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Tahmoor Coal Pty Ltd

2020 ANNUAL REVIEW, AEMR AND REHABILITATION REPORT

March 2021

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Document Control

PUBLICATION DATE:	31/03/2021
REVIEW DATE:	31/03/2021
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VERSION NUMBER:	**Rev 1**
COMMENTS:	**Final**

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1 Title Block

Table 1-1 Title Block

Name of operation	Tahmoor Coal – SIMEC Mining
Name of operator	Tahmoor Coal Pty Ltd
Development consent / project approval #	DA 1975, DA 1979, DC 57/93, DC 67/98, DA 190/85, DA 162/76
Name of holder of development consent / project approval	Tahmoor Coal Pty Ltd
Mining lease #	Tahmoor Coal Holdings - ML1376, ML1308, ML1539, ML1642 & CCL716 Bargo Coal Holdings - CCL747
Name of holder of mining lease	Tahmoor Coal Pty Ltd Bargo Collieries Pty Ltd
Water licence #	WAL36442
Name of holder of water licence	Tahmoor Coal Pty Ltd
MOP/RMP start date	1/10/2020
MOP/RMP end date	16/06/2024
Annual Review start date	01/01/2020
Annual Review end date	31/12/2020
I, Zina Ainsworth, certify that this audit report is a true and accurate record of the compliance status of Tahmoor Coal Mine for the period 1 January 2020 and 31 December 2020 and that I am authorised to make this statement on behalf of Tahmoor Coal 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	**Zina Ainsworth**
Title of authorised reporting officer	**Environment and Community Manager**
Signature of authorised reporting officer	
Date	*31/03/21*

2 Statement of Compliance

Table 2 outlines the statement of compliance with the relevant conditions for the reporting period.

Table 2-1 Statement of Compliance (2020)

Were all the conditions of the relevant approvals complied with?	Compliance
ML1376	Yes
ML1308	Yes
ML1539	Yes
ML1642	Yes
CCL716	Yes
CCL747	Yes
Auth206	Yes
Auth410	Yes
EPL 1389	No • Licence limits exceeded in relation to section L2.1 of EPL1389 on the 16th April 2020. Turbidity and TSS exceeded due to sediment laden waters discharged through Licence Discharge Point 1. • Low and medium-risk non-compliance from 2020 Independent Audit.
WAL36442	Yes
DA 1975	Yes
DA 1979	Yes
DA 190/85	Yes
DA 57/93	No • Low-risk non-compliances from 2020 Independent Audit.
DA 67/98	No • Administrative non-compliances from 2020 Independent Audit.

The 2020 Independent Environmental Audit identified twelve (12) non-compliances, which ranged from administration to medium impact and noted sixteen (16) improvement reccomendations.

3 Independent Audit

An Independent Environmental Audit was conducted by SLR in September 2020 during this reporting period. The audit recommendations and actions undertaken are outlined in **Table 3-1.** The next independent audit is due to be conducted in September 2023.

Table 3-2 provides a statement of compliance for Tahmoor Coal for 2020.

Table 3-1 Actions from 2020 Independent Environmental Audit

Ref	Description	Risk	Tahmoor Coal Comment/Action	Timing
Non-Compliance Recommendations				
DA 67/98				
12	NC REC 1 - Groundwater Groundwater quality data need to be presented in the form of tables which list all monitored parameters and graphs to show the changes in water quality.	Administrative	All groundwater quality data will be presented in the 2020 Annual Review and Six Monthly Subsidence Impact Report.	2020 Annual Review: 31st March 2021 **COMPLETED - see Appendix 17 and 18** **Six Monthly Subsidence Impact Report: 15th May 2021**
13H(c)	NC REC 2 - Groundwater It is recommended that: - groundwater quality data is reported fully ie all parameters that are sampled and analysed need to be reported along with trends in time. - any non-compliance and exceedance of triggers should be followed up and documented along with management measures reported as per TARP in WMP, 2015 and WMP, 2019 - while no auditing is required for groundwater resources in WMP (2019), the auditing in line with LW W1-W2 Extraction Plan should be undertaken to ensure that the water quality of the creeks does not further deteriorate.	Administrative	All groundwater quality data will be presented in the 2020 Annual Review and Six Monthly Subsidence Impact Report. The next Six Monthly Subsidence Impact Report will also document the progress of actions / management measures (if required) from previous or current non-compliance or triggers in accordance with the LW W1-W2 Water Management Plan TARP. Monitoring of water quality of creeks is reviewed and discussed by the Tahmoor Coal Environmental Response Group on a monthly basis in light of the the TARPs, and further investigations are complete where deemed necessary.	2020 Annual Review: 31st March 2021 **COMPLETED – see Appendix 17 and 18** Six Monthly Subsidence Impact Report: 15th May 2021

40	NC REC 3 – Recommendations Provide notifications to relevant landowners of any monitored exceedances. If investigations have shown that it is not attributable to Tahmoor operations, provide evidence to the landowner.	Administrative	In the event of a monitoring value exceedance, Tahmoor Coal will log the exceedance via the Cority compliance software, investigate the cause for the exceedance, and provide evidence to relevant landholders where necessary.	Ongoing as required
44, 46	NC REC 4 – Management Plans Review the AQGHGMP and NMP required by this consent. The management plans should be updated to: - list all relevant statutory conditions (including consents and EPL) along with where they are addressed in the report, including this Management Plans condition 44. - a review of baseline data since the commencement of monitoring under this consent - include the real time monitoring TARPs within the management plans and not as separate procedures - include protocols for incident and complaints management and notifications	Administrative	Tahmoor Coal will implement these changes in the next review in accordance with Condition 46 of DA 67/98.	13th April 2021
48	NC REC 5 – Notifications Update PIRMP notification procedure to include DPIE and NRAR. Review any additional agencies which may require notification of incidents.	Administrative	Tahmoor Coal will implement these changes in the next Pollution Incident Response Management Plan (PIRMP) review.	30th April 2021 **COMPLETED – PIRMP notification procedure section updated**
DA 57/93				
41	NC REC 6 – REA Management Plan Include additional detail in Table 1 of the REA Management Plan to address where each specific requirement of the plan has been addressed, and if not provide justification.	Non – Compliant (Low Risk)	The REA Management Plan will be updated to include how it addresses specific requirements.	30th April 2021

41	NC REC 7 – REA Management Plan Include detailed design drawings of the REA and stormwater management system within the management plan. The site water management plan for example does not show the water management at the eastern side of the REA.	Non – Compliant (Low Risk)	Design drawings of the REA will be included in the REA Management Plan in the next review/update.	30th April 2021
41	NC REC 8 – Topsoil/rehabilitation Complete cover crop seeding of topsoil stockpile areas.	Non – Compliant (Low Risk)	Tahmoor Coal intends to relocate a section of topsoil stockpile from the central section to the eastern batter of the REA by 5eporti. July 2021. This section was noted during the audit as requiring reseeding due to lack of sufficient ground cover. Once relocated, Tahmoor Coal will commence seeding of the topsoil stockpile areas.	30th September 2021
41	NC REC 9 – Topsoil/rehabilitation Reduce topsoil stockpile height to <3m and ensure stockpiles resulting from future disturbance be a maximum of be 3m high and be seeded with a temporary vegetation cover.	Non – Compliant (Low Risk)	Topsoil stockpiles will be reduced to less than 3m by 5eporti. July 2021 in conjunction with the works to be completed under NC REC 8 (movement of topsoil stockpile). Once relocated, Tahmoor Coal will commence seeding of the topsoil stockpile areas.	30th September 2021
41	NC REC 10 – Rehabilitation Ensure future contour drains and other water management structures at the Reject Emplacement Area are constructed in accordance with approved designs and complete erosion repairs/rock lining of existing contour drain.	Non – Compliant (Low Risk)	Tahmoor Coal will continue to implement rock drainage lines where needed throughout the REA, and repair as necessary.	Ongoing as required
EPL 1389				

A3	NC REC 11 – Water Treatment Plant Continue investigations to commission the water treatment plant in consultation with the EPA.	Non – Compliant (Low Risk)	Tahmoor Coal is required, under EPL1389 (2/12/2020) Special Condition E1, to install and test the Pilot Plant by 31/10/2021, and commission the Final Plant prior to commencement of secondary coal extraction in the Tahmoor South area (currently scheduled for September 2022).	Pilot plant: 31st October 2021 Final Plant: ~ September 2022
L1	NC REC 12 – Water/incident management Ensure all follow up actions proposed in the incident report have been implemented and are documented in the Water Management Plan. Update the Water Management Plan to include details of the implemented measures and to document the TARP for water turbidity levels. Report the status of the follow up actions in the next annual review.	Non-compliant (Medium Risk)	Actions will be implemented and documented in the next revision of the Soil and Water Management Plan, with results reported in the 2020 Annual Review.	Update of Soil and Water Management Plan: 13th April 2021 2020 Annual Review: 31st March 2021 **COMPLETED – see Section 18.2.2**
Improvement Recommendations				
DA 57/93 C46	Improvement REC 1 – Reporting Include reference to the requirements of Condition 46 of DA 57/93 into future iterations of the MOP and include a table to show where these conditions have been addressed.	NA	Future versions of the MOP will include reference to Condition 46. Note that the current MOP will expire 2024, and Tahmoor South approval is currently being sought with the Independent Planning Commission.	16th June 2024, or following Tahmoor South approval.

DA 57/93 C46	Improvement REC 2- Rehabilitation Develop a formalised Rehabilitation Quality Assurance Process throughout the life of rehabilitation to include verification of activities and procedures and tracking of key data at each phase of rehabilitation (ie topsoil depth, amelioration, seed mix, weather conditions). It is recommended that GIS may be incorporated into the QA process to track phases of rehabilitation. This will assist in identifying differences in rehabilitation and determining factors for success and failure.	NA	Future rehabilitation activities will incorporate these rehabilitation recommendations. A Rehabilitation Quality Assurance Process will be detailed in an updated version of the Annual Rehablitation and Land Management Plan, and results will be included in subsequent Annual Review.	30th April 2021
DA 57/93 C46	Improvement REC 3 – Rehabilitation Prepare a topsoil inventory to understand volumes of material available for rehabilitation.	NA	Tahmoor Coal will complete a topsoil stocktake and initiate a topsoil inventory.	30th April 2021
DA 57/93 C46	Improvement REC 4 – Rehabilitation Consider climatic conditions in rehabilitation timings and planning and utilise water carts or similar to assist in watering in of tubestock in dry conditions.”	NA	Climatic conditions will be considered during future rehabilitation activities and will be tracked as per Improvement REC 2.	30th April 2021
EPL 1389 L1	Improvement REC 5 – Erosion/Water management Install temporary erosion and sediment controls at the drain between M4 and LDP1 until vegetation establishment is complete.	NA	Tahmoor Coal will implement erosion and water management controls to prevent degradation.	30th April 2021
EPL 1389 L1	Improvement REC 6 – Erosion/Water management Complete repairs to erosion and sediment controls and eroded batter adjacent to LDP1.	NA	Tahmoor Coal will implement erosion and water management controls to prevent degradation.	30th April 2021

ML1308 3(f); ML 1376 Variation (f); ML 1539 3(a)	Improvement REC 7 – Reporting Include comparison with completion criteria in the Annual Reviews and rehabilitation reports. Review and implement Resources Regulator rehabilitation reform reporting requirements as required.	NA	Tahmoor Coal will include comparison with completion criteria in the 2020 Annual Review and rehabilitation reports. The RR rehabilitation reforms will be implemented into this Annual Review as required.	31st March 2021 **COMPLETED – see Section 19**
DA 67/98 C40	Improvement REC 8 – Incident reporting All exceedances should be documented in the incidents/compliance register along with any investigations. The incidents register should include note of whether or not the incident is "notifiable" and document notification if it has occurred.	NA	In the event of an exceedance Tahmoor Coal will log via the Cority compliance software and investigate as necessary.	Ongoing as required
NA	Improvement REC 9 – Reporting Include reporting on GHG in the annual reviews.	NA	A summary of GHG performance will be included in the 2020 Annual Review.	31st March 2021 **COMPLETED – see Section 10.3**
NA	Improvement REC 10 – ML 1376 Undertake further consultation with RR regarding status of mining lease application and obtain confirmation of expected date of approval.	NA	Tahmoor Coal will consult RR regarding status of mining lease.	30th April 2021
NA	Improvement REC 11 – Hydrocarbons Clean up hydrocarbon staining around diesel storage and associated workshops	NA	The area of concern will undergo a thorough clean and relevant Tahmoor Coal personnel advised house keeping standards.	30th April 2021

NA	Improvement REC 12 – Reporting Include table showing actual daily results in discharge volumes against the approved volumes in Annual Review (as a table) as per the Annual Return (ie min, max and average). Reporting of volume should be in the same units as the limit (KL) rather than ML. Also recommended to update discharge figure in the Annual Reviews to show the discharge limit of 15500 KL/day.	NA	Tahmoor Coal will include comparison results and discharge figure in the 2020 Annual Review.	31st March 2021 **COMPLETED – see Section 18.2**
NA	Improvement REC 13 – Weed management Some evidence of weeds was noted around the Pit Top, ventilation shaft and in rehabilitation areas. Additional weed management recommended.	NA	Tahmoor Coal will review weed management practices and implement changes at the site to prevent areas of weed growth as required.	30th April 2021
NA	Improvement REC 14 – Safety Vegetation has been cleared to facilitate rehabilitation works at Myrtle Creek in accordance with the CMAP. It is recommended to install safety bunting at the top of the creek embankment until vegetation is re-established.	NA	Currently a farm fence has been installed at the top of Myrtle Creek where vegetation has been cleared. Native vegetation has been planted where vegetation was removed, and a hinge joint fence will be attached to the farm fence until vegetation has grown.	30th April 2021
NA	Improvement REC 15 – Water take Review water take reported in 2017-2019 Annual Reviews. Provide justification for inconsistencies in the reported numbers.	NA	Tahmoor Coal will review the reported water take in previous Annual Reviews and justify in the 2020 Annual Review.	31st March 2021 **COMPLETED – see Section 18.2**

NA	Improvement REC 16 – Subsidence Due to the recent amendment to the 1961 Mine Subsidence Compensation Act in 2017, all claims and compensation for impacts after 1 January 2018 will be directed by SA NSW to the operating mine responsible. It would therefore be in the best interests of the mine to ensure all development that is approved by SA NSW is compatible with the predicted subsidence effects at Tahmoor.	NA	Tahmoor Coal is given with an opportunity to provide advice on new developments by SA NSW, however the implementation of this advice is at the discretion of SA NSW and other regulators. Tahmoor Coal will continue to provide advice on new developments based on future mine planning and potential subsidence effects.	Ongoing as required

Table 3-2 Compliance Summary (2020)

Relevant Approval	Condition #	Condition Description	Compliance statement	Section addressed in Annual Review
EPL 1389	L2.1	Concentration Limits exceeded for Turbidity and TSS during 17th April 2020.	Non-compliant	Section 18

4 Introduction

4.1 Background

Tahmoor Coal Mine (Tahmoor Mine) is an underground coal mine located approximately 80 kilometres (km) south-west of Sydney between the towns of Tahmoor and Bargo, New South Wales (NSW). Tahmoor Mine produces up to three million tonnes of Run of Mine (ROM) coal per annum from the Bulli Coal Seam. Tahmoor Mine produces a primary hard coking coal product and a secondary higher ash coking coal product that are used predominantly for coke manufacture for steel production. Product coal is transported via rail to Port Kembla and Newcastle for Australian domestic customers and export customers.

Tahmoor Mine has been operated by Tahmoor Coal Pty Ltd (Tahmoor Coal) since the mine commenced in 1979 using board and pillar mining methods, and via longwall mining methods since 1987. Tahmoor Coal is a wholly owned entity within the SIMEC Mining Division of the GFG Alliance group.

Tahmoor Coal has previously mined 33 longwalls to the north and west of the Tahmoor Mine's current Pit Top location. Tahmoor Coal is currently mining Longwall West 2 (LW W2) in accordance with Development Consents and Extraction Plan Approval.

The Department of Planning, Industry and Environment (DPIE) and the Department of Regional NSW – Resources Regulator (Resources Regulator) approved that the Annual Review prepared under Condition 45 of Development Consent DA 67/98 can also fulfil the requirement of the Annual Environmental Management Report (AEMR). This was to reduce duplication of reported information to both Government authorities. In addition this document fulfils the requirements of condition (f) of ML 1376 variation issued on 7th December 2020 which requires a Rehabilitation Report.

This Annual Review is for the reporting period of 1 January 2020 to 31 December 2020.

A plan of Tahmoor Coal showing the regional context, development consent boundary and mining lease boundaries is shown in **Figure 1**.

Contact information for Tahmoor Coal senior management and environment and community staff are listed in **Table 4-1**.

Table 4-1 Tahmoor Coal Contacts

Name	Position held	Contact details
Tahmoor Coal Management		
Peter Vale	General Manager (Head of Coal Mines)	(02) 4640 0100
Environment and Community Management Team		
Zina Ainsworth	Environment & Community Manager	(02) 4640 0100
David Talbert	Projects Manager	(02) 4640 0028
Thomas O'Brien	Environment Specialist	(02) 4640 0018
Amanda Fitzgerald	Community Officer	(02) 4640 0079
Amanda Francis	Community Liason Specialist	(02) 4640 0025
April Hudson	Approvals Specialist	(02) 4640 0022
Nick Le Baut	Environment Projects Coordinator	(02) 4640 0090
Natalie Brumby	Graduate Environment and Community Officer	(02) 4640 0048

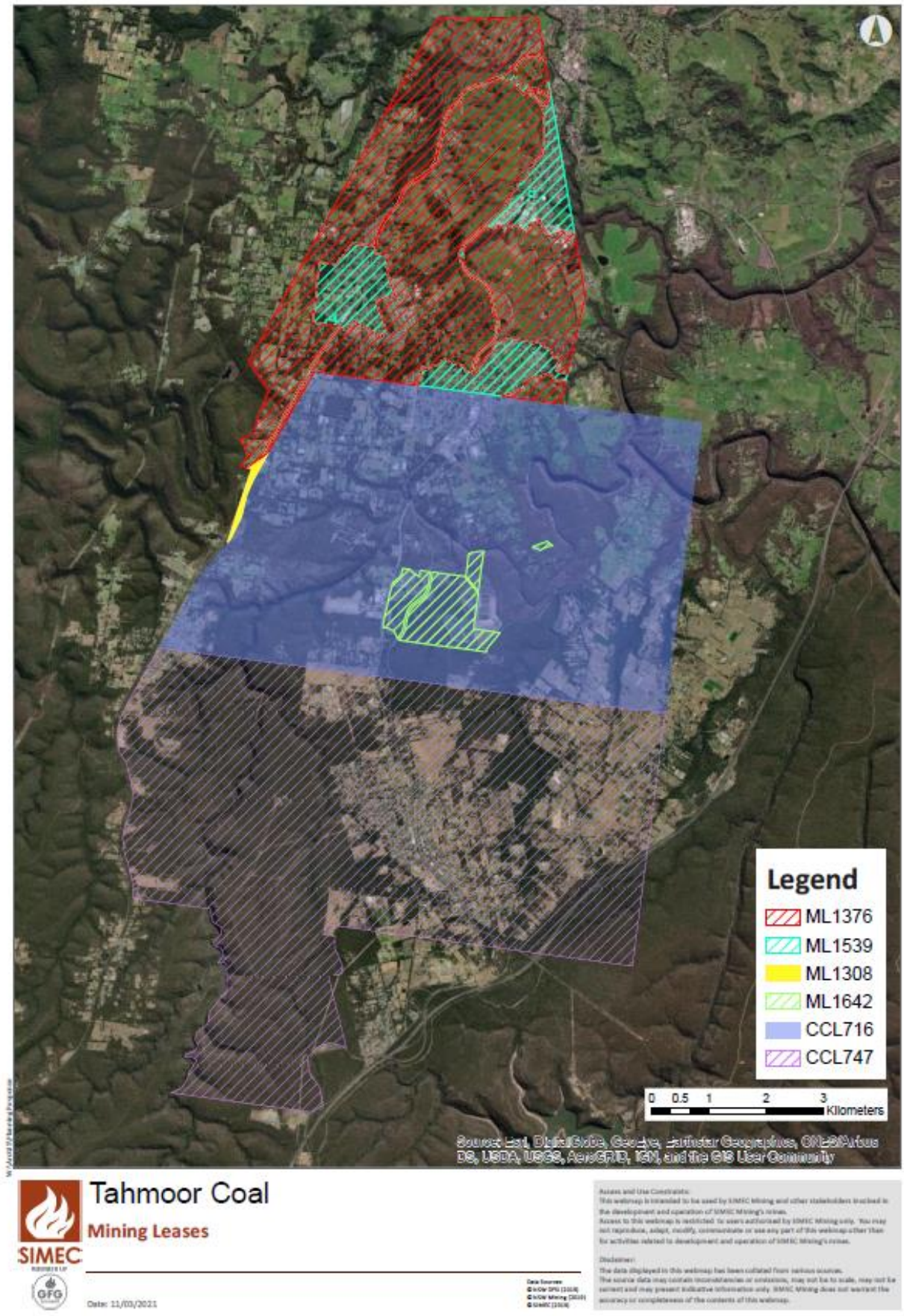


Figure 1 Mining Tenure

5 Approvals

The Tahmoor Mine development consents, mining tenure and environmental licences are outlined in **Table 5-1**.

Table 5-1 Consents and Licences

Consent Number	Consent Description	Date Granted	Expiry Date
Development Consents			
DA 1975	Underground Mine	26/03/1975	No expiry
DA 162/76	Bargo Consent	21/04/1976	No expiry
DA 1979	Coal Preparation Plant Stockpiles and Refuse Emplacement Area	23/08/1979	No expiry
DA 1979 (Mod 1)	Modification for road haulage of trial coal shipments	16/09/1985	No expiry
DA 190/85	Surface Works for Gas Extraction	16/12/1985	No expiry
DA 1979 (Mod 2)	Modification for Upgrades for Longwall Mining	05/11/1986	No expiry
DA 1979 (Mod 3)	Modification for Road haulage in Wollondilly Shire and when rail unavailable	1988	No expiry
DA 57/93	Tahmoor North Project	07/09/1994	No expiry
DA 1979 (Mod 4)	Modification for Road haulage to Corrimal and Coal Cliff Coke Works	13/12/1994	No expiry
DA 67/98	Tahmoor North Extension Project	25/02/1999	16/06/2024
DA 67/98 (Mod 1)	Modification for additional areas to be subsided	26/11/2006	16/06/2024
DA 57/93 (Mod 1)	Modification for heritage approval condition	07/06/2007	No expiry
DA 67/98 (Mod 2)	Modification for Redbank Tunnel Subsidence Management	08/04/2012	16/06/2024
DA 67/98 (Mod 3)	Modification for Redbank Tunnel Rail Deviation – Subdivision of Land	25/11/2012	16/06/2024
DA 67/98 (Mod 4)	Modification for subsidence are update	15/10/2018	16/06/2024
Mining Tenure – Mining Leases & Exploration Authorisations			
Consolidated Coal Lease 716	Tahmoor Mining Lease – Renewal documentation submitted and being assessed	15/06/1990	13/03/2021
Mining Lease 1376	Tahmoor North Mining Lease	28/08/1995	28/08/2016 (approval pending)
Mining Lease 1308	Mining Lease to west of CCL716	02/03/2014	02/03/2035
Mining Lease 1539	Tahmoor North Extension Mining Lease	16/06/2003	16/06/2024
Mining Lease 1642	Pit Top and REA surface Mining Lease	27/08/2010	27/08/2031
Consolidated Coal Lease 747	Bargo Mining Leases	23/05/1990	06/11/2025
Environmental Licences			

EPL 1389	Environmental Protection Licence– Licence variation 2nd Dec 2020	17/10/2000	No expiry
WAL36442	Water Access Licence	06/12/2013	No expiry

6 Operations Summary

6.1 Mining Operations

Mining activities during the reporting period have been conducted in accordance with the approved Mining Operation Plan (MOP) and Extraction Plan approvals. The MOP was updated in September 2020 and is next scheduled to be revised in September 2024.

Extraction of Longwall West 1 (LW W1) was completed on 6th November 2020, and LW W2 extraction commenced on 7th December 2020.

No seismic or exploration activity has occurred during the reporting period.

Table 6-1 outlines a summary of operational performance at Tahmoor Mine.

Table 6-1 **Operational Performance**

Material	Approved Limit (Specify Source)	Previous Reporting Period (Actual) Tonnes	This Reporting Period (Actual) Tonnes	Next Reporting Period (Forecast) Tonnes
Waste Rock /Overburden	-	0	0	0
ROM Coal/Ore	-	2,368,128	2,354,901	3,038295
Coarse Reject	-	532,964	1,025,137	1,056,853
Fine Reject (Tailings)	-	0	0	0
Saleable Product	3,500,000 (EPL 1389)	1,825,175	1,338,913	2,013,421

The Environmental Impact Statement for the Tahmoor South Project was submitted to DPIE in January 2019. Public exhibition was held and the project was subsequently amended and resubmitted in February 2020. The amendments included:

- A revised mine plan with reduced longwall widths and heights;
- A revised Reject Emplacement Area (REA) plan which reduced the footprint;
- Review of REA Operations;
- Confirmation of the Power Line Easement; and
- Review of Ventilation requirements.

A second amendment report was submitted in August 2020 which included the following amendments:

- Removal of two longwalls LW107B and LW108B;
- Containment of REA on its approved disturbance footprint; and
- Amendments to the construction layout of the ventilation shafts and associated transmission lines.

This project is currently in the final stage of determination with the Independent Planning Commission (IPC) for assessment.

6.2 Next Reporting Period

Table 6-2 outlines the proposed longwall sequencing for the completion of mining within Tahmoor North Mining Domain. LW W1 has been completed and LW W2 has commenced mining, and two (2) additional longwalls are proposed for the Western Domain region (Longwalls West 3 (LW W3) and West 4 (LW W4)).

Appendix 12 outlines the planned longwall layout and planned longwall progress plot for the Western Domain longwalls.

Table 6-2 Longwall Sequencing

Longwall Block	Proposed Start	Proposed Completion
Western Domain – Longwall West 1	15/11/2019 (Actual)	06/11/2020 (Actual)
Western Domain – Longwall West 2	05/12/2020 (Actual)	11/07/2021
Western Domain – Longwall West 3	14/08/2021	23/03/2022
Western Domain – Longwall West 4	20/04/2022	31/08/2022

7 Actions Required from Previous Annual Review

No actions were required from DPIE or Resources Regulator for the 2019 Annual Review.

8 Environmental Performance

Environmental performance and implemented and/or proposed management activities at Tahmoor Mine is outlined in **Table 8-1**. Further details regarding environmental performance is given in **Sections 8 to 22**.

Table 8-1 Environmental Performance

Aspect	Approval Criteria/EIS Prediction	Performance During the Reporting Period	Trend/key management implications	Implemented / proposed management actions
Noise	Maximum L10 reading of 45 dBA within 3 m of a residence Maximum L10 reading of 37 dBA at the REA	Monitoring results all within approved criteria	Noise levels compliant	Continue regular monitoring of noise levels
Blasting	Tahmoor Coal does not conduct surface blasting activities			
Air quality	Maximum deposited dust annual average of 4 g/m^2/month (DA67-98 MOD3)	High results recorded for January 2020 due to bushfires in the region.	Air quality levels generally within approved criteria	Continue regular monitoring of air quality levels
	Maximum total suspended particulate (TSP) matter annual average of 90 µg/m^3 (DA67-98 MOD3)			
	Maximum particulate matter (PM10) annual average of 30 µg/m^3 (DA67-98 MOD3)			
	Maximum particulate matter (PM10) 24-hour average of 50 µg/m^3 (DA67-98 MOD3)			
	Maximum increase in deposited dust level over an annual period of 2 g/m^2/month (DA67-98 MOD3)			
Biodiversity	-	Nothing to report	N/A	Continue current management and monitoring activities
Heritage	Aboriginal cultural heritage site at Redbank Creek	Nothing to report	Heritage compliant	Continue current management and monitoring activities
Water Quality	EPL 1389 Conditions	One (1) non-compliance	Water quality compliant with EPL	Continue current management and

Aspect	Approval Criteria/EIS Prediction	Performance During the Reporting Period	Trend/key management implications	Implemented / proposed management actions
				monitoring activities. Construct new Pilot Plant and Water Treatment Plant
Subsidence	Subsidence Management Plan and Extraction Plan approvals	Seven (7) subsidence notifications	Subsidence monitoring results generally within predictions	Continue current management and monitoring activities. Complete remediation works for Redbank and Myrtle Creek.

9 Operational Noise

9.1 Environmental Management

Tahmoor Mine is approved to operate 365 days a year, 24 hours a day.

Tahmoor Mine and its associated facilities operate in accordance with noise criteria provided by the 1975 and 1994 Development Consents.

Noise conditions are listed in Conditions 73 and 74 (DA 57/93 Tahmoor North development consent) as follows:

> *Condition 73: The noise level emanating from Tahmoor Mine and any associated facilities, including the Washery, stock pile area and rail loading facility, shall not exceed an L10 level of 45 dBA when measured within 3 m of any residence.*
>
> *Condition 74: The noise emanating from operations at the refuse emplacement site shall not exceed an L10 of 37 dBA or background +5 dBA whichever is the greater when measured within 3 m of any residence.*

The DA 57-93 consent conditions reference a distance of three (3) metres (m) from any residence that was constructed or approved prior to 1994.

Tahmoor Coal operates a real-time noise monitoring system which includes a Trigger Action Response Plan (TARP) and alarm system, linked back to the mine's 24-hour control room.

Attended due diligence monitoring is conducted quarterly during the reporting period as part of ongoing noise compliance work aimed at identifying and implementing targeted reasonable and feasible noise reduction.

9.2 Environmental Performance

Tahmoor Coal's real-time noise monitoring data and due diligence assessments continued to demonstrate compliance with the site's development consent noise criteria, with all monitoring results satisfying the noise assessment goals for the mine Pit Top, No.2 ventilation shaft and REA operational areas.

Appendix 2 outlines the locations of the noise monitoring locations and **Appendix 3** contains a summary of noise monitoring completed from 2014 to 2020.

Tahmoor Coal received four (4) noise complaints in 2020. Two (2) complaints received from the same resident in relation to departure and arrival of trains to the mine site during night-time. One (1) noise complaint received from another resident in relation to train arrival and departure during night-time and one (1) noise complaint received from a resident not attributed from mining related activities.

9.3 Further Improvements

In relation to the noise compliants received, DPIE requested a noise monitoring plan to be submitted. This was approved in December 2020. The plan includes attended and unattended noise monitoring at a number of locations near the rail line leading to Tahmoor Mine. The program is currently being implemented.

Tahmoor Coal will continue to operate and monitor the sites real-time noise monitoring network and alarm system, which includes a monitor at the mines Pit Top facility and at residences along Olive Lane. This system has proved effective in managing compliance with development consent noise criteria.

Tahmoor Coal will continue to operate and monitor the sites noise levels in accordance with the approved Noise Management Plan.

10 Air Quality

10.1 Environmental Management

Tahmoor Coal manages air quality in accordance with the air quality management plan approved by the DPIE on 10 December 2012 (*TAH-HSEC-00170– Air Quality & Greenhouse Gas Management Plan).*

A comprehensive system of controls is detailed for managing particulate matter on-site, including dust suppression sprays on the coal stockpiles (automatically triggered by pre-defined meteorological conditions), and visual triggers for operators and site personnel. Water carts are used at the REA and Pit Top hardstand to reduce wheel generated dust from mobile equipment. Unsealed access ways are controlled through the daily deployment of water carts to control dust.

The site also utilises a chemical dust suppressant 'PetroTac' on highly trafficked areas to prevent wheel generated dust from mobile equipment. This suppressant is applied monthly to hardstand areas.

10.2 Environmental Performance – Dust

The annual average depositional dust monitoring results for the reporting period, expressed as insoluble solids (g/m^2/month), are compared against those from previous reporting periods and reviewed monthly. Monitoring results indicate that all recorded dust levels are within limits set by EPL 1389, with results below the annual average of 4 g/m^2/month. Depositional dust results during the reporting period are outlined in **Table 10-1** and **Figure 2** and have remained relatively stable compared to 2019 results. Air quality monitoring site locations are shown in **Appendix 9**.

Table 10-1 Depositional Dust Gauge Data

Month/Site	1	2	3	4	7	8	9	10	11	12
Jan-20	0.80	1.30	0.90	1.50	3.10	1.60	0.8	2.5	2.4	2.3
Feb-20	5.10	6.30	9.30	6.40	7.10	7.80	5.8	7.1	10.0	6.5
Mar-20	0.40	0.50	1.20	0.40	0.50	1.00	0.4	1.3	1.0	0.9
Apr-20	0.50	0.70	0.80	0.50	0.50	2.70	0.1	1.2	0.5	0.9
May-20	0.50	0.30	1.00	0.80	0.20	0.90	0.4	0.5	0.1	0.5
Jun-20	0.50	0.60	0.50	0.80	0.40	0.90	0.1	0.3	0.3	0.5
Jul-20	0.50	0.40	0.60	0.50	0.30	1.00	0.1	1.4	0.3	0.4
Aug-20	0.20	*	1.20	0.40	0.20	2.10	0.2	0.5	0.9	0.7
Sep-20	0.70	0.10	0.50	0.50	0.50	2.20	0.2	1.6	1.2	0.4
Oct-20	0.70	0.30	0.70	2.60	0.40	1.30	0.5	4.1**	0.8	0.5
Nov-20	0.80	1.20	1.90	1.90	0.80	1.00	0.5	5.8**	0.6	1.3
Dec-20	0.20	0.40	0.60	2.10	0.50	1.10	0.4	7.2**	0.8	0.9
Average	**0.91**	**1.1**	**1.6**	**1.5**	**1.2**	**2.0**	**0.8**	**1.8**	**1.6**	**1.3**

Notes:

* Dust Vial broked in transit

** Dust Gauge contaminated with Insects, Polysaccharide Slime and Vegetation.

Figure 2 indicates that there are no trends of concern occurring within depositional dust sites 1-12. In general, levels continue to fluctuate between an average of 0.5 – 2.0 g/m^2/month. Due to no significant changes to the scale and location of the mining operation, it is anticipated levels will continue within this range throughout 2021.

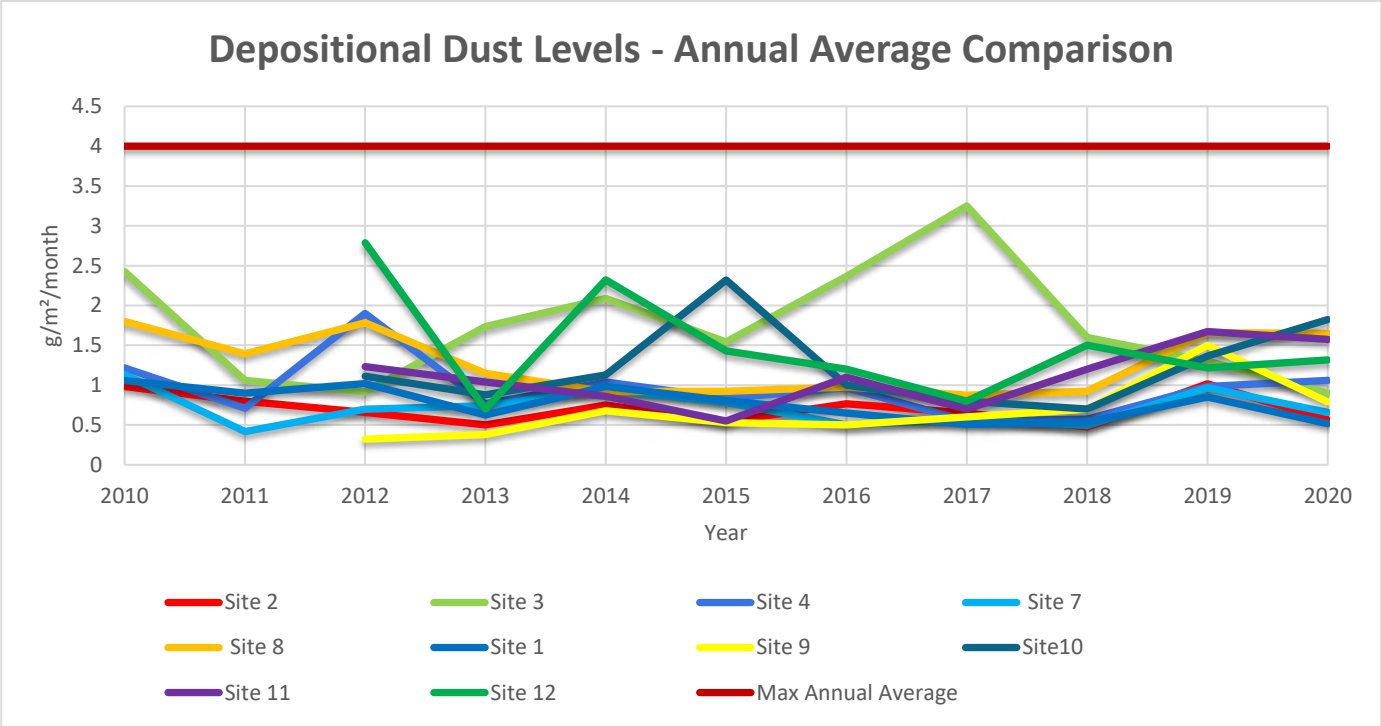


Figure 2 Depositional Dust Monitoring Annual Average Comparison

Figure 3 and **Figure 4** outline the results of the particulate matter (PM10) monitoring at Charlies Point Road, Olive Lane and Hodgson Grove in Tahmoor. PM10 particles have a diameter of 10 micrometers or smaller and are found in dust and smoke as a common air pollutant. Monitoring sites have been established since August 2013.

In **Figure 3,** the historical high recorded in Q1 2019 was attributed to a localised dust event at Hodgson Grove (87.9 µg/m^3) that is not thought to be related to mining operations. During 2020, Hi vol results have remained low and well below our 24 hour Maximum Average Level of 50 µg/m^3.

In **Figure 4**, bushfires and hazard reduction burns impacted on the air quality significantly during November and December 2019 causing a steep increase in the TEOM annual average but have considerably declined during 2020 forcasting to return to baseline levels during 2021. During 2020, PM10 results at Charlies Point Road have remained below our Maximum Annual average of 30 µg/m^3.

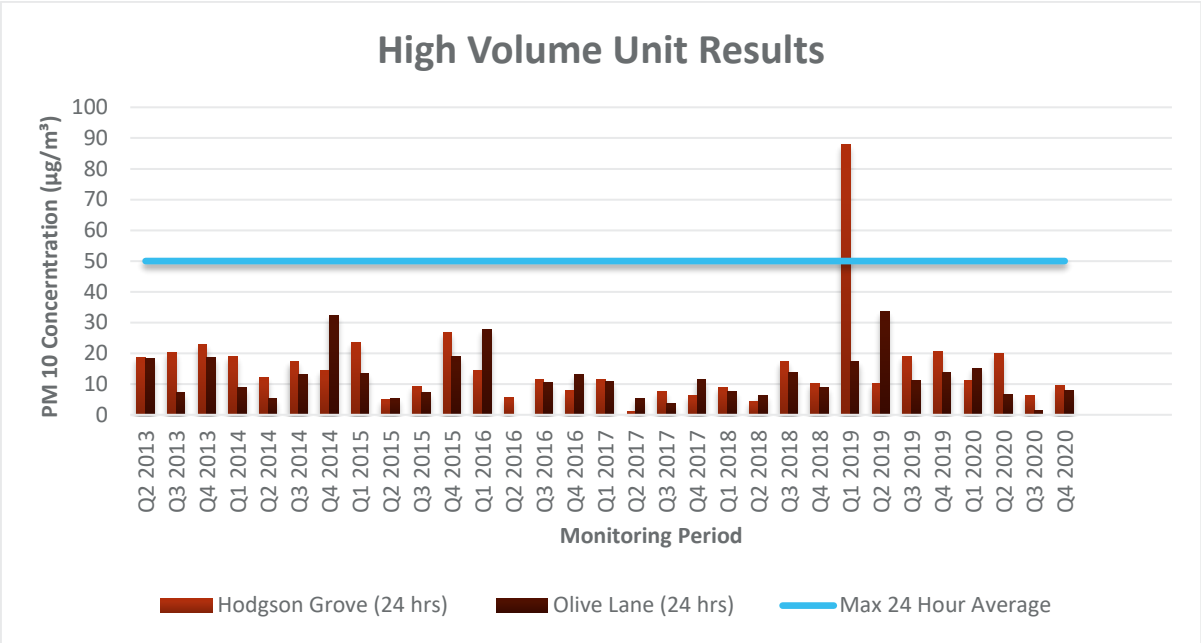


Figure 3 High Volume Air Quality Monitoring Results

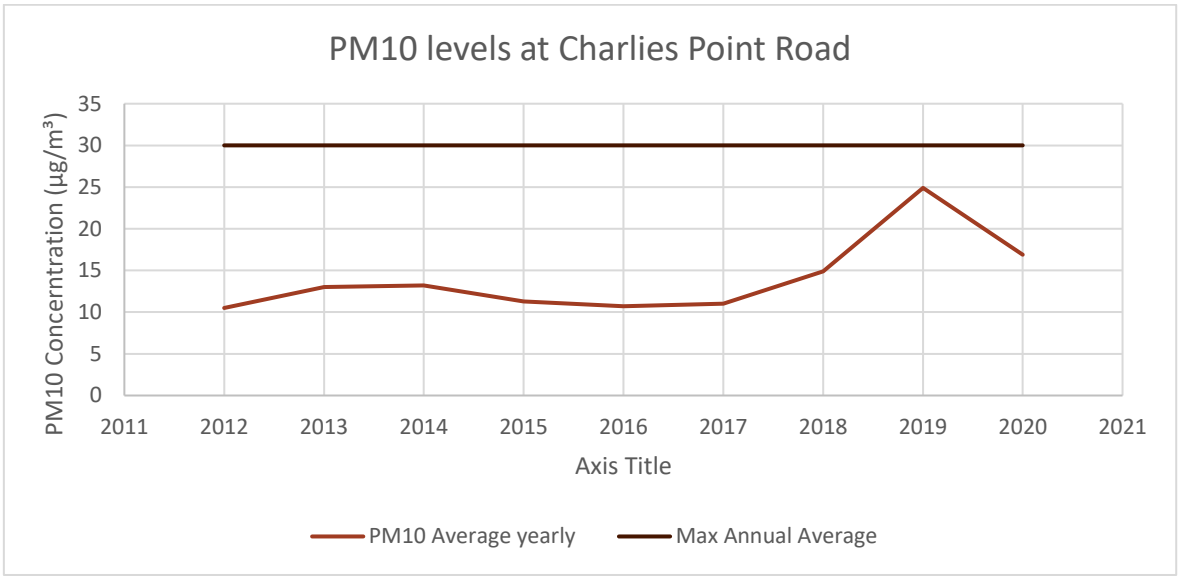


Figure 4 PM10 Annual Average

10.3 Environmental Performance – Greenhouse Gas Emissions

Greenhouse gas emissions (GHG) are reported every six (6) months in the National Greenhouse and Energy Reporting (NGERS) scheme as a requirement under the National Greenhouse and Energy Reporting Act 2007 (NGER Act). NGER provides information about GHG emissions, energy production and energy consumption. The inclusion of GHG emissions in the Annual Review has been a recommendation received from the 2020 Independent Environmental Audit.

Carbon Dioxide Emmisions (CO2-e) for the Financial Year 2020 and previous years is shown in **Table 10-2** below, as well as further explanation of the data.

Table 10-2 Annual Greehouse Gas Emissions for Financial Year

Year	Scope 1 (Mt CO2-e)	Scope 2 (Mt CO2-e)	Total Scope 1+2 (Mt CO2-e)	Explanation for results
FY16	1.643	0.085	1.727	Finished Longwall (LW) 29 to start of LW 30. A 78 day changeout between longwalls occurred versus a budget of 28 days. The cause of delays included 12 days lost due to surface dam subsidence risk management.
FY17	1.625	0.085	1.710	(none)
FY18	1.396	0.082	1.478	Decrease in emissions with use of more accurate gas composition 25eportin (SICK Analyser) on Shaft 2 (VAM) emissions. In Dec 17 there was a Pit bottom roof fall which delayed mining for 25eporti. 12 days.
FY19	1.260	0.083	1.343	Decrease in Greenhouse emissions driven by plant outage for 10 weeks at Tahmoor due to Number 3 shaft safety incident (shaft winder), however 4 weeks of this period was a Longwall changeover, so the additional impact was 6 weeks. The Net Energy Consumed increased in main due to a higher ratio of CH4 to CO2 in mine gas flaring at Tahmoor due to longwall gas geology.
FY20	1.239	0.088	1.326	In H1 FY20 – Reduction in normal VAM emissions Sept-Nov 19 due to a longwall non-production period due to extended LW changeout (discontinuity). Ramp up of longwall production within the new, more highly CH4 rich Domain has been significantly slower than forecast. Dec19- Bushfire site power outage.

10.4 Further Improvements

No complaints have been received to date regarding dust or air quality in 2020. Tahmoor Coal will continue to operate and monitor the sites dust and air quality levels in accordance with the approved Air Quality and Greenhouse Gas Management Plan.

11 Biodiversity

11.1 Environmental Management

Tahmoor Coal undertakes ecological assessments prior to undertaking activities likely to require vegetation clearing. Several threatened plant species have previously been identified on the surface mining lease areas, including *Grevillea parviflora* and *Persoonia bargoensis,* which have been identified at the REA, near the No.2 Shaft area, and along Charlies Point Road in proximity to the proposed TSC-1 and TSC-2 Vent Shaft sites and electricity powerline easement.

Grevillea parviflora is listed as vulnerable on both the *Biodiversity Conservation Act 2016* (BC Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). *Persoonia bargoensis* is listed as endangered under the BC Act and vulnerable under the EPBC Act.

Terrestrial ecology (amphibians and riparian vegetation) and aquatic ecology (macroinvertebrates) studies have also been conducted along Myrtle Creek and Redbank Creek to monitor impacts to stream health from subsidence and in response to post-mining creek remediation works currently being conducted. Monitoring was conducted using standard Australian River Assessment System (AUSRIVAS) methods and quantitative macroinvertebrate surveys in autumn and spring 2019, before remediation commenced, and autumn 2020, after remediation was complete in Pool 23. The report outlined that, in general, the aquatic habitat was similar at most sites when compared to previous survey; with Pool 23 scoring in Band B in Spring 2020. These studies have offered promising results to date from Tahmoor Coal's Creek Remediation Works and the re-establishment of aquatic life in remediated pools.

Baseline terrestrial and aquatic ecology studies have previously been conducted within waterway catchments in the Western Domain in Stonequarry Creek, Matthews Creek and Cedar Creek before mining LW W1. This baseline monitoring was completed in early 2020 and further monitoring in relation to mining activities commenced in Autumn 2020. Terrestrial and aquatic monitoring of these waterway catchments will continue to be monitored and assessed through-out the mining of the Western Domain longwalls.

Additional baseline aquatic ecology studies were also previously conducted within the waterway catchments in the Tahmoor South Area to supplement baseline data captured in 2014. The current studies include survey for macroinvertebrates in various creeks, and the threatened Sydney Hawk Dragonfly (adults, exuviates and larvae) in the Bargo River.

11.2 Environmental Performance

Throughout the reporting period various due diligence ecology surveys were completed at the REA and other operational areas associated where ground disturbance was planned to occur.

There were no reportable incidents related to ecological impacts during the reporting period.

11.3 Further Improvements

Ecological surveys will continue to be undertaken as required to manage compliance and impact assessment.

12 Aboriginal Cultural and Historical Heritage

12.1 Environmental Management

Prior to the extraction of each longwall, a search is completed to confirm if new Aboriginal cultural or historical heritage sites have been identified.

An Extraction Plan was approved by DPIE for the extraction of LW W1 and LW W2 in 2019. The Heritage Management Plan recorded 25 Aboriginal sites in the Study Area, comprising 17 rock shelters (including those with multiple features), one grinding groove site, six open artefact sites and one modified tree. Monitoring and management measures are detailed within the Extraction Plan and assessment of monitoring results reviewed in the two (2) Six Monthly Report 1 and Report 2 (**Appendix 14** and **Appendix 15** respectively).

12.2 Environmental Performance

All Aboriginal and historical heritage items were managed in accordance with the relevant approvals during the reporting period.

During the reporting period for the Six Monthly Subsidence Impact Reports (15th November 2019 – 6th November 2020), there were no reportable incidents related to Aboriginal Cultural items during the reporting period. However, one (1) Level Two TARP trigger occurred to a sandstone culvert in the Picton-Mittagong Loop line during regular monitoring according to the Picton-Mittagong Loop line Monitoring Report 46.

A Level 2 TARP Trigger according to the Historical Heritage TARP occurred due to a small transverse crack up to 1 millimetre in width had become evident across the downside culvert overt about 0.4-0.5 m inside the headwall. This minor crack was pre-existing and had been observed due to minor opening of the aperture. It is likely that the minor pre-existing crack is related to the construction of the brick wall founded on the sandstone culvert headwall crest and associated lateral loading from the retaining wall and steep batter slope. It is possible that the recent minor subsidence effect may have resulted in slight opening of the crack.

It was noted in the report that the crack was minor and was not adversely affecting the structural integrity of the culvert. No further developments of this crack had been noted in subsequent weekly reports during the reporting period. Due to the results being within predictions and the craking being minor and existing prior to mining, it was concluded that the current rail monitoring program would be maintained and future results monitored more closely.

12.3 Further Improvements

Aboriginal cultural and historical heritage due diligence assessments will continue to be undertaken by qualified Aboriginal cultural and historic heritage consultants.

Aboriginal cultural and historical heritage assessment process will identify items of significance and propose mitigation measures to ensure compliance with statutory requirements. Additionally, Tahmoor Coal aims to maintain valued working relationships with local Registered Aboriginal Parties (RAPS).

13 Erosion and Sediment Control

13.1 Environmental Management

Tahmoor Coal has a Soil & Water Management Plan and project specific Erosion & Sediment Control Plans, prepared generally in accordance with the requirements of *Managing Urban Stormwater* (OEH, 2008), including *Volume 2E Mines and Quarries* (2008) (also known as 'the Blue Book').

A number of drive-in sumps are procareiously positioned around Pit Top to capture and hold sediment laden water. Settling dams are also utilised to capture and settle sediments prior to discharge via Tahmoor Coal's Licence Discharge Point 1 (LDP1).

The unsealed equipment storage area between dams M1, M2, M3 and M4 is treated regularly with a dust suppressant to seal the roadways and reduce wind blown dust activity. The sealing agent is also useful in reducing sediment mobilisation during stormwater runoff.

The storm water consolidation project has continued to enable better operational control of the site which includes the addition of flocculent into surface water runoff prior to discharge.

13.2 Environmental Performance

Water and Dust sampling and Continuous Gauge downloads are carried out monthly by third Party Licenced Contractors and results obtained for the reporting period reflect Tahmoor Coal has operated within maximum levels as required by EPL 1389.

13.3 Further Improvements

Tahmoor Coal will continue to implement control strategies identified in Tahmoor Coal's Soil and Water Management Plan which incorporate site-wide erosion and sediment controls.

14 Contaminated Land

14.1 Environmental Management

A Stage 1 Preliminary Contamination Investigation was completed by GHD in 2017 and actions from that audit have been closed out, including removal of former underground storage tanks (USTs) and remediation works around the waste oil tanks and diesel above ground storage tanks (ASTs).

Groundwater monitoring around the UST area is ongoing.

14.2 Environmental Performance

A Hazardous Building Material audit and inspection was undertaken by GHD in 2018.

This audit focused on:

- Asbestos containing materials (ACM);
- Lead based paint systems;
- Lead Dust;
- Synthetic Mineral Fibre (SMF);
- Polychlorinated Biphenyls (PCBs) in light fittings; and
- Ozone depleting substances (ODS).

The Hazardous Materials Audit identified several actions were planned for completion during 2019 and these are outlined within **Table 14-1**.

Table 14-1 Hazardous Building Material Audit Actions

Action	Proposed Completion Date
Remove vinyl floor tiles from 5 offices and replace with new tiles	Complete
Labelling of all asbestos	Complete
Seal or encapsulate the eaves of BU001 which were found to contain asbestos	Works delayed – to be completed in 2021
Remove dust on upper surface of ceiling panels in muster area	Complete
Remove dust in Washery HV switch room SR 105 and SR106- low level lead contamination	Complete
Remove dust from No3 Switch room SR103 – high lead on top of st169	Complete

There were no reportable incidents related to contaminated land during the reporting period.

14.3 Further Improvements

Tahmoor Coal will continue to monitor potential areas of contaminated lands across the site and have one (1) action to complete from the 2018 Hazardous Building Materials Audit (refer to **Table 14-1**).

15 Bushfire Management

15.1 Environmental Management

During 2020, Tahmoor Coal reviewed and updated the Bushfire Management Plan (BMP) in consultation with the Wollondilly Rural Fire Service (RFS) to include an updated hazard reduction burn schedule as a response to the Green Wattle Bushfire of November 2019 to January 2020 (see **Figure 5**). The BMP provides significant detail on the location of all Tahmoor Coal land holdings with detailed maps showing Asset Protection Zones (APZ), Land Management Zones (LMZ) and Strategic Fire Zones (SFZ), gate/track/road access for all locations, and a detailed schedule of hazard reduction activities required for each location.

15.2 Environmental Performance

During 2020, Fire trail vegetation clearance works were completed around the property perimeters of Pit Top, REA fire trails, Shaft site 1 and Shaft site 2. No hazard reduction burns were completed during the reporting period and no wild fires were reported in the region.

15.3Further Improvements

Tahmoor Coal will continue to implement hazard control strategies outlined in the BMP.

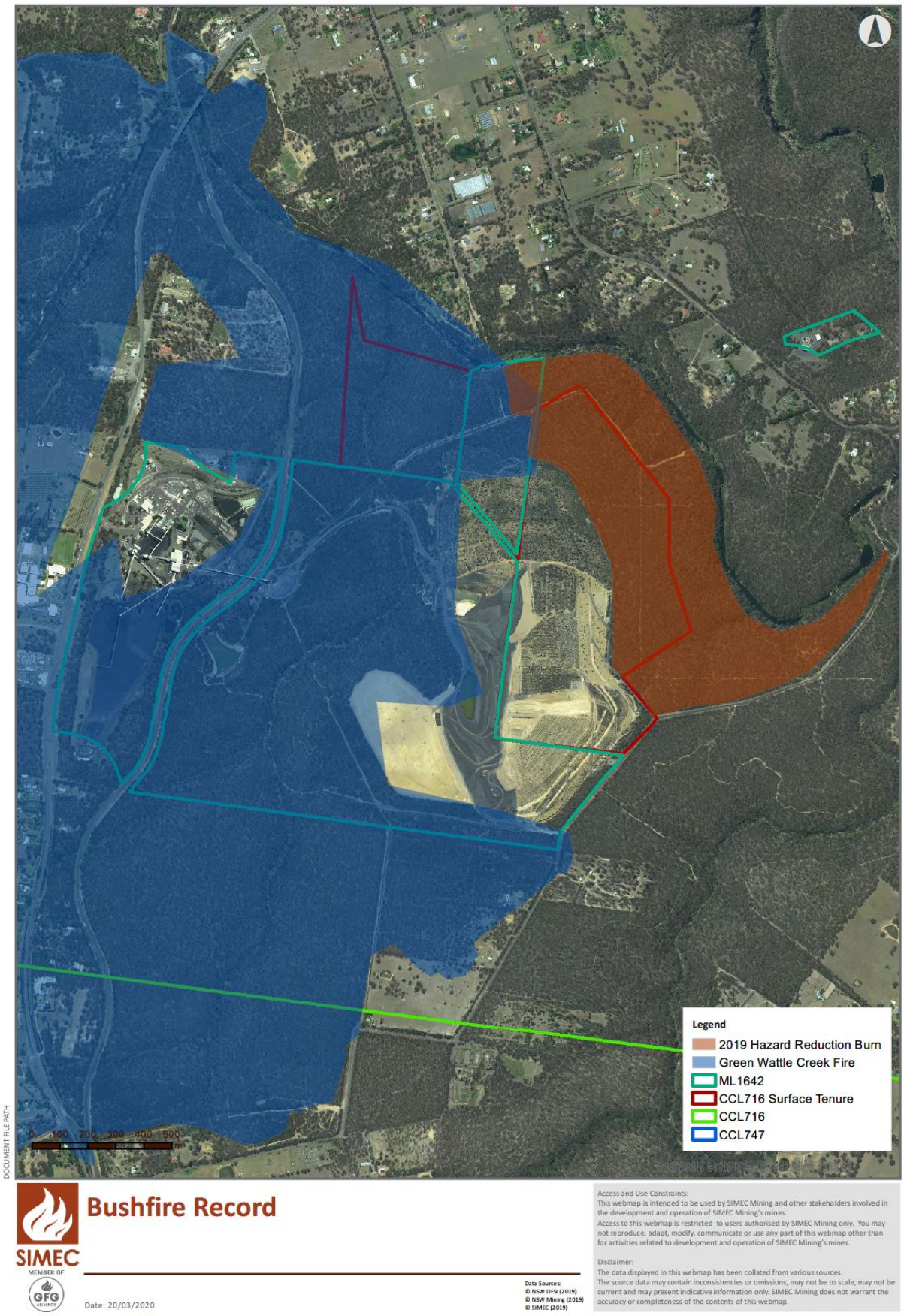


Figure 5 Bushfire Record

16 Mine Subsidence

16.1 Environmental Management

Tahmoor Coal completed extraction of LW W1 on 6th November 2020, and LW W2 commenced on 5th December 2020. All subsidence related impacts are managed in accordance with the LW W1-W2 Extraction Plan approval.

16.2 Environmental Performance

A detailed review of subsidence monitoring data and impacts is provided in the Tahmoor Coal Six Monthly Subsidence Impact Reports. These reports fulfil the reporting requirement of the Extraction Plan approved for LW W1-W2, and cover the period from 15 November 2019 to 6 November 2020. These requirements are outlined in **Section 6.1.4** of the LW W1-W2 Extraction Plan, which are derived from Section 6 of the DPIE *Draft Guidelines for the Preparation of Extraction Plans V5* (DPE, 2015). These reports provide the Secretary of DPIE with a summary of subsidence and environment monitoring results, subsidence impacts and management actions undertaken during the reporting period. The following Reports are found in the Appendix:

- **Appendix 14 –** Six Monthly Subsidence Impact Report – Report 1; and
- **Appendix 15 –** Six Monthly Subsidence Impact Report – Report 2.

16.3 Surface Water

During the reporting period for the Six Monthly Subsidence Impact Reports (15th November 2019 – 6th November 2020), no observable stream bed craking has been observed in Matthews Creek, Cedar Creek or Stonequarry Creek as a result of subsidence impacts. However, water level TARP triggers and Water Quality TARP triggers have been met and further details are explained in the Six Monthly Subsidence Impact Reports 1 and 2 (**Appendix 14 and Appendix 15** respectfully).

Level 2 TARP observations for the reporting period included a reduction in stream flow, pool levels at monitoring site CB (Pool CR14) and Water Quality changes for Electrical Conductivity, Dissolved Nickel, Dissolved Zinc and pH for selected pools. These TARP triggers did not require notification and the results were within predictions.

Level 3 TARP triggers according to the Natural Drainage Behaviour TARP occurred due to gas bubbling observations in Matthews Creek (Pool MR45). These observations occurred during six (6) monitoring occasions (24th February 2020, 27th February 2020, 24th March 2020, 24th April 2020, 26th May 2020, and 25th June 2020).

Actions completed included the discussion of the TARP trigger at the Tahmoor Coal Environmental Response Group (ERG) on 10th March 2020 and the completion of gas sampling on 2nd April 2020. The gas composition report for the sample indicated that the gas originated from the shallow Hawksbury Sandstone stratas and/or shallow anoxic muds. It was not possible to definitively determine that gas release at Pool MR45 was related to longwall mining in the local area. As gas bubbling frequency did not increase during the current reporting period, the ERG agreed no further actions were required.

As a consent condition for the commencement of LW W2 extraction, DPIE have requested that the frequency of visual inspections of MR45 be increased from monthly to fortnightly during active subsidence period of LW W2 extraction. In addition, DPIE have also requested that the frequency of flow monitoring in proximity to MR45 to increase from monthly to fortnightly. Tahmoor Coal have proposed that this increase in flow monitoring occur at site 'MG'. These requirements have been incorporated into the Water Management Plan and the monitoring program.

Monitoring of flow and visual inspection of pools will continue under the existing monitoring program.

16.4 Groundwater

16.4.1 Six Monthly Subsidence Impact Report results

During the reporting period for the Six Monthly Subsidence Impact Reports (15th November 2019 – 6th November 2020), a Groundwater Bore level TARP trigger and a Shallow Groundwater Pressures TARP trigger occurred. Further details are explained in the Six Monthly Subsidence Impact Reports 1 and 2 (**Appendix 14** and **Appendix 15** respectfully).

Level 3 TARP Triggers according to the Groundwater Bore Level TARP occurred due to reduced water level elevation below baseline range. However, groundwater levels were within predictions and were not connected to any surface water impacts. Further actions included closely monitoring future results and maintaining current monitoring frequency.

As a consent condition for the commencement of LW W2 extraction, DPIE have requested that the monitoring frequency of Open Stand Pipe (OSP) groundwater level at P12C is increased from monthly to fortnightly for the duration of LW W2 extraction. This requirement has been included in the Water Management Plan and the Monitoring Program.

Level 3 TARP Triggers according to the Shallow Groundwater Pressures TARP occurred as a result of a number of shallow Vibrating Wire Piezometers (VWPs) recording a trend of depressurisation below baseline range. However, groundwater levels were within predictions and were not connected to any surface water impacts. Further actions included closely monitoring future results and maintaining current monitoring frequency.

As a consent condition for the commencement of LW W2 extraction, DPIE have requested that the monitoring frequency of VWP groundwater pressure at TNC36 is increased from monthly to fortnightly for the duration of LW W2 extraction. This requirement has been included in the Water Management Plan and the Monitoring Program.

A number of Level 2 TARP exceedances for groundwater quality have also occurred for lithium (Li), iron (Fe), zinc (Zn), barium (Ba), aluminium (Al) and strontium (Sr). There has been a return to non-exceedance levels in all cases below the proposed trigger levels, except for the following where the exceedance is the last available data point (January/February 2021 for P bores and October 2020 for private bores):

- P13A, P13B, P13C – Lithium (Li)
- P16B – Iron (Fe), Manganese (Mn), Copper (Cu), Lead (Pb), Zinc (Zn), Aluminium (Al), Barium (Ba)
- P17 – Aluminium (Al)

- GW105546 – strontium (Sr).
- GW105467 – copper (Cu), lead (Pb), barium (Ba).
- GW105228 – manganese (Mn), zinc (Zn), lithium (Li), strontium (Sr), barium (Ba).
- GW072402 – strontium (Sr).

These exceedances are discussed in **Appendix 16.** No notifications of these exceedances were required according to the LW W1-W2 Water Management Plan TARPs.

Further details of impacts to Groundwater from LW W1 are found in **Appendix 14** and **Appendix 15**.

16.4.2 Additional Annual monitoring results

In addition to the Six Monthly Subsidence impact results, groundwater levels at P12C, P13C, P16B and P16C have exceeded the Level 4 TARP criteria due to on-going reduction in groundwater level (more than 2 m) over a period of six months likely caused by mining of LW W1. Groundwater level exceedances at the shallow VWP's were also recorded in the TNC036 intakes (shallower than 200 mbgl) as per the TARP Level 4 criteria. Further information about these exceedances are provided in **Appendix 16.**

These exceedances were notified to relevant government agencies in December 2020, as referenced in **Table 16-1**. Investigations are continuaing and will be reported to relevant agencies.

16.5 Rail Infrastructure

During the reporting period for the Six Monthly Subsidence Impact Reports (15th November 2019 – 6th November 2020), there have been three (3) 'Blue Triggers' according to the Picton-Mittagong Loop Line TARP and the Main Southern Railway TARP.

Blue Trigger at Embankment and Culvert (88.387 km) according to the Picton-Mittagong Loop-line TARP. On 16th April 2020, a tension crack was observed along the crest of the embankment on down-side at 88.387 km during an inspection of the Embankment and Culvert (88.400 km) on the Picton-Mittagong loop line, as discussed in Six Monthly Subsidence Impact Report 1 (**Appendix 14**). It was determined that heavy vehicle traffic and the presence of an old steel water pipe buried beneath the crest may have influenced crack formation at this location, and there was no evidence of embankment instability.

Blue Trigger for Joint Closure (88.5-88.6km) according to the Picton-Mittagong Loop-line TARP on 14th September 2020. Detailed measurements were completed between 88.35 km and 88.65 km where expected ground shortening has occurred. More than 50% of joints have closed between 88.5 km and 88.6 km triggering a blur TARP trigger. Adjustments to the track between 88.5 km and 88.6 km were completed on 12th October 2020, resolving the TARP trigger. Visual inspections of the location will continue under the existing monitoring program.

Blue Trigger at Ballast Top Subway (86.838 km) according to the Main Southern Railway TARP occurred in March 2020. Changes in distances across the Ballast Top Subway (86.838 km) abutment exceeded the monitoring review point trigger level during the local 3D survey of the structure (Report 1, **Appendix 14**). Further actions were not required as the issue was reviewed by the RMG and resolved by May 2020. Following inspection by a structural engineer, the changes noted appeared to have been related to continuation of pre-existing conditions and were unlikely

to be mining induced. Visual inspections of the structure will continue under the existing monitoring program.

Further details of impacts to Rail Infrastructure from LW W1 are found in **Appendix 14** and **Appendix 15**.

16.6 Subsidence Event Notifications

There were seven (7) subsidence incidents and ongoing management reporting notifications for LW W1 in 2020.

Notifications to Government agencies is required according to the LW W1-W2 Extraction Plan, in particular the TARPs under the relevant Infrastructure and Environmental Management Plans. Notifications provided during the reporting period are summarised in **Table 16-1**.

Table 16-1 Subsidence Event Notifications

Date	Location	Longwall	Subsidence Incident Reported
16th April 2020	Picton to Mittagong Loop line	LW W1	Tension crack reported at Rail embankment 88.400 km.
18th September 2020	4 Booyong Close Picton between Pegs B2 and B3	LW W1	Two compression humps developed at the property. This resulted in noticeable impacts to external rear cobblestone paving.
13th October 2020	21 Stonequarry Creek Road, Picton located between Pegs S26 to S28	LW W1	Ceiling in the main bathroom has deflected down and has formed a large bow .
3rd November 2020	Road surface of 5 Carramar Close, Picton between Pegs C5 and C9	LW W1	Cracking has developed in two locations in the road outside the property. This has resulted in noticeable impacts to the bitumen surface along the roadway, there are no safety concerns.
24th November 2020	6 Booyong Close, Picton located between Pegs B3 to B5	LW W1	Pier movement and cut slippage under the house has occurred at the property.
25th November 2020	Carramar Close, Picton at Peg C9 – between property numbers 7 and 9	LW W1	Water leak has developed at the very end of Carramar Close between No. 7 and 9.
30th December 2020	Piezometers P12 (intake P12C), P13 (intake P13C), P16 (intakes P16B and P16C), and TNC36 (intakes at 65, 97 and 169 metres below ground level)	LW W1	Level 4 TARP trigger – Depressurisation of groundwater aquifers has exceeded a two metre reduction below the lowest pre-mining level for a period of greater than six months in P12C, P13C, P16B and P16C. These reductions in water level were determined not to be controlled by climatic or anthropogenic factors. Level 4 TARP trigger – Depressurisation of groundwater aquifers has exceeded a five metre reduction below the lowest pre-mining level for a period of greater than six months at TNC36 (65, 97 and 169 metres below ground level intakes). These reductions in water level were determined not to be controlled by climatic or anthropogenic factors.

16.7 Subsidence Monitoring

Subsidence monitoring has been completed during the reporting period in accordance with the approved Tahmoor Coal LW W1-W2 Extraction plan, specifically as summarised in the LW W1-W2 Subsidence Monitoring Program.

On completion of a Longwall, the active subsidence zone is resurveyed, and comparative analysis of predicted and actual subsidence forecasts are reported in the 6 monthly Subsidence Report. LW W1-W2 Six Monthly Subsidence Report 1 **(Appendix 14)** and Report 2 **(Appendix 15)** demonstrates observed subsidence has been less than predicted subsidence, tilt and curvature during the reporting period.

Notable environmental monitoring observations during the reporting period are discussed in section 16.3 (Surface water), Section 16.4 (Groundwater) and Section 12.2 (Aboriginal Cultural and Historical Heritage).

16.8 Further Improvements

Tahmoor Coal have commited to the installation of a pre-mining and post-mining height of fracture hole is to be installed over LW W2 and associated headings as stated in accordance with the LW W1–W2 Water Management Plan. The pre-mining borehole has been installed and the post-mining borehole will be installed once subsidence impacts from LW W2 are finalised over the top of LW W2.

An additional shallow groundwater monitoring bore (P15) is currently being installed between LW W3 and Stonequarry Creek, this groundwater bore will assist in gaining a better understanding of the aquifier.

17 Natural Heritage

17.1 Environmental Management

No natural heritage sites have been identified.

17.2 Environmental Performance

There were no reportable incidents related to natural heritage during the reporting period.

17.3 Further Improvements

Natural heritage surveys will continue to be undertaken as per operational needs and approval requirements to manage compliance and impacts.

18 Water Management

18.1 Groundwater

18.1.1 Environmental Management

Longwalls are extracted within Tahmoor North at a depth of approximately 450 m in the Bulli Seam. Water from sedimentary layers above the mine workings seep into the mine at a rate of approximately 2.9 ML/day. This water is pumped to the surface and directed to the mine's Pit Top treatment dams. Water quality and flow is monitored under the conditions of Tahmoor Coal's EPL 1389 and Water Licence 36442.

A schematic of the Tahmoor Mine water management system and water quality infrastructure is outlined within **Appendix 7**. This schematic details main water sources and their particular flow paths across the mine site and the eventual discharge via Tahmoor Coal's LDP1.

Groundwater bores at Tahmoor Coal Pit Top and REA are monitored quarterly for Water quality and water levels. These levels have remained relatively stable through out the reporting period, for further information refer to **Appendix 17** for groundwater data from boreholes located at Pit Top and the REA area. The below **Figures 6** to **Figure 11** illustrate changes in level data, pH and EC results over time from the end of 2019 to the beginning of 2021.

18.1.2 Environmental Performance

A plan showing the location of all monitoring bores in the Tahmoor North, Tahmoor South and Western Domain mining areas are shown in **Appendix 8** and reported in the Tahmoor Coal Six Monthly Subsidence Impact Report 1 & 2 (**Appendix 14** and **Appendix 15**, respectively). Piezometers located at Tahmoor Coal's Pit Top and REA are monitored quarterly for water quality and with continual level data logged and downloaded quarterly. For further information refer to **Appendix 17.**

Table 18-1 provides a summary of groundwater outflow from 2015 to 2020 and is illustrated in **Figure 6**.

There were no reportable incidents related to groundwater pollution during the reporting period.

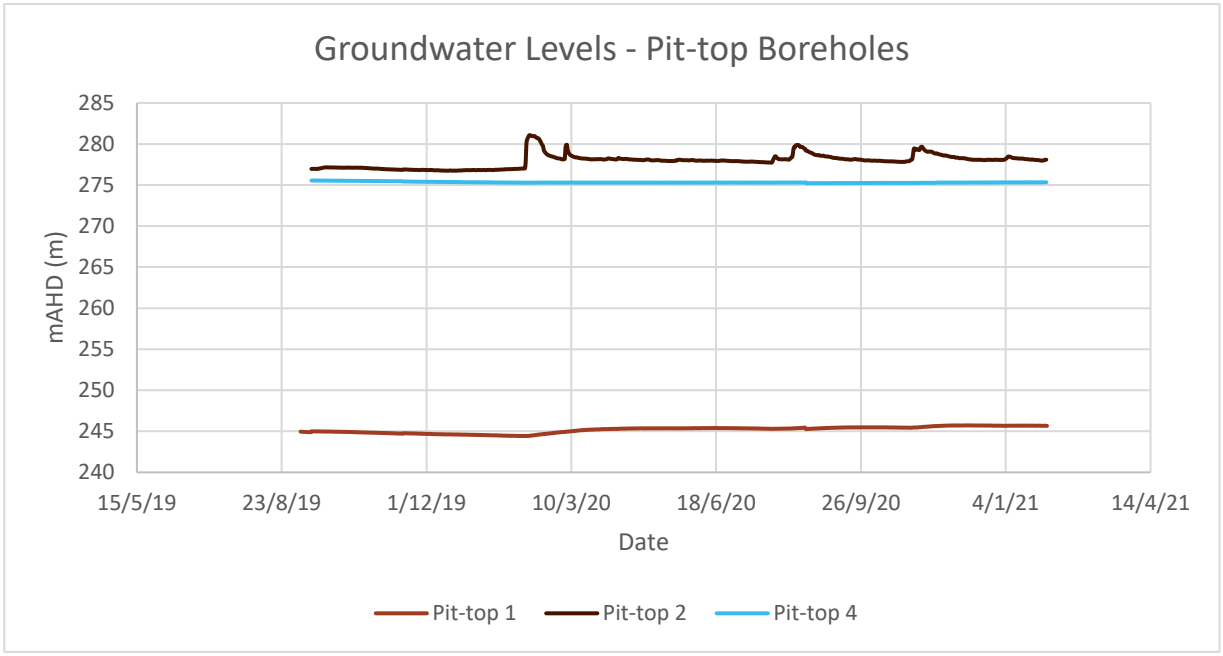


Figure 6 Borehole groundwater levels for Pit Top

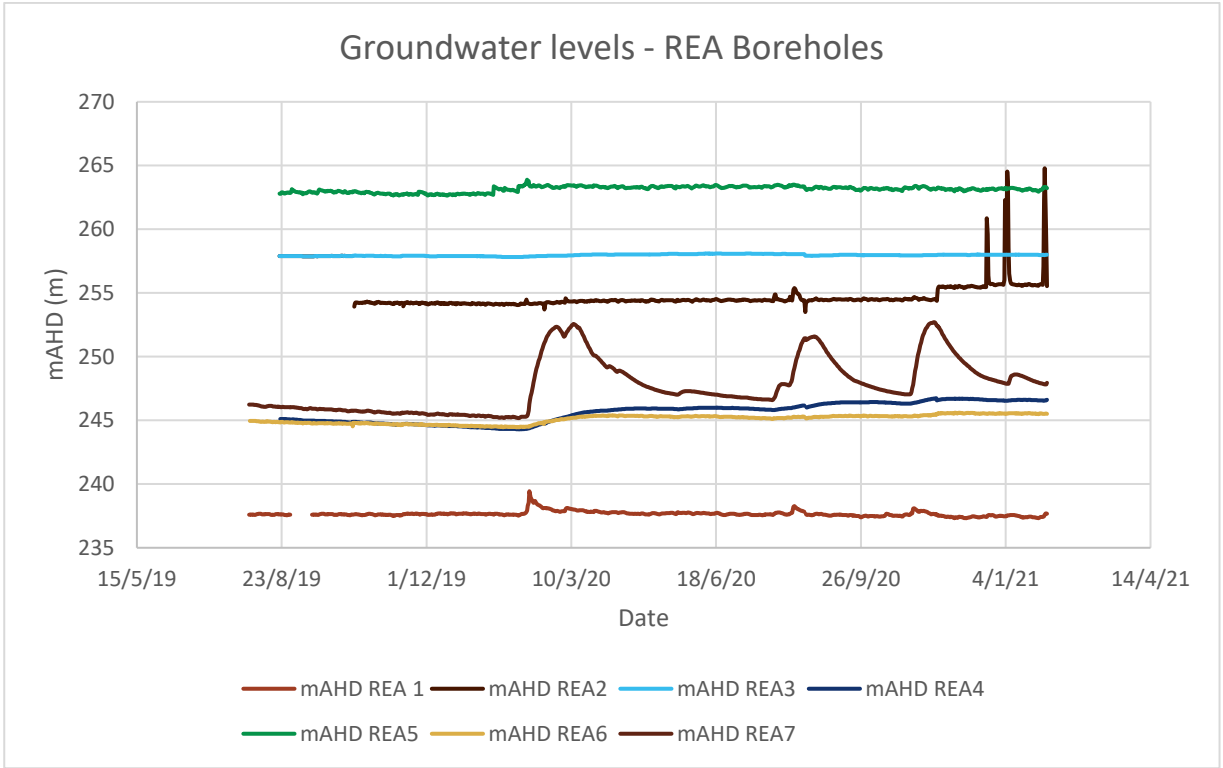


Figure 7 Borehole groundwater levels for REA

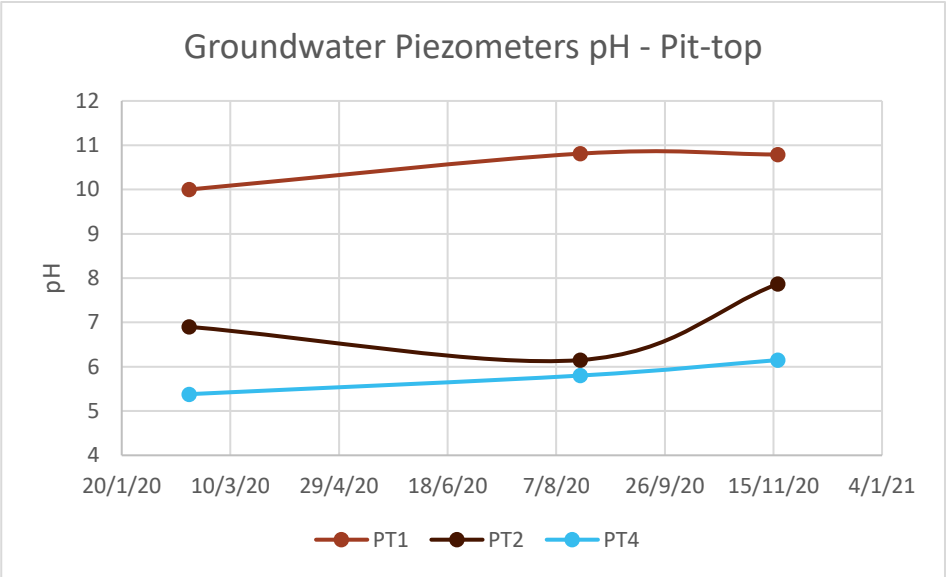


Figure 8 Groundwater Pit Top Piezometers – pH

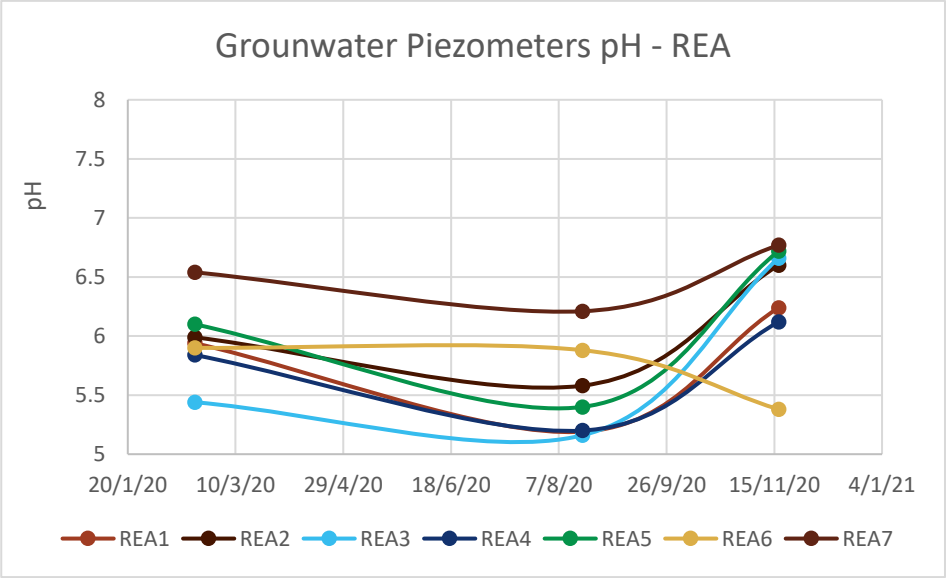


Figure 9 Groundwater REA Piezometers – pH

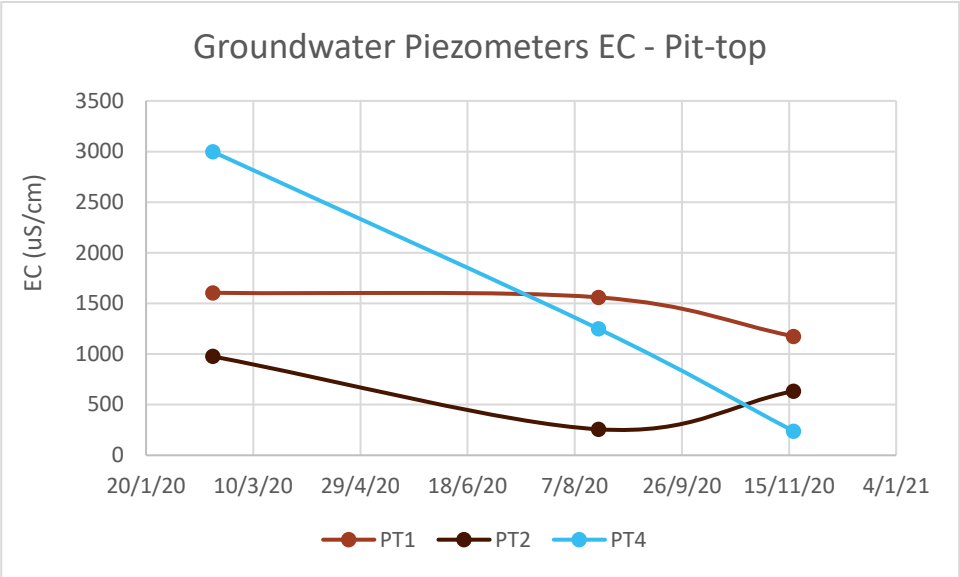


Figure 10 Groundwater Pit Top Piezometers – EC

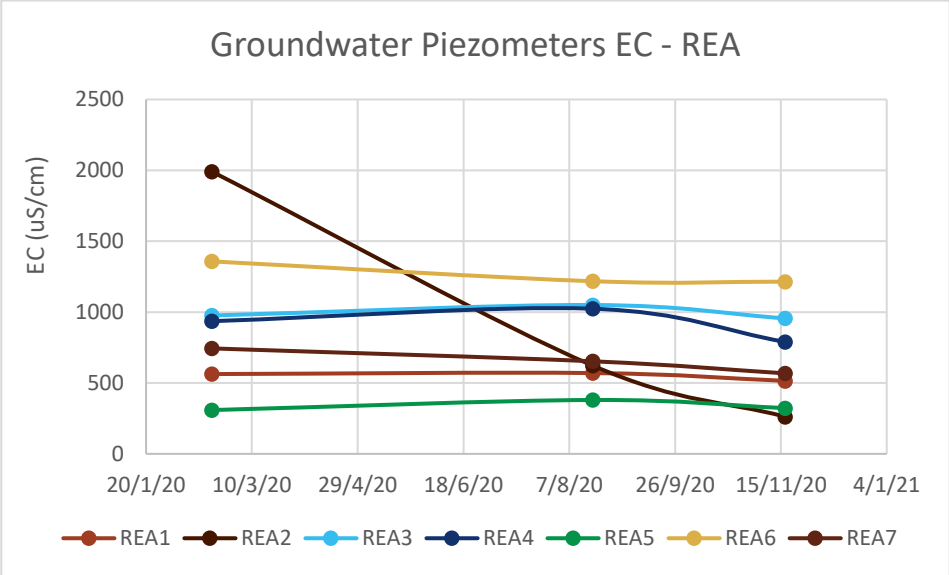


Figure 11 Groundwater REA Piezometers – EC

Table 18-1 Summary of Groundwater Outflow

Date	Water Licence #	Water Sharing plan/source and management zone (as applicable)	Entitlement per water year (ML)	Total Water loss from Underground (ML) *includes vent air and entrained ROM	Total from Underground (ML)	Total Water to Underground (ML)	Calculated Groundwater Inflow/Take (ML)
Jan-Dec 2015	36442	Greater Metropolitan Region Groundwater Sources / Sydney Basin Nepean Groundwater Source	1642	1189	1600.93	411.87	1189.06
Jan-Dec 2016	36442	Greater Metropolitan Region Groundwater Sources / Sydney Basin Nepean Groundwater Source	1642	1099	1524.50	424.92	1099.58
Jan-Dec 2017	36442	Greater Metropolitan Region Groundwater Sources / Sydney Basin Nepean Groundwater Source	1642	1085	1514.02	428.85	1085.17
Jan-Dec 2018	36442	Greater Metropolitan Region Groundwater Sources / Sydney Basin Nepean Groundwater Source	1642	940	1360.67	420.59	940.08
Jan-Dec 2019	36442	Greater Metropolitan Region Groundwater Sources / Sydney Basin Nepean Groundwater Source	1642	1009	1469.50	460.64	1008.86
Jan-Dec 2020	36442	Greater Metropolitan Region Groundwater Sources / Sydney Basin Nepean Groundwater Source	1642	1072	1619.49	547.52	1071.97

*Inconsistencies of Groundwater calculations from 2017-2019 AEMR's were noted in the Independent Environmental Audit 2020. Slight inconsistencies were noted from *Tahmoor Coal's Groundwater data excel* and were due to an incorrect calculation and have been corrected in the table above.

In addition, extra information has been provided above with the addition of 'Total Water to Underground' (Water sent from Tahmoor Coal's Recycle Water Treatment Plant and Sydney Water to underground workings), 'Calculated Groundwater inflow' ('Calculated inflow' euqals 'Total from' less 'Total to' the mine workings) and 'Total water loss from Underground' (includes vented moisture and water entrained in ROM material extracted).

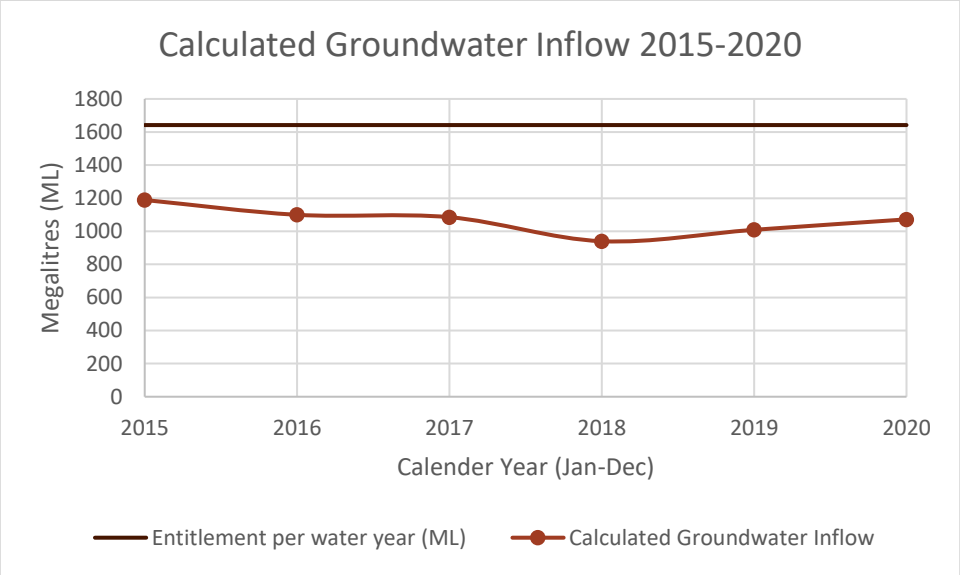


Figure 12 Calculated Groundwater Inflow Annual Volume (Calender Year)

Please note Tahmoor Coal have remained within groundwater extraction limits as per the water licence WAL36442 for 2020 (as shown in **Figure 12** above) and the water year FY20.

18.1.3 Further Improvements

Tahmoor Coal will continue to implement the Groundwater Management Plan, and ongoing monitoring and reporting will occur in accordance with the conditions in the water licence.

18.2 Surface Water

18.2.1 Environmental Management – Water Quality

Tahmoor Coal is licensed to discharge water from one (1) licenced discharge location and overflow from three (3) Licenced Overflow Points (LOPs) during periods of wet weather (as per EPL 1389) which refers to more than 10 mm of rainfall within a 24 hour period at the premisis. The location of the Licensed Discharge Point 1 and LOPs are described in **Table 18-2** and shown in **Appendix 5.**

Table 18-2 Licensed Discharge and Overflow Points Locations

Point	Location
LDP 1	Discharge from Dam M4
LOP 3	Overflow from the REA Dam S9
LOP 4	Overflow from REA Dam S4
LOP 5	Overflow from REA Dam S8

18.2.2 Environmental Performance – Water Quality

Water discharged from LDP1 is monitored monthly via a grab sample and is conducted and analysed by an independent laboratory.

The EPL 1389 states maximum discharge limits for alalytes discharged via LDP1, these results are provided in **Table 18-4** for the reporting period. The water quality trend for LDP1 is outlined in **Figures 13** to **Figure 19** and shows relatively consistent results from monthly data in the last 5 years of monitoring.

During the reporting period, on the 17th April 2020, an unexpected clay material was unable to be processed by the Coal Handling Preparation Plant (CHPP) efficiently, which caused highly turbid water to be discharged into Tahmoor Coal's surface water dams and eventually discharged via LDP1 into Tea Tree Hollow Creek. This caused elevated levels for TSS and Turbidity in the April 2020 monthly sample result. Immediate mitigation actions were undertaken which were effective in reducing the Turbidity. Further long-term initiatives have been implemented at site to effectively identify and mitigate a repeat incident from occurring again. The Independent Environmental Audit 2020 recommended the inclusion of the following table (**Table 18-3**) outlining the status of follow up actions from the incident.

Table 18-3 Follow-up actions from water incident of 17th April 2020

Follow up Actions	Status
Trial of a real time turbidity monitor on the thickener overflow	Completed
Install real time water turbidity monitoring of thickener overflow	Completed
Develop and implement Trigger Action Response Plan (TARP) for the thickener overflow	Completed
Trial of water turbidity meter within the dam system	Completed
Real time monitoring equipment and TARP for water turbidity levels for dam level readings	Completed
Documented process for the regular inspection and monitoring of dams	Completed
Alternate flocculent product as recommended by independent consultant	Completed
A review of the chemical products used throughout the process – from underground, to the CHPP to the discharge point and ensure their usage is compatible and efficient	Completed
Review of communication between underground operations and CHPP	Completed
Purchase portable turbidity meter to assist with water management	Completed
Updated documents relating to water management at site	Completed
Training on updated Water management system	Completed

Tahmoor Coal has been issued with an updated EPL in December 2020 which includes additional analytes required for monthly monitoring and further requirements for the implementation of a Water Treatment Plant to treat mine effluent waters before being discharged into Tea Tree Hollow Creek. Additional requirements include Aquatic monitoring, Toxicity monitoring and a Sediment Contamination investigation to be conducted within the required timeframes.

Table 18-4 LDP1 Discharge Water Quality

	pH	Electrical Conductivity	Total Suspended Solids (TSS)	Turbidity	Enterococci	Total Nitrogen	Aluminium	Arsenic	Barium	Copper	Nickel	Zinc	Oil & Grease
	pH Unit	µS/cm	mg/L	NTU	CFU/100ml	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
100th Percentile Concentration Limits	6.5-9	2,600	30	150	1700	8	110	200	6440	5	200	300	10
Jan-2020	8.6	2140	14	9.4				69			60	40	<5
Feb-2020	8.5	2030	20	19.7				64			57	39	<5
Mar-2020	8.6	1870	18	40.9				50			46	43	<5
Apr-2020	8.1	2070	21	31				71			58	59	<5
May-2020	8.3	2120	<5	10.3				30			62	40	<5
Jun-2020	8.7	2280	9	7.7				73			70	66	<5
Jul-2020	8.8	2130	13	15.7				52			49	58	<5
Aug-2020	8.8	1900	17	16.9				50			53	53	<5
Sep-2020	8.5	2130	10	12.4				64			75	64	<5
Oct-2020	8.5	2140	19	6				57			66	62	<5
Nov-2020	8.7	2020	17	6.7				47			58	21	<5
Dec-2020	8.6	2350	<5	3.9	170	3	<10	105	3230	1	74	49	<5

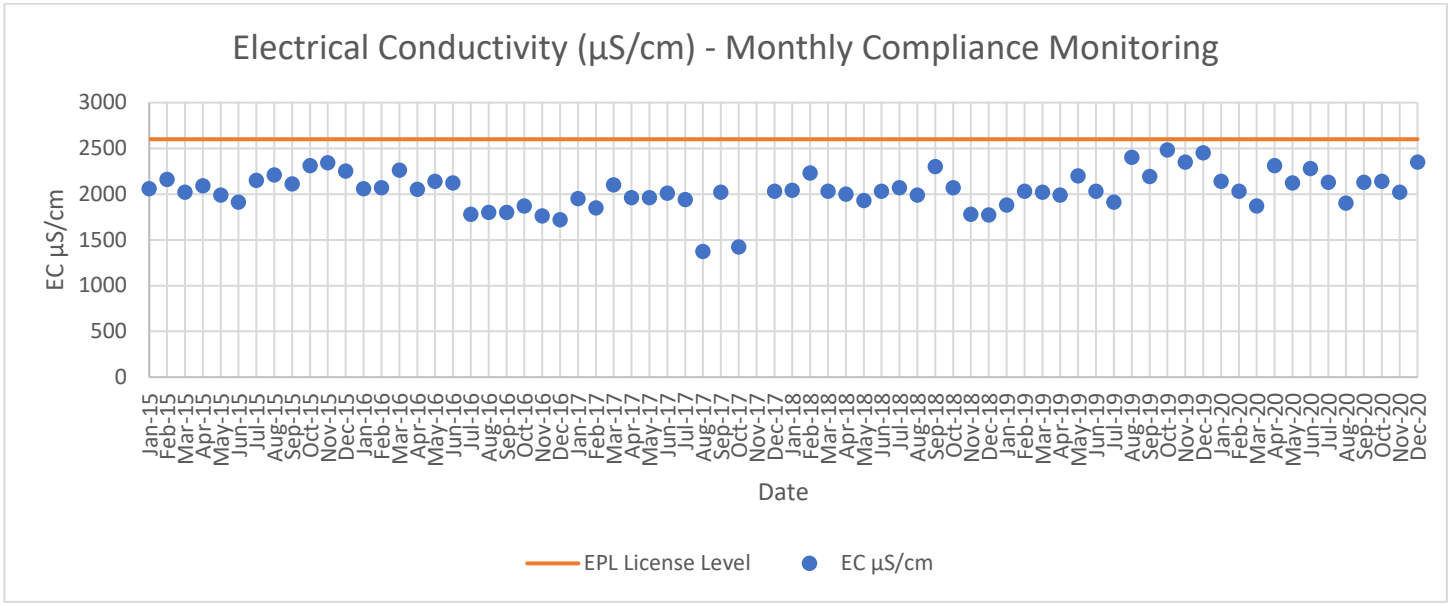


Figure 13 Monthly Compliance Monitoring of Electrical Conductivity at LDP1 from 2015-2020.

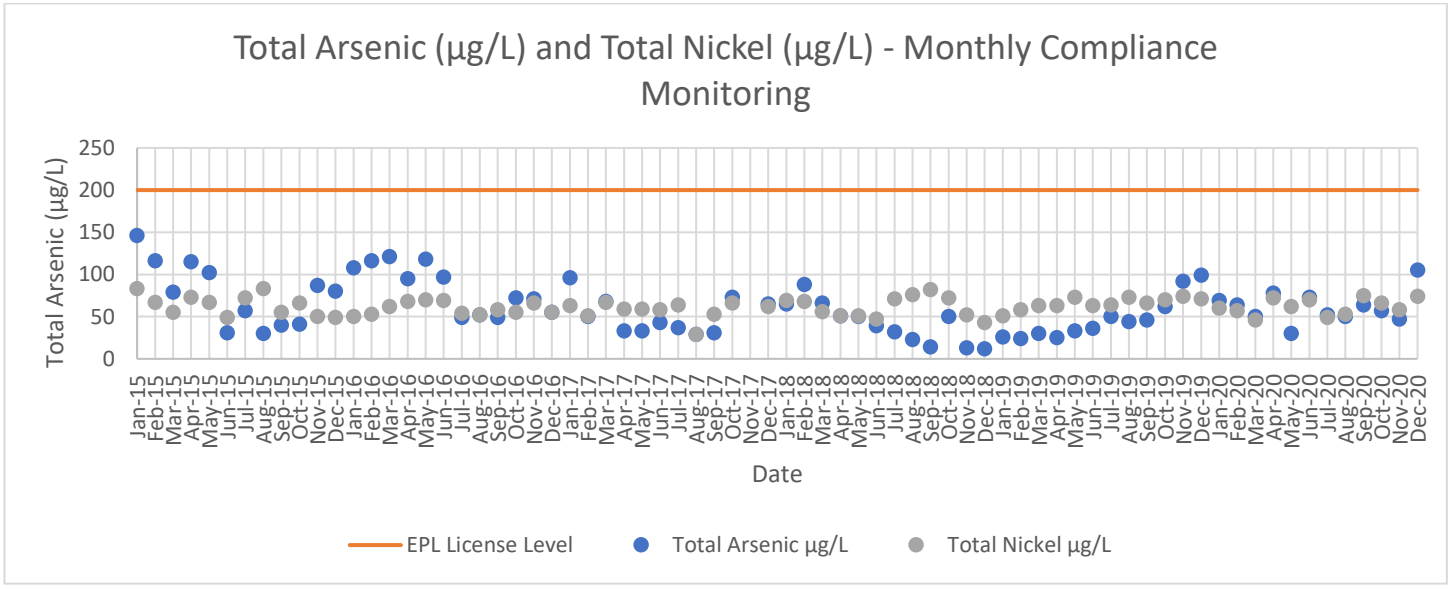


Figure 14 Monthly Compliance Monitoring of Arsenic and Nickel at LDP1 from 2015-2020.

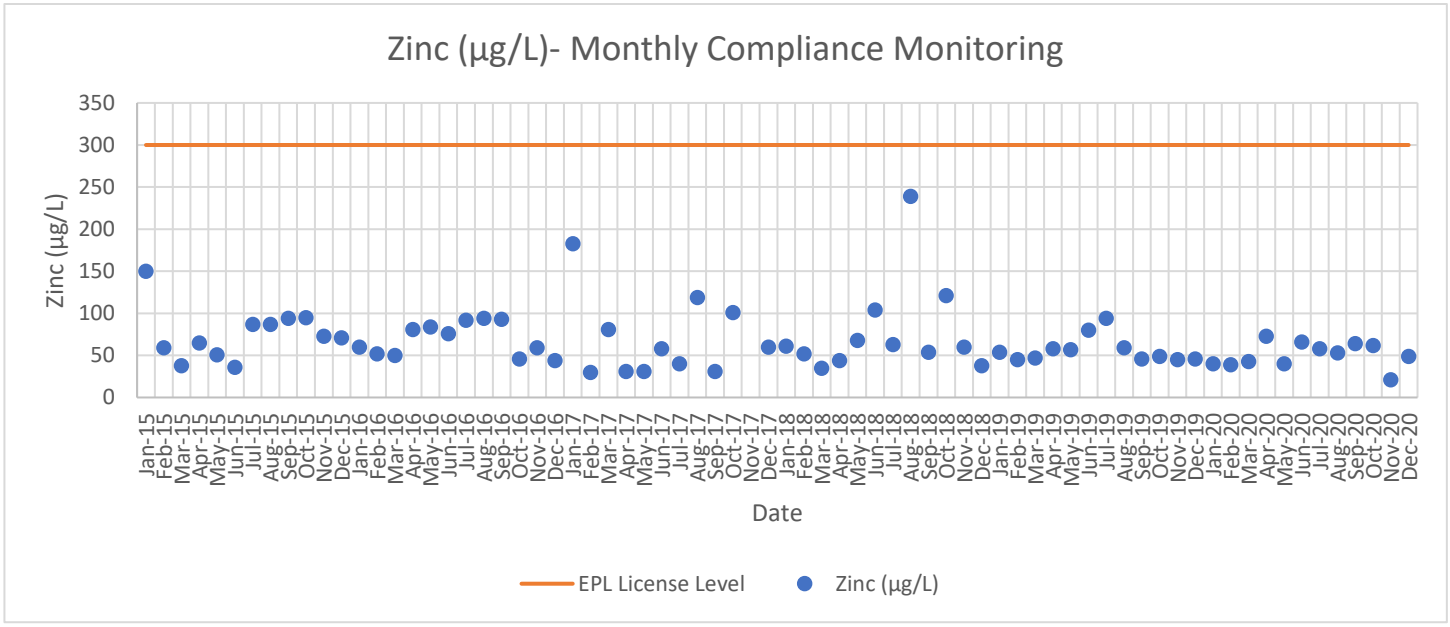


Figure 15 Monthly Compliance Monitoring of Zinc at LDP1 from 2015-2020.

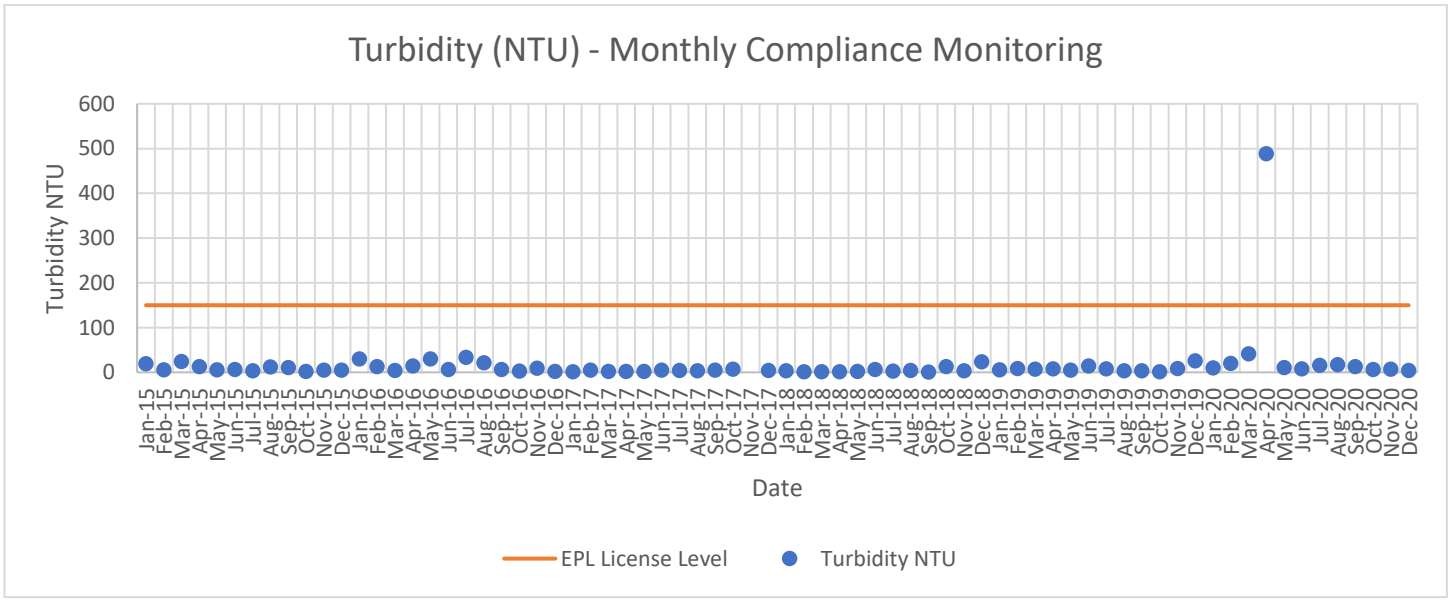


Figure 16 Monthly Compliance Monitoring of Turbidity at LDP1 from 2015-2020.

***Exceedance in April 2020 atributed to Turbid Water discharge incident**

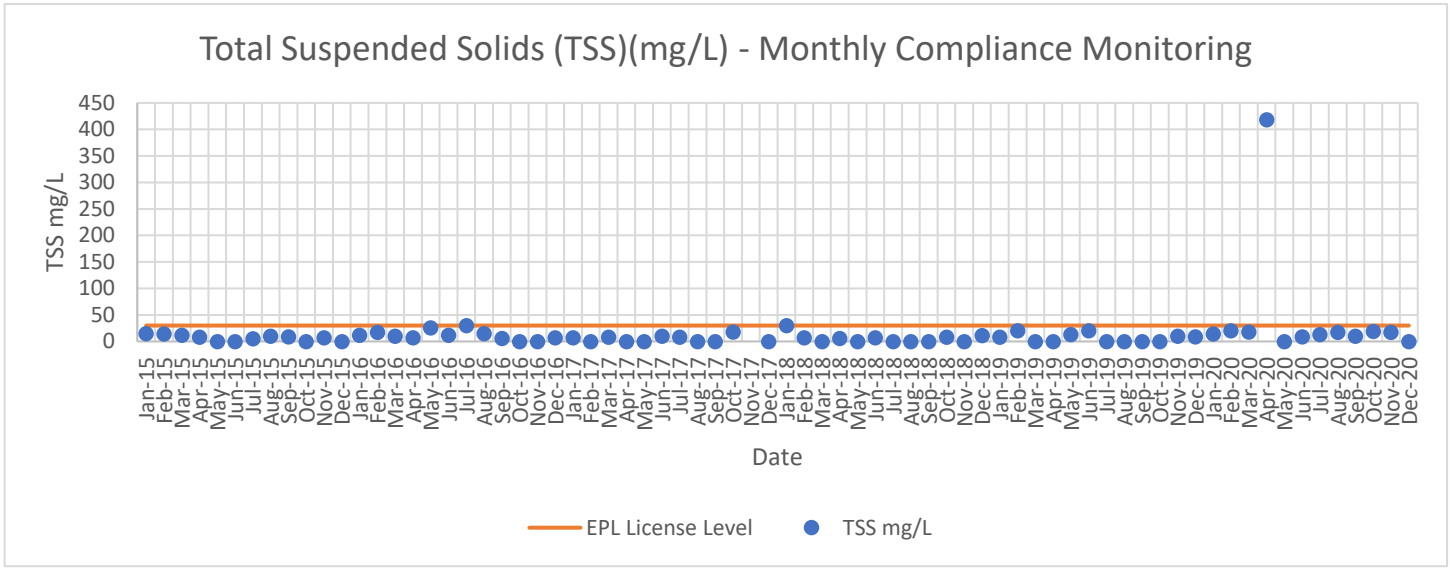


Figure 17 Monthly Compliance Monitoring of Total Suspended Solids at LDP1 from 2015-2020.

***Exceedance in April 2020 atributed to Turbid Water discharge incident**

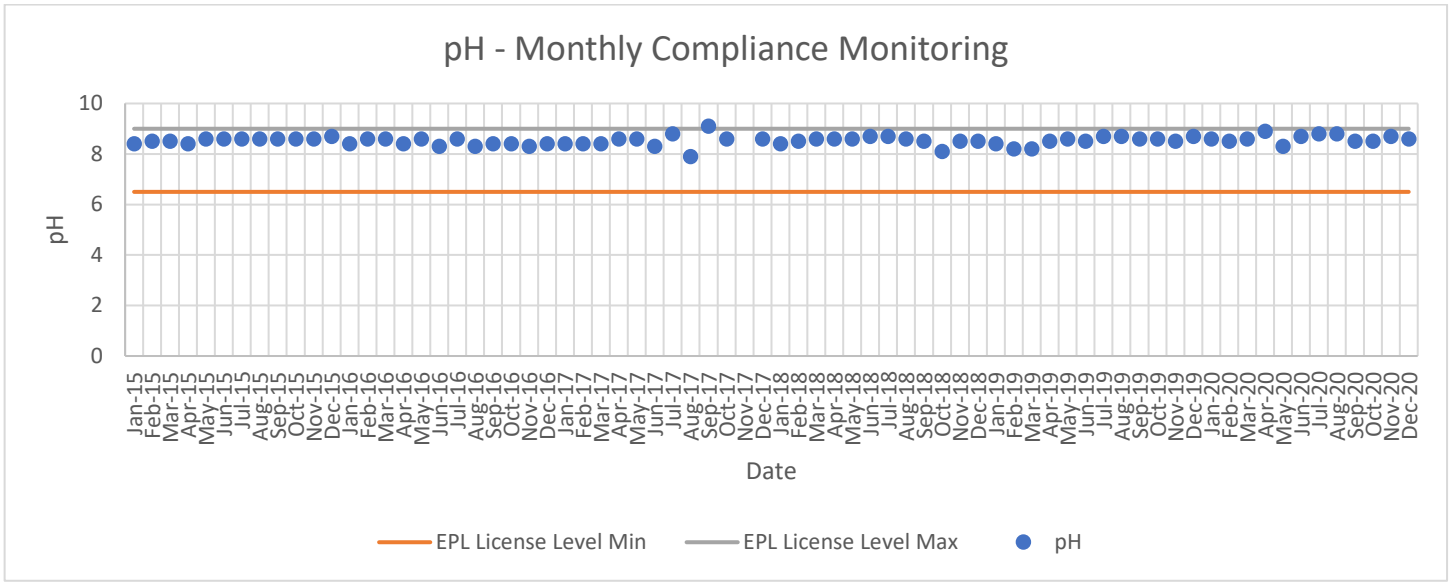


Figure 18 Monthly Compliance Monitoring of pH at LDP1 from 2015-2020.

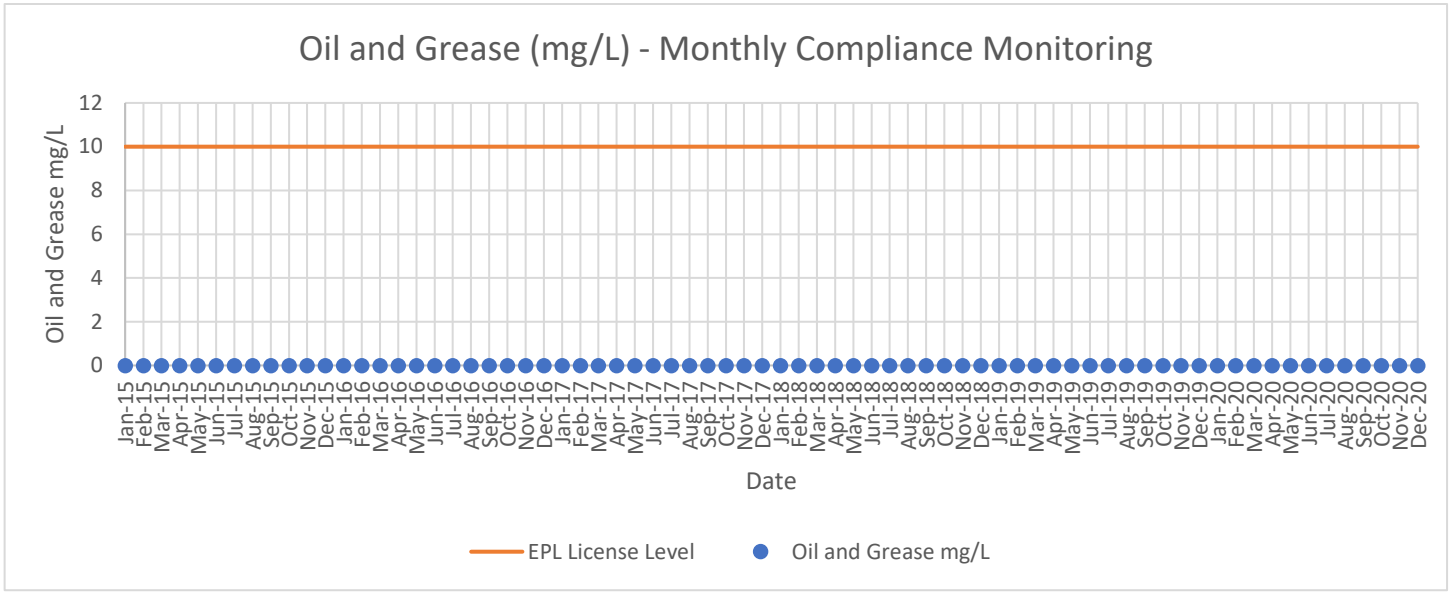


Figure 19 Monthly Compliance Monitoring of Oil and Grease at LDP1 from 2015-2020.

Note results have been consistently <5 mg/L every month.

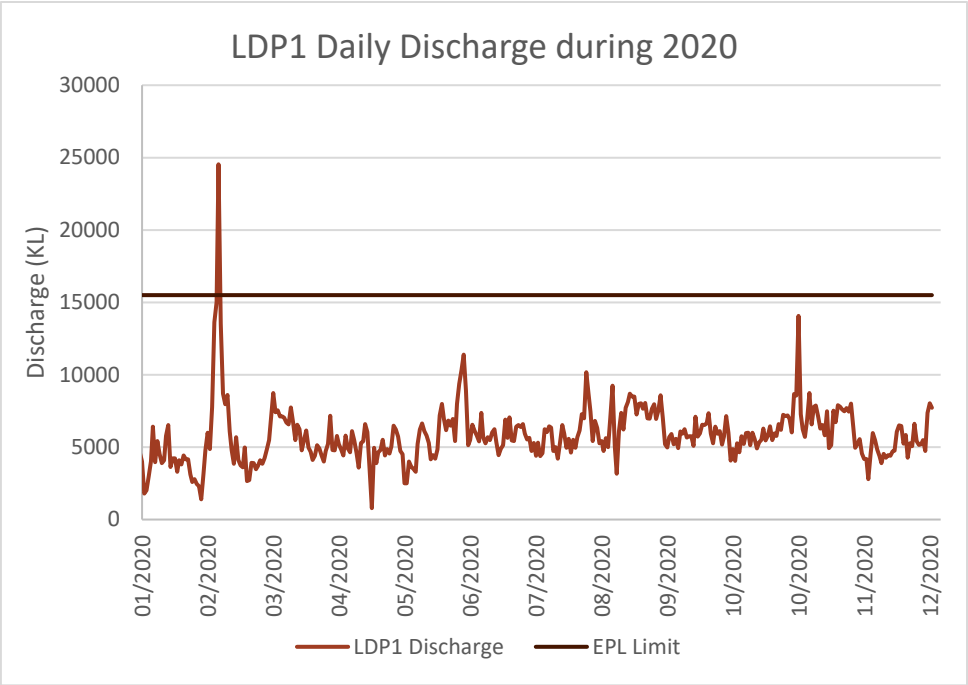
18.2.3 Environmental Management – Water Discharge

Tahmoor Coal is licensed to discharge water from one (1) licenced discharge location and overflow from three (3) LOPs during periods of wet weather (as per EPL 1389) which refers to more than 10 mm of rainfall within a 24 hour period at the premisis. The location of the LDP1 and LOPs are described in **Table 15** and shown in **Appendix 5.**

On average Tahmoor Mine discharged 5,819 kL/day with a total of 2,129,625 kL or approximately 2,130 ML discharged during the reporting period. This is shown in **Table 18-5, Figure 20** and **Figure 21.** The peak in Table 20 in February 2020 was as a result of heavy rainfall. This is in accordance as per EPL 1389 (more than 10 mm rainfall in 24 hrs, recorded from Tahmoor Coal's Pit Top weather station).

Table 18-5 Daily Discharge (KL) via Licence Discharge Point 1 (LDP1)

Day	Jan (kL)	Feb (kL)	Mar (kL)	Apr (kL)	May (kL)	Jun (kL)	Jul (kL)	Aug (kL)	Sep (kL)	Oct (kL)	Nov (kL)	Dec (kL)	EPL Daily Discharge Limit (kL)
1	5988	1405	4259	4798	5741	8912	4744	5255	4974	4862	7274	4193	15500
2	3988	3136	4847	4779	4745	5138	5286	5420	5696	4057	6234	2791	15500
3	4438	4778	5487	5783	4505	5481	4407	4735	5914	5260	5712	4490	15500
4	4638	6002	6991	5209	2505	6551	5314	5624	5209	4646	6923	5983	15500
5	4002	4870	8733	4856	2495	6129	4384	5005	5579	5761	8741	5482	15500
6	1805	7755	7410	4417	4013	5786	4573	7036	4937	5223	6572	4814	15500
7	2025	13619	7549	5800	3641	5396	6240	9236	6084	5981	7777	4371	15500
8	2979	15017	7130	4908	3501	7358	6031	5064	5937	5988	7879	3898	15500
9	4024	24536	7120	4641	3293	5674	6427	3156	6228	5135	7147	4532	15500
10	6419	13512	7042	6113	5216	5272	6350	6096	5665	5992	6288	4262	15500
11	3971	8690	6704	5465	6216	5687	4744	7360	5745	5562	6528	4452	15500
12	5430	7962	6561	4633	6645	5482	5003	6217	5754	4909	5816	4414	15500
13	4503	8607	7746	3592	6108	6018	4203	7711	5078	5339	7485	4718	15500
14	3902	6091	6698	5284	5793	6244	5324	8117	7091	5513	4939	4762	15500
15	4103	4812	5487	5406	5289	5330	6521	8697	5722	6293	5130	6053	15500
16	5781	3854	6548	6595	4164	4453	5940	8484	5949	5470	7532	6506	15500
17	6517	5691	6246	6032	4453	4890	4967	8488	6553	5772	6718	6449	15500
18	3628	4119	4770	3464	4214	5142	5569	7255	6533	6428	7906	5253	15500
19	4220	3746	5479	786.4	4837	6901	4631	7983	6639	5483	7777	5844	15500
20	4219	3608	6141	4948	7193	5639	5510	8040	7355	5950	7620	4267	15500
21	3299	4987	4979	3901	7996	7051	4948	7644	5922	5767	7478	5271	15500
22	4089	2646	4672	4645	6975	5464	5684	8053	5276	6595	7691	5067	15500
23	3799	2714	4126	4806	6169	5414	6140	6999	6408	6196	7459	6617	15500
24	4426	3925	4407	5515	6828	6424	7286	6964	5925	7240	8009	5426	15500
25	4166	3893	5135	4431	6483	6524	6984	7649	6099	7149	6390	5154	15500
26	4155	3480	4910	4867	6948	6393	10174	7954	5182	7198	4949	5192	15500
27	3111	3706	4435	4555	5414	6602	8665	6944	5727	6946	5232	5480	15500
28	2580	4091	4015	5045	7987	5925	7457	7525	7150	6025	5558	4739	15500
29	2800	3861	4732	6474	9375	5537	5427	8583	6002	8664	4548	7368	15500
30	2450	NA	5218	6221	10317	5637	6821	7014	4072	8563	4547	8031	15500
31	2313	NA	7171	NA	11397	NA	6325	5201	NA	14059	NA	7714	15500
MIN	1805	1405	4015	786.4	2495	4453	4203	3156	4072	4057	4547	2791	
MAX	6517	24536	8733	6595	11397	8912	10174	9236	7355	14059	8741	8031	
AVERAGE	3993	6383	5895	4932	5821	5948	5874	6952	5880	6259	6662	5277	



*The spike in February 2020 is attributed to a rainfall high event.

Figure 20 Daily Discharge (kL) via LDP1

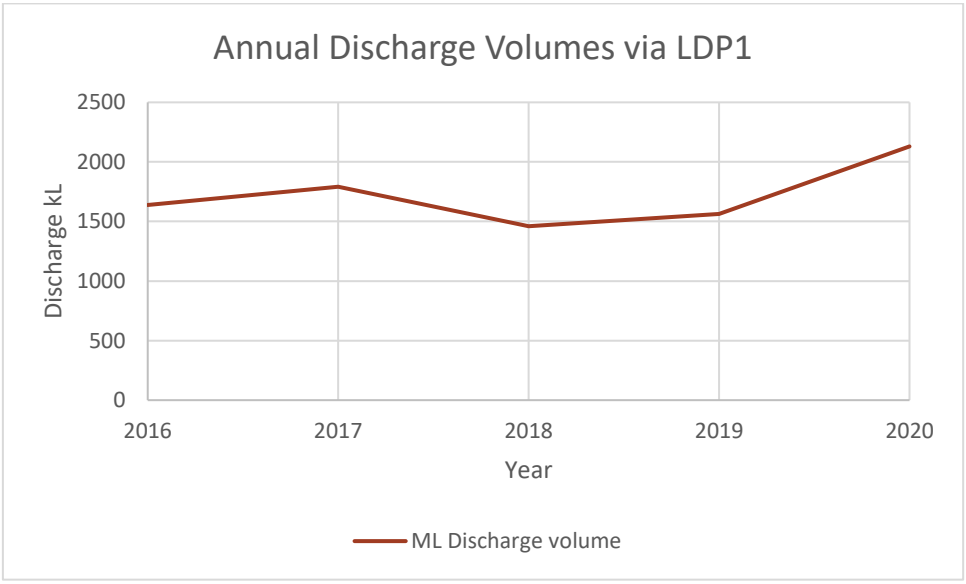


Figure 21 Volume (ML) of Discharge from LDP1

18.2.4 Further Improvements

Tahmoor Coal has demonstrated a significant reduction in historical non-compliances with EPL water conditions, with the performance improvement attributed to the implementation of water management Pollution Reduction Program (PRPs) at Tahmoor Coal from 2011 to present.

18.2.5 Potable Water Supply

Sydney potable water is utilised across Tahmoor Coal with applications in amendities across Pit Top facilities and sent underground for Longwall applications. Emphasis is placed on utilising Recycled water and seeking to reduce Sydney Water potable water use on site where possible. The average monthly potable water usage was 33 ML/month.

18.2.6 Recycled Water Treatment Plant

Tahmoor Coal continues to recycle mine water from the sealed longwall goafs to the south of the No.3 Shaft for reuse in the mine operations underground and various surface facilities. **Table 18-6** demonstrates a decrese in the use of Sydney potable water however there is a corresponding decrease in Recycled Water Treatment Plant (RWTP) use during the reporting period.

Table 18-6 Recycled and Potable Water Use

Water usageWater Usage	2015	2016	2017	2018	2019	2020
Potable Water Usage (kL)	437,440	402,840	259,668	133,389	414,115	396,435
Recycled Water Usage (kL)	261,870	308,290	200,755	388,449	291,372	186,584*
ROM tonnes	2,632,695	2,721,284	2,107,326	2,110,328	2,388,854	2,354,901
Potable Water Intensity (L/ROM tonne)	166	156	123	63	173	151

*Reduction in Recycled water usage for the reporting period is attributed to damage to the borehole which supply the plant water to underground workings.

18.2.7 Water Storage Volumes

Data regarding stored water volume is provided within **Appendix 5.**

Tahmoor Coal does not participate in any salinity trading scheme, and therefore does not report controlled discharge water in this section.

Water used or contaminated by mining activities is discharged at the approved licence discharge or overflow point. Each discharge is sampled and tested monthly in accordance with the EPL conditions.

Mine water and storm water is discharged into Tea Tree Hollow which flows into the Bargo River. Water samples from the Bargo River are also taken monthly, upstream and downstream of the confluence of Tea Tree Hollow.

The layout of the site's water management system is outlined within **Appendix 5** and **Appendix 7**.

19 Rehabilitation

A summary of the Tahmoor Mine rehabilitation is provided within **Table 19-1**. Approximately five (5) hectares of land will be prepared for rehabilitation during the next reporting period and active rehabilitation will be commenced shortly thereafter.

Table 19-1 Rehabilitation Summary

Mine Area Type	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
	2019 (ha)	**2020 (ha)**	**2021 (ha)**
A. Total mine footprint	142.5	142.5	142.5
B. Total active disturbance	74.5	74.5	78.5
C. Land being prepared for rehabilitation	0	0	5
D. Land under active rehabilitation	0	0	0
E. Completed Rehabilitation	0	0	0

Annual rehabilitation monitoring was conducted during the reporting period. Bushfires affected the area in late 2019 destroying reference sites and plots established in stages 6 and 9, however during the annual walkover 2020 evidence of epicormic growth across all sites have been noted and regrowth of grasses and forbs as groundcover have regenerated. Midstorey species were consumed by the fire however some eucalyptus seedling have been noted indicating a viable seed bank of eucalyptus in the soil. No significant changes were noted for vegetation quality, structure and diversity in the monitoring period (September 2019 to September 2020). There has been a significant dry period over the past couple of years which has affected the two lower strata.

Generally, additional characteristics and changes that were noted include:

- Adequate growth in all canopy species including juveniles and seedlings;
- Some death in all mid storey species, particularly Acacia parramattensis and Hakea sp., possibly resulting from the drought conditions experienced over the past consecutive years;
- Death of midstorey species, Acacia spp. And Allocasuarina littoralis in stages 6 and 9 which were consumed by fire;
- Weed cover was low overall, however populations have increased over the last 12 months and increased weed management is required;
- Hrowth rates overall are adequate in newly established revegetation;
- Number of target species recorded in all vegetation areas consistent with 2019 levels despite drought conditions and despite reference sites recovering from fire;
- Signs of a rabbit population observed;
- Minor gully erosion evident, however erosion control adequate with remediation on-going; and
- Herbivory of planted grasses in grass trials reducing reproductive potential of grass species.

19.1 Environmental Performance

A Rehabilitation Improvement Plan in association with a TARP included a classification status of each assessed area forming the basis for the TARP for each stage showed in **Table 19-2** and **Table 19-3**.

Table 19-2 TARP Classification

Annual Rehabilitation Status	Description	Action
VC	Generally, exceeds the good practice standards and regulatory requirements by a significant margin.	No further action. Continue to maintenance activities as scheduled.
C	Generally good practice standards and regulatory requirements subject to normal variance.	No further action. Continue to maintenance activities as scheduled.
NC1	Not complying with some regulatory requirements and improvement needed to meet required good practice standards. Required works minor in nature and generally within budgeted site program.	Undertake minor works to improve rehabilitation to minimum standard prior to next annual inspection.
NC2	Not complying with significant risk to this inspection item, urgent corrective action needed. Requirements generally substantial in nature and beyond a budgeted site program.	Undertake major works required to improve rehabilitation to minimum standard prior to next annual inspection.

Table 19-3 TARP Rehabilitation Performance

Area	Status Rating	Comments/Opportunity for improvement
Stage 1-2	C	Some minor gully erosion to be improved, continued weed control.
Stage 3-5	C	Some evidence of surface crusting in limited areas, continued weed control. Opportunity for planting with understorey species in limited areas
Stage 7	NC1	Continued weed control. Opportunity for planting with understorey species
Stage 8	NC1	Continued weed control
Stage 6 & 9	NC1	Minor erosion, sediment fence to be replaced or removed. Opportunity for planting and brush mulching with understorey species
Stage 10	C	Continued weed control
Stage 12	C	Opportunity for brush mulching to increase species diversity in understorey species
Stages 14-16	C	Continued weed control for priority and environmental weeds

Figure 22 demonstrates future rehabilitation works planned for commencement during 2021 however no rehabilitation works were completed during 2020. Current Emplacement is taking

place within the red section shown in **Figure 22** and clearance works are planned for 2021 within the orange section, for further details see **Appendix 11**.

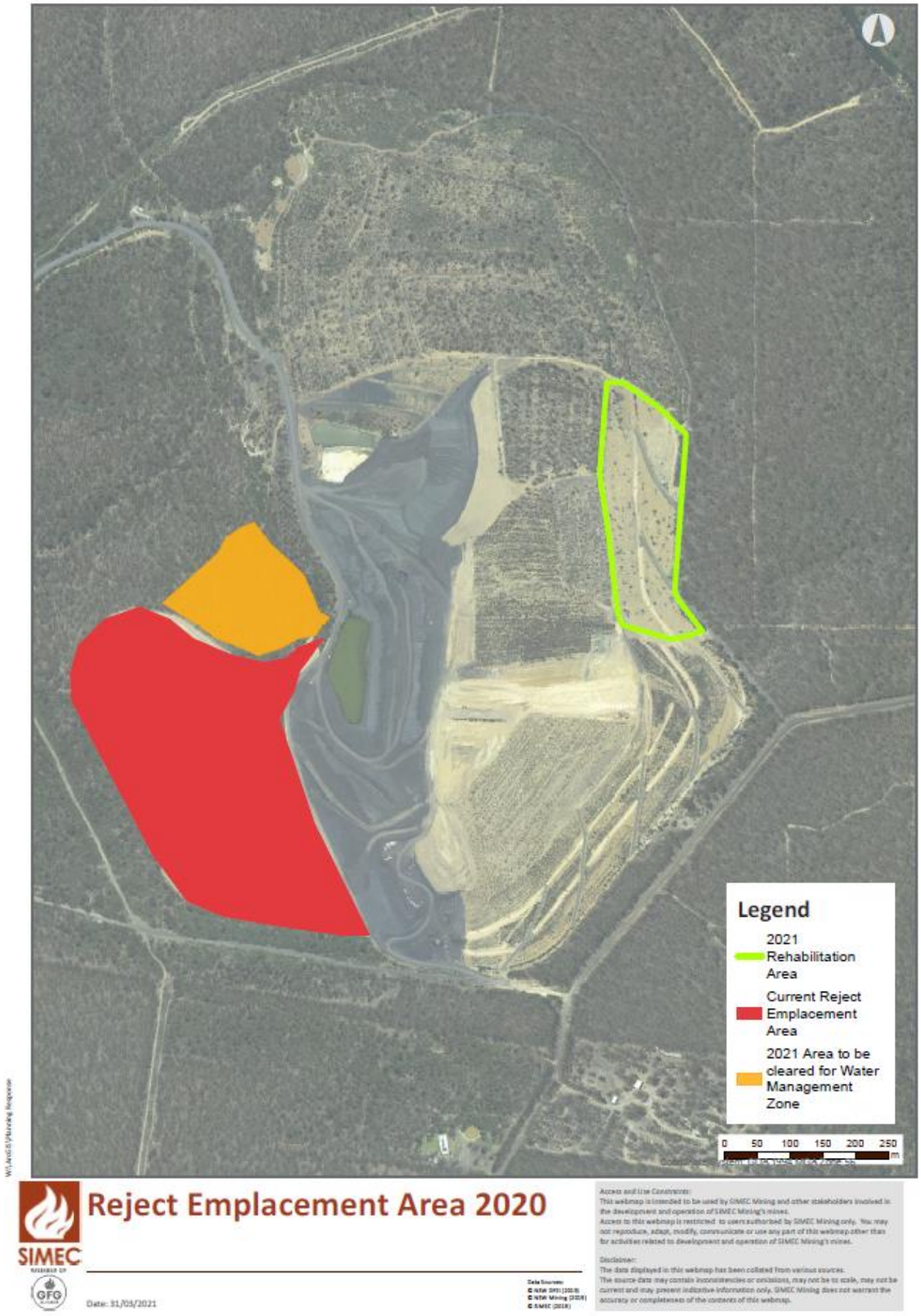


Figure 22 Reject Emplacement Area 2020 Progress and 2021 proposed works.

19.2 Mine Closure

19.2.1 Post mining Land use

There are several post mining land use options that may be applicable for the Tahmoor Mine site including residential, industrial or a return to native bushland.

The likely final land use option for most of the Tahmoor Mine closure domains will be a return to native bushland (refer to **Figure 23**). However, the final land use options will be confirmed in the detailed closure planning process, which involves undertaking a final land use analysis.

A detailed closure plan was developed as part of the Environmental Impact Statement for the Tahmoor South Project, as the Rehabilitation and Mine Closure Strategy (July 2020, SLR).

19.2.2 Rehabilitation Indicators

The REA key rehabilitation indicators include the following:

- Average depth of fill will be 12 metres;
- Maximum slope on final landform external batters will be 1:4 (generally will be 1:8);
- External batters should have gently sloping contour drains, reporting to water storage dams;
- Topsoil placement depth >300 mm;
- All final landform slopes to be contour ploughed prior to seeding or planting;
- Target <10% weeds infestation within monitoring transects;
- Target evidence of second-generation flora germination in monitoring transects (monitored annually); and
- Rehabilitation monitoring transects contain flora species and structural characteristics like the desired vegetation communities at the analogue sites (monitored annually).

The MOP outlines that soils found at Tahmoor Mine have been identified as part of the Lucas Heights Soil Landscape and occurring adjacent to the Gymea Soil Landscape. Soil limitations of the landscape include stoniness, hard setting surfaces and low soil fertility. Erosion on the landscape is generally low. Where possible, deeper soil horizons are reserved for subsoil and capping material, while the top soil horizons with the highest organic content is reserved to rehabilitation and direct seeding/planting.

A combination of sterile cover crops and grass, shrub and tree seed mixes are used at the REA to achieve the rehabilitation objective of native bushland. A species list has been developed and refined based on Tahmoor Coal 's development consents and the results of annual rehabilitation monitoring (identifying which species have proven more successful than others).

Hollow bearing trees and timber logs from clearing activities at the REA have been salvaged and stockpiled for use throughout rehabilitation areas. Logs and hollows are spread throughout

rehabilitation areas where access permits, to provide structure and encourage colonisation by fauna.

All mine closure domains (including active domains still in operational use) specific in Tahmoor Mine Conceptual Mine Closure Plan and MOP were assessed to establish an annual record of the status of each domain, including photographic monitoring to show progress and changes year to year included in the annual walkover (**Appendix 13**).

Monthly surveying is conducted in active landform areas to monitor maximum slope to conform to final landform designs.

Tahmoor Coal has five (5) identified primary closure domains based on operational function and geography. Most of these domains are connected or within close proximity of one another, and will therefore share similar final landforms and rehabilitation objectives. A schedule of these domains, with the rehabilitation status and the start and end of the MOP term, is provided in **Table 19-4** and shown in **Appendix 1.**

Table 19-4. Tahmoor Coal Closure Domains

Domain	Description	Rehabilitation Status	
		MOP Commencement	MOP Completion
1	Tahmoor Mine Main Pit Top Area	-	-
1A	CHPP	Active Area	Active Area
1B	Rail Loading Facility	Active Area	Active Area
1C	Main Workshop and Administration Area	Active Area	Active Area
1D	No.3 Shaft and Gas Drainage Plant	Active Area	Active Area
1E	Sewage/Water Treatment Plant	Active Area	Active Area
2	Product Stockpile Area	Active Area	Active Area
3	Refuse Emplacement Area	Active Area, Ecosystem Est., and Ecosystem Dev.	Active Area, Ecosystem Est., and Ecosystem Dev.
4	No.1 Ventilation Shaft	Active Area	Active Area
5	No.2 Ventilation Shaft	Active Area	Active Area
6	Off Title Subsidence Area	Active Area	Active Area

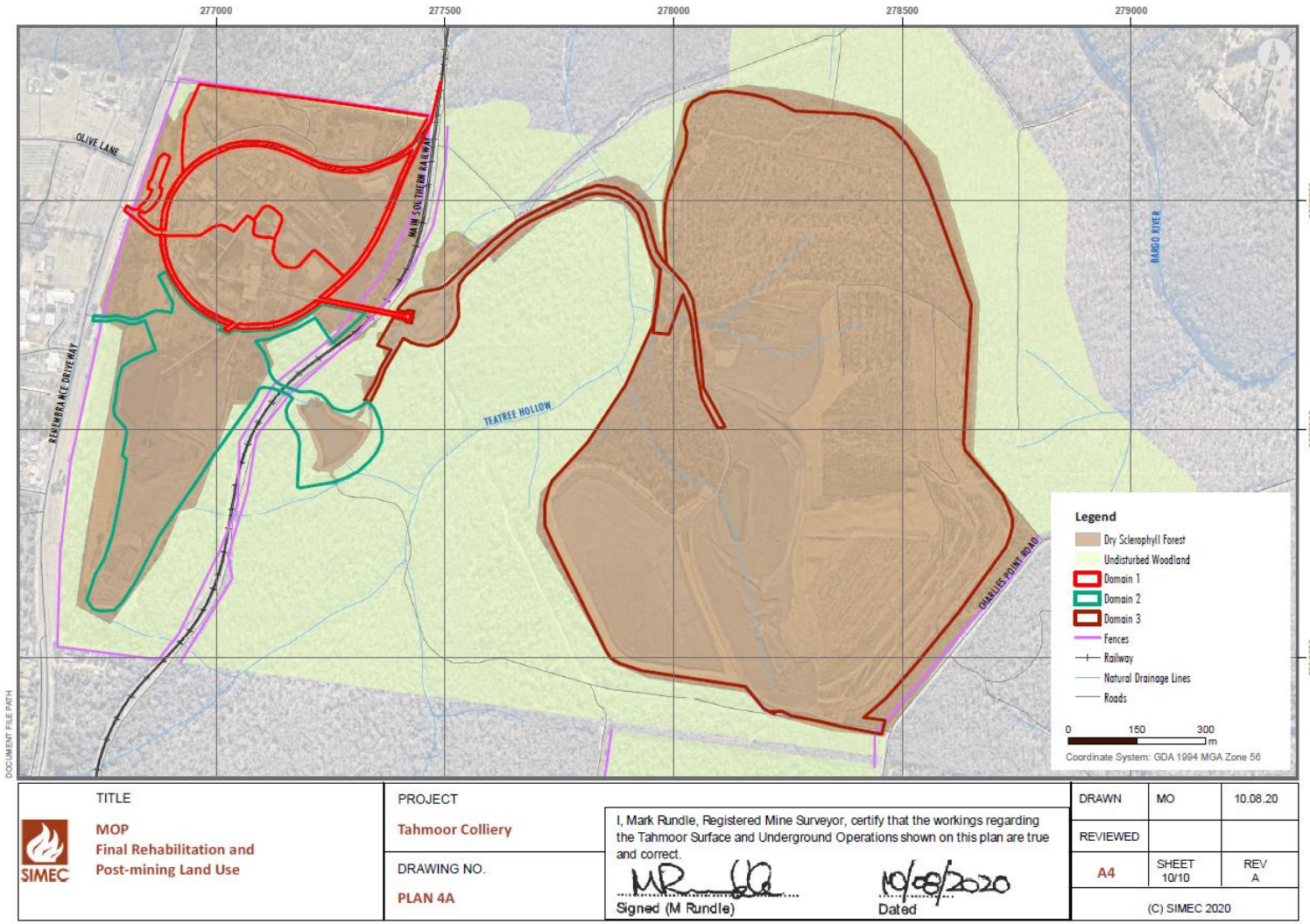


Figure 23 Final rehabilitation and post-mining land use.

20 Weeds

20.1 Environmental Management

A Weed Management Plan has been developed as part of the site Environmental Management System. The purpose of this plan is to outline management strategies and controls for noxious and environmental weeds, so that weed infestations are controlled and kept at an acceptable level on all lands owned or managed by the mine. A summary of weed species targeted during the reporting period, and control methods used, is provided in **Table 20-1.**

Table 20-1 Weed Target Species

Target Weed Species	Date of Control	Treatment Method
African Lovegrass (Eragrostis curvula)	All seasons	Herbicide (Glyphosate)
Hedge Mustard (Sisymbrium orientale)	All seasons	Herbicide (Glyphosate Dicamba)
Whiskey Grass (Andropogon virginicus)	All seasons	Herbicide (Glyphosate)
Serrated Tussock (Nassella trichotoma)	All seasons	Herbicide (Glyphosate)
Fireweed (Senecio riensis madagasca)	Winter or as detected	Hand Weeding & Herbicide (Glysophate) Late Autumn
Swan Plant (Gomphocarpus fruticosus)	All seasons	Hand Weeding
Western Australian Golden Wattle (Acacia saligna)	All seasons	Cut stump removal and herbicide application
Couch (Cynodon dactylon)	All seasons	Herbicide (Glyphosate)
Fountain Grass (Cenchrus setaceus)	All seasons	Herbicide (Glyphosate)
Catsear (Hypochaeris radicata)	All seasons	Herbicide (Glyphosate)
Narrow-leafed Cotton Bush (Gomphocarpus fruticosus)	All seasons	Herbicide (Glyphosate Dicamba)
Flaxleaf Fleabane (Conyza bonariensis)	All seasons	Herbicide (Glyphosate resistant)
Scarlet Pimpernel (Anagallis arvensis)	All seasons	Herbicide (Glyphosate Dicamba)
Veined Verbena (Verbena rigida)	All seasons	Herbicide (Glyphosate Dicamba)
Paspalum (Paspalum dilatatum)	All seasons	Herbicide (Glyphosate)
Red-flowered Mallow (Modiola caroliniana)	All seasons	Hand weeding & Herbicide (Glyphosate)
Plantain (Plantago 61eporting61)	All seasons	Herbicide (Glyphosate)

20.2 Environmental Performance

Weed management of all land owned or managed by Tahmoor Coal has continued through the reporting period. Monthly Environmental inspections across Pit Top, REA, Shaft site 1, Shaft site 2 and the Bargo shaft site continually monitor weed prevalence across these sites and target area's of concern to be controlled within the next month by Tahmoor Coal's Grounds maintenance contractors.

Continuation of the current weed control program and additional attention to weed incursion in newly vegetated areas and control of *Andropogon virginicus, Eragrostis curvula, Sisymbrium officinale, Acacia saligna*, and seedling *Leptospermum laevigatum* has been recommended and is monitored monthly.

There were no reportable incidents related to weed management during the reporting period.

20.3 Further Improvements

Tahmoor Coal will continue weed management activities monthly received associated leased and owned land, which includes monitoring of our rehabilitation areas at the REA.

20.4 Actions for the Next Reporting Period

Rehabilitation works on the eastern batter of the REA are planned to be commenced in September 2021. Rehabilitation targets for the next reporting period (1st January 2021 – 31st December 2021) are outlined in **Table 20-2**.

Table 20-2 Rehabilitation Targets

Category	Targets for 2021 (ha)				
	Q1	Q2	Q3	Q4	Total (Target)
Disturbed	0	4	0	0	4
Levelled/Re-contoured	0	0	0	0	0
Seeded	0	0	5	0	5
Established	0	0	0	0	0

A summary of maintenance activities completed and proposed for all rehabilitated land is outlined within **Table 20-3**.

Table 20-3 Rehabilitation Maintenance Activities

Nature of Treatment	Area (Ha) this 63eporting period	Area (Ha) next reporting period	Comments, Control Strategies, Treatment Detail
Additional erosion control (drains re-contouring, rock protection)	<1	<1	Routine improvements and maintenance to existing stormwater drainage system and erosion/sediment controls on disturbed areas.
Re-covering (detail – further topsoil, subsoil sealing, etc)	0	4	No rehabilitation conducted in 2020 Exterior Batters of Western section to be covered in 2021 with top soil and seeded with a prescribed grass mix.
Soil treatment (detail – fertiliser, lime, gypsum, etc)	0	5	No rehabilitation conducted in 2020 Soil treatments to be applied to the Eastern batter in 2021

Nature of Treatment	Area (Ha) this 63eporting period	Area (Ha) next reporting period	Comments, Control Strategies, Treatment Detail
Treatment management (detail – grazing, cropping, slashing, etc)	0	0	N/A
Re-seeding/planting (detail – species density, season, etc)	0	5	No rehabilitation conducted in 2020 Seeding to be conducted on the Eastern Batter in 2021
Adversely affected by weeds (detail, type and treatment)	0	0	No areas adversely affected by weeds for 2021
Feral animal control (detail – additional fencing, trapping, baiting, etc)	0	80	Feral Cats and foxes to be trapped across site as required. Some baiting of rabbits next reporting period

21 Community

21.1 Community Engagement Activities

Tahmoor Coal recognises that genuine partnerships with stakeholders and local communities are an essential part of community engagement.

Tahmoor Coal has established a good working relationship with the local community throughout its operations and seeks to continue this as new projects are established. There is a focus on providing timely and accurate information regarding its performance to its varied stakeholders.

The method of consultation used varies depending on the scale of project, stakeholder type and preferred method of communication.

The following consultation methods are commonly used to communicate and engage with stakeholders:

- Newsletters – distributed by email, website, post and printed posters displayed in various locations;
- Resident Information Packs – Distributed to residents in current and future proposed mining areas and website;
- Face to face consultation meetings, eg. Local landholders, schools, businesses and community groups;
- Website (www.tahmoorcoal.com.au) containing a variety of information and reports;
- 24-hour complaints line – phone number displayed on newsletter, website and distributed as required, eg. Face to face meetings;
- Tahmoor Coal Community Consultative Committee (TCCCC) Meetings – four (4) quarterly meetings held in 2020 (5th March, 4th June, 3th September and 3th December);
- Community Information Sessions – biannually or as required at the various locations (open to all members of the public) (20th February for Western Domain and 28th April for Tahmoor South – held online due to Covid-19 restrictions);
- End of Panel Report – distributed to TCCCC and available on Tahmoor Coal website; and
- 2020 Tri-annual Independent Environmental Audit Report – distributed to TCCCC and available on Tahmoor Coal's website.

21.2 Community Contributions

Tahmoor Coal contributes to the social and economic development of sustainable communities associated with its operations and ensures the rights of communities in which it operates are respected and supported. This achieved by:

- Identifying the communities and stakeholders associated with our operations and actively engaging with them as early as possible and throughout the life cycle of the operations to establish relationships based on mutual benefit and active participation;
- Respecting the cultural, customs, interests and rights of communities, including indigenous peoples and vulnerable or disadvantaged groups;

- Working with governments, local authorities, community representatives, inter-governmental and non-governmental organisations and other interested parties to develop and support projects that benefit the communities associated with our operations; and
- Contributing an indicative amount of $100,000 each year to fund initiatives that benefit the communities associated with our operations, particularly those located in remote areas or in regions with a lower level of social and economic development and infrastructure.

21.3 Community Investment Program

In 2020 some of the major sponsorships and donations included support for:

- Buxton Rural Fire Brigade: Two volunteer firefighters, Geoffrey Keaton and Andrew O'Dwyer, lost their lives fighting fires near Buxton on 19 December 2019. To recognise their heroic efforts in helping to save the local township, members of the community proposed that a memorial be created to commemorate their lives and to express the community's gratitude to the Keaton and O'Dwyer families. Tahmoor Coal contributed funding for the installation of an RFS Fire Truck Memorial Playground within Telopea Park.
- Wollondilly Shire Council Beach Bus: The Beach Bus is a free service travelling to the Illawarra Beaches daily during the summer months. The program primarily targets the 8000 young people in the LGA. Wollondilly is significantly transport disadvantaged and has a lack of free or affordable entertainment options for young people. The service enables young people to meet with or develop new friendships while undertaking a recreational activity that promotes healthy lifestyle and fitness. Ultimately, it connects the community throughout summer, providing them with an opportunity to socialise, exercise and unwind. Tahmoor Coal provides the financial support to allow two buses to run at no cost to participants during January 2020 with over 400 people using the bus in 2020.
- The Dementia Café: The Café is a safe and informal way for carers and people living with dementia to access support within the Wollondilly area. It is a place where people can socialise with others in a similar situation, and share their wisdom, tears and frustrations over a cup of tea or coffee.
- Our Community Pantry: OCP is a food-rescue service that diverts safe and edible food, household items, fruit, vegetables and bakery items heading to landfill. OCP provides food hampers at five outreach locations in the local area and surrounds. In 2020, Tahmoor Coal partnered with OCP for the use of Tahmoor Coal's Administration Block carpark for the Bargo food hamper collection every Friday night.

In accordance with Tahmoor Coal Community Development Plan and Community Investment Program, all community investment activities, whether financial or in-kind support, should target the following group-wide focus areas:

- Community development;
- Education;
- Health; and
- Environment.

An overview of the Tahmoor Coal community contributions during 2020 are outlined in **Table 21-1**. Due to Covid-19 restrictions, several community events and activities were cancelled or postponed.

Table 21-1 Community Contributions in 2020

Category	Contributions in 2020
Community Received	$44,500
Health	$4000
Environment	$0
Education	$720
Total	**$49,220**

21.4 Community Complaints

During the reporting period a total of 9 Community Complaints were received, which was well within the annual target of less than 20 community complaints. As outlined in **Figure 24** and **Table 21-2**, there has been a significant reduction in community complaints since 2010, with stable complaints for 2019 and 2020 with 9 received for each year. The types of complaints received for the reporting period include four (4) noise related to which 2 were from the same resident, three (3) vibration related to which 2 were from the same resident, one (1) bushfire hazard/Tree fallen and one (1) water related complaint.

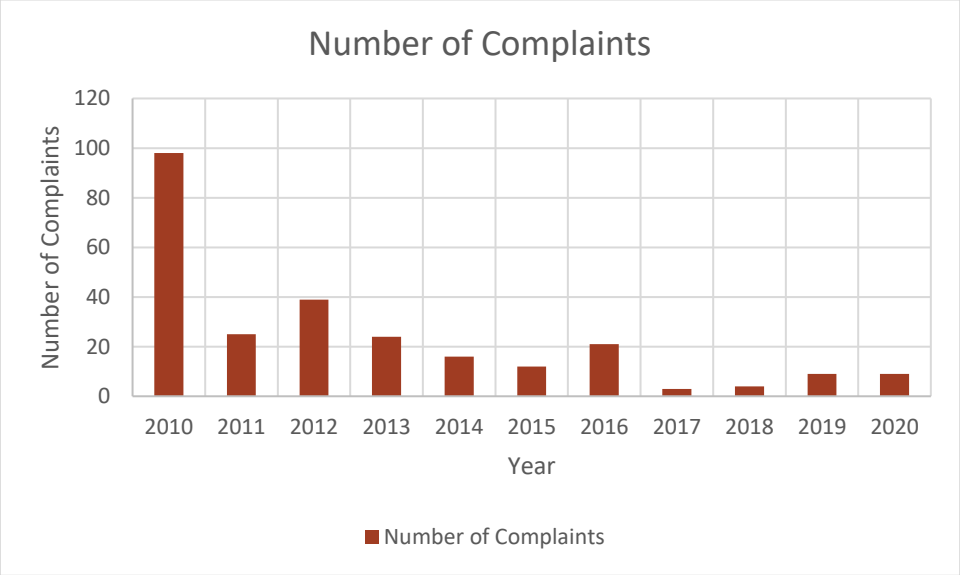


Figure 24 Community Complaint Statistics

Table 21-2 Complaint Details

Date	Type	Complaint Details
7th April, 4th August and 28th September 2020	Noise	Noise Complaint regarding Train noise (arrival and departure), Pit Top and REA operations disturbing during the evening. Numerous meetings with landowner to better understand concerns. Specialist Noise Consultant undertook noise assessment and advised results were within Development Consent conditions, advised DPIE and EPA. Developed noise monitoring program and approved by DPIE. Noise monitoring program currently being progressed.
13th April and 6th August 2020	Vibration	Complaint regarding Vibrations felt within house near Western Domain mining area. Investigated Noise/Vibration specialist and not attributed to mining activities.
8th May 2020	Noise (drilling)	Complaint received in reference to drilling noise in the early morning. Investigated and not related to mining related activities.
29th June 2020	Bushfire hazard/Fallen Tree	Complaint in regards to a fallen Tree across a fire trail road on Bargo property. Reported to RFS who then removed the tree.
4th August 2020	Vibration	Vibrations felt on aluminium windows of home causing rattling of windows during evening and early hours of morning around the rear of the house. Investigated and modifications to windows implemented with agreement of landowner.
22nd December 2020	Water	Complaint related to Mine water discharge quality and aesthetics. Investigated and not related to mining activities, reported to EPA.

22 Incidents, Notifications and Non-Compliances during the Reporting Period

Tahmoor Coal received one (1) non-compliance in regards to turbid Water discharged through our LDP1 which occurred on the 17th April 2020.

A summary of all environmental incidents which occurred during the reporting period is outlined within **Table 22-1** below.

In total there were ten (10) incidents, with seven (7) related to subsidence, and three (3) related to water management.

Table 22-1 **2020 Incidents, notifications and non-compliances**

Date	Classification	Type	Location	Details	Action/s taken
16/04/2020	Cat 0	Subsidence event notification	Main Southern Rail at Embankment 88.400km	Tension crack reported at Rail embankment 88.400km.	- Geotechnical Inspection by Newcastle Geotech (completed 17/04 and advice of no immediate concerns) -Map location of crack (20/04/20) to record any changes in crack dimensions. - Maintain weekly survey and inspections. -Convene a meeting of Embankment Subcommittee to determine any additional actions (17/04/2020).
04/2020	Cat 2	Water Management	LDP1 – Pit Top	Release of Turbid waters via LDP1	Immediate mitigation measures undertaken including water stopped from being pumped out,
05/2020	Cat 1	Water Management	Upstream of LDP1 – Pit Top	Creek section upstream of LDP1 was cleaned out without Environmental controls put in place.	
18/09/2020	Cat 0	Subsidence event notification	4 Booyong Close Picton	Two compression humps developed the property. This	Land owner was notified immediately. Building Inspecterinspected damage.

			between Pegs B2 and B3	resulted in noticeable impacts to external rear cobblestone paving. Impacts to the house were localised to exterior corner of house. Pre-existing cracks have widened and new cracks have formed. No impacts observed inside the house.	An SRG meeting was held to assess latest ground survey results and consider additional management measures going forward. Trip hazards repaired, increased visual monitoring to once a week, Structural Engineer inspection conducted, data assessed on a weekly basis, continued consultation with landowner and Resourses Regulator informed.
13/10/2020	Cat 0	Subsidence event notification	21 Stonequarry Creek Road, Picton located between Pegs S26 to S28	Ceiling in the main bathroom has deflected down and has formed a large bow due to a building defect where adhesive glue has given way from ceiling sheet install.	Building Inspector reported to Tahmoor Coal immediately. Structural Engineer Inspection completed. Bthroom ceiling repaired, increased visual inpections to once a week, commence weekly survey peg monitoring around house, survey data and findings reviewed weekly by SRG, continued consultation with landowners and Resourses Regulator and SA NSW informed.
10/2020	Cat 1	Water Management	LDP1 – Pit Top	Clean out sediment accumulation at LDP1 caused turbid waters higher than anticipated during the planning process but within EPL limits	Immediate stoppage of works was implemented by Environmental Department.
3/11/2020	Cat 0	Subsidence event notification	Road surface of 5 Carramar Close, Picton between Pegs C5 and C9	Cracking had developed in two locations in the road outside the property located at 5 Carramar Close Picton. This resulted in noticeable impacts to the bitumen surface along the roadway.	Tahmoor Coal immediately arranged for an inspection to be conducted. Road surface repaired. Increased visual monitoring, full street survey conducted including additional survey across the road to determine closure weekly, Gas inspection conducted. Notified Endevour Energy and Telstra. Data and survey assessed weekly. Continued consultation with residents. Resourses Regulator, SA NSW, Wollondilly Shire Council and stakeholders informed.

24/11/2020	Cat 0	Subsidence event notification	6 Booyong Close, Picton located between Pegs B3 to B5	Pier movement and cut slippage under the house has occurred at the property.	Tahmoor Coal immediately arranged for an inspection to be conducted. SRG meeting conducted. Temporary support structure installed, Inspection by a Structural Engineer conducted, House survey conducted, Completed repairs, weekly visual monitoring conducted, Weekly review of data and survey by SRG, consultation with landowner and notification sent to Resourses Regulator and SA NSW.
25/11/2020	Cat 0	Subsidence event notification	Carramar Close, Picton at Peg C9 – between property numbers 7 and 9	Water leak developed at the very end of Carramar Close between Nos. 7 and 9.	Sydney Water notified immediately. Sydney Water conducted repair work. Tahmoor Coal notified residents of repair work. SMEC conducted full street survey including additional survey across the road to determine closure weekly. Data assessed weekly. Consultation with residents. Resourses Regulator, SA NSW and relevant stakeholders informed.

22/12/2020	Cat 0	Subsidence event notification	Piezometers P12 (intake P12C), P13 (intake P13C), P16 (intakes P16B and P16C), and TNC36 (intakes at 65, 97 and 169 metres below ground level)	Level 4 TARP trigger – Depressurisation of groundwater aquifers has exceeded a two metre reduction below the lowest pre-mining level for a period of greater than six months in P12C, P13C, P16B and P16C. These reductions in water level were determined not to be controlled by climatic or anthropogenic factors. Level 4 TARP trigger – Depressurisation of groundwater aquifers has exceeded a five metre reduction below the lowest pre-mining level for a period of greater than six months at TNC36 (65, 97 and 169 metres below ground level intakes). These reductions in water level were determined not to be controlled by climatic or anthropogenic factors.	As per the relevant Groundwater TARPs, the following actions will be completed: Continue monitoring and review as per the current monitoring program. Discuss the groundwater monitoring results at the next monthly ERG meeting (scheduled for 19th January 2021). Completion of groundwater investigation to determine if the observed depressurisation results are within the modelled parameters. Tahmoor Coal will report the findings of this investigation to DPIE when available. Tahmoor Coal propose to revise the relevant groundwater TARPs to include any impacts on shallower aquifers or the surface water system so as to provide a more holistic assessment of impact. Any revised TARPs will be submitted to DPIE for approval.

23 Activities to be Completed during the Next Reporting Period (1st January 2021 – 31st December 2021)

The following activities are aimed to improve the environment and/or community performance of Tahmoor Coal and are planned to be completed during the next reporting period:

- Progress Myrtle Creek and Redbank Creek CMAP;
- Complete installation and testing of Pilot Water Treatment Plant for processing discharge water;
- Submit initial Aquatic Health Monitoring Program for the Bargo River as directed in EPL 1389;
- Complete a Sedimentation Investigation in Tea Tree Hollow Creek and Bargo river as directed in EPL 1389;
- Continue required studies for the Tahmoor South Project;
- Continue community engagement for Tahmoor South Project; and
- Undertake studies required to support Extraction Plan for LW W3-W4.

24 Related Documents

Related Documents directly related to or references from this document are provided below in **Table 24-1**.

Table 24-1 Related Documents

Document Title	Document Number
Air Quality and Greenhouse Gas Management Plan	TAH-HSEC-00170
Conceptual Closure Plan	TAH-HSEC-00121
Noise Management Plan	TAH-HSEC-00150
Soil and Water Managemnt Plan	TAH-HSEC-00016
Longwall West 1 and West 2 (LW W1-W2) Extraction Plan	TAH-HSEC-00248
Mining Operations Plan (MOP) 2020-2024	20079

25 Abbreviations

Abbreviations used in this document are provided below in **Table 25-1**.

Table 25-1 Abbreviations

Abbreviation	Definition
ACM	Asbestos containing materials
AEMR	Annual Environmental Management Report
APZ	Asset Protection Zones
ASTs	Above ground storage tanks
AUSRIVAS	Australian River Assessment System
BC Act	*Biodiversity Conservation Act 2016*
BMP	Bushfire Management Plan
CCL	Consolidated Coal Lease
CHPP	Coal Handling Preparation Plant
CMAP	Corrective Management Action Plan
DA	Development Application
DPIE	Department of Planning, Industry and Environment
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environmental Protection Licence
ERG	Tahmoor Coal Environmental Response Group
GHG	Greenhouse gas
GIS	Global Information System
IPC	Independent Planning Commission
km	Kilometre
KL	Kilolitres
LDP1	Licenced Discharge Point 1
LMZ	Land Management Zones
LOP	Licenced Overflow Point
LW	Longwall
LW W1	Longwall West 1
LW W1-W2	Longwall West 1 and West 2
LW W2	Longwall West 2
LW W3	Longwall West 3
m	Metres
ML	Mining Lease
MOP	Mining Operation Plan

Abbreviation	Definition
NGERS	National Greenhouse and Energy Reporting
NSW	New South Wales
ODS	Ozone depleting substances
OSP	Open Stand Pipe
PCBs	Polycholorinated Biphenyls
PIRMP	Pollution Incident Response Management Plan
PM10	Particulate Matter smaller than 10 micrometres
PRP	Pollution Reduction Program
QA	Quality assurance
RAPs	Registered Aboriginal Parties
REA	Reject Emplacement Area
RFS	Rural Fire Service
RWTP	Recycled Water Treatment Plant
Resources Regulator	Department of Regional NSW – Resources Regulator
ROM	Run of Mine
SFZ	Strategic Fire Zones
SLR	SLR Consulting Australia Pty Ltd
SMF	Syntheci Mineral Fibre
TSS	Total Suspended Solids
Tahmoor Coal	Tahmoor Coal Pty Ltd
Tahmoor Mine	Tahmoor Coal Mine
TARP	Trigger Action Response Plan
TCCCC	Tahmoor Coal Community Conultative Committee
USTs	Underground storage tanks
VWP	Vibrating Wire Piezometer
WMP	Water Management Plan
WWTP	Waste Water Treatment Plant

26 Appendices

Table 26-1 Appendix Details

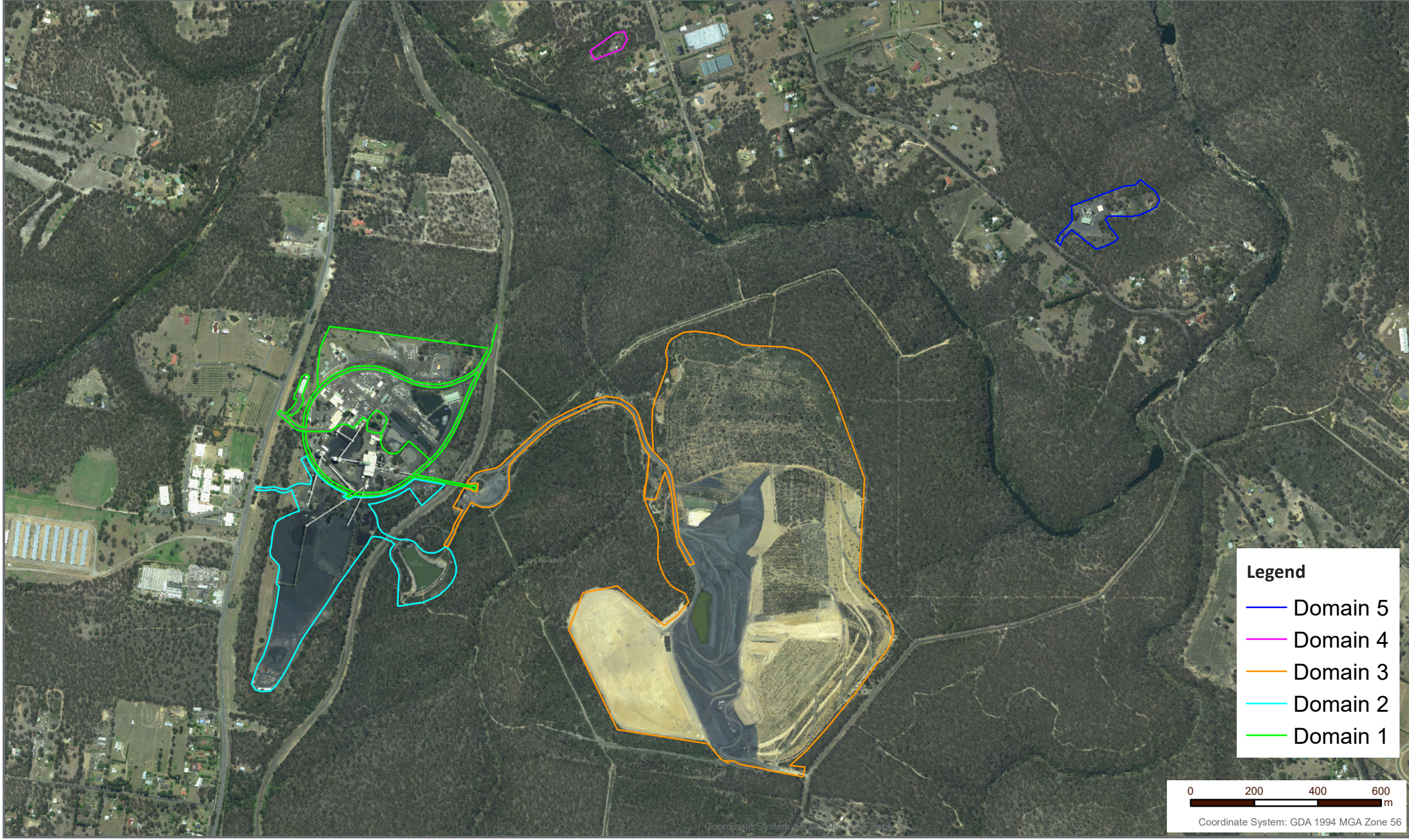
Appendix Number	Details
Appendix 1	Closure Domains
Appendix 2	Noise Monitoring Locations
Appendix 3	Noise Monitoring Results
Appendix 4	Biodiversity Survey – Threatened Flora
Appendix 5	Licence Discharge and Overflow Points
Appendix 6	Dam Water Volumes
Appendix 7	Surface Water Management Schematic
Appendix 8	Groundwater Monitoring Locations
Appendix 9	Air Quality Monitoring Points
Appendix 10	Rehabilitation Monitoring
Appendix 11	MOP Rehabilitation
Appendix 12	Mining Progress Figure
Appendix 13	Annual Rehabilitation Monitoring Report
Appendix 14	Six Monthly Subsidence Report 1
Appendix 15	Six Monthly Subsidence Report 2
Appendix 16	Groundwater Monitoring results for LW W1 (excerpt from LW W3-W4 Groundwater Technical report) Draft
Appendix 17	Groundwater Pit Top Borehole Data 2020

SIMEC

MEMBER OF GFG ALLIANCE

APPENDIX 1

simecgfg.com



Closure Domains

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Closure Domains

Date: 30/03/2020

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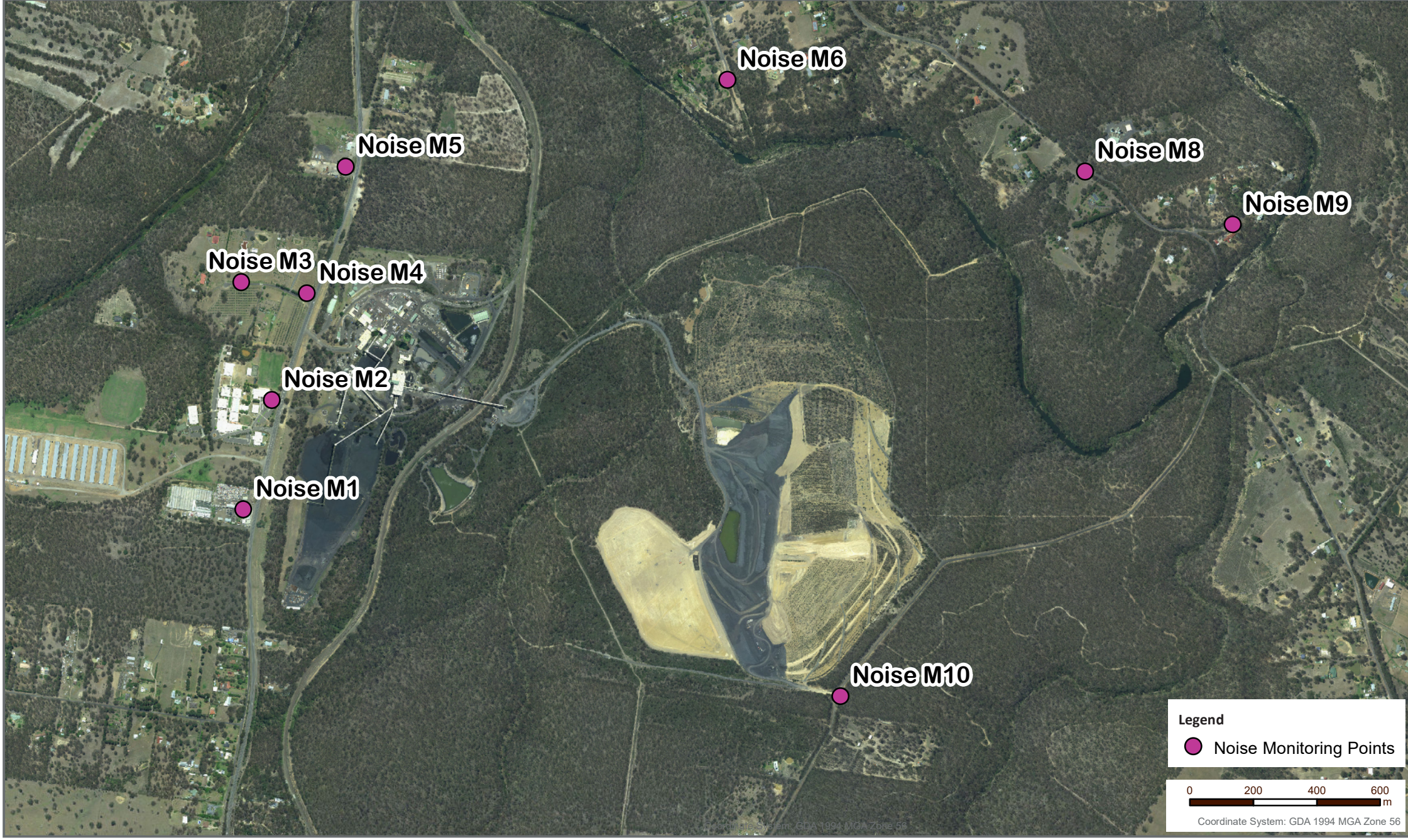
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Noise Monitoring Locations

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Noise Monitoring

Date: 30/03/2020

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Year	Site	Assessment Goal L10	Estimated contribution Q1 (L10)	Estimated contribution Q2 (L10)	Estimated contribution Q3 (L10)	Estimated contribution Q4 (L10)	Description	Residential Property
2014			<45/6	<48	<48	<48		
2015			<52	<50	<46	54/5		
2016			<50	<50	<55	<45	Remembrance Driveway (Service Station)	No
2017	M1		53/4	50/1	54/5	53/4		
2018			48/9	50/1	<45	<45		
2019			<49	<52	<56	<45		
2020			<48	<46	<46	<44		
2014			46/7	47	<60	47		
2015			<53	<54	<47	55/6		
2016			<50	<50	<50	<46	Remembrance Driveway (School Entrance Road)	No
2017	M2		53/4	55/7	56/7	53/3		
2018			48/9	50/1	<45	<46		
2019			<53	<56	<56	<48		
2020			<48	<46	<48	<45		
2014			<44	<47	<45	<42		
2015			<48**	<47	<42	44/5		
2016			44/5	<40	<45	<45*		
2017	M3	45	<45**	<47**	<47	<45*	Olive Lane (End of Cul-de-sac)	Yes
2018			<47***	<47**	<44	<47***		
2019			<46***	<47***	<42**	<44		
2020			<46***	<44**	<46**	<45**		
2014			<45	<49	<47	<45		
2015			<48	<53	<47	47/8		
2016			<45	<40	<45	<46	Olive Lane/Remembrance Driveway Intersection	No
2017	M4		<48	<50	<50	<50		
2018			<45	<50	<50	<48		
2019			<50	<46	<46	<50		
2020			<48	<47	<47	<46		
2014			<40	<40	<47	<40		
2015			<40	<46	<42	<42		
2016			<40	<40	<45	<45*	Remembrance Driveway (Service Station)	Yes
2017	M5	45	<45**	<45**	<45	<40		
2018			<35	<35	<45	<40		
2019			<43**	<45**	<40**	<40		
2020			<44**	<45**	<35	<40		
2014			<35 (<35)	<43 (<35)	<38 (<35)	<30		
2015			<30	40/1 (-)	40/1 (-)	39/40 (-)		
2016			<35 (<35)	<50	<55	<45		
2017	M6	45 (37)	<40** (<35)	<40** (<35)	<40 (<35)	<40 (<35)	Stratford Road	Yes
2018			<35	<37	<40	<40**		
2019			<35**	<37**	<39**	<39		
2020			<35	<39	<35	<40		
2014			<35	<35	<35	<30		
2015			<30	35/6(-)	<35	<30 (-)		
2016			<30 (-)	<30 (-)	<30 (-)	<35*(-)		
2017	M7	45 (37)	<35**(<35)	<35**(<35)	<35**(<35)	<35**(<35)	Hodgson Grove (End of Cul-de-sac)	Yes
2018			<35	<35	<35	<35		
2019			<35	<35	<35	<35		
2020			<35	<35	<35	<35		
2014			<35	<35	<35	<32		
2015			<33	32/3(-)	<34	<35 (-)		
2016			<33 (-)	<30 (-)	<30 (-)	<40* (<35)		
2017	M8	45 (37)	<35**(<35)	<35**(<35)	<37**(<35)	<37**(<35)	Rockford Road	Yes
2018			<35	<35	<35	<40		
2019			<35	<35	<35	<35		
2020			<35	<35	<35	<37**		
2014			<35	<35	<35	<30		
2015			<30	<30 (-)	<30 (-)	<30 (-)		
2016			<30 (-)	<30 (-)	<30 (-)	<35* (<35)		
2017	M9	45 (37)	<35* (<35)	<35* (<35)	<35* (<35)	<35* (<35)	Kammer Place (End of Cul-de-sac)	Yes
2018			<35	<35	<35	<35		
2019			<35	<35	<35	<35		
2020			<35	<35	<35	<35		
2014			<35 (<35)	<36 (<35)	<32 (<35)	<30		
2015			<30	<30	<6	<35		
2016			<30	<35	<35	<35		
2017	M10		<45	<45	<35	<35	Charlies Point Road	No
2018			<35	<35	<35	<35		
2019			<35	<35	<35	<35		
2020			<35	<35	<30	<30		

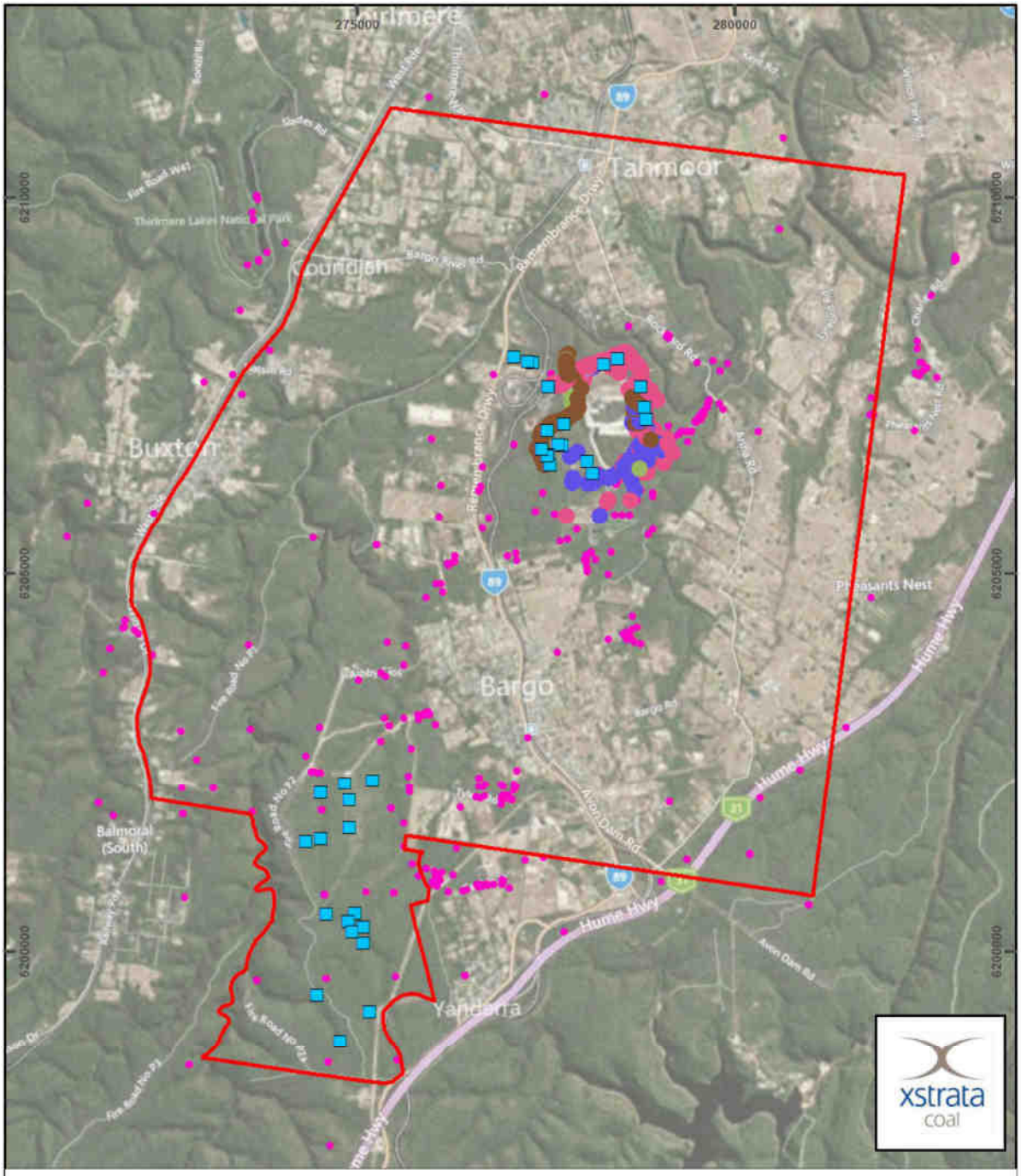
NOTES: # Ambient noise controlled by insects (2-5kHz)
* Includes DECC INP +2dB(A) allowance (INP Section 11.1.3)
** Includes +2dB correction for low frequency noise (NPfl Table C.1)
*** Includes +5dB correction for low frequency noise (NPfl Table C.1)
() Noise Assessment Goal for REA

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CCL747 - CCL716 Lease Area

BioBanking Plots

Threatened flora located during field survey

Epacris purpurascens var. purpurascens

Grevillea parviflora ssp. parviflora

Persoonia bargoensis

Persoonia glaucescens

Pomaderris brunnea

Previously recorded threatened fauna (8 March 2013)

Tahmoor Coal Survey - Threatened Flora

Drawn by: RJ

Project Mgr: NW

Date: 8/03/2013

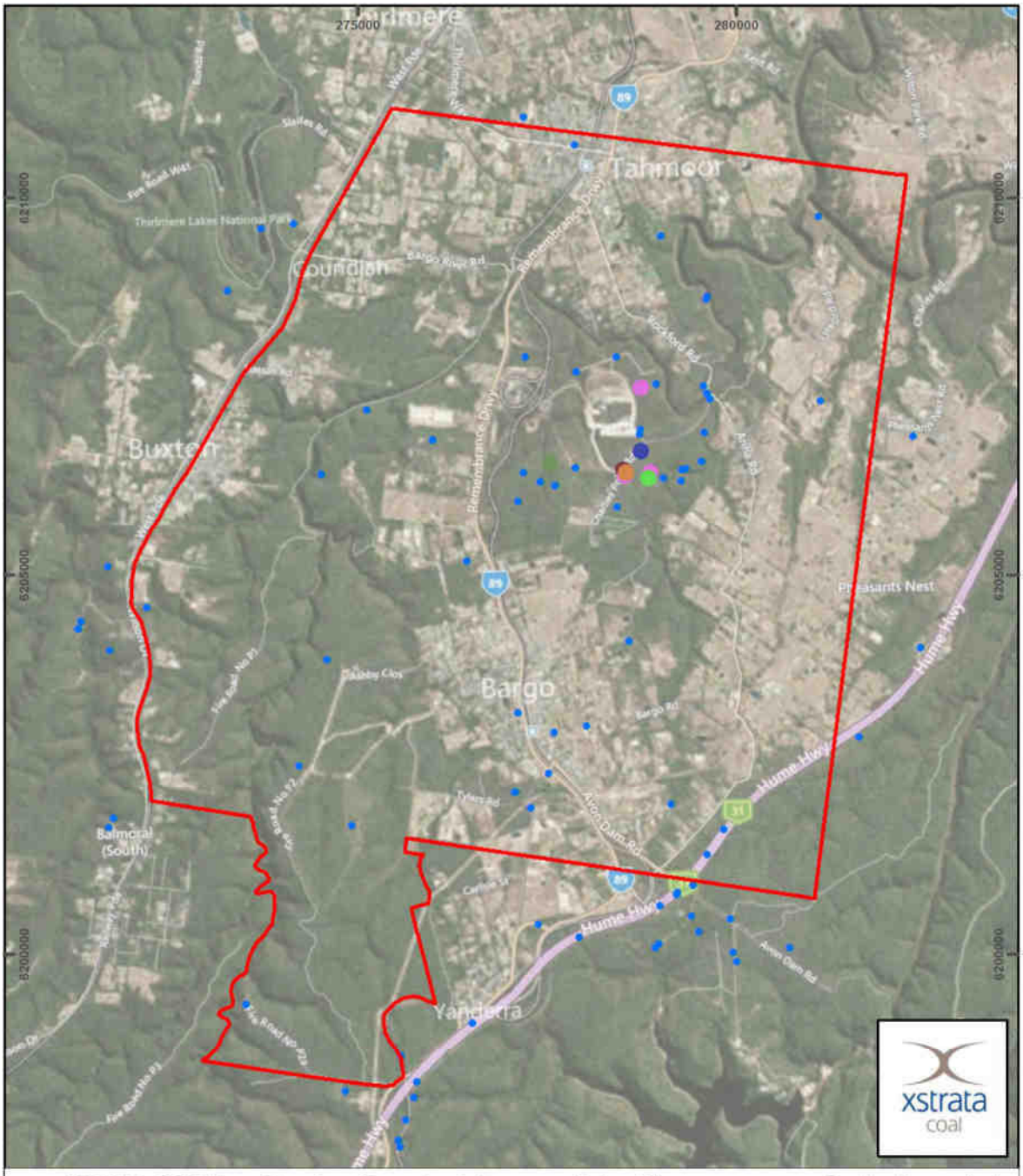
N W E S

km 0 1 2

Imagery: (c) 2010 Microsoft and its data suppliers

Horizontal Datum: GDA 1994 MGA Zone 56

niche Environment and Heritage



CCL747 - CCL716 Lease Area

Threatened fauna located during field survey

- East Coast Freetail Bat
- Eastern Bent-wing Bat
- Eastern Cave Bat
- Eastern False Pipistrelle
- Large-footed Myotis
- Little Eagle
- Powerful Owl

Previously recorded threatened fauna (8 March 2013)

Tahmoor Coal Survey - Threatened Fauna

Drawn by: RJ

Project Mgr: NW

Date: 8/03/2013

N W E S

km 0 1 2

Imagery: (c) 2010 Microsoft and its data suppliers

Horizontal Datum: GDA 1994 MGA Zone 56

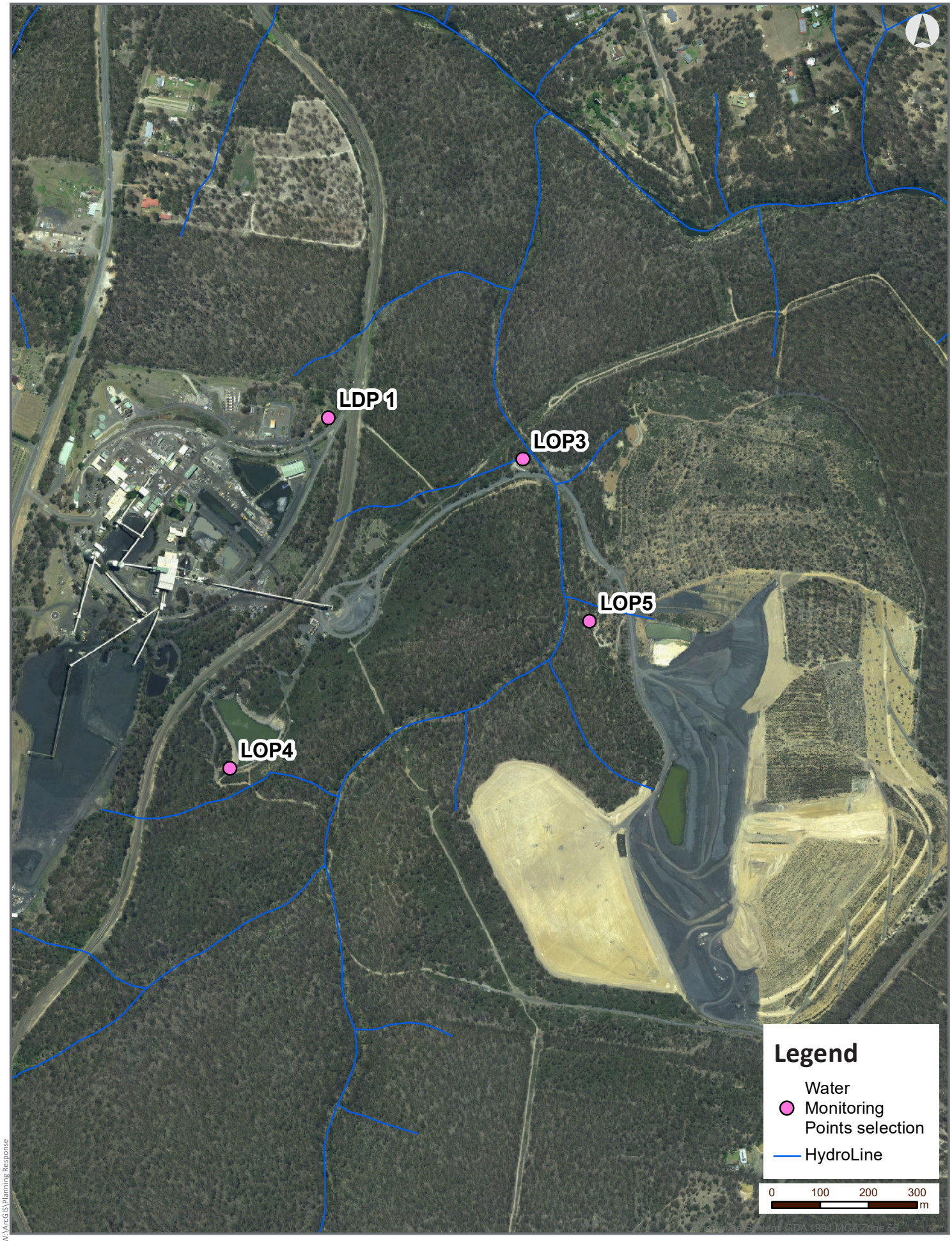
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W:\ArcGIS\Planning Response

Tahmoor Coal
Licence Discharge Point and Licenced Overflow Points

Date: 15/03/2021

Data Sources:
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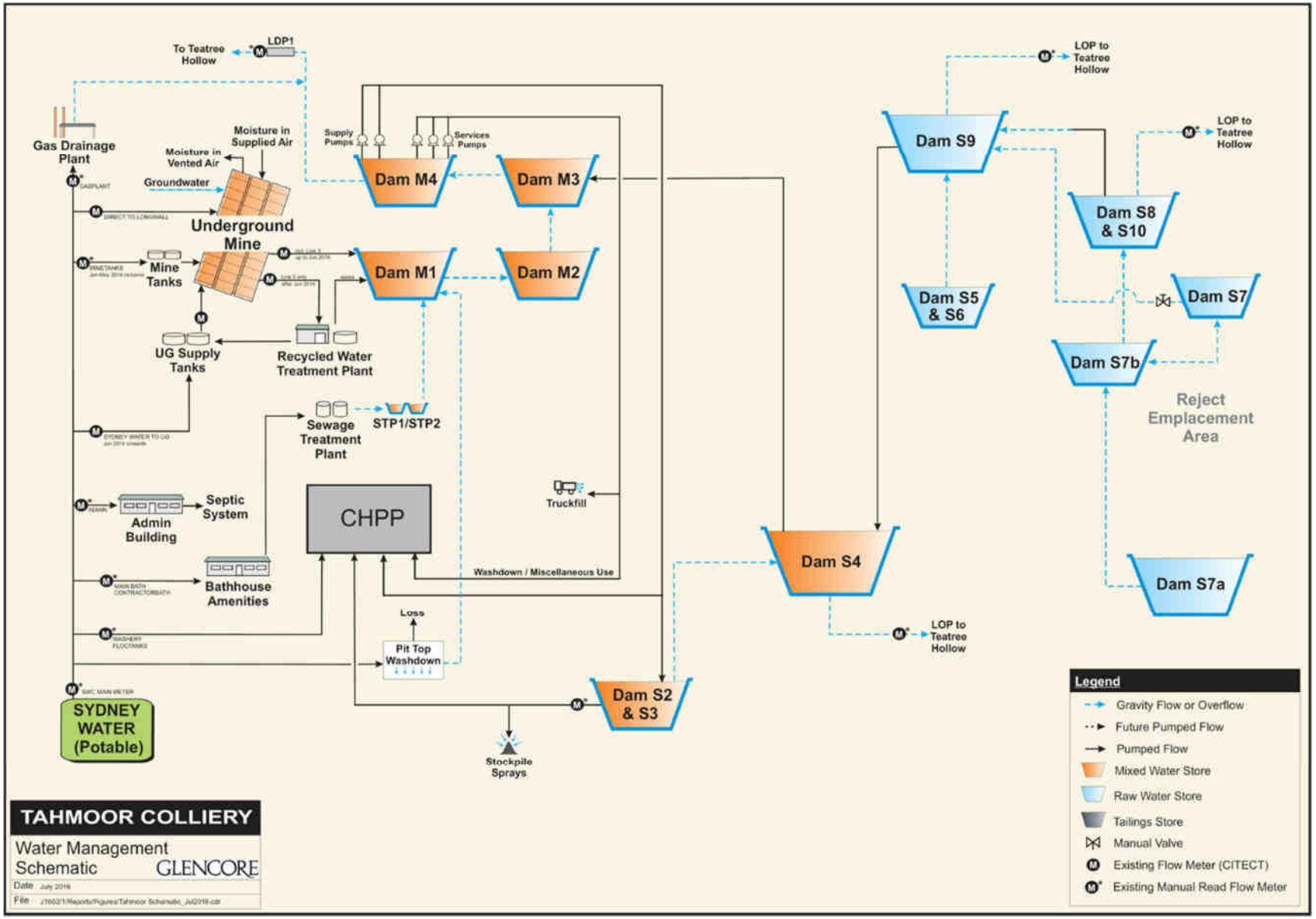
Estimated Water Volume				
Water Storage Name	**Beginning 2020**	**End 2020**	**Capacity**	**Comments**
M1	1.8ML	1.8ML	1.8ML	M series Dams act together to treat mine water pumped from Underground and stormwater, discharged via LDP1
M2	0.5ML	0.5ML	0.5ML	
M3	9.0ML	9.0ML	9.0ML	
M4	8.0ML	8.0ML	8.0ML	
M5	1.0ML	0.5ML	3.0ML	First settling Dam for No.2 Shaft Site area (stormwater)
M6	0.5ML	2ML	4.5ML	Second settling Dam for No.2 Shaft Site area (stormwater)
S1	0ML	0ML	14.5ML	The coking coal stockpile acts as a retention basin during major storms. Discharges to S2 Dam. Stockpile Dams are kept full and are used to supply water used for Dust suppression. Discharges to S4 Dam.
S2/S3	8.3ML	8.3ML	8.3ML	
S4	5ML	4ML	36.9ML	The Dam is designed to act as a retention basin with a controlled outlet. Discharges via overflow Point 4.
S5	0.01ML	0.1ML	0.5ML	Silt Trap only. Discharges to S6
S6	0.5ML	0.5ML	1.5ML	This Dam is designed to act as a retention basin with a controlled outlet.
S7	7ML	10ML	41.5ML	This is the main catchment for runoff from the REA. The dam is a retention basin during peak rainfall events. All water is pumped into Dam S4 via S9.
S7a	12ML	10ML	12.0ML	These Dams are designed to act as retention basins with a controlled outlet to S7 Dam.
S7b	0.5ML	0.5ML	1.0ML	
S8	0.1ML	0.3ML	4.5ML	Dam retains overflow from S7b. Pumps to Dam S9. Discharges via LOP5.
S9	0.15ML	0.15ML	0.4ML	Silt trap only for sealed Haul road. Wet werll pumps to Dam S4. Discharges via LOP3.
STP1	590KL	590KL	590KL	Treated effluent overflows to M1 Dam.
STP2	590KL	590KL	590KL	
Tank No.1	250KL	250KL	250KL	Underground potable water supply
Tank No.2	250KL	250KL	250KL	Underground potable water supply

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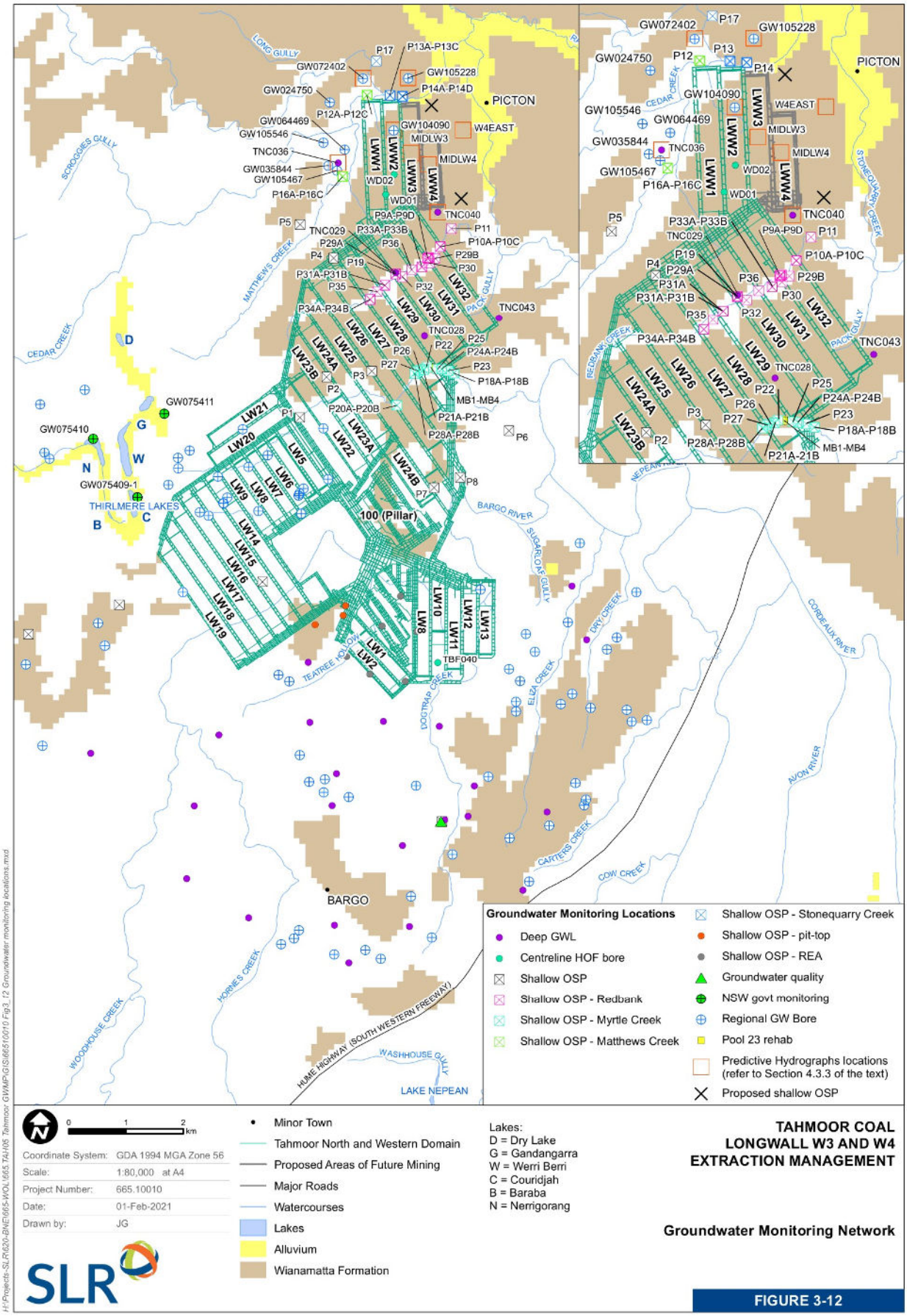

To Teatree Hollow
LDP1
Gas Drainage Plant
Moisture in Vented Air
Moisture in Supplied Air
Groundwater
Underground Mine
Supply Pumps
Services Pumps
Dam M4
Dam M3
Dam M1
Dam M2
Mine Tanks
UG Supply Tanks
Recycled Water Treatment Plant
Sewage Treatment Plant
STP1/STP2
CHPP
Truckfill
Admin Building
Septic System
Bathhouse Amenities
Washdown / Miscellaneous Use
Loss
Pit Top Washdown
SYDNEY WATER (Potable)
Stockpile Sprays
Dam S2 & S3
Dam S4
LOP to Teatree Hollow
Dam S9
Dam S8 & S10
Dam S5 & S6
Dam S7
Dam S7b
Dam S7a
Reject Emplacement Area
TAHMOOR COLLIERY
Water Management Schematic
GLENCORE
Date July 2016
File J:\6023\1\Reports\Figures\Tahmoor Schematic_Jul2016.cdr
Legend
Gravity Flow or Overflow
Future Pumped Flow
Pumped Flow
Mixed Water Store
Raw Water Store
Tailings Store
Manual Valve
Existing Flow Meter (CITECT)
Existing Manual Read Flow Meter

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TAHMOOR COAL LONGWALL W3 AND W4 EXTRACTION MANAGEMENT

Groundwater Monitoring Network

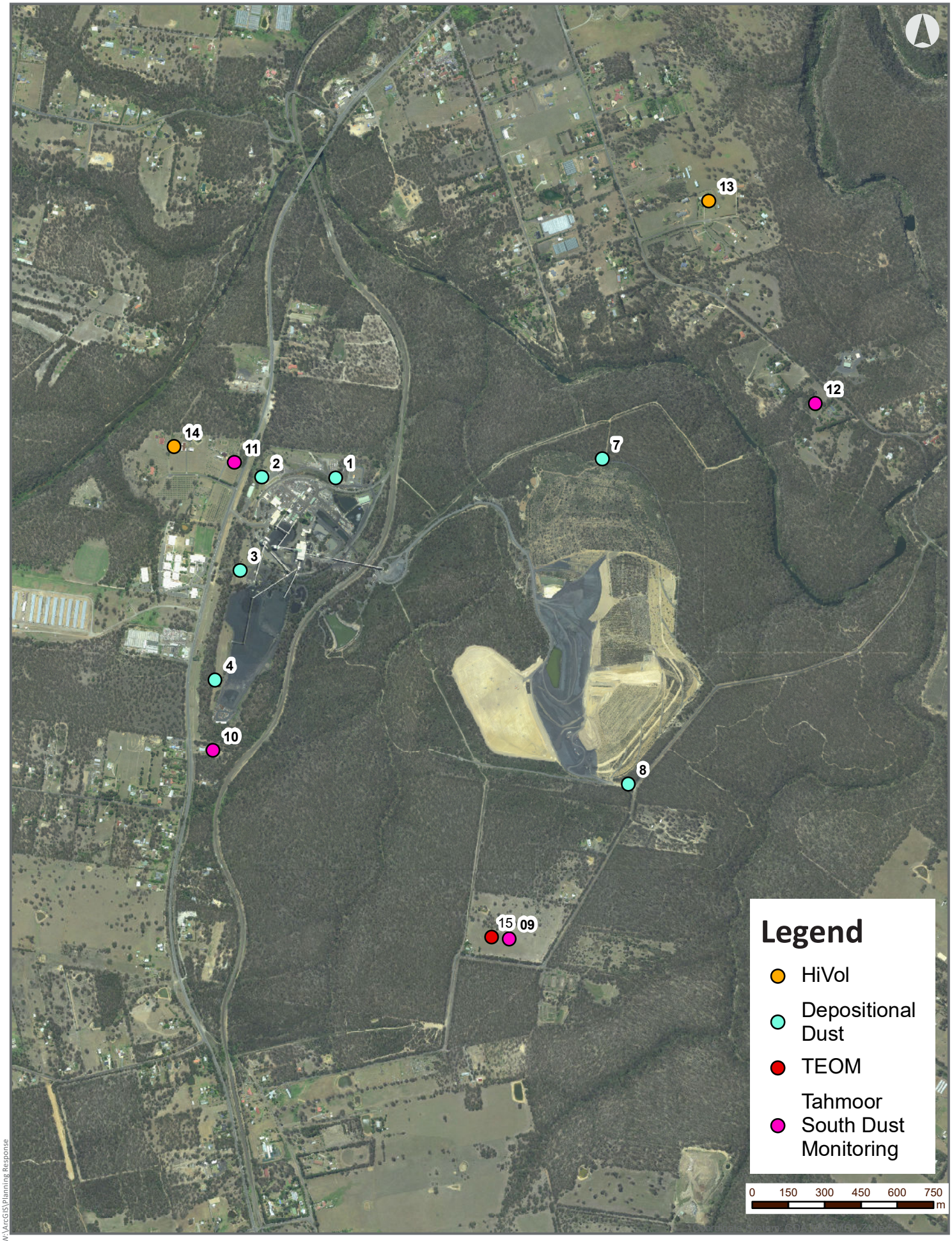
FIGURE 3-12

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W:\ArcGIS\Planning Response

Tahmoor Mine

Dust Monitoring Points

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Monitoring Plots



Legend

- Refuse Emplacement Area
- Stage Boundaries
- Permanent Monitoring Plots

0 50 100 200
Metres

Datum/Projection:
GDA 1994 MGA Zone 56

N

ecological AUSTRALIA
www.ecosus.com.au

Prepared by: EB Date: 18/12/2017

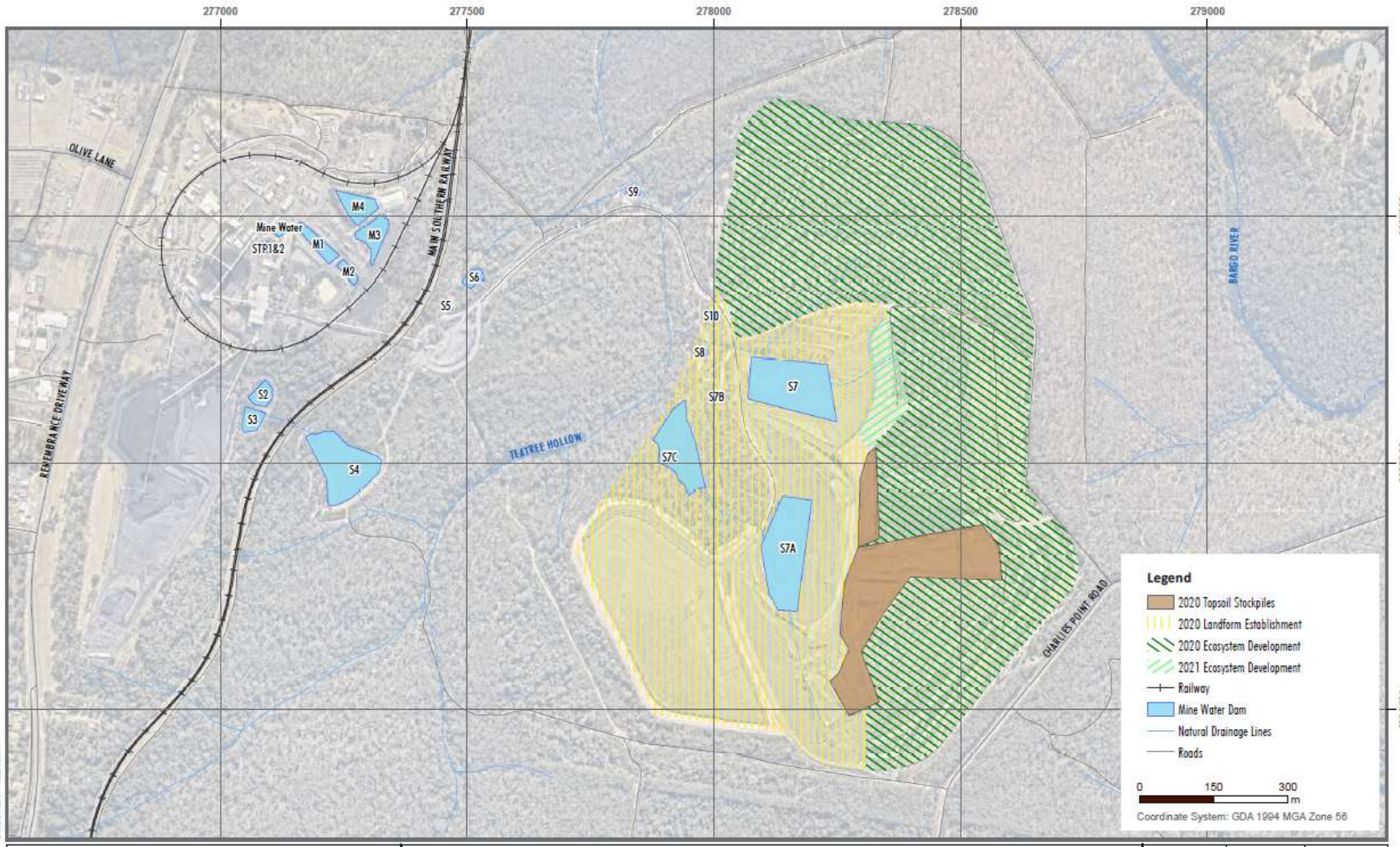

Features
CO1
A1
A3
1
2
A2
B2
4
B3
5
B1
3
6
D1
D2
7
G1
G2
9
G1
G2
8
10
I1
I2
12b
F1
F2
12a
14 & 16
14
H1
H2
16
CO2
Legend
Refuse Emplacement Area
Stage Boundaries
Monitoring Plots
Features
Acacia saligna
Nassella neesiana
Eragrostis curvula
Eragrostis curvula large patch
Minor gully erosion
Sisymbrium officinale
Sisymbrium officinale & Cenchrus setaceus
Waste
0 55 110 220
Metres
Datum/Projection
GDA 1994 MGA Zone 56
nearmap
Imagery: 05/09/2020
N
Prepared by: JK
Date: 8/12/2020

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DOCUMENT FILE PATH

TITLE **MOP** **Mining and Rehabilitation** **Year 1 - 2020**	PROJECT **Tahmoor Colliery** DRAWING NO. **PLAN 3A**	I, Mark Rundle, Registered Mine Surveyor, certify that the workings regarding the Tahmoor Surface and Underground Operations shown on this plan are true and correct. Signed (M Rundle) Dated 10/08/2020	DRAWN	MO	12.08.20
			REVIEWED		
			A4	SHEET 8/10	REV A
			(C) SIMEC 2020		

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LONGWALL WEST 1

LONGWALL WEST 2

LONGWALL WEST 3

LONGWALL WEST 4

TGW2

MGW2

MGW3

MGW4

901 PANEL

902 PANEL

CLOSED

OPEN

277.80

6/2/2021

18/2/2021

2/3/2021

12/3/2021

24/3/2021

7/4/2021

18/4/2021

29/4/2021

13/5/2021

23/5/2021

3/6/2021

16/6/2021

24/6/2021

29/6/2021

11/7/2021

23/7/2021

31/8/2021

17/9/2021

5/10/2021

16/10/2021

28/10/2021

9/11/2021

23/11/2021

3/12/2021

15/12/2021

29/12/2021

11/1/2022

22/1/2022

5/2/2022

17/2/2022

3/3/2022

13/3/2022

23/3/2022

5/5/2022

25/5/2022

3/6/2022

15/6/2022

26/6/2022

6/7/2022

19/7/2022

28/7/2022

9/8/2022

20/8/2022

24/8/2022

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Tahmoor Coking Mine Rehabilitation Monitoring 2020

Tahmoor Coal Pty Ltd.

ecological AUSTRALIA
A TETRA TECH COMPANY

1300 646 131
www.ecoaus.com.au

DOCUMENT TRACKING

Project Name	Tahmoor Coking Mine Rehabilitation Monitoring 2020
Project Number	20SYD 17154
Project Manager	Stacey Wilson
Prepared by	Stacey Wilson
Reviewed by	Toni Frecker
Approved by	Meredith Henderson
Status	**Draft**
Version Number	**V1**
Last saved on	**24 December 2020**

This report should be cited as 'Eco Logical Australia 2020. *Tahmoor Coking Mine Rehabilitation Monitoring 2020*. Prepared for Tahmoor Coal Pty Ltd..'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Tahmoor Coal Pty Ltd.

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Template 2.8.1

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2.1 Monitoring results prior to 2020 5
2.2 Monitoring results in 2020 6

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Abbreviations

Abbreviation	Description
ELA	Eco Logical Australia Pty Ltd
GCAA	Glencore Coal Assets Australia
MOP	Tahmoor Colliery Mine Operations Plan 2012 - 2019 (XCN 2012)
OGM	Organic Growth Medium
REA	Refuse Emplacement Area

1. Introduction

In 2020, rehabilitation monitoring was carried out by Eco Logical Australia Pty Ltd (ELA) in accordance with the Tahmoor EMS-MGP-002 Biodiversity and Land Management Plan and GCAA CAA HSEC PRO 0010 11.16 Completion Criteria and Rehabilitation Monitoring guidelines which require both:

- an annual walkover inspection of all areas within the Refuse Emplacement Area (REA) where rehabilitation activities have been completed including newly established revegetation
- monitoring of permanent monitoring sites within each mine closure Domain. Within the REA (closure Domain 3) permanent plots have been established in each development stage to assess revegetation progress.

These guidelines state:

"The objective of this monitoring is to evaluate progress of rehabilitation towards fulfilling long term land use objectives, such as the development towards a self-sustaining ecosystem."

Rehabilitation of vegetation within the REA has been carried out since 1993 as each stage of the refuse emplacement was constructed. The permanent monitoring sites program began in 2010 with the establishment of two permanent plots within each existing section of the REA and two reference site plots within relatively undisturbed native vegetation nearby. As each Stage of the REA was completed permanent plots have been established following revegetation. In addition, further plots were established in areas greater than four hectares to address the recommendations for native vegetation monitoring provided in CAA HSEC PRO 0010 11.16 Completion Criteria and Rehabilitation Monitoring. In future, in accordance with monitoring guidelines, additional permanent plots will be installed as each area of revegetation within the REA reaches an age of 5 years from planting.

Monitoring of permanent sites in the rehabilitation areas provides information regarding changes in both vegetation growth, senescence, colonisation and species diversity. In addition, indication of the success of the rehabilitation is gained through comparison of both vegetation structure and species composition with the reference sites monitored in nearby bushland. Methods for measuring these values include detailed species counts and cover within 2 m x 2 m nested quadrats and species diversity, canopy cover, growth rates, reproductive potential and progress within a 20 m x 10 m plot. Photographic monitoring of plots is also implemented.

The walkover inspection records details across each stage and includes information on the following factors

- evidence of soil profile development and visual assessment of surface materials
- evidence of erosion and stability, and function of erosion and sediment control structures
- growth rates and evidence of plant mortality or dieback
- species diversity including identification of target species
- presence of over-storey, mid-storey and understorey species
- evidence of reproductive potential
- evidence of biological nutrient cycling
- occurrence of potholing or slumping and evidence of spontaneous combustion

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- evidence of contamination or other limitations to vegetative establishment.

Native grass species have been trialled in areas where the existing vegetation within established revegetation areas was sparse. These grass planting trials were monitored to review the survival and growth of planted species.

More detailed presentation of the monitoring results is included in the appendices:

- **Appendix A - Monitoring 2020 – Mine Closure Domains 1 – 5 Permanent Sites** and
- **Appendix B - Monitoring 2020 - Annual Walkover – Refuse Emplacement Area and No. 2 Shaft Power Corridor.**

These appendices include collated details of the recorded monitoring results, the collected field data sheets and monitoring photographs.

2. Results

2.1 Monitoring results prior to 2020

Revegetation across the REA was highly variable with some sections approximately 20 years old and others newly established with seeding carried out 12 months prior to monitoring. The native species included in the revegetation mix also varies, in both diversity and structural representation, between those areas revegetated prior to 2006 and those revegetated more recently.

Characteristics of sections revegetated prior to 2006 include:

- canopy species including *Eucalyptus* species, *Angophora* species and *Allocasuarina littoralis* providing cover ranging from good to limited, heights up to 10 m and exhibiting good growth. Second generation *Allocasuarina littoralis* were common near mature plants, with other canopy species second generation plants beginning to appear.
- smaller tree species including *Acacia decurrens and Acacia binervia* were also regenerating with second generation individuals present
- a midstorey that varied from dense stands of *Kunzea ambigua* (Tick Bush) or the non-local species *Leptospermum laevigatum* (Coast Teatree) to scattered *Acacia* species interspersed with other less abundant native species.
- highly effective weed control actions reduced weed cover where extensive stands of the weed *Andropogon virginicus* (Whiskey Grass) and smaller populations of *Eragrostis curvula* (African Lovegrass) were present and excluded all other species. Weed cover generally low with weed control providing good on-going results.
- increasing colonisation by native grasses with cover increasing annually in most areas, including where exotic grasses have been controlled.
- vegetation that was dominated by *Acacia* species, many of which are senescent or in some sections mixed native vegetation that is not representative of the local native plant communities. Senescent Acacias becoming less common.
- good species diversity including target species; however, many species had a low abundance.
- all species exhibited signs of good reproduction potential including the threatened species, *Persoonia bargoensis* and *Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea).

Characteristics of sections revegetated in 2007 (Stage 8)

- originally planted with pasture species as a stabiliser, and was still dominated by exotic grasses in 2016
- trial of reseeding using the soil amelioration product OMG proved not suitable for the REA
- very limited cover by native species, both target and non-target
- scattered patches of native grasses with good cover prior to 2017.

Characteristics of sections revegetated post 2010 are:

- generally good germination rates on level areas with species from all strata represented
- germination more variable on slopes but still adequate
- growth rates moderate to very good

- limited weed populations.

2.2 Monitoring results in 2020

Erosion control structures were rock lined prior to monitoring in 2019 to further control erosion on the slopes of the REA. Monitoring in 2020 confirmed that these areas are still in good condition, with no major erosion issues evident, minor gully erosion is present in limited areas with minor works required to rectify this erosion. As we enter into a La Nina event there will be an expected high increase of rainfall until February of 2021, during this time erosion control measures and gully erosion should be carefully monitored.

An area in Stage 1 where seepage affected vegetation growth was rehabilitated with the ripping of the soil surface and mulching in 2018. This area continues to be in a good condition with no seepage evident in 2020.

The grass trials ground cover persists, although herbivory remains a limitation to the reproductive potential of the grasses. Subshrubs have colonised sections within the grass trial area in some instances. Grass trials A to E contain single wire fencing; Grass trial F contains a series of fenced plots constructed alongside one another, some with single wire fencing and some with ringlock fencing. It remains evident that those grass trials with ringlock fencing are better at excluding herbivory than those with single wire and corresponded with a higher diversity and density of both grass and shrub species in comparison to the plots with less protection.

Fire in late 2019 burnt through the reference sites and plots established in stages 6 and 9. These monitoring plots were affected by full-canopy fires. Despite all strata being consumed by fire there is evidence of epicormic growth in canopy species across all sites, and grasses and forbs have regenerated in the groundcover. All midstorey species were consumed by fire with little evidence of these species regenerating yet, however some Eucalyptus seedlings were noted across the burnt areas indicating that there are viable Eucalyptus seeds in the soil seedbank.

For most plots not affected by fire, there have been no significant changes to the vegetation quality, structure and diversity in the past 12 months. There has been a significant dry period over the past couple of years which has primarily affected the two lower strata. Generally, additional characteristics and changes that were noted include

- adequate growth in all canopy species including juveniles and seedlings
- some death in all mid storey species, particularly *Acacia parramattensis* and *Hakea* sp., possibly resulting from the drought conditions experienced over consecutive years.
- death of midstorey species, *Acacia* spp. and *Allocasuarina littoralis* in stages 6 and 9 which were consumed by fire.
- weed cover was low overall, however populations have increased over the last 12 months and increased weed management is required.
- growth rates overall are adequate in newly established revegetation
- number of target species recorded in all revegetation areas consistent with 2019 levels despite drought conditions and despite the reference sites recovering from fire.
- signs of a rabbit population observed
- minor gully erosion evident, however erosion control adequate with remediation on-going

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- herbivory of planted grasses in grass trials reducing reproductive potential of grass species.

Table 1 provides further details of the monitoring results from 2020 in comparison with results from earlier years and recommendations.

Table 1: Key monitoring results

Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2019	Results from survey 2020	Recommendations
Soil profile development	Highly variable and developing in the older stages of rehabilitation around leaf and grass litter, fallen timber, native grass clumps, and newer revegetation in rip lines.	Development recorded in rip lines and areas with high leaf litter. Cover with grass litter low due to drought conditions	Infill planting with native grass tubestock in areas of limited groundcover. Slash grasses following seeding to provide additional organic litter where cover is good.
Evidence of erosion	Isolated areas of minor gully erosion, rill and sheet wash have been recorded. Remediation works carried out at several locations. Additional drains installed to direct stormwater and addressing erosion in new rehabilitation area. Stormwater drains in some sections were rock lined to provide better erosion control.	Limited, minor gully erosion present.	Repair areas of minor gully erosion with minor works (i.e. filling with rocks, branches, logs etc.) Monitor minor and major gully erosion as rainfall is expected to increase due to La Nina.

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Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2019	Results from survey 2020	Recommendations
Native plant species diversity	Species diversity has increased since monitoring began, with an increase in groundcover species seen in areas of weed control within the early revegetation areas. Native herbs and forbs are more abundant in areas where native grasses are colonising. The midstorey is dominated by *Acacia* spp., but also includes *Dodonaea* spp*., Persoonia* spp*., Kunzea ambigua and Cassinia* sp*.* Groundcover species diversity is good with herbs, sedges, lilies and grasses all represented; however many species have low abundance.	<u>Burnt vegetation</u> Reference sites and stages 6 and 9 results were consumed by fire in 2019. These areas show evidence of epicormic growth in canopy species. Midstorey species consumed by fire and have not begun to regenerate as yet. Grass and forb cover in the understorey is regenerating and generally include good species diversity and cover and include target species. Leaf and twig litter slowly accumulating. <u>Non-burnt vegetation</u> Native species diversity remains consistent overall allowing for a dry season and a decrease in species diversity in undisturbed bushland. *Acacia* diversity reduced with senescence in some shrub species. Senescence of *Hakea* species also noted across stages 1 and 2. The number of target species (i.e. those consistent with reference sites and nearby native vegetation) within each monitoring plot remains adequate to good despite earlier drought conditions. Species diversity in canopy species adequate on average in most REA stages, however some sections have more limited diversity. Midstorey species diversity more limited. Forb species diversity limited.	Re-assess diversity following non-drought conditions. Re-assess cover and diversity in burnt vegetation, particularly noting if any midstorey species have recovered. Assess if weed levels have significantly increased in areas of burnt vegetation. Maintain weed control program with attention to avoiding off-target damage

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Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2019	Results from survey 2020	Recommendations
Native plant cover (overstorey, midstorey, groundcover)	Native cover is highly variable within all strata across the REA and, with some small areas devoid of vegetation. Canopy cover varies from good to very low, with much of the revegetation too young to provide a meaningful measurement. Sub-shrub cover is more limited with a number of species failing to reach maturity. Groundcover varies within the established revegetation areas from 100% to 0%. Colonisation by grasses and groundcover species is patchy but improving slowly.	Native plant cover remains variable across the REA, with groundcover varying greatly and some areas devoid of groundcover species. Otherwise, native plant cover is increasing at a slow rate. Colonisation by groundcover species including grasses and sedges delayed by earlier drought conditions In more recent revegetation areas, native cover is consistent with high numbers of juvenile canopy species.	Infilling with native grass tubestock. Further protection of these plantings from herbivory is to be considered. Strategies to manage these grassy swards to increase soil organic matter would be beneficial. Increase weed control program using targeted methods during peak growing seasons Monitor rabbit population Planting of canopy tubestock or brush mulching with canopy species (other than *Acacia* species) in sections with no canopy species. Any additional tubestock planting will require irrigation for 6 months to ensure establishment. Re-assess plant cover following increased rainfall events during La Nina.

Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2019	Results from survey 2020	Recommendations
Native plant growth rates and regeneration	Canopy species growth is adequate and is consistent with the growth rates determined in the undisturbed nearby native vegetation. Second generation canopy species are prevalent in the earlier revegetation areas. Many *Acacia parramattensis* are senescent or have died and fallen. Some species (particularly sub shrubs) failing to thrive to maturity, possibly due to selective herbivory by rabbits. Native grasses are regenerating and spreading in some sections strongly.	For those monitoring plots burnt in the 2019 bushfires the following characteristics were noted: • all strata consumed by fire • canopy species showing epicormic growth • midstorey is absent, *Allocasuarina* and *Acacia* species did not survive hot fire • groundcover has recolonised following fire, generally low cover however, some monitoring plots have higher diversity of species post fire. • leaf litter and woody material largely consumed by fire, reduced cover of grass, twig litter is available. Growth rates are variable in newly established revegetation areas. Growth rates are generally better in those areas with low slope, indicating that moisture availability is limiting growth on steeper sections. The growth rate in canopy species remains consistent. Senescent *Acacia* midstorey species are present across the REA. Growth rates, other than that of sub-shrubs, are adequate but variable. Second generation recruitment in this stratum is greatest in *Acacia* species, with recruitment in other species increasing slowly. Native grasses have increased in some monitoring plots despite drought conditions.	Maintain monitoring annually to detect impact of factors other than drought conditions

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Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2019	Results from survey 2020	Recommendations
Threatened flora	Two threatened species have been observed within the rehabilitation areas, *Grevillea parviflora* subsp. *parviflora* and *Persoonia bargoensis*	The population of *Grevillea parviflora* subsp. *parviflora* within Stage 6 has significantly decreased as a result of fire in late 2019. One individual seeding was found within this area during 2020 monitoring. The population of *Persoonia bargoensis* is increasing within areas of early revegetation. It is unknown if the plants previous recorded within the No 2 shaft 11kV power line were lost to fire in late 2019.	Continue to monitor threatened species populations to detect impact the fire has had on these populations. Weed control in the vicinity of these species to be carried out by hand.
Weed occurrences and cover	Weed densities were highly variable across the REA. Heavy infestations of *Andropogon virginicus* (Whiskey Grass) and smaller populations of *Eragrostis curvula* (African Lovegrass), *Sisymbrium officinale* (Hedge Mustard) and *Nassella trichotoma* (Serrated Tussock) were observed within the early rehabilitated areas in the north of the REA prior to 2010. Weed control programs were instigated with strong results. *Andropogon virginicus* and *Eragrostis curvula* continued to be present in isolated patches within the REA. *Cenchrus setaceus* (Fountain Grass) colonised the slopes of Stage 5 in 2017.	Weed cover is generally low across the REA, however there is increased cover by *Eragrostis curvula* in several stages - the upper benches of Stages 14 and 16 and Stage 12, and the western section of stage 10. Patches of this weed are increasing across the REA. *Cenchrus setaceus* (Fountain Grass) continues to spread on the slopes of Stage 5. The population of *Sisymbrium officinale* has increased over the last 12 months. The small population of *Gomphocarpus fruticosus* has increased over the last 12 months.	Increase weed monitoring and weed control program overall, targeting key areas of weed infestations Care to avoid off-target damage during weed control works is to be considered. Control *Cenchrus setaceus* by slashing prior to seed set in early summer and spot spraying. Follow up is required for this species. Control *Gomphocarpus fruticosus* (Narrow-leaf Cotton Bush). Minor infestations or small patches of young seedling plants can be sprayed with glyphosate or physically removed by grubbing or hand pulling. Follow up is required for this species

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Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2019	Results from survey 2020	Recommendations
Non-local native species	Non-local native species are common within those sections of the REA which were revegetated prior to 2000 and are uncommon elsewhere. *Leptospermum laevigatum* is the most abundant non-local native species and is colonising strongly outside the original area of planting. *Acacia saligna* (Western Australian golden wattle) was recorded as both mature trees and juveniles. This species was controlled across the REA prior to November 2016. Most other species within this category are present in limited numbers and populations are not increasing.	*Leptospermum laevigatum* remains abundant within the oldest revegetation area with scattered individuals beyond stages 1 and 2. These species have not been included in more recent seedings for revegetation within the REA. Limited *Acacia saligna* seedlings were located across the REA.	Control the spread of *Leptospermum laevigatum* by controlling seedlings outside stages 1 and 2. Maintain monitoring for *Acacia saligna* and conrol opportunistically during weed conrol activities. Training may be required to identify this species.
Feral fauna	Evidence of significant rabbit population. Herbivory by this species was considered to be impacting on the success of revegetation by the selective removal of some species. Rabbit population controlled in 2017.	A small rabbit population remains.	Rabbit monitoring to continue and control programme in conjunction with neighbouring properties if required. Consultation with Local Land Services advisable.

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References

Eco Logical Australia 2019. *Tahmoor Colliery Rehabilitation Monitoring 2019.* Prepared for Tahmoor Coal Pty Ltd



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APPENDIX 14

SIX MONTHLY SUBSIDENCE IMPACT REPORT

REPORT 1 - MAY 2020

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APPENDIX 15

SIX MONTHLY SUBSIDENCE IMPACT REPORT

REPORT 2 - NOVEMBER 2020

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APPENDIX 16

MINE OPERATIONS PLAN

2020-2024

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APPENDIX 17

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		TDS	Na	Ca	K	Mg	Cl	F	HCO3	SO4	TP	TN	FeT	Fe	MnT	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr		DOC
REA3	**16/07/19**	595	125	48	5.8	31	285	0.11	125	19	0.37	1.4	8.6	3.7	2.5	2.2	<0.001	<0.001	0.46	0.04	0.01	<0.01	0.017	0.17	0.10		2
REA4	**16/07/19**	480	115	22	15	20	235	0.15	63	28	0.28	1.8	19	12	2.4	2.3	<0.001	<0.001	0.50	0.03	<0.01	<0.01	0.022	0.16	0.089		2
REA5	**16/07/19**	390	84	28	4.6	18	190	0.13	65	17	0.26	1.0	20	6.5	2.1	2.1	<0.001	<0.001	0.66	0.03	0.03	<0.01	0.010	0.12	0.056		<1
REA6	**16/07/19**	1220	340	62	4.9	27	445	0.20	280	170	0.50	0.7	43	11	2.5	2.3	<0.001	<0.001	0.28	0.04	0.01	<0.01	0.026	0.10	0.29		9
REA7	**16/07/19**	680	215	21	16	15	50	0.19	635	26	0.07	0.9	6.5	5.5	0.22	0.17	<0.001	<0.001	0.20	0.04	0.01	<0.01	0.28	0.73	0.24		4
REA2	**09/08/19**	1740	445	67	8.9	91	995	0.18	92	58	0.08	0.5	27	20	3.2	3.0	<0.001	<0.001	0.68	0.06	<0.01	<0.01	0.039	0.13	0.19		1
REA1	**12/09/19**	260	78	3.2	2.5	8.2	81	0.14	130	2	<0.01	0.6	9.5	8.6	0.71	0.66	<0.001	<0.001	0.18	0.04	<0.01	<0.01	0.084	0.062	0.013		
REA1	**10/10/19**	250	73	4.1	2.1	8.2	79	0.14	135	2	0.06	0.7	16	16	0.95	0.90	<0.001	<0.001	0.017	0.05	0.04	<0.01	0.11	0.083	0.021		4

REA 2	**10/ 10/ 19**	16 90	43 0	62	8. 8	86	96 0	0. 18	92	64	0. 06	0. 7	41	38	3. 4	3. 4	<0 .0 01	<0 .0 01	0. 16	0. 06	0. 03	<0 .0 1	0. 04 8	0. 17	0. 23		2
REA 3	**10/ 10/ 19**	55 0	11 5	24	4. 7	29	30 5	<0 .1	37	15	0. 13	0. 9	40	39	2. 8	2. 8	<0 .0 01	<0 .0 01	0. 19	0. 03	0. 05	<0 .0 1	0. 01 7	0. 26	0. 08 1		<1
REA 4	**10/ 10/ 19**	49 5	11 0	31	10	20	23 0	0. 12	72	42	0. 06	2. 5	21	21	2. 5	2. 5	<0 .0 01	<0 .0 01	0. 07 2	0. 02	0. 05	<0 .0 1	0. 01 8	0. 13	0. 06 6		10
REA 5	**10/ 10/ 19**	37 0	81	24	3. 2	17	18 5	<0 .1	61	14	0. 09	0. 5	17	15	2. 3	2. 3	<0 .0 01	<0 .0 01	0. 77	0. 03	0. 02	<0 .0 1	0. 01 4	0. 19	0. 08 4		2
REA 6	**10/ 10/ 19**	11 20	28 5	65	5. 2	26	38 5	0. 25	31 5	12 0	0. 16	1. 7	65	33	3. 3	3. 0	<0 .0 01	<0 .0 01	0. 03 5	<0 .0 1	0. 01	<0 .0 1	0. 02 5	0. 10	0. 27		5
REA 7	**10/ 10/ 19**	46 5	15 0	20	13	12	43	0. 21	41 0	33	0. 08	1. 1	3. 0	1. 6	0. 50	0. 50	<0 .0 01	<0 .0 01	0. 01 6	0. 02	<0 .0 1	<0 .0 1	0. 21	0. 35	0. 11		3
REA 1	**14/ 11/ 19**	26 5	84	3. 5	1. 3	6. 4	87	0. 21	12 5	6	0. 08	0. 7	15	15	1. 0	0. 91	<0 .0 01	<0 .0 01	0. 02 1	0. 06	0. 03	<0 .0 1	0. 14	0. 07 9	0. 01 8		2
REA 2	**14/ 11/ 19**	17 70	45 0	60	10	82	98 5	0. 22	12 0	61	0. 17	1. 9	52	49	3. 5	3. 3	<0 .0 01	<0 .0 01	0. 20	0. 05	0. 02	<0 .0 1	0. 07 2	0. 18	0. 29		3
REA 3	**14/ 11/ 19**	50 0	12 0	7. 2	3. 2	30	30 0	<0 .1	5	13	0. 15	1. 1	39	38	2. 8	2. 8	<0 .0 01	<0 .0 01	0. 23	0. 03	0. 04	<0 .0 1	0. 02 0	0. 27	0. 06 7		<1
REA 4	**14/ 11/ 19**	51 0	11 5	27	8. 4	21	24 5	0. 13	85	27	0. 15	3. 6	21	18	2. 6	2. 4	<0 .0 01	<0 .0 01	0. 07 8	0. 01	0. 03	<0 .0 1	0. 03 4	0. 06 7	0. 09 0		16

REA 5	**14/ 11/ 19**	35 5	86	8. 5	2. 2	14	19 5	0. 11	8	11	0. 11	0. 6	33	32	2. 3	2. 3	<0 .0 01	<0 .0 01	1. 8	0. 06	0. 03	<0 .0 1	0. 01 3	0. 16	0. 10		1
REA 6	**14/ 11/ 19**	97 0	26 0	58	4. 1	23	38 0	0. 27	22 5	11 0	0. 40	1. 0	42	31	2. 7	2. 4	<0 .0 01	<0 .0 01	0. 01 9	<0 .0 1	0. 04	<0 .0 1	0. 03 7	0. 08 8	0. 26		6
REA 7	**14/ 11/ 19**	47 0	14 0	18	10	11	45	0. 20	38 5	39	0. 09	1. 1	3. 4	1. 2	0. 48	0. 44	<0 .0 01	<0 .0 01	0. 02 7	0. 02	0. 03	<0 .0 1	0. 23	0. 28	0. 15		6
REA 1	**20/ 02/ 20**	27 5	82	5. 6	2. 5	6. 7	88	0. 23	12 5	8	0. 04	0. 3	11	9. 2	0. 72	0. 71	<0 .0 01	<0 .0 01	0. 03 6	0. 06	0. 04	<0 .0 1	0. 11	0. 07 7	0. 02 7	<0 .0 1	2
REA 2	**20/ 02/ 20**	12 20	27 5	77	14	51	55 0	0. 21	22 5	10 5	0. 13	1. 8	18	14	2. 2	1. 8	<0 .0 01	<0 .0 01	0. 09 0	0. 02	0. 03	<0 .0 1	0. 02 9	0. 13	0. 53	<0 .0 1	13
REA 3	**20/ 02/ 20**	48 5	12 5	8. 4	5. 3	26	28 5	0. 11	4	15	0. 10	0. 5	23	18	2. 3	2. 3	<0 .0 01	<0 .0 01	0. 26	0. 03	0. 05	<0 .0 1	0. 01 5	0. 19	0. 06 3	<0 .0 1	1
REA 4	**20/ 02/ 20**	49 0	11 5	22	8. 5	19	23 5	0. 12	85	19	0. 06	1. 7	20	18	2. 3	2. 2	<0 .0 01	<0 .0 01	0. 09 5	0. 01	0. 03	<0 .0 1	0. 01 9	0. 08 2	0. 08 2	<0 .0 1	9
REA 5	**20/ 02/ 20**	15 0	24	12	4. 1	6. 9	49	<0 .1	37	24	0. 12	1. 9	3. 4	2. 7	0. 35	0. 35	<0 .0 01	<0 .0 01	0. 13	0. 01	0. 04	<0 .0 1	0. 01 1	0. 04 8	0. 05 7	<0 .0 1	8
REA 6	**20/ 02/ 20**	82 0	22 0	42	5. 2	20	34 5	0. 24	16 0	84	0. 28	0. 7	31	27	2. 1	2. 0	<0 .0 01	<0 .0 01	0. 08 7	0. 04	0. 02	<0 .0 1	0. 02 0	0. 10	0. 30	<0 .0 1	7
REA 7	**20/ 02/ 20**	42 5	12 5	15	11	10	43	0. 21	34 0	35	0. 09	0. 8	0. 80	0. 76	0. 23	0. 21	<0 .0 01	<0 .0 01	0. 02 3	0. 01	0. 03	<0 .0 1	0. 19	0. 11	0. 12	<0 .0 1	5

REA 1	**17/ 11/ 20**	245	88	5.1	1.8	6.7	83	0.16	120	11	0.10	0.6	19	13	0.85	0.74	<0.001	<0.001	0.056	0.05	0.04	<0.1	0.10	0.081	0.021	<0.1	2
REA 2	**17/ 11/ 20**	380	43	64	20	9.0	43	0.14	225	77	0.10	0.9	3.6	2.6	0.10	0.10	<0.001	<0.001	0.049	<0.1	0.04	<0.1	0.003	0.026	0.44	<0.1	19
REA 3	**17/ 11/ 20**	485	110	10	3.3	29	280	<0.1	<1	16	0.07	0.4	39	34	2.6	2.2	<0.001	<0.001	0.10	0.03	0.02	<0.1	0.010	0.23	0.051	<0.1	<1
REA 4	**17/ 11/ 20**	500	115	31	7.2	23	240	0.11	105	13	0.10	1.6	18	16	2.4	2.1	<0.001	<0.001	0.047	<0.1	0.01	<0.1	0.023	0.067	0.11	<0.1	3
REA 5	**17/ 11/ 20**	195	43	12	4.1	10	95	<0.1	23	24	0.08	0.9	4.0	3.7	0.28	0.25	<0.001	<0.001	0.94	0.02	<0.1	<0.1	0.004	0.073	0.064	<0.1	2
REA 6	**17/ 11/ 20**	790	235	36	4.2	25	355	0.26	140	70	0.41	1.2	60	27	2.3	2.0	<0.001	<0.001	0.066	0.04	0.02	<0.1	0.019	0.13	0.29	<0.1	4
REA 7	**17/ 11/ 20**	395	130	13	10	9.4	43	0.17	315	30	0.08	0.7	4.9	1.5	0.31	0.29	<0.001	<0.001	0.059	0.01	0.02	<0.1	0.14	0.085	0.085	<0.1	3
REA 1	**01/ 02/ 21**	250	79	3.4	1.2	6.4	82	0.20	115	10	0.04	0.5	12	12	0.90	0.85	<0.001	<0.001	0.024	0.05	0.01	<0.1	0.10	0.085	0.019	<0.1	2
REA 2	**01/ 02/ 21**	315	31	63	14	7.2	36	0.13	215	48	0.12	1.2	3.1	1.6	0.07	0.06	<0.001	<0.001	0.026	<0.1	0.05	<0.1	0.004	0.054	0.41	<0.1	19
REA 3	**01/ 02/ 21**	470	110	10	2.5	29	280	<0.1	<1	19	0.11	0.4	33	30	2.9	2.3	<0.001	<0.001	0.14	0.03	0.04	<0.1	0.011	0.22	0.053	<0.1	1

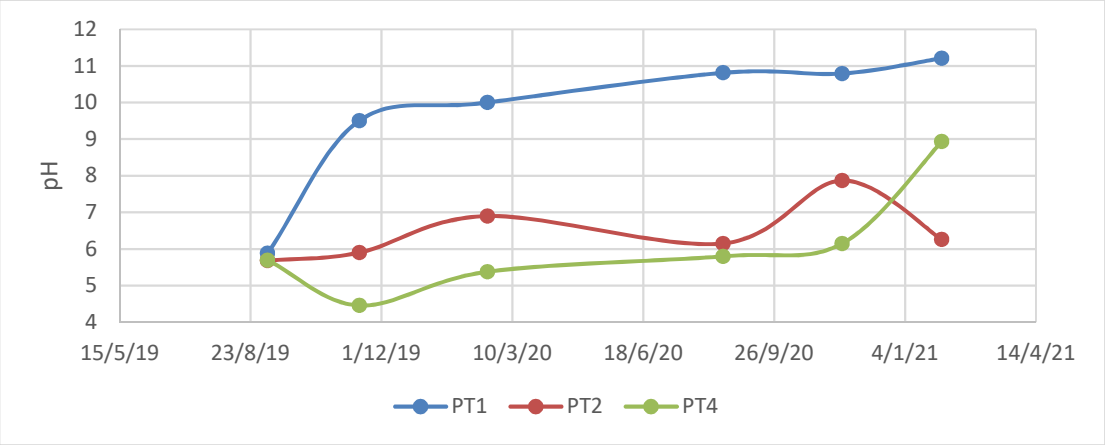
REA 4	**01/02/21**	440	105	20	6.1	19	235	<0.1	43	14	<0.01	0.3	30	23	2.5	2.2	<0.001	<0.001	0.036	<0.01	0.02	<0.01	0.015	0.18	0.18	<0.01	2
REA 5	**01/02/21**	295	76	7.9	2.9	15	165	0.11	7	23	0.06	0.4	15	13	1.9	1.7	<0.001	<0.001	1.1	0.03	0.03	<0.01	0.007	0.11	0.060	<0.01	2
REA 6	**01/02/21**	815	225	32	3.5	24	390	0.30	140	66	0.33	1.0	53	24	2.4	2.2	<0.001	<0.001	0.047	0.04	0.02	<0.01	0.021	0.12	0.28	<0.01	3
REA 7	**01/02/21**	390	125	13	10	8.8	39	0.21	320	29	0.04	0.4	1.4	1.2	0.15	0.11	<0.001	<0.001	0.050	0.01	0.02	<0.01	0.16	0.14	0.081	<0.01	4

		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Site	**Date**	**TDS**	**Na**	**Ca**	**K**	**Mg**	**Cl**	**F**	**HCO3**	**SO4**	**TP**	**TN**	**FeT**	**Fe**	**MnT**	**Mn**	**Cu**	**Pb**	**Zn**	**Ni**	**Al**	**As**	**Li**	**Ba**	**Sr**	**Se**	**DOC**
PIT TOP 1	**5/09/2019**	970	300	14	86	14	260	0.23	495	51	0.18	2.2	4.6	0.14	0.36	0.33	0.003	<0.001	0.052	0.03	0.04	<0.01	0.15	0.047	0.10		7
PIT TOP 2	**5/09/2019**	520	72	83	12	33	30	0.14	560	6	0.12	1.0	8.1	2.5	0.23	0.18	0.001	<0.001	0.012	<0.01	<0.01	<0.01	0.021	1.2	0.82		6
PIT TOP 4	**5/09/2019**	1750	570	40	7.3	69	1060	0.40	62	36	0.19	1.5	3.4	0.56	4.3	4.2	0.004	<0.001	1.2	0.07	0.05	<0.01	0.025	0.17	0.11		3
PIT TOP 1	**14/11/19**	800	265	8.2	66	7.5	230	0.25	165	37	0.08	1.8	1.0	0.95	0.05	0.03	0.001	<0.001	0.006	0.03	0.05	<0.01	0.22	0.023	0.14	140	11

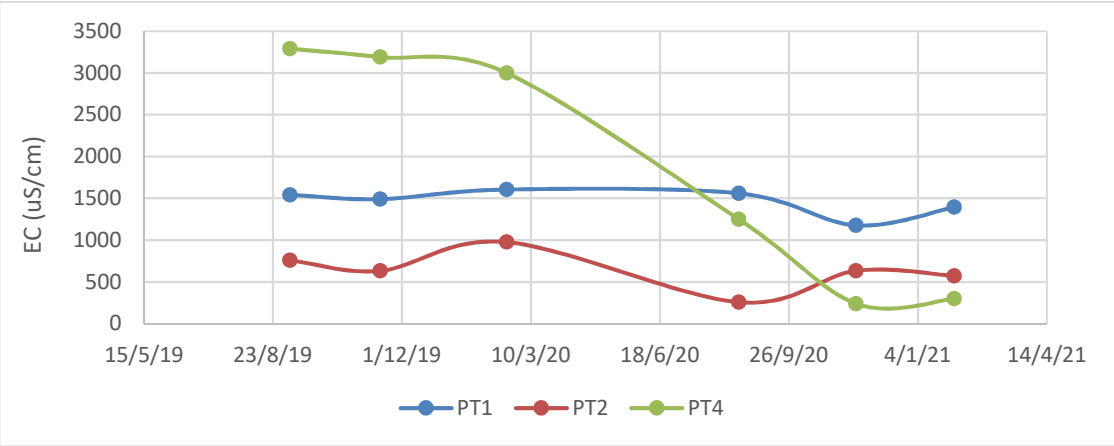
PIT TOP 2	**14/11/19**	425	76	43	9.5	21	34	0.11	385	20	5.5	6.0	110	8.5	0.46	0.14	<0.001	<0.001	0.008	<0.01	0.03	<0.01	0.013	0.74	0.60		4
PIT TOP 4	**14/11/19**	1710	530	29	5.7	70	1020	0.51	<1	42	0.11	1.7	5.4	1.8	4.4	4.3	0.005	0.003	0.56	0.07	0.11	<0.01	0.046	0.17	0.14		4
PIT TOP 1	**20/02/20**	680	245	1.6	64	1.4	200	0.22	10	32	3.7	2.4	1.5	1.4	0.06	0.04	<0.001	<0.001	0.016	0.03	0.05	<0.01	0.21	0.016	0.11	<0.01	9
PIT TOP 2	**20/02/20**	560	43	105	18	36	34	0.13	570	21	0.05	4.0	1.2	0.55	0.08	0.05	<0.001	<0.001	0.085	<0.01	0.01	<0.01	0.12	0.95	1.1	<0.01	5
PIT TOP 4	**20/02/20**	1700	500	23	11	72	1020	0.45	<1	47	0.05	0.9	1.7	1.3	3.8	3.8	0.009	0.011	0.62	0.09	1.3	<0.01	0.037	0.19	0.18	<0.01	3
PIT TOP 1	**17/11/20**	620	260	0.8	59	0.9	185	0.21	<1	29	0.10	1.3	4.7	0.52	0.06	0.05	<0.001	<0.001	0.032	0.02	0.28	<0.01	0.14	0.012	0.12	<0.01	12
PIT TOP 2	**17/11/20**	370	43	64	13	20	19	<0.1	365	20	0.08	0.7	10	3.2	0.13	0.13	<0.001	<0.001	0.017	<0.01	0.03	<0.01	0.025	1.3	0.74	<0.01	3
PIT TOP 4	**17/11/20**	155	26	19	7.3	6.1	11	<0.1	115	23	0.12	1.4	1.6	1.3	0.09	0.08	<0.001	<0.001	0.34	<0.01	0.05	<0.01	0.013	0.11	0.17	<0.01	11
PIT TOP 1	**01/02/21**	630	250	0.5	59	0.6	195	0.23	<1	28	0.05	1.4	190	16	0.10	0.08	<0.001	<0.001	0.030	0.02	0.31	<0.01	0.14	0.015	0.12	<0.01	13
PIT TOP 2	**01/02/21**	360	38	66	14	21	15	<0.1	385	17	0.03	0.7	5.1	3.8	0.14	0.11	<0.001	<0.001	0.015	<0.01	0.05	<0.01	0.027	1.3	0.74	<0.01	4

PIT TOP 4	**01/02/21**	140	27	12	6.8	4.5	17	0.11	98	16	0.15	3.0	3.1	1.2	0.06	0.04	<0.001	<0.001	0.10	<0.01	0.03	<0.01	0.034	0.068	0.47	<0.01	15

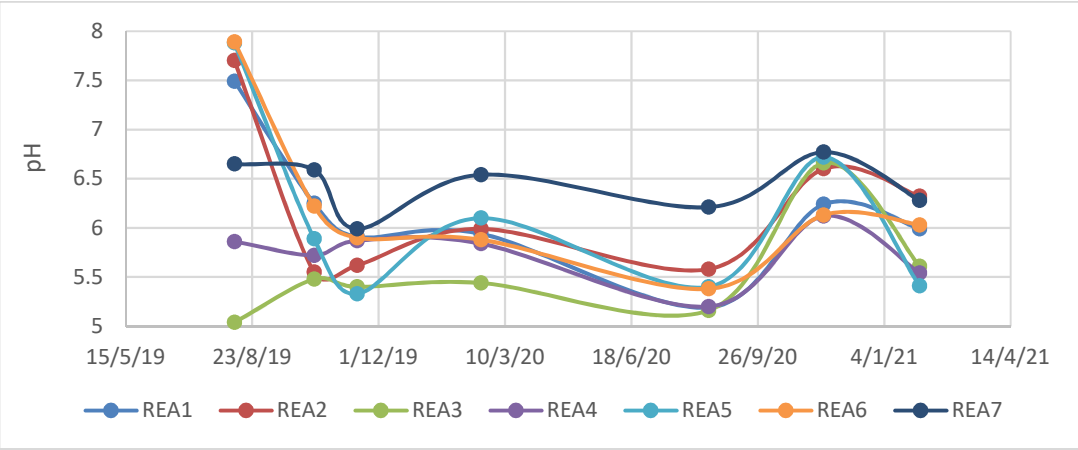
	PT1	**PT2**	**PT4**
5/9/19	5.88	5.68	5.69
14/11/19	9.5	5.9	4.46
20/2/20	10	6.9	5.38
18/8/20	10.81	6.15	5.8
17/11/20	10.79	7.87	6.15
1/2/21	11.21	6.26	8.93
Min	5.88	5.68	4.46
Max	11.21	7.87	8.93
Median	10.395	6.205	5.745



	PT1	PT2	PT4
5/9/19	1542	758	3290
14/11/19	1490	632	3190
20/2/20	1605	977	3000
18/8/20	1560	257	1250
17/11/20	1176	633	240
1/2/21	1395	572	298
Min	1176	257	240
Max	1605	977	3290
Median	1516	632.5	2125



pH	REA1	REA2	REA3	REA4	REA5	REA6	REA7
9/8/19	7.49	7.7	5.04	5.86	7.88	7.89	6.65
11/10/19	6.25	5.55	5.48	5.72	5.89	6.22	6.59
14/11/19	5.91	5.62	5.4	5.87	5.33	5.9	5.99
20/2/20	5.94	5.99	5.44	5.84	6.1	5.88	6.54
18/8/20	5.19	5.58	5.16	5.2	5.4	5.38	6.21
17/11/20	6.24	6.6	6.66	6.12	6.72	6.13	6.77
1/2/21	5.99	6.32	5.61	5.54	5.41	6.03	6.28
Min	5.19	5.55	5.04	5.2	5.33	5.38	5.99
Max	7.49	7.7	6.66	6.12	7.88	7.89	6.77
Median	5.99	5.99	5.44	5.84	5.89	6.03	6.54



EC	REA1	REA2	REA3	REA4	REA5	REA6	REA7
9/8/19	477	2940	1030	958	750	1780	1084
11/10/19	583	4200	1000	747	608	1450	672
14/11/19	519	3400	1270	930	634	1377	787
20/2/20	563	1992	976	936	309	1358	744
18/8/20	570	623	1050	1024	380	1218	653
17/11/20	515	262	956	790	323	1215	568
1/2/21	502	333	1055	754	490	1193	632
Min	477	262	956	747	309	1193	568
Max	583	4200	1270	1024	750	1780	1084
Median	519	1992	1030	930	490	1358	672

