

# Enabling Progressive Closure for Sustainable Development



SCIENCE ADVISORY BOARD FOR CONTAMINATED SITES IN BC

**okane**



Mike O'Kane, Okane Consultants  
SABCS 10<sup>th</sup> Annual Workshop  
Virtual – October 7, 2020

# First things First... let's get on the Same Page



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## Enabling Progressive Closure for Sustainable Development



Mike O'Kane, Okane Consultants  
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- **Gorman and Dzombak, 2018**
  - "...meeting present needs without compromising needs of future generations..."





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## Enabling **Progressive Closure** for Sustainable Development

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- **Progressive Closure...?**
- **Different for different people / groups**
  - Site
  - Corporate
  - Stakeholders
  - Communities
  - Regulators

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## Enabling **Progressive Closure** for Sustainable Development

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- **Progressive Closure...?**
- **Different for different people / groups**

*“...reduce extent of disturbed lands, in turn reduce total liability considered in financial reporting, LoM planning, and financial assurance...”*





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- **Progressive Closure...?**
- **Different for different people / groups**

*“...a life of mine process that produces benefits that enable post-mining land-use objectives to be achieved...”*



**Australian Government**  
**Department of Industry, Science,  
Energy and Resources**



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- **Progressive Closure...?**
- **Different for different people / groups**

*“...the process of restoring land that has been mined to a natural or economic usable state in an ongoing manner over the life of mine...”*



# First things First... let's get on the Same Page



- **Progressive Closure...?**
- **Likely... we can agree on Intent and Outcome**

*“...reduce residual risk at closure...”*

*“...optimize closure costs...”*

***Intent and Outcome***

# Progressive Closure

- **Reduce residual risk and optimize closure, and...**

- Enhance social acceptance and stakeholder relationships,
- Develop experience and knowledge for closure works, and
- Provide tax benefits (in some jurisdictions)



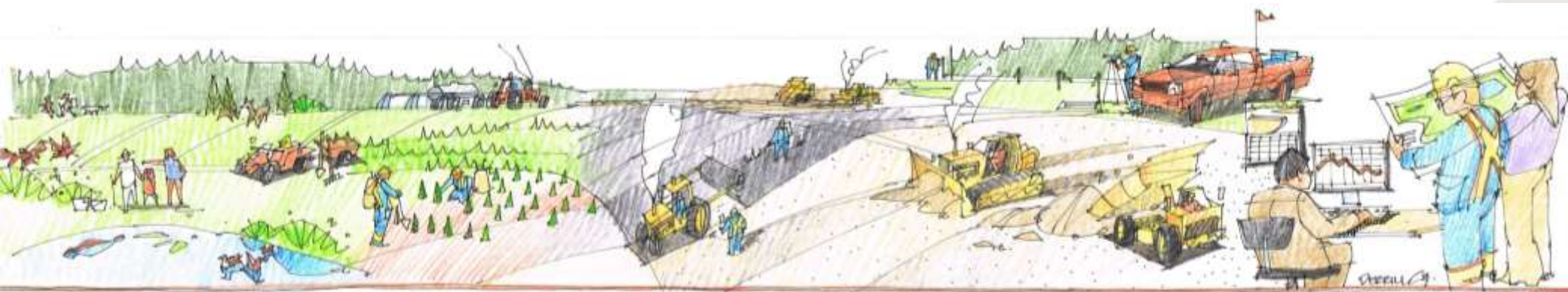


# Progressive Closure, and Sustainable Development

- **Reduce residual risk and optimize closure, and...**

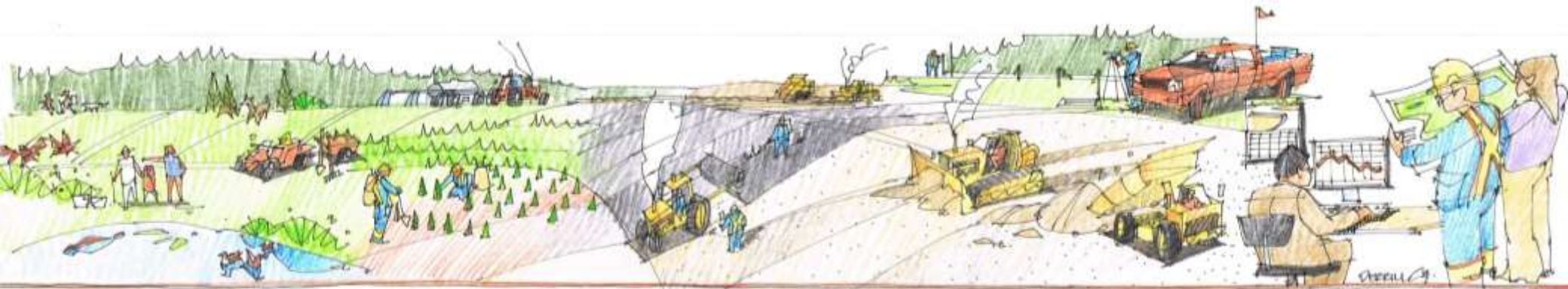
- Enhance social acceptance and stakeholder relationships,
- Develop experience and knowledge for closure works, and
- Provide tax benefits (in some jurisdictions)

“...meeting present needs without compromising needs of future generations...”



# Progressive Closure, and Sustainable Development

Makes sense...



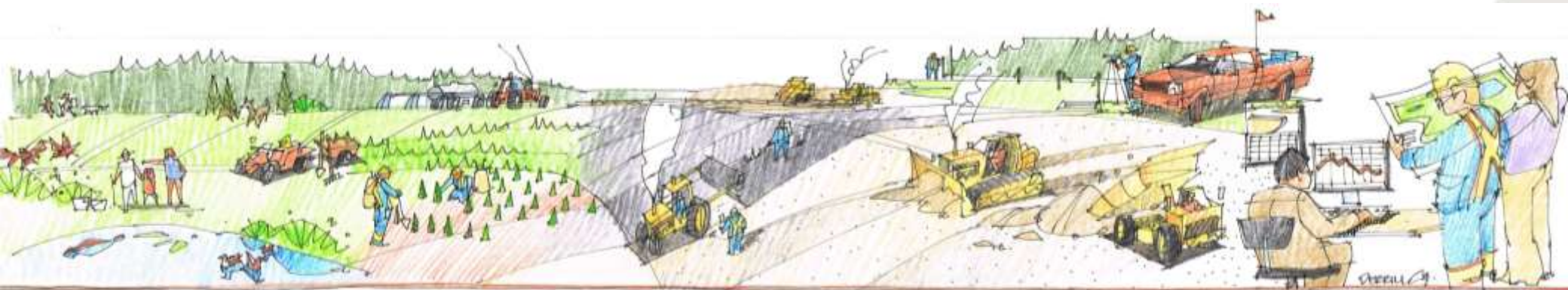


# Progressive Closure, and Sustainable Development

Makes sense...

...so why, despite these being *'best practice'*,

Is, for example in the mining industry, ...progressive closure *not widely implemented?*





# Progress... Check-In... On Track?

## Enabling Progressive Closure for Sustainable Development



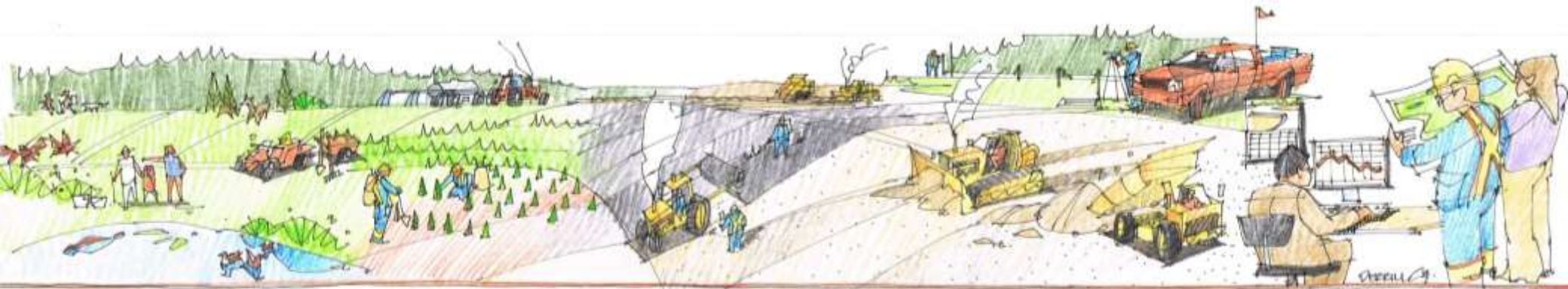
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# Progressive Closure...a Focus on Mining

## ***In general...***

- *In the mining industry...*
  - business planning processes...*
  - focus on development of a resource*





# Progressive Closure...a Focus on Mining

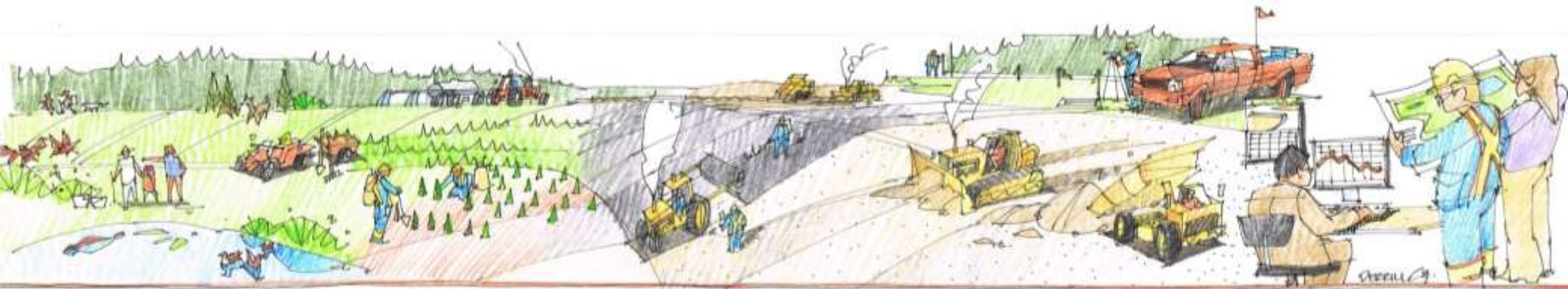
## **In general...**

- *In the mining industry...  
business planning processes...  
focus on development of a resource*



## **However...**

- *The true value of your asset will, eventually, include closure*





# Progressive Closure...a Focus on Mining

## **In general...**

- *In the mining industry...  
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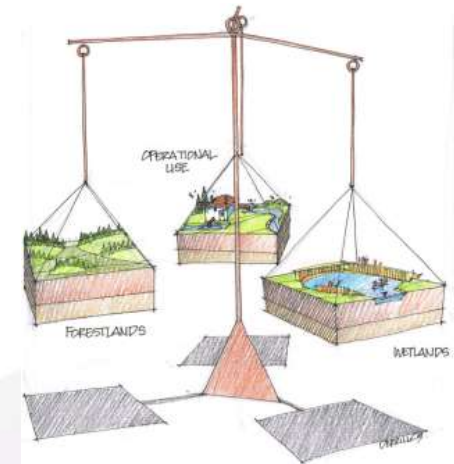


## **However...**

- *The true value of the asset will, eventually, include closure*

## **As well as...**

- *Asset value should consider future land use, and/or re-purposing of the land and associated infrastructure*

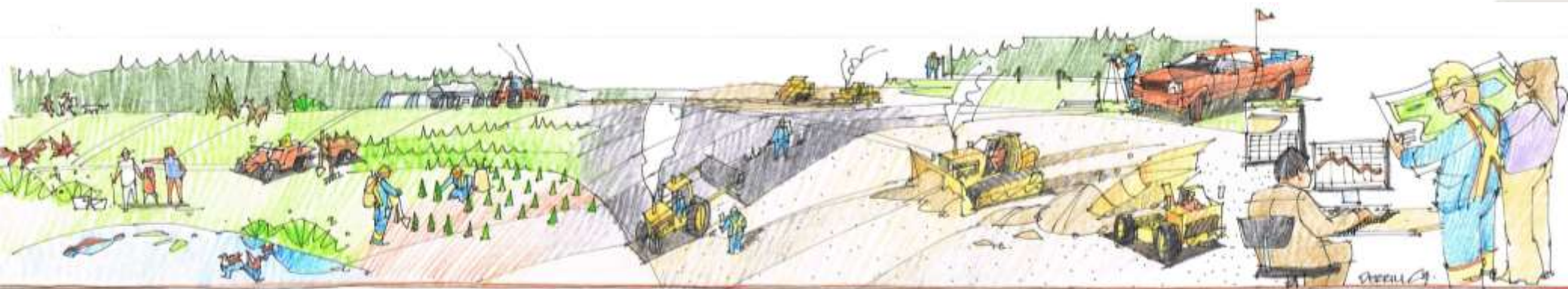


# Progressive Closure

**Makes sense...**

**...so why, despite these being  
'best practice',**

**Is, for example in the mining industry,  
...progressive closure  
not widely implemented?**



# Could we be Part of the Challenge...?







**Of all human fears, the two most effective in the prevention of one's development are the fear of failure and the fear of success**



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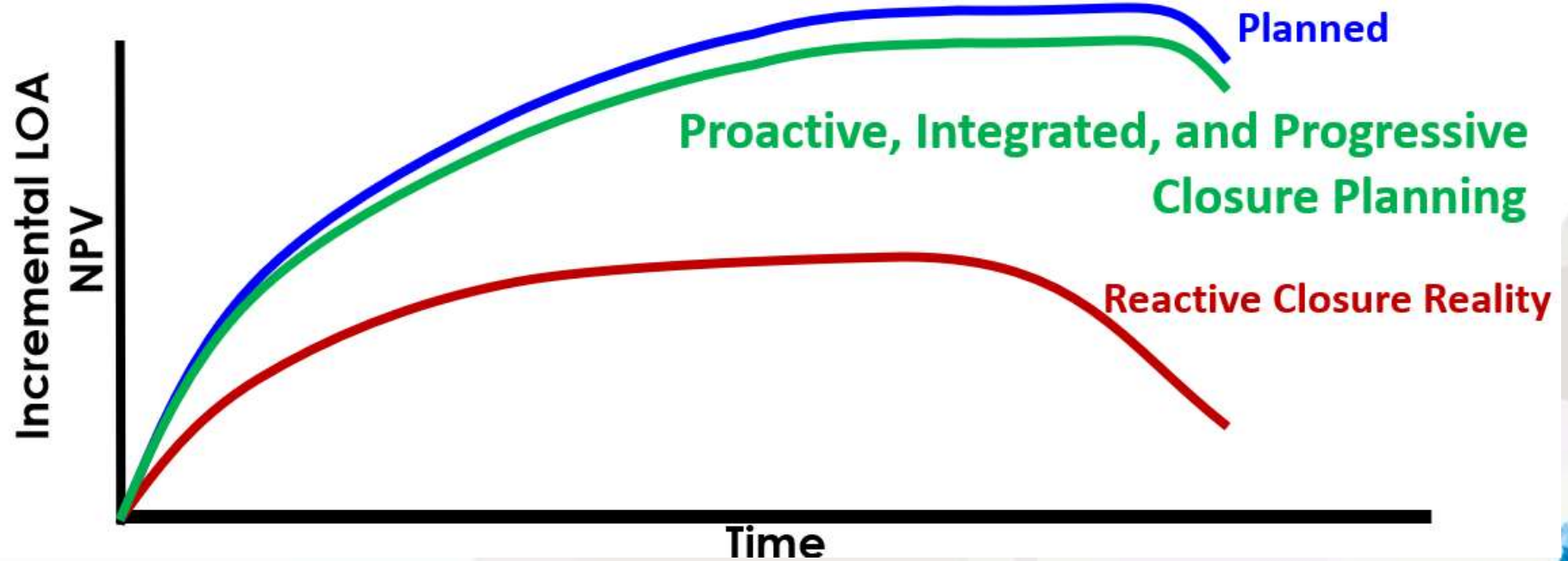
1  
Of f all human fears, the two most  
3 4  
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6 7 8  
and the fear of f success  
9 10



# Could we be Part of the Challenge...?



# Could we be Part of the Challenge...?



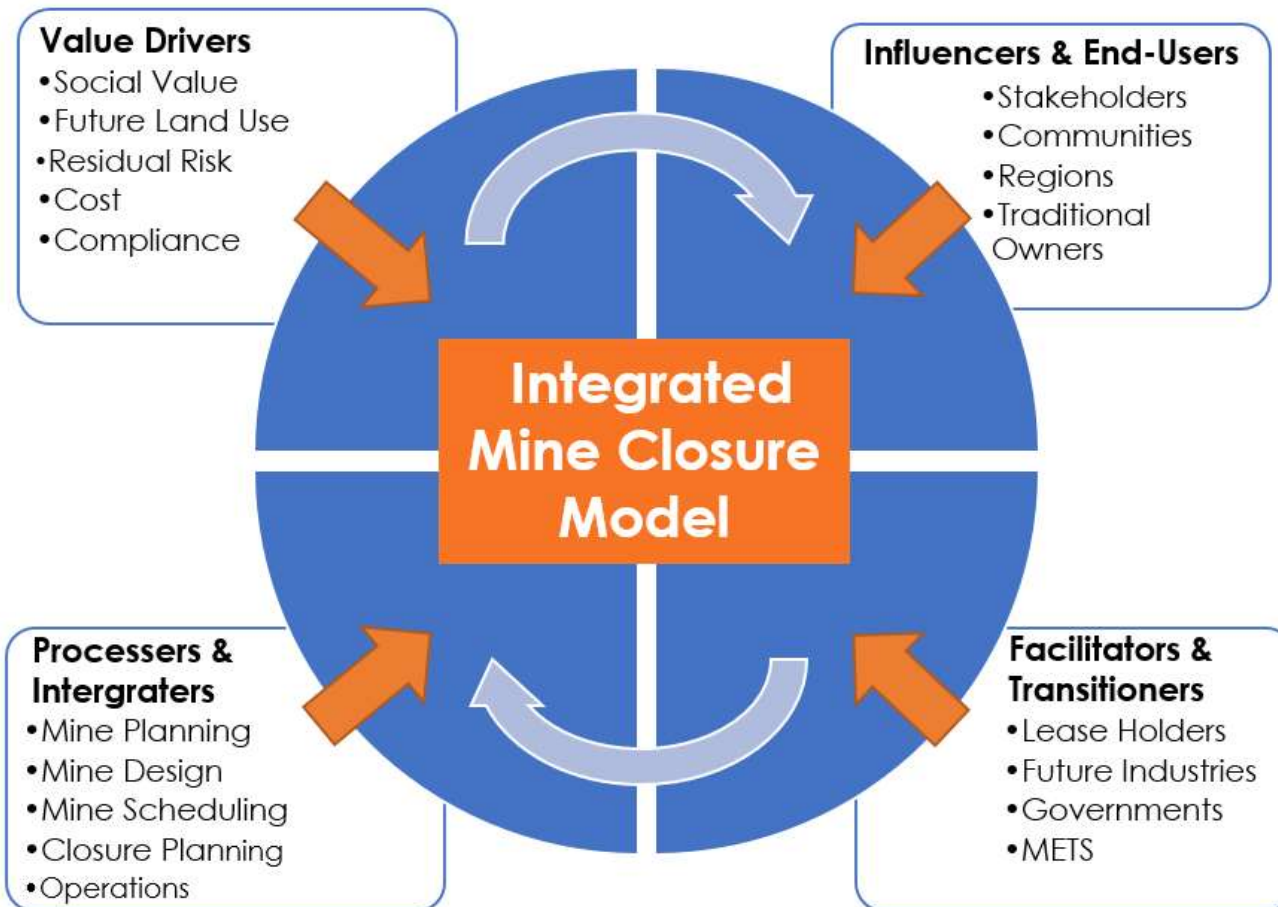


# Making ourselves the Solution...





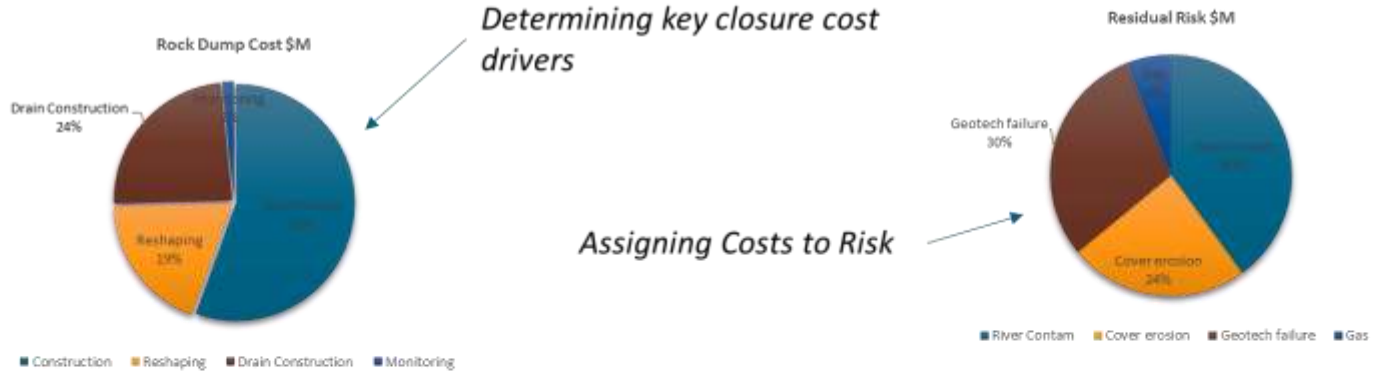
# An Integrated Closure Model



# Roadmap to Closure and Relinquishment

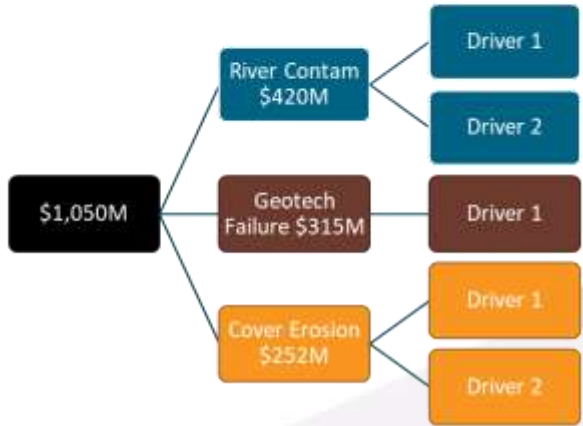
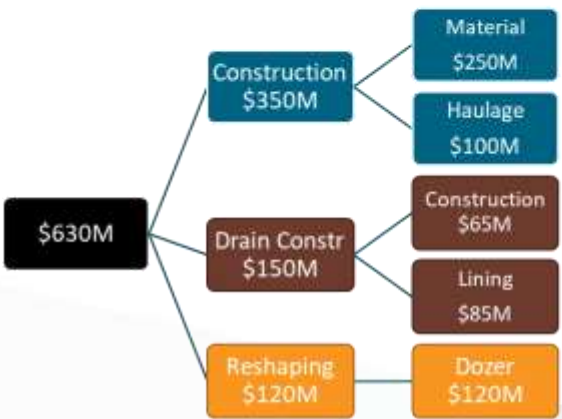


# Roadmap to Closure and Relinquishment



Determining key closure cost drivers

Assigning Costs to Risk





# Progress... Check-In... On Track?

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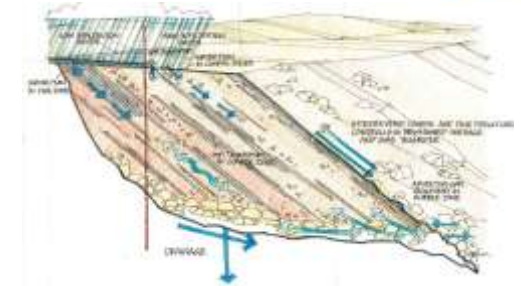




# ...at some point in time, We need to Model!!!

## • Interpretation

- Understand processes and/or site-specific control on these processes
  - ...to prove a hypothesis....
  - .....to train our thinking
- To make sense of monitoring data



**Conceptual Representation**



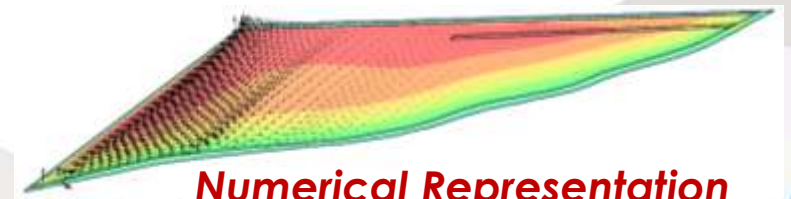
**Physical Reality**

## • Design – to inform on design / decisions

- Evaluation of relative performance of alternatives

## • Prediction

- To make a final prediction of future behaviour or impact



**Numerical Representation**



# Predictive Modelling

Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed
									
76°	74°	70°	70°	71°	76°	75°			

# Predictive Modelling



- “...One-day ‘accurate’ ...”
- “...forecasting rain is harder...” very site-specific
- “...a consensus forecast...”
- “...still many unknowns...”
- **“...we get a chance everyday to start fresh to give people an accurate forecast...”**

# Predictive Modelling

***It is about Enhancing Decisions and Informing Design***



- “...One-day ‘accurate’ ...”
- “...forecasting rain is harder...” very site-specific
- “...a consensus forecast...”
- “...still many unknowns...”
- **“...we get a chance everyday to start fresh to give people an accurate forecast...”**



# Predictive Modelling

## The Observational Method

1. *Exploration sufficient to establish the general nature, pattern, and properties... but not necessarily in detail*
2. *Most probable conditions... most conceivable deviations from these conditions*
3. *Establish a design based on a working hypothesis of behaviour anticipated for the most probable conditions*
4. *Select quantities to be observed as construction proceeds and calculate anticipated values on the basis of the working hypothesis*
5. *Calculate values for the same quantities under the most unfavourable conditions with available data*
6. *Select in advance a course of action or design modification for foreseeable significant deviation of the observational findings from those predicted on the basis of the working hypothesis*
7. *Measure quantities to be observed and evaluated on actual conditions*
8. *Modify design to suit actual conditions*



Karl von Terzaghi

Mechanical engineer



Ralph Brazelton Peck

Civil engineer

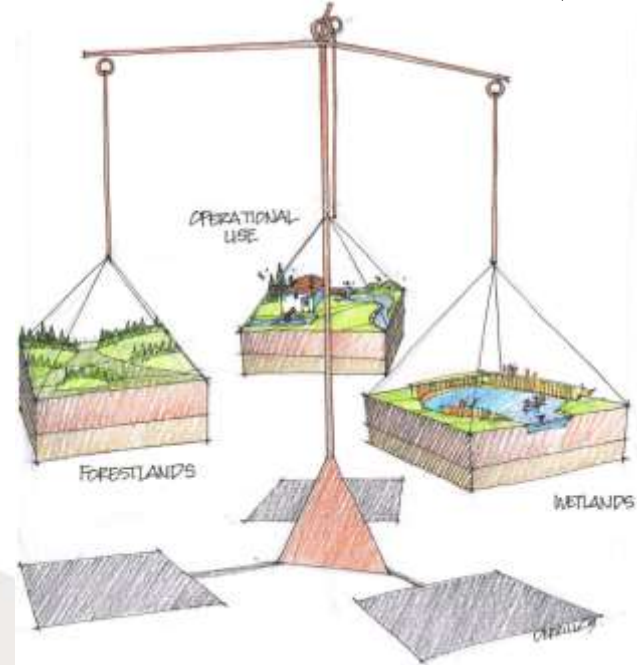
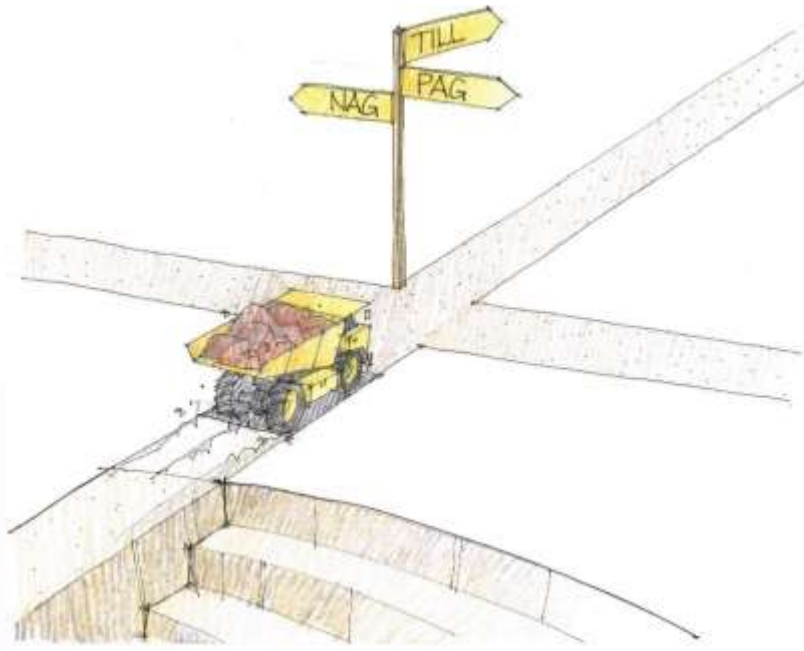
# ... "Better" ... Predictive Models

## The Observational Method

“...simplicity ...”

“...address uncertainty...”

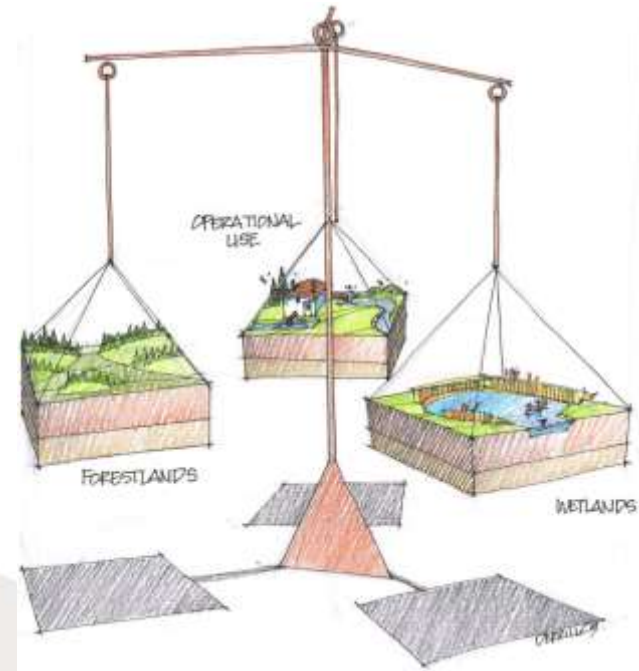
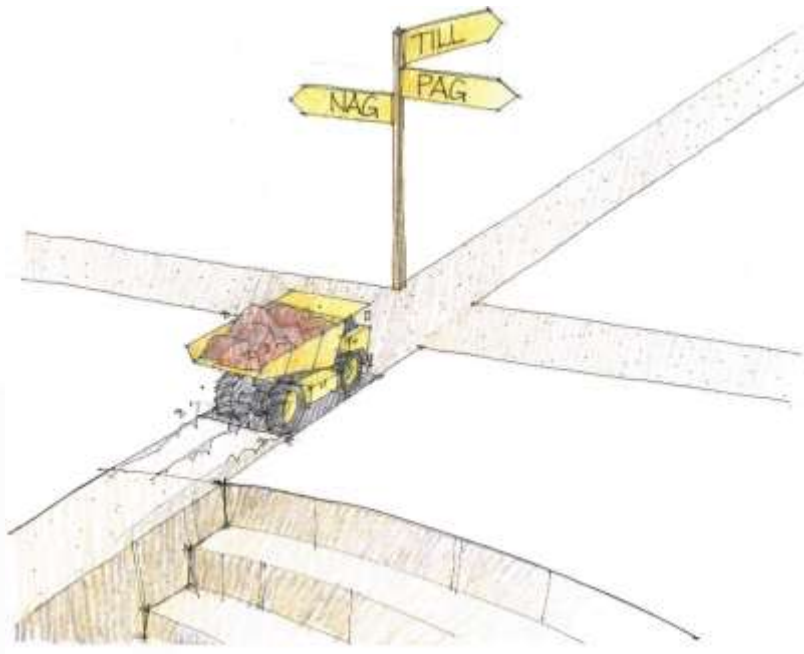
“...prediction, monitoring, feedback,  
teamwork, learning...”



# ...”Better”...Predictive Models

## *The Observational Method*

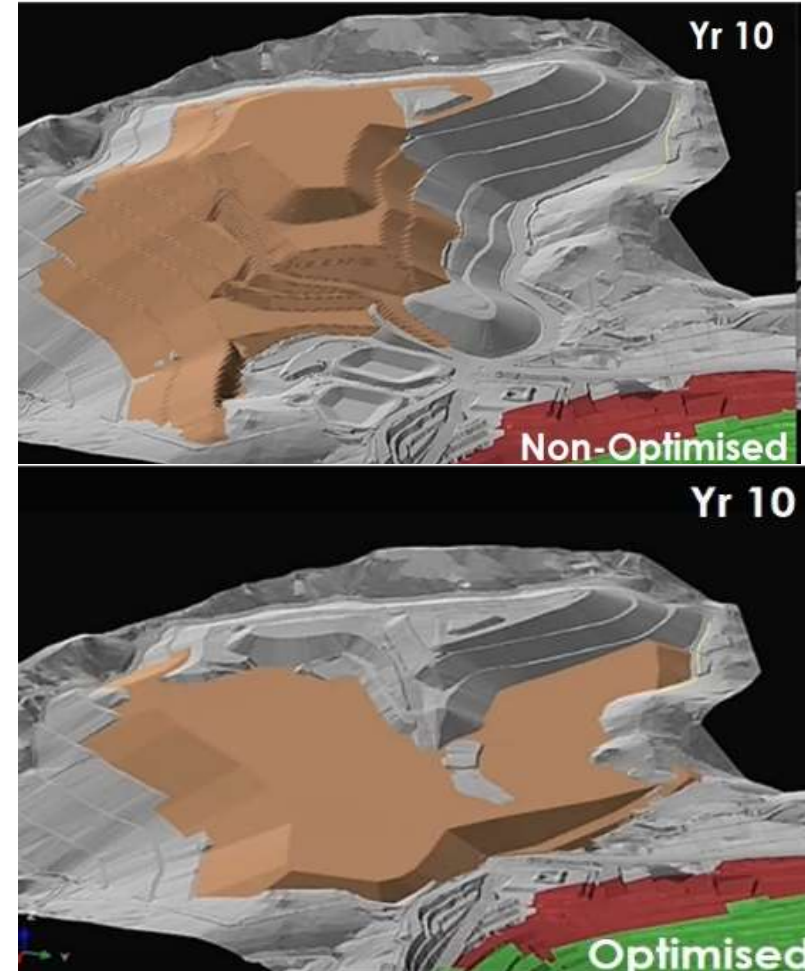
***“...the observational method overcomes limitations of conventional design by evaluating feedback from actual conditions...”***





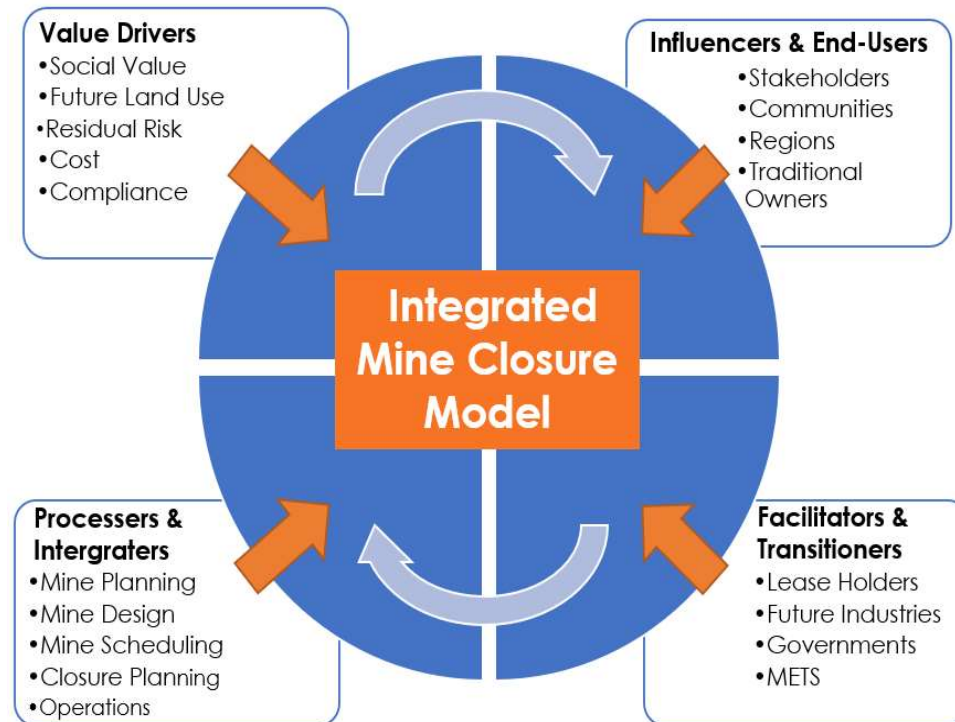
# Our Opportunity... Integration...

- **Clearly identified risk drivers**
- **Accurate estimates of closure liabilities**
- **True valuation of progressive closure activities**
- **Sustainable Development**



# Our Opportunity... **One Source of Truth**

- **Clearly identified risk drivers**
- **Accurate estimates of closure liabilities**
- **True valuation of progressive closure activities**
- **Sustainable Development**



# Progress... Check-In... On Track?

## Enabling Progressive Closure for Sustainable Development

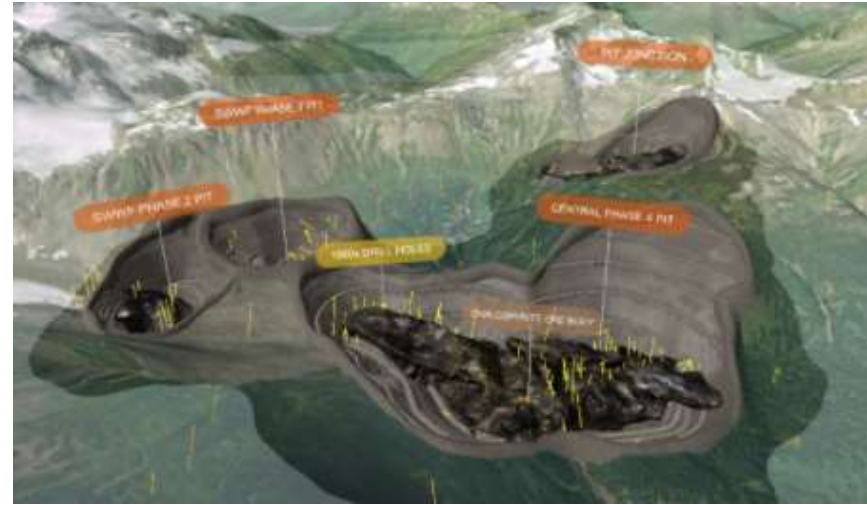


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# Brining it Together...







# Progress... Check-In... On Track?

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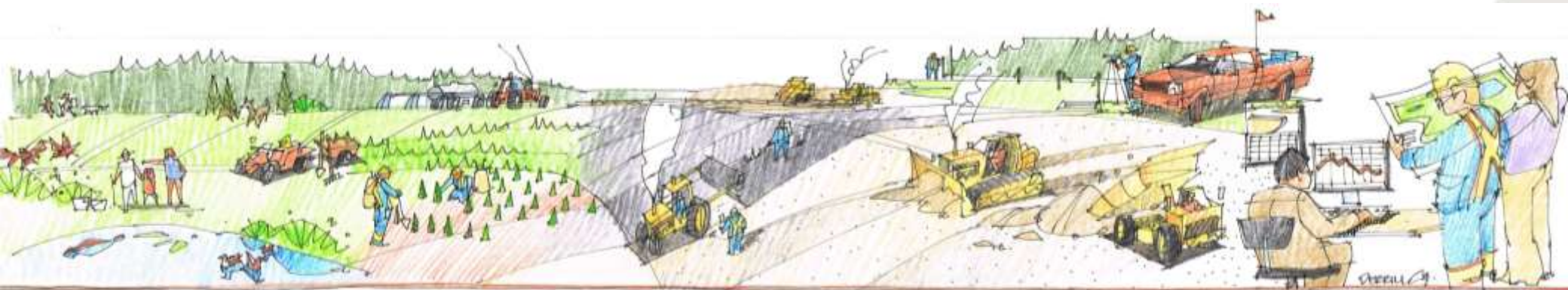


# Progressive Closure, and Sustainable Development

Makes sense...

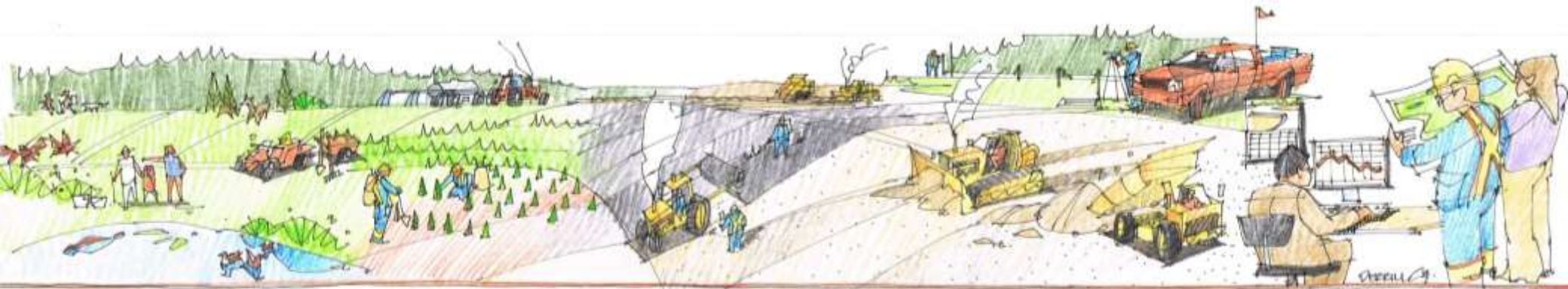
...so why, despite these being *'best practice'*,

Is, for example in the mining industry, ...progressive closure *not widely implemented?*



# Progressive Closure, and Sustainable Development

*So... again, Why Not?...*



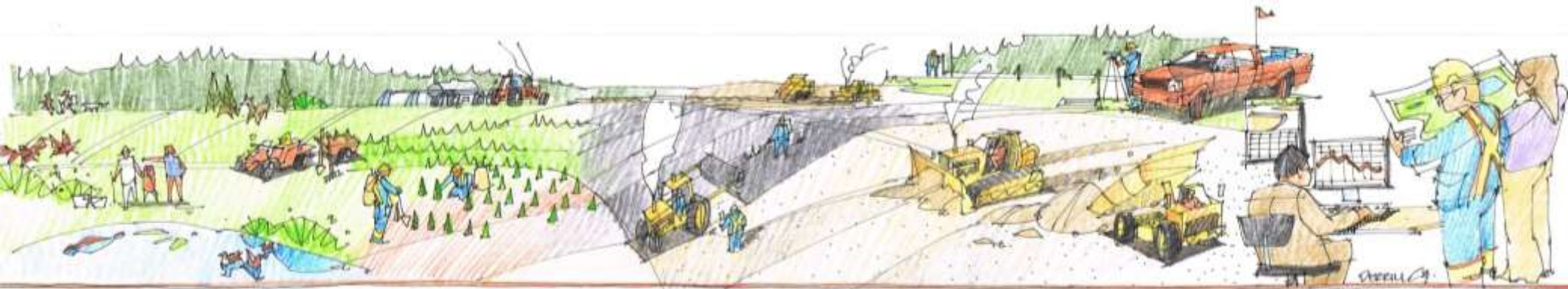


# Progressive Closure, and Sustainable Development

**So... again, Why Not?...**

**Yes...**

**perhaps because operators are not typically measured in respect of KPIs around progressive closure**

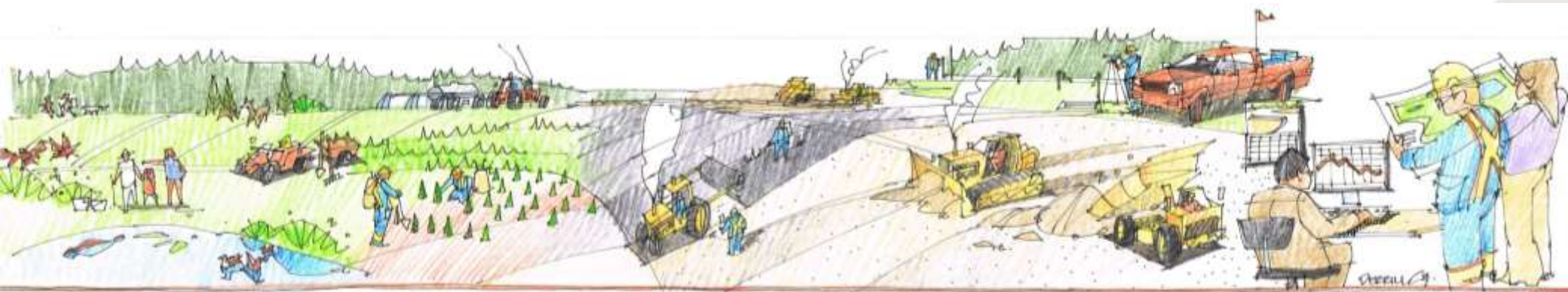




# Progressive Closure, and Sustainable Development

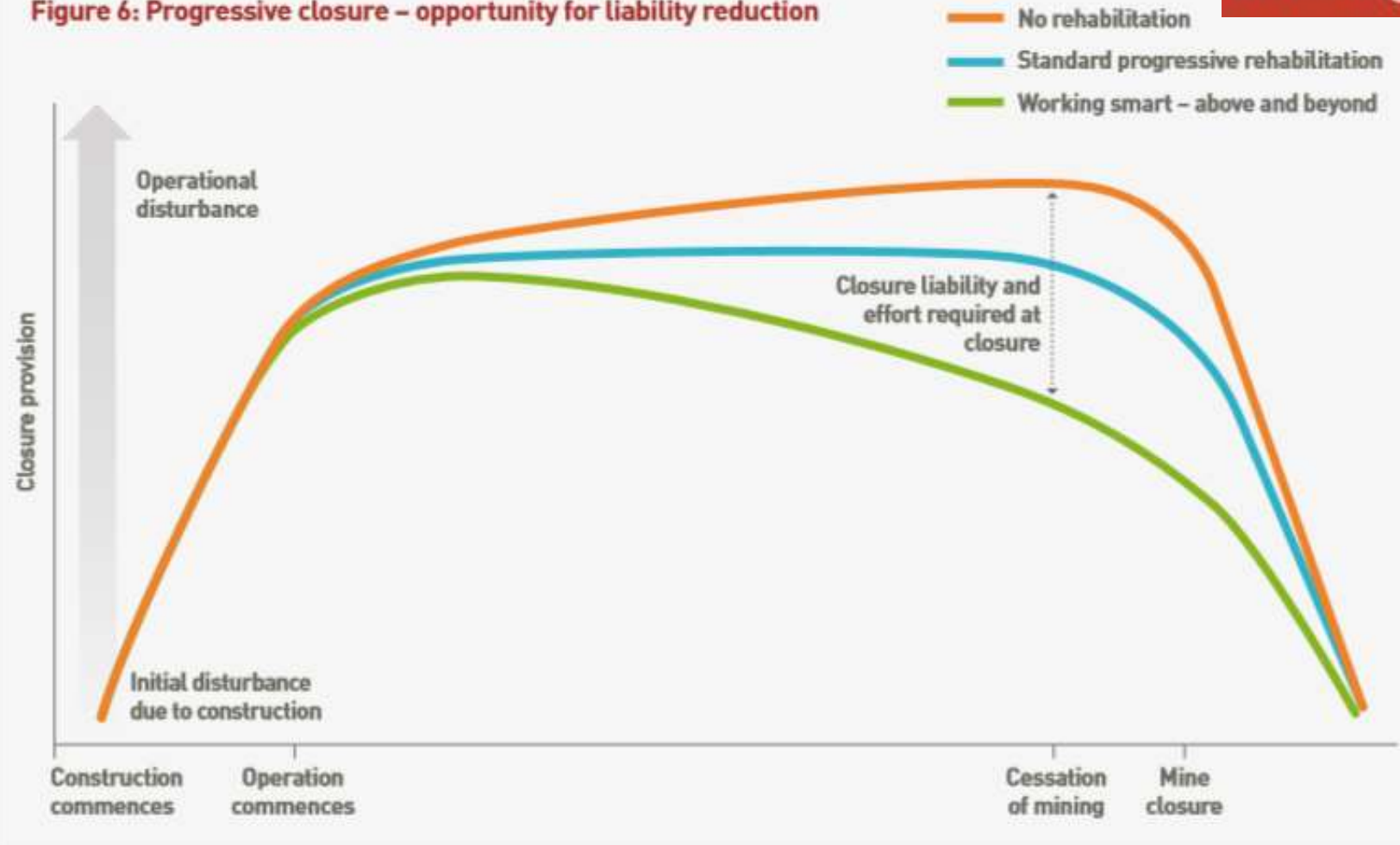
***But really...***

***.... its simply because its not part of the plan... the LOM***



# Our Opportunity

**Figure 6: Progressive closure – opportunity for liability reduction**



Source: Anglo American

# Okane Consultants



## Mine Environment Neutral Drainage (MEND)

- Design, Construction and Performance Monitoring of Cover Systems for Waste Rock and Tailings
- Cold Regions Cover System Design Technical Guidance Documents
- Macro-Scale Cover Design and Performance Monitoring Manual
- Modelling the Critical Interactions between Cover Systems and Vegetation

**okane** | **25**  
25 Years Advancing Mine Closure Solutions



# Thank You!

Feel free to reach out to [info@okc-sk.com](mailto:info@okc-sk.com) with any follow up questions

