Water Management at Mining Operations

Potential Impacts on the Water Environment

- Sediment laden runoff from overburden emplacements, waste rock dumps, stockpiles and disturbed areas
- Stormwater contamination from process plants, workshops and vehicle washdown areas
- Acid mine drainage
- Elevated salinity levels and salt leached from freshly exposed overburden

Impact of Eroded Sediment

- Sediment generated by erosion of disturbed soils is most common impact
- Necessary to manage by adoption of erosion and sediment controls
- Goal is to ensure no pollution of surface water and groundwater
- Applied measures seek to minimise impacts from erosion and sedimentation by application of best management practices

Management Principles

- Minimise erosion
- Capture sediment from disturbed areas
  - Assess soil and water implications
  - Plan for erosion and sediment control
  - Minimise disturbance area
  - Conserve topsoil for rehabilitation
  - Control water by diversion of upslope “clean” water, slowing flows to avoid erosion and capturing sediment laden water from disturbed areas
  - Rehabilitate promptly after disturbance
  - Maintain erosion and sediment control measures through life of project

Strategy

Effective erosion and sediment control throughout life of project involves:

- Planning and design
- Operations
- Closure and rehabilitation
- Erosion and Sediment Control Strategies outlined in the Surface Water Management Plan (Appendix of Water Management Plan)

Considerations

- Scope and scale of development
- Sensitivity of receiving environment
- Rainfall and soil characteristics
- Regulatory compliance
- Area and duration of exposure
- Emphasis on design and scheduling of rehabilitation rather than reliance on short term measures

Emphasis

- Erosion control as a pollution prevention strategy
- Separation of clean and dirty water by diversion of clean water around site and away from operational areas
- Management and maintenance of long-term controls

Planning phase

- Design drainage for life of mine
- Divert runoff
- Allow free drainage of runoff whilst minimising erosion
- Staging development of mine
- Separate and treat sediment laden water
- Utilise water from sediment ponds for dust suppression and irrigation where possible

Constructional phase measures

- Clearly identifying and delineating areas to be disturbed and limiting disturbance to those areas
- Minimisation of all disturbed areas
- Stabilisation by progressive rehabilitation as soon as practicable
- Construction of diversion drains/bunds/coffer dams upslope of areas to be disturbed to direct clean runoff away from disturbed areas
- Construction of catch drains and sediment dams to capture runoff from disturbed areas as required

Constructional phase measures

- Construction of other erosion and sediment controls works such as silt fences prior to construction works commencing within the catchment area
- Construction of culverts, as required, under access roads, site services corridors and site haul roads
- Construction of drainage controls such as table drains at roadsides and hardstand areas as required
- Use of scour protection in temporary diversion drains
- Construction of all temporary drains as earthen drains at typical grades no steeper than 5% (maximum peak velocities ~1.5m/s) to minimise scouring, otherwise providing adequate scour protection

Constructional phase measures

- Use of stabilising vegetation, geotextile liners, rock check dams etc. (as appropriate) in drains as required to reduce water velocities and prevent scouring
- Construction of graded banks over the majority of the reshaped overburden areas to minimise erosion and re-direct runoff to catch drains and water disposal areas
- Locate stockpiled material away from concentrated water flows and seeding topsoil stockpiles if stored for longer than six months
- Construction of road and earthworks cut and fill batters at appropriate slopes to maximise long term stability; and
- Regular inspection and maintenance of erosion and sediment controls

Operational phase

- Minimise extent of disturbed areas
- Use both temporary and permanent earthworks to minimise erosion
- Promptly stabilise landforms
- Design temporary surface water collection and conveyance systems to minimise erosion
- Inspect measures daily and “after rain”
- Maintain and modify measures as necessary
- Utilise voids for storage

Operational phase measures

- Clearly identifying and delineating areas (through the use of flagging, fencing or bunds) required to be disturbed and limiting disturbance to those areas
- Minimising areas to be disturbed and cleared and limiting machinery disturbance to these areas
- Interception of runoff from disturbed catchment areas in pit or sediment dams
- Preferential diversion of clean runoff away from disturbed areas
- Reshaping, topsoiling and vegetating road cut and fill batters as soon as practical

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Operational phase measures

- Progressively stripping and direct emplacement or stockpiling topsoil for later use in rehabilitation
- Clearing and topsoil stripping to be undertaken ahead of mining operations
- Seeding of topsoil stockpiles stored for more than six months
- Prompt revegetation of areas as soon as earthworks and mining are complete
- Construction of sediment dams/controls to capture runoff from the office and workshop facilities and roadside table drains

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Operational phase measures

- Locate stockpile areas away from concentrated water flows
- Monitoring and maintenance of clean water diversion systems including outlets
- Regular inspection and maintenance of all erosion and sediment controls and rehabilitated areas; and
- Maintenance of design capacity of sedimentation dams by removing built-up sediment

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Closure and rehabilitation phase

- Minimise long term erosion through effective revegetation
- Monitor and maintain vegetation, particularly in the early phase of rehabilitation

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Rehabilitation phase measures

- Progressive rehabilitation of disturbed land as soon as practicable in accordance with the Mining Operations Plan (MOP) and the Rehabilitation Management Plan (RMP)
- Construction of drainage controls to improve the stability of rehabilitated land
- Reshaping, topsoiling and vegetating former areas used for earthworks, roads and batters as soon as practical upon completion of works
- Application of gypsum, lime or other appropriate soil ameliorant at quantified rates to mitigate soil sodicity/dispersibility where exposed subsoils have been identified

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Rehabilitation phase measures

- Control of weeds through selective herbicide application and the reseeding of areas that fail to establish
- Construction and installation of erosion and sediment controls such as silt fences, catch drains, grass swales, buffer strips and sediment dams down slope of rehabilitation areas
- Regular inspections and maintenance of all erosion and sediment control works; and
- Restricting access to rehabilitated areas through the use of fencing and/or signposting

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Documentation

- Document adopted strategy in:
  - Environmental management plan
  - Mine operation plan
  - Water management plan
  - Erosion and sediment control plan
- Document current E&SC practices
- Allow for plan revision
- Maintain flexibility to accommodate changes

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Responsibility

- Clearly document staff and contractor responsibilities
- Delegate responsibilities for inspection and maintenance of erosion and sediment control measures
- Involve all staff in inspection and maintenance rather than making it the responsibility of a single or small number of staff
- Note that principals cannot transfer obligations under the POEO Act

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Final landform

- Short term measures should be an integral part of planning for the intended final landform
- Slope has a significant effect on soil erosion, in particular the placement of spoil above natural surface levels
- Slow water flow off slopes to minimise erosion
- Note rilling as an indicator of increased velocity
- Create convex upper slopes and concave lower slopes
- Back-slope benches

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