To: Hazelwood Rehabilitation Project Inquiry and Advisory Committee

18 November 2026

Hazelwood Rehabilitation Environment Effects Statement (EES)

We appreciate the opportunity to provide feedback to the Hazelwood Rehabilitation Project Inquiry and Advisory Committee (IAC) regarding the environmental effects of the proposed rehabilitation of the Hazelwood coal mine.

We acknowledge the Gunaikurnai as the Traditional Custodians of the Durt'Yowan (Latrobe River), its wetlands, and the Gippsland Lakes. We pay our respects to their Elders past and present.

About Environment Victoria

Environment Victoria is the leading not-for-profit environmental advocacy organisation in Victoria. With more than 40 grassroots member groups and over 200,000 individual supporters, we've been representing Victorian communities on environmental matters for over 55 years. Through advocacy, education and empowerment, Environment Victoria seeks significant and enduring solutions that will safeguard the environment and future wellbeing of all Victorians.

We campaign for a fast and fair transition away from fossil fuels, and have a long history of standing with the Latrobe Valley community and its workers. This has included deep organising and advocacy work over the past decade, supporting mine rehabilitation and advocating for a just, clean energy transition as coal plants retire. We know from previous large economic transitions that just leaving it to the private market will leave communities in the lurch. The Latrobe Valley community needs support to seize the opportunities that come with a planned transition, including opportunities from rehabilitation and post-closure land uses. Mine operators must be held responsible for clean-up so that local communities are protected from the health impacts of contaminated water, air and land, and aren't made to bear the financial burden.

1 Introduction

The Hazelwood coal mine is a massive site, comparable in size to the entire town of Morwell which is directly adjacent. As the first of three major coal mines in the Latrobe Valley region to close, and in close proximity to residential areas, waterways and aquifers, it is imperative that an appropriately high, precedent-setting standard is set for the closure.

Mine closure is a well-understood field with established guidelines and practices. For example, the International Council on Mining and Metals (ICMM) publishes the *Integrated Mine Closure: Good*

PO BOX 12575 A'BECKETT STREET, VICTORIA, AUSTRALIA 8006 LEVEL 2, 60 LEICESTER STREET, CARLTON, VICTORIA, AUSTRALIA 3053
Tel (03) 9341 8100 Email: admin@environmentvictoria.org.au **www.environmentvictoria.org.au** ABN 84 495 053 605 Reg No A0023095M

Practice Guide, which emphasises the importance of having a vision for post-closure, linked to realistic post-closure land uses.[1] Unfortunately, the EES fails at this first step. It is not written with any post-closure land use in mind beyond "a range of productive land uses […] determined at a later time."[2]

Without identifying realistic post-closure land uses – a process that needs to be undertaken with the community and Traditional Owners – there is no basis on which to identify sensitive receptors, undertake risk assessments, and articulate clear closure criteria. Post-closure land use planning is not a brainstorming exercise; it is an iterative and evidence-based process to demonstrate that the identified end points are achievable. Rehabilitation must demonstrate no significant risk or show through a transparent basis of evidence, acceptable to stakeholders, that opportunity will exceed risks. Anything less is just marketing.

Environment Victoria is anxious for an appropriate and leading-practice rehabilitation plan to be approved for the Hazelwood mine. The rehabilitation of the Hazelwood coal mine is a pivotal point in the future of water for the Latrobe Valley and Gippsland, an area that is already under significant water stress. A decade has already passed since the cessation of power generation at Hazelwood, with limited and opaque progress on rehabilitation despite repeated advice from experts and significant community interest. The EES process needs to deliver to a high standard.

People in Gippsland care deeply about water and climate. Several groups have already articulated their visions for the land and waters after coal.

- The Gunaikurnai Land and Waters Aboriginal Corporation published a position statement, *Healing Wurruk After Coal*, which sets out a vision, principles and priorities for healing landscapes and relationships, embedding cultural knowledge into future work on Wurruk (land) and realising economic independence for Gunaikurnai communities.[3]
- The Concerned Waterways Alliance calls for a "no net ecological harm" approach to rehabilitation that heals the Latrobe-Lakes system rather than shifting harm downstream.[4]
- In 2023 Latrobe Valley community leaders explored perspectives on the energy transition with The Next Economy and expressed desires for stronger environmental protections, sustainable and creative solutions to mine and site rehabilitation and repurposing, and greater support for self-determined Traditional Owner leadership.[5]
- The Cooperative Research Centre into Transformations in Mining Economies (CRC TIME) has worked with a wide range of Gippsland stakeholders to develop understandings of mine closure and post-mine land use since 2020.[6]

[1] International Council on Mining and Metals, 'Integrated Mine Closure: Good Practice Guide', 2025, https://www.icmm.com/integrated-mine-closure.
[2] Engie, *Hazelwood EES: Chapter 04 Project Description* (2026) p4-8.
[3] Gunaikurnai Land and Waters Aboriginal Corporation, *Healing Wurruk after Coal: Position Statement* (Kalimna West, Victoria, 2025), https://gunaikurnai.org/wp-content/uploads/2025/10/Healing-Wurruk-after-Coal-Position-Statement-FINAL.pdf.
[4] 'Submission to the Draft Hazelwood Declared Mine Rehabilitation Plan | Concerned Waterways Alliance', accessed 16 November 2026, https://concernedwaterwaysalliance.org/submission-to-the-draft-hazelwood-declaredmine-rehabilitation-plan/.
[5] The Next Economy. What next? Community Perspectives on Latrobe Valley's Energy Transition. 2023. https://nexteconomy.com.au/work/what-next-community-perspectives-on-the-energy-transition-in-the-latrobe-valley/.
[6] *CRC TiME • Post-Mine Transitions*, 15 April 2015, https://crctime.com.au/.

- Great Latrobe Park has set out a vision for economic development and liveability of which rehabilitated landforms are a key part.[7]

These are just some examples – there are many more.

During September and October 2026, Environment Victoria conducted 56 surveys at the clock tower in Sale, which draws town water from the Gippsland Basin. Of those who responded, 91 percent said they were "concerned" or "really concerned" about the security or availability of freshwater supplies in the coming decade, citing mismanagement, competing demands for water, climate change and salinity/pollution as key matters of concern. In addition, 89 percent were "concerned" or "really concerned" about the health of local rivers, wetlands and the Gippsland Lakes. They saw low flows, salinity and pollution as major issues.

This submission is based on our internal review of the EES and other relevant documents, as well as advice from mine closure expert Professor Thomas Baumgartl (Dr. rer. Nat; FAusIMM) and other mine rehabilitation experts. Our aim is to provide detailed and evidence-based feedback towards a rehabilitation plan that sufficiently addresses long term risks to rivers, wetlands and groundwater, flora and fauna, cultural values, and community values, and that demonstrates a pathway to achieving realistic and beneficial outcomes.

This submission reflects the parts of the EES that we were able to review within the short public exhibition period. Where we have not commented on aspects of the EES, this should not be interpreted as endorsement.

1.1 Capabilities of the IAC

Much of our feedback relates to water quality (both surface and groundwater). While we have no objection to any of the appointed IAC members, we note that water is not strongly featured among the members' key capabilities.

We respectfully request that the IAC consider expanding membership to include key capabilities including hydrogeology, aquatic ecology and geochemistry. In addition, we encourage the IAC to draw on expertise from jurisdictions with greater experience in mine pit lakes, such as Western Australia.

1.2 Summary of our key concerns

We consider the EES to be incomplete, underdeveloped and not meeting industry-leading practice. It requires a comprehensive and transparent options analysis that evaluates benefits and residual liabilities together. It needs to present an integrated, iterative process that incorporates specific objectives linked to post-closure land uses.

The fact that so many local groups have self-organised to develop their own visions for post-closure land use is an asset to this project that should be built on – not ignored.

Knowledge gaps need to be addressed, not dismissed. Well-defined closure criteria, as well as processes for when controls fail, models and observations don't align, or water quality deteriorates, need to be defined.

The evidence for long-term chemical stability and protection of all relevant water values still needs to be established:

[7] 'Great Latrobe Park — Transform Latrobe Growth beyond Coal', Great Latrobe Park — Transform Latrobe Growth beyond Coal, accessed 16 November 2026, https://www.glp.org.au.

- The water quality assessment needs to demonstrate long-term chemical stability over 200 – 500 years.
- The assessment must show that rehabilitation will not unacceptably affect downstream water quality, groundwater-dependent ecosystems, cultural values, other water users, and future uses.
- It must be demonstrated that the pit lake and any receiving waters will meet defined environmental objectives over the relevant timescale – not that they will merely behave as modelled – and the default guideline values (DGVs) must match the objectives.
- Modelling needs to account for all contaminants of particular concern (COPC) and all pathways by which they could enter the pit lake.
- If connected to the Morwell River, outlet criteria must address all COPC – not just pH, total dissolved solids and turbidity.
- Water supply trade-offs and cumulative catchment effects need to be shown to be acceptable during drought and under climate change.
- Water quality modelling needs to cover the full consequences of stratification and high nutrient concentrations.

Closure outcomes must demonstrate a safe, stable and non-polluting landform.

- Long-term performance needs to be verified against genuinely SMART[8] closure criteria, tied to the closure objectives, that can be used to indicate success.
- Any dependence on pumping, top-up water, gates or other controls needs defined failure scenarios (what happens if controls fail or things don't behave as modelled?), response measures and funded roles and responsibilities. These need to cover the life of the landform including after Engie has relinquished responsibility.
- The closure timeline needs to be sufficiently long to demonstrate long-term stability of groundwater, evapoconcentration, chemistry, nutrients and ecology.
- Claims of ecological benefits from the pit lake need to be backed with plans to achieve land uses for wildlife, such as habitat creation.

Biodiversity and ecological values

- The assessment needs to demonstrate avoidance and minimisation first, with any required offsets addressed separately.
- Ecological objectives should be measurable and tied to water quality, nutrients, dissolved oxygen, stratification, algal and cyanobacterial blooms, sediment chemistry and relevant aquatic species.
- The consequences of contaminant accumulation and intermittent river connection need to be addressed against the intended ecological values, using the appropriate standards.
- Knowledge gaps such as the occurrence and distribution of groundwater-depended ecosystems (GDEs) need to be addressed.
- Source-pathway-receptor (SPR) modelling then needs to incorporate all of these relevant sources, pathways and receptors.

Amenity, socio-economic and land use

- Potential (yet to be demonstrated) benefits need to be distinguished from committed, funded and feasible outcomes.

[8] Specific, measurable, achievable, relevant and time-bound.

- Future benefits and residual liabilities must be assessed together, including quantification and providing for their management at relinquishment.
- The EES should consider the impacts on the local climate.

The rehabilitation of the Hazelwood Ash Retention Area (HARA) and its associated impacts should be incorporated into the EES, and hence subject to the same level of transparency, risk assessment and public participation.

The proposed interconnection with the Morwell River should not be approved without further assessment and justification as part of a quantified options analysis. The risk of catastrophic river capture needs to be examined in detail.

Water entitlements for Hazelwood should be brought into line with those in place for the rehabilitation of the Yallourn and Loy Yang mines, in terms of conditions, caps and pricing. They should be administered via a public, Ministerial decision process.

The geotechnical assessment has gaps and questions:

- Ensure appropriate assumptions and parameter values were used, particularly coal friction angles and the presence of joints in coal seams.
- Leakage of water from the pit into the surrounds needs to be assessed.
- Subsidence risks to Morwell township from groundwater rebound need to be fully assessed.
- Treatment of the covered batter and overburden slopes (such as fertilisation) need to address the requirements of post-closure land uses, and incorporated into water quality assessments.

1.3 Concerned Waterways Alliance (CWA)

Environment Victoria is a member of the CWA which has also submitted to this EES. Rather than duplicating the content of the CWA submission here, we endorse the CWA submission in full.

2 Detailed feedback

2.1 Adherence to industry-leading guidelines and practice

Industry-leading practice is unequivocal that mine closure needs to be planned around clear and agreed-upon objectives for future land use. The ICMM *Good Practice Guide* emphasises the importance of *early* definition of closure vision, principles and objectives, underpinned by the potential post-closure land use(s) of the site.[9] Closure planning is cyclic as information and knowledge is updated through progressive closure. Definition of the vision, principles and objectives is a necessary part of this cycle – not a job for later.[10]

The Australian Government's mine closure guidelines state that general objectives (safe to humans, domestic livestock and wildlife; non-polluting; stable; and able to sustain an agreed post-closure land use) should be accompanied by site-specific rehabilitation objectives for each defined land use.[11] Engie has only provided general objectives. The Australian Government guidelines are clear that the rehabilitation performance objectives (or completion criteria) "[…] should ideally be drafted in the planning phase of the mine, in consultation with key stakeholders, and then regularly reviewed as research, monitoring and progressive rehabilitation are undertaken."

[9] International Council on Mining and Metals, 'Integrated Mine Closure'.
[10] International Council on Mining and Metals, 'Integrated Mine Closure'.
[11] Department of Foreign Affairs and Trade, *Mine Closure - Leading Practice Sustainable Development Program for the Mining Industry* (2016), https://www.industry.gov.au/publications/leading-practice-handbooks-sustainable-mining/mine-closure.

Similarly, Asia-Pacific Economic Cooperation (APEC) states that selecting post-closure land use is arguably the single most important decision in developing a closure plan, as it will define all closure and reclamation activities. The APEC guidelines say that a focus on post-closure land use should start at the early planning stage.[12]

The Draft Declared Mine Rehabilitation Plan (DMRP) in the EES package cites ICMM guidelines but omits the closure vision, principles and objectives in its depiction of the ICMM framework.[13] The EES expresses an insistence that post-closure land use will not be contemplated in any detail until some unspecified time in the future. As the Draft DMRP states, "Post closure land capability/land use to be informed by consultation with relevant stakeholders (to be pursued in future following the successful completion of the relevant works)."

Engie should already have developed specific rehabilitation objectives for all relevant land uses, and these should be used to set appropriate and relevant standards that reflect the level of protection for agreed values and outcomes and to inform the risk assessment.

2.2 Use of relevant standards for water quality

The EES needs to demonstrate that the pit lake can become an ecologically acceptable water body. 'Safe to wildlife' is a minimum general rehabilitation objective in Australia.[14] For this, the fundamental benchmark is protection of the receiving ecosystem and relevant receptors. The required evidence is a clearly articulated and site-specific ecological objective, agreed with stakeholders, demonstrating that long-term lake water quality will not cause unacceptable ecological effects without requiring management intervention.

Relevant receptors include fauna listed under the Environment Protection and Biodiversity Conservation (EPBC) Act and the Flora and Fauna Guarantee (FFG) Act known to or likely to use the site. This includes waterfowl which feed upon pit lake organisms and may have body burdens of COPC through bioaccumulation, biomagnification, direct contact and ingestion of lake water and sediments.

The correct benchmarks must be used. The EES dismisses the ANZG guidelines for freshwater aquatic ecosystems as "highly conservative". However, these guidelines are appropriate for pit lakes because they account for all water quality values for wildlife, including not just aquatic biota but resting, breeding and feeding birds. Furthermore, the ANZG guidelines state that 99% species protection DGV should be applied for highly bioaccumulating toxicants or where local biological or chemical data has not been gathered.

However, the EES adopts the lower-standard 95% species protection values. This means that biomagnification of heavy metals has not been considered, which contravenes leading pit lake management advice.[15] Both mercury and selenium biomagnify in pit lake aquatic ecosystems and

---

[12] Asia-Pacific Economic Cooperation, *Mine Closure - Checklist for Governments* (2018), https://www.apec.org/apecapi/publication/getfile?publicationId=1cdf75cc-f4cd-40a1-bbde-22e6c833718e.

[13] Engie, *Hazelwood Rehabilitation EES - Attachment II: Draft Declared Mine Rehabilitation Plan* (2026) p5, Figure 1.1.

[14] Department of Foreign Affairs and Trade, *Mine Closure - Leading Practice Sustainable Development Program for the Mining Industry*.

[15] Cherie D. McCullough and Mark A. Lund, 'Opportunities for Sustainable Mining Pit Lakes in Australia', *Mine Water and the Environment* 25, no. 4 (2006): 220–26, https://doi.org/10.1007/s10230-006-0136-0; Robert G. Doupé and Alan J. Lymbery, 'Environmental Risks Associated with Beneficial End Uses of Mine

therefore require assessment at 99%.[16] In addition, the modelling only includes dissolved contaminants and assumes that many metal contaminants will only occur in non-toxic forms without substantiating this claim, a gap that was also identified by the Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development (IESC) review for the Australian Government in 2025.[17] Again, the 99% DGV should apply because of this incomplete coverage.

Even incorrectly applying the lower standard of 95%, the pit lake water quality fails to meet benchmarks for aluminium, copper, chromium and zinc. The modelling shows increasing toxicity over time, resulting in declining ecosystem health.

The EES prefers benchmarks based on Australian drinking water guidelines and livestock drinking water guidelines, which are less onerous than the guidelines for freshwater aquatic ecosystems. However, drinking of pit lake water by humans or livestock is not mentioned in any discussion of post-closure land use. On the contrary, the Draft DMRP includes measures to prevent livestock from accessing the lake. These are irrelevant benchmarks to be modelling against.

2.3 Ecological outcomes and risk assessment

The crucial question for the EES is whether the proposed final ecosystem will protect existing environmental values and achieve a defensible, sustainable ecological endpoint. This has not been clearly demonstrated due to the shortcomings with the pit lake modelling detailed throughout this submission. The assessment needs to demonstrate avoidance and mitigation, with any offsets addressed separately. The creation of aquatic habitat via a pit lake does not automatically compensate for other ecological impacts.

For the lake, ecological objectives should be measurable and tied to water quality, nutrients, dissolved oxygen, stratification, algal and cyanobacterial blooms, sediment chemistry and relevant aquatic species. The consequences of contaminant accumulation and intermittent river connection need to be assessed against the intended ecological values.

Environmental risk assessment (ERA) of potentially contaminated mine water such as the Hazelwood pit lake is advised in mining environmental management guidance for the Asia-Pacific region and the Commonwealth in order to understand and manage closure risk.[18] As a fundamental step in determining and evaluating risk, a conceptual SPR model summarising key contaminant sources,

---

Lakes in Southwestern Australia', *Mine Water and the Environment* 24, no. 3 (2005): 134–38, https://doi.org/10.1007/s10230-005-0084-0.

[16] C. J. Twaroski and L. I. Segroves, 'Existing Mine Pit and Natural Lakes in Northern Minnesota as Predictors of Total Mercury Concentration of a Mine Pit at Closure', in *Proceedings of the Sixth International Conference on Mine Closure*, ed. A. B. Fourie et al. (Australian Centre for Geomechanics, 2011), https://doi.org/10.36487/ACG_rep/1152_61_Twaroski; L. L. Miller et al., 'Selenium Bioaccumulation in Stocked Fish as an Indicator of Fishery Potential in Pit Lakes on Reclaimed Coal Mines in Alberta, Canada', *Environmental Management* 52, no. 1 (2013): 72–84, https://doi.org/10.1007/s00267-013-0038-4.

[17] Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development, *Advice to Decision Maker on Coal Mining Project - Hazelwood Rehabilitation*, IESC 2025-162 (2025), https://www.iesc.gov.au/sites/default/files/2025-12/iesc-advice-hazelwood-rehabilitation-project.pdf.

[18] Department of Industry Science and Resources, *Preventing Acid and Metalliferous Drainage* (2022), https://www.industry.gov.au/publications/leading-practice-handbooks-sustainable-mining/preventing-acid-and-metalliferous-drainage; Asia-Pacific Economic Cooperation, *Mine Closure - Checklist for Governments*; Department of Foreign Affairs and Trade, *Mine Closure - Leading Practice Sustainable Development Program for the Mining Industry*.

pathways and receptors should be developed. The model must consider both limnology and aquatic ecology of the Latrobe region as well as known general principles and physical, chemical and ecological limitations to development of pit lake aquatic ecosystems.[19]

Lists of fauna expected to occur in the study area should include expected species likely to utilise the lake or be affected by changes to the Latrobe Valley region. In particular, the list should include species where the published understanding of their ecology indicates they are likely to interact with lentic waterbodies such as the pit lake. There is a risk that wildlife attracted to the pit lake could face poor health outcomes if the water quality is poor, whereby the lake effectively functions as an "attractive nuisance".[20]

The appropriate DGVs provide a starting point for assessing water quality risk to wildlife.[21] As noted earlier, the EES adopts inappropriate standards for water quality and impacts on wildlife. In addition, aquatic ecosystems are defined by regionally and site-specific climate, geochemistry and ecology which can differ significantly between geographic locations and following different land uses.[22] In particular, mining regions often contain enriched catchment geochemistry with resultant surface and groundwater hydro-chemistries of elevated contaminant concentrations.[23] Therefore the SPR model needs to be site-specific.

[19] Aneta Bylak et al., 'Analysis of Macrobenthic Communities in a Post-closure Sulphur Pit Lake (Poland)', *Mine Water and the Environment* 38, no. 3 (2019): 536–50, https://doi.org/10.1007/s10230-019-00624-2; Helena Otahelova, 'Distribution of Aquatic Macrophytes in Pit Lakes in Relation to the Environment (Borská Nížina Lowland, Slovakia)', *Ekologia-Bratislava*, 1 January 2006, https://www.academia.edu/81384753/Distribution_of_aquatic_macrophytes_in_pit_lakes_in_relation_to_the_environment_Borsk%C3%A1_n%C3%ADz_ina_lowland_Slovakia_; Heather Proctor and Andrew Grigg, 'Aquatic Invertebrates in Final Void Water Bodies at an Open-Cut Coal Mine in Central Queensland', *Australian Journal of Entomology* 45, no. 2 (2006): 107–21, https://doi.org/10.1111/j.1440-6055.2006.00529.x; Erin J. Thomas et al., 'Diatoms and Macroinvertebrates as Biomonitors of Mine-Lakes in Collie, Western Australia', *Journal of the Royal Society of Western Australia* 89, no. 3 (2006): 109--117; Brent G. Parsons et al., 'Relationships between Lake Water Chemistry and Benthic Macroinvertebrates in the Athabasca Oil Sands Region, Alberta', *Journal of Limnology* 69, no. 1s (2010): 118–25, https://doi.org/10.4081/jlimnol.2010.s1.118; Jasmina Kamberović, *ALGAE AND MACROPHYTES OF MINE PIT LAKES IN THE WIDER AREA OF TUZLA, BOSNIA AND HERZEGOVINA*, n.d., accessed 5 November 2026, https://www.academia.edu/16558878/ALGAE_AND_MACROPHYTES_OF_MINE_PIT_LAKES_IN_THE_WIDER_AREA_OF_TUZLA_BOSNIA_AND_HERZEGOVINA.

[20] J. V. Parshley and C. S. MacCallum, *Attractive Nuisances and Wicked Solutions*, ed. A. B. Fourie and M. Tibbett, Mine Closure 2016: 11th International Conference on Mine Closure, 2016 15–17 March, Perth (Australian Centre for Geomechanics, 2016), 229–40, https://doi.org/10.36487/ACG_rep/1608_15_Parshley.

[21] Australian Government, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (2018), https://www.waterquality.gov.au/anz-guidelines.

[22] Robert G. Wetzel, *Limnology: Lake and River Ecosystems*, 3rd ed (Academic Press, 2001).

[23] C. McCullough and J. J. Pearce, 'What Do Elevated Background Contaminant Concentrations Mean for AMD Risk Assessment and Management in Western Australia?', *Research Outputs 2014 to 2021*, 1 January 2014, https://ro.ecu.edu.au/ecuworkspost2013/868.

2.4 Gaps in pit lake modelling

Conceptual pit lake modelling supports empirical modelling and should integrate hydrogeology, hydrology, geochemistry, ecology and limnology to show that water quality guidelines will be met.[24] In this section, we detail the following gaps in the pit lake modelling:

- Duration
- Coverage of contaminants
- Stratification
- Harmful algal blooms.

Other issues regarding the pit lake modelling are included in subsequent sections.

2.4.1 Duration

The EES uses a time horizon of 100 years for modelling water quality in the pit lake, including the decades of filling, which is inexplicably half the duration of the geotechnical stability and groundwater modelling. We note that the IESC also asked for this modelling to go beyond 100 years.[25] Engie's response speculates about contaminant concentrations beyond 100 years, yet the modelling has not been included in the EES.[26]

The key issue in determining appropriate time horizons is the chemical stability of the lake. The APEC hierarchy of closure needs places physical stability and chemical stability as the most fundamental needs, without which compliance should not be granted.[27] Chemical stability is not demonstrated by the 100-year modelling in the EES – the model predicts the continuing deterioration of water quality.

APEC discusses appropriate planning horizons for mine closures, stating that closure works are expected to last a very long time, often "in perpetuity" or "until the next ice age".[28] Obviously there are limitations to what timescales can be meaningfully modelled, however APEC puts the model upper limit at 10,000 years.[29]

Useful reference points for determining the planning horizon include the design life of the overall closure system, the design life of specific closure components, or the recurrence interval of design events such as 1 in 1000-year storms while also accounting for climate change.[30]

In the case of Hazelwood – a pit lake in a temperate climate undergoing fast fill from a river diversion – because the lake interacts dynamically with a river system and may be intended for recreation and wildlife, the modelling focus needs to represent the shift from raw water-volume

[24] T. Eshtawi et al., *Review of Models Used to Simulate Hydrological and Geochemical Issues Related to Closure of Open Pit Mines* (Cooperative Research Centre for Transformations in Mining Economies, 2025); J. Tomlin et al., *Applying Leading Practice Modelling of Residual Mine Voids for Mine Rehabilitation Planning*, Technical Paper 3 (Office of the Queensland Mine Rehabilitation Commissioner, 2025).
[25] Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development, *Advice to Decision Maker on Coal Mining Project - Hazelwood Rehabilitation*.
[26] Engie, *Hazelwood Rehabilitation EES - Attachment VI: Response to IESC Advice* (2026).
[27] Asia-Pacific Economic Cooperation, *Mine Closure - Checklist for Governments*.
[28] Asia-Pacific Economic Cooperation, *Mine Closure - Checklist for Governments*.
[29] Asia-Pacific Economic Cooperation, *Mine Closure - Checklist for Governments*.
[30] Asia-Pacific Economic Cooperation, *Mine Closure - Checklist for Governments*.

recovery to long-term biological and geochemical stability.[31] The modelling time frame should cover distinct structural phases spanning at least 200 to 500 or more years.[32]

2.4.2 Coverage of contaminants

The EES must provide credible results concerning pit lake water quality, accounting for all COPC. The risk assessments need to include all COPC, including sources, pathways and receptors, and based on industry-leading guidelines on COPC risk from mining such as the DFAT guidelines.[33] The EES must account for all pathways by which contaminants can enter the lake including waste materials, host geology, groundwater, waste-rock landforms, tailings/ash and other contaminated in-pit landforms.

In addition to the gaps described in the earlier section regarding water quality standards and listed species, the pit lake water quality modelling does not include solutes and metals originating from the pit materials themselves despite the fact that testing has shown leachate metals from weathered and fresh coal, overburden and ash. It is known that flooding a mine pit will flush stored oxidation products and contaminants from pit walls and mine materials.[34]

Further, decommissioning the cooling pond exposes potentially contaminated sediments and "unknown waste deposits". Potentially contaminated materials will be exposed and mobilised during the closure process without a sufficiently demonstrated contaminant pathway assessment. Exposure and disturbance of these sediments during rehabilitation, including re-establishment of Eel Hole Creek through the disturbed area, is likely to lead to the transport of contaminants downstream into the Morwell River. Given the complexity of contaminant pathways for this project, it is not credible to separate out assessment of the cooling pond, nor other areas that contribute.

2.4.3 Stratification

Stratification is recognised as a major control on Hazelwood pit lake water quality evolution, and the likelihood for stratification of Latrobe Valley pit lakes has long been established.[35] Stratification could lead to chemical stagnation at the bottom of the lake, triggering the release of elevated heavy metals and salts that exceed standard ANZG guidelines. I can also contribute to algal blooms (discussed in the next subsection). If the lake is connected to local waterways, any sudden mixing event or controlled discharge of this stratified water into the Morwell River presents a severe risk to downstream aquatic and riparian ecosystems.

Leading pit lake closure planning guidance specifically says that advanced pit-lake assessments should model stratification and calibrate it against field data because it can materially affect water quality.[36]

---

[31] Cherie D. McCullough et al., 'Realizing Beneficial End Uses from Abandoned Pit Lakes', *Minerals* 10, no. 2 (2020): 133, https://doi.org/10.3390/min10020133.

[32] Eshtawi et al., *Review of Models Used to Simulate Hydrological and Geochemical Issues Related to Closure of Open Pit Mines*.

[33] Department of Foreign Affairs and Trade, *Mine Closure - Leading Practice Sustainable Development Program for the Mining Industry*.

[34] 'GARD Guide - Global Acid Rock Drainage Guide', GARD Guide, accessed 21 October 2026, https://gardguide.com/.

[35] R. Hardie and A. Sims, 'Integrating Catchment, Waterway and Environmental Risk to Support a Pit Lake Closure Strategy', ed. AB Fourie et al. (Australian Centre for Geomechanics, 2026), 1–13, https://papers.acg.uwa.edu.au/p/2615_15_Hardie/.

[36] Department of Mines, Petroleum and Exploration, *Mine Closure Plan Guidance – How to Prepare in Accordance with Part 1 of the Statutory Guidelines for Mine Closure Plans* (Government of Western Australia, 2025), https://www.wa.gov.au/government/publications/mine-closure-plan-guidance-how-

Although the EES acknowledges stratification, the water quality modelling does not give enough information to determine whether the full biogeochemical consequences of stratification and mixing have been robustly demonstrated. Importantly, seasonal changes or full lake turnovers could bring water that is highly contaminated with ammonia, free phosphorus and reduced and bioavailable forms of dissolved metals and metalloids from deoxygenated bottom water to the surface waters. The effect of lake stratification and evapoconcentration of COPCs in surface waters is also not accounted for in water quality risk assessments.

2.4.4 Harmful algal blooms

High nutrient concentrations coupled with regular and extended thermal stratification over summer creates a high likelihood of cyanobacterial blooms in pit lakes.[37] This is certainly the case for Hazelwood, given the potential introduction of nutrients from soil fertilisation and/or the interconnection with the Morwell River, combined with stable thermal stratification. Nitrogen nutrients can present risks in pit lakes both through direct toxicity and through eutrophication.[38] Eutrophication is a known risk from the Hazelwood pit lake and it must be included in predictive water quality and associated risk assessments.[39]

The EES predicts that nitrate-N, total nitrogen, reactive phosphorus and total phosphorous nutrient concentrations exceed the ANZG guideline values for freshwater aquatic ecosystems at the 95% species protection levels in all scenarios – substantially so in the interconnected scenario.[40] The modelling indicates that nutrient levels in the pit lake could lead to moderate to high levels of plant primary production and, under certain conditions, algal blooms. However, no bio-geochemical processes (including nutrient cycles) are considered as part of EES water quality modelling.

Engie dismisses the risk of harmful algal blooms associated with nutrient levels in the pit lake as "[…] comparable to risks currently experienced within other human-made waterbodies in Victoria."[41] This is not a useful comment; the proposed pit lake will create a new source, habitat and transport pathway that increases algal bloom frequency, duration, biomass or downstream exposure to human and ecological receptors.

The inherent risk presented by this additional, massive lake with a high chance of harmful algal blooms must be managed to an acceptable risk quantum, and the risks to pit lake discharge should be considered in addition to those of COPC concentrations.

---

prepare-accordance-part-1-of-the-statutory-guidelines-mine-closure-plans; J. A. Vandenberg et al., 'Use of Water Quality Models for Design and Evaluation of Pit Lakes', in *Mine Pit Lakes: Closure and Management*, ed. Cherie D. McCullough (Australian Centre for Geomechanics, 2011), https://www.researchgate.net/publication/265489943_Use_of_water_quality_models_for_design_and_evaluation_of_pit_lakes; Jerry Vandenberg et al., 'The Future Direction of Pit Lakes: Part 2, Corporate and Regulatory Closure Needs to Improve Management', *Mine Water and the Environment* 41, no. 2 (2022): 544–56, https://doi.org/10.1007/s10230-022-00868-5; Devin Castendyk et al., 'A Validated Method for Pit Lake Water Sampling Using Aerial Drones and Sampling Devices', *Mine Water and the Environment* 39, no. 3 (2020): 440–54, https://doi.org/10.1007/s10230-020-00673-y.

[37] Włodzimierz Marszelewski et al., 'Understanding Abiotic and Biotic Conditions in Post-closure Pit Lakes for Efficient Management: A Case Study (Poland)', *Mine Water and the Environment* 36, no. 3 (2017): 418–28, https://doi.org/10.1007/s10230-017-0434-8.

[38] Cherie D. McCullough, 'The Importance of Nitrate Dynamics in Mine Pit Lakes of Drier Regions', *Mine Water and the Environment* 43, no. 2 (2024): 231–54, https://doi.org/10.1007/s10230-024-00987-1.

[39] Victorian Government, *Hazelwood Mine Fire Inquiry Report 2015/2016. Volume IV, Mine Rehabilitation*. (2016), https://www.vgls.vic.gov.au/client/en_AU/search/asset/1306811/0.

[40] We reiterate that the assessment should use the 99% species protection levels.

[41] Engie, *Hazelwood Rehabilitation EES - Chapter 10: Lake Water Balance and Water Quality* (2026).

2.5 Hazelwood ash retention area (HARA)

The Hazelwood Ash Retention Area (HARA) is an ash landfill that will be submerged inside the pit lake under Engie's proposal. Coal ash can contain serious contamination, or it can be benign, and the nature and rehabilitation of the HARA has long been a concern of advocates and community members.[42]

Previous assessment of the HARA ash found it to include the major constituents (90% in total – listed in order of decreasing percentage) calcium, magnesium, sodium, sulphate and iron. The ash has the potential to leach major ions (sulphate, sodium, chloride, calcium and potassium), metals (aluminium, copper, cobalt, iron, manganese, molybdenum, nickel, selenium), boron and fluoride, and trace concentrations of selected other contaminants. The ash water is also noted to be highly alkaline (pH 12.3-12.7) and saline (TDS, 16,000 mg/L).[43]

If uncapped and unsubmerged, the HARA is a source of dust pollution requiring water suppression. However, underwater mine waste disposal can introduce closure risks such as contamination of the pit lake, surface waters and groundwater. There are no Environment Protection Authority (EPA) guidelines for submerged landfills in Victoria.

It is concerning that the rehabilitation of the HARA is not explicitly being considered in the public EES process; instead, it is being negotiated with the EPA without public participation. The environmental audits undertaken as part of EPA processes have also assumed that the pit lake is not interconnected with the Morwell River. We argue that if the community is expected to eventually make use of the pit lake, studies and modelling regarding the HARA should be published and considered as part of the EES process. An additional concern is that the HARA has not been subject to the review of the IESC.[44]

The 2020 environmental audit of the HARA found that groundwater from at least some of the surrounding bores are affected by leachate from the disposal of ash waste. As a result, beneficial uses of groundwater for water-based recreation, potable water supply, stock watering and irrigation were ruled out in that audit because of the contaminated groundwater at the HARA. The dewatering regime at that time produced a cone of depression that was thought to capture the groundwater contaminated by the HARA. The audit also noted that it did not consider the risk to receptors following the cessation of the dewatering.[45] Given the exclusion of the HARA rehabilitation from the EES process, it is not clear how the present regime and the proposed rehabilitation of both the HARA and the coal mine change this situation.

The EES contends that the HARA contributes insignificantly to overall pit lake water quality because its seepage is diluted by other inflows over the 100-year simulation. However, there has been no infiltration testing of the HARA or external overburden dumps. Over the life of the pit lake, this contribution may be more significant, especially where the model itself predicts ongoing

[42] 'Reports: Engie's Plan for Hazelwood Will Release Toxic Coal Ash Pollution', *Environmental Justice Australia*, n.d., accessed 22 October 2026, https://envirojustice.org.au/publication/reports-engies-plan-for-hazelwood-will-release-toxic-coal-ash-pollution/.
[43] AECOM, *Environmental Audit: Landfill Operations - Hazelwood Power Station* (2017).
[44] Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development, *Advice to Decision Maker on Coal Mining Project - Hazelwood Rehabilitation*.
[45] AECOM, *Environmental Audit: Landfill Operations - Hazelwood Power Station* (2020).

concentration beyond 100 years. Risks from wind-driven shoreline erosion of the HARA – as well as the eastern highwall – should be addressed but have not.[46]

Planning for mine waste disposal requires a detailed characterisation of mine wastes and their behaviour in the specific pit lake environment.[47] Passive diffusion and the effects of wave action on HARA weathering should be considered in both conceptual and empirical modelling and need to be demonstrated over the relevant period.[48]

Other critical internal and pit lake-HARA interaction processes are the contaminant inventory, leachate chemistry, source-term longevity, hydraulic connection, contaminant attenuation, sediment accumulation, oxidation-reduction behaviour, changing lake levels and the effects of changing groundwater gradients.

A key concern about the submerged HARA is the risk of suspended ash cenospheres visible on the surface of the lake and potentially releasing mobile toxins including heavy metals.[49] We note that the draft DMRP states that cenosphere studies have been done, however we are not aware that these studies have been make public. Other information such as the design of the HARA capping has been agreed with the EPA, but is not public.

Given that progress appears to have been made on the capping design and risks of the HARA rehabilitation, there is now a need for transparency. We recommend that the IAC ask that all HARA studies are tabled as part of this EES process, given that the public is expected to make use of the pit lake in future. We also ask that the IAC ensure that Engie has fully implemented all recommendations made by the environmental auditor since 2017.

2.6 Interconnection with the Morwell River

The proposed rehabilitation plan involves connecting the pit lake to the Morwell River via a constructed channel and inlet with engineered gates and taking peak flows from the Morwell River. The justification provided is that this would reduce reliance on surface water from Moondarra Reservoir and pumped groundwater. Interconnection would also support a slightly faster fill of the pit lake (reducing filling time by only around 0.3 to 1.1 years). However, serious concerns have been raised about the interconnected option.

The interconnection has been raised as an issue of concern by the IESC.[50] The IESC identified that many of the potential impacts of the project are associated with the connected scenario, including:

---

[46] C. D. McCullough et al., *Process-Based Erosion Modelling for Shoreline Rehabilitation Design of a Coal Mine Pit Lake*, ed. A. B. Fourie and M. Tibbett, Mine Closure 2019: 13th International Conference on Mine Closure, 2019 3-5 September 2019, Perth (Australian Centre for Geomechanics, 2019), 75–88, https://doi.org/10.36487/ACG_rep/1915_07_McCullough.

[47] C. D. McCullough et al., *Mine Waste Disposal in Pit Lakes: A Good Practice Guide*, ed. A. B. Fourie et al., Mine Closure 2024: 17th International Conference on Mine Closure, 2024 26-28 November 2024, Perth (Australian Centre for Geomechanics, 2024), 1063–76, https://doi.org/10.36487/ACG_repo/2415_76.

[48] Christopher Gammons et al., 'Creating Lakes from Open Pit Mines: Processes and Considerations, Emphasis on Northern Environments', *Geological Engineering*, 1 January 2009, https://digitalcommons.mtech.edu/geol_engr/2; McCullough et al., *Mine Waste Disposal in Pit Lakes*.

[49] Environmental Justice Australia, 'Reports: Engie's Plan for Hazelwood Will Release Toxic Coal Ash Pollution', *Environmental Justice Australia*, n.d., accessed 12 November 2026, https://envirojustice.org.au/publication/reports-engies-plan-for-hazelwood-will-release-toxic-coal-ash-pollution/.

[50] Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development, *Advice to Decision Maker on Coal Mining Project - Hazelwood Rehabilitation*.

- Risk of catastrophic capture of the Morwell River if the inlet structure fails, with likely severe downstream impacts in the Morwell and Latrobe Rivers.
- Clearing an additional 0.743 ha of Swampy Riparian Woodland.
- Reduced bankfull and overbank flows in the middle Latrobe River at Toms Bridge.
- Entrapment, injury and impeded migration of aquatic fauna.
- Deteriorating water quality from metals and nutrients from pit lake discharge to the Morwell River.
- Increased potential for eutrophication of the pit lake due to input from Morwell River floodwaters.
- Changes in erosion and sedimentation dynamics in the Morwell River.

All these potential impacts can be avoided with the unconnected option. Accordingly, the IESC states that the unconnected scenario is "strongly recommended".

River capture is a well-established risk that has already occurred in the Latrobe Valley at the Yallourn mine and elsewhere.[51] The EES does not address this risk. Instead, Engie proposes that the interconnection design, performance criteria, safety and risk, constructability, operability and operating philosophy would be considered later, outside of the EES process and the oversight of the IAC. Such a significant risk needs to be examined in detail through the EES process.

Downstream environmental impacts are also of great concern, as any sudden mixing event or controlled discharge presents a severe risk to downstream aquatic and riparian ecosystems. This is especially the case given the likelihood of stratification, eutrophication and contamination. Fundamentally, pit lake flow-through must protect existing river values, referencing the appropriate ecosystem protection guidelines.[52] The EES acknowledges exceedances of aluminium, copper, chromium and zinc have the potential to impact the receiving environments to pit lake discharges. Other COPC, such as selenium, have not been assessed.

The hydrologic and design details, which are material to impacts including erosion and fish passage, have not been demonstrated. Despite this, Engie states that impacts "can be effectively managed". Design details are required at this point to assess all relevant environmental risks and to understand long-term sustainability, including financial sustainability in perpetuity.[53]

The proposed interconnected system has intermittent rather than permanent flow, and the EES predicts inflow and discharge behaviour under different climate scenarios. As a result, there is a range of possible hydrological regimes for which the EES needs to establish the chemical consequences. For example, the EES should quantify whether the Morwell River can provide sufficient dilution, alkalinity and flushing to maintain acceptable pit lake and downstream water quality in all scenarios.

---

[51] C. D. McCullough, 'Consequences and Opportunities from River Breach and Decant of an Acidic Mine Pit Lake', *Ecological Engineering* 85 (December 2015): 328–38, https://doi.org/10.1016/j.ecoleng.2015.10.001.

[52] C. McCullough et al., 'Breach and Decant of an Acid Mine Lake by a Eutrophic River: River Water Quality and Limitations of Use', *Research Outputs 2013*, 1 January 2013, https://ro.ecu.edu.au/ecuworks2013/306.

[53] L. F. Sawatsky et al., 'Hydrologic and Geomorphic Design of Pit Lakes for Long-Term Sustainability', in *Mine Pit Lakes: Closure and Management*, ed. Cherie D. McCullough (Australian Centre for Geomechanics, 2011).

The EES proposes that where concentrations of COPC exceed applicable water quality guidelines, outflows from the lake would be prevented via the engineered gates. However, the modelling predicts that multiple contaminants would exceed guidelines, thus surely preventing the lake from ever being connected to the Morwell River by this same rationale.

Pit lake water storage volume is also finite so preventing outflow is not a sustainable solution to preventing discharges containing high-risk concentrations of pit lake contaminants. The practicability of short-term storage, and potential requirements for treatment prior to discharge, should be determined.

Regardless, whether the Morwell River interconnection provides for the maintenance of acceptable water quality for both the pit lake and downstream, and under the full range of climatic and hydrological conditions, needs to be demonstrated quantitatively, particularly during drought.

We also note that all environmental audits of the Hazelwood Ash Retention Area (HARA) have been done on the basis that the pit lake is not interconnected with the Morwell River. Given this and other interdependencies between the rehabilitation of the HARA and the pit lake, we suggest that the IAC and EPA consider bringing both of these projects into the EES process so they can be comprehensively assessed together.

2.6.1 Water pricing

In late 2025 the Victorian Government approved an application by AGL to take 35 GL of water annually for 30 years (1074 GL in total) from the Latrobe River system at a price of $230 per ML, for the future rehabilitation of the Loy Yang coal mine. A similar pricing arrangement was announced for the Yallourn bulk entitlement for rehabilitation on 9 October 2026.[54] Expectations are now set for these two mines – but not for Hazelwood.

Presently, there is a bulk water entitlement in place for Engie Hazelwood to purchase water from Moondarra Reservoir from Gippsland Water. According to the EES, the utilisation of flood flows from the Morwell River would require an additional licence under the *Water Act 1989*.[55]

Just as pricing is in place for bulk water entitlements for Yallourn and Loy Yang, water from the Morwell River should be metered and paid for by Engie at a price that incorporates escalation in real terms. This should be designed to ensure that the choice of filling water supply is driven by environmental considerations – not economic considerations. In addition, proceeds from water pricing should be managed in line with the other two mines, and fund repair and protection of the region's waterways.

2.6.2 Slow or fast fill

The speed of fill is related to the Morwell River interconnection decision, as interconnection would provide extra water. The IESC identified that fast filling has the potential to reduce flows and ecological outcomes in the Tyers River downstream of Moondarra Reservoir.[56] Currently, the Tyers River receives environmental flows which are mostly supplied when the reservoir spills, and these waters contribute significantly to summer and autumn freshes in the Latrobe River in most years. Fill

[54] 'Backing Latrobe Valley And Gippsland', accessed 16 November 2026, https://www.premier.vic.gov.au/backing-latrobe-valley-and-gippsland.
[55] Engie, *Hazelwood Rehabilitation EES - Technical Report B: Water Resource Use and Regulation* (2026).
[56] Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development, *Advice to Decision Maker on Coal Mining Project - Hazelwood Rehabilitation*.

rates should be conditional on environmental flow triggers that protect the Tyers River and other waterways during fill.

2.6.3 Water take conditions and consistency with other mines

Hazelwood's water is not subject to the conditions applied to the Yallourn and Loy Yang mines. The Latrobe Valley Regional Rehabilitation Strategy (LVRRS) Amendment sets four conditions for surface water access at Yallourn and Loy Yang:[57]

- A time limit of up to 30 years from the initial supply date, or until 2065, whichever is earlier, with access limited to winter and spring only (June to November).
- No diversion of winter–spring baseflows below 447 ML/day, measured at Willow Grove.
- A limit of 44 GL per year on the licensees' Blue Rock Reservoir shares.

Together, these conditions support a maximum of about 63 GL per year, equal to the average historical gross take for power generation.

AGL's bulk entitlement for Loy Yang is capped at 35.8 GL a year, matching historical power-generation use, and water may be taken only once rehabilitation commences under an approved Declared Mine Rehabilitation Plan. Take is limited to the wettest times of year to reduce effects on priority summer and autumn river flows. AGL must also pay a water access price, with revenue going to the Regional Jobs and Infrastructure Fund. Similar conditions apply to Yallourn.

The government's guidance does not apply these conditions to Hazelwood, because Engie already has surface water access through a commercial agreement with Gippsland Water. This means that the mine that needs the most water and is the first to fill does so without the appropriate safeguards that apply to Yallourn and Loy Yang. Engie holds no entitlement of its own and the arrangement lacks the public process, Ministerial oversight and conditions applied at the other mines. The EES assesses the effects of filling on the assumption that this supply is available, without testing whether the Latrobe system could sustain the take under conditions of the kind the government considers necessary elsewhere.

We ask the IAC to recommend that any approval be conditional on protections at least equivalent to those applying to Yallourn and Loy Yang, including:

- Seasonal limits so that take occurs only in the wettest months, with a protected baseflow threshold at an appropriate compliance point.
- A maximum annual volume no greater than Hazelwood's historical net use, and a time limit on water access.
- Fill rates and timing that protect Tyers River environmental flows and the summer and autumn freshes in the Latrobe River, with fill paused when flow triggers are reached.
- Public reporting of all water taken for rehabilitation, from every source.
- Any water taken from the Morwell River to be metered and paid for by Engie at a price that incorporates escalation in real terms.

[57] Department of Energy, Environment and Climate Action, *Explanatory Note: Guidance on the Type of Access Arrangements That Could Apply to Surface Water from the Latrobe River System for the Purpose of Mine Rehabilitation* (Victorian Government, 2023), https://www.water.vic.gov.au/__data/assets/pdf_file/0030/684444/Explanatory-note-guidance-to-surface-water-access-for-Latrobe-Valley-mine-rehabilitation.pdf.

- A water access price consistent with the price now applied at Loy Yang and Yallourn, with revenue directed to restoring the Latrobe River system. This links to the pricing section above.

We also ask the IAC to recommend that the Minister bring Engie's water supply into a public, Ministerial decision process.

2.7 Climate change

The EES explicitly models climate scenarios and water availability and concludes that water will generally be available to fill and maintain the lake, although in dry scenarios groundwater top-up may be required to maintain the proposed RL +45 m pit lake water level.

The accuracy of the climate scenario modelling can be affected by changes to modelled evaporation, rainfall, inflow, lake residence time, salinity, groundwater gradients and stratification. However, if future climate outcomes differ from those modelled, this pre-defined optimal lake level will change. A best-practice adaptive closure strategy should therefore establish trigger levels, not merely a target level.

The predicted pit lake water quality does not vary significantly across the climate change scenarios modelled. It is possible that this lack of variance is attributable to the insufficient modelling duration to account for future climate differences.

It is unclear if climate change has been applied to groundwater modelling, especially with regard to how groundwater levels may reduce in the future and how pit lake abstractions might put more pressure on this resource.

2.8 Local climate

The EES does not consider how the introduction of a new, massive, deep body of water will alter the local climate. However, this is an important effect that is exacerbated by the location in the Latrobe Valley, which is a geographic depression bordered by the Strzelecki Ranges and the Baw Baw Plateau as well as the cumulative impacts of the future Yallourn and Loy Yang pit lakes.

The eventual storage of over 2,350 GL of water across three pit lakes in a valley region has the potential to change the local climate.[58] This is an effect of the proposed pit lake which directly impacts the community and influences other processes, and hence needs to be better understood through the EES project.

Potential local climate impacts include the following:

- Acting as a heat sink for solar radiation during hot summer days and slowly releasing the heat at night.[59] This is likely to lower maximum daytime temperatures and raise minimum nighttime temperatures in Morwell, Traralgon, Moe and in the surrounding region.
- Significant continuous evaporation due to the large surface area, resulting in higher local relative humidity and potentially more frequent and dense morning fog. This is most likely to occur in mornings during autumn and winter. Increased fog has flow-on effects such as traffic hazards to the nearby M1, which is already a dangerous road during fog.

[58] Zhiyuan Yang et al., 'Assessing the Hydroclimatic Impacts of Expanding a Large Inland Lake in Australia', *Global and Planetary Change* 252 (September 2025): 104878, https://doi.org/10.1016/j.gloplacha.2025.104878.

[59] Lijuan Wen et al., 'Impacts of the Two Biggest Lakes on Local Temperature and Precipitation in the Yellow River Source Region of the Tibetan Plateau', *Advances in Meteorology* 2015, no. 1 (2015): 248031, https://doi.org/10.1155/2015/248031.

- The temperature differential between the deep, cool pit lake(s) and rapidly heating land can generate lake breezes during summer afternoons, altering wind patterns across the valley.

2.9 Groundwater

Far beyond a lake-filling exercise, Hazelwood is fundamentally a groundwater rehabilitation project following decades of groundwater depressurisation and later retention of extracted groundwater in the mine void. The proposal seeks to pump groundwater into the mine void until a final pit lake level of RL +45 m AHD is reached. In the following phase, groundwater seepage would occur into the pit lake and pumped groundwater could be used to top-up the lake to make up for evaporation, by up to 5 GL/year.

There is little data on the occurrence and distribution of groundwater dependent ecosystems (GDEs) that might be affected by the proposed rehabilitation strategy. The IESC in 2025 recommended additional work on GDEs, including collection of sufficient field data to investigate the impact of changes to groundwater levels in the Haunted Hills Formation (HHF) to GDEs, sampling stygofauna in the HHF where changes to groundwater levels and quality are expected to occur, and monitoring and mitigation measure for subterranean and terrestrial GDEs.[60] Environmental audits of the HARA have also noted that the groundwater monitoring regime is designed for the mining phase and needs to be reconfigured for rehabilitation. We note that in response to the advice of both the IESC and the independent environmental auditor, Engie resisted undertaking new fieldwork or expansions to the existing groundwater monitoring network.[61]

It is also unclear how groundwater chemistry will influence pit lake water quality in the long term. Additional groundwater modelling is required to determine the effects of lake top-ups after filling. This should include the influence of climate change, especially how groundwater levels may reduce in future and how pit lake abstractions might produce more pressure on this resource. Conversely, the EES needs to include the HARA in full, as subaqueous disposal can contaminate groundwater (as well as surface water and pit lake water).

2.10 Options analysis

Decision making for pit lake post-closure land use should be a collaborative process involving all key regional stakeholders, including local communities and First Nations groups.[62] Options analyses must be transparent, and preferably directly involve external stakeholders in the assessment process. At a minimum, stakeholders should understand what variables, and their weightings, influence model outcomes. Like all options analysis methods, multi-criteria analysis (MCA) is sensitive to selection of variables and especially their determined weighting.[63]

However, the MCA outlined in the EES provides little detail and transparency. Without knowledge of how the MCA model was constructed, it is impossible to understand how reasonable the findings

[60] Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development, *Advice to Decision Maker on Coal Mining Project - Hazelwood Rehabilitation*.
[61] AECOM, *Environmental Audit: Mine Void - Part 2, Hazelwood Power* (2025); Engie, *Hazelwood Rehabilitation EES - Attachment VI: Response to IESC Advice*.
[62] Sandy Worden et al., 'Regional Post-closure Land Use Assessment: An Interdisciplinary and Multi-Stakeholder Approach', *Resources Policy* 89 (February 2024): 104680, https://doi.org/10.1016/j.resourpol.2024.104680.
[63] I. Lourel et al., *A Step-by-Step Guide for Evaluating the Preferred Closure Scenarios Using a Hybrid Options Assessment Model*, ed. M. Tibbett et al., Mine Closure 2022: 15th International Conference on Mine Closure, 2022 4-6 October 2022, Brisbane (Australian Centre for Geomechanics, 2022), 503–12, https://doi.org/10.36487/ACG_repo/2215_35.

are. Equally, the workshop nature of the MCA means that findings will be heavily influenced by workshop attendee skills and experience. However, no detail of these were provided.

What detail is provided raises questions; for example, one negative impact attributed to Alternative 5 (full pit lake without river interconnection) was gradual deterioration in pit lake water quality over time.[64] This same negative impact was not attributed to Alternative 6 (the preferred option of full pit lake with river interconnection) despite the fact that the water quality modelling shows gradual deterioration in pit lake water quality over the 100 year modelling period.

The MCA also states that equal weightings were applied across criteria due to the "inherent subjectivity" of weightings.[65] However, the choice of criteria is also subjective.

Although stakeholders provided some input, it is unclear how informed stakeholders were of pit lake closure risks, opportunities and potential post-closure land use opportunities to make qualified contributions, should they have had an opportunity to do so. Stakeholders should be given an opportunity to directly contribute to the planning process in a qualified manner. Consequently, Engie must ensure that stakeholders understand general concepts around pit lake closure planning and outcomes, and particularly legacy pit lake benefits and risks.

For instance, evaporation from open water bodies of the scale of the proposed Hazelwood pit lake will require an estimated 5 to 10 GL of water every year just to offset. Cumulative losses of water to evaporation from all three mines rehabilitated as pit lakes will be even higher. The options analysis should account for this in-perpetuity natural resource loss transparently, and including the cost.

Recreation, productive land use, ecological benefits and flood mitigation should be evaluated alongside water demand, residual contamination, safety restrictions, maintenance costs and long-term governance. The APEC checklist specifically highlights the importance of quantifying residual liabilities and providing for their management at relinquishment.[66]

2.11 Post-closure land use

Post-closure land use outcomes presented in the EES are optimistic but vague. A high-level pit lake that provides a high level of stability and water quality would maximise the possibilities for potential future public access. Much amenity could be gained in local and regional communities and visitors being able to access the lake. However, the EES only notes "possible public access" rendering stakeholders unclear of what post-closure land use the pit lake could provide; even with a closure timeline proposed of only 5 to 10 years.

Post-closure land use planning is not merely a brainstorming exercise. Potential uses must be evidence-based and supported by modelling that shows that they are both practicable and socio-economically feasible.[67] The EES should demonstrate post-closure land uses are realistic and have

[64] Engie, *Hazelwood Rehabilitation EES - Attachment I: Landform and Water Supply Alternatives Assessment* (2026).
[65] Engie, *Hazelwood Rehabilitation EES - Attachment I: Landform and Water Supply Alternatives Assessment*.
[66] Asia-Pacific Economic Cooperation, *Mine Closure - Checklist for Governments*.
[67] Michael Wessel et al., 'Economic Feasibility of Semi-Underground Pumped Storage Hydropower Plants in Open-Pit Mines', *Energies* 13, no. 16 (2020): 4178, https://doi.org/10.3390/en13164178.

not only stakeholder support, but a clear socio-economic model, even if that quantifies non-economic values such as amenity.[68] Without evidence, proposals are little better than marketing.

Identifying post-closure land use(s) allows appropriate standards, benchmarks and closure criteria to be defined – all of which are essential and needed now.

2.12 Closure criteria

It is not sufficient to predict via modelling that certain acceptable endpoints will be reached. It is necessary to define closure criteria, which are agreed standards or levels of performance that indicate the success of rehabilitation and define when the operator's liability for the area ceases.[69] Closure criteria define what needs to be achieved in order to progressively rehabilitate and relinquish the mine.

Closure criteria must be specific, measurable, achievable, relevant and time-bound (SMART).[70] Closure requires demonstrated achievement of physical, hydrological, chemical and ecological performance criteria, supported by monitoring that validates the predictive models and demonstrates that the lake and any connected receiving waters are stable or improving and capable of supporting the agreed post-closure land use without unacceptable active intervention.

However, the EES does not meet this standard. As an example, proposed pit lake closure criteria include reaching the fill level of RL +45 m AHD, water-quality observations falling within the modelled range, or a specified period of monitoring having elapsed. These criteria do not reflect performance and do not validate the predictive models.

The criterion for pit lake water quality states that it should be "trending toward long term model predictions over consecutive years" but long-term modelling has not been done, and the number of consecutive years could comply by being as low as two – hardly indicative of the long term. Ranges must be clearly defined as quantified values and criteria should include requirements for model calibration and validation as the lake fills. Water quality criteria should be also tied to water balance criteria.[71] Explicit numerical completion criteria should then be defined, comprehensively covering physical, hydrological, chemical, ecological and groundwater aspects.[72]

Nutrient concentrations and chlorophyll-a should remain within a range demonstrated to support the agreed ecological state. Therefore, best practice would identify the actual ecological endpoint; for example, "no persistent cyanobacterial bloom exceeding X days or Y biomass under defined conditions".

---

[68] N. Lienhoop and F. Messner, 'The Economics of Mine Pit Restoration: The Case of Pit Lakes in Lusatia, Germany', in *Acidic Pit Lakes - The Legacy of Coal and Metal Surface Mines*, ed. Walter Geller et al., Environmental Science and Engineering (Springer Berlin Heidelberg, 2013), https://doi.org/10.1007/978-3-642-29384-9_5.

[69] R. E. Young et al., *A Framework for Developing Mine-Site Completion Criteria in Western Australia* (The Western Australian Biodiversity Science Institute, 2019), https://www.wa.gov.au/government/publications/framework-developing-mine-site-completion-criteria-western-australia.

[70] Young et al., *A Framework for Developing Mine-Site Completion Criteria in Western Australia*.

[71] M. Schultze et al., *Monitoring for Pit Lake Planning, Filling and Use: Why? When? What?*, ed. A. B. Fourie et al., Mine Closure 2024: 17th International Conference on Mine Closure, 2024 26-28 November 2024, Perth (Australian Centre for Geomechanics, 2024), 1049–62, https://doi.org/10.36487/ACG_repo/2415_75.

[72] Schultze et al., *Monitoring for Pit Lake Planning, Filling and Use*.

Completion criterion 46 requires minimising the potential for development of "unfavourable biota". This statement is far too vague for a final closure criterion – unfavourable biota could mean cyanobacteria, invasive species, nuisance algae, fish, plant pests, mosquitoes, eutrophic conditions, or others. Pit lakes may attract aquatic pest animals and plants including aquarium escapees already established as biodiversity risks in waterways of the region proposed for connection to the lake, such as feral goldfish (*Carassius auratus*) and koi carp (*Cyprinus carpio*).[73] Finfish and crayfish can also be introduced to pit lakes by itinerant waterfowl which pass through the area and especially by direct human translocations.[74]

Completion criterion 42 states "pit-lake water quality must be within specified parameters and, where required for intended land uses, comply with recreational, drinking-water and livestock guidelines.", yet provides no rationale for why these guidelines are chosen to protect values that are not stated for the pit lake. The relevance of Australian drinking water guidelines is unclear as the pit lake is not proposed as a potable source in post-closure land use planning. This criterion should be rewritten to a narrative objective, for example with the format, "Any discharge from the pit lake shall not cause an unacceptable impact on the environmental values of the receiving environment and shall comply with site-specific, risk-based water-quality objectives for all relevant contaminants and ecological parameters."

Water quality closure criteria should be tied to clear purpose – the closure objectives. The Australian government's Leading Practice Sustainable Development Program for the Mining Industry approach recommends identifying these environmental values explicitly, as in, "What are we actually trying to protect?" Engie's framework is weak on identifying contaminants, transport processes and receptors as ecological consequence, and this is reflected in the closure criteria.

Although potential ecological benefits could be realised through the pit lake providing a large resource for visiting waterbirds, little evidence is provided for this. Pit lakes typically offer little useful waterfowl habitat and therefore closure planning that aims to achieve land uses for waterfowl need to include steps such as habitat creation.[75]

2.13 Closure timeline

Failure to account for long temporal scales is a recurring closure-planning failure.[76] Although the EES has recognised the long time scale for groundwater and geotechnical behaviour, it has not demonstrated the same level of closure thinking for lake geochemistry and ecology. The proposed five-to-10-year passive period is therefore likely to be extremely naïve and optimistic in relation to

[73] Cherie D. McCullough, 'Below Water Table Mining, Pit Lake Formation, and Management Considerations for the Pilbara Mining Region of Western Australia', *Mining* 4, no. 4 (2024): 863–88, https://doi.org/10.3390/mining4040048.

[74] Adrian Pinder et al., 'Spread of the Non-Native Redclaw Crayfish Cherax Quadricarinatus (von Martens, 1868) into Natural Waters of the Pilbara Region of Western Australia, with Observations on Potential Adverse Ecological Effects', *International Journal of Field Research on Biological Invasions* 8, no. 4 (2019): 882–97; McCullough and Lund, 'Opportunities for Sustainable Mining Pit Lakes in Australia'; Doupé and Lymbery, 'Environmental Risks Associated with Beneficial End Uses of Mine Lakes in Southwestern Australia'.

[75] Rachele Bernasconi et al., 'Floating Islands as a Tool to Promote Biodiversity in Pit Lakes', *Proceedings of the International Mine Water Association (IMWA) Conference*, 2025; Mark Lund and C. McCullough, 'Restoring Pit Lakes - Factoring in the Biology', paper presented at Mine pit lakes: Closure and management, 2011, https://ro.ecu.edu.au/ecuworks2011/303.

[76] C. D. McCullough, *Key Mine Closure Lessons Still to Be Learned*, ed. A. B. Fourie and M. Tibbett, Mine Closure 2016: 11th International Conference on Mine Closure, 2016 15–17 March, Perth (Australian Centre for Geomechanics, 2016), 325–38, https://doi.org/10.36487/ACG_rep/1608_23_mccullough.

other significant pit lake closures including Lake Kepwari (Premier Coal Mine) and AK1 pit lake (Argyle Diamond Mine), both in Western Australia. This is especially the case for Hazelwood, where the underlying groundwater recovery is expected to continue for around 200 years and evaporation is only roughly estimated.

Although five to 10 years might demonstrate initial water-level stability, early geotechnical response and even an initial ecological response, this short duration cannot by itself demonstrate (in order of dependencies):

1. Eventual groundwater equilibrium;
2. Long-term evapoconcentration;
3. Long-term chemical equilibrium;
4. Long-term nutrient cycling;
5. Long-term ecological stability.

Failure to account for sufficiently long durations also underestimates long-term pit lake contaminant concentrations and associated environmental risks. Pit lake guidance stresses that pit-lake predictions need to support long-term closure outcomes and that monitoring needs to continue until closure objectives are demonstrable.[77]

Modelling and associated risk assessment must be to a longer term with residual risk, growing loss of opportunity and management requirements explicitly quantified and accepted by stakeholders.

2.14 Ongoing liability, monitoring, maintenance and management

Best-practice closure seeks to minimise dependence on institutional controls and active management as long-term operating expenditure can create a liability much greater than the initial closure capital cost.[78] However, active monitoring and management with the next land manager should not be confused with a genuinely passive closure outcome. Engie's closure concept for the Hazelwood mine is not a truly "passive" (zero-liability/walk-away) concept as monitoring and maintenance will be required for decades to hundreds of years or more.

Poor pit lake water quality can potentially cause harm to humans and wildlife, and long-term water treatment is generally incompatible with relinquishment and should be avoided where practical. Consequently, although pitched as a "passive" solution, the more important the engineered gates are to managing pit lake waters to prevent environmental harm, the less convincing the claim that the final landform is inherently passive. A Declared Mine Fund must be able to cover post-closure costs, for which a perpetuity model could theoretically be used, although the exact contribution cannot yet be determined.

2.15 Soil and geotechnical issues

Feedback in this section was provided by Professor Thomas Baumgartl (Dr. rer. Nat; FAusIMM).

2.15.1 Reference to geomechanical parameters

Chapter 3 (Technical report G6); Table 12: the factor of safety (FoS) and probability of failure (PoF) analysis used a range of values for the relevant material properties, overburden and coal. Some of these parameter values deviate from the values which have been identified for Yallourn coal as part

[77] Schultze et al., *Monitoring for Pit Lake Planning, Filling and Use*.
[78] Asia-Pacific Economic Cooperation, *Mine Closure - Checklist for Governments*.

of the batter stability project.[79] A reference for the investigation of Hazelwood coal material properties and stability simulation, or a justification of the difference in parameters values, is necessary. In particular, the friction angle of coal used in the Technical Report is much higher (40° vs 31.4°) and hence will calculate greater stability.

For Yallourn coal these values have been determined as per the below table.[80]

TABLE 5.8. SELECTED GEOTECHNICAL PARAMETER (SHAGHAGHI, GHADRDAN, & TOLOOIYAN, DESIGN AND OPTIMISATION OF DRAINAGE SYSTEMS FOR FRACTURED SLOPES USING THE XFEM AND FEM, 2020)

Material	Sat. Unit Weight (kN/m^3)	Elastic Modulus (MPa)	Poisson's Ratio	Friction Angle (degree)	Cohesion (kPa)	Tension Cut-off (kPa)	Void Ratio
Brown Coal	11.5	35	0.2	31.4	155	130	0.65
Non-coal	20.9	45	0.2	31.0	23	1	0.65

2.15.2 Seismic stability

The assessment of the seismic stability from earthquakes (Technical report G2, G4, G6, G9: Chapter 6 Seismic stability) concludes that for all stability sections the FoS is greater than 1.1. However, there are several values in Table 28 (technical report G6) less than 1.1 and for section WSW (Technical report G9) the FoS is below 1.

From the assessment it appears that the model uses a coherent coal seam, but not considering the existence of joints, fracturing the coal seam. This may have important implications in case of an earthquake event. In a scenario of a water-filled pit, joints will be equally water-filled, the height of filling increasing dependent on the slope of the groundwater surface and distance from the lake/pit. According to literature, shear waves (S-waves) cannot travel through liquid and the energy converts into P-waves. These compressional waves created in the joint may have de-stabilising consequences, leading to block-slide failure, similarly to what occurred at the Yallourn batter failure event in 2007 and ground movement mechanisms as described in the technical report G1: chapter 6.2.2.3.

The principle of block sliding and its consequences which led to the Yallourn batter failure is explained in the *Key Hazard Series: Block Sliding* fact sheet published by the Mine Land Rehabilitation Authority.[81] An equivalent scenario may be conceivable when sudden pressure on the water body of a water-filled joint is created by the transition of a S-wave into a P-wave.

A potential mobilisation through block-sliding may have a higher likelihood due to the low unit weight of brown coal and a much higher buoyancy effect than for mineral substrates. See also the introduction in EES Technical Report G11, chapter 8.4, 2nd paragraph, where this characteristic of coal and its possible consequences with regard to block movement is also described:

[79] Tahereh Shaghaghi et al., 'Design and Optimisation of Drainage Systems for Fractured Slopes Using the XFEM and FEM', *Simulation Modelling Practice and Theory* 103 (September 2020): 102110, https://doi.org/10.1016/j.simpat.2020.102110.
[80] Shaghaghi et al., 'Design and Optimisation of Drainage Systems for Fractured Slopes Using the XFEM and FEM'.
[81] Mine Land Rehabilitation Authority, *Key Hazards Series: Block Sliding* (Victorian Government, 2025).

> "The unit weight of the brown coal is approximately 11.2 kN/m^3 which is low for a material with rock like features and is only slightly heavier than water (9.8 kN/m^3). The low unit weight of the coal is an unusual characteristic that causes the coal mass to be highly sensitive to groundwater level changes within the coal mass. In effect with the low strength interseam clays underneath, the coal mass near the mine batters behaves much like blocks of ice floating in water, wherein relatively small changes (in disturbing forces for instance) can cause coal blocks to move laterally relative to one another if there is room to move. These effects are however reduced further from the mine batters where the lateral confinement of the coal units is increased."

2.15.3 Subsidence and rebound

Due to depressurisation of the aquifers, subsidence occurred reaching up to 2.6m measured in parts of Morwell township. Re-pressurisation of the aquifers as part of rehabilitation and filling the pit to +45 m AHD will lead to groundwater level increase and rebound. The magnitude of the land rebound is not clear and difficult to predict, but it is assumed in the EES (Chapter 14) to be small and most likely to have only minor impacts, with mitigation measures in place.

The groundwater rebound will also lead to an increase of the groundwater level towards the wetland area with an estimated increase of 10m. An anticipated long term groundwater level of +40 m AHD in the vicinity of the mine will lead to a further increase of the groundwater level away from the mine towards Morwell township. Given a largely irreversible subsidence of land in the township, there is a possibility for low lying areas created by subsidence to be negatively affected by the increasing groundwater level. The increase in the groundwater level may lead to waterlogging of low-lying areas and potentially affect the stability of built structures. A detailed land survey of the extent of the subsidence and modelling of the expected future groundwater level would clarify the risk and allow counter measures to be taken in advance.

2.15.4 Land use and management of rehabilitated slopes

There is no information about the planned land use of the covered batter and overburden slopes. The soil covers on the slopes are relatively steep. For long term land use and management, it will be important to understand what the intended land use will be. For example, grazing can have implications for slope stability/soil surface integrity as cattle or sheep can create trampling paths, which can be the starting point for erosion.

From a long-term point of view, is there on-going fertilisation required or is the soil cover self-sustaining? Ongoing fertilisation may be required to minimise risk of erosion by guaranteeing a high vegetation cover. The EES lacks information about a soil monitoring program for the sloped cover, which is usually in place for new constructed rehabilitated landforms.

2.15.5 Risk of leakage from pit at +45 m AHD

While artificial lakes like the filled Hazelwood pit usually have a lake surface water level higher than the groundwater with the intent to have positive pressure against the batters and contribute to higher batter safety, water will seep into the surrounds of the pit lake as a consequence. In case of Hazelwood the pressure difference is suggested to be 5m (+45 m AHD water level and +40 m AHD groundwater level in the vicinity of the pit).

Given the geological situation of a fractured character of the coal seams and the existence of joints (and horizontal bore hole drains), there is a likelihood of leakage of water (however of unknown quantity) from the pit, requiring potentially larger amounts of top up water than just for compensating evaporational losses. The fractures allowing water flow out of the pit can occur

anywhere in the pit, they are not bound to certain depths as water flow is created by the pressure difference only, irrespective of the flow path of water.

See also comment Technical Report C1, chapter 7.1, where this possibility is mentioned. However, this may occur not only temporarily, but permanently:

> "However, the evolution of the groundwater system towards a new equilibrium will be highly dynamic, depending on the rate of flooding of the pit, timing of cessation of pumping and operations of the surrounding mines and subsequently there may be times when the lake becomes higher than the piezometric heads, temporarily recharging the aquifers (GHD, 2018a).
>
> There are currently more than 300 horizontal gallery drains present in the M1 coal. Together with the fracture connectivity in the M1 coal/aquifer, the shallow depth of the M1 aquifer below the base of the mine and the degree of ground movement that occurred during mining have potentially enhanced connectivity between the M1 coal/aquifer and lake."

Thank you for your attention to this submission. You are welcome to contact me on the details below, should you wish to discuss this submission in more detail.

Dr Kat Lucas-Healey
Senior Climate and Energy Advisor
Environment Victoria
k.lucashealey@environmentvictoria.org.au
0404 571 605