

# Best practice approaches for rehabilitation and management of mine voids

## Background to rehabilitation and management of mine voids

Open cut mining practices have historically left open mining pits (referred to as ‘residual voids’) in place at the end of mining. Often, residual voids fill with groundwater after mining. In Queensland, all land disturbed during mining is to be progressively rehabilitated to a stable condition<sup>1</sup> after mining. Land is in a stable condition if— (a) the land is safe and structurally stable; and (b) there is no environmental harm being caused by anything on or in the land; and (c) the land can sustain a post-mining land use (PMLU). In some instances, mine voids can be backfilled to create an area of land suitable for a PMLU such as grazing or natural ecosystems. This approach can help to minimise or avoid closure risks, though backfilling a void may not always be possible or practical to achieve.

Voids left in place (i.e., not backfilled) after mining typically become filled with water and become pit lakes. These structures can pose ongoing risks that may need to be managed but, in some instances, they can also be used to generate potential opportunities for post-mining uses. Examples include irrigation of crops, provision of stock drinking water, pumped storage hydropower, aquaculture or development of recreational areas. There are a range of social, economic, environmental, and legal considerations to consider when identifying a suitable post-mine use for a water-filled void.

Where a mine void cannot be rehabilitated to a ‘stable condition’, it may be proposed as a non-use management area (NUMA) and managed in accordance with best practice. An exception is that a residual void located in a floodplain must achieve a ‘stable condition’ (see section 126D(3) of the *Environmental Protection Act 1994*). Although legislative reforms are likely to constrain the number of NUMAs in the future, historical approvals allow for many residual voids to be retained in the landscape without achieving a PMLU. Any new proposal for a NUMA would be subject to a Public Interest Evaluation to assess whether it is in the public interest for the land not to be rehabilitated to a stable condition, or where it can be demonstrated that its rehabilitation would cause a greater risk of environmental harm than not rehabilitating it.

A NUMA is to be managed in a way that achieves best practice management and minimises risks to the environment (Department of Environment and Science, 2021). A Progressive Rehabilitation and Closure Plan should describe completion criteria for measuring whether a NUMA has achieved ‘sufficient improvement’ prior to closure where each of the following is minimised; the risk of the area collapsing, eroding or subsiding, the need to actively manage the area, and access to the area by an animal or person by, for example, fencing the boundary of the area (Department of Environment and Science, 2021). There is uncertainty for both the regulator and industry regarding how the management milestone of ‘sufficient improvement’ of a NUMA void can be unequivocally demonstrated.

There is need to develop best practice advice relating to rehabilitation planning for mine voids to achieve a PMLU or manage them as best as possible as a NUMA. Best practices should seek to improve the procedures and practices used to assess and avoid, mitigate or manage the risks associated with residual voids and seek to achieve beneficial use where possible.

---

<sup>1</sup>The meaning of ‘stable condition’ is defined in the *Environmental Protection Act 1994* section 111A.



## Stakeholder perspectives on research needs

Stakeholder consultation has been undertaken to seek feedback on rehabilitation research relating to best practices for voids and is summarised below.

- Stakeholders and the public may hold misperceptions about the distinction between the risks associated with a residual void that has a PMLU and one that is proposed as a NUMA void. It was suggested that there may be varying expectations around whether residual voids can and should be backfilled.
- There is a lack of consistency in how modelling tools are used to predict long term water balance and water quality in voids and model outputs can have quite different implications for management and rehabilitation. In particular, the timeframe used in water quality models can influence whether a residual void is designated as a NUMA or whether it is considered able to sustain a PMLU.
- Stakeholders were interested in innovative post-mining uses for voids but suggested that complex approvals are a disincentive to including these in rehabilitation planning.
- There was considerable uncertainty regarding how to demonstrate 'sufficient improvement' of a NUMA void during rehabilitation.
- Stakeholders identified the need for guidance on how to design a void monitoring program including the selection of monitoring locations, monitoring indicators, appropriate monitoring timeframes and sampling frequency and duration.
- Cumulative impacts or benefits where multiple voids are in proximity from neighbouring mines was recognised as having potential impacts on groundwater or potential opportunities for habitat creation and connectivity but there is currently a lack of approaches to assess their cumulative impacts and benefits.
- Aquatic ecosystems were commonly raised as a potential PMLU for residual voids though there are no clear strategies or criteria requirements for the rehabilitation of voids to aquatic ecosystems.
- Water treatment provides an opportunity to increase beneficial water use, however, it is only used at a limited number of mines. Opportunities and risks associated with this require further consideration.
- There is variation in the approaches to managing structural stability of high walls and pits.

## Research plan

The Office of the Queensland Mine Rehabilitation Commissioner is undertaking research on void management practices in Queensland, focussing on the key issues and constraints associated with managing residual voids. The forward research plan includes the following topics:

- providing information to enhance understanding of mine voids and requirements for their management or rehabilitation after mine closure,
- describing best practice approaches for modelling long term water balance and water quality of voids,
- evaluating potential opportunities and constraints for post-mining uses of residual voids,
- describing best practice approaches to develop management milestones and milestone criteria to demonstrate sufficient improvement of voids considered NUMAs,
- reviewing current technologies and options for the treatment of water in residual voids.

## References

Department of Environment and Science. (2021). *Guideline - Progressive rehabilitation and closure plans (PRC plans)*, Version 2, ESR/2019/4964. Queensland Government. Available at: [https://environment.des.qld.gov.au/\\_\\_data/assets/pdf\\_file/0026/95444/rs-gl-prc-plan.pdf](https://environment.des.qld.gov.au/__data/assets/pdf_file/0026/95444/rs-gl-prc-plan.pdf) (Accessed: 11/03/2022).