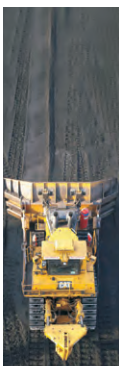
STRATFORDCOAL
Part of the Yancoal Australia Group

Stratford Extension Project
Environmental Impact Statement





APPENDIX R

ENVIRONMENTAL RISK ASSESSMENT

On Thursday 28 June 2012, Yancoal Australia Limited was listed on the Australian Stock Exchange and merged with Gloucester Coal Ltd (GCL) under a scheme of agreement on the same date. Stratford Coal Pty Ltd is now a wholly owned subsidiary of Yancoal Australia Limited. Any reference to GCL in this Appendix should be read as Yancoal Australia Limited.

Stratford Extension Project

Environmental Risk Assessment

***Prepared for*:**	**Stratford Coal Pty Ltd**
Prepared by:	**Safe Production Solutions**
Author:	***Dr Peter Standish***
Date of Team Review:	**19 January 2012**
Job Number:	**J4120**

Doc No: **D5738** ***Version:*** **B** ***Date:*** **12/03/2012**

Safe Production Solutions Pty. Ltd.
ABN: 16 097 038 296
155 Birch Avenue
Dubbo NSW 2830
NSW AUSTRALIA 2830

Tel: +61 2 6885 6611
Fax: +61 2 6885 6011
Web Site: www.spsolutions.com.au
E-mail: sps@spsolutions.com.au

Stratford Extension Project – Environmental Risk Assessment

DOCUMENT CONTROL AND DISTRIBUTION

Document No.	D5738
Title	Stratford Extension Project – Environmental Risk Assessment
General Description	Report on the team based risk assessment
Key Supporting Documentation	• AS/NZS ISO 31000:2009 *Risk Management – Principles and Guidelines* (Standards Australia/Standards New Zealand, 2009); • HB 203:2006 *Environmental Risk Management – Principles and Process* (Standards Australia/Standards New Zealand, 2006); • MDG1010 *Minerals Industry Safety and Health Risk Management Guideline* (NSW DII, 2011); and • Director-General's Requirements.

Versions

Version	Date	Description	Created By	Reviewed
A	24/01/12	Draft report for internal review	PNS	JS
B	12/03/12	Updated draft to reflect team comments	PNS	JS

Distribution List of Latest Version

User	No. Copies
Resource Strategies	1 (Electronic)
SP Solutions	1 (Electronic)

TABLE OF CONTENTS

List of Figures

List of Tables

List of Attachments

EXECUTIVE SUMMARY

This document is an Environmental Risk Assessment (ERA) which identifies risks associated with key potential environmental issues associated with the Stratford Extension Project (the Project). The Project is an extension of the existing Stratford Coal Mine and Bowens Road North Open Cut, referred to collectively as the Stratford Mining Complex.

On 19 January 2012, a team consisting of Stratford Coal Pty Ltd (SCPL) personnel and specialist consultants participated in a facilitated ERA workshop. The scope of the workshop was:

> *To conduct a risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment.*

The ERA workshop included:

1. Establishing the context, including review of supporting information and objectives.
2. Identifying risks via a number of risk management techniques, including:
   a. brainstorming;
   b. modified hazard and operability analysis; and
   c. keyword (loss generation) techniques.
3. Analysis of identified risks and nomination of key potential environmental issues.
4. Ranking of the risks, including consideration of mitigation measures.

Key Potential Environmental Issues

Key potential environmental issues were identified by the ERA team using a voting system, whereby team members were assigned a number of 'votes' to their key issues. The key potential environmental issues identified by the ERA team (**Table ES-1**) were considered to be key issues for further assessment in the Environmental Impact Statement (EIS). The key potential environmental issues identified in the ERA will be addressed in the EIS, and its supporting specialists reports included as appendices to the EIS:

- Appendix A – Groundwater Assessment.
- Appendix B – Surface Water Assessment.
- Appendix C – Noise and Blasting Assessment.
- Appendix D – Air Quality and Greenhouse Gas Assessment.
- Appendix E – Flora Assessment.
- Appendix F – Terrestrial Fauna Assessment.
- Appendix G – Aquatic Ecology Assessment.
- Appendix H – EPBC Act Controlling Provisions.
- Appendix I – Aboriginal Cultural Heritage Assessment.
- Appendix J – Non-Aboriginal Heritage Assessment.
- Appendix K – Agricultural Assessment.
- Appendix L – Geochemistry Assessment.
- Appendix M – Land Contamination Assessment.
- Appendix N – Road Traffic Assessment.
- Appendix O – Visual Assessment.
- Appendix P – Socio-Economic Assessment.
- Appendix Q – Preliminary Hazard Analysis.

Table ES-1 - Key Potential Environmental Issues to be Further Assessed in the EIS

Ref	Subject Area	Issue Identified	EIS Appendix/Section
SX019	Groundwater	Potential cumulative groundwater impacts as a result of the AGL Gloucester LE Pty Ltd (AGL) Gloucester Gas Project, proposed Rocky Hill Coal Project and the Project.	Appendix A and Section 4
SX020	Groundwater	Final void water management and development of groundwater sinks in the long-term.	Appendix A and Section 4
SX072	Groundwater	Potential groundwater related impacts (e.g. baseflow loss) on Dog Trap Creek, Avondale Creek and associated alluvium.	Appendix A and Section 4
SX085	Groundwater	Potential reduction in yield in surrounding landholder bores (e.g. Stratford) resulting from the Project.	Appendix A and Section 4
SX072A	Groundwater	Potential leakage of stored mine water in the Stratford East Dam through underlying coal seams to Stratford East Open Cut – resulting in higher groundwater inflows requiring management.	Appendix A and Section 4
SX007	Surface Water	Potential for long-term spill of water with elevated salinity from final voids.	Appendix B and Section 4
SX008	Surface Water	Long-term stability of upslope permanent diversions.	Appendix B and Section 4
SX009	Surface Water	Long-term stability of unnamed tributary to Avondale Creek.	Appendix B and Section 4
SX014	Surface Water	Design of post-mine landform water management to be stable in the long-term, including upslope diversions.	Appendix B and Section 4
SX018	Surface Water	Site water balance and management of surplus mine water on-site to achieve zero discharge of mine water.	Appendix B and Section 4
SX024	Noise	Potential for intrusive noise and sleep disturbance impacts on some receivers including dwellings, schools, a church and recreational areas resulting from Project operations.	Appendix C and Section 4
SX026	Noise	Noise amenity and sleep disturbance impacts on near-by receivers from Project road and rail operations during daytime, evening and night-time.	Appendix C and Section 4
SX089	Noise	Operational requirement for additional fixed and mobile plant - leading to additional noise impacts.	Appendix C and Section 4
SX101	Noise	Noise performance and non-compliance with noise criteria during Project operations.	Appendix C and Section 4
SX030	Air Quality	Increased emissions of PM_{10}/$PM_{2.5}$/total suspended particles (TSP)/dust deposition from the Project resulting in the potential for increase in predicted impact (health and amenity) at residential receivers.	Appendix D and Section 4
SX031	Air Quality	Potential for increase in cumulative impact associated with the Project, proposed Rocky Hill Coal Project and the AGL Gloucester Gas Project.	Appendix D and Section 4
SX032	Air Quality	Heightened community concern regarding health related air quality issues, including cumulative impacts.	Appendix D and Section 4
SX084	Air Quality	Potential for an increase in dust and aerial contaminants on Stratford homes resulting in contamination of their tank water supplies.	Appendix D and Section 4
SX091	Air Quality	Changes in the air quality effects between modelled and actual levels experienced (due to conservative assumptions in modelling).	Appendix D and Section 4
SX038	Flora & Fauna	Potential for loss of terrestrial flora and fauna and their habitat - other species (non-threatened).	Appendices E and F and Section 4
SX039	Flora & Fauna	Fragmentation of habitats impacting movement of fauna.	Appendix F and Section 4

Table ES-1 – Key Potential Environmental Issues to be Further Assessed in the EIS (Continued)

Ref	Subject Area	Issue Identified	EIS Appendix/Section
SX040	Flora & Fauna	Potential impacts on threatened fauna species (Squirrel Glider, Glossy Black-cockatoo and New Holland Mouse).	Appendix F and Section 4
SX044	Flora & Fauna	Failure of revegetation and/or habitat enhancement in the offset area or biodiversity enhancement areas.	Appendices E and F and Section 4
SX047	Flora & Fauna (Aquatic Ecology)	Potential change in flow persistence in Avondale Creek, Dog Trap Creek and/or Avon River leading to adverse aquatic ecology impacts.	Appendix G and Section 4
SX068	Aboriginal/Non-Aboriginal Heritage	Potential indirect impacts on potential cultural site CTS-1.	Appendix I and Section 4
SX051	Socio-Economic	Potential impacts on amenity (effects on tourism, loss of farming land, proximity to Stratford), water quality (environmental), noise, air quality, health and transport.	Appendix P and Section 4
SX043	Rehabilitation/ Closure	Potential for failure of revegetation and/or habitat enhancement on post-mine landforms.	Section 5
SX083	Rehabilitation/ Closure	Geotechnical issues related to the Roseville West Pit Extension (where excavating through reject material).	Section 5
SX062A	Rehabilitation/ Closure	Long-term stability and rehabilitation of coal handling and preparation plant (CHPP) rejects deposited in the co-disposal areas.	Section 5

Risk Ranking

Risk ranking was undertaken by the team on loss scenarios, based on a subset of the key potential environmental issues (**Table ES-1**). A summary of the risk ranking results is presented in **Table ES-2**.

With the consideration of potential controls, all of the potential loss scenarios were ranked within the 'Medium - As Low As Reasonably Practicable' or the 'Low' range by the ERA team.

Table ES-2 – Risk Ranking

Study Area	Issue	Ranking Basis/Unwanted Event	Risk[1]
Groundwater	Potential cumulative groundwater impacts as a result of the AGL Gloucester Gas Project, proposed Rocky Hill Coal Project and the Project.	Considered the potential for groundwater depressurisation/drawdown and impact on surrounding groundwater users. Risk considered both with and without AGL Gloucester Gas Project and proposed Rocky Hill Coal Project and cumulative scenario assumed that AGL wells would be installed between Roseville West Pit Extension and Stratford concurrent with Roseville West Pit Extension mining. Mitigation discussion noted that the timing/sequence of the other operations to occur concurrently is not certain, therefore the issue was also considered on an SCPL only basis.	**14 Medium (cumulative)** **18 Low (SCPL only)**
	Final void water management and development of groundwater sinks in the long-term.	Considered the potential for surface water spills from final voids due to reporting catchment and pit inflows. Mitigated by design of void to be a groundwater sink in the long-term, e.g. reduction of size of final void by partially backfilling completed pit with waste rock, minimisation of surface water catchment reporting to final void and final void water balance indicating that spills are unlikely.	**22 Low**

Table ES-2 – Risk Ranking (Continued)

Study Area	Issue	Ranking Basis/Unwanted Event	Risk[1]
Groundwater (Continued)	Potential groundwater related impacts (e.g. baseflow loss) on Dog Trap Creek, Avondale Creek and associated alluvium.	Considered the depressurisation of underlying coal measures and potential for reduction of flows in Dog Trap Creek and Avondale Creek from removal of alluvium with contained water and potential impacts on baseflow. Dog Trap and Avondale Creeks considered separately. Mitigated by avoidance of mining within Dog Trap Creek alluvium and recovery of groundwater levels post-mining.	**10 Medium (Dog Trap Creek)** **15 Medium (Avondale Creek)**
	Potential reduction in yield in surrounding landholder bores (e.g. Stratford) resulting from the Project.	Considered the potential for reduced yield/access to water for surrounding landholders including Stratford bores as a result of groundwater depressurisation/drawdown (Project-only).	**18 Low**
	Potential leakage of stored mine water in the Stratford East Dam through underlying coal seams to Stratford East Open Cut – resulting in higher groundwater inflows requiring management.	Considered potential for leakage of water from Stratford East Dam to the Stratford East Open Cut during mining operations. Mitigated by limited potential for environmental impact as any water would be collected in mine water system and managed accordingly.	**25 Low**
Surface Water	Potential for long-term spill of water with elevated salinity from final voids.	Considered the potential for long-term saline contaminant migration to downstream waterways and consequent impacts on downstream water users and ecology. This could occur if the void does not act as a localised groundwater sink. Risks considered separately for surface water users and aquatic ecology.	**23 Low (surface water users)** **20 Low (aquatic ecology)**
	Long-term stability of unnamed tributary to Avondale Creek.	Considered the potential for stability issues associated with an unnamed tributary of Avondale Creek, when water is temporarily diverted into it as part of the upslope water diversion system. Mitigated by the progressive development of upslope diversions (and reporting catchment), short-term and localised impacts (whilst upslope water is being diverted there during operations).	**25 Low**
	Design of post-mine landform water management to be stable in the long-term, including upslope diversions.	Considered long-term sediment/contaminant migration to downstream waterways and consequent impact on downstream water users and ecology. A failure of the landform could potentially cause these losses to occur. Risks considered separately for surface water users and aquatic ecology.	**21 Low (surface water users)** **17 Low (aquatic ecology)**
	Site water balance and management of surplus mine water on-site to achieve zero discharge of mine water.	Considered the potential for an uncontrolled discharge of mine water. Mitigated by site water management system design and implementation (i.e. minimise disturbed catchment; progressive rehabilitation resulting in free-draining landforms; expansion of dust suppression use and irrigation on contained catchments; use of pit voids and disruption to mine operations [operational risk]).	**23 Low (surface water users/ aquatic ecology)**

Table ES-2 – Risk Ranking (Continued)

Study Area	Issue	Ranking Basis/Unwanted Event	Risk[1]
Noise	Potential for intrusive noise and sleep disturbance impacts on some receivers including dwellings, schools, a church and recreational areas resulting from Project operations.	Considered exceedances of criteria leading to a significant loss of amenity amongst receivers. Mitigated by use of noise attenuated fleet items, bunding of on-site haul roads and rail operations, and operation of a real-time noise monitoring system.	**14 Medium**
	Noise amenity and sleep disturbance impacts on near-by receivers from Project road and rail operations during daytime, evening and night-time.	Considered potential for additional rail noise impacts. Mitigated by minimal additional train movements for the Project (i.e. one additional peak rail movement per day).	**14 Medium**
Air Quality	Increased emissions of PM_{10}/$PM_{2.5}$/TSP/dust deposition from the Project resulting in the potential for increase in predicted impact (health and amenity) at residential receivers.	Considered the potential for exceedance of criteria leading to loss of amenity and health impacts amongst receivers. Mitigated by air quality mitigation measures (including additional watering) to minimise predicted air quality impacts.	**14 Medium**
	Potential for increase in cumulative impact associated with the Project, proposed Rocky Hill Coal Project and the AGL Gloucester Gas Project.	Considered the increased potential for cumulative impacts. Mitigated by distance between proposed operations and orientation of the operations relative to each other limits potential for cumulative impacts.	**21 Low**
	Potential for an increase in dust and aerial contaminants on Stratford homes resulting in contamination of their tank water supplies.	Considered the possibility of contamination of residential water supplies sourced from household tanks. Mitigated by relatively low contribution of air pollutants by the mine and findings of a range of scientific studies including a local Gloucester Shire Council study.	**25 Low**
Flora & Fauna	Potential for loss of terrestrial flora and fauna and their habitat - other species (non-threatened)	Considered the potential loss of a local population (non-threatened fauna) and their habitats. Mitigated by minimisation of disturbance areas, Flora and Fauna Management Plan and Project offset outcomes.	**23 Low**
	Fragmentation of habitats impacting movement of fauna.	Considered the potential for increased isolation of habitat due to Project-related clearing, leading to a decrease in habitat connectivity and therefore the potential for a decrease in fauna diversity. Mitigated by minimisation of disturbance areas, Flora and Fauna Management Plan and Project offset.	**18 Low**
	Potential impacts on threatened fauna species (Squirrel Glider, Glossy Black-cockatoo and New Holland Mouse).	Considered the potential loss of a local population (threatened fauna). Mitigated by minimisation of disturbance areas, Flora and Fauna Management Plan and Project offset.	**17 Low**

Table ES-2 – Risk Ranking (Continued)

Study Area	Issue	Ranking Basis/Unwanted Event	Risk[1]
Flora & Fauna (Continued)	Failure of revegetation and/or habitat enhancement in the offset area or biodiversity enhancement areas.	Considered the potential for failure of biodiversity enhancement in offset areas. Considered with monitoring of rehabilitation progress and implementation of remedial measures in place.	**21 Low**
	Potential change in flow persistence in Avondale Creek, Dog Trap Creek and/or Avon River leading to adverse aquatic ecology impacts.	Considered the potential for changes in flow regimes in Avondale Creek, Dog Trap Creek and/or Avon River resulting in adverse impacts on aquatic ecology. Mitigated by implementation of upslope diversion system and progressive rehabilitation to minimise catchment excision over the life of the Project.	**15 Medium (Avondale Creek)** **25 Low (Avon River)** **22 Low (Dog Trap Creek)**
Aboriginal/Non-Aboriginal Heritage	Potential indirect impacts on potential cultural site CTS-1.	Considered the potential for damage to potential cultural site CTS-1 due to proximate mining activities. Mitigated by the isolation of the area, therefore avoiding any direct impacts, and that predicted blast vibration levels are likely to be below relevant criteria.	**21 Low**
Rehabilitation/ Closure	Potential for failure of revegetation and/or habitat enhancement on post-mine landforms.	Considered the potential for failure of revegetation and/or habitat enhancement on post-mine landforms, and failure to establish biodiversity in areas rehabilitated to woodland. Mitigated by past successful rehabilitation practices and appropriate future rehabilitation planning.	**17 Low**
	Geotechnical issues related to the Roseville West Pit Extension (where excavating through reject material).	Considered the challenges of rehabilitating exposed rejects in the low wall of the Roseville West Pit Extension, potentially resulting in an unstable final landform and failure of old Roseville Pit. Mitigated by geotechnical considerations incorporated into final pit design.	**21 Low**
	Long-term stability and rehabilitation of CHPP rejects deposited in the co-disposal areas.	Considered the potential for stability and rehabilitation success of rehabilitation of areas above CHPP rejects emplacements. Mitigated by placement of rejects below the groundwater table level and placement of waste rock on top of rejects material.	**22 Low**

[1] Risk - Ranking basis 1 (highest risk) to 25 (lowest risk). Risk rankings defined as 1 to 6 – High; 7 to 15 - Medium (or ALARP) and 16 to 25 - Low.

Stratford Extension Project – Environmental Risk Assessment

1 INTRODUCTION

This document is an Environmental Risk Assessment (ERA) which identifies risks associated with key potential environmental issues associated with the Stratford Extension Project (the Project). The Project is an extension of the existing Stratford Coal Mine (SCM) and Bowens Road North Open Cut (BRNOC), referred to collectively as the Stratford Mining Complex.

Stratford Coal Pty Ltd (SCPL) is the owner and operator of the Stratford Mining Complex. SCPL is a wholly owned subsidiary of Gloucester Coal Ltd. The Stratford Mining Complex is located approximately 10 kilometres (km) south of Gloucester and 100 km north of Newcastle in New South Wales (NSW) (Figure 1). Another Gloucester Coal Ltd subsidiary, Duralie Coal Pty Ltd, owns and operates the Duralie Coal Mine (DCM), which is located some 20 km to the south of the Stratford Mining Complex.

The Project would be an extension of the Stratford Mining Complex and would involve open cut mining at a rate of up to 2.6 million tonnes per annum (Mtpa). It would also require the development of supporting infrastructure and modifications to some existing infrastructure. A description of the Project is provided in Section 2 in the Main Report of the Environmental Impact Statement (EIS).

1.1 AIM AND OBJECTIVES

The aim of the ERA workshop was:

> *To identify key potential environmental issues for further assessment in the Environmental Impact Statement.*

The primary objectives of this ERA were to:

1. identify the key potential environmental issues associated with the Project; and
2. assess the level of risk for a selection of potential loss scenarios associated with the key potential environmental issues.

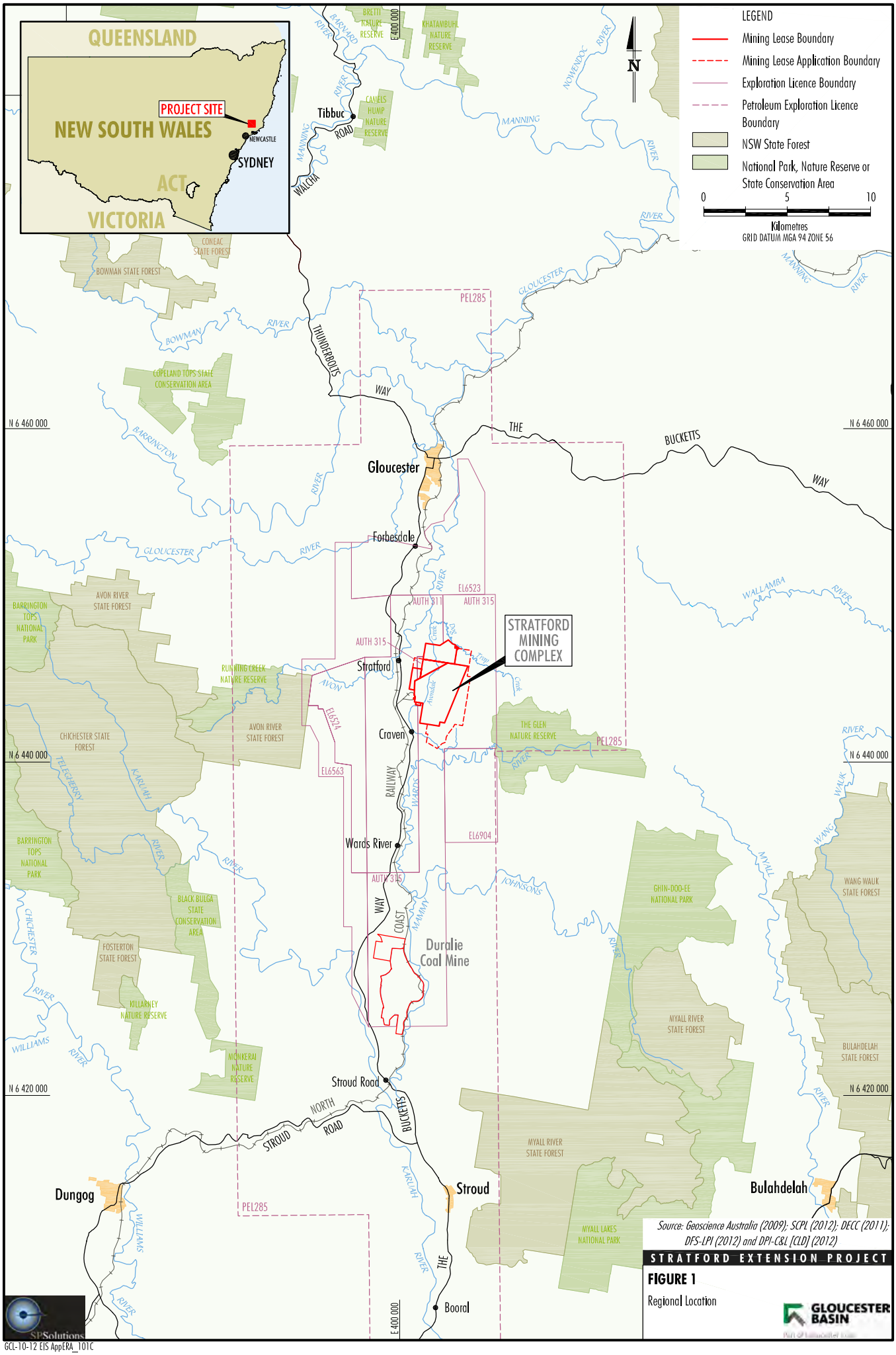
The ERA team identified the following items as desired outcomes from the process:

1. identification of key potential environmental issues to be further assessed in the EIS; and
2. a document suitable for inclusion in the EIS and prepared in accordance with Australian Standard/New Zealand Standard (AS/NZS) ISO 31000:2009 Risk Management – Principles and Guidelines (Standards Australia/Standards New Zealand, 2009).

A list of key words and their definitions is provided in Attachment A.

1.2 CLIENT

The client for the ERA is SCPL.



Source: Geoscience Australia (2009); SCPL (2012); DECC (2011); DFS-LPI (2012) and DPI-C&L [CLD] (2012)

STRATFORD EXTENSION PROJECT

FIGURE 1

Regional Location

GLOUCESTER BASIN

SPSolutions

GCL-10-12 EIS AppERA_10TC

1.3 SCOPE

The Director-General's Requirements (DGRs) for the Project stipulate:

> *… the EIS must include a:*
> *…*
> - *risk assessment of the potential environmental impacts of the development identifying the key issues for further assessment;*

Consistent with the DGRs, the scope of the ERA was:

> *To conduct a risk assessment of the potential environmental impacts of the Project, identifying the key issues for further assessment.*

1.4 CLARIFYING POINTS

The ERA team discussion of the scope raised the following clarifying points:

- Safety issues were not intended to be covered.
- The geographical extent of the Project area was understood to include the Development Application area.

1.5 RISK ASSESSMENT PROCESS

The risk assessment process was based on the framework provided in Figure 2 (based on AS/NZS ISO 31000:2009 [Standards Australia/Standards New Zealand, 2009] [note: this document has replaced AS/NZS 4360:2004 Risk Management], MDG1010 *Minerals Industry Safety and Health Risk Management Guideline* [NSW Department of Industry and Investment (NSW DII), 2011] and HB 203:2006 *Environmental Risk Management – Principles and Process* [Standards Australia/Standards New Zealand, 2006]).

1.6 RESOURCING, SCHEDULE AND ACCOUNTABILITIES

The following resources were allocated in order to effectively conduct the ERA:

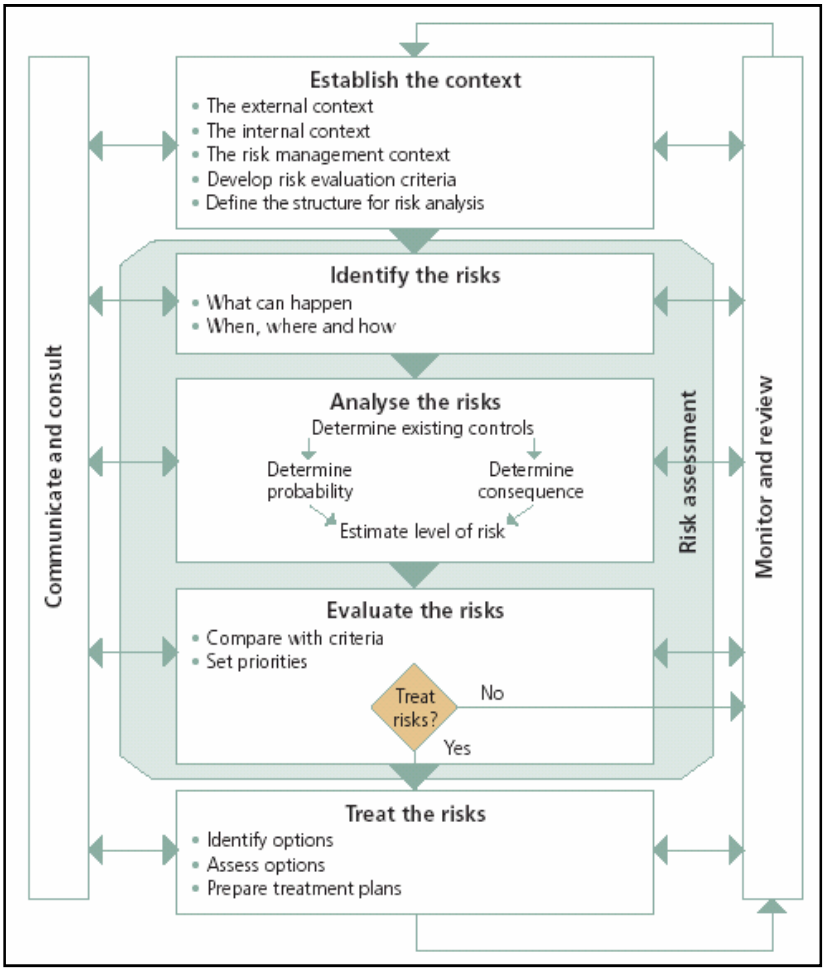
1. team of personnel with suitable experience and knowledge of coal mining operations and environmental issues in the area associated with the Project;
2. external facilitators for the risk assessment and write-up of results; and
3. aerial photographs, drawings, the DGRs for the Project and other supporting information.

The outcomes of the ERA and associated accountabilities will be integrated into the EIS and overall SCPL management systems so that they are effectively reviewed, implemented and monitored.

1.7 METHOD

1.7.1 Framework

Figure 2 outlines the overall framework utilised for the ERA. This framework is further discussed in Section 1.7.2 - Key Steps with respect to the subject area.



Source: **Standards Australia/Standards New Zealand, 2009.**

Figure 2 - Risk Management Process (AS/NZS ISO 31000:2009)

1.7.2 Key Steps

The key steps in the process included:

1. confirming the scope of the ERA;
2. listing the key assumptions on which the ERA is based;
3. reviewing available data on the Project including reports, plans, maps and aerial photos (both prior to and during the workshop);

4. conducting a team-based risk assessment that:
   a) provided detailed descriptions of the tasks to be undertaken and the proposed method;
   b) identified hazards and assessed the level of risk; and
   c) developed a list of recommended controls to treat the risk (through prevention, monitoring, management and rehabilitation strategies);
5. preparing a draft report in accordance with AS/NZS ISO 31000:2009 (Standards Australia/Standards New Zealand, 2009) and MDG1010 (NSW DII, 2011) standards, for review by SCPL personnel and ERA team members;
6. incorporating comments from SCPL and the ERA team; and
7. finalising the report and issuing a controlled copy for ongoing use.

With respect to the overall framework (Figure 2), steps 1 to 3 above represent the 'establish the context' phase, step 4 represents the 'identify risks', 'analyse risks', 'evaluate risks' and step 5 represents the 'treat risks' phases.

As described in Section 1.1, the outcomes of the ERA and associated accountabilities will be integrated into the EIS and overall SCPL management systems so that they are effectively reviewed, implemented and monitored.

1.7.3 External Facilitation

The team was facilitated through the process by ***SP Solutions*** – a company specialising in risk assessments and risk management programmes. The facilitator, Peter Standish, is experienced with coal mining and many aspects of environmental monitoring and rehabilitation.

The team was encouraged and "challenged" to identify a wide range of environmental impacts or hazards including consideration of far-field impacts (i.e. those impacts affecting the off-site environment).

It is important to understand that the outcomes of this ERA:

1. are process driven;
2. challenge current thinking and may not necessarily reflect "pre-conceived" ideas; and
3. are the result of the team assembled to review the topic and not the result of any one individual or organisation.

2 ESTABLISH THE CONTEXT

2.1 ORGANISATIONAL CONTEXT

SCPL is the proponent and the Project is an extension of the Stratford Mining Complex.

The current mining activities at the Stratford Mining Complex include coal extraction from the existing SCM and BRNOC open cut mining operations. The extracted coal is processed in an existing coal handling and preparation plant (CHPP) at the Stratford Mining Complex.

The location of the existing SCM and BRNOC is shown on Figure 3.

Construction at the SCM commenced in 1995 and the Stratford Main Pit was mined for eight years. The Stratford Main Pit is now used for co-disposal of CHPP rejects and water storage. The BRNOC has been in operation since 2003. All coal produced at BRNOC is transported via existing haul roads to the run-of-mine (ROM) pad, where it is blended and processed in the CHPP. The Stratford Mining Complex currently extracts coal from the Roseville West Pit which commenced in 2007, and from the BRNOC. Small quantities of CHPP rejects are also recovered by excavation from the western co-disposal area for re-processing in the CHPP when the opportunity arises.

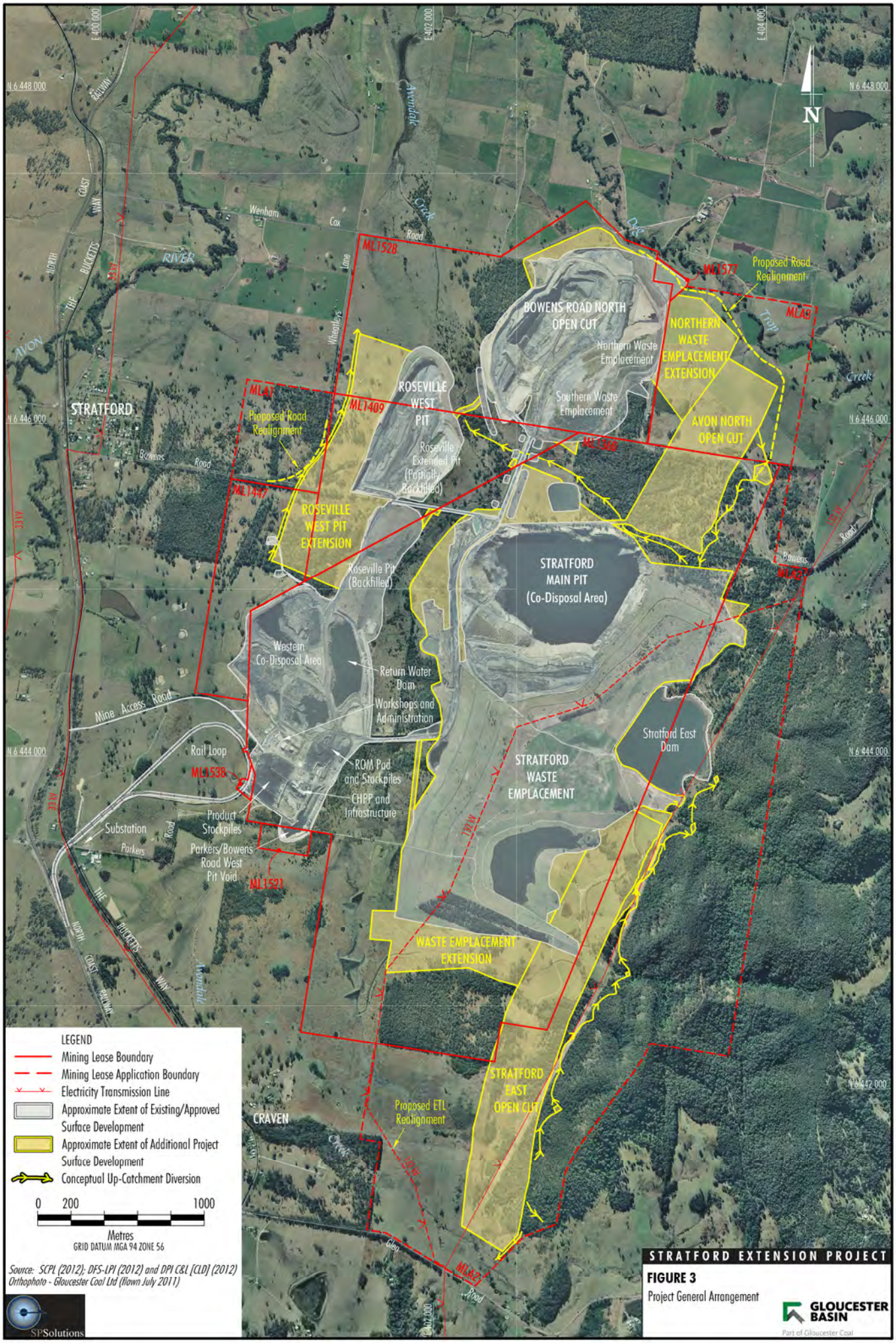
The DCM commenced coal production in 2003. ROM coal mined at the DCM is transported on the North Coast Railway to the Stratford Mining Complex where it is unloaded and processed at the CHPP.

The CHPP is used to process ROM coal from the SCM, BRNOC and the DCM, and to re-process CHPP rejects from the western co-disposal area. Blended coal products are transported by rail to the Port of Newcastle for export and domestic customers.

2.2 PROJECT SUMMARY

The main activities associated with the development of the Project would include (Figure 3):

- ROM coal production up to 2.6 Mtpa for an additional 11 years (commencing approximately 1 July 2013 or upon the grant of all required approvals), including mining operations associated with:
  - completion of the BRNOC;
  - extension of the existing Roseville West Pit; and
  - development of the new Avon North and Stratford East Open Cuts;
- exploration activities;
- progressive backfilling of mine voids with waste rock behind the advancing open cut mining operations;
- continued and expanded placement of mine waste rock in the Stratford Waste Emplacement and Northern Waste Emplacement;
- progressive development of new haul roads and internal roads;
- coal processing at the existing CHPP including Project ROM coal, sized ROM coal received and unloaded from the DCM and material recovered periodically from the western co-disposal area;
- stockpiling and loading of product coal to trains for transport on the North Coast Railway to Newcastle;



GCL-10-12 EIS AppERA_102B

- disposal of CHPP rejects via pipeline to the existing co-disposal area in the Stratford Main Pit and, later in the Project life, the Avon North Open Cut void;
- realignments of Wheatleys Lane, Bowens Road, and Wenham Cox/Bowens Road;
- realignment of a 132 kilovolt (kV) power line for the Stratford East Open Cut;
- continued use of existing contained water storages/dams and progressive development of additional sediment dams, pumps, pipelines, irrigation infrastructure and other water management equipment and structures;
- development of soil stockpiles, laydown areas and gravel/borrow areas, including modifications and alterations to existing infrastructure as required;
- monitoring and rehabilitation;
- all activities approved under DA 23-98/99 and DA 39-02-01; and
- other associated minor infrastructure, plant, equipment and activities, including minor modifications and alterations to existing infrastructure as required.

The Project general arrangement is shown in Figure 3.

A description of the Project is provided in Section 2 in the Main Report to the EIS.

2.3 RISK MANAGEMENT CONTEXT

This ERA has been conducted in accordance with the DGRs for the Project (Section 1.3).

In addition, the ERA was cognisant of the following documents:

- AS/NZS ISO 31000:2009 (Standards Australia/Standards New Zealand, 2009);
- HB 203:2006 *Environmental Risk Management – Principles and Process* (Standards Australia/Standards New Zealand, 2006); and
- MDG1010 (NSW DII, 2011).

A Preliminary Environmental Assessment was undertaken for the Project in 2011 (SCPL, 2011). The key potential environmental impacts identified in the assessment relating to the Project were also considered in this ERA.

2.4 RISK CRITERIA

The risk criteria utilised is to reduce the risk to *As Low As Reasonably Practicable* (ALARP) or lower. Figure 4 schematically shows the three risk management zones *viz*. intolerable, ALARP and tolerable. The middle zone is referred to as the ALARP zone.

Flying is an example of a risk considered by most people to be a tolerable risk; whilst smoking is generally considered to be an activity which cannot be justified on any grounds from a risk perspective. This is shown graphically in Figure 4. Intolerable items such as smoking are at the top of the pyramid whereas much lower risks, such as flying, sit at the lower end of the ALARP zone (close to tolerable).

The risk ranking matrices used during the ERA workshop are presented in Section 4.

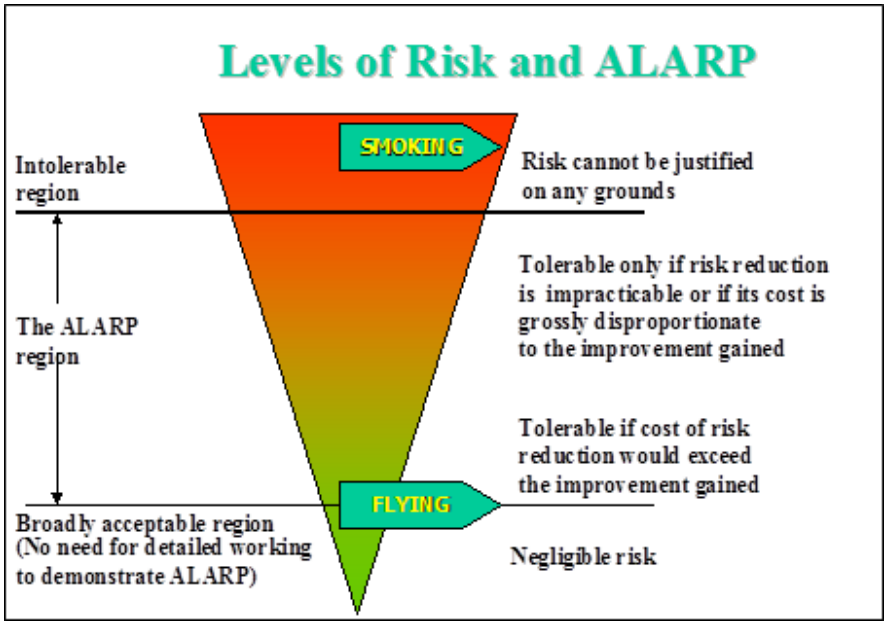


Figure 4 – Risk Criteria "ALARP"

3 IDENTIFY RISKS

3.1 OVERVIEW

The identification of risks involved the use of risk assessment "tools" appropriate for identifying potential loss scenarios associated with the Project. The tools used were:

- Introduction – Before the potential issues were brainstormed, it was important that the whole team had a good understanding of the Project. This was confirmed by the facilitator.
- Brainstorming – This was used to draw out the main issues using the understanding, relevant experience and knowledge of the team. This session also used prompt words to build on the experience base of the team and identify any potential environmental issues and potential loss scenarios.
- Modified Hazard and Operability (HAZOP) Analysis – This involved the review of key words drawn from the DGRs for the Project and aerial photographs, and the consequent identification of potential environmental issues at each location during each phase of operation.

3.2 ERA TEAM

The team met for the ERA workshop at the Stratford Mining Complex on 19 January 2012. A team-based approach was utilised in order to have an appropriate mix of skills and experience to identify the potential environmental issues and potential loss scenarios. All team members also reviewed the content of this report. Details of the team members and their relevant qualifications and experience are included in Table 1.

Table 1 – ERA Team

Name	*Position/Affiliation*	*Relevant Qualifications and Experience*
Peter Standish	Facilitator - SP Solutions	PhD, BE (Hon), Dip Bus Mgt, Risk Analysis Trained. Certificate of Competence as a Manager. Thirty-three years of experience in underground and open cut mining operations with operating, managerial and contract management experience. Involved in environmental risk reviews for seven years. Conducting Risk Analyses for 12 years.
Mike Smith	General Manager - Gloucester Basin – SCPL	Dip Chemistry, RCA Trained/Presenter (Tap Root). Forty years industrial experience.
Tony Dwyer	Manager Environment and Approvals – SCPL	BSc - Grad Dip Natural Resources, Masters of Env & Business Mgt. Fifteen years industrial experience
Noel Merrick	Principal - Heritage Computing	PhD, MSc, GDip (DP), BSc; Groundwater modeller, hydrogeologist & geophysicist. Forty years experience.
Tony Marszalek	Principal Engineer - Gilbert & Associates	M Eng, BE (Civil), 26 years experience in mining related waste and water resources
Ronan Kellaghan	Senior Air Quality Scientist - PAE Holmes	BSc, MSc, 10 years industrial experience in Environmental sector. Eight years consulting in air quality in Australia.
Francine Triffett	Environmental Scientist - PAE Holmes	B Resource & Environmental Mgt. Three and a half years experience.
Glenn Thomas	Technical Director - SLR Consultants	BSc. Twenty years experience in mining and infrastructure noise impact assessment and control.

Table 1 – ERA Team (Continued)

Name	*Position/Affiliation*	*Relevant Qualifications and Experience*
Peter Cribb	Principal – Resource Strategies	BAg Sc. Over 20 years industry experience.
Aaron Hagenbach	Senior Environmental Manager – Resource Strategies	BE (Env)(Hon). Twelve years experience environmental management and project approvals in resource industry.
Clive Berry	Senior Environmental Manager - Resource Strategies	BE (Environmental). Eleven years experience environmental management and project approvals in resource industry.
Jamie Gleeson	Environmental Manager - Senior Ecologist - Resource Strategies	BSc (Ecology)(Hon). Eleven years experience in ecological assessment and environmental management in resource industry.
Jamie Warwick	Environmental Project Manager - Resource Strategies	BE (Civil). One year environmental management experience.

3.3 RISK IDENTIFICATION

3.3.1 Brainstorming

The brainstorming process is intended to allow for a relatively unstructured, free flowing series of issues and ideas to be generated. It is enhanced through the use of key word association processes based on work by Edward de Bono, and is intended to generate a wide range of data on losses, controls and general issues related to the Project area.

No "filtering" of the data is allowed during the process and the reader should be conscious of the intent of not missing a potential "left field" loss when reading through the material.

Issues identified during the brainstorming session are presented in Attachment B.

3.3.2 Modified HAZOP

The next "tool" applied with the team was a modified HAZOP. In this process the Project General Arrangement (e.g. Figure 3) was referred to along with a consideration of the phases of operation and the potential impacts that could arise.

The generic key words used in the process representing environmental issue subject areas (generally based on the headings in the DGRs for the Project) were:

- Noise.
- Surface Water.
- Air Quality.
- Groundwater.
- Flora and Fauna.
- Aquatic Ecology.
- Rehabilitation/Closure.
- Socio-Economic.
- Aboriginal/Non-Aboriginal Heritage.
- General.
- Land Resources.
- Transport.
- Visual.

3.3.3 Identification of Key Environmental Issue Types

In accordance with the DGRs for the Project, the key potential environmental issues were identified through a 'voting' system whereby team members were assigned a number of "votes" to allocate to what they considered to be the key environmental issues. Issues that received one or more 'votes' were designated to be key environmental issues. Key potential environmental issues are those issues with assigned 'votes' and are shown in Table 2.

Table 2 – Key Potential Environmental Issues

Ref	Subject Area	Issue Identified	Votes
SX019	Groundwater	Potential cumulative groundwater impacts as a result of the AGL Gloucester LE Pty Ltd (AGL) Gloucester Gas Project, proposed Rocky Hill Coal Project and the Project.	10
SX020	Groundwater	Final void water management and development of groundwater sinks in the long-term.	1
SX072	Groundwater	Potential groundwater related impacts (e.g. baseflow loss) on Dog Trap Creek, Avondale Creek and associated alluvium	4
SX085	Groundwater	Potential reduction in yield in surrounding landholder bores (e.g. Stratford) resulting from the Project.	2
SX072A	Groundwater	Potential leakage of stored mine water in the Stratford East Dam through underlying coal seams to Stratford East Open Cut – resulting in higher groundwater inflows requiring management..	1
SX007	Surface Water	Potential for long-term spill of water with elevated salinity from final voids.	5
SX008	Surface Water	Long-term stability of upslope permanent diversions.	2
SX009	Surface Water	Long-term stability of unnamed tributary to Avondale Creek.	1
SX014	Surface Water	Design of post-mine landform water management to be stable in the long-term, including upslope diversions.	8
SX018	Surface Water	Site water balance and management of surplus mine water on-site to achieve zero discharge of mine water.	6
SX024	Noise	Potential for intrusive noise and sleep disturbance impacts on some receivers including dwellings, schools, a church and recreational areas resulting from Project operations.	8
SX026	Noise	Noise amenity and sleep disturbance impacts on near-by receivers from Project road and rail operations during daytime, evening and night-time.	6
SX089	Noise	Operational requirement for additional fixed and mobile plant – leading to additional noise impacts.	2
SX101	Noise	Noise performance and non-compliance with noise criteria during Project operations.	7
SX030	Air Quality	Increased emissions of PM_{10}/$PM_{2.5}$/total suspended particulates (TSP)/dust deposition from the Project resulting in the potential for increase in predicted impact (health and amenity) at residential receivers.	10
SX031	Air Quality	Potential for increase in cumulative impact associated with the Project, proposed Rocky Hill Coal Project and the AGL Gloucester Gas Project.	2
SX032	Air Quality	Heightened community concern regarding health related air quality issues, including cumulative impacts.	4
SX0084	Air Quality	Potential for an increase in dust and aerial contaminants on Stratford homes, resulting in contamination of their tank water supplies.	1
SX091	Air Quality	Changes in the air quality effects between modelled and actual levels experienced (due to conservative assumptions in modelling).	1
SX038	Flora & Fauna	Potential for loss of terrestrial flora and fauna and their habitat - other species (non-threatened).	4
SX039	Flora & Fauna	Fragmentation of habitats impacting movement of fauna.	5
SX040	Flora & Fauna	Potential impacts on threatened fauna species (Squirrel Glider, Glossy Black-cockatoo and New Holland Mouse).	5
SX044	Flora & Fauna	Failure of revegetation and/or habitat enhancement in the offset area or biodiversity enhancement areas.	1

Table 2 – Key Potential Environmental Issues (Continued)

	Subject Area		Votes
SX047	Flora & Fauna (Aquatic Ecology)	Potential change in flow persistence in Avondale Creek, Dog Trap Creek and/or Avon River leading to adverse aquatic ecology impacts.	2
SX068	Aboriginal/ Non-Aboriginal Heritage	Potential indirect impacts on potential cultural site CTS-1.	1
SX051	Socio-Economic	Potential impacts on amenity (effects on tourism, loss of farming land, proximity to Stratford), water quality (environmental), noise, air quality, health and transport.	4
SX043	Rehabilitation /Closure	Potential for failure of revegetation and/or habitat enhancement on post-mine landforms.	1
SX083	Rehabilitation /Closure	Geotechnical issues related to the Roseville West Pit Extension (where excavating through reject material).	2
SX062A	Rehabilitation /Closure	Long-term stability and rehabilitation of CHPP rejects deposited in the co-disposal areas.	5

The key potential environmental issues identified in the ERA will be addressed in the EIS and its supporting specialists reports, included as appendices to the EIS:

- Appendix A – Groundwater Assessment.
- Appendix B – Surface Water Assessment.
- Appendix C – Noise and Blasting Assessment.
- Appendix D – Air Quality and Greenhouse Gas Assessment.
- Appendix E – Flora Assessment.
- Appendix F – Terrestrial Fauna Assessment.
- Appendix G – Aquatic Ecology Assessment.
- Appendix H – EPBC Act Controlling Provisions.
- Appendix I – Aboriginal Cultural Heritage Assessment.
- Appendix J – Non-Aboriginal Heritage Assessment.
- Appendix K – Agricultural Assessment.
- Appendix L – Geochemistry Assessment.
- Appendix M – Land Contamination Assessment.
- Appendix N – Road Traffic Assessment.
- Appendix O – Visual Assessment.
- Appendix P – Socio-Economic Assessment.
- Appendix Q – Preliminary Hazard Analysis.

3.3.4 Overview of Priorities by Study Area

The key potential environmental issues identified in Section 3.3.3 were then grouped by study area to obtain an indication of the priority environmental study areas for the EIS. The identified priority environmental study areas for the Project EIS based on the voting system adopted in the ERA are (number of votes received in each study area in parentheses):

- Noise (23).
- Surface water (22).
- Groundwater (18).
- Air Quality (18).
- Flora and Fauna (includes Aquatic Ecology) (17).
- Rehabilitation/closure (8).
- Socio - Economic (4).
- Aboriginal/non-aboriginal heritage (1).

The number of votes assigned to each priority study area is shown graphically in Figure 5.

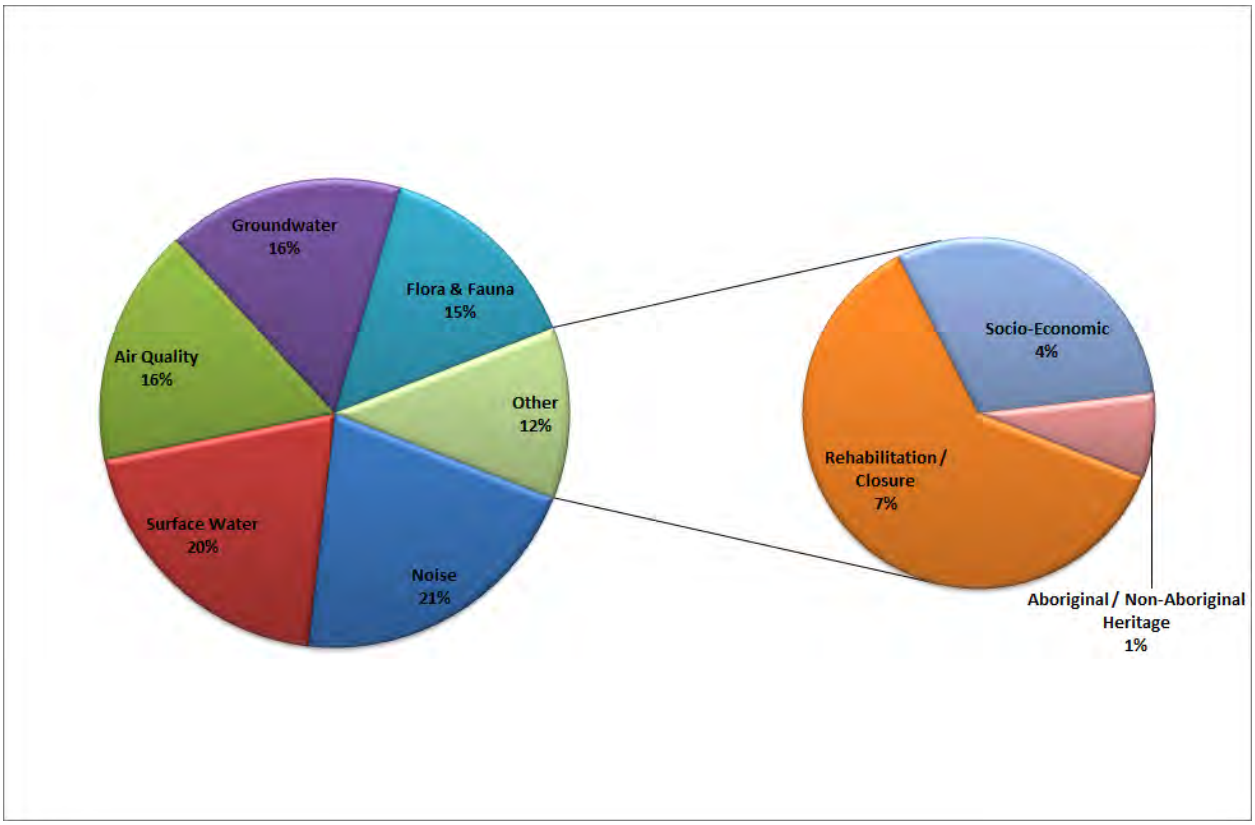


Figure 5 – Proportional Priorities by Study Area (ERA Team Assigned)

4 ANALYSE RISKS

4.1 PROBABILITY AND MAXIMUM REASONABLE CONSEQUENCE

Potential loss scenarios (primarily based on the identified key potential environmental issues) were ranked for risk by the ERA team. A tabular analysis was used for this risk ranking process, based on the probability and consequence of a loss scenario occurring as decided by the ERA team.

The following definition of risk was used:

- the combination of the probability of an unwanted event occurring; and
- the maximum reasonable consequences (MRCs) should the event occur.

Table 3 to Table 6 inclusive present the ERA matrix tools that were utilised for ranking risks.

Table 3 – Qualitative Measures of Probability

Rank (P)	Probability	Descriptor
A	Almost Certain	Happens often
B	Likely	Could easily happen
C	Possible	Could happen and has occurred elsewhere
D	Unlikely	Hasn't happened yet but could
E	Rare	Conceivable, but only in extreme circumstances

Table 4 – Qualitative Measures of Maximum Reasonable Consequence[1]

Ref (C)	Consequence	Comment
1	Extreme environmental harm	E.g. widespread catastrophic impact on environmental values of an area.
2	Major environmental harm	E.g. widespread substantial impact on environmental values of an area.
3	Serious environmental harm	E.g. widespread and considerable impact on environmental values of an area.
4	Material environmental harm	E.g. localised and considerable impact on environmental values of an area.
5	Minimal environmental harm	E.g. minor impact on environmental values of an area.

[1] Notes: MRC: – The worst-case consequence that could reasonably be expected, given the scenario and based upon experience at the operation and within the mining industry.

Table 5 – Quantitative Measures of Maximum Reasonable Consequence

Asset/Infrastructure	
1	More than $50 million (M) loss or production delay
2	$10M to $50M loss or production delay
3	$1M to $10M loss or production delay
4	$100 thousand (k) to $1M loss or production delay
5	Less than $100k loss or production delay

Table 6 – Risk Ranking Table

Consequence (C)	Probability (P)					
		A	B	C	D	E
	1	1 (H)	2 (H)	4 (H)	7 Med	11 Med
	2	3 (H)	5 (H)	8 Med	12 Med	16 (L)
	3	6 (H)	9 Med	13 Med	17 (L)	20 (L)
	4	10 Med	14 Med	18 (L)	21 (L)	23 (L)
	5	15 Med	19 (L)	22 (L)	24 (L)	25 (L)

Notes:

L = Low; M = Moderate; H = High

Risk Numbering:
1 = highest risk, 25 = lowest risk

Legend:

Risk Levels:

	Tolerable
	ALARP
	Intolerable

4.2 RISK RANKING

Using the ERA matrix tools (Tables 3 to 6), risk ranking was undertaken by the team on loss scenarios based on the key potential environmental impacts (Table 7).

Table 7 – Risk Ranking Results

Study Area	Issue	Ranking Basis/Unwanted Event	Consequence	Probability	Risk[1]
Groundwater	Potential cumulative groundwater impacts as a result of the AGL Gloucester Gas Project, proposed Rocky Hill Coal Project and the Project.	Considered the potential for groundwater depressurisation/drawdown and impact on surrounding groundwater users. Risk considered both with and without AGL Gloucester Gas Project and proposed Rocky Hill Coal Project and cumulative scenario assumed that AGL wells would be installed between Roseville West Pit Extension and Stratford concurrent with Roseville West Pit Extension mining. Mitigation discussion noted that the timing/sequence of the other operations to occur concurrently is not certain, therefore the issue was also considered on an SCPL only basis.	**4** **4**	**B** **C**	**14 Medium (cumulative)** **18 Low (SCPL only)**
	Final void water management and development of groundwater sinks in the long term.	Considered the potential for surface water spills from final voids due to reporting catchment and pit inflows. Mitigated by design of void to be a groundwater sink in the long term e.g. reduction of size of final void by partially backfilling completed pit with waste rock, minimisation of surface water catchment reporting to final void and final void water balance indicating that spills are unlikely.	**5**	**C**	**22 Low**
	Potential groundwater related impacts (e.g. baseflow loss) on Dog Trap Creek, Avondale Creek and associated alluvium.	Considered the depressurisation of underlying coal measures and potential for reduction of flows in Dog Trap Creek and Avondale Creek from removal of alluvium with contained water and potential impacts on baseflow. Dog Trap and Avondale Creeks considered separately. Mitigated by avoidance of mining within Dog Trap Creek alluvium and recovery of groundwater levels post-mining.	**4** **5**	**A** **A**	**10 Medium (Dog Trap Creek)** **15 Medium (Avondale Creek)**

Table 7 – Risk Ranking Results (Continued)

Study Area	Issue	Ranking Basis/Unwanted Event	Consequence	Probability	Risk[1]
Groundwater (Continued)	Potential reduction in yield in surrounding landholder bores (e.g. Stratford) resulting from the Project.	Considered the potential for reduced yield/access to water for surrounding landholders including Stratford bores as a result of groundwater depressurisation/drawdown (Project-only).	**4**	**C**	**18 Low**
	Potential leakage of stored mine water in the Stratford East Dam through underlying coal seams to Stratford East Open Cut – resulting in higher groundwater inflows requiring management.	Considered potential for leakage of water from Stratford East Dam to the Stratford East Open Cut during mining operations. Mitigated by limited potential for environmental impact as any water would be collected in mine water system and managed accordingly.	**5**	**E**	**25 Low**
Surface Water	Potential for long-term spill of water with elevated salinity from final voids.	Considered the potential for long-term saline contaminant migration to downstream waterways and consequent impacts on downstream water users and ecology. This could occur if the void does not act as a localised groundwater sink. Risks considered separately for surface water users and aquatic ecology.	**4** **3**	**E** **E**	**23 Low (surface water users)** **20 Low (aquatic ecology)**
	Long-term stability of unnamed tributary to Avondale Creek.	Considered the potential for stability issues associated with an unnamed tributary of Avondale Creek, when water is temporarily diverted into it as part of the upslope water diversion system. Mitigated by the progressive development of upslope diversions (and reporting catchment), short-term and localised impacts (whilst upslope water is being diverted there during operations).	**5**	**E**	**25 Low**
	Design of post-mine landform water management to be stable in the long-term, including upslope diversions.	Considered long-term sediment/contaminant migration to downstream waterways and consequent impact on downstream water users and ecology. A failure of the landform could potentially cause these losses to occur. Risks considered separately for surface water users and aquatic ecology.	**4** **3**	**D** **D**	**21 Low (surface water users)** **17 Low (aquatic ecology)**

Table 7 – Risk Ranking Results (Continued)

Study Area	Issue	Ranking Basis/Unwanted Event	Consequence	Probability	Risk[1]
Surface Water (Continued)	Site water balance and management of surplus mine water on-site to achieve zero discharge of mine water.	Considered the potential for an uncontrolled discharge of mine water. Mitigated by site water management system design and implementation (i.e. minimise disturbed catchment; progressive rehabilitation resulting in free-draining landforms; expansion of dust suppression use and irrigation on contained catchments; use of pit voids and disruption to mine operations [operational risk]).	**4**	**E**	**23 Low (surface water users/ aquatic ecology)**
Noise	Potential for intrusive noise and sleep disturbance impacts on some receivers including dwellings, schools, a church and recreational areas resulting from Project operations.	Considered exceedances of criteria leading to a significant loss of amenity amongst receivers. Mitigated by use of noise attenuated fleet items, bunding of on-site haul roads and rail operations, and operation of a real-time noise monitoring system.	**4**	**B**	**14 Medium**
	Noise amenity and sleep disturbance impacts on near-by receivers from Project road and rail operations during daytime, evening and night-time.	Considered potential for additional rail noise impacts. Mitigated by minimal additional train movements for the Project (i.e. one additional peak rail movement per day).	**4**	**B**	**14 Medium**
Air Quality	Increased emissions of PM_{10}/$PM_{2.5}$/TSP/dust deposition from the Project resulting in the potential for increase in predicted impact (health and amenity) at residential receivers.	Considered the potential for exceedance of criteria leading to loss of amenity and health impacts amongst receivers. Mitigated by air quality mitigation measures (including additional watering) to minimise predicted air quality impacts.	**4**	**B**	**14 Medium**
	Potential for increase in cumulative impact associated with the Project, proposed Rocky Hill Coal Project and the AGL Gloucester Gas Project.	Considered the increased potential for cumulative impacts. Mitigated by distance between proposed operations and orientation of the operations relative to each other limits potential for cumulative impacts.	**4**	**D**	**21 Low**

Table 7 – Risk Ranking Results (Continued)

Study Area	Issue	Ranking Basis/Unwanted Event	Consequence	Probability	Risk[1]
Air Quality (Continued)	Potential for an increase in dust and aerial contaminants on Stratford homes resulting in contamination of their tank water supplies.	Considered the possibility of contamination of residential water supplies sourced from household tanks. Mitigated by relatively low contribution of air pollutants by the mine and findings of a range of scientific studies including a local Gloucester Shire Council study.	**5**	**E**	**25 Low**
Flora & Fauna	Potential for loss of terrestrial flora and fauna and their habitat - other species (non-threatened)	Considered the potential loss of a local population (non-threatened fauna) and their habitats. Mitigated by minimisation of disturbance areas, Flora and Fauna Management Plan and Project offset outcomes.	**4**	**E**	**23 Low**
	Fragmentation of habitats impacting movement of fauna.	Considered the potential for increased isolation of habitat due to Project-related clearing, leading to a decrease in habitat connectivity and therefore the potential for a decrease in fauna diversity. Mitigated by minimisation of disturbance areas, Flora and Fauna Management Plan and Project offset.	**4**	**C**	**18 Low**
	Potential impacts on threatened fauna species (Squirrel Glider, Glossy Black-cockatoo and New Holland Mouse).	Considered the potential loss of a local population (threatened fauna). Mitigated by minimisation of disturbance areas, Flora and Fauna Management Plan and Project offset.	**3**	**D**	**17 Low**
	Failure of revegetation and/or habitat enhancement in the offset area or biodiversity enhancement areas.	Considered the potential for failure of biodiversity enhancement in offset areas. Considered with monitoring of rehabilitation progress and implementation of remedial measures in place.	**4**	**D**	**21 Low**
	Potential change in flow persistence in Avondale Creek, Dog Trap Creek and/or Avon River leading to adverse aquatic ecology impacts.	Considered the potential for changes in flow regimes in Avondale Creek, Dog Trap Creek and/or Avon River resulting in adverse impacts on aquatic ecology. Mitigated by implementation of upslope diversion system and progressive rehabilitation to minimise catchment excision over the life of the Project.	**5** **5** **5**	**A** **E** **C**	**15 Medium (Avondale Creek)** **25 Low (Avon River)** **22 Low (Dog Trap Creek)**

Table 7 – Risk Ranking Results (Continued)

Study Area	Issue	Ranking Basis/Unwanted Event	Consequence	Probability	Risk[1]
Aboriginal/Non-Aboriginal Heritage	Potential indirect impacts on potential cultural site CTS-1.	Considered the potential for damage to potential cultural site CTS-1 due to proximate mining activities. Mitigated by the isolation of the area, therefore avoiding any direct impacts, and that predicted blast vibration levels are likely to be below relevant criteria.	**4**	**D**	**21 Low**
	Potential for failure of revegetation and/or habitat enhancement on post-mine landforms.	Considered the potential for failure of revegetation and/or habitat enhancement on post-mine landforms, and failure to establish biodiversity in areas rehabilitated to woodland. Mitigated by past successful rehabilitation practices and appropriate future rehabilitation planning.	**3**	**D**	**17 Low**
	Geotechnical issues related to the Roseville West Pit Extension (where excavating through reject material).	Considered the challenges of rehabilitating exposed rejects in the low wall of the Roseville West Pit Extension, potentially resulting in an unstable final landform and failure of old Roseville Pit. Mitigated by geotechnical considerations incorporated into final pit design.	**4**	**D**	**21 Low**
	Long-term stability and rehabilitation of CHPP rejects deposited in the Stratford Main Pit (co-disposal area).	Considered the potential for stability and rehabilitation success of rehabilitation of areas above CHPP rejects emplacements. Mitigated by placement of rejects below the groundwater table level and placement of waste rock on top of rejects material.	**5**	**C**	**22 Low**

5 MONITOR AND REVIEW

5.1 NOMINATED CO-ORDINATOR

The nominated client review facilitator is Tony Dwyer, Manager Environment and Approvals, SCPL.

It is understood the nominee will co-ordinate the inclusion of the key potential environmental issues into the various studies undertaken as part of the EIS and the overall SCPL management systems.

5.2 COMMUNICATION AND CONSULTATION

Consultation, involvement of personnel (SCPL and their specialists) and communication of the process and outcomes of the ERA are intended to be achieved by the inclusion of this report and the relevant specialist assessments addressing the key potential environmental issues in the EIS and the overall SCPL management systems.

5.3 CONCLUDING REMARKS

The risk assessment process conducted by the team was aligned with AS/NZS ISO 31000:2009 (Standards Australia/Standards New Zealand, 2009) and MDG1010 (NSW DII, 2011), with the intention of identifying the key potential environmental issues for the Project to be further assessed in the EIS.

An appropriately detailed assessment of the key potential environmental issues will be included in the EIS appendices/sections, as presented in Table 8.

Table 8 – Key Potential Environmental Issues to be Further Assessed in the EIS

Ref	Subject Area	Issue Identified	EIS Appendix/Section
SX019	Groundwater	Potential cumulative groundwater impacts as a result of the AGL Gloucester Gas Project, proposed Rocky Hill Coal Project and the Project.	Appendix A and Section 4
SX020	Groundwater	Final void water management and development of groundwater sinks in the long-term.	Appendix A and Section 4
SX072	Groundwater	Potential groundwater related impacts (e.g. baseflow loss) on Dog Trap Creek, Avondale Creek and associated alluvium.	Appendix A and Section 4
SX085	Groundwater	Potential reduction in yield in surrounding landholder bores (e.g. Stratford) resulting from the Project.	Appendix A and Section 4
SX072A	Groundwater	Potential leakage of stored mine water in the Stratford East Dam through underlying coal seams to Stratford East Open Cut – resulting in higher groundwater inflows requiring management.	Appendix A and Section 4
SX007	Surface Water	Potential for long-term spill of water with elevated salinity from final voids.	Appendix B and Section 4
SX008	Surface Water	Long-term stability of upslope permanent diversions.	Appendix B and Section 4
SX009	Surface Water	Long-term stability of unnamed tributary to Avondale Creek.	Appendix B and Section 4
SX014	Surface Water	Design of post-mine landform water management to be stable in the long-term, including upslope diversions.	Appendix B and Section 4
SX018	Surface Water	Site water balance and management of surplus mine water on-site to achieve zero discharge of mine water.	Appendix B and Section 4

Table 8 – Key Potential Environmental Issues to be Further Assessed in the EIS (Continued)

Ref	Subject Area	Issue Identified	EIS Appendix/Section
SX024	Noise	Potential for intrusive noise and sleep disturbance impacts on some receivers including dwellings, schools, church and recreational areas resulting from Project operations.	Appendix C and Section 4
SX026	Noise	Noise amenity and sleep disturbance impacts on near-by receivers from Project road and rail operations during daytime, evening and night-time.	Appendix C and Section 4
SX089	Noise	Operational requirement for additional fixed and mobile plant – leading to additional noise impacts.	Appendix C and Section 4
SX101	Noise	Noise performance and non-compliance with noise criteria during Project operations.	Appendix C and Section 4
SX030	Air Quality	Increased emissions of PM_{10}/$PM_{2.5}$/TSP/dust deposition from the Project resulting in the potential for increase in predicted impacts (health and amenity) at residential receivers.	Appendix D and Section 4
SX031	Air Quality	Potential for increase in cumulative impact associated with the Project, proposed Rocky Hill Coal Project and the AGL Gloucester Gas Project.	Appendix D and Section 4
SX032	Air Quality	Heightened community concern regarding health related air quality issues, including cumulative impacts.	Appendix D and Section 4
SX084	Air Quality	Potential for an increase in dust and aerial contaminants on Stratford homes resulting in contamination of their tank water supplies.	Appendix D and Section 4
SX091	Air Quality	Changes in the air quality effects between modelled and actual levels experienced (due to conservative assumptions in modelling).	Appendix D and Section 4
SX038	Flora and Fauna	Potential for loss of terrestrial flora and fauna and their habitat - other species (non-threatened).	Appendices E and F and Section 4
SX039	Flora and Fauna	Fragmentation of habitats impacting movement of fauna.	Appendix F and Section 4
SX040	Flora and Fauna	Potential impacts on threatened fauna species (Squirrel Glider, Glossy Black-cockatoo and New Holland Mouse).	Appendix F and Section 4
SX044	Flora and Fauna	Failure of revegetation and/or habitat enhancement in the offset area or biodiversity enhancement areas.	Appendices E and F and Section 4
SX047	Flora and Fauna (Aquatic Ecology)	Potential change in flow persistence in Avondale Creek, Dog Trap Creek and/or Avon River leading to adverse aquatic ecology impacts.	Appendix G and Section 4
SX068	Aboriginal/Non-Aboriginal Heritage	Potential indirect impacts on potential cultural site CTS-1.	Appendix I and Section 4
SX051	Socio-Economic	Potential impacts on amenity (effects on tourism, loss of farming land, proximity to Stratford), water quality (environmental), noise, air quality, health and transport.	Appendix P and Section 4
SX043	Rehabilitation/Closure	Potential for failure of revegetation and/or habitat enhancement on post-mine landforms.	Section 5
SX083	Rehabilitation/Closure	Geotechnical issues related to the Roseville West Pit Extension (where excavating through reject material).	Section 5
SX062A	Rehabilitation/Closure	Long-term stability and rehabilitation of CHPP rejects deposited in the co-disposal areas.	Section 5

The risk rankings indicate that the loss scenarios ranked were within the “Medium - ALARP” or the “Low” range.

SP Solutions would like to thank all of the personnel who contributed to the risk assessment in particular those personnel from SCPL and Resource Strategies who prepared source material for the team session.

Peter Standish, March 2012

6 REFERENCES

NSW Department of Industry and Investment (2011) *MDG1010 Mineral Industry Safety and Health Risk Management Guideline.* January 2011.

Standards Australia/Standards New Zealand (2006) *HB 203:2006 Environmental Risk Management – Principles and Process*.

Standards Australia/Standards New Zealand (2009) *AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines.*

Stratford Coal Pty Ltd (2011) *Stratford Extension Project Description and Preliminary Environmental Assessment.*

ATTACHMENT A – DEFINITIONS

Term	Explanation
ALARP	"As Low As Reasonably Practicable". The level of risk between tolerable and intolerable levels that can be achieved without expenditure of a disproportionate cost in relation to the benefit gained.
AS/NZS ISO 31000:2009	Australian Standard/New Zealand Standard on Risk Management (see references in Section 6).
Cause	A source of harm.
Control	An intervention by the proponent intended to either Prevent a Cause from becoming an incident or to reduce the outcome should an incident occur.
DGRs	Director-General's Requirements.
ERA	Environmental Risk Assessment.
MDG1010	NSW Department of Industry and Investment guideline on risk management (see references in Section 6).
Outcome	The end result following the occurrence of an incident. Outcomes are analogous to impacts and have a risk ranking attached to them.
Personnel	Includes all people working in and around the site (e.g. all contractors, sub-contractors, visitors, consultants, project managers etc.).
Practicable	The extent to which actions are technically feasible, in view of cost, current knowledge and best practices in existence and under operating circumstances of the time.
PM_{10}	Particulate matter less than 10 microns in size.
$PM_{2.5}$	Particulate matter less than 2.5 microns in size.
Receiver	A location where people may experience noise or air quality impacts, for example a dwelling.
Review	An examination of the effectiveness, suitability and efficiency of a system and its components.
Risk	The combination of the potential consequences arising from a specified hazard together with the likelihood of the hazard actually resulting in an unwanted event.
TSP	Total Suspended Particulates
TSS	Total Suspended Solids

ATTACHMENT B - ISSUE IDENTIFICATION RESULTS

The output from the team's "brainstorming" is presented below. This list has been sorted according to the study area which were drawn, in part, from the Director-General's Requirements received for the Project.

Ref	Study Area	Issue Identified
SX066	Aboriginal/Non-Aboriginal Heritage	Potential impacts on Aboriginal heritage sites.
SX067	Aboriginal/Non-Aboriginal Heritage	Potential indirect impacts on non-Aboriginal heritage items.
SX068	Aboriginal/Non-Aboriginal Heritage	Potential indirect impacts on potential cultural site CTS-1.
SX073	Aboriginal/Non-Aboriginal Heritage	Potential risks to unknown cultural heritage sites.
SX030	Air Quality	Increased emissions of PM_{10}/$PM_{2.5}$/total suspended particulates/dust deposition from the Project resulting in the potential for increase in predicted impact (health and amenity) at residential receivers.
SX031	Air Quality	Potential for increase in cumulative impact associated with the Project, proposed Rocky Hill Coal Project and the AGL Gloucester LE Pty Ltd (AGL) Gloucester Gas Project.
SX032	Air Quality	Heightened community concern regarding health related air quality issues, including cumulative impacts.
SX033	Air Quality	Increased impacts (health and amenity) associated with the transport of coal by rail.
SX034	Air Quality	Increase in greenhouse gas emissions as a result of the Project and increased financial liability under the carbon tax.
SX035	Air Quality	Impacts associated with blast-fume emissions.
SX036	Air Quality	Odour from spontaneous combustion events.
SX037	Air Quality	Potential dust impacts on 132 kiolvolt (kV) electricity transmission line.
SX075	Air Quality	Greenhouse gas emissions due to transfer of bulk water quantities around the site.
SX084	Air Quality	Potential for an increase in dust and aerial contaminants on Stratford homes resulting in contamination of their tank water supplies.
SX091	Air Quality	Changes in the air quality effects between modelled and actual levels experienced (due to conservative assumptions in modelling).
SX038	Flora & Fauna	Potential for loss of terrestrial flora and fauna and their habitat - other species (non-threatened).
SX039	Flora & Fauna	Fragmentation of habitats impacting movement of fauna.
SX040	Flora & Fauna	Potential impacts on threatened fauna species (Squirrel Glider, Glossy Black-cockatoo and New Holland Mouse).
SX041	Flora & Fauna	Loss of additional vegetation when a large proportion of some vegetation has already been cleared in the region (Cabbage Gum Woodland).
SX042	Flora & Fauna	Incursion and spread of environmental weeds and feral vertebrate fauna.
SX044	Flora & Fauna	Failure of revegetation and/or habitat enhancement in the offset area or biodiversity enhancement areas.
SX045	Flora & Fauna	Loss of fauna due to interactions with the final voids.
SX046	Flora & Fauna	Effects on existing/approved wildlife corridors.
SX047	Flora & Fauna	Potential change in flow persistence in Avondale Creek, Dog Trap Creek and/or Avon River leading to adverse aquatic ecology impacts.
SX079	Flora & Fauna	Potential impacts on the Glen Nature Reserve from Project operations.
SX092	Flora & Fauna	Effects of the operation on the proposed offset (physically close to the operation).
SX062B	Flora & Fauna	Bushfire risk to proposed biodiversity offset.
SX069	General	Potential interactions with the proposed Stroud to Lansdowne Project 330 kV electricity transmission line.
SX070	General	General refuse disposal.
SX082	General	Longer term public safety from the final voids and general site areas and mine landforms.
SX019	Groundwater	Potential cumulative groundwater impacts as a result of the AGL Gloucester Gas Project, proposed Rocky Hill Coal Project and the Project.
SX020	Groundwater	Final void water management and development of groundwater sinks in the long-term.
SX021	Groundwater	Potential groundwater-related impacts on Dog Trap Creek alluvium (i.e. induced leakage).
SX071	Groundwater	Potential impacts (i.e. drawdown, quality and recharge) of the Project on groundwater levels and groundwater dependent surface water features and ecosystems.
SX072	Groundwater	Potential groundwater related impacts (e.g. baseflow loss) on Dog Trap Creek, Avondale Creek and associated alluvium.

Ref	Study Area	Issue Identified
SX085	Groundwater	Potential reduction in yield in surrounding landholder bores (e.g. Stratford) resulting from the Project.
SX072A	Groundwater	Potential leakage of stored mine water in the Stratford East Dam through underlying coal seams to Stratford East Open Cut – resulting in higher groundwater inflows requiring management.
SX059	Land Resources	Potential impacts on land use/capability resulting from the Project.
SX060	Land Resources	Potential impacts on soils and erosion potential resulting from the Project.
SX061	Land Resources	Potential for land contamination.
SX063	Land Resources	Increased bushfire risk.
SX094	Land Resources	Retention of coal handling and preparation plant (CHPP) reagents in rejects (land contamination issue).
SX097	Multiple	Potential for requiring a larger product stockpile if unable to rail coal due to existing consent constraints.
SX022	Noise	Potential blast flyrock impacts on existing/approved infrastructure (i.e. electricity transmission lines, gas pipelines/wells, and roads) or heritage items.
SX023	Noise	Intrusive noise impacts on sensitive receivers resulting from on-site and off-site Project construction, (i.e. internal haul roads, earth bunds and barriers, Wenham Cox Road/Bowens Road, Wheatleys Lane and Bowens Road.
SX024	Noise	Potential for intrusive noise and sleep disturbance impacts on some receivers including dwellings, schools, a church and recreational areas resulting from Project operations.
SX025	Noise	Cumulative noise impacts from the concurrent operation of the Project, AGL Gloucester Gas Project and proposed Rocky Hill Coal Project.
SX026	Noise	Noise amenity and sleep disturbance impacts on nearby receivers from Project road and rail operations during daytime, evening and night-time.
SX027	Noise	Impacts on occupant comfort from air blast and ground vibration emissions as a result of daytime blasting.
SX028	Noise	Potential for vibration impacts on buildings and heritage items.
SX029	Noise	Potential inconsistency between New South Wales (NSW) Industrial Noise Policy assessment process and consented noise and weather limits results in additional periods where real time controls are required.
SX074	Noise	Requirement to purchase nearby properties due to noise affectation (and being unable to do so).
SX078	Noise	Noise related issues associated with Stratford East Open Cut (from an assessment perspective) - potential impacts in the Glen Road area.
SX089	Noise	Operational requirement for additional fixed and mobile plant - leading to additional noise impacts.
SX090	Noise	Degree of buffer required if there is a difference between modelled and actual operational noise levels.
SX096	Noise	Implementation of earlier noise mitigation commitments prior to commencement of the Project.
SX101	Noise	Noise performance and non-compliance with noise criteria during Project operations.
SX043	Rehabilitation/Closure	Potential for failure of revegetation and/or habitat enhancement on post-mine landforms.
SX062	Rehabilitation/Closure	Permanent loss of land due to increased number of final voids.
SX065	Rehabilitation/Closure	Management of CHPP rejects backfilled in-pit - particularly potential acid mine drainage issues.
SX083	Rehabilitation/Closure	Geotechnical issues related to the Roseville West Pit Extension (where excavating through reject material).
SX095	Rehabilitation/Closure	Quality of irrigation water (suitability).
SX062A	Rehabilitation/Closure	Long-term stability and rehabilitation of CHPP rejects deposited in the co-disposal areas.
SX048	Socio-Economic	Continued employment of approximately 125 personnel, including flow on effects to the regional and NSW economy.
SX049	Socio-Economic	Employment of approximately 125 additional personnel.
SX050	Socio-Economic	Continued payment of royalties to the state and other tax payments.
SX051	Socio-Economic	Potential impacts on amenity (effects on tourism, loss of farming land, proximity to Stratford), water quality (environmental), noise, air quality, health and transport.
SX052	Socio-Economic	Continued spending on community initiatives.
SX053	Socio-Economic	Loss of skilled labour from other employment sections to mining.
SX098	Socio-Economic	Loss of retail and administrative personnel in Gloucester to the mine.
SX099	Socio-Economic	Additional "load" on emergency services and other community organisations to support the mine.
SX001	Surface Water	Insufficient site contained water storage capacity or insufficient freeboard leading to spill from contained water storages.

Ref	Study Area	Issue Identified
SX002	Surface Water	Inability of mine water management system to capture contaminated runoff leading to increase in total suspended solids (TSS) Avondale Creek.
SX003	Surface Water	Discharge of potential TSS in runoff to sediment dams which spill to Avondale Creek.
SX004	Surface Water	Saline seepage from waste rock emplacements affecting Avondale Creek.
SX005	Surface Water	Irrigation or dust suppression activities generating salt build-up which migrates through waste rock emplacements as seepage and discharges to Avondale Creek.
SX006	Surface Water	Wind-borne migration of irrigation or dust suppression waters to Avondale Creek.
SX007	Surface Water	Potential for long-term spill of water with elevated salinity from final voids.
SX008	Surface Water	Long-term stability of upslope permanent diversions.
SX009	Surface Water	Long-term stability of unnamed tributary to Avondale Creek.
SX010	Surface Water	Long-term stability of final landform drainage.
SX011	Surface Water	Rupture in CHPP rejects pipeline and discharge of rejects to Avondale Creek.
SX012	Surface Water	Rupture of water pipeline/s pumping mine water across tributary of Avondale Creek leading to downstream discharge.
SX013	Surface Water	Ability of planned Project water management system to be adapted to any planned future modifications/expansions.
SX014	Surface Water	Design of post-mine landform water management to be stable in the long-term, including upslope diversions.
SX015	Surface Water	Potential for spills from final voids.
SX016	Surface Water	Unexpected structural dam (water storage) failure.
SX017	Surface Water	Potential for exacerbation of flooding in Avondale Creek caused by mine landforms and road crossing.
SX018	Surface Water	Site water balance and management of surplus mine water on-site to achieve zero discharge of mine water.
SX064	Surface Water	Potential for salt build-up in rehabilitation areas due to irrigation leading to potential limitation to long-term agricultural production/vegetation growth.
SX077	Surface Water	Geochemical characteristics (potentially acid-forming issues) for waste rock associated with the Stratford East Open Cut.
SX080	Surface Water	Stability of Stratford East and Avon North Open Cut pit walls and potential impact on upslope water diversions (i.e. geotechnical issues).
SX093	Surface Water	Potential for contamination of mine water resulting from use of CHPP reagents.
SX100	Surface Water	Hydrocarbon spill or effluent contaminated runoff into waterways.
SX054	Transport	Impacts on the local road network associated with Project-related traffic, particularly potential for cumulative effects with proposed Rocky Hill Coal Project and AGL Gloucester Gas Project.
SX055	Transport	Increased travel distances due to Wenham Cox Road/Bowens Road, Wheatleys Lane and Bowens Road realignments and effects on road users during construction.
SX056	Transport	Effects of increased number of product coal trains on the rail network.
SX081	Transport	Closure of roads during blasting activities.
SX087	Transport	Change in viewscape due to mining operations - leading to potential transport/driver attention/safety related issues.
SX088	Transport	Off-site issues due to material transported to or from the Project.
SX057	Visual	Effects of increase in height of Stratford Waste Emplacement on visual impacts.
SX058	Visual	Potential for lighting impacts.
SX076	Visual	Impacts of active mine activities.
SX086	Visual	Change in viewscape due to mining operations (potentially significant from some off-site locations).

About Your Report

Your report has been developed on the basis of your unique and specific requirements as understood by ***SP Solutions*** and only applies to the subject matter investigated. Your report should not be used or at a minimum it MUST be reviewed if there are any changes to the project and Key Assumptions. ***SP Solutions*** should be consulted to assess how factors that have changed subsequent to the date of the report affect the report's recommendations. ***SP Solutions*** cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

To avoid misuse of the information contained in the report it is recommended you confer with ***SP Solutions*** before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Costly problems can occur when other design professionals develop their plans based on misinterpretations of the report. To help avoid misinterpretations of the report, retain ***SP Solutions*** to work with other professionals who are affected by the report. Have ***SP Solutions*** explain the report implications to professional affected by them and then review plans and specifications produced to see how they have incorporated the report findings.

The report as a whole presents the findings of the site specific assessment and the report should not be copied in part of altered in any way.

SP Solutions is familiar with a variety of techniques and approaches that are used to identify and reduce a broad range of risks over the life of projects and operations. It is common that not all approaches will be necessarily dealt with in your report due to concepts proposed, recommendations by the team at the time or the scope determined by you. Speak with ***SP Solutions*** to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Reporting relies on:

- interpretation of factual information based on judgement and opinion;
- valid and factual inputs supplied by all third parties;
- key assumptions outside the influence of ***SP Solutions***; and
- the result of any team based approach to review the topic and is therefore not the result of any one individual or organisation (including ***SP Solutions***).

As such, any uncertainty may result in claims being lodged against consultants which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from ***SP Solutions*** to other parties but are included to identify where ***SP Solutions'*** responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from ***SP Solutions*** closely and do not hesitate to ask any questions that you may have.

No warranty of representation, either expressed or implied with respect to this document, its quality, accuracy, merchantability or fitness for a particular purpose is made. As a result, this document is provided "as is" and the reader assumes the entire risk as to its quality and accuracy.

In no event will ***SP Solutions*** be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or inaccuracy in the document, even if advised of the possibility of such damages.

The warranty and remedies set forth above are exclusive and in lieu of all others, oral or written or implied. No employee, associate, contractor or other representative of ***SP Solutions*** is authorised to make any modification, extension or addition to this warranty.