BMA SUSTAINABLE LANDFORM GUIDELINE

SAFE
STABLE
SUSTAINABLE

Revised	Date
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CONTENTS

1 PREAMBLE

Historically, the rehabilitation effort of opencut coal mines in Central Queensland has been relatively ad-hoc and conducted as an activity based on regrading accessible mine spoil disturbed by open cut mine operations. The focus of mine planning has essentially been on scheduling excavation and short hauling overburden while the solutions to producing a sustainable long term landform were being developed. This has resulted in a disconnect between mine planning, operations and rehabilitation. The focus for rehabilitation has been on the one to five year time frame, viewed as more of an imposition and not seen as part of the mining operation aimed at reducing closure liability.

It is estimated that BMA mine leases currently account for approximately 9% of BHP Billiton managed lands, yet represents some 45% of the total land disturbance requiring rehabilitation. There is also a considerable and increasing backlog of rehabilitation which is being driven by mining production scheduling demands, coupled with deeper prestrip excavation requirements. This is also reflected in an ever increasing liability.

Until recently, many mines considered that there would be little requirement for rehabilitation of the entire disturbed area. The perception being that the rehabilitation effort should focus on external facing spoil and crest areas, with little attention being paid to major disturbance elements such as ramps and voids, despite the substantial erosion and land stability risks that these areas bring to the overall spoil landform.

In recent years, however, a greater awareness of stewardship, community and sustainability issues associated with opencut mining have arisen. BHP Billiton closure planning has provided increased recognition that 'rehabilitation' applies to all of the mined out and disturbed lands on the BMA minesites. It is now recognized that major disturbance categories such as ramps and final voids will also generally require substantial rehabilitation to provide stable and beneficial use outcomes compatible with the BHP Billiton Sustainable Development Policy. Sequenced excavation to enable cost effective backfill of ramps and voids will be necessary in some instances to allow progressive rehabilitation and reduce liabilities well before eventual mine closure.

Final landform investigations have also shown that:

- Design and construction of a cost effective stable final landform is not economically feasible in the latter stages of typical pit development. Costs would be prohibitive to undertake very major spoil regrade or backfill activities after shorter haul and incremental cost opportunities are lost.
- Spoil room availability is highly sensitive to final highwall location.
- A set of operational principles is required to ensure a suitable landform by mine closure.
- These principles must allow for variation in location of the final highwall.

Work undertaken at several BMA mine sites indicates that increasing amounts of prestrip spoil will be generated for the balance of mine life. Some mines, for example Saraji Mine, have huge predicted spoil room deficits which may require an alteration of conventional mining practices. The solution to the spoil room deficit may rest upon cost effective utilization of voids using a scheduled sequential void infill strategy. To deliver stable self sustaining and beneficial landuses, pit and ramp voids need to be closed down in a logical sequence to enable spoil to be used for backfill rather than creating unsustainable landforms on a lowest cost production basis. The implementation of changed mining strategies to apparent dip mining may also facilitate improved spoil backfill and lowered overall mine closure liability.

There is also recognition that there are significant rehabilitation challenges and liabilities associated with ‘conventional’ out of pit rejects and tailings placement. Placement in ramps and pits can significantly reduce this rehabilitation challenge. Therefore utilization of voids will also need to take into account tailings and coal reject disposal.

The rehabilitation of disturbed land is considered to be an integral part of sustainable BMA open cut mining. BHP Billiton mining operations are now required to mandate closure planning processes aimed at mitigating the rehabilitation liability by end of mine life, with only residual completion of work during the decommissioning phase. This can only be achieved by closely coordinated mine and final landform planning. Above all, careful consideration by mine planning personnel is required in designing excavation and spoil placement programs, and importantly scheduling mining activity to provide a favorable closure outcome. It is recognized that this requires some cultural change and redeployment of responsibilities to some extent.

Spoil placement planning to reduce long term disturbance is seen as an essential element in closure liability reduction as well as enabling progressive rehabilitation to occur. If careful planning is not undertaken, unacceptably high liabilities to the company and the community will occur. It is now recognized that BMA requires the implementation of fundamental performance criteria to control the landform planning process. Changed practices are required to assure the achievement of long term sustainability outcomes sought by BMA, the EPA and the community.

In summary, so that closure liabilities can be adequately managed, mine operations must be undertaken in accordance with agreed operational principles or strategies which should be implemented early in the mine development at appropriate and logical times and not at the end of mine life when opportunities for cost effective spoil placement will have passed. Proactive, Life of Asset (LoA) spoil fit is required as an essential planning tool so decision making does not regress to be reactive.

The practice of scheduling mining programs for maximizing returns based on contemporary coal prices will need to be changed to ensure that cash flows are balanced with reduced longer term closure liability.

This Guideline outlines BMA requirements for spoil placement and final landform design and development. Also included are background information on legal aspects, corporate closure, risk management and sustainability requirements which have direct bearing on BMA’s decision to implement changes to mine planning strategies, scheduling and operational practices aimed at lowered closure liability and sustainable outcomes.

1.1 NON CONFORMING STANDARDS

These guidelines do not override any existing commitment in any statutory operational approval including Environmental Authorities, Environmental Management Plans, or Plans of Operations where there may be commitment to higher standards of environmental performance. However, when sites may wish to apply different design strategies than outlined in this guideline, the site shall demonstrate that such design criteria are likely to meet closure liability minimisation and rehabilitation sustainability requirements.

1.2 SCOPE LIMITATION

It should be noted that the following guidelines have been developed on a conservative basis given the generally poor outcomes for Tertiary spoil rehabilitation in the Bowen Basin to date. Effective rehabilitation of mine spoil in the Bowen Basin has proved to be extremely challenging. A harsh climatic environment typified by periods of extreme rainfall and drought, together with landforms built from fragile spoil demands that conservative treatments are applied wherever possible. Sites are encouraged to investigate various combinations and permutations of spoil type/depth/treatments that may be used to overcome erosional instability in the pathway to successful vegetation establishment.

Clearly, the final treatment of any particular spoil situation must recognise the existence of existing constraints. Thus in some instances, depth of durable rock, topsoil and design slope might vary from the Guideline in situations where particular resource, operational or infrastructure limits might apply. Nonetheless safe, stable and sustainable rehabilitation outcomes are mandated by BMA.

It is not the intent of this document to provide detailed design for any particular aspect of landform construction; such detail will be site specific. These guidelines are aimed at establishing overall management, planning, design principles and performance criteria that are applicable to mining, bulk earthworks and spoil placement programs which are the important elements controlling the **overall shape** of the final landform and the ultimate liability of the company at mine closure.

1.3 UPDATE & REVIEW

This Guideline is a reference document for all BMA Closure Plans (also known as Life of Mine Plans). It is a living document and will necessarily develop into the future. Regular update and review is required to reflect possible changes in corporate requirements, legislation, community expectations and mining practices. Other triggers for change to the guidelines include continuous improvement initiatives and improved industry understanding in rehabilitation practices and sustainability outcomes and learning’s. Annual review and update in line with BHP Billiton Closure Standard July 04 is required.

2 SUSTAINABLE DEVELOPMENT

BHP Billiton has implemented its Sustainable Development Policy across all of its operations in which striving for **zero environmental harm** is the foundation of the Policy. BMA as a subsidiary of BHP Billiton is committed to managing its business in accordance with this Policy. Those requirements of the Sustainable Development Policy which are particularly pertinent to the creation of safe, stable and sustainable landforms include the following:

- Not compromising safety
- Identifying, assessing and managing risks
- Reducing and preventing pollution
- Enhancing biodiversity
- Stakeholder consultation

The Minerals Council of Australia (MCA) has redeveloped its sustainable development code. The code is now known as “Enduring Value – the Australian Minerals Industry Framework for Sustainable Development.”

The key role of “Enduring Value “ is to translate the Principles of Sustainable Development into practices that ensure that industry operates in a manner which is attuned to the expectations of the community, and which seeks to maximize the long-term benefits to society that can be achieved through the effective management of Australia’s natural resources.

The code defines Sustainable Development in operational terms as being to:

1. Implement and maintain ethical business practices and sound systems of corporate governance.
2. Integrate sustainable development considerations within the corporate decision making process.
3. Uphold fundamental human rights and respect cultures, customs and values in dealings with employees and others who are affected by our activities.
4. Implement risk management strategies based on valid data and sound science.
5. Seek continual improvement of our health and safety performance.
6. Seek continual improvement of our environmental performance.

Further explanation is provided by the code for environmental aspects as:

a) Assess the positive and negative, the direct and indirect, and the cumulative environmental impacts of new projects – from exploration through to closure.

b) Implement an environmental management system focused on continual improvement to review, prevent, mitigate or ameliorate adverse environmental impacts.

c) Rehabilitate land disturbed or occupied by operations in accordance with appropriate post-mining land uses.

d) Provide for safe storage and disposal of residual wastes and process residues.

e) Design and plan all operations so that adequate resources are available to meet the closure requirements of all operations.

BHP Billiton is a signatory to the MCA Enduring Value, thus BMA is also committed to operating its mines in accordance with "Enduring Value" as well as BHP Billiton Sustainable Development Policy requirements.

LEGAL PROVISIONS

2.1 QUEENSLAND ENVIRONMENTAL LEGISLATION

The environmental management and regulation of the mining industry in Queensland for leases established under the Mineral Resources Act is administered by the Environmental Protection Agency through provisions of the Environmental Protection Act 1994 (EP Act). This Act provides for the assessment and the issuing of environmental authorities for mining activities, and enforcement of the conditions of the authority. Some leases established under the CQCA Agreement Act may not be directly regulated by the EP Act; however BMA has entered into a written agreement with the Queensland Government to operate all its mines in accordance with the EP Act.

The Queensland regulator requires that land disturbed by mining is rehabilitated to stable and beneficial agreed uses. Overall the three mandatory rehabilitation requirements for stability, beneficial use and protection of water quality remain. These elements are further defined as:

- **Stable landform** – the requirement to place spoil to final landform design standard. Stability covers both erosional and geotechnical stability. Attainment of erosional stability requires substantially more effort in planning and construction than is required for geotechnical stability.
- **Beneficial use** – e.g. stable native bush land, grazing or cropping with no ongoing liability to BMA nor BHP Billiton or the community.
- **Preservation of downstream water quality** – existing and future use of the down stream water not compromised. Silts, salts and acids are not released from spoil or voids to groundwater or surface water.

Progressive rehabilitation is Queensland government policy and it is up to the mining company to demonstrate that its rehabilitation programs are effective in permanently stabilizing land and returning a beneficial agreed landuse. Permanence is not a well defined term, but has connotations of time passing for many generations at least. EPA once referred to 150 years as being a reasonable expectation for tailings dams to perform without significant failure, but now indicate a much longer passage of time is appropriate.

The **EPA Guideline 18: Rehabilitation Requirements for Mining Projects** clarifies what the Government expects for minesite rehabilitation and the general performance goals appear to be more stringent than earlier guidelines. The guideline specifies the following rehabilitation goals for mining disturbance:

- Safe to humans and wildlife.
- Non-polluting.
- Stable.
- Able to sustain an agreed post-mining land use.

The regulator has also provided some clarification on its preferred position for acceptance of final voids (including voids, shafts, adits and subsidence areas) in the guideline. The guideline refers to three basic levels of acceptance:

- Generally acceptable - requires extensive void treatment including the possibility of backfill or considerable regrading,
- May be acceptable - a minimalist treatment is imposed such as sealing coal seams and hazardous material, allowing the void to fill with water, building a safety bund, battering unstable slopes etc. to ensuring minor risk to fauna or stock. Overall the regulator may consider a land use situation of “unused void with low risk”.
- Rarely acceptable - leaving a void that has or accumulates hazardous material, poor quality water and is in a structurally unsound condition.

In view of the regulatory requirements for **acceptable** rehabilitation, it is unlikely that mine leases rehabilitated to an inadequate standard will be able to be relinquished. Inadequate rehabilitation may include a landform with erosional processes causing vegetation failure. This may involve active, sheet wash, rill and gully development on the batters of the final landform as may be evident on any topographic feature such as on boxcut spoil faces, dump batters, tailings dams embankments and open voids and ramps.

Compliance with all legislation including the EP Act has important business implications for BMA and BHP Billiton.

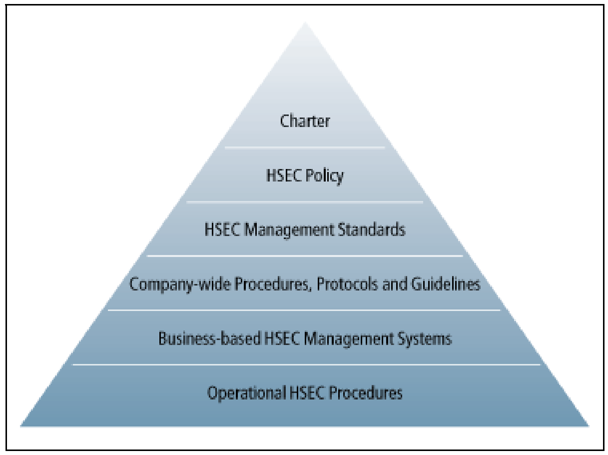
2.2 Corporations Duty to Declare Liabilities

There is a requirement under Australian corporation’s law for companies to accurately estimate and state their liabilities. Furthermore as a US listed corporation, BHP Billiton operations must comply with the Sarbanes Oxley Act 2002. Sarbanes Oxley legislation was enacted to address perceived abuses, questionable reporting and inadequate management practices after a series of high profile scandals and market crashes of large US corporations such as WorldCom and Enron.

The Act requires that both the CEO and CFO certify that internal financial control of the Group is effective. Criminal penalties apply to certifications issued in bad faith

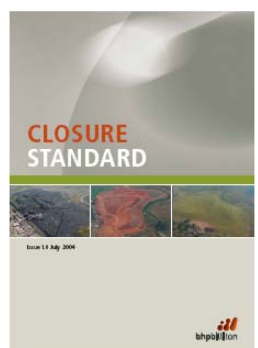
3 OPERATIONAL MANAGEMENT & CLOSURE PLANNING

BHP Billiton's position is that it has an overriding commitment to health, safety, environmental responsibility and sustainable development. All operations have been informed via dissemination of charters, policies and standards that rehabilitation of disturbed land to meet or exceed community and regulatory expectations is essential to maintain and enhance its reputation including at a local, national and international level. The mechanisms that deliver this requirement for high standard of environmental performance include:



- Charters, Policies, Standards, management systems, guidelines and operational procedures which demonstrate a very strong commitment to best practice environmental management. The BHP Billiton Charter mandates an overriding commitment to health, safety, environmental responsibility and sustainable development.
- The Sustainable Development Policy includes a commitment to enhance biodiversity protection by assessing and considering ecological values and land-use aspects in investment, operational and closure activities.
- The Health Safety Environment and Community Standard No 12 on Stewardship mandates that the lifecycle HSEC impacts are minimized and managed and initiatives are identified and implemented to reduce the environmental impact of operations. This includes that Programs are implemented to protect, manage and, where appropriate, enhance biodiversity values.

BMA operations must comply with the BHP Billiton Closure Standard. The standard mandates compliance with relevant legislative and regulatory requirements and links to BHP Billiton's Charter and Sustainable Development Policy. The closure standard objectives include:



1. Ensuring shareholder value is preserved.
2. Establishing BHP Billiton management accountability and ownership of closure activity.
3. Complying with relevant or applicable legislative requirements.
4. Limiting or mitigating adverse environmental effects, including biodiversity.
5. Providing a reasonable basis on which the financial consequences of closure can be estimated, recognized and managed.
6. Avoiding or minimizing costs and long term liabilities to BHP Billiton and to the government and public.
7. Achieving sustainable land-use conditions as agreed with the applicable government regulator and affected communities.

8. Ensuring investment decisions include appropriate consideration of closure, including both quantitative and qualitative impacts of closure.

All BMA mines are now aware of the Closure Standard and its requirements. KPI's have been set in Management Teams Scorecards and all sites are progressing closure planning. Essential to the closure planning and implementation process is the development of a final landform plan based on sustainability principles and demonstration that such a plan is being implemented in day to day operations - including short, medium, and long term plans and reflected directly in mining scheduling and spoil placement programs.

3.1 THE EWRM PROCESS

Risk assessment is routine practice for all BMA operations. The Enterprise-Wide Risk Management (EWRM) Policy is progressively embedding risk management processes into all critical business systems to enable the company to adopt a precautionary approach to business management. When critical decisions are being made, managers are required to look beyond the obvious risks and recognize all sources of uncertainty, including issues related to health, safety, environment and community.

EWRM is now integrated into the way BMA carries out its business. The EWRM process was applied as a fundamental part of implementation of the Closure Standard at the BMA sites. All sites have prepared a risk register which includes the major risks for closure and beyond. The risk assessment was undertaken by various site personnel including long term planners, environmental personnel, representatives from CHPP and mine operations.

The Closure standard requires that risk assessment include a range analysis approach to factor in future uncertainty such as the timing of closure, future legislative requirements, the effectiveness of rehabilitation and the cost of rehabilitation beyond closure. Risk and range analyses were concluded and across all mine sites a number of common major risks were quickly identified by the various working groups. Nearly all of these risks were related to landform stability and the adequacy of the site's rehabilitation programs. These landform based risks included:

- Rehabilitation Criteria – company may not meet performance criteria or government raises goal posts.
- Final Landform Stability - principally poor design parameters with inherent high erosion risks.
- Final Voids Stability – long term stability cannot be met without substantial treatment.
- Tailings Dam Failure – wall fails due to erosion, seismic event etc.
- Creek Diversion – poor design and or construction leads to erosion of batters and siltation further downstream.
- Out of Pit Reject Dumps. Insufficient capping allows fire to establish; erosion of batters exposes rejects etc.

EWRM risk assessments show that the most substantive risks which have great potential impact to the business relate to the erosional and geotechnical stability of the final landform (voids and spoils). Landscape disturbance is the major impact of opencut mine operations and represents by far the greatest element of the rehabilitation liability.

Overall at the end of 2006, BMA mines have a significant rehabilitation liability based on current unit costs for rehabilitation and treatments outlined in EM Plans and Environmental Authorities. However, the EWRM process found that some of the existing 'approved' treatments do not meet BHP Billiton sustainability requirements, hence substantially greater potential costs to mitigate landform disturbance have been estimated. Higher costs are indicated particularly for pits and ramps than can not be cost effectively backfilled as part of operational spoil placement operations.

The EWRM process highlighted that the final landform should not be considered as merely a consequence of an excavation program, but rather the outcome of a planned optimized mining and spoil placement program by which a stable landform has been reinstated.

3.2 TERTIARY SPOIL

One of the greatest challenges to the achievement of erosionally stable landforms in Central Queensland is the effective rehabilitation of Tertiary spoil. Much of the Tertiary spoil being excavated as prestrip is inhospitable to revegetation and has a high to extreme erosion risk. The poor performance of this spoil is a consequence of adverse physical and chemical factors including:

- High exchangeable sodium percentage (ESP) - generally > 15%, thus the spoil material is dispersive and erodible
- Low cation exchange capacity (CEC) – generally < 10 - 15 meq/100 grams, thus the spoil material is very infertile.
- Highly variable pH, mostly alkaline to pH 9.0 plus, leading to nutrient availability limitations.
- Often quite saline up to 4,000uS/cm and exceeding vegetation tolerance limits.
- Unfavourable particle size with fine sand and silt >50% and clays up to 30%. This predisposes the material to strong surface crust development and high erodibility.

Management of inhospitable **Tertiary** spoil is required to ensure that erosion impacts are tolerable. This requires a conservative approach to rehabilitation and involves moderate slopes generally less than 10% together with application of a cover of hospitable non dispersive Permian Spoil. On steeper slopes, such as short angle of repose dump surfaces, encapsulation of Tertiary material with a thick cover of durable rock is recommended. The rock should contain sufficient benign, preferably fertile fines to provide a growth media for native vegetation. If the rock contains insufficient fines, topsoil or like material may have to be dozed across the rock surface/face.

Poor quality Permian spoil can also require special treatments such as capping with more hospitable benign spoil.

Selective handling practices using the mine earthworks schedule effectively provides a great opportunity to isolate hostile and or dispersive spoils. Overburden characterisation must be carried out including establishment of an inventory of competent rock resources. The mapping and management of all spoil materials and the associated selective handling via the earthworks/mining schedule throughout the life of mine will help provide for a cost effective long term sustainable rehabilitation outcome.

3.3 LANDFORM ELEVATION

Landform stability involving elevated spoil dumps depends on two primary aspects, firstly spoil characteristics as discussed above and secondly on the height differential. Height differential between dump crest and natural ground or base of final void together with design grade dictates the final slope length. Long slopes are conducive to erosional instability, whereas steep slopes are susceptible to mass failure – i.e. geotechnical instability.

BMA and industry experience on the rehabilitation of significantly elevated dumps is limited to about 50m to 60m. Much higher elevations have been proposed, thus there will be risks involved with the rehabilitation of more elevated spoil associated with longer slopes due to much larger potential for scouring during storms events. For example, the lowwall elevation for a deep pit scenario might be comprised of 150m of dragline and prestrip spoil sitting above a 200m deep pit, thus the total slope length is 350m before regrade or backfill treatment. On a 10% regrade basis alone, a total drainage slope length of up to 3.5 kilometres could eventuate. Thus effective erosion mitigation, drainage control and landform design is critical for the minescape is to be effectively stabilized.

Long steep slopes (250m) appear to have been satisfactorily stabilized at Goonyella Riverside mine on a 50 - 60m high out of pit Tertiary spoil dump. Parts of the outer face have been regraded to 25 – 30% and mulched with a sandstone rock mix. After several years, no significant erosional damage is apparent and native vegetation establishment is extensive. Other treatments such as spray mulching and fibre matting with pasture establishment on the same spoil dump have not been as successful.

A portion of the outer face of the same dump was regarded in 2007 to approximately 14% forming an exceptionally long overall slope (450m). Cross slope drainage structures have been installed to reduce effective slope length and the slope has been topsoiled, ripped and seeded. Despite the intensive design and construction effort undertaken by that site to rehabilitate this slope, significant gullying occurred during a typical intense rainfall event when piping of dispersive spoils caused localized failure of the graded bank system. Also, an associated rock lined waterway failed largely due to dispersion and sediment mobilization below the rock protection. Failures of even much shorter lengths of Tertiary spoil rehabilitation are not uncommon on Tertiary spoil in the Bowen Basin.

Rehabilitated long slopes formed on dispersive Tertiary spoil, even slopes established at relatively modest grades are prone to failure. Capping with a less dispersive media is necessary. In general, the development of landforms which are entirely dependent on the performance of cross slope drainage structures and down slope armored waterways will carry a risk of failure into the future as well as require ongoing expenditure for maintenance. Thus there is scope for changing conventional practices and the development of landforms which are more attuned with geomorphological processes. Landforms with a high drainage density and limited slope length are more likely to be capable of tolerating periods of intense rainfall.

At this stage it appears that rock mulching will offer greater prospects of achieving stability on the batters of elevated Tertiary spoil landforms, compared to conventional regrade treatments. However, whatever the actual prescription is applied, the design ought to be conservatively based and attempt to build in reasonable tolerance for uncertainty such as settlement, exposure to high intensity rainfall, bush fire and drought events.

Note that generally slopes are measured as percentages (%) for ease of calculations. See Table 1 Slope Conversion Chart which compares various slope gradients (%) with degrees and also rise and fall ratios.

TABLE 1 SLOPE CONVERSION CHART

Percent	Degrees	Horizontal: Vertical	Comments
1	0.6	100:1	**Preferred conventional rehabilitation slopes <10%. Moderate Erosion Risk. Long slopes increase risk.**
2	1.1	50:1	
3	1.7	33:1	
7	4.0	14.3:1	
8	4.8	11.9:1	
10	5.7	10:1	
12	6.8	8.3:1	**Frequently fails under conventional rehabilitation. High Erosion risk. Long slopes increase risk.**
14	8.0	7.1:1	
15	8.5	6.7:1	
17	9.5	6:1	
20	11.3	5:1	**Very Steep - Extreme erosion risk. Generally Requires rock mulching.**
27	15.0	3.7:1	
33	18.4	3:1	
36	20.0	2.7:1	
45	24.0	2.2:1	
49	26.0	2:1	
58	30.0	1.7:1	
62	32.0	1.6:1	**Extremely Steep to Exceeding Angle of repose. Increasing geotechnical failure risk.**
67	34	1.5:1	
70	35.0	1.4:1	
75	**37.0***	**1.3:1**	
84	40.0	1.2:1	
100	45.0	1:1	
119	50	0.8:1	

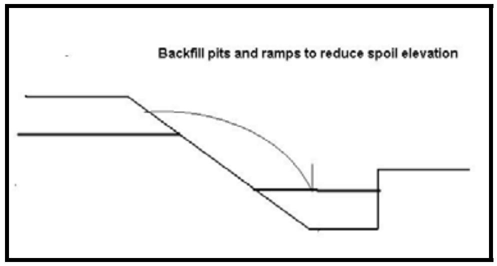
***** Typical angle of repose of coarse-grained mine waste.

3.4 LANDFORM DRAINAGE CHALLENGE

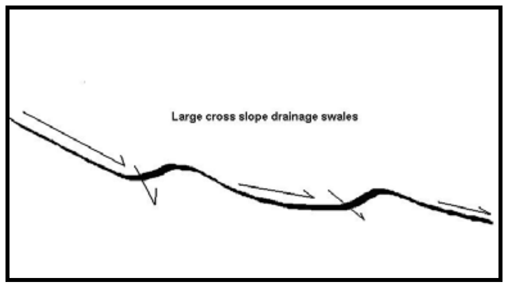
Drainage consideration for final landforms is becoming increasingly important given the expected increased elevations of mine spoil areas at many BMA Mine sites. Thus the potential for creation of extremely long regraded slope profiles following landform shaping is significant. It is recognized that the risk of erosion on long spoil slopes is considerable, particularly during the vegetation establishment phase in which there is little or no grass cover. Use of cross slope drainage structures at least on a temporary basis is warranted. Once pasture has established it may be practicable to remove the network of small profiled graded banks without causing substantial disruption of the new vegetation cover.

However, it is recognized that even well vegetated long rehabilitated slopes carry a risk of failure as down slope flow lengths can be extreme and at some point significant overland flow will occur during storm events. Strategies that may be employed to bring **longer term erosion risks** down to more tolerable levels include one or more of the following:

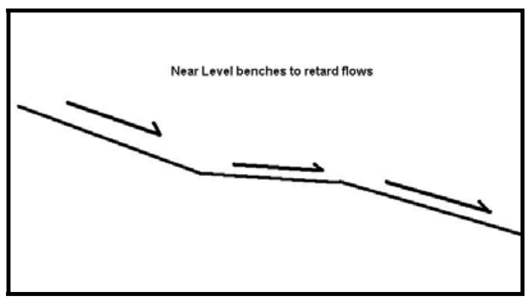
1. Maximizing spoil backfill to voids to reduce spoil elevations.



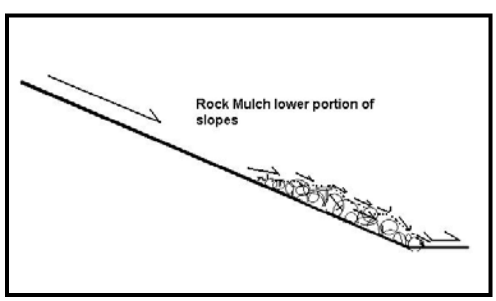
2. Incorporation of permanent drainage structures into the landform such as large drainage swales which function to permanently reduce effective slope length.



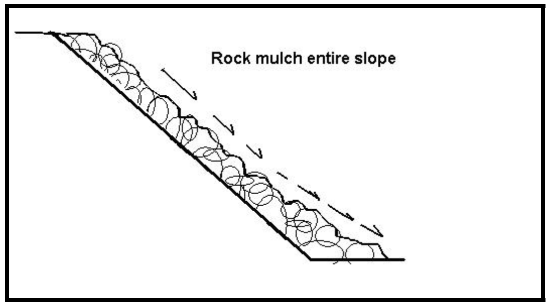
3. Near flat Benching at intervals to encourage water to slow and spread at intervals down slope.



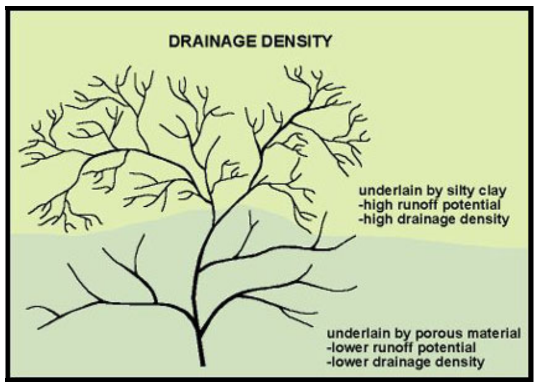
4. Rock mulching the lower portion of the slope in which erosive surface runoff during storm events is predicted.



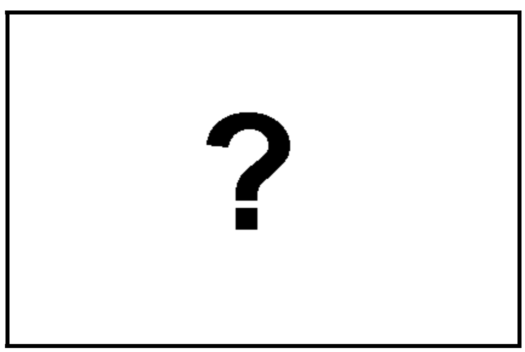
5. Steepening slopes to reduce slope length and then and covering with a thick absorbent rock mulch.



6. Application of more conservative geomorphological or fluvial design based approach which attempts to create a naturalized drainage regime with drainage density sufficient to prevent the development of significant sheet and rill erosion (No cross slope drainage intervention).



7. Any other drainage strategy which offers sound prospects for achievement of a safe, stable, sustainable rehabilitated landform. BMA continuous improvement programs will continue to work towards improved outcomes for sustainable landforms.



4 MINE PLANNING & OPERATIONS ROLES & RESPONSIBILITIES

4.1 INTRODUCTION

This Guideline provides a hierarchical set of strategies aimed to produce safe, stable, self sustaining landforms, and as a consequence will also reduce rehabilitation costs at closure and meet or exceed statutory requirements. The design criteria are sufficiently flexible to accommodate the projected land capability, site geology, depth of final workings, elevation of spoil emplacement areas, and availability of capping material and spoil quality.

These preferred landform criteria follow-on from the closure planning process and have been developed to assist mines in improving operational strategies and design criteria necessary for the rehabilitation of mining affected land. It is recognized that such improvements will require some changes to roles, accountabilities and planning practices such as:

- Roles and accountabilities may need to be adjusted to ensure that a satisfactory closure program can be implemented.
- Refining closure plans (Life of Mine Plans) to clarify the nature and extent of the preferred final landforms for each site.
- Realistic mine life estimation through the comprehensive Resource Development Plan.
- Estimating excavation and spoil placement requirements.
- Scheduling mining operations to ensure cost effective closure scenarios
- Constructing mine landforms which meet stability criteria.

The key principles which support sustainability objectives and which underpin the development of the Landform Planning Guidelines include:

- Minimizing the disturbance footprint
- Protecting and where practicable enhancing biodiversity
- Progressive Rehabilitation
- Selective handling of spoil materials
- Stable landform outcomes – erosional and geotechnical
- Beneficial final landuse
- No off site impacts – protection of downstream waters
- Minimizing company liability
- Meeting or exceeding community expectation and regulatory requirements

These guidelines also address roles and responsibilities necessary to implement changed practices and outline design strategies which support the sustainable mine landform outcomes being sought by BHP Billiton.

4.2 CORPORATE MANAGERS

Successful implementation of the closure planning process and consequent reductions in corporate closure liabilities as well as improved stakeholder relationships (at Local, State, National and

International levels) is ultimately dependent on BMA as a corporation taking all necessary action to ensure that all of its operations meet BHP Billiton closure requirements.

Corporate Mine Managers shall establish KPI's for Mine Managers, including senior site executives (GM's) for:

- Implementing practices to ensure that closure planning and liability reduction strategies are developed and embedded into the mine operation.

4.3 MINE MANAGEMENT

Successful implementation of the closure planning process on individual mine sites and development of effective programs aimed at liability minimization is dependent on the mine manager embracing the closure concepts and taking all necessary action to ensure that operations conducted at the site align with agreed closure plan strategies.

Mine Managers shall establish KPI's for mine planning and production managers for:

- Development of the Closure Plan for the site.
- Ensuring that the Final landform plan is fully consistent with Life of Asset Plan and that the Final Landform Plan is fully imbedded into Short, Medium and Long term mine plans.
- Carrying out progressive rehabilitation

4.4 MINE PLANNING

Mine planners are responsible for developing mine plans which align with agreed closure strategies and the development of the minescape in accordance with final landform and progressive rehabilitation requirements.

Mine planning for operations should include the following:

- Develop Final Landform Plan
- Integrate LOA and Landform Plan
- Identify resources for rehabilitation (soil, rock and hospitable spoil)
- Identify inhospitable spoil and plan for its isolation.
- Schedule mining and spoil placement programs to meet Closure Plan and Landform Plan requirements.

4.5 MINE OPERATIONS

Operations will conduct all mining excavation, spoil and CPP waste placement in conformance with the long term planning requirements.

These requirements include:

- Placement of all waste material (spoil, reject & tailings) should conform to the development of final landform design strategies, be consistent with the development of a stable long term landform outcome and progressive rehabilitation requirements.
- Short haul options for waste disposal (spoil, rejects & tailings) which do not support long term agreed landform outcomes should be avoided.
- Spoil shall be placed only in accordance with the short term spoil dumping plans and schedules for any particular area. Short term plans must be consistently linked to long term plans which in turn are fully compliant with the Closure Plan and Final Landform Plan.

4.6 MINE ENVIRONMENT

Environmental officers coordinate the development of closure plans and supporting investigations and provide an advisory service to Technical Services, Mine Planning and Operations.

Environmental impact and mitigation management should include:

- Consult with Mine planning with the development of the final landform plan by providing advice on landform design strategies, erosional stability and landform treatments.
- Review mine plans to check conformance with BMA closure requirements, progressive rehabilitation goals and the closure plan.
- Prepare specification for detailed rehabilitation treatments for landforms developed by mine planning and technical services. Plan those tasks necessary to rehabilitate the spoil landform that has been constructed in accordance with agreed final spoil landform criteria.
- Complete, maintain and update the mine Closure Plan in alignment with BHP Billiton requirements.

5 LANDFORM DESIGN CRITERIA

5.1 SPOIL PLACEMENT

Steep slopes are prone to aggressive erosion. Tertiary materials at most mines are dispersive whereas Permian materials tend to be far less dispersive.

Inpit spoil placement over dragline spoil and, in ramps and voids is preferred method of spoil disposal. Out of Pit dumps increase the disturbance footprint and overall liability and should be avoided if practicable.

Spoil should be placed according to mine plans and designs which meet key closure requirements for cost effective stable landform and rehabilitation outcomes. Strategies used to meet closure requirements include:

- Progressively backfilling of final voids including ramps and mine void that have been identified as no longer needed for other strategic uses e.g. not required for CPP waste or water supply purposes.
- Backfilling of final voids and regrading of ramps sequentially with prestrip spoil material, to reduce the number of open pits at closure.
- Developing final spoil landform grades which average 10% slope or less (Subject to encapsulation with more hospitable Permian spoil)
- Taking into account material types and selective handling requirements as per mandated material management implemented through the earthworks /spoil handling schedule.

Utilization of voids can be a more cost effective means of pre-strip placement, rather than hauling material up to significant elevation or long distances up dip. In addition, void infill will also result in substantial reduction of rehabilitation liability. Progressive rehabilitation requirements are such that campaign mining and void infill may be a preferred strategy.

5.2 REGRADED SPOIL SURFACE TREATMENTS

Treatment strategies outlined for final earthworks on spoil emplacements include:

- Slopes established at 10% or less, Tertiary spoil material (or any other inhospitable or dispersive spoil) should be covered with at least 0.5 m benign rocky Permian spoil, then 300mm clay topsoil (if available), then ripped and seeded.
- Slopes comprising Tertiary spoil 10% to 15% should be lined with no less than 1m of selected rocky benign Permian spoil, then topsoiled to 300mm and ripped and seeded.
- On steep batters (15% - 25%) either a minimum of 1m of durable rock mulching over 1m minimum depth of benign rocky Permian spoil cap or 2m of durable rock mulching should be applied. Slopes greater than 25% require application of at least 2 m of durable rock mulch. Slopes greater than 33% should be avoided.

See Table 2 which summarizes requirements for the surfaces of final spoil landforms.

TABLE 2 SPOIL DUMP SURFACE TREATMENTS

Slope %	Rocky Permian Spoil Cover* (m)	Durable Rock Mulch (m)	Topsoil Depth (cm)	Notes
<10	0.5	0	30	This is the preferred final landform slope for all areas when slopes are not lined with durable rock mulch.
10 -15	1.0	0	30	Limit to areas of short slopes e.g. less than 50m.
15 – 25	1.0	1.0	0 – 30	Steep long slopes e.g. lowwalls and ramps require this treatment.
25-33	0	2.0	-	Thicker durable rock mix on shorter steeper slopes.

* Suitable capping spoil should have pH(1:5) in range 6.0 - 8.5 and EC(1:5) < 600uS/cm and ESP < 10%. Use of the lower ESP spoils is always preferred. If acid conditions are suspected, the measured NAG pH should be greater than pH4.5.

Spoil placement in other configurations is possible for example:

- Use of geomorphological design based landform concepts. This is an emerging concept based on design of landforms which fit more comfortably with natural drainage and erosional processes. These landforms do not rely on cross slope drainage structures, or benched arrangements and are developed with sufficient drainage intensity to limit slope length and consequent erosional processes to tolerable levels. However, more design assessment and investigation is required to demonstrate cost and feasibility.

- Benched landforms are unproven but may be may acceptable – provisional design criteria are as follows:
  - i) Lifts between benches <10m.
  - ii) Final batters between lifts no steeper than 25% and covered with 2m of durable rock mulch.
  - iii) Benches >10m width with 5% crossfall, covered with 1m Permian spoil and topsoiled.

Note: BMA experience with long rock armored slopes is limited to those formed from a 60m vertical elevation spoil dump. Thus unless conducted on a trial basis, dump vertical elevation should be limited to less than 60m. Dumps in excess of 60m will require geotechnical investigation as well as additional considerations for erosion control which may involve, thicker rock mulch application to buffer and retard surface runoff, graded banks and rock armoured waterways, benching etc.

5.3 RAMPS

Ramps make up a considerable percentage of the mine disturbance footprint. Steep sides and long slopes produce ongoing landform instability and the integrity of rehabilitation above ramp crests is jeopardized unless ramp batters are stabilized:

Ramps treatments include:

- Backfilling sequentially with mine spoil or CPP waste.
- Regraded to <10% and capped with Permian spoil as required.
- Steeper slope options should not normally exceed 25% slope and be capped with at least two meters of durable rock and soil matrix.
- Drainage off adjacent prestrip dumps should be integrated into the ramp backfill design.
- Unless backfill is planned, rehabilitation of spoil adjacent to ramps and lowwalls should leave sufficient width for future spoil regrade so that existing rehabilitation is not destroyed when ramps are regraded.

See Table 2 which provides further criteria for surface treatment including Permian capping, rock mulch and topsoil requirements.

Wherever practicable, Highwall and Lowwall Ramps are preferred to conventional ramp inclines through the spoil mass. This substantially increases inpit spoil disposal capacity as well as reduced landform reshaping costs and providing opportunities for progressive rehabilitation. BMA landform studies show that improved spoil fit and reduced haul elevation opportunities are available through strategic ramp infill.

5.4 LOWWALL

Lowwalls are typically characterized by substantial spoil height above the pit. Very long steep angle of repose batters are conducive to permanent landform instability and the integrity of rehabilitated spoil on the crest above is jeopardized unless lowwalls are stabilized.

Lowwalls may be:

- Backfilled sequentially with mine spoil or CPP waste.
- Regraded to <10% and capped with Permian spoil as required.
- Steeper slope options should not exceed 25% slope and be and capped with at least 2m of durable rock and soil matrix as described for the highwall.
- Drainage off adjacent prestrip dumps should be integrated into the lowwall treatment design.

See Table 2 which provides further criteria for surface treatments including Permian capping, rock mulch and topsoil requirements

When voids are used for spoil disposal or can be strategically used for tailings disposal, lowwall reshaping costs can be substantially reduced.

5.5 HIGHWALL

Tertiary strata on highwalls is generally dispersive and exhibits low strength. Permian mudstones and shales are also frequently unstable; bedding and faulting planes on highwalls and endwall faces create further opportunities for instability.

Highwalls are a major long term safety risk to humans and fauna. Erosion and back-cutting of Tertiary strata may cause considerable degradation to surrounding land.

Remediation strategies for final highwalls can include:

- Sequential backfilling of final voids with prestrip spoil and or CPP waste.
- Regrading to <10% slope, covering with at least 1m benign rocky Permian spoil before topsoil application. (The 0.5m application depth referred to in S6.1 is associated with shorter slope treatments than is envisaged for the very long slopes that might be produced from regrade of the high and low wall).
- Alternatively, a steeper slope up to 25% can be formed and clad with durable rock mulch to at least 2 m deep. If rocky hospitable Permian spoil is placed at least 1m depth first, the thickness of the durable rock mulch cover may be reduced to 1 m. Note that the lowwall should be regraded first to minimize the amount of natural ground that will be disturbed by regarding the highwall.

During operations, mine planners should develop mine schedules showing how the mining operation can optimize the backfill of final voids, minimizing lengths of residual highwalls, and satisfy progressive rehabilitation requirements.

Some strategies that may be examined in minimizing closure costs for final voids include:

- Rescheduling mining sequences of pits, to demonstrate progressive backfilling of open void up to an economic limit.
- Changed mining practices – e.g. change from mining down dip across the strike to apparent dip and terrace mining methodology.
- Not mining deeper seams for last one or more strips to result in a shallow final void. For example, mine three seams, then two seams, then one seam.
- Narrowing final strip to reduce future void volume and regrade cost.
- Highwall spoil dumping to place spoil as close as possible to final void to reduce future regrade length and cost.
- Highwall treatments to render wall safe and stable using a range of potential options – including blasting to form rocky scree at less than 45% slope, benched structures with durable rock cladding (if wall is erodible), large protection bund beyond crest of highwall – at least 3 m high and 10 m wide and covered with durable rock mulch.
- Any other strategy which has clear benefits for reducing the cost of mining and rehabilitating the void providing safety, sustainability and stability requirements are met.

5.6 TAILINGS DISPOSAL

Above ground tailings disposal facilities are costly to rehabilitate, increase the disturbance footprint, have significant long term potential for instability and leachate generation.

Tailings disposal preferences are as follows:

- In pit disposal is the preferred option. Above ground out of pit facilities should not be constructed unless there is a clear business case demonstrating that the benefits outweigh the costs. This includes consideration of the potential cost impact for excavation of the tailings deposit at mine closure and haulage to a suitable void for permanent isolation and rehabilitation.

- Co-disposal methodology is preferred to conventional slurry deposition as water recovery is maximized; potential impacts on groundwater are reduced and geotechnical strength, hence access for timely rehabilitation is improved.

Disposal of tailings slurry without beaching and water recovery is poor practice, reduces progressive rehabilitation opportunities and increases likelihood of groundwater impacts. Disposal of coarse rejects on tailings dam surfaces may assist with the development of the final landform design.

Rehabilitation treatments for above ground tailings dams should include:

- Rock cladding to >1m depth on dam wall batters or batters re-established at no steeper than 15% and topsoiled ripped and seeded.
- Capping tailings surface with at least 2m benign spoil.
- Prevention of surface ponding and building a drainage surface that sheds water from the capping in a sustainable fashion.
- Applying 250 - 300mm topsoil; application of native seed, and fertilizer to establish a diverse vegetative cover.

Rehabilitation of inpit tailings disposal sites includes:

- Capping tailings surface with at least 2m benign spoil.
- Prevention of surface ponding and building a drainage surface that sheds water from the capping in a sustainable fashion.
- Applying 250 - 300mm topsoil; application of native seed, and fertilizer to establish a diverse vegetative cover.

Above ground out of pit tailings dams increase the disturbance footprint, often impact on biodiversity, reduce visual amenity and are difficult to redevelop into landforms compatible with the surrounding natural terrain. Unless substantial embankment stabilization is undertaken, these structures will require ongoing maintenance after mine closure.

5.7 Reject Disposal

Above ground out of pit reject disposal facilities are costly to rehabilitate, increase the disturbance footprint and have significant potential for leachate generation.

The preferred disposal is placement of rejects in voids to reduce backfill and regrade costs. Out of pit facilities should not be constructed unless there is a clear business case demonstrating that the benefits outweigh the costs. This includes consideration of the potential cost impact for excavation of the rejects deposit at mine closure and haulage to a suitable void for permanent isolation and rehabilitation.

Rehabilitation of out of pit reject dumps should include:

i) Regrading to < 10% overall grade.
ii) Capping with at least 2m benign spoil.
iii) Rock lining of earthen batters with durable rock soil mix to 2m depth.

iv) Coverage of 250 - 300mm topsoil, then seeding and fertilizing native to establish a diverse vegetative cover.

v) Where dumps are elevated, significant rock lined drainage structures may be required to limit erosion down batter slopes.

Rehabilitation of inpit rejects disposal sites should include

- Covering with at least 2m competent benign spoil with final grades less than 10%.
- Application of 250 - 300mm topsoil, then seeding and fertilizing native to establish a diverse vegetative cover.

Above ground out of pit reject dumps increase the disturbance footprint, often impact on biodiversity, are unsightly and difficult to redevelop into landforms that are compatible with the surrounding natural terrain. Unless substantial embankment stabilization is undertaken, these structures will require ongoing maintenance after mine closure.

5.8 DIVERSIONS

6.7.1 Major Creeks and Waterways

Major Creeks in Central Queensland are critical for regional biodiversity maintenance. Mining through major waterways may contradict BHP Billiton commitment to protect and enhance biodiversity values in its Sustainable Development Policy.

Diversions of major creeks and waterways should be avoided to minimize impacts on riparian ecology. If diversion of a major creek or waterway is necessary, the investment decision includes a full realistic cost estimate for the construction of a permanent diversion designed to meet all DNRW requirements as well as providing for long term maintenance costs.

Performance criteria that should be included in the design of diversions includes:

- If dispersive earth forms the embankments, batter slopes of less than 15%, are required unless the batters are lined with competent coarse durable sandstone, volcanic rock or some other equivalent permanently durable rock material.
- Maintain buffer around existing creeks, rivers and diversions sufficient to demonstrate that there is a 50m wide clearance between crest of the creek, river or diversion embankment and the projected toe of the spoil emplacement after it has been regraded to <10% or to steeper gradient if it is to be rock mulched.
- Where practicable, the existing stream length should be re-established in the diversion planning. The Regulator does not often approve diversions which do not meet stream length / stream power criteria.
- Early construction of the new channel forward of an upstream plug is preferred to enable enhanced establishment and stability of riparian vegetation, before the plug is excavated and the new channel is exposed to river flows.

Several BMA sites are outlaying considerable expenditures on rebuilding poorly performing diversions. These are structures in which the original design engineers gave little or no

consideration to fundamental fluvial processes and landform stability aspects including stream length restoration, batter stability and biodiversity values. Poor design outcomes impact the business reputation, make for non compliant outcomes and can have significant adverse impact on the business value.

6.7.2 Minor Creeks

Diversions of minor creeks and waterways are recognized as necessary for effective mining operations, for reasons including access to resource, cost effective mining operations and prevention of pit flooding.

Diversions of minor waterways may proceed when:

- The diversion of any minor waterway, particularly its final drainage alignment, should be consistent with the agreed long term landform.
- A satisfactory long term permanent corridor for the waterway is identified and subject to cost assessment and that cost must be included in the investment decision,
- Regulatory approval to divert the minor waterway has been granted.

Whenever practicable, minor diversions should be constructed on a permanently sustainable basis. Many licensed "temporary" diversions are approved only for the operational life of the mine and reconstruction is required upon closure.

All diversions should preferably be constructed well in advance of mining operations to allow inundation and sediment "drape" as well as vegetation establishment for one or more seasons prior to being exposed to full creek flow.

5.9 UNDERGROUND MINING SUBSIDENCE

Subsidence of land above mined out underground workings can cause disruption to surface drainage with consequent impacts on landuse and environmental values.

All BMA using underground mining methodology shall develop and implement a Subsidence Management Plan which should include a range of subsidence mitigation management strategies including:

- Mapping projected subsidence areas during the mine planning phase enabling changes in panel orientation and size to avoid significant impacts to infrastructure, drainage regimes and landuse activities.
- Stakeholder identification and consultation.
- Remedial Activities e.g.
  - Backfilling and or deep ripping cracked zones to close over cracks and reduce potential for small fauna trapping, enable safe access by stock and landholders/lessees.
  - Revegetating affected areas
  - Constructing drainage rectification works to ensure that landuse impacts are ameliorated.

Detailed subsidence management plans will be prepared for each stage of the project identifying specific subsidence management measures to be implemented for each mining area.

5.10 REHABILITATION MATERIALS RESOURCE INVENTORY

Sustainable landform development will rely on the capability and quantity of topsoil, spoil and rock resources that may exist at the site.

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Resource characterization and inventory is fundamental to sound planning practice. All mine sites should prepare the following:

- Inventory of soil type and volumes stockpiled and balance of soil resources in the planned disturbance footprint.
- Spoils characterization mapping covering all existing spoil areas as well as future disturbance areas. This will provide information on existing spoil areas that may require capping with benign spoil, the location and volume of available benign spoil and as well define areas in the future which may also require capping or selective handling to avoid a cap requirement.
- Inventory of available durable rock material, quantities required to complete the final landform and an action plan signed off by mine management to recover and store that rock for the rehabilitation requirement. This will require interrogation of exploration data and also possibly commissioning drill hole based exploration program aimed specifically at identifying and quantifying the existence of durable rock strata that may lie in the planned mining path

- Durable rock resources should be mapped and made available on GIS and mine planning tools used for scheduling.

Durable rock is a very valuable resource for rehabilitation of mine site disturbance as its use brings substantial potential to reduce rehabilitation costs and increase the likelihood of achieving erosional stability on steep slopes, diversion channels and dam embankments.

Further information on rock and spoil resource inventory development requirements for mine sites is outlined in BMA's "Overburden Material Characterization for Exploration Programs at BMA Mine Sites and Exploration Leases. This guideline addresses the identification of suitable and unsuitable rock and spoil media to support final landform design and rehabilitation.

ATTACHMENT 1   PHOTOGRAPHS

EXAMPLES OF ACCEPTABLE AND UNACCEPTABLE REHABILITATION OUTCOMES

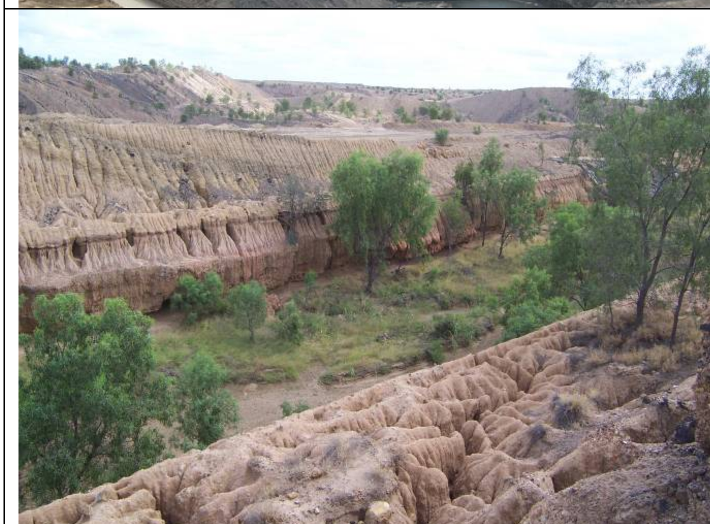
	Steep (17%) rehabilitation on Tertiary spoil – approximately 15 years after completion of rehabilitation work. Site is badly eroded with significant gully development.
	Completely failed rehabilitation. Sodic Tertiary spoil on 12% slope – topsoil layer has eroded completely. Rills and gullies are levelling the landform.

	Permian spoil – at low 5% gradient, dense well established pastures with no evidence of erosion. Background, ungraded spoil.
	As above, another area of well established rehabilitation sited on Permian spoil at approximately 12% grade.
	Tertiary Spoil out of pit dump, steeper 25% batters have been clad with sandstone. Native trees and shrubs establishing. A viable strategy for rehabilitation of Tertiary spoil dumps.

	As above, but also showing the marked difference between exposed Tertiary Spoil and rock mulched area.
	14% Regraded Tertiary spoil slope below breach in a graded bank. Extreme erosion can occur when graded banks fail. The overall slope length on this outer batter approaches 450m in length. Failure of a graded bank, particularly one in the upper slope area can cause localised catastrophic gullying. Graded banks in Dispersive Tertiary spoil are high risk
	Rock lined waterway established in Tertiary Spoil has been deeply scoured following storm event. Geofabric has been used but has not prevented failure of this structure. Use of big rock without benefit of a considerable percentage finer media such as non dispersible clays and gravels, has allowed water to flow through the open rock matrix at the interface of the geotextile and dispersible Tertiary spoil. The Tertiary spoil at the base of the waterway has simply dispersed and mobilised with low flows and the structure has eventually collapsed into the incised scour.

	10% regraded Tertiary slope with 0.5m of Permian spoil rubble spread across the area before topsoiling, ripping and seeding. This practice promises to provide good erosion control during the high risk pasture and shrub development stage.
	Deep steep ramps, major liability if left insitu. Regrading or backfilling is required to enable these areas to form part of the rehabilitated landscape. The preference is to use these voids for spoil disposal. Unless rock mulched, these slopes require regrading to less than 12% for Permian spoil and less than 10% for Tertiary spoil.
	Deep steep ramp with angle of repose batters below existing poor quality rehabilitation of Tertiary spoil. Unless ramps are regraded or backfilled, erosional processes will cause gullies and rills to extend into the rehabilitation above crest. Future regrading of ramp batters below existing rehabilitation will consume much of the rehabilitation, unless these ramps are backfilled with prestrip spoil.

Major operational pit. Mines need to ensure that plans are in place to stabilise final voids using progressive backfill, major regrade efforts, benching with durable rock cladding and other techniques that ensures the area is safe and stable when the lease is relinquished.



Creek Diversion through Tertiary spoil. A costly example of earlier poor diversion design outcomes with significant potential for downstream sediment impact.

Severe back cutting of Quaternary alluvium in small creek diversion. Extreme erosion can occur when stream length and or substantial outlet protection is not catered for. Expensive repair undertaken as shown below in following image.

	Rebuilt above diversion. Work effort required new channel excavation, backfilling of original diversion channel and construction of a substantial rock lined waterway into the creek.
	Rilled and piped out external wall of tailings dam. Wall constructed from extremely dispersive Tertiary spoil.
	Gross instability of Tertiary spoil in water filled void.

	Durable rock being used to line re constructed diversion channel. Original diversion channel failed due to inadequate design.