17 APPENDIX F – GROUND CONTROL MANAGEMENT PLAN

ALCOA – ANGLESEA MINE

GROUND CONTROL MANAGEMENT PLAN

Approvals			
Signed copy to be held in Anglesea Mine Office			
Mine Manager	(signed)	(date)	25/02/2011
Mine Supervisor	(signed)	(date)	25/02/2011

Document Control	
First Originated	September 2010
Issue Date (this revision)	September 2010
Revision No.	1.0
Next Revision Date	September 2011
Printed	25/02/2011 9:37:00
Path	P:\1347_G Alcoa Anglesea Contract\Tech\Geotechnical\GCMP\2431.doc

UNCONTROLLED COPY WHEN PRINTED

DRAFT REPORT

TABLE OF CONTENTS

TABLE INDEX

FIGURE INDEX

APPENDICES

EXECUTIVE SUMMARY

Alcoa's Anglesea mine is located at Anglesea, on the south western Peninsula; approximately 35 kilometres from Geelong. The Anglesea Mine supplies coal to the Anglesea Power Station since its inception in 1969. The mine has been operating since 1961 and is an open-cut mine approximately 100 metres deep.

This *Ground Control Management Plan* (*GCMP*) is intended to guide Alcoa's management of geotechnical hazards by providing a framework for which the Mine Manager can implement strategies and delegate tasks related to geotechnical hazard management. In reading this *GCMP* it is important that notice be taken of the requirements (roles and responsibilities) of each individual party.

The *GCMP* is structured as follows:

Design – Geotechnical hazard control at the *Design* stage aims to prevent or minimise geotechnical hazards by considering geotechnical issues at the various stages of mine design.

Implementation – Geotechnical hazard control at the *Implementation* stage ensures that geotechnical considerations of mine designs are put into practice during mining operations.

Verification – Geotechnical hazard control at the *Verification* stage aims to verify that designs have been implemented and are operating within acceptable geotechnical constraints, by applying reviews, monitoring and other checks.

Geotechnical Hazard Management – Geotechnical hazard control at the *Hazard Response* stage aims to maintain safe operating conditions after a geotechnical hazard has been identified.

Reporting & Auditing – Each aspect of the GCMP requires that processes are documented and reported. Audits will be carried out as specified in the GCMP.

Training - Geotechnical hazard control at the *Training* stage aims to ensure that all personnel who have responsibilities under this GMS have the appropriate skills and knowledge to carry them out.

The GCMP document must be clearly and regularly communicated to all open pit personnel and be a readily accessible document for all.

1 INTRODUCTION

This Ground Control Management Plan (GCMP) is for use within Alcoa's Anglesea Mine for management of geotechnical hazards within the mine. Geotechnical hazards may be associated with (but are not limited to) the following: pit slopes, stock piles, spoils, waste dumps and any soil/rock material used for retention; i.e. dams or tailings facilities.

The GCMP formalises the management of geotechnical hazards at the Anglesea Mine. This is achieved by identifying, managing, communicating and documenting geotechnical hazards.

1.1 Scope

The document scope is to describe how slope geotechnical management is carried out at the Anglesea Mine in order to prevent geotechnical hazards, identify geotechnical hazards, reconcile actual versus design, and communicate geotechnical hazard issues. This GCMP also defines processes for the management of geotechnical hazards of waste dumps and stockpiles.

1.2 Background

Anglesea Mine has been operating since 1961, and currently supplies coal to the Anglesea Power Station; that opened in 1969. Various consultants have assisted the Anglesea Mine over the years, with BFP Consultants providing geological, mining and geotechnical engineering support for the mine from 1997 to 2005. Numerous reports regarding the slope failures and monitoring assessments were produced. From mid 2005 to mid 2009, Coffey Mining provided the mine planning and geotechnical engineering support, including three to six monthly geotechnical inspections and slope monitoring reporting. Since 2009, Mining One Consultants have been providing support to the Anglesea Mine in mine planning and geotechnical support as required.

1.3 Legislative Framework

Mine Legislation in Victoria is controlled by the State Government of Victoria and administered by the Department of Primary Industries (Victoria). WorkSafe Victoria administers OH&S (Occupation Health and Safety). Relevant Victorian legislation applying to this matter, including subordinate legislation where not specifically mentioned includes, but without being limited to:

- Environmental Protection Act 1997;
- Mineral Resources Act 1990;
- Mineral Resources Sustainable Development Act 1990 (MRSD Act)
- Mineral Resource Development Regulations 2002;
- Mines Act 1958;
- Occupational Health and Safety Act 2004;
- Occupational Health and Safety Regulations 2007; and
- Water Act 1989.

In addition to the above, where practical, relevant Australian and International Standards, Codes and Best Practices should be followed.

1.4 Roles and Responsibilities

The Mine Manager is responsible for:

- Implementation, updating and periodic review of at the GCMP at the Anglesea Mine;
- Day to day application of the GCMP;
- Communication of the GCMP;
- Delegation of tasks under the GCMP to relevant stakeholders; and
- Review of the GCMP; annually or more frequently as required.

The following table (*Table 1.1*) sets out the tasks required to be undertaken and the corresponding roles and responsibilities.

Table 1.1 Roles and Responsibilities

Task	Sub-Task	Role	Responsibility*
Prisms	Surveying	Contract Surveyor	N Brockman
GPS Monitoring Pins	Surveying	Contract Surveyor	N Brockman
Piezometers	Readings	Mine Supervisor/Delegate	N Brockman
Rain Gauges	Readings	Mine Supervisor/Delegate	N Brockman
Inclinometers	Readings	Mine Supervisor/Delegate	N Brockman
Berm and Batter	Inspections	Mine Supervisor	N Brockman
Slope Failures	Site Geotechnical Log	Mine Manager/Mine Supervisor	Chris Rolland/N Brockman
Hazard (Potential) Identification	Visual	All Personnel	All Personnel
Risk Assessment Process	Site Geotechnical Log	Mine Manager	Chris Rolland
Geotechnical Analysis	Prism Data	Geotechnical Consultant	Mining One
	GPS Data		
	Piezometer Data		
	Rainfall Data		
	Inclinometer Data		
	Berm and Batter Inspections Notes		
Slope Change	Design	Geotechnical Consultant	Mining One
Slope Change	Approval	Mine Manager	Chris Rolland
Operational Pit Changes	Approval	Mine Manager	Chris Rolland
Slope Design	Validation of Constructed vs Design	Mine Supervisor	N Brockman
Training	Organisation	Mine Manager	Chris Rolland
Auditing	12 Month Review	Mine Manager	Chris Rolland
GCMP	Review/Changes	Geotechnical Consultant	Mining One

** as at September 2010*

1.5 Geological Setting

The Anglesea Mine is located within a coastal environment. An early Tertiary age sedimentary sequence up to 140 metres thick hosts two potentially economic seams of brown coal. The Upper Seam is being mined at present and generally exhibits a close to flat dip in the current mining area. The Lower Seam is made up of three separate coal seams, separated by layers of inter-seam clay.

The overburden material consists of fine sands, silty sand, silty clay and clayey silts. The overburden is approximately 70 metres thick and exhibits soil like characteristics.

2 DESIGN

Design is a term used to describe the action where a required outcome is realised through the implementation of defined principles to achieve an outcome. The design in this case is the determination of open pit slope geometry; such as batter angle, batter height, berm width, etc.

Incorporating geotechnical hazard control at the *Design* stage aims to prevent or minimise geotechnical hazards by considering geotechnical issues at the various stages of mine design.

The design process is dictated by the geotechnical and geological parameters of the Anglesea Mine site. The design, in terms of slope geometry, is set out in *Appendix A*.

2.1 Slope Design Requirements

Slope stability is typically defined in terms of Factor of Safety (FoS) and Probability of Failure (PoF). Factor of Safety (FoS) is a ratio between stabilising and destabilising net effects acting on an object. Theoretically a FoS less than 1.0 will fail; conversely a FoS greater than 1.0 will be sustained in equilibrium. A Probability of Failure (PoF) represents the likelihood of failure.

When slope stability is undertaken, industry best practice is used to define the required FoS/PoF combination.

2.2 Geotechnical Slope Design Parameters

The current slope design configuration used for the determination of slope geometry is listed in *Appendix A*. These parameters are to be used for designing and checking mine slope angles. These parameters in *Appendix A* should be regularly compared with the current mining practices to ensure compliance.

2.3 Geotechnical Strength Parameters

The following table is a summary from Coffey Mining Report *MINENHIL00024AF* (Ref. 1), which summarises material parameters for materials encountered at Anglesea Mine.

Table 2.1 Laboratory testing Results – Coffey Mining Report *MINENHIL00024AF* (Ref. 1)

Soil Type	Test type	Cohesion (kPa)	Friction Angle (degrees)	Dry Density (t/m^3)	Sample Location
Lignite	Direct Shear	50	20	NA	BH3, 22m RL
Lignite	Triaxial	10	15	1.3	Hole 762 26m DH (1999)
Lignite	Direct Shear	150	18	1.9	Hole 770 35.5mRL
Sandy Clay	Triaxial	24.5	24	1.5	Hole 763 30mRL
Sandy Clay/Coal Interface	Direct Shear	85	16	NA	Hole 763 5.1mRL
Silty Clay	Triaxial	235	4	1.3	BH3, 19m RL
Silty Clay	Triaxial	19.6	32	1.3	Hole 764 18.8mRL
Silty Clay	Triaxial	15	18	1.2	Hole 762 13mRL
Silty Clay	Triaxial	30	28	1.7	Hole 762 7mRL
Silty Clay	Triaxial	20	21	1.5	Hole 763 16.6mRL
Silty Sand	Triaxial	20	31	1.6	BH3, 37m RL

The following geotechnical design parameters were used by Coffey Mining when completing slope stability analysis for the south-west wall in 2009:

Table 2.2 Material Properties – Coffey Mining (Ref. 1)

[Used by Coffey Mining for Slope Stability Analysis of the south-west wall]

Material	Unit Weight (kN / m^3)	Cohesion (kPa)	Friction Angle (degrees)
Coal	15	30	27
Silty Sand	16	20	31
Silty Clay	14	21	25
Clayey Silt	14	21	25
Fine Sand	16	20	31
Floor Seam – Wet Clay	15	0	10

2.4 Geotechnical Considerations for Design

Geotechnical issues to be considered with regards to the long term stability of the pit are:

- Circular failure of the overburden and waste dumps material; and
- Wall failures through rock mass, or along rock structures, including deep seated block sliding along the base of the upper coal seam.

2.5 Seismic Criteria

Seismic inputs into a design account for the effects of earthquake motion on stability. According to Geosciences Australia – Earthquake Hazard Map of Australia 1991 (Ref. 2); the Anglesea area is in a 0.10 g acceleration zone. Slope design should consider seismic acceleration as part of the design process.

2.6 Hydrology and Hydrogeology

Rainfall in the Anglesea area is approximately 800 to 830 mm annually (*Appendix B*). Higher rainfall periods are between May and October. However it is not unusual to experience higher rainfall outside of these periods. Slope movements at Anglesea have not been linked to high rainfall events.

Further information on the Hydrology and Hydrogeology can be found in the

2.7 External Influences on Ground Control

Any external influence which is thought to adversely affect the stability of the wall should be geotechnically assessed as part of designs. These influences may include, but are not limited to;

- Waste dumps being designed near pit wall limits;
- Structures erected in the proximity of the pit limits;
- Water pooling at the crest of a slope; and
- Excess pore water pressure identified behind a slope.

3 IMPLEMENTATION

The implementation of the *GCMP* is through a systematic approach. Listed below are the required checks that are to be performed at specified/required intervals.

3.1 Change Integration

3.1.1 Slope Design

At times, there may be a requirement for the geometry of the pit to change to accommodate certain aspects of mining and/or the elimination of a geotechnical hazard. If a change from the current design practice is required, the design change must be reviewed for geotechnical compliance. Situations where the slope design may need to be changed are:

- Movement of access ramps;
- Reduction/increase of angles to facilitate change of mining direction;
- To provide bunding/buttressing in unstable areas;
- Increase catch protection on berms for rilling and/or rock falls; and
- Allowance for further monitoring devices.

Most often, major design changes will be undertaken off site by specialist designers. Input data from on-site is required to provide current information about the site conditions. Slope design changes must be reviewed by the Geotechnical Consultant and signed off and approved by the Mine Manager.

3.1.2 Operation Changes to Pit Designs

An operation change can be described as a change in the method of day to day execution of mining. Operation changes can include a variety of changes, too numerous to list. However the process is similar to pit design changes in that any geometry change must be designed and approved for use by the Mine Manager.

4 VERIFICATION

Verification is the process where an external/independent body reviews work for process and technical correctness. Verification can also include the back analysis of failures for comparison against geotechnical assumptions.

4.1 Site Monitoring Plan

Geotechnical monitoring is required to gather data on slope movement (direct measurement of slope response), and slope stability influences (indirect aspects, such as rainfall and piezometric levels). Each item of collected data listed below must be interpreted in conjunction with each other, along with considerations of mining activity and location, as, quite often each set of monitoring data are interlinked.

The following table (*Table 4.1*) lists the currently required monitoring frequency that should be used for the various available instruments. More frequent monitoring may be required from time to time depending on interpretation of the data, and may be directed at the discretion of the Mine Manager, or recommended by the Geotechnical Consultant.

Table 4.1 Monitoring Frequency

Slope Monitoring Instrument	Monitoring Frequency
Survey Prisms	Fortnightly
GPS Pins	Every two months
Inclinometers	Every third month
Piezometers	Monthly

4.2 Design Validation

4.2.1 Geotechnical Parameters

The validation of the geotechnical parameters used in design models can be realised through the back analysis of failures. A completed back analysis of failures using the 'current' geotechnical design parameters should be compared with the field case. If there is a discrepancy, a review of the parameters should be undertaken to ensure that they are reflective of the in-situ scenario.

4.2.2 Geological Model

A Geological Model is created from drill hole data and localised mapping of the area. As the excavation is undertaken, variances from the Geological Model may become apparent. These changes should be updated in the Geological Model. A constantly updated Geological Model can assist in helping to define limits of boundaries and excavations.

4.2.3 Hydrogeological Model

A major influence on slope stability is the presence of water and the effect thereof. Therefore it is important that constant monitoring of all measuring devices is undertaken to constantly redefine the Hydrogeological Model. The level of a water table will rise and fall with time and it is these changes that must be constantly taken into account within the model.

4.2.4 Survey Prisms

Prisms are a means to detect movement at a point in all three dimensions (Easting, Northing and Reference Level). Readings are taken (in millimetres) using surveying equipment. Prisms can indicate a movement or acceleration of a wall for example.

Prism data is formatted and placed with previous survey data in a database. Review and interpretation of this data is undertaken to highlight any potential issues (irregular movement) and longer term movement trends.

Contract surveyors are responsible for the survey, and sending the data to the Geotechnical Consultant.

Review of prism readings and database management is conducted by the Geotechnical Consultant as soon as practicable after receipt of the data, and is reported to the Mine Manager and other interested stakeholders as directed by the Mine Manager.

4.2.5 GPS Monitoring Pins

GPS monitoring pins are a means to measure slope movement at locations that are not possible to survey from within the mine. These are typically located around the site, beyond the pit crest and are monitored at regular intervals by the Contract Surveyor.

Review of GPS readings and database management is conducted by the Geotechnical Consultant as soon as practicable after receipt of the data, and is reported to the Mine Manager and other interested stakeholders as directed by the Mine Manager.

4.2.6 Piezometers

Piezometers are used to measure the location of the groundwater table, or the pressure of confined water. Piezometers should be read at regular intervals as specified in Table 4.1. Rainfall data must be read in conjunction with piezometer data to properly assess the impact of rainfall on slope stability.

Review of piezometer readings and database management is conducted by the Geotechnical Consultant as soon as practicable after receipt of the data, and is reported to the Mine Manager and other interested stakeholders as directed by the Mine Manager.

4.2.7 Rain Gauges

Rain gauges are an indication of the total rainfall over a selected period of time at a specific location. Rainfall can influence groundwater levels and can cause surface erosion, potentially affecting the slope stability.

Rain gauges must be read daily or more frequently depending on the quantity of rainfall.

Rainfall data must be sent at monthly intervals, or more frequently if required, to the Geotechnical Consultant for interpretation with piezometer and other data.

Review of rain gauge readings and database management is conducted by the Geotechnical Consultant as soon as practicable after receipt of the data, and is reported to the Mine Manager and other interested stakeholders as directed by the Mine Manager.

4.2.8 Inclinometers

Inclinometers are used to measure lateral displacement within boreholes drilled into a slope. Inclinometers should be periodically read by the Mine Supervisor and sent to the Geotechnical Consultant for interpretation.

Review of inclinomter readings and database management is conducted by the Geotechnical Consultant as soon as practicable after receipt of the data, and is reported to the Mine Manager and other interested stakeholders as directed by the Mine Manager.

4.2.9 Berm and Batter Inspections

Berm inspections involve the regular walk-over and visual inspection of the catch berms and pit slopes. The inspections are used to record the following:

- Cracking on berms and pit crests;
- Crest damage or crest loss;
- Excessive rilling;
- Rock fall (pieces of rock falling from wall);
- Ponded water;
- Loss of berm access; and
- Failure of catch fences, bunding, safety infrastructure.

Berm inspections will be carried out daily by the Mine Supervisor and will be documented in a Mine Inspection Log. Anomalous conditions will be reported to the Mine Manager, who may at his discretion obtain advice from the Geotechnical Consultant on implications for mine safety.

All personnel working within the mine are required to assess their work areas for safety issues, including the state of berms and batters. Conditions of concern must be reported to the Mine Supervisor, who will then assess, record and report the conditions as specified above for the daily inspection.

The Geotechnical Consultant will visually inspect and assess conditions as part of their six monthly review.

4.3 Data Collection

Data collection involves ongoing collection of technical information that is required for compliance with geotechnical design and verification. Data collection comes in various forms and, includes information from the above *Site Monitoring Plan* and specialist data collection techniques.

4.3.1 Geotechnical and Geological Mapping

Geotechnical Mapping is a term used to describe the collection of geotechnical data from exposures of rock and soil. The fundamental purpose of geotechnical mapping is:

- Increase knowledge of ground conditions within the mine site;
- Collect data for use in analysis; and
- Verify current geotechnical and geological models.

Geotechnical mapping at Anglesea mine is not undertaken often, due to the consistent nature of the materials encountered.

4.3.2 Laboratory Testing

Laboratory testing is a process where samples from the field are taken and tested according to defined standards. The results are used to define the material parameters in a slope design.

Samples will be collected for laboratory testing as deemed necessary by the Geotechnical Consultant for slope design purposes. This would typically be done during any diamond drilling investigations.

The Geotechnical Consultant will select samples, specify test types, and interpret and report results to the Mine Manager. Testing will be carried out to appropriate standards by a NATA registered laboratory.

4.3.2.1 Rock

Laboratory testing of rock should be undertaken when there is insufficient data and/or a new lithology it is encountered; where there is insufficient data for a basis of design. Laboratory testing of rock is the best means to determine the relevant properties for design and analysis. Some commonly used tests are:

- Direct shear testing of rock defects;
- Uniaxial compressive strength (UCS);
- Young's Modulus of Elasticity and Poisson's Ratio;
- Brazilian tensile test; and
- Porosity, density and permeability.

Due to the materials encountered at Anglesea Mine these tests are not often performed.

4.3.2.2 Soil

Laboratory testing involves the collection of samples from representative materials throughout the site for compliance with the design parameters being used. The nature of the Anglesea mine dictates that the thick overburden, of fundamentally soil like material, and the basal clay seam at the base of Upper Coal Layer will be two of the determining factors in slope design.

Laboratory testing can include the following tests:

- Moisture content;
- Consolidation tests;
- Triaxials;

- Permeability; and
- Atterbergs.

These tests can be used in establishing base parameters and programmed testing can lead to a full model being produced for highlighting differences with the open pit area.

4.3.3 Recording of Slope Failures

A slope failure database is very important for understanding issues that lead to failures, thereby helping to prevent similar failures in the future. With the recorded data, the event can be back analysed to further understanding and apply this knowledge to future design.

Slope failures must be recorded by the Mine Supervisor as part of the *Site Monitoring Plan (Section 4.1)*. All slope failures should be thoroughly investigated by the Geotechnical Consultant and reported to the Mine Manager. The extent of investigations will be determined by the Geotechnical Consultant according to industry best practice standards as appropriate for the type and scale of failure.

5 GEOTECHNICAL HAZARD MANAGEMENT

A hazard may be defined by a potential/concurrent incident that can cause the loss of operational controls; with respect to both human and inanimate objects.

5.1 Geotechnical Hazard Awareness

Regular communication and training is required to be given to all mine personnel about geotechnical hazards and controls that are in place to manage them. Further, if required a map within the mine office should be utilised to highlight any geotechnical hazards within the mine site and their controls.

5.2 Geotechnical Hazard Detection

The detection of geotechnical hazards before they present as slope failures is important. Integrated with the *Site Monitoring Plan*, hazard detection involves identifying a potential hazard before it becomes an event. Through the monitoring of the installed slope monitoring equipment, with analysis of the data, potential hazards can be detected in some circumstances.

5.3 Risk Matrix

A risk matrix is used to rate risks according to their Likelihood and Consequence. The following table below is the risk matrix to classify identified Geotechnical Hazards in terms of risk and is based on the Australian Standard for risk assessment, (Ref. 3):

Table 5.1 Risk Matrix

	Consequences				
Probability	Catastrophic	Major	Moderate	Minor	Insignificant
Almost Certain	Critical	Critical	Critical	High	Medium
Likely	Critical	Critical	High	Medium	Medium
Possible	Critical	High	High	Medium	Low
Unlikely	High	High	Medium	Low	Low
Rare	High	Medium	Low	Low	Low

The above table (*Table 5.1 – Risk Matrix*) must be applied to each identified hazard, by selecting a consequence and likelihood according to the Standard.

This risk matrix is designed to work in conjunction with the *Site Geotechnical Log* (See Section 5.9). The log is designed to identify the risk, classify the risk and describe actions to minimise the risk.

5.4 Risk Assessment Process

Geotechnical risk assessments must be conducted by the Mine Manager, who may obtain advice from, or delegate the process to the Geotechnical Consultant.

Geotechnical risk assessments will be carried out for identified geotechnical hazards as frequently as required to assess the current nature of the risk. For example, if the likelihood or the consequence were to increase, the risk must be re-assessed.

The Mine Manager must implement all controls specified in the risk assessment.

5.5 Hazard Classification

The classification of hazards must be separated between loss of life and/or injury to the loss of operational control at the mine. A classification rating should be given to every hazard identified. The classification is based upon the likelihood and consequence of the hazard; using *AS/NZS ISO 31000:2009* as a basis and replacement for *AS/NZS 4360-2004*.

To simplify the classification system for a real time application, the following can be applied to identify hazards for classification into broad groups:

Table 5.2 Hazard Classification

Hazard Level	Description	Action
LOW	Low likelihood and probability of failure	Continue monitoring and review
MEDIUM	Moderate consequence and possibility of failure	Some action may be required usually within 24 hours, continuing improvement to reduce hazard level
HIGH	High consequence and likely to fail	Cordoning off area, restricting movement, action plan to reduce and negate failure
CRITICAL	Catastrophic consequences with near certain failure	Immediate action required, i.e. evacuation

5.6 Hazard Communication

Hazards must be communicated to all personnel working within the mine by appropriate means such as verbal briefings and notices on safety boards. Further, if required to or directed to by Responsible Authorities communication must be an open dialogue. Responsible Authorities may include:

- Department of Primary Industries;
- Country Fire Authority;
- Department of Sustainability and Environment;
- Environmental Protection Agency;
- Water and Catchment Management Authorities; and
- Vicroads and Department of transport.

5.7 Hazard Prevention

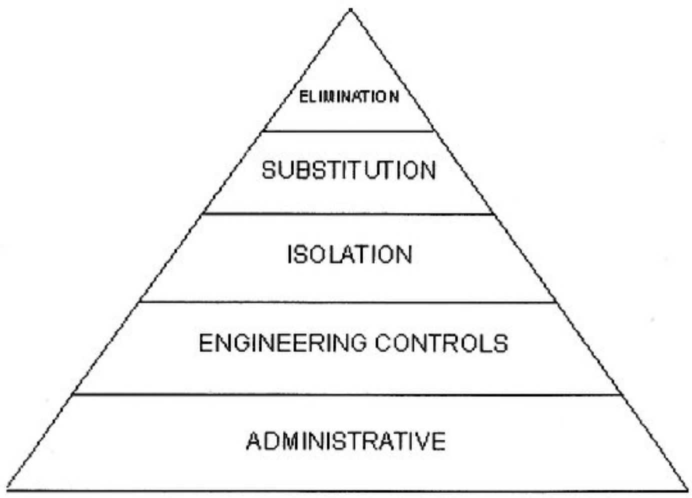
The prevention of hazards is the best engineering control that can be used. Through a systematic approach including geotechnical design, and verification (*Site Monitoring Plan* and *Data Collection* with analysis of data); potential hazards can be realised and prevented. The preventative measures required vary according to the likelihood and consequence of the failure.

5.8 Geotechnical Hazard Mitigation

Hazard mitigation involves reducing the consequences of a potential failure. If a hazard cannot be eliminated, operational and engineering controls must be put into place to reduce or eliminate the consequences of the hazard.

The following hierarchy of control can be applied to the mitigation of hazards:

Figure 5.1 Hierarchy of Control



Elimination – The hazard can be mined out or removed from the mine site

Substitution – Modifications to the pit design and changes of operational procedures

Isolation – The cordoning off of an area to restrict access, using a variety of methods such as windrows, bollards, fencing, etc.

Engineering Controls – Altered slope design to improve stability, such as providing buttressing or catch berm capacity, safety berms, or improving knowledge of slope responses using additional monitoring equipment.

Administrative – Communication of Geotechnical Hazards, geotechnical reporting and Job Safety Analysis (JSA) for one such example.

5.9 Risk Register – Site Geotechnical Log

A Geotechnical Risk Register must be kept on site at all times. This risk register is incorporated into the *Site Geotechnical Log* for simplicity and efficiency. The *Site Geotechnical Log* will be built up over time and have a close out process.

The close out process illustrates that action has been taken to reduce the risk classification level. *Appendix C* contains an example of the system used at Anglesea Mine.

6 REPORTING

Reporting is a required part of the *Ground Control Management Plan*. A fully documented system that records all facets covered within the GCMP must be maintained for future auditing and analysis. Reporting frequency and intensity must be conducted at the discretion of the Mine Manager.

Listed below are examples of types of reports that should be produced and information contained there within. These are described throughout the GCMP in their relevant sections and are summarised here.

6.1 Geotechnical Site Log

A Geotechnical Site Log, as described in *Section 5.9*, is used to list all of the geotechnical hazards found on the site. Hazards will have been identified and given a risk rating accordingly. The site log is required to document all geotechnical hazards at the site. The required information to be included in the report is, as a minimum:

- Date of hazard identified;
- Location;
- Detailed description of the hazard;
- Risk rating;
- Recommended actions and controls (remediation of the hazard);
- Post remediation risk rating; and
- Additional comments.

Appendix C is an example of a Geotechnical Site Log with a Risk Classification System.

6.2 Reporting Responsibilities

The following table (*Table 6.1*) sets out the reporting requirements of this *GCMP* and the parties responsible.

Table 6.1 Reporting Responsibilities

Report	Role	Responsibility*
Geotechnical Site Log	Mine Manager	Chris Rolland
Mine Inspection Log	Mine Manager/Mine Supervisor	Chris Rolland/ Nick Brockman
Six Monthly Geotechnical Reviews	Geotechnical Consultant	Mining One

**as at September 2010*

7 TRAINING

The training and further profession development of all personnel; on-site is imperative. Keeping up to date with changes in Legislation and Codes of Practice(s) is the easiest way to implement any change. With regards to *Ground Control Management Plan* it is recommend that a training seminar be carried out to inform personnel of the possible risks regarding geotechnical hazards.

Having trained personnel on staff will relieve the work load of one person; and result in a greater knowledge of hazards identification and awareness. It is the responsibility of the Mine manager to mandate that all personnel undertake training to fully understand the relevance and importance of this document. The application of ground management is not the responsibility of one person, but a collective team effort.

8 AUDITING

Periodic audits of geotechnical hazards and hazard control processes must be carried out at regular intervals by an external specialist. Items that must be addressed in each audit are:

- Overall site geotechnical conditions and geotechnical hazard management;
- Review of geotechnical ground control management;
- Data review and monitoring review;
- Stability and soundness of geotechnical geometry;
- Implementation of the GCMP;
- Compliance with this GCMP;
- The effectiveness and validity of this GCMP; and
- Responsibilities and accountabilities are being met.

This document, along with all Alcoa documents relevant to Ground Control at the Anglesea Mine, should be reviewed every twelve months or as specified by the Mine Manager.

9 REFERENCES

1. Coffey Mining, January 2009, "Anglesea Coal Mine SW Corner Slope Stability Analysis" Report No. MINENHIL00024AF.
2. McCue, K., (compiler), Gibson, G., Michael-Leiba, M., Love, D., Cuthbertson, R., & Horoschun, G., 1993, "Earthquake hazard map of Australia, 1991" – Geosciences Australia
3. Committee OB-007, 20 November 2009, "Risk Management – Principles and Guidelines" (AS/NZS ISO 31000:2009)

Appendix A
Alcoa – Anglesea Mine

Slope Design Parameters

Summary of Overburden Slope Design Parameters, Recommendations & Measurements		Anglesea Coal Mine (1979-1997)	BFP Consultants (1997)	Anglesea Coal Mine (1997 - 2005)	Anglesea Coal Mine present	2009 Survey	
						Re-entrant No 1	Re-entrant No 2
Batter Angle	Above Haul Road	37°	25°	30°	30°	24.3°	26°
	Below Haul Road	45°	45°	45°	33.7°	42.3°	34.2°
Berm Width	Above Haul Road	5m	5m	Varies	Varies	8.5 & 11.8m	8m
	Below Haul Road	5m	5m	5m	Nil *	3m (silted)	6m
Batter Height	Above Haul Road	12m	12m	Varies	Varies	5, 14 & 18m	12 & 14m
	Below Haul Road	12m	12m	Varies	Varies	13 & 20m	34m
Intermediate Angle	Above Haul Road	29.7°	21.3°	21.3°	21.3°	19.5°	23.2°
	Below Haul Road	35.2°	35.2°	35.2°	33.7°	42.3°	34.2°

<u>Notes:</u> 1. 1979 design for upper batters was for 5m berms spaced at 12m vertical intervals, graded to run water at 1 in 125. Batter angle was 1 in 1⅓ or ~37°. The grade was later steepened to 1 in 100.

2. At some stage, the grading was reversed to run water to the west. This combined with the varying lengths of the berms resulted in the vertical spacing necessarily departing from the original 12m.

3. As a practical result of the BFP Consultants recommendations, a uniform batter angle of 30° was adopted, and the berm width was made variable (that is, greater than 5m) to enable an overall batter angle <25° to be achieved as the height varied with the natural surface topography.

4. In 2005 it was decided to reverse the drainage direction of the haulage berm again. This was achieved by placing fill on the western end of the berm. It was felt that this was safe as there would still be no significant amount of clay below the berm.

5. It was found impractical to maintain drainage on the berms below the haulage level. The resulting batter erosion could not be effectively repaired as the natural angle of repose of local material is flatter than the 45° batter angle. A slope of 1 in 1.5 or ~33.7° was adopted for planning purposes.

Appendix B

Rainfall Data – Anglesea Area

Bureau of Meteorology

Site Geotechnical Log

Example

Hazard No.	Date	Location	Hazard	Consequences	Likelihood	Consequence	Risk Rating	Responsibility	Completed Actions - Date	By Who	Likelihood	Consequence	Rating
1	24/08/2010	West Wall	Loose rock on crest	Can fall and injure person(s), plant and equipment	**Possible**	**Major**	**High**	Mine Manager	1. Set up barriers and fence off exclusion zone. 2. Remove rock	1. C. Rolland 2. N. Brockman	**Rare**	**Insignificant**	**Low**

DOCUMENT INFORMATION

Status	Draft
Version	A
Print Date	-
Author(s)	Christopher Ralph, Ben Roache
Reviewed By	David Lucas
Pathname	P:\1347_G Alcoa Anglesea Contract\Tech\Geotechnical\GCMP
File Name	2431.doc
Job No	1347_G
Distribution	PDF emailed to client for review

DOCUMENT CHANGE CONTROL

Version	Description of changes/amendments	Author (s)	Date

DOCUMENT REVIEW AND SIGN OFF

Version	Reviewer	Position	Signature	Date