Appendix D

EP / SMP Area 4

Risk Assessment

DONALDSONCOAL
Part of the Yancoal Australia Group

HMS

Donaldson Coal

Abel Mine
Extraction Plan / Subsidence Management Plan Area 4 Risk Assessment

Final Report
April 2014
HMS1283

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Donaldson Coal

Abel Mine
Extraction Plan / Subsidence Management Plan Area 4 Risk Assessment

Final Report
April 2014
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Client:
Mr Tony Sutherland, Technical Services & Manager Mining Engineering, Donaldson Coal

Author:
Mr David Swan, Managing Director, HMS Consultants Australia Pty Ltd.

This Report was prepared on the basis of information recorded by HMS Consultants Australia Pty. Ltd during the risk assessment workshop held on the 3rd April 2014, being group consensus opinion of the subsidence risks issues associated with mining and extracting coal within EP / SMP Area 4 at Abel Mine.

File	Report	Prepared By	Peer Review	Client Review	Date
20140403 HMS1283 Abel SMP Area 4 Risk Assessment Draft Report	Draft	D Swan	C Allanson	Mine	April 14
20140403 HMS1283 Abel EP SMP Area 4 Risk Assessment Final Report	Final	D Swan		Mine	May 14

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1 EXECUTIVE SUMMARY

HMS Consultants Australia Pty Ltd (HMS) was engaged by Mr Tony Sutherland, Technical Services Manager and Manager Mining Engineering for Abel Mine, Donaldson Coal, for the provision of consultancy services in accordance with the scope to facilitate a risk assessment on the extraction and subsidence risk issues associated with Extraction Plan (EP) / Subsidence Management Plan (SMP) Area 4 at Abel Mine.

This risk assessment followed a recent community consultation forum where information for mining EP / SMP Area 4 was presented to the local community. Questions raised by the community during this forum were reviewed and considered by the risk workshop team as part of this assessment.

The risk assessment workshop was conducted at the Abel Mine Offices on the 3rd April 2014. This report incorporates the findings from the workshop which was facilitated on a consultative basis.

The primary risk control measure for protecting principal residences within the EP / SMP Area 4, is the creation of Subsidence Control Zones which provides for first workings only (that is, no pillar extraction), this risk reduction strategy has proven very successful for Area 2 and 3 and is a very proactive approach to reducing the risk of damage to principal residences.

The reader should refer to Section 3 for details of the context of the risk assessment, including the scope, assumptions and limitations. Section 7 should be referred to for a summary of results. Risk ranking was undertaken in accordance with the Yancoal Coal Risk Matrix, provided in Appendix E.

Twenty nine (29) risk issues were identified in the Abel Mine EP/SMP Area 4 Risk Assessment.

There were Nil (0) **"extreme"** risks and four (4) "**High**" risks identified by the risk assessment team. The "**High**" risks are summarised in sub process order in *Table 1 – High Risks,* following:

SP#	Risk Issue	Existing Controls	Further Actions
2.01.01	Injury to road user on Blackhill Rd, Meredith Rd and Browns Rd due to impact of mine subsidence	1. Road management plan with Cessnock City Council 2. Public Safety Management Plan 3. Ongoing consultation 4. Industry experience mining under roads at similar depth 5. Experience from SMP Area 3	1. Review and update Built Features MP including Road MP and Public Safety MP 2. Review Blackhill Rd risk assessment to include Meredith and Browns Rd 3. Panel design to minimise impact to Blackhill Rd
2.04.01	Use of disturbed State Survey Marks	1. Location of marks known 2. Notify Department of Lands 3. Requirement to re-establish marks following subsidence	1. Conduct further searches to identify State Survey Marks
3.05.02	Personal injury from dam wall failure including flooding of John Renshaw Dr and Blackhill Rd	1. 3 x 1200mm diameter culverts under John Renshaw Dr 2. Develop Dam Monitoring and Management Strategy (DMMS) for all dams prior to any mining occurring which will impact on the dams 3. PSMP process	1. Develop specific DMMS and PSMP 2. Consider partial extraction system under dam 3. Consider installing an extensometer and piezometer in adjacent Panel prior to undermining dam 4. Survey dam 5. Conduct dam specific RA including public safety on John Renshaw Dr and inrush potential 6. CL88 process 7. review impacts on previously undermined dams 8. Consult with RMS
7.01.01	Injury to persons and/or animals, due to sinkholes (shallow workings)	1. No extraction <50m depth of cover 2. Full extraction in Area 4 3. Full extraction in borehole seam workings 200m above Panels 30 and 32 4. Archival research on historical workings	1. Borehole seam reactivation issue to be assessed in MSEC report 2. Assess 50m depth of cover over Panel 29

Table 1 – High Risks

One (1) risk was assessed as having a potentially "**Catastrophic**" consequence. This risk is SP#3.05.02 summarised in Table 1 above.

Based on the information analysed during this risk assessment and provided the existing controls and further actions are implemented effectively the author concludes that the resultant risk profile for Abel Mine, EP / SMP Application Area 4 should be acceptable to all relevant stakeholders.

Appendix A presents the further actions in an Action Plan in risk rank order with responsibilities and completion dates assigned.

A full list of risks in assessment order, risk rank order and consequence order respectively are shown in Appendices B-D.

2 INTRODUCTION

HMS Consultants Australia Pty Ltd (HMS) was engaged by Mr Tony Sutherland, Technical Services Manager and Manager Mining Engineering for Abel Mine, Donaldson Coal, for the provision of consultancy services in accordance with the scope to facilitate a risk assessment on the extraction and subsidence risk issues associated with Extraction Plan (EP) / Subsidence Management Plan (SMP) Area 4 at Abel Mine.

The risk assessment workshop was conducted at the Abel Mine Offices on the 3rd April 2014.

This report incorporates the findings from the workshop which was facilitated on a consultative basis.

3 CONTEXT

3.1 BACKGROUND

Abel Mine is an underground bord and pillar mine located approximately 25km north-west of Newcastle, NSW. Mining operations commenced adjacent to the Donaldson Open Cut Coal Mine (now closed) in March 2008.

The mine utilises existing surface infrastructure and the Bloomfield Coal Handling and Preparation Plant, rail loader and rail loop for coal processing and loading on trains for transport to the Newcastle Coal Port for export.

Abel Mine is owned and operated by Yancoal Australia.

A condition of Abel's Mining Lease 1618 requires the leaseholder to prepare a SMP prior to commencing underground mining operations which will potentially lead to subsidence of the land surface.

Abel Mine has been undertaking the extraction of coal successfully, optimising mining methods, based on observed impacts as well as data collection since 2010.

The run of mine production for CY 2014 is planned at 2.7mt.

A summary of significant approvals for Abel follow:

- Environmental Assessment lodged 2006
- Project approval granted June 2007
- Mining Lease ML1618 granted May 2008
- SMP Area 1 approved May 2010
- SMP Area 2 approved Dec 2011
- SMP Area 3 approved July 2013
- Mod 3 approved Dec 2013 (requires an Extraction Plan application to Department of Planning and Infrastructure (DoPI) for all secondary workings)

The Abel Mine EP / SMP Application Area 4 is shown below in *Figure 1 – Abel Mine EP / SMP Application Area 4.*

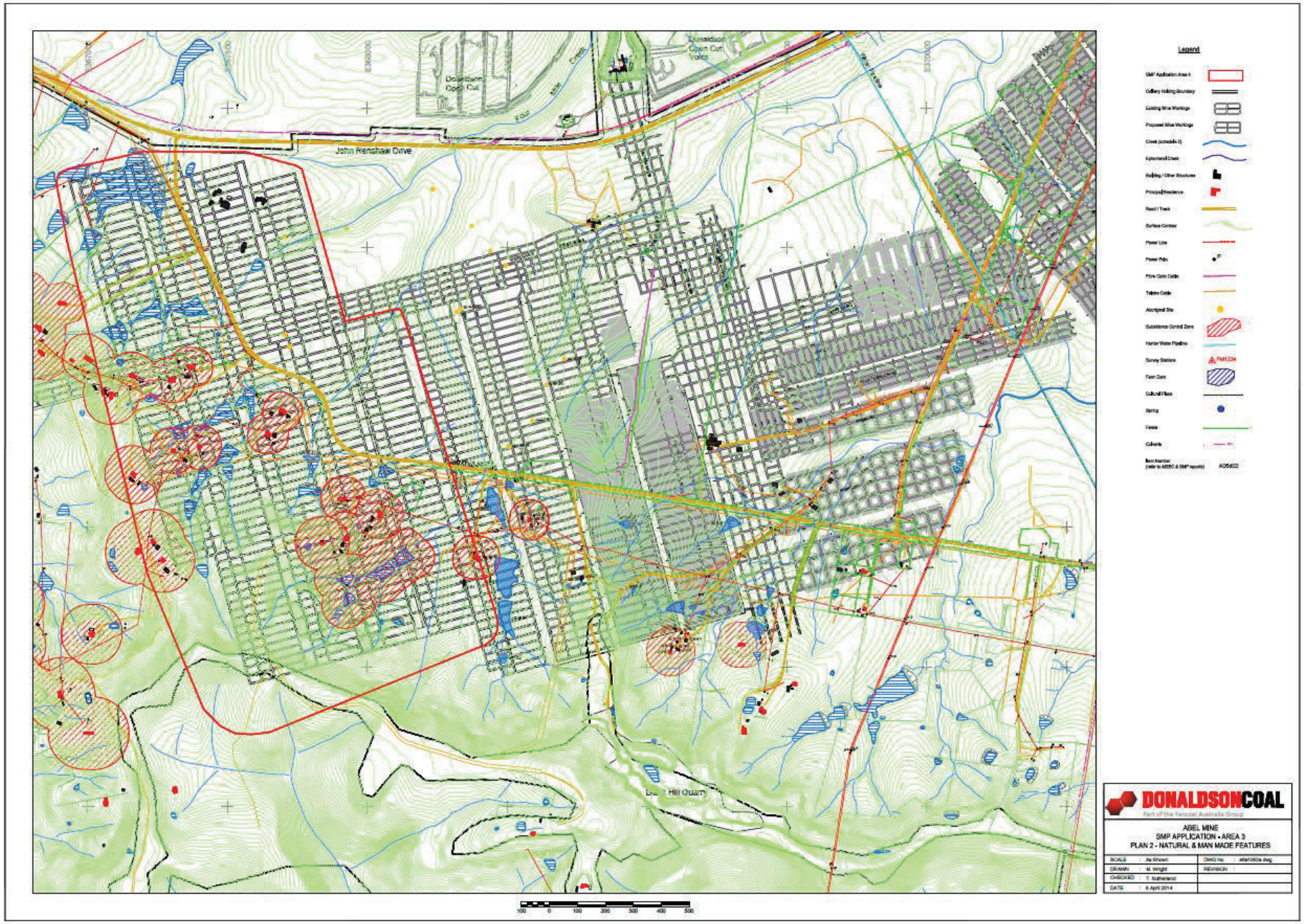

Figure 1 – Abel Mine EP / SMP Application Area 4

3.2 PURPOSE

The purpose of this risk assessment was to identify and assess the surface and subsurface subsidence risks associated with the extraction of coal within EP / SMP Area 4 as well as identify and document management priorities.

3.3 SCOPE

The physical scope of this extraction and subsidence risk assessment is delineated by the red line and labelled EP / SMP Area 4 in *Figure 1 – Abel Mine EP / SMP Application Area 4,* an area of approximately 208ha. The assessment includes the following considerations as a minimum:

- Identify subsidence risks from all potential sources for Abel EP / SMP Area 4, including:
  - Surface:
    - Surface improvements / structures including private, public and mine assets, roads, tracks, power lines, utilities, etc.
    - Natural features, e.g. watercourses, catchment areas, flora and fauna, drainage patterns and hydrology
    - Features of cultural and heritage significance
  - Sub-surface, geo-hydrology, water table, etc.
  - Other

A detailed scope of the risk issues examined is provided in *Section 6.3 Process and Sub Process Areas*.

3.4 OBJECTIVES

The objective of the risk assessment was to facilitate a structured process to enable critical and objective challenge of the subject area to assist Abel fulfil its obligations:

- Protecting the health and safety of persons in accordance with the requirements of:
  - Work Health and Safety Act (2011) and Regulations (2011)
  - Coal Mine Health and Safety Act (2002) and Regulations (2006)
- Relevant Planning, Environmental, and other Legislation
- Welfare of live stock
- By involving relevant key stakeholders, operational personnel, mine management and a qualified and experienced facilitator

The risk assessment was undertaken in accordance with the Australian & New Zealand Standard for Risk Management AS/NZS ISO 31000:2009 and MDG1010 – Risk Management Handbook for the Mining Industry.

3.5 ASSUMPTIONS

The following assumptions were agreed by the workshop team:

- 4 years of pillar extraction experience at Abel Mine
- EP / SMP Area 4, includes;
  - 39 earth dams
  - 16 principal residences

  - 19 properties
  - Nil fibre optic cable
- West Borehole seam fully caved and 200m above subject seam
- Seam thickness 2.2 – 3.4m.
- Extraction void width of 170m – 230m
- Depth of cover 55m in the north and 280m in the south of the subject area
- EP / SMP Area 4 will have full extraction panels with the flexibility to retain long-term stable pillars for the protection of surface features
- Subsidence protection by either first workings/ or partial extraction
- No pillar extraction < 50m depth of cover
- Panel widths of 156m - 216mwith appropriately designed barrier pillars

3.6 EXCLUSIONS & LIMITATIONS

This risk assessment was limited to EP / SMP Area 4 as defined in *Figure 1 – Abel Mine EP / SMP Application Area 4.*

4 DEFINITIONS AND ABBREVIATIONS

4.1 DEFINITIONS

Cause

The direct and indirect causal factors that must be present for identified risk issue / loss to occur.

Consequence

The outcome of an event expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain. There may be a range of possible outcomes associated with an event.

Likelihood

Presented as a qualitative description of the likelihood of a potential event based on its expected frequency of occurrence.

Risk

Determined by the Risk Assessment Team – brain storming from a blank sheet or following a structured process and is related to the causes and material impacts on the strategic, operational and project objectives.

Risk Ranking

The numerical value and descriptor applied to a risk determined from Yancoal Coal Risk Matrix, by reading the junction of Likelihood line and Consequence column.

Risk Level

The risk level is the categorisation of the risk issue for management action, in accordance with the Yancoal Coal Risk Matrix.

4.2 ABBREVIATIONS

SMP	Subsidence Management Plan
EP	Extraction Plan
MP	Management Plan
EMP	Environmental Management Plan
PSMP	Property Subsidence Management Plan
SCZ	Subsidence Control Zones
PEMP	Pillar Extraction Management Plan
ATM	Authority to Mine
BFMP	Built Features Management Plan
PuSMP	Public Safety Management Plan
DMMS	Dam Monitoring Management Strategy
GWMP	Ground Water Management Plan
RMP	Road Management Plan
DCTS	Donaldson Coal Technical Services
DCEC	Donaldson Coal Environment and Community
TARP	Trigger Action Response Plan

5 WORKSHOP PARTICIPANTS

A key factor in the effectiveness of the exercise is the availability of relevant information and expertise. A workshop team made up of operational, technical and management personnel representing Abel, together with independent specialists and an independent facilitator achieved this.

The role of team members was to provide their expertise, experience and technical knowledge, and to respect that provided by others. Outcomes were dependent upon group consensus.

The facilitator's role was to understand the Client's requirements and offer advice as to the best approach to meet the workshop objectives. He assisted the team by providing a systematic process and maintaining focus on the Scope and Objectives. HMS documented the workshop process and outcomes, and offered post-workshop feedback to the Client and team.

The team members are listed in *Table 2 – Risk Assessment Participants*, following:

Name	Position/ Title	Organisation	Industry Experience (Yrs)	Site Experience (Yrs)	3/4/2014
Tony Sutherland	Technical Services / Manager Mining Engineering	Donaldson Coal	30+	6.5	X
Matt Wright	Registered Mine Surveyor	Donaldson Coal	9	6.5	X
Daniel Lee	Registered Surveyor – Co-Facilitator	Donaldson Coal	5	5	X
Phil Brown	Environmental & Community Relations Manager	Donaldson Coal	20	11	X
James Barbato	Subsidence Engineer	MSEC	10	5	X
Allan Jennings	Abel CCC	Resident	30	5	X
Steve Perrens	Consulting Engineer	Evans & Peck	40+	15	X
Fiona Christiansen	Civil Engineer	Evans & Peck	20		X
Colin Dove	Civil Engineer	Telstra Consultant	40+	7	X
David Swan	Managing Director – Facilitator	HMS	30+	-	X

Table 2 – Risk Assessment Participants

6 METHOD OF APPROACH

6.1 HMS RISK MANAGEMENT MODEL

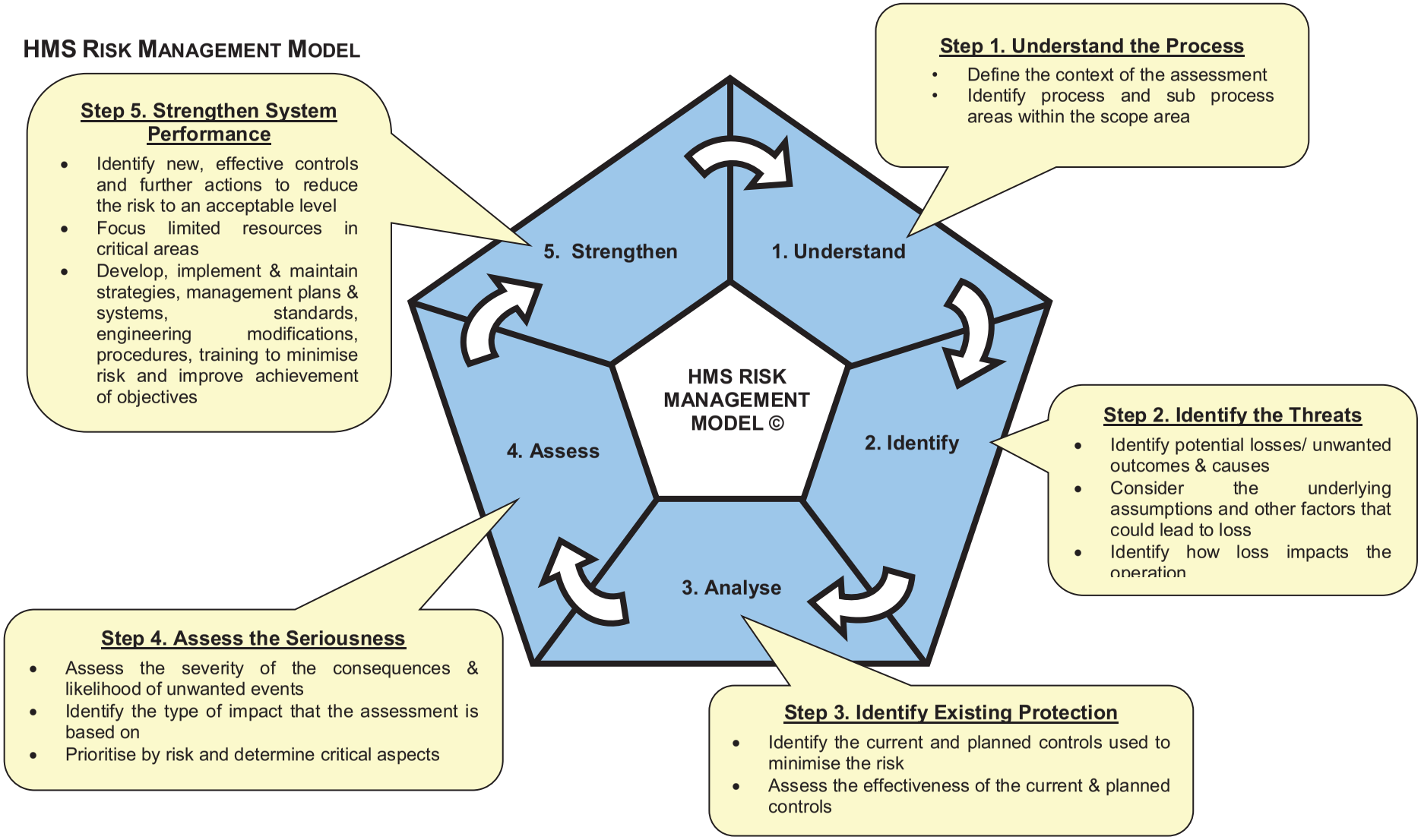

Figure 2 – HMS Risk Management Model

6.2 PRELIMINARIES

At the commencement of the workshop:

- The names, position / title and experience of the workshop team were recorded
- The workshop scope was discussed and agreed upon
- Technical presentations and detailed plans were provided to the workshop team

6.3 PROCESS AND SUB PROCESS AREAS

The risk assessment process followed the structure presented in *Table 3 – Process Areas & Sub-Process Areas*, below, being those identified by the team as the main process areas and sub-process areas for EP / SMP Area 4.

Note: The NSW Department of Mineral Resources Guideline for Application for Subsidence Management Approvals – Appendix B listing was utilised as a basis of identification of Areas & Sub-Areas for consideration for the risk assessment. The list in its entirety is shown in Appendix F – NSW Department of Mineral Resources Guideline for Subsidence Management Approvals – Appendix B.

Process Area	#	Sub-Process Area
Natural Features	1.01	First or second order tributaries
	1.02	Aquifers, known groundwater resources
	1.03	Springs
	1.04	Land prone to flooding or inundation
	1.05	Natural Vegetation
	1.06	Steep slopes (1 in 3)
Public Utilities	2.01	Roads (all types, including culverts)
	2.02	Electricity power lines (overhead/underground)
	2.03	Telecommunication lines (overhead/underground)
	2.04	State Survey marks
3.Farm Land and Facilities	3.01	Agricultural utilisation or agricultural suitability of farm land
	3.02	Internal Access Roads / tracks
	3.03	Fences, gates, cattle grids and cattle yards
	3.04	Farm dams and water reticulation system
	3.05	Farm dams and water reticulation system (large northern dam – Talley dam)
	3.06	Farm structures e.g. sheds
Residential Establishments	4.01	Principal Residences and proposed Principal Residences
	4.02	"Other surface structures" e.g. sheds, solar panels, septic tanks, rainwater tanks, swimming pools and separate garages
Areas of Archaeological and/or Cultural Significance	5.01	Aboriginal heritage
Commercial Establishments	6.01	Fuel depot
	6.02	Radio communication tower
Other	7.01	Sinkholes
	7.02	Additional subsidence from old workings

Table 3 – Process and Sub Process Areas Considered

6.4 RISK ISSUES IDENTIFIED

The risk assessment workshop team systematically considered each sub-process area to identify potential subsidence risks that may arise from extraction within EP / SMP Area 4. Each risk was assessed for its potential impact.

Each potential risk was assessed for subsidence risk that could be caused during and after the mining of EP / SMP Area 4. The underlying causes were then identified and recorded for each identified risk issue.

The risk assessment team identified the existing / planned controls to address the causes and control the risk issue.

6.5 RISK EVALUATION

Risk was determined on a residual risk basis, i.e. in consideration of the effectiveness of the existing controls. Whilst worst case scenarios were discussed by the risk assessment team, the worst case consequence scenario was not necessarily the consequence severity chosen for risk ranking. The risk assessment team used their industry and site experience, as well as their knowledge of the effectiveness of the actual Abel controls, to choose the most appropriate consequence severity for risk ranking. Likelihood was chosen relative to the agreed consequence severity.

The facilitator played a key role in challenging the risk assessment team's perception and tolerance to risk at this stage.

The risk ranking and risk level were chosen using the Yancoal Coal Risk Matrix (see *Appendix E)*.

6.6 RISK REDUCTION STRATEGY

The risk ranking and risk level were primary drivers for identifying risk issues where better risk control is required. Following evaluation of the residual risk, the team then identified additional risk controls that should be implemented to reduce each risk to a level as low as reasonably practical.

6.7 RISK ASSESSMENT FOLLOW-UP

Following completion of this risk assessment, it is recommended that an audit or review of existing controls and additional actions is carried out at an appropriate time to ensure they have been properly implemented to control the identified subsidence risks to an acceptable level.

Appendix A presents a summary of additional controls from this risk assessment in the form of an Action Plan.

7 RESULTS

There were twenty nine (29) risk issues identified in the risk assessment workshop.

7.1 RISK DISTRIBUTION

The following *Table 4 – Risk Distribution by Risk Ranking* summarises the risk distribution of all risks by risk rank.

RISK RANKING	No.	%
Extreme	0	0
High	4	14
Moderate	12	41
Low	13	45
TOTAL	**29**	**100**

Table 4 – Risk Distribution by Risk Rank

Nil (0) "**Extreme**" risk and four (4) "**High**" risks were identified by the risk assessment team. The "**High**" risks are summarised as:

- Risk Issue #2.01.01 Injury to road user on Blackhill Rd, Meredith Rd and Browns Rd due to impact of mine subsidence
- Risk Issue #2.04.01 Use of disturbed State Survey Marks
- Risk Issue #3.05.02 Personal injury from dam wall failure including flooding of John Renshaw Dr and Blackhill Rd
- Risk Issue #7.01.01 Injury to persons and/or animals, due to sinkholes (shallow workings)

7.2 CONSEQUENCE DISTRIBUTION

The following *Table 5 – Risk Distribution by Consequence* summarises the risk distribution of all risks by consequence.

CONSEQUENCE	No.	%
Catastrophic	1	3
Major	2	7
Moderate	3	10
Minor	16	56
Insignificant	7	24
TOTAL	**29**	**100**

Table 5 – Risk Distribution by Consequence

One (1) risk was assessed as having a potentially "**Catastrophic**" consequence. Two (2) risks were assessed as having a potentially "**Major**" consequence, they are summarised as:

- Risk Issue #3.05.02 Personal injury from dam wall failure including flooding of John Renshaw Dr and Blackhill Rd
- Risk Issue #2.01.01 Injury to road user on Blackhill Rd, Meredith Rd and Browns Rd due to impact of mine subsidence
- Risk Issue #7.01.01 Injury to persons and/or animals, due to sinkholes (shallow workings)

8 ACTION PLAN

An action plan has been prepared (see Appendix A), listing the status of all additional controls (Actions) from the risk assessment. Actions required are listed in risk ranking priority order, with timing and responsible person indicated for each.

A full listing of all results is shown in Appendices B to D, being the risk registers in assessment, risk rank and consequence order respectively.

APPENDIX A

Donaldson Coal

Abel Mine EP/SMP Area 4 Risk Assessment

Action Plan

April 2014

H# Process Sub-process	Risk Issue	Further Actions	Who	When
2.01.01 Public Utilities Roads (all types, including culverts)	Injury to road user on Blackhill Rd, Meredith Rd and Browns Rd due to impact of mine subsidence	1. Review and update Built Feature MP including Road MP and Public Safety MP 2. Review Blackhill Rd risk assessment to include Meredith and Browns Rd 3. Panel design to minimise impact to Blackhill Rd	1. DCTS 2. DCTS 3. DCTS	June 2014 and ongoing Before undermining Before undermining
2.04.01 Public Utilities State Survey marks	Use of disturbed State Survey Marks	1. Conduct further searches to identify State Survey Marks	1. DCTS	Sept 2014
3.05.02 Farm Land and Facilities Farm dams and water reticulation system (Large northern dam - Talley dam)	Personal injury from dam wall failure including flooding of John Renshaw Dr and Blackhill Rd	1. Develop specific DMMS and PSMP 2. Consider partial extraction system under dam 3. Consider installing an extensometer and piezometer in adjacent Panel prior to undermining dam 4. Survey dam 5. Conduct dam specific RA including public safety on John Renshaw Dr and inrush potential 6. CL88 process 7. review impacts on previously undermined dams 8. Consult with RMS	1. DCTS 2. DCTS 3. DCEC 4. DCTS 5. DCTS 6. DCTS 7. DCTS 8. DCTS	Jan 2016 Jan 2016 Jan 2015 Jan 2016 July 2015 Sept 2014 Jan 2016 Jan 2016
7.01.01 Other Sinkholes	Injury to persons and/or animals	1. Borehole seam reactivation issue to be assessed in MSEC report 2. Assess 50m depth of cover over Panel 29	1. DCTS 2. DCTS	Sept 2014 Oct 2014
1.01.01 Natural Features Schedule 1 or Schedule 2 tributaries	Loss of surface water flow in existing creeks	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. Donaldson Coal Technical Services (DCTS)	Sept 2014 and ongoing
1.02.02 Natural Features Aquifers, known groundwater resources	Additional flow to underground workings resulting in business interruption	1. Consider installation of additional piezometers and surface extensometers 2. Investigate options for managing additional water make	1.Donaldson Coal Environment and Community (DCEC) 2. DCTS	Sept 2014 Sept 2014
1.02.03 Natural Features Aquifers, known groundwater resources	Elevated salinity in groundwater inflows through mine workings	1. Investigate options for managing additional water make	1. DCTS	Sept 2014
1.03.01 Natural Features Springs	Increase of flow from saline spring on Osborn's property	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014

H# Process Sub-process	Risk Issue	Further Actions	Who	When
1.06.01 Natural Features Steep slopes (1 in 3)	Increased width in surface cracking resulting in issues with public safety / erosion	1. Steep slope characterisation 2. To be assessed as per the PSMP process 3. Review existing methods of remediation for larger cracks	1. DCTS 2. DCTS 3. DCTS	Sept 2014 Sept 2014 and ongoing Sept 2014 and ongoing
2.03.01 Public Utilities Telecommunication lines (overhead/ underground	Damage to Telstra Local Copper Cables	1. Undertake an audit of copper cable locations within SMP Area 4 and develop a MP to mitigate risk 2. Consider provision of mobile phones in PSMP in the event of damage to Telstra cables	1. DCTS 2.DCTS	Sept 2014 Sept 2014
3.02.01 Farm Land and Facilities Internal access roads / tracks	Damage to internal property access tracks	1. Develop specific PSMP's	1. DCTS	Sept 2014 and ongoing
3.04.01 Farm Land and Facilities Farm dams and water reticulation system	Damage to dams and water reticulation systems resulting in loss of service-ability / integrity of dam wall	1. Develop specific DMMS and PSMP	1. DCTS	Sept 2014 and ongoing
3.05.01 Farm Land and Facilities Farm dams and water reticulation system (Large northern dam - Talley dam)	Damage to dam resulting in loss of aesthetics	1. Develop specific DMMS and PSMP 2. Consider partial extraction system under dam 3. Consider installing an extensometer and piezometer in adjacent Panel prior to undermining dam 4. Survey dam 5. conduct dam specific RA including public safety on John Renshaw Dr and inrush potential 6. CL88 process 7. review impacts on previously undermined dams	1. DCTS 2. DCTS 3.DCTS 4. DCTS 5. DCTS 6. DCTS 7. DCTS	Jan 2016 Jan 2016 Jan 2015 Jan 2016 July 2015 Sept 2014 Jan 2016
3.06.01 Farm Land and Facilities Farm structures e.g. sheds	Damage to farm structures due to subsidence	1. Develop specific PSMP	1. DCTS	Sept 2014
4.02.01 Residential Establishments "Other surface structures" e.g. sheds, solar panels, septic tanks, rainwater tanks, swimming pools and separate garages	Damage to other structures	1. Develop specific PSMP	1. DCTS	Sept 2014 and ongoing
5.01.02 Areas of Archaeological and/or Cultural Significance Aboriginal heritage	Damage to Black Hill Pathway	1. Review methods of surface remediation with stakeholders to ensure no loss of value of Black Hill Pathway occurs whilst subsidence remediation works are undertaken 2. Record location of Black Hill Pathway on EP / SMP Application Plan 2 3. Further discussions with South East Archaeology	1. DCEC 2. DCTS 3. DCEC	Sept 2014 Completed Sept 2014

H# Process Sub-process	Risk Issue	Further Actions	Who	When
1.01.02 Natural Features Schedule 1 or Schedule 2 tributaries	Increased erosion	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014 and ongoing
1.02.01 Natural Features Aquifers, known groundwater resources	Loss of groundwater resource	1. Confirm no bores in Area as per PSMP process	1. DCTS	Sept 2014
1.04.01 Natural Features Land prone to flooding or inundation	Increased area of ponding or flooding as a result of subsidence and rainfall event	1. Assessment based on additional modelling to determine post mining contours	1. DCTS	Sept 2014
1.05.01 Natural Features Natural Vegetation	Change in habitat / fauna	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014
1.05.02 Natural Features Natural Vegetation	Visual impact	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014
2.02.01 Public Utilities Electricity power lines (overhead/ underground)	Damage and / or loss of clearance to 11kV Ausgrid Power line	1. Review and update existing Ausgrid Power line MP 2. Clearance surveys to be conducted prior to completion of MP review 3. Site inspection and actions by Ausgrid	1. DCTS 2. DCTS 3. AusGrid	Sept 2014 Sept 2014 Sept 2014
3.01.01 Farm Land and Facilities Agricultural utilisation or agricultural suitability of farm land	Stock safety Temporary loss of utilisation	1. Develop PSMP's	1. DCTS	Sept 2014 and ongoing
3.03.01 Farm Land and Facilities Fences, gates and cattle grids and cattle yards	Damage to fences and / or gates including resulting loss of livestock	1. Develop specific PSMP's	1. DCTS	Sept 2014 and ongoing
4.01.01 Residential Establishments Principal Residences and proposed Principal Residences	Damage to Principal Residences requiring repair	1. Mine Subsidence Board pre mining building and property inspections 2. Develop Monitoring arrangements (Subsidence) 3. Develop specific PSMP	1. DCTS 2. DCTS 3. DCTS	Sept 2014 and ongoing Sept 2014 and ongoing Sept 2014 and ongoing
5.01.01 Areas of Archaeological and/or Cultural Significance Aboriginal heritage	Damage to Aboriginal artefacts e.g. isolated scatters	1. Review methods of surface remediation with stakeholders to ensure artefacts are not damaged whilst any subsidence remediation works are undertaken 2. Further discussions with South East Archaeology	1. DCEC 2. DCEC	Sept 2014 Sept 2014
6.01.01 Commercial Establishments Fuel Depot	Damage to fuel depot and building	1. Mine Subsidence Board inspections to determine tolerable levels 2. Develop specific PSMP	1. DCTS 2. DCTS	June 2016 June 2016

H# Process Sub-process	Risk Issue	Further Actions	Who	When
6.02.01 Commercial Establishments Radio Communication Tower	Damage to tower	1. Mine Subsidence Board inspections to determine tolerable levels 2. Develop specific PSMP 3. Review by telecommunications engineer	1. DCTS 2. DCTS 3. DCTS	June 2016 June 2016 June 2016
7.02.01 Other Additional subsidence from old workings	Reactivation of borehole seam workings causing impacts to the surface	1. Borehole seam reactivation issue to be assessed in MSEC report	1. DCTS	Sept 2014

APPENDIX B

Donaldson Coal

Abel Mine EP/SMP Area 4 Risk Assessment

Risk Table (Assessment Order)

April 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
1	Natural Features	1.01	Schedule 1 or Schedule 2 tributaries	1.01.01	Loss of surface water flow in existing creeks	1. Surface cracking 2. Cracking in creek 3. Ponding in creek	1. Surface grades minimise ponding 2. Experience from SMP Area 1, 2 and 3 show location, intensity and depth of cracking is relatively minor 3. Provide supplementary supply in the event of water loss from dams 4. Dam monitoring management strategy (DMMS) 5. previous experience from region show minimal impacts on ephemeral streams from surface cracking following remediation 6. Inspections, remediation as per the Property Subsidence MP (PSMP) and Environmental MP (EMP) including surface water management plan	E	2	C	8	M	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. Donaldson Coal Technical Services (DCTS)	Sept 2014 and ongoing
1	Natural Features	1.01	Schedule 1 or Schedule 2 tributaries	1.01.02	Increased erosion	1. Step / scarp subsidence developing a head cut scouring erosion	1. Has not happened in previous SMP Areas 2. Inspections, remediation as per the Property Subsidence MP (PSMP) and Environmental MP (EMP)	E	2	D	5	L	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014 and ongoing
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.01	Loss of groundwater resource	1. Connective cracking 2. Depressurisation of aquifers due to mining activities greater than predicted 3. Intersection with geological structures	1. Ground Water Management Plan 2. Limited resource not currently utilised (no registered ground water bores) 3. Past experience mining in area	E	2	D	5	L	1. Confirm no bores in Area as per PSMP process	1. DCTS	Sept 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.02	Additional flow to underground workings resulting in business interruption	1. Connective cracking 2. Depressurisation of aquifers due to mining activities greater than predicted 3. Intersection with geological structures	1. Ground Water Management Plan 2. Pumping capacity is approximately 3 times current flows 3. Mapping of geological structures 4. Additional surface storage (West pit) available 5. CL88 process 6. Existing surface water management plan 7. Existing underground water storage area (East Area)	O	2	C	8	M	1. Consider installation of additional piezometers and surface extensometers 2. Investigate options for managing additional water make	1.Donaldson Coal Environment and Community (DCEC) 2. DCTS	Sept 2014 Sept 2014
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.03	Elevated salinity in groundwater inflows through mine workings	1. Connection with overlying aquifers with elevated salinity 2. Possible increase in salinity at greater depths	1. Ground Water Management Plan 2. Monitoring flow and salinity 3. Additional surface storage (West pit) available 4. Existing underground water storage area (East Area) 5. Previous experience from existing areas	E	2	C	8	M	1. Investigate options for managing additional water make	1. DCTS	Sept 2014
1	Natural Features	1.03	Springs	1.03.01	Increase of flow from saline spring on Osborn's property	1. Change in shallow ground water due to mining activities	1. Inspections, remediation as per the Property Subsidence MP (PSMP) and Environmental MP (EMP) 2. Investigations by Hydrogeologist 3. Location of spring confirmed 4. Water sampling undertaken	E	3	D	9	M	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014
1	Natural Features	1.04	Land prone to flooding or inundation	1.04.01	Increased area of ponding or flooding as a result of subsidence and rainfall event	1. Differential Subsidence associated with flat gradients 2. Significant rainfall event	1. Ephemeral streams 2. Existing natural gradients 3. Existing farm dams on stream alignments	E	1	D	2	L	1. Assessment based on additional modelling to determine post mining contours	1. DCTS	Sept 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
1	Natural Features	1.05	Natural Vegetation	1.05.01	Change in habitat / fauna	1. Falling tree 2. Dieback	1. Mine design 2. Monitoring arrangements 3. Visual inspections 4. TARPs - remediation works 5. Previous experience 6. Environmental Management plan Including Flora and Fauna MP	E	1	D	2	L	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014
1	Natural Features	1.05	Natural Vegetation	1.05.02	Visual impact	1. Falling tree 2. Dieback	1. Mine design 2. Monitoring arrangements 3. Visual inspections 4. TARPs - remediation works 5. Previous experience 6. Environmental Management plan Including Flora and Fauna MP 7. PSMP process	E	1	D	2	L	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014
1	Natural Features	1.06	Steep slopes (1 in 3)	1.06.01	Increased width in surface cracking resulting in issues with public safety / erosion	1. Strain 2. Topography	1. Surface gradients less than 1 in 2 2. Naturally vegetated slopes 3. Higher depth of cover (>140m)	E	3	D	9	M	1. Steep slope characterisation 2. To be assessed as per the PSMP process 3. Review existing methods of remediation for larger cracks	1. DCTS 2. DCTS 3. DCTS	Sept 2014 Sept 2014 and ongoing Sept 2014 and ongoing
2	Public Utilities	2.01	Roads (all types, including culverts)	2.01.01	Injury to road user on Blackhill Rd, Meredith Rd and Browns Rd due to impact of mine subsidence	1. Cracking 2. Steps (Scarps) 3. Change in road profile 4. Reduction in sight distance on road 5. Change in drainage / damage to culverts 6. Tree falling	1. Road management plan with Cessnock City Council 2. Public Safety Management Plan 3. Ongoing consultation 4. Industry experience mining under roads at similar depth 5. Experience from SMP Area 3	P	4	D	14	H	1. Review and update Built Feature MP including Road MP and Public Safety MP 2. Review Blackhill Rd risk assessment to include Meredith and Browns Rd 3. Panel design to minimise impact to Blackhill Rd	1. DCTS 2. DCTS 3. DCTS	June 2014 and ongoing Before underminin g Before underminig

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
2	Public Utilities	2.02	Electricity power lines (overhead/ underground)	2.02.01	Damage and / or loss of clearance to 11kV Ausgrid Power line	1. Subsidence 2. Tilt	1. Timber poles more resilient to subsidence impacts 2. Built Features MP including Power line Management Plan 3. Industry and Donaldson experience mining under power lines at similar depth 4. Site specific subsidence predictions	O	2	D	5	L	1. Review and update existing Ausgrid Power line MP 2. Clearance surveys to be conducted prior to completion of MP review 3. Site inspection and actions by Ausgrid	1. DCTS 2. DCTS 3. AusGrid	Sept 2014 Sept 2014 Sept 2014
2	Public Utilities	2.03	Telecommunication lines (overhead/ underground)	2.03.01	Damage to Telstra Local Copper Cables	1. Strains	1. Built Features MP including Telstra copper Management Plan 2. Industry and Donaldson experience mining under power lines at similar depth 3. Site specific subsidence predictions	O	3	D	9	M	1. Undertake an audit of copper cable locations within EP / SMP Area 4 and develop a MP to mitigate risk 2. Consider provision of mobile phones in PSMP in the event of damage to Telstra cables	1. DCTS 2.DCTS	Sept 2014 Sept 2014
2	Public Utilities	2.04	State Survey marks	2.04.01	Use of disturbed State Survey Marks	1. Disturbance of State Survey Marks due to subsidence	1. Location of marks known 2. Notify Department of Lands 3. Requirement to re-establish marks following subsidence	O	2	A	16	H	1. Conduct further searches to identify State Survey Marks	1. DCTS	Sept 2014
3	Farm Land and Facilities	3.01	Agricultural utilisation or agricultural suitability of farm land	3.01.01	Stock safety Temporary loss of utilisation	1. Surface cracking	1. Previous Donaldson experience 2. Ongoing consultation with property owners 3. Established methods of remediation 4. PSMP including the option to install electric fence to exclude stock from impacted areas	R	2	D	5	L	1. Develop PSMP's	1. DCTS	Sept 2014 and ongoing
3	Farm Land and Facilities	3.02	Internal access roads / tracks	3.02.01	Damage to internal property access tracks	1. Cracking 2. Steps (Scarps) 3. Change in road profile 4. Change in drainage 5. Tree falling	1. Previous Donaldson experience 2. Ongoing consultation with property owners 3. Established methods of remediation 4. PSMP process	O	2	B	12	M	1. Develop specific PSMP's	1. DCTS	Sept 2014 and ongoing

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
3	Farm Land and Facilities	3.03	Fences, gates and cattle grids and cattle yards	3.03.01	Damage to fences and / or gates including resulting loss of livestock	1. Strain 2. Subsidence 3. Falling tree 4. Cracking	1. Previous Donaldson experience 2. Ongoing consultation with property owners 3. Established methods of remediation 4. Establishing electric fence on external road boundary 5. PSMP process	R	2	D	5	L	1. Develop specific PSMP's	1. DCTS	Sept 2014 and ongoing
3	Farm Land and Facilities	3.04	Farm dams and water reticulation system	3.04.01	Damage to dams and water reticulation systems resulting in loss of service-ability / integrity of dam wall	1. Cracking 2. Strains	1. Statement of commitments to provide water in the event of interruption of supply of water from dam 2. Develop Dam Monitoring and Management Strategy (DMMS) for all dams prior to any mining occurring which will impact on the dams 3. PSMP process	O	2	C	8	M	1. Develop specific DMMS and PSMP	1. DCTS	Sept 2014 and ongoing
3	Farm Land and Facilities	3.05	Farm dams and water reticulation system (Large northern dam - Talley dam)	3.05.01	Damage to dam resulting in loss of aesthetics	1. Cracking 2. Strains	1. Statement of commitments to provide water in the event of interruption of supply of water from dam 2. Develop Dam Monitoring and Management Strategy (DMMS) for all dams prior to any mining occurring which will impact on the dams 3. PSMP process	R	2	B	12	M	1. Develop specific DMMS and PSMP 2. Consider partial extraction system under dam 3. Consider installing an extensometer and piezometer in adjacent Panel prior to undermining dam 4. Survey dam 5. conduct dam specific RA including public safety on John Renshaw Dr and inrush potential 6. CL88 process 7. review impacts on previously undermined dams	1. DCTS 2. DCTS 3.DCTS 4. DCTS 5. DCTS 6. DCTS 7. DCTS	Jan 2016 Jan 2016 Jan 2015 Jan 2016 July 2015 Sept 2014 Jan 2016

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
3	Farm Land and Facilities	3.05	Farm dams and water reticulation system (Large northern dam - Talley dam)	3.05.02	Personal injury from dam wall failure including flooding of John Renshaw Dr and Blackhill Rd	1. Cracking 2. Strains 3. LTA dam condition	1. 3 x 1200 diameter culverts under John Renshaw Dr 2. Develop Dam Monitoring and Management Strategy (DMMS) for all dams prior to any mining occurring which will impact on the dams 3. PSMP process	P	5	D	19	H	1. Develop specific DMMS and PSMP 2. Consider partial extraction system under dam 3. Consider installing an extensometer and piezometer in adjacent Panel prior to undermining dam 4. Survey dam 5. Conduct dam specific RA including public safety on John Renshaw Dr and inrush potential 6. CL88 process 7. review impacts on previously undermined dams 8. Consult with RMS	1. DCTS 2. DCTS 3. DCEC 4. DCTS 5. DCTS 6. DCTS 7. DCTS 8. DCTS	Jan 2016 Jan 2016 Jan 2015 Jan 2016 July 2015 Sept 2014 Jan 2016 Jan 2016
3	Farm Land and Facilities	3.06	Farm structures e.g. sheds	3.06.01	Damage to farm structures due to subsidence	1. Strains 2. Tilt	1. Previous industry and Donaldson experience with mining under similar structures 2. Ongoing consultation with property owners 3. Established methods of remediation 4. Farm structures inherently more flexible than brick structures 5. PSMP process	O	2	C	8	M	1. Develop specific PSMP	1. DCTS	Sept 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
4	Residential Establishments	4.01	Principal Residences and proposed Principal Residences	4.01.01	Damage to Principal Residences requiring repair	1. Subsidence impacts	1. Statement of Commitments 2. Subsidence control zones (SCZ) to limit subsidence to 20mm at Principal Residences (assumed 26.5 degrees for design purposes) 3. Pillar Extraction Management Plan (PEMP) including Authority to Mine (ATM) 4. Mine schedule provides for substantial amount of subsidence data prior to setting out SCZ underneath Principal Residences 5. Periodic review and recalibration if required of subsidence model 6. Mine design and layout 7. SMP mine design compliance audit 8. PSMP process 9. Experience with SMP Area 2 and 3	O	1	D	2	L	1. Mine Subsidence Board pre mining building and property inspections 2. Develop Monitoring arrangements (Subsidence) 3. Develop specific PSMP	1. DCTS 2. DCTS 3. DCTS	Sept 2014 and ongoing Sept 2014 and ongoing Sept 2014 and ongoing
4	Residential Establishments	4.02	"Other surface structures" e.g. sheds, solar panels, septic tanks, rainwater tanks, swimming pools and separate garages	4.02.01	Damage to other structures	1. Strains 2. Tilt	1. Previous industry and Donaldson experience with mining under similar structures 2. Ongoing consultation with property owners 3. Established methods of remediation 4. PSMP process	O	2	C	8	M	1. Develop specific PSMP	1. DCTS	Sept 2014 and ongoing
5	Areas of Archaeological and/or Cultural Significance	5.01	Aboriginal heritage	5.01.01	Damage to Aboriginal artefacts e.g. isolated scatters	1. Subsidence	1. Artefact locations have been identified 2. Heritage surveys have been completed 3. Aboriginal Heritage Assessment report has been finalised 4. Subsidence assessment indicates artefact scatters are unlikely to be impacted 5. Consultation with Aboriginal community	R	2	C	5	L	1. Review methods of surface remediation with stakeholders to ensure artefacts are not damaged whilst any subsidence remediation works are undertaken 2. Further discussions with South East Archaeology	1. DCEC 2. DCEC	Sept 2014 Sept 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
5	Areas of Archaeological and/or Cultural Significance	5.01	Aboriginal heritage	5.01.02	Damage to Black Hill Pathway	1. Subsidence	1. Location of Black Hill Pathway is known 2. Cultural Heritage Assessment Report for Abel Upgrade Modification has determined that partial or no loss of value will occur in the event of subsidence impacting Black Hill Pathway and that no management action is required	R	2	C	8	M	1. Review methods of surface remediation with stakeholders to ensure no loss of value of Black Hill Pathway occurs whilst subsidence remediation works are undertaken 2. Record location of Black Hill Pathway on EP / SMP Application Plan 2 3. Further discussions with South East Archaeology	1. DCEC 2. DCTS 3. DCEC	Sept 2014 Completed Sept 2014
6	Commercial Establishments	6.01	Fuel Depot	6.01.01	Damage to fuel depot and building	1. Subsidence	1. Ground Truthing 2. PSMP process 3. Located within overlapping SCZ's	O	1	E	1	L	1. Mine Subsidence Board inspections to determine tolerable levels 2. Develop specific PSMP	1. DCTS 2. DCTS	June 2016 June 2016
6	Commercial Establishments	6.02	Radio Communication Tower	6.02.01	Damage to tower	1.Subsidence	1. Ground truthing 2. PSMP process 3. Located within overlapping SCZ's	O	1	D	2	L	1. Mine Subsidence Board inspections to determine tolerable levels 2. Develop specific PSMP 3. Review by telecommunications engineer	1. DCTS 2. DCTS 3. DCTS	June 2016 June 2016 June 2016
7	Other	7.01	Sinkholes	7.01.01	Injury to persons and/or animals	1.Subsidence	1. No extraction <50m depth of cover 2. Full extraction in Area 4 3. Full extraction in borehole seam workings 200m above Panels 30 and 32 4. Archival research on historical workings	P	4	D	14	H	1. Borehole seam reactivation issue to be assessed in MSEC report 2. Assess 50m depth of cover over Panel 29	1. DCTS 2. DCTS	Sept 2014 Oct 2014
7	Other	7.02	Additional subsidence from old workings	7.02.01	Reactivation of borehole seam workings causing impacts to the surface	1.Subsidence	1 .Full extraction in borehole seam workings 200m above Panels 30 and 32 2. Archival research on historical workings 3. Approx. 200m. of interburden between seams	O	1	D	2	L	1. Borehole seam reactivation issue to be assessed in MSEC report	1. DCTS	Sept 2014

APPENDIX C

Donaldson Coal

Abel Mine EP/SMP Area 4 Risk Assessment

Risk Table (Risk Rank Order)

April 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
3	Farm Land and Facilities	3.05	Farm dams and water reticulation system (Large northern dam - Talley dam)	3.05.02	Personal injury from dam wall failure including flooding of John Renshaw Dr and Blackhill Rd	1. Cracking 2. Strains 3. LTA dam condition	1. 3 x 1200 diameter culverts under John Renshaw Dr 2. Develop Dam Monitoring and Management Strategy (DMMS) for all dams prior to any mining occurring which will impact on the dams 3. PSMP process	P	5	D	19	H	1. Develop specific DMMS and PSMP 2. Consider partial extraction system under dam 3. Consider installing an extensometer and piezometer in adjacent Panel prior to undermining dam 4. Survey dam 5. Conduct dam specific RA including public safety on John Renshaw Dr and inrush potential 6. CL88 process 7. review impacts on previously undermined dams 8. Consult with RMS	1. DCTS 2. DCTS 3. DCEC 4. DCTS 5. DCTS 6. DCTS 7. DCTS 8. DCTS	Jan 2016 Jan 2016 Jan 2015 Jan 2016 July 2015 Sept 2014 Jan 2016 Jan 2016
2	Public Utilities	2.04	State Survey marks	2.04.01	Use of disturbed State Survey Marks	1. Disturbance of State Survey Marks due to subsidence	1. Location of marks known 2. Notify Department of Lands 3. Requirement to re-establish marks following subsidence	O	2	A	16	H	1. Conduct further searches to identify State Survey Marks	1. DCTS	Sept 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
2	Public Utilities	2.01	Roads (all types, including culverts)	2.01.01	Injury to road user on Blackhill Rd, Meredith Rd and Browns Rd due to impact of mine subsidence	1. Cracking 2. Steps (Scarps) 3. Change in road profile 4. Reduction in sight distance on road 5. Change in drainage / damage to culverts 6. Tree falling	1. Road management plan with Cessnock City Council 2. Public Safety Management Plan 3. Ongoing consultation 4. Industry experience mining under roads at similar depth 5. Experience from SMP Area 3	P	4	D	14	H	1. Review and update Built Feature MP including Road MP and Public Safety MP 2. Review Blackhill Rd risk assessment to include Meredith and Browns Rd 3. Panel design to minimise impact to Blackhill Rd	1. DCTS 2. DCTS 3. DCTS	June 2014 and ongoing Before underminin g Before underminig
7	Other	7.01	Sinkholes	7.01.01	Injury to persons and/or animals	1.Subsidence	1. No extraction <50m depth of cover 2. Full extraction in Area 4 3. Full extraction in borehole seam workings 200m above Panels 30 and 32 4. Archival research on historical workings	P	4	D	14	H	1. Borehole seam reactivation issue to be assessed in MSEC report 2. Assess 50m depth of cover over Panel 29	1. DCTS 2. DCTS	Sept 2014 Oct 2014
3	Farm Land and Facilities	3.02	Internal access roads / tracks	3.02.01	Damage to internal property access tracks	1. Cracking 2. Steps (Scarps) 3. Change in road profile 4. Change in drainage 5. Tree falling	1. Previous Donaldson experience 2. Ongoing consultation with property owners 3. Established methods of remediation 4. PSMP process	O	2	B	12	M	1. Develop specific PSMP's	1. DCTS	Sept 2014 and ongoing

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
3	Farm Land and Facilities	3.05	Farm dams and water reticulation system (Large northern dam - Talley dam)	3.05.01	Damage to dam resulting in loss of aesthetics	1. Cracking 2. Strains	1. Statement of commitments to provide water in the event of interruption of supply of water from dam 2. Develop Dam Monitoring and Management Strategy (DMMS) for all dams prior to any mining occurring which will impact on the dams 3. PSMP process	R	2	B	12	M	1. Develop specific DMMS and PSMP 2. Consider partial extraction system under dam 3. Consider installing an extensometer and piezometer in adjacent Panel prior to undermining dam 4. Survey dam 5. conduct dam specific RA including public safety on John Renshaw Dr and inrush potential 6. CL88 process 7. review impacts on previously undermined dams	1. DCTS 2. DCTS 3.DCTS 4. DCTS 5. DCTS 6. DCTS 7. DCTS	Jan 2016 Jan 2016 Jan 2015 Jan 2016 July 2015 Sept 2014 Jan 2016
1	Natural Features	1.03	Springs	1.03.01	Increase of flow from saline spring on Osborn's property	1. Change in shallow ground water due to mining activities	1. Inspections, remediation as per the Property Subsidence MP (PSMP) and Environmental MP (EMP) 2. Investigations by Hydrogeologist 3. Location of spring confirmed 4. Water sampling undertaken	E	3	D	9	M	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014
2	Public Utilities	2.03	Telecommunication lines (overhead/ underground)	2.03.01	Damage to Telstra Local Copper Cables	1. Strains	1. Built Features MP including Telstra copper Management Plan 2. Industry and Donaldson experience mining under power lines at similar depth 3. Site specific subsidence predictions	O	3	D	9	M	1. Undertake an audit of copper cable locations within EP / SMP Area 4 and develop a MP to mitigate risk 2. Consider provision of mobile phones in PSMP in the event of damage to Telstra cables	1. DCTS 2.DCTS	Sept 2014 Sept 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
1	Natural Features	1.06	Steep slopes (1 in 3)	1.06.01	Increased width in surface cracking resulting in issues with public safety / erosion	1. Strain 2. Topography	1. Surface gradients less than 1 in 2 2. Naturally vegetated slopes 3. Higher depth of cover (>140m)	E	3	D	9	M	1. Steep slope characterisation 2. To be assessed as per the PSMP process 3. Review existing methods of remediation for larger cracks	1. DCTS 2. DCTS 3. DCTS	Sept 2014 Sept 2014 and ongoing Sept 2014 and ongoing
1	Natural Features	1.01	Schedule 1 or Schedule 2 tributaries	1.01.01	Loss of surface water flow in existing creeks	1. Surface cracking 2. Cracking in creek 3. Ponding in creek	1. Surface grades minimise ponding 2. Experience from SMP Area 1, 2 and 3 show location, intensity and depth of cracking is relatively minor 3. Provide supplementary supply in the event of water loss from dams 4. Dam monitoring management strategy (DMMS) 5. previous experience from region show minimal impacts on ephemeral streams from surface cracking following remediation 6. Inspections, remediation as per the Property Subsidence MP (PSMP) and Environmental MP (EMP) including surface water management plan	E	2	C	8	M	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. Donaldson Coal Technical Services (DCTS)	Sept 2014 and ongoing
4	Residential Establishments	4.02	"Other surface structures" e.g. sheds, solar panels, septic tanks, rainwater tanks, swimming pools and separate garages	4.02.01	Damage to other structures	1. Strains 2. Tilt	1. Previous industry and Donaldson experience with mining under similar structures 2. Ongoing consultation with property owners 3. Established methods of remediation 4. PSMP process	O	2	C	8	M	1. Develop specific PSMP	1. DCTS	Sept 2014 and ongoing

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
3	Farm Land and Facilities	3.04	Farm dams and water reticulation system	3.04.01	Damage to dams and water reticulation systems resulting in loss of service-ability / integrity of dam wall	1. Cracking 2. Strains	1. Statement of commitments to provide water in the event of interruption of supply of water from dam 2. Develop Dam Monitoring and Management Strategy (DMMS) for all dams prior to any mining occurring which will impact on the dams 3. PSMP process	O	2	C	8	M	1. Develop specific DMMS and PSMP	1. DCTS	Sept 2014 and ongoing
3	Farm Land and Facilities	3.06	Farm structures e.g. sheds	3.06.01	Damage to farm structures due to subsidence	1. Strains 2. Tilt	1. Previous industry and Donaldson experience with mining under similar structures 2. Ongoing consultation with property owners 3. Established methods of remediation 4. Farm structures inherently more flexible than brick structures 5. PSMP process	O	2	C	8	M	1. Develop specific PSMP	1. DCTS	Sept 2014
5	Areas of Archaeological and/or Cultural Significance	5.01	Aboriginal heritage	5.01.02	Damage to Black Hill Pathway	1. Subsidence	1. Location of Black Hill Pathway is known 2. Cultural Heritage Assessment Report for Abel Upgrade Modification has determined that partial or no loss of value will occur in the event of subsidence impacting Black Hill Pathway and that no management action is required	R	2	C	8	M	1. Review methods of surface remediation with stakeholders to ensure no loss of value of Black Hill Pathway occurs whilst subsidence remediation works are undertaken 2. Record location of Black Hill Pathway on EP / SMP Application Plan 2 3. Further discussions with South East Archaeology	1. DCEC 2. DCTS 3. DCEC	Sept 2014 Completed Sept 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.02	Additional flow to underground workings resulting in business interruption	1. Connective cracking 2. Depressurisation of aquifers due to mining activities greater than predicted 3. Intersection with geological structures	1. Ground Water Management Plan 2. Pumping capacity is approximately 3 times current flows 3. Mapping of geological structures 4. Additional surface storage (West pit) available 5. CL88 process 6. Existing surface water management plan 7. Existing underground water storage area (East Area)	O	2	C	8	M	1. Consider installation of additional piezometers and surface extensometers 2. Investigate options for managing additional water make	1.Donaldson Coal Environment and Community (DCEC) 2. DCTS	Sept 2014 Sept 2014
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.03	Elevated salinity in groundwater inflows through mine workings	1. Connection with overlying aquifers with elevated salinity 2. Possible increase in salinity at greater depths	1. Ground Water Management Plan 2. Monitoring flow and salinity 3. Additional surface storage (West pit) available 4. Existing underground water storage area (East Area) 5. Previous experience from existing areas	E	2	C	8	M	1. Investigate options for managing additional water make	1. DCTS	Sept 2014
3	Farm Land and Facilities	3.01	Agricultural utilisation or agricultural suitability of farm land	3.01.01	Stock safety Temporary loss of utilisation	1. Surface cracking	1. Previous Donaldson experience 2. Ongoing consultation with property owners 3. Established methods of remediation 4. PSMP including the option to install electric fence to exclude stock from impacted areas	R	2	D	5	L	1. Develop PSMP's	1. DCTS	Sept 2014 and ongoing

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
5	Areas of Archaeological and/or Cultural Significance	5.01	Aboriginal heritage	5.01.01	Damage to Aboriginal artefacts e.g. isolated scatters	1. Subsidence	1. Artefact locations have been identified 2. Heritage surveys have been completed 3. Aboriginal Heritage Assessment report has been finalised 4. Subsidence assessment indicates artefact scatters are unlikely to be impacted 5. Consultation with Aboriginal community	R	2	C	5	L	1. Review methods of surface remediation with stakeholders to ensure artefacts are not damaged whilst any subsidence remediation works are undertaken 2. Further discussions with South East Archaeology	1. DCEC 2. DCEC	Sept 2014 Sept 2014
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.01	Loss of groundwater resource	1. Connective cracking 2. Depressurisation of aquifers due to mining activities greater than predicted 3. Intersection with geological structures	1. Ground Water Management Plan 2. Limited resource not currently utilised (no registered ground water bores) 3. Past experience mining in area	E	2	D	5	L	1. Confirm no bores in Area as per PSMP process	1. DCTS	Sept 2014
2	Public Utilities	2.02	Electricity power lines (overhead/ underground)	2.02.01	Damage and / or loss of clearance to 11kV Ausgrid Power line	1. Subsidence 2. Tilt	1. Timber poles more resilient to subsidence impacts 2. Built Features MP including Power line Management Plan 3. Industry and Donaldson experience mining under power lines at similar depth 4. Site specific subsidence predictions	O	2	D	5	L	1. Review and update existing Ausgrid Power line MP 2. Clearance surveys to be conducted prior to completion of MP review 3. Site inspection and actions by Ausgrid	1. DCTS 2. DCTS 3. AusGrid	Sept 2014 Sept 2014 Sept 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
3	Farm Land and Facilities	3.03	Fences, gates and cattle grids and cattle yards	3.03.01	Damage to fences and / or gates including resulting loss of livestock	1. Strain 2. Subsidence 3. Falling tree 4. Cracking	1. Previous Donaldson experience 2. Ongoing consultation with property owners 3. Established methods of remediation 4. Establishing electric fence on external road boundary 5. PSMP process	R	2	D	5	L	1. Develop specific PSMP's	1. DCTS	Sept 2014 and ongoing
1	Natural Features	1.01	Schedule 1 or Schedule 2 tributaries	1.01.02	Increased erosion	1. Step / scarp subsidence developing a head cut scouring erosion	1. Has not happened in previous SMP Areas 2. Inspections, remediation as per the Property Subsidence MP (PSMP) and Environmental MP (EMP)	E	2	D	5	L	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014 and ongoing

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
4	Residential Establishments	4.01	Principal Residences and proposed Principal Residences	4.01.01	Damage to Principal Residences requiring repair	1. Subsidence impacts	1. Statement of Commitments 2. Subsidence control zones (SCZ) to limit subsidence to 20mm at Principal Residences (assumed 26.5 degrees for design purposes) 3. Pillar Extraction Management Plan (PEMP) including Authority to Mine (ATM) 4. Mine schedule provides for substantial amount of subsidence data prior to setting out SCZ underneath Principal Residences 5. Periodic review and recalibration if required of subsidence model 6. Mine design and layout 7. SMP mine design compliance audit 8. PSMP process 9. Experience with SMP Area 2 and 3	O	1	D	2	L	1. Mine Subsidence Board pre mining building and property inspections 2. Develop Monitoring arrangements (Subsidence) 3. Develop specific PSMP	1. DCTS 2. DCTS 3. DCTS	Sept 2014 and ongoing Sept 2014 and ongoing Sept 2014 and ongoing
6	Commercial Establishments	6.02	Radio Communication Tower	6.02.01	Damage to tower	1.Subsidence	1. Ground truthing 2. PSMP process 3. Located within overlapping SCZ's	O	1	D	2	L	1. Mine Subsidence Board inspections to determine tolerable levels 2. Develop specific PSMP 3. Review by telecommunications engineer	1. DCTS 2. DCTS 3. DCTS	June 2016 June 2016 June 2016

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
7	Other	7.02	Additional subsidence from old workings	7.02.01	Reactivation of borehole seam workings causing impacts to the surface	1.Subsidence	1 .Full extraction in borehole seam workings 200m above Panels 30 and 32 2. Archival research on historical workings 3. Approx. 200m. of interburden between seams	O	1	D	2	L	1. Borehole seam reactivation issue to be assessed in MSEC report	1. DCTS	Sept 2014
1	Natural Features	1.04	Land prone to flooding or inundation	1.04.01	Increased area of ponding or flooding as a result of subsidence and rainfall event	1. Differential Subsidence associated with flat gradients 2. Significant rainfall event	1. Ephemeral streams 2. Existing natural gradients 3. Existing farm dams on stream alignments	E	1	D	2	L	1. Assessment based on additional modelling to determine post mining contours	1. DCTS	Sept 2014
1	Natural Features	1.05	Natural Vegetation	1.05.01	Change in habitat / fauna	1. Falling tree 2. Dieback	1. Mine design 2. Monitoring arrangements 3. Visual inspections 4. TARPs - remediation works 5. Previous experience 6. Environmental Management plan Including Flora and Fauna MP	E	1	D	2	L	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
1	Natural Features	1.05	Natural Vegetation	1.05.02	Visual impact	1. Falling tree 2. Dieback	1. Mine design 2. Monitoring arrangements 3. Visual inspections 4. TARPs - remediation works 5. Previous experience 6. Environmental Management plan Including Flora and Fauna MP 7. PSMP process	E	1	D	2	L	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014
6	Commercial Establishments	6.01	Fuel Depot	6.01.01	Damage to fuel depot and building	1. Subsidence	1. Ground Truthing 2. PSMP process 3. Located within overlapping SCZ's	O	1	E	1	L	1. Mine Subsidence Board inspections to determine tolerable levels 2. Develop specific PSMP	1. DCTS 2. DCTS	June 2016 June 2016

APPENDIX D

Donaldson Coal

Abel Mine EP/SMP Area 4 Risk Assessment

Risk Table (Consequence Order)

April 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
3	Farm Land and Facilities	3.05	Farm dams and water reticulation system (Large northern dam - Talley dam)	3.05.02	Personal injury from dam wall failure including flooding of John Renshaw Dr and Blackhill Rd	1. Cracking 2. Strains 3. LTA dam condition	1. 3 x 1200 diameter culverts under John Renshaw Dr 2. Develop Dam Monitoring and Management Strategy (DMMS) for all dams prior to any mining occurring which will impact on the dams 3. PSMP process	P	5	D	19	H	1. Develop specific DMMS and PSMP 2. Consider partial extraction system under dam 3. Consider installing an extensometer and piezometer in adjacent Panel prior to undermining dam 4. Survey dam 5. Conduct dam specific RA including public safety on John Renshaw Dr and inrush potential 6. CL88 process 7. review impacts on previously undermined dams 8. Consult with RMS	1. DCTS 2. DCTS 3. DCEC 4. DCTS 5. DCTS 6. DCTS 7. DCTS 8. DCTS	Jan 2016 Jan 2016 Jan 2015 Jan 2016 July 2015 Sept 2014 Jan 2016 Jan 2016
2	Public Utilities	2.01	Roads (all types, including culverts)	2.01.01	Injury to road user on Blackhill Rd, Meredith Rd and Browns Rd due to impact of mine subsidence	1. Cracking 2. Steps (Scarps) 3. Change in road profile 4. Reduction in sight distance on road 5. Change in drainage / damage to culverts 6. Tree falling	1. Road management plan with Cessnock City Council 2. Public Safety Management Plan 3. Ongoing consultation 4. Industry experience mining under roads at similar depth 5. Experience from SMP Area 3	P	4	D	14	H	1. Review and update Built Feature MP including Road MP and Public Safety MP 2. Review Blackhill Rd risk assessment to include Meredith and Browns Rd 3. Panel design to minimise impact to Blackhill Rd	1. DCTS 2. DCTS 3. DCTS	June 2014 and ongoing Before underminin g Before underminig

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
7	Other	7.01	Sinkholes	7.01.01	Injury to persons and/or animals	1.Subsidence	1. No extraction <50m depth of cover 2. Full extraction in Area 4 3. Full extraction in borehole seam workings 200m above Panels 30 and 32 4. Archival research on historical workings	P	4	D	14	H	1. Borehole seam reactivation issue to be assessed in MSEC report 2. Assess 50m depth of cover over Panel 29	1. DCTS 2. DCTS	Sept 2014 Oct 2014
1	Natural Features	1.03	Springs	1.03.01	Increase of flow from saline spring on Osborn's property	1. Change in shallow ground water due to mining activities	1. Inspections, remediation as per the Property Subsidence MP (PSMP) and Environmental MP (EMP) 2. Investigations by Hydrogeologist 3. Location of spring confirmed 4. Water sampling undertaken	E	3	D	9	M	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014
1	Natural Features	1.06	Steep slopes (1 in 3)	1.06.01	Increased width in surface cracking resulting in issues with public safety / erosion	1. Strain 2. Topography	1. Surface gradients less than 1 in 2 2. Naturally vegetated slopes 3. Higher depth of cover (>140m)	E	3	D	9	M	1. Steep slope characterisation 2. To be assessed as per the PSMP process 3. Review existing methods of remediation for larger cracks	1. DCTS 2. DCTS 3. DCTS	Sept 2014 Sept 2014 and ongoing Sept 2014 and ongoing
2	Public Utilities	2.03	Telecommunication lines (overhead/ underground)	2.03.01	Damage to Telstra Local Copper Cables	1. Strains	1. Built Features MP including Telstra copper Management Plan 2. Industry and Donaldson experience mining under power lines at similar depth 3. Site specific subsidence predictions	O	3	D	9	M	1. Undertake an audit of copper cable locations within EP / SMP Area 4 and develop a MP to mitigate risk 2. Consider provision of mobile phones in PSMP in the event of damage to Telstra cables	1. DCTS 2.DCTS	Sept 2014 Sept 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
1	Natural Features	1.01	Schedule 1 or Schedule 2 tributaries	1.01.01	Loss of surface water flow in existing creeks	1. Surface cracking 2. Cracking in creek 3. Ponding in creek	1. Surface grades minimise ponding 2. Experience from SMP Area 1, 2 and 3 show location, intensity and depth of cracking is relatively minor 3. Provide supplementary supply in the event of water loss from dams 4. Dam monitoring management strategy (DMMS) 5. previous experience from region show minimal impacts on ephemeral streams from surface cracking following remediation 6. Inspections, remediation as per the Property Subsidence MP (PSMP) and Environmental MP (EMP) including surface water management plan	E	2	C	8	M	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. Donaldson Coal Technical Services (DCTS)	Sept 2014 and ongoing
1	Natural Features	1.01	Schedule 1 or Schedule 2 tributaries	1.01.02	Increased erosion	1. Step / scarp subsidence developing a head cut scouring erosion	1. Has not happened in previous SMP Areas 2. Inspections, remediation as per the Property Subsidence MP (PSMP) and Environmental MP (EMP)	E	2	D	5	L	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014 and ongoing
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.01	Loss of groundwater resource	1. Connective cracking 2. Depressurisation of aquifers due to mining activities greater than predicted 3. Intersection with geological structures	1. Ground Water Management Plan 2. Limited resource not currently utilised (no registered ground water bores) 3. Past experience mining in area	E	2	D	5	L	1. Confirm no bores in Area as per PSMP process	1. DCTS	Sept 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.02	Additional flow to underground workings resulting in business interruption	1. Connective cracking 2. Depressurisation of aquifers due to mining activities greater than predicted 3. Intersection with geological structures	1. Ground Water Management Plan 2. Pumping capacity is approximately 3 times current flows 3. Mapping of geological structures 4. Additional surface storage (West pit) available 5. CL88 process 6. Existing surface water management plan 7. Existing underground water storage area (East Area)	O	2	C	8	M	1. Consider installation of additional piezometers and surface extensometers 2. Investigate options for managing additional water make	1.Donaldson Coal Environment and Community (DCEC) 2. DCTS	Sept 2014 Sept 2014
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.03	Elevated salinity in groundwater inflows through mine workings	1. Connection with overlying aquifers with elevated salinity 2. Possible increase in salinity at greater depths	1. Ground Water Management Plan 2. Monitoring flow and salinity 3. Additional surface storage (West pit) available 4. Existing underground water storage area (East Area) 5. Previous experience from existing areas	E	2	C	8	M	1. Investigate options for managing additional water make	1. DCTS	Sept 2014
2	Public Utilities	2.02	Electricity power lines (overhead/ underground)	2.02.01	Damage and / or loss of clearance to 11kV Ausgrid Power line	1. Subsidence 2. Tilt	1. Timber poles more resilient to subsidence impacts 2. Built Features MP including Power line Management Plan 3. Industry and Donaldson experience mining under power lines at similar depth 4. Site specific subsidence predictions	O	2	D	5	L	1. Review and update existing Ausgrid Power line MP 2. Clearance surveys to be conducted prior to completion of MP review 3. Site inspection and actions by Ausgrid	1. DCTS 2. DCTS 3. AusGrid	Sept 2014 Sept 2014 Sept 2014
2	Public Utilities	2.04	State Survey marks	2.04.01	Use of disturbed State Survey Marks	1. Disturbance of State Survey Marks due to subsidence	1. Location of marks known 2. Notify Department of Lands 3. Requirement to re-establish marks following subsidence	O	2	A	16	H	1. Conduct further searches to identify State Survey Marks	1. DCTS	Sept 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
3	Farm Land and Facilities	3.01	Agricultural utilisation or agricultural suitability of farm land	3.01.01	Stock safety Temporary loss of utilisation	1. Surface cracking	1. Previous Donaldson experience 2. Ongoing consultation with property owners 3. Established methods of remediation 4. PSMP including the option to install electric fence to exclude stock from impacted areas	R	2	D	5	L	1. Develop PSMP's	1. DCTS	Sept 2014 and ongoing
3	Farm Land and Facilities	3.02	Internal access roads / tracks	3.02.01	Damage to internal property access tracks	1. Cracking 2. Steps (Scarps) 3. Change in road profile 4. Change in drainage 5. Tree falling	1. Previous Donaldson experience 2. Ongoing consultation with property owners 3. Established methods of remediation 4. PSMP process	O	2	B	12	M	1. Develop specific PSMP's	1. DCTS	Sept 2014 and ongoing
3	Farm Land and Facilities	3.03	Fences, gates and cattle grids and cattle yards	3.03.01	Damage to fences and / or gates including resulting loss of livestock	1. Strain 2. Subsidence 3. Falling tree 4. Cracking	1. Previous Donaldson experience 2. Ongoing consultation with property owners 3. Established methods of remediation 4. Establishing electric fence on external road boundary 5. PSMP process	R	2	D	5	L	1. Develop specific PSMP's	1. DCTS	Sept 2014 and ongoing
3	Farm Land and Facilities	3.04	Farm dams and water reticulation system	3.04.01	Damage to dams and water reticulation systems resulting in loss of service-ability / integrity of dam wall	1. Cracking 2. Strains	1. Statement of commitments to provide water in the event of interruption of supply of water from dam 2. Develop Dam Monitoring and Management Strategy (DMMS) for all dams prior to any mining occurring which will impact on the dams 3. PSMP process	O	2	C	8	M	1. Develop specific DMMS and PSMP	1. DCTS	Sept 2014 and ongoing

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
3	Farm Land and Facilities	3.05	Farm dams and water reticulation system (Large northern dam - Talley dam)	3.05.01	Damage to dam resulting in loss of aesthetics	1. Cracking 2. Strains	1. Statement of commitments to provide water in the event of interruption of supply of water from dam 2. Develop Dam Monitoring and Management Strategy (DMMS) for all dams prior to any mining occurring which will impact on the dams 3. PSMP process	R	2	B	12	M	1. Develop specific DMMS and PSMP 2. Consider partial extraction system under dam 3. Consider installing an extensometer and piezometer in adjacent Panel prior to undermining dam 4. Survey dam 5. conduct dam specific RA including public safety on John Renshaw Dr and inrush potential 6. CL88 process 7. review impacts on previously undermined dams	1. DCTS 2. DCTS 3.DCTS 4. DCTS 5. DCTS 6. DCTS 7. DCTS	Jan 2016 Jan 2016 Jan 2015 Jan 2016 July 2015 Sept 2014 Jan 2016
3	Farm Land and Facilities	3.06	Farm structures e.g. sheds	3.06.01	Damage to farm structures due to subsidence	1. Strains 2. Tilt	1. Previous industry and Donaldson experience with mining under similar structures 2. Ongoing consultation with property owners 3. Established methods of remediation 4. Farm structures inherently more flexible than brick structures 5. PSMP process	O	2	C	8	M	1. Develop specific PSMP	1. DCTS	Sept 2014
4	Residential Establishments	4.02	"Other surface structures" e.g. sheds, solar panels, septic tanks, rainwater tanks, swimming pools and separate garages	4.02.01	Damage to other structures	1. Strains 2. Tilt	1. Previous industry and Donaldson experience with mining under similar structures 2. Ongoing consultation with property owners 3. Established methods of remediation 4. PSMP process	O	2	C	8	M	1. Develop specific PSMP	1. DCTS	Sept 2014 and ongoing

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
5	Areas of Archaeological and/or Cultural Significance	5.01	Aboriginal heritage	5.01.01	Damage to Aboriginal artefacts e.g. isolated scatters	1. Subsidence	1. Artefact locations have been identified 2. Heritage surveys have been completed 3. Aboriginal Heritage Assessment report has been finalised 4. Subsidence assessment indicates artefact scatters are unlikely to be impacted 5. Consultation with Aboriginal community	R	2	C	5	L	1. Review methods of surface remediation with stakeholders to ensure artefacts are not damaged whilst any subsidence remediation works are undertaken 2. Further discussions with South East Archaeology	1. DCEC 2. DCEC	Sept 2014 Sept 2014
5	Areas of Archaeological and/or Cultural Significance	5.01	Aboriginal heritage	5.01.02	Damage to Black Hill Pathway	1. Subsidence	1. Location of Black Hill Pathway is known 2. Cultural Heritage Assessment Report for Abel Upgrade Modification has determined that partial or no loss of value will occur in the event of subsidence impacting Black Hill Pathway and that no management action is required	R	2	C	8	M	1. Review methods of surface remediation with stakeholders to ensure no loss of value of Black Hill Pathway occurs whilst subsidence remediation works are undertaken 2. Record location of Black Hill Pathway on EP / SMP Application Plan 2 3. Further discussions with South East Archaeology	1. DCEC 2. DCTS 3. DCEC	Sept 2014 Completed Sept 2014
1	Natural Features	1.04	Land prone to flooding or inundation	1.04.01	Increased area of ponding or flooding as a result of subsidence and rainfall event	1. Differential Subsidence associated with flat gradients 2. Significant rainfall event	1. Ephemeral streams 2. Existing natural gradients 3. Existing farm dams on stream alignments	E	1	D	2	L	1. Assessment based on additional modelling to determine post mining contours	1. DCTS	Sept 2014
1	Natural Features	1.05	Natural Vegetation	1.05.01	Change in habitat / fauna	1. Falling tree 2. Dieback	1. Mine design 2. Monitoring arrangements 3. Visual inspections 4. TARPs - remediation works 5. Previous experience 6. Environmental Management plan Including Flora and Fauna MP	E	1	D	2	L	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
1	Natural Features	1.05	Natural Vegetation	1.05.02	Visual impact	1. Falling tree 2. Dieback	1. Mine design 2. Monitoring arrangements 3. Visual inspections 4. TARPs - remediation works 5. Previous experience 6. Environmental Management plan Including Flora and Fauna MP 7. PSMP process	E	1	D	2	L	1. Inspections, remediation as per the Property Subsidence MP and Environmental MP	1. DCTS	Sept 2014
4	Residential Establishments	4.01	Principal Residences and proposed Principal Residences	4.01.01	Damage to Principal Residences requiring repair	1. Subsidence impacts	1. Statement of Commitments 2. Subsidence control zones (SCZ) to limit subsidence to 20mm at Principal Residences (assumed 26.5 degrees for design purposes) 3. Pillar Extraction Management Plan (PEMP) including Authority to Mine (ATM) 4. Mine schedule provides for substantial amount of subsidence data prior to setting out SCZ underneath Principal Residences 5. Periodic review and recalibration if required of subsidence model 6. Mine design and layout 7. SMP mine design compliance audit 8. PSMP process 9. Experience with SMP Area 2 and 3	O	1	D	2	L	1. Mine Subsidence Board pre mining building and property inspections 2. Develop Monitoring arrangements (Subsidence) 3. Develop specific PSMP	1. DCTS 2. DCTS 3. DCTS	Sept 2014 and ongoing Sept 2014 and ongoing Sept 2014 and ongoing
6	Commercial Establishments	6.01	Fuel Depot	6.01.01	Damage to fuel depot and building	1. Subsidence	1. Ground Truthing 2. PSMP process 3. Located within overlapping SCZ's	O	1	E	1	L	1. Mine Subsidence Board inspections to determine tolerable levels 2. Develop specific PSMP	1. DCTS 2. DCTS	June 2016 June 2016

P#	Process	S#	Sub-process	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	Who	When
6	Commercial Establishments	6.02	Radio Communication Tower	6.02.01	Damage to tower	1.Subsidence	1. Ground truthing 2. PSMP process 3. Located within overlapping SCZ's	O	1	D	2	L	1. Mine Subsidence Board inspections to determine tolerable levels 2. Develop specific PSMP 3. Review by telecommunications engineer	1. DCTS 2. DCTS 3. DCTS	June 2016 June 2016 June 2016
7	Other	7.02	Additional subsidence from old workings	7.02.01	Reactivation of borehole seam workings causing impacts to the surface	1.Subsidence	1 .Full extraction in borehole seam workings 200m above Panels 30 and 32 2. Archival research on historical workings 3. Approx. 200m. of interburden between seams	O	1	D	2	L	1. Borehole seam reactivation issue to be assessed in MSEC report	1. DCTS	Sept 2014

APPENDIX E

Donaldson Coal

Abel Mine EP/SMP Area 4 Risk Assessment

Yancoal Coal Risk Matrix

April 2014

Yancoal Risk Matrix		Effect / Consequence				
Loss Type		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
(P) Harm to People		**Slight injury or health effects** – first aid / minor or no medical treatment level	**Minor injury or health effects** – restricted work or minor lost time injury	**Serious bodily injury or health effects** – major lost time injury / permanent disability	Single fatality, permanent total disabilities	Multiple fatalities
(E) Environmental Impact		**Environmental nuisance** – trivial or negligible, short term impact to area of low significance, minimal or no physical remediation required No regulation. Cost < $1,000	**Minor environmental harm** – short term impact to area of limited local significance, limited physical remediation Reportable Breach /Minor Non Compliance, potential warning notice, other notices (infringement / prosecution) unlikely. Costs $1,000 - $5,000	**Serious environmental harm** – medium term impact to area of local conservation value, medium term physical remediation, actual community health impacts or significance or pollution or contamination Infringement Notice but Prosecution unlikely Costs $5k - $50k	**Major environmental harm** – long term reversible impacts to area of regional conservation significance, health statistics in community alter as a result of this incident or pollution or contamination Prosecution Costs $50k - $500k	**Extreme environmental harm** – irreversible impacts on environmental values of extreme & widespread areas, or those of national conservation significance, community fatalities or pollution or contamination Prosecution, License revoked Costs > $500k
(O) Asset Damage and Other Consequential Losses		**Slight damage** < $0.1M or < 1 shift disruption to operation	**Minor damage** $0.1M - $1.0M. or 1 Shift – 1 day disruption to operation	**Local damage** $1.0M - $5.0M or 1 day - 1 week disruption to operation	**Major damage** $5.0M -$25.0M or 1 week – 1 month Partial loss of operation	**Extreme damage** > $25.0M.or > 1 month Substantial or total loss of operation
(R) Impact on Reputation		**Slight impact –** Public awareness may exist but no public concern Isolated compliance failure – no brand damage	**Limited impact –** Some local public concern Intervention of regulating authority – minimal brand damage	**Considerable impact -** Regional public concern Major compliance failure involving fines – medium brand damage	**National impact –** National public concern Temporary withdrawal of license to operate – significant brand damage	**International impact -** International public attention Loss of shareholder confidence – irreparable brand damage
Likelihood	**Likelihood Examples (Guide)**	**Level of Risk**				
A (Almost Certain)	Likely that the unwanted event could occur several times per year at this location	**11** (M)	**16** (H)	**20** (H)	**23** (E)	**25** (E)
B (Likely)	Likely that the unwanted event could occur several times per year in the Australian mining industry; or could happen annually	**7** (M)	**12** (M)	**17** (H)	**21** (E)	**24** (E)
C (Possible)	The unwanted event could well have occurred in the Australian mining industry at some time in the past 10 years	**4** (L)	**8** (M)	**13** (H)	**18** (H)	**22** (E)
D (Unlikely)	The unwanted event has happened in the Australian mining industry at some time; or could happen in 50 years	**2** (L)	**5** (L)	**9** (M)	**14** (H)	**19** (H)
E (Rare)	The unwanted event has never been known to occur in the Australian mining industry; or is highly unlikely that it could ever occur	**1** (L)	**3** (L)	**6** (M)	**10** (M)	**15** (H)

Risk Rating	Risk Level	Risk Management	Reporting Timeframe if Incident	Investigation if Incident	Action Development Timeframe
21 - 25	(E) Extreme	Stop operations or don't proceed with activity (Make Safe). Immediate intervention required from Senior Management.	COO – in next monthly report GM – within 2 hours	External facilitated investigation	Within 24 hrs w/ copy "entered" for COO monitoring of status.
13 - 20	(H) High	Imperative to eliminate or reduce risk by introduction of controls. Do not proceed with activity until reviewed by Senior Management.	COO – in next monthly report GM – within immediate shift	Internal / external facilitator	Within 7 days w/ copy "entered" for COO monitoring of status.
6 - 12	(M) Moderate	Corrective action to be determined. Do not proceed without authorisation from Supervisor.	GM - within 24 hrs	Detailed investigation including hard controls	Within 14 days
1 - 5	(L) Low	Safe to continue activity once risk is minimised.	Manager - within 24 hrs.	Consider further actions	Within 60 days.

APPENDIX F

Donaldson Coal

Abel Mine EP/SMP Area 4 Risk Assessment

April 2014

NSW Department of Mineral Resources Guideline for Subsidence Management Approvals – Appendix B

Area	#	Sub-Area
Natural Features	1.01	Catchment areas and declared Special Areas
	1.02	Rivers and creeks
	1.03	Aquifers, known groundwater resources
	1.04	Springs
	1.05	Sea/lake
	1.06	Shorelines
	1.07	Natural dams
	1.08	Cliffs / pagodas
	1.09	Steep slopes
	1.10	Escarpments
	1.11	Land prone to flooding or inundation
	1.12	Swamps, wetlands, water related ecosystems
	1.13	Threatened and protected species
	1.14	National parks
	1.15	State recreation areas
	1.16	State forests particularly areas zoned FMZ 1, 2 and 3
	1.17	Natural vegetation
	1.18	Areas of significant geological interest, and
	1.19	Any other feature considered significant
Public Utilities	2.01	Railways
	2.02	Roads (all types)
	2.03	Bridges
	2.04	Tunnels
	2.05	Culverts
	2.06	Water/gas/sewerage pipelines
	2.07	Liquid fuel pipelines
	2.08	Electricity transmission lines (overhead/underground) and associated plants
	2.09	Telecommunication lines (overhead/underground) and associated plants
	2.10	Water tanks, water and sewage treatment works
	2.11	Dams, reservoirs and associated works
	2.12	Air strips
	2.13	Any other infrastructure items
Public Amenities	3.01	Hospitals
	3.02	Places of worship
	3.03	Schools
	3.04	Shopping centres
	3.05	Community centres
	3.06	Office buildings
	3.07	Swimming pools
	3.08	Bowling greens

Area	#	Sub-Area
	3.09	Ovals and cricket grounds
	3.10	Race courses
	3.11	Golf courses
	3.12	Tennis courts
	3.13	Any other amenities considered significant
Farm Land and Facilities	4.01	Agricultural utilisation or agricultural suitability of farm land
	4.02	Farm buildings / sheds
	4.03	Gas and / or fuel storages
	4.04	Poultry sheds
	4.05	Glass houses
	4.06	Hydroponic systems
	4.07	Irrigation systems
	4.08	Fences
	4.09	Farm dams
	4.10	Wells, bores
	4.11	Any other feature considered significant
Industrial, Commercial and Business Establishments	5.01	Factories
	5.02	Workshops
	5.03	Business or commercial establishments
	5.04	Gas and / or fuel storages and associated plants
	5.05	Waste storages and associated plants
	5.06	Buildings, equipment and operations that are sensitive to surface movements
	5.07	Surface mining (open cut) voids and rehabilitated areas
	5.08	Mine infrastructure including tailings dams and emplacement areas
	5.09	Any other feature considered significant
Areas of Archaeological and/or Heritage Significance	6.01	Areas of Archaeological and/or Heritage Significance
Items of Architectural Significance	7.01	Items of Architectural Significance
Permanent Survey Control Marks	8.01	Permanent Survey Control Marks
Residential Establishments	9.01	Houses
	9.02	Flats / Units
	9.03	Caravan parks
	9.04	Retirement/aged care villages
	9.05	Associated structures such as workshops, garages, on-site waste water systems, water or gas tanks, swimming pools and tennis courts
	9.06	Any other feature considered significant

APPENDIX G

Donaldson Coal

Abel Mine EP/SMP Area 4 Risk Assessment

April 2014

MDG1014 Checklist

1. Mineral Resources MDG 1014 Check List

To ensure this risk assessment complies with the Minerals Resources MDG 1010 Risk Management Handbook, the following checklist/ sign-off (MDG 1014) has been included.

Sub-sections 1.1, 1.2 and 1.3 have been completed by Donaldson Management

1.1 Report Checklist

1.	Is there a description of the operation or equipment being assessed?	Yes / No
2.	Is there a summary of the strategic, corporate and risk management context?	Yes / No
3.	Is there a list of the people involved in the risk identification step, together with their organisational roles and experience relevant to the risk assessment topic?	Yes / No
4.	Is there an adequately detailed outline of the approach used to identify the risks?	Yes / No
5.	Is there an outline of the method used for assessing the likelihood and consequences of the risks?	Yes / No
6.	Are there two lists of identified risks, ranked by: a) risk magnitude , and b) consequence magnitude	Yes / No
7.	Is there discussion of the basis for defining either the safety standard to be achieved, or the level of risk management expenditure?	Yes / No
8.	Is there a list of the main actions to be taken to reduce risks and to manage risks?	Yes / No
9.	Have responsibilities for implementing additional controls / further actions been allocated?	Yes / No
10.	Is there a timetable for implementing main actions?	Yes / No
11.	Does the report specify a requirement for a working audit required after completion of all implementation stages?	Yes / No

1.2 Risk Assessment Process Evaluation

How do you rate the following:		***Poor***			***Good***	
		(Please Circle)				
1.	The range of expertise of team which did the study	1	2	3	4	5
2.	The appropriateness of the degree of detail of the study	1	2	3	4	5
3.	The comprehensiveness of the systematic approach	1	2	3	4	5
4.	The identification of the key risk scenarios to be addressed	1	2	3	4	5
5.	The bases for deciding the required safety level or effort	1	2	3	4	5
6.	The method for assessing likelihood and consequences	1	2	3	4	5
7.	The thoroughness of consideration of planned risk reduction actions	1	2	3	4	5
8.	The thoroughness of consideration of existing or planned risk controls	1	2	3	4	5
9.	The objectivity and balance of the study (i.e. not unduly optimistic or pessimistic	1	2	3	4	5

1.3 Risk Assessment Process Signoff

Name: Tony Sutherland

Position: Technical Services Manager and Manager Mining Engineering

Signature:  Date: 20-5-14