

Utilizing Landform Evolution Modelling to Promote Sustainable and Cost-Effective Mine Rehabilitation and Closure Designs

Mignon du Plessis (Beng Civil Engineering), Mogomotsi Gare (B.Sc. Environmental Sciences)

Currently, primary legislative texts such as the Mineral and Petroleum Resources Development Act (MPRDA) and the National Environmental Management Act (NEMA), which govern mine closure and rehabilitation, do not explicitly mandate erosion modelling. Instead, they require the identification of potential erosion risks and the implementation of mitigation measures to reduce these risks. Utilizing Landscape Evolution Modelling (LEM) in the design of rehabilitation landscapes can help address issues of landscape degradation and sustainability that may arise during the mine relinquishment phase. Addressing these technical issues can not only help overcome current relinquishment challenges but also inform the development of alternative closure solutions.

CAESAR-Lisflood is a Landscape Evolution Model (LEM) that can assist with early identification of design shortcomings in relation to long-term stability and erosion control measures as a result of uncertainties related to climate change, future land use, and potential changes in soil properties over extended timeframes.

Recently, Agreenco applied CAESAR-Lisflood to address these challenges in predicting both short-term and long-term erosion for the closure and rehabilitation of several decommissioned open-cast pits. The project involved simulating erosion scenarios over 5-year and 45-year periods, assessing potential gully formation and sedimentation impacts. By comparing these scenarios, the project identified potential design deficiencies, enabling pre-emptive adjustments to enhance the stability and sustainability of the closure design.

In summary, CAESAR-Lisflood offered critical inputs to develop a framework during the rehabilitation design phase to promote sustainable and cost-effective mine rehabilitation. By adding this layer to closure planning it not only enhances compliance with regulatory requirements but also contributes to the long-term sustainability of mine closure projects.