

Book Review by:

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Mine Pit Lakes: Closure and Management

Published by the Australian Centre for Geomechanics

Edited by Dr Clint D. McCullough, Edith Cowan University

Mine Pit Lakes: Closure and Management, recently compiled by Clint McCullough and published by the Australian Centre for Geomechanics, provides an excellent overview of an important topic. The book is written with the practitioner in mind and the authors of the various chapters have done a fantastic job of summarising how to plan, develop, and manage pit lakes. It is quite readable, without a lot of jargon, and will be useful to engineers and managers at mine sites who are involved in designing pit lakes and developing or implementing mine closure plans, as well as regulators who oversee pit lake development and stakeholders who wish to be well informed. It incorporates case studies from around the world and uses them to illustrate many key aspects of pit lake planning and management.

Planning for mine closure is a central theme and is illustrated not only by technical considerations, such as planning lake design features (e.g. slope aspects, bathymetry, and water balance), littoral zone development, and biology, but also aspects that are not normally addressed in more technical books, such as various ways to incorporate stakeholder involvement, and the hows and whys of water quality monitoring. Another nice aspect is that, in addition to pit lakes at coal and hard rock mines, pit lakes that will be formed as a result of oil sands development, which is beginning to be a hot issue in North America, have been incorporated.

It is worth noting that another book on pit lakes is scheduled to be published by Springer in 2012. Since I have had the opportunity to read (and edit) the draft version of that yet-to-be-published book, I can report that there is surprisingly little overlap, since that one is much broader in scope, is focused more on the science than on the planning and management (engineering) aspects, and has a more academic orientation. Anyone who wishes to be completely up to date should, of course, read both.

Mine Pit Lakes: Closure and Management is broken down into three sections: design, development, and closure (6, 4, and 3 chapters, respectively), but, since planning for mine closure is a central theme, pit lakes as a closure technique is addressed, to some extent, throughout the book. Each of the three

sections is a compilation of fairly short chapters that can be read without reference to the chapters that precede it.

The design section represents nearly half of the book. The first chapter is a summary of things to consider before deciding whether and how best to backfill mine waste and tailings into a mine pit that will subsequently be filled with water, including material consolidation and using liners to protect groundwater. The second chapter in the design section summarises virtually all of the other aspects of planning a pit lake into 14 pages, using a “lessons learned” approach.

The next two chapters both address aspects of stakeholder involvement, which may be a little too much of a good thing; the second of these two chapters, which reports on the regional aspects of stakeholder involvement, is an overly detailed accounting of a specific case study that had barely begun.

An excellent introduction to designing pit lakes based on engineering considerations follows; it successfully makes the point that pit lakes must be designed for long-term success, and illustrates how key aspects of natural lakes can, and should, be considered when designing a mine pit lake.

This is followed by a chapter on how water quality models are used to design and assess pit lakes. It is a well-written overview, and includes an interesting case study based on a model developed for oil sands pit lakes that incorporates, by necessity, chemical reactions not normally considered in such models. Given the importance of water quality modelling to pit lake planning and design, I personally would have liked to have seen modelling covered to an even greater degree, but I suppose that given how fast models are evolving, a more detailed approach would become dated fairly quickly.

The development section consists of four chapters, three that address biological aspects and one that addresses ways to fill the pit lakes. The first of these chapters focuses on developing a sustainable ecosystem in pit lakes based on lessons learned by studying natural lakes, despite the significant inherent differences between the two. This is followed by a very nice discussion on the importance of pit lake margins to sustainable pit lakes and how important riparian vegetation is to bank stability, biodiversity, lake aesthetics, wave action, and other important aspects.

The next chapter discusses how to fill mine pits with water and is based on the well-established premise that it is almost always better to fill a mine pit rapidly, when that is an option, and uses examples, mostly from German lignite mines, on how that can be accomplished.

The development section concludes with a chapter on developing a bacteria-based sulfate-reducing ecosystem within a pit lake, and how doing so can improve water quality in pit lakes that are acidic and metal laden. It is interesting to see how this topic, which was quite controversial a decade ago, is now accepted as a valid approach to water quality remediation.

The book concludes with three chapters on how pit lakes can be rationally incorporated into mine closure as long as they are planned for. The closure section starts appropriately with a chapter on the way regulations and policy guidelines affect pit lake development around the world. This chapter

concludes by making the point that regulatory compliance, though necessary, is not the sole goal. Instead, pit lakes should play a key role in a mining company's overall sustainability strategy.

The next chapter addresses the important topic of monitoring water quality. This chapter could have been placed just as easily in the other two sections since baseline monitoring has to start before mining even begins and continues throughout the mining and closure process, but the authors of this chapter have focused on how monitoring is necessary to manage pit lake water quality, and address practical aspects, such as where and how to sample, and what to measure. Their case study is the infamous Berkeley Pit, which has been filling with very acidic water since mining ceased in 1982; monitoring there will determine when chemical treatment of the lake system will begin, but is also being used to optimise an ongoing copper extraction process.

Finally, the section's last chapter deals with risk management as it relates to health and safety issues, such as avoiding deaths by drowning and illnesses caused by chronic exposure to water contaminants.

Overall, this book is an excellent investment for anyone interested in pit lake design and development. It is a concise, well-conceived, and generally well-written volume. Anyone who deals with pit lakes will find much to learn from it and will want to have it on their bookshelf, as they will find many opportunities to consult it again and again.