

Assessment of rehabilitation completion criteria for mine closure evaluation

Never Stand Still

Engineering

School of Mining Engineering

Mascha Blommerde

PhD Candidate

The Australian Centre for Sustainable Mining Practices (ACSMP)

School of Mining Engineering

UNSW Australia

Joint-supervisors:

Professor Roslyn Taplin & Dr. Simit Raval

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1. Introduction

- Various regulations by regional or national governments (ICMM 2001, ANZMED/MCA 2000, DIT 2006a/b, EUR-Lex n.d.).
- Deem closure as successful or not (ICMM 2001, ANZMED/MCA 2000, DIT 2006a/b, EUR-Lex n.d.).
- Properly planned closure provides opportunities (DEHP 2014).
- Flexibility of mine closure plan and associated cost estimates (ICMM 2011, DIT 2006a, IIED/WBCSD 2002).

2. Completion criteria, performance indicators

Mine completion criteria (DIT 2006a, DTI 2013, ANZMEC/MCA 2000, Brearley 2003):

- End land use objective
- End point: objective, target level or value
- Numerical value, by measurement of performance indicators
- Standard to be met to have a successful rehabilitation outcome
- Achieve each phase of rehab before proceeding to next phase
- Approved by appropriate regulatory body



2. Completion criteria, performance indicators

Performance indicators (DIT 2006a, DTI 2013, ANZMEC/MCA 2000, Brearley 2003):

- Measure progress of the completion criteria/objectives
- Biophysical environment, e.g. pH, biomass, slope, topsoil depth etc.
- Location and ecosystem specific
- Track progress, negative changes and trends of sustainable ecosystems
- Measured and audited



3. International leading practice

- Canada
- United States of America
- European Union and Member States



3. International leading practice

- Breaking New Ground: Mining, Minerals, and Sustainable Development (MMSD) (IIED/WBCSD 2002).
- Discussion paper 'MMSD+10: Reflecting on a decade of mining and sustainable development' (Buxton 2012).
- ICMM Toolkit: Planning for Integrated Mine Closure (ICMM 2011).
- Financial institutions
 - Voluntary programs (Equator Principles) (The World Bank Group 2008, The Equator Principles Association n.d., The World Bank Group n.d.)



- Canada

Responsibility at provincial level (NRC n.d., NRC 1996, Hart et al. 2012)

- Ownership of natural resources
- Responsible for policies, regulations and guidelines
- Certified Closure Plan needed
- Financial Assurance
- Progressive rehabilitation



- United States of America

National environmental laws - Responsibility on a State level (UN 2011, OSMRE n.d.)

- State-specific laws, regulations, technical requirements and guidance
- Closure permit: detailed assessments of conditions during operations + predicted post-closure conditions
- Closure plans required for “Approval to Operate”
- Financial assurance: estimates of closure costs
- Closure approval: conditions after closure, plans for long-term monitoring



- European Union

Mining Waste Directive (MWD) - Directive 2006/21/EC (MonTec GmbH 2007, EUR-Lex n.d.)

Obligations of EU Member States / mining companies:

- Bring legislation into force
- Submission of waste management plan
- Financial guarantee
- Inspections by the competent authority



Before and after mine closure end-land use, Ferropolis, Dessau, Germany

4. Australian completion criteria

Australian Commonwealth

- State/Territory specific Mining law and EPA guidelines
- Leading Practice Sustainable Development Program for the Mining Industry (DIS n.d., DIT 2006a, DIT 2006b)



States:

- LPSD program as guideline
- Learning from each other!
- Criteria set through Lease agreement, Mining Operation Plan, Closure Plan
- Difference between Performance Indicators and Completion Criteria
- Emphasis on monitoring
- Financial assurance / bonds (calculation tool)
- Progressive rehabilitation

4. Australian completion criteria

Australian State/Territory	Closure and Rehabilitation Documentation
Queensland	Rehabilitation Requirements for Mining Resource Activities - EM1122 (DEHP 2014)
New South Wales	ESG3: Mining Operations Plan (MOP) Guidelines (DTI 2013)
Northern Territory	CA7-011 Mine Close Out Objectives - Life of Mine Planning Objectives (DME 2006)
	AA7-019 Information Sources for Mining Management Plan Preparation (DME 2011)
	AA7-026 Exploration Operations Mining Management Plan Structure Guide (which includes a Template Document as well) (DME 2010a)
	AA7-027 Extractive Operations Mining Management Plan Structure Guide (includes a Template Document) (DME 2010b)
South Australia	AA7-030 Template for the Preparation of a Mining Management Plan (includes a Template Document) (DME 2013)
	MG1 Guidelines for Miners: Mining Approval Processes in South Australia (PIRSA 2009)
	MG2 Guidelines for Miners: Preparation of a Mining Lease Proposal or Mining and Rehabilitation Program (MARP) in South Australia (PIRSA 2011)
	MG12 Guidelines for Miners: Preparation of a Mine Operations Plan (MOP) (MITRE 2012a)
	MG6 Guidelines for Miners: Preparation of a Program for Environment Protection and Rehabilitation (PEPR) for Extractive Mineral Operations in South Australia (MITRE 2012b)
Tasmania	MG8 Guidelines: Program for Environment Protection and Rehabilitation (PEPR) for Low Impact Mineral Exploration in South Australia (MITRE 2013)
	Decommissioning & Rehabilitation Plan (DRP) – A guideline for the Tasmanian mining industry (EPA TAS 2011)
Victoria	Rehabilitation Plans & Other Environmental Aspects of Work Plans Guidelines for Environmental Management in Exploration and Mining Minerals and Petroleum Division (DEER 2004)
	Code of Practice for Mineral Exploration, Standards, procedures and practical guidance under the Mineral Resources (Sustainable Development) Act 1990 (DSDBI 2014)
Western Australia	Guidelines for Preparing Mine Closure Plans (DMP & EPA 2015)

Table: Australian State and Territory guidelines and closure documentation

- NSW completion criteria

NSW regulatory objective: *“to promote a culture of environmental protection and best practice environmental management in the exploration, mining and petroleum industries”* (DRE n.d., DTI 2013)

- NSW Trade & Investment, Department of Resources and Energy (DRE)
- NSW Environment Protection Authority (EPA)



- NSW Mining Operations Plan

NSW mine closure and rehabilitation document - ESG3: Mining Operations Plan (MOP) Guidelines (DTI 2013)

- Detailed table/reporting template for each phase of rehabilitation and domain
 - ✧ performance indicators
 - ✧ completion criteria

- Monitoring
- Financial bonds
- Progressive rehab

Objective	Performance Indicator (something that can be measured)	Completion Criteria (Quantifiable Target)	Justification/ Source	Complete (yes/no)	Link to TARP	Progress at start of MOP
Phase – Ecosystem and land Use Establishment						
Domain – Rehabilitation Area - Woodland						
Establishment of a representative number of species and at similar density to a reference ecological community	Species richness	X per ha	Landscape Management Plan		p. 8	Ongoing
	Presence of recalcitrant species	Present	Landscape Management Plan		p. 7	Ongoing
Species specific habitat and/or nesting features are incorporated where relevant in areas across the site	Number of artificial hollows installed	12 per hectare	Analogue Site		NA	Ongoing
	Rock pile density	30 m2 per hectare	Analogue Site		NA	Ongoing

Table: 'Rehabilitation Table' example page from the NSW Mining Operation Plan guidelines (DTI 2013)

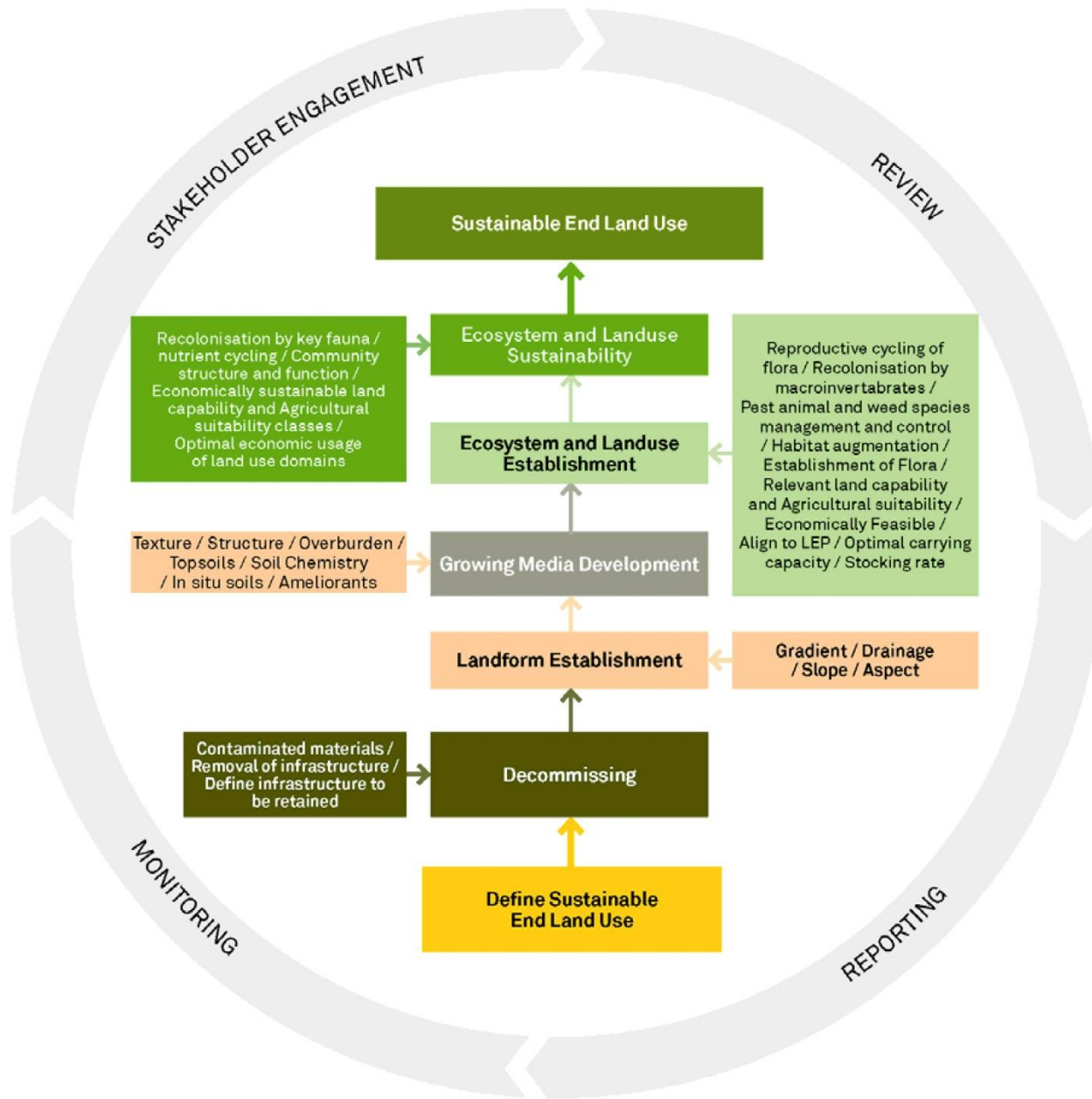


Figure: NSW rehabilitation Phases with Post Mining Land Use Goal – Native plant ecosystem (DTI 2013)

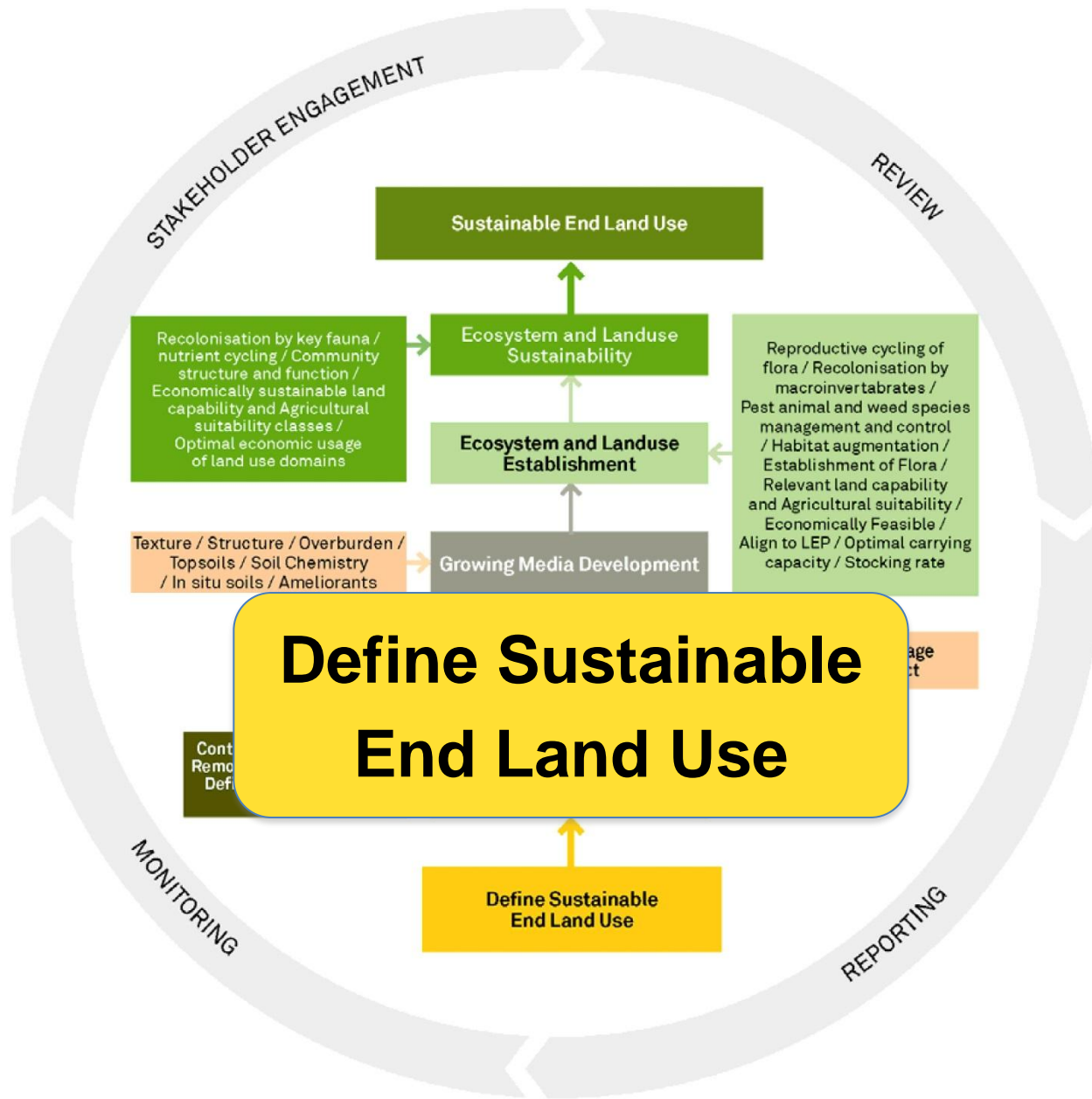


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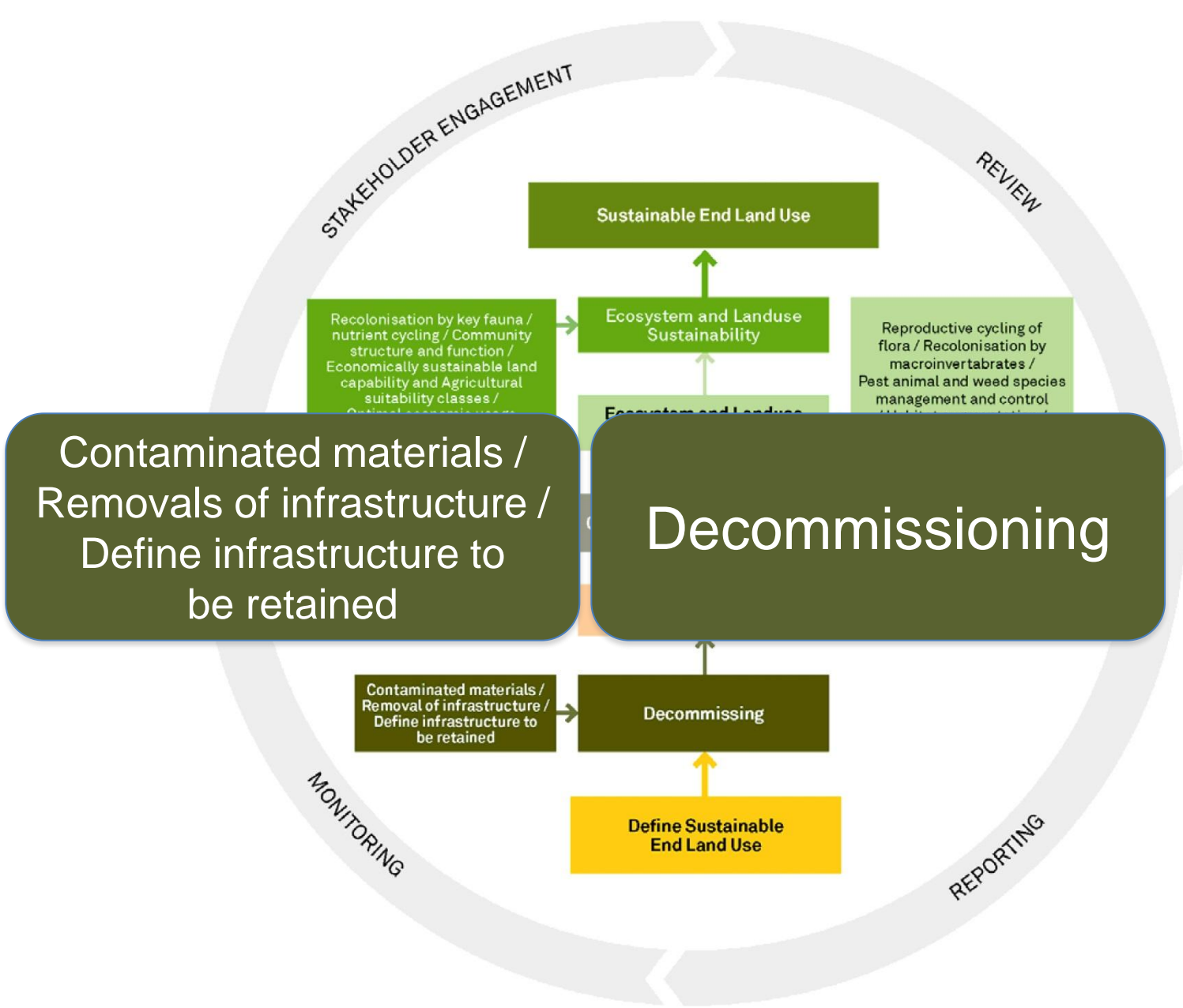


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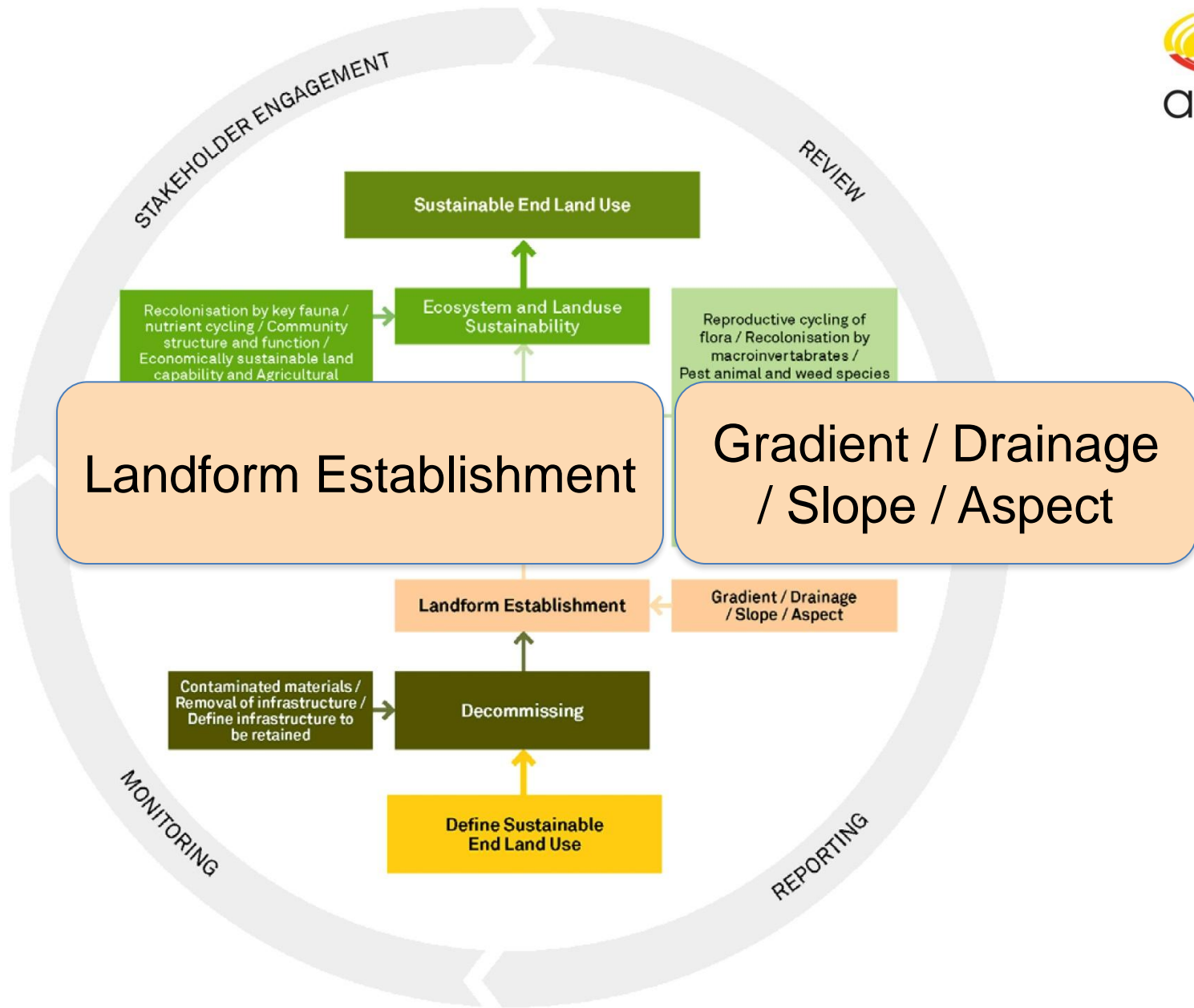


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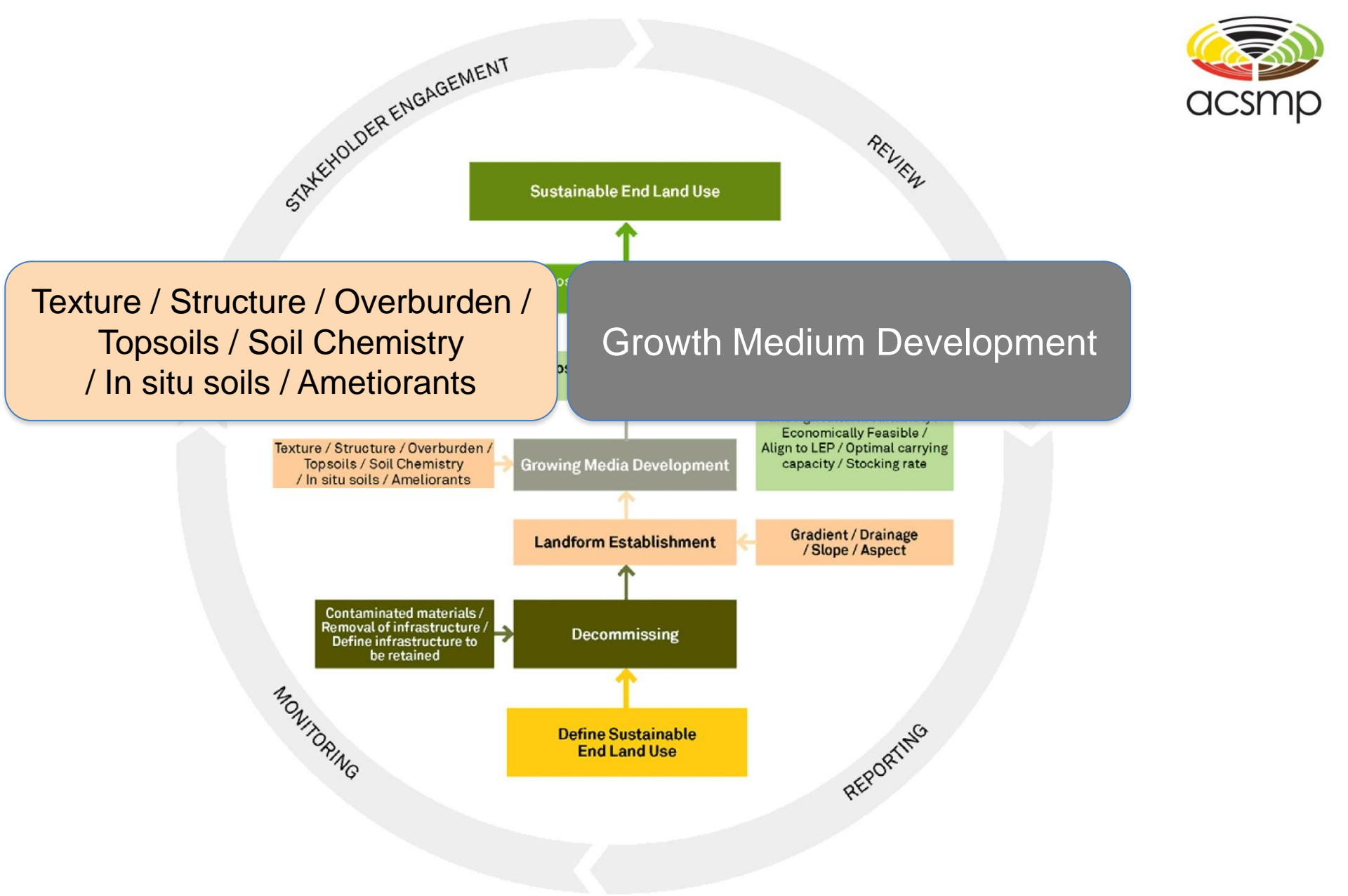


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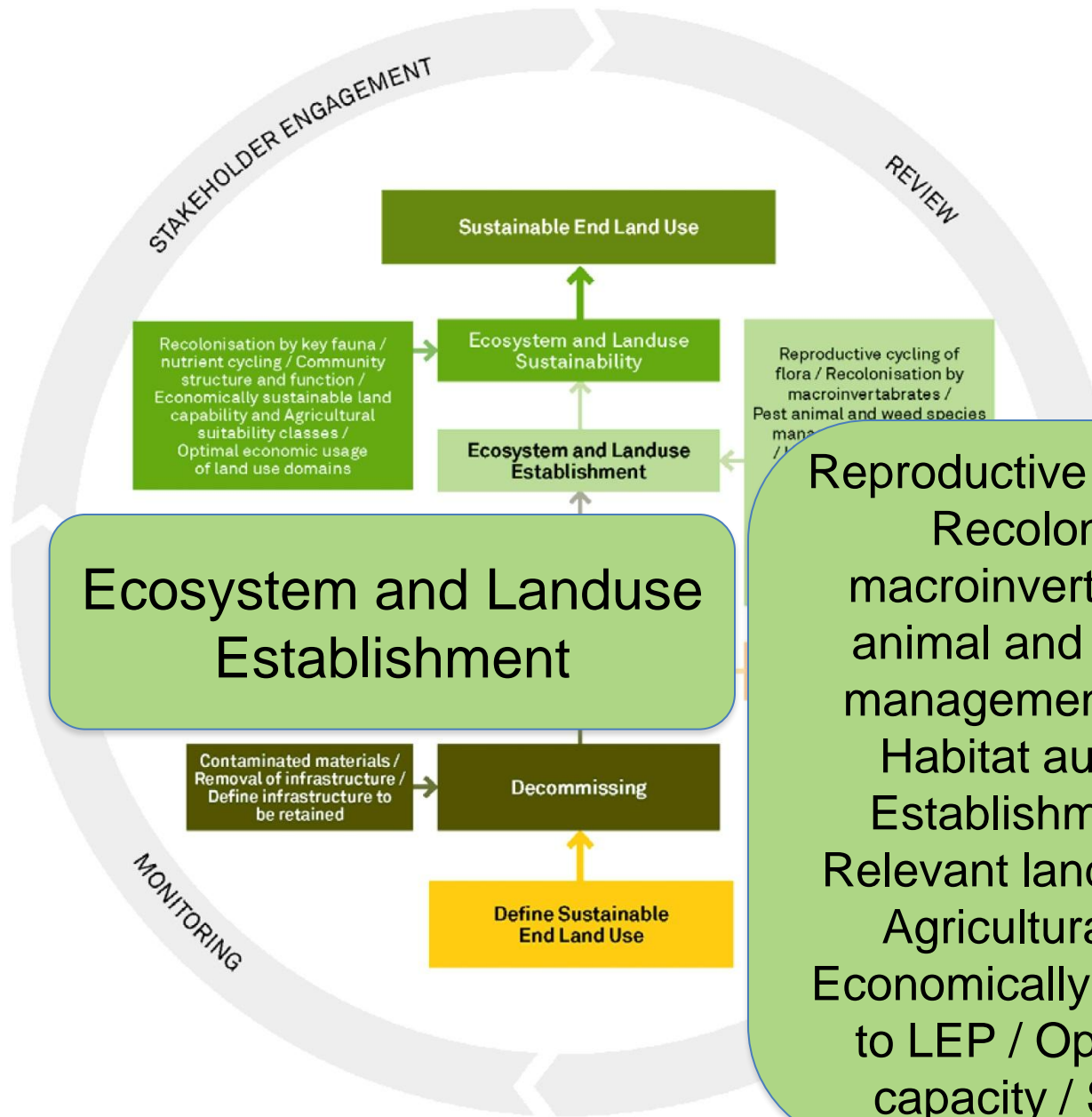


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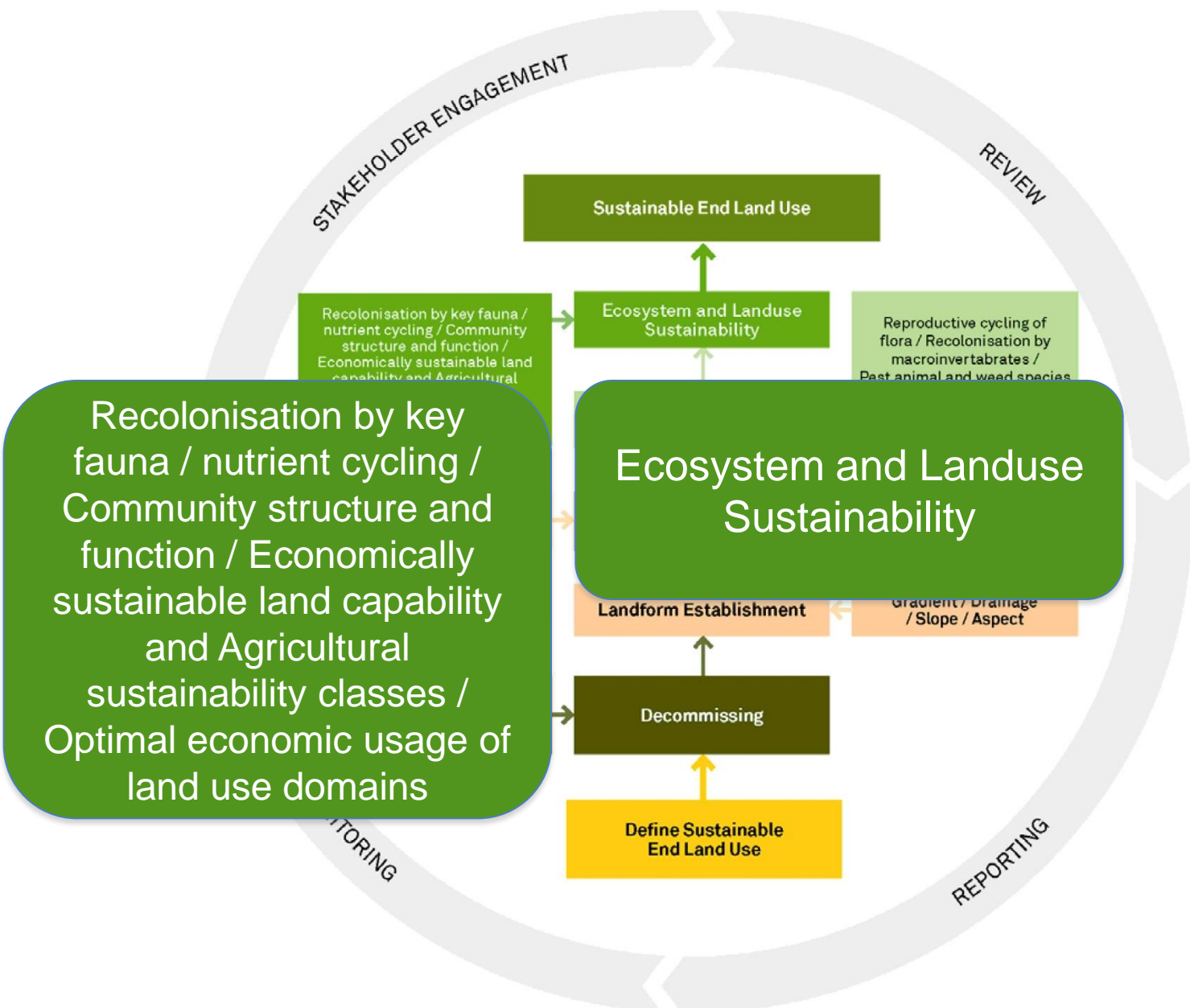


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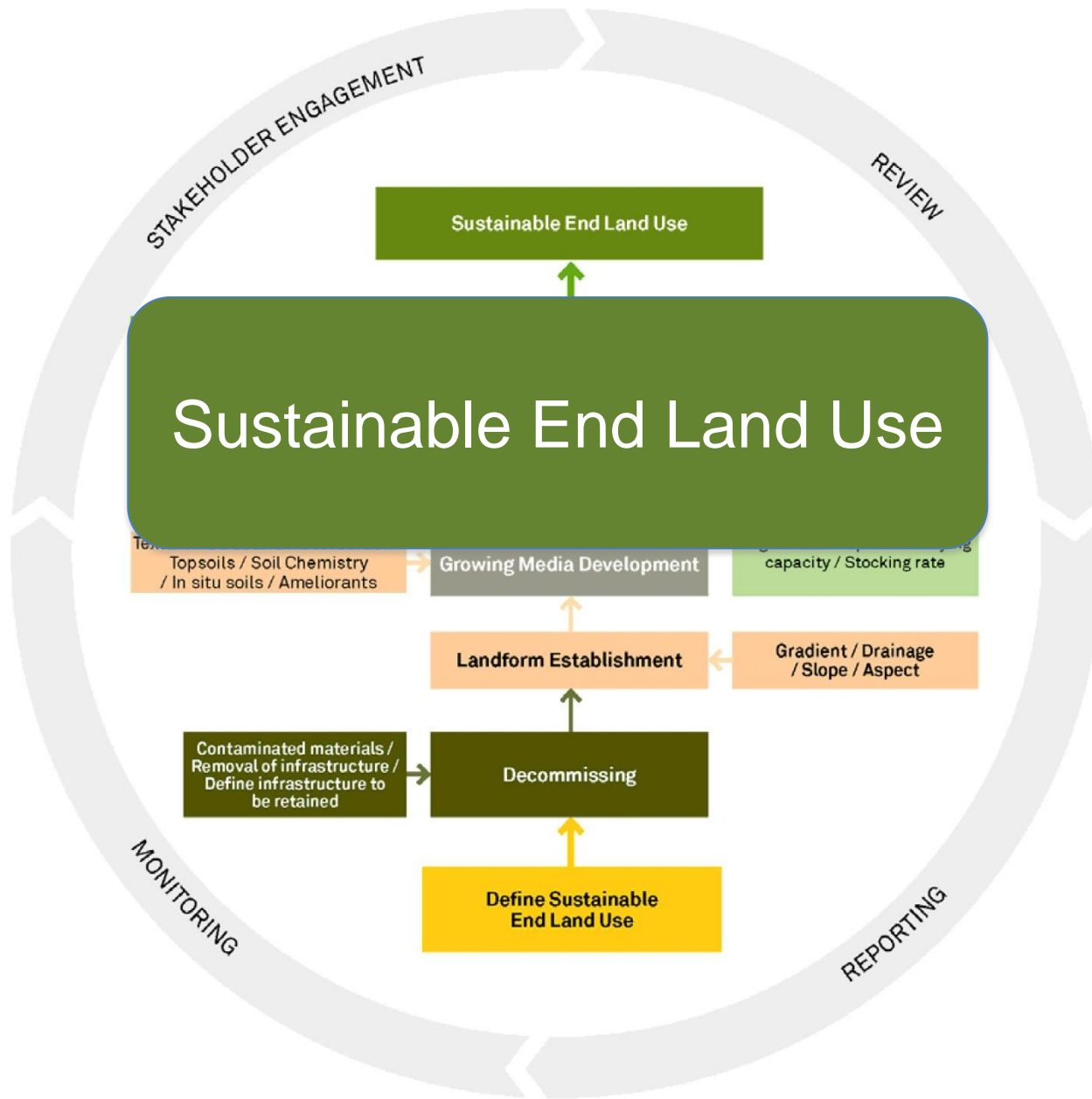


Figure: NSW rehabilitation Phases with Post Mining Land Use Goal – Native plant ecosystem (DTI 2013)

5. Comparative assessment

International leading practice on mine closure

- Mine closure regulated per state /province
- Financial assurance / Bonds
- Progressive rehabilitation and Monitoring

Australian comparison

- WA, NSW and Qld most elaborate guidelines
- Leading Practice Sustainable Development Program for the Mining Industry
(DIS n.d.)
- Need for stronger guidance and key requirements

6. Conclusions

- Minimal specification of Completion Criteria or Performance Indicators
 - Up to the company to develop, justified
 - Approval of closure plan and conditions by the regulatory body
- Unclear, certification of surrender or relinquishment
- Unclear, defined rules and regulations



6. Conclusions

Issues with Australian mine closure guidelines

- Currently lease and bond relinquishment, difficult or even unattainable.
- Gaps between regulatory guidance and successful relinquishment.

- Need for clearer standards by regulators for rehabilitation and relinquishment to proceed.
- Need for more uniform and realistic set of requirements to be applied nationwide in Australia.
- Thus need for clearer guidelines on performance indicators and completion criteria and clearer (quantifiable) relinquishment criteria

➤ Quantitative framework for mine closure evaluation

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Cartoon by Nicholson from "The Australian" newspaper: www.nicholsoncartoons.com.au

Mascha Blommerde

m.blommerde@student.unsw.edu.au