence ponds warrants further investigation.
Pasture		
Pasture biomass	Less than 20% reduction in pasture biomass in impact zones in comparison to control zones	Performance criteria not met at Pillar LW103/104. Additionally, the Pillar Zone LW102/103, zones within LW104 (excluding the Pillar Zone) and LW105/106 have failed the performance criteria despite increasing in mean pasture biomass since baseline, these zones have not increased to the extent of the control zones. Sites within the transition zone of LW102, 103, 104 105, 106 have recently undergone rehabilitation works and therefore the failure of these zones is considered reasonable. Additionally, analysis of the 2021 biomass data between zones using ANOVA indicated that mean biomass of the impact zone was not significantly different from the controls ($p<0.05$).
Weed species	Weed species identified and managed according to the weed management measures provided in the Rehabilitation Management Plan	Weed management programs were implemented at NM during 2021. Weed management consists of spot spraying programs periodically throughout the year. Locations are based on ELA monitoring reports and locations of listed weed species. No significant weed management programs have been developed for the pasture areas, as this will likely take the form of landholder management and pasture improvement (or as recommended in subsequent monitoring reports).
Weed cover	Less than 10% increase in weed cover in impact zones in comparison to the control zone	Performance criteria not met: In 2021, mean weed cover increased at 13 of 17 impact zones since the pre-mining survey monitoring period. Analysis of the 2021 weed species cover data between zones using ANOVA indicated that mean biomass of the impact zone was not significantly different from the controls ($p<0.05$).

Performance Measures	Performance Criteria	Comment
Soil nutrient status		
pH	pH remains within +/- 0.5 pH unit of baseline pH. If soil amelioration is undertaken, pH is to remain within recommended pH range for pasture (5.2-8.0).	Soil surveys are to be undertaken at baseline and then at a frequency of every three years. The next soil survey is scheduled for spring 2023 as the last survey was undertaken in spring 2020
EC	Less than 20% increase in EC in comparison to baseline values.	Soil surveys are to be undertaken at baseline and then at a frequency of every three years. The next soil survey is scheduled for spring 2023 as the last survey was undertaken in spring 2020
Organic matter	Less than 20% reduction in organic matter in comparison to baseline values.	Soil surveys are to be undertaken at baseline and then at a frequency of every three years. The next soil survey is scheduled for spring 2023 as the last survey was undertaken in spring 2020
Nitrogen	Less than 20% reduction in total nitrogen in comparison to baseline values.	Soil surveys are to be undertaken at baseline and then at a frequency of every three years. The next soil survey is scheduled for spring 2023 as the last survey was undertaken in spring 2020
Phosphorous	Less than 20% reduction in phosphorous in comparison to baseline values.	Soil surveys are to be undertaken at baseline and then at a frequency of every three years. The next soil survey is scheduled for spring 2023 as the last survey was undertaken in spring 2020
Creek stability and condition		
Field survey of creek stability and condition	Field survey of creek stability and condition	Based on recommendations given in the 2020 monitoring report (ELA, 2021), LiDAR which is ordered annually by NCOPL, was to be used as a more accurate measurement for cross sectional change, however the data sent to ELA by NCOPL in 2021 was corrupt and as such no quantitative assessment was able to be completed.

LW107-LW110

Surface cracking		
Surface cracking Inspection	Permanent cracks (which do not self-close within one month of longwall face passing) are remediated as soon as practicably possible (and safe to do so).	Known subsidence cracks identified within past monitoring reports that occur over LW107 and LW108 have been remediated since undermining was completed.

Performance Measures	Performance Criteria	Comment
	Surface cracking is remediated to prevent erosion and slope instability issues within 6 months of mining of each longwall.	
Topographic form (Lidar)		
Landscape morphology	Subsidence across the landscape does not exceed subsidence predictions for LW107 to LW110.	LiDAR analysis across the LW107-110 area is undertaken every 3 years and was last undertaken in 2020. Therefore, LiDAR analysis was not undertaken in 2021 and this performance criteria could not be assessed. In 2021, predicted maximum subsidence was 2.75m and maximum subsidence observed was 2.75m.
Creek lines	No identifiable change to overall drainage pattern.	LiDAR was to be used as a more accurate measurement for cross sectional change, however the data sent to ELA by NCOPL in 2021 was corrupt and as such no quantitative assessment was able to be completed. A geomorphic survey of creek line showed minor erosion or no significant changes in the creeks.
Groundcover (multi-spectral images – erosion and pasture cover)	Identified areas of NDVI change (greater than 1 standard deviation from the mean change) investigated in the field to determine the source of the change.	NDVI analysis in 2021 identified 21 significant changes in PAB including 16 significant decreases when compared to 2014 which can be mostly attributed to the clearance of vegetation for mining compounds, tracks, and infrastructure. However, significant decreases were identified along watercourses including Pine Creek above LW107, LW108 and LW109 which indicate a loss of PAB which may be derived from an increase in water levels, potentially related to subsidence ponding. As per the LMP and BMP NCOPL should conduct site investigation to determine the cause of change and appropriate management response.
	Site specific management report prepared and recommendations implemented where necessary.	

Subsidence Pond Monitoring

The results of annual monitoring undertaken during the reporting period, as required by the Subsidence Pond Management Plan (SPMP) are summarised below:

- NDVI analysis in 2021 identified significant changes in photosynthetically active biomass (PAB) which can be attributed to the increase in water within the site due to significant rainfall since 2020. Increased water in the subsidence ponds and creeks have resulted in a reduction in PAB of the

area, whilst areas in depressions and surrounding water sources have experienced increases in groundcover.

- 2021 EC water quality data has decreased from 2020 in most samples, due to persistent and increased rainfall. A small amount of data points from 2021 are higher than 2020 results, likely due to localised environmental affects close to sampling dates (including increased sediment runoff or subsurface disturbances). EC is currently below the Australian and New Zealand Environment and Conservation Council (ANZECC) water quality guideline limits for freshwater ecosystems, and therefore does not trigger any responses for water quality (ponding) under the Trigger Action Response Plan (TARP) within the Water Management Plan (WMP).
- It is apparent that emergent and fringing vegetation is naturally increasing in extent around the perimeter of the LW101 pond. The LW104 subsidence pond exhibited the highest level of inundation since 2017 during the 2021 monitoring period, which has lead towards tree stress development.

The 2021 subsidence pond monitoring results are found in Appendix G.

Pre-Clearing and Clearing Surveys

During the reporting period the mine has undertaken clearing to facilitate surface disturbance activities. The ecological works for the clearing consisted of the following activities;

- Fauna and flora Pre-clearing Surveys;
- Clearance Supervision; and
- Post-felling inspections.

Prior to the commencement of any disturbance activities the limits of clearing are surveyed and physically marked with flagging tape. Targeted threatened flora surveys were conducted prior to clearing activities commencing with all threatened flora identified during these surveys recorded and their locations mapped using hand held GPS units.

Fauna pre-clearance surveys were also conducted and consisted of identifying, marking and documenting suitable fauna habitat features. These features generally include nests, large woody debris and trees bearing hollows, which have the potential to support species such as bats, gliders, possums, reptiles and birds. All trees with habitat features are felled following a clearing protocol and is done in the presence of a suitably competent ecologist. All trees identified as having habitat features were recorded using a hand-held GPS unit.

Fauna was encountered during clearance works undertaken during the reporting period, including species of birds, mammals and reptiles.

The following threatened fauna species were encountered during the clearing works:

- *Saccolaimus flaviventris* (Yellow-bellied Sheathe-tailed Bat) - listed as vulnerable under the State Biodiversity Conservation Act 2016.

The following threatened flora species were encountered during the clearing works:

- *Tylophora linearis* – listed as Vulnerable under the BC Act and listed as Endangered under the EPBC Act.

6.6.2.2 BOS Environmental Performance

The Biodiversity Offset Strategy (Eco Logical, 2019) was approved by NSW DPIE on 25th September 2019 and by the Commonwealth DAWE on 16th September 2019 which commits NCO to managing the

offset areas to achieve a 'like for like or better' and 'maintained or improved' biodiversity outcomes on the 1,244ha Kenna Offset property located offsite adjacent to the southern boundary of the Kaputar National Park and the 431 ha Onsite (Rosevale, Greylands, Omeo, Greylands Park, Kurrajong Park and West Haven) Offset properties located within and adjacent to the western boundary NCO mining lease and to the east of Jacks Creek State Forest apart of the large "Pilliga Forest" remnant.

Weather Summary of NCO Offset Properties

Regionally central meteorological station to the BOAs is the Gunnedah Pool site (BOM 2021) which has recorded highly variable rainfall over the last 3 years; from driest in 140 years of 237mm in 2019, followed by above average rainfall years in 2020 and 2021 of 833mm and 990mm respectively resulting in major flooding of the Namoi River in November and December 2021. NCO maintain two meteorological stations across the BOA with a summary of weather conditions experienced at Offset properties during the 2021 reporting period:

Kenna - Annual average daily temperature ranges were 1°C to 38°C in 2021. The total annual rainfall in 2021 was 747mm with the maximum in November (156mm) and minimum in April (11mm);

Rosevale - Annual average daily temperature ranges were -3°C to 37°C in 2021. The total annual rainfall in 2021 was 847mm with the maximum in November (166mm) and minimum in April (16mm).

Offset Security Management

Between 27th September 2019 and 16th July 2021; NCO successfully registered seven Conservation Agreements on the land titles for the seven Offset properties as required of the BOS. The Conservation Agreements were secured under Part 4 Division 12 of the NSW National Parks and Wildlife Act 1974 in accordance with Commonwealth EPBC Act Approval 2009/5003 Conditions 2a&b and NSW Project Approval 08_0144 Schedule 5 Condition 7. WHC will reengage with NPWS that had previously shown interest in certain NCO Offset properties being transferred to National Park Estate.

Infrastructure Management

During the reporting period, a total of 6.9km of new fencing (fauna friendly) was constructed along the perimeter of the prospective NCO Offset properties of High Range and Caloola North as well as maintenance of signage and gates undertaken as required to continue to restrict unauthorised access and minimise livestock incursion. Also during the reporting period, 4.75km of redundant internal fences were deconstructed on Rosevale Offset and prospective NCO Offset properties of High Range and Caloola North and 41 items of redundant or derelict assets/infrastructure were removed, previously associated with the former agricultural use of the NCO BOA. Waste removed is either recycled (in the case for scrap metal) or disposed offsite (general municipal waste and tyres) at local Waste Management Facilities. Any remaining derelict assets/infrastructure items will continue to be assessed, removed and remediated as required prior to potential transfer of NCO Offset properties to National Park Estate.

Seed Management

The routine seed assessments on the NCO BOA aims to identify on a seasonal basis the life cycle stage and development of native plants to identify what, where, when and how to target appropriate resources to collect seed for future revegetation programs. A total of 7 species were collected resulting in 815 grams of local provident seed from across the NCO BOA. As part of the WHC group wide revegetation planning; the onsite collected seed was supplemented with commercially sourced local and regional provident seed by reputable seed collectors. A local revegetation provider was engaged to propagate the seed to produce Box Gum and non-EEC/CEEC Woodland overstorey species seedlings

required for the 2021 revegetation program completed as well as planning for the 2022 revegetation program for the NCO BOA.

Revegetation Management

The NCO BOMP revegetation strategy focuses on restoration and revegetation of cleared non-native grassland (former cultivation) and derived native grasslands and assisting natural regeneration in better quality woodland areas. During the reporting period, revegetation ground preparation utilised tractors and excavators augering holes (to a depth >0.3m) to relieve compaction, improve permeability and infiltration to increase sub-surface soil moisture for planting. There was no understorey revegetation carried out during the reporting period due to above average rainfall and vegetation growth preventing ecological burns from being undertaken and thus preventing adequate ground preparation from occurring. The overstorey revegetation program was undertaken between June and August 2021 with 7,116 hiko seedlings of Box-Gum and other Woodland species planted over 96ha of the NCO BOA. Combined with good seasonal conditions, routine tree watering and maintenance activities post planting have been successful to ensure that over 95% survival has been achieved for the Kenna Offset property which is commensurate with the target Woodland vegetation structure.

Heritage Management

During the reporting period, annual heritage inspections were completed on the 15 known Aboriginal archaeological heritage sites (plus one just outside the Kenna boundary) within the NCO BOA. Each site is maintained with demarcation fencing around the heritage site perimeter and signage to mitigate access and disturbance. During this reporting period, 11 new Aboriginal archaeological heritage site were identified on prospective NCO Offset properties of High Range and Caloola North. Further, 800m of fencing was maintained during 2021 of the total 1.5km of demarcation fencing around these heritage sites across the NCO BOA.

Habitat Management

During the reporting period, no habitat augmentation was undertaken on the NCO BOA.

Weed Management

WHC coordinated routine formal weed monitoring/inspections undertaken across NCO BOA in February, May, September and December 2021. The priority weeds identified included legacy weeds inherited from previous owner's management regimes such as African Lovegrass, Mother of Millions, Green Cestrum, Coolatai Grass, Green Cestrum, African Box Thorn and Common Prickly Pear as well as a range of broadleaf weeds within revegetation areas. The weed monitoring/inspections ensure that timely and prioritised weed control is undertaken on a seasonal basis with the spatial information directly given to spraying contractors to identify what, where, when and how to target appropriate resources across the NCO BOA for weed control.

During the reporting period, WHC implemented a weed control program across the Narrabri BOA including 1,224ha treated between January and December 2021 targeting primarily Fleabane, Coolatai Grass, African Love Grass, Box Thorn, Prickly Pear, Mother of Millions, Saffron Thistle, Green Cestrum, and Broadleaf weed species as required. Only appropriately qualified and experienced weed contractors (AQF3 accreditation or higher for use of herbicide) were engaged to undertake weed control works for WHC.

Feral Animals Management

WHC coordinated routine formal feral animal monitoring across NCO BOA in February, May, September, and November 2021. The adoption of a "monitor, measure and manage" approach to feral animal management will allow WHC to implement adaptive management in response to changes being measured through monitoring in feral animal abundance specific to the different geographical regions of the NCO BOAs. Feral animal monitoring utilises the relevant methodologies for specific feral animals generally in accordance with the NSW DPI Monitoring Techniques for Vertebrate Pests so that a range of methods can be used such as transects/spotlighting and cameras traps where practicable and relevant to specific offset areas/properties. Monitoring demonstrated that certain animals like Eastern Grey Kangaroos are in high abundance throughout the year and Feral Pigs can be high in abundance seasonally; with all other feral animal species recorded as scarce abundance levels across 2021. The feral animal monitoring ensures that timely and prioritised feral animal control is undertaken on a seasonal basis identifying what, where, when and how to target appropriate resources across the NCO BOAs for feral animal management.

During the reporting period, WHC implemented a comprehensive feral animal control program across the Kenna and Onsite Offset properties with routine 1080 baiting and pig trapping programs undertaken in March (32 Foxes removed from 136 baits presented and 12 Pigs trapped), June & July (29 foxes removed from 114 baits presented and 34 Feral Pigs were trapped), September (14 Foxes removed from 111 baits presented and 4 Feral Pigs trapped) and December 2021 (24 Foxes removed from 74 baits presented). A total of 435 baits were presented across the NCO BOA with 23% taken by feral animals. Night time open range shooting programs were implemented in conjunction with the other routine control programs resulting in an additional 4 Rabbits, 40 Hares, 2 Feral Pigs and 2 Foxes controlled in 2021. The Feral Goat harvesting during the reporting period resulted in 8 Goats being captured with salables Goats on sold to an abattoir. Only appropriately qualified and experienced feral animal contractors (appropriate feral animal management qualifications, NSW fire arm licence and pesticide accreditation where relevant) were engaged to undertake feral animal control works for WHC.

Soil & Erosion Management

Annual inspections were undertaken including unsealed fire break tracks and associated drainage structures across the NCO BOA to review appropriate erosion and sediment control measures required in accordance with the Blue Book (Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004)). Despite the above average rainfall during the reporting period; no locations of targeted additional maintenance was identified out of 3 observations within the NCO BOA to mitigate further erosion and sedimentation. The remaining sites and tracks/drainage structures are maintained during routine WHC Biodiversity fire break track maintenance program.

Grazing Management

NCO BOA were destocked in September 2016 and continued to be destocked and no strategic grazing occurring during the reporting period. There was one instance of stock incursion on the Kenna Offset property during the reporting period; with the stock quickly retrieved and fence repaired to maintain to a stock proof condition.

Bushfire Management

During the reporting period, no bushfires occurred and no ecological burns were undertaken.

Monitoring Program

During the reporting period, the ecological monitoring program of the Narrabri BOA included winter bird surveys that were undertaken in August 2021 and annual spring flora monitoring of 52 sites across 12 vegetation zones (VZs) undertaken during November 2021 plus annual fauna monitoring surveys involved 26 bird monitoring sites, 10 pitfall/funnel trap sites, 24 diurnal herpetofauna survey sites and 15 echolocation sites were undertaken from September 2021. During the winter bird surveys, one threatened species (Grey-crowned Babbler) was recorded. During flora monitoring, 3 VZs (Floodplain Transition Woodlands, Northern Montane Heaths and Western Slopes Grassy Woodlands – Semi-cleared condition) were recorded as meeting or exceeding completion criteria for all 4 biometrics. Native plant species richness (NPS) completion criteria (native species richness benchmark for relevant biometric vegetation communities) was met or exceeded at 10 out of 12 VZs. Native overstorey cover (NOS) completion criteria (minimum overstorey cover benchmark for relevant biometric vegetation communities) was met or exceeded at 4 out of 12 VZs. Native midstorey cover (NMS) completion criteria (minimum midstorey cover benchmark for relevant biometric vegetation communities) was met or exceeded at 9 out of 12 VZs. Native ground cover grass (NGCG) completion criteria (minimum groundcover benchmark for relevant biometric vegetation communities) was met or exceeded at 11 out of 12 VZs. Comparison of individual plot data shows that NPS decreased from 100% last year to 85% of sites meeting or exceeding completion criteria in 2021. Native overstorey cover (NOS) increased from 23% last year to 29% of sites meeting or exceeding the completion criteria. Native midstorey cover (NMS) was generally consistent with the previous year with 59% of sites in 2020 and 58% of sites in 2021 meeting or exceeding the completion criteria. Native ground cover grass (NGCG) was generally consistent with the previous year with 82% of sites in 2020 and 81% of sites in 2021 meeting or exceeding the completion criteria. Preliminary results from Onsite BOA diurnal herpetofauna surveys indicated that 8 species of reptile were detected across 12 sites (average 1.7; range 0 to 4). Pitfall trapping and funnel trapping surveys on the Onsite BOA have detected 29 species of fauna, including 16 frog species, 11 reptile species and 2 native mammal species. Site species richness ranged between 1 and 18 and averaged 8.7. By habitat, 29 species were detected in woodland (average 11.6, range 3 to 18) and one species was detected in grasslands (average 0.5, range 0 to 1). Spring bird surveys of the Kenna BOA recorded 73 bird species were recorded during standardised bird surveys across 26 sites with species richness values ranging from 5 to 34. In 2020, 77 bird species were detected while in 2019, 68 bird species were detected. By habitat, 52 species were detected in 7 remnant woodland sites (average 23.7; range 18 to 31), 33 species in 10 revegetation sites (average 7.8; range 3 to 16), and 53 species in 9 regenerated sites (average 19.3; range 8 to 34). Preliminary results from Kenna BOA diurnal herpetofauna surveys indicated there were 15 species of reptile across 12 sites (average 1.8; range 1 to 6). By habitat, 14 were detected in remnant woodland (average 3.1, range 1 to 6), 1 species was detected in the revegetation sites (average 0.25, range 0 – 1) and 1 species was detected in naturally regenerating sites (average 0.4, range 0 – 1).

6.6.3 Proposed Improvement Measures

- Subsidence Pond investigations: during the next reporting period Narrabri Mine will engage specialists to undertake engineering studies into geomorphic design options that would enable the subsidence pond areas to freely drain in a safe and stable way. Following the engineering design options an environmental assessment will be completed to determine the options for implementation.
- Review the monitoring requirements in the BOS as per the above recommendations.
- Continue the weed and feral animal control programs and subsequent monitoring.

6.7 ABORIGINAL CULTURAL HERITAGE

6.7.1 Environmental Management

Aboriginal Cultural Heritage is managed in accordance with the Aboriginal Cultural Heritage Management Plan (ACHMP), which was prepared to satisfy Schedule 4, Condition 23, and the Statement of Commitments (SoC) detailed in the PA 08_0144. Revision 5 of the ACHMP was provided to the DPI&E for review and approval in April 2021. No communication has been received following document submission. Revision 5 of the ACHMP incorporated additional Aboriginal cultural heritage sites identified during surveys for the *Narrabri Underground Mine Stage 3 Extension Project* (the Stage 3 Project).

6.7.2 Environmental Performance

Soil Disturbance Monitoring

As outlined in the ACHMP, any soil disturbance work within 100 m of a drainage line or in areas not already cleared for agriculture requires the presence of the Registered Aboriginal Parties (RAPs) to minimise the risk of sites/objects of Aboriginal Cultural Heritage significance being disturbed by clearing activities.

Archaeological Salvage Program

No sites were salvaged during the reporting period.

Ongoing Consultation

Narrabri Mine maintains regular contact with a representative of the RAPs in order to ensure appropriate cultural heritage supervision is available for planned surface disturbance activities.

Formal bi-annual consultation meetings are held with the RAPs senior representatives.

Previously Unidentified Sites

No new sites were recorded during the reporting period.

Non-compliance

No non-compliances were recorded for the reporting period.

6.7.3 Proposed Improvement Measures

A fencing audit was undertaken during the 2020 reporting period identifying potential for improvements to be made to fencing around ACH sites. An improved fencing standard was established in late 2020 with improvement works commencing in early 2021. Fencing surrounding all registered ACH sites is to be upgraded to the new standard, with upgrades continuing throughout the next reporting period.

6.8 HISTORIC HERITAGE

There are no items of historic heritage identified in the mining area and hence no specific management measures are required.

6.9 TRANSPORT

6.9.1 Environmental Management

Traffic impacts associated with the Narrabri Mine are managed in accordance with Schedule 4, Conditions 25 to 27 of the PA 08_0144.

6.9.2 Environmental Performance

The portion of Greylands Road that traverses the mining area has been purchased by the mine and is no longer accessible to the public. Scratch Road, in the western portion of the mining lease, has not been utilised to construct mining related infrastructure and as such no agreement has been developed with Narrabri Shire Council (NSC) for the use of this road.

The mine constructed the intersection to the mine in consultation with both NSC and Transport for NSW (TfNSW). TfNSW has advised the mine that the ongoing maintenance of the intersection is the responsibility of the TfNSW.

During the reporting period the mine applied for a Modification to the Project Approval 08_0144 for a change in mining method for longwall panels 201 and 202 to bord and pillar mining. An assessment of road transport impacts associated with the Modification was completed, which identified up to 60 additional traffic movements per day impacts would be required for the life of the bord and pillar operation. Modification 7 was approved on 23 November 2021 and includes conditions requiring the use of shuttle buses for the Modification 7 workforce.

6.9.3 Proposed Improvement Measures

The Shuttle Bus Traffic Control Protocol will be developed and implemented to address the new conditions associated with Modification 7.

The mine will continue to liaise with TfNSW and NSC as required.

6.10 WASTE MANAGEMENT

6.10.1 Environmental Management

Narrabri Mine aims to implement all reasonable and feasible measures to minimise waste and ensure it is appropriately stored, handled and disposed. Waste materials at the mine are managed in accordance with:

- Schedule 4, Condition 33 of PA 08_0144;
- the Narrabri Mine Waste Management Plan (Waste MP) prepared to satisfy the requirements of PA 08_0144;
- the Pollution Incident Response Management Plan (PIRMP); and
- the legal and strategic framework for managing wastes in NSW.

Narrabri Mine waste streams include general waste, underground waste, oil & greases, recyclables (steel and paper/cardboard), drill cuttings and effluent.

6.10.2 Environmental Performance

Waste Streams

Inspections of waste management practices are carried out to ensure general, hydrocarbon and recyclable waste is segregated. Additional segregation of general waste occurs at the licenced

contractor's facility to ensure the maximum amount of material can be recycled. Data on waste streams are collated using information provided by the licenced contractors. These records have been included in Figure 11 which shows waste stream volumes over a 5 year period. It should be noted that the licensed waste contractor changed halfway through 2018, which affected the availability of some waste records.

A total of approximately 1,722 tonnes (t) of general waste was removed during the reporting period. These figures are comparable to the previous reporting period. Approximately 6 tonnes of cardboard/paper, 172 tonnes of timber and 164 tonnes of steel were recycled during the reporting period. Approximately 51,300 L of used oils were collected and recycled during the reporting period by an authorised contractor, which has decreased from the previous reporting period.

Effluent from the sewage and ablutions facilities at the mine is managed through a Sewage Treatment Plant (STP) with a Continuous Extended Aeration Process. The plant is made up of a series of industrial plastic tanks. Each tank provides a separate function in order to treat the sewage for the required quality and quantity. During the STP process a waste product (sludge) is collected weekly and transported by licensed contractor to the Tamworth Treatment Works. During the reporting period a total of 531,600 L was collected and transported off-site, which is comparable to the previous reporting period quantities.

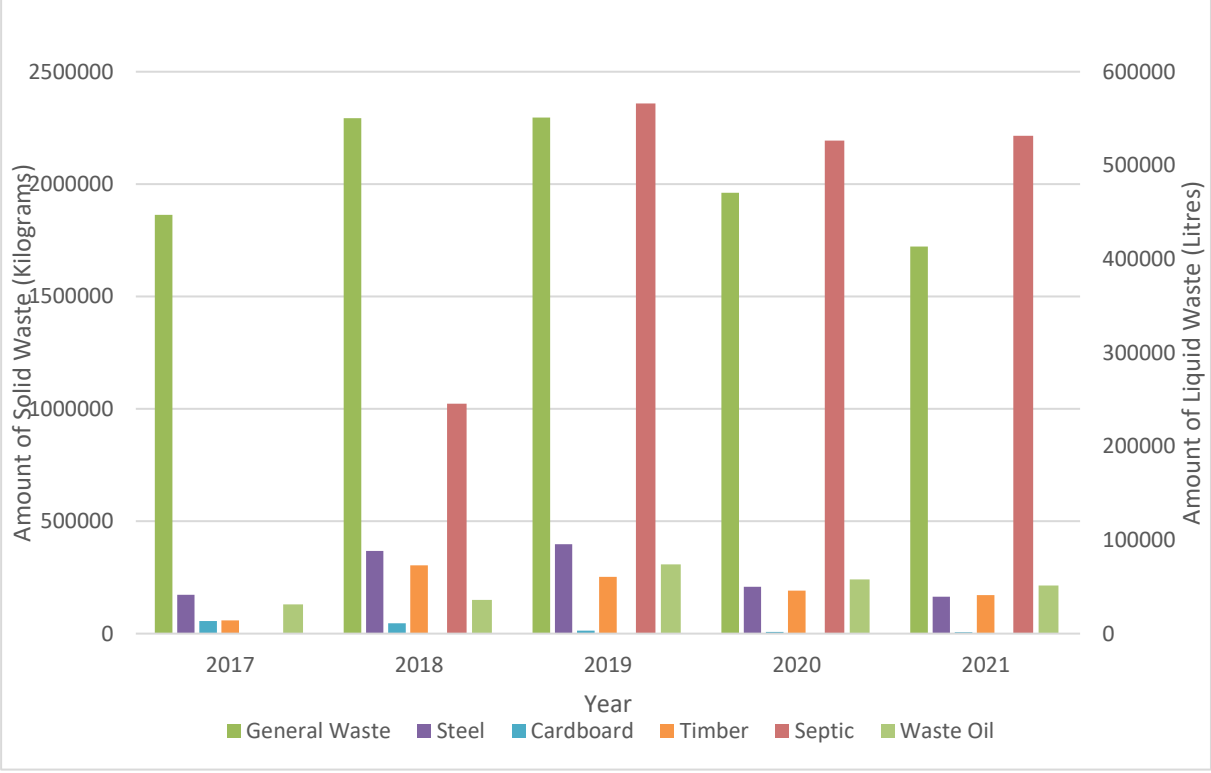

Figure 11: Comparison of waste streams over the previous 5 years

Drill cuttings from exploration, gas drainage and service borehole drilling are excavated from sumps and disposed of in the Rejects Emplacement Area as per site approval conditions.

Waste Incident

During the 2019 reporting period it was reported that an incident occurred involving the disposal of used underground self-rescuer emergency breathing canisters in to the General Waste stream at the mine which were subsequently disposed of into the Narrabri Landfill facility. The NSW EPA issued Narrabri Mine with several Clean-Up Notices during the 200 reporting period, and in consultation with the EPA and Narrabri Shire Council the Landfill clean-up activities were completed to the satisfaction of all parties. Clean-Up Notice 1597023 (dated 14 July 2020) remains in force, which requires NCO to undertake bi-monthly leachate monitoring at the NSC Landfill facility, with further actions required should a significant increase in pH be observed. To date no significant increases have occurred. NCO are required to submit a report at the completion of the monitoring program (estimated June 2022) for NSW EPA to review.

During the reporting period improvements were made to the overflow drain from the washdown bay, with the (previously) overland flows now enclosed in pipework. The improvements were communicated to the EPA.

6.10.3 Proposed Improvement Measures

Narrabri Mine will continue to monitor wastes on a regular basis to effectively manage waste generated by the operation and maximise re-use and recycling opportunities.

6.11 VISUAL & LIGHTING

6.11.1 Environmental Management

Visual amenity and lighting impacts associated with the Narrabri Mine are managed in accordance with Schedule 4, Conditions 28 and 29 of the PA 08_0144. Various onsite measures have been implemented during previous reporting periods to mitigate visual impacts of the mine including (but not limited to):

- construction of an amenity bund on the southern and western boundaries of the site to obscure views from the south and west;
- the train load-out bin, CHPP, secondary crusher and rotary breaker buildings are manufactured from a green sheeting;
- use of directional lighting in lieu of general area lighting;
- consideration of fixed versus mobile lighting, locations and orientation;
- fixed lighting designed and procured in accordance with *Australian Standard (AS) 4282 – 1997: Control of Obtrusive Effects of Outdoor Lighting* (AS4282); and
- visual lighting inspections as required.

6.11.2 Environmental Performance

No direct community complaints were received during the reporting period relating to the visual amenity or lighting associated with the mine.

6.11.3 Proposed Improvement Measures

No additional improvement measures are proposed during the next reporting period.

Management measures described above will continue to be implemented.

6.12 BUSHFIRE

6.12.1 Environmental Management

Bushfire hazards and risks associated with the Narrabri Mine are managed in accordance with Schedule 5, Conditions 3 and 4 of PA 08_0144, i.e. the Rehabilitation Management Plan (RMP) that forms part of the Landscape Management Plan (LMP). Various treatments have been implemented during the reporting period and previous periods to manage and control potential bushfire risks including:

- implementation of the Bushfire Prevention Standard and Bushfire Emergency Response Procedure;
- Supervisors providing bushfire ratings prior to contractors working on site and providing regular updates on bushfires nearby;
- implementing bushfire Trigger Action Plans (TARPs) and PIRMP;
- participation by Whitehaven Coal personnel in the Narrabri Rural Bushfire Brigade meetings;
- implementation of various bushfire hazard controls , including Hot Work areas/permits, the mine is a non-smoking site and maintenance of equipment/infrastructure;
- monitoring of fuel loads occurred in the Narrabri Mine offset area known as ‘Kenna”;
- implementing onsite training programs; and,
- maintenance of the roads and tracks within the Narrabri Mine ML was undertaken prior to the bushfire season. Roads and tracks can act as firebreaks and help to facilitate access across the site.

6.12.2 Environmental Performance

No bushfires occurred adjacent to or within the Narrabri Mine ML 1609 area during the reporting period.

6.12.3 Proposed Improvement Measures

No additional improvement measures are proposed during the next reporting period.

Management measures described above will continue to be implemented during the next reporting period.

Narrabri Mine have been in consultation with Forestry Corporation of NSW to undertake controlled hazard reduction burns in areas of Jacks Creek State Forest adjacent to the Western boundary of the Mine Lease. The burns are scheduled during the next reporting period.

6.13 MINE SUBSIDENCE

6.13.1 Environmental Management

During the reporting period underground development continued into LW panels LW110, LW203, and the 200 Mains. The extraction height averaged 4.3 m and the depth of cover ranged between 250 m and 290 m.

6.13.1.1 Subsidence Monitoring

Subsidence monitoring was conducted in accordance with the approved Extraction Plan. Subsidence remained within predicted ranges for all matter except maximum compressive strain and maximum total tensile strain (Table 16). Amendments to the Extraction Plan LW101-106 and LW107-LW110 were approved during the reporting period; the amendments included the removal of subsidence monitoring lines above LW106 and LW107

6.13.2 Environmental Performance

Electricity Transmission Lines

The 11 kV power line that traverses LW101 to LW105 has been decommissioned and as such, the Essential Energy Management Plan and its monitoring requirements are no longer in effect.

Telecommunications Infrastructure

No telecommunications infrastructure exists within the Extraction Plan area for LW101 to LW110.

Public Roads

The one public road within the mining area, known as Greylands Road, has been purchased by the mine and is no longer accessible to the public. Repairs required for traffic-ability for mine personnel are undertaken as required.

Land Surface

No new subsidence related ponding has been identified in LW109 during the reporting period.

Subsidence monitoring has been undertaken in accordance with the Extraction Plan requirements, and the internal document 'Subsidence Management Procedure'. There have been rehabilitation activities of subsidence cracks across the active subsidence areas and previously subsided longwall panels.

Buildings and Other Structures

No buildings or sheds were undermined during the reporting period.

Water Storage Dams and Contour Banks

No known farm dams or contour banks were undermined during the reporting period.

Fences and gates

No fences were undermined during the reporting period. Narrabri Mine has excluded all stock from the active mining area by erecting a fence outside of the subsidence zone to the east of LW101. Any fences/gates required post-mining will be re-instated.

Mine Infrastructure

Pipelines connecting gas drainage wells and the Personal Emergency Device (PED) cable were undermined during the reporting period however no impacts were recorded on this infrastructure. All gas drainage infrastructure in the active mining area is inspected and maintained to ensure subsidence does not adversely impact this equipment. Narrabri Mine also decommissions gas drainage infrastructure when it is no longer required.

6.13.2.1 Comparison against Predictions

Narrabri Mine has monitored the subsidence movement across the surface of LW 108, LW109 & Line H in accordance with the approved Extraction Plans. The table below outlines the maximum subsidence parameters recorded as part of the subsidence monitoring program and a comparison with the maximum predicted subsidence parameters as outlined in the Extraction Plan. Subsidence prediction exceedances did not occur during the reporting period. The results are summarised below:

Summary of results for the most recently completed survey measurements indicate:

- The maximum subsidence measurement of Line H 2.71m was within the predicted value of 2.75m. LW 108 measurements are within predicted values.

- The maximum tilt measurements recorded were within the predicted values.
- The maximum tensile and compressive strain measurements for LW108 exceeds predicted values. Line H measurements were within predicted values.

No mine emergency response procedures were activated because of subsidence during the reporting period.

6.13.3 Proposed Improvement Measures

Further actions will be undertaken to establish an integrated electronic GIS based monitoring platform for environmental monitoring, including subsidence crack monitoring.

Table 16: Subsidence Parameters – Predicted and Measured

Longwall Panels (LW) 107 – 108		
	Maximum Predicted Extraction Plan	Maximum Measured
Line 101 – Centre of LW101 – Monitoring has ceased		
Line 102 – Centre of LW102 – Monitoring has ceased		
Line 103 – Centre of LW103 – Northern – Monitoring has ceased		
Line 103 – Centre of LW103 – Southern – Monitoring has ceased		
Line 104 – Centre of LW104 – Northern – Monitoring has ceased		
Line 104 – Centre of LW104 – Southern – Monitoring has ceased		
Line 105 – Centre of LW105 – Northern – Monitoring has ceased		
Line 105 – Centre of LW105 – Southern – Monitoring has ceased		
Line 106 – Centre of LW106 – Northern – Monitoring has ceased		
Line 107 – Centre of LW107 – Northern - Monitoring has ceased		
Line 108 (last measured 07/01/22)		
Subsidence (m)	2.75	2.71
Tilt (mm/m)	38	36.3
Tensile Strain (mm/m)	10	16.2
Compressive Strain (mm/m)	13	38.9
Line 108 – Southern		
Line A – Cross Panel Survey Line – Being closed out		
Line B – Pine Creek Tributary 1 – Monitoring has ceased		
Line D – Pine Creek– Monitoring has ceased		
Line E – Pine Creek Tributary 1 Crossline 1 – Monitoring has ceased		
Line F – Pine Creek Tributary 1 Crossline 2 – Monitoring has ceased		
Line G – Pine Creek Tributary 1 Crossline 3 – Monitoring has ceased		
Line H – Cross Panel Survey Line (last measured 07/01/22)		
Subsidence (m)	2.75	2.75
Tilt (mm/m)	53	31.7
Tensile Strain (mm/m)	13 – 20^	16.6

Longwall Panels (LW) 107 – 108		
	Maximum Predicted Extraction Plan	Maximum Measured
Compressive Strain (mm/m)	16 – 24^	9.6

7 WATER MANAGEMENT

7.1 WATER SUPPLY

A pipeline from the Namoi River is the main source of raw water supply for the Narrabri Mine. Water from this pipeline can be taken from either the Namoi Alluvium or the Namoi River. Table 17 summarises the water licences held by Narrabri Coal for mining purposes and water during the 2020/21 water year (i.e. the 2021 financial year).

Table 17: Narrabri Mine Water Take

Water Access Licence	Water Sharing Plan	Water Source and Management Zone	Annual Use limit	Passive Take / Inflows	Water Take	Total Take
WAL 12833	Upper and Lower Namoi Groundwater Sources	Upper Namoi Zone 5 Namoi Valley (Gin's Leap to Narrabri) Groundwater Source	134[3]	6[2]	10.6	10.6
WAL 20131	Upper and Lower Namoi Groundwater Sources	Upper Namoi Zone 5 Namoi Valley (Gin's Leap to Narrabri) Groundwater Source	300[3]		0	0
WAL 12822	Upper and Lower Namoi Groundwater Sources	Upper Namoi Zone 5 Namoi Valley (Gin's Leap to Narrabri) Groundwater Source	86[3]		0	6
WAL15922	NSW Great Artesian Basin Groundwater Source	Southern Recharge Groundwater Source	322.4	21[1,2]	0	21[1]
WAL 29549	NSW Murray Darling Basin Porous Rock Groundwater Sources	Gunnedah – Oxley Basin MDB Groundwater Source	1,022.5	435	435	435
WAL43017	NSW Murray Darling Basin Porous Rock Groundwater Sources	Gunnedah – Oxley Basin MDB Groundwater Source	503.8		0	0
WAL 2671	Upper Namoi and Lower Namoi Regulated River Water Sources	Lower Namoi Regulated River Water Source	60	7[2]	0	0
WAL 6762	Upper Namoi and Lower Namoi Regulated River Water Sources	Lower Namoi Regulated River Water Source (High security)	20		12	20
WAL 2728	Upper Namoi and Lower Namoi	Lower Namoi Regulated River Water Source	12.5		0	0

	Regulated River Water Sources					
WAL 20152	Upper Namoi and Lower Namoi Regulated River Water Sources	Lower Namoi Regulated River Water Source	750		472.7[4]	472.7

[1] Water Statement from NSW Water records 248 ML groundwater usage. No active pumping from Narrabri Mine was undertaken. Passive take estimated from 2020 groundwater recalibration as 21 ML for the year. The 248ML has been included on WAL29549

[2] Predicted Annual Inflow Volume from 2020 groundwater recalibration during mining (until 2044).

[3] The combined annual use limit from the Namoi groundwater work approval was determined to be 400ML in August 2020.

[4]Water Order debits for WAL20152 totalled 472.7ML, actual water extraction was 277.6ML. WAL6762 water order debits was 20ML, total extraction was 12ML, reported Total Take includes Passive Take/Inflow of 7ML.

7.2 SURFACE WATER MANAGEMENT

7.2.1 Environmental Management

The Narrabri Mine water management system is managed in accordance with:

- Schedule 4, Conditions 10 to 17 of PA 08_0144;
- EPL 12789 Conditions P1, L1, L2 and M2; and
- the Narrabri Mine Water Management Plan (WMP) and the Extraction Plan – Water Management Plan (EP–WMP) prepared to satisfy the requirements of PA 08_0144.

During the reporting period various strategies were implemented to manage surface water including:

- Separation of clean water, i.e. surface water runoff where water quality is not affected by mining operations, utilizing clean water diversion drains;
- Collection of water from disturbed areas in sediment control dams, i.e. SD1-SD6 and SD8;
- Containment of water potentially affected by coal or other substances and stored within HDPE lined ponds, e.g. hydrocarbons, either from the underground operation or as runoff from the surface facilities/coal processing area, i.e. SB1-SB4;
- The use of appropriate erosion and sediment controls, including silt fences, rock checks and other measures as required;
- No uncontrolled discharge of mine water off-site;
- Increased capacity of water treatment plants to reduce increased levels of stored mine process water captured as a result of the above average rainfall recorded during the reporting period;
- Engaged suitably qualified experts to design additional brine storage dam;
- Updated the site water balance model to ensure on-site water demands are satisfied whilst minimising offsite water impacts; and
- Regular sampling and inspections of the onsite and surrounding surface water system. Surface water monitoring locations are illustrated on Figure 2.

7.2.2 Environmental Performance

Surface Water Quality

Narrabri Mine undertakes a surface water monitoring program which includes water pumped from the underground workings. The results of the water quality sampling conducted during the reporting are shown in Appendix D and F, refer to results for the 'Box Cut' sampling location. All water contained within the rail loop dam complex and sediment basins (SB1-4) are contained in HDPE lined ponds and either processed via a Reverse Osmosis treatment plant or reused in operational areas of the mine. Narrabri Coal commissioned an additional hire RO treatment plant in November 2021 to assist with treating an increased amount of water from excess runoff received throughout the year. The subsequent brine produced from the RO plant is stored in HDPE lined dams within the rail loop.

Wet Weather Discharge Monitoring

Routine surface water monitoring undertaken around the site includes sediment dam discharges and upstream and downstream locations within the approved ML 1609 were sampled when flowing, for pH, Electrical Conductivity (EC), Oil & Grease (O&G) and Total Suspended Solids (TSS).

Controlled wet weather discharges occurred in during November and December of 2021 from EPL locations SD2 and SD4. The discharge events were in response to significant rainfall events occurring over the Narrabri Mine with the onsite meteorological station recording 250mm for November and 80mm for December 2021. Four discharge events occurred from SD2 (10, 15, 22 November and 10 December 2021) and two discharge events occurred from SD4 (24 November and 9 December 2021). The sediment dams and streams were monitored according to discharge criteria limits and timings outlined within EPL 12789. Surface water results for pH, electrical conductivity, oil and grease and total suspended solids from discharge events are included in Appendix D. Results from the discharge samples are also reported in the EPL Annual Return. All wet weather discharges were within EPL12789 criteria. No previous reporting period discharge events have occurred onsite as far back as the 2018 Reporting Period.

Table 18: Controlled Discharge Monitoring

Date	Location	5 day Rolling Rainfall Total (mL)	pH (field)	Oil and Grease (mg/L)	Total Suspended Solids (mg/L)
EPL Criteria		n/a	6.5 - 8.5	10	50
10/11/2021	SD2	102.6	7.95	<5	6*
22/11/2021	SD2	69.4	8.03	<5	70*
24/11/2021	SD4	70	8.28	<5	46*
9/12/2021	SD4	55.6	8.08	<5	56*
10/12/2021	SD2	50.6	7.78	<5	80*

*as per EPL12789 L2.5 (a), TSS concentration limits are permitted to be exceeded for water discharged following rainfall measured at the premises that exceeds 38.4mm over any consecutive 5 day period

No raffinate was discharged to Namoi River during the reporting period.

Subsidence Surface Water Impacts

Refer to Section 6.6.2.1 (Subsidence Pond Monitoring) of this report. Results of the subsidence ponding water quality sampling conducted during the reporting period are shown in Appendix G.

7.2.3 Proposed Improvement Measures

As a result of updates to the Water Balance Model during the 2021 reporting period, there are a number of actions planned for the next reporting period, which include:

- Construction of additional brine storage;

- Improvements to the capacity and performance of the site water treatment plants; and
- Enhanced evaporation of brine through the use of evaporator fans during favourable conditions; and
- Development of Raffinate Discharge Control and Monitoring Plan in consultation with DPI&E.

Narrabri Mine will continue to progress refinements to the Water Management plan in consultation with DPI&E.

7.3 GROUNDWATER

7.3.1 Groundwater Monitoring

Groundwater at the Narrabri Mine is managed in accordance with the WMP prepared to satisfy the requirements of the PA 08_0144. Currently groundwater monitoring is conducted at sites located within and surrounding the mine as illustrated on Figure 3 and as outlined in Table 19.

Table 19: Groundwater Monitoring Summary

Location	Parameters	Frequency
All Standpipes P1,P2, P3, P4, P5, P6,P7,P8, P9, P10, P11,P12, P13,P16,P17, P19, P28, P29, P30, P31, P32, P33, P34, P58, P39a, P39b, P43, P47, P51, P52, P53, P58, WB2, WB3a, WB3b, WB4, WB5a, WB5b, WB6a, WB6b, and WB7	Water level EC pH TDS Metals Anions and Cations	Monthly (water level, pH and EC) Quarterly for P28-34 and P58 (water Level, pH, EC, cations and anions) Annually (full water quality)
Vibrating Wire Piezometers P40, P42, P44, P45, P46, P48, P54, P55 and P56	Water pressure (level)	Daily (Data Logger)
Mine water pumped into and out of the mine (Box Cut)	EC pH TDS Metals Anion and Cations Flow	Monthly (full water quality and flow)

7.3.2 Environmental Performance

Annual Hydrogeological Review

An annual hydrogeological review was undertaken by Groundwater Exploration Services for the period 1 January 2021 to 31 December 2021. The results of the review are summarised below. Groundwater monitoring results for this reporting period are provided in Appendix E as required by the WMP.

Standpipe Piezometers

Climate conditions and more specifically rainfall patterns over the past few years have been highly variable with an extended below average rainfall period occurring from early 2017 through to early 2020 followed by above average rainfall in 2020 and 2021. Rainfall in November was 197mm which is greater than the 95th percentile of rainfall data for Narrabri.

A rainfall residual mass showed that there is a close correlation with groundwater levels in a number of monitoring standpipes screened in shallow weathered strata including Napperby Formation and also in Garrawilla Volcanics. Generally, this is only seen in monitoring standpipes with total depths less than 30m. Deeper than this and these environmental variables appear to be insulated.

Standpipe piezometers showing a clear drawdown in response to mining activities in this reporting period (2021) is limited to P16 screened at a total depth of 146m in the Garrawilla Volcanics and P11 within the Purlawaugh Formation.

P11 is located at the southern edge of LW206 where pressures have been declining at a rate just under 2 m per year since 2013. Water levels at P11 remain 14m above maximum predicted drawdown level. The groundwater level in P16 has been gradually declining since longwall 106 and has exceeded the maximum predicted drawdown level during the reporting period. The underlying Napperby Formation drawdown in the same area is in excess of 100m. P16 is the only location where the Garrawilla volcanics has exceeded the drawdown criteria. It is likely that the model either does not have geometry of the Garrawilla in this area represented well or the connectivity of the Garrawilla and the Napperby in this area requires a review.

The mine lease is surrounded by a ring of monitoring bore locations which includes alluvium associated with the Namoi River and standpipe piezometers across the different stratigraphic units. It is noteworthy that monitored levels in standpipe piezometers outside the mine lease (i.e. P1 – P7) show no impacts of mining activities. The Narrabri Coal Operations Groundwater Model Five Year Calibration Report Update (Age, 2020)

provides maximum drawdown impacts. Although the mine has not yet reached full depth and maximum drawdown will occur in the future, the monitoring locations P1 – P7 show no trend as yet that suggests this drawdown is currently occurring.

Vibrating Wire Piezometers (VWP)

The VWP network has continued to evolve in recent years with older single instrument piezometers surrounding the box cut area and targeted multi-level VWP (P57) being decommissioned as predicted impacts pass with progressive mine development. Additional VWP's have been installed in southern areas providing a greater sub-regional context to groundwater pressures at depth.

P40 located at the southern edge of LW110 is the most consequential VWP site for this review period as it is located in proximity to mining activities. The hydrograph shows punctuated response to LW107 with the Brigalow Sandstone reacting soon after longwall start (at great distance) and with approach of the longwall to the central mains in the case of the Hoskissons Coal Seam. This data signal at this site appears to be at the point of failure, possibly due to subsidence related strain. However, filtering has revealed some useful data. In the 2020 reporting period, the reducing pressures in these lower strata (Hoskissons Coal Seam and Brigalow Sandstone) levelled out and became asymptotic with the predicted maximum predicted drawdown levels for this location. This trend remains stable in 2021. Overlying stratigraphy has been insulated from these significant pressure declines and remain well above modelled maximum predicted drawdown levels. The pressures in the Garrawilla Volcanics at P40 is very close in relative level to that of standpipe P16, also screened within the Garrawilla Volcanics located on the western margins of the mine plan.

All trends provided by the VWP network are consistent with predictions of impacts associated with mining activities.

Groundwater Quality

Electrical Conductivity (EC) is the primary analyte used for this review period to assess trends and potential unforeseen impacts on the groundwater environment

During 2021, the most significant event is an increase in salinity in a number of deeper standpipe piezometers (>40m) where the increase has been dramatic. This includes P10, P19 and P39b. It is noted that a bore identification issue accounts for P19 and that a pump was installed in at the time this was reconciled. Pumps have also been installed in P10 and following an earlier recommendation to review sample collection methods, it appears that more appropriate purging during sampling is responsible for these changes. Data from these locations will be followed closely, however it appears the baseline conditions were not well understood, and these elevated levels are normal. Although 2021 experienced an above average rainfall, the preceding three years are well below average and there may be some lag in the recovery of salinity levels.

Rail loop seepage detection

Seven monitoring wells were installed in areas surrounding the Rail Loop dams between June and October 2009 (P28-P34). Bores were drilled to depths of 15 and 25 m below ground level (m bgl) into weathered sandstone and siltstone of the Upper Napperby Formation. An additional monitoring well (P58) was installed in 2020 to further investigate groundwater dynamic surrounding the Rail Loop dam complex after one site observed an increase in water level that had previously been dry. P58 is screened deeper than other sites (33 – 39m bgl) and was designed to intersect the natural shallow groundwater table which is dislocated from the levels indicated by the shallower dam monitoring wells. These 8 bores surrounding the rail loop are now included in EPL12789 and results are sent to the EPA quarterly in accordance with condition R4.3.

A detailed review of the Rail Loop Dam complex and related groundwater monitoring network was conducted in 2020. Since then quarterly reviews have been sent to the EPA and have indicated evidence that the difference in chemical ion signature between the stored water which is pumped from the underground mine and the signature that of the network which on the whole, extends to a period before any significant filling occurred.

During the reporting period the monitoring bores immediately surrounding the Rail Loop dam complex have with the exception of P58 all risen slightly. This is assessed to be the result of response to above average rainfall during the reporting period and in particular a 95th percentile rate in November. This occurring after continued above average rainfall rates throughout 2021.

Compensatory Water Supply

No compensatory water has been required as no privately-owned water supplies have been affected.

7.3.3 Proposed Improvement Measures

An updated Water Management Plan (v3) and the Groundwater Model (5 yearly) Recalibration report were submitted to the DPI&E for review in September 2020. During the next reporting period Narrabri Mine will continue to progress refinements to the Water Management Plan in consultation with DPI&E.

Monitoring bores that have become obsolete due to mining through these areas will be grouted during the next reporting period. These include P14 (90BL254661), P15 (90BL254961), and P18 (90BL254662).

7.4 SITE WATER BALANCE

Surface water

Table 20 presents an estimate of the volume of stored water at the beginning and end of the reporting period (i.e. calendar year). Narrabri Coal pumped 232ML into Dam D from Namoi Alluvium or the Namoi River water sources via approved Water Access Licences during the reporting period (i.e. calendar year). Narrabri Coal also utilised water from sediment basins for mine supply.

Table 20: Stored Water

	Volumes Held (ML)		Capacity at the end of the Reporting Period (ML)
	Start of Reporting Period	At end of Reporting Period	
Raw Water (Dam D and B1 in Rail loop)	90.4	78.1	46.4
Dirty Water (in Sediment Dams and Basins SD1-SD8 and SB1-SB4)	73.5	71.5	125
Rail Loop Dams (A1-A3, B2 and C)	460.5	487.1	60
* Additional 40ML of storage in containment bund in rail loop.			

Groundwater Inflows

The annual groundwater inflow to the workings has been less than the water use limits of WAL29549 (nominated works 90WA822539) of 818ML/year. In accordance with future impact predictions associated with the groundwater assessment, additional allocation was sought through a controlled action in 2019 for an additional 403 units. The WAL43017 (403 units) was issued in November 2019. The annual inflow that was predicted to be extracted from mining activities from the recalibrated groundwater model during 2021 was 813ML. The pumped volume from the box cut was 436ML during the reporting period. The calculated water take utilising inputs and losses of water within the mine are represented by the waterfall chart below (Figure 12). The predicted groundwater inflow for 2022 is 927ML from the model recalibration. Groundwater consultants were engaged to review the 2020 model recalibration against 10 years of mine operation and have adjusted the expected flows for 2022 to be 648ML. The 2021 mining activities were below forecast production at approximately 3.6MT below the planned 6MT due to operational constraints. This would go some way to a cause for the lower than predicted inflow rates.

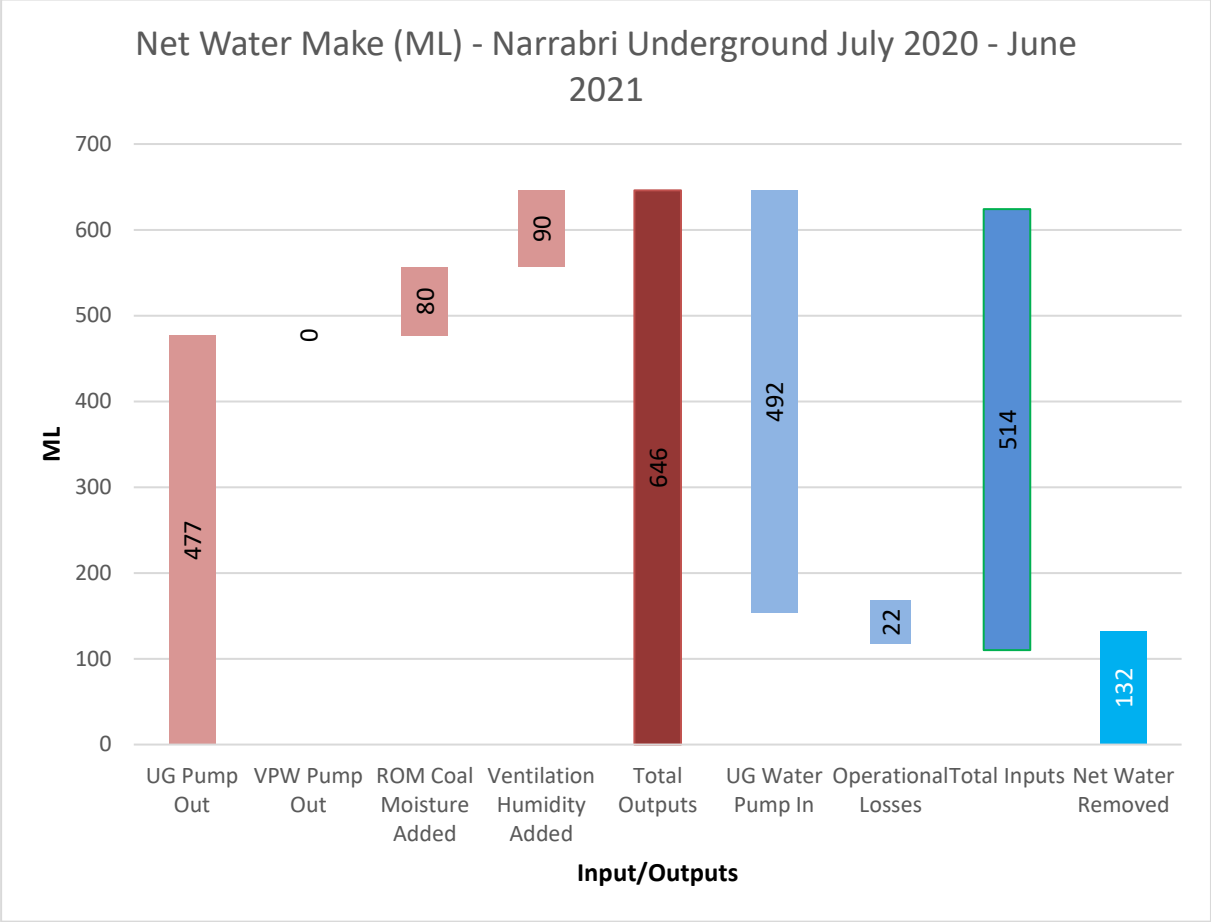

Figure 12: Waterfall chart showing water inputs and outputs for the 2021 water year

8 REHABILITATION

The rehabilitation objectives for the Narrabri Mine are described in Schedule 5, Conditions 1 to 4 of PA 08_0144. The MOP summarises the key elements for rehabilitation as well as providing a description of activities and mine landforms.

8.1 REHABILITATION PERFORMANCE DURING THE REPORTING PERIOD

8.1.1 Status of Mining and Rehabilitation

Rehabilitation activities were undertaken over the disturbed areas above LW107-109 during the reporting period, with approximately 12 hectares progressed to Active Rehabilitation. Rehabilitation activities undertaken during the reporting period included: decommissioning drill holes; filling in sumps associated with drilling activities; grading landforms and re-spreading topsoil/subsoil; fertilising and seeding topsoiled areas; and weed management.

Refer to **Error! Reference source not found.**. Rehabilitation of 12 ha of drilling pads and gas drainage i nfrastructure sites was undertaken during the reporting period. This rehabilitation has occurred up to and including surface areas above LW107-109 and is progressing closely behind the underground extraction area (LW110).

8.1.2 Post Rehabilitation Land Uses

The rehabilitation completion criteria will be consistent with the description in the Landscape Management Plan. The area in the west of ML 1609 will be returned to native woodland and the area in the east of the ML will be returned to the relevant land capability class.

8.1.3 Rehabilitation Performance Indicators

Table 21**Error! Reference source not found.** summarises the rehabilitation status for the Narrabri Mine, also refer to Figure 13. Note that areas for each 'Main Area Type' have been reported to align with definitions in the *Annual Review Guideline* (DP&E 2015).

Table 21: Rehabilitation Status

Mine Area Type	Previous Reporting Period (2020)	This Reporting Period (31/12/2021-Actual)	Next Reporting Period 2022 (Forecast)
A. Total mine footprint	406	416	483
B. Total active disturbance	270	262	312
C. Land being prepared for rehabilitation	25	31	40
D. Land under active rehabilitation	111	123	131
E. Completed rehabilitation	0	0	0

8.1.4 Decommissioning and Demolition Activities

No decommissioning activities were undertaken during the reporting period outside of the reclaiming of gas drainage infrastructure, which is re-used where possible.

8.1.5 Other Rehabilitation Activities

No other rehabilitation activities a have been undertaken during the reporting period.

8.1.6 Departmental Sign-off of Rehabilitated Areas

Departmental sign-off was not requested during the reporting period.

8.1.7 Variations in Activities against MOP/RMP

Narrabri Mine prepared a Mining Operations Plan to cover the period 01 December 2020 to 31 December 2023. The MOP was submitted to the Resources Regulator and approved on 26 November 2020.

The disturbance and rehabilitation activities completed during 2021 were generally in accordance with indicative plans in the MOP. The MOP target for cumulative rehabilitated area at the end of the MOP term (01 December 2021) was 127.3 hectares. As per **Error! Reference source not found.** the c umulative rehabilitation area at the end of the reporting period was 123 hectares. Mining production in LW109 during the reporting period was significantly less than forecast (refer Table 6- 3.37Mt ROM coal mined, compared to 2021 forecast of 6.37Mt forecast) due to unplanned geological fault structures encountered. As the longwall did not progress to plan the availability to complete rehabilitation was affected. Rehabilitation activities scheduled for the Reject Emplacement Area during the reporting period were unable to be completed, due to consultation with the Resources Regulator and subsequent changes to the landform design to incorporate elements of geomorphic design.

8.1.8 Monitoring

Internal rehabilitation/revegetation monitoring undertaken to date has primarily been limited to inspections of roads/creeks impacted by subsidence, water management structures, soil stockpiles and seeded areas for evidence of instability/erosion or poor germination, and borehole sealing. This process will continue over the life of the mine, with the extent and nature of activities undertaken being consistent with the relevant MOP, Extraction Plan, Landscape Management Plan and other relevant management plans prepared in satisfaction of PA 08_0144.

8.1.9 Trials, Research Projects and Initiatives

During the reporting period Narrabri engaged specialist consultants to assist with the redesign of the Reject Emplacement Area to incorporate aspects of geomorphic design and assessment of changes to the final land use (from light grazing to native vegetation). Consultation with the Resources Regulator was completed on the redesign approach, and the technical studies to update the Reject Emplacement Area Capping Assessment and Closure Design Report have been completed. The updated report has yet to be assessed by the Resources Regulator.

8.1.10 Key Issues to Achieving Successful Rehabilitation

The key issues to achieving successful rehabilitation include:

- Poor quality or lack of volume of topsoil;
- Loss or alteration to existing habitats due to subsidence, erosion, weeds and/or pests;
- Alteration of drainage lines due to subsidence;
- Contaminated land occurring onsite;
- Ongoing greenhouse gas emissions due to inadequate sealing of mine entries etc;
- Loss of agricultural resources due to mining disturbance; and
- Discharge of saline or contaminated water.

In cases where the performance is sub-optimal, additional management measures will be implemented (e.g. replanting, repairing landform and water management features, application of mulch/fertilisers, feral animal and weed control etc.).

8.2 ACTIONS FOR THE NEXT REPORTING PERIOD

Work will progress on removing houses and associated infrastructure on mine-owned land that are no longer required or that have been affected by subsidence.

Weed and pest animal control programs and monitoring will continue.

The rehabilitation actions for the next reporting period are detailed in the approved MOP, which covers the period to December 2023. Narrabri Mine are amending the Rehabilitation Management Plan to ensure compliance with the new rehabilitation conditions required by the rehabilitation reform amendments to the *Mining Act 1992.*

Staged rehabilitation of the REA will progress following acceptance of the revised Rejects Emplacement Area Capping Assessment and Closure Design, which incorporates aspects of geomorphic design.

8.2.1 Proposed Research and Rehabilitation for 2022

An integrated electronic GIS based monitoring platform was proposed in the 2021 Annual Review. This project was delayed to ensure that NSW mining lease rehabilitation reforms were captured within this program. This application is expected to be developed and implemented within the 2022 reporting period to capture and track surface disturbance and rehabilitation.

9 COMMUNITY

Social impacts and opportunities associated with the Narrabri Mine are managed in accordance with PA 08_0144 and the Statement of Commitments (SoC) (Appendix 3 of PA 08_0144).

9.1 COMMUNITY ENGAGEMENT ACTIVITIES

In accordance with Schedule 6, Condition 9 of PA 08_0144, a Community Consultative Committee (CCC) has been formed and operating since 2008. The committee comprises representatives of Narrabri Shire Council, Narrabri Mine and the community. Since its inception, the CCC has met quarterly. The CCC met four times during the reporting period on the 10 March 2021, the 2 June 2021, the 13 October 2021 and the 15 December 2021.

Narrabri Mine representatives continue to maintain contact with neighbours near the mine site. These contacts not only provide a means of information dissemination, but also enable Narrabri Mine to ascertain and address any potential concerns.

In addition, information relating to the mine is available: on the Whitehaven Coal website; the annual sustainability report; and at consultation meetings as required with neighbours and a range of stakeholders including government and non-government agencies. Whitehaven Coal meets regularly with the Narrabri Shire Council and is a regular attendee at the Narrabri and Boggabri Business Chamber meetings.

9.2 COMMUNITY CONTRIBUTIONS & INITIATIVES

As well as attending functions, WHC and Narrabri Mine also contributed to the community by providing approximately $56,000 in financial support to the Narrabri community and sponsorship to various community events and initiatives during the reporting period.

Table 22: Donations to organisations in the Narrabri locality during 2021

Organisation	Description	Amount granted
Narrabri Rugby League Football Club	2021 - Yearly Sponsorship	$25,000.00
The Rotary Club of Narrabri	NSW Science and Engineering Challenge	$5,000.00
Narrabri Shire Council	Sponsorship to CREATE	$5,000.00
Nurruby Children's Services Incorpo	Establishment & Fit out for Nurruby Boggabri Early Learning Facility (Sponsorship)	$21,000

9.3 COMMUNITY COMPLAINTS

Narrabri Mine maintains a designated complaints line. In the event of a complaint, details pertaining to the complainant, complaint and action taken are recorded on a complaint register.

During the reporting period, one complaint were made to the mine. The complaint was received via the telephone complaints line. A summary of the complaints (by category) received during the reporting period are detailed in **Error! Reference source not found.**. A register summarising the complaint d etails is also available on the Whitehaven Coal website.

Table 23: Summary of Community Complaints and Enquiries

Complaint	Complaint Category	Method
1	Other (Odour)	Phone (complaints line)

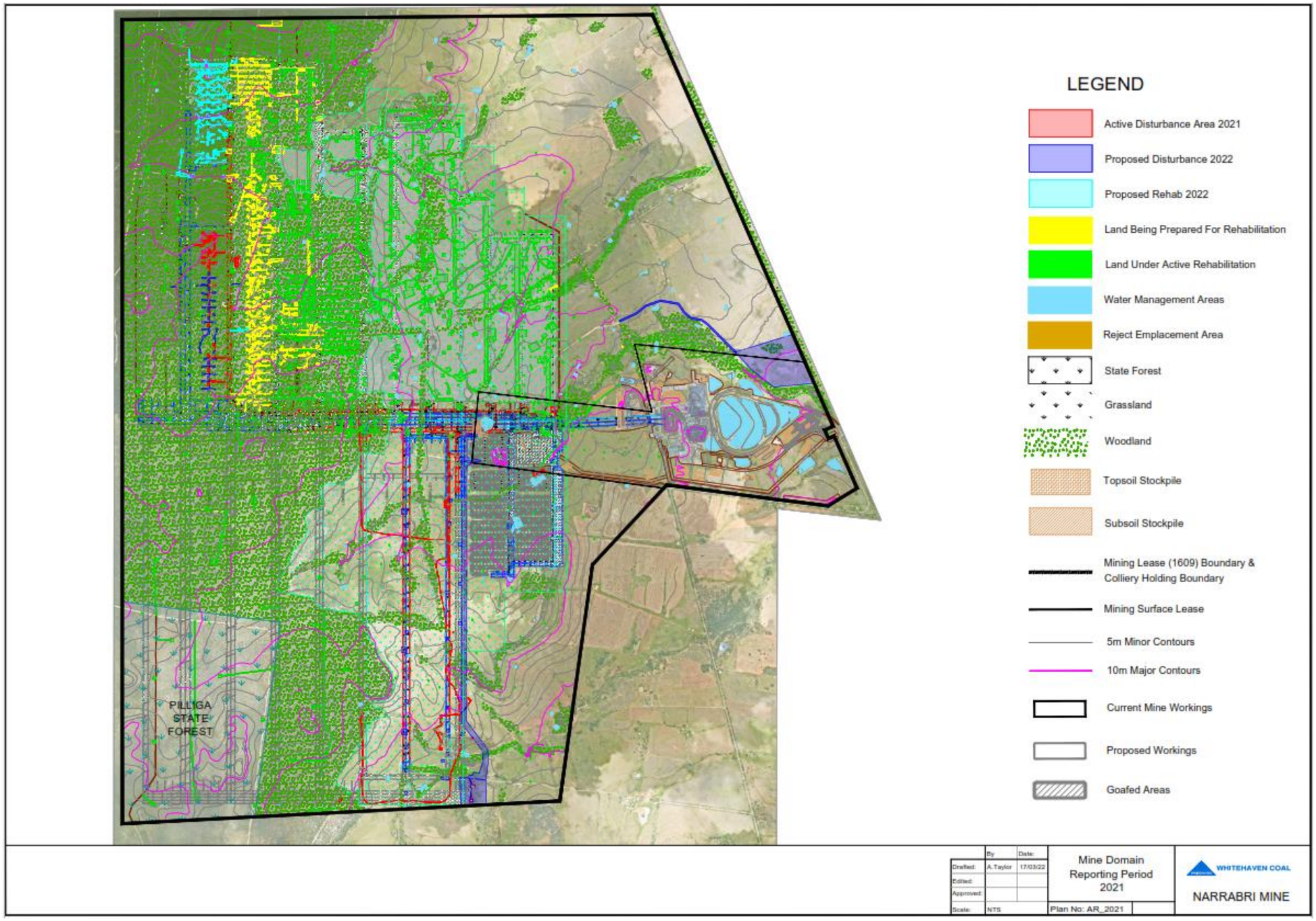

Figure 13: Mine Domains Reporting Period 2021

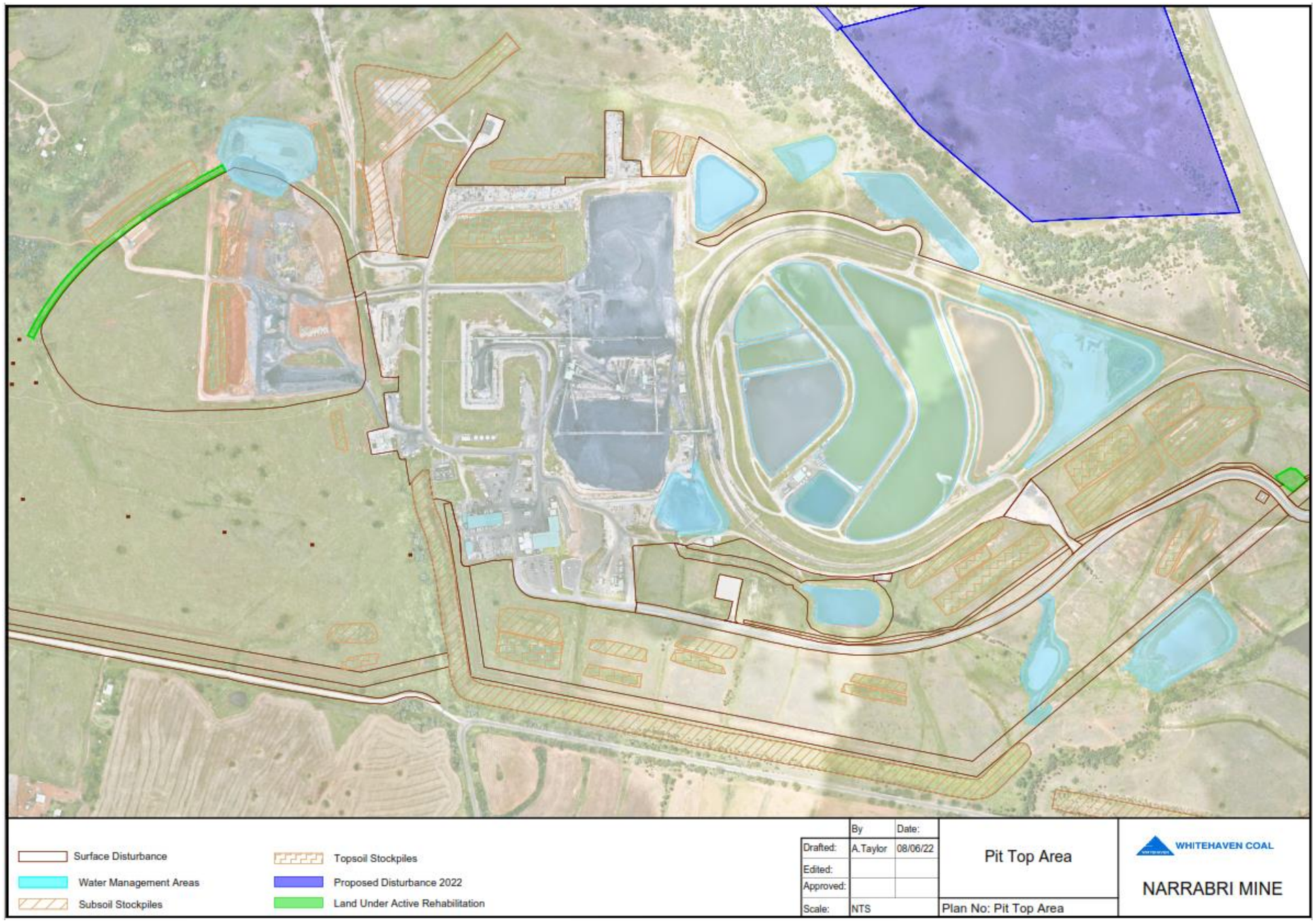

Figure 14: Mine Domains Reporting Period 2021 (Pit Top Area)

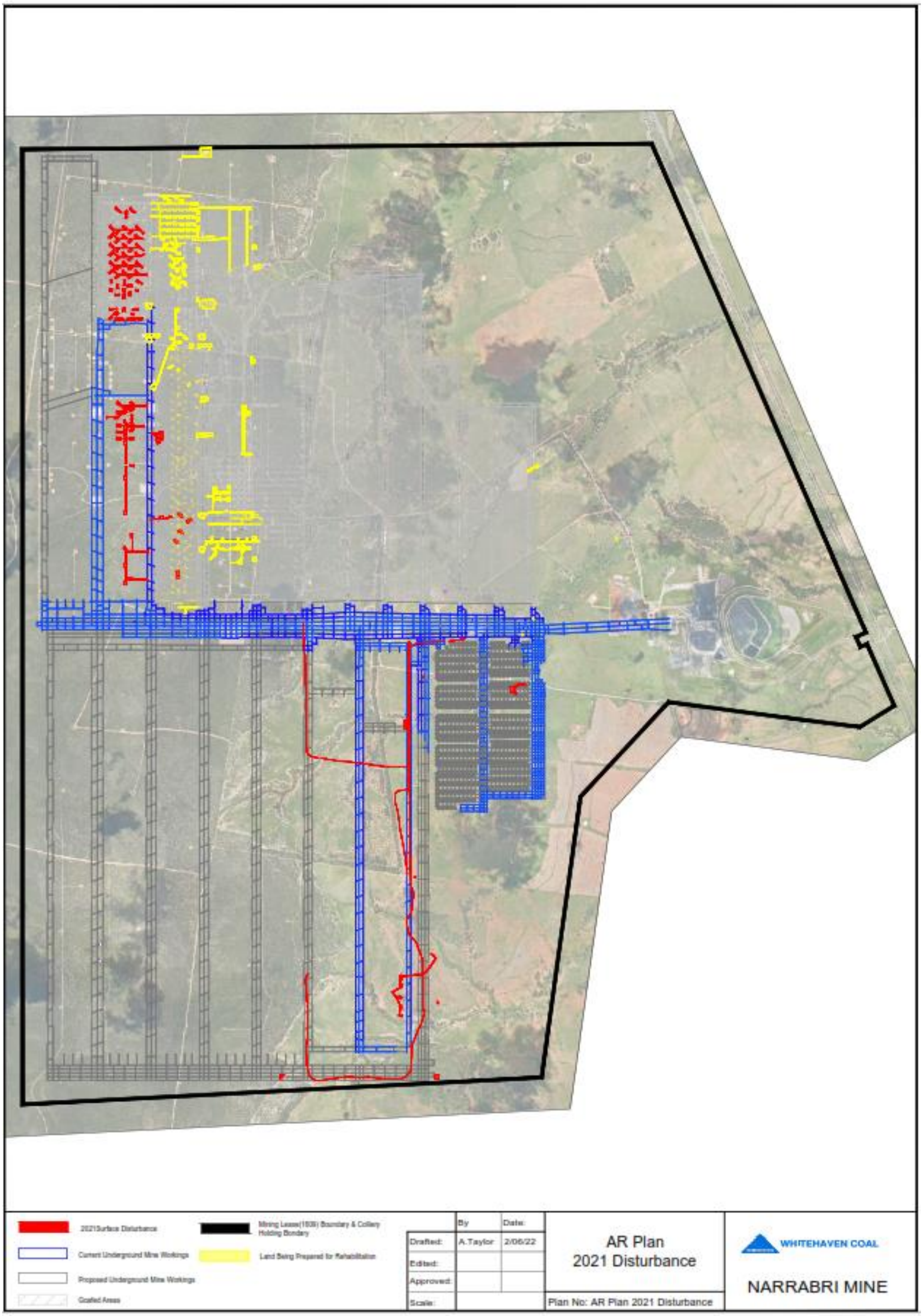

Figure 15: Mine Domains Reporting Period 2021 (Disturbance Footprint)

9.3.1 Complaint Trends

One complaint was received during the reporting period which is a decrease from the 2020 annual review period (Figure 16).

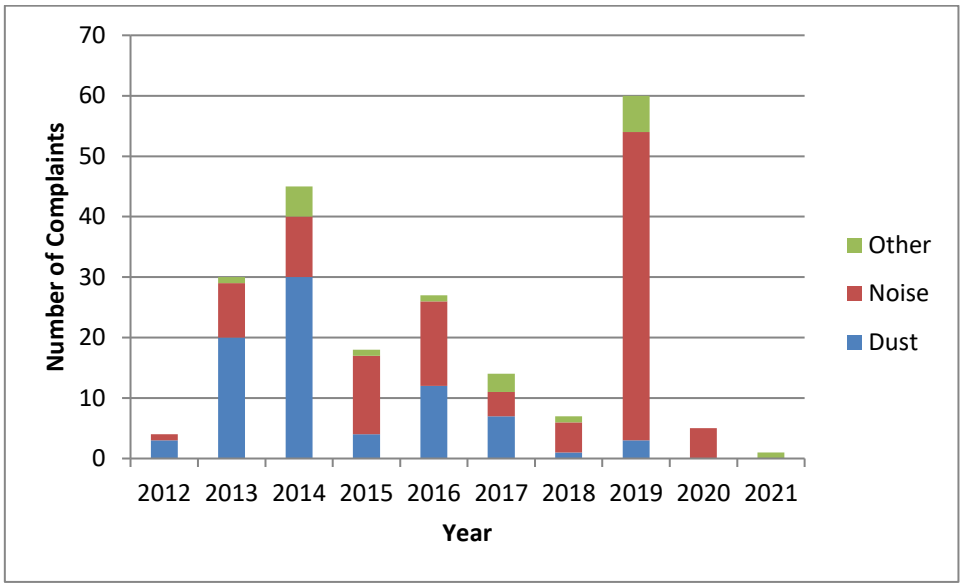

Figure 16: Complaints Trend since commencement of operations

9.3.2 Actions & Proposed Improvements

No actions additional to the above described measures are planned for the next reporting period.

10 INDEPENDENT AUDIT

10.1 INDEPENDENT ENVIRONMENTAL AUDIT

Narrabri Mine were not required to complete an Independent Environmental Audit (IEA) during the 2021 reporting period.

In accordance with Schedule 6, Condition 7 of PA 08_0144 the next IEA will be commissioned by 13 September 2022.

11 INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

11.1 NON-COMPLIANCES

The compliance status of the Narrabri Mine against relevant approvals during the reporting period was assessed in Section 1 as at the end of the reporting period (i.e. 31 December 2021). Further details of any non-compliance and actions undertaken or proposed for the following reporting period is summarised in Table 24.

Table 24: Non-Compliance Details and Proposed Action Plan

Non - Compliance	Date	Cause	Action Plan	Due Date

Note: No non-compliances were recorded during the reporting period.

11.2 REPORTABLE INCIDENTS OR EXCEEDANCES

Details of reportable monitoring exceedances or incidents are included below:

- During the reporting period exceedances of the 24-hour criterion (50 µg/m3) were reported to DPI&E. On the 2nd of June 2021 the ND10 'Turrabaa' monitoring unit measured PM10 levels of 82 µg/m3. The Turrabaa monitoring unit is located to the South East of the mine pit top area. During the sample period, the dominant wind direction was South East, and no coal was being processed or loaded onto trains. There were roadworks occurring on the Kamilaroi Highway, near ND10 monitoring unit and the result was likely related to the roadworks occurring on the highway, not mining activities. The exceedance was reported to the DPIE who acknowledged that it was unlikely that site activities impacted the data, but required NCO to include the result in annual average calculations as it was not the result of an extraordinary event.

11.3 REGULATORY ACTIONS

No official cautions, warning letters or penalty notices were issued to the mine during the reporting period.

Narrabri Coal Pty Ltd (NC) and Narrabri Coal Operations Pty Ltd (NCO) were convicted of a total of 19 offences under the *Mining Act 1992* in the Land and Environment Court on 13 August 2021, for failing to comply with conditions of an activity approval for Exploration License 6243. The activities associated with this incident occurred during the 2019 reporting period and included the drilling of two exploration boreholes in the wrong location, failure to properly rehabilitate and seal boreholes, construction of access tracks in incorrect locations and failure to prepare a Rehabilitation Management Plan within the required timeframe. The imposed fines totaled $372,500 and the prosecutor's professional costs. All fines and costs associated with the prosecution have been paid, and all required actions completed.

Inspectors from the Resources Regulator attended site on 11 March 2021 and undertook general compliance inspections of the Rejects Emplacement Area management, subsidence crack rehabilitation and other progressive rehabilitation activities. No non-compliances or areas of concern were identified and no further correspondence issued by the Resources Regulator.

The EPA undertook scheduled site inspections on 15 April 2021 and 13 October 2021 and undertook general compliance inspections of the coal stockpiles, brine dams and workshop/refueling areas. No non-compliances were identified during the inspections. Following the April inspection EPA issued a letter (on 27 July 2021) outlining several opportunities for improvement; including managing overflow from the oil/water separator, windblown litter collection and dangerous goods storage. Narrabri addressed the EPA identified issues and provided a written response to EPA on 27 August 2021; no further regulator action was required.

12 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Activities to be completed in the next reporting period to improve the environmental or community performance of the Narrabri Mine, in addition to those separately identified in Section 11 include:

- In accordance with a Pollution Reduction Study on EPL12789 during the reporting period the mine will upgrade two stockpile sprays.
- Subsidence Pond management- finalise the engineering studies into geomorphic design options that would enable the subsidence pond areas to freely drain in a safe and stable way. Following the engineering design options an environmental assessment will be completed to determine the options for implementation.
- Provide the updated Reject Emplacement Area Capping Assessment and Closure Design report to the Resources Regulator, to obtain their assessment on suitability for use; prior to implementation of the revised rehabilitation criteria on the completed section of the final landform.
- Construct additional brine storage dam, continue with capacity and performance improvements of the water treatment plants, and develop a Raffinate Discharge Control and Monitoring Plan in consultation with DPI&E.
- Continue the weed and feral animal control programs and subsequent monitoring.
- Further actions will be undertaken to establish an improved GIS based monitoring platform for environmental monitoring, including subsidence crack monitoring and disturbance and rehabilitation tracking.
- A fencing audit was undertaken during the reporting period identifying improvements to fencing around ACH sites. A comprehensive fencing improvement program has been scheduled to commence in early 2021, including replacement and improvement of fencing around all registered ACH sites.
- Review and revision of various Environmental Management Plans.
- Seeking approval to relevant approval modifications or amendments.
- Continued community liaison and engagement with local stakeholders.

Appendix A – *Flora Species List*

Appendix A - Flora Species List

Scientific Name	Native/ Exotic	AMBS-1	AMBS-2	GRY-1-G	KEN-10-G	KEN-11-G	KEN-12-G	KEN-13-G	KEN-14-G	KEN-15-G	KEN-16-G	KEN-17-S	KEN-18-S	KEN-19-S	KEN-1-G	KEN-20-S	KEN-21-S	KEN-22-D	KEN-23-D	KEN-24-D	KEN-25-D	KEN-26-D	KEN-27-D	KEN-28-D	KEN-29-S	KEN-2-G	KEN-30-S	KEN-31-S	KEN-32-S	KEN-33-C	KEN-34-C	KEN-35-C	KEN-36-C	KEN-37-C	KEN-38-C	KEN-39-C	KEN-3-G	KEN-40-C	KEN-41-C	KEN-42-R	KEN-43-R	KEN-44-R	KEN-4-G	KEN-5-D	KEN-6-D	KEN-7-D	KEN-8-D	KEN-9-D	ROV-1-G	ROV-2-G	ROV-3-G	ROV-4-G	ROV-5-G	ROV-6-D	ROV-7-D	ROV-8-D	ROV-9-D	S-10	S-12	S-12-Rep	S-13	S-13-Rep	S-16	S-16-Rep	S-19-Rep	S-5	WEH-1-G
Abutilon oxycarpum	native												X		X											X		X									X																								X						
Acacia burrowii	native		X																																														X	X	X	X											X	X	X		X
Acacia cheelii	native					X	X																																																			X									
Acacia deanei	native																																																	X			X		X					X				X			X
Acacia deanei subsp. deanei	native																																																																X		
Acacia decora	native				X	X			X																																	X																									
Acacia gladiiformis	native																																																															X			
Acacia ixiophylla	native																																																																		X
Acacia leiocalyx subsp. leiocalyx	native	X		X																																													X	X	X	X	X											X	X		
Acacia penninervis	native	X																																																X													X	X			
Acacia salicina	native																															X																																			
Acacia spp.	native							X		X							X												X									X			X																		2								X
Acacia triptera	native																																																									X									
Actinotus gibbonsii	native			X																																																															
Actinotus helianthi	native	X		X																																																															
Agapanthus spp.	exotic																																																									X								
Aira spp.	exotic																																																																	
Ajuga australis	native								X	X																																	X																								
Alectryon oleifolius	native																																																																	
Allocasuarina diminuta	native	X																																																														X			
Allocasuarina luehmannii	native																																																				X		X				X								
Alphitonia excelsa	native		X		X	X	X				X		X	X		X											X															X							X	X								X									X
Alstonia constricta	native										X					X																										X								X																	
Alternanthera denticulata	native																																										X																X								
Alternanthera nana	native																									X																																									
Alternanthera sp. A	native														X																																																				
Alternanthera spp.	native									X								X					X																X																												
Amaranthus spp.	native												X																																																						
Amyema miquelii	native																								X																																										
Amyema pendula	native																																																																		
Anagallis spp.	exotic																							X																																											
Ancistrachne spp.	native																																																						X											
Ancistrachne uncinulata	native																																																										X							
Angophora floribunda	native																							X		X											X																														
Anthosachne scabra	native																				X						X											X					X																	X							
Arenaria leptoclados	exotic							X		X																																																									
Arenaria spp.	exotic																																										X																								
Argemone ochroleuca subsp. ochroleuca	exotic																		X																																																
Aristida caput-medusae	native																																																X	X			X														X
Aristida contorta	native																																																																		
Aristida jerichoensis	native																																																																		
Aristida personata	native						X																																										X	X	X	X											X	X			
Aristida ramosa	native				X	X			X	X								X		X	X		X				X	X					X	X	X				X	X	X	X		X		X		X						X	X					X	X					X	

Aristida spp.	native					X						X	X						X			X				X																				X					X							X							X	X			X
Aristida vagans	native										X			X										X	X																																		X			X					
Arthropodium milleflorum	native																																																																
Arthropodium minus	native																																							X																											
Arthropodium sp. B	native				X																																						X																								
Asperula conferta	native																																																																
Asperula spp.	native																																				X																														
Asteraceae indeterminate	native																							X																																			X							X	
Austrostipa ramosissima	native																								X												X																														
Austrostipa scabra	native				X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X		X	X	X	X	X					X	X	X		X		X	X	X	X	X		X	X	X		X			X		X	X	X	X	X	X	X	X				X	X
Austrostipa scabra subsp. scabra	native																		X			X																																													
Austrostipa spp.	native				X	X				X												X					X																							X			X					X		X			X		X		X
Austrostipa verticillata	native												X		X	X	X				X					X	X	X	X								X				X		X	X				X		X			X						X	X	X	X	X	X			
Avena barbata	exotic																																			X																															
Avena sativa	exotic																																																																
Avena spp.	exotic																			X																																															
Bertya opponens	native																																																X	X															X		
Beyeria viscosa	native				X	X	X		X	X																														X	X	X																									
Bidens pilosa	high threat								X	X	X	X	X	X											X	X	X	X									X						X			X		X										X	X	X						X	
Bidens spp.	high threat																																																																
Bidens subalternans	high threat					X										X										X																				X																					
Boerhavia coccinea	native																																																																
Boerhavia dominii	native								X		X	X	X			X	X	X		X	X	X		X	X		X	X					X	X	X								X	X	X	X		X													X					X	
Boerhavia spp.	native																																								X	X																									
Boronia glabra	native			X																																																												X			
Boronia occidentalis	native			X																																													X	X													X	X			
Boronia spp.	native																																																		X																
Bothriochloa decipiens	native											X																																																						X	
Bothriochloa decipiens var. decipiens	native																			X	X						X																	X		X		X						X													
Bothriochloa macra	native																X			X	X													X												X																					
Bothriochloa spp.	native																																					X																	X												
Brachychiton populneus	native							X		X			X	X		X		X									X		X											X	X		X			X		X					X					X		X			X		X		
Brachychiton populneus subsp. populneus	native					X																															X																														
Brachyscome goniocarpa	native																																																				X														
Brachyscome spp.	native																																																X	X																	
Brassica spp.	exotic																																																																
Brassica tournefortii	high threat																																																																
Breynia oblongifolia	native									X																											X						X														X									
Briza minor	exotic																																																						X												
Bromus alopecuros	exotic															X																																																			
Bromus brevis	exotic																												X																																						
Bromus catharticus	exotic												X		X								X	X	X	X		X									X						X																								
Bromus molliformis	exotic																	X	X		X		X													X		X	X																												
Bromus spp.	native																							X																																											

Brunoniella australis	native					X	X		X	X			X	X			X																							X	X	X											X								X	X			X	X	X
Brunoniella spp.	native																																																									X								
Bryophyllum daigremontianum	exotic																																																													X					
Bryophyllum delagoense	high threat																																																									X	X	X						
Buglossoides arvensis	exotic																		X																																																
Bulbine bulbosa	native																																																																	
Bulbine semibarbata	native		X															X																																			X					X				X					
Bulbine spp.	native												X															X																																							
Caesia spp.	native																																																																	
Calandrinia spp.	native																																																								X									
Callitris endlicheri	native																																																		X	X											X	X			
Callitris glaucophylla	native				X	X	X		X	X	X	X		X		X	X					X			X	X	X	X	X				X			X	X			X	X	X	X			X		X	X					X	X			X	X			X			X	X	X
Calotis cuneata	native																																																																X	
Calotis cuneifolia	native																																																X	X				X	X	X	X								X	X	X		X
Calotis hispidula	native																	X										X																																								
Calotis lappulacea	native					X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X						X		X	X	X	X	X	X	X			X	X	
Calytrix tetragona	native	X		X	X																																															X											X	X			
Capparis arborea	native														X																																																				
Capparis mitchellii	native														X																																																				
Capsella bursa-pastoris	exotic																		X				X													X																																
Carduus nutans	exotic																																																																	
Carduus spp.	exotic																																																																	
Carex inversa	native									X		X	X					X	X		X				X			X								X	X	X	X					X				X																			
Carthamus lanatus	high threat							X					X								X	X									X		X	X	X		X	X							X	X								X		X										X	
Carthamus spp.	exotic																																																																	
Cassinia quinquefaria	native						X		X	X																																															X									
Cassinia sifton	native																																									X																									
Cassinia spp.	native																																																		X													X			2
Cassytha glabella	native	X	X	X																																																																
Casuarina cristata	native																																																										X							
Centaurea calcitrapa	exotic																X							X					X																																						
Centaurea melitensis	exotic									X	X	X	X					X	X	X	X	X	X				X	X						X	X	X		X	X	X				X	X	X	X	X	X																			X	
Centaurea solstitialis	exotic													X		X																																																			
Centaurea spp.	exotic																																																																	
Centaurium erythraea	exotic													X		X						X		X														X	X				X		X												X									X	
Centaurium spp.	exotic				X	X	X		X	X								X		X	X		X				X	X		X	X	X	X	X	X									X		X		X							X	X	X		X									
Centipeda racemosa	native																																																																	
Centipeda spp.	native																	X																																																	
Cerastium glomeratum	exotic																																			X																														
Chamaesyce drummondii	native										X		X			X	X			X	X						X	X										X							X	X										X		X	X		X					X	
Chamaesyce spp.	native																																							X																	X										
Cheilanthes austrotenuifolia	native									X																																																									
Cheilanthes distans	native				X	X	X	X	X	X	X																										X				X		X			X												X									
Cheilanthes sieberi	native		X		X	X	X		X		X	X	X	X		X	X			X			X		X	X	X		X	X		X	X	X			X		X						X	X		X	X	X	X		X	X	X	X	X	X	X		X		X	X	X	X	X
Cheilanthes sieberi subsp. sieberi	native							X										X	X		X	X						X								X					X	X	X	X																							

Chenopodium cristatum	native																																																																
Chenopodium spp.	native																																																					X											
Chloanthes parviflora	native	X		X																																															X	X												X			
Chloris divaricata var. divaricata	native																																																										X							
Chloris spp.	native																																																																
Chloris truncata	native														X		X	X		X	X	X	X		X			X																X				X											X			X				X	
Chloris ventricosa	native									X			X		X													X											X				X													X				X	X						
Chondrilla juncea	exotic																				X	X									X		X	X										X	X	X	X							X													
Chrysocephalum apiculatum	native				X				X												X										X					X						X								X				X	X								X		X	X	
Chrysocephalum semipapposum	native						X																																X																								X	X	X		
Chrysocephalum spp.	native																												X																																						
Ciclospermum spp.	exotic																																			X																															
Cirsium vulgare	exotic														X																						X																														
Cleistochloa rigida	native	X	X	X																																																															
Clematis decipiens	native								X																																																										
Commelina cyanea	native									X			X				X									X										X																						X									
Commelina ensifolia	native																																				X																														
Commelina lanceolata	native															X																																																			
Convolvulus erubescens	native																											X									X	X							X																						
Convolvulus graminetinus	native																																																					X													
Convolvulus spp.	native												X					X		X			2				X					X							X							X		X								X	X		X	X	X	X				X	
Conyza bonariensis	exotic														X									X																																											
Conyza canadensis	exotic														X										X																																										
Conyza spp.	exotic					X				X		X	X			X	X	X	X	X	X	X	X			X	X	X	X	X		X	X	X	X	X	X	X	X		X		X	X	X	X	X	X						X		X	X	X	X	X			X			X	
Coronidium oxylepis	native																																																															X			
Corymbia trachyphloia	native	X		X																																													X	X	X	X											X	X			
Cotula australis	native												X						X			X										X				X		X	X																												
Crassula colorata	native																																												X																						
Crassula sieberiana	native																					X																X				X															X										
Crassula spp.	native																														X		X	X	X											X									X			X									
Crinum flaccidum	native												X															X															X			X												X		X							
Cucumis myriocarpus subsp. leptodermis	exotic																																																																		
Cyclospermum leptophyllum	exotic																	X	X		X		X					X									X						X	X				X						X													
Cymbidium suave	native																																																																		
Cymbonotus lawsonianus	native																																																																	X	
Cymbopogon refractus	native				X	X	X		X	X		X		X				X		X	X				X		X						X	X							X	X	X	X	X	X		X		X			X	X	X			X					X	X	X	X	X
Cynodon dactylon	native												X		X		X	X								X		X		X		X	X	X	X																			X		X										X	
Cynoglossum australe	native									X													X					X															X																X								
Cyperus eragrostis	high threat																																																											X							
Cyperus fulvus	native																																																																		
Cyperus gracilis	native				X	X	X	X	X	X	X	X	X		X	X	X		X						X	X		X								X	X	X		X	X	X	X	X		X		X					X	X							X	X			X	X	
Cyperus spp.	native				X	X	X					X			X								X																							X													X						X		
Dampiera lanceolata var. lanceolata	native	X	X																																															X	X															

Dampiera spp.	native			X																																																															
Daucus glochidiatus	native				X	X		X	X	X	X	X		X	X			X	X	X	X	X	X	X			X	X					X	X		X	X		X	X	X	X	X	X	X	X	X	X		X			X		X	X	X	X	X				X				
Denhamia cunninghamii	native																																																															X		X
Desmodium brachypodum	native						X				X				X		X								X		X		X																																						
Desmodium spp.	native													X		X																																																			
Desmodium varians	native				X	X	X		X	X		X																									X					X																									
Dianella longifolia	native				X																																																				X			X						
Dianella revoluta	native			X			X																																																									X	X		X
Dichanthium sericeum	native					X					X									X			X		X			X	X											X		X			X	X								X		X	X									X	
Dichanthium sericeum subsp. sericeum	native																																																																	
Dichelachne micrantha	native					X			X																																		X															X									
Dichondra repens	native												X	X	X	X	X				X		X	X	X	X			X								X																						X			X				X	
Dichondra sp. A	native				X	X	X				X	X															X																X	X		X												X									
Dichondra sp. Inglewood	native							X	X	X								X	X	X	X	X						X					X	X	X	X		X	X	X	X	X			X		X	X					X		X					X	X		X				X
Dichondra spp.	native																																																							X	X										
Dichopogon fimbriatus	native				X		X				X	X	X																																													X								X	
Dichopogon strictus	native							X																												X		X			X																										
Digitaria ammophila	native																																																																		
Digitaria breviglumis	native																																																X																		
Digitaria brownii	native												X	X		X				X	X		X			X	X								X									X																							
Digitaria ciliaris	exotic																																																																		
Digitaria diffusa	native										X																																																								
Digitaria divaricatissima	native									X			X							X	X					X	X							X														X																			
Digitaria eriantha	exotic																													X	X	X	X			X			X																												
Digitaria spp.	native																																										X							X	X	X												X			
Dodonaea boroniifolia	native																																																																		
Dodonaea falcata	native	X		X																																																															
Dodonaea sinuolata	native					X																																																													
Dodonaea spp.	native													X																																					X																
Dodonaea viscosa	native				X				X	X																																	X						X	X								X		X			X	X			X
Dodonaea viscosa subsp. angustifolia	native										X																													X	X	X																							X		
Dysphania cristata	native																																																																		
Dysphania pumilio	native																X																																																		
Dysphania spp.	native											X						X																																																X	
Echinochloa crus-galli	exotic																																																																		
Echium plantagineum	exotic														X															X	X	X				X		X	X	X	X	X					X																				
Einadia hastata	native						X				X			X	X										X	X											X																								X				X	X	
Einadia nutans	native														X	X	X					X	X						X	X	X	X	X	X	X	X		X			X	X				X	X	X								X	X		X			X	X				
Einadia nutans subsp. nutans	native																																						X																												
Einadia polygonoides	native											X	X	X		X	X	X	X	X	X			X	X		X	X	X															X															X	X	X	X				X	
Einadia spp.	native							X											X			X																		X																						X					
Einadia trigonos	native					X			X	X		X	X					X		X	X		X				X	X		X			X	X	X			X					X	X		X	X	X					X							X	X		X				
Eleocharis spp.	native																																										X																								

Elymus scaber	native																																																																	
Elymus spp.	native																																																																	
Emex australis	exotic																																												X																					
Enchylaena tomentosa	native													X						X		X																																	X	X	X	X					
Enneapogon cylindricus	native																																																																	
Enneapogon gracilis	native																																																																X	
Enneapogon nigricans	native					X			X	X			X																																										X		X					
Enneapogon spp.	native			X	X		X	X											X	X											X							X																				X				
Enteropogon acicularis	native											X						X	X	X				X	X																																X				X	
Entolasia marginata	native																																																																	
Epaltes australis	native																																																					X				X							
Epaltes spp.	native																																																						X											
Eragrostis alveiformis	native																									X																																								
Eragrostis brownii	native																						X																																		X		X					
Eragrostis cilianensis	exotic																																																																	
Eragrostis curvula	high threat											X							X	X	X						X	X	X	X	X	X	X		X	X					X	X	X						X	X												
Eragrostis elongata	native																																																X				X		X		X		X	X			
Eragrostis lacunaria	native										X																																															X	X		X				
Eragrostis leptostachya	native								X			X		X					X		X																		X									X	X			X						X	
Eragrostis megalosperma	native								X																																																									
Eragrostis parviflora	native																																																																X	
Eragrostis spp.	native				X	X		X		X		X					X		X	X	X	X				X		X						X	X		X							X	X								X		X	X	X	X	2	X				X		
Eremophila bignoniiflora	native																																																																	
Eremophila deserti	native																																																												X					
Eremophila mitchellii	native																																																											X						
Eriochloa pseudoacrotricha	native													X		X		X		X			X	X																			X											X						X
Eriochloa spp.	native																																																							X										
Erodium cicutarium	exotic																																																																	
Erodium crinitum	native										X								X														X																															
Erodium moschatum	exotic																					X																																												
Erodium spp.	native														X																																																			
Eucalyptus albens	native								X		X	X	X			X	X	X	X		X		X	X	X								X		X	X	X		X			X																	X	
Eucalyptus behriana	native																																																															X		
Eucalyptus blakelyi	native																								X										X					X																								
Eucalyptus chloroclada	native																																																													X	X			
Eucalyptus crebra	native			X			X	X		X	X	X		X	X		X	X			X	X	X		X									X			X									X											X	X	X
Eucalyptus crebra x nubila	native					X																																																												
Eucalyptus dealbata	native				X		X	X		X																						X												X									X									
Eucalyptus fibrosa	native		X	X																																												X	X	X											X	X			X
Eucalyptus melanophloia	native			X	X																			X	X																																								
Eucalyptus melliodora	native																	X		X						X																																							

Eucalyptus microcarpa	native																																																						X	X					X	X						
Eucalyptus pilligaensis	native																																																											X			X			X		
Eucalyptus populnea subsp. bimbil	native																																																											X							
Eucalyptus spp.	native	X		X						X											X																													X																	
Euchiton sphaericus	native				X	X	X		X	X	X	X					X	X		X	X	X	X	X			X	X		X	X	X	X	X	X	X			X				X	X		X	X	X					X					X					X	X		X	
Euchiton spp.	native							X																														X		X	X	X			X																						
Eulalia aurea	native																																						X																												
Euphorbia drummondii	native																								X																																										
Euphorbia spp.	native																						X																			X																	X								
Evolvulus alsinoides	native				X		X		X			X		X		X		X			X				X		X						X	X	X																		X								X	X		X			
Evolvulus alsinoides var. decumbens	native										X																																															X									
Fimbristylis dichotoma	native																	X									X												X																X												
Fimbristylis spp.	native																																																									X									
Foeniculum vulgare	exotic																																																																		
Fumaria spp.	exotic																																																																		
Gahnia aspera	native																																																														X	X	X		X
Galium gaudichaudii	native					X					X				X																						X																														
Galium leptogonium	native																																							X																											
Galium spp.	native							X		X																X																	X																								
Gamochaeta spp.	exotic											X					X	X		X			X	X			X			X		X	X	X	X				X					X	X		X	X								2			X						X	X	
Geijera parviflora	native									X	X		X		X	X	X								X	X		X	X								X	X		X	X	X	X										X						X	X	X	X			X	X	
Geranium homeanum	native																																																																		
Geranium solanderi	native				X					X				X	X	X	X				X				X	X	X	X	X								X						X																							X	
Geranium solanderi var. solanderi	native																																																																		
Geranium spp.	native							X																												X			X	X																											
Glandularia aristigera	exotic																																																					X	X	X				X							
Glossocardia bidens	native				X	X		X	X	X	X	X																							X					X	X	X			X																				X	
Glycine canescens	native				X	X	X																																																			X									
Glycine clandestina	native						X		X	X	X			X	X		X				X						X		X								X						X	X						X			X		X			X	X			X	X		X	X	X
Glycine spp.	native																								X																							X												X							
Glycine stenophita	native							X																																																											
Glycine tabacina	native				X	X		X	X	X		X	X	X	X		X				X				X	X	X	X					X			X	X	X	X	X	X	X	X														X	X			X				X	X	
Glycine tomentella	native																																																						X												
Gnephosis tenuissima	native																																																															X			
Gomphocarpus fruticosus	exotic														X																																																				
Gomphrena celosioides	exotic																																X																	X																	
Gonocarpus elatus	native	X	X	X		X	X																																										X	X	X	X	X					X					X	X	X		X
Gonocarpus spp.	native							X																																																											
Goodenia cycloptera	native																																																														X				
Goodenia fascicularis	native																																																																		

Goodenia glabra	native							X																																																					X		X		
Goodenia hederacea	native									X																																																								
Goodenia heteromera	native		X																										X																																						
Goodenia rotundifolia	native	X		X																																													X	X	X	X												X	X	X		X
Goodenia spp.	native																X																																										X			X					
Grevillea floribunda subsp. floribunda	native																																																															X			
Haloragis heterophylla	native						X	X													X												X	X				X	X				X		X												X									
Haloragis serra	native																																																																		
Haloragis spp.	native																																																																		
Hardenbergia violacea	native																																																															X			
Harmogia densifolia	native	X		X																																															X																
Hedypnois rhagadioloides	exotic																																																																		
Heliotropium amplexicaule	high threat																				X							X																																							
Heliotropium spp.	native																																				X																														
Hibbertia circumdans	native	X	X	X																																																														
Hibbertia covenyana	native	X		X																																																														
Hibbertia obtusifolia	native																																																															X			
Hibbertia spp.	native																																																			X															
Hibiscus sturtii	native																																																X				X														
Homoranthus flavescens	native																																																X	X													X	X	X		
Hordeum leporinum	exotic															X			X				X																					X																							
Hordeum marinum	exotic																							X																																											
Hordeum spp.	exotic																			X																																															
Hordeum vulgare	exotic																									X		X																																							
Hovea spp.	native																																																															X			
Hyparrhenia hirta	high threat																																																						X												
Hypericum gramineum	native							X																									X	X									X											X			X									
Hypochaeris albiflora	exotic																																							X																											
Hypochaeris glabra	exotic				X	X		X	X	X								X												X	X	X	X	X	X	X		X	X							X	X		X	X			X	X	X	X	X	X		X			X	X	X		
Hypochaeris microcephala	exotic																																																							X										
Hypochaeris radicata	exotic																				X																								X																						
Indigofera adesmiifolia	native						X	X																																																									X		X
Indigofera australis	native																																																																X		
Indigofera spp.	native																												X																																						
Isoetopsis graminifolia	native																																																								X										
Jasminum lineare	native							X				X																												X																											
Jasminum suavissimum	native																																																										X							
Juncus filicaulis	native																																																																		
Juncus spp.	native								X													X						X																																						
Keraudrenia corollata	native																																															X	X																		

Lachnagrostis filiformis	native														X			X					X																																													
Lactuca serriola	exotic														X				X				X	X			X	X																																							
Lagenophora spp.	native																																																																		
Lamium amplexicaule	exotic																		X																	X							X																								
Leiocarpa panaetioides	native																																																																		
Leontodon rhagadioloides	exotic																					X																X								X										X	X										
Leontodon saxatilis	exotic																																																																		
Lepidium africanum	exotic									X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X			X				X	X	X	X	X	X												X						X	
Lepidium bonariense	exotic											X	X																				X																											X							
Lepidium didymum	exotic																																																																		
Lepidium spp.	native																																				X	X																													
Lepidosperma laterale	native	X		X																																																												X			
Leptochloa asthenes	native					X			X	X		X	X															X															X																								
Leptochloa decipiens	native							X																																X	X	X																									
Liliaceae indeterminate	exotic													X															2																																						
Linaria arvensis	exotic												X					X		X	X						X								X								X	X		X	X	X																			
Linaria pelisseriana	exotic																															X																																			
Linaria spp.	exotic																																																						X												
Linum spp.	native																																																																		
Lobelia spp.	native						X																																																												
Lolium perenne	exotic																				X	X				X				X		X	X	X		X		X	X						X		X																				
Lolium rigidum	exotic															X	X				X				X			X	2			X		X	X												X							X	X	X											
Lolium spp.	exotic												X											X																																											
Lomandra filiformis																																																		X														X			
Lomandra filiformis subsp. coriacea	native																																																																		
Lomandra filiformis subsp. filiformis	native																																																																		
Lomandra longifolia	native																																																											X							
Lomandra multiflora	native																																																															X		
Lomandra multiflora subsp. multiflora	native				X	X								X															X																					X			X										X	X			X
Lomandra spp.	native							X		X																										X						X																									
Loranthaceae indeterminate	exotic																																									X																									
Lycium ferocissimum	high threat												X		X										X			X																																X							
Lysimachia arvensis	exotic					X			X	X	X		X		X		X	X	X	X	X	X	X			X	X	X	X		X	X	X	X	X		X	X	X				X	X	X	X	X	X						X	X	X	X	X					X		X	X	
Lythrum hyssopifolia	native																																																						X												
Macrozamia spp.	native																																																														X				
Maireana enchylaenoides	native												X															X																																							
Maireana microphylla	native											X	X					X										X																													X			X	X						
Malva neglecta	exotic																		X							X										X	X																														
Malva parviflora	exotic												X					X																																																		

Malvaceae indeterminate	exotic																																																																		
Malvastrum americanum	exotic																																																																		
Marrubium vulgare	exotic												X		X											X																																									
Marsdenia viridiflora	native																																																																		
Marsdenia viridiflora subsp. viridiflora	native				X	X	X																																										X															X			
Medicago minima	exotic							X																		X														X																X											
Medicago polymorpha	exotic																					X						X								X		X	X			X																									
Medicago spp.	exotic																												X			X					X																														
Medicago truncatula	exotic																		X											X																		X								X	X										
Melaleuca bracteata	native														X											X											X						X																								
Melaleuca spp.	native																																																																		
Melaleuca uncinata	native																																																																		X
Melichrus erubescens	native																																																			X															
Melichrus urceolatus	native	X	X	X	X																																																									X				
Mentha satureioides	native																			X																												X																			
Microlaena stipoides	native									X					X								X			X											X						X						X	X								X					X	X	X		
Microlaena stipoides var. stipoides	native																																																																		
Micromyrtus sessilis	native																																																									X									
Micromyrtus spp.	native																																																																		
Microtis spp.	native																																																					X													
Microtis unifolia	native																																																						X												
Mimulus gracilis	native																	X			X																																														
Mimulus prostratus	native																																																																		
Mimulus spp.	native																																							X																	X								X		
Misopates orontium	exotic					X				X	X	X	X	X		X	X	X	X	X	X	X				X	X	X	X	X		X	X	X	X	X		X		X	X	X	X	X	X	X	X	X										X								X	
Misopates spp.	exotic																																																																		
Muehlenbeckia rhyticarya	native																																																X																		
Muellerina eucalyptoides	native																												X																																						
Myoporum montanum	native																																																																		
Nicotiana spp.	native																																				X																														
Nicotiana suaveolens	native														X																																																				
Notelaea microcarpa	native		X		X			X					X																																																						
Notelaea microcarpa var. microcarpa	native																																				X			X	X	X																X									
Notothixos cornifolius	native																																																																		
Nyssanthes spp.	native																																																											X							
Oenothera spp.	exotic																																											X																							
Olearia decurrens	native																																																				X														
Olearia elliptica	native																																								X																										
Olearia elliptica subsp. elliptica	native				X																																																														

Oncinocalyx betchei	native											X																																																							
Opercularia diphylla	native																																																														X	X		
Opuntia aurantiaca	high threat																																																																		
Opuntia spp.	high threat																																								X																										
Opuntia stricta	exotic						X	X	X														X									X																	X						X		X	X			X	X				
Opuntia stricta var. stricta	high threat																																																																		
Ornithopus compressus	exotic																X	X												X			X	X	X				X						X		X							X	X												
Ornithopus spp.	exotic																																				X																														
Oxalis chnoodes	native																																																																		
Oxalis exilis	native																																																																		
Oxalis perennans	native					X				X	X	X					X				X			X	X		X									X			X				X	X	X																				X	
Oxalis radicosa	native																																																																		
Oxalis spp.	native				X				X				X	X	X	X		X	X	X		X	X			X		X	X	X	X	X	X	X	X			X			X	X				X	X		X			X	X	X	X	X		X	X	X		X				X
Oxytes brachypoda	native			X	X		X	X	X		X	X						X																					X	X	X	X			X	X										X									
Panicum effusum	native			X	X	X	X	X		X	X		X	X	X	X	X		X	X		X	X	X	X	X		X					X	X	X	X		X	X					X				X					X	X	X			X	X			X	X			X	
Panicum spp.	native																				X																							X				X				X			X	X			X	X		X	X	X		X
Papaver dubium	exotic																	X																																																	
Papaver spp.	exotic																										X																																								
Parietaria debilis	native						X																																																												
Parietaria judaica	exotic																								X																																									
Parsonsia eucalyptophylla	native					X	X			X		X			X									X	X	X	X												X	X	X	X										X						X		X					X	X
Parsonsia spp.	native																																																																		
Paspalidium distans	native												X	X	X	X						X						X																													X			X					
Paspalidium gracile	native																																																																		
Paspalidium spp.	native			X	X	X	X	X	X		X	X								X				X	X	X	X									X			X	X	X	X	X					X	X	2			2							2	2		X	X	X	X	X
Paspalum dilatatum	high threat																																																																		
Petrorhagia dubia	exotic																													X	X	X	X	X																			X												
Petrorhagia nanteuilii	exotic				X		X	X	X	X	X		X		X			X	X	X	X	X	X			X		X					X	X	X	X	X			X	X		X	X		X	X						X		X		X								X	
Petrorhagia nanteulii	exotic											X					X																									X			X																					
Petrorhagia spp.	exotic																																																																		
Phebalium squamulosum		X		X																																												X	X	X	X	X											X		X		X
	native	X		X																																												X	X	X	X	X											X		X		X
	native	X	X	X																																												X	X	X	X	X											X	X	X		X
	native																																																X														X				
	native						X																																																												
Wiry Spurge	native									X	X						X			X	X					X						X	X				X	X	X	X				X	X	X		X	X				X	X		X			X				X	X		
Rice Flower	native								X																																																										
	native			X	X						X																															X																								
Silky Rice-flower	native																																																																		
Poison Pimelea	native			X	X			X	X			X	X	X	X									X	X	X		X									X			X	X	X	X														X									
	native						X																																																												
Butterbush	native																																																																		
	native																																																																			
Shade Plantain	native											X													X		X						X																										X							
Lamb's Tongues	native																					X																							X																						
Plantain	native								X																																																		X						X	
	native																																																																		
	native																																									X																								
Tussock	native																																																																		
Snowgrass	native			X			X	X	X																																																X									
	native																																																																		

Grasses, reeds and bamboos	native																																					X		X	X						X									X	X		X		X						
Polycarpon tetraphyllum	exotic												X					X	X	X	X	X											X	X	X		X	X	X				X	X	X	X	X	X								X				X						X	
Polygonum aviculare	exotic																																																																		
Polygonum spp.	native																	X																																																	
Pomaderris spp.	native																																																															X		
Pomax umbellata	native	X	X	X																																															X	X											X	X	X		X
Poranthera microphylla	native							X																																										X			X										X	X			
Portulaca bicolor var. rosea	native																																																								X									
Portulaca oleracea	native											X													X		X																																	X							
Portulaca pilosa	exotic																																																				X														
Portulaca spp.	native																																																									X		X							
Prostanthera ringens	native																																																																		X
Pseudognaphalium luteoalbum	native									X											X											X		X																																	
Psydrax odorata	native																																										X																									
Psydrax oleifolia	native																																							X																										X		
Pterostylis spp.	native																																																							X											
Ranunculus sessiliflorus	native																		X																	X																															
Ranunculus spp.	native																																																																		
Rapistrum rugosum	exotic																											X																																							
Rhodanthe spp.	native																																																																		
Romulea spp.	exotic																																																																		
Rostellularia adscendens	native																																								X	X																			X						
Rostraria cristata	exotic																	X		X								X															X																								
Rumex brownii	native									X		X	X	X	X	X	X	X	X	X		X	X	X		X		X					X			X			X	X			X	X		X	X	X						X	X												
Rumex crispus	exotic																																																																		
Rytidosperma longifolium	native																																																									X								X	
Rytidosperma racemosum	native																																																																		
Rytidosperma racemosum var. racemosum	native																																							X	X	X																									
Rytidosperma spp.	native				X	X	X	X	X	X			X	X									X		X			X	X																													X	X	X	X	X					
Salsola australis	native																	X																																																	
Salsola kali var. kali	native																								X																																										
Salvia reflexa	exotic																																										X																								
Salvia spp.	native																																																																		
Schkuhria pinnata var. abrotanoides	exotic											X						X		X		X					X							X	X										X	X																					
Schkuhria spp.	exotic																																																																		
Schoenus apogon	native																																																									X									
Schoenus ericetorum	native																																																		X																
Schoenus kennyi	native			X																																																															
Schoenus spp.	native																					X																																													
Scleria mackaviensis	native				X																																																														
Sclerolaena birchii	native											X	X				X	X	X		X		X		X		X	X		X		X	X	X				X						X		X		X						X		X	X		X	X	X	X				X	
Sclerolaena muricata	native													X																																																					
Scutellaria humilis	native							X	X	X																																	X																								
Senecio quadridentatus	native																																												X	X																	X				
Senecio spp.	native					X				X																													X																										X		

Senna artemisioides subsp. zygophylla	native																																																														X				
Senna barclayana	native																				X					X											X						X																							
Sida corrugata	native								X			X	X				X	X			X		X	X	X		X	X					X		X				X		X			X			X	X											X		X	X				X	
Sida cunninghamii	native				X																X				X			X					X									X		X	X										X					X	X				X		X
Sida hackettiana	native																																											X										X					X							
Sida petrophila	native																												X																																						
Sida rhombifolia	exotic												X																															X															X							
Sida spinosa	exotic									X		X	X			X	X	X	X	X	X	X				X	X	X	X	X			X	X	X	X	X	X	X		X		X	X	X	X	X	X						X								X				X	
Sida spp.	native																																							X									X	X			X				X										
Sigesbeckia australiensis	native					X				X		X																X																														X									
Sigesbeckia orientalis	native																																										X																								
Sigesbeckia orientalis subsp. orientalis	native															X																					X																														
Sigesbeckia spp.	native																																																																		
Silene gallica	exotic																																																					X	X												
Silybum marianum	exotic																							X													X																														
Sisymbrium irio	exotic												X						X									X																																						X	
Sisymbrium officinale	exotic															X								X	X	X			X																																						
Sisymbrium orientale	exotic											X	X					X		X								X								X								X	X		X	X																			
Sisymbrium spp.	exotic																								X																																										
Sisyrinchium spp.	exotic																															X																							X												
Solanum cinereum	native				X	X	X		X	X	X		X	X		X												X												X	X	X																									
Solanum cleistogamum	native																																																															X			
Solanum elaeagnifolium	high threat																																																																		
Solanum esuriale	native																																																																	X	
Solanum ferocissimum	native																																																X				X										X		X		X
Solanum jucundum	native																																																X				X							X	X		X	X			X
Solanum nigrum	exotic												X	X	X	X									X	X		X									X			X			X															X	X	X							
Solanum parvifolium subsp. parvifolium	native																																								X	X											X							X	X		X				
Solanum spp.	native																																																								X		X			X			X		
Solenogyne bellioides	native																																																									X									
Solenogyne gunnii	native																																																																		
Solenogyne spp.	native																																																																		
Sonchus asper	exotic										X																																																							X	
Sonchus oleraceus	exotic				X	X	X	X	X	X		X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X		X	X		X	X	X	X	X	X	X	X						X	X			X							X		X
Sonchus spp.	native																																																						X											
Spergularia spp.	native					X						X						X																																																	
Sporobolus caroli	native																																																																		
Sporobolus creber	native					X		X			X	X	X			X	X	X	X	X	X	X	X	X			X		2				X	X	X	X		X	X				X	X		X		X						X	X	X	X	X	X	X	X	X				X	
Sporobolus spp.	native																																																																		
Stachys arvensis	exotic												X	X	X	X		X		X	X	X	X	X		X	X	X	X				X			X		X	X				X	X				X																			
Stachys byzantina	exotic																																																																		
Stackhousia monogyna	native										X																																																									
Stackhousia muricata	native							X																																																											
Stackhousia viminea	native				X	X	X		X			X		X							X								X													X																									
Stuartina muelleri	native							X																																																											
Swainsona galegifolia	native				X				X	X																														X	X	X																X									

Swainsona spp.	native																																																											X									
Teucrium betchei	native								X																																																												
Teucrium corymbosum	native							X																																	X	X																										
Teucrium spp.	native																																																																	
Thelymitra spp.	native	X																																																X								X										
Thyridolepis mitchelliana	native																																									X							X	X		X	X										X	X	X		X
Tragus australianus	native																	X																																																	
Tribulus micrococcus	native												X					X									X																																								
Tribulus minutus	native																																																																		
Tribulus spp.	native																											X																																							
Tribulus terrestris	exotic																		X																																																
Tricoryne spp.	native																																																											X									
Trifolium angustifolium	exotic																												X				X	X	X	X		X	X																												
Trifolium arvense	exotic				X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X						X	X	X	X	X	X							X	X	X	X								X	
Trifolium campestre	exotic																			X	X						X			X		X	X	X									X	X		X	X	X						X	X			X									
Trifolium dubium	exotic																					X														X		X	X						X											X	X										
Trifolium glomeratum	exotic							X	X	X		X	X	X	X		X	X	X		X	X			X	X	X	X		X		X	X	X	X	X	X	X	X				X		X	X								X	X	X	X									X	
Trifolium spp.	exotic													X	X								X	2																																											
Tripogon loliiformis	native											X																																																							
Triptilodiscus pygmaeus	native				X	X																					X																															X					X				
Unknown A	native			X																																																															
Urochloa panicoides	exotic																																																																		
Urtica incisa	native																									X											X																														
Verbascum spp.	exotic															X																																																			
Verbascum thapsus subsp. thapsus	exotic						X																																																												
Verbascum virgatum	exotic																																X					X					X				X							X													
Verbena bonariensis	exotic																													X													X																								
Verbena caracasana	exotic														X				X																																																
Verbena gaudichaudii	native														X						X								X																									X								X				X	
Verbena officinalis	exotic																							X												X					X	X																									
Verbena spp.	native																X																							X																											
Vernonia cinerea	native																																							X													X												X		X
Veronica plebeia	native																																																														X				
Vicia spp.	exotic																									X																																									
Vittadinia cervicularis	native																																																																		
Vittadinia cervicularis var. cervicularis	native																					X																																													
Vittadinia cuneata	native				X	X			X	X		X	X	X	X	X	X	X		X			X		X	X		X	X								X						X	X		X	X	X																		X	
Vittadinia cuneata var. cuneata	native																																							X	X	X																									
Vittadinia cuneata var. hirsuta	native										X																																																								
Vittadinia dissecta	native					X			X																								X								X	X	X		X								X										X	X			
Vittadinia muelleri	native				X	X	X		X		X	X						X		X		X					X						X	X	X	X		X	X			X			X	X		X								X	X	X								X	
Vittadinia pterochaeta	native																																					X																													
Vittadinia pustulata	native					X						X						X		X			X				X			X	X	X	X	X	X									X			X	X		X				X	X			X		X	X		X				

Vittadinia spp.	native						X												X					X			X										X			X	X		X															X		X			X					
Vittadinia sulcata	native																								X					X														X			X														X							
Vulpia spp.	exotic								X									X			X							X		X	X	X	X	X				X								X									X	X		X					X				
Wahlenbergia communis	native				X	X	X		X	X		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X		X		X	X	X	X	X		X	X	X						X	X	X	X		X							2	
Wahlenbergia gracilis	native											X		X	X	X	X	X		X	X			X			X						X	X	X								X	X				X																	X	X	
Wahlenbergia graniticola	native																																																				X	X													
Wahlenbergia planiflora	native				X	X	X																										X		X																												X				
Wahlenbergia spp.	native							X	X	X	X	X							X	X		X				X	X										X		X						X					X					X			X									
Wurmbea spp.	native					X																																																				X									
Xanthium spinosum	high threat																																																																		
Xerochrysum bracteatum	native					X		X		X									X			X								X			X	X				X						X		X		X		X							X									X	
Xerochrysum spp.	native										X			X		X	X							X					X																								X						X								
Zaleya galericulata	native																		X																																																
Zornia dyctiocarpa var. dyctiocarpa	native				X																																																													

Appendix B – *Photo Monitoring Points*

Appendix B 2021 Vegetation plot photo monitoring points

Greylands

Photo Point	Easting/Northing GDA 94 MGA 55	Vegetation Community Represented
S12 Rep	777944/6622966	PCT 88 Pilliga Box- White Cypress - Buloke shrubby woodland in the Brigalow Belt South Bioregion - moderate condition

Floristic Monitoring Site 12 (S12 REP)

NE corner facing 225^0

SE corner facing 315^0

SW corner facing 45^0

NW corner facing135^0

Omeo

Photo Point	Easting/Northing GDA 94 MGA 55	Vegetation Community Represented
S13	777503/6623535	PCT 81 Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion – moderate condition
S13 Rep	777517/6623446	PCT 81 Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion – moderate condition

Floristic Monitoring Site 13 (S13)

NE corner facing 225^0

SE corner facing 315^0

SW corner facing 45^0

NW corner facing 135^0

FLORISTIC MONITORING SITE 13 REP (SITE 13 REP)

NE corner facing 225^0

SE corner facing 315^0

SW corner facing 45^0

NW corner facing 135^0

Greylands Road

Photo Point	Easting/Northing GDA 94 MGA 55	Vegetation Community Represented
S14	772044 6622014	PCT 406: White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests

Floristic Monitoring Site 14 (S14)

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

Kurrajong Park

Photo Point	Easting/Northing GDA 94 MGA 55	Vegetation Community Represented
MP1	772046/6621836	PCT 406 White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests
MP2	772017/6621487	PCT 404 Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests

Floristic Monitoring Site MP1

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

Floristic Monitoring Site MP2

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

WEST HAVEN

Photo Point	Easting/Northing GDA 94 MGA 55	Vegetation Community Represented
S14 Rep	772044/6622014	PCT 404 Red Ironbark – White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests – good condition

Floristic Monitoring Site (S14 REP)

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

ROSEVALE

Photo Point	Easting/Northing GDA 94 MGA 55	Vegetation Community Represented
S15	774820/6624353	PCT 619 Derived Wire Grass grassland of the NSW Brigalow Belt South Bioregion and Nandewar Bioregion
S15 Rep	775169/6625903	PCT 619 Derived Wire Grass grassland of the NSW Brigalow Belt South Bioregion and Nandewar Bioregion
S16	774549/6624447	PCT 409 Dirty (Baradine) Gum - White Bloodwood - White Cypress Pine - Motherumbah shrubby woodland on sandy soils in the Pilliga Scrub and surrounding region, Brigalow Belt South Bioregion – good condition
S16 Rep	774578/6624562	PCT 401 Rough-barked Apple- Blakely's Red Gum – Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region – good condition
S17	774876/6625270	PCT 404 Red Ironbark – White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests – good condition
S17 Rep	774785/6624728	PCT 406 White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests – good condition
S18	773697/6625385	PCT 404 Red Ironbark – White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests – moderate condition
S18 Rep	773628/6625124	PCT 406 White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests – moderate condition
S19	774779/6625869	PCT 404 Red Ironbark – White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests – good condition
S19 Rep	774775/6625848	PCT 404 Red Ironbark – White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests – good condition

Floristic Monitoring Site (S15)

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

Floristic Monitoring Site (S15REP)

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

Floristic Monitoring Site (S16)

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

Floristic Monitoring Site (S16REP)

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

Floristic Monitoring Site (S17)

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

Floristic Monitoring Site (S17REP)

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

Floristic Monitoring Site 18 (S18)

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

Floristic Monitoring Site 18 REP (S18REP)

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

Floristic Monitoring Site 19 (S19)

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

Floristic Monitoring Site 19 (S19 REP)

Facing NE 45^0

Facing SE 135^0

Facing SW 225^0

Facing NW 315^0

Appendix C – *Fauna Species List*

Appendix C Fauna Species List

Birds

Common Name	Scientific Name	RB1	RB2	RB3	RB4	RB5	RB6	RB7	RB8	RB11	RB13	RB14	RB17	RB18	RB19	RB20	Grand Total
Apostlebird	*Struthidea cinerea*	21	12		15											6	**54**
Australasian Grebe	*Tachybaptus novaehollandiae*	2															**2**
Australian Magpie	*Gymnorhina tibicen*				4	6		1	2				1			1	**15**
Australian Raven	*Corvus coronoides*	2	2	7		2	1	1		1	1	1					**18**
Australian Ringneck	*Barnardius zonarius*													1			**1**
Australian Wood Duck	*Chenonetta jubata*				1												**1**
Bar-Shouldered Dove	*Geopelia humeralis*	5		2				1	2	2	1	1		3			**17**
Black-Eared Cuckoo	*Chalcites osculans*					1			1								**2**
Black-Faced Cuckoo-Shrike	*Coracina novaehollandiae*		1	1	1					1				1		1	**6**
Blue-Faced Honeyeater	*Entomyzon cyanotis*		2		1												**3**
Brown Honeyeater	*Lichmera indistincta*	1													3		**4**
Brown Quail	*Synoicus ypsilophorus*				4												**4**
Brown-Headed Honeyeater	*Melithreptus brevirostris*	2															**2**
Chestnut-Rumped Thornbill	*Acanthiza uropygialis*						3										**3**
Cockatiel	*Nymphicus hollandicus*					12											**12**
Common Bronzewing	*Phaps chalcoptera*		1		1	4	1			2			1	1	1		**12**
Crested Pigeon	*Ocyphaps lophotes*	17	2	1	3	1							2				**26**
Diamond Dove	*Geopelia cuneata*	3												1			**4**
Double-Barred Finch	*Taeniopygia bichenovii*	12			2		4	5				5	1	5			**34**
Eastern Koel	*Eudynamys orientalis*						1										**1**

Appendix C Fauna Species List

Eastern Rosella	*Platycercus eximius*	2				2			1				2				**7**
Eastern Yellow Robin	*Eopsaltria australis*	1	1	4		1	8	1		2	2		2		1	1	**24**
Emu	*Dromaius novaehollandiae*						1										**1**
Fan-Tailed Cuckoo	*Cacomantis flabelliformis*										1						**1**
Fuscous Honeyeater	*Ptilotula fusca*														1		**1**
Galah	*Eolophus roseicapilla*	10	15	12	7		1	1	6				1				**53**
Golden Whistler	*Pachycephala pectoralis*		1	1			2	1			1		1				**7**
Grey Butcherbird	*Cracticus torquatus*	1				2											**3**
Grey Fantail	*Rhipidura fuliginosa*	4				1	5	2			1	2		3	2	1	**21**
Grey Shrike-Thrush	*Colluricincla harmonica*	2							1		1	1	1	1	2		**9**
Grey-Crowned Babbler (Eastern Subspecies)	***Pomatostomus temporalis temporalis***	7	6		6				1				1				**21**
Inland Thornbill	*Acanthiza apicalis*	7		4			6	4			1		3	4	2	5	**36**
Jacky Winter	*Microeca fascinans*							1	1								**2**
Laughing Kookaburra	*Dacelo novaeguineae*		3		1	3			3	1	1					2	**14**
Leaden Flycatcher	*Myiagra rubecula*				1				1		1						**3**
Little Corella	*Cacatua sanguinea*							1	1								**2**
Magpie-Lark	*Grallina cyanoleuca*	1				1		1			2	1	1				**7**
Masked Woodswallow	*Artamus personatus*												13				**13**
Mistletoebird	*Dicaeum hirundinaceum*	1	1			1											**3**
Musk Lorikeet	*Glossopsitta concinna*								1								**1**
Noisy Friarbird	*Philemon corniculatus*	4		4		16	5		11	1	2		2		2		**47**
Noisy Miner	*Manorina melanocephala*		1							7							**8**

Appendix C Fauna Species List

Olive-Backed Oriole	*Oriolus sagittatus*					3	1				6	1		1	1		**13**
Painted Button-Quail	*Turnix varius*													1			**1**
Pallid Cuckoo	*Heteroscenes pallidus*	1	1	3			1										**6**
Peaceful Dove	*Geopelia placida*	1			2	1	1										**5**
Pied Butcherbird	*Cracticus nigrogularis*	2	1		1									1		1	**6**
Pied Currawong	*Strepera graculina*	1						1		4			1	2	1	2	**12**
Rainbow Bee-Eater	*Merops ornatus*	1	4	1	5	9	4	10	3		1			1		1	**40**
Red Wattlebird	*Anthochaera carunculata*								2							1	**3**
Red-Backed Kingfisher	*Todiramphus pyrrhopygius*										1						**1**
Red-Rumped Parrot	*Psephotus haematonotus*												2				**2**
Red-Winged Parrot	*Aprosmictus erythropterus*								1								**1**
Rufous Songlark	*Cincloramphus mathewsi*	1															**1**
Rufous Whistler	*Pachycephala rufiventris*	6	8	6	2	4	6	12	1	3		4	3	7	4	3	**69**
Sacred Kingfisher	*Todiramphus sanctus*										1			1			**2**
Shining Bronze-Cuckoo	*Chalcites lucidus*							1							1		**2**
Singing Honeyeater	*Gavicalis virescens*					2											**2**
Speckled Warbler	***Chthonicola sagittata***	5		3			10	1			1			5		2	**27**
Spiny-Cheeked Honeyeater	*Acanthagenys rufogularis*	3	2			1		1			1		1	1	3		**13**
Spotted Pardalote	*Pardalotus punctatus*			1						1							**2**
Striated Pardalote	*Pardalotus striatus*			1		3							1				**5**
Striped Honeyeater	*Plectorhyncha lanceolata*	4				3			3								**10**
Sulphur-Crested Cockatoo	*Cacatua galerita*			1													**1**

Appendix C Fauna Species List

Superb Fairy-Wren	*Malurus cyaneus*			1				6				1				1	**9**
Torresian Crow	*Corvus orru*	2	2			2			2						1		**9**
Varied Sittella	***Daphoenositta chrysoptera***					1		1							1		**3**
Variegated Fairy-Wren	*Malurus lamberti*							2									**2**
Weebill	*Smicrornis brevirostris*	2	2	9		2	3	6	3	1	1	4	1	7	1	4	**46**
Welcome Swallow	*Hirundo neoxena*							1									**1**
Western Gerygone	*Gerygone fusca*	2	1	1									1				**5**
White-Bellied Cuckoo-Shrike	*Coracina papuensis*										1						**1**
White-Breasted Woodswallow	*Artamus leucorynchus*												4				**4**
White-Browed Babbler	*Pomatostomus superciliosus*			2													**2**
White-Eared Honeyeater	*Nesoptilotis leucotis*						2										**2**
White-Throated Gerygone	*Gerygone olivacea*										1				1		**2**
White-Throated Treecreeper	*Cormobates leucophaea*									3			1		2	2	**8**
White-Winged Chough	*Corcorax melanorhamphos*		5		2	9			1								**17**
White-Winged Fairy-Wren	*Malurus leucopterus*				5												**5**
White-Winged Triller	*Lalage tricolor*													1			**1**
Willie Wagtail	*Rhipidura leucophrys*	5	1	1	2	1			1					1			**12**
Yellow Thornbill	*Acanthiza nana*	14		4	3		10	6		3	1		1	8	2	2	**54**
Yellow-Faced Honeyeater	*Caligavis chrysops*	2		1													**3**
Zebra Finch	*Taeniopygia guttata*	1		1							1						**3**
	GRAND TOTAL	**165**	**81**	**74**	**71**	**94**	**76**	**68**	**49**	**32**	**31**	**21**	**48**	**57**	**32**	**37**	**936**

Appendix C Fauna Species List

Mammal Reptiles and Frogs

Group	Scientific Name	RVL-PIT-01	RVL-PIT-02	RVL-PIT-03	RVL-PIT-04	RVL-PIT-05	RVL-PIT-06	RVL-PIT-07	HRA-PIT-01	HRA-PIT-02	HRA-PIT-03	HRA-AF-01	RVL-AF-02	RVL-AF-03	RVL-AF-04	RVL-AF-05	RVL-AF-08	Total
Amphibian	Litoria rubella	0	0	0	0	0	0	0	0	1	2	2	0	0	0	0	0	**5**
Amphibian	Cyclorana alboguttata	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	**3**
Amphibian	Limnodynastes dumerilii	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	**3**
Amphibian	Limnodynastes tasmaniensis	0	3	6	1	5	1	0	2	0	0	0	0	0	0	0	0	**18**
Amphibian	Limnodynastes terraereginae	0	1	8	2	13	0	0	21	21	5	0	0	0	0	0	0	**71**
Amphibian	Litoria caerulea	0	0	0	1	0	0	0	7	1	0	0	0	0	0	0	0	**9**
Amphibian	Liotora latopalmata	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
Amphibian	Neobatrachus sudelli	0	0	0	0	2	0	0	2	2	3	0	0	0	0	0	0	**9**
Amphibian	Platyplectrum ornatum	0	0	0	1	0	0	0	61	25	30	0	0	0	0	0	0	**117**
Amphibian	Uperloia rugosa	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	**2**
Amphibian	Crinia signifera	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**2**
Mammal	Antechinus flavipes	0	0	2	0	0	1	0	1	0	0	0	0	0	0	0	0	**4**
Mammal	Mus musculus	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	**3**
Mammal	Sminthopsis murina	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**1**
Reptile	Amphibolurus muricatus	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	**2**
Reptile	Anamalopus luekartii	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	**2**
Reptile	Cryptoblepharus pulcher	0	0	0	1	0	0	0	0	2	0	0	0	0	1	1	0	**5**

Appendix C Fauna Species List

Reptile	Cryptoblepharus pannosus	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
Reptile	Ctenotus allotropis	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	**3**
Reptile	Ctenotus robustus	0	0	0	7	1	1	0	2	3	3	0	0	0	0	0	0	**17**
Reptile	Diporiphora nobbi	0	0	0	1	1	0	0	1	2	0	0	0	1	0	0	0	**6**
Reptile	Lerista punctatovittata	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	**2**
Reptile	Lerista timida	0	1	0	1	0	1	0	5	1	0	0	1	0	0	0	0	**10**
Reptile	Morethia boulengeri	0	0	3	0	3	0	0	8	3	0	0	3	0	0	0	1	**21**
Reptile	Pogona barbata	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	**3**
Reptile	Delma inornata	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**1**
Reptile	Diplodactylus vittatus	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	**3**
Reptile	Heteronotia binoei	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	**3**
Reptile	Demansia psammophis	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	**2**
Reptile	Egernia striolata	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	**2**
	GRAND TOTAL	**1**	**6**	**22**	**18**	**27**	**6**	**1**	**122**	**67**	**47**	**2**	**5**	**1**	**2**	**3**	**1**	**331**

Appendix D – *Surface Water Monitoring*

Appendix D - Surface Water Monitoring Results

Date	Sample Location	pH	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Grease & Oil (mg/L)	Total Organic Carbon (TOC)	Comments
20 January 2021	A1	9.2	7050	4960	<5	14	
20 January 2021	A2	9	6710	4650	<5	17	
20 January 2021	A3	8.9	6470	4420	<5	448	
20 January 2021	B1	8.6	592	336	<5	14	
20 January 2021	B2	9.5	37100	32000	<5	1170	
20 January 2021	C	9.6	48600	26	<5	1340	
20 January 2021	D	8.1	375	61	<5	12	
22 February 2021	A1	9.3	7400	25	<6	1	
22 February 2021	A2	9.1	6750	36	<6	----	
22 February 2021	A3	9.2	7050	206	<6	----	
22 February 2021	B1	8.5	550	<5	<5	5	
22 February 2021	B2	9.7	38500	217	<5	----	
22 February 2021	C	9.6	54800	100	<5	----	
22 February 2021	D	8.5	430	32	<5	<1	
23 February 2021	BOX CUT	8.8	5570	3960	44	84	
23 February 2021	SB1	9.4	6930	1680	5	----	
23 February 2021	SB2	9.2	4370	16	<5	20	
23 February 2021	SB3	9.5	5450	31	<5	----	
23 February 2021	SB4	9.6	4100	24	<5	----	
23 February 2021	SD1	8.7	660	28	5	11	
23 February 2021	SD2	9	278	31	<5	6	
23 February 2021	SD3	8.8	582	36	5	9	
23 February 2021	SD4	9.1	705	30	<5	7	
23 February 2021	SD5	8.7	400	1300	6	16	
23 February 2021	SD6	9.6	635	13	<5	11.2	
23 March 2021	A1	9.6	6800	28	<5	<1	
23 March 2021	A2	9.3	6050	52	7	16	
23 March 2021	A3	9.2	5400	154	<5	<1	
23 March 2021	B1	8.8	605	<5	<5	5	
23 March 2021	B2	9.7	27900	320	<5	<1	
23 March 2021	C	9.8	59300	139	<5	<1	
23 March 2021	D	8.3	450	36	<5	5	
29 March 2021	Boxcut	8.8	6680	13100	23	10	
29 March 2021	SD3	8.1	575	20	<5	14	
29 March 2021	SD4	8	630	27	<5	7	
29 March 2021	SD6	8.7	526	14	<5	9	
30 March 2021	SB1	9.4	6050	600	<5	6	
30 March 2021	SB2	9.5	3300	49	<5	10	

30 March 2021	SB3	9.4	2650	372	<5	6	
30 March 2021	SB4	9.6	2800	34	<5	19	
30 March 2021	SD1	8.1	702	12	<5	9	
30 March 2021	SD2	7.9	274	<5	<5	11	
30 March 2021	SD5	7.7	146	24	<5	15	
22 April 2021	A1	9.3	5800	26	<5	----	
22 April 2021	A2	9	5760	23	<5	----	
22 April 2021	A3	9.1	6180	182	<5	----	
22 April 2021	B1	8.8	695	<5	<5	8	
22 April 2021	B2	9.7	22000	104	<5	----	
22 April 2021	C	9.8	51700	72	<5		
22 April 2021	D	7.9	385	33	<5	40	
27 April 2021	Boxcut	8.7	5800	1900	51	300	
27 April 2021	SB1	9.3	5230	21900	38	287	
27 April 2021	SB2	9.4	3580	6	<5	3	
27 April 2021	SB3	8.9	6600	2150	<5	11	
27 April 2021	SB4	9.2	3100	19	9	32	
19 May 2021	A1	9	6450	18	<5	4	
19 May 2021	A2	8.9	6200	59	17	17	
19 May 2021	A3	8.7	5900	195	23	23	
19 May 2021	B1	7.5	460	9	>5	<5	
19 May 2021	B2	9.4	30500	162	7	4	
19 May 2021	C	9.3	55000	280	13	3	
19 May 2021	D	9.4	565	60	<5	18	
27 May 2021	SB1	9.5	6200	81	<5	31	
27 May 2021	SB2	9.6	3600	34	<5	<1	
27 May 2021	SB3	9.6	3900	168	<5	18	
27 May 2021	SB4	9.3	3200	11	<5	15	
27 May 2021	SD1	8.6	765	8	<5	<1	
27 May 2021	SD2	9	295	27	<5	6	
27 May 2021	SD3	8.9	705	42	<5	<1	
27 May 2021	SD4	9	885	34	<5	<1	
27 May 2021	SD5	8.2	205	48	<5	6	
27 May 2021	SD6	9.2	550	6	<5	<1	
27 May 2021	Boxcut	8.7	5250	3070	41	488	
17 June 2021	A1	9.1	6200	60	<5	----	
17 June 2021	A2	9.2	5550	56	<5	----	
17 June 2021	A3	0.8	5200	406	<5	----	
17 June 2021	B1	7.7	415	5	<5	<1	
17 June 2021	B2	9.7	20700	21	<5	----	
17 June 2021	C	9.8	51800	82	<5	----	
17 June 2021	D	7.2	450	46	<5	4	
22 June 2021	Boxcut	8.6	4450	901	76	270	

22 June 2021	SB1	9.5	5850	78	<5	10	
22 June 2021	SB2	9.5	3800	20	<5	11	
22 June 2021	SB3	9.6	1870	224	<5	16	
22 June 2021	SB4	9.7	2950	120	<5	31	
22 June 2021	SD1	8.2	760	22	<5	5	
22 June 2021	SD2	8.1	320	20	<5	6	
22 June 2021	SD3	8.3	530	45	<5	3	
22 June 2021	SD4	9	1100	71	<5	<1	
22 June 2021	SD5	7.8	155	<5	<5	13	
22 June 2021	SD6	8.8	560	<5	<5	3	
20 July 2021	SD1	8.36	851	10	<5	14	
20 July 2021	SD3	8.87	949	54	<5	16	
20 July 2021	SD8	8.07	108	82	<5	10	
20 July 2021	SD2	8.12	291	18	<5	14	
20 July 2021	SD4	8.8	734	36	<5	14	
20 July 2021	SD5	7.44	110	7	<5	14	
20 July 2021	SD6	8.94	356	6	<5	8	
20 July 2021	SB1	9.04	4488	115	<5	35	
20 July 2021	SB2	8.23	2783	14	<5	9	
20 July 2021	SB3	9.11	1465	67	<5	12	
20 July 2021	SB4	9.3	1866	92	<5	14	
28 July 2021	A1	9.11	4528	15	<5	25	
28 July 2021	A2	8.89	4254	75	<5	41	
28 July 2021	A3	8.87	4349	230	<5	40	
28 July 2021	B1	7.33	229	<5	<5	<1	
28 July 2021	B2	9.46	15.11	25	<5	59	Outliers in data, have spoken with coalbed
28 July 2021	C	9.72	36.54	106	<5	8	Outliers in data, have spoken with coalbed
28 July 2021	D	8.54	358	36	<5	<1	
29 July 2021	Boxcut	8.62	4581	996	13	79	
19 August 2021	SB1	9	5.093	102	<5	23	
19 August 2021	SB2	9.28	3063	14	<5	16	
19 August 2021	SB3	9.19	2351	40	<5	14	
19 August 2021	SB4	9.33	2123	78	<5	6	
19 August 2021	SD1	8.36	923	7	<5	10	
19 August 2021	SD2	8.4	316	13	<5	10	
19 August 2021	SD3	8.96	1251	48	<5	12	
19 August 2021	SD4	8.94	953	21	<5	11	
19 August 2021	SD5	7.45	126	8	<5	12	
19 August 2021	SD6	9.11	409	5	<5	7	
19 August 2021	SD8	9.44	143	128	<5	8	
24 August 2021	A1	8.99	4657	20	<5	21	
24 August 2021	A2	8.81	4566	38	<5	25	
24 August 2021	A3	8.8	4567	174	<5	25	

24 August 2021	B1	7.57	342	12	<5	4	
24 August 2021	B2	9.41	16.07	57	<5	38	
24 August 2021	C	9.65	36.37	71	<5	106	
24 August 2021	D	9.28	634	74	<5	6	
24 August 2021	Boxcut	8.46	4065	2240	8	19	
20 September 2021	Boxcut	8.48	4245	452	<5	23	
21 September 2021	SB1	9.02	5043	1000	<5	185	
21 September 2021	SB2	9.12	3468	18	<5	11	
21 September 2021	SB3	9.07	2972	128	8	34	
21 September 2021	SB4	9.25	2283	10	<5	5	
21 September 2021	SD1	8.4	976	12	<5	10	
21 September 2021	SD2	8.7	384	20	<5	10	
21 September 2021	SD3	8.94	1561	24	<5	12	
21 September 2021	SD4	8.9	1175	8	<5	9	
21 September 2021	SD5	7.8	152	18	<5	15	
21 September 2021	SD6	9.05	444	8	<5	10	
21 September 2021	SD8	7.95	157	80	<5	10	
27 September 2021	A1	8.8	5616	15	5	-	
27 September 2021	A2	8.8	5631	59	6	-	
27 September 2021	A3	8.7	5630	214	16	-	
27 September 2021	B1	7.4	413	<5	<5	-	
27 September 2021	B2	9.4	21440	8	<5	-	
27 September 2021	C	9.5	43800	50	<5	-	
27 September 2021	D	8.5	680	70	<5	-	
30 September 2021	SD2	8.43	372	15	22	11	
30 September 2021	SD4	8.96	1180	16	15	12	
19 October 2021	Boxcut	8.5	5148	1100	25	91	
19 October 2021	SB1	9	6330	70	<5	18	
19 October 2021	SB2	9.3	3742	36	<5	8	
19 October 2021	SB3	9.33	1800	34	<5	2	
19 October 2021	SB4	9.2	2846	226	6	4	
19 October 2021	SD1	7.9	692	8	<5	11	
19 October 2021	SD2	8.33	473	5	<5	8	
19 October 2021	SD3	8.4	919	18	<5	10	
19 October 2021	SD4	8.8	1224	<5	<5	8	
19 October 2021	SD5	8.3	186	5	<5	13	
19 October 2021	SD6	8.9	499	<5	<5	7	
19 October 2021	SD8	8.7	157	119	<5	6	
25 October 2021	A1	8.9	5424	8	<5	31	
25 October 2021	A2	8.7	4685	46	5	66	
25 October 2021	A3	8.6	4402	969	<5	88	
25 October 2021	B1	7.4	439	<5	<5	4	
25 October 2021	B2	9.5	43510	25	<5	133	

25 October 2021	C	9.5	22270	56	<5	685	
25 October 2021	D	8.5	716	52	<5	9	
8 November 2021	SD2	8.47	496	13	<5	11	
8 November 2021	SD4	8.9	1801	42	7	11	
10 November 2021	SD2	7.95	508	6	<5	9	Discharge - EPL Sample. Rainfall >38.4mm, TSS limit does not apply
11 November 2021	A1	8.95	5330	28	<5	38	
11 November 2021	A2	8.75	4676	38	23	61	
11 November 2021	A3	8.75	3906	5740	69	123	
11 November 2021	B1	9.39	840	<5	<5	<1	
11 November 2021	D	9.52	20130	21	<5	6	
11 November 2021	B2	9.6	36280	58	<5	120	
11 November 2021	C	8.77	813	81	<5	689	
11 November 2021	SB2	9.23	2660	35	<5	19	
11 November 2021	SB3	9	1350	294	<5	10	
11 November 2021	SB4	9.32	2580	42	<5	15	
11 November 2021	SD2	8.12	366	117	<5	16	
12 November 2021	SD1	7.74	400	77	<5	21	
12 November 2021	SD2	7.88	382	91	<5	14	
15 November 2021	SD2	8.13	344	41	<5	11	Discharge - EPL Sample
15 November 2021	SD1	7.8	409	38	<5	15	
15 November 2021	SD3	8.3	723	56	<5	11	
15 November 2021	SD4	8.65	886	50	<5	10	
15 November 2021	SD5	7.99	180	12	<5	12	
15 November 2021	SD6	8.3	456	11	<5	8	
15 November 2021	SD8	7.99	105	1120	<5	7	
16 November 2021	SD2	8.1	371	44	<5	10	
17 November 2021	Boxcut	8.49	5550	629	<5	69	
17 November 2021	D	8.74	742	51	<5	8	
22 November 2021	SD2	8.03	501	70	<5	13	Discharge - EPL Sample. Rainfall >38.4mm, TSS limit does not apply
23 November 2021	SD2	8.07	503	61	<5	12	
24 November 2021	SD2	8.03	563	52	<5	8	
24 November 2021	SD4	8.28	747	46	<5	10	Discharge - EPL Sample. Rainfall >38.4mm, TSS limit does not apply
25 November 2021	SD2	8.15	502	34	<5	10	
25 November 2021	SD4	8.21	708	24	<5	14	
26 November 2021	SD2	8.19	455	30	5	8	
26 November 2021	SD4	8.28	779	41	<5	11	
27 November 2021	SD2	7.9	966	126	<5		
27 November 2021	SD4	7.63	843	74	<5		
28 November 2021	SD2	8.12	361	52	<5		
28 November 2021	SD4	8.35	989	94	<5		
29 November 2021	SD4	7.99	934	40	<5		
30 November 2021	SD4	8.17	1010	18	<5		

1 December 2021	SD4	8.34	1151	24	<5		
9 December 2021	SD4	8.08	870	56	<5	10	Discharge - EPL Sample. Rainfall >38.4mm, TSS limit does not apply
9 December 2021	SD2	8.52	560	94	<5	10	
10 December 2021	SD2	7.78	601	80	<5	13	Discharge - EPL Sample. Rainfall >38.4mm, TSS limit does not apply
10 December 2021	SD4	8.27	965	93	<5	13	
11 December 2021	SD2	7.95	732	38	<5		
11 December 2021	SD4	8.45	969	33	<5		
12 December 2021	SD2	8.64	1187	36	<5		
12 December 2021	SD4	8.4	1106	13	<5		
13 December 2021	SD4	8.39	1111	11	<5		
14 December 2021	SD1	9	2420	13	<5	12	
14 December 2021	SD2	8.96	1690	28	14	15	
14 December 2021	SD3	8.26	554	44	9	15	
14 December 2021	SD4	8.74	1290	30	8	15	
14 December 2021	SD5	8.99	346	15	<5	7	
14 December 2021	SD6	8.2	492	<5	<5	10	
14 December 2021	SD8	8.37	105	134	<5	9	
14 December 2021	SB1	9.12	5560	95	9	50	
14 December 2021	SB2	9.08	2570	18	6	11	
14 December 2021	SB3	9.21	20100	40	<5	20	
14 December 2021	SB4	9.34	1650	30	<5	11	
14 December 2021	A1	8.99	5100	52	<5	25	
14 December 2021	A2	8.92	5560	16	5	25	
14 December 2021	A3	9.55	17800	17	<5	38	
14 December 2021	B1	7.69	342	<5	<5	2	
14 December 2021	D	8.67	459	170	<5	15	
14 December 2021	B2	9.52	20400	25	<5	43	
14 December 2021	C	9.63	36000	56	<5	95	
14 December 2021	Boxcut	8.51	5420	172	<5	2	

Appendix E – *Groundwater Monitoring*

Appendix E - Groundwater Monitoring Results

Site ID	Piezometer / Water Bore	Date	Time	Depth to Water - mbgl	Depth to Stand mbtoc	Field Parameters			Total Metals																	Mercury (Hg) - mg/L	pH Lab	EC - Lab - µs/cm	Major Cations				Total Cations - meq/L	Major Anions						Total Anions - meq/L	Ionic Balance	Ammonia as Nitrogen (N)	Nitrite as N - mg/L	Nitrate as N - mg/L	NOX as N - mg/L	Total Dissolved Solids
						pH - Field	EC - Field - µs/cm	Temp - Field - °C	Aluminium (Al) - mg/L	Arsenic (As) - mg/L	Barium (Ba) - mg/L	Beryllium (Be) - mg/L	Cadmium (mg/L)	Chromium (Cr) - mg/L	Cobalt (Co) - mg/L	Copper (Cu) - mg/L	Iron (Fe) - mg/L	Lead (Pb) - mg/L	Manganese (Mn) - mg/L	Nickel (Ni) - mg/L	Vanadium (V) - mg/L	Zinc (Zn) - mg/L				Calcium (Ca) - mg/L	Magnesium (Mg) - mg/L	Sodium (Na) - mg/L	Potassium (K) - mg/L		Chloride (Cl) - mg/L	Sulfate (SO4) - mg/L	Hydroxide Alkalinity as CaCO3 - mg/L	Carbonate Alkalinity as CaCO3 - mg/L	Bicarbonate Alkalinity as CaCO3 - mg/L	Alkalinity - mg/L							
ANZECC Guideline - stock drinking water									*5*	*0.5*			*0.01*	*1*	*1*	*1*		*0.1*			*1*		*20*	*0.002*			*1000*						*1000*									*1500*	*400*		*4000*
P1	**NG1**	**27-Jan-21**	1130	22.13	23.11	7.6	4150	20.4																																			
		02-Mar-21	920	22.20	23.18	7.4	3990	19.7																																			
Depth	**50**	**30-Mar-21**	920	22.34	23.32	7.4	3980	19.3																																			
Format.	**Garrawilla**	**29-Apr-21**	1015	22.41	23.39	7.5	3570	19.7																																			
		31-May-21	905	22.06	23.04	7.5	3710	20.6																																			
		23-Jun-21	1000	22.58	23.56	7.5	4020	21.1																																			
		29-Jul-21	810	22.59	23.57	8	3800	19.9																																			
		28-Aug-21	1350	21.99	23	7.52	3814	19.6																																			
		05-Oct-21	1430	22.48	23.49	7.43	3809	21.7	0.7	0.004	0.646	<0.001	<0.0001	0.002	0.002	0.008	1.52	0.011	0.421	0.009	<0.01	0.019	<0.0001	8	4160	30	28	897	25	39.6	740	27	<1	<1	1150	1150	44.4	5.72	1.87	0.23	<0.01	0.15	2420
		11-Jan-22	1030	22.27	23.27	7.83	4300	26.1																																			
P2	**NG2**	**25-Jan-21**	1335	28.55	29.46	6.8	22300	19.8																																			
		24-Feb-21	1330	28.51	29.42	6.6	22400	20.7																																			
Depth	**50**	**01-Apr-21**	1230	28.42	29.33	6.9	22100	20																																			
Format.	**Napperby**	**27-Apr-21**	1310	28.54	29.45	6.9	22200	19.8																																			
		27-May-21	1310	28.45	29.36	6.9	21100	21.7																																			
		22-Jun-21	1320	28.42	29.33	6.8	20500	21.1																																			
		29-Jul-21	930	28.39	29.3	6.9	19982	21.2																																			
		28-Aug-21	1020	28.59	29.51	6.69	19862	18.4																																			
		05-Oct-21	1530	28.33	29.25	6.664	1984	22.1	7.85	0.005	1.81	<0.001	0.0002	0.015	0.019	0.056	20.5	0.015	1.64	0.032	0.04	0.06	<0.0001	7.42	20300	170	372	3690	81	202	5800	312	<1	<1	<1	<1	170	8.49	3.66	<0.01	0.02	0.02	12600
		11-Jan-22	1130	28.24	29.16	6.74	20979	24.3																																			
P3	**NG3**	**25-Jan-21**	955	10.01	10.94	6.6	18750	20.3																																			
		24-Feb-21	950	10.03	10.96	6.5	19040	19.2																																			
Depth	**45**	**01-Apr-21**	1010	10.00	10.93	6.7	18180	19.3																																			
Format.	**Pamboola**	**29-Apr-21**	945	10.10	11.03	7.2	22300	20.2																																			
		28-May-21	1035	10.11	11.04	6.9	20900	20.9																																			
		23-Jun-21	940	10.03	10.96	6.9	26700	21.1																																			
		29-Jun-21	900	10.05	10.98	6.6	17450	20.9																																			
		28-Aug-21	1400	10.04	10.96	6.58	18152	17.1																																			
		05-Oct-21	1630	10.06	10.98	6.6	17867	21.3	4.85	0.007	0.826	<0.001	0.0017	0.01	0.007	0.028	8.32	0.009	0.111	0.018	0.03	0.042	0.0007	7.23	18700	317	433	3050	41	185	5580	1190	<1	<1	1190	1190	206	5.31	0.56	<0.01	0.04	0.04	12200
		11-Jan-22		10.04	10.98	6.9	18800	22.9																																			
P4	**NG4**	**25-Jan-21**	1230	16.82	17.7	6.7	28100	21.1																																			
		24-Feb-21	1225	17.58	18.46	6.6	29100	20.6																																			
Depth	**30**	**01-Apr-21**	1100	16.82	17.7	6.7	27600	20																																			
Format.	**Napperby**	**27-Apr-21**	1450	16.85	17.73	6.5	25800	19.9																																			
		27-May-21	1140	16.82	17.7	6.6	26900	21.4																																			
		22-Jun-21	1155	16.77	17.65	6.6	26800	21.9																																			
		29-Jul-21	1230	16.75	17.63	6.86	25444	20.6																																			
		28-Aug-21	911	16.87	17.74	6.41	25665	18.4																																			
		05-Oct-21	1730	16.71	17.58	6.55	25485	21.1	1.26	0.004	0.274	<0.001	0.0002	0.003	0.015	0.013	4.11	0.008	1.44	0.023	<0.01	0.033	<0.0001	6.75	26000	216	546	4620	88	259	7800	1680	1	1	2170	2170	298	7.08	1.39	<0.01	<0.01	<0.01	17600
		11-Jan-22	1600	16.70	17.57	6.66	26776	24																																			
P5	**NG5**	**25-Jan-21**	1020	23.04	23.98	6.7	28700	21																																			
		24-Feb-21	1200	23.05	23.99	6.6	28300	20.7																																			
Depth	**30**	**01-Apr-21**	1040	23.00	23.94	6.6	27500	20.2																																			
Format.	**Pamboola**	**27-Apr-21**	930	23.02	23.96	6.6	25100	19.9																																			
		27-May-21	915	23.02	23.96	6.6	26800	21																																			
		22-Jun-21	930	22.98	23.92	6.7	26700	21.1																																			
		29-Jul-21	1140	23.33	24.27	6.7	26053	22.2																																			
		28-Aug-21	830	23.08	24.01	6.42	26560	17.9																																			
		05-Oct-21	1800	23.02	23.95	6.64	26321	21.3	1.64	0.003	0.305	<0.001	0.0001	0.003	0.014	0.018	3.62	0.009	1.66	0.033	<0.01	0.034	<0.0001	6.87	27100	226	475	4960	82	268	8630	864	<1	<1	2090	2090	303	6.12	5.13	<0.01	<0.01	<0.01	17400
		12-Jan-22	1770	22.73	23.65	6.73	7950	24.8																																			
P6	**NG6**	**25-Jan-21**	1045			Dry																																					
		24-Feb-21	1015			Dry																																					
Depth	**90**	**30-Mar-21**	1145			Dry																																					
Format.	**Pilliga Sandstone**	**27-Apr-21**	955			Dry																																					
		27-May-21				Dry																																					
		22-Jun-21				Dry																																					
		30-Jul-21				Dry																																					
		28-Aug-21	900			Dry																																					
		04-Oct-21				Dry																																					
		12-Jan-22	1530			Dry																																					
P7	**NG7**	**25-Jan-21**	1135	63.13	64.07																																					
		24-Feb-21	1040	63.16	64.1																																						
Depth	**90**	**30-Mar-21**	1130	63.23	64.17																																					
Format.	**Pilliga Sandstone**	**27-Apr-21**	1020	60.25	61.19																																					
		27-May-21	1015	63.21	64.15																																					
		22-Jun-21	1030	63.24	64.18																																					
		30-Jul-21	1045	62.33	63.27	6.3	121	20.4																																			
		28-Aug-21	1040	63.18	64.07	5.11	132	17.1																																			
		04-Oct-21	1230	63.07	64.01	5.41	123	22.1	0.67	<0.001	0.052	<0.001	<0.0001	0.008	0.006	<0.001	0.87	0.001	0.088	0.06	<0.01	0.011	<0.0001	6.42	115	<1	1	21	2	1.05	28	3	<1	<1	17	17	1.19	----	<0.01	<0.01	<0.01	<0.01	81
		12-Jan-22	1500	62.27	63.19	5.51	124	22.6																																			
P8	**NC-110S**	**25-Jan-21**	1200	50.50	51.54	7.1	763	19.9																																			
		24-Feb-21	1130	50.50	51.54	7.3	815	18.7																																			
Depth	**65**	**30-Mar-21**	1050	50.53	51.57	7.1	925	18.5																																			
Format.	**Purlawaugh**	**27-Apr-21**	1115	50.55	51.59	7.3	930	18.3																																			
		27-May-21	1105	50.57	51.61	7.3	840	19.7																																			
		22-Jun-21	1125	50.57	51.61	7.3	860	19.7																																			
		30-Jul-21	1045	49.76	50.8	7.2	814	19.2																																			
		28-Aug-21	1130	50.78	51.58	6.45	762	17.9																																			
		05-Oct-21	1200	50.80	51.6	7.56	752	21.2	2.23	0.005	0.374	<0.001	<0.0001	0.005	0.005	0.056	4.13	0.057	1.56	0.011	<0.01	0.19	<0.0001	7.28	918	28	12	139	9	8.66	127	19	<1	<1	287	287	9.71	5.72	0.02	<0.01	0.07	0.07	523
		12-Jan-22	1450	50.75	51.58	7.03	878	22.8																																			
P9	**GWB5S**	**27-Jan-21**	1230	26.31	27.12	6.7	22400	21.1																																			
		02-Mar-21	1050	26.33	27.14	6.6	22700	20.6																																			
Depth	**30**	**30-Mar-21**	1030	26.39	27.2	6.6	22500	20.5																																			
Format.	**Purlawaugh**	**29-Apr-21**	1120	26.40	27.21	6.7	21400	20.1																																			
		31-May-21	1040	26.41	27.22	6.7	21200	21.4																																			
		23-Jun-21	1155	26.44	27.25	6.6	21900	22																																			
		30-Jul-21	1030	25.87	26.68	7.13	20965	19.6																																			
		28-Aug-21	1200	26.23	27.21	6.72	21550	18.7																																			
		05-Oct-21	845	26.31	27.29	6.8	20580	23.5	0.29	<0.001	0.027	<0.001	<0.0001	0.002	<0.001	0.013	4.24	0.006	0.116	0.006	<0.01	0.048	<0.0001	7.56	21400	359	413	3600	46	210	6520	1700	<1	<1	724	724	234	5.44	1.45	0.02	0.08	0.1	14200
		11-Jan-22	1645	26.70	27.31	6.85	21730	24.1																																			

P10	**NC-030D**	**25-Jan-21**	1300	20.50	21.48																																						
		24-Feb-21	1250	20.54	21.52																																						
Depth	**130**	**01-Apr-21**	1140	20.44	21.42																																						
Format.	**Napperby**	**27-Apr-21**	1225	20.40	21.38																																						
		27-May-21	1220	20.41	21.39																																						
		22-Jun-21	1230	20.39	21.37																																						
		16-Jul-21	1300	20.31	21.29	6.92	15609	20.3																																			
		28-Aug-21	1220	21..2	22.25	6.78	15874	18.2																																			
		05-Oct-21	1300	20.13	21.18	6.75	15683	23	0.2	<0.001	0.12	<0.001	<0.0001	0.002	<0.001	0.014	0.78	0.002	1.43	0.01	<0.01	0.013	<0.0001	7.61	16300	324	308	2610	44	156	4940	770	<1	<1	1110	1110	178	6.41	1.24	<0.01	<0.01	<0.01	10200
		13-Jan-22	8000	23.42	24.47	6.78	16291	24.1																																			
P11	**NC-030S**	**25-Jan-21**	1310	31.08	32.07	7.3	6100	20.1																																			
		24-Feb-21	1305	30.98	31.97	7.2	6110	20																																			
Depth	**50**	**01-Apr-21**	1200	30.91	31.9	7.5	5820	19.5																																			
Format.	**Purlawaugh**	**27-Apr-21**	1240	31.64	32.63	7.5	5750	19.4																																			
		27-May-21	1240	31.67	32.66	7.5	5570	20.8																																			
		22-Jun-21	1250	31.89	32.88	7.6	5870	21.2																																			
		16-Jul-21	1400	32.15	33.18	7.34	5601	20.9																																			
		18-Aug-20	1430	29.57	30.61	6.86	7554	18.1																																			
		05-Oct-21	1330	32.40	33.44	7.1	7902	21.9	1.74	0.006	0.725	<0.001	<0.0001	0.003	0.02	0.015	3.64	0.008	9.29	0.146	<0.01	0.044	<0.0001	7.46	8320	270	116	1090	7	70.6	2650	1	<1	<1	285	285	80.5	6.52	0.14	<0.01	<0.01	<0.01	5500
		13-Jan-22	900	32.68	33.72	6.88	7833	22.3																																			
P12	**NC-098D**	**27-Jan-21**	1155	44.66	45.47																																						
		02-Mar-21	1015	44.70	45.51																																						
Depth	**90**	**30-Mar-21**	955	44.61	45.42																																						
Format.	**Napperby**	**29-Apr-21**	1050	44.53	45.34																																						
		31-May-21	1005	45.04	45.85																																						
		23-Jun-21	1230	45.06	45.87																																						
		16-Jul-21	1000	45.06	45.87	7.54	2984	20.8																																			
		29-Aug-21	820	45.14	45.9	7.4	3058	18.4																																			
		05-Oct-21	930	45.13	45.89	7.44	2980	22	0.02	0.01	0.066	<0.001	<0.0001	<0.001	0.004	0.003	0.39	<0.001	0.414	0.038	<0.01	0.006	<0.0001	8.05	3160	27	14	656	8	31.2	433	<1	<1	<1	1180	1180	35.8	6.79	0.56	<0.01	<0.01	<0.01	1890
		13-Jan-22	1000	45.19	45.94	7.77	3085	22.5																																			
P13	**NC-098S**	**27-Jan-21**	1150	12.98	13.85	7.6	2110	19.9																																			
		02-Mar-21	1000	12.77	13.64	7.5	2190	19.4																																			
Depth	**30**	**30-Mar-21**	940	12.72	13.59	7.6	1840	18.8																																			
Format.	**Garrawilla**	**29-Apr-21**	1040	12.56	13.43	7	1540	19.2																																			
		31-May-21	955	12.65	13.52	7.2	1520	20.4																																			
		23-Jun-21	1220	12.72	13.59	7.3	1375	20.8																																			
		29-Jul-21	1630	11.83	12.7	8	1740	19.9																																			
		29-Aug-21	1300	12.82	13.74	7.12	2100	18.1																																			
		05-Oct-21	950	12.72	13.64	7.47	1183	21.23	0.45	0.002	0.118	<0.001	<0.0001	0.001	0.005	0.006	1.08	0.004	0.168	0.01	<0.01	0.018	<0.0001	7.77	1420	61	55	123	4	13	178	200	<1	<1	326	326	15.7	9.32	0.02	<0.01	<0.01	<0.01	878
		11-Jan-22	1500	12.01	12.87	7.5	1045	22.6																																			
P16	**NC-119D**	**25-Jan-21**	1130	78.15	78.99																																						
		24-Feb-21	1100	78.14	78.98																																						
Depth	**146**	**30-Mar-21**	1110		Dip tape stoped at 82m																																						
Format.	**Garrawilla**	**27-Apr-21**	1045		Dip tape stoped at 82m																																						
		27-May-21	1035		Dip tape stoped at 82m																																						
		22-Jun-21	1050		Dip tape stoped at 82m																																						
		30-Jul-21	1100	79.18	80.02	7.01	4325	20.6																																			
		29-Aug-21	950	79.21	80.11	7.11	4311	17.6																																			
		04-Oct-21	1130	80.30	81.2	6.63	4370	24.5	0.03	<0.001	2.28	<0.001	<0.0001	<0.001	<0.001	0.008	1.64	0.001	0.067	0.021	<0.01	0.03	0.0001	7.45	4660	66	20	833	27	41.9	1120	<1	<1	<1	709	709	45.8	4.45	16.9	0.03	1.3	1.33	2490
		12-Jan-22	1630	81.21	82.00	7.16	4567	24.6																																			
P17	**NC-119S**	**25-Jan-21**	1135			Dry																																					
		24-Feb-21	1105			Dry																																					
Depth	**56**	**30-Mar-21**	1115			Dry																																					
Format.	**Purlawaugh**	**27-Apr-21**	1050			Dry																																					
		27-May-21	1040			Dry																																					
		22-Jun-21	1100			Dry																																					
		30-Jul-21	1130			Dry																																					
		29-Aug-21	930			Dry																																					
		04-Oct-21	1145			Dry																																					
		12-Jan-22	1700			Dry																																					
P19	**NC-123R**	**20-Jan-21**	1030	130.44	130.89																																						
		22-Feb-21	1130	130.58	131.03																																						
Depth	**187**	**30-Mar-21**	1240	130.61	131.06																																						
Format.	**Pamboola**	**22-Apr-21**	1200	131.10	131.55																																						
		31-May-21	1125	131.17	131.62																																						
		23-Jun-21	1115	129.71	130.16																																						
		16-Jul-21	1230	132.50	132.95	6.71	11101	20.7																																			
		29-Aug-21	1100		131.75	6.82	11100	20.7																																			
		05-Oct-21	815	131.55	132																																						
		12-Jan-22	930	132.83	133.29	6.8	11080	22.4																																			
P30		**27-Jan-21**	1105	13.20	13.98	6.8	22000	19.8																																			
		02-Mar-21	1215	13.12	13.9	6.8	22100	20.1																																			
Depth	**25**	**26-Mar-21**	1340	13.01	13.79	7.6	19603	24.5																7.72	19900	173	432	3670	17	204	6360	1260	<1	<1	732	732	220	3.77	0.04	0.03	8.79	8.82	12800
Format.	**Rail Loop Dam**	**30-Mar-21**	1200	13.01	13.79	6.9	23000	19.8																																			
		29-Apr-21	1330	12.98	13.76	7	19300	19.5																																			
		31-May-21	1320	12.91	13.69	7.1	19450	21.5																																			
		20-Jun-21	1030	12.92	13.7	7.37	19014	21																7.59	18900	170	444	3780	8	210	6380	1300	<1	<1	833	833	224	3.19					12700
		23-Jun-21	1330	12.94	13.72	7	19340	21.1																																			
		30-Jul-21	800	12.90	13.68	7.34	19151	20.2																																			
		27-Aug-21	730	12.86	13.58	7.11	22989	16.9																																			
		06-Oct-21	1000	12.80	13.52	7.01	18865	19.5	0.3	0.002	0.078	<0.001	<0.0001	0.001	0.001	0.001	0.51	0.002	0.012	0.002	<0.01	<0.005	<0.0001	7.67	19600	170	387	3380	17	188	6040	1260	<1	<1	811	811	213	6.25	<0.01	<0.01	8.77	8.77	12400
		11-Jan-22	930	12.66	13.40	7.05	19590	23.5																7.92	18000	162	436	3720	19	206	6540	1300	<1	<1	867	867	229	5.2					12600
P29		**27-Jan-21**	1050	4.87	5.8	7.9	9900	19.1																																			
		02-Mar-21	1230	4.83	5.76	7.8	9700	20																																			
Depth	**25**	**26-Mar-21**	1100	4.70	5.63	7.7	10825	23																7.95	11000	56	129	2150	10	107	3110	450	<1	<1	638	638	110	1.22	0.02	<0.01	11.9	11.9	6780
Format.	**Rail Loop Dam**	**30-Mar-21**	1355	4.81	5.74	7.8	9800	19.4																																			
		29-Apr-21	1320	4.73	5.66	8.1	9170	19.2																																			
		31-May-21	1310	4.61	5.54	8.2	9430	20.8																																			
		20-Jun-21	1100	4.50	5.43	7.65	11035	20.2																7.67	11200	58	144	2380	8	118	3510	514	<1	<1	780	780	125	2.8					6720
		23-Jun-21	1340	4.68	5.61	7.9	9410	20.6																																			
		30-Jul-21	745	4.49	5.42	7.71	11088	20.3																																			
		27-Aug-21	710	4.45	5.28	7.51	10372	16.5																																			
		06-Oct-21	900	4.34	5.17	7.84	11210	19.1	0.06	0.001	0.237	<0.001	<0.0001	<0.001	<0.001	0.001	0.11	<0.001	0.006	0.002	0.02	<0.01	<0.0001	7.98	12100	64	131	2130	8	107	3540	507	<1	<1	728	728	125	7.82	<0.01	<0.01	11.7	11.7	8870
		11-Jan-22	800	4.15	4.99	7.4	16505	22.3																7.92	15700	88	231	2670	6	140	5400	666	<1	<1	606	606	178	12.1					9990
P28		**27-Jan-21**	1040		0.93	Dry																																			
		02-Mar-21	1235		0.93	Dry																																			
Depth	**15**	**25-Mar-21**	700		0.93	Dry																																			
Format.	**Rail Loop Dam**	**30-Mar-21**	1400		0.93	Dry																																			

		29-Apr-21	13.05		0.93	Dry																																					
		31-May-21	1255		0.93	Dry																																					
		20-Jun-21	930		0.93	Dry																																					
		23-Jun-21	1320		0.93	Dry																																					
		30-Jul-21	730		0.93	Dry																																					
		27-Aug-21	700		0.93	Dry																																					
		06-Oct-21	800		0.93	Dry																																					
		11-Jan-22	830			Dry																																					
P31		27-Jan-21	1035	16.02	16.93	7.4	6850	20.1																																		
		02-Mar-21	1250	15.96	16.87	7.4	6760	20.2																																		
Depth	**15**	25-Mar-21	800	16.07	16.98	Insuffiecent water to sample																																				
Format.	**Rail Loop Dam**	30-Mar-21	1410	16.11	17.02	7.5	7030	19.6																																		
		29-Apr-21	1300	16.41	17.32	7.6	6750	19.9																																		
		31-May-21	1250	16.17	17.08	7.7	6560	21.6																																		
		20-Jun-21	1130	16.13	17.04	7.36	6937	21.5															7.56	7330	122	210	1260	14	78.5	1790	329	<1	<1	930	930	75.9	1.69					4220
		23-Jun-21	1315	16.20	17.11	7.6	6590	21.2																																		
		30-Jul-21	820	16.15	17.06	7.28	7000	20.1																																		
		27-Aug-21	800	16.11	17.01	6.99	7521	16.7																																		
		06-Oct-21	1300	16.09	16.99	7.56	6800	20	0.27	<0.001	0.126	<0.001	<0.0001	<0.001	<0.001	0.002	0.56	0.003	0.048	0.002	<0.01	0.006	<0.0001	7.76	7380	90	148	1120	12	65.7	1820	324	1	1	879	879	75.6	7.04	0.03	<0.01	9.65	9.65	4150
		04-Jan-22	1200	15.71	15.71	7.29	7080	24.8																8.01	6780	81	150	1100	12	64.5	1720	309	<1	<1	698	698	68.9	3.26					4180
P32		27-Jan-21	1000	7.45	8.41	8.5	1970	20.6																																		
		22-Feb-21	1040	7.29	8.25	8.1	1825	21																																		
Depth	**15**	26-Mar-21	1000	7.42	8.38	8.4	2192	23.4																8.28	3020	2	15	713	2	32.4	291	214	<1	7	1020	1020	33	0.98	0.74	<0.01	2.5	2.5	2040
Format.	**Rail Loop Dam**	30-Mar-21	1430	7.43	8.39	8.3	1870	20.6																																		
		29-Apr-21	1240	6.96	7.92	8.4	1820	20.6																																		
		31-May-21	1230	7.15	8.11	8.5	1790	22.3																																		
		20-Jun-21	1230	6.71	7.67	8.38	1876	21.9																8.53	2040	<1	4	523	<1	23.1	50	83	<1	102	929	1030	23.7	1.37					1330
		23-Jun-21	1250	6.80	7.76	8.4	1750	22.1																																		
		31-Jul-21	840	6.69	7.65	8.4	1888	20.5																																		
		27-Aug-21	830	7.04	7.99	8.21	1902	17.2																																		
		06-Oct-21	1200	6.93	7.88	8.73	1823	19.2	0.12	0.003	0.012	<0.001	<0.0001	0.002	<0.001	0.003	0.16	<0.001	0.01	0.001	0.04	0.008	<0.0001	8.54	2000	1	4	449	<1	19.9	40	67	<1	67	954	1020	22.9	6.99	0.02	0.01	4.36	4.37	1290
		04-Jan-22	1100	6.41	7.35	8.33	2459	26.4																8.69	2520	1	10	554	1	25	182	132	<1	131	779	910	26.1	2.09					1770
P33		27-Jan-21	1010		0.97	Dry																																					
		02-Mar-21	1255		0.97	Dry																																					
Depth	**15**	25-Mar-21	830		0.97	Dry																																					
Format.	**Rail Loop Dam**	30-Mar-21	1420		0.97	Dry																																					
		29-Apr-21	1245		0.97	Dry																																					
		31-May-21	1235		0.97	Dry																																					
		23-Jun-21	1255		0.97	Dry																																					
		30-Jul-21	900		0.97	Dry																																					
		27-Aug-21	900		0.97	Dry																																					
		06-Oct-21	730		0.97	Dry																																					
		04-Jan-22	1100		0.97	Dry																																					
P34		27-Jan-21	1020		0.95	Dry																																					
		02-Mar-21	1300		0.95	Dry																																					
Depth	**15**	25-Mar-21	900		0.95	Dry																																					
Format.	**Rail Loop Dam**	30-Mar-21	1415		0.95	Dry																																					
		29-Apr-21	1250		0.95	Dry																																					
		31-May-21	1240		0.95	Dry																																					
		23-Jun-21	1300		0.95	Dry																																					
		30-Jul-21	930		0.95	Dry																																					
		27-Aug-21	910		0.95	Dry																																					
		06-Oct-21	1300		0.95	Dry																																					
		04-Jan-22	1120		0.95	Dry																																					
P47		27-Jan-21	1245	24.00	25.25	7	6290	20.5																																		
		02-Mar-21	1115	23.99	25.24	7	6360	20.9																																		
Depth	**30.5**	30-Mar-21	1220	24.02	25.27	6.9	6090	20.6																																		
Format.	**Garrawilla**	29-Apr-21	1140	24.03	25.28	7	5910	20.6																																		
		31-May-21	1100	24.10	25.35	7.1	5830	22.2																																		
		23-Jun-21	1135	24.05	25.3	7	5770	22																																		
		30-Jul-21	700	27.10	28.35	7.33	4039	19.6																																		
		29-Aug-21	1400	24.04	25.38	6.96	6063	18.4																																		
		05-Oct-21	1100	23.97	25.31	6.98	6060	22.5	1.92	0.002	0.064	<0.001	<0.0001	0.009	0.015	0.012	2.85	0.002	0.113	0.037	<0.01	0.017	<0.0001	7.88	6610	35	112	1160	38	62.4	1100	384	<1	<1	1380	1380	66.6	3.26	0.45	<0.01	<0.01	<0.01	3920
		12-Jan-22	730	23.93	24.91	7.08	6383	23.2																																		
P39A		25-Jan-21	925	6.58	7.58																																					
		24-Feb-21	900	6.58	7.58																																					
Depth	**80**	01-Apr-21	915	6.52	7.52																																					
Format.	**Watermark**	29-Apr-21	900	6.67	7.67																																					
		28-May-21	945	6.53	7.53																																					
		23-Jun-21	900	6.47	7.47																																					
		16-Jul-21			No Access - Tracks to wet																																					
		29-Aug-21	1000	5.64	6.66	7.21	5852	17.8																																		
		04-Oct-21	1330	5.32	6.34	7.05	5189	22.7	2.16	0.005	0.152	<0.001	<0.0001	0.011	0.008	0.004	7.72	0.002	0.963	0.019	<0.01	0.017	<0.0001	7.96	6440	98	87	1080	20	59.5	1520	149	<1	<1	778	778	61.5	1.64	1.57	<0.01	0.01	0.01	3620
		12-Jan-22	1230	6.10	7.1	6.99	5203	22.5																																		
P39B		25-Jan-21	935	6.91	7.81	8	7090	19.9																																		
		24-Feb-21	925	6.96	7.86	7.9	7340	19.2																																		
Depth	**32**	01-Apr-21	940	6.81	7.71	7.9	6810	18.2																																		
Format.	**Alluvium**	29-Apr-21	915	6.96	7.86	7.8	6750	19.9																																		
		28-May-21	1000	6.75	7.65	7.7	6790	20.3																																		
		23-Jun-21	915	6.79	7.69	7.6	6850	19																																		
		16-Jul-21			No Access - Tracks to wet																																					
		29-Aug-21	900	6.67	7.71	7.11	9123	16.6																																		
		04-Oct-21	1400	6.42	7.46	7.34	891	22.4	48.8	0.01	2.12	0.004	0.0003	0.139	0.303	0.083	89.5	0.058	1.52	0.227	0.2	0.186	<0.0001	7.79	8880	143	202	1410	16	85.5	2270	857	<1	<1	488	488	91.6	3.46	1.46	0.04	2.56	2.6	5450
		12-Jan-22	1330	5.85	6.92	7.41	8899	22.6																																		
P43		25-Jan-21	910	8.51	9.46	7.3	11650	21.2																																		
		24-Feb-21	845	8.54	9.49	7.3	11560	21.1																																		
Depth	**65**	01-Apr-21	900	8.47	9.42	7.3	9960	20.7																																		
Format.	**Watermark**	29-Apr-21	830	8.70	9.65	7.3	9590	20.8																																		
		28-May-21	945	8.68	9.63	7.3	10400	21.9																																		
		23-Jun-21	830	8.77	9.72	7.2	10200	21.8																																		
		16-Jul-21			No Access - Tracks to wet																																					
		29-Aug-21	1100	8.28	9.32	6.99	11485	18.4																																		
		04-Oct-21	1500	8.08	9.12	7.38	11194	22.9	0.22	0.002	0.155	<0.001	<0.0001	0.002	0.002	0.002	0.72	<0.001	2.95	0.004	<0.01	0.02	<0.0001	7.91	11800	122	194	2010	38	110	3520	430	<1	<1	796	796	124	5.84	4.62	0.85	0.88	1.73	6930
		12-Jan-22	1100	7.87	8.83	7.44	12058	24.4																																		
P51		20-Jan-21	1115	7.20	7.78	7.5	22000	21.9																																		
		02-Mar-21	1125	7.09	7.67	7.4	22100	21.3																																		
Depth	**17**	30-Mar-21	1250	7.15	7.73	7.4	22100	21.4																																		
Format.	**Napperby (REA)**	29-Apr-21	1200	7.19	7.77	7.5	20900	21.5																																		

		31-May-21	1140	7.06	7.64	7.5	20800	22.3																																			
		23-Jun-21	1030	7.22	7.8	7.4	21200	22.8																																			
		30-Jul-21	1500	7.13	7.71	7.05	19558	22.8																																			
		27-Aug-21	930	7.05	7.65	7.21	20389	18.6																																			
		06-Oct-21	1400	7.06	7.66	7.25	19615	21.7	1.34	0.002	0.12	<0.001	<0.0001	0.002	0.002	0.005	1.46	0.003	0.168	0.005	<0.01	0.019	<0.0001	7.95	20500	40	400	3560	11	190	6610	802	<1	<1	824	824	220	7.22	0.02	<0.01	0.04	0.04	12800
		11-Jan-22	1230	6.83	7.43	7.4	20843	24.3																																			
P52		20-Jan-21	1130	9.65	10.2	7.4	2320	20.2																																			
		02-Mar-21	1140	9.54	10.09	7.3	2240	20.6																																			
Depth	**24**	30-Mar-21	1300	8.20	8.75	7.3	2270	20.6																																			
Format.	**Napperby (REA)**	29-Apr-21	1210	8.81	9.36	7.4	2100	20.4																																			
		31-May-21	1150	8.91	9.46	7.4	1925	22.2																																			
		23-Jun-21	1045	7.98	8.53	7.3	2050	21.7																																			
		30-Jul-21	1530	7.38	7.93	7.4	2161	21.5																																			
		27-Aug-21	1000	8.31	8.8	7.02	2056	17.7																																			
		09-Oct-21	1500	8.21	8.7	2.26	2091	21.5	0.33	<0.001	0.218	<0.001	<0.0001	<0.001	0.006	0.003	0.59	<0.001	0.428	0.024	<0.01	0.022	<0.0001	7.91	2240	101	99	188	8	21.6	377	87	<1	<1	661	661	25.6	8.64	0.04	<0.01	0.01	0.01	1310
		11-Jan-22	1330	6.21	6.72	7.62	2282	23.2																																			
P53		20-Jan-21	1145	11.80	12.3	7.7	1080	20.2																																			
		02-Mar-21	1205	11.71	12.21	7.5	1065	20.6																																			
Depth	**24**	30-Mar-21	1310	10.99	11.49	7.6	1040	20.6																																			
Format.	**Garrawilla (REA)**	29-Apr-21	1220	11.08	11.58	7.6	1050	20.4																																			
		31-May-21	1200	11.24	11.74	7.7	1010	22.1																																			
		23-Jun-21	1055	10.55	11.05	7.5	1010	21.9																																			
		30-Jul-21	1545	9.88	10.38	7.62	1043	21.4																																			
		27-Aug-21	1030	10.47	10.98	7.19	1082	18.4																																			
		06-Oct-21	1600	10.44	10.95	7.38	1023	22.1	1.43	<0.001	0.18	<0.001	<0.0001	0.006	0.003	0.008	2.13	0.002	0.16	0.015	<0.01	0.036	<0.0001	8	1070	50	44	112	5	11.1	76	17	<1	<1	494	494	12.4	5.33	0.13	0.27	1.81	2.08	586
		11-Jan-22	1400	8.58	9.09	7.62	1120	23.9																																			
P58		27-Jan-21	920	18.41	18.86	7.3	9330	21.1																																			
Depth	40	02-Mar-21	1320	18.37	18.82	7.2	9610	20.6																																			
Formation	**Rail Loop Dam**	26-Mar-21	900	18.33	18.78	7.1	10556	24.8																7.8	10900	73	85	2790	64	134	1010	75	<1	<1	5530	5530	140	2.52	5.33	<0.20	<0.20	<0.20	7730
		30-Mar-21	1325	18.58	19.03	7.2	9620	20.2																																			
		22-Apr-21	1130	18.39	18.84	7.2	9170	20.1																																			
		31-May-21	1215	18.42	18.87	7.3	9140	21.6																																			
		20-Jun-21	1000	18.27	18.72	6.77	10437	21.7																7.37	10800	68	99	3090	64	148	999	78	<1	<1	5600	5600	142	2.04					7520
		23-Jun-21	1355	18.43	18.88	7.2	9370	21																																			
		30-Jul-21	1600	18.25	18.7	6.76	10435	20.5																																			
		27-Aug-21	1100	18.17	18.57	7.01	9863	17																																			
		06-Oct-21	700	18.16	18.56	6.92	10330	19.4	0.24	0.019	0.587	<0.001	<0.0001	0.004	0.005	0.004	0.55	0.001	0.732	0.017	0.01	0.041	<0.0001	7.19	11100	66	79	2670	54	127	1030	83	<1	<1	5080	5080	132	1.91	4.79	<0.01	<0.01	<0.01	7520
		04-Jan-22	830	18.05	18.45	7.16	11031	25.9																8.08	11300	50	80	2860	70	135	1170	90	<1	<1	4510	4510	125	3.95					7470
Mayfield Spring Top		25-Jan-21	1400			8.6	1455	25.4																																			
Depth	**0**	24-Feb-21	1350			9.1	2310	23.7																																			
Merrilong Dam		01-Apr-21	1300			8.1	780	19.6																																			
		27-Apr-21	1340			8.8	1400	18.8																																			
		31-May-21	935			8.9	1825	15.7																																			
		22-Jun-21	1400			8.8	1480	14.1																																			
		20-Sep-21	1430			8.87	2260	23.12															<0.0001	8.59	2270	36	70	317	10	21.6							21.4	0.43					1360
WB2		27-Jan-21	1210			7.7	1830	24.8																																			
		02-Mar-21	1030			7.3	1950	22.6																																			
Depth	**Unknown**	30-Mar-21	1010			7.4	1890	20.4																																			
Format.	**Garrawilla**	29-Apr-21	1100			7.6	1625	21.1																																			
		31-May-21	1020			7.6	1750	15.1																																			
		23-Jun-21	1205			7.5	1850	20.5																																			
		29-Jul-21	1600	11.93	12.31																																						
		29-Aug-21	1500	12.45	12.86	6.91	2165	19.2																																			
		05-Oct-21	1000	12.38	12.85	6.88	2174	20.8	2.34	<0.001	0.11	<0.001	<0.0001	<0.001	0.002	0.028	0.23	0.002	0.067	0.003	<0.01	0.086	<0.0001	7.78	2280	137	113	124	2	21.6	523	94	<1	<1	392	392	24.5	6.42	<0.01	<0.01	2.22	2.22	1560
		11-Jan-22	1430	11.23	11.7	7.13	2497	26																																			
WB3b		21-Jan-21	1447	8.63	9.14	7.4	730	23.1																																			
		23-Feb-21	1003	8.56	9.07	7.13	741	22.4																																			
Depth	**Unknown**	19-Mar-21	1436	8.64	9.15	6.87	735	23.43																																			
Format.	**Namoi Alluvium**	12-Apr-21	959	8.58	9.092	7.07	731	21.4																																			
		11-May-21	1352	8.50	9.007	7.32	745	21.9																																			
		16-Jun-21	1628	8.35	8.86	7.03	737	21.5																																			
		08-Jul-21	1557	8.33	8.836	7.2	752	21.3																																			
		04-Aug-21	1248	8.24	8.746	7.24	757	21.162																																			
		21-Sep-22	1139	8.44	8.945	7.1	760	21.4																																			
		18-Oct-21	1420	8.76	9.268	6.59	81.6	22.162	<0.01	<0.001			<0.0001	<0.001	<0.001	<0.001	0.21	<0.001	0.467	<0.001		<0.005	<0.0001	7.95	790	51	26	81	3	8.28	70	17	<1	<1	300	300	8.32	0.23	0.13	<0.01	<0.01	<0.01	498
		09-Nov-21	1038	8.13	8.643	7.19	767	22.388																																			
		16-Dec-21	1227	5.75	6.257	6.98	759	21.9																																			
		12-Jan-22	839	5.88	6.393	7.33	753	21.5																																			
WB4		21-Jan-21	1422	8.92	9.47	7.26	909	23																																			
		23-Feb-21	1022	8.91	9.46	7.03	913	22.4																																			
Depth	**Unknown**	19-Mar-21	1358	8.92	9.47	6.74	914	22.6																																			
Format.	**Namoi Alluvium**	12-Apr-21	929	8.90	9.453	6.8	913	21.5																																			
		11-May-21	1423	8.90	9.452	7.17	916	21.6																																			
		16-Jun-21	1613	8.88	9.432	6.98	907	21.5																																			
		08-Jul-21	1614	8.88	9.426	6.96	905	21.2	<0.01	<0.001			<0.0001	<0.001	<0.001	0.001	<0.05	<0.001	<0.001	0.002		<0.005	<0.0001	8	332	51	26	81	3	3.36	28	28	<1	<1	108	108	3.53	2.44	<0.01	<0.01	<0.01	<0.01	280
		04-Aug-21	1334	8.85	9.395	6.92	917	20.623																																			
		21-Sep-21	1112	8.80	9.354	7.06	891	21.1																																			
		18-Oct-21	1321	8.77	9.318	6.57	897	22.542																																			
		09-Nov-21	1132	8.69	9.239	7.16	904	22.302																																			
		16-Dec-21	1300	8.69	9.238	7.03	909	22.71																																			
		12-Jan-22	803	8.53	9.078	7.03	909	22.036																																			
WB5a		21-Jan-21	13.09	9.88	11	6.82	472.9	20.6																																			
		23-Feb-21	1057	9.90	11.02	6.67	355.2	20.8																																			
Depth	**Unknown**	19-Mar-21	1305	9.87	10.99	6.5	417.3	21.3																																			
Format.	**Namoi Alluvium**	12-Apr-21	835	9.73	10.846	6.47	424	20.3																																			
		11-May-21	1229	9.96	11.083	6.9	373	21.8																																			
		16-Jun-21	1540	9.56	10.68	6.87	355	21.4																																			
		08-Jul-21	1445	9.58	10.703	7	463	21																																			
		04-Aug-21	1142	9.36	10.482	6.68	496.7	20.052																																			
		21-Sep-21	1016	7.74	8.862	7.13	348.3	19.4																																			
		18-Oct-21	1205	9.29	10.412	6.53	332.6	20.64	<0.01	0.008			<0.0001	<0.001	<0.001	<0.001	0.63	<0.001	0.674	<0.001		<0.005	<0.0001	7.72	325	23	13	23	2	3.27	21	22	<1	<1	128	128	3.61	4.92	0.04	<0.01	<0.01	<0.01	206
		09-Nov-21	932	8.11	9.23	6.93	335	20.027																																			
		16-Dec-21	1025	7.62	8.742	6.55	363	18.9																																			
		12-Jan-22	1147	8.49	9.608	7.19	283.1	19.414																																			
WB5b		21-Jan-21	1323	10.67	11.79	7.45	444.3	20.9																																			
		23-Feb-21	1113	10.89	12.01	7.39	413.2	21																																			
Depth	**Unknown**	19-Mar-21	1316	10.50	11.62	7.2	408.8	21																																			
Format.	**Namoi Alluvium**	12-Apr-21	1457	9.95	11.069	7.27	370	21																																			

		11-May-21	1248	10.29	11.409	7.42	421	21.4																																						
		16-Jun-21	1548	10.04	11.162	7.22	397	21.3																																						
		08-Jul-21	1457	9.95	11.069	7.27	370	21																																						
		04-Aug-21	1156	9.70	10.816	7.04	498.6	21.018																																						
		21-Sep-21	1026	9.59	10.71	7.26	438.7	20																																						
		18-Oct-21	1038	9.46	10.575	6.61	519	21.278	<0.01	<0.001			<0.0001	<0.001	<0.001	<0.001	0.32	<0.001	0.166	<0.001		<0.005	<0.0001	7.82	508	46	19	30	2	5.22	34	12	<1	<1	208	208	5.36	1.41	0.04	<0.01	<0.01	<0.01	294
		09-Nov-21	9.39	9.48	10.598	7.26	398.4	20.42																																						
		16-Dec-21	1033	8.19	9.307	7.01	375	18.48																																						
		12-Jan-22	1159	8.82	9.938	7.49	304.7	19.508																																						
WB6b		**21-Jan-21**	1221	11.83	12.67	7.26	586	22																																						
		23-Feb-21	1203	26.70	27.54	7.13	585	21.7																																						
Depth	**Unknown**	**19-Mar-21**	1227	12.15	12.99	6.73	588	21.4																																						
Format.	**Namoi Alluvium**	**12-Apr-21**	802	12.03	12.865	6.82	596	20.027																																						
		11-May-21	1140	11.62	12.455	6.97	581	20.9																																						
		16-Jun-21	1508	11.87	12.707	6.87	591	20.7																																						
		08-Jul-21	1415	11.23	12.073	7.19	582	20.7																																						
		04-Aug-21	1107	11.02	11.864	7.09	586	20.025																																						
		21-Sep-21	937	10.80	11.637	7.37	582	19.4																																						
		18-Oct-21	956	10.62	11.463	6.9	613	21.647	<0.01	<0.001			<0.0001	<0.001	<0.001	<0.001	0.59	<0.001	0.359	<0.001		<0.005		8.03	598	41	19	63	2	6.4	28	23	<1	<1	289	289	7.04	4.77	0.04	<0.01	<0.01	<0.01	348
		09-Nov-21	824	11.21	12.052	7.24	614	21.344																																						
		16-Dec-21	909	9.66	10.496	6.95	608	21.26																																						
		12-Jan-22	1006	20.78	21.616	7.41	596	21.491																																						
WB7		**25-Jan-21**	845	2.48	2.48	7.3	967	22.8																																						
		24-Feb-21	820	2.51	2.51	7.3	942	21.6																																						
Depth	**Unknown**	**01-Apr-21**	1330		No Access, gate locked																																								
Format.	**Namoi Alluvium**	**27-Apr-21**	900	4.17	4.17	7.4	880	13																																						
		27-May-21	845	4.06	4.06	7.3	825	12.7																																						
		22-Jun-21	900	3.28	3.28	7.2	790	11.6																																						
		29-Jul-21	1120	4.63	4.63	8.42	839	13.2																																						
		29-Aug-21	1123	2.80	3.68	7.31	880	17.8																																						
		06-Oct-21	1300	4.12	5	7.43	784	14.8	<0.01	<0.001	0.007	<0.001	<0.0001	<0.001	<0.001	0.019	2.56	<0.001	0.348	<0.001	0.01	0.012	<0.0001	7.74	837	36	21	107	1	8.2	84	43	<1	<1	274	274	8.74	3.16	<0.01	<0.01	0.04	0.04	466
		11-Jan-22	1530	4.27	5.18	7.6	774	26																																						
WB10		**06-Oct-21**	1200	20.14	20.34	6.78	4690	22.3	0.08	<0.001	0.073	<0.001	<0.0001	0.004	<0.001	0.008	0.91	0.002	0.013	0.003	<0.01	0.027	<0.0001	7.69	5100	209	269	328	4	46.9	1300	60	<1	<1	676	676	51.4	4.56	<0.01	<0.01	5.36	5.36	3190
Formation	**Napperby**	**12-Jan-22**	1000	12.54	12.74																																							

Appendix F – *Ambient Flow Monitoring*

Appendix F - Ambient Flow Monitoring Results

Date	Sample Location	pH	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Grease & Oil (mg/L)	Total Organic Carbon (TOC)	Comments
26 February 2021	KC2US	7.2	120	17	<5	23	Turbid, no odour, brown colour, Trickle flow
26 February 2021	KCDS	7.7	170	115	<5	11	Turbid, no odour, brown colour, Trickle flow
26 February 2021	KCUS	7.3	130	50	<5	8	Turbid, no odour, brown colour
26 February 2021	PC1	8.4	590	148	<5	23	Turbid, no odour, brown colour, Trickle flow
25 March 2021	KC1US	7.5	100	90	<5	12	
25 March 2021	KC2DS	7.2	190	32	<5	16	
25 March 2021	KC2US	7.4	85	7	<5	13	
25 March 2021	KCDS	7.2	195	40	<5	13	
25 March 2021	KCUS	7.2	235	47	<5	12	
25 March 2021	PCa	6.6	55	142	<5	13	
26 March 2021	PC1	7.5	150	28	13	15	
11 June 2021	KC2DS	7.3	95	403	<5	8	
11 June 2021	KC1US	7.7	125	123	<5	9	
11 June 2021	KC2US	7.6	85	58	<5	9	
11 June 2021	KCDS	7.5	115	83	<5	8	
11 June 2021	KCUS	7.5	150	78	<5	7	
11 June 2021	PC1	7.4	235	77	<5	8	
11 June 2021	PCa	7.76	176	39	<5	10	
15 July 2021	PC1	7.41	64	29	<5	16	
15 July 2021	PCa	7.12	171	109	<5	16	
15 July 2021	KC2DS	7.12	52	42	<5	18	
15 July 2021	KC2US	7.11	35	50	<5	18	
15 July 2021	KC1DS	7.83	74	251	<5	21	
15 July 2021	KC1US	7.16	54	1030	<5	17	
15 July 2021	KCDS	7.43	9.9	512	<5	18	
15 July 2021	KCUS	7.24	111	620	<5	17	
13 October 2021	KC1DS	7.95	186	124	<5	13	
13 October 2021	PC1	7.58	164	45	<5	9	
13 October 2021	PCa	7.4	155	23	<5	15	
13 October 2021	KCUS	7.51	124	41	6	9	
12 November 2021	KC1DS	7.76	140	109	<5	23	
11 November 2021	KC1US	6.72	109	101	<5	14	
11 November 2021	KC2DS	7.77	315	94	<5	15	
11 November 2021	KC2US	7.15	81	58	<5	26	

11 November 2021	KCDS	7.78	137	48	<5	15	
11 November 2021	KCUS	7.66	302	69	<5	14	
12 November 2021	PC1	7.41	124	88	<5	7	
12 November 2021	PCa	7.33	120	60	<5	18	
15 November 2021	KC1DS	7.6	380	26	<5	18	Discharge Event - EPL Sample
15 November 2021	KC2DS	7.4	204	16	<5	17	
15 November 2021	KCUS	7.8	622	<5	<5	6	
15 November 2021	PC1	7.37	165	80	<5	12	
22 November 2021	KC1DS	7.91	136	77	<5	19	Discharge Event - EPL Sample
22 November 2021	KC1US	7.63	98	67	<5	18	
22 November 2021	KC2DS	7.51	101	21	<5	19	
22 November 2021	KC2US	7.22	62	24	<5	20	
22 November 2021	KCDS	7.44	120	44	<5	19	
22 November 2021	KCUS	7.4	154	96	<5	20	
22 November 2021	PC1	7.75	118	77	<5	18	
24 November 2021	KC2DS	7.94	535	22	<5	11	Discharge Event - EPL Sample
24 November 2021	KC1US	7.84	148	24	<5	17	
24 November 2021	KC1DS	7.92	350	22	<5	20	
24 November 2021	KCUS	7.93	571	<5	<5	13	
24 November 2021	PC1	7.57	153	19	<5	18	
9 December 2021	KC1DS	8.04	236	101	<5	18	Discharge Event - EPL Sample
9 December 2021	KC2DS	7.42	104	26	<5	16	
9 December 2021	KCDS	7.41	130	36	<5	13	
9 December 2021	KC2US	7.01	49	20	<5	14	
9 December 2021	KCUS	7.42	211	54	<5	15	
9 December 2021	KC1US	7.68	106	38	<5	10	
9 December 2021	PCa	7.48	246	58	<5	25	
9 December 2021	PC1	7.42	135	87	<5	14	
10 December 2021	KC1DS	8.25	694	160	<5	13	Discharge Event - EPL Sample
10 December 2021	KC2DS	7.64	147	22	<5	12	
10 December 2021	KCUS	7.74	471	15	<5	11	
10 December 2021	KC1US	7.73	120	49	<5	11	
10 December 2021	PCa	7.51	99	73	<5	18	
10 December 2021	PC1	7.85	117	50	<5	11	

Appendix G – *Subsidence Pond Monitoring*

Appendix G - Subsidence Pond Monitoring

Date	Sample ID	Electrical Conductivity (µS/cm)
28/01/2021	LW101 Ponding	302
28/01/2021	LW102 North	341
28/01/2021	LW102 South	233
28/01/2021	LW103 Ponding	355
28/01/2021	LW104 North	237
28/01/2021	LW105 North	302
28/01/2021	LW105 South	DRY
28/01/2021	LW106 North	183
28/01/2021	LW107 North Ponding	362
28/01/2021	LW108 North Ponding	DRY
28/01/2021	LW108 South Ponding	266
24/02/2021	LW101 Ponding	355
24/02/2021	LW102 North	414
24/02/2021	LW102 South	264
24/02/2021	LW103 Ponding	382
24/02/2021	LW104 North	255
24/02/2021	LW105 North	315
24/02/2021	LW105 South	DRY
24/02/2021	LW106 North	210
24/02/2021	LW107 North Ponding	DRY
24/02/2021	LW108 North Ponding	DRY
24/02/2021	LW108 South Ponding	285
26/03/2021	LW101 Ponding	165
26/03/2021	LW102 North	150
26/03/2021	LW102 South	175
26/03/2021	LW103 Ponding	330
26/03/2021	LW104 North	155
26/03/2021	LW105 North	160
26/03/2021	LW105 South	405
26/03/2021	LW106 North	150
26/03/2021	LW107 North Ponding	180
26/03/2021	LW108 North Ponding	DRY
26/03/2021	LW108 South Ponding	185
26/04/2021	LW101 Ponding	230
26/04/2021	LW102 North	260
26/04/2021	LW102 South	180
26/04/2021	LW103 Ponding	410
26/04/2021	LW104 North	198
26/04/2021	LW105 North	210
26/04/2021	LW105 South	DRY
26/04/2021	LW106 North	175
26/04/2021	LW107 North Ponding	245
26/04/2021	LW108 North Ponding	DRY
26/04/2021	LW108 South Ponding	215
31/05/2021	LW101 Ponding	245
31/05/2021	LW102 North	385

31/05/2021	LW102 South	205
31/05/2021	LW103 Ponding	480
31/05/2021	LW104 North	210
31/05/2021	LW105 North	200
31/05/2021	LW106 North	180
31/05/2021	LW107 North Ponding	300
31/05/2021	LW108 South Ponding	230
23/06/2021	LW101 Ponding	174
23/06/2021	LW102 North	185
23/06/2021	LW102 South	170
23/06/2021	LW103 Ponding	410
23/06/2021	LW104 North	168
23/06/2021	LW105 North	170
23/06/2021	LW105 South	390
23/06/2021	LW106 North	146
23/06/2021	LW107 North Ponding	210
23/06/2021	LW108 North Ponding	135
23/06/2021	LW108 South Ponding	205
30/07/2021	LW101 Ponding	72
30/07/2021	LW102 North	110
30/07/2021	LW102 South	93
30/07/2021	LW103 Ponding	274
30/07/2021	LW104 North	107
30/07/2021	LW105 North	92
30/07/2021	LW105 South	DRY
30/07/2021	LW106 North	92
30/07/2021	LW107 North Ponding	152
30/07/2021	LW108 North Ponding	DRY
30/07/2021	LW108 South Ponding	205
23/08/2021	LW101 Ponding	146
23/08/2021	LW102 North	183
23/08/2021	LW102 South	119
23/08/2021	LW103 Ponding	350
23/08/2021	LW104 North	119
23/08/2021	LW105 North	98
23/08/2021	LW105 South	47
23/08/2021	LW106 North	164
23/08/2021	LW107 North Ponding	217
23/08/2021	LW108 North Ponding	DRY
23/08/2021	LW108 South Ponding	251
24/09/2021	LW101 Ponding	172
24/09/2021	LW102 North	307
24/09/2021	LW102 South	139
24/09/2021	LW103 Ponding	288
23/09/2021	LW104 North	214
23/09/2021	LW105 North	139
23/09/2021	LW105 South	-
23/09/2021	LW106 North	162
23/09/2021	LW107 North Ponding	272
23/09/2021	LW108 North Ponding	-

23/09/2021	LW108 South Ponding	298
13/10/2021	LW101 Ponding	164
12/10/2021	LW102 North	316
12/10/2021	LW102 South	142
12/10/2021	LW103 Ponding	293
12/10/2021	LW104 North	174
12/10/2021	LW105 North	132
12/10/2021	LW105 South	59
12/10/2021	LW106 North	122
13/10/2021	LW107 North	195
13/10/2021	LW108 North	DRY
12/10/2021	LW108 South	224
26/11/2021	LW101 Ponding	127
26/11/2021	LW102 North	149
26/11/2021	LW102 South	138
26/11/2021	LW103 Ponding	131
26/11/2021	LW104 North	95
26/11/2021	LW105 North	92
26/11/2021	LW105 South	65
26/11/2021	LW106 North	66
26/11/2021	LW107 North	83
26/11/2021	LW108 North	46
26/11/2021	LW108 South	225
15/12/2021	LW101 Ponding	163
15/12/2021	LW102 North	189
15/12/2021	LW102 South	171
15/12/2021	LW103 Ponding	177
15/12/2021	LW104 North	162
15/12/2021	LW105 North	155
15/12/2021	LW105 South	176
15/12/2021	LW106 North	177
15/12/2021	LW107 North	174
15/12/2021	LW108 North	373
15/12/2021	LW108 South	207