NSW GOVERNMENT

Cadia East Gold/Copper Project

Modification Assessment
(MP 06_0295 MOD 12)

September 2018

Cover photo

[Cadia Open Cut Pit (Source: Department of Planning and Environment)]

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Executive Summary

Cadia Valley Operations is an operational mining complex in the Central Tablelands of NSW (see **Figure 1**). The mining complex includes the active Cadia East underground mine, the Cadia Hill open cut mine (which ceased operations in 2012), the Ridgeway underground mine (which was placed on care and maintenance in 2016) and the Blayney Dewatering Facility (located approximately 25 kilometres [km] east of the mine).

On 9 March 2018, part of the embankment of the northern tailings storage facility failed which led to a limited breakthrough of tailings into the southern tailings storage facility.

In April 2018, the Department approved a modification to allow 30 million tonnes (Mt) of tailings to be deposited into the Cadia Hill open cut pit over an 18 month period (Modification 11). Investigations into the cause of the tailings dam failure and engineering solutions to repair the embankment are still ongoing. To allow further contingency for future mine operations, Cadia Holdings Pty Ltd (Cadia) is seeking a modification of its project approval for the mine to deposit a further 70 Mt of tailings into the open cut pit.

The Department is satisfied that the continuation of in-pit tailings deposition would not result in any increase in environmental impacts beyond those that were previously assessed and approved and has recommended that the modification be approved.

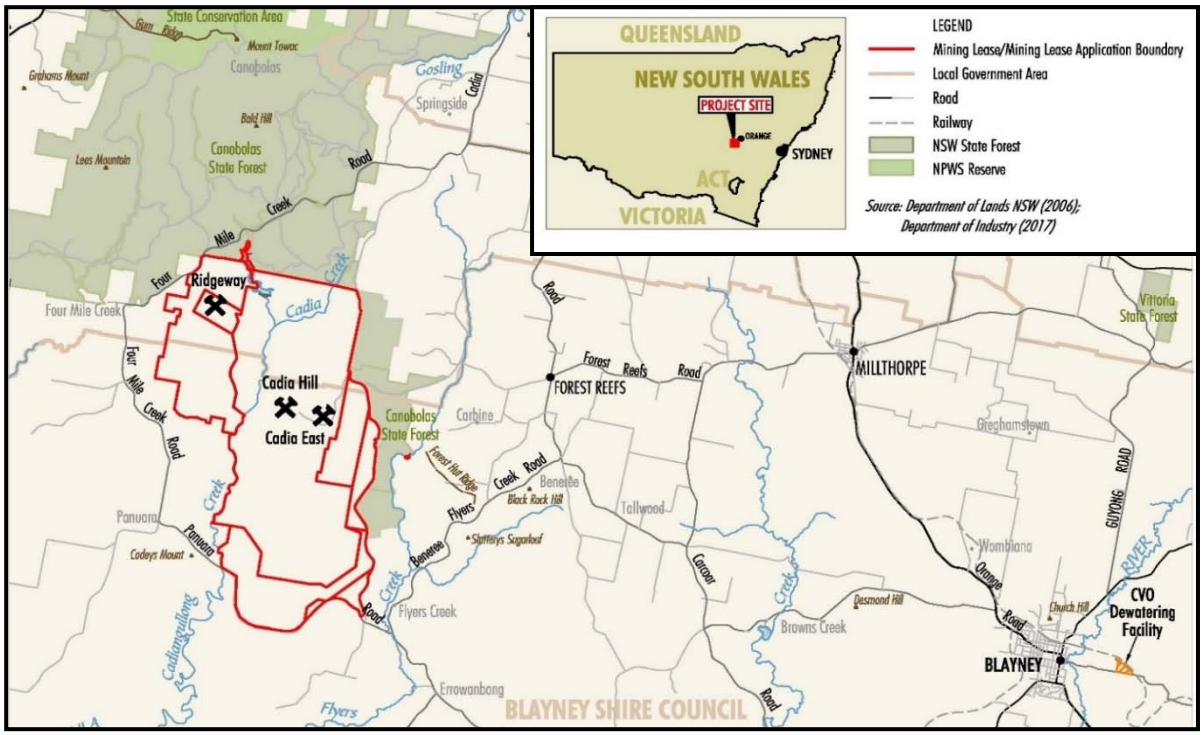

Figure 1: Regional Location

Contents

1. Introduction

Cadia owns and operates the Cadia Valley mining complex, located approximately 25 km southwest of Orange. The complex is located within the Cabonne and Blayney local government areas. The active Cadia East underground mine produces a copper concentrate and gold bullion.

The mining complex operates under the Cadia East project approval (PA 06_0295), granted by the Minister for Planning on 6 January 2010.

The project approval has been modified 11 times, and allows Cadia to undertake the following activities until 30 June 2031:

- extract ore from the Cadia and Ridgeway mines;
- process up to 32 Mt of ore a year; and
- transfer processed ore via a pipeline to the Blayney Dewatering Facility, where it is dewatered and transported via rail to Port Kembla for export.

The processing of the copper and gold ore produces a tailings waste stream of 30 Mt a year. The project approval allows the disposal of tailings into two tailings storage facilities, the Northern Tailings Storage Facility (NTSF) and the Southern Tailings Storage Facility (STSF). Deposition of 30 Mt of tailings into the open cut pit is also permitted for a period of 18 months.

The mining complex is a major employer in the regional area and at full production employs an average of 880 workers.

2. Proposed Modification

On 9 March 2018, part of the embankment of the northern tailings storage facility failed which led to a limited breakthrough of tailings into the southern tailings storage facility. The tailings material was fully contained with no discharge to the environment and suitable contingency measures were put in place to manage ongoing residual risks, including the construction of a containment bund and increased real-time radar monitoring of the dam wall.

Operations were suspended while investigations into the cause of the failure and the implementation of contingency measures commenced. These investigations into engineering solutions to repair the embankment to allow deposition into the NTSF were expected to take about 18 months.

On 20 April 2018, the Department approved a modification to allow 30 Mt of tailings to be deposited into the open cut for a period of 18 months. This allowed the mine to return to full production.

Cadia, in consultation with relevant regulators, has appointed an expert panel to investigate the cause(s) of the slump. The investigation is complex and requires a wide range of testing and analysis to fully understand the cause(s) of the event and remediation required. Cadia anticipates that the expert panel's investigation findings won't be received until early 2019, and the repair of the NTSF is expected to take several years. Accordingly, Cadia is seeking to modify its project approval to continue to use the open cut pit as an alternative tailings storage facility, including the deposition of an additional 70 Mt of tailings into the pit.

The approved and proposed deposition areas are shown in **Figure 2.** The proposed modification activities are all within previously disturbed areas.

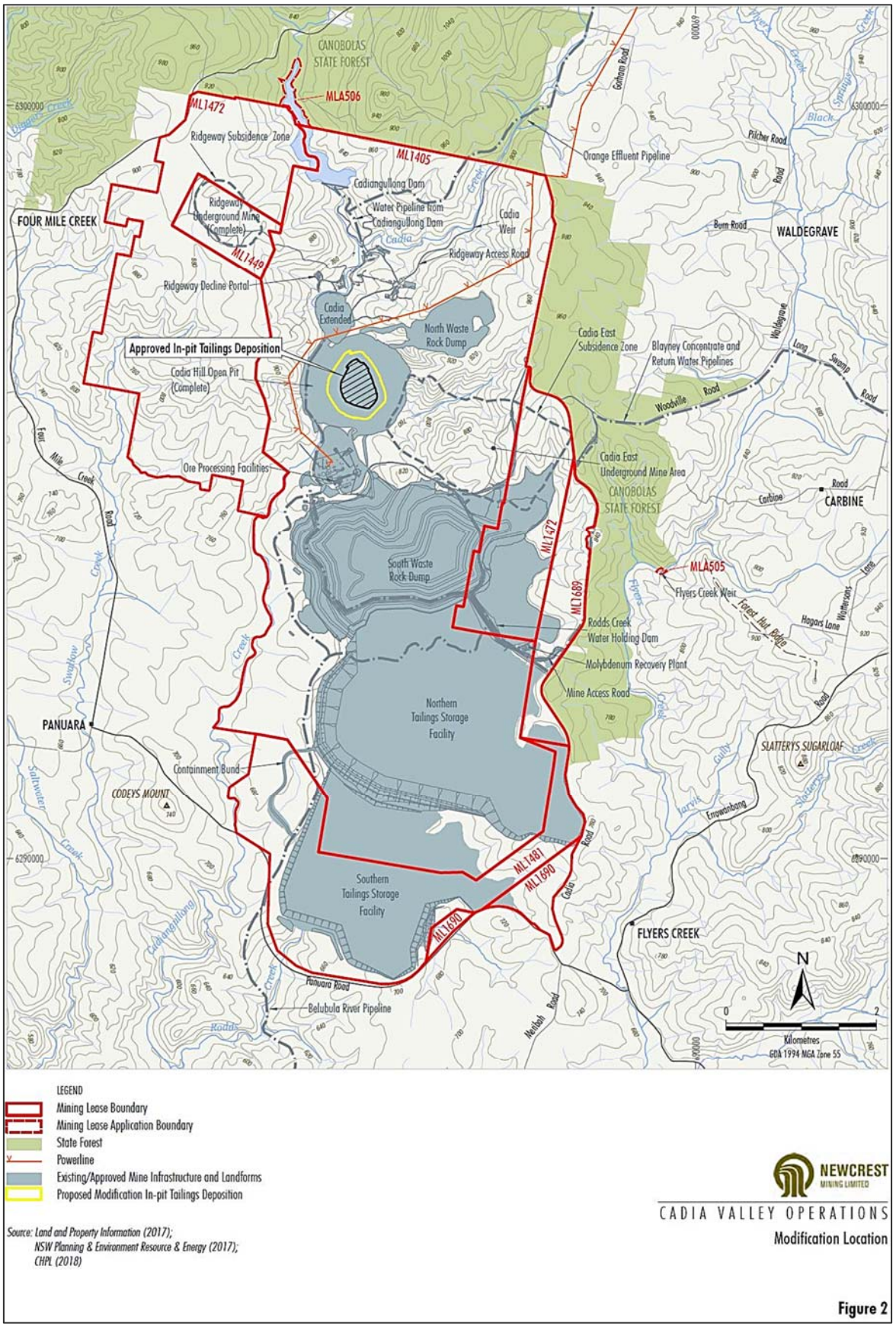

Figure 2: Proposed Modification Layout

The Cadia Hill open cut pit is around 500 metres (m) deep (Australian Height Datum (AHD) 220 m). The proposed modification would increase the tailings depth by 140 m, up to a final elevation of AHD 560 m compared to the currently approved level of AHD 420 m, once consolidated.

Full details of the proposed modification are included in Cadia's Statement of Environmental Effects (SEE) (see **Appendix B**).

3. Statutory Context

3.1 Scope of Modification

The Cadia East Project was originally approved under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Under clause 6 of Schedule 2 of the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017*, the Cadia East Project was transitioned to State Significant Development (SSD) by order, which took effect by publication in the NSW Government Gazette on 13 April 2018.

A modification application under Section 4.55 (1A) for a modification involving minimal environmental impact was submitted to the Department on 10 August 2018.

Based on its assessment, the Department considers that the application can be characterised as a modification to the existing approval as the proposal:

- would not significantly increase the environmental impacts of the project as approved;
- is substantially the same development as originally approved in 2010; and
- would not change the approved mining, processing and transport methods, extraction rate, or schedule of the land.

Consequently, the Department considers that the proposed modification is within the scope of Section 4.55 (1A) of the EP&A Act.

3.2 Consent Authority

The Minister for Planning is the consent authority for the modification application. However, under the Minister's delegation of 11 October 2017, the Director, Resource and Energy Assessments, may determine the application. This is because no public objections were made, the relevant Councils did not object to the proposal and a political disclosure statement has not been made.

4. Engagement

The Department referred the application to key government agencies for comment and made it publicly available on its website from 25 August 2018. No comments from the general public were received by the Department on the modification.

The Department notes the modification is supported by Orange, Cabonne and Blayney Shire Councils, acknowledging the importance of the mining complex to the regional economy, including ongoing employment of the existing workforce.

The Department received advice from five government agencies, none of which object to the proposed modification. A summary of the advice is provided below.

The **Environment Protection Authority** (EPA) supports the modification and agrees the modification would have negligible environmental impact due to the low inherent permeability of the surrounding rock and that the tailings would be contained within the pit. The EPA also supports the new groundwater monitoring bores near the open cut pit. The EPA also recommended that Cadia should to continue to evaluate options for reducing moisture content in the tailings, which may reduce the volume of tailings and extend the storage life of the pit. Cadia responded by advising that it continues to target high density tailings through existing initiatives (for example, tailings thickeners) and would continue to evaluate options to further dewater tailings prior to placement.

The **Department of Industry – Lands and Water** (DoI L&W) re-iterated its previous recommendations requesting that additional deep groundwater monitoring bores be installed in the groundwater near the base of the pit to confirm the predicted hydraulic gradient would remain towards the pit, including collection of deeper groundwater quality data during and after the emplacement of tailings. The Department notes this was addressed in the assessment of the previous modification application (Modification 11) and the conditions of approval were updated accordingly. As such, the Department has not made any further recommendations in the modified conditions for this application. The Department has considered groundwater impacts further in Section 5.1.

The **Division of Resources and Geoscience** (DRG) advised that the emplacement of tailings is unlikely to sterilise economically viable ore reserves and did not object to the emplacement of further tailings in the pit.

The **Resources Regulator** within the Department advised it had no specific issues relating to mine safety or rehabilitation.

The **Office of Environment and Heritage** (OEH) did not raise concerns about the modification and noted that the bats previously using an adit within the pit had been removed in accordance with the approved Land and Biodiversity Management Plan and the adit permanently closed.

5. Assessment

In assessing the merits of the modification application, the Department has considered the:

- previous Environmental Assessments (EAs) for the project;
- modification application and existing conditions of approval;
- agency comments on the application; and
- requirements of the EP&A Act.

A list of the key documents that informed the assessment is provided in **Appendix A**.

5.1 Water Resources

The key issue for the proposed modification relates to whether further emplacement of tailings in the Cadia Hill open cut void would result in impacts on groundwater and surface water resources, beyond those already approved for the mine.

The SEE includes a groundwater impact assessment undertaken by Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) and a surface water assessment, including a final void water balance, undertaken by Hydro Engineering & Consulting (HEC). These assessments were also peer reviewed by Dr Noel Merrick.

The assessment was informed by groundwater modelling that has been re-calibrated twice since the original 2009 Cadia East EA, with the current groundwater model developed in 2016 in consultation with DoI L&W and the Department.

For an impact to occur to water resources, leachate from the tailings emplaced in the open cut would need a migration pathway to groundwater or surface water assets – including groundwater dependent ecosystems and surface and groundwater users.

There are several reasons why the continued emplacement of tailings into the Cadia open cut is predicted to have a negligible impact on water resources.

Formation of a permanent groundwater sink

As noted in the assessment of Modification 11, the Cadia open cut and the adjoining Cadia East subsidence zone were predicted in the 2009 EA to form a contiguous groundwater sink. The revised final void water balance completed by HEC for the modification also confirms that the open cut and subsidence zone would remain a long-term groundwater sink.

This occurs because groundwater from the surrounding rock flows into the open cut, the underground mining panels, and the voids/fractures formed from subsidence of the land over the cave mining area. Once mining is completed, groundwater levels are predicted to recover until a new equilibrium is reached and a pit lake would form, with a direct hydraulic connection between the open cut pit and subsidence void (see **Figure 3**).

With the formation of a pit lake, there would be a permanent loss of groundwater from the system due to evaporation from the pit lake surface, with groundwater from the surrounding rock continuing to flow into the void due to the hydraulic gradient.

This means the area is predicted to remain a groundwater and surface water sink such that any leachate released from the tailings would not migrate to adjoining groundwater or surface water resources.

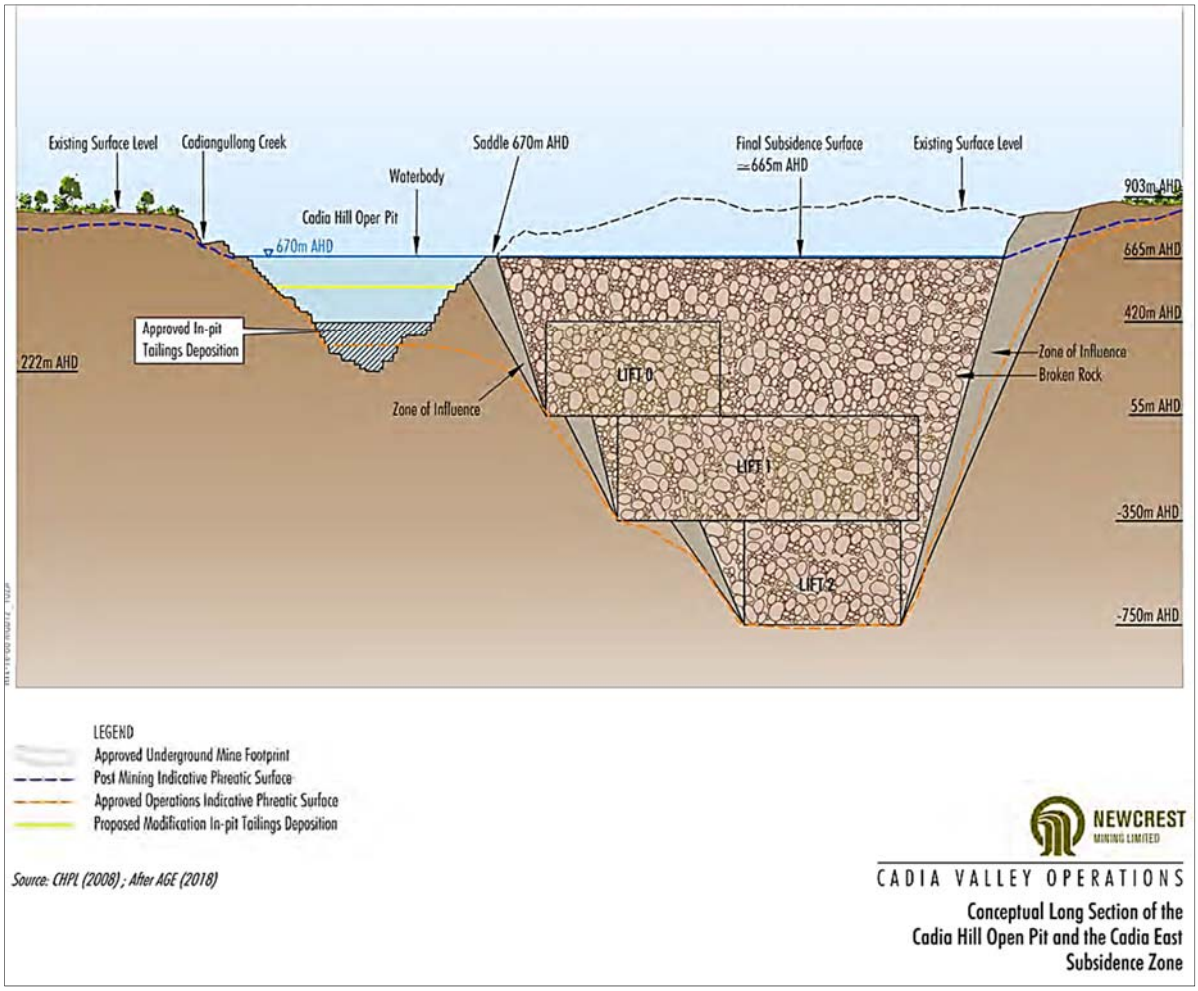

Figure 3: *Groundwater levels during operations and post mining recovery*

The predicted equilibrium level of 670 m AHD for the pit/subsidence lake would also be 51 m below the spill point at 721 AHD into the adjoining surface water system, with the base level of Cadiangullong Creek at 708 m near the pit and 38 m above the pit lake equilibrium level.

Dr Merrick concludes that *"the evidence for ongoing behaviour of the Cadia Hill pit as a groundwater sink is compelling"* and he concurs with AGE's conclusion that *"the risk to the groundwater regime from tailings emplacement is considered negligible."*

Permeability of the Cadia Hill pit shell

The tailings would be deposited deep into the Cadia pit shell which is entirely within the Ordovician volcanic basement rock. This rock has a very low permeability, with the recent groundwater modelling assuming a permeability in the range $5x10^{-12}$ to $6x10^{-11}$ meters per second (m/sec). This permeability is orders of magnitude below the EPA's current standard for tailings facilities, which requires a permeability of $1x10^{-9}$ m/sec.

This very low permeability is supported by the low groundwater inflow observed seeping into the pit and the high pore water pressure measured close to the pit wall. This is shown in **Figure 3** above where the groundwater or phreatic surface during mining operations is maintained near the void wall. It is estimated from groundwater modelling that there is currently around 0.7 megalitres (ML) of seepage into the pit daily.

Regardless of the low permeability of the rock, which means that seepage rates are very low, given that the open cut and adjoining subsidence area remain a groundwater sink, the permeability of the tailings emplacement area within the pit is not a material issue. Dr Merrick relevantly concludes:

"The usual requirement of 10^{-9} m/sec as the permeability of a liner/ container, for prevention of leakage/ seepage, is irrelevant when the fluid feature is a gaining system (a sink)"

The Department also notes that there are several fault lines that intersect the open cut. Faults can act as higher permeability conduits. However again, as the open cut will be a permanent groundwater sink, it is predicted that there would be no groundwater movement outwards into the surrounding rock through faults.

Tailings leachate quality

The 2009 EA identified that the water quality in the final lake void would progressively deteriorate because of the pit lake forming and salts concentrating over time and through acid generation from sulphide materials remaining in-situ within the Cadia East caving void area. HEC considered this in its review for this modification and concluded that neither of these drivers of final void water quality would be changed by the modification.

The Department also notes that the approved Water Management Plan already includes provision for tailings leachate to be pumped to the Cadia open cut pit as a management measure during excess wet weather periods to protect the tailings and Upper Rodd Creek dam embankments during flood events.

Conclusion

Based on the above, both the Department and the EPA are satisfied that the continued emplacement of tailings within the Cadia open cut would have no additional impact on water resources beyond that predicted by the existing groundwater model, and would not adversely impact groundwater or surface water quality.

The Department also notes that the existing conditions of approval require Cadia to undertake a comprehensive groundwater monitoring program (including monitoring the hydraulic gradient and groundwater quality around the base of the Cadia open cut pit) and to review the groundwater monitoring network, including the installation of additional monitoring bores. The Department notes that Cadia has since commissioned 12 monitoring bores in and around the pit to assist with monitoring of tailings deposition in the pit, as part of its revised Water Management Plan prepared following Modification 11. The Water Management Plan would be further reviewed and updated in consultation with DoI L&W, following approval of this modification application. Monitoring results would continue to be reported in Cadia's Annual Review. The Department has therefore not recommended any amendments to the approval conditions in this regard.

5.2 Other Issues

Table 1 summarises the Department's consideration of other issues related to the modification.

Table 1 | Assessment of other issues

Issue	Consideration	Recommendation
Final Landform	• The final landform of the Cadia Hill pit area would not change due to the modification. A pit lake would develop over the emplaced tailings with the stabilised water level predicted to be at AHD 670 m, about 110 m above the emplaced tailings. Under these circumstances, it is proposed that the tailings material would not be capped with soil and/or higher permeability capping materials. • Given the conclusions of the water assessments that the modification would cause no material change to the water quality impacts from the approved project, the Department is satisfied that the proposed modification is consistent with the approved final	• Comply with existing conditions.

	landform. As noted in Section 4, the Resources Regulator advised it had no comments in regard to rehabilitation.	
Mine Safety and Hazards	• The emplacement of tailings to AHD 560 m would not materially change safety hazards in the underground workings due to the low permeability of the Ordovician rock in the open cut pit and distance to the Cadia East underground workings. • As noted in Section 4, the Resource Regulator has advised it has no specific issues with mine safety because of the modification.	• Comply with existing conditions.
Noise and Air Quality	• Tailings deposition is undertaken deep in-pit in a central location of the mine. • There would be no significant incremental increase in air or noise impacts. • The approval conditions impose strict noise and air conditions including noise and air limits, air quality operating conditions and air and noise monitoring requirements.	• Comply with existing conditions.
Social and Economic	• The proposed modification would allow the mine to continue to operate at full production while engineering solutions to repair the tailings dam are considered. This would facilitate the continued social and economic benefits of the mine, including direct employment of an average of 880 employees, direct revenues from operations, investments in public infrastructure and services, business opportunities for local suppliers and a range of indirect economic benefits.	• Noted.
Resource Utilisation	• DRG has confirmed that the emplacement of tailings within the Cadia Hill open cut would not sterilise economically viable ore resources.	• Noted.

6. Evaluation

The Department has assessed the modification application and supporting information in accordance with the relevant requirements of the EP&A Act.

The Department considers that the proposed modification to place additional tailings in the Cadia Hill pit can be undertaken with no significant environmental impacts on biodiversity, heritage or the amenity of surrounding residences.

The Department is satisfied there would be minimal environmental risk to groundwater, noting that additional groundwater monitoring would be undertaken as part of the long-term water management strategy that includes ongoing verification and validation of the groundwater model.

Importantly, the modification would enable the full benefits of the project to be realised without any significant environmental impacts beyond those assessed and approved for the original project. Consequently, the Department considers the modification is in the public interest and can be approved, subject to conditions.

7. Recommendation

7.1 Recommended Conditions

The Department has drafted a Notice of Modification (see **Appendix C**) for the proposed modification, as well as a consolidated version of the project approval as modified (see **Appendix D**).

Cadia has reviewed the proposed conditions and has raised no concerns.

It is recommended that the Director, Resource and Energy Assessments as delegate of the Minister for Planning:

- **considers** the findings and recommendations of this report; and
- **determines** that the application (06_0295 MOD 12) falls within the scope of section 4.55(1A) of the EP&A Act;
- **accepts and adopts** all of the findings and recommendations in this report as the reasons for making the decision to grant approval to the application;
- **modifies** the approval (06_0295); and
- **signs** the attached approval of the modification (**Appendix C**).

Recommended by:

21/9/18

Rose-Anne Hawkeswood
Senior Environmental Assessment Officer
Resource and Energy Assessments

Recommended by:

21/9/18

Phillipa Duncan
Team Leader
Resource and Energy Assessments

8. Determination

The recommendation is: **Adopted / Not adopted by:**

24/9/18

Steve O'Donoghue
A/Director
Resource and Energy Assessments

Appendices

Appendix A – List of Documents

The Department has considered the:

- Cadia Valley Operations (July 2018) Cadia Hills Tailings Continuation Modification – Statement of Environmental Effects;
- advice from key Government agencies, including DRG, EPA, the Resources Regulator and the Department of Industry – Lands and Water;
- letters provided by Blayney Shire Council, Cabonne Council and Orange City Council;
- existing conditions of approval;
- relevant environmental planning instruments, policies and guidelines; and
- relevant requirements of the EP&A Act.

Appendix B – Statement of Environmental Effects

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=9548

Appendix C – Notice of Modification

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=9548

Appendix D – Consolidated Approval

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=9548