RESPONSE TO SUBMISSIONS

ANGUS PLACE COLLIERY

Angus Place Mine Extension Project

State Significant Development 5602

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Centennial Coal

Angus Place Mine Extension Project

Response to Submissions

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ABBREVIATIONS

ACH	Aboriginal Cultural Heritage
AEMR	Annual Environmental Management Report
ANZECC	Australian and New Zealand Conservation Council
AP	Angus Place
APC-VS2	Angus Place Colliery Ventilation Shaft 2
APC-VS3	Angus Place Colliery Ventilation Shaft 3
AQ	Aquifer
ARMCANZ	Agriculture and Resources Management Council of Australia and New Zealand
BACI	Before After Control Impact
BMCC	Blue Mountains City Council
BMCS	Blue Mountains Conservation Society
CCC	Community Consultative Committee
CMRR	Coal Mine Roof Rating
CSIRO	Commonwealth Scientific and Industrial Research Organisation
dBA	Decibel Noise Level
DEWHA	Former Commonwealth Department Environment, Water Heritage and the Arts
DGRs	Director General's Requirements
DgS	Ditton Geological Services Pty Ltd
DoE	Commonwealth Department of the Environment
DoP	NSW Department of Planning
DP&E	NSW Department of Planning and Environment
DPI NOW	NSW Department of Primary Industries - NSW Office of Water
DPI – OAS&FS	NSW Department of Primary Industries – Office of Agriculture Sustainability and Food Security
DRE	NSW Division of Resources and Energy
EECs	Endangered Ecology Community

EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Agency
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EPL	Environmental Protection License
FCNSW	Forestry Corporation of NSW
GBMA	Greater Blue Mountains Area
GDE	Groundwater Dependent Ecosystem
GHG	Greenhouse Gas
GIA	Groundwater Impact Assessment
GPS	Global Positioning System
GWIA	Groundwater Impact Assessment
ha	Hectare
HCPL	Helensburgh Coal Pty Ltd
IESC	Commonwealth Independent Expert Scientific Committee
KM	Kilometre
KTP	Key Threatening Process
KVAR	Kerosene Vale Fly-ash Repository
LDP	Licensed Discharge Point
LEG	Lithgow Environment Group
LGA	Local Government Area
LW	Longwall
MEP	Mine Extension Project
ML	Megalitre
MOP	Mining Operations Plan
MSEC	Mine Subsidence Engineering Consultants Pty Ltd
MU	Mapping Unit

NCC	Nature Conservation Council
NIA	Noise Impact Assessment
NGER Act	National Greenhouse and Energy Reporting Act 1997 (Cmwlth)
NGOs	Non-Governmental Organisation
NPHS	Newnes Plateau Hanging Swamp
NPSS	Newnes Plateau Shrub Swamp
NPWS	NSW National Parks and Wildlife Service
NSW	New South Wales
NSW Health - NBMLHD	NSW Health – Nepean Blue Mountains Local Health District
NTU	Nephelometric Turbidity Units
OEH	NSW Office of Environment and Heritage
PA	Project Approval
ROM	Run of mine coal
POEO Act	Protection of the Environment Operations Act 1997 (NSW)
PRP	Pollution Reduction Program
PUR	Polyurethane Resin
REA	Reject Emplacement Area
RMS	NSW Roads and Maritime Services
RO	Reserve Osmosis
RPS	RPS Australia East Pty Ltd
SCA	Sydney Catchment Authority
SCSGBM	Stop Coal Seam Gas Blue Mountains
SDWTS	Springvale Delta Water Transfer Scheme
SEPP	State Environmental Planning Policy
SSCAD	Sawyers Swamp Creek Ash Dam
SSD	State Significant Development
SV	Springvale
SWIA	Surface Water Impact Assessment
TAI	The Australia Institute

tCO_2-e	Carbon Dioxide Tonnes Equivalent
TEOM	Tapered Element Oscillating Microbalance
THPSS	Temperate Highland Peat Swamps on Sandstone
TMP	Traffic Management Plan
TSC Act	Threatened Species Conservation Act 1995 (NSW)
TSP	Total Suspended Particulate
VPA	Voluntary Planning Agreement
WMA	Water Management Act 2000 (NSW)
WMP	Water Management Plan

1.0 INTRODUCTION

Angus Place Colliery is an existing underground coal mine producing high quality thermal coal for domestic markets. It is located 15 kilometres to the northwest of the regional city of Lithgow and 120 kilometres west northwest of Sydney in New South Wales.

The mine's current approval (PA06_0021) was granted in September 2006 under Part 3A of the Environmental Planning and Assessment Act, 1979. PA06_0021 and its subsequent modifications remain current and authorises the extraction of up to 4 million tons of run of mine (ROM) coal per annum. The development consent will expire in August 2024. A new Development Consent is required to ensure Angus Place Colliery is operational beyond this date.

An Environmental Impact Statement (EIS) was submitted to NSW Planning and Environment in April 2014 for the Angus Place Mine Extension Project (MEP) (the Project). The exhibition period for the EIS commenced on 12 April 2014 and ended on 26 May 2014.

The Applicant for the Project is Centennial Angus Place Pty Limited (Centennial Angus Place). Angus Place Colliery is owned by Centennial Springvale Pty Limited (as to 50%) and Springvale SK Kores Pty Limited (as to 50%) as participants in the Angus Place/Springvale unincorporated joint venture. Angus Place Colliery is operated by Centennial Angus Place, for and on behalf of, the joint venture participants.

While there has been no change to the Project from that presented in the EIS, additional assessments have however been completed to support the Project which have been included in this Response to Submissions (RTS). These additional assessments include:

- A Regional Water Quality Impact Assessment to assess the impacts of the proposed increase in mine water discharge to the Coxs River catchment as a result of the closing down of the Wallerawang Power Station (**Appendix 2**);
- The establishment of Site Specific Trigger Values for licenced discharge points LDP009 (**Appendix 3**);
- An interpretive report on the EPA's Direct Toxicity Assessment of LDP009 water discharge (**Appendix 9**);
- An ecotoxicology assessment on the Coxs river and mine water discharge (**Appendix 10**);
- An assessment of the height of fracturing above the Springvale and Angus Place longwalls (**Appendix 6**); and
- The revision of the Regional Biodiversity Offset Strategy (**Appendix 4**).

1.1 Scope

This RTS has been prepared in accordance with section 75H(6) of the EP&A Act and considers the matters raised in submissions received by NSW Planning and Environment during the public exhibition of the EIS. This report builds on information presented in the EIS and is to be read in conjunction with the EIS.

The electronic version of the EIS can be found on the NSW Department of Planning and Environment website (http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=5602) or the Centennial Coal website (www.centennialcoal.com.au).

1.2 Project Overview

The Project will:

- in general, include all currently approved operations, facilities and infrastructure of the Angus Place Colliery, except as otherwise indicated in this EIS;
- continue to extract up to 4 million tonnes per annum of ROM coal from the Lithgow Seam underlying the Project Application Area;
- extend the life of the mine for an additional 25 years with rehabilitation to be undertaken after this period.
- develop underground access headings and roadways from the current mining area to the east to allow access to the proposed mining area;
- undertake secondary extraction by retreat longwall mining for the proposed longwall panels LW1001 to LW1019;
- continue to use the existing ancillary surface facilities at the Angus Place Colliery pit top;
- continue to manage the handling of ROM coal through a crushing and screening plant at the Angus Place Colliery pit top and the subsequent loading of the coal onto the existing road haulage trucks for dispatch to offsite locations;
- continue to operate and maintain the existing ancillary surface infrastructure for ventilation, electricity, water, materials supply, and communications at the Angus Place pit top and on Newnes Plateau;
- install and operate seven additional dewatering borehole facilities on Newnes Plateau and the associated power and pipeline infrastructure;
- upgrade and extend the existing access tracks from Sunnyside Ridge Road to the dewatering borehole facilities;
- install and operate dewatering reinjection boreholes and pipeline infrastructure at the existing ventilation facility site (APC-VS2);
- construct and operate a downcast ventilation shaft (APC-VS3) and upgrade the existing access track to the proposed facility from Sunnyside Ridge Road;
- continue to use the existing Springvale Delta Water Transfer Scheme (SDWTS);
- manage predicted increase in mine inflows using a combination of direct water transfer to the Wallerawang Power Station, via the SDWTS, and discharge water through Angus Place Colliery's licensed discharge point LDP001 and Springvale Mine's LDP009;
- continue to undertake existing and initiate new environmental monitoring programmes;

- continue to operate 24 hours per day, seven days per week, 52 weeks a year;
- continue to provide employment to a full time workforce of up to 300 direct employees and contractors;
- progressively rehabilitate disturbed areas at infrastructure sites no longer required for mining operations;
- undertake life-of-mine rehabilitation at the Angus Place pit top and the Newnes Plateau infrastructure disturbance areas to create final landforms commensurate with the surrounding areas and the relevant zonings of the respective areas;
- transfer the operational management and physical infrastructure regarding coal processing and distribution infrastructure to the Centennial Western Coal Services Project (when approved); and
- continue exploration activities, predominately borehole drilling, to further refine the existing geological model.

1.3 Background

In 2011, Springvale Mine and Angus Place Colliery referred (separately) longwall extraction actions to the then Department of Sustainability, Environment, Water, Population and Communities (SEWPaC, now Department of the Environment, DotE) (referred to as EPBC 2011/5949 and EPBC 2011/5952 respectively). To support these applications, a significant body of work, referred to as the Preliminary Documentation, was submitted in 2011 to SEWPaC and placed on public exhibition during the assessment process. The Preliminary Documentation included discussion on:

- The area of THPSS within the proposed mining areas, including the angle of draw;
- The cumulative impacts to THPSS resulting from past and potential mining activities, including how these activities might impact THPSS in a regional context;
- The area of habitat for listed threatened fauna species within the proposed mining areas, including the angle of draw;
- Evidence as to why alternative mining methods including bord and pillar methods, cannot be used, in particular whilst mining under THPSS;
- Information and clarification on whether water is treated prior to discharge; and
- How each operation would ensure that ecosystem health of the THPSS would remain intact, and include ensure that mining would not result in the need to implement ecological community recovery measures. This report included:
    - Information on how the impacts of mining would be assessed, including the use of appropriately scaled statistical analysis (Before-After-Control-Impact, or BACI) with a minimum of 2 years of baseline data
    - A description of the predicted impacts (direct and indirect) and management mechanisms designed to ensure that predicted impacts are avoided in the first instance, where impacts are unavoidable, mitigation and remediation measures were included in the report.

- o Information on the indicators of change, established trigger levels and management responses, including mitigation and remediation measures to protect THPSS.

- o An independent peer review by two experts with expertise in hydrology, water quality, ecology and geomorphology of THPSS (Dr Grant Hose and Dr Kirsty Fryirs) who were approved by the Department.

In 2012, based on the information provided to the Department, these actions were conditionally approved by the Minister. The key conditions of approval for the Springvale Mine[1], relevant to this RTS, were:

1. Unless otherwise agreed by the minister in writing, longwall mining is not to be undertaken in areas directly below known **high quality** sites of temperate highland peat swamps on sandstone or within approved buffer zones (as per condition 2) If at anytime the person taking the action seeks the **minister's** agreement to vary this condition the person taking the action must demonstrate in writing that a proven technology or engineering methodology will be used for the proposed longwall mining that prevents **severe impacts** of **subsidence** on temperate highland peat swamps on sandstone, or that would allow any **severe impacts** on temperate highland peat swamps on sandstone to be remediated[2].

2. Within three months of the date of this approval, the person taking the action must submit details of proposed buffer zones around **high quality** temperate highland peat swamps on sandstone for the **minister's** approval. The buffer zones must be approved by the **minister** before mining of longwalls 416 and 417 can commence.

Throughout 2012 and 2013, Centennial undertook investigations to satisfy these conditions and in 2013 and 2014, Centennial submitted a substantial body of work to the Department of the Environment, including:

- Justification for the selection of a 26.5 degree angle of draw buffer, including background information on the buffer zone selection.

- Application to Mine within Buffer Zones, supported by three volumes of supplementary information, including nine (9) swamp case studies, and various reports on swamp geology, results of ground penetrating radar (GPR) and resistivity studies on East Wolgan Swamp, critical analysis on the different mine geometries between longwall 411 (East Wolgan Swamp impacts) and longwalls 415 to 417, geotechnical investigation into East Wolgan Swamp, and others.

- Various case studies on remediation measures taken to remediate impacts to swamp communities.

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[1] There were no similar conditions for Angus Place, as the referred action was not mining directly under THPSS.

[2] **High quality** is defined as those parts of Sunnyside East and Carne West swamps marked on the relevant Appendix to the approval. **Severe impact** is defined as impacts to THPSS that indicate a long term change in swamp hydrology, water quality of flora composition. This includes fracturing of the rock strata beneath the swamp, evident through an extended (longer than that recorded in reference sites during the same period) reduction in groundwater levels. **Subsidence** is defined as any and all ground movements that result from mining. **Minister** is defined as the Minister administering the Environment Protection and Biodiversity Conservation Act 1999 and includes a delegate of the Minister.

- Springvale Mine Temperate Highland Peat Swamps on Sandstone Monitoring and Management Plan.

- Angus Place Colliery Temperate Highland Peat Swamps on Sandstone Monitoring and Management Plan.

This body of work is extensive, comprehensive and supported by various levels of peer review. For example, both the Springvale Mine Temperate Highland Peat Swamp on Sandstone Monitoring and Management Plan and the Angus Place Colliery Temperate Highland Peat Swamps on Sandstone Monitoring and Management Plan were peer reviewed by Dr David Goldney and Dr Grant Hose. Dr Hose was an expert who had previously been approved by the Department of the Environment to peer review previous swamp reports. Dr David Goldney was the expert who had undertaken an independent investigation into the impacts of mining on swamps at Angus Place Colliery for the then Department of Environment, Water, Heritage and Arts (DEWHA).

As a result of investigations into THPSS hydrogeology and interactions with mine subsidence, changes to the mine design were made, based on reduced mining void widths and increased chain pillar widths. The changes have been made in the context of cover depths in proposed future mining areas in the vicinity of THPSS and are designed to a criterion of sub-critical panel geometry. Subsidence modelling indicates that the design changes will result is very significant reductions to total subsidence and differential subsidence movements. These changes were made specifically to reduce the environmental impacts of longwall mining under the Newnes Plateau, and demonstrate Centennial's commitment to sustainable mining practices.

Since the Interim IESC advice was issued in February 2012, and as identified above, Centennial Coal has prepared, and submitted to the Department of the Environment, numerous documents to demonstrate compliance with the conditions of EPBC approvals for Springvale Mine and Angus Place Colliery, EPBC 2011/5949 and EPBC 2011/5952 respectively. These documents are available on the Centennial Coal website, www.centenniacoal.com.au.

Based on the reports provided to it, on 21 October 2013, the Department of the Environment approved mining beneath THPSS under the terms of EPBC 2011/5949 Condition 1. The mine design approach for all future longwall mining described in the Springvale MEP EIS and the Angus Place MEP EIS in the vicinity of THPSS is consistent with that approved for longwall mining beneath THPSS by DotE under EPBC2011/5949, and is summarised below.

This body of work has been relied upon, and supplemented with additional work, for the Springvale MEP EIS and the Angus Place MEP EIS.

In undertaking this work, Centennial Coal has recognised the conservation values that the Newnes Plateau and Ben Bullen State Forest currently holds and will hold in the future following cessation of forestry and mining activities. These conservation values have been identified through consultation with a number of stakeholders and a literature review of stakeholder documentation, including:

- The Greater Blue Mountains World Heritage Area Strategic Plan (2009 to 2019)[3];

- 'Save our Swamps' documentation (2010);

- Review of Piezometer Monitoring Data in Newnes Plateau Shrub Swamps and their Relationship with Underground Mining in the Western Coalfield, DECCW (2010);

[3] A full list of references is available in the Regional Biodiversity Strategy, at **Appendix 4**

- Coalpac Consolidation Project Planning Assessment Commission Report, (2013);
- The Geoheritage and Geomorphology of the Sandstone Pagodas of the North-western Blue Mountains region (NSW), Washington et al, (2011);
- The Gardens of Stone Park Proposal: Stage 2, the Western Escarpment, Airly-Genowlan Mesa, Newnes Plateau and related Crown lands, (2005)[4];
- The Impact of Coal Mining on the Gardens of Stone, Colong Foundation for Wilderness, (2010); and
- Alteration of Habitat Following Subsidence due to Longwall Mining – Key Threatening Process Listing, Office of Environment and Heritage, (2005).

This review identified the common theme and desire to protect, conserve, preserve and rehabilitate the environmental values of the Newnes Plateau for recreation and tourism purposes. This includes consideration of:

- Threats to conservation values that include (but are not limited to) fire, pests and weeds;
- Methods to establish the health status of swamp communities to guide management decisions, as discussed in Chapter 10.3 of the EIS;
- Impacts of mine water discharge on swamp communities, as discussed in Chapter 2 and Chapter 8 of the EIS;
- Value of pagoda systems that occur within the Banks Wall and Burra Moko Head Sandstones, as discussed in Chapter 2 and Chapter 10.1 of the EIS[5];
- Impacts of mining related activities to areas with potential conservation value, including construction of access roads and utility corridors, historical cliff collapses, potential changes to hydrology; as discussed in Chapter 2 and Chapter 10.1, 10.2 and 10.3 of the EIS;
- Support by Centennial Coal Company Ltd for the reservation of Mugii Murum-ban State Conservation Area in a State Conservation Area in 2011;
- A heritage assessment for the Mount Airly Oil Shale Ruins, completed by Centennial Airly Pty Ltd in 2013;
- A heritage assessment of the St Johns Church, Wallerawang, completed as part of the Lidsdale Siding Upgrade Project;

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[4] Including *The Gardens of Stone Park Proposal Stage Two Illustrated: A proposal to extend the Gardens of Stone and Blue Mountains National Parks and create a Gardens of Stone Conservation Area and a Western Escarpment State Conservation Area*, Blue Mountains Conservation Society and the Colong Foundation for Wilderness, 2005.

Seeing the Gardens…the other Blue Mountains: Nature based tourism and recreation in the Gardens of Stone Stage Two Park Proposal, Blue Mountains Conservation Society and the Colong Foundation for Wilderness, 2009

[5] The EIS refers to the Environmental Impact Statement of the Springvale Mine Extension Project and the Angus Place Colliery Extension Project, unless specified otherwise.

- Discharge of water away from the World Heritage Area and reuse of water for industrial purposes, as discussed in Chapter 10.2 of the EIS;

- Subsidence protection zones whilst maintaining economically viable operations, as discussed in Chapter 8 of the EIS;

- Collection of real time and relevant data to inform understanding of the biodiversity and geo-diversity values, as discussed in Chapter 2 and Chapter 10 and 10 of the EIS;

- Management and monitoring of underground mining operations to achieve predicted height of fracturing, thereby minimising to the greatest extent possible surface related impacts, as discussed in Chapter 2 and Chapter 8 of the Springvale Mine Extension Project EIS and the Angus Place Mine Extension Project EIS; and

- Recognition of the geo-diversity of pagoda systems and avoidance of impacts to these systems within the EIS (Chapter 8)

By taking into consideration the measures identified above, the conservation values of the Newnes Plateau, and the Ben Bullen State Forest, and the management strategies to avoid and mitigate impacts, the mining operations at Angus Place and Springvale can be managed to achieve a future conservation outcome.

On 7th August 2014, the Independent Expert Scientific Committee (IESC) released three reports on Temperate Highland Peat Swamps on Sandstone (THPSS). These reports were commissioned in 2012 by the then Interim Independent Expert Scientific Committee in response to advice sought by SEWPaC on the referrals described above. The Interim IESC advice concluded that:

Given the likelihood that further longwall developments will be proposed in areas containing the listed endangered ecological community, the Interim Committee agreed that it would seek approval from the Minister to commission a program of independent research into issues such as: the capacity to predict subsidence-related impacts on peat swamps from longwall mining; mitigation and remediation techniques, including self-amelioration; the hydrological and hydrogeological characteristics of the temperate highland peat swamps on sandstone community; and the relationship of the orientation and dimensions of longwall mine plans to potential subsidence risk.

These reports are:

- Temperate Highland Peat Swamps on Sandstone: longwall mining engineering design – subsidence prediction, buffer distances and mine design options, knowledge report (Coffey Geotechnics).

- Temperate Highland Peat Swamps on Sandstone: ecological characteristics, sensitivities to change, and monitoring and reporting techniques, knowledge report (Jacobs SKM).

- Temperate Highland Peat Swamps on Sandstone: evaluation of mitigation and remediation techniques, knowledge report (University of New South Wales).

The reports were heavily referenced in the advice provided by the IESC on the Springvale MEP and the Angus Plce MEP on the 25 August 2014.

At the request of the Department of Planning and Environment, Centennial Coal has prepared a response, supported by further technical assessment by subsidence and hydrogeological experts, to the three reports produced by the IESC. This response is included in **Appendix 13**, **Appendix 14** and **Appendix 15**. Responses to the comments raised by the IESC in the advice of 25 August 2014 are included in this RTS.

In general the IESC Reports:

- Do not consider all of the relevant publicly available information in developing arguments about the effects of longwall mining on Temperate Highland Peat Swamps on Sandstone communities (THPSS).
- Where publicly available data has been used in the preparation of the reports certain data has been excluded where it does not support the position argued in the IESC reports.
- Certain reference sources cited in the IESC report contain material which is not based on data and is biased against coal mining.

As noted above, Centennial Coal has invested substantial time and resources into meeting, and exceeding, its compliance obligations under existing approvals, and will continue to do so in the future. Centennial Coal has done this in five broad areas:

1. Investigation of impacts to THPSS, namely East Wolgan Swamp and the consequent Enforceable Undertaking entered into in 2011;
2. Development of an adaptive management framework and response, following the conclusion of investigations;
3. Comprehensive analysis and review of the mine design at both the Springvale and Angus Place operations;
4. Further analysis and review of the potential for impacts to THPSS; and
5. Investigation into the potential impacts of water discharged from the underground mining operations on the receiving environment.

These areas are discussed further below, and are comprehensively addressed in the Springvale MEP EIS, the Angus Place MEP EIS and **Section 3.1.15** of this RTS.

1.3.1 Investigating Impacts to THPSS

Centennial acknowledged in Chapter 2 and Chapter 8 of the Springvale MEP EIS and the Angus Place MEP EIS that longwall mining has caused impacts to certain THPSS, however, as identified in these documents, this has not been the case in all instances.

Chapter 2 of both the Springvale MEP EIS and the Angus Place MEP EIS acknowledged that subsidence impacts to swamp hydrology have been noted at two swamps (Kangaroo Creek Swamp and East Wolgan Swamp). Where impacts to certain THPSS on the Newnes Plateau have occurred, Centennial has conducted extensive research to understand the causes of the impacts. Centennial has used the findings of the research to avoid and mitigate both past and future impacts of longwall mining and related activities to THPSS on the Newnes Plateau.

Extensive research and investigation, lead primarily by work commissioned by the then DEWHA (the Goldney 2010 Report), has shown that impacts to THPSS on the Newnes Plateau have been caused primarily by:

- Licenced discharge of mine water through THPSS; and
- Changes to swamp hydrology caused by cracking of rock substrate beneath THPSS as a result of mine subsidence.

The Goldney 2010 Report found that *the principal cause of impacts* to East Wolgan Swamp and Narrow Swamp was water discharged from the underground mining operations. This finding has been reinforced by research conducted by the University of Queensland, most recently an ACARP report published in July 2014 on monitoring upland swamps the subject of mine subsidence using high resolution imagery. As a result of the finding, Centennial has not discharged mine water through THPSS on the Newnes Plateau since 2010 and is committed to managing mine water through the Water Transfer Scheme (WTS), which transfers mine water off the Newnes Plateau. The finding of major impacts caused by mine water discharge is not acknowledged in the IESC Reports. Further, neither these reports (the Goldney 2010 Report and the University of Queensland research), nor Centennial's response to the findings, have been referenced in the IESC Reports.

Following completion of the DEWHA investigation and the Goldney 2010 Report, in November 2011, Centennial (through its Joint Venture) and the Minister for the Environment entered into an Enforceable Undertaking under section 486DA of the Environment Protection and Biodiversity Conservation Act 1999. Under this Enforceable Undertaking, the Joint Venture entered into a research agreement with the Australian National University to undertake a comprehensive research program into THPSS[6].

It should be noted that within the Enforceable Undertaking, Centennial did not concede to breaching the EPBC Act, however, acknowledged that the Minister considered that the actions taken by Angus Place Colliery and Springvale Mine has resulted in a significant impact to THPSS, specifically, Narrow Swamp, Junction Swamp and East Wolgan Swamp.

More detail on the investigations undertaken by Centennial Coal into the impacts to THPSS is included in Chapter 2 of the Springvale EP EIS and Chapter 2 of the Angus Place MEP EIS and within this RTS at **Appendix 13**, **Appendix 14** and **Appendix 15**, including:

- case studies on all swamps mined under at both Angus Place and Springvale;
- The role of high flow through swamps, in particular, water discharged from underground mining operations;
- The role of major geological fault structures;
- How the longwall orientation and in-situ stress direction/magnitude affects the expression of surface subsidence; and
- The importance of mine design criteria, in particular the use of sub-critical width longwall panels, to reduce the height of continuous fracturing above the longwall.

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[6] It should be noted that in this report, a reference to the federally listed endangered ecological community Temperate Highland Peat Swamps on Sandstone, includes a reference to the State listed endangered ecological communities incorporating the Newnes Plateau Shrub Swamps and Newnes Plateau Hanging Swamps. The extent to which these communities have been described under these listings is discussed further in response to the IESC Report on ecological characteristics of THPSS.

1.3.2 Adaptive Management Framework

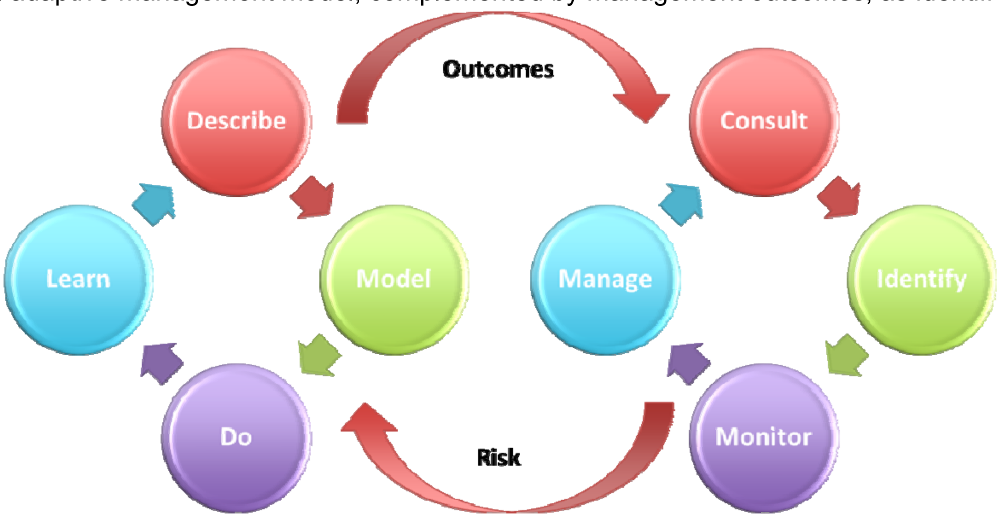
Environmental systems are dynamic and can change through environmental conditions and management actions. Within ecological systems, environmental variation carries an inherent level of uncertainty in the ability to isolate the natural variables that might lead to significant changes. Compounding this, management decisions and expectations can vary over time and can directly and indirectly influence the way environmental systems respond to change.

Uncertainty in natural systems needs to be accounted for in any adaptive management framework, and can include, amongst other things, the inherent environmental variation found in natural systems and the uncertainty around resource definition.

To account for this uncertainty, adaptive management is the structured process of learning through doing, and adapting based on what is learned (Williams, 2011). Williams (2011) suggests that the National Research Council (2004) definition of adaptive management provided a clear understanding of the intent behind an adaptive management framework, notably, one of flexible decision making, adjusted to consider uncertainties, as management outcomes are understood. Monitoring of these outcomes is essential to both scientific understanding as well as iterative management decision making.

Within the Springvale MEP EIS and the Angus Place MEP EIS, new information and the use of new, improved technology have informed Centennial Coal's decision to modify its mine design criteria, currently adopted for Longwall 415 to 417 at Springvale Mine. The outcomes of the information collected from previous longwalls and the longwalls 415 to 417 has been used to inform the mine design used for the Springvale MEP EIS and the Angus Place MEP EIS.

Following the significant body of work undertaken to gain approval under the EPBC Act for the Springvale Mine and Angus Place Colliery described above, in 2012, Centennial Coal commenced a process of establishing an Adaptive Management Framework to each environmental value being assessed through the environmental impact assessment process. This framework consisted of the traditional adaptive management model, complemented by management outcomes, as identified below:



The Framework relies on:

- A description of the environmental value and its role in the landscape, including the aspects of the Project that might result in a significant impact to the environmental value (noting that not all aspects of a project will generate impacts, and that not all aspects of a project will result in a significant impact).
- A model of the environmental response to certain management actions/decisions, supported by the description of the environment, with clearly articulated assumptions.

- Mechanisms to test the model, including the use of sensitivity analyses (where appropriate), and validation of the model with actual data collected (in Centennial's case, this might be site specific data or regional data used where this type of data would add to model interpretation and understanding).

- Engagement with relevant stakeholders in the description of the environment and the development of models, model outcomes and management actions/decisions.

- Identification of clear management objectives for each environmental value.

- Monitoring the system using best available technologies and multiple lines of evidence, to evaluate progress against objectives, determine the status of the system, increase our understanding of the system and the potential impacts to it, and to refine the modelling used to underpin the impact assessment.

- Selection of appropriate management actions, taking into consideration risk, costs, benefits, consequences to resource development and the potential for/likelihood of system recovery.

The outcomes of the framework are reported to relevant stakeholders, with mitigation and remediation actions applied, if required. The whole process is an ongoing system of testing, learning, monitoring and managing. Environmental responses are monitored using multiple lines of evidence to establish threshold criteria against which impacts can be measured. Threshold criteria are based on the environmental response to a range of parameters that, when combined, may result in an undesirable or significant impact. To support this approach, each technical assessment, therefore, within the Springvale MEP EIS and the Angus Place MEP EIS has:

- described the existing environment and included any assumptions/interpretations that were used,

- tested the assessment through predictions of impact that have been subject to sensitivity, validated (using existing data) and/or monitored to evaluate the assessment's effectiveness, and

- provided for the outcomes of monitoring to be analysed against the predictions to understand/refine/modify the assessment and/or the project.

The outcomes derived from the Framework and supporting technical assessments are translated into management plans and/or management commitments.

An example of this adaptive management approach in practice within Centennial Coal was the management of *Persoonia hindii* on the Newnes Plateau following approval of the Springvale Bore 8 Project and the Angus Place Ventilation Facility Project. Both projects were approved to clear 93 and 1269 *P. hindii* respectively. By adopting a management strategy that included maximising avoidance of this threatened species, no plants were removed for the Bore 8 Project and 91 were removed for the Ventilation Facility Project, a reduction of 94%.

The Springvale MEP EIS and the Angus Place MEP EIS included the outcomes of this in several key specialist studies and commitments. These are described further below.

The Adaptive Management Framework is a triple bottom line framework in that, as well as the environmental consequences of the project, it includes consideration of socio-economic impacts and benefits, the costs of these on local and regional communities and the residual consequences of net impacts/benefits on local and regional economies. These assessments include the costs and benefits of the management commitments made within the EIS, and allows for monitoring of the social response to these management actions in the implementation and operational stages of the Projects. As an example of this, further analysis is included Chapter 6 of the Springvale MEP EIS and the Angus Place MEP EIS.

The Centennial Coal Adaptive Management Framework is underpinned by risk. Several risk assessments have been undertaken throughout the development of the Projects to establish a risk profile and ensure that adequate management controls were identified and implemented such that risk and uncertainty could be reduced. Whilst not exhaustive, the key risk areas for the Springval MEP and the Angus Place MEP are:

- Mine design, and its associated subsidence effects resulting in significant or unexpected environmental and social consequences.
- Impacts to State and Federally listed groundwater dependent ecosystems, namely THPSS.
- Impacts to ecosystems of the Upper and Lower Coxs River from water discharges, including impacts to the Sydney Drinking Water Catchment.

As these key risk areas have also been identified by the IESC and the questions presented to that Committee by the joint submission from the Department of Planning and Environment and the Department of the Environment, generalised consideration of these has been included in this section of the RTS. The specific issues raised in submissions on these risk areas are dealt with under **Section 3.1.15** of this RTS.

Other impacts and benefits, including amenity, traffic and agricultural suitability are dealt with individually within this RTS.

1.3.3 Mine Design

Underground mining at the Angus Place Colliery commenced in 1979, whilst underground mining at the Springvale Mine commenced in 1993. Monitoring of the environment on the Newnes Plateau substantially commenced in 2002. Monitoring of the underground mining conditions has been ongoing since the mining operations commenced.

Monitoring data is collected using a range of techniques as detailed below.

Monitored Parameter	Methodology Used
Geological and geotechnical constraints	Landsat photo imagery interpretation Aerial photo interpretation Aeromagnetic data interpretation Surface lineament trends Geological mapping Geotechnical mapping Extensometer data trends (including the use of underground telltales) Longwall support hydraulic pressure trends Internal reports on underground mining conditions Exploration borehole data (cores, geophysical

	logging)
Surface water (commenced in 2002)	Flow gauges
Groundwater (commenced in 2002)	Standpipe piezometers Vibrating wire piezometers
Ecology (commenced in 2003)	Unmanned aerial vehicle surveys LiDAR Ground truthing using quadrats/transects Standpipe piezometers Ecotoxicology testing
Subsidence (ongoing since 1995)	LiDAR Subsidence lines

As detailed in Chapter 2 and Chapter 8 of the Springvale MEP EIS and the Angus Place MEP EIS, this data is analysed to establish the extent to which geological and geotechnical factors can influence subsidence outcomes on sensitive surface features. By adopting these multiple lines of evidence, changes that occur at one location in space can be placed into the context of the surrounding environment.

As described in Chapter 8 of the Springvale MEP EIS and the Angus Place MEP EIS, both the Angus Place Colliery and the Springvale Mine have had a history of difficult geotechnical conditions. Due to these conditions, significant effort has been expended on understanding the underground mining conditions that could result in roof failures, thereby placing personnel and equipment at risk.

Roof conditions are generally poorest where major geological structures are present within the mined seam and high vertical and horizontal stresses occur. Coincident with this, surface expression of subsidence is greatest when geological structures have strong surface expression (typically as deep valleys/gorges) and, in the case of Springvale Mine and Angus Place Colliery, are recognised as basement faults from aeromagnetic data.

A review of subsidence results for all extracted longwalls at Springvale Mine show increases in subsidence above the last six longwalls extracted (LW410 to LW415) as compared to the first ten longwalls (LW1, LW401 to LW409.

Springvale Mine has used width-to-depth ratios to inform future mine design as they are the most important predictors of subsidence behaviour. The ratio is expressed as the longwall void width divided by the depth of cover of strata above the seam. The subsidence effects of these ratios are summarised as follows:

- Subcritical longwall panels are deeper than they are wide ($W/H < 0.9$) and cause lower magnitudes of subsidence than shallower panels due to natural arching of the overburden across the extracted coal seam.
- Critical longwall panels that are almost as deep (H) as they are wide (W) (i.e. $0.9 < W/H < 1.4$) and is the point where yielding of the overburden starts to occur and maximum subsidence is likely to develop if the panel widths are increased.

- Supercritical longwall panels are not as deep (H) as they are wide (W) (i.e. W/H > 1.4) and will cause complete yielding of the overburden and maximum subsidence that is proportional to the mining height (up to 60% of the mined seam thickness).

The measured maximum subsidence above the longwalls LW410 – LW415 with 315 m void widths was higher than the earlier panels (LW1 and LW401 to LW409) where void width ranged from 254 m to 266 m and depths of cover between 300 – 400 m. This placed the wider longwall panels outside the sub-critical range, resulting in surface expression of subsidence effects (as described in Section 2.6.2 and Section 8.2.1).

An analysis of the sensitivity of void widths at Springvale Mine identified that:

- marginal subsidence reductions would occur for longwall void widths between 150 m and 260 m and that the greatest reductions can be made from 315 m to 260 m; and

- marginal strain reduction would occur for widths between 150 m and 260 m and that the greatest reduction can be made from 315 m to 260 m.

The relevance of the Springvale Mine experience is that the previously mined narrower sub-critical longwalls had significantly less subsidence than the wider, critical longwalls that contributed to unpredicted environmental consequences above Springvale Mine. The mine design consequence is that narrower panels (261 m void width) are proven to minimise impacts on sensitive surface features.

For both the Springvale Mine Extension Project and the Angus Place Mine Extension Project, Centennial Coal has implemented a management strategy to avoid or minimise the impacts to sensitive surface features:

1. Avoid mining under the sensitive surface feature; or

2. Where avoidance is not possible, mine design under the sensitive surface feature has a sub-critical void width.

A sub-critical void width of 261 metres with chain pillars at least 55 metres wide will be implemented at Springvale Mine for longwalls 416 to 431.

Variable sub-critical void widths will be implemented at the Angus Place Colliery, as the majority of sensitive surface features have been avoided.

Of critical importance to the sub-critical void width is the subsequent management of the continuous height of fracturing as a result of this mine design change. A significant body of work undertaken over the last 40 years on the issue of hydraulic connection and underground mining has been used as evidentiary input into the height of fracturing model undertaken by DgS (2014) for the Springvale MEP and Angus Place MEP. Reference to work undertaken by Holla (1987, 1989, 1991), Mills and O'Grady (1998), Gale (2008) and Mills (2011), amongst others, was included in the peer review of the DgS model undertaken by MSEC (2014). Research published by the Australian Coal Association Research Program (ACARP) and undertaken by CSIRO (2007) (ACARP C14033) and SCT (2008) (ACARP C13013) highlights that the impact of mining induced fractures depends on a complex combination of the mining geometry and the lithology and geology of the overburden strata.

This conclusion contracts significantly with that of Tammetta (2014) and the IESC Reports. Notably, these reports ignore the work of DgS, considered by several peer reviewers as a superior model due to its basis in geotechnical theory, alignment with Australian conditions and inclusion of geology. Further comparison between the Tammetta Model and the DgS Model can be found in **Appendix 6**.

This approach has avoided direct impacts to 97% of cliffs and pagodas, 5 shrub swamps (and numerous hanging swamps), all major water courses (including Carne Creek and Wolgan River) and all but four (4) aboriginal archaeology sites. Centennial acknowledges that indirect impacts, particularly to

THPSS and the tributaries of major watercourses, have the potential to occur within the Springvale MEP and Angus Place MEP Project Application Areas, and beyond. These indirect impacts have been considered in detail within the respective subsections of Chapter 10 of each EIS, and further detailed in specific responses in this RTS.

All documentation supporting this research, investigations and outcomes is available on the Centennial Coal website, www.centennialcoal.com.au.

1.3.4 Impacts to State and Federally Listed Endangered Ecological Communities

Centennial Coal has acknowledged the importance of the THPSS in the landscape. Research conducted over the last 5 years (2009 to 2014) by the University of Queensland has worked towards quantifying the nature and extent of the community across the Newnes Plateau. Further work undertaken through the Enforceable Undertaking has been targeted towards:

- The nature and extent of THPSS;
- THPSS water balances;
- Functionality of swamps;
- Environmental history and origins;
- Ecology/biodiversity of major structural species;
- Contribution to the landscape;
- Condition status/mapping;
- Monitoring of selected reference sites; and
- Thresholds for recovery.

The University of Queensland is currently conducting research on communities identified as temperate treeless palustrine swamps in a 268 square kilometre area which includes the Newnes Plateau. Based on publicly available combined mapping from the temperate zone of New South Wales and manual interpretation of the numerous vegetation classifications used, a region containing more than 1000 shrub swamp communities per degree of latitude/longitude was identified which contained the communities mapped as Newnes Plateau shrub swamps. A report based on the research will be published and finalised in 2014.

In 2010, the University of Queensland, via funding from the Australian Coal Association Research Program (ACARP) commenced an investigation into the potential of small unmanned aerial vehicle (UAV) platforms to capture imagery of THPSS. The purpose of the research was to establish whether this technology could be used to develop monitoring tools for detecting change in condition and composition of THPSS communities that may then be correlated to potential impacts from underground mining. The project was successful in generating multi-spectral orthophoto mosaics with resolutions of less than 10 centimetres, resulting in greater coverage of THPSS communities in remote and difficult to access locations. The ACARP report was published in September 2014.

Ultimately, it is the swamp condition and health that will determine whether there has been a significant impact. To assist in understanding how to establish impacts, the University of Queensland have developed a Monitoring Handbook, titled Flora monitoring methods for Newnes Plateau Shrub Swamps and Hanging Swamps (2014). This Monitoring Handbook identifies that there are three environmental factors with affect floristics (1) geology, through subsidence responses, (2) hydrology (including water quality, groundwater level, flow and infiltration) and (3) flora composition and condition. The Monitoring Handbook identifies performance indicators for vegetation monitoring that take into consideration these factors and their effects on swamp health. Three trigger levels have been established and will be used to determine impacts, when measured against a baseline:

- Reduction in live vegetation cover of more than 20% within the community, compared with baseline data;
- A single patch of non-vegetative cover greater than $400m^2$ doubles in size compared with baseline data; and
- A significant increase in exotic species cover compared with the baseline data.

The Monitoring Handbook includes a statistically valid sampling design capable of recording change as a result of exceedance of these triggers.

Chapter 2 of the Springvale MEP EIS and the Angus Place MEP EIS describes in detail the research and monitoring outcomes that have been undertaken by Centennial Coal on THPSS of the Newnes Plateau since 2002.This body of data, complemented by a specific exploration drilling program conducted in 2011 and 2012 (incorporating 17 fully cored holes and analysis of a further 84 existing exploration holes with geophysical data) has confirmed a number of assumptions regarding the formation of THPSS, including:

- There are over 3200 THPSS in the Blue Mountains and Southern Highlands, forming over 15000 years ago, and ranging in size from $400m^2$ to 42 hectares (Fryirs, 2013).
- Geology plays a critical role in the formation of swamps, as evidenced by the comprehensive exploration program of the upper geological sequence.
- THPSS typically form where aquitards within the Burralow Formation (highest geological unit on the Newnes Plateau) direct groundwater flow laterally into incised valleys and gorges.
- The YS4 (SP4 in CSIRO COSFLOW Model) aquitard within the Burralow Formation plays a significant role in separating the upper and lower perched aquifers on the Newnes Plateau and is the aquitard above which most THPSS form.
- The thicker the Burralow Formation, the larger the THPSS.
- THPSS also form within the Banks Wall Sandstone, below the Burralow Formation, however, these swamps are generally narrower and less extensive than those that form within the Burralow Formation.
- THPSS have variable hydrology, ranging from periodically waterlogged in the upper reaches and permanently waterlogged in the lower reaches.
- Vegetation characteristics of THPSS[7] are closely associated with local hydrology, meaning that the vegetation within a swamp can be as diverse and the vegetation between swamps.

[7] The State listed Newnes Plateau Shrub Swamps (NPSS, MU50) and Newnes Plateau Hanging Swamps (NPHS, MU51) were described in the 2006 listing as low dense fern-dominated communities usually perched on a hillside with few

- The difference in pre and post mining groundwater levels are attributable to near surface aquitards of the Burralow Formation as evidenced through the calibration and validation pf piezometric data.

- Measured strains at Springvale and Angus Place have been in excess of 0.5mm/m tensile and 2mm/m compressive, without causing measurable impacts to groundwater levels in THPSS.

- Impacts to THPSS have occurred where measured strains have been above 5mm/m tensile and 10mm/m compressive, which has occurred only where longwall panel width is in the critical range.

- Swamp water level fluctuations show a strong correlation to the cumulative rainfall deviation and no relationship to longwall mining.

- Water discharged from underground mining operations is the primary contributing factor to mining related impacts on THPSS.

- There is no evidence of severe impacts to THPSS health as a result of mining related subsidence.

A comprehensive analysis of the impacts of mining on THPSS of the Newnes Plateau was included in Chapter 2 of the Springvale MEP EIS and the Angus Place MEP EIS, and has been detailed further in response to the IESC Reports at **Appendix 13 Appendix 14** and **Appendix 15**. Specifically, a number of factors must occur together in order for a mining related impact to manifest within THPSS. These are detailed in Chapter 2 of the Springvale MEP EIS and the Angi Place MEP EIS, and are further discussed in **Section 3.2.8** of this RTS. In summary:

- Prolonged surface flows at rates of up to 12Ml/day (in the case of impacts to East Wolgan Swamp, this was through licensed discharge from the underground mining operations);

- intersection of major geological fault structures;

- orientation of the longwall panel sub-parallel to the major structures;

- steepness and depth of the valley within which the swamp occurs;

- prevailing in-situ stress direction and magnitude (for example, Springvale longwalls sub-perpendicular to principal horizontal stress direction);

- critical width longwall panel design;

- location of the geological structure close to the permanent barrier pillar; and

- interaction of adjacent mine workings and subsidence effects due to close proximity.

Removing any one of these factors will reduce the likelihood and severity of mining related impacts on THPSS. Through the removal of two of these factors, prolonged surface flows through licensed discharge and implementation of sub-critical longwall panel design, the likelihood and severity of impacts on THPSS is reduced to negligible.

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trees present and are groundwater dependent. The listing for NPHS was based on two sites, the listing for NPSS was based on seven sites.

Centennial's investment in understanding the nature, extent, occurrence and functionality of THPSS has spanned over a decade and run into many millions of dollars. This has resulted in a high level of confidence in the modelled outcomes, management actions and mitigation strategies adopted and implemented at both the Springvale Mine and Angus Place Colliery. The risk of significant impact to THPSS has been reduced to negligible.

Despite the evidence to support that the changes to the mine design will provide an adequate level of protection for THPSS (that is, not result in a significant impact), Centennial has undertaken to provide a hierarchical management strategy for the THPSS within the respective Project Application Areas for the Springvale MEP and the Angus Place MEP. This management strategy is premised on no direct impacts to THPSS, therefore there is no requirement to provide a direct/like for like offset for the community[8].The Regional Biodiversity Strategy includes a management strategy (detailed below) for the management of indirect and residual impacts to THPSS where mitigation measures are not successful.

This management strategy, and the approach to developing it, is described in detail in **Appendix 4**, and summarised below:

- To ensure impacts to THPSS are within those predicted within the Springvale MEP EIS and the Angus Place MEP EIS, Centennial will:
  - Undertake annual monitoring for ecosystem health using the University of Queensland Monitoring Handbook (Flora monitoring methods for Newnes Plateau Shrub Swamps and Hanging Swamps, 2014) or its latest version.
    - The objectives of the University of Queensland Monitoring Handbook include, amongst other things:
      - A focus on vegetation community structure and diversity, including biological indicator species.
      - Trigger values focussed on detecting impacts of subsidence and/or changes in groundwater and surface water flows, including information on how the triggers were derived.
      - A sampling design that is statistically capable of detecting changes in the indicator variables.
      - An adaptive management mechanism for refining trigger values and determining the length of time a THPSS is monitored.
    - The following figure, taken from the Monitoring Handbook, identifies how the data collected will be used to inform management decision making.

[8] This is consistent with the application of the EPBC Offsets Policy and the NSW Offsets Policy for Major Projects.

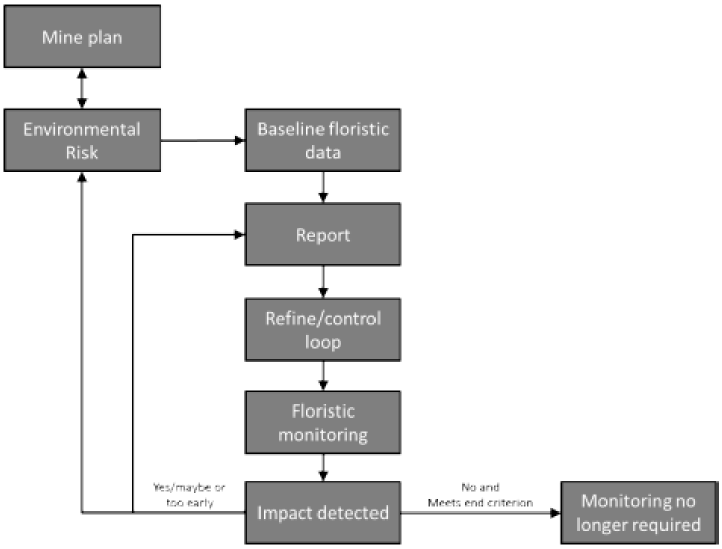


Figure 4.1: Conceptual framework showing how data from flora monitoring informs the environmental risk assessment and monitoring conclusions.

- o Where this monitoring identifies mining related impacts, mitigation measures will be implemented (including soft and hard engineering measures discussed further in **Appendix 4**).
- o Reconcile the annual monitoring every five (5) years (to allow for trend analysis to occur).
  - Where impacts, attributable to mining, are above triggers, additional mitigation will be undertaken.
  - Where impacts are attributable to mining and cannot be mitigated, or mitigation is not successful, offsets for the residual impacts will be provided.

The combination of offset land, using land with higher conservation priorities, and the THPSS management strategy is considered to adequately compensate for the indirect impacts to THPSS.

1.3.5 History of Water Management and Impacts from Water Discharge

The Coxs River drains a catchment of about 2630 km2 on the western side of the Blue Mountains. The Coxs River catchment is bounded to the west by the Great Dividing Range, to the north by the upper Colo River catchment, and to the south by the Wollondilly River catchment. A tributary of the Nepean River, the Coxs River now flows into Lake Burragorang (behind Warragamba Dam), the largest of Sydney's water-supply reservoirs, which is regulated by the Sydney Catchment Authority and managed by Sydney Water.

Before European settlement Aborigines lived in the catchment for many thousands of years. Early explorers provide a picture of the local vegetation, which is of heavily forested hill slopes, opening into more open woodland and some areas of grassland in the wider valleys.

Between 1820 and 1840 many land grants were allocated to settlers, primarily for grazing. To extend grazing areas, the early settlers felled many trees for building homesteads, fences and stockyards.

In 1905 a major bushfire swept through forests and pastures of the upper catchment leaving bare soil and blackened stumps. Following this fire, rabbit populations increased rapidly, leading to widespread land degradation.

Mining in Coxs River catchment commenced in late 1800's and included the now decommissioned Vale of Clywdd, Commonwealth Colliery, Western Main, Eastern Main, Ivanhoe, Lamberts Gully, Wallerawang Collieries and the contemporary mining operations at Pinedale, Springvale and Angus Place.

The Wallerawang Power Station was commissioned in the late 1950's, with Lake Wallace ad Lake Lyall commissioned in 1979. Sawyers Swamp Creek Ash Dam was constructed in 1979 for the Wallerawang Power Station. The Wallerawang Power Station was converted to a dry process in around 2002.

The Mount Piper Power Station was built between 1992 and 1993. Thompson Creek Reservoir was built to provide a staging dam for that Power Station.

Wallerawang and Mount Piper Power Stations require large volumes of water for cooling processes within the system. These power stations operate three reservoirs, Lake Wallace (capacity of 4221 ML), Thompsons Creek Dam (capacity of 27500 ML) and Lake Lyell (capacity of 34192 ML).

Whilst it is acknowledged that the Wallerawang Power Station was placed onto care and maintenance in early 2014, a significant volume of water is required for power generation at the Mount Piper Power Station. On average, almost 40ML per day is utilised for cooling and other purposes at the Mount Piper Power Station. At their peak, the two power stations would draw as much as 69ML per day from the Coxs River catchment.

Lyell Dam was operated transparently (no diversions) until 1991. The effects of the dam on the downstream flow regime were minor during this period. Total flow volumes would have been slightly reduced by evaporation from the reservoir. In 1992 water extraction from the reservoir increased, greatly modifying the flow regime immediately downstream. Intermittent release of water is required from Lake Lyell to provide environmental flows to Coxs River downstream.

Mine Water Management at Springvale Mine

Springvale Mine commenced operations in 1993. The underground mine is located within the catchment divide of Coxs River and Wolgan River, whilst the surface facilities lie wholly within the Coxs River catchment. Water collected in the underground mine was originally discharged from the pit top via LDP001 (EPL 3607) to Coxs River via Springvale Creek. However, the need for dewatering of mine inflows, generated during coal extraction from the Lithgow Seam, was established shortly after the mine commenced operations, and a water management plan was developed.

The first licensed discharge of mine water on the Newnes Plateau occurred on 16 April 1997 at the Springvale Bore 1 facility at using seam to surface water pumping systems for the extraction of water from the underground mine. Bore facilities were established at the northern end of the longwall panels, where water accumulated following extraction of coal. Establishment of Bores 2 to 4 in the series followed sequentially. Prior to 2006, the bores transferred water to settlement ponds on Newnes Plateau. This water was then discharged via LDP004 and LDP005 (Springvale Mine EPL 3607) and LDP006 (Angus Place Colliery EPL 467) into the tributaries of the Wolgan River.

Following the listing of Newnes Plateau Shrub Swamps as Endangered Ecological Communities on 15 July 2005 under the Threatened Species Conservation Act 1995, Centennial Coal worked with Delta Electricity (former owner of Wallerawang Power Station) in consultation with the EPA to implement a Springvale Delta Water Transfer Scheme (SDWTS) for the transfer of water from the underground mine to the Wallerawang Power Station, where the water was to be used in the cooling towers. The commissioning of the SDWTS on 5 February 2006 was part of a Pollution Reduction Program and occurred in conjunction with the establishment of the Bore 5 Facility on Newnes Plateau.

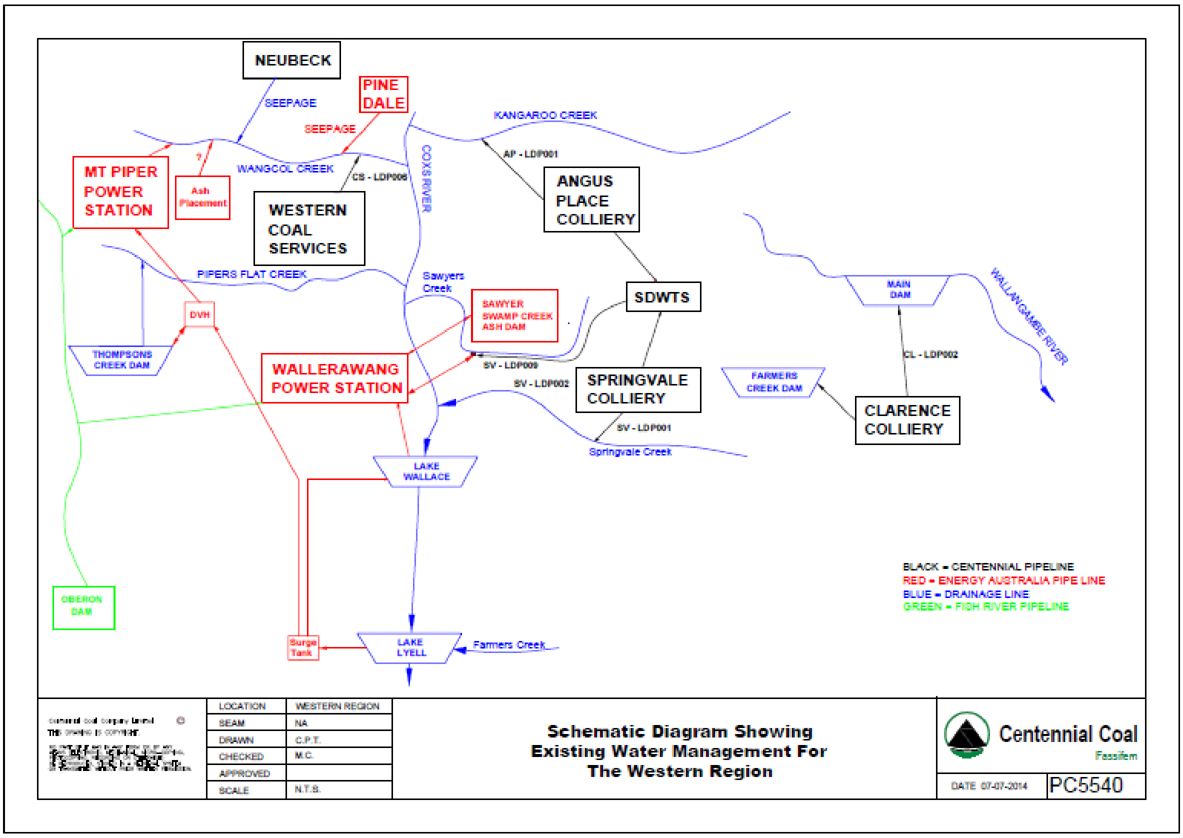
The SDWTS has served two functions since its introduction in 2006. The first was to remove permanent water discharges from the Newnes Plateau and the second was to reduce the volume of water sourced by the local power station (Wallerawang Power Station) from the regional surface rivers and lakes which feed into the Sydney drinking water catchment.

Since the establishment of the SDWTS Springvale Mine has established two additional bore facilities, Bore 6 and Bore 8, on Newnes Plateau. Bore 8 is licensed as a dewatering bore by the NSW Office of Water (10BL603519). One additional Springvale Mine bore facility connects to the SDWTS at Ventilation Shaft 3 (10BL601863). While water is also pumped to the surface via the Pit Top Collection System (10BL602017) for process water this system is not connected to the SDWTS. Excess water from the system is via LDP001 to Springvale Creek.

The SDWTS has a maximum total capacity of 30 ML/day for most of the network except between Springvale Mine's LDP009 (EPL 3607) and Wallerawang Power Station where the capacity is approximately 58 ML/day.

With the commissioning of the SDWTS, on 3 October 2006 Springvale Mine's EPL3607 was varied to only allow emergency discharges via LDP004 and LDP005 on the Newnes Plateau. From early 2007 to April 2010, due to issues with the SDWTS infrastructure and management of the system, licensed emergency discharges of mine water to Narrow and East Wolgan Swamps via LDP004, LDP005 and LDP006 were frequently required to ensure the safety of mine workers. The infrastructure issues have been resolved over the life of the SDWTS and there have been no mine water discharges on the Newnes Plateau since 10 April 2010. The Goldney Report found that impacts to East Wolgan and Narrow Swamps were largely the result of mine water discharge from licensed discharge points LDP004 and LDP005 on the Newnes Plateau.

With the removal of water discharges on the Newnes Plateau, the utilisation of the SDWTS became critical for continued dewatering of the underground mine. Turbidity of the water discharged to the scheme required the installation of settling ponds near the Kerosenevale Ash Dam. These ponds were installed in 2010. In 2012, in consultation with the EPA, Springvale Mine began discharging water from these ponds to Sawyers Swamp Creek, a tributary of the Coxs River, via a new discharge point, LDP009. The following schematic shows how water in the Upper Coxs River is managed.



Since 2007, the Springvale Mine Environmental Protection Licence has been varied 19 times with five (5) Pollution Reduction Programs requiring investigation into water quality of the discharges to either the Wolgan River or Coxs River. These Pollution Reduction Programs included completion of ANZECC water quality assessments, options to improve water quality in the Coxs River and ecotoxicology assessments of licensed discharge points. The following table provides a summary of these variations.

Variation Date	Summary of Variation Notice
24 September 2001	License review of EPL3607
4 September 2002	Pollution Reduction Program for a Wastewater Management Option Study, consistent with the prioritised management actions under the Catchment Management Blueprint; water quality and flow objectives for the Hawkesbury Nepean River System; ecosystem protection targets under the ANZECC Water Quality Guidelines; and Schedule 2 of the Clean Water Regulation 1972
28 March 2003	Variation to include ventiliation shaft
19 December 2003	Variation to include coal conveyor
3 September 2004	Variation to extend the time for the PRP study of 4 Setpebmer 2002
11 October 2004	Variation to provide an emergency discharge point for mine dewatering
8 August 2005	Variation to pH criteria of licensed discharges and

	include blasting limits for the Lamberts Gully operation
26 April 2006	Variation to remove PRP for water options (deemed to be satisfied) and remove the emergency discharge
3 October 2006	Variation to include LDP004 and LDP005 as emergency discharges on EPL3607, following commissioning of the SDWTS in 2006
21 August 2007	Variation to allow for non-emergency discharges to quantify flow characteristics along ephemeral reaches of the Wolgan River
9 September 2009	Variation to include a PRP for water quality investigations at LDP006 at Lamberts Gully
10 September 2010	Variation for further review of water quality at LDP006 at Lamberts Gully
5 July 2011	Administrative amendments to the license
19 December 2011	Further water quality investigations at LDP006 and inclusion of the dust PRPs
2 August 2012	Variation to include LPD009 and a PRP to investigate and report on options to improve water quality at LDP009
21 May 2013	Variation to include requirement for ANZECC assessment at LDP006 and POP on turbidity at LDP009
12 August 2014	Variation to include a PRP to undertake exotoxicology assessment at LDP009

In response to these PRPs and submissions made on the Springvale MEP EIS and the Angus Place MEP EIS, Centennial has undertaken a whole of catchment review of water management in the Upper and Lower Coxs River catchments. This reports supporting this review included:

- Appendices to the Springvale MEP EIS and the Angus Place MEP EIS:
    - Groundwater Impact Assessment (Appendix E).
    - Surface Water Impact Assessment (Appendix F).
    - Regional water and salt balance report, incorporating volume, quality and flow characteristics of the Upper Coxs River (Attachnment E to Appendix F).
    - Aquatic Ecology Impact Assessment, including potential impacts to stygofauna (Appendix G).
    - Terrestrial Ecology Impact Assessment (Appendix H).
    - Regional Biodiversity Strategy Appendix I).
- Appendices to this RTS:

- o Springvale and Angus Place Regional Water Quality Impact Assessment (RPS 2014a) (**Appendix 2**).
- o Revised Regional Biodiversity Offset Strategy (RPS 2014c) (**Appendix 4**).
- o Coxs River Ecotoxicology Assessment (GHD 2014b) (**Appendix 10**).

In summary, this review concluded:

- The Upper Coxs River catchment is heavily modified, following over 100 years of mining and other industrial water uses.
- Salinity from water discharged from the underground mine is not having a detrimental impact on the receiving environment, or ecology, of the Upper Coxs River catchment.
- The quality of water discharged from the underground mining operations meets all water quality criteria at LDP009 and LDP001.
- Dissolved zinc was exceeded in Lake Wallace, dissolved copper and zinc were exceeded in Wangcol Creek, however, the presence of these metals was insufficient to cause toxicity.
- There was evidence of toxicity in the Upper Coxs River, above water discharge points, suggesting lower pH causes an ionic imbalance that is corrected by higher pH downstream.
- Industrial water users in the Upper Coxs River have a heavy reliance on water discharged from the underground mining operations.
- Water quality in Lake Burragorang (Warragamba Dam) will increase slightly due to the water discharged from the underground mining operations, which is well below the salinity levels identified under the Australian Drinking Water Guidelines.

The results of these assessments are further discussed in **Section 3.1.26 and Section 3.1.27** of this RTS.

Mine Water Management at Angus Place Colliery

Angus Place Colliery is an extension of the now abandoned Newcom Mine at Kerosene Vale and commenced operations in 1979. The Angus Place colliery holding traverse both the Wolgan River/Carne Creek and Coxs River catchments.

Angus Place Colliery, since its inception in 1979, discharged mine water via LDP001 and LDP004 (EPL467) to Kangaroo Creek, which forms the upper reaches of the Coxs River. . In the early 1980s, the mine was pumping 1.8 ML/day of water into Kangaroo Creek.

Surplus mine water extracted via the Pit Top Collection System (10BL601838) for process water is discharged to Kangaroo Creek at LDP001. On 16 May 2002, EPL 467 was varied to allow licensed discharges from LDP001 from 9.5 ML/day to increase to 20 ML/day.

In 2005, Angus Place Colliery commenced the process of obtaining a contemporary approval for the underground and surface mining operations. In 2006, the Colliery was granted Project Approval under the former Part 3A of the EP&A Act, PA 06_0021. For the purposes of discharge of water from the underground mining operations, the Angus Place Colliery Environmental Assessment (EA), dated January 2006, included at section 2.8:

Water make from the coal face is pumped from temporary holding dams (fish tanks) and then to longwall goaf areas to settle. Water is then pumped to an underground collection point and then to the *surface into concrete tanks. Overflow from the concrete tanks is into two surface settling ponds for further treatment.*

Water from the surface concrete tanks is recycled underground for fire fighting, dust suppression and process purposes. Water from these tanks is also used for fire fighting on the surface.

The surface water management system at Angus Place relies on the separation of clean and dirty water surface runoff and the management of mine water make that is pumped to the surface from underground. Integral to the surface water management system are licensed discharge points that are managed in accordance with the requirements of Angus Place's Environment Protection Licence (EPL). Water is discharged from the Colliery to the Cox's River Catchment.

At section 2.3.3 of the EA:

The EPL cover Angus Place activities to a scale of 2 – 3.5 Mtpa, a sewage treatment plant and prescribes volume limits and water quality limits for each discharge point. A variation of the EPL is not considered necessary as this application does not propose activities outside the existing Colliery Holding, which represents the EPL defined premises.

In 2006 the 930 Bore facility (10BL601852) was installed on Newnes Plateau for the extraction of mine water from Longwall 930 and transfer to the SDWTS. 930 Bore was decommissioned in 2007 and Bore 940 facility (10BL601851) (was installed on the Newnes Plateau to remove water from Longwall 940 for the transfer of mine water into the SDWTS. 940 Bore remains in service.

On 13 October 2006, EPL 467 was varied to permit emergency discharge of mine water into Narrow Swamp at LDP006. As a result of changes to the mine water management system at Angus Place emergency discharge provisions at LDP006 were able to be relinquished and on 29 July 2013 EPA varied EPL467 to remove LDP006 from the licence. This change resulted in a need to ensure all water collected in the underground mine workings could be discharged from the mine via LDP001. This was an essential requirement to maintain a safe underground working environment.

On 17 July 2007, the EPA varied EPL467 to increase licensed discharges from LDP001 from 20 ML/day to 30 ML/day and remove LDP004 from the licence. This variation was consistent with the description in the EA supporting PA 06_0021, allowing water from the underground mining operations to be discharged through LDP001 to Kangaroo Creek and was essential in maintaining a safe underground working environment.

With the majority of underground water being directed from the Angus Place workings into the SDWTS, in 2011 EPL 467 was varied by the EPA and required Angus Place Colliery to modify the underground pumping regime such that no mine water would be discharged through LDP001 under normal operating conditions by 30 June 2013. Angus Place Colliery has modified its underground pumping regime and decreased the flow into Kangaroo Creek through LDP001 since mid-2012 from in excess of 6 ML/day to 1-2 ML/day. This reduction in discharge of mine water into Kangaroo Creek was achieved by increasing utilisation of 940 Bore facilities to transfer water to the SDWTS, and utilisation of disused underground workings to store excess water. However, the available storage within the underground workings is reaching capacity, requiring the volumetric discharge at LDP001 to be increased to ensure a safe underground working environment.

The SDWTS is currently transferring approximately 23 ML/day of mine water to Springvale Mine's LDP009 (EPL 3607), of which approximately 7 ML/day is transferred from Angus Place 940 Bore.

The SDWTS represents a multi-million dollar investment for Centennial Coal, which was designed to service the life of mine water management needs and allowed the water to be used by a local industrial user (Delta Electricity, now Energy Australia).

At the time of commissioning the SDWTS was awarded several green globe awards by the NSW Government Department of Energy, Utilities, and Sustainability for superior performance in the development and delivery of water efficiency initiatives, as follows:

- Water recycling and conservation leadership.
- Water and energy savings action plan - excellence achievement.
- Water champion business achievement.

With the commitment in 2009 to cease discharging underground water to the Newnes Plateau, alternative water management strategies have been investigated, and to the extent these were practical and feasible, implemented. This has included:

- Installation of sedimentation ponds at the Kerosene Vale Ash Dam to manage turbidity.
- Installation of a water treatment system (flocculation) at the LDP009 discharge site, to manage elevated arsenic (in particular).
- Re-organisation of the underground water management systems to allow for utilisation of limited underground storage spaces for water retention and management.
- Significant capital investment through dewatering bores, pipelines, gravity tanks and the like to transfer water from the underground mining operations to the Coxs River catchment for use by significant industrial water users.
- Extensive and ongoing investigations into alternative water management options, requiring significant investment from government and other stakeholders in order to be realised.
- Repeated investigations into the quality of water discharged from the underground mining operations, the results of which indicate that the water discharged is not having a significant detrimental impact on the catchment.
- Significant investment, through the Revised Regional Biodiversity Strategy contained at **Appendix 4** of this RTS, in the restoration and rehabilitation of the Upper Coxs River to improve amenity, water quality and biodiversity.

2.0 SUMMARY OF SUBMISSIONS

The Angus Place MEP EIS was placed on public exhibition from 12 April to 26 May 2014. During this period, 441 submissions were received.

Of the 441 submissions received:

- 13 were from government agencies;
- 14 were from special interest groups; and
- 414 were from community individuals.

Government agency submissions were received from:

- Commonwealth Department of the Environment (DotE) (including the Independent Expert Scientific Committee (IESC));
- Heritage Council of NSW;
- Lithgow City Council;
- NSW Department of Trade Investment Regional Infrastructure and Services - Division of Resources and Energy (DRE);
- NSW Department of Primary Industries – NSW Office of Water (DPI NOW);
- NSW Department of Primary Industries – Crown Lands (DPI – Crown Lands);
- NSW Department of Primary Industries - Office of Agricultural Sustainability and Food Security (DPI – OAS&FS);
- NSW Environment Protection Authority (EPA);
- NSW Health – Nepean Blue Mountains Local Health District (NSW Health - NBMLHD);
- NSW Office of Environment and Heritage (OEH);
- Roads and Maritime Services (RMS);
- Sydney Catchment Authority (SCA); and
- TransGrid.

Of the 14 submissions from special interest groups:

- 8 were in objection to the Project; and
- 6 were in support of the Project.

Of the 414 community individual submissions received:

- 161 submissions were in support of the Project
- 235 submissions were in objection to the Project; and

- 8 provided comment on the Project.

Additionally the NSW Department of Planning and Environment and the Commonwealth Department of the Environment, in a letter dated 2 July 2014, jointly referred the development applications for both the Angus Place and Springvale MEPs to the Independent Expert Scientific Committee for its consideration and advice.

As a result of the submissions received, additional commitments have been made by Centennial Angus Place and included in a revised Statement of Commitments provided in **Section 5.0** of this RTS.

2.1 Summary of Issues Raised

A summary of the issues raised by the government agencies is provided in **Table 1**, a summary of the issues raised by special interest groups is provided in **Table 2** and a summary of the submissions made by individual community members is provided in **Table 3.** Detailed responses to each of the issues raised are provided in **Section 3.0**.

Table 1 - Summary of Government Agency Submissions

Area of Concern	Raised By	Summary of Issue
Aboriginal Heritage (Section 3.1.1)	NSW Office of Environment and Heritage (OEH)	OEH considers that a more definitive assessment of the probability of roof fall collapse is required in rock shelters that have cultural deposits. In other assessments the standard used in assessing subsidence effects on Aboriginal Cultural Heritage (ACH) in longwall mining operations has been based on percentage estimates. A minimum 10% chance of roof fall collapse is an accepted threshold range from which decisions about appropriate mitigation can be considered. It is OEH's view that in circumstances where the chance of roof fall collapse exceeds 10% the appropriate mitigation is to excavate the shelter for salvage of Aboriginal objects and extract as much information that is appropriate for interpretation and educational purposes.
		OEH considers that structurally sensitive Aboriginal sites should also be monitored during the progression of adjacent longwalls and as the underlying longwall progresses. If damage begins to appear during progression of mining in proximity to the sites, appropriate action should be taken. This should be incorporated in the Cultural Heritage Management Plans, which should be developed in consultation with the Registered Aboriginal Stakeholders and OEH.
		The action relating to skeletal remains should be reworded.
	Lithgow City Council	The Applicant shall ensure that the development does not cause any direct or indirect impact on identified Aboriginal sites located outside of the approved disturbance area of the development on the site.
Air Quality (Section 3.1.2)	NSW Health	To minimise any potential health impacts it is recommended that, should the project be approved, the proponent is required to implement all reasonable and feasible measures to minimise particulate matter emissions. Such measures might include reactive dust management systems.

Area of Concern	Raised By	Summary of Issue
		The modelling that has been conducted includes only external sites that are operational or have been approved and will be operational in the near future when considering cumulative dust and particulate matter. The modelling does not include proposed developments, such as Neubeck, Cullen Valley and Invincible Mines which may become operational during the lifespan and Springvale and Angus Place Mines. The cumulative effect of all the developments which are in close proximity to each other may result in air quality exceedences for sensitive receivers.
Biodiversity Strategy (Section 3.1.3)	NSW Office of Environment and Heritage (OEH)	OEH considers that the Regional Biodiversity Strategy included in the EISs does not fulfil the Director-General's requirements as it has not demonstrated that the biodiversity values of the region will be maintained or improved in the medium to long term. Importantly, the proponent has only assessed offsetting requirements for impacts associated with vegetation clearing activities and has not considered losses to habitat and ecosystem condition that will be a direct impact from rock fracturing and changed hydrology in its offsetting strategy. In addition, the selection of the proposed offset is not justified and the proposed Regional Biodiversity Strategy does not fulfil all of the NSW Offset Principles for Major Projects as presented in the Draft Policy.
	Commonwealth Department of the Environment (DotE)	The proponent must meet the requirements of the EPBC Environmental Offsets Policy (October 2012) and Offsets Assessment Guide, including legal arrangements and funding provision for in-perpetuity management of offset lands, prior to the finalisation of an EPBC approval.
		The Department notes that whilst both EIS documents acknowledge the potential for some impacts on the THPSS ecological community (the total area of THPSS being mined under being 96.6 ha), the proposed offset area does not contain any THPSS nor does it appear to have any habitat for EPBC listed threatened species (such as the Blue Mountain Water Skink) that may be impacted by the proposed action.
		The Response to Submissions reports should provide information that shows how the proposed offsets comply with the Offsets Policy including, if necessary, the location of THPSS offsets (to account for any residual impact to THPSS once any avoidance has been taken into account), their current condition, the management actions proposed to improve ecological condition and the preferred mechanism for in-perpetuity conservation. Any other matters of national environmental significance requiring an offset should also be covered.
Construction	Lithgow City Council	The applicant is to apply for a construction certificate with Lithgow City Council or Private Certifier for all building construction works.

Area of Concern	Raised By	Summary of Issue
(Section 3.1.4)		A Construction Management Plan is to be prepared in consultation with Lithgow City Council and implemented for the duration of the construction phase at each project site.
Cumulative Impacts (Section 3.1.5)	NSW Office of Environment and Heritage (OEH)	The interaction of the two mines where they come into close proximity to one another does not appear to have been specifically addressed in the EIS apart from an indication in Table 9.4 of the Springvale EIS.
European Heritage (Section 3.1.6)	Heritage Council of NSW	A European heritage field survey should have been undertaken to confirm the results of the desktop survey. Further assessment is recommended to ensure that no historic heritage is present within the project boundaries
Exploration (Section 3.1.7)	Division of Resources and Energy (DRE)	Proposed exploration activities must be notified to DRE and, where applicable, to the Forestry Corporation of NSW including copies of due diligence assessments and site assessments where available. Exploration must not commence until appropriate approvals and/or consents have been obtained from these agencies.
	NSW Office of Environment and Heritage (OEH)	No information regarding how much disturbance is required per drill hole or how many drill holes are estimated over the life of the Projects. There is no information provided regarding how much cumulative disturbance the exploration programme has caused in the past, nor how much is anticipated in the future. This has the potential to impact a large area over time.
		While it is proposed that assessments will be provided to DP&E, there is no information provided regarding whether these will be reviewed, or whether further approvals will be required. OEH considers that the EISs do not contain sufficient information to enable an informed and legally defensible decision to be made regarding the proposed exploration programme.
	Lithgow City Council	Drill sites and associated access tracks are to be located where possible to avoid threatened flora species, avoid hollow bearing trees, avoid EECs, minimise clearing and avoid identified Aboriginal heritage sites.
General (Section 3.1.8)	Lithgow City Council	Lithgow City Council is to be notified of any modifications and determinations.
		The applicant is to prepare and submit Annual Reviews (formerly Annual Environmental Management Reports) to Lithgow City Council to review.
		The applicant may carry out coal transportation and processing operations on the site for up to 13 year from the date of this consent. Rehabilitation works are able to proceed after this end date.
		The applicant shall produce up to 4 million tonnes of coal per year for up to 25 years.

Area of Concern	Raised By	Summary of Issue
	NSW Office of Environment and Heritage (OEH)	A section in both the Springvale and Angus Place subsidence assessments entitled "History of Mining beneath Swamps" which contains what appear to be omissions, factual inaccuracies and unsubstantiated opinions.
Groundwater (Section 3.1.9)	NSW Office of Water (NOW)	The expansion of the groundwater monitoring network, and the associated monitoring schedules to be updated in the Water Management Plan (WMP), should carried out in consultation with the Office of Water.
		The modelling used to support the EIS should be regularly updated to enable confirmation that the predicted mine water takes are not exceeding, and are not likely to exceed, the predictions made in the EIS. These periodic reviews should be incorporated within the overall annual environmental monitoring plan and the results made available to NOW in a suitable electronic format.
		The proponent must maintain records of annual water take from water sources impacted by the development and reported in the annual environmental report.
		The specific impacts of the permanent reductions (and in some cases increases) in baseflow to local swamps and surface streams are not discussed in the hydrogeological impacts report. These impacts are not discussed at all in the Surface Water Impact Study but are included in the ecological assessments.
		NOW suggest a commitment to comply with the Water Sharing Plan in the Statement of Commitments.
	NSW Office of Environment and Heritage (OEH)	No extensometer data is reported, but it is noted that a wide range of impacts have been measured on groundwater aquifer levels over both Springvale and Angus Place mines.
	Commonwealth Department of the Environment (DotE)	The EIS, including the groundwater model, does not provide a reasonable assessment of impacts to THPSS. Confidence in the groundwater model's capacity to predict site specific impacts to individual THPSS is low. In particular the model scale is not appropriate to predict impacts to THPSS, and a number of THPSS are not included within the groundwater model and therefore groundwater related impacts to these swamps cannot be predicted.

Area of Concern	Raised By	Summary of Issue
		The groundwater model has been constructed using industry best practice methods and is acceptable for predicting mine inflows. However, the scale of the groundwater model is inappropriate to predict groundwater related impacts to individual THPSS. Further, a number of swamps are not incorporated into the groundwater model. Finer scaled, site specific models, informed by a conceptualisation of the hydrology and hydrogeology, would be needed to have confidence in the predictions of groundwater impacts to individual swamps.
		Confidence in groundwater model predictions is limited by a lack of site specific hydrogeological data and lineament groundwater flow behaviour. The assessment of surface water impacts, including cumulative impacts, needs to consider contaminants such as copper, zinc, nitrogen and phosphorus, which groundwater quality monitoring shows all exceed ANZECC guidelines.
		Is the groundwater model suitably robust, and are the resulting quantitative predictions accurately and reasonably described?
		The groundwater model is a regional scale model that provides generally robust predictions of mine groundwater inflows. These are reasonably described. However, due to the scale of the groundwater model, it is limited in its capability to predict groundwater related impacts to surface water systems including those affecting THPSS and proximal reaches of the Coxs River. This results in a low level of confidence in the predictions of impacts to Cox's River and THPSS baseflows described within the EIS.
Infrastructure (Section 3.1.10)	TransGrid	Lot 5 in DP829137 appears to be the closest parcel of land to TransGrid's infrastructure. Any development proposed near TransGrid's infrastructure is subject to SEPP (Infrastructure) 2007, in particular regulation 45.
Landowner Consent (Section 3.1.11)	Crown Lands	A review by Crown Lands of the Project Application form has noted that Section 7, Landowner's consent, has not been completed. As Crown land together with a number of Crown Roads is located with the Project Boundary Application Area, the Applicant would need to seek consent from Crown Lands.
Mine Design	Commonwealth Department of the Environment (DotE)	The longwalls should be modified to avoid directly undermining Tri-Star and Trail 6 swamps.

Area of Concern	Raised By	Summary of Issue
(Section 3.1.12)	Independent Expert Scientific Committee (IESC)	Longwall mining in areas directly below known high quality sites of temperate highland peat swamps on sandstone should be restricted which may potentially reduce the risk of unacceptable impacts on the endangered ecological community, particularly if appropriate buffers that reflect the local geological characteristics are incorporated between the longwall mining panels and high quality swamps. The Interim Committee supports the proposal that this condition could be revisited if the proponent is able to demonstrate that a proven technology or engineering methodology can be used that prevents the risk of subsidence in the listed ecological community, or that would allow any subsidence related impacts to be remediated.
Mining Title (Section 3.1.13)	Division of Resources and Energy (DRE)	The proponent is required to hold appropriate mining titles from DRE in order to mine this mineral. The project area is within exploration and mining titles held by the company. The company must ensure that an appropriate mining title must be held to cover areas to be mine and the project's supporting infrastructure and mining purpose activities to be conducted.
Monitoring/Management (Section 3.1.14)	Division of Resources and Energy (DRE)	The Proponent should review the current monitoring program to ensure it is in line with the principles of Before-After/Control-Impact (BACI) monitoring approach with the focus on ensuring this approach is consistent and clearly identifiable in the reporting of monitoring data; Control sites should be identified and chosen to best represent the impacted sites (similar hydrological conditions). Control sites should be used for surface water (flow and quality) and shallow groundwater within swamps and water courses.
		A review of the planned monitoring of the swamps within the project area should be undertaken to ensure sufficient data capture is available to assess the full extent of the groundwater interactions down and across the swamp profile (multiple piezometers in each swamp). Monitoring focus should also include the AQ3-AQ6 (Burralow Formation) strata using multilevel piezometers with hourly readings. Where multi-level piezometers are not used within the swamps the instrument should be placed at a depth greater then 3m within the swamp profile to avoid historical issues with loss of data due to hole being too shallow. This monitoring should also be reflected in the control sites selected (as indicated above).
		The nearest Longwall to the Wolgan River is LW1002 at 240m. LW1019 will be 400m from Carne Creek. The predicted subsidence and tilting of these watercourses are not expected to result in any stream bed cracking or loss of surface waters. The proposed monitoring will rely on upstream and downstream monitoring on these two watercourses. Pool depth monitoring of the key pools in the watercourses should also be undertaken to confirm these predictions.

Area of Concern	Raised By	Summary of Issue
	NSW Office of Environment and Heritage (OEH)	OEH considers that, given the potential for fracturing of bedrock in drainage lines, monitoring of groundwater and flows on drainage lines within 800m of the Gardens of Stone National Park is required.
		There is no appropriate monitoring of flow in streams which is capable of testing the veracity of the claims made in the EIS of no impact to flows.
		There is no indication of what actions will be taken if monitoring indicates that mining-induced impacts occur.
	NSW Office of Water (NOW)	The proposed surface water and groundwater management plans should identify critical impact thresholds in groundwater levels and quality and surface water flows and water quality to enable adaptive response and management of operations.
		A mechanism for identifying and reporting variations from predictions should be clearly stated within the Plan.
		To improve the coverage of baseline characterisation data, it is recommended data loggers be installed in key monitoring bores to enable continuous monitoring of groundwater levels in response to rainfall events.
		A minimum of 2 years of baseline data should be applied for all GDE sites within range of longwall panels.
	Independent Expert Scientific Committee (IESC)	A comprehensive monitoring and management plan should be produced that takes into account the hydrological and geological context in which the swamps sit and includes: i. potential geological and hydrological impacts in upstream tributaries that feed into the peat swamps and in areas laterally adjacent to peat swamps; ii. potential downstream geological and hydrological impacts; iii. potential lateral geological and hydrological impacts.
Newnes Plateau Shrub Swamps/Hanging Swamps (Section 3.1.15)	NSW Office of Environment and Heritage (OEH)	Having significantly damaged Newnes Plateau Shrub Swamp EECs in the past, the EISs do not provide any definitive evidence or guarantee that further NPSS will not be impacted by the current mine plan or future longwalls.

Area of Concern	Raised By	Summary of Issue
		The irreversibility of impacts to EECs are a significant consideration for OEH. If the relatively impermeable base of the Newnes Plateau Shrub Swamps or Hanging Swamps is fractured, then any perched aquifer is likely to drain downwards into the fracture network, thereby altering natural groundwater levels within the swamp and leading to increased desiccation. These impacts have already been demonstrated for Centennial's longwall operations at both Springvale and Angus Place mines. They have also been well documented in the Southern Coalfield for coastal upland swamps.
		In contrast to the experience at Springvale and Angus Place mines, OEH notes the comparative lack of impact at Centennial's Clarence Colliery operations to NPSS which uses an alternative mining methodology. The recently approved 900 Series at Clarence Colliery are located just on the other side of the Pine Plantation from the proposed Springvale Mine longwalls and operates in similar depths of cover. Subsidence at Clarence Colliery is of the order of 100mm compared to 1500-2000 mm at Springvale and Angus Place.
		The current expansion at Angus Place Mine could be modified so that there was no direct undermining of the NPSS (only two swamps Trail 6 Swamp and Tri-Star Swamp lie directly above the planned longwalls). Shortening of longwalls to avoid adverse geological conditions has been common practice in the past at Springvale and Angus Place mines and OEH believes this should be applied to the two NPSS located directly above the proposed Angus Place longwalls.
		The History of Mining Beneath Swamps section of the Subsidence Impact Assessments fails to discuss the interaction of geological structures and swamp impacts.
	Commonwealth Department of the Environment (DotE)	Longwall mining beneath THPSS may fracture the sandstone substrate and alter the swamp's water balance. The Department is unaware of any proven strategies to effectively mitigate longwall mining impacts other than avoiding impacts through changes to mine plan layout.
		The frequency of subsidence impacts (caused by longwall mining) on swamps appears to be low but when such impacts occur they are likely to have a high impact on the ecological functioning of individual swamps.

Area of Concern	Raised By	Summary of Issue
		The Subsidence Impact Assessment predicts values for subsidence, upsidence, tilts, curvatures, hogging and sagging that if realised would, according to the EIS, have minimal impacts on the swamps. Similar estimates have been made for projects on the Newnes Plateau in the past (Springvale and Angus Place). In these cases it has been documented that longwall mining (conducted under EPBC approval 2011/5952- Angus Place Colliery) resulted in major impacts on East Wolgan Swamp (subsidence and cracking) and significant impacts on Kangaroo Creek Swamp (undermined, with water losses from the ecosystem).
		The current EIS fails to acknowledge the failure of past predictions and that longwall mining below the swamps could result in further irreparable damage to THPSS.
		Neither EIS provides convincing evidence that THPSS will be immune from similar impacts to those that damaged the ecological community in the past. The reduction in longwall widths to 261m provides no reassurance that THPSS will not be impacted by bed rock fracturing as some of the previous impacts (Kangaroo Creek Swamp) occurred with 262m wide longwalls (longwall 940).
		Impacts to undermined THPSS have historically been severe, resulting in changes to the hydrological and hydrogeological regimes, vegetation composition and structure, and large reductions in THPSS extent. These changes have been significant and are considered to be beyond the ability of the ecological community to recover naturally. As yet, there is no scientific evidence or industry based results to indicate that such impacts to THPSS can be remediated successfully.
		The subsidence related impacts affecting overlying and adjacent THPSS would be expected to include fracturing of underlying bedrock, a water storage capacity increase within the bedrock fracture network, a decrease in surface water flow provision from upstream tributaries and a corresponding decrease in standing surface water level. Other impacts to THPSS may include nick point erosion, peat slumping, changes to the swamp inundation regime and a decline in the biological diversity and/or species composition of swamps. Such impacts are highly likely to be severe and potentially irreparable.
		Due to the low level of confidence in the groundwater model's capacity to predict hydrological impacts to individual THPSS, the likelihood, extent and significance of groundwater impacts to swamps cannot be determined with certainty. Swamps that are directly undermined or overlie structural lineaments are more likely to be severely impacted due to the instability of underlying strata and locally increased subsidence effects. Given the temporal variability and time lags with which impacts are observed in THPSS, the significance of groundwater impacts may not be readily determined for some time.

Area of Concern	Raised By	Summary of Issue
		Avoidance of undermining and locating longwalls such that tensile and compressive strains are below 0.5 mm/m and 2 mm/m respectively at THPSS sites are considered the most effective ways to manage the potential impacts to THPSS. This strategy should also be applied to any upstream tributaries that provide a significant proportion of surface flow to THPSS.
		The only known strategy to reduce the risk of impact to THPSS ecological communities within the project area would be to alter the mine layout such that swamps are not undermined by longwall panels and longwalls are sufficiently removed from THPSS such that tensile and compressive strains at THPSS sites are below 0.5 mm/m and 2 mm/m respectively. This avoidance strategy should also be applied to any upstream tributaries that provide a significant proportion of surface flow to THPSS. This approach is the most likely to prevent impacts to THPSS given the potential severity of impacts, difficulties in the accurate and confident prediction of impacts, and the ineffectiveness of other mitigation and management measures. Further, there is no currently available scientific evidence to demonstrate that remediation activities are able to successfully restore the ecological and hydraulic functions of these threatened ecological communities to preimpact condition.
		The groundwater model is a regional scale model that provides generally robust predictions of mine groundwater inflows. These are reasonably described. However, due to the scale of the groundwater model, it is limited in its capability to predict groundwater related impacts to surface water systems including those affecting THPSS and proximal reaches of the Coxs River. This results in a low level of confidence in the predictions of impacts to Cox's River and THPSS baseflows described within the EIS.
		There appears to be a high risk of severe impact to the EPBC Act listed (endangered) Temperate Highland Peat Swamps on Sandstone that is present directly above or laterally adjacent to the proposed longwall panels associated with the Centennial Coal mining proposal; with this risk being greater for the proposed Springvale Colliery than the Angus Place Colliery.
		The evidence that longwall mining under the Newnes Plateau may have at least partially contributed to previous damage to the listed endangered ecological community in that area suggests that the likelihood of the risk being realised is also high.
		The mitigation measures proposed by the proponent are unlikely to reduce the risk or the likelihood of the risk being realised to an acceptable level.
		The hydrological requirements of the peat swamps are not well enough understood to accurately predict the cumulative impacts of longwall mining.

Area of Concern	Raised By	Summary of Issue
		The proponent has not characterised existing surface water, groundwater and ecological conditions for the majority of THPSS within the proposed project area. Seasonal surface water flow and an assessment, or estimation, of the baseflow component of the Coxs River are not provided and are needed to enable the prediction of impacts to seasonal flows within, and interactions between, surface water and groundwater systems, including those associated with THPSS. This information would also improve predictions of discharge and baseflow losses within the Coxs River and the potential for downstream impacts to occur.
		Does the EIS, and in particular the groundwater model and the treatment of subsidence and fracturing predictions, provide a reasonable assessment of the likelihood, extent and significance of impacts on overlying adjacent swamps?
		The EIS, including the groundwater model, does not provide a reasonable assessment of impacts to THPSS. Confidence in the groundwater model's capacity to predict site specific impacts to individual THPSS is low. In particular the model scale is not appropriate to predict impacts to THPSS, and a number of THPSS are not included within the groundwater model and therefore groundwater related impacts to these swamps cannot be predicted.
		Impacts to undermined THPSS have historically been severe, resulting in changes to the hydrological and hydrogeological regimes, vegetation composition and structure, and large reductions in THPSS extent. These changes have been significant and are considered to be beyond the ability of the ecological community to recover naturally. As yet, there is no scientific evidence or industry based results to indicate that such impacts to THPSS can be remediated successfully.
		The subsidence related impacts affecting overlying and adjacent THPSS would be expected to include fracturing of underlying bedrock, a water storage capacity increase within the bedrock fracture network, a decrease in surface water flow provision from upstream tributaries and a corresponding decrease in standing surface water level.
		Due to the low level of confidence in the groundwater model's capacity to predict hydrological impacts to individual THPSS, the likelihood, extent and significance of groundwater impacts to swamps cannot be determined with certainty. Swamps that are directly undermined or overlie structural lineaments are more likely to be severely impacted due to the instability of underlying strata and locally increased subsidence effects. Given the temporal variability and time lags with which impacts are observed in THPSS, the significance of groundwater impacts may not be readily determined for some time.

Area of Concern	Raised By	Summary of Issue
		The EIS states that fracturing up to 50 mm wide is predicted to occur within the shallow bedrock of THPSS wherever they are undermined. Impacts to THPSS are considerably more likely to occur where swamps are directly undermined. Fracturing to further THPSS and their upstream tributaries would be expected to occur where compressive and tensile strains exceed 0.5 mm/m and 2 mm/m respectively. Strain is caused by the horizontal movement of the ground surface relative to two fixed points. Tensile strain occurs where the distance between two points increases and compressive strain occurs where the distance between two points decreases.
		Avoidance of undermining and locating longwalls such that compressive and tensile strains are below 0.5 mm/m and 2 mm/m respectively at THPSS sites are considered the most effective ways to manage the potential impacts to THPSS. This strategy should also be applied to any upstream tributaries that provide a significant proportion of surface flow to THPSS.
		The proponent has stated that cracks are predicted to form within the sandstone substrate underlying many swamps within the project area. The proponent states that these cracks will naturally fill with soil and peat (self-ameliorate), and therefore impacts related to these bedrock fractures are “considered unlikely”. However, THPSS are exceptionally slow to self-heal or self-ameliorate. Examples of lowland swamps from the Southern Coalfields of New South Wales show that without attempted rehabilitation, self-amelioration is not evident within two lowland swamps over a 25 to 30 year period5. Based on a lack of supporting evidence and available literature, self-amelioration is not considered to be a reliable or effective remediation method.
		The only known strategy to reduce the risk of impact to THPSS ecological communities within the project area would be to alter the mine layout such that swamps are not undermined by longwall panels and longwalls are sufficiently removed from THPSS such that tensile and compressive strains at THPSS sites are below 0.5 mm/m and 2 mm/m respectively5. This avoidance strategy should also be applied to any upstream tributaries that provide a significant proportion of surface flow to THPSS. This approach is the most likely to prevent impacts to THPSS given the potential severity of impacts, difficulties in the accurate and confident prediction of impacts, and the ineffectiveness of other mitigation and management measures.
Noise	Lithgow City Council	Noise monitoring and management should be implemented where possible.

Area of Concern	Raised By	Summary of Issue
(Section 3.1.16)	NSW Health	There is increasing evidence that exposure to noise is associated with health effects. We recommend that the noise mitigation strategies listed in the application become part of the conditions of approval to ensure there are minimal impacts on the local community from noise.
Physical Impacts (Section 3.1.17)	Commonwealth Department of the Environment (DotE)	The Department notes that the proposed project footprint borders the Greater Blue Mountains World Heritage Area (Gardens of Stone National Park) and that surface impacts resulting from longwall mining may impact on the values of this Area.
Planning Agreement/Contributions (Section 3.1.18)	Lithgow City Council	Council would like the opportunity to enter into a Voluntary Planning Agreement for both projects. Council also has a Section 94A Contributions Plan which imposes a 1% Contribution on all developments over $200,000. Should the proponent not enter into a Voluntary Planning Agreement for the proposal then a condition should be placed on the consent requiring payment of a contribution in accordance with Council's Section 94A Contributions Plan.
Rehabilitation (Section 3.1.19)	Division of Resources and Energy (DRE)	The Proponent shall rehabilitate the site to the satisfaction of the Secretary of the Department of Trade and Investment, or his delegate. Rehabilitation must be substantially consistent with the Rehabilitation Objectives described in the EIS and the Statement of Commitments in Chapter 11 of the EIS.
		The Proponent must prepare and implement a Rehabilitation Plan.
	Lithgow City Council	A Rehabilitation Management Plan is to be prepared in consultation with Lithgow City Council and implemented for the project.
	Commonwealth Department of the Environment (DotE)	Remediation strategies in areas affected by longwall mining are primarily designed to restore flows and the hydrological regime. Other remediation strategies have been focused on sealing fracture networks on cracked stream beds and have not addressed fractures occurring beneath peat sediments. The Department is unaware of any examples of THPSS impacted by longwall mining that have been successfully remediated.
	Independent Expert Scientific Committee	There is little evidence that the suite of remediation measures proposed would be effective in repairing damage to the endangered ecological community if the proposed longwall mining did lead to impacts such as fracturing of a peat swamp basin. Previous experience with implementation of such remediation measures has shown little or no success.

Area of Concern	Raised By	Summary of Issue
Stygofauna (Section 3.1.20)	NSW Office of Environment and Heritage (OEH)	It is important to note that stygofauna (and potential stygofauna) were actually found. Since this was the first survey of its kind for stygofauna in the area, there is the potential for the species collected to be unique. Unfortunately the taxonomic level of identification is currently inadequate to investigate whether these animals are new to science, and the implications of potential impacts from longwall mining affecting groundwater aquifers in which the stygofauna exist cannot be ascertained.
Subsidence (Section 3.1.21)	NSW Office of Environment and Heritage (OEH)	MSEC has provided no data, statistical analysis or graphics to support the factor of 10x maximum curvature used in their stress calculations. The derived maximum strains and levels of stress obtained by the DgS (2014) methodology should be used for subsidence predictions rather than the 10x maximum curvature calculation.
		Information should be provided on the height of fracturing that has occurred as a result of earlier Springvale and Angus Place mining operations.
		OEH has concerns regarding predictions for stress, upsidence and valley closure.
		MSEC provides no scientific evidence that diverted surface water re-emerges in the catchment.
		The assessment of potential subsidence impacts to streams in the EIS is does not include a specific assessment of 3rd order streams.
		It is likely that fracturing of bedrock under the swamps and drainage of perched aquifers will also lead to a loss of flow in these 3rd order streams.
		Due to the extremely wide longwalls (360m) proposed at Angus Place, OEH expects there will be widespread fracturing of cliffs, steep slopes and drainage lines
		OEH does not support the definitions of cliff and minor cliff presented the Subsidence Impact Assessments
	Division of Resources and Energy (DRE)	After reviewing the EIS, DRE is of the view that risks of mine subsidence related to the above-mentioned subsidence issues are similar to those at the mine's current mining operation and should be manageable through the Extraction Plan process.

Area of Concern	Raised By	Summary of Issue
		On page 5 of the Springvale Subsidence Impact Assessment it is stated that diversion of surface water flows beneath the swamps could occur due to valley related upsidence movements, however, the likely impacts are likely to be low because the drainage lines upstream of the swamps are generally ephemeral and therefore surface water flows occur during and shortly after rainfall events. The EIS fails to identify a key concern that should diversion occur, the swamps will no longer have access to this water, which could have significant impacts on their long term survival. Many Australian ecosystems rely solely or mainly on ephemeral surface water flows.
	Commonwealth Department of the Environment (DotE)	Page 82 of the Angus Place Subsidence Report states that fracturing could occur in the top most bedrock in swamps directly above the proposed longwalls. The Report also states that the shrub swamps comprise significant quantities of sediment and fracturing of shallow bedrock beneath these swamps is likely to be filled with soil during subsequent flow events along the drainage lines. Examples of where this has been known to occur should be provided.
		The incremental profile method utilised in the EIS provides reasonable predictions of subsidence likely to occur as a result of the proposed longwall design. However, there is a lower degree of confidence in subsidence predictions proximal to “type 1” and “type 2” lineaments, which are the shallow manifestations of deep, underlying faults. As a result, the EIS subsidence and flora impact assessments based on the subsidence predictions do not adequately consider the potential site specific subsidence impacts to overlying individual THPSS.
		A series of lineaments (shallow manifestations of deep, underlying faults) have been identified within the geological strata of the project area and are, in some areas, several hundred metres wide. Four lineament types were identified, and two of these types (“type 1” and “type 2”) are considered important in determining the structural stability of the underground mining areas add the overlying geological strata. These lineament zones increase the risk and severity of subsidence in their vicinity.

Area of Concern	Raised By	Summary of Issue
		While the incremental profile method applied within the subsidence assessment generally provides reasonable predictions of subsidence parameters, there is low confidence in the approach of increasing subsidence predictions by 25 per cent in the vicinity of “type 1” and “type 2”structural lineaments. The EIS states, (Appendix D, p. 33), observed subsidence effects in the vicinity of these lineaments at the existing operations are highly variable and are, in places, up to eight times greater than predictions derived using this approach. Subsidence over previously mined longwall panels, in proximity to “type 1” and “type 2” structural lineaments, at the existing Angus Place operations contributed to severe impacts to overlying THPSS.
		Based on the documentation provided in the EIS nine THPSS (including groups or swamp clusters) are located within the potential subsidence impact zone, and a number of these, such as Trail 6 Swamp and Tri Star Swamp, are proposed to be undermined. The EIS (p. 274) states that fracturing up to 50 mm wide is predicted to occur within the shallow bedrock of THPSS wherever they are undermined. Impacts to THPSS, such as those identified in paragraph 16, are considerably more likely to occur where swamps are directly undermined. Fracturing to further THPSS and their upstream tributaries would be expected to occur where compressive and tensile strains exceed 0.5 mm/m and 2 mm/m respectively. Strain is caused by the horizontal movement of the ground surface relative to two fixed points. Tensile strain occurs where the distance between two points increases and compressive strain occurs where the distance between two points decreases.
		The risk and potential severity of impacts is higher for Tri Star Swamp and Trail 6 Swamp. These swamps are both proposed to be undermined with the resulting conventional subsidence predicted to be 1.9 and 0.95 m, respectively. Additionally, Tri Star Swamp is situated above a “type 2” structural lineament and longwall panels below Trail 6 Swamp are, in places, critical in width (longwall width to depth of cover ratio of 0.96).
		Critical panel widths and structural lineaments were factors resulting in severe impacts to East Wolgan Swamp and Narrow Swamp, which were previously undermined on the Newnes Plateau. Impacts to East Wolgan Swamp and Narrow Swamp have been identified in literature and also described within the EIS (Appendix D, p. 77). Impacts included rapid decline of groundwater, peat desiccation and associated slumping, loss of natural surface flows through swamp channels and almost complete decline of THPSS flora species. Surface flows were found to be flowing into the subsidence induced bedrock fracture network and not resurfacing downstream. At East Wolgan Swamp, it was later identified that this water was pooling within bedding separation of strata approximately 60 to 70 m underneath the swamp.

Area of Concern	Raised By	Summary of Issue
		Avoidance of undermining and locating longwalls such that tensile and compressive strains are below 0.5 mm/m and 2 mm/m respectively at THPSS sites are considered the most effective ways to manage the potential impacts to THPSS5. This strategy should also be applied to any upstream tributaries that provide a significant proportion of surface flow to THPSS.
		The proponent has designed the longwall mine layout to avoid some THPSS (Twin Gully Swamp and several unnamed swamps), and to minimise subsidence through narrowing of several longwalls and increasing chain pillar widths. However, a number of THPSS remain overlying or within the potential subsidence impact zone of the proposed longwalls. Fracturing in the bedrock below these swamps is expected to occur where tensile and compressive strains caused by conventional subsidence exceed 0.5 mm/m and 2 mm/m respectively5. Fracturing within the bedrock of tributaries upstream of THPSS is also predicted to occur. The risk of bedrock fracturing is reduced by minimising the exposure of bedrock to strain. Ensuring that tensile and compressive strains are below 0.5 mm/m and 2 mm/m respectively at THPSS sites is the only measure known to prevent impacts to THPSS5. To avoid impacts to the surface water hydrological regime of THPSS, this avoidance strategy would also need be applied to upstream tributaries that provide a significant proportion of surface water flows to downstream THPSS.
		The only known strategy to reduce the risk of impact to THPSS ecological communities within the project area would be to alter the mine layout such that swamps are not undermined by longwall panels and longwalls are sufficiently removed from THPSS such that tensile and compressive strains at THPSS sites are below 0.5 mm/m and 2 mm/m respectively. This avoidance strategy should also be applied to any upstream tributaries that provide a significant proportion of surface flow to THPSS. This approach is the most likely to prevent impacts to THPSS given the potential severity of impacts, difficulties in the accurate and confident prediction of impacts, and the ineffectiveness of other mitigation and management measures. Further, there is no currently available scientific evidence to demonstrate that remediation activities are able to successfully restore the ecological and hydraulic functions of these threatened ecological communities to pre-impact condition.

Area of Concern	Raised By	Summary of Issue
		The proponent has stated that cracks are predicted to form within the sandstone substrate underlying many swamps within the project area. The proponent states that these cracks will naturally fill with soil and peat (self-ameliorate), and therefore impacts related to these bedrock fractures are “considered unlikely”. However, THPSS are exceptionally slow to self-heal or self-ameliorate. Examples of lowland swamps from the Southern Coalfields of New South Wales show that without attempted rehabilitation, self-amelioration is not evident within two lowland swamps over a 25 to 30 year period. Based on a lack of supporting evidence and available literature, self-amelioration is not considered to be a reliable or effective remediation method.
Surface Disturbance (Section 3.1.22)	Division of Resources and Energy (DRE)	To accommodate increased water make into the mine, up to 15 boreholes have been proposed to aid in dewatering. A construction footprint of 90m x 110m has been proposed for each bore site. DRE considers that the footprint should be reduced as much as practical. Specific details of the planned clearing and footprint with associated plans need to be provided to DRE for review. Angus Place should rationalise the proposed dewatering boreholes to ensure a minimal disturbance on the Newnes Plateau. This rationalisation should include putting more than 4 Boreholes on each pad in order to reduce the number of pads and clearing required.
		The proponent shall carry out all surface disturbing activities in a manner that, as far is reasonably practicable, minimises potential for dust emissions and shall carry out rehabilitation of disturbed areas progressively, as soon as reasonably practicable, to the satisfaction of the Secretary or his delegate.
	NSW Office of Environment and Heritage (OEH)	OEH notes that a number of dewatering bores are proposed to be constructed in close proximity to the national park boundary. These will require additional access tracks. OEH is concerned regarding damage caused by recreational use of these new tracks and the potential for them to create new access points to the national park.
Traffic Management (Section 3.1.23)	Roads and Maritime Services (RMS)	Prior to the commencement of each stage of the extension project a Traffic Management Plan (TMP) shall be prepared in consultation with Lithgow City Council, Forestry Corporation of NSW and Roads and Maritime to outline measures to manager traffic related issues associated with the construction and operation of each stage of the project. The TMP shall detail the potential impacts associated with each stage, the measures to be implemented and the procedures to monitor and ensure compliance.
	Lithgow City Council	A Traffic Management Plan be prepared in consultation with Lithgow City Council and implemented for the duration of the operational phase at each project site.

Area of Concern	Raised By	Summary of Issue
		All construction heavy vehicle trips to/from the Newnes State Forest sites be undertaken during daylight hours, which would generally require them to occur between 6.00am and 6.00pm.
Water Flows (Section 3.1.24)	Division of Resources and Energy (DRE)	East Wolgan Swamp remediation works have been undertaken in 2014. Coir logs, sand bags and weirs used to aid swamp rehydration works. Direct seeding and brush matting has also been used. This type of remediation will help with surface flows but will not address the loss of water through the cracked/faulted substrate.
	NSW Environment Protection Authority (EPA)	If the median flow rate from Angus Place LDP001 (3.29 ML/day) when put in context of the median flows in the Coxs River at the NOW Wallerawang gauging station (13.3 ML/day NOW gauge data; notes in the EIS that the median flow figure is quoted lower at 12.2 ML/day), LDP001 potentially represents close to 25% of the median flow in the Coxs River recorded at Wallerawang. Such a potential impact is not discussed in the EIS for either Springvale or Angus Place Mine expansions. A combined discharge of 30-50 ML/day would see untreated mine water comprise the bulk of the median flow in the Coxs River upstream of Lake Wallace.
	Sydney Catchment Authority (SCA)	The EIS states that the baseflow to creeks within the Coxs River catchment is predicted not to be impacted due to the proposed extension at "Springvale" (pages 74 and 75 of Appendix E). Clarification is needed as to whether this prediction is related to Angus Place or Springvale Colliery extension and accordingly corrected.
		The baseflow reductions in Kangaroo Creek are inconsistently presented in the EIS (pages 74 and 75 of Appendix E). Figures 55 and 57 presenting baseflow predictions either do not show Kangaroo Creek or Kangaroo Creek has not been labelled clearly.
Water licencing (Section 3.1.25)	NSW Office of Water (NOW)	The EIS predicts that the mine inflows into the disturbed areas above the Angus Place longwalls from the (Sydney Basin) Richmond Groundwater Source will reach a maximum of 9,690 ML/year by 2033, and the current licensed entitlement is only 2,523 units where currently 1 unit equals 1 ML. The proponent is aware of the deficit but has not addressed this issue in the EIS, and it is recommended that the proponent meet with the Office of Water at the earliest possible opportunity.
		The take of surface water requires further assessment. Assessment should consider: • Capture of surface run off from dams • Indirect losses or reduction in surface water flows due to impacts from underground mining • Reduction of storages of swamps due to impacts from underground mining.

Area of Concern	Raised By	Summary of Issue
		The EIS does not include details of any unregulated category licences held by the proponent or any discussion on how they are planning to comply with the WMA requirements. The proponent must identify licensable take and hold unregulated category access licences from the relevant water source of the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011.
		Any ongoing take of water post-closure of the mine will need to be accounted for by holding or maintaining licences.
		The proponent must maintain records of annual water take from water sources impacted by the development and reported in the annual environmental report.
		It is not clear from the EIA/GIA documentation that the losses of surface baseflow have been included in the total estimate of groundwater take. This should be clarified during licensing.
Water Management (Section 3.1.26)	NSW Environment Protection Authority (EPA)	Much of the proponent's reasoning for discharging the large volumes of untreated mine water is based on a stated demand for mine water which currently does not exist, and any future use is subject to changes to the operation of the nearby power stations.
		The recent situation of Wallerawang Power Station, with one electricity generation unit being closed permanently and the other one mothballed until further notice, has resulted in about a halving of the demand for water usage by Energy Australia for use by this power station. The 40 ML/day requirement for Mount Piper is less than the daily maximum volume of mine water to be produced by the proposed mine expansion.
		Mine water until recently was only transferred to the Wallerawang Power Station via the dedicated mine water transfer pipeline SDWTS. As the SDWTS does not continue on to Mount Piper, mine water cannot be transferred directly to Mount Piper Power Station. In addition, the EPA understands that Energy Australia has expressed no interest at present in utilising the mine water and no interest in extending the SDWTS to the Mount Piper Power Station. With Wallerawang Power Station currently not operating the SDWTS is now no longer being utilised and most mine water (all Springvale and a portion of Angus Place) is now currently discharged through the Springvale Colliery licensed discharge point LDP009 (up to approximately 30 ML/day) to the Coxs River catchment with a very low level of treatment (i.e. for suspended solids).

Area of Concern	Raised By	Summary of Issue
		The EISs can be considered to be highly misleading because the overwhelming bulk of the water impact assessment assumes the SDWTS is operating when it currently is not, and its future is dependent on the operational capacity of Wallerawang Power Station. Both the Angus Place and Springvale EISs have sections detailing water balance and salt balance modelling for mine water discharges. However, since both models have assumed that there are transfers via the SDWTS which is either not happening or based on changed circumstances at Wallerawang Power Station, the modelling and subsequent conclusions are flawed. Water and salt balances for the Coxs River catchment need to be redone under the real proposed scenario which is direct discharge of 30MLlday (rising to 50MLlday if both mine projects are approved) of poorly treated, high salinity mine water into the Coxs River catchment.
		The discharge limits that have been applied to mine water discharges (LDP001 and LDP009) to the Coxs River by the EPA, were established on an interim basis to enable the mines to continue to operate while undertaking works identified in pollution reduction programs (PRPs) attached to both licences to identify and implement a solution to the mine water discharge quality. The PRPs have required either the development of options to cease water discharges (such as redirecting mine water at Angus Place backed into old underground workings) or to develop options to treat mine water to ensure any discharge can meet the ANZECC (2000) trigger value for upland rivers of 350 µS/cm.
		To date no option(s) to cease or treat the mine water has been developed by Centennial Coal. Centennial's approach to mine water is to continue and to increase the discharge from LDP001 and LDP009 to the environment for the next 3 decades without treating the mine water to an appropriate standard. The EPA's ongoing programs are not based on the continuation of the discharging of high volumes of potentially toxic, saline mine water often containing high (relative to ANZECC) levels of metal contaminants to the receiving environment of the Upper Coxs River catchment. Furthermore, it is misleading to suggest that a discharge of this magnitude and poor quality directly into Coxs River tributary streams will have a neutral or beneficial effect on water quality in Sydney's drinking water catchment or the upper Coxs River and its tributaries in terms of hydrology and aquatic health.
		Discrepancies identified in what the Project estimates will be the mine water discharge volumes from both Angus Place and Springvale combined for each year. The total volume of predicted mine water each year to be discharged to LDP's and the SDWTS from both mines should be the same.

Area of Concern	Raised By	Summary of Issue
	NSW Office of Environment and Heritage (OEH)	OEH is aware that electricity generation from Wallerawang Power Station has been suspended, a process that began in early 2014. The EIS has not been updated to reflect this change in circumstances. OEH assumes, therefore, that the proposal would result in a significant increase in waste water being discharged via the licenced discharge point into Coxs River, with none of the mine water being utilised for power production. OEH considers that the EIS and associated documents need to be revised to take into account the closure of Wallerawang Power Station. In particular, the expected discharges and associated impacts on the Coxs River need to be re-assessed.
	Sydney Catchment Authority (SCA)	The SCA is concerned about the increased mine water discharges and associated water quality impacts (salinity) to Kangaroo Creek and Coxs River. The SCA notes that there is currently a Pollution Reduction Program with respect to discharge at Angus Place requiring reduction in salinity levels.
Water Quality (Section 3.1.27)	Sydney Catchment Authority (SCA)	Salinity predictions have been undertaken for the location below the confluence with the Coxs River, not where discharge occurs in Kangaroo Creek. No predictions are made on what would be an expected increase in salinity compared to the current conditions at the discharge point LDP001. The SCA notes that there is currently a Pollution Reduction Program (PRP) on EPL467 with respect to discharge at LDP001 which requires a reduction in salinity levels from 1,100 to 350µS/cm.
		Salinity predictions have not been undertaken for scenario (1) no upgrade of SDWTS and (2) no SDWTS availability and all mine discharges (28.6ML/day) being discharged to the Kangaroo Creek and Coxs River.
		Salinity predictions have not been undertaken when excess inflows, more than the Wallerawang power station demand of 30 ML/d, is proposed to be discharged at LDP009, at a point immediately upstream of Lake Wallace.
		There is no assessment on whether elevated salt levels are likely in the Coxs River where it enters Lake Burragorang.
		The model predictions for the average Coxs River salinity should include an envelope around the average showing 10th and 90th percentiles.
		The EIS states that based on data available, the estimated error in predictions is approximately ±30%. It is not clear if the upper limits would still fall within an acceptable level of impact.

Area of Concern	Raised By	Summary of Issue
		The SCA is concerned about the proposal to transfer mine water to the local power stations (Mt Piper and Wallerawang) which the SCA understands will have limited and reduced availability due to the recent decision to place the Wallerawang power station in care and maintenance. As a consequence, there may be additional discharges of mine water into receiving watercourses of approximately 30 ML/d from this project. These discharges would further impact the quality of receiving waters and the EIS has not addressed this issue. The SCA considers that the Proponent should· either consider an alternative opportunity for mine water reuse or treatment of mine water to a higher level before discharge.
	NSW Environment Protection Authority (EPA)	The discharge from Angus Place LDP001 to Kangaroo Creek (a tributary of the Coxs River) actually represents the first major impact of mine water discharges on the Coxs River. Conductivity in Kangaroo Creek is increased from a median level of 51 micro- Siemens per centimetre (µS/cm) Electrical Conductivity upstream of LDP001 to 900 µS/cm downstream of LDP001 (GHD 2010; Figures of 651 µS/cm upstream and 770 µS/cm downstream are given in the EIS Table 3.9). This represents a 12-fold to 18-fold increase in median conductivity in Kangaroo Creek as a result of the Angus Place LDP001 discharge, and as previously mentioned in the cover letter currently the subject of a PRP. Upstream of the confluence of Kangaroo Creek and the Coxs River the median concentration for conductivity was 107 µS/cm while median concentration in the Coxs River downstream of this confluence was 513 µS/cm (Angus Place (Angus Place EIS Table 3.9). This represents an almost 5-fold increase in median conductivity in the Coxs River likely to be due in large part to the Angus Place LDP001 discharge.
		The Angus Place EIS acknowledges that salinity in the Coxs River is currently in excess of ANZECC guidelines for the protection of aquatic ecosystems and that modelling indicates that salinity will increase due to the extension of Angus Place Colliery. However, the EIS maintains that aquatic and riparian ecosystems are adapted to this environment and predicated salinity is within the range experienced historically in the Coxs River catchment. These conclusions are not supported by the research work of Department of Environment, Climate Change and Water scientists in September to October 2009 that had found that salinity levels in the Coxs River had increased since the 1980's, and that the aquatic ecosystems were now dominated by pollution tolerant taxa, and that Kangaroo Creek downstream of the Angus Place discharge at LDP001 was found to have an impoverished diversity of macroinvertebrate fauna.

Area of Concern	Raised By	Summary of Issue
		The cumulative water quality impacts of Angus Place and Springvale mine water discharges to the Coxs River, an important contributing source to Sydney's drinking water supply, were not modelled for all relevant contaminants, did not consider all likely discharge conditions, and are therefore not accurately and reasonably described.
		Salinity was the only water quality variable modelled for cumulative impacts. The cumulative impact of other contaminants was not provided, even though the EIS states (Appendix C within Appendix F) that levels of copper, zinc, nitrogen and phosphorus have been elevated above ANZECC 95th percentile protection level for slightly to moderately disturbed ecosystems. The contributing water quality impacts to Coxs River from other mines in the area are not quantified.
		Water quality impact estimations for the Coxs River for both Angus Place and Springvale were conducted for scenarios that included the transfer of large volumes of water through the Springvale Delta Water Transfer Scheme (SDWTS) to the Wallerawang Power Station. This may no longer be a viable option because the Wallerawang Power Station has been placed into care and maintenance. Increased discharge volumes resulting from reduced demand from the Wallerawang Power Station would affect the outcome of the cumulative water quality impact assessment and should be considered as a potential discharge scenario.
	Commonwealth Department of the Environment (DotE)	The proponent's estimation of downstream impacts was limited to site water balance and cumulative salt mass balance modelling that did not model impacts beyond the upper Coxs River catchment (i.e. not downstream of Lake Lyell). In addition, the existing condition of the Coxs River was not adequately described and the downstream impact modelling that was undertaken included transfer of large volumes of water through the SDWTS to the Wallerawang Power Station, which may no longer be a viable option.
		Water quality impact estimations for the Coxs River need to consider increased discharge volumes to Coxs River resulting from reduced demand from the Wallerawang Power Station. The assessment of mine water discharges needs to consider the resulting cumulative concentrations of a range of contaminants, in addition to salt, within Coxs River.
		Are the cumulative water quality impacts of discharges to the Coxs River accurately and reasonably described?
		The cumulative water quality impacts of Angus Place and Springvale mine water discharges to the Coxs River, an important contributing source to Sydney's drinking water supply, were not modelled for all relevant contaminants, did not consider all likely discharge conditions, and are therefore not accurately and reasonably described.

Area of Concern	Raised By	Summary of Issue
		Salinity was the only water quality variable modelled for cumulative impacts. The cumulative impact of other contaminants was not provided, even though the EIS states (Appendix C within Appendix F) that levels of copper, zinc, nitrogen and phosphorus have been elevated above ANZECC 95th percentile protection level for slightly to moderately disturbed ecosystems. The contributing water quality impacts to Coxs River from other mines in the area are not quantified.
		Water quality impact estimations for the Coxs River for both Angus Place and Springvale were conducted for scenarios that included the transfer of large volumes of water through the Springvale Delta Water Transfer Scheme (SDWTS) to the Wallerawang Power Station. This may no longer be a viable option because the Wallerawang Power Station has been placed into care and maintenance. Increased discharge volumes resulting from reduced demand from the Wallerawang Power Station would affect the outcome of the cumulative water quality impact assessment and should be considered as a potential discharge scenario.
		Is the information provided sufficient to predict any changes to either water quality or water quantity in the Coxs River at Kelpie Point which would arise as a result of the mining operation? (Kelpie Point – station no. 563000 – is located on the Coxs River close to its entry location into Warragamba Dam. The Sydney Catchment Authority has undertaken flow and quality monitoring at this location for extended periods).
		The proponent's estimation of downstream impacts was limited to site water balance and cumulative salt mass balance modelling that did not model impacts beyond the upper Coxs River catchment (i.e. not downstream of Lake Lyell). In addition, the existing condition of the Coxs River was not adequately described and the downstream impact modelling that was undertaken included transfer of large volumes of water through the SDWTS to the Wallerawang Power Station, which may no longer be a viable option.
		What are the predicted changes to water quality water quantity in the Coxs River at Kelpie Point and what are the consequences for stored water within Warragamba Dam?
		Water quantity and quality changes in the Coxs River at Kelpie Point cannot be reliably estimated based on the information presented in the EIS documentation, as detailed in the response to Question 7. For similar reasons, the consequences for stored waters in Warragamba Dam also cannot be reliably estimated from information in the EIS.

Area of Concern	Raised By	Summary of Issue
		Protection of the long-term ecosystem health of Coxs River should include consideration of the ANZECC and ARMCANZ (2000) Guidelines, through an agreed set of approval trigger discharge values and management protocols. Where salinity or other contaminants of concern are likely to exceed trigger values, management and treatment options may include, but are not limited to, reverse osmosis and ion exchange technologies.
	Office of Agricultural Sustainability and Food Security (OAS&FS)	It is important however that the current water quality conditions will be maintained and it is recommended that this commitment is reflected in the conditions of approval.

Table 2 - Summary of Special Interest Group Submissions

Area of Concern	Raised By	Summary of Issue
Biodiversity Strategy (Section 3.2.1)	Lithgow Environment Group (LEG) And The Colong Foundation for Wilderness	The Director General's requirements for the offset strategy requires Centennial Coal to develop 'An offset strategy, which is clearly quantified, to ensure that the development maintains or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term'. Centennial Coal and RPS have taken a miserly interpretation of this direction.
		Only Matters of National Environmental Significance and Endangered Ecological Communities are considered in relation to indirect impacts. For example, the offset analysis has not been applied to the 200 hectares of the Birds Rock Flora Reserve that will be damaged by the proposed mining.
		Centennial claim that 'the residual impacts following avoidance and mitigation are not significant, as such direct offsets are not required'. Centennial, having found themselves not responsible for impacts, magnanimously offers an offset 'provision of land to compensate potential impacts' to these nationally endangered swamps.
		Centennial Coal proposes to protect for the conservation by setting aside 342.2 hectares of former farmland in the Capertee Valley it claims may have 160 fauna species and various endangered communities. None of the proposed offset compensate 'like-for- like' the loss of nationally endangered swamps or the impacted Tablelands Snow gum - Black Sallee, - Candlebark and Ribbon Gum Grassy Woodland on or below Newnes Plateau.
		Lot 135 also covers the new Angus Place Vent Shaft No 2 and Springvale Bore 8, as well as the Western Coal Services Upgrade Project. The proposed offset is also to cover, for reasons that are not explained, the Clarence Reject Emplacement Area VI.
		The total of 100 hectares of swamps and 31.5 hectares of native forest cleared for infrastructure for the two current mine extensions as explained in the tables 11 to 15 is misleading. It is unclear how much clearing and so-called indirect impacts on EEC are being compensated by this one offset, perhaps an additional 200 hectares, perhaps much more land is directly impacted.
		The omission of the total land area to be cleared and that 'indirectly impacted' means that the offset analysis in Appendix I does not comply with the Director General's requirement for clear quantification. To be clear, the offsets for Angus Place Vent Shaft No 2 and Springvale Bore 8, Western Coal Services Upgrade Project and the Clarence Reject Emplacement Area VI are not quantified.
		Lot 135 DP 755757 is only 86.7 hectares in size (App I, section 6.2 and Table 17), so the earlier reference to '342.2 hectares of critically endangered ecological community and habitat for over 160 fauna species' on page 3 is wrong. The area of endangered ecological community is very small.

Area of Concern	Raised By	Summary of Issue
		Table 18 reveals that only 10 hectares of a critically endangered Box Gum Woodland and Derived Native Woodlands exists on the site. All the claimed threatened animals listed in Table 18 are not recorded from observation, rather it is claimed that the woodlands are 'very likely' to provide habitat for such wildlife (page 23 and note that title of Table 18 is species recorded in the site and locality.
		As non-threatened degraded woodland species are used for the credits, then non-threatened species for the indirectly impacted woodlands and forests on Newnes Plateau should also be part of the offset calculation. The proposed Angus Place extension covers 2,638 hectares and the proposed Springvale extension covers 1,860 hectares (including the 131.5 hectares of EECs and clearing). These impacted forests are part of a reserve proposal initially put forward by the National Parks and Primitive Areas Council in 1932.
		The offset analysis is further confused by the statement that 'Both the Springvale Mine Project and the Angus Place Project will not impact upon 'credit species' and therefore only ecosystem credits are required' (Page 30, App. I). This statement is wrong. Giant Dragonfly, Blue Mountains Sink, and Boronia deanei will be impacted causing the loss of local populations.
		The offset analysis does not properly consider naturally rare ecosystems, like the three swamp EECs and other Groundwater Dependent Ecosystems. In Table 21 all the Temperate Highlands Peat Swamps on Sandstone (BioBank Units 562 and 592, equivalent to MU's 50,51 and 52), for example, receive a total score of only -1,306 units and this is for damaging 100 hectares in 63 near-pristine EEC swamps. This score compares with a total score of -1,424 units given for clearing 23 hectares open forest and shrubby woodlands at the proposed Angus Place extension for facilities. The latter result seems reasonable for common sclerophyll forests and woodlands, the former result is grossly underestimated for swamps extending over five times the area being impacted by a key threatening process.
		The Ecosystem Credit Balance in Table 21 does not properly recognise the important value of these swamps and is completely unacceptable. The analysis demonstrates that reducing ecosystems to numbers does not inform decision making, but rather confuse the issue.
		The offset analysis is deficient as the values for known populations of threatened species at risk of local extinction are not individually calculated.
		The statement regarding MU20 made on page 32 and in Table 23 is not reported in Table 17 and appears as double counting. It should be ignored.

Area of Concern	Raised By	Summary of Issue
		Eliminating the 8 hectares of cleared derived grassland that appears to be cattle paddocks leaves just 2 hectares of a critically endangered community in the proposed offset. The proposed exchange of 2 hectares of critically endangered box gum woodlands on farmland for 100 hectares of diverse, intact EEC swamps is presented in a misleading manner.
		LEG does not consider the proposed research to be an appropriate supplementary measure for the loss of threatened plants and animals through development. Recovery plans and research are needed, but not at the expense of retaining important habitat.
Compliance (Section 3.2.2)	Lithgow Environment Group (LEG)	Between 2000 and 2012 1039 Incidents of Licence Non-compliance were recorded under Environmental Protection Licences (EPLs) issued to Angus Place (EPL 467) and Springvale Colliery (EPL 3607) under the Protection of the Environment Operations Act 1997 (POEO Act). None of these Non-compliances, Penalty Notices, or Pollution Reduction Notices are mentioned anywhere in the EIS. Why not?
Consultation (Section 3.2.3)	Colong Foundation	None of the Colong Foundation's concerns were properly addressed. The Colong Foundation has not been approached by Centennial for a meeting in the last four years. Very few, if any, of the concerns raised by the Colong Foundation have been 'closed out' as suggested by Centennial in Table 7.1. The claim that 'Centennial will continue to consult and engage with these groups to achieve outcomes of the Consultation Strategy' has not been the Colong Foundation's experience in the last four years.
Ecology (Section 3.2.4)	Nature Conservation Council of NSW (NCC)	This project will adversely impact on important terrestrial and stream environments in 2,638 hectares of Newnes Plateau in a significant part of the Gardens of Stone region.
		The proposed construction of seven de-watering facilities will fragment the public forest and significantly adds to the burden of infrastructure on Newnes Plateau in the Gardens of Stone region.
		The sandstone strata supporting the 22 nationally endangered swamps, and particularly the 7 shrub swamps, will also develop a large number of fractures. Centennial predicts these cracks to be 5 to 50mm wide and 10 to 15 metres deep. All these nationally endangered swamps will dry out due to the lowered groundwater levels. The peat soils that support these swamps will then decompose. Over a period of years eucalypts and banksias will migrate into these dying swamps as they evolve into dry land communities.
	The Colo Committee	Centennial claims 'Longwall mining by the Project is unlikely to have a significant impact on swamps' even though longwalls 1016 and 1017 pass under Trail 6 swamp and others pass under Tri Star swamp.

Area of Concern	Raised By	Summary of Issue
		The proponent is quite clear that there will be significant impact on a Flora Reserve of high conservation value. If you change surface water drainage then you change the plant communities that can survive there, thus damaging this conservation significance.
	Blue Mountains Conservation Society (BMCS)	The consultants have asserted 'that any effects on potential populations of the endangered Adams Emerald Dragonfly will be insignificant'. It is impossible to make such a statement, considering that there have never been any ecological studies of this species and limited aquatic sampling was undertaken for this project.
		The BMCS strongly supports the consultants' recommendation to undertake more comprehensive, and better designed, pre-mining surveying, and finer resolution taxonomic identification of stygofauna; such surveying must be implemented if this project proceeds to ensure that the diversity of stygofauna is properly assessed and potential risks of the project determined.
		One of the more important components of the Newnes Plateau environment is the system of shrub swamps (NPSS). The expansion of these mines would put at risk 17 swamps listed as nationally endangered, plus 31 hanging swamps. These swamps store water and release it gradually, maintaining stream flow even in drier periods. The loss of water into cracked streambeds upstream of, or under, these swamps leads to their desiccation and the complete destruction of the ecosystem in each affected valley.
		Dr Baird disputes the conclusion of the consultants that there will be no significant impact in relation to the Key Threatening Process of subsidence from longwall mining.
	The Colong Foundation for Wilderness	Newnes State Forest has only been subjected to selective logging in certain places, and is mostly unlogged old growth forest, contrary to the claims on page 97, s 2.8.1 in Vol. 1 of the EIS. The claim that 'as a consequence of forest harvesting and fires, large areas of forest are relatively young with a low to moderate density of hollow-bearing trees' is an overstatement. These eucalypt forests and woodlands are adapted to wild fire and mostly old-growth with a high density of hollows. Further, the sheltered gully forests offer protection for wildlife and even the hottest fires do not entirely burn Newnes Plateau due to its dissected, rocky terrain. The overall importance of this forest should not be discounted as claimed by Centennial Coal.
		The Foundation disputes the number of shrub swamps in the subsidence area with Centennial Coal, as five shrub swamps are clumped under the name Tri Star Swamp.

Area of Concern	Raised By	Summary of Issue
		The sandstone strata supporting the 22 nationally endangered swamps, and particularly the 7 shrub swamps, will also develop a large number of fractures. Centennial predicts these cracks to be 5 to 50mm wide and 10 to 15 metres deep. All these nationally endangered swamps will dry out due to lowered groundwater levels. The peat soils that support these swamps will then decompose. Over a period of years eucalypts and banksias will migrate into these dying swamps as they evolve into dry land communities.
		Trail 6 swamp (NPSS) contains suitable habitat for Petalura gigantea (Pg) and Eulamprus leuraensis (El). LW1016 and LW1017 should be shortened in length to avoid this swamp, which is over a Type 3 structure. Trail 6 swamp is in a very similar position to Twin Gully Swamp which is protected but is not over any structure.
	Lithgow Environment Group (LEG)	Centennial distinguished plant communities that are allegedly indirectly impacted from those that are directly impacted. By indirectly impacted, Centennial means plant communities that have been subjected to longwall mining where it claims there is no significant impact to these communities. Notwithstanding the fact that longwall mining is a Key Threatening Process for nationally threatened swamps, Centennial has convieniently found that longwall mining is 'unlikely' to have an impact on these swamps.
		The Lithgow Environment Group disputes that the impacts on the three EECs that comprise the Temperate Highlands Peat Swamps on Sandstone (THPSS) are indirectly impacted by the proposed longwall mining operations. Longwall mining is a Key Threatening Process and is likely to directly impact on THPSS through mine subsidence. Damage to swamps above the area of direct influence of the mining operations is clearly a likely impact.
		Centennial claims the proposed longwall mining will have no likely cause extinction for local populations of the Giant Dragonfly, Blue Mountains Skink, and Boronia deanei due to the drying out of nationally endangered swamps that paradoxically would be a direct impact of mining. The analysis of the impact on these species is not unlikely or low, as claimed, but likely as longwall mining is a key threatening process to the swamp habitat in with they live.
		LEG believes that the monitoring of the nationally endangered swamps is misleading and that proper mapping of these swamps is still incomplete after decades of ineffective management. Despite the expense, the mapping is inadequate so that dramatic changes to mined vegetation communities over time have not been reported.
		The swamps to be impacted upon by the proposed mining are the best remaining on Newnes Plateau. The reported findings in Table 2 to Table 5 (App. I) are inaccurate and misleading in relation to swamps and the abovementioned species found within them as they are inconsistent with the evidence.

Area of Concern	Raised By	Summary of Issue
		The claim in Appendix I that the proposed mining is consistent with the threat abatement plan for Blue Mountains Skink is wrong, as the impacts are not adequately mitigated by the proposed longwall mining arrangements.
		In Table 4 of Appendix I that bulldozing an unnecessary road and ten metre wide pipeline easement through a Tablelands Snow gum - Black Sallee - Candlebark and Ribbon Gum Grassy Woodland is unlikely to have an adverse impact on this Threatened Ecological Community is also wrong.
		The analysis regarding frog impacts in Table 2 to Table 5 is wrong, as it assumes that swamps and streams are unaffected by the proposed longwall mining.
		Swamp ecosystems can not be replanted or repaired following damage by longwall mining.
	Stop Coal Seam Gas Blue Mountains (SCSGBM)	Important terrestrial and stream environments in this significant part of the Gardens of Stone region must not be damaged by longwall mining.
		The sandstone strata supporting the 22 nationally endangered swamps, including the 7 shrub swamps must not be fractured.
Economic (Section 3.2.5)	The Australia Institute (TAI)	Various - TAI raised a number of concerns in relation to the adequacy of the Economic Assessment for the Project in the context of: • Its compliance with 'state and federal guidelines' for preparation of cost benefit analyses; and • Its failure to 'meet standards expected in the economics profession'.
Exploration (Section 3.2.6)	Blue Mountains Conservation Society (BMCS)	The DA for the neighbouring Centennial mine, Springvale, undertakes to "continue exploration activities, predominantly borehole drilling to further refine the existing geological model", but the Angus Place EIS includes no such commitment. Is this just an oversight?
General (Section 3.2.7)	Blue Mountains Conservation Society (BMCS)	It is confusing regarding the intention in the AP EIS to "include all currently approved operations, facilities and infrastructure of the Springvale Mine". Why would Angus Place use the Springvale plant?
		The proposed 25 year Consent Period is far too long given the history of 'unforeseen' impacts associated with Angus Place and Springvale Colliery's including cliff falls, swamp deaths, and water quality breaches. Planning consent should be limited to a maximum of 5 years, and must be subject to performance 'triggers' that ensure the health and integrity of nationally endangered swamps, the Coxs River and Sydney Drinking Water Catchment, and national and World Heritage values. If the trigger levels are exceeded then the Consent should be reviewed to address any failures.
	Stop Coal Seam Gas Blue Mountains (SCSGBM)	The Angus Place and the adjoining Springvale mine extension proposals must be subject to a Planning Assessment Commission review with concurrent Public Hearings.

Area of Concern	Raised By	Summary of Issue
Historic Impacts (Section 3.2.8)	Nature Conservation Council of NSW (NCC) Blue Mountains Conservation Society (BMCS) The Colong Foundation for Wilderness Lithgow Environment Group (LEG)	Various special interest groups have raised concerns regarding a number of impacts considered to be attributable to the mining operations of Angus Place Colliery. These historic issues raised can be summarised into 5 specific areas which include: • Loss of water flow in creeks as a result of subsidence cracking; • Changes to ecological communities; • Impacts to water quality; • Impacts to swamps; and • Cliff falls.
	Nature Conservation Council of NSW (NCC)	Centennial Coal must not be allowed to simply replicate the damage it has already caused to nationally threatened upland swamps on the Newnes Plateau for which it was required by the Commonwealth Government to pay $1.45 million in reparations.
	Blue Mountains Conservation Society (BMCS)	Local mining history has demonstrated that subsidence damage and/or eco-toxic mine water effluent discharges from Angus Place and Springvale Colliery's have caused irreparable damage to a Federally Listed Endangered Ecological Community THPSS at Junction Swamp, Narrow Swamp, East Wolgan Swamp, Kangaroo Swamp, and Lamb's Creek Swamp. That is clearly an unacceptable situation.
	Lithgow Environment Group (LEG)	In addition to mine subsidence and mine water discharge damage there are other mine related impacts to endangered swamps which must be avoided. For example, LEG believes that the trail bike tracks below running from Campbell's Road down into East Wolgan Swamp were initially started by Consultants monitoring for Springvale and/or Angus Place Colliery, and subsequently have been used by other trail bike riders. The resultant erosion gullies are very deep and is causing localised drying out of a hanging swamp. We believe that Centennial should be required to remediate the tracks put in by their Consultants.
		Bushfire is a serious problem for damaged swamps, as the peat can burn deeply, can massively accelerate erosion, and subsequently affect natural regeneration. Centennial's rehabilitation efforts at East Wolgan Swamp could all be gone in a matter of minutes. It is better not to damage swamps in the first place, but when they have been damaged some fire management planning must be undertaken by those responsible.
	Stop Coal Seam Gas Blue Mountains (SCSGBM)	Centennial Coal must not be allowed to simply replicate the damage it has already caused to nationally threatened upland swamps on the Newnes Plateau for which it was required by the Commonwealth Government to pay $1.45 million in reparations.

Area of Concern	Raised By	Summary of Issue
Mine Design (Section 3.2.9)	The Colo Committee	Centennial Coal must be required to consider alternative bord and pillar mining methods for its proposed Angus Place extension. Centennial's Airly mine in the Capertee Valley operates to a depth of 405 metres underground in the same geology. If Centennial can operate Airly Colliery as a bord and pillar mine, then it can also operate Springvale mine in this manner.
		The intensity of longwall mining is reduced so that all nationally endangered swamps are protected – this includes shortening longwalls 1017 and 1016 to protect Trail 6 swamp and shortening longwalls 1004, 1005 and 1006 to protect the Tri Star Swamp complex. Narrowing and/or splitting longwall panels 1007, 1008, 1009 and 1010 occurs to prevent fracture damage to the Birds Rock Flora Reserve. Splitting longwalls 1013 and 1014 occurs to prevent damage to pagodas and cliffs.
	Blue Mountains Conservation Society (BMCS)	Bord and pillar is a clearly more benign process, and has been practiced at Centennial's nearby Clarence Colliery. However, in this instance, the mining method was chosen for reasons of engineering safety (the stope back was too solid to collapse in a controlled manner) rather than any display of environmental sensitivity.
		The intensity of longwall mining is reduced so that all nationally endangered swamps are protected – this includes shortening longwalls 1017 and 1016 to protect Trail 6 swamp and shortening longwalls 1004, 1005 and 1006 to protect the Tri Star Swamp complex. Narrowing and/or splitting longwall panels 1007, 1008, 1009 and 1010 occurs to prevent fracture damage to the Birds Rock Flora Reserve. Splitting longwalls 1013 and 1014 occurs to prevent damage to pagodas and cliffs.
	The Colong Foundation for Wilderness	The mining footprint must be significantly lessened and mining methods reduced in intensity to protect Carne Creek, pagodas, cliffs and the nationally endangered swamps of the proposal area. Centennial Coal must be required to consider alternative bord and pillar mining methods for the proposed extension to Angus Place Colliery. Centennial's Airly Mine in the Capertee Valley operates to depth of 405 metres in the same geology, which includes bad mine roof conditions and many structural features. If Centennial can operate Airly Colliery as a bord and pillar mine, then it can also operate Springvale mine in this manner.
	Lithgow Environment Group (LEG)	The mining footprint of the Angus Place Extension must be significantly lessened and the intensity of mining methods reduced to protect nationally endangered swamps, Carne Creek, pagodas and cliffs. Centennial Coal must be required to consider alternative bord-and-pillar mining methods in these environmentally sensitive areas.

Area of Concern	Raised By	Summary of Issue
		The intensity of longwall mining should be reduced so that all nationally endangered swamps are protected – this includes shortening longwalls 1017 and 1016 to protect Trail 6 swamp and shortening longwalls 1004, 1005 and 1006 to protect the Tri Star Swamp complex; Narrowing and/or splitting the longwall panels 1007, 1008, 1009 and 1010 to prevent fracturing damage in the Birds Rock Flora Reserve and Splitting longwalls 1013 and 1014 to prevent damage to pagodas and cliffs, as proposed.
Monitoring (Section 3.2.10)	The Colong Foundation for Wilderness	The monitoring has not provided the necessary information to assist decision-makers regarding the damage to these swamps and streams. This could be as simple as the provision of clear images to regulators of the worst examples of dead swamp vegetation and streambed cracking. Groundwater monitoring bores, for example, meet regulatory requirements but do not appear to identify problems that can be observed in dying swamp vegetation.
		Some swamps in the Gardens of Stone are used as controls for current mining activity. These swamps are not separate from mining activity and are scheduled to be undermined. Mining would nullify their value as a control.
		Swamp vegetation condition monitoring programs often do not refer back to the original vegetation condition at the time of the preparation of the environmental impact statement.
		Centennial Coal has admitted that its monitoring has contributed to damaging these nationally endangered swamps. 'Centennial's monitoring effort on the Newnes Plateau is extensive (refer to Figure 3.9 in Vol. 1 of the EIS) and contributes to an increase in anthropogenic impacts, such as recreational 4WDs, through the establishment of access tracks for monitoring' (Page 39, App. I, Vol. 2 of the EIS). Centennial Coal has not rehabilitated tracks cut to monitoring sites. Once the monitoring effort is completed, inappropriate recreational use continues causing ongoing environmental degradation.
		Centennial Coal's consultants use trail bikes to access monitoring sites, and appear to drive through nationally threatened swamps.
		Centennial proposes to curtail swamp monitoring, apparently because it has 'proven' in this EIS report that longwall mining causes no significant damage to nationally endangered swamps, despite the activity being a key threatening process endangering swamps. Centennial further proposes to fund rehabilitation of the trails it cut for monitoring purposes using the funds saved from curtailing its monitoring effort.

Area of Concern	Raised By	Summary of Issue
		The Swamp Plan is based on incorrect geological and geomorphological assumptions and a flawed monitoring strategy that could not detect damage in a timely fashion. The Swamp Plan's conclusion that longwall mining of Newnes Plateau would be benign demonstrates that the coal industry can't be trusted to protect significant environmental values, such as the nationally endangered swamps found in the Gardens of Stone.
	The Colo Committee	Subsidence monitoring should be by a third party agency, such as the Office of Environment and Heritage, and monitoring should be paid for by Centennial Coal. Monitoring of surface flow and near-surface groundwater monitoring must create a comprehensive picture of the sub-catchments affected by mining. Monitoring of changes in ecosystem condition must include well exposed, wide angle impacts of affected areas with GPS co-ordinates.
Physical Impacts (Section 3.2.11)	Blue Mountains Conservation Society (BMCS)	Minimal impact is zero impact. Since the document then states that "Impacts that do arise would be managed by …" clearly indicates that impacts are expected, not minimised.
Rehabilitation (Section 3.2.12)	Nature Conservation Council of NSW (NCC)	Progressive rehabilitation undertaken by Centennial has proven ineffective and incomplete. Many tens of kilometres of access roads have not been closed and rehabilitated.
	The Colo Committee	All past tracks and trails created by Centennial Coal and its consultants, including those established by trail bikes, should be recorded and plans set in place as soon as practicable to rehabilitate these trails on an on-going basis and as part of the rehabilitation program for this mine.
	The Colong Foundation for Wilderness	Even when rehabilitation action has been triggered by the 'Swamp Plan' it has been ineffectual and half-hearted. The rolls of coir logs have been found left abandoned, the dumping of branches from the surrounding forest will encourage dry-land vegetation, not the regeneration of swamp vegetation.
Subsidence (Section 3.2.13)	Nature Conservation Council of NSW (NCC)	All 2,638 hectares affected by the proposed longwall mining will be subject to surface cracking. Entire sub-catchments will be fractured to a depth of 15 to 20 metres.
		The mining footprint must be significantly lessened and mining methods reduced in intensity to protect Carne Creek, pagodas, cliffs and the nationally endangered swamps of the proposal area.
	Blue Mountains Conservation Society (BMCS)	There should be no surface cracking of stream beds, under swamps or of pagodas, rock outcrops or cliffs.
		The western coalfield has a history of cliff collapses due to subsidence from longwall mining. As was demonstrated by the nearby Coalpac Consolidated Project, the companies involved greatly underestimated the level of cliff collapse that has already occurred. Conservation volunteers have been able to find, locate and document a great many instances that mining consultants failed to find.

Area of Concern	Raised By	Summary of Issue
	The Colong Foundation for Wilderness	Surface cracking is predicted to be less than 5 to 25mm wide, with isolated cracking is some locations greater than 50mm. This needs to be read in the context of the heavily jointed and faulted area proposed to be mined. In this context cracking in the order of 50mm will be more likely in areas with geotechnical hazards. It appears hat cracking along Wolgan River will be exacerbated by a lineament zone. Lineament zones will also increase cracking if longwalls 1010 to 1017 are mined as proposed. Cliffs are associated with these lineaments and these areas are more unstable so a more precautionary approach is needed in relation to setbacks.
		All 2,638 hectares affected by the proposed longwall mining will be subject to surface cracking. Entire sub-catchments will be fractured to a depth of 15 to 20 metres.
Surface Infrastructure (Section 3.2.14)	The Colong Foundation for Wilderness	The proposed clearing of 14 hectares of forest for an additional ventilation facility is excessive and its proposed location close to the Wolgan River is unacceptable. In addition a further 9.25 hectares of clearing is associated with seven boreholes. The proposed construction of seven de-watering facilities will further fragment the public forest significantly adding to the infrastructure burden on Newnes Plateau in the Gardens of Stone reserve proposal.
	Blue Mountains Conservation Society (BMCS)	As this mine progressively advances under the plateau, there is a concomitant advance of the associated industrial landscape across largely pristine woodland. Exemplifying this forest destruction is the proposed additional clearing of an extraordinary 23.25ha for a ventilation facility, seven dewatering bores and a ten metre wide pipeline easement connecting these sites. All this industrial development significantly adds to the burden of infrastructure on Newnes Plateau in the Gardens of Stone region; to date progressive rehabilitation has proven ineffective.
	Nature Conservation Council of NSW (NCC)	The proposed clearing of 14 hectares of forest for an additional ventilation facility is excessive and its proposed location close to the Wolgan River is unacceptable.
	Stop Coal Seam Gas Blue Mountains (SCSGBM)	The scenic western edge of the Newnes Plateau must be protected from further scarring by new roads, pipeline and electricity easements.
Surface Water (Section 3.2.15)	Emirates	Carne Creek is our only source of water. Any impacts to water volumes in Carne Creek impacts our business.
	Stop Coal Seam Gas Blue Mountains	Carne Creek is currently in a pristine state, and its waters that flow through the Greater Blue Mountains World Heritage Area are of the highest standard. This creek must not run bright orange or suffer reduced flows, just like the Wolgan River after Centennial Coal wrecked it.
Tourism (Section 3.2.16)	Blue Mountains Conservation Society (BMCS)	The growing and sustainable tourist industry is being consistently damaged by the impacts of coal mining in this spectacular region. The price of this development is too high.

Area of Concern	Raised By	Summary of Issue
Water Management (Section 3.2.17)	Nature Conservation Council of NSW (NCC)	NCC objects to the proposed discharge of up to 43.8ML/day of untreated eco-toxic mine effluent to the Coxs River via the Springvale-Delta Water Transfer Scheme (SDWTS). This inappropriate discharge is inconsistent with the Sydney Catchment Authority Sydney Drinking Water Audit 2010 recommendations that require improved treatment of such licensed discharges.
		The Wallerawang Power Plant is shut, possibly permanently, and the current proposal to supply cooling water is not viable.
		The enormous quantities of mine effluent, currently running at 8.4ML/day must be treated using reverse osmosis technology to remove all metals and salts.
		Any malfunction of SDWTS, such as following a bushfire, must not result in emergency discharges to the World Heritage Area via Wolgan River or Carne Creek but be reinserted underground into the mine.
	The Colo Committee	All proposed discharge of up to 43.8ML/day of mine effluent to the Coxs River via the Springvale-Delta Water Transfer Scheme (SDWTS) is treated by reverse osmosis technology to remove salt and metals to a standard that protects, the Coxs River, the downstream drinking water supply and near-pristine ecosystems in the World Heritage Area.
		In the event of a malfunction of SDWTS, such as during and following a bushfire, emergency discharges must be reinserted underground into the mine and under no circumstances released to the World Heritage Area via Wolgan River or Carne Creek.
		Reinserted mine effluent must be properly treated and not allowed to re-emerge in an unauthorised or unregulated manner.
	Stop Coal Seam Gas Blue Mountains (SCSGBM)	The proposed discharge of up to 43.8ML/day of eco-toxic mine effluent must be treated using reverse osmosis technology to remove all metals and salts before discharge to the Coxs River.
	Blue Mountains Conservation Society (BMCS)	Malfunction of SDWTS, such as following a bushfire, must not result in emergency discharges to the World Heritage Area via Wolgan River or Carne Creek but reinserted underground into the mine.
	Lithgow Environment Group (LEG)	The ownership and responsibility for the SDWTS is very unclear, as the situation regarding who is responsible for rehabilitating the Kerosene Vale Fly Ash Repository. Critical Issues such as the EPL's, land ownership, and final rehabilitation of the entire route of the SDWTS should have been clarified in the EIS, and must be clarified prior to any consent approval.

Area of Concern	Raised By	Summary of Issue
		The EIS claims that untreated discharges will go to Wallerawang Power Station, but it has ceased operation and is expected to remain so. As a result these untreated discharges will go directly into the Coxs River via the licenced discharge point LDP009, or into LDP1 in Kangaroo Creek upstream of Lake Wallace.
		Figure 26 from the EIS clearly shows that salinity levels will spike dramatically reaching a peak from 2020 to 2025. Section 4.2.2, p. 65, identifies that the median salinity at LDP001 is 1,010µS/cm. Several Metals at LDP1 already exceed the ANZECC guidance including Copper at 0.002mg/L (guidance 0.0014mg/L); Aluminium of 0.02mg/L; and Zinc at 0.046mg/L (guidance 0.008mg/L). These pollution effects will be magnified during drought conditions, which are likely to become more prevalent during the life of these mines due to climate change.
		On 9 May 2010 the EPA issued Angus Place (EPL 467) with a Pollution Reduction Notice to reduce the estimated 1,000 tonnes of salt deposited from LDP1 into Kangaroo Creek each year based on the average flow rate of 731ML. This Proposal aims to increase that flow rate 3 – 14 times. The proponent proposes to treble the flow from LDP1 to 2,300ML, and if the SDWTS is unavailable, to increase the flow from between 6 and 14 times (4,750ML up to 10,457ML). In total this proposal will discharge and some 31 tonnes/day (or 11,247 tonnes/year) of metal-rich Salts into the Coxs River which supplies Sydney with drinking water.
		At LDP005 LEG Streamwatch volunteers recorded a Salinity level of 1030 µS/cm; Turbidity of 40 NTU (exceeded EPL limit); pH 7.5; Dissolved Oxygen 4.3 mg/L (52%); Available Phosphate 0.07 ppm; and Water Temperature of 25^{o}C. The water had a chemically odour – attributable we believe to Solcenic water-soluble hydraulic oils, used in and spilled in vast quantities by long wall mining equipment.
		The proposed discharge of 43.8 ML/day of eco-toxic saline minewater will have adverse impacts on aquatic life and natural ecosystems in the Coxs River, Sydney Drinking Water Catchment and Greater Blue Mountains Heritage Area which it flows through, as well as potentially for Carne Creek, the Wolgan River, and Wollemi National Park if any SDWTS malfunctions necessitate further Emergency Discharge's on Newnes Plateau.
		At the source of the Coxs River in Long Swamp LEG Streamwatch volunteers have consistently recorded salinity levels of 30 µS/cm. Just 4.8km downstream at LDP001 the median salinity is 33 times higher at 1,010 µS/cm and 1,055 µS/cm at LDP009. The high salinity of this mine water will significantly affect aquatic and riparian ecosystems that have evolved under very low nutrient conditions, and water users in the Sydney Drinking Water Catchment.

Area of Concern	Raised By	Summary of Issue
		The proposed discharges from LDP001 and LDP009 are inconsistent with the Sydney Catchment Authority Audit 2010, which included recommendations requiring improved treatment of POEO licenced discharges in the Coxs River Catchment. Numerous reports since 1966 have highlighted the highly polluted condition of the Coxs River.
		The proposed discharges risk cancelling out negotiations between the EPA, Blue Mountains Conservation Society, and Delta Electricity to establish EPL limits for concentrations of Copper, Zinc, Aluminium, Boron, Fluoride, Arsenic, Nickel and Salts being discharged from LDP009 into the Coxs River. Delta had agreed to construct a Reverse Osmosis (RO) Plant to treat the SDWTS effluent after use for cooling, and pipe the brine waste to Mt Piper Flyash Repository for disposal. The closure of Wallerawang Power Station jeopardises this.
		It is in the public interest to control metal and salt pollutants at their source – the coal mines that operate within the Sydney Drinking Water Catchment. The current SDWTS proposal to provide cooling water to Wallerawang Power Station is no longer viable. The closure of this plant means these salts and metals will instead be flushed into the Coxs River through the Greater Blue Mountains World Heritage Area and into Lake Burragorang – Drinking Water Supply for 4 million people. Before discharge, this mine water must be treated to a standard that protects undisturbed aquatic ecosystems and the health of downstream water-users. The only effective way to treat the high levels of turbidity, heavy metals (including Aluminium, Zinc, Copper and Nickel) and salinity is by requiring Centennial to install reverse osmosis (RO) technology to remove all metals and salts.
		A map was provided to LEG at a Delta Western Reference Group Meeting in 2008. It shows the SDWTS Pipeline route, and identifies that a section of Pipeline is managed by Centennial, while Delta Electricity is responsible for another section. Despite 1000's of pages of documents in the EIS, it is still unclear whether Energy Australia has accepted responsibility for Delta's section of the Pipeline, whether Energy Australia are happy for Centennial staff/contractors to access Energy Australia owned land at Kerosene Vale Fly-Ash Repository (KVAR) and Licence Discharge Point LDP009, and who is ultimately responsible for the EPL Licences for all parts of the SDWTS.
	The Colong Foundation for Wilderness	Any malfunction of the SDWTS, such as the destruction of the pipeline during a bushfire, must not result in emergency discharges to the World Heritage Area via Wolgan River or Carne Creek. The existing EPL3607 must require LDP004 and LDP005 to be decommissioned as emergency discharge points.

Area of Concern	Raised By	Summary of Issue
		The proposal to redirect emergency mine inflows from the SDWTS underground into the Angus Place Colliery's 900 water storage area via the existing Angus Place 940 Bore facility is conditionally supported, provided that these transfers do not then re-emerge to the surface and escape the mine site as untreated effluent. The Colong Foundation is, however, suspicious of the above arrangement given the previous unauthorised mine effluent discharges.
Water Resources (Section 3.2.18)	Nature Conservation Council of NSW	Surface groundwater aquifers will become more permeable and interconnected. Centennial predicts surface aquifer drawdown to be 10 metres under ridges to 0.5 metres under shrub swamps. This range seems to be an underestimate as the longwall mining proposed at Angus Place Mine is more intensive than at Springvale Colliery, but the same degree sandstone cracking and groundwater drawdown is predicted.
		Carne Creek is currently in a pristine state, and its waters that flow through the Greater Blue Mountains World Heritage Area are of the highest standard. The extensive fracturing of the sandstone associated with longwall mining of headwater swamps will release high levels of metals, notably manganese and iron, polluting Carne Creek and making it run bright orange, just like the Wolgan River did once. Flows in Carne Creek will also become irregular.
	The Colo Committee	The extension area underlies the top part of Carne Ck, and incredibly seeks to mine under this.
		Emergence of near surface groundwater with elevated levels of salt or metal precipitate in Carne Creek must be prevented.
	Emirates	In the past 2 months Wolgan River has dried up as well as the swamps above Wolgan Falls which feed Wolgan River. Some of that might be due to recent lack of rain, but I assume it is not just the dry weather but new cracks in the catchment area from expanding mining operations from Angus Place colliery
		There are the construction works (new bore holes, power lines, pipelines and access roads) being undertaken at the moment in the area of Sunny Ridge Road (off Blackfellows Hand Road). This activity resulted from recent approvals for long wall mining expansions into the Carne Creek catchment area. This is our water supply and the lifeline of the Wolgan further down.
	Blue Mountains Conservation Society (BMCS)	This development application involves plans to pump up to 43 million litres of contaminated water a day into the same river, which feeds into the Lake Burragorang, an important part of Sydney's drinking water supply. Under the current proposal, the mine water would apparently be released into the river untreated, despite having elevated salt and heavy metal levels. The specific route is via Sawyers Swamp Creek into the Coxs River.

Area of Concern	Raised By	Summary of Issue
		The discharge to be made under the current application, of to 43.8ML/day of untreated eco-toxic mine effluent, would flow to the Coxs River via the Springvale Delta Water Transfer Scheme (SDWTS). Such an inappropriate discharge is inconsistent with the SCA Sydney Drinking Water Audit 2010 Recommendations.
		Any discharge needs to be subject to high level remediation, such as via reverse osmosis filtration, to remove environmentally damaging heavy metals and salts, so the treatment must be undertaken prior to the water leaving the mine site. It is essential that the Centennial Angus Place guarantees that ANZECC guidelines for upland waterways will be heeded. The responsible approach would be to discharge only water that has been treated to a pristine level.
		It needs to be emphasised that Carne Creek is currently in a pristine state, and its waters are of the highest standard. This creek was a key determinant in the location of the Emirates eco-resort. The extensive fracturing of the sandstone associated with longwall mining of headwater swamps will release high levels of metals, notably manganese and iron, polluting Carne Creek. The comparative water qualities at the junction of Carne Creek and the Wolgan River, near the resort, clearly demonstrate the degree of pollution of the latter.
		There is considerable concern on the figures quoted by the company, specifically the water discharge amounts. We are led to believe that the 43 million litres per day (max) for the life of the mine (5 times the mine’s current discharge) will come only from the seam and not from nearer surface aquifers. This requires an apparently unreasonably large volume of produced water from the seam and no breaching of aquicludes above the seam being mined. This appears inaccurate and should be verified by an independent study. In this regard, the Society supports the establishment of a system of truly independent consultants to conduct all environmental impact assessments.
		Appendix E, part 1 of The Groundwater Impact Assessment for the proposal, asserts that ground cracking under the swamps would be temporary due to the cracks being filled by sediment. This presupposes that loose sandy sediment would have low permeability, a dubious contention that the Society rejects. For a start, it would depend on the size distribution of the particular sediment. It is instructive to reflect that coal seam gas extraction from fracking is enabled by the injection of sand into microfractures, yet in a curious twist the gentle washing of sand into the cracks under these swamps supposedly inhibits fluid flow.

Area of Concern	Raised By	Summary of Issue
		The East Wolgan swamp demonstrated a rather perverse endless loop of increasing toxicity. Water from the mine was discharged above the swamp, damaging the downstream section until the water disappeared into the ground. Despite the undemonstrated assertion from the mine consultants that the water would resurface further downstream, due to the streambed cracking being attributed by the company to upsidence, the clear fate of the water would be to re-enter the mine workings via the broken, collapsed sequence above the long wall panel. The water would then have to be pumped and discharged again, presumably collecting more toxic components from successive trips through the coal seams.
		The aquifer interference policy requires that a proponent demonstrates variability to lawfully take water within the limits of their licence and the water sharing plan. The Society notes that there appears to be a discrepancy (deficit) between the extraction licence and the estimated inflow in 2023. That deficit is in relation to what is required for the Richmond groundwater source, and is approximately 7 GL. Furthermore, the society is of the opinion that there is insufficient water to allow this level of extraction.
	The Colong Foundation for Wilderness	Carne Creek is currently in a pristine state, and its waters that flow through the Greater Blue Mountains World Heritage Area are of the highest standard. This creek was a key determinant in the location of the Emirates eco-resort. The extensive fracturing of sandstone associated with longwall mining under its headwater swamps will release high levels of metals, notably manganese and iron, polluting Carne Creek and making it run bright orange, just like the Wolgan River once did. Flows in Carne Creek will also become irregular.
		Centennial Coal claims that much of the water disappearing from fractured streambeds may re-emerge further downstream. There is evidence to the contrary for East Wolgan Swamp. Such re-emergent surface water is often heavily contaminated with groundwater polluted with salt and metals. This re-emergent, potentially eco-toxic water could not help a swamp or affected stream reach upstream that had suffered water loss. Any downstream sensitive instream environments and riparian environments, such as some shrub swamps and the Greater Blue Mountains World Heritage Area, could be impacted by eco-toxic groundwater effluent.

Area of Concern	Raised By	Summary of Issue
		The consultants for Centennial Coal make assertions that there is no net loss of water from stream catchments and that 'Any diverted surface water is likely to re-emerge into the catchment further downstream'. The consultants for Centennial conclude 'It is unlikely, however, that this would result in adverse impacts on the overall quality and quantity of water flowing from the catchment.' This statement is misleading. It is more likely that what has happened previously to the Wolgan River and to Kangaroo Creek will be repeated in the streams above the proposed longwall mining area. In these areas, water was lost downstream as well as within the mining area. Even if this was not the case, the water diverted into the near-surface groundwater does not assist the natural functioning of swamps undermined, even if the water does emerge downstream.
		Similar discharges of orange sediment to those described above for Waratah Rivulet and the Wolgan River but now proposed for an area of Newnes Plateau upstream of the Greater Blue Mountains World Heritage Area are of great concern. Any water flowing through cracks and dilated sandstone strata must not pollute the World Heritage Area and the relevant regional discharge standard must use a pristine creek (e.g. Carne Creek) as a baseline, not some standard provided by a degraded creek nearby. The Colong Foundation requests that the high conservation/ecological value ANZECC/ARMCANZ (2000b) system is the appropriate guide for deriving default triggers for the World Heritage Area and its upstream buffer area, particularly for Carne Creek which has salinity lower than rainwater.
		Surface groundwater aquifers will become more permeable and interconnected. Centennial predicts surface aquifer drawdown to be 10 metres under ridges to 0.5 metres under shrub swamps. This range seems to be an underestimate as the longwall mining proposed at Angus Place Mine is more intensive than at Springvale Colliery, but the same degree of sandstone cracking and groundwater drawdown is predicted.
		Centennial alleged that Area 300 can store water 'at an average rate of approximately 4.7 megalitres of water per day. This underground water storage appears to be the source of water emerging nearby at Lambs Creek which was subjected to longwall mining several decades ago. The Colong Foundation has observed a large amount of water welling up from the ground into a wetland on Lambs Creek near where the creek emerges onto private land. Upstream of this swamp, the creek is dry due to longwall mining operations at a shallow depth of cover. This water re-emergence appears to be an unlicensed discharge from the underground water storage, Area 300, Angus Place Colliery. This discharge was not considered in the Water Balance provided in the Environmental Assessment for modification of the Project Approval. The emergence of water make into Lambs Creek should be investigated to confirm that it has water make characteristics. If it has, then the applicant should be asked to explain why it has not notified authorities of this source of mine effluent for the last three decades.

Area of Concern	Raised By	Summary of Issue
	Lithgow Environment Group (LEG)	The Emirates Wolgan Valley Resort & Spa, Newnes Hotel and Cabins, local farmers, graziers and residents depend on this water for survival. Centennial must be required to enter into compensation arrangements in the event that Carne Creek or the Wolgan River either cease flowing, or become polluted to the point of being unfit for human consumption due to emergency mine water discharges.
		The conclusion of the EIS after hydraulic investigation and modelling is that after cracking the ground of 1000's of hectares and subsequently pumping away 43.8 ML/day will have "…minimal impact on the shallow and perched aquifer systems across Newnes Plateau ". Given the volume of water to be pumped out from the mine as well as the undoubted effect this will have on underground aquifers (which it is impossible to predict), any normal person would agree that conclusion defies scientific evidence and logical argument.

Table 3 - Summary of Community Individual Submissions

Area of Concern	Centennial Submission ID	Summary of Issue
Air Quality (Section 3.3.1)	AP0182	The dust and pollution will adversely affect those who live in the region, causing health issues, as we've seen in the CoalPac mines.
	AP0225, AP0244	Centennial claims only a small contribution to the amount of State and Federal GHG emissions, but omit the Scope 3 emissions about which they say the greatest emission sources associated with the Project are those related to the downstream combustion of the coal (Scope 3), the management of which is not in Centennial Angus Place's control.
	AP0225, AP0244	Counting the Scope 1-3, Angus Place mine will be producing 1,061,024 tCO2-e/annum. Over the proposed 25 year life of the mine when combined with the figures for the Springvale and Clarence mines, this is a large cumulative effect.
	AP0407	Centennial argue that GHG emissions of all machinery required in the operations and all clearing of forest required for above ground supporting infrastructure is "negligible". However the entire purpose of this project is to sell for combustion 4.5 million tons of the thermal coal p.a. for 13 years.

Area of Concern	Centennial Submission ID	Summary of Issue
Consultation (Section 3.3.2)	AP0003, AP0058, AP0066, AP0071, AP0074, AP0078, AP0080, AP0086, AP0086a, AP0090, AP0093, AP0102, AP0103, AP0105, AP0111, AP0115, AP0116, AP0120, AP0121, AP0123, AP0124, AP0125, AP0126, AP0128, AP0129, AP0130, AP0131, AP0136, AP0144, AP0145, AP0147, AP0149, AP0150, AP0151, AP0152, AP0156, AP0160, AP0161, AP0163, AP0165, AP0166, AP0171, AP0176, AP0177, AP0177a, AP0178, AP0183, AP0184, AP0185, AP0192, AP0210, AP0214, AP0218, AP0219, AP0226, AP0227, AP0229, AP0231, AP0232, AP0236, AP0243, AP0250, AP0252, AP0253, AP0254, AP0257, AP0258, AP0261, AP0263, AP0265, AP0266, AP0268, AP0273, AP0276, AP0280, AP0283, AP0284, AP0285, AP0287, AP0291, AP0294, AP0295, AP0297, AP0298, AP0301, AP0302, AP0303, AP0304, AP0305, AP0307, AP0309, AP0311, AP0314, AP0318, AP0319, AP0326, AP0327, AP0330, AP0332, AP0334, AP0335, AP0336, AP0338, AP0339, AP0340, AP0341, AP0343, AP0344, AP0346, AP0347, AP0348, AP0349, AP0350, AP0351, AP0352, AP0356, AP0359, AP0360, AP0361, AP0362, AP0363, AP0367, AP0368, AP0371, AP0373, AP0374, AP0375, AP0376, AP0377, AP0379, AP0380, AP0382, AP0383, AP0384, AP0385, AP0386, AP0387, AP0388, AP0389, AP0390, AP0394, AP0395, AP0397, AP0398, AP0399, AP0400, AP0401, AP0402, AP0403, AP0405, AP0406, AP0407, AP0409	The Angus Place and the adjoining Springvale mine extension proposals must be subject to a Planning Assessment Commission review with concurrent Public Hearings.
	AP0134, AP0201, AP0248, AP0279, AP0393	This proposal and the adjoining Springvale mine extension proposal should be subject to a stringent planning assessment and PAC review process.
	AP0150	Community consultations must be transparent, unbiased and engaged when conducted in regards to this Project.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0407	Chapter 7 states that: "The public, including community groups and adjoining and affected landowners were identified and consulted with as part of the consultation and engagement strategy "(p201). None of the Wolgan Valley residents were contacted by Centennial including Emirates Wolgan Resort and Spa. Nor were The Blue Mountains Conservation Society, the Colong Foundation for Wilderness or the Lithgow Environment group.
	AP0407	After requesting to make a presentation to the Centennial Community Consultation Committee meeting of 8 April, 2014 I was refused by the Chairman, Howard Fisher. However my written presentation was read out during that meeting through committee member Ian Coates. Apparently, there was no discussion and he was told that I would receive a response from Centennial. I have not heard from them.
Cultural Heritage (Section 3.3.3)	AP0160	The Garden of Stone area has profound cultural and physical heritage values that should be preserved.
	AP0173	The project will hamper tourism therefore destroying the opportunity for local Aboriginal people to benefit in a positive way as tour guides of the many local art sites.

Area of Concern	Centennial Submission ID	Summary of Issue
Ecology (Section 3.3.4)	AP0003, AP0058, AP0066, AP0071, AP0074, AP0078, AP0080, AP0086, AP0086a, AP0089, AP0090, AP0093, AP0102, AP0103, AP0105, AP0111, AP0115, AP0116, AP0120, AP0123, AP0124, AP0125, AP0126, AP0128, AP0129, AP0130, AP0131, AP0136, AP0144, AP0145, AP0147, AP0149, AP0150, AP0151, AP0152, AP0156, AP0160, AP0161, AP0165, AP0166, AP0171, AP0176, AP0177, AP0177a, AP0178, AP0183, AP0184, AP0185, AP0192, AP0210, AP0214, AP0218, AP0219, AP0226, AP0227, AP0229, AP0231, AP0232, AP0236, AP0243, AP0250, AP0252, AP0253, AP0254, AP0257, AP0258, AP0261, AP0263, AP0265, AP0266, AP0268, AP0273, AP0276, AP0280, AP0283, AP0284, AP0285, AP0287, AP0288, AP0290, AP0291, AP0294, AP0295, AP0297, AP0298, AP0301, AP0302, AP0303, AP0304, AP0305, AP0309, AP0311, AP0314, AP0318, AP0319, AP0326, AP0327, AP0330, AP0332, AP0334, AP0335, AP0336, AP0339, AP0340, AP0341, AP0343, AP0344, AP0346, AP0347, AP0348, AP0349, AP0350, AP0351, AP0352, AP0356, AP0359, AP0360, AP0361, AP0362, AP0363, AP0367, AP0368, AP0371, AP0373, AP0374, AP0375, AP0376, AP0377, AP0379, AP0380, AP0382, AP0383, AP0384, AP0385, AP0386, AP0387, AP0388, AP0389, AP0390, AP0394, AP0395, AP0397, AP0398, AP0399, AP0400, AP0401, AP0402, AP0403, AP0405, AP0406, AP0407, AP0409	Important terrestrial and stream environments in this significant part of the Gardens of Stone region must not be damaged by long wall mining but instead protected in a state conservation area.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0003, AP0058, AP0066, AP0071, AP0074, AP0078, AP0080, AP0086, AP0086a, AP0089, AP0090, AP0093, AP0097, AP0102, AP0103, AP0105, AP0111, AP0115, AP0116, AP0120, AP0123, AP0124, AP0125, AP0126, AP0128, AP0129, AP0130, AP0131, AP0136, AP0144, AP0145, AP0147, AP0149, AP0150, AP0151, AP0152, AP0156, AP0160, AP0161, AP0163, AP0165, AP0166, AP0171, AP0176, AP0177, AP0177a, AP0178, AP0183, AP0184, AP0185, AP0192, AP0210, AP0214, AP0218, AP0219, AP0226, AP0227, AP0229, AP0231, AP0232, AP0236, AP0240, AP0243, AP0250, AP0252, AP0253, AP0254, AP0257, AP0258, AP0261, AP0265, AP0266, AP0268, AP0273, AP0276, AP0280, AP0283, AP0284, AP0285, AP0287, AP0291, AP0294, AP0295, AP0297, AP0298, AP0301, AP0302, AP0303, AP0304, AP0305, AP0309, AP0311, AP0314, AP0318, AP0319, AP0326, AP0327, AP0330, AP0332, AP0335, AP0336, AP0339, AP0340, AP0341, AP0343, AP0344, AP0346, AP0347, AP0348, AP0349, AP0350, AP0351, AP0352, AP0356, AP0359, AP0360, AP0361, AP0362, AP0363, AP0367, AP0368, AP0371, AP0373, AP0374, AP0375, AP0376, AP0377, AP0379, AP0380, AP0382, AP0383, AP0384, AP0385, AP0386, AP0387, AP0388, AP0389, AP0390, AP0394, AP0395, AP0397, AP0398, AP0399, AP0400, AP0401, AP0402, AP0403, AP0405, AP0406, AP0407, AP0409	Centennial Coal must not be allowed to simply replicate the damage it has already caused to nationally threatened upland swamps on the Newnes Plateau for which it was required by the Commonwealth Government to pay $1.45 million in reparations.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0003, AP0058, AP0066, AP0071, AP0074, AP0078, AP0080, AP0086, AP0086a, AP0090, AP0093, AP0102, AP0103, AP0105, AP0111, AP0115, AP0116, AP0120, AP0121, AP0123, AP0124, AP0125, AP0126, AP0128, AP0129, AP0130, AP0131, AP0136, AP0144, AP0145, AP0147, AP0149, AP0150, AP0151, AP0152, AP0156, AP0160, AP0161, AP0163, AP0165, AP0166, AP0171, AP0176, AP0177, AP0177a, AP0178, AP0183, AP0184, AP0185, AP0192, AP0210, AP0214, AP0218, AP0219, AP0226, AP0227, AP0229, AP0231, AP0232, AP0236, AP0243, AP0250, AP0252, AP0253, AP0254, AP0257, AP0258, AP0261, AP0265, AP0266, AP0268, AP0273, AP0276, AP0280, AP0283, AP0284, AP0285, AP0287, AP0291, AP0294, AP0295, AP0297, AP0298, AP0301, AP0302, AP0303, AP0304, AP0305, AP0309, AP0311, AP0314, AP0318, AP0319, AP0326, AP0327, AP0330, AP0332, AP0334, AP0335, AP0336, AP0339, AP0340, AP0341, AP0343, AP0344, AP0346, AP0347, AP0348, AP0349, AP0350, AP0351, AP0352, AP0356, AP0358, AP0359, AP0360, AP0361, AP0362, AP0363, AP0367, AP0368, AP0371, AP0373, AP0374, AP0375, AP0376, AP0377, AP0379, AP0380, AP0382, AP0383, AP0384, AP0385, AP0386, AP0387, AP0388, AP0389, AP0390, AP0394, AP0395, AP0397, AP0398, AP0399, AP0400, AP0401, AP0402, AP0403, AP0405, AP0406, AP0409	The sandstone strata supporting the 22 nationally endangered swamps, including the 7 shrub swamps must not be fractured.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0003, AP0058, AP0066, AP0071, AP0074, AP0078, AP0080, AP0086, AP0086a, AP0090, AP0093, AP0102, AP0103, AP0105, AP0111, AP0115, AP0116, AP0120, AP0123, AP0124, AP0125, AP0126, AP0128, AP0129, AP0130, AP0131, AP0136, AP0144, AP0145, AP0147, AP0149, AP0150, AP0151, AP0152, AP0156, AP0160, AP0161, AP0165, AP0166, AP0171, AP0176, AP0177, AP0177a, AP0178, AP0183, AP0184, AP0192, AP0210, AP0214, AP0218, AP0219, AP0226, AP0227, AP0229, AP0231, AP0232, AP0236, AP0243, AP0250, AP0252, AP0253, AP0254, AP0257, AP0258, AP0261, AP0265, AP0266, AP0268, AP0273, AP0276, AP0280, AP0283, AP0284, AP0285, AP0287, AP0291, AP0294, AP0295, AP0297, AP0298, AP0301, AP0302, AP0303, AP0304, AP0305, AP0309, AP0311, AP0314, AP0318, AP0319, AP0326, AP0327, AP0330, AP0332, AP0335, AP0336, AP0339, AP0340, AP0341, AP0343, AP0344, AP0346, AP0347, AP0348, AP0349, AP0350, AP0351, AP0352, AP0356, AP0359, AP0360, AP0361, AP0362, AP0363, AP0367, AP0368, AP0371, AP0373, AP0374, AP0375, AP0376, AP0377, AP0379, AP0380, AP0382, AP0383, AP0384, AP0385, AP0386, AP0387, AP0388, AP0389, AP0390, AP0394, AP0395, AP0397, AP0398, AP0399, AP0400, AP0401, AP0402, AP0403, AP0406, AP0409	The proposed clearing of 14 hectares of forest for an additional ventilation facility is excessive and its proposed location close to the Wolgan River is unacceptable.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0003, AP0058, AP0066, AP0071, AP0074, AP0078, AP0080, AP0086, AP0086a, AP0090, AP0092, AP0093, AP0102, AP0103, AP0105, AP0111, AP0115, AP0116, AP0120, AP0123, AP0124, AP0125, AP0126, AP0128, AP0129, AP0130, AP0131, AP0136, AP0144, AP0145, AP0147, AP0149, AP0150, AP0151, AP0152, AP0156, AP0160, AP0161, AP0163, AP0165, AP0166, AP0171, AP0176, AP0177, AP0177a, AP0178, AP0183, AP0184, AP0192, AP0202, AP0210, AP0214, AP0218, AP0219, AP0220, AP0226, AP0229, AP0231, AP0232, AP0236, AP0243, AP0250, AP0252, AP0253, AP0254, AP0257, AP0258, AP0261, AP0263, AP0265, AP0266, AP0268, AP0273, AP0276, AP0280, AP0283, AP0284, AP0285, AP0287, AP0291, AP0294, AP0295, AP0297, AP0298, AP0301, AP0302, AP0303, AP0304, AP0305, AP0307, AP0309, AP0311, AP0314, AP0318, AP0319, AP0326, AP0327, AP0330, AP0332, AP0334, AP0335, AP0336, AP0339, AP0340, AP0341, AP0343, AP0344, AP0346, AP0347, AP0348, AP0349, AP0350, AP0351, AP0352, AP0356, AP0359, AP0360, AP0361, AP0362, AP0363, AP0367, AP0368, AP0371, AP0373, AP0374, AP0375, AP0376, AP0377, AP0379, AP0380, AP0382, AP0383, AP0384, AP0385, AP0386, AP0387, AP0388, AP0389, AP0390, AP0394, AP0395, AP0397, AP0398, AP0399, AP0400, AP0401, AP0402, AP0403, AP0405, AP0406, AP0409	Carne Creek, pagodas, cliffs and the many nationally endangered swamps that the current proposal puts at risk must not be damaged.
	AP0129	A complex risk assessment to international standards must be completed by independent ecological experts.
	AP0310	A number of threatened species and endangered ecological communities will be compromised by the proposed extension.
	AP0210	Centennial has turned swamps to dust by cracking near surface aquifers.
	AP0004, AP0210	Centennial has already poisoned nationally endangered swamps with eco-toxic mine effluent.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0007, AP0148, AP0168, AP0225, AP0251, AP0229, AP0244, AP0290, AP0316, AP0279, AP0324, AP0326, AP0357, AP0338, AP0396	In total 73 nationally endangered swamps will be damaged by cracking of the underlying sandstone causing the swamps to dry out by the groundwater level falling by 10 m. This will increase bushfire risk and lead to dried out swamps being replaced by dry land floral communities.
	AP0148, AP0229, AP0316, AP0326, AP0357, AP0407	The peat soils that supported the swamps will decompose and over a period of years eucalypts and banksias will migrate into the dying swamps as they evolve into dryland communities.
	AP0148, AP0229, AP0251, AP0316, AP0324, AP0326, AP0357	Impacts to swamps will result in many threatened plants and animals supported by them being killed, including the giant dragonfly.
	AP0021	The impacts of past mining have been dealt with cursorily in the EIS which essentially argues that there have been no direct impacts on swamps by subsidence. There have clearly been impacts.
	AP0021	Both East Wolgan and Narrow have now been severely degraded by mining impacts and acknowledged in the imposition of Enforceable Undertaking, though the impacts of the excess mine water is conveniently used as the cause of the damage, damage which has left the drainage line of East Wolgan in particular a 30 m wide stretch of bare dry earth with no evidence of recovery after nearly 6 years.
	AP0021	East Wolgan and probably Narrow Swamps appear to be suffering, and it can be expected that the remaining swamp vegetation will gradually dry out and change, probably after a major bushfire that will probably kill off remaining swamp plants and allow woodland species to invade.
	AP0071	Kangaroo Swamp, Lambs Creek Swamp, Junction Swamp and East Wolgan Swamp have all been lost, although each was supposed to be protected under both State TSC Act and EPBC Act for Endangered Ecological Communities.
	AP0083, AP0134, AP0142	The project will cause destruction of our natural environments that protect our flora and fauna that also provide clean water, air, a carbon sink, link to our cultural heritage and a tourist attraction.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0106, AP0323, AP0325	The current surface works are involving extensive clearing. The forests need to be maintained for the future, enough land has been taken from nature.
	AP0110	Centennial "admits its mining will fracture iconic Birds Rock, a Flora Reserve, and the sandstone beds under 73 nationally endangered swamps".
	AP0122, AP0213, AP0290, AP0310, AP0331, AP0396	The Commonwealth Department of the Environment has found that Centennial's longwall mining activities on the Newnes Plateau caused a loss of ecosystem function shown by loss of peat, erosion, vegetation dieback and weed invasion in 3 swamps (East Wolgan Swamp, Junction Swamp, Narrow Swamp). This shows they are not capable of protecting the environment and must not happen again.
	AP0199, AP0200, AP0201, AP0203, AP0313, AP0393	Longwall mining under the endangered ecological communities and rock pagodas and cliffs will cause subsidence damage.
	AP0225, AP0244, AP0308	The Angus Place and Springvale extension proposals are a direct threat to core of the shrub swamp area in the headwaters of Carne Creek. The EEC listed endangered ecological community of Newnes Plateau Shrub Swamps should not be mined under.
	AP0282	Sound from mine ventilation has seen a decline in native animal activity in the area.
	AP0293	Australia's natural heritage is currently at risk. Therefore increasing the risk and impinging on a pristine wilderness area should not occur.
	AP0407	The sandstone rock supporting the 41 nationally endangered swamps, and particularly the 11 shrub swamps affected by the proposal, will also develop a large number of fractures. Centennial predicts these cracks to be 5 to 50mm wide and 10 to 15 metres deep.
	AP0393	The evidence shows that the protection of the Burralow Formation aquitard AQ6 is critical to swamp protection but that AQ6 will drop well below root depth and by up to 10m, if mining is permitted.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0393	Peizometric traces have been impossible to interpret. The multiple traces on Fig 2.14 and 2.15 make them unreadable. Colour differentiation is indistinct, the traces overlap and the data is unclear. The depths of sediment are not given, nor are the times when the swamps were undermined or the longwalls involved.
	AP0393	The Report notes (p 82 and Fig 2.27), Kangaroo Creek1 hydrograph dropped after mining nearby at Angus Place in 2008 and has not recovered. As it is a small swamp, the impacts may not be dramatic, but it shows clearly that undermining does lead to long-term loss of water from the swamp sediments.
	AP0393	The mine water discharges into East Wolgan Swamp caused scalding in a narrow line down the valley axis. It did not support the vegetation over most of the swamp but killed it along the line of maximum discharge, encouraging erosion.
	AP0393	Hanging swamps are the forgotten swamps in the EIS. Section 2.8.3.5 deals with impacts of past undermining - all examples are of valley floor swamps, although Kangaroo Creek could perhaps be described as a hanging swamp. While recognising the importance of the hanging swamps, the Report does not address the impacts of mining on them. Yet they are clearly at least as vulnerable to diversion of water via bedrock cracking as valley floor swamps.
	AP0209	This project has the potential to lead to the irrevocable degradation and potential destruction of several Newnes Plateau Shrub Swamps (NPSS), an Endangered Ecological Community (EEC), which forms part of the Commonwealth listed Temperate Highland Peat swamps on Sandstone (THPSS) EEC, with resultant negative impacts upon their associated groundwater dependent species. These species may include threatened flora and fauna, such as the endangered Giant Dragonfly (Petalura gigantea), endangered Blue Mountains Water Skink (Eulamprus leuraensis), and vulnerable Dean's Boronia (Boronia deanei deanei), all of which are obligate mire (peat swamp) dwelling species.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0209	Reduced groundwater availability as a result of subsidence from the longwall mining will result in long-term degradation and contraction of the NPSS, compounding predicted effects of climate change. This will result in reduced spatio-temporal distribution of suitable breeding habitat for Petalura gigantea (Pg), and will threaten the persistence of other groundwater dependent species, including Boronia deanei, Eulamprus leuraensis (El), Euastacus australasiensis, and other organisms such as stygofauna.
	AP0209	The impact of selective logging across the project area is overstated in S 2.8.1 of the EIS.
	AP0209	Section 2.8.2 of the EIS Pt 1 fails to identify likely presence of El and Pg in the project area. Pg has been recorded in Sunnyside Swamp. Trail 6 Swamp, Twin Gully Swamp and Tri Star Swamp contain some suitable habitat for Pg and El. Both species have been recorded in most NPSS in the Carne Creek catchment.
	AP0209	The EIS states that any effects on potential populations of the endangered Adams Emerald Dragonfly will be insignificant. It is impossible to make this statement, considering that there have never been any ecological studies of this species and limited aquatic sampling was undertaken for this project.
	AP0209	The recommendation to undertake more comprehensive, and better designed pre-mining surveying, and finer resolution taxonomic identification of stygofauna, must be implemented if this project proceeds to ensure that the diversity of stygofauna is properly assessed and potential risks of the project determined.
	AP0209	Fauna surveying was inadequate for the EIS, if they did not at least find swamp rats Rattus lutreolus (evidence observed by I.R.C. Baird in most NPSS) and Antechinus spp. And Eulamprus leuraensis in NPSS. The lack of observation of small terrestrial mammals in these swamps is also a serious deficiency.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0209	The claims in Appendix H of the EIS Main Document Vol. 2 that there has been no significant damage to shrub swamps from subsidence, although the Main Report clearly identifies swamps significantly affected by mine subsidence, in addition to mine water discharge, e.g. East Wolgan Swamp.
	AP0209	The proposition on p. 86 of the EIS Main Document Vol. 2 Appendix H that a lowering of water tables in swamps as a result of any subsidence will not negatively affect groundwater dependent species is incorrect. Pg, for example, is reliant upon moist to waterlogged substrate for ovipositing and larval establishment. A drying of the surface peat is required to a shallow depth to reduce the spatial extent of potential breeding habitat in a particular swamp. The assumption assumes that no significant subsidence and lowering of water tables will occur, which is contrary to the recognition elsewhere in the EIS that there will be some lowering of water tables in swamps.
	AP0209	P. 94 of the EIS Main Document Vol. 2 Appendix H states that since 2005 there has been no loss of EECs or populations of threatened species. This ignores East Wolgan Swamp, where subsidence is identified as a contributing factor to the damage to this NPSS, in addition to mine water discharge. To state that “the minor alterations to the hydrological regime predicted are unlikely to modify the vegetation communities present in the short or long term” is totally unacceptable and inaccurate. The previously undermined Junction Swamp, where El was recorded in 2001, has been substantially degraded following a lowering of the water table in that swamp. El has not subsequently been recorded there and the habitat may now be unsuitable for the species.
	AP0209	Assessment for Boronia deanei ssp. deanei is flawed. Any NPSS population of this species, which is subjected to medium to long term lowering of the water table, will be at risk of a reduction and potentially loss of that population in the long term.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0209	Assessment for P. gigantea is flawed. The requirement for moist to saturated substrate for successful oviposition and larval burrow establishment is the critical factor in the persistence of this species in swamps. Because of the long larval stage, some late stage larvae in established burrows may be able to persist until emergence, even after some lowering of water tables; however, successful reproduction, and thus persistence of populations, will be limited by the availability of suitable wet substrate for ovipositing and larval establishment.
	AP0209	Assessment of Eulamprus leuraensis is flawed. The report states that El occurs in non-swamp habitat, however, any records for this species in non-swamp habitats are likely to be of wandering or foraging individuals temporarily outside their core swamp habitat. The assessment of no significant impact upon this species is based on the flawed presumption that there will be no significant lowering of the water table in a particular swamp. A relatively minor loss of groundwater could have a deleterious effect on a local swamp population of this species.
	AP0209	A comprehensive, systematic pre-mining stygofauna survey must be implemented across the project area, with finer resolution taxonomic identification of stygofauna, to ensure that the diversity of stygofauna is properly assessed and potential risks of the project determined.
	AP0021	Monitoring data in the EIS indicate that there will be drawdown in all the swamps with a maximum drop of 36 cm in Gang Gang Southeast Swamp, though the EIS does not think this will cause any impact, though if the ecological dynamics in the swamp are considered t is evident that a permanent water level drop will cause major drying out of surface substrate and dislocation of swamp species. It is likely that these water level changes will be permanent and result in reduction in size of the swamps over time as swamps gradually dry out and are invaded by woodland species. Certainly the East Wolgan drainage line has been completely dry for the last 5 years and is showing no sign of recovery.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0225, AP0244	The amount and scale of the infrastructure will be increased, including: a 14ha clearing for one mine vent, seven more dewatering sites (for Angus Place) with power, pipelines and tracks and clearings 90m x 110m, and two additional borehole sites (for Springvale). Exploration drill holes and groundwater monitoring holes, as well as subsidence monitoring activities will also occur.
	Shine Laboratory, The University of Sydney	The Newnes Plateau Swamps proposed to be undermined support a population stronghold of the Blue Mountains Water Skink in this region, and a significant alteration in hydrology of the swamps, such as a loss of groundwater through subsidence, would negatively affect the suitability of the habitat. This in turn may cause a substantial reduction in abundances within swamps, and an overall reduction in populations of skinks throughout that region. The ability of individuals and populations of the Blue Mountains Water Skink to recover from such an event is unknown. (S Gorissen and R Shine, Shine Laboratory, The University of Sydney)
General (Section 3.3.5)	AP0058, AP0405	The scenic western edge of the Newnes Plateau must be protected from further scarring by new roads, pipeline and electricity easements.
	AP0092, AP0163, AP0202, AP0220, AP0253, AP0263, AP0280, AP0307, AP0311, AP0334, AP0335, AP0396, AP0405, AP0407	Centennial must revise the proposal to improve environmental outcomes.
	AP0076, AP0150	The environment can not thrive let alone coexist with mining operations as it leads to ill health for the earth and the population.
	AP0152, AP0210	Centennial Coal has already extensively and severely damaged parts of the Newnes Plateau by blighting the landscape with a network of roads, pipes, survey lines and power lines.
	AP0007, AP0062, AP0083, AP0106, AP0132, AP0142, AP0158, AP0160, AP0182, AP0191, AP0202, AP0213, AP0220, AP0223, AP0225, AP0244, AP0278, AP0281, AP0308, AP0310, AP0311, AP0312, AP0313, AP0315, AP0321, AP0324, AP0326, AP0337, AP0345, AP0364, AP0396, AP0405	Any future mine expansions in the Newnes Plateau region of the Blue Mountains should not be allowed as they will irreversibly damage the unique and fragile environments through cumulative impacts from subsidence, pollution, and water quality threats to ecology, water, air, noise, cultural heritage and local residents.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0091	Centennial Coal has shown disregard for the environment in which it works, having been fined $1.5 million in reparations for damage to upland swamps on the Newnes Plateau.
	AP0113, AP0251	The price of coal is dropping globally. Once the global coal price drops below $60 per tonne, which will happen by the end of the decade on current trends, the industry is over in Australia.
	AP0157	The Angus Place mine has already caused subsidence and pollution and the extension will markedly increase the damage and pollution.
	AP0157	Coal is an outdated fuel so any jobs created are short term.
	AP0062, AP0076, AP0113, AP0148, AP0152, AP0168, AP0182, AP0205, AP0216, AP0222, AP0278, AP0299, AP0345, AP0364, AP0372, AP0381	In this era when we need to focus on renewable sources of energy, there are no viable reasons for extending this mine.
	AP0076, AP0122, AP0142, AP0182, AP0225, AP0244, AP0251	Centennial has a bad track record with polluting creeks and streams, plus the ugly scars on the Newnes Plateau area which are made to provide infrastructure to support the mine operation.
	AP0199, AP0203, AP0204, AP0407	The amenity of the Newnes Plateau will be spoilt by the great amount of mining surface infrastructure by the three mines operating there side by side.
	AP0279	Coal is currently over supplied and thus Centennial should not damage the region for minimal profit.
	AP0230, AP0329, AP0338	Centennial must be made to fix previous serious environmental damage done by the pre-existing coal mine and provide evidence that they are capable of working in an environment without damaging it before any further extensions can be considered.
	AP0331	The Development Consent must be subject to periodic third party reviews to ensure that adjoining conservation areas are not adversely affected.
	AP0333	This project must not be allowed to go ahead without sufficient environmental protections to the fragile ecosystems.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0338	The EIS tends to only be a theoretical document and have little credence in terms of impacts and mitigation actions.
	AP0407	The EIS mentions everything that supports the application but leaves out aspects which might speak against it.
	AP0209	The proposed Angus Place mine extension should not be granted development consent unless Development consent is staged, with a review every five years and is subject to performance standards triggers that ensure the health and integrity of receiving waters and heritage values.
Groundwater (Section 3.3.6)	AP0106	Approximately 1.5 m subsidence and cracking caused by the project will destroy the water table.
	AP0203, AP0407	Longwall mining affects groundwater as groundwater will find its way through cliff cracks into the mine affecting the aquifers.
	AP0393	It is misleading and inaccurate to argue that mining has not caused a drop in the water tables of the undermined swamps above the Springvale and Angus Place mines.
Mine Design (Section 3.3.7)	AP0209, AP0210, AP0407	Mining intensity should be reduced.
	AP0209	Narrowing and/or splitting the longwall panels 1007, 1008, 1009 and 1010 must occur to prevent damage from fracturing in the Birds Rock Flora Reserve. Splitting longwalls 1013 and 1014 must occur to prevent damage to pagodas and cliffs, as proposed.
	AP0021	The NPSS swamps particularly those in Carne Creek catchment must not be impacted by the proposed mining. This can be achieved by not mining under individual swamps, or by using bord and pillar operations or by substantially reducing the long wall dimensions.
	AP0209	LW1015 to LW1017 should be shortened in length to avoid Trail 6 Swamp completely as a precautionary measure, or further reduced in panel width, with increased pillar widths, to further minimise risk of subsidence.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0209	The longwall panels were shortened to not go under Twin Gully Swamp and such shortening should also be applied to LW1004 to LW1006 in the case of Tri Star Swamp. If shortening is not feasible, then LW1004 to LW1006 should be further reduced in width, with increased pillar widths, to further minimise risk of subsidence.
	AP0209	The proponent's justification for the currently proposed panel widths under the swamps is not substantiated.
	AP0021	There should be no mining under the swamps as has protected Sunnyside Swamp, or if not possible to reduce the width of the long walls which are proposed to be up to 261 m to between 115-160m as used elsewhere to reduce subsidence.
	AP0209, AP0225, AP0244, AP0407	Centennial says that due to a weak roof and a high stress environment longwall mining is the only option, however Clarence Colliery successfully uses bord & pillar mining methods and the Airly mine in the Capertee Valley operates to depth of 405 metres underground in the same geology, with bad mine roof conditions, including many structural defects.
Monitoring (Section 3.3.8)	AP0209	Monitoring of surface flow and near-surface groundwater monitoring must create a comprehensive picture of the sub-catchments affected by mining.
	AP0209	Monitoring guidelines must clearly specify how the condition of groundwater dependent indicator plant species and the general condition of groundwater dependent ecosystems will be performed.
	AP0396	Conditions of approval are in no way sufficient to prevent damage in a fragile environment without extensive independent monitoring.
Noise (Section 3.3.9)	AP0225, AP0244	Centennial states the noise of the dewatering pumps can only be heard up to 100m away, however the noise can travel much further across valleys, up to 1km, and the pumps run non-stop most of the time.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0282	Mine ventilation is capable of producing sound energy at frequencies able to cause the population to feel effects from low frequency sound or infrasound. These effects are already being seen in the population.
Rehabilitation (Section 3.3.10)	AP0209	All past tracks and trails created by Centennial Coal and its consultants, including those established by trail bikes, need to be recorded and plans set in place to rehabilitate these trails on an on-going basis and as soon as practicable as part of the on-going rehabilitation program for this mine.
	AP0076	The mining industries attempts at rejuvenating areas have shown minimal success, this shows these areas will not be returned to the natural pristine state they once were.
Socio-Economic (Section 3.3.11)	AP0004, AP0062, AP0225, AP0244, AP0251, AP0326, AP0292	This area is a tourist attraction for national and international visitors. The project would destroy NSW's reputation to these tourists by destroying a prestige destination spot now and for future generations.
	AP0191	Damage to Carne Creek will have serious consequences for the Emirates Wolgan Valley Resort and Spa.
	AP0345, AP0364	Any jobs created by the project are false economies based on short term gains, damaging future prospects for generations.
	AP0310	The extension will only create 30 jobs.
Subsidence (Section 3.3.12)	AP0229, AP0316, AP0326, AP0357, AP0407	As a result of subsidence movements, the surface sandstone rock will be cracked to a depth of 15 to 20 metres over the entire area mined. Bird Rock will be fractured.
	AP0065, AP0070, AP0182, AP0191, AP0209, AP0264, AP0279, AP0308, AP0324	The possibility of subsidence from longwall mining in these areas and the inevitable impact on the environment from cracking the underlying sandstone layers which support the lakes, stream beds, swamps, pagodas, rock outcrops, walking tracks and cliffs should not be allowed. This subsidence will also increase bushfire risk.
	AP0121, AP0316, AP0326, AP0357	Angus Place extension will cause the land to subside up to 1.9 m.
	AP0142	Wilderness areas must not be required to be off limits to visitors due to subsidence dangers.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0168, AP0229, AP0240, AP0316, AP0326, AP0354, AP0357	The subsidence caused by the project in large areas of the plateau will cause deep cracking and cause aquifers to drop by up to 10 m. This is irreversible.
	AP0225, AP0244	The project will include longwall panels LW1007 to LW1019 which are in the critical panel width range. All panels should be sub-critical width to minimise subsidence or to not allow maximum subsidence.
	AP0225, AP0244, AP0358	The project says that the proposed new vent No.3 “cannot be subject to mine subsidence as this may impact on the integrity of the ventilation infrastructure”. However Centennial is prepared to compromise the integrity of the biodiversity and geodiversity of the Newnes Plateau, as subsidence is bound to happen above longwall mining.
	AP0233, AP0338, AP0354, AP0357	Areas close to the Angus Place Colliery's existing works and other existing mines already show prominent examples of cracking and collapse. This damage must not be allowed to extend to the Gardens of Stone.
	AP0407	The Heritage section of the SoEI offers the description of the historic site of a grinding stone at site 45-1-0002. After stating that "no spoiling or cracking is predicted" (p. 479) for cliffs and pagodas "the sandstone where the grinding groove is or was located" can be expected "to fracture and damage the site should it still remain." (p480). Therefore all the cliffs and pagodas will be fine but the grinding stone will fracture and vanish.
	AP0407	Fracturing of the rock underneath the surface will occur as a result of the longwall mining and the use of tentative language in the EIS statement is an attempt to minimize the potential for this serious damage to the cliff and pagoda landscape to occur.
	AP0407	All 1,860 hectares affected by the proposed longwall mining will be subject to surface cracking. Surface groundwater aquifers will become more permeable and interconnected.
	AP0209	Subsidence monitoring should be by a third party agency, such as the Office of Environment and Heritage, and monitoring should be paid for by Centennial Coal.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0173	Mining should not be allowed at the thinnest points of access where pagodas have developed their most advanced forms. This is seen in longwall panel LW501 which is approximately 40% overlain by a rocky spur.
	AP0225, AP0244	From the project, steep slopes are predicted to experience tension cracking at the top and sides, and compression ridges at the bottom.
	AP0225, AP0244	The project will cause some cliffs, pagodas and other rock formations are likely to experience fracturing and spalling to 1% to 3% of total exposed rock face areas which are located above longwalls.
Surface Water (Section 3.3.13)	AP0003, AP0058, AP0066, AP0071, AP0074, AP0078, AP0080, AP0086, AP0086a, AP0090, AP0093, AP0102, AP0103, AP0105, AP0107, AP0111, AP0115, AP0116, AP0120, AP0123, AP0124, AP0125, AP0126, AP0128, AP0129, AP0130, AP0131, AP0136, AP0144, AP0145, AP0147, AP0149, AP0150, AP0151, AP0152, AP0156, AP0160, AP0161, AP0163, AP0165, AP0166, AP0171, AP0176, AP0177, AP0177a, AP0178, AP0183, AP0184, AP0192, AP0209, AP0210, AP0214, AP0218, AP0219, AP0226, AP0227, AP0229, AP0231, AP0232, AP0236, AP0243, AP0250, AP0252, AP0253, AP0254, AP0257, AP0258, AP0261, AP0265, AP0266, AP0268, AP0273, AP0276, AP0280, AP0283, AP0284, AP0285, AP0287, AP0291, AP0294, AP0295, AP0297, AP0298, AP0301, AP0302, AP0303, AP0304, AP0305, AP0307, AP0309, AP0311, AP0314, AP0318, AP0319, AP0326, AP0327, AP0330, AP0332, AP0334, AP0335, AP0336, AP0339, AP0340, AP0341, AP0343, AP0344, AP0346, AP0347, AP0348, AP0349, AP0350, AP0351, AP0352, AP0356, AP0359, AP0360, AP0361, AP0362, AP0363, AP0367, AP0368, AP0371, AP0373, AP0374, AP0375, AP0376, AP0377, AP0379, AP0380, AP0382, AP0383, AP0384, AP0385, AP0386, AP0387, AP0388, AP0389, AP0390, AP0394, AP0395, AP0396, AP0397, AP0398, AP0399, AP0400, AP0401, AP0402, AP0403, AP0405, AP0406, AP0407, AP0409	The proposed discharge of up to 43.8ML/day of eco-toxic mine effluent must be treated using reverse osmosis technology to remove all metals and salts before discharge to the Cox's River.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0003, AP0058, AP0066, AP0071, AP0074, AP0078, AP0080, AP0086, AP0086a, AP0089, AP0090, AP0093, AP0102, AP0103, AP0105, AP0111, AP0115, AP0116, AP0120, AP0123, AP0124, AP0125, AP0126, AP0128, AP0129, AP0130, AP0131, AP0136, AP0144, AP0145, AP0147, AP0149, AP0150, AP0151, AP0152, AP0156, AP0160, AP0161, AP0163, AP0165, AP0166, AP0171, AP0176, AP0177, AP0177a, AP0178, AP0183, AP0184, AP0192, AP0202, AP0210, AP0214, AP0218, AP0219, AP0220, AP0226, AP0229, AP0231, AP0232, AP0236, AP0243, AP0250, AP0252, AP0253, AP0254, AP0257, AP0258, AP0261, AP0265, AP0266, AP0268, AP0273, AP0276, AP0280, AP0283, AP0284, AP0285, AP0287, AP0288, AP0291, AP0294, AP0295, AP0297, AP0298, AP0301, AP0302, AP0303, AP0304, AP0305, AP0309, AP0311, AP0314, AP0318, AP0319, AP0326, AP0327, AP0330, AP0332, AP0334, AP0335, AP0336, AP0339, AP0340, AP0341, AP0343, AP0344, AP0346, AP0347, AP0348, AP0349, AP0350, AP0351, AP0352, AP0356, AP0359, AP0360, AP0361, AP0362, AP0363, AP0367, AP0368, AP0371, AP0373, AP0374, AP0375, AP0376, AP0377, AP0379, AP0380, AP0382, AP0383, AP0384, AP0385, AP0386, AP0387, AP0388, AP0389, AP0390, AP0394, AP0395, AP0397, AP0398, AP0399, AP0400, AP0401, AP0402, AP0403, AP0405, AP0406, AP0407, AP0409	Carne Creek is currently in a pristine state, and its waters that flow through the Greater Blue Mountains World Heritage Area are of the highest standard. This creek must not run bright orange or suffer reduced flows, just like the Wolgan River after Centennial Coal wrecked it.
	AP0007, AP0168, AP0191, AP0210, AP0229, AP0255, AP0256, AP0281, AP0324, AP0408	The discharge from both mines of metal-rich salts will impact the Cox's river that supplies Sydney with drinking water, part of the Warragamba catchment. This will lead to possible contamination of Sydney's drinking water.
	AP0092, AP0134, AP0142, AP0148, AP0163, AP0209, AP0316, AP0326, AP0354, AP0357, AP0407	The combined effluent from both mines will be 43.8ML/day in 2023. 30.8 tonnes/day of toxic effluent will be discharged into the Cox River which supplies Sydney' drinking water. This is unacceptable.
	AP0070	The proposal will cause creek flows and swamp waters to move many meters underground and pretend that nothing has happened.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0071, AP0228	No mining discharge water should be allowed to leave a mining site and flow into natural creeks and streams unless it equals the same natural background levels. These streams should be protected.
	AP0071	Mining discharge water should be treated with desalination methods and not filtration dams. Mining discharge water from this particular area is over 1000µs/cm which is breaching the ANZECC guidelines.
	AP0071, AP0182	Centennial must address the current discharge from Angus Place and Springvale which up until March 2014 was piped to Wallerawang Power Station and treated by desalination method, however due to the shut down of Wallerawang Power Station is now flowing into the Cox's River.
	AP0091, AP0107, AP0134, AP0154, AP0191, AP0204, AP0293	Carne Creek and other waterways in the area must not be permanently despoiled by reduced water flows and the discharge of toxic effluent.
	AP0092	An additional ventilation facility proposed location close to Wolgan River is unacceptable.
	AP0106	This proposal plans to pollute Sydney's water supply.
	AP0134	The mine effluent discharged into the Cox River will lead to negative impacts on the surrounding environment and local recreational fishing.
	AP0168, AP0279, AP0316, AP0326, AP0338, AP0354, AP0357, AP0358	The project will impact on Carne Creek, the Wolgan River, Marrangaroo Creek, Bunglebouri Creek, Wolgan River and Rocky Creek headwaters and catchments. These impacts will be unable to be mitigated.
	AP0191, AP0200, AP0293	The Wolgan River is dry, where it once ran into the valley as a magnificent waterfall. This must not happen to Carne Creek.
	AP0358	The project proposes to discharge saline mine effluent, untreated, to the hydrological catchment of Warragamba Dam.
	AP0338, AP0358	More information on the mitigation of increased concentrations of heavy metals into the Cox's River and Sydney's water supply plus potential health impacts mediated through water quality and security is urgently required.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0407	The Wallerawang Power Plant has shut down, possibly permanently. The current SDWTS proposal to provide water to this plant is not viable.
	AP0358	The proposed discharges must be subjected to a pollution licence that limits concentration levels for metal and salt pollutants with adequate pollution controls in place.
	AP0358	Angus Place mine currently discharges 4.43ML/day into the Cox River via the Springvale Delta Water Transfer Scheme. This effluent has unacceptably high levels of turbidity, heavy metals and salinity.
	AP0358, AP0407	Before discharge, the mine water must be treated to a standard that protects undisturbed aquatic ecosystems using reverse osmosis technology to remove metals and salts.
	AP0407	The eco-toxic mine effluent currently running at 12.5ML/day has unacceptably high levels of turbidity, heavy metals and salinity.
	AP0407	The impact of subsidence on surface water in Appendix F, Chapter 6.4 p.98 investigates impacts on Marrangaroo Creek, Wolgan River and as far as the Colo River. Carne Creek which will be directly undermined is left out.
	AP0407	The SoEI states "The consequence of increased discharge to the Cox's River is not significant since there is excess demand for this water resource in this catchment." (p.479). This argument neglects the fact that the mine discharge water is contaminated with heavy metals and is of high salinity.
	AP0407, AP0209, AP0407	Any malfunction of the SDWTS, such as following a bushfire, must not result in emergency discharges to the World Heritage Area via Wolgan River or Carne Creek. These discharges must be properly treated and reinserted underground into the mine instead.
	AP0209	There should be no emergence of near surface groundwater with elevated levels of salt or metal precipitate in Carne Creek.

Area of Concern	Centennial Submission ID	Summary of Issue
	AP0209	Discharge of what is effectively untreated, highly contaminated mine water to Kangaroo Creek via LDP001, and subsequently to the Cox's River, is inappropriate. The measures proposed to mitigate the ongoing and increasing damage to these aquatic ecosystems are inadequate.
	AP0209	A complete redesign of the waste water management system is essential, ensuring Centennial is held accountable for ensuring the water management system is designed to cope with all scenarios and ensure that no waste water is ever transferred to watercourses.
	AP0209	Emergency discharge points in the Wolgan River and Carne Creek must be eliminated and those discharge licences voided.
	AP0225, AP0244	The effective doubling of discharge via the water transfer scheme (the SDWTS), with flow of saline ground water to the Cox's River catchment will have a detrimental effect on the aquatic biota.
Traffic (Section 3.3.14)	AP0225, AP0244	The project will lead to another increase in traffic on poor quality state forest roads 24 hours a day, 7 days a week.
Visual (Section 3.3.15)	AP0225, AP0244	Centennial says there will be little visual impact at their test sites, but if you travel to say Birds Rock lookout (one of their test sites) you see numerous examples of their mining infrastructure along the way.

3.0 RESPONSE TO SUBMISSIONS

3.1 Response to Government Agency Submissions

3.1.1 Aboriginal Heritage

OEH considers that a more definitive assessment of the probability of roof fall collapse is required in rock shelters that have cultural deposits. In other assessments the standard used in assessing subsidence effects on Aboriginal Cultural Heritage (ACH) in longwall mining operations has been based on percentage estimates. A minimum 10% chance of roof fall collapse is an accepted threshold range from which decisions about appropriate mitigation can be considered. It is OEH's view that in circumstances where the chance of roof fall collapse exceeds 10% the appropriate mitigation is to excavate the shelter for salvage of Aboriginal objects and extract as much information that is appropriate for interpretation and educational purposes. (OEH)

As detailed in Section 6.8.3 of the Subsidence Assessment prepared by MSEC and provided as Appendix D to the EIS, it is extremely difficult to assess the likelihood of instabilities for the rock shelters based upon predicted ground movements. The likelihood of the shelters becoming unstable are dependent on a number of factors which are difficult to fully quantify. These factors include jointing, inclusions, weaknesses within the rockmass, groundwater pressure and seepage flow behind the rockface. Even if these factors could be determined, it would still be difficult to quantify the extent to which these factors may influence the stability of the shelter naturally or when it is exposed to mine subsidence movements.

The predicted curvatures and conventional strains for the Angus Place MEP are similar to the movements typically observed in the Southern Coalfield, where there is extensive experience of mining beneath rock shelters. It has been reported that, where longwall mining has previously been carried out in the Southern Coalfield, beneath 52 shelters, that approximately 10% of the shelters have been affected by fracturing of the strata or shear movements along bedding planes and that none of the shelters have collapsed. This suggests that the likelihood of any significant physical impacts on Sites 45-1-0084 and 45-1-2756/2757, resulting from the extraction of the proposed longwalls, is relatively low.

Centennial Coal is currently in the process of developing a regional Aboriginal Cultural Heritage Management Plan for its western operations. The regional Aboriginal Cultural Heritage Management Plan is being developed in consultation with relevant Registered Aboriginal Parties and government agencies including OEH. The regional Aboriginal Cultural Heritage Management Plan will include a consistent approach to the monitoring and management of all Aboriginal heritage sites within the extent of mining leases and exploration licences for Centennial Coal's western operations and encompasses the Angus Place Colliery. Monitoring of Aboriginal Heritage sites subject to subsidence will be undertaken prior to, during and at the completion of impacts from mining with any management actions required to be implemented developed in consultation with the relevant Registered Aboriginal Parties and OEH.

Potential impacts from mining will be able to be identified early and appropriate management actions taken to minimise the risk where appropriate. Any impacts will be mitigated in consultation with the relevant Registered Aboriginal Parties and OEH.

OEH considers that structurally sensitive Aboriginal sites should also be monitored during the progression of adjacent longwalls and as the underlying longwall progresses. If damage begins to appear during progression of mining in proximity to the sites, appropriate action should be

taken. This should be incorporated in the Cultural Heritage Management Plans, which should be developed in consultation with the Registered Aboriginal Stakeholders and OEH. (OEH)

Centennial Coal is currently in the process of developing a regional Aboriginal Cultural Heritage Management Plan for its western operations. The regional Aboriginal Cultural Heritage Management Plan is being developed in consultation with relevant Registered Aboriginal Parties and government agencies including OEH.

A project inception meeting for the development of the regional Aboriginal Cultural Heritage Management Plan was held on 16 July 2014 and was attended by a representative from OEH.

The regional Aboriginal Cultural Heritage Management Plan will include a consistent approach to the monitoring and management of all Aboriginal heritage sites within the extent of mining leases and exploration licences for Centennial's western operations and encompasses Angus Place Colliery. Monitoring of Aboriginal Heritage sites subject to subsidence will be undertaken prior to, during and at the completion of impacts from mining with any management actions required to be implemented developed in consultation with the relevant Registered Aboriginal Parties and OEH.

Once finalised, the regional Aboriginal Cultural Heritage Management Plan will be submitted to NSW Planning and Environment for approval.

The action relating to skeletal remains should be reworded. (OEH)

Angus Place Colliery acknowledges OEH's proposed rewording of this management action and will ensure that through the development of the regional Aboriginal Cultural Heritage Management Plan following development consent that the management action will read as "In the unlikely event that skeletal remains are identified, work must cease immediately in the vicinity of the remains and the area cordoned off. NSW Police are to be contacted in first instance. No further action is to be taken until the Police provide written advice to the proponent on how to progress. If determined to be Aboriginal, the proponent must contact the Enviro line (on 131 555), a suitably qualified archaeologist and representatives of the local Aboriginal community stakeholders to determine an action plan for the management of the skeletal remains, formulate management recommendations and to ascertain when work can recommence."

The Applicant shall ensure that the development does not cause any direct or indirect impact on identified Aboriginal sites located outside of the approved disturbance area of the development on the site. (Lithgow City Council)

A Cultural Heritage Impact Assessment was prepared by RPS to support the Project and is provided as Appendix K to the EIS.

As identified in the Cultural Heritage Impact Assessment, no Aboriginal heritage sites were located within areas to be disturbed for surface infrastructure. 14 sites were identified within the subsidence impact area. Of the 14 sites within the subsidence impact area, only three are at risk of harm. The regional Aboriginal Cultural Heritage Management Plan will include a consistent approach to the monitoring and management of all Aboriginal heritage sites within the extent of mining leases and exploration licences for Centennial's western operations and encompasses Angus Place Colliery. Monitoring of Aboriginal Heritage sites subject to subsidence will be undertaken prior to, during and at the completion of impacts from mining with any management actions required to be implemented developed in consultation with the relevant Registered Aboriginal Parties and OEH.

No impacts to Aboriginal heritage sites beyond the subsidence impact area or surface disturbance areas are predicted.

3.1.2 Air Quality

To minimise any potential health impacts it is recommended that, should the project be approved, the proponent is required to implement all reasonable and feasible measures to minimise particulate matter emissions. Such measures might include reactive dust management systems. (NSW Health)

As detailed in Section 10.7.2 of the EIS, two co-located high volume air samplers measuring TSP and PM_{10} concentrations on a 1-in-6-day cycle have been operating on site at Angus Place Colliery since 2009. In addition, static dust monitoring commenced in January 2011 at eight monitoring locations surrounding the Project Area. The locations of these dust monitors are shown on Figure 3.8 in the EIS.

In addition to the air quality monitoring detailed in the EIS, a TEOM is currently installed and operating at Blackmans Flat. Angus Place Colliery will commit to installing an additional TEOM as part of a regional air quality monitoring programme that is currently being developed by Centennial Coal for its western operations. This has been included in the revised Statement of Commitments contained in **Section 5.0** of this RTS.

An Air Quality Impact Assessment was prepared by SLR Consulting to support the Project and is provided as Appendix M to the EIS. The air quality impact assessment included the development of a dispersion model for the construction, operation and site rehabilitation phases of the Project. The results of the dispersion modelling are provided in Section 10.7.3 of the EIS and demonstrate that the Project is predicted to comply with all relevant air quality criteria at all representative receptors during construction, operation and rehabilitation phases of the Project.

The current air quality management measures employed at Angus Place Colliery include:

- The enclosure of all coal transfer points on three sides;
- Enclosure of the crusher operations; and
- The utilisation of water sprays to suppress emissions of dust from coal stockpiles.

These management measures will continue to be implemented throughout the life of the Project.

As detailed in Section 11 of the EIS, the Air Quality Management Plan will be updated within 6 months of receiving Development Consent. The Air Quality Management Plan will include all monitoring locations and dust mitigation measures to be implemented for the life of the Project.

The modelling that has been conducted includes only external sites that are operational or have been approved and will be operational in the near future when considering cumulative dust and particulate matter. The modelling does not include proposed developments, such as Neubeck, Cullen Valley and Invincible Mines which may become operational during the lifespan and Springvale and Angus Place Mines. The cumulative effect of all the developments which are in

close proximity to each other may result in air quality exceedences for sensitive receivers. (NSW Health)

The cumulative assessment of any future proposed developments, such as Neubeck Project, Cullen Valley and Invincible Mines, which may become operational in the future, will be considered by those projects in their respective EISs.

3.1.3 Biodiversity Strategy

OEH considers that the Regional Biodiversity Strategy included in the EISs does not fulfil the Director-General's requirements as it has not demonstrated that the biodiversity values of the region will be maintained or improved in the medium to long term. Importantly, the proponent has only assessed offsetting requirements for impacts associated with vegetation clearing activities and has not considered losses to habitat and ecosystem condition that will be a direct impact from rock fracturing and changed hydrology in its offsetting strategy. In addition, the selection of the proposed offset is not justified and the proposed Regional Biodiversity Strategy does not fulfil all of the NSW Offset Principles for Major Projects as presented in the Draft Policy. (OEH)

Section 5 and Section 6 of the Regional Biodiversity Strategy (revised August 2014) have been updated to include further detail on the biodiversity values of each Project Application Area and the proposed Offset Land.

Offsets are required where the impacts associated with a project cannot be avoided or mitigated. Where impacts cannot be avoided, the Draft NSW Biodiversity Offsets Policy for Major Projects requires reasonable attempts to be made to minimise the impact (or make the impact less severe). Where all attempts have been made to avoid or minimise the impacts, offsets should be used to compensate for the residual impacts.

Impact assessments for subsidence (MSEC 2013) and groundwater (RPS 2014a) found that significant reductions or reversals of grade that could otherwise cause ponding or scouring are unlikely to occur. Further to this, no losses of infiltrated water and minimal divergence of surface water would be expected within shrub swamps or upstream drainage lines (RPS 2014, Flora and Fauna Impact Assessment). This is due to the expected height of continuous fracturing, as a result of subcritical longwall width, being below the Mount York Claystone, a geological layer significant in its role as a barrier to vertical fracture propagation. These studies, and the Flora and Fauna Impact Assessment for the Project (Appendix H to the EIS) concluded that there are no expected direct impacts to hydrology as a result of rock fracturing. Therefore, there are no residual impacts that would require an offset.

Section 2 of the Regional Biodiversity Strategy (revised September 2014, and included in **Appendix 4** of this RTS), outlines how each project within the Strategy addresses the NSW Offsets Principles (published by the NSW OEH in July 2013). The Draft NSW Biodiversity Offsets Policy for Major Projects was released for public comment in March 2014. Public submissions on the Draft Policy closed on 9 May 2014. Project applications for the Springvale MEP, Angus Place MEP, Airly MEP and the Neubeck Coal Project were submitted prior to, or during the public exhibition phase of the Draft Policy. The Draft Policy will be phased into use through transitional arrangements, which are anticipated to commence in late 2014. The Draft Policy will include flexibility in its application during this transitional period, with the transition taking approximately 18 months once the Draft Policy has been adopted by Government.

Regardless, Centennial Coal has reviewed the Draft Policy and its expectations against the strategy detailed in the Regional Biodiversity Strategy. Amendments have been made in the Regional Biodiversity Strategy (revised August 2014) to reflect this review.

The proponent must meet the requirements of the EPBC Environmental Offsets Policy (October 2012) and Offsets Assessment Guide, including legal arrangements and funding provision for in-perpetuity management of offset lands, prior to the finalisation of an EPBC approval. (DotE)

Section 2 of the Regional Biodiversity Strategy (revised September 2014) provides further detail on how the Regional Biodiversity Strategy meets the requirements of the EPBC Environmental Offsets Policy (2012) and the Offsets Assessment Guide.

Section 8 of the Regional Biodiversity Strategy (revised September 2014) provides detail on how the Offset Land will be secured, including anticipated timeframes for securing the land and Section 9 provides detail on the management plan requirements for the offset land.

The Department notes that whilst both EIS documents acknowledge the potential for some impacts on the THPSS ecological community (the total area of THPSS being mined under being 96.6 ha), the proposed offset area does not contain any THPSS nor does it appear to have any habitat for EPBC listed threatened species (such as the Blue Mountain Water Skink) that may be impacted by the proposed action. (DotE)

The Response to Submissions reports should provide information that shows how the proposed offsets comply with the Offsets Policy including, if necessary, the location of THPSS offsets (to account for any residual impact to THPSS once any avoidance has been taken into account), their current condition, the management actions proposed to improve ecological condition and the preferred mechanism for in-perpetuity conservation. Any other matters of national environmental significance requiring an offset should also be covered. (DotE)

The EPBC Environmental Offsets Policy requires offsets to be considered where there is a residual impact following measures to avoid and mitigate. Particular consideration, in the context of the residual impacts, should be given to the attributes being impacted, how important that attribute is to the ecology of the MNES and how much the attribute is being impacted (that is, the scale of the impact). The offset package should consider the improvements that the offset will deliver for the attribute being impacted and the level of averted loss resulting from the proposed offset with a view to achieving a minimum conservation gain.

The Flora and Fauna Impact Assessments for the Springvale MEP and the Angus Place MEP conclude that there will be no significant impact to MNES, including the THPSS. Chapter 2 of the EIS for each project provides details on the investigation efforts undertaken to establish the mechanisms that could lead to a mining related impact to THPSS and associated fauna species. These investigations have concluded that there are a number of causal factors that, in combination, would result in impacts occurring. Where any one of these causal factors can be avoided, the causal linkage to impact will not be realised. These causal factors and the management controls implemented by Springvale Coal are detailed in in Table 2.6 of the EIS.

Whilst the combination of these assessments have concluded that there will be no significant impact to MNES, and therefore no requirement for a direct offset, Centennial has committed to improving the quality of THPSS within its Project Application Area for each Project through its Revised Regional Biodiversity Strategy. The Regional Biodiversity Strategy a management strategy (detailed below) for the management of indirect and residual impacts to THPSS where mitigation measures are not successful. This management strategy, and the approach to developing it, is described in detail in **Appendix 4**, and summarised below:

- To ensure impacts to THPSS are within those predicted within the Springvale MEP EIS and the Angus Place MEP EIS, Centennial will:

- o Undertake annual monitoring for ecosystem health using the University of Queensland Monitoring Handbook (Flora monitoring methods for Newnes Plateau Shrub Swamps and Hanging Swamps, 2014) or its latest version.

  - ▪ The objectives of the University of Queensland Monitoring Handbook include, amongst other things:

    - ➢ A focus on vegetation community structure and diversity, including biological indicator species.

    - ➢ Trigger values focussed on detecting impacts of subsidence and/or changes in groundwater and surface water flows, including information on how the triggers were derived.

    - ➢ A sampling design that is statistically capable of detecting changes in the indicator variables.

    - ➢ An adaptive management mechanism for refining trigger values and determining the length of time a THPSS is monitored.

  - ▪ The following figure, taken from the Monitoring Handbook, identifies how the data collected will be used to inform management decision making.

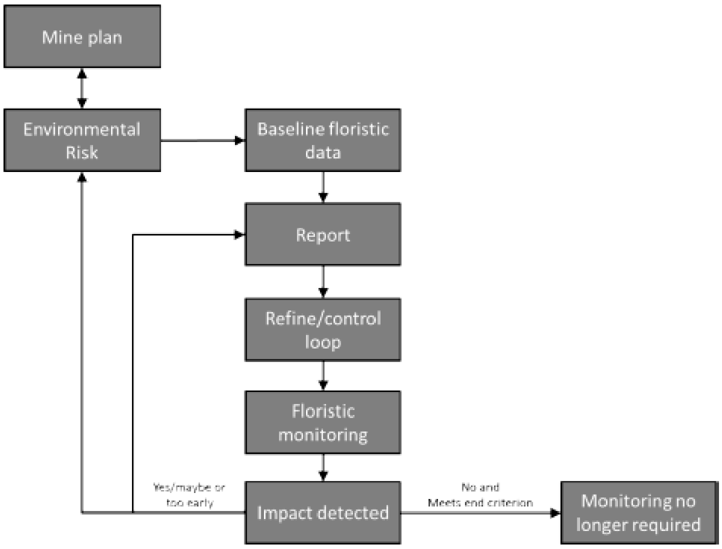


Figure 4.1: Conceptual framework showing how data from flora monitoring informs the environmental risk assessment and monitoring conclusions.

- o Where this monitoring identifies mining related impacts, mitigation measures will be implemented (including soft and hard engineering measures discussed further in **Appendix 4**).

- o Reconcile the annual monitoring every five (5) years (to allow for trend analysis to occur).

  - ▪ Where impacts, attributable to mining, are above triggers, additional mitigation will be undertaken.

  - ▪ Where impacts are attributable to mining and cannot be mitigated, or mitigation is not successful, offsets for the residual impacts will be provided.

This THPSS management strategy is considered to adequately compensate for the indirect impacts to that community.

When the EPBC Environmental Offsets Policy is applied to the THPSS, no direct offset is required.

3.1.4 Construction

The applicant is to apply for a construction certificate with Lithgow City Council or Private Certifier for all building construction works.

Centennial Angus Place will apply for a construction certificate with Lithgow City Council or Private Certifier for all building construction works as required.

A Construction Management Plan is to be prepared in consultation with Lithgow City Council and implemented for the duration of the construction phase at each project site.

As detailed in Section 11.0 of the EIS within the Statement of Commitments, Centennial Angus Place will commit to developing a Construction Environmental Management Plan in consultation with the Forestry Corporation of NSW six (6) months prior to construction of surface facilities on the Newnes Plateau.

Centennial Angus Place will commit to providing a copy of the Construction Environmental Management Plan to Lithgow City Council for their consideration. This has been included in the revised Statement of Commitments contained in **Section 5.0** of this RTS.

3.1.5 Cumulative Impacts of Mine Subsidence

The interaction of the two mines where they come into close proximity to one another does not appear to have been specifically addressed in the EIS apart from an indication in Table 9.4 of the Springvale EIS. (OEH)

The proposed longwalls at the Angus Place and the Springvale MEPs are located at a distance of 780 m apart, at their closest point. The depth of cover in this location is around 420 m and, therefore, the 26.5 degree angle of draw lines extends distances of 210 metres outside the proposed longwalls. The 26.5 degree angle of draw lines from each of the collieries do not overlap and are separated by a minimum distance of 360 m.

The predicted vertical subsidence within the Study Area (i.e. 26.5 degree angle of draw line) for the Angus Place MEP, due to the extraction of the proposed longwalls associated with the Springvale MEP, is less than 20 mm and vice versa. The natural and built features located within the Study Area for the Angus Place MEP, therefore, are not affected by the conventional mine subsidence movements resulting from the proposed longwalls at the Springvale MEP and vice versa.

The predicted vertical subsidence at the surface between the two MEPs and outside the respective Study Areas (i.e. 26.5 degree angle of draw lines), is less than 20 mm due to the extraction of the proposed longwalls at both collieries. The natural and built features in this location are not expected to be adversely impacted by the conventional ground movements.

Valley related and far-field horizontal movements extend outside the 26.5 degree angle of draw lines. For this reason, the impact assessments for the features located between the two collieries which could be sensitive to these movements have considered the cumulative effects of mining at both sites. In Section 5.1 of the subsidence reports, it was stated that:

"The natural features within the Extension Area which have already experienced mine subsidence movements due to the previously extracted longwalls at Angus Place and Springvale Collieries have been assessed based on the predicted movements due to both the existing and proposed longwalls (i.e. cumulative movements). These features include: The Wolgan River; Carne Creek; Shrub swamps within the Wolgan River valley; and Cliffs and pagoda complexes within the Wolgan River valley".

The sections of the Wolgan River and Carne Creek predicted to experience valley related movements resulting from the proposed longwalls at the Angus Place MEP are not predicted to experience any measurable valley related movements due to the proposed longwalls at the Springvale MEP and vice versa. Whilst the impact assessments for these streams and the associated features along their alignments considered the cumulative subsidence movements resulting from the proposed longwalls at both mines, the predicted movements could be considered in isolation since there is no overlap.

The smaller drainage lines located between the Study Areas for the Angus Place and Springvale MEPs could experience small valley related movements from the proposed longwalls at both collieries, but these are not expected to be sufficient to result in adverse impacts.

3.1.6 European Heritage

A European heritage field survey should have been undertaken to confirm the results of the desktop survey. Further assessment is recommended to ensure that no historic heritage is present within the project boundaries. (Heritage Council of NSW)

A Cultural Heritage Impact Assessment was prepared by RPS Australia East to support the Project and is provided as Appendix K to the EIS. Section 7.2 of the Cultural Heritage Impact Assessment acknowledges that a pedestrian survey of the Project Application Area was undertaken by RPS archaeologists David White, Philippa Sokol, Rebecca Yit and Kerrie Grant from 6 March to 13 April 2012.

The pedestrian survey undertaken was designed to identify both Aboriginal and historic (European) heritage items. It is acknowledged in Section 7.7 of the Cultural Heritage Impact Assessment that during the course of the archaeological survey, no new historic heritage sites were identified.

3.1.7 Exploration

Proposed exploration activities must be notified to DRE and, where applicable, to the Forestry Corporation of NSW including copies of due diligence assessments and site assessments where available. Exploration must not commence until appropriate approvals and/or consents have been obtained from these agencies. (DRE)

As detailed in Section 4.2 of the EIS, exploration activities will continue throughout the life of the Project within the Project Application Area with a view of refining the site's existing geological model used for detailed mine planning. Approval for these activities is sought as part of the Project.

All exploration activities will be carried out in accordance with the requirements of the Mining Act 1992 and relevant mineral authorities, including the Environmental Impact Assessment and any associated Development Consent.

Proposed exploration activities will be notified to DRE and where applicable to the Forestry Corporation of NSW. All required approvals will be obtained prior to the commencement of any exploration activities. Copies of any due diligence assessments will also be provided to DRE and Forestry Corporation of NSW (or other landowners if not within a State Forest). This commitment has been included in the revised Statement of Commitments contained in **Section 5.0** of this RTS.

No information regarding how much disturbance is required per drill hole or how many drill holes are estimated over the life of the Projects. There is no information provided regarding how much cumulative disturbance the exploration programme has caused in the past, nor how much is anticipated in the future. This has the potential to impact a large area over time. (OEH)

As detailed in Section 4.2 of the EIS, exploration activities will continue throughout the life of the Project within the Project Application Area with a view of refining the site's existing geological model used for detailed mine planning.

A standard disturbance footprint for exploration drilling activities is 40 metres x 40 metres. All drilling activities are to be undertaken within this confine.

Centennial Angus Place has developed an area-based assessment procedure for exploration activities to ensure that they are conducted in an environmentally responsible manner and with due consideration to the community. This includes a risk-based process for the selection, assessment and environmental management of proposed drill pad sites and access tracks based on environmental, geological, logistical and other operational constraints. This process has successfully been adopted in the past by Centennial Angus Place.

Drill sites and associated access tracks will be located where possible to:

- avoid threatened flora species;
- avoid hollow bearing trees;
- avoid endangered ecological communities;
- minimise clearing; and
- avoid identified Aboriginal heritage sites.

The decision to locate a drill site is subject to various geological and topographical constraints. It is also subject to agreement from landowners to provide access. As such, it is not possible to provide intended locations for exploration drill sites, or the number of exploration drill sites, for the life of the Project as part of the EIS.

Upon completion of exploration activities, all boreholes and surface disturbance will be sealed and rehabilitated in accordance with the appropriate guidelines at the time. Regular follow up inspections of rehabilitated drill sites will be undertaken to ensure appropriate rehabilitation has been achieved.

Due to the low level of impact on the ecology as a result of exploration drilling, the requirement to adhere to conditions of various exploration licences and a history of successful rehabilitation of exploration drill sites, Centennial Angus Place does not consider that exploration drilling activities will have any significant impact on the area over time and not required to be offset.

While it is proposed that assessments will be provided to DP&E, there is no information provided regarding whether these will be reviewed, or whether further approvals will be required. OEH considers that the EISs do not contain sufficient information to enable an informed and legally defensible decision to be made regarding the proposed exploration programme. (OEH)

As detailed in Section 4.2 of the EIS, the exploration programme will be undertaken throughout the life of the Project and approval for these activities is sought as part of the Project. Only landowner access approval will be required once Development Consent is granted. The process for the selection of exploration drill sites is detailed in Section 4.2 of the EIS. Due diligence assessments will be provided to NSW Planning and Environment for their information only. Copies of any due diligence assessments will also be provided to DRE and Forestry Corporation of NSW (or other landowners if not within a State forest). This commitment has been included in the revised Statement of Commitments contained in **Section 5.0** of this RTS.

Drill sites and associated access tracks are to be located where possible to avoid threatened flora species, avoid hollow bearing trees, avoid EECs, minimise clearing and avoid identified Aboriginal heritage sites. (Lithgow City Council)

As detailed in Section 4.2 of the EIS, Angus Place Colliery will continue to utilise area-based assessment procedures for the management of exploration activities to ensure that they are conducted in an environmentally responsible manner and with due consideration to the community. This will include a risk-based process for the selection, assessment and environmental management of proposed drill pad sites and access tracks based on environmental, geological, logistical and other operational constraints.

Drill sites and associated access tracks will be located where possible to:

- avoid threatened flora species;
- avoid hollow bearing trees;
- avoid endangered ecological communities;
- minimise clearing; and
- avoid identified Aboriginal heritage sites.

The location of proposed geological exploration boreholes is currently unknown, and as a consequence, detailed environmental and social impact assessment cannot be undertaken at this time. As the required drill hole locations are determined, Centennial Angus Place will undertake a series of due diligence assessments to consider ecology, archaeology and noise as relevant. The appropriate industry and legislative guidelines and policies in force at the time will be referenced and the assessments provided to the NSW Planning and Environment. Copies of any due diligence assessments will also be provided to DRE and Forestry Corporation (or other landowners if not within a

State Forest). This commitment has been included in the revised Statement of Commitments contained in **Section 5.0** of this RTS.

The general approach of the due diligence assessments will be to conduct site investigation to ensure that significant impacts are avoided.

3.1.8 General

Lithgow City Council is to be notified of any modifications and determinations. (Lithgow City Council)

Noted

The applicant is to prepare and submit Annual Reviews (formerly Annual Environmental Management Reports) to Lithgow City Council to review. (Lithgow City Council)

Centennial Angus Place will continue to provide copies of the Annual Reviews to Lithgow City Council.

The applicant may carry out coal transportation and processing operations on the site for up to 13 years from the date of this consent. Rehabilitation works are able to proceed after this end date. (Lithgow City Council)

Noted. As described in Section 4.1 of the EIS, Centennial Angus Place is seeking approval to undertake the activities as described in the EIS for a period of 25 years from date of consent.

The applicant shall produce up to 4 million tonnes of coal per year for up to 25 years. (Lithgow City Council)

As described in Section 4.1 of the EIS, Centennial Angus Place is seeking approval to produce up to 4 million tonnes of coal per year during the life of the Project (up to 25 years).

A section in both the Springvale and Angus Place subsidence assessments entitled "History of Mining beneath Swamps" which contains what appear to be omissions, factual inaccuracies and unsubstantiated opinions. (OEH)

Centennial acknowledges in Section 2.6.2.7 of the EIS the historical impacts to Swamps as a result of previous mining and mining related activities. Longwalls have been extracted directly or partially beneath 13 shrub swamps and 26 hanging swamps. Surface impacts have been observed at five swamps including Kangaroo Creek Swamp, Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp. These have been investigated and where impacts have been observed, these have been identified as largely the result of mine water discharge.

Investigations have identified that erosional and flora dieback impacts at Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp were caused by changes to swamp hydrology related to mine water discharge and were not related to subsidence. As a result of this finding, future mine dewatering systems have been designed to ensure that discharge of mine water to Newnes Plateau Shrub Swamps is avoided.

Subsidence effects to aspects of swamp hydrology have been noted at two swamps (Kangaroo Creek Swamp and East Wolgan Swamp). In both of these cases investigations have revealed that mine design was a primary causative factor. The ratio of longwall mining void width to depth of cover over mine workings was identified to be in the critical subsidence behaviour range. Following this investigation, the mine design was modified for all future proposed mining areas in the vicinity of Newnes Plateau Shrub Swamps to ensure that the ratio of longwall mining void width to depth of cover over mine workings was in the sub-critical subsidence behaviour range. No subsidence effects to swamp hydrology or flora communities have been identified in areas where sub-critical mine design has been used in the past.

The reference to the number of swamps which have been directly mined beneath on the Woronora Plateau in the Subsidence Assessment provided as Appendix D to the EIS, was based on the research by Niche Environmental and Heritage which stated that “Over 500 swamps have been directly mined beneath on the Woronora Plateau” (Baker, Tweed and Richardson, 2012).

The mining beneath swamps on the Woronora Plateau includes bord and pillar (partial and total extraction) and more recently longwall mining. The details provided in Table 5.10 of the subsidence report were limited to the total extraction and longwall mining cases only.

Discussions were not provided on the swamps at Dendrobium Mine as this is an active mine with ongoing groundwater and visual monitoring. The latest AEMR for Dendrobium Mine (IC, 2013) stated that “Groundwater monitoring in Swamp 15b and Swamp 12 has detected reduced groundwater levels or increased rates of recession following extraction of Longwall 7 and 8. Dieback of an area of Pouched Coral Fern was observed in July and October 2012. Dieback of Pouched Coral Fern and Button Grass over a larger area was noted in March 2013. Further monitoring of Swamp 15b and control swamps will be conducted to assess whether this change is a result of subsidence”.

The width-to-depth ratios where the longwalls were located directly beneath the swamps at Dendrobium Mine varied between 0.9 and 1.1 and the extraction height was 3.9 metres, which are greater than those for the proposed longwalls at Angus Place and Springvale Collieries. The experiences at Dendrobium Mine, therefore, are less relevant to the proposed longwalls.

3.1.9 Groundwater

The expansion of the groundwater monitoring network, and the associated monitoring schedules to be updated in the Water Management Plan (WMP), should carried out in consultation with the NSW Office of Water. (NOW)

The groundwater monitoring network, and the associated monitoring schedules, will be updated as part of the revisions to the Water Management Plan which will be developed in consultation with the NSW Office of Water. Groundwater monitoring data that has been and is currently being collected has provided a detailed understanding of the hydrogeological regime at Angus Place Colliery. As such, future groundwater monitoring will be limited and specifically targeted to identify potential knowledge gaps in the understanding of groundwater regimes in order to assist in the identification of potential impacts.

The modelling used to support the EIS should be regularly updated to enable confirmation that the predicted mine water takes are not exceeding, and are not likely to exceed, the predictions made in the EIS. These periodic reviews should be incorporated within the overall annual environmental monitoring plan and the results made available to NOW in a suitable electronic format. (NOW)

Groundwater models will be updated every 6 months and a review will be included in the Annual Review. Copies of the Annual Review will continue to be provided to NOW. This commitment has been included in the revised Statement of Commitments provided in **Section 5.0** of this RTS.

The proponent must maintain records of annual water take from water sources impacted by the development and reported in the annual environmental report. (NOW)

Centennial Angus Place will maintain records of annual water take from water sources impacted by the development and report these in the Annual Review.

The specific impacts of the permanent reductions (and in some cases increases) in baseflow to local swamps and surface streams are not discussed in the hydrogeological impacts report. These impacts are not discussed at all in the Surface Water Impact Study but are included in the ecological assessments. (OEH)

The Groundwater Impact Assessments quantifies the impact on the NPSS in terms of net change in baseflow contribution. The impact of this change on the ecosystem of the NPSS is then discussed in the Ecological Assessment. Section 7.3.5 of the Groundwater Impact Assessments refers readers to the specialist ecology reports for detailed discussion regarding potential impacts to GDEs.

Section 7.3.5 also states that none of the swamps included in the modelling are predicted to have significant reductions in baseflow. Loss of baseflow contribution in terms of volumes required for water accounting purposes are discussed separately in Section 8 of the Groundwater Impact Assessments.

The losses of surface baseflow have been included in the total estimate of surface water take rather than groundwater take as it comprises a net reduction in contribution to a surface water feature.

Section 8.2 details the surface water licensing requirements, which are presented for the individual swamps on Table 8.5 and summarised per Management Zone on Table 8.7.

For Angus Place, the maximum total annual licensing requirement due to baseflow reduction is 73.8 ML/yr for the Wywandy River Management Zone and 321.8 ML/yr for the Colo River management Zone.

NOW suggest a commitment to comply with the Water Sharing Plan in the Statement of Commitments.

Centennial Angus Place will continue to consult with the NSW Office of Water regarding the granting of adequate water licences over the life of the Project in order to comply with the relevant Water Sharing Plan over the life of the Project.

No extensometer data is reported, but it is noted that a wide range of impacts have been measured on groundwater aquifer levels over both Springvale and Angus Place mines. (OEH)

Section 2.6.2.6 of the EIS presents extensometer data from borehole SPR40. Reviews of the extensometer data have identified three distinct zones of sub-surface fracturing that indicate continuous fracturing between strata units (A-Zone), discontinuous fracturing and strata dilation (B-Zone) and a deformed elastic zone (C-Zone). The relationships of these zones to overlying strata are illustrated in Figure 2.23 of the EIS.

Further information to support the determination of the height of fracturing including additional information from extensometer data is provided in **Appendix 6** to this RTS. An additional peer review was carried out by MSEC with their report provided as **Appendix 7** to this RTS.

The groundwater model has been constructed using industry best practice methods and is acceptable for predicting mine inflows. However, the scale of the groundwater model is inappropriate to predict groundwater related impacts to individual THPSS. Further, a number of swamps are not incorporated into the groundwater model. Finer scaled, site specific models, informed by a conceptualisation of the hydrology and hydrogeology, would be needed to have confidence in the predictions of groundwater impacts to individual swamps. (DotE)

A detailed response has been provided in Section 2.1 of **Appendix 16**.

Confidence in groundwater model predictions is limited by a lack of site specific hydrogeological data and lineament groundwater flow behaviour. The assessment of surface water impacts, including cumulative impacts, needs to consider contaminants such as copper, zinc, nitrogen and phosphorus, which groundwater quality monitoring shows all exceed ANZECC guidelines. (DotE)

A detailed response has been provided in Section 2.1 of **Appendix 16**.

Is the groundwater model suitably robust, and are the resulting quantitative predictions accurately and reasonably described? (DotE)

The groundwater model is a regional scale model that provides generally robust predictions of mine groundwater inflows. These are reasonably described. However, due to the scale of the

groundwater model, it is limited in its capability to predict groundwater related impacts to surface water systems including those affecting THPSS and proximal reaches of the Coxs River. This results in a low level of confidence in the predictions of impacts to Cox's River and THPSS baseflows described within the EIS. (DotE)

A detailed response has been provided in Section 2.2 of **Appendix 16**.

3.1.10 Infrastructure

Lot 5 in DP829137 appears to be the closest parcel of land to TransGrid's infrastructure. Any development proposed near TransGrid's infrastructure is subject to SEPP (Infrastructure) 2007, in particular regulation 45. (TransGrid)

Centennial Angus Place acknowledges that any development undertaken near TransGrid owned infrastructure is subject to clause 45 of SEPP (Infrastructure) 2007.

3.1.11 Landowner Consent

A review by Crown Lands of the Project Application form has noted that Section 7, Landowner's consent, has not been completed. As Crown land together with a number of Crown Roads are located with the Project Boundary Application Area, the Applicant would need to seek consent from Crown Lands. (Crown Lands)

Section 7 of the Development Application form is related to "Landowner's Consent". Landowner consent is not required as long as the applicant advertises the project within 14 days of submitting a development application in accordance with clause 8F(3) of Environmental Planning and Assessment Regulation 2000. The Angus Place MEP was advertised by Centennial Angus Place in the Lithgow Mercury on 30 November 2014 and The Land on 5 December 2014.

3.1.12 Mine Design

The longwalls should be modified to avoid directly undermining Tri-Star and Trail 6 swamps. (DotE)

Longwall mining in areas directly below known high quality sites of temperate highland peat swamps on sandstone should be restricted which may potentially reduce the risk of unacceptable impacts on the endangered ecological community, particularly if appropriate buffers that reflect the local geological characteristics are incorporated between the longwall mining panels and high quality swamps. The Interim Committee supports the proposal that this condition could be revisited if the proponent is able to demonstrate that a proven technology or engineering methodology can be used that prevents the risk of subsidence in the listed ecological community, or that would allow any subsidence related impacts to be remediated. (IESC)

Centennial Angus Place has developed a reliable and detailed understanding of the environmental constraints as a result of experience from operating Angus Place Colliery over many years and from the environmental management and monitoring regimes. Using this knowledge, potential environmental constraints have been taken into account during the mine design process to ensure the Project is undertaken safely and in the most environmentally sensitive manner feasible.

The approach of Angus Place Colliery to the MEP has been to apply a best practice system of environmental management, that is, adopt a hierarchy of avoiding, minimising, mitigating and finally, offsetting residual impacts.

In 2002, Angus Place Colliery and Springvale Mine commenced intensive monitoring, investigations and research to better understand the surface environment overlying the mining areas. These investigations have included groundwater, surface water, ecological aspects and the interplay of these aspects on shrub swamps.

The data collected and analysed over the past 11 years has been critical to providing evidence that the technologies and engineering methodologies proposed for longwall mining at Angus Place Colliery and Springvale Mine will minimise impacts to sensitive surface features.

In 2008 and 2009, monitoring at Angus Place and Springvale Collieries detected impacts attributable to mining-related activities at two Temperate Highland Peat Swamps on Sandstone (THPSS), listed under the Environment Protection and Biodiversity Conservation Act 1999. These collieries have since then launched an extensive investigative program to determine the factors causing these impacts. In addition, investigations were targeted to determine the hydrogeological characteristics of THPSS'. The purpose of these investigations was to ascertain the coincident characteristics which lead to THPSS formation and to understand the sensitivity of those characteristics to mine subsidence behaviour.

The results of investigations have allowed Angus Place Colliery and Springvale Mine to understand the multiple co-incident factors that have led to historical mining-related impacts and implement management practices to ensure mining impacts will be avoided in the future or can be managed appropriately. The mine design was identified as the key controllable factor by and Springvale's mine design was changed in 2011 following the investigations in order to mitigate potential impacts to THPSS on the Newnes Plateau.

Since the investigations were conducted, Angus Place Colliery has been proactive in avoiding or minimising potential subsidence impacts to the geodiversity and biodiversity of the mining area using a comprehensive multi-disciplinary risk-based approach to mine planning and mine design in conjunction with a rigorous monitoring program.

The monitoring techniques employed are wide-ranging and complementary and the combined results provide insights into roles factors such as geology, hydrogeology, topography play in THPSS formation and the effects of mine subsidence on THPSS.

The extensive monitoring and investigation process employed by Angus Place Colliery, which utilised multiple lines of evidence to support the management decisions, created the foundations for an adaptive management outcome. Mine design changes (in the form of reduced longwall void width and increased chain pillar width) were implemented in 2011 and are planned in all proposed mining areas where NPSS are present.

Based on the results of the investigation and changes implemented in response to the investigation, the Department of the Environment gave approval to mine beneath THPSS under EPBC2011/5949 in October 2013. The outcome of detailed mine planning and design as discussed above is that the Angus Place mine plan minimises predicted subsidence and reduces the occurrence of subsidence effects beyond predictions.

The mine design has been specifically modified in the area of Tri-Star and Trail Six Swamps, with a void width reduction from 360m to 261m. This mine design approach is consistent with that used for at Springvale and approved by DotE under EPBC2011/5949.

It should be noted to avoid directly undermining Tri-Star and Trail 6 swamps, is not feasible for Angus Place Colliery and is not necessary based on the predicted impacts to the swamps as a result of the mine design proposed.

3.1.13 Mining Title

As coal is a prescribed mineral under the Mining Act 1992, the proponent is required to hold appropriate mining titles from DRE in order to mine this mineral. The project area is within exploration and mining titles held by the company. The company must ensure that an appropriate mining title must be held to cover areas to be mine and the project's supporting infrastructure and mining purpose activities to be conducted. (DRE)

As detailed in Section 3.1.3 of the EIS, Centennial Angus Place operates under a number of mineral authorities consisting of mining leases, coal leases, authorisations and exploration licences. A list of relevant mineral authorities is provided in Table 3.3 of the EIS.

The Project Application Area is defined by Mining Lease 1424 (ML 1424) and Exploration Licence boundaries (EL6856 and EL6293). As detailed in Section 5.3.2 of the EIS, to permit the extraction of coal within the Project Application Area, a new mining lease will be required over the Project Application Area under the Mining Act 1992.

3.1.14 Monitoring/Management

The Proponent should review the current monitoring program to ensure it is in line with the principles of Before-After/Control-Impact (BACI) monitoring approach with the focus on ensuring this approach is consistent and clearly identifiable in the reporting of monitoring data; Control sites should be identified and chosen to best represent the impacted sites (similar hydrological conditions). Control sites should be used for surface water (flow and quality) and shallow groundwater within swamps and water courses. (DRE)

The peer reviewed THPSS Monitoring and Management Plan (THPSS MMP) which has been approved by the Federal Department of the Environment (DotE) is aligned with Before-After/Control-Impact (BACI) design. This management plan is currently in the process of approval by DRE as part of the Subsidence Management Plan Environmental Management Plan.

A review of the planned monitoring of the swamps within the project area should be undertaken to ensure sufficient data capture is available to assess the full extent of the groundwater interactions down and across the swamp profile (multiple piezometers in each swamp). Monitoring focus should also include the AQ3-AQ6 (Burralow Formation) strata using multilevel piezometers with hourly readings. Where multi-level piezometers are not used within the swamps the instrument should be placed at a depth greater then 3m within the swamp profile to

avoid historical issues with loss of data due to hole being too shallow. This monitoring should also be reflected in the control sites selected (as indicated above). (DRE)

The suggested approach has been used in mining areas at Springvale and Angus Place mines since 2005 (e.g.Kangaroo Creek Swamp, West Wolgan Swamp, Narrow Swamp, East Wolgan Swamp, Sunnyside Swamp, Sunnyside East Swamp, Carne West Swamp and Gang Gang Swamp). Each of these swamps has multiple piezometers installed within the swamp and aquifer piezometers installed in the ridges between the swamps.

All other Newnes Plateau Shrub Swamps (NPSS) in the MEP areas have at least one piezometer installed in them, with a minimum of two years baseline data.

Due to potential impacts to THPSS associated with using truck mounted drill rigs required to drill into the rock underlying the swamps (to allow for installation of multi-level piezometers), it was decided to use a combination of piezometers as follows:

- Swamp Piezometers, which monitor water level every three hours using a datalogger and are installed in hand augered holes within the peat / soil profile of the swamp (bottom of monitoring bore at or near bedrock)

- Aquifer Piezometers, which monitor water levels every three hours using a datalogger and are installed in boreholes drilled from the top of the ridges adjacent to Newnes Plateau Shrub Swamps (NPSS) using truck mounted drill rigs. They monitor standing water levels in the Burralow Formation aquifers (AQ5 and AQ6), which supply water through the valley floor / wall seepage mechanism.

- Multi-Level Vibrating Wire Piezometers, which monitor water pressure at different levels within the strata every two hours using a datalogger and are installed in boreholes drilled from the top of the ridges adjacent to NPSS using truck mounted drill rigs. They monitor groundwater pressure in aquifers between the surface and the Lithgow Seam (AQ1 to AQ6).

The close proximity of instruments in the piezometer network has been used in conjunction with a three dimensional topographic and stratigraphic model to enable an understanding of groundwater levels and their interaction with swamps. **Figure 1** below shows a cross section of topography, stratigraphy, groundwater levels along a transect between a number of monitoring bores. EIS Section 2.6.2.6 Figures 2.24 to 2.26 shows a similar transect between ridge piezometer bores installed in 2005.

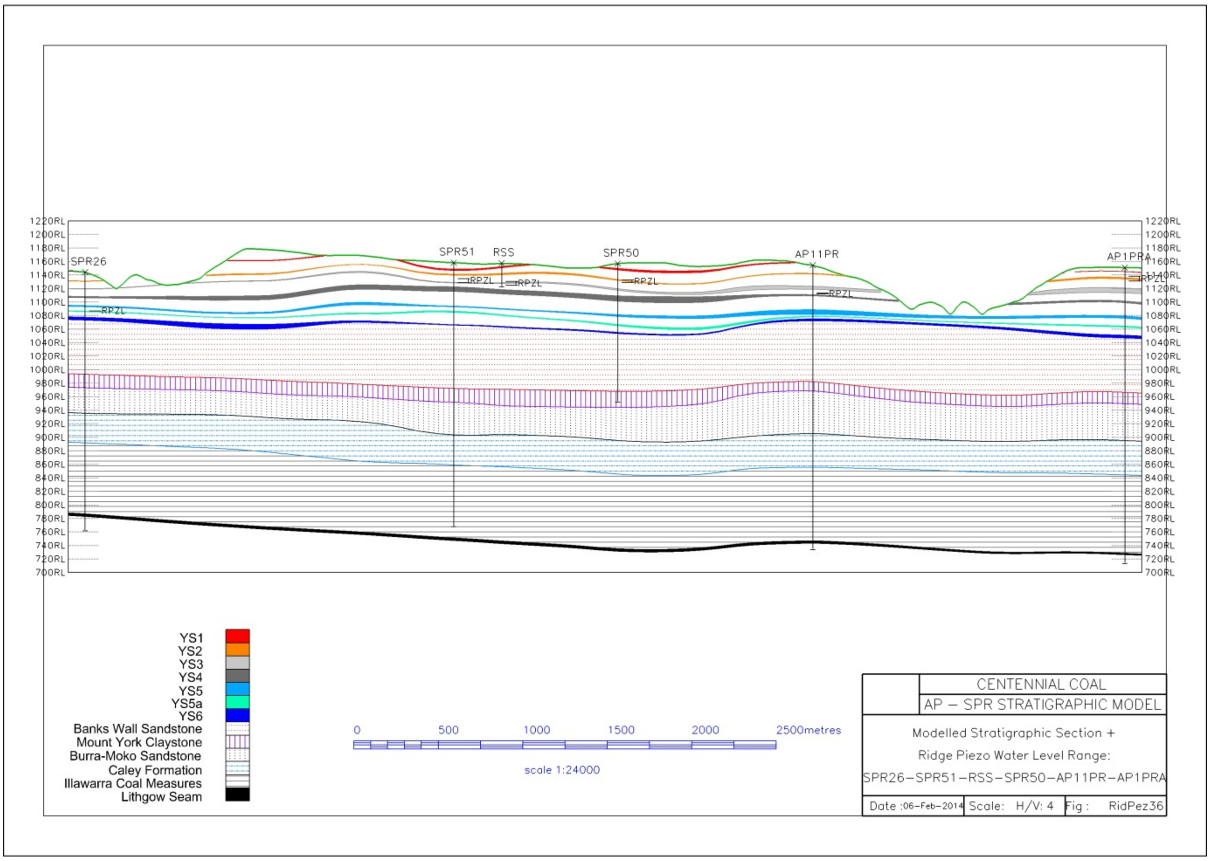


Figure 1 - Monitoring Bore Transect

The nearest Longwall to the Wolgan River is LW1002 at 240m. LW1019 will be 400m from Carne Creek. The predicted subsidence and tilting of these watercourses are not expected to result in any stream bed cracking or loss of surface waters. The proposed monitoring will rely on upstream and downstream monitoring on these two watercourses. Pool depth monitoring of the key pools in the watercourses should also be undertaken to confirm these predictions. (DRE).

There is no appropriate monitoring of flow in streams which is capable of testing the veracity of the claims made in the EIS of no impact to flows. (OEH)

OEH considers that, given the potential for fracturing of bedrock in drainage lines, monitoring of groundwater and flows on drainage lines within 800m of the Gardens of Stone National Park is required. (OEH)

As detailed in Section 10.1.3 of the EIS, the mine plan shows that the Wolgan River will not be undermined and nor will it be within the angle of draw. The minimum distance from the Wolgan River centreline to the nearest longwall panel LW1002 is 240 m. The closest that mining will approach Carne Creek is approximately 400 m southeast of LW1019.

The maximum predicted subsidence parameters in the Wolgan River channel due to movements from extraction of longwalls in both Angus Place and Springvale Projects are:

- <20 mm subsidence;
- 290 mm upsidence;
- 0.2 mm/m tilt; and
- 360 mm closure.

The Wolgan River is not predicted to experience measurable conventional strains; however valley movements will generate maximum compressive strains of less than 1 mm/m.

Predictions for section of Carne Creek closest to the proposed longwalls are:

- <20 mm subsidence;
- 25 mm upsidence
- 50 mm closure

The predicted tilt of 0.2 mm/m for the Wolgan River is very small in comparison to the natural grade of the River, which ranges from 25 mm/m to 200 mm/m and therefore there no significant ponding, flooding, scouring is predicted. Similarly, the predicted cross tilt of 0.2 mm/m represents a change in cross-grade of 1 in 5,000 which is not predicted to effect the stream alignment.

The Wolgan River has previously experienced up to 270 mm subsidence and 310 mm closure due to previous extraction of longwalls at both Angus Place and Springvale, which caused no significant fracturing or related surface water diversions. It is not predicted that any significant fracturing or water diversion will occur due to the Project.

The compressive strains due to the valley closure movements are expected to be less than 0.5 mm/m. The predicted movements at the closest section of Carne Creek to the extraction area are very small and no adverse consequences are predicted.

For unnamed watercourses, the maximum predicted tilt within the Project Application Area is 20 mm/m and as the typical channel grades in the Project Application Area vary between 25 mm/m and 300 mm/m, these tilts are unlikely to have any adverse effect.

In regards to the Gardens of Stone National park, it is acknowledged that while it is possible that minor and isolated fracturing could occur, it is considered extremely unlikely, as fracturing at this distance has only been observed within very large and incised river valleys in the Southern Coalfield. In these cases, the fracturing did not result in any adverse impacts on the stream health or have environmental consequence.

While it is possible that minor and isolated fracturing could occur within the National Park, it is considered extremely unlikely that this would occur, as fracturing at this distance has only been observed within very large and incised river valleys in the Southern Coalfield. In these cases, the fracturing did not result in any adverse impacts on the stream health or have environmental consequence.

The drainage lines within the National Park located closest to the proposed mining are much smaller and less incised than the river valleys where fracturing has been observed well outside the extents of mining. Whilst far-field horizontal movements (i.e. effects) are predicted to extend into the National Park, it is not anticipated that these would result in adverse impacts (i.e. environmental consequence).Springvale Mine and Angus Place Colliery have has previously extracted longwalls from beneath more than 40 kilometres of watercourses and monitoring shows that any impacts to surface water flows are transient at worst.

10.1.3.4 of the EIS states that as no significant consequences to watercourses are predicted, monitoring will be confined to flow monitoring upstream and downstream of the Wolgan River and Carne Creek which is already being undertaken. Flow monitoring on drainage lines within 800m of the longwall voids from LW1008 will be installed to measure far field effects. This commitment, made in the EIS, has now been included in the Revised Statement of Commitments contained in **Section 5.0** of this RTS.

An extensive surface water flow and quality monitoring program is already in place for the Wolgan River and its catchment.

Water quality monitoring is undertaken within the Wolgan River in addition to the swamps that flow into the Wolgan River. The surface water quality monitoring program within Wolgan River, Tri-Star Swamp and Twin Gully Swamp comprises of a full suite of analytes based on ANZECC sampling requirements. A summary of this existing baseline dataset and basic statistical analysis in presented in Appendix C of the Surface Water Impact Assessment (EIS Appendix F). It is noted for completeness that other swamps within the Wolgan River catchment have historically been monitored over several years. These swamps include West Wolgan Swamp, Narrow Swamp, East Wolgan Swamp, Junction Swamp and Sunnyside Swamp.

There are flow records of the Wolgan River from 2004 which indicate that it is a perennial river with flow occurring throughout the year. In addition to the Wolgan River downstream flow monitoring site, several weirs have been established within the swamps which contribute to the Wolgan River catchment (refer Table 3.12 of EIS Appendix F). Monitoring weirs equipped with shallow standpipe piezometers are predominantly used to calculate flow rates. More recently, a high-resolution pressure sensor unit has been established in the flow channel downstream of Tri-Star swamp as a low impact method of measuring swamp surface water outflow. Equipped with a remote data upload system this is a low impact method of continuously monitoring creek flow rates.

No additional flow monitoring is considered necessary.

There is no indication of what actions will be taken if monitoring indicates that mining-induced impacts occur. (OEH)

A mechanism for identifying and reporting variations from predictions should be clearly stated within the Plan. (NOW)

Chapter 11 of the EIS lists the Statement of Commitments of the Project and details the management plans that will be developed or updated for the Project following the granting of Development Consent. Centennial Angus Place will commit to developing Trigger Action Response Plans as part of the development of these management plans which will detail the response to be taken if mining induced impacts occur. This has been included in the revised Statement of Commitments contained in **Section 5.0** of this RTS.

The proposed surface water and groundwater management plans should identify critical impact thresholds in groundwater levels and quality and surface water flows and water quality to enable adaptive response and management of operations. (NOW)

To improve the coverage of baseline characterisation data, it is recommended data loggers be installed in key monitoring bores to enable continuous monitoring of groundwater levels in response to rainfall events. (NOW)

A comprehensive monitoring and management plan should be produced that takes into account the hydrological and geological context in which the swamps sit and includes:
i. potential geological and hydrological impacts in upstream tributaries that feed into the peat swamps and in areas laterally adjacent to peat swamps;
ii. potential downstream geological and hydrological impacts;
iii. potential lateral geological and hydrological impacts. (IESC)

As detailed in the Statement of Commitments contained within Section 11.0 of the EIS, Centennial Angus Place will develop a Water Management Plan for the Project within six (6) months of development consent. Centennial Angus Place will develop the Water Management Plan in consultation with the NOW. This has been included in the revised Statement of Commitments contained in **Section 5.0** of this RTS.

A minimum of 2 years of baseline data should be applied for all GDE sites within range of longwall panels. (NOW)

Centennial Angus Place has committed to monitoring groundwater dependant ecosystems potentially impacted by the Project. Groundwater monitoring will be undertaken 2 years prior to, during and for 2 years following completion of mining in the adjacent longwall panel.

3.1.15 Newnes Plateau Shrub Swamps/Hanging Swamps

Having significantly damaged Newnes Plateau Shrub Swamp EECs in the past, the EISs do not provide any definitive evidence or guarantee that further NPSS will not be impacted by the current mine plan or future longwalls. (OEH)

Centennial Angus Place acknowledges in Section 2.6.2.7 of the EIS the historical impacts to Shrub Swamps as a result of previous mining and mining related activities. Longwalls have been extracted directly or partially beneath 13 shrub swamps and 26 hanging swamps. Surface impacts have been observed at five swamps including Kangaroo Creek Swamp, Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp. These have been investigated and where impacts have been observed, these have been identified as largely the result of mine water discharge. From early 2007 to April 2010, due to issues with the SDWTS infrastructure and management of the system, licensed emergency discharges of mine water to Narrow and East Wolgan Swamps via LDP004, LDP005 and LDP006 were required to ensure the safety of mine workers.

Chapter 2 of the EIS for both Angus Place and Springvale MEPs provides details on the investigation efforts undertaken to establish the mechanisms that could lead to a mining related impact to THPSS and associated fauna species. These investigations have concluded that there are a number of causal factors that, in combination, would result in impacts occurring. Where any one of these causal factors can be avoided, the causal linkage to impact will not be realised. These causal factors and the management controls implemented by Centennial Angus Place and Springvale Coalare detailed in Table 2.6 of the EIS.

Investigations have identified that erosional and flora dieback impacts at Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp were caused by changes to swamp hydrology related to mine water discharge and were not related to subsidence. As a result of this finding, future mine dewatering systems have been designed to ensure that discharge of mine water to Newnes Plateau Shrub Swamps is avoided. This is discussed in Section 4.10.1 of the EIS.

Subsidence effects to aspects of swamp hydrology have been previously noted at two swamps (Kangaroo Creek Swamp and East Wolgan Swamp). In both of these cases investigations have revealed that mine design was a primary causative factor. The ratio of longwall mining void width to depth of cover over mine workings was identified to be in the critical subsidence behaviour range. Following this investigation, the mine design was modified for all future proposed mining areas in the vicinity of Newnes Plateau Shrub Swamps to ensure that the ratio of longwall mining void width to depth of cover over mine workings was in the sub-critical subsidence behaviour range. No subsidence effects to swamp hydrology or flora communities have been identified in areas where sub-critical mine design has been used in the past.

From the detailed investigations conducted at Springvale Mine and Angus Place Colliery commencing in 2002, the following conclusions can be drawn.

- Detailed analysis of baseline data has shown that there is significant variability between individual THPSS (refer Corbett et al 2014).
- Discharge of mine water into THPSS caused impacts on swamp hydrology and geomorphology and flora communities.
- Longwall mining conducted within a 26.5o angle of draw caused no measurable impacts to THPSS.
- As noted above, subsidence caused localised impacts on NPSS hydrology in Kangaroo Creek Swamp and East Wolgan Swamp. Investigations revealed that a combination of measurable factors was required in order to cause an impact on NPSS hydrology. These factors were consistent with those identified by researchers in the field of mine subsidence.
- The hydrology of the Burralow Formation aquifer/aquitard system has not been significantly affected by mine subsidence.
- Mine design in future planned mining areas has been informed by the results of the investigations into the causes of impacts on THPSS from mining related activities in order to prevent impacts in the future.

There has been significant effort at Angus Place Colliery to prioritise avoidance and reduction of potential impacts and constraints of surface features and geological and geotechnical issues, while considering mine safety, feasibility and optimisation. Sensitive surface features have been avoided where Project viability was not at risk. Section 8.3.4 of the EIS describes in detail the alternative mine layouts which were considered.

Previous Springvale Mine's experience at extracting longwalls of a wide range of void widths is that the previously mined narrower sub-critical longwalls had significantly less subsidence than the wider, critical longwalls that contributed to unpredicted environmental consequences above Springvale Mine. The mine design consequence is that narrower panels (261 m void width) are proven to minimise impacts on sensitive surface features. An analysis of the sensitivity of void widths at Springvale Mine identified that:

- marginal subsidence reductions would occur for longwall void widths between 150 m and 260 m and that the greatest reductions can be made from 315 m to 260 m; and
- marginal strain reduction would occur for widths between 150 m and 260 m and that the greatest reduction can be made from 315 m to 260 m.

The sensitivity analyses confirm that narrowing the longwalls to <260 m does not afford additional environmental advantages but comes at a cost to the business viability at Angus Place Colliery.

As such, the following controls have been applied:

- Longwalls adjacent to the Gardens of Stone National Park are to be extracted towards the National Park with potential ground movements progressively monitored and managed as required. This adaptive management approach complements the mine plan design in reducing impacts to the existing environment;

- LW 1004 to LW 1006 will be designed with 261 m voids. The depths of cover directly above these proposed longwalls range from 330 m to 420 m with resulting sub-critical void width to depth ratios of 0.60 to 0.85, which is less than previous longwall development at Angus Place.
- LW1001, LW1002 and LW1003 will be designed with 285 m voids.
- LW1013 and LW1014 have both been split into two sections (A and B) to avoid intervening cliff and pagoda complexes. The longwall sections will be linked underground by twin 5 m wide development headings to provide safe access and ventilation. These first workings will not generate surface subsidence.
- LW1007 to LW1019 will be 350 m wide, with chain pillars 55 m wide. Depths of cover range from 360 m to 420 m. The resulting sub-critical void width to depth ratios are within the range of 0.85 to 1.0, which is similar to those for the previously extracted longwalls at Angus Place.
- LW1010 has been shortened to avoid mining under Twin Gully Swamp.

The irreversibility of impacts to EECs are a significant consideration for OEH. If the relatively impermeable base of the Newnes Plateau Shrub Swamps or Hanging Swamps is fractured, then any perched aquifer is likely to drain downwards into the fracture network, thereby altering natural groundwater levels within the swamp and leading to increased desiccation. These impacts have already been demonstrated for Centennial's longwall operations at both Springvale and Angus Place mines. They have also been well documented in the Southern Coalfield for coastal upland swamps. (OEH)

Longwall mining beneath THPSS may fracture the sandstone substrate and alter the swamp's water balance. The Department is unaware of any proven strategies to effectively mitigate longwall mining impacts other than avoiding impacts through changes to mine plan layout. (DotE)

The mitigation measures proposed by the proponent are unlikely to reduce the risk or the likelihood of the risk being realised to an acceptable level. (IESC, 2012)

Section 2.6.2.7 of the EIS describes historical impacts to Newnes Plateau THPSS from mining related activities by Springvale Mine and Angus Place Colliery.

As identified in Section 2.6.2.7 of the EIS: "Subsidence effects to aspects of swamp hydrology have been noted at two swamps (Kangaroo Creek Swamp and East Wolgan Swamp). In both of these cases investigations have revealed that mine design was a primary causative factor. The ratio of longwall mining void width to depth of cover over mine workings was identified to be in the critical subsidence behaviour range. Following this investigation, the mine design was modified for all future proposed mining areas in the vicinity of Newnes Plateau Shrub Swamps to ensure that the ratio of longwall mining void width to depth of cover over mine workings was in the sub-critical subsidence behaviour range. No subsidence effects to swamp hydrology or flora communities have been identified in areas where sub-critical mine design have been used in the past."

Kangaroo Creek Swamp is located above Angus Place LW940 and LW950 which had widths of 262 metres and 292 m, respectively. The depth of cover at this swamp varies between 265 m at the downstream end to 280 m at the upstream end. The width-to-depth ratios at this swamp, therefore, vary between 0.97 above LW940 to 1.04 above LW950.

The longwall width-to-depth ratios at Kangaroo Creek Swamp are greater than those where the proposed longwalls are located beneath Tri Star and Trail 6 Swamps at the Angus Place MEP (0.8 to

0.9) and beneath the shrub swamps at the Springvale Extension Project (0.70 to 0.75). The proposed longwalls beneath the shrub swamps in both Angus Place and Springvale mining areas are more sub-critical than LW940 and LW950 beneath Kangaroo Creek Swamps.

The mine design approach for all future longwall mining proposed in the Springvale Mine and Angus Place Colliery MEPs is consistent with that approved for longwall mining beneath THPSS by Department of the Environment under the EPBC Act (approval EPBC2011/5949 for Springvale Mine's LE416 and LW417.

It is noted that fracturing of bedrock due to mine subsidence does not necessarily imply that there will be loss of surface or standing water. Bedrock contains natural joints and discontinuities due to erosion and weathering processes. Subsurface monitoring by Mills (2003 and 2007) and Mills and Huuskes (2004) along the Waratah Rivulet found that the fracture network beneath the stream extended to a depth of 12 m and bed separation and dilation extended to a depth of 20 m. For subcritical longwalls with sufficient depth of cover to develop a constrained zone, the diverted surface water flows are confined in the shallow network, which then re-emerge further downstream after sufficient fall of the stream bed elevation.

Rehabilitation works are currently being undertaken on the East Wolgan Swamp. As noted in Section 2.6.2.6 of the EIS, OEH approved the undertaking restoration actions at East Wolgan Swamp, and issued a certificate under Section 95 of the TSC Act on 25 November 2013.

Page 80 of the EIS briefly describes the rehabilitation works proposed for the East Wolgan Swamp and approved remediation works have been carried out since January 2014. The slumping area identified in LEG and Colong Foundation submissions dated May 2014 has now been rehabilitated as shown in the figures below.

Figure 2 - Slumping area identified in LEG and Colong Foundation Submissions (May 2014)

Figure 3 - Slumping Area in Figure 2 in Process of Rehabilitation in Accordance with Section 95 Approved Remediation Plan (June 2014)

Figure 4 - Partly Remediated Slumping Area Shown in Figure 2 Following Further Remediation (June 2014)

Soft engineering solutions for the remediation of minor impacts to swamps have been developed by Blue Mountains City Council and have been shown to be successful in a number of cases, discussed in detail in Section 3.1.18. For major impacts hard engineering solutions will be required.

The following excerpt from Springvale Mine's EPBC Approval 2011/5949 Condition 1 Application of March 2013 specifically discusses "hard engineering" solutions which may be employed in the event of major impacts to THPSS caused by cracking of underlying rock:

Hard Engineering Solutions

Hard engineering solutions may be required where cracking of the base of a THPSS may cause drainage of water away from the THPSS, which may have the potential to affect to the health of the system. Aquifer modelling and the groundwater and swamp health case studies presented in the EIS show that this is extremely unlikely. However, proven technologies related to other mining operations developed to remediate cracking of rock structures are now discussed. The integrity of the water retaining structure within the THPSS is restored through the implementation of these remediation strategies. The strategies have been researched and modified so as to suit the specific THPSS systems above the Angus Place mining operation.

Injection Grouting

Grouting of rock formations has been occurring since the 1800's *(Heidarzadeh et al (2007)*), and the technology has evolved since this time. It can be used in a range of different applications. Grouting is utilised to either stabilise rock formations or to manage the flow of groundwater and has been implemented successfully for decades in underground coal minesin Australia and overseas.

This technology has been recently adapted to seal mine subsidence related surface and subsurface cracking in rock bars in the southern coalfields of NSW.

"Injection grouting" is the process of injecting grout using pre-drilled holes into a cracked rock bar or swamp substrate. Grouting involves injecting a permanent low permeability material into cracked areas to provide a seal to control vertical or horizontal water flows. There are various types of grouts that can be used but generally they will be either cement based or polyurethane resins (PUR). The use of injection grouting for remediating subsidence cracking has been pioneered in the southern coalfields of NSW and has been used to successfully repair cracking in surface and near surface rock substrates.

Grout is pumped into the targeted area at low pressure once the grouting holes have been drilled. High viscosity grouts are used for vertical fracturing as the setting time for vertical holes needs to be shorter to optimise the use of the grout which flows faster in vertical cracks under the influence of gravity. Lower viscosity grouts would be used where horizontal cross linking of cracks is present.

A specific example of where PUR grouting has been shown to successfully repair a rock substrate can be seen at Helensburgh Coal Pty Ltd (HCPL) in the NSW Southern Coalfields. Experience at HCPL has shown that grouting using PUR can be used to successfully fill cracks ranging from small sub millimetre sized cracks to open fractures greater than 100mm.

A trial was conducted at HCPL on the WRS4 rock bar in the Waratah Rivulet and was followed by a remediation report (Waratah Rivulet Remediation Trial Activities – Completion Report (2007)). The main findings of the remediation report were:

- PUR is non-toxic.
- PUR injection can be conducted in an environmentally acceptable fashion.
- PUR injection is suitable for sealing cracking in rocks from less than 1mm to greater than 100mm.
- Pre and post permeability testing showed that permeability was reduced by several orders of magnitude following PUR injection.
- The PUR injection process was transferrable to other areas where cracking of rock had occurred

The HCPL PUR grouting programs are used to seal cracking in outcropping rock bars. However, it is considered that this technology is transferrable and can be used to seal cracks in swamp bases as a swamp *base* is analogous to a rock bar, albeit one covered with peat and sand.

The use of cementitious grouts has also been used to successfully remediate subsidence induced cracking which led to water loss in watercourses in the Southern Coalfield. Injection grouting with cementitious grouts was successfully used for rock bar rehabilitation in the Georges River.

Where alluvial material overlies sandstone, injection grouting through drill rods has also been used successfully to seal void under the alluvial material (soil / peat). This technique was also used in the Georges River, where 1-2m of loose sediment was grouted through using purpose designed grouting pipes.

In the case of East Wolgan Swamp, subsidence impacts to rock underlying the swamp are very localised and allow for targeted rehabilitation.

In contrast to the experience at Springvale and Angus Place mines, OEH notes the comparative lack of impact at Centennial's Clarence Colliery operations to NPSS which uses an alternative mining methodology. The recently approved 900 Series at Clarence Colliery are located just on the other side of the Pine Plantation from the proposed Springvale Mine longwalls and operates in similar depths of cover. Subsidence at Clarence Colliery is of the order of 100mm compared to 1500-2000 mm at Springvale and Angus Place. (OEH)

Clarence Colliery extracts coal from the Katoomba seam, which lies approximately 100m above the Lithgow Seam, from which coal is extracted at Springvale Mine and Angus Place Colliery.

The depth of cover range in future mining areas at Angus Place is 270-450m (typically 370m). The depth of cover range in future mining areas at Springvale is 180-420m (typically 400m). The depth of cover range at Clarence is 130-320m (typically 240m).

Section 8.2.1 of the EIS deals with the reasons for selection of the longwall mining method at Springvale Mine and Angus Place Colliery. More detail is provided below.

<u>Springvale and Angus Place Mining Method</u>

As a means of assessing alternative mining methods suitable for utilisation at Springvale Mine and Angus Place Colliery, the viability of Bord and Pillar mining with partial pillar extraction was assessed in the report “Strata Engineering Pty Ltd (2010) Report No. 03-123-AGP-33 Partial Extraction at Depths of >300m”.

Bord and Pillar mining with partial pillar extraction is often perceived as an alternative to the longwall method of mining, however it is dependent on the structural competency of the roof (strata overlying the coal seam) and the stress environment (which is a function of the depth of the coal seam below the surface).

Strata Engineering (2010) stated: “The common feature of all mines practising partial extraction is the ability to drive “extended cuts” (i.e. to reliably and consistently cut out >6m prior to installing roof support, usually in a cyclic or “place changing” system of development. The potential to do so successfully can be assessed using the Coal Mine Roof Rating or “CMRR” system, to analyse the impact of roof competency on extended cut behaviour, in the context of the stress environment and specifically depth.”

CMRR is calculated by determining a weighted average of the rock properties in the roof above the coal seam. It is based on the thickness, shear strength, compressive strength, moisture sensitivity, presence of ground water and degree of homogeneity of the roof.

The CMRR system categorises roof competency as follows:

- CMRR <45 - Weak Roof
- CMRR = 45 to 65 - Moderate Roof
- CMRR >65 - Strong Roof

Published CMRR data from Springvale Mine and Angus Place Colliery has been gathered from a number of locations and ranges from 31 – 35. The roof at Angus Place Colliery is classed as weak under the CMRR system.

The Depth of Cover at Springvale Mine in the area of LW 416-418 ranges from 350 m to 420 m.

Figure 5 is a graph of 18 Australian case studies and 44 case studies from the US database. The dashed blue line is the discriminant equation, which is the relationship that best separates the ‘always stable’ from the ‘sometimes’ and ‘never stable’ cases. The Australian ‘always stable’ cases are generally characterised by CMRRs of >50 and depths of ≤ 300m. The Springvale data is expressed as a regime defined by the CMRR range of 35 to 40 and a depth range of 300m to 400m (i.e. within the red box in the figure).

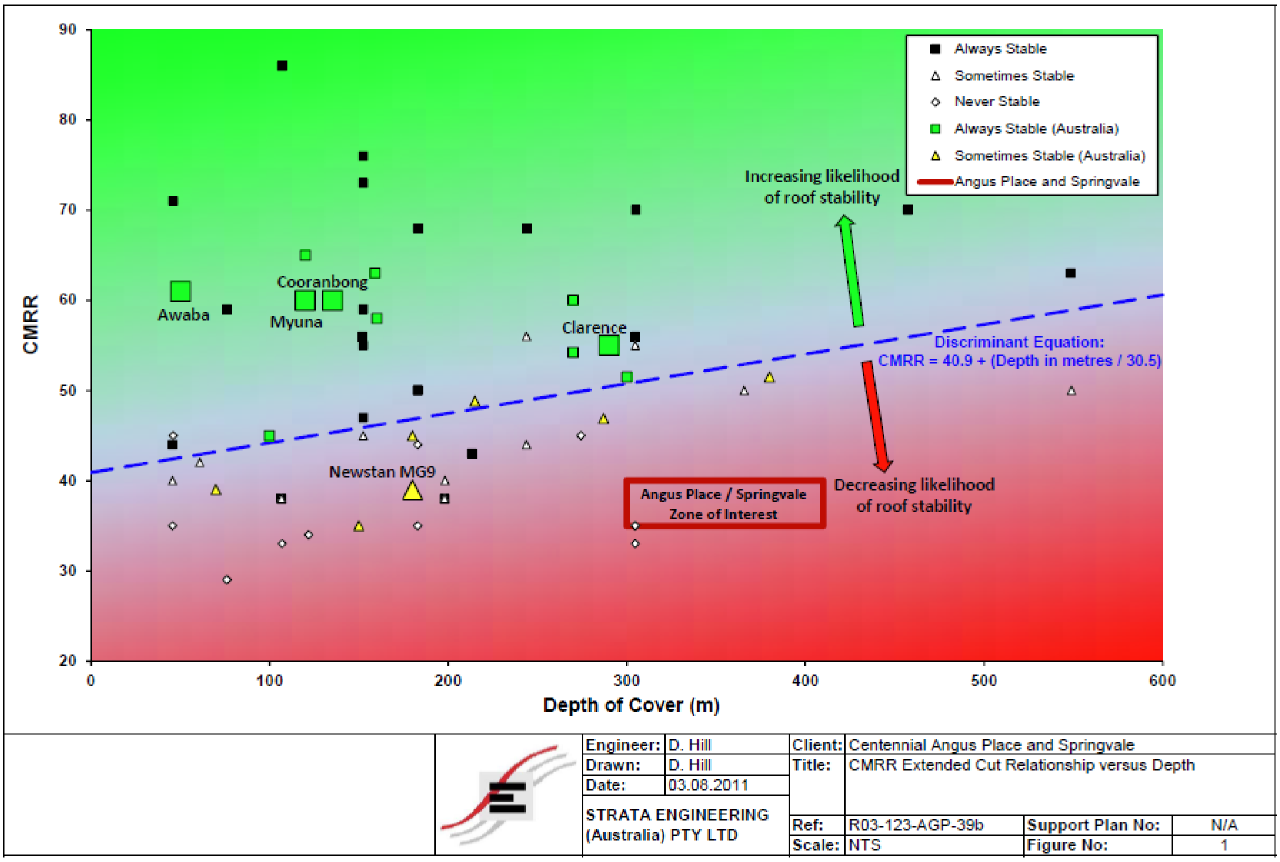


Figure 5 - Coal Mine Roof Rating Versus Depth of Cover

Strata Engineering (2010) stated: “With regard to the Angus Place / Springvale ‘regime’, the data all lies below the discriminant equation line, with adverse implications for the stability of extended cut stability. The available precedents suggest that failure is almost certain at a depth of >200 m.”

Strata Engineering (2010) concluded: “There is no known precedent, in Australia at least, for a safe and viable partial extraction operation in the geotechnical environment under consideration. The primary issue is that it is considered unlikely that the increased roadway width of around 5.5m required for any partial extraction operation could be safely, consistently and economically driven with the current level of roof and rib support technology.”

As a result of the findings of the Strata Engineering Pty Ltd report, the Bord and Pillar and partial pillar extraction mining method is not considered viable as an alternative to longwall mining in the current proposed mining areas at Angus Place Colliery and Springvale Mine.

OEH has referred to the bord and pillar / partial extraction mining system at Clarence Colliery. Clarence Colliery mines the Katoomba Seam at depths of cover of typically 100 to 290m, with a generally strong sandstone roof (CMRR 50-60). All of the Clarence Colliery data lies above the discriminant equation line in **Figure 5** (i.e. in the “always stable” classification). The Angus Place and Springvale situation cannot be compared to Clarence Colliery.

A number of alternate mining layouts were investigated for Angus Place Colliery and are discussed in Section 8.3.2 of the EIS. The evolution of mine design at Angus Place Colliery, including different mine plans options considered, is discussed in Section 8.3.3 of the EIS. The alternate mining layouts considered at Angus Place Colliery included:

- Further Reduction in Longwall Width and Increase in Pillar Size.
- Changing Distribution of Longwalls to Avoid Undermining THPSS.

- Shortening Longwalls to Avoid Undermining THPSS.
- "Splitting" Longwall Mining Blocks to Avoid Undermining THPSS.
- Cessation of Mining North of 400 Panel Main Headings.

None of the alternate mining layouts represent a viable business case for Centennial Angus Place.

The current expansion at Angus Place Mine could be modified so that there was no direct undermining of the NPSS (only two swamps Trail 6 Swamp and Tri-Star Swamp lie directly above the planned longwalls). Shortening of longwalls to avoid adverse geological conditions has been common practice in the past at Springvale and Angus Place mines and OEH believes this should be applied to the two NPSS located directly above the proposed Angus Place longwalls. (OEH)

Centennial Coal has developed a reliable and detailed understanding of the environmental constraints as a result of experience from operating Angus Place Colliery over many years and from the environmental management and monitoring regimes. Using this knowledge, potential environmental constraints have been taken into account during the mine design process to ensure the Project is undertaken safely and in the most environmentally sensitive manner feasible.

The approach of Angus Place Colliery to the MEP has been to apply a best practice system of environmental management: that is a hierarchy of avoiding, minimising, mitigating and finally, offsetting residual impacts.

In 2002, Angus Place Colliery commenced intensive monitoring, investigations and research to better understand the surface environment. These investigations have included groundwater, surface water, ecological aspects and the interplay of these aspects on swamps.

The data collected and analysed over the past 11 years has been critical to proving that the technologies and engineering methodologies for longwall mining will minimise impacts to sensitive surface features.

The outcome of detailed mine planning and design as discussed above is that the Angus Place mine plan minimises predicted subsidence and reduces the occurrence of subsidence effects beyond predictions. There has been significant effort to prioritise avoidance and reduction of potential impacts and constraints of surface features and geological and geotechnical issues, while considering mine safety, feasibility and optimisation.

Shortening of longwall blocks is not common practice at Springvale and Angus Place. The Life of Mine planning process used at Springvale and Angus Place involves scheduling of mining activities based on a mine plan developed for all remaining mineable reserves, The mine schedule requires a balance between underground roadway development and longwall production activities. Changes to mine plans can severely disrupt production continuity and business viability.

The mine design has been specifically modified in the area of Tri-Star and Trail Six Swamps, with a void width reduction from 360m to 261m to result in subcritical longwall panel design. This mine design approach is consistent with that used at Springvale and approved for longwall mining beneath THPSS by DotE under EPBC2011/5949.

The History of Mining Beneath Swamps section of the Subsidence Impact Assessments fails to discuss the interaction of geological structures and swamp impacts. (OEH)

The section on the history of mining beneath swamps in the Subsidence Impact Assessment (Appendix D of the EIS) provides background information and was intended that it be read in conjunction with the background information provided by other specialist consultants. These specialist consultants provide further and more detailed information on historical observations including the effects of mining on groundwater, surface water and ecology.

Non-conventional movements are often observed within valleys due to combinations of valley related movements and the presence of surface lineaments. The predicted closure movements across the valleys (including the influence of the surface lineaments) were determined using the method outlined in 2002 ACARP Research Project C9067. The reliability of this method was reviewed in Section 3.8 of the Subsidence Impact Assessment report, based on ground monitoring data from Angus Place and Springvale Collieries, and it was found that the “observed closure movements along these monitoring lines were less than those predicted using the 2002 ACARP method”.

The frequency of subsidence impacts (caused by longwall mining) on swamps appears to be low but when such impacts occur they are likely to have a high impact on the ecological functioning of individual swamps. (DotE)

Section 2.6.2.7 of the EIS describes historical impacts to Newnes Plateau THPSS and acknowledges “Subsidence effects to aspects of swamp hydrology have been noted at two swamps (Kangaroo Creek Swamp and East Wolgan Swamp)”. Case studies of both of these swamps are included in Section 2.6.2.6 of the EIS.

In the case of Kangaroo Creek Swamp, changes to standing water levels as measured by KC1 swamp piezometer were recorded following mining. Swamp hydration from a spring upstream of the swamp and valley wall seepage associated with the Burralow Formation geology has not been significantly affected by longwall mining. Vegetation monitoring at Kangaroo Creek Swamp has not demonstrated changes to the flora community within the swamp.

In the case of East Wolgan Swamp, Goldney et al (2010), an independent report commissioned by DEWHA (now Department of the Environment) concluded the following with regard to East Wolgan Swamp: “Site 10 (East Wolgan Samples a and b): There has been a significant and catastrophic impact on this swamp, where ecological and geomorphic thresholds have been exceeded. Shrub components had disappeared, a significant thickness of peat had been washed away and a heavy deposit of patchy sand of unknown origin was deposited over what remains of the swamp bed. We attributed this swamp’s destruction principally to mine water discharge. However, we are unable to determine the role of longwall mining as a contributing factor since mine water discharge impacts have very likely masked the longwall mining impacts. We have determined that these impacts were very likely significant”.

Mine design changes have now been implemented to prevent future subsidence impacts to Newnes Plateau Shrub Swamps.

Following extensive investigations to determine impact causes to THPSS on the Newnes Plateau, the following actions have been completed to prevent impacts to swamps on the Newnes Plateau.

<u>Mine Re-Design to Reduce Subsidence</u>

Major design changes have been made to the Angus Place mine plan in order to reduce subsidence from longwall mining. These changes are based on the following dimensional changes:

- Void width reduced from 315m to 261m when Shrub Swamps exist above the panel.
- Pillar width increased from 45m to 58m when Shrub Swamps exist above the panel.

These changes have been made specifically to reduce the environmental impacts of longwall mining under the Newnes Plateau, and demonstrate Centennial Angus Place's commitment to sustainable mining practices. The changes have been made in good faith and at significant cost to the business at a time when there was no guarantee of approval for ongoing mining activities.

Studies To Understand Swamp Formation and Interactions with Mine Subsidence

Studies have been conducted by Angus Place Colliery and Springvale Mine in the following areas to improve understanding of swamp formation and interactions with mine subsidence:

- Geology and hydrogeology
- Swamp hydrology
- Mine design and subsidence

These studies have been used to inform mine design in order to prevent future impacts to Newnes Plateau THPSS. The mine design approach for all future longwall mining under shrub swamps in the proposed Springvale and Angus Place mining areas is consistent with that approved for longwall mining beneath THPSS by the Department of the Environment under EPBC2011/5949.

The Subsidence Impact Assessment predicts values for subsidence, upsidence, tilts, curvatures, hogging and sagging that if realised would, according to the EIS, have minimal impacts on the swamps. Similar estimates have been made for projects on the Newnes Plateau in the past (Springvale and Angus Place). In these cases it has been documented that longwall mining (conducted under EPBC approval 2011/5952- Angus Place Colliery) resulted in major impacts on East Wolgan Swamp (subsidence and cracking) and significant impacts on Kangaroo Creek Swamp (undermined, with water losses from the ecosystem). (DotE)

The current EIS fails to acknowledge the failure of past predictions and that longwall mining below the swamps could result in further irreparable damage to THPSS. (DotE)

Neither EIS provides convincing evidence that THPSS will be immune from similar impacts to those that damaged the ecological community in the past. The reduction in longwall widths to 261m provides no reassurance that THPSS will not be impacted by bed rock fracturing as some of the previous impacts (Kangaroo Creek Swamp) occurred with 262m wide longwalls (longwall 940). (DotE)

There appears to be a high risk of severe impact to the EPBC Act listed (endangered) Temperate Highland Peat Swamps on Sandstone that is present directly above or laterally adjacent to the proposed longwall panels associated with the Centennial Coal mining proposal; with this risk being greater for the proposed Springvale Colliery than the Angus Place Colliery. (DotE)

The evidence that longwall mining under the Newnes Plateau may have at least partially contributed to previous damage to the listed endangered ecological community in that area suggests that the likelihood of the risk being realised is also high. (DotE)

Centennial Angus Place and Springvale Coal have had significant experience in undermining swamp systems. Angus Place Colliery and the neighbouring Springvale Mine have together directly or partially undermined 13 shrub swamps and 26 hanging swamps. Surface impacts have been observed at four of these swamps (Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp).

An independent investigation by Goldney et al (2010) undertaken on behalf of the then Commonwealth Department of, Environment, Water, Heritage and the Arts (DEWHA) found that the major cause of most of the impacts at Narrow Swamp North and Narrow Swamp South was mine water discharge and not subsidence related ground movements. Impacts at East Wolgan Swamp and Kangaroo Creek Swamp appear to have been caused by a combination of subsidence-related ground movements, mine water discharge and erosion, with the particular contribution of subsidence impacts unable to be quantified.

The chronology below illustrates when the impacts to East Wolgan Swamp and Kangaroo Creek Swamp occurred and the subsequent investigation process, action plan implementation and granting of EPBC 2011/5952 approval.

<u>Chronology of THPSS Impacts from Longwall Mining and Subsequent Actions</u>

- Impacts to East Wolgan Swamp hydrology were recorded in 2008
- Impacts to Kangaroo Creek Swamp hydrology were recorded in May 2008
- Investigations of the incidents and reporting to NSW Government agencies were conducted in 2009
- DEWHA investigations / reporting were conducted in 2010 (Goldney et al 2010)
- Implementation of actions by Centennial Angus Place and Springvale Coal to cease mine water discharge to swamps and modify mine design to reduce longwall void width and increase chain pillar width occurred in 2010 / 2011
- Enforceable Undertaking under Section 486DA of the EPBC Act by the Federal Minister for the then Department of Sustainability, Environment, Water, Population and Communities on 12 October 2011
- Angus Place Colliery's Referral under the EPBC Act for Longwalls 900W and 910N lodged with SEWPaC in May 2011
- Angus Place EPBC 2011/5952 approval for Longwalls 900W and 910N issued in April 2012
- Longwall mining under EPBC 2011/5952 commenced in Longwall 900W in April 2014

Section 2.6.2.7 of the EIS acknowledges historical impacts to Newnes Plateau THPSS from mining related activities by Springvale Mine and Angus Place Colliery and identifies the major causes of impacts to Newnes Plateau THPSS from mining related activities as mine water discharge and mine subsidence.

Section 2.6.2.7 of the EIS further summarises the changes to mine water management on the Newnes Plateau and mine design changes implemented to prevent future impacts to THPSS.

Chapter 8 of the EIS details the changes to mine design which occurred following the investigation into subsidence impacts at East Wolgan Swamp and Kangaroo Creek Swamp.

Actions taken by Springvale Mine and Angus Place Colliery to prevent impacts to Newnes Plateau THPSS are summarised below:

Mine Re-Design to Reduce Subsidence

Major design changes have been made to the Springvale mine plan in order to reduce subsidence from longwall mining. These changes are based on the following dimensional changes:

- Void width reduced from 315m to 261m
- Pillar width increased from 45m to 58m

These changes have been made specifically to reduce the environmental impacts of longwall mining under the Newnes Plateau, and demonstrate Centennial Angus Place's commitment to sustainable mining practices. The changes have been made in good faith and at significant cost to the business at a time when there was no guarantee of approval for ongoing mining activities.

Centennial Angus Place accepts that impacts at Kangaroo Creek Swamp and East Wolgan Swamp have occurred, and in the case of Kangaroo Creek Swamp the subsidence related impacted occurred with 262 m wide longwall. Kangaroo Creek Swamp is located above Angus Place LW940 and LW950 which had widths of 262 metres and 292 m, respectively. The depth of cover at this swamp varies between 265 m at the downstream end to 280 m at the upstream end. The width-to-depth ratios at this swamp, therefore, vary between 0.97 above LW940 to 1.04 above LW950 and fall in the critical behaviour range.

The longwall width-to-depth ratios at Kangaroo Creek Swamp and East Wolgan Swamp are greater than those where the proposed longwalls are located beneath Tri Star and Trail 6 Swamps at the Angus Place MEP (0.8 to 0.9) and beneath the shrub swamps at the Springvale Extension Project (0.70 to 0.75). The proposed longwalls beneath the shrub swamps in both Angus Place and Springvale mining areas are more sub-critical than the critical LW940 and LW950 beneath Kangaroo Creek Swamps.

No Further Mine Water Discharges to Swamps

- Springvale Mine and Angus Place Colliery's mine water management system on the Newnes Plateau has been modified through the following management measures to eliminate mine water impacts to Newnes Plateau swamps. There have been no mine water discharges to Newnes Plateau Swamps since April 2010.
- Dewatering bore facilities are located downstream of swamps (e.g. Springvale Bore 8 facility is located downstream from Sunnyside East Swamp and Carne West Swamp).
- Re-design of Angus Place Colliery's mine dewatering infrastructure underground to allow storage of emergency discharges in the Angus Place 900 Area Water Storage.
- Angus Place Colliery's emergency discharge point (LDP006) was relinquished on 29 July 2013 following a variation to EPL467.
- Springvale Mine's emergency discharge points, LDP004 and LDP005 will be relinquished as part of the Springvale MEP, as discussed in Section 4.10.1 of the EIS. It is planned to re-inject any future emergency discharges underground into the Angus Place 900 Area Water Storage. Prior to relinquishment, the following processes must be completed:
- Aquifer Injection Licence to allow re-injection into mine workings voids.
- Testing of current infrastructure and design / build of additional required infrastructure for mine water management.

Studies to Understand Swamp Formation and Interactions With Mine Subsidence

Studies have been conducted by Centennial in the following areas to improve understanding of swamp formation and interactions with mine subsidence:

- Geology and Hydrogeology
- Swamp Hydrology
- Mine Design and Subsidence

These studies have been used to inform the mine design in order to prevent future impacts to Newnes Plateau THPSS. The mine design approach for all future longwall mining in the Springvale and Angus Place MEP areas is consistent with that approved for longwall mining beneath THPSS by the Department of the Environment under EPBC2011/5949 approval.

As indicated in section 2.6.2.6 of the EIS, OEH approved the undertaking restoration actions at East Wolgan Swamp, and issued a certificate under Section 95 of the TSC Act on 25 November 2013. Approved remediation works have been carried out since January 2014.

Centennial Angus Place refutes the claim that longwall mining conducted under EPBC approval 2011/5952 (Angus Place Colliery) has resulted in major impacts on East Wolgan Swamp (subsidence and cracking) and significant impacts on Kangaroo Creek Swamp (undermined, with water losses from the ecosystem). EPBC approval 2011/5952 was granted in April 2012 and relates specifically to mining under Angus Place LW900W (extraction commenced in April 2014) and LW910 (not yet extracted). No THPSS overlie these longwalls (refer to Figure 10.1 of the Angus Place MEP EIS) and no impacts to any THPSS in the vicinity have been predicted or have occurred.

As discussed below subsidence related impacts to East Wolgan Swamp and Kangaroo Creek Swamp were recorded in 2008 and the then Commonwealth Department of, Environment, Water, Heritage and the Arts (DEWHA) commissioned an independent investigation into the impacts in 2010; the results of which are reported in Goldney et al (2010). The impacts to East Wolgan Swamp and Kangaroo Creek Swamp occurred well before the grant of EPBC approval 2011/5952.

Centennial Angus Place and Springvale Coal contest Department of the Environment's claim that water losses from the Kangaroo Creek Swamp ecosystem have occurred due to longwall mining. Photo monitoring has been undertaken at three locations along the Kangaroo Creek at locations and periods indicated below. The monitoring photos and additional details are provided in **Appendix 11**.

- **Kangaroo Creek Dam** – overlies Springvale Mine's previously mine LW401 (refer Figure 3.1 of the Springvale EIS), which was undermined in 1996. The site is downstream from the Kangaroo Creek Swamp South (refer Figure 2.2 of the Angus Place EIS and Figure 2.7 of the Springvale EIS) and upstream from the Kangaroo Creek Waterhole location (see below). Photo monitoring conducted in the period 30 December 2009 to 8 June 2012 (refer **Appendix 11**) at this location shows that the dam has contained water on 22 out of 24 monitoring occasions (conducted monthly or bi-monthly).

- **Kangaroo Creek Waterhole** – this is the location within the Kangaroo Creek Swamp and two piezometers at downstream (KC1) and upstream (KC2) locations have been monitoring groundwater levels since July 2005 and end 2008, respectively. Groundwater levels at KC1 appear to have been affected by the longwall mining of Angus Place Colliery's LW940 resulting in a sudden reduction in groundwater levels in June 2008, unrelated to rainfall). In the five years of photographic monitoring since the measured reduction in groundwater levels in 2008, only three monitoring events out of 41 monthly or bi-monthly monitoring events showed no water in the waterhole (February 2014, June 2014 and August 2014), and these events show strong correlation to deficit in rainfall in the period.

- **Kangaroo Creek Downstream** – overlies Angus Place Colliery's LW910 (not mined as yet) and downstream from the Kangaroo Creek Waterhole (see above). Photo monitoring at this location over the period 30 August 2012 to 18 September 2013 shows presence of water at the location on all monitoring occasions confirming no water has been lost from the Kangaroo Creek ecosystem.

It is noted that Kangaroo Creek Swamp South was undermined by Springvale Mine's LW401. An aerial assessment of the Newnes Plateau Shrub Swamps by Blue Mountains City Council as 'Caring for Country Save Our Swamps 2010 Project' has noted the overall condition of the Kangaroo Creek Swamp South as 'Good', which is the highest category in the assessment report.

The hydrological requirements of the peat swamps are not well enough understood to accurately predict the cumulative impacts of longwall mining. (DotE)

Section 2.6.2 of the EIS summarises the findings of studies conducted on the geology, hydrogeology and hydrology of THPSS on the Newnes Plateau. It further relates specific groundwater response of swamps and surrounding aquifers to longwall mining.

The proponent has not characterised existing surface water, groundwater and ecological conditions for the majority of THPSS within the proposed project area. Seasonal surface water flow and an assessment, or estimation, of the baseflow component of the Coxs River are not provided and are needed to enable the prediction of impacts to seasonal flows within, and interactions between, surface water and groundwater systems, including those associated with THPSS. This information would also improve predictions of discharge and baseflow losses within the Coxs River and the potential for downstream impacts to occur. (DotE)

A detailed response has been provided in Section 2.1 of **Appendix 16**.

Does the EIS, and in particular the groundwater model and the treatment of subsidence and fracturing predictions, provide a reasonable assessment of the likelihood, extent and significance of impacts on overlying adjacent swamps? (DotE)

The EIS, including the groundwater model, does not provide a reasonable assessment of impacts to THPSS. Confidence in the groundwater model's capacity to predict site specific impacts to individual THPSS is low. In particular the model scale is not appropriate to predict impacts to THPSS, and a number of THPSS are not included within the groundwater model and therefore groundwater related impacts to these swamps cannot be predicted. (DotE)

A detailed response has been provided in Section 2.2 of **Appendix 16**.

Impacts to undermined THPSS have historically been severe, resulting in changes to the hydrological and hydrogeological regimes, vegetation composition and structure, and large reductions in THPSS extent. These changes have been significant and are considered to be

beyond the ability of the ecological community to recover naturally. As yet, there is no scientific evidence or industry based results to indicate that such impacts to THPSS can be remediated successfully. (DotE)

The subsidence related impacts affecting overlying and adjacent THPSS would be expected to include fracturing of underlying bedrock, a water storage capacity increase within the bedrock fracture network, a decrease in surface water flow provision from upstream tributaries and a corresponding decrease in standing surface water level. (DotE)

Due to the low level of confidence in the groundwater model's capacity to predict hydrological impacts to individual THPSS, the likelihood, extent and significance of groundwater impacts to swamps cannot be determined with certainty. Swamps that are directly undermined or overlie structural lineaments are more likely to be severely impacted due to the instability of underlying strata and locally increased subsidence effects. Given the temporal variability and time lags with which impacts are observed in THPSS, the significance of groundwater impacts may not be readily determined for some time. (DotE)

The EIS states that fracturing up to 50 mm wide is predicted to occur within the shallow bedrock of THPSS wherever they are undermined. Impacts to THPSS are considerably more likely to occur where swamps are directly undermined. Fracturing to further THPSS and their upstream tributaries would be expected to occur where compressive and tensile strains exceed 0.5 mm/m and 2 mm/m respectively. Strain is caused by the horizontal movement of the ground surface relative to two fixed points. Tensile strain occurs where the distance between two points increases and compressive strain occurs where the distance between two points decreases. (DotE)

A detailed response has been provided in Section 2.2 of **Appendix 16**.

Avoidance of undermining and locating longwalls such that compressive and tensile strains are below 0.5 mm/m and 2 mm/m respectively at THPSS sites are considered the most effective ways to manage the potential impacts to THPSS. This strategy should also be applied to any upstream tributaries that provide a significant proportion of surface flow to THPSS. (DotE)

The proponent has stated that cracks are predicted to form within the sandstone substrate underlying many swamps within the project area. The proponent states that these cracks will naturally fill with soil and peat (self-ameliorate), and therefore impacts related to these bedrock fractures are "considered unlikely". However, THPSS are exceptionally slow to self-heal or self-ameliorate. Examples of lowland swamps from the Southern Coalfields of New South Wales show that without attempted rehabilitation, self-amelioration is not evident within two lowland swamps over a 25 to 30 year period5. Based on a lack of supporting evidence and available literature, self-amelioration is not considered to be a reliable or effective remediation method. (DotE)

A detailed response has been provided in Section 2.2 of **Appendix 16**.

The only known strategy to reduce the risk of impact to THPSS ecological communities within the project area would be to alter the mine layout such that swamps are not undermined by longwall panels and longwalls are sufficiently removed from THPSS such that tensile and compressive strains at THPSS sites are below 0.5 mm/m and 2 mm/m respectively5. This

avoidance strategy should also be applied to any upstream tributaries that provide a significant proportion of surface flow to THPSS. This approach is the most likely to prevent impacts to THPSS given the potential severity of impacts, difficulties in the accurate and confident prediction of impacts, and the ineffectiveness of other mitigation and management measures. (DotE)

A detailed response has been provided in Section 2.2 of **Appendix 16**.

3.1.16 Noise

Noise monitoring and management should be implemented where possible. (Lithgow City Council)

There is increasing evidence that exposure to noise is associated with health effects. We recommend that the noise mitigation strategies listed in the application become part of the conditions of approval to ensure there are minimal impacts on the local community from noise. (NSW Health)

A Noise Impact Assessment was prepared by SLR Consulting to support the Project and provided as Appendix L to the EIS.

The Noise Impact Assessment predicts the following:

- Construction noise levels to be significantly below the construction noise goals at the nearest sensitive receiver and that the potential construction noise impacts of the Project are negligible.
- Operational noise emissions will be within the Project specific noise criteria for all residential receptors.
- No noise level increases are predicted at the nearest residential receivers due to proposed additional infrastructure associated with the Project.
- The amenity criterion of 50 dBA for a passive recreational area will be met a distances of approximately 550 m and 700 m from the APC-VS2 site under calm and prevailing metrological conditions respectively.
- Noise levels in the vicinity of the proposed dewatering boreholes are predicted to meet the acceptable amenity criterion of 50 dBA for a passive recreational area at distances of less than 100 m from the boreholes.
- There is a small area of Sunnyside Ridge Road to the east of the APC-VS2 area which is predicted to experience exceedances of the Project specific noise criteria for a passive recreational area. However, Sunnyside Ridge Road is promoted for use as a 4WD track and noise impacts on potential users are considered insignificant.
- Noise from traffic servicing surface infrastructure sites will be significantly below the relevant Industrial Noise Policy criteria and therefore no significant consequences are predicted.
- As detailed in Section 10.6.6 of the EIS, while noise modelling has indicated that there will be negligible noise impacts, the following noise mitigation and management measures will be implemented:

- workers will be regularly trained (i.e. toolbox talks) to use the equipment in ways that minimise noise.
- mobile plant will be operated in a quiet, efficient manner.
- plant and equipment will be well maintained including regular inspection and maintenance.
- for equipment with enclosures (i.e. compressor rooms) it will be ensured that doors and seals are well maintained and kept closed when in use;
- noise monitoring on site and within the community will be continued in accordance with the Angus Place Noise Monitoring Programme;
- onsite noise mitigation measures and plant operating procedures will be refined where practical;
- clear signage will be provided including relevant contact numbers for community enquiries; and
- community issues of concern will be addressed promptly.

As committed to in the Statement of Commitments contained in Section 11.0 of the EIS, the noise monitoring programme at Angus Place Colliery will be updated to include noise monitoring at sensitive receptors, in accordance with the Project Specific Noise Criteria. The noise monitoring programme will include continuous, unattended noise monitoring and operator attended quarterly noise monitoring.

3.1.17 Physical Impacts

The Department notes that the proposed project footprint borders the Greater Blue Mountains World Heritage Area (Gardens of Stone National Park) and that surface impacts resulting from longwall mining may impact on the values of this Area. (DotE)

As detailed in Section 10.1.4.2 of the EIS, the Gardens of Stone National Park, which is part of the Greater Blue Mountains Area World Heritage Area and National Heritage Place, is located adjacent to the northern-eastern edge of the Project, approximately 170 m from LW1014A and outside the 26.5 degree angle of draw. The area of National Park closest to LW1014A could experience very small vertical movements (less than 20 mm), but it is not expected to experience any measurable conventional tilts, curvatures or strains.

Far field movements are those movements that can be expected to occur at some distance from the mine face. These movements consist of low level strains. Low level strains are likely to affect linear infrastructure (such as pipelines) and may contribute to valley closure movements at some distance from the longwall edge. MSEC (2013) has calculated that the extent of far field movements from the longwalls at Angus Place is 800m from the goaf.

The maximum strains at either Springvale or Angus Place mines in areas outside the angle of draw have been measured at 1.3 mm/m tensile and 0.5 mm/m compressive. These strains did not result in any noticeable soil cracking. Therefore it is not expected that there will be any adverse impacts in the National Park.

Section 8.6 of the EIS details how longwalls adjacent to the Gardens of Stone National Park are to be extracted towards the National Park with potential ground movements progressively monitored and managed as required. This adaptive management approach complements the mine plan design in reducing impacts to the existing environment.

The current subsidence monitoring programme measures maximum vertical subsidence, tilts and strains induced by previous and current mining, and includes ground surveys along representative subsidence monitoring lines. This programme will be the basis of ongoing subsidence monitoring for the Project. Revisions to the programme will include the required adaptive management procedures as mining approaches the Gardens of Stone National Park, in the later years of mining.

3.1.18 Planning Agreement/Contributions

Council would like the opportunity to enter into a Voluntary Planning Agreement for both projects. Council also has a Section 94A Contributions Plan which imposes a 1% Contribution on all developments over $200,000. Should the proponent not enter into a Voluntary Planning Agreement for the proposal then a condition should be placed on the consent requiring payment of a contribution in accordance with Council's Section 94A Contributions Plan. (Lithgow City Council)

As detailed in Section 6.2.2 of the EIS, NSW Planning and Environment has determined that the appropriate planning authority to determine if a Voluntary Planning Agreement (VPA) or S94 contribution is applicable to Lithgow City Council. Discussions between the Centennial Coal and Lithgow City Council are underway with a VPA to be finalised prior to determination of the Project. Centennial Angus Place will continue working with Lithgow City Council regarding these arrangements.

3.1.19 Rehabilitation

The Proponent shall rehabilitate the site to the satisfaction of the Secretary of the Department of Trade and Investment, or his delegate. Rehabilitation must be substantially consistent with the Rehabilitation Objectives described in the EIS and the Statement of Commitments in Chapter 11 of the EIS. (DRE)

Centennial Angus Place will rehabilitate the site to the satisfaction of the Secretary of the Department of Trade and Investment, or his delegate. Rehabilitation will be substantially consistent with the rehabilitation objectives described in Section 10.11.1 of the EIS, the Decommissioning and Rehabilitation Strategy provided as Appendix P and Statement of Commitments included in Chapter 11 of the EIS.

The Proponent must prepare and implement a Rehabilitation Plan. (DRE)

A Rehabilitation Management Plan is to be prepared in consultation with Lithgow City Council and implemented for the project. (Lithgow City Council)

Section 5.3.2 of the EIS identifies that it is expected that the conditions of the new mining lease and SSD consent will require a new Mining Operations Plan (MOP) to be prepared for the Project. The new MOP will include a detailed Rehabilitation Plan. In accordance with Section 1.4 of the ESG3: Mining Operations Plan (MOP) Guidelines, September 2013 (DRE), consultation with relevant landholders, community groups and government agencies (including the Lithgow City Council) will be undertaken in the development of the MOP.

Remediation strategies in areas affected by longwall mining are primarily designed to restore flows and the hydrological regime. Other remediation strategies have been focused on sealing fracture networks on cracked stream beds and have not addressed fractures occurring beneath peat sediments. The Department is unaware of any examples of THPSS impacted by longwall mining that have been successfully remediated. (DoE)

There is little evidence that the suite of remediation measures proposed would be effective in repairing damage to the endangered ecological community if the proposed longwall mining did lead to impacts such as fracturing of a peat swamp basin. Previous experience with implementation of such remediation measures has shown little or no success. (IESC)

The Blue Mountains City Council's Upland Swamp Rehabilitation Program was commenced in 2006 after Blue Mountains Swamps were listed as part of the Temperate Highland Peat Swamps on Sandstone endangered ecological community, with the aim of protecting and restoring Blue Mountains Swamp across the local government area (LGA).

In August 2008 Blue Mountains City Council and Lithgow City Councils formed a partnership to deliver the 'Save our Swamps' (S.O.S) project to restore Temperate Highland Peat Swamps on Sandstone across both LGAs supported by grant funding of $250,000 over 3 years from the Urban Sustainability program of the NSW Environmental Trust.

The 'Save our Swamps"' project has been assisting in the management and conservation of the nationally threatened Temperate Highland Peat Swamps on Sandstone (THPSS) ecological community across the Blue Mountain and Lithgow LGAs.

In 2009 the 'Save our Swamps' project received a $400,000 federal 'Caring for Country' grant to expand the program to incorporate Wingecarribee Shire Council and Gosford City Council.

The innovative integrated and landscape scale approach to the management of THPSS has resulted in the 'Save our Swamps 'project receiving four awards including:

- National Governments Local Government Award for Innovation in Natural Resource Management 2010;
- United Nations World Environment Day Award for Excellence in Overall Environmental Management 2011 (Special Commendation);
- NSW Sustainable Cities award for Biodiversity Conservation 2010; and
- National Keep Australia Beautiful (Tidy Town award) for Biodiversity Conservation 2011.

As part of a collaborative approach to information and skill sharing the practical knowledge and lessons learnt from the Save Our Swamps project, BMCC has developed a practical set of guidelines entitled "Soft engineering solutions for swamp remediation - a 'how-to' guide". The guide was created by Blue Mountains City Council with the assistance of Lithgow City Council, Gosford City Council, Wingecaribee Shire Council. This publication comprehensively covers soft engineering swamp rehabilitation applications, techniques and materials. It also covers background information on swamp geomorphology, threats and impacts to Temperate Highland Peat Swamps on Sandstone swamps.

The 'How to guide' includes case studies on successful implementation of remediation to THPSS comprising:

- Braeside Swamp located in the Blue Mountains LGA;
- Marmion Swamp located in the Blue Mountains LGA;
- Wentworth Falls Swamp located in the Blue Mountains LGA;

- Happy Valley Swamp located in the Lithgow LGA;
- Ellem Gully Swamp located in the Gosford LGA; and
- Paddys River Swamp located in the Wingecarribee LGA.

Section 2.6.2.7 of the EIS describes historical impacts to Newnes Plateau THPSS from mining related activities by Springvale Mine and Angus Place Colliery and notes that subsidence effects to aspects of swamp hydrology have been noted at two swamps, namely Kangaroo Creek Swamp and East Wolgan Swamp. In both of these cases investigations have revealed that mine design was a primary causative factor. In response to these impacts and to avoid any future subsidence-related impacts Springvale Mine and Angus Place Colliery have re-designed the proposed longwalls beneath THPSS to be sub-critical with void widths of 261 m. No subsidence effects to swamp hydrology or flora communities have been identified in areas where sub-critical mine design have been used in the past.

It should be noted the mine design approach proposed for longwall mining under the THPSS in the proposed Springvale and Angus Place mining areas is consistent with that approved for longwall mining beneath THPSS by the Department of the Environment under EPBC2011/5949 approval for LW416 and LW417.

Rehabilitation works at the East Wolgan Swamp are currently being undertaken under an approved rehabilitation management strategy. Subsidence impacts to rock underlying the swamp are very localised and allow for targeted rehabilitation. Rehabilitation works use the soft engineering techniques developed by BMCC discussed above, and hard engineering technique proposed and approved under Springvale Mine's EPBC Approval 2011/5949 Condition 1 Application (March 2013). The hard engineering technique is to be used for the repair of major impacts to THPSS caused by cracking of underlying rock. Details of the technique are discussed above in Section 3.1.14. The progress made to date on the rehabilitation works is provided in **Figure 3**.

3.1.20 Stygofauna

It is important to note that stygofauna (and potential stygofauna) were actually found. Since this was the first survey of its kind for stygofauna in the area, there is the potential for the species collected to be unique. Unfortunately the taxonomic level of identification is currently inadequate to investigate whether these animals are new to science, and the implications of potential impacts from longwall mining affecting groundwater aquifers in which the stygofauna exist cannot be ascertained. (OEH)

Centennial Angus Place acknowledges that the aquatic ecology assessment undertaken for the Project identified the presence of stygofauna.

Additionally, Centennial Angus Place will commit to undertaking a regional stygofauna assessment which will:

- Collate existing available information on groundwater bores, water quality and characteristics in Centennial Coal's area of operations throughout the Western Coalfield.
- Use this information to form a prioritisation list of likely areas for GDEs to occur.
- Use the prioritisation protocol to identify bores that can be sampled to provide data on the presence and significance of fauna both within and outside mine areas.
- Identify any stygofauna found to a minimum of Family level.

- Advise on the significance of the findings.
- Examine relationship between bore characteristics and presence of stygofauna.

The Statement of Commitments contained in **Section 5.0** of this RTS has been updated to include this commitment.

3.1.21 Subsidence

MSEC has provided no data, statistical analysis or graphics to support the factor of 10x maximum curvature used in their stress calculations. the derived maximum strains and levels of stress obtained by the DgS (2014) methodology should be used for subsidence predictions rather than the 10 x maximum curvature calculation. (OEH)

Information should be provided on the height of fracturing that has occurred as a result of earlier Springvale and Angus Place mining operations. (OEH)

OEH has concerns regarding predictions for stress, upsidence and valley closure. (OEH)

<u>Strain</u>

The "10 times" factor is used to provide predictions for conventional strain, which are the normal levels of strain which occur when the ground subsides conventionally and, therefore, do not include the localised non-conventional (i.e. anomalous or valley related) strains. Hence, these strains represent typical or likely values rather than the maximum or peak values. The purpose of providing predictions for conventional strains is to allow the comparison of the typical movements from location to location across the mining area.

It is highlighted in Section 4.3 of the subsidence report, that "there can be considerable variation from the linear relationship, resulting from non-conventional movements or from the normal scatters which are observed in strain profiles". For this reason statistical analyses of strain has been undertaken which provides the predictions for strain including both conventional and non-conventional movements. The results of the statistical analysis are provided in Sections 4.3.1 to 4.3.3 of the subsidence report, which are based on the measured strains at Angus Place and Springvale Collieries.

The impact assessments for the natural and built features have been based on the outcomes from the statistical analyses (i.e. based on the peak strains which include non-conventional movements), rather than on the conventional strains (i.e. typical or average movements).

The predicted conventional strains have been provided for each feature in Chapters 5 and 6 of the MSEC report, to allow a comparison of the typical movements expected from location to location. It is stated each time that "Non-conventional movements can also occur as a result of, amongst other things, anomalous movements" and then refers the reader to the statistical analyses provided in Chapter 4 for the peak or maximum strains. The impact assessments are based on the statistical analysis (i.e. peak strains) rather than the conventional (average) strains.

The linear factor is dependent on the overburden geology and the depth of cover and, therefore, varies from Coalfield to Coalfield. Hence, a factor of 15 is used in the Southern Coalfield and a factor of 10 is used in the Newcastle, Hunter and Western Coalfields. No data or statistical analyses were provided to justify the 10 factor, as the predicted conventional strains were not used for the impact assessments, but for comparative purposes only. The impact assessments were based on the statistical analyses of strain provided in Chapter 4 which used to local and site specific monitoring data from Angus Place and Springfield Collieries.

Closure

The use of 200 mm predicted closure for the Bulli Seam Operations Part 3A Application was to assess the potential for impacts on rock bar controlled streams in the Southern Coalfield. This value was adopted by Illawarra Coal as it represented a low probability of impact on the standing water pool levels upstream of rockbars.

In that application, the use of 200 mm predicted closure in relation to swamps was only considered to assess the potential for fracturing of bedrock and rock bars (i.e. the subsidence effects) rather than to assess the consequences (i.e. impacts on vegetation, water levels and swamp health). MSEC does not support the use of 200 mm predicted closure as a threshold for potential environmental consequences (i.e. impacts) on swamps.

Lineaments and Swamps

The statement that the “compressive strains at the lineaments above the proposed LW1001 to LW1019 will be similar to those observed above the previously extracted longwalls” was intended to refer to (but was not specifically stated) the locations where the mining geometry (i.e. width-to-depth ratios) are similar to the previous longwalls. The compressive strains will be less where the longwall width-to-depth ratios are less than the previously extracted longwalls.

Tri-star swamp is the only swamp located above the proposed LW1001 to LW1019 that is coincident with a Type 1 or 2 lineament. In this location the longwalls have been narrowed to 261 metres and the width-to-depth ratio varies between 0.80 and 0.90. There is no Type 1 or 2 lineaments identified beneath either Twin Gully Swamp (which is also outside of the longwalls) or Trail 6 Swamp (which is above the narrower longwalls).

The strains across the lineaments above the previously extracted longwalls were measured at monitoring lines where the width-to-depth ratios varied up to 1.1. The compressive strains at the swamps coincident with Type 1 and 2 lineaments above the proposed longwalls, therefore, are expected to be less than the maxima previously measured.

Kangaroo Creek Swamp is located above Angus Place LW940 and 950 which had widths of 262 metres and 292 metres, respectively. The depth of cover at this swamp varies between 265 metres at the downstream end to 280 metres at the upstream end. The width-to-depth ratios at this swamp, therefore, vary between 0.97 above LW940 to 1.04 above LW950.

The longwall width-to-depth ratios at Kangaroo Creek Swamp are greater than those where the proposed longwalls are located beneath Tri Star and Trail 6 Swamps at the Angus Place Extension Project (0.8 to 0.9) and beneath the shrub swamps at the Springvale Extension Project (0.70 to 0.75).

Two piezometers (KC1 and KC2) were installed near Kangaroo Creek Swamp, with the monitoring results presented in Section 2.6.2.6 of the EIS written report. Piezometer KC2 showed a sudden drop in groundwater level in June 2008, which was unrelated to rainfall, during the extraction of LW940. Piezometer KC1 still shows strong correlation to rainfall indicating that the groundwater levels in this location have not been affected by mining.

An assessment of the effects on subsidence on the swamps at Angus Place and Springvale Collieries by Fletcher et al (2013) found that “Kangaroo Creek and West Wolgan swamps have not shown significant trajectories towards non-swamp vegetation community type, sustained degradation of structural species condition or increases in weedy species richness”.

Also as described in the EIS written report that “Flora monitoring at Kangaroo Creek Shrub Swamp indicated no trend of decreasing condition and that species abundance is not declining. The available evidence indicates that underground mining has not resulted in any negative effects on Kangaroo Creek Shrub Swamp”.

It is considered that the impact of mining on the groundwater level at Kangaroo Creek Swamps was the result of the high longwall width-to-depth ratio (up to 1.04) in combination with the presence of near surface geological structure.

Height of Fracturing

Information on the height of fracturing based on extensometer and piezometer data from LW411 and LW412 was presented in Section 2.6.2.6 of the EIS (Figure 2.22). The monitoring "indicates that the height of continuous fracturing above longwall mining areas in the Lithgow Seam is truncated at 132 m height above the workings at the interface of the Burra-Moko Head Sandstone". Discontinuous fracturing and strata dilation continued a further 124 m, into the Banks Wall Sandstone, to a height of 99 m below the surface above LW411.

Microseismic monitoring was also undertaken between the 01 July 2010 and 31 December 2010 in the vicinity of LW413. The data indicated that the majority of the seismic events (which were associated with shear failure mechanisms) occurred below the Mount York Claystone. The interpretation of this data is that the height of the continuous fracture zone is within the Burra-Moko Head Sandstone (refer Table 2.5 of the EISs).

The discussion provided in Section 4.6 of the Subsidence Impact Assessment report (Appendix D) provides a guide on the height of fracturing (both continuous and discontinuous) based on the mining geometry alone. The height of connective cracking is not only dependant on the mining geometry (i.e. panel width) but also other important factors including: the site specific geology of the overburden; the presence of massive spanning strata units (which can reduce the overall height of fracturing); and the presence of aquitards (which can reduce the height of continuous or connective fracturing).

The overburden contains a number of aquitards, including the Mount York Claystone and the claystone layers YS1 to YS6 (refer Table 2.5 and Figure 2.12 in the EIS). The detailed numerical groundwater modelling by CSIRO (EIS Appendix E) assesses the changes in permeability of the overburden (i.e. height of continuous fracturing) which includes the influence of these claystone units.

In addition to using the CSIRO groundwater numerical model noted above, an empirical model has been developed as part of the RTS to characterise changes to groundwater systems caused by longwall mining throughout the overburden lithology. This empirical model, prepared by Ditton Geotechnical Services Pty Ltd (DgS), is provided in **Appendix 6** and described briefly below. The response provided below should be read in conjunction with the report entitled "Subsurface Fracture Zone Assessment above the Proposed Springvale and Angus Place Mine Extension Project Area Longwalls", DgS Report No. SPV 003/7b, dated 10 September 2014, and

"Peer Review of Mine Subsidence Induced Height of Fracturing Issues for Angus Place and Springvale Collieries", D Kay, MSEC, 20 September 2014.

It is recognised that longwall mining results in surface and sub-surface subsidence displacements and it creates new fractures and opens up or widens pre-existing bedding planes and natural joints within the overburden. The location of and the impacts from these mining induced fractures within the overburden depend on both the mining geometry and the geology and lithology of the strata (refer MSEC report in **Appendix 7**).

The opening of existing joints and bedding planes and the creation of new mining induced cracks within the overburden over a mined panel increases the permeability of the existing strata layers. The height at which new mining induced fractures (height of fracturing (HoF)) may form above a mined panel has been measured to be up to 1 to 1.5 times the panel width, depending on the spanning capacity of the overlying strata and the bulking of the goafed strata. However, the creation of these new fractures, which while has the effect of increasing horizontal permeability, does not necessarily imply that a direct hydraulic connection will exist vertically up through the strata layers to each fracture.

Significant volumes of mine inflow only occur from the height where the fractures form a connected continuous path or a conductive network towards the mined opening. The height of the connected fracturing zone (HoCF) is defined as the height of a zone above the seam that mining induced connected or continuous fractures can transmit water from the overlying strata to the mined void, or, the height of a zone above the seam from which water would flow freely into the mine. The HoCF above the extracted longwalls, is commonly much lower than the HoF, depending on many factors listed below:

- widths of extraction
- heights of extraction
- depths of cover
- presence and proximity of previous workings, if any, near the current extractions
- presence of pre-existing natural joints within each strata layer
- thickness, geology and geo-mechanical properties of each strata layer
- angle of break of each strata layer
- spanning capacity of each strata layer, particularly those layers immediately above the collapsed and fractured zones
- bulking ratios of each strata layer within the collapsed zone
- groundwater factors such as the presence of and the head in aquiclude or aquitard zones within the overburden and the permeability of each strata layer.

In this RTS the height of continuous fracturing (HoCF) has been assessed for all longwalls in the proposed Project Application Areas for the Angus Place and Springvale projects using the DgS and Hydrosimulations Geology Pi-Term model. This new methodology is co-authored by Steve Ditton (DgS) and Noel Merrick (Hydrosimulations) and was presented at the Australian Earth Sciences Convention in July 2014.

The Pi-Term empirical model for the determination of HoCF by DgS is based on an extensive database of 34 case studies from all NSW and Queensland Coalfields. The new methodology recognises the key fracture height driving parameters of panel width (W), cover depth (H), mining thickness (T), and local geology factors (t'), which represents the effective thickness of strata at height of A-Zone to estimate the A-Zone and B-Zone horizons above a given longwall panel. The effective delineation of A- B- and C-Zones is critical to understanding effects to groundwater in the overburden and these subsidence zones are defined in **Appendix 6** as follows:

- A-Zone – Continuous fracture zone (unconstrained) with Caved zone included in this zone
- B-Zone – Discontinuous fracture zone (dilated bedding and constrained)
- C-Zone – Elastic deformation zone (dilated bedding and constrained)

The Geology Pi-Term model presented in **Appendix 6** has also been calibrated against Springvale Mine and Angus Place Colliery data from a number of multi-level extensometers, multi-level vibrating wire piezometers and groundwater level monitoring bores.

The process by which the Pi-Term empirical model was calibrated to the geological and hydrogeological conditions and then used to model subsidence zones in future mining areas at Angus Place Colliery and Springvale Mine was through:

- Measuring subsidence zones using extensometers
- Measuring groundwater effects within different subsidence zones using vibrating wire piezometers AND water level monitoring piezometers (changes in storage though minor bed separation may change pressures without measurable changes in water level)
- Modelling of subsidence zones using the Pi-Term Model (calibrated to site measured data)
- Use of historical piezometric response within the measured subsidence zones to approximate future groundwater response in the overburden (modelled subsidence zones) throughout the mine extension areas.

The Geology Pi-Term model has been used to predict the A-Zone and B-Zone fracture heights above:

- Springvale Mine's LW415 to LW423 – refer to Table 7A and Figures 8a to 8c in DgS report in **Appendix 6** for the predicted fractures heights for the A- and B-horizons
- Springvale Mine's LW424 to LW432, LW501 to LW503 – refer to Table 7B and Figures 9a to 9e in DgS report in **Appendix 6** for the predicted fractures heights for the A- and B-horizons
- Angus Place Colliery's LW1001 to LW1019 – refer to Table 7C and Figures 10a to 10d in DgS report in **Appendix 6** for the predicted fractures heights for the A- and B-horizons.

The predicted sub-surface fracture height outcomes for the proposed mining layouts in the Angus Place and Springvale Mine Extension Projects, based on the Geology Pi-Term Model, are summarised in Section 8.0 of the DgS report in **Appendix 6**. The predictions indicate that the A-Zone for the proposed longwalls is likely to occur up to the Upper Caley Sandstone with the B-Zone developing in the Burra-Moko Head and Banks Walls Sandstone.

It should be noted that the microseismic data (refer Section 4.3.8 and Figure 7 of the DgS report) from overburden monitoring at Springvale Mine's LW413 appears to support the modelled height of the A-Zone.

It is certainly the case that significant claystone aquitards are present in the overburden lithology and that these have a significant effect on groundwater behaviour in response to longwall mining. The Mount York Claystone (analogous to the Bald Hill Claystone in the Southern Coalfield) is a major claystone unit (average 22 m thick and laterally continuous across the historical and proposed mining areas of the Angus Place and Springvale Mine Extension Project Application Areas) and lies approximately 200 m above the Lithgow Seam. Measurement with multi-level vibrating wire piezometers in 26 different boreholes over up to a 12 year monitoring period indicates that desaturation of the AQ3 aquifer (refer Table 2.5 of the EISs) which underlies the Mount York Claystone is very significant, compared to a relatively minor response in the AQ4 aquifer which overlies the Mount York Claystone.

The Geology Pi-Term model is superior to the existing models for the determination of HoCF as it does recognise geology from a geotechnical perspective. The Geology Pi-Term model was peer reviewed by Don Kay from MSEC and the peer review report is included in **Appendix 7**. This peer review was undertaken in conjunction with the reviews of two ACARP reports:

- CSIRO, Guo, Adhikary & Gaveva, (2007), ACARP C14033, "Hydrogeological Response to Longwall Mining",
- SCT, Gale, (2008), ACARP C13013 "Aquifer Inflow Prediction above Longwall Panels".

MSEC (Don Kay) has noted the following in respect of the Geology Pi-Term model developed for the Angus Place and Springvale Mine Extension Projects:

MSEC has reviewed the above referenced CSIRO and DgS Reports and found that they provide detailed information on the existing environment, the groundwater systems, the overburden and the presence of layers of low permeability for this Western Coalfields area. The selection and use of both numerical and empirical models which have been calibrated to site data over many years and used for the Angus Place and Springvale Mine Extension Projects, are believed to represent the current "industry best practice".

MSEC has reviewed these reports and, in our opinion, we consider the assessments of the HoCF for the proposed longwalls at Angus Place and Springvale Collieries that are included in these reports are reasonable for this particular geological region.

It is noted that these reports have provided geologically adjusted and calibrated predictions and assessments of the likely HoCF over the proposed longwalls at Angus Place and Springvale Collieries, which, in our opinion, appear to be appropriate for this geological region and, hence, should provide a satisfactory estimate for the impact assessments on the groundwater systems from the proposed mining for this particular geological region.

MSEC provides no scientific evidence that diverted surface water re-emerges in the catchment. (OEH)

The assessment of potential subsidence impacts to streams in the EIS is does not include a specific assessment of 3rd order streams. (OEH)

It is likely that fracturing of bedrock under the swamps and drainage of perched aquifers will also lead to a loss of flow in these 3rd order streams. (OEH)

Fracturing of bedrock due to mine subsidence does not necessarily imply that there will be loss of surface or standing water. Bedrock contains natural joints and discontinuities due to erosion and weathering processes.

Subsurface monitoring by Mills (2003 and 2007) and Mills and Huuskes (2004) along the Waratah Rivulet found that the fracture network beneath the stream extended to a depth of 12 metres and bed separation and dilation extended to a depth of 20 metres. For subcritical longwalls with sufficient depth of cover to develop a constrained zone, the diverted surface water flows are confined in the shallow network which then re-emerges further downstream after sufficient fall of the stream bed elevation.

Examples of this include the Bargo River above Tahmoor LW14 to LW19 and the Waratah Rivulet at Metropolitan Colliery, where the surface water flows which were diverted into the fracture networks beneath these streams re-emerged further downstream of the impact site.

Southern Coalfield Inquiry (DoP, 2008) stated that there is "No evidence was presented to the Panel to support the view that subsidence impacts on rivers and significant streams, valley infill or headwater swamps, or shallow or deep aquifers have resulted in any measurable reduction in runoff to the water supply system operated by the Sydney Catchment Authority or to otherwise represent a threat to the water supply of Sydney or the Illawarra region. However, this does not discount the possibility that a reduction in runoff may be realised under certain conditions, including downwards leakage to mining operations, especially where a shallow depth of cover prevails or a structural feature provides a conduit for flow".

The third order streams are located within and downstream of Tri Star, Twin Gully, Gang Gang and Marrangaroo Creek Swamps. The potential for impacts on the sections of these streams within the swamps are assessed as part of the swamps. The sections of these streams located downstream of Tri

Star Swamp and Twin Gully Swamp are located outside the extents of the proposed longwalls and adverse impacts are not anticipated.

There are short sections of the third order streams located downstream of Gang Gang and Marrangaroo Creek Swamps which are located directly above the longwalls. The potential impacts for these are the same as those assessed for the drainage lines.

Due to the extremely wide longwalls (360m) proposed at Angus Place, OEH expects there will be widespread fracturing of cliffs, steep slopes and drainage lines. (OEH)

OEH does not support the definitions of cliff and minor cliff presented the Subsidence Impact Assessments. (OEH)

Cliffs AP-CL1 and AP CL2 are located outside the extents of the longwalls (i.e. above solid coal) and it is considered unlikely that these would experience adverse impacts. As stated in the subsidence report that "This is supported by extensive experience from the NSW Coalfields, at depths of cover greater than 200 metres, where no cliff instabilities have been observed where cliffs have been located wholly outside the extents of extracted longwalls. It is noted, however, that some minor rock falls have been observed outside the extents of extracted longwalls".

Elsewhere, the longwall layouts for the Angus Place and Springvale Extension Projects have been designed such that the identified cliffs are located outside the 26.5 degree angle of draw lines and, therefore, no adverse impacts are anticipated.

A detailed study of the effects of mine subsidence movements on cliffs and escarpments was undertaken as part of a NERDDP Study (1991), including longwall and bord and pillar mining at collieries in the Western Coalfield including: Angus Place; Baal Bone; Hassans Walls; Lithgow Valley; Katoomba and Newnes; and also included several collieries in the Southern Coalfields including: Dombarton; Nattai North; and Huntley. It found that, in all cases, the recorded cliff instabilities had occurred within a 26.5 degree angle of draw line from the extents of mining. The cliff instabilities also occurred only after part of the cliff line was directly mined beneath, or after mining either side of the cliffline (i.e. behind the cliff as well as beneath the valley).

Wide spread fracturing is also not anticipated along the steep slopes and drainage lines, with cracking in the surface soils expected to be similar to those observed at the mine which were typically within the range of less than 5 mm to 25 mm. It is possible that wider cracking could occur in some isolated locations. Whilst wider longwalls are proposed at Angus Place Colliery, the width-to-depth ratios are similar to the previously extracted Springvale LW410 to LW414. The width-to-depth ratios for the remaining proposed longwalls at Angus Place Colliery and the proposed longwalls at Springvale Colliery are similar to less than the previously extracted longwalls.

The definitions of a "cliff" and a "minor cliff" in the subsidence report are consistent with the definitions provided in the NSW Department of Planning and Environment Standard and Model Conditions for Underground Mining (DoP, 2012):

"Cliff - Continuous rock face, including overhangs, having a minimum length of 20 metres, a minimum height of 10 metres and a minimum slope of 2 to 1 (>63.4º).

Minor Cliff - A continuous rock face, including overhangs, having a minimum length of 20 metres, heights between 5 metres and 10 metres and a minimum slope of 2 to 1 (>63.4º); or a rock face having a maximum length of 20 metres and a minimum height of 10 metres".

The detailed management strategies, monitoring programs and actions for the sensitive features will be developed as part of the Extraction Plan process.

On page 5 of the Springvale Subsidence Impact Assessment it is stated that diversion of surface water flows beneath the swamps could occur due to valley related upsidence movements, however, the likely impacts are likely to be low because the drainage lines upstream of the swamps are generally ephemeral and therefore surface water flows occur during and shortly after rainfall events. The EIS fails to identify a key concern that should diversion occur, the swamps will no longer have access to this water, which could have significant impacts on their long term survival. Many Australian ecosystems rely solely or mainly on ephemeral surface water flows. (DotE)

It was stated in Section 5.4.3 of the subsidence report that:

"Centennial has previously extracted longwalls beneath more than 40 kilometres of creeks and drainages lines at Angus Place and Springvale Collieries. Changes in surface water flows and a decline in the piezometric surface at an adjacent monitoring bore were observed along Kangaroo Creek after the extraction of Angus Place LW940. A letter by Centennial (2008) to the then Department of Primary Industries stated that "Following rainfall during the last week, surface flow has resumed over the Longwall 940 surface area of Kangaroo Creek and water level in the bore has returned to within 50mm of the previous level", which indicates that these impacts appear to be transient. Elsewhere, there has been no reported loss of surface water flows or adverse impacts on the drainage lines for the previous mining at these collieries".

If adverse impacts were observed as a result of surface cracking in the ephemeral drainage lines, these could be remediated by "infilling with soil or other suitable materials, or by locally regrading and recompacting the surface".

Page 82 of the Angus Place Subsidence Report states that fracturing could occur in the top most bedrock in swamps directly above the proposed longwalls. The Report also states that the shrub swamps comprise significant quantities of sediment and fracturing of shallow bedrock beneath these swamps is likely to be filled with soil during subsequent flow events along the drainage lines. Examples of where this has been known to occur should be provided. (DotE)

Southern Coalfield Inquiry (DoP, 2008) stated that "There are a number of examples of natural processes of remediation in the Southern Coalfield. Stream bed cracking, surface water drainage to the subsurface and ferruginous springs which occurred in the Upper Bargo River in 2002 is now barely evident. In the lower Cataract River (where subsidence caused severe stream bed cracking between 1993 and 1997 and a simultaneous period of historically low water flows led collectively to a loss of flow, drainage of pools, loss of fish life and significant water quality changes), exposed stream bed cracks have subsequently been colonised by various biota. Water quality is now sufficient to support aquatic macrophytes and small fish".

Tahmoor Colliery reported that there was "sporadic cracking of the river bed and the drying out of some ponds at the time of mining. Subsequently, the fracture network in the Upper Bargo River appears to have largely self healed, surface water levels have returned to their pre-mining steady state, and there are no obvious impacts on ecology" (DoP, 2008).

The incremental profile method utilised in the EIS provides reasonable predictions of subsidence likely to occur as a result of the proposed longwall design. However, there is a lower degree of confidence in subsidence predictions proximal to “type 1” and “type 2” lineaments, which are the shallow manifestations of deep, underlying faults. As a result, the EIS subsidence and flora impact assessments based on the subsidence predictions do not adequately consider the potential site specific subsidence impacts to overlying individual THPSS. (DotE)

A series of lineaments (shallow manifestations of deep, underlying faults) have been identified within the geological strata of the project area and are, in some areas, several hundred metres wide. Four lineament types were identified, and two of these types (“type 1” and “type 2”) are considered important in determining the structural stability of the underground mining areas add the overlying geological strata. These lineament zones increase the risk and severity of subsidence in their vicinity. (DotE)

The reliability of the predictions obtained using the Incremental Profile Method (IPM) in the locations of the Type 1 and 2 surface lineaments was reviewed in Section 3.6.2 of the Subsidence Impact Assessment report appended as Appendix D in the Angus Place and Springvale EISs. The review of the ground monitoring data from the mines found that locally increased vertical subsidence occurs where the longwalls had been extracted beneath the surface lineaments, for example, the maximum vertical subsidence exceeded the predictions obtained using the standard IPM by 27% above the eastern end of Angus Place Colliery’s LW940 and by 5 to 10 % above the eastern ends of LW950 and LW960. As stated in Section 3.6.2 of the Subsidence Impact Assessment report “the subsidence predictions have been increased by 25% in the locations of these surface lineaments directly above the proposed longwalls” to account for the effect of the Type 1 and 2 structures. However it should be then noted, that the potential for impacts do not result from absolute vertical movement, but rather from differential horizontal movements (i.e. closure and strain), which are discussed below.

The predicted valley related movements were determined using the empirical method outlined in ACARP Research Project No. C9067 (ACARP, 2002). The reliability of this method for use at Angus Place and Springvale Collieries based on the local mining conditions and in the locations of the Type 1 and 2 surface lineaments was reviewed in Section 3.8 of the Subsidence Impact Assessment reports. The monitoring data was reviewed where previously extracted longwalls at the mine had extracted beneath surface lineaments, including the: A-Line, C-Line, E-Line and F-Line at Angus Place Colliery; and the B-Line, EWS-Line and M-Line at Springvale Colliery. It was found that “the observed closures were less than those predicted using the 2002 ACARP method” and that there was “a large variation between the observed and predicted closures at each location, with the ratios varying between 0.31 and 0.89 (i.e. 31% and 89%)”.

The large variation between observed and predicted movements was due to: the closure and conventional movements being additive directly above the extracted longwalls; and the closure movements being reduced by the conventional movements above the chain pillars. It was stated in Section 3.8 of the Subsidence Impact Assessment report that the closure movements are expected to be: “typically in the order of 60% to 90% of that predicted using the 2002 ACARP method” in the locations directly above the proposed longwalls; and “in the order of 30% and 60% of that predicted using the 2002 ACARP method” in the locations directly above the chain pillars.

While the incremental profile method applied within the subsidence assessment generally provides reasonable predictions of subsidence parameters, there is low confidence in the approach of increasing subsidence predictions by 25 per cent in the vicinity of “type 1” and “type 2”structural lineaments. The EIS states, (Appendix D, p. 33), observed subsidence effects in the vicinity of these lineaments at the existing operations are highly variable and are, in places, up to eight times greater than predictions derived using this approach. Subsidence over

previously mined longwall panels, in proximity to “type 1” and “type 2” structural lineaments, at the existing Angus Place operations contributed to severe impacts to overlying THPSS. (DotE)

The predicted vertical subsidence obtained using the IPM was increased in the locations of the Type 1 and 2 surface lineaments by: using a percentage increase directly above the longwalls where the magnitudes of the predicted movements are the greatest; and using an absolute value for the increased subsidence in the locations outside the longwalls where the magnitudes of the predicted subsidence are small.

The review of IPM in the locations of the Type 1 and 2 surface lineaments using the monitoring data from the mine found that the vertical subsidence exceeded the standard model by between 5 and 27% in locations directly above the extracted longwalls. It was therefore considered appropriate to increase the predicted vertical subsidence by +25% where the surface lineaments were located directly above the proposed longwalls.

It was recognised in the Subsidence Impact Assessment report, that the observed movements could exceed the predictions from the standard IPM by much greater percentages where the surface lineaments were located outside and immediately adjacent to the longwalls, since the magnitudes of the predicted movements are much lower. It was considered more appropriate to adopt an absolute value for the increased subsidence in the locations outside the longwalls, rather than to adopt a percentage increase because of the lower predicted magnitudes. This was outlined in Section 3.6 of the Subsidence Impact Assessment report which stated that “As the observed subsidence could exceed the predictions by more than +25% outside and adjacent to the proposed longwalls, the natural and built features in these locations have been assessed for potential impacts resulting in localised subsidence up to 800 mm”. The value of 800 mm was adopted based on the maximum vertical subsidence observed at the surface lineaments located outside and adjacent to the longwalls, which occurred to the east of Angus Place Colliery’s LW960.

The potential for impact on features located near the bases of valleys is not dependent on the vertical subsidence, but rather the differential horizontal movements, i.e. closure movements and the associated compressive strains. The valley closure movements were determined using the method outlined in ACARP Research Project No. C9067 (ACARP, 2002) and the reliability of this method at Angus Place and Springvale Collieries and in the locations of the Type 1 and 2 surface lineaments is discussed previously in this RTS.

Based on the documentation provided in the EIS nine THPSS (including groups or swamp clusters) are located within the potential subsidence impact zone, and a number of these, such as Trail 6 Swamp and Tri Star Swamp, are proposed to be undermined. The EIS (p. 274) states that fracturing up to 50 mm wide is predicted to occur within the shallow bedrock of THPSS wherever they are undermined. Impacts to THPSS, such as those identified in paragraph 16, are considerably more likely to occur where swamps are directly undermined. Fracturing to further THPSS and their upstream tributaries would be expected to occur where compressive and tensile strains exceed 0.5 mm/m and 2 mm/m respectively. Strain is caused by the horizontal movement of the ground surface relative to two fixed points. Tensile strain occurs where the distance between two points increases and compressive strain occurs where the distance between two points decreases. (DotE)

The risk and potential severity of impacts is higher for Tri Star Swamp and Trail 6 Swamp. These swamps are both proposed to be undermined with the resulting conventional subsidence predicted to be 1.9 and 0.95 m, respectively. Additionally, Tri Star Swamp is situated above a “type 2” structural lineament and longwall panels below Trail 6 Swamp are, in places, critical in width (longwall width to depth of cover ratio of 0.96). (DotE)

Critical panel widths and structural lineaments were factors resulting in severe impacts to East Wolgan Swamp and Narrow Swamp, which were previously undermined on the Newnes Plateau. Impacts to East Wolgan Swamp and Narrow Swamp have been identified in literature and also described within the EIS (Appendix D, p. 77). Impacts included rapid decline of groundwater, peat desiccation and associated slumping, loss of natural surface flows through swamp channels and almost complete decline of THPSS flora species. Surface flows were found to be flowing into the subsidence induced bedrock fracture network and not resurfacing downstream. At East Wolgan Swamp, it was later identified that this water was pooling within bedding separation of strata approximately 60 to 70 m underneath the swamp. (DotE)

The impacts on East Wolgan Swamp and Narrow Swamp were due to combinations of: surface related activities (i.e. mine water discharge), higher longwall width-to-depth ratios; and the presence and surface lineaments.

The report by Goldney et al (2010) stated that the impacts on: East Wolgan Swamp "are likely due to synergisms between subsidence induced impacts and mine water discharge"; Narrow Swamp North "are very likely due to flow releases from Springvale Mine. Any adverse impacts due to LWM [Longwall Mining] and mine subsidence per se, if present, are likely to be completely masked by the major impacts described"; and Narrow Swamp South that the "potential impacts from mine water discharge are a very likely explanation along with possible direct impacts from LWM. Any impacts from LWM are likely masked by the possible significant impacts of mine water discharge."

The impacts to East Wolgan Swamp were investigated by the University of Queensland (Fletcher and Erskine, 2014) which found that "The primary cause for vegetation loss appears to be the flow path of mine discharge water through the studied shrub swamp community. This conclusion is supported by the presence of shrub swamp species surrounding impacted areas caused by discharge events which ended in March 2010."

East Wolgan Swamp was located above Springvale LW411 (315 m wide) and Angus Place LW960 and LW970 (both 293 m wide), as well as the barrier pillar between these longwalls. The swamp was also coincident with a Type 1 surface lineament. The depth of cover beneath this swamp varies between 290 m at the downstream end (above the longwall commencing end) to 330 m at the upstream end. The width-to-depth ratios at this swamp, therefore, vary between 0.9 above LW960 and LW970 to 1.1 above LW411. The impacts on this swamp were the result of the combination of: mine water discharge, higher longwall width-to-depth ratios; and the presence and the surface lineament. The impacts on Narrow Swamps North and South appear to be primarily the result of mine water discharge, with the effects of mine subsidence 'masked' by these impacts.

Tri-star Swamp is the only swamp located above the proposed longwalls in the Angus Place Mine Extension Project that is coincident with a Type 1 or 2 lineament. In this location the longwalls have been narrowed to 261 m and the width-to-depth ratio varies between 0.80 and 0.90. There are no Type 1 or 2 lineaments identified beneath either Twin Gully Swamp (which is also outside of the longwalls) or Trail 6 Swamp (which is above the narrower longwalls).

In the Springvale Mine Extension Project Sunnyside and Carne West Swamps are coincident with Type 1 lineaments and Gang Gang South West, Gang Gang East and Marrangaroo Creek Swamps are coincidence with Type 2 lineaments. The depths of cover beneath these swamps are typically between 340 m and 370 m and the width-to-depth ratios vary between 0.70 and 0.75.

The longwall width-to-depth ratios at East Wolgan Swamp are greater than those where the proposed longwalls are located beneath the shrub swamps at the Angus Place (Tri Star and Trail 6 Swamps) and the Springvale Mine Extension Projects (Sunnyside, Carne West, Gang Gang South West, Gang Gang East and Marrangaroo Creek Swamps). Centennial Angus Place and Springvale Coal have also developed management plans to minimise the potential for future impacts resulting from mining related surface activities, including mine water discharge and activity on nearby roads.

Avoidance of undermining and locating longwalls such that tensile and compressive strains are below 0.5 mm/m and 2 mm/m respectively at THPSS sites are considered the most effective ways to manage the potential impacts to THPSS5. This strategy should also be applied to any upstream tributaries that provide a significant proportion of surface flow to THPSS. (DotE)

The proponent has designed the longwall mine layout to avoid some THPSS (Twin Gully Swamp and several unnamed swamps), and to minimise subsidence through narrowing of several longwalls and increasing chain pillar widths. However, a number of THPSS remain overlying or within the potential subsidence impact zone of the proposed longwalls. Fracturing in the bedrock below these swamps is expected to occur where tensile and compressive strains caused by conventional subsidence exceed 0.5 mm/m and 2 mm/m respectively5. Fracturing within the bedrock of tributaries upstream of THPSS is also predicted to occur. The risk of bedrock fracturing is reduced by minimising the exposure of bedrock to strain. Ensuring that tensile and compressive strains are below 0.5 mm/m and 2 mm/m respectively at THPSS sites is the only measure known to prevent impacts to THPSS5. To avoid impacts to the surface water hydrological regime of THPSS, this avoidance strategy would also need be applied to upstream tributaries that provide a significant proportion of surface water flows to downstream THPSS. (DotE)

The only known strategy to reduce the risk of impact to THPSS ecological communities within the project area would be to alter the mine layout such that swamps are not undermined by longwall panels and longwalls are sufficiently removed from THPSS such that tensile and compressive strains at THPSS sites are below 0.5 mm/m and 2 mm/m respectively. This avoidance strategy should also be applied to any upstream tributaries that provide a significant proportion of surface flow to THPSS. This approach is the most likely to prevent impacts to THPSS given the potential severity of impacts, difficulties in the accurate and confident prediction of impacts, and the ineffectiveness of other mitigation and management measures. Further, there is no currently available scientific evidence to demonstrate that remediation activities are able to successfully restore the ecological and hydraulic functions of these threatened ecological communities to pre-impact condition. (DotE)

The magnitudes of 0.5 mm/m tensile and 2 mm/m compressive are guides to the potential for fracturing in bedrock due to conventional subsidence movements. The basis for these values is that fracturing is rarely seen in the Southern Coalfield as a result of conventional subsidence movements, i.e. away from valley bases, where the maximum ground strains are typically in this order. These strain values should not be used as an indicator of the potential for environmental consequence (i.e. impact) on surface features, as fractures at these magnitudes tend to be minor and isolated. This is supported by the PAC review (2010) for the Bulli Seam Operations which stated that “As already noted, it is based on MSEC’s advice that fracturing of sandstone has generally been observed in the Southern Coalfield once systematic compressive strain has exceeded 2 mm/m. This concurs with the Panel’s experience. However, based on the Panel’s own inquiries, field inspections and experience, total diversion of surface flow into a subsidence-induced subsurface fracture system requires higher total compressive strains that are very dependent on geological factors such as strata composition, thickness and bedding laminations. Limited measurements suggest a threshold total compressive strain[156] value for total diversion of flow in sandstone environments of the order of 7 mm/m, however the database is too small to be reliable at this point in time.”

The proponent has stated that cracks are predicted to form within the sandstone substrate underlying many swamps within the project area. The proponent states that these cracks will naturally fill with soil and peat (self-ameliorate), and therefore impacts related to these bedrock fractures are “considered unlikely”. However, THPSS are exceptionally slow to self-heal or self-ameliorate. Examples of lowland swamps from the Southern Coalfields of New South Wales show that without attempted rehabilitation, self-amelioration is not evident within two lowland

swamps over a 25 to 30 year period. Based on a lack of supporting evidence and available literature, self-amelioration is not considered to be a reliable or effective remediation method. (DotE)

The two lowland swamps cited appear to refer to Drillhole and Flat Rock Swamps. Investigations of these swamps identified that impacts had developed at these swamps prior to mine subsidence and that they were also affected by physical disturbances. Tomkins and Humphreys (2006) were engaged by the Sydney Catchment Authority to assess the erosion in swamps on the Woronora Plateau, including Flat Rock and Drill Hole Swamps, and concluded that:

“Human disturbance in the catchment, particularly direct physical disturbance such as at Drillhole Swamp has been found to be an important trigger of erosion of swamps. The impact of mine subsidence, however is less clear. Both Swamp 18 and Flat Rock Swamp featured scour pools and gully erosion well before any direct effects of mining were observed. It may be likely that dewatering of swamps due to mining increases the sensitivity of swamps to other influences such as wildfires.”;

and that

“The impacts of mining on erosion of Swamp 18 and Flat Rock Swamp is less clear as both swamps were already in the process of erosion prior to the commencement of known mining and ground subsidence.”

The findings were supported by the Southern Coalfields Inquiry (DP&I, 2008) which stated that:-

“Most impacted swamps that the Panel was made aware of were valley infill swamps (e.g. Flatrock Swamp and Swamps 18 and 19). However, at all sites inspected by the Panel, there had been a range of other environmental factors in play, including evidence of pre-existing scour pools, previous initiation of erosion, concurrent drought, and subsequent heavy rainfall and/or severe bushfires. The sequence of events was not clear in relation to the swamp impacts (drying, erosion and scouring, water table drop, burning, vegetation succession, etc).”;

and that in relation to Drill Hole Swamp:

“gully erosion was not directly caused by mining subsidence, per se. Significant site disturbance took place as a result of site clearing, soil disturbance and erosion associated with the drilling of a stratigraphic drillhole in 1976 for the Reynolds Inquiry. Tomkins and Humphreys conclude that the cause of the gully erosion was this site disturbance, coupled with an extreme rainfall event.”

Flat Rock and Drillhole Swamps should not be used as examples of how swamps recover from mine subsidence related impacts, as these swamps showed existing erosion and scouring prior to mining and had physical disturbances from natural causes (i.e. fire, heavy rainfall and drought) and human activities (i.e. construction of roads and installation of monitoring boreholes).

After reviewing the EIS, DRE is of the view that risks of mine subsidence related to the above-mentioned subsidence issues are similar to those at the mine's current mining operation and should be manageable through the Extraction Plan process. (DRE)

As detailed in Section 5.3.2 of the EIS, it is expected that the conditions of the new mining lease and SSD consent will require an Extraction Plan to be prepared and approved for the Project.

3.1.22 Surface Disturbance

To accommodate increased water make into the mine, up to 15 boreholes have been proposed to aid in dewatering. A construction footprint of 90m x 110m has been proposed for each bore site. DRE considers that the footprint should be reduced as much as practical. Specific details of the planned clearing and footprint with associated plans need to be provided to DRE for review. Angus Place should rationalise the proposed dewatering boreholes to ensure a minimal disturbance on the Newnes Plateau. This rationalisation should include putting more than 4 Boreholes on each pad in order to reduce the number of pads and clearing required. (DRE)

The Project will require control of the increased volume of mine water make to meet underground safety and operational requirements. As such, new dewatering bore facilities will be required to continue to deliver water into the SDWTS (which will continue to be utilised as part of the Project).

Section 1.5 of the EIS states that the project will install and operate seven additional dewatering borehole facilities on the Newnes Plateau. Although up to 15 sites have been identified, only seven of these will be developed. The 15 Environmental Study Areas for the dewatering bore facilities are shown on Figure 4.1 in the EIS.

Dewatering bore facility sites have been identified based upon mine design requirements, and environmental constraints from a desktop analysis. The preferred options for the final placement of the dewatering boreholes will balance dewatering needs with potential environmental impacts.

A number of boreholes with submersible pumps will extend from the surface to below the Lithgow Coal Seam at each of the seven dewatering bore facility sites. A concept layout for the dewatering bore facility is provided in Figure 4.3 of the EIS. Depending on dewatering requirements, more than four boreholes may be constructed at each of the seven dewatering bore facility sites to be developed.

As detailed in Section 4.3 of the EIS, the construction footprint of each bore site will be approximately 90 m x 110 m while the final constructed footprint will be 50 m x 70 m. This disturbance footprint includes a 20 metre Asset Protection Zone around each dewatering bore facility. The disturbance footprints take into consideration the disturbance requirements for construction equipment operating on the site and cut and fill requirements to create a suitable level surface. The disturbance footprint during required construction will be reduced if and where possible however approval is being sought for the maximum disturbance footprint of one hectare.

The proponent shall carry out all surface disturbing activities in a manner that, as far is reasonably practicable, minimises potential for dust emissions and shall carry out rehabilitation of disturbed areas progressively, as soon as reasonably practicable, to the satisfaction of the Secretary or his delegate. (DRE)

As detailed in Section 10.7.5 of the EIS, potential air quality impacts can be mitigated through the continued implementation of existing management measures such as water spraying, minimisation of exposed areas and ceasing work during adverse weather conditions.

Section 10.11.4.1 of the EIS details potential progressive rehabilitation implementation. Surface infrastructure proposed on the Newnes Plateau will require the disturbance of areas peripheral to operational areas. For example, the SDWTS duplication and the installation of buried connecting pipelines and power lines to dewatering boreholes will require the clearing of a corridor approximately 10 m wide, but half of this will be rehabilitated on installation of the services.

As surface infrastructure becomes surplus to requirements, the facility (e.g. dewatering facility) will be decommissioned and the sites progressively rehabilitated. Any exploration drill holes will be rehabilitated on completion.

Progressive rehabilitation is not feasible at the pit top, as the entire area and contained facilities are required until the cessation of mining, at which time a staged rehabilitation process will commence.

All rehabilitation will be undertaken to the satisfaction of the Secretary or his delegate.

OEH notes that a number of dewatering bores are proposed to be constructed in close proximity to the national park boundary. These will require additional access tracks. OEH is concerned regarding damage caused by recreational use of these new tracks and the potential for them to create new access points to the national park. (OEH)

As detailed in Section 10.5.3 of the EIS, access to existing and proposed Newnes Plateau surface infrastructure (APC-VS3, SDWTS and the borehole sites) will be via existing roads and tracks. The heavy and light vehicle access routes will link to upgraded and extended access tracks. Each of the borehole sites will require an upgrade and extension of existing access tracks off Sunnyside Ridge Road. As agreed with the Forestry Corporation of NSW, these upgraded access tracks will initially provide a width of 10 m to accommodate an access track and infrastructure corridor, before the infrastructure corridor is rehabilitated, retaining a 5 m access track.

The existing access routes are also used by other vehicles associated with the adjacent Springvale Mine, logging and forestry management and by recreational vehicles. These access tracks are largely well-formed gravel, all weather roads providing for two-way traffic.

As proposed in Section 8.1.1.3 of the Rehabilitation and Decommissioning Strategy prepared by SLR to support the Project and provided as Appendix P to the EIS, access tracks upgraded or established as part of the Project on the Newnes Plateau will remain for use as access tracks by recreational users and by Forestry Corporation of NSW.

3.1.23 Traffic Management

Prior to the commencement of each stage of the extension project a Traffic Management Plan (TMP) shall be prepared in consultation with Lithgow City Council, Forestry Corporation of NSW and Roads and Maritime to outline measures to manager traffic related issues associated with the construction and operation of each stage of the project. The TMP shall detail the potential impacts associated with each stage, the measures to be implemented and the procedures to monitor and ensure compliance. (RMS)

As detailed in Section 10.5.5 of the EIS and the Traffic Impact Assessment (Appendix J to the EIS), a Construction Traffic Management Plan will be prepared in consultation with the Forestry Corporation of NSW; This will include measures such as warning signs at appropriate locations on the main access roads to the infrastructure sites, advising public road users of when access tracks will be used by increased numbers of heavy vehicles and other construction traffic. Caution will be advised to all road users.

Centennial Angus Place will commit to developing the Construction Traffic Management plan in consultation with Lithgow City Council and RMS.

A Traffic Management Plan be prepared in consultation with Lithgow City Council and implemented for the duration of the operational phase at each project site. (Lithgow City Council)

As detailed in Section 10.5.4 of the EIS and the Traffic Impact Assessment (Appendix J to the EIS), operationally, the existing traffic generated by the Angus Place pit top will remain unchanged as a result of the Project and therefore there are no additional consequences. Annual growth and short term construction peaks associated with other sub-regional projects would increase traffic flows for a small number of hours per day, but total flows through 2024 would continue to allow the Castlereagh Highway to operate at an acceptable level of service. The traffic generated as a result of the Project will have no significant impact upon the capacity, efficiency and safety of the local, sub-regional and regional road network over the life of the Project.

As detailed in Section 10.5.5, a Construction Traffic Management Plan will be prepared in consultation with the Forestry Corporation of NSW; however will be restricted to construction activities only. No traffic management plan is considered required for the operation of the Project due to there being no additional consequences on the capacity, efficiency and safety of the local road network.

All construction heavy vehicle trips to/from the Newnes State Forest sites be undertaken during daylight hours, which would generally require them to occur between 6.00am and 6.00pm. (Lithgow City Council)

As detailed in Section 10.5.5 of the EIS and the Traffic Impact Assessment (Appendix J to the EIS), all heavy vehicle trips within the Newnes State Forest will be undertaken during daylight hours to maximise safety. These heavy vehicle movements will generally be between the hours of 6am and 6pm.

3.1.24 Water Flows

East Wolgan Swamp remediation works have been undertaken in 2014. Coir logs, sand bags and weirs used to aid swamp rehydration works. Direct seeding and brush matting has also been used. This type of remediation will help with surface flows but will not address the loss of water through the cracked/faulted substrate. (DRE)

As explained in Section 2.6.2.6 of the EIS, the baseline data indicates that East Wolgan Swamp was a periodically waterlogged swamp before commencement of mining activities.

At East Wolgan Swamp a localised cavity formed the base of the swamp which led to the loss of surface water flows between 2008 and 2010.

In the case of East Wolgan Swamp, where localised hydrological impacts were caused by mine subsidence, a combination of causative factors was present. The factors identified are consistent with those identified by other researchers as parameters with significant influence on mine subsidence behaviour.

In summary, the key co-incident factors related to cavity formation at East Wolgan Swamp are listed below:

- Mine Water Discharge.

- Intersection of major geological fault structures.
- Orientation of the longwall panel sub-parallel to the major structures.
- Steepness and depth of East Wolgan Swamp valley at Northern end.
- Prevailing in-situ stress direction and magnitude.
- Critical width longwall panel design.
- Location of the geological structure close to the permanent barrier pillar (at location of cavity formation).
- Two mines adjacent to each other drawing overburden in opposite directions.

In the case of East Wolgan Swamp, subsidence impacts to rock underlying the swamp are very localised and allow for targeted rehabilitation.

One of the conditions of the OEH approved restoration actions at East Wolgan Swamp (Section 95 certificate issued under the TSC Act on 25 November 2013), includes excavation and examination of the bedrock at the cavity location to determine whether the need for grouting exists, which may result in the need for hard engineering solutions described below.

The following excerpt from Springvale Mine's EPBC Approval 2011/5949 Condition 1 Application of March 2013 specifically discusses "hard engineering" solutions which may be employed in the event of major impacts to THPSS caused by cracking of underlying rock:

Hard Engineering Solutions

Hard engineering solutions may be required where cracking of the base of a THPSS may cause drainage of water away from the THPSS, which may have the potential to affect to the health of the system. Aquifer modelling and the groundwater and swamp health case studies presented in this document show that this is extremely unlikely. However, proven technologies related to other mining operations developed to remediate cracking of rock structures are now discussed. The integrity of the water retaining structure is restored through the implementation of these remediation strategies. The strategies have been researched and modified so as to suit the specific THPSS systems above the Springvale mining operation.

Injection Grouting

Grouting of rock formations has been occurring since the 1800's *(Heidarzadeh et al (2007)*), the technology has evolved since this time. It can be used in a range of different applications. Grouting is utilised to either stabilise rock formations or to manage the flow of groundwater and has been implemented successfully for decades in underground coal mines in Australia and overseas.

This technology has been recently adapted to seal mine subsidence related surface and subsurface cracking in rock bars in the southern coalfields of NSW. "Injection grouting" is the process of injecting grout using pre-drilled holes into a cracked rock bar or swamp substrate. Grouting involves injecting a permanent low permeability material into cracked areas to provide a seal to control vertical or horizontal water flows. There are various types of grouts that can be used but generally they will be either cement based or polyurethane resins (PUR). The use of injection grouting for remediating subsidence cracking has been pioneered in the southern coalfields of NSW and has been used to successfully repair cracking in surface and near surface rock substrates.

Grout is pumped into the targeted area at low pressure once the grouting holes have been drilled. High viscosity grouts are used for vertical fracturing as the setting time for vertical holes needs to be shorter to optimise the use of the grout which flows faster in vertical cracks under the influence of gravity. Lower viscosity grouts would be used where horizontal cross linking of cracks is present.

A specific example of where PUR grouting has been shown to successfully repair a rock substrate can be seen at Helensburgh Coal Pty Ltd (HCPL) in the NSW Southern Coalfields. Experience at HCPL has shown that grouting using PUR can be used to successfully fill cracks ranging from small sub millimetre sized cracks to open fractures greater than 100mm.

A trial was conducted at HCPL on the WRS4 rock bar in the Waratah Rivulet and was followed by a remediation report (Waratah Rivulet Remediation Trial Activities – Completion Report (2007)). The main findings of the remediation report were:

- PUR is non-toxic.
- PUR injection can be conducted in an environmentally acceptable fashion.
- PUR injection is suitable for sealing cracking in rocks from less than 1mm to greater than 100mm.
- Pre and post permeability testing showed that permeability was reduced by several orders of magnitude following PUR injection.
- The PUR injection process was transferrable to other areas where cracking of rock had occurred.

The HCPL PUR grouting programs are used to seal cracking in outcropping rock bars. However, it is considered that this technology is transferrable and can be used to seal cracks in swamp bases as a swamp base is analogous to a rock bar, albeit one covered with peat and sand.

The use of cementitious grouts has also been used to successfully remediate subsidence induced cracking which led to water loss in watercourses in the Southern Coalfield. Injection grouting with cementitious grouts was successfully used for rock bar rehabilitation in the Georges River.

Where alluvial material overlies sandstone, injection grouting though drill rods has also been used successfully to seal void under the alluvial material (soil / peat). This technique was also used in the Georges River, where 1-2m of loose sediment was grouted through using purpose designed grouting pipes.

If the median flow rate from Angus Place LDP001 (3.29 ML/day) when put in context of the median flows in the Coxs River at the NOW Wallerawang gauging station (13.3 ML/day NOW gauge data; notes in the EIS that the median flow figure is quoted lower at 12.2 ML/day), LDP001 potentially represents close to 25% of the median flow in the Coxs River recorded at Wallerawang. Such a potential impact is not discussed in the EIS for either Springvale or Angus Place Mine expansions. A combined discharge of 30-50 ML/day would see untreated mine water comprise the bulk of the median flow in the Coxs River upstream of Lake Wallace. (EPA)

For clarification, the quoted median flow figure of 12.2 ML/day is for the Coxs River above Lake Wallace based on NOW gauge 2012054 data through to July 2011.

Additional water balance modelling has been undertaken to address the potential impacts of the discharge of 30-50 ML/day to the Coxs River. This is presented as **Appendix 2** to this RTS.

The EIS states that the baseflow to creeks within the Coxs River catchment is predicted not to be impacted due to the proposed extension at "Springvale" (pages 74 and 75 of Appendix E). Clarification is needed as to whether this prediction is related to Angus Place or Springvale Colliery extension and accordingly corrected. (SCA)

The reference to the proposed extension at Springvale is a typographic error and should have instead referenced the proposed Angus Place Mine Extension.

The section in question references Figures 29, 31, 39 and 41 of the GWIA which present the predicted drawdown within the Lithgow Seam and in the uppermost layer for both isolated (Angus Place only) and cumulative (Angus Place plus Springvale) drawdown.

The prediction is therefore relevant to Angus Place in isolation as well as the cumulative impact with Springvale.

The baseflow reductions in Kangaroo Creek are inconsistently presented in the EIS (pages 74 and 75 of Appendix E). Figures 55 and 57 presenting baseflow predictions either do not show Kangaroo Creek or Kangaroo Creek has not been labelled clearly. (SCA)

Kangaroo Creek reach 1 (Reach KC1) is presented on Figure 57 as K1 Base, K1 No New, and K1 No New SV. Kangaroo Creek reach 2 (Reach KC2) is presented on Figure 55 as K2 Base, K2 No New, and K2 No New SV.

For Kangaroo Creek reach 2 (Figure 55) all three scenarios show no significant difference for both the mining and post mining predictions and plot directly on top of each other. The uppermost plot that can be seen is for K2 No New SV. Therefore no impacts due to the extension projects are predicted.

For Kangaroo Creek reach 1 (Figure 57) the K1 base and K1 No New SV plot closely but do diverge slightly towards the end of mining, showing minor cumulative impact from Springvale. Both K1 Base and K1 No New SV diverge from the K1 No New scenario at the commencement of the AP longwalls, with the difference being attributable to the Angus Place extension.

3.1.25 Water Licensing

The EIS predicts that the mine inflows into the disturbed areas above the Angus Place longwalls from the (Sydney Basin) Richmond Groundwater Source will reach a maximum of 9,690 ML/year by 2033, and the current licensed entitlement is only 2,523 units where currently 1 unit equals 1 ML. The proponent is aware of the deficit but has not addressed this issue in the EIS, and it is recommended that the proponent meet with the Office of Water at the earliest possible opportunity. (NOW)

The take of surface water requires further assessment. Assessment should consider:

- **Capture of surface run off from dams**
- **Indirect losses or reduction in surface water flows due to impacts from underground mining**
- **Reduction of storages of swamps due to impacts from underground mining. (NOW)**

The EIS does not include details of any unregulated category licences held by the proponent or any discussion on how they are planning to comply with the WMA requirements. The proponent

must identify licensable take and hold unregulated category access licences from the relevant water source of the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011. (NOW)

Centennial Coal met with the NSW Office of Water on 13 June 2014 to discuss the water licensing requirements for the Project. Centennial's western operations as a whole are not predicted to require additional water entitlements until 2018. Centennial acknowledges that it is legally obligated to hold the necessary entitlements to undertake its operations. Centennial acknowledges that a review of recharge studies may not result in a change to the licensing requirements for Springvale and Angus Place's future water need. Centennial acknowledges that this may present a compliance risk beyond 2020.

The following strategy will be adopted by Centennial to secure water licenses required for the Project:

- Trade, within the constraints of the relevant Water Sharing Plan, with other Centennial Coal water license holders.
- Obtain, when available through controlled allocation orders under the relevant Water Sharing Plan, additional allocations.
- Review the hydrogeological model and predicted water inflows for the Project on a 6 monthly basis to ensure adequate accounting for water take and license requirements.
- Contribute to the 2016 Water Sharing Plan review process, as agreed with the NSW Office of Water.

The Statement of Commitments contained in **Section 5.0** of this RTS has been updated to include this commitment.

Any ongoing take of water post-closure of the mine will need to be accounted for by holding or maintaining licences. (NOW)

Centennial Angus place will maintain water licences for the on-going take of water post closure of the mine.

The proponent must maintain records of annual water take from water sources impacted by the development and reported in the annual environmental report. (NOW)

Centennial Angus Place will commit to maintain records of annual water take from water sources impacted by the Project and report these in the Annual Review, to be provided to the NOW.

It is not clear from the EIA/GIA documentation that the losses of surface baseflow have been included in the total estimate of groundwater take. This should be clarified during licensing.

The losses of surface baseflow have been included in the total estimate of surface water take rather than groundwater take as it comprises a net reduction in contribution to a surface water feature.

Section 8.2 of the Groundwater Impact Assessment details the surface water licensing requirements, which are presented for the individual swamps on Table 8.5 and summarised per Management Zone on Table 8.7.

For Angus Place Colliery, the maximum total annual licensing requirement due to baseflow reduction is 73.8 ML/yr for the Wywandy River Management Zone and 321.8 ML/yr for the Colo River management Zone.

3.1.26 Water Management

Mine water until recently was only transferred to the Wallerawang Power Station via the dedicated mine water transfer pipeline SDWTS. As the SDWTS does not continue on to Mount Piper, mine water cannot be transferred directly to Mount Piper Power Station. In addition, the EPA understands that Energy Australia has expressed no interest at present in utilising the mine water and no interest in extending the SDWTS to the Mount Piper Power Station. With Wallerawang Power Station currently not operating the SDWTS is now no longer being utilised and most mine water (all Springvale and a portion of Angus Place) is now currently discharged through the Springvale Colliery licensed discharge point LDP009 (up to approximately 30 ML/day) to the Coxs River catchment with a very low level of treatment (i.e. for suspended solids). (EPA)

Noted.

Much of the proponent's reasoning for discharging the large volumes of untreated mine water is based on a stated demand for mine water which currently does not exist, and any future use is subject to changes to the operation of the nearby power stations. (EPA)

The recent situation of Wallerawang Power Station, with one electricity generation unit being closed permanently and the other one mothballed until further notice, has resulted in about a halving of the demand for water usage by Energy Australia for use by this power station. The 40 ML/day requirement for Mount Piper is less than the daily maximum volume of mine water to be produced by the proposed mine expansion. (EPA)

The EISs can be considered to be highly misleading because the overwhelming bulk of the water impact assessment assumes the SDWTS is operating when it currently is not, and its future is dependent on the operational capacity of Wallerawang Power Station. Both the Angus Place and Springvale EISs have sections detailing water balance and salt balance modelling for mine water discharges. However, since both models have assumed that there are transfers via the SDWTS which is either not happening or based on changed circumstances at Wallerawang Power Station, the modelling and subsequent conclusions are flawed. Water and salt balances for the Coxs River catchment need to be redone under the real proposed scenario which is direct discharge of 30MLIday (rising to 50MLIday if both mine projects are approved) of poorly treated, high salinity mine water into the Coxs River catchment. (EPA)

Despite the shelving of the Wallerawang Power Station, there is still significant demand for water from heavy industry in the Coxs River catchment, namely from the Mount Piper Power Station. The predicted impact to flow and quality downstream of Lake Lyell are addressed in the regional water quality impact assessment, which is attached to this letter as **Appendix 2**. The regional water quality impact assessment addresses scenarios whereby water is discharged directly at Springvale LDP009 rather than being utilised by the Wallerawang Power Station.

As presented in the conceptual hydrogeological model in the EISs, the regional groundwater flow direction is to the northeast, at a similar gradient to the dip of the coal seams. Groundwater that is currently being extracted from the coal seams, and in the future, received recharge from the Coxs River in the past. This is due to the Coxs River having eroded the landscape over geological time to the extent that the coal seams were exposed on the valley floor. These surface exposures of coal have, essentially, already been mined via past operations of Centennial and others.

The classification of the proposed groundwater discharge as “high salinity” is, in itself, misleading.

The median salinity at Angus Place LDP001 was reported in the EIS for Angus Place, Table 10.4a, to be 1010μS/cm (n=33) to the end of July 2012. The water quality dataset has now been updated through to 30 June 2014 and the updated median is 1050μS/cm (n=83). Summary statistics of the updated water quality dataset is presented in the SSTV Assessment presented as **Appendix 3** to this RTS. The median salinity at Springvale LDP009 was reported in the EIS for Springvale, Table 10.4a, to be 1055μS/cm (n=8). The water quality dataset at Springvale has now been updated through to 29 May 2014 and the updated median is 1060μS/cm (n=95). It is noted that the frequency of monitoring at both Angus Place LDP001 and Springvale LDP009 has been increased.

If a conversion factor of 0.67 is assumed between salinity (as EC, μS/cm) and TDS (mg/L), an EC of 1050μS/cm is equivalent to a TDS of 704mg/L and an EC of 1060μS/cm is equivalent to 710mg/L. Water of this quality is not of high salinity and is classified as fresh and within the acceptable range for drinking water. The ADWG (NHMRC, 2011) classifies a TDS of <600mg/L, based on aesthetic and not health, to be good quality drinking water and a range between 600 to 900mg/L to be fair quality. This is equivalent to the guidance adopted by the World Health Organisation (WHO, 2011) where a TDS of <600mg/L is generally considered to be good, with an upper limit on palatability of 1000mg/LThe resulting impact of discharging water of this quality at Angus Place LDP001 and Springvale LDP009 will be neutral or beneficial in that future discharges are expected to be of equivalent water quality to the currently approved discharge.

The discharge limits that have been applied to mine water discharges (LDP001 and LDP009) to the Coxs River by the EPA, were established on an interim basis to enable the mines to continue to operate while undertaking works identified in pollution reduction programs (PRPs) attached to both licences to identify and implement a solution to the mine water discharge quality. The PRPs have required either the development of options to cease water discharges (such as redirecting mine water at Angus Place backed into old underground workings) or to develop options to treat mine water to ensure any discharge can meet the ANZECC (2000) trigger value for upland rivers of 350 μS/cm. (EPA)

An assessment of site specific trigger values (SSTV) has been undertaken for Angus Place LDP001 and Springvale LDP009. The only analytes whose median concentrations were found to exceed the ANZECC guidelines for protection of aquatic ecosystems were Salinity, as EC, Copper (Springvale LDP009 only) and Zinc. At both Angus Place LDP001 and Springvale LDP009, Copper and Zinc are also found to be elevated in the upstream sampling points.

Further discussion with regard to these analytes is provided in the SSTV analysis attached as **Appendix 3** to this RTS.

Following public exhibition of the EIS, a review of the EPA Direct Toxicity Assessment on Springvale’s LDP009 discharge was undertaken by GHD (**Appendix 9** to this RTS). Following the review, an additional Direct Toxicity Assessment, provided as **Appendix 10** to this RTS, was carried out on discharge water from LDP001 at Angus Place and LDP009 at Springvale. The methodology for the Direct Toxicity Assessment was approved by the EPA in August 2014. The results of the Direct Toxicity Assessment show that there is no toxicity associated with the Discharge water from LDP001. Although toxicity has been observed at LDP009, it has been demonstrated that neither the EC or bicarbonate concentrations have any effect on the toxicity of the water. Lowering the EC may have a detrimental effect on the system as shown by the high toxicity at sites upstream of LDP001. The chemistry of water quality discharged through LDP009 does not point to any source in particular that is leading to the toxicity being observed. As such, Centennial proposes to undertake further investigations into the toxicity of LDP009 water discharge to identify the cause of the toxicity. Without knowing what is causing the toxicity, the application of a treatment system is premature as you won't know what you are treating for. As such, no additional treatment of mine water is considered necessary at this stage.

To date no option(s) to cease or treat the mine water has been developed by Centennial Coal. Centennial's approach to mine water is to continue and to increase the discharge from LDP001 and LDP009 to the environment for the next 3 decades without treating the mine water to an appropriate standard. The EPA's ongoing programs are not based on the continuation of the discharging of high volumes of potentially toxic, saline mine water often containing high (relative to ANZECC) levels of metal contaminants to the receiving environment of the Upper Coxs River catchment. Furthermore, it is misleading to suggest that a discharge of this magnitude and poor quality directly into Coxs River tributary streams will have a neutral or beneficial effect on water quality in Sydney's drinking water catchment or the upper Coxs River and its tributaries in terms of hydrology and aquatic health. (EPA)

The SCA is concerned about the increased mine water discharges and associated water quality impacts (salinity) to Kangaroo Creek and Coxs River. The SCA notes that there is currently a Pollution Reduction Program with respect to discharge at Angus Place requiring reduction in salinity levels. (SCA)

As presented in the EIS, mine water make at Springvale is expected to cease in February 2025 and at Angus Place in December 2032, a period of 19 years. These dates presume the mine extension program commenced in July 2014. The statement that there will be discharge to the environment for the next 3 decades is not correct.

As previously discussed, the discharge water quality from Angus Place and Springvale Mines is not considered to be saline, in fact the median water quality, of approximately 700mg/L TDS, is classified as fresh and within the acceptable range for good quality drinking water with respect to TDS. Drever (1997) classifies fresh waters are sufficiently dilute to be potable, that is, less than about 1,000mg/L TDS. Brackish waters are too saline to be potable, but are significantly less saline than seawater, the range is approximately 1,000mg/L to 20,000mg/L TDS. Saline waters have salinities similar to or greater than that of seawater (35,000mg/L TDS) and brines are waters significantly more saline than seawater.

An assessment of site specific trigger values (SSTV) has been undertaken for Angus Place LDP001 and Springvale LDP009. The only analytes whose median concentrations were found to exceed the ANZECC guidelines for protection of aquatic ecosystems were Salinity, as EC, Copper (Springvale LDP009 only) and Zinc. At both Angus Place LDP001 and Springvale LDP009, Copper and Zinc are also found to be elevated in the upstream sampling points.

Further discussion with regard to these analytes is provided in the SSTV analysis attached as **Appendix 3** to this RTS.

As presented in the EIS Section 10.2.4, relevant NSW Water Quality Objectives (WQOs) include:

- Aquatic Ecosystems

- Visual Amenity
- Drinking Water – Groundwater
- Industrial Water Supplies.

Relevant NSW River Flow Objectives, presented in Section 10.2.4 of the EIS, include:

- Protection of Natural Dry Pools in Dry Times
- Protect Natural Low Flows
- Maintain Wetland and Floodplain Inundation
- Maintain Natural Flow Variability
- Manage Groundwater for Ecosystems.

A regional water quality impact assessment is presented as **Appendix 2** to this RTS. The model is a daily rainfall/runoff model based on the AWBM, implemented within GoldSIM. Pertinent results are presented below, with full details presented in **Appendix 2**.

There are two Water Management Strategies proposed with respect to extension of Angus Place and Springvale Mines:

Water Strategy WS1 - Angus Place discharging all mine water make at Angus Place via Angus Place LDP001 (up to 30.8ML/d) and Springvale discharging all mine water make at Springvale via Springvale LDP009 (up to 18.8ML/d)

Water Strategy WS2a - Angus Place discharging to Springvale LDP009 (up to 30.0ML/d) via the existing SDWTS pipeline, to the extent available, with excess discharged through Angus Place LDP001 (up to 15.5ML/d)

Water Strategy WS2b – Angus Place discharging to Springvale LDP009 (up to 43.4ML/d), with upgrade of the SDWTS pipeline to 50ML/d when combined mine water make exceeds 30ML/d), with excess discharged through Angus Place LDP001 (2.0ML/d).

It is noted that for the purpose of modelling the null case consists of both Angus Place and Springvale ceasing discharge at the end of the calibration period on 30 June 2014.

<u>Kangaroo Creek / Coxs River above Wangcol Creek/Blue Lagoon</u>

The layout of the water quality model in this vicinity is presented below (**Figure 6**) and show the relevant sub-catchments modelled.

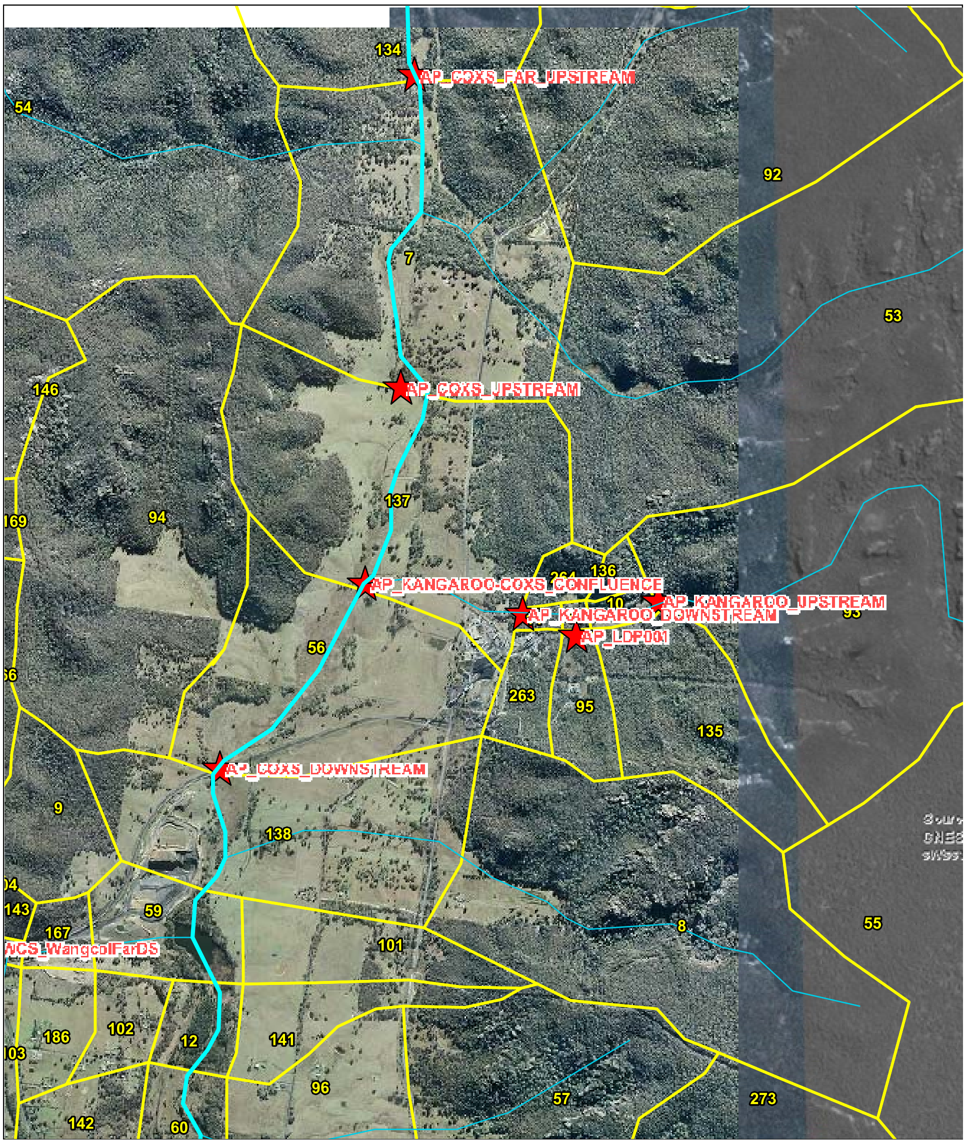


Figure 6 - Layout of the Water Quality model at Kangaroo Creek.

Water quality modelling indicates that historical discharge at Angus Place LDP001 accounts for observed increase in salinity in Kangaroo Creek and the Upper Coxs River above Blue Lagoon. The calibration simulation is presented below at monitoring station AP_KANGAROO_DOWNSTREAM (#011).

Modelling assumes water quality upstream of point of discharge of Angus Place LDP001 to Kangaroo Creek (#010 and above) is 50mg/L TDS. Modelled water quality at monitoring station AP_COXS_FAR_UPSTREAM (#134) is also 50mg/L TDS.

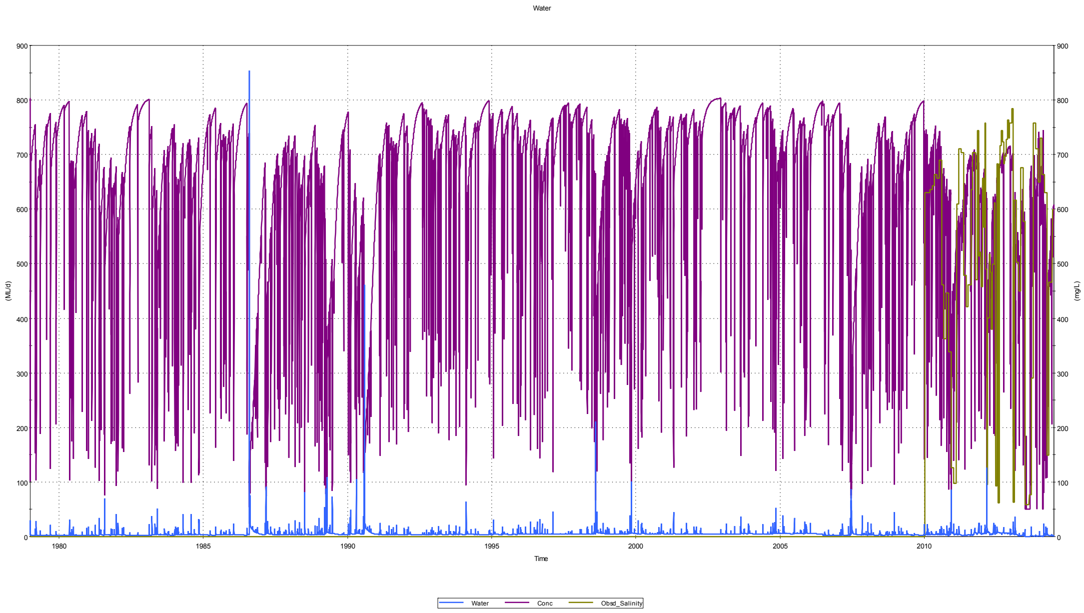


Figure 7 - Historical Daily Flow (ML/d) and Salinity (mg/L) at Sub-Catchment #011

The calibrated model assumes historical discharge from Angus Place LDP001 at 2ML/d from 1979, increasing linearly to 5ML/d prior to activation of the SDWTS in June 2006, however, this is a conservative assumption.

Monitoring location AP_COXS_DOWNSTREAM (#056) corresponds with historical monitoring in the AWT (1992) study at their site, E005. At that location, salinity ranged between 40mg/L in 1980 and 335mg/L in 1989. Current salinity at that location, from monitoring at AP_COXS_DOWNSTREAM on 5 March 2014, is 610mg/L.

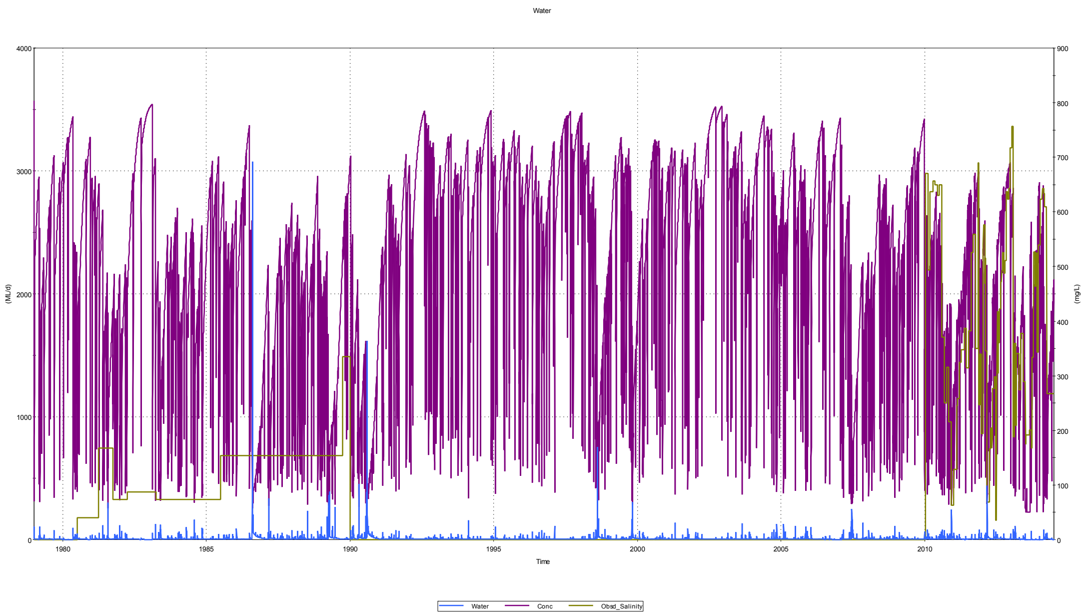


Figure 8 - Historical Daily Flow (ML/d) and Salinity (mg/L) at Sub-Catchment #056

Review of simulated daily flows in Kangaroo Creek at point of discharge of Angus Place LDP001 (#011) during historical discharge indicates that River Flow Objective – Maintain Natural Flow Variability has been met in the past. During prediction simulation of WS1 and WS2a, there is increased discharge (on a continuous basis); however, variability of flow is still evident but mine water discharge does dominate flows in Kangaroo Creek. During prediction simulation of WS2b, discharge at Angus Place LDP001 remains at 2ML/d. Under this condition, flow variability at point of discharge to Kangaroo Creek is consistent with historical and the River Flow Objective is satisfactorily met.

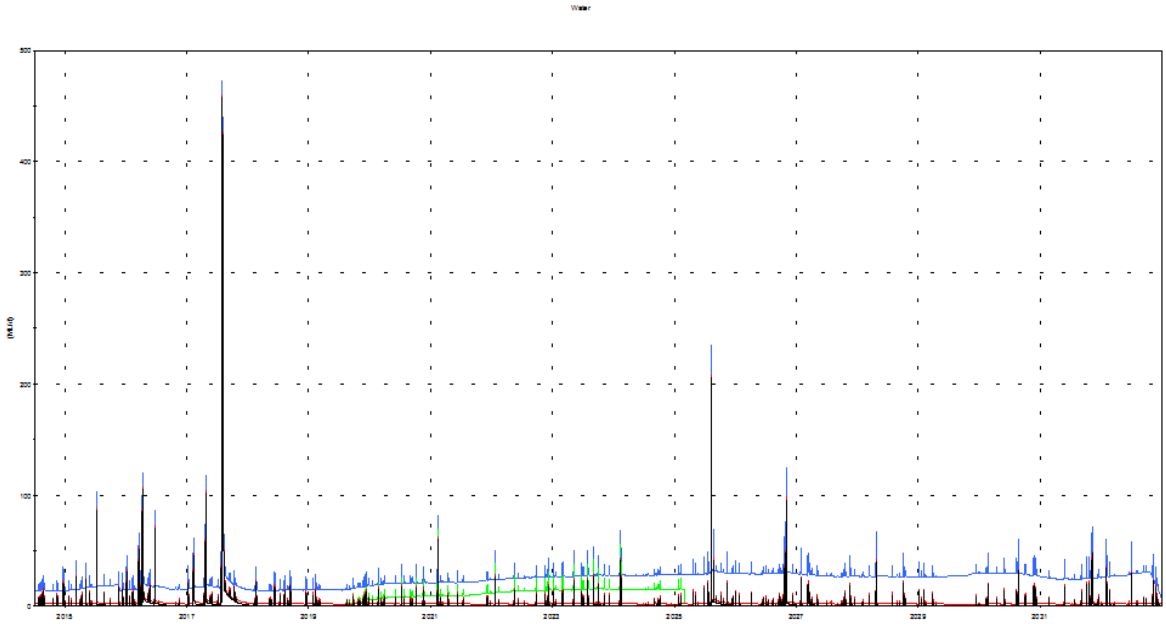


Figure 9 - Predicted Daily Flow (ML/d) at Sub-Catchment #011

Blue is WS1, Green is WS2a, Red is WS2b and Black is Null

Flow statistics of prediction simulated flow at this location are tabulated below, including for the prediction null case.

Table 4 - Predicted Daily Flow Statistics (ML/d) at Sub-Catchment #011

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	0.1	0.0	5.4	2.0	2.0
5%	2.2	0.1	14.5	2.1	2.1
10%	2.4	0.1	14.9	2.2	2.1
20%	2.9	0.2	17.1	2.3	2.2
50%	4.1	0.5	26.1	2.9	2.5
80%	5.3	1.2	28.8	12.1	0.8
90%	6.7	2.9	29.4	15.1	4.9
95%	9.6	6.4	30.9	15.7	8.4
Maximum	853.8	458.4	473.5	460.4	460.4

Predicted salinity at #011 is presented below (**Figure 10**) and summary statistics are tabulated (**Table 5**).

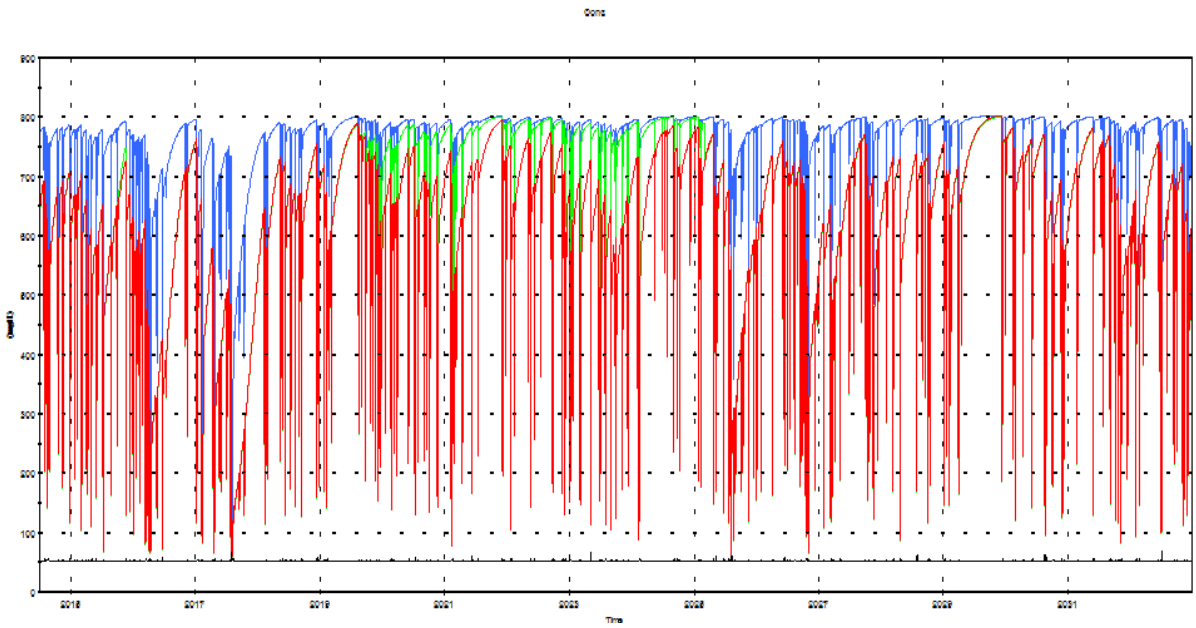


Figure 10 – Predicted Daily Salinity (mg/L) at Sub-Catchment #011

Blue is WS1, Green is WS2a, Red is WS2b and Black is Null

Table 5 - Predicted Daily Salinity (mg/L) at Sub-Catchment #011

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	50	50	75	55	55
5%	277	50	614	266	232
10%	429	50	703	388	356
20%	573	50	760	548	524
50%	704	50	789	698	664
80%	762	51	798	776	733
90%	780	52	800	790	759
95%	790	54	802	797	775
Maximum	804	68	804	804	804

From the above, predicted salinity in Kangaroo Creek is 804mg/L at maximum at #011. This is consistent with assumed salinity of mine water make at Angus Place. Salinity ranges between 100mg/L and 804mg/L at #011, with median being 789mg/L during WS1.

Review of predicted salinity against historical observation indicates the proposed condition is consistent with historical impact of mine water discharge. As noted above, assumed water quality of Kangaroo Creek, upstream of point of discharge is 50mg/L.

Predicted daily flows at #056 are presented graphically below (**Figure 11**) as well as summary statistics in tabular format (**Table 6**).

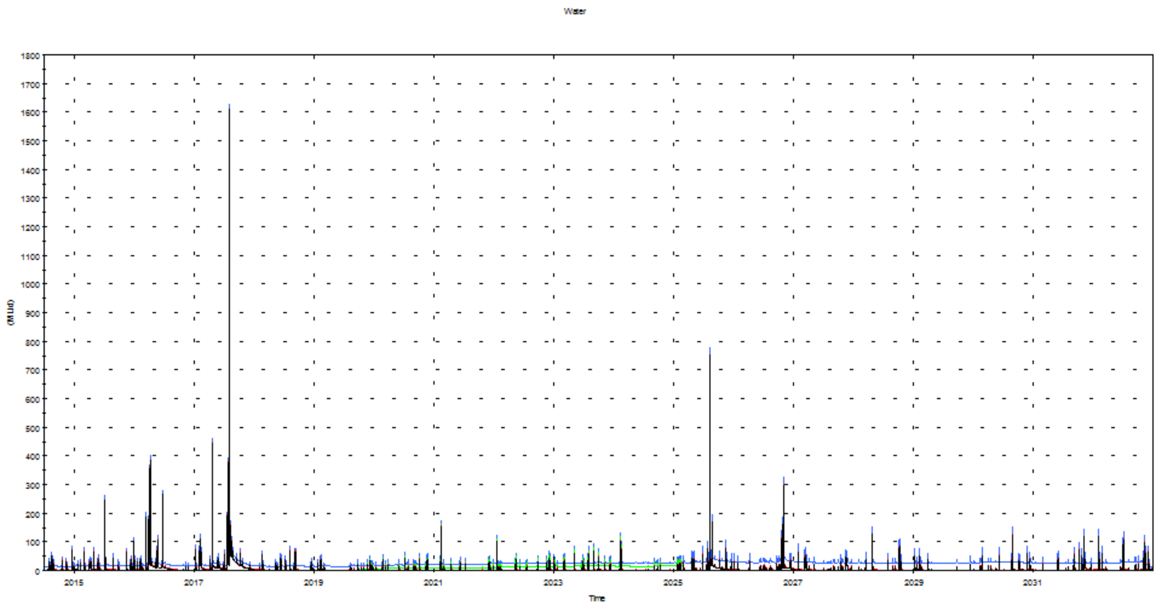


Figure 11 - Predicted Daily Flow (ML/d) at #056

Table 6 – Predicted Daily Flow Statistics (ML/d) at Sub-Catchment #056

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	0.3	0.0	6.9	2.0	2.0
5%	2.5	0.2	15.3	2.4	2.2
10%	3.0	0.4	16.2	2.6	2.4
20%	3.8	0.6	19.8	3.0	2.6
50%	5.1	1.4	27.4	5.1	3.4
80%	8.0	4.4	30.1	15.1	6.4
90%	14.4	11.4	34.8	16.9	13.4
95%	26.6	22.9	44.8	26.9	24.9
Maximum	3076.6	1613.7	1628.8	1615.7	1615.7

Review of simulated daily flow in Coxs River at monitoring location AP_COXS_DOWNSTREAM indicates River Flow Objective – Natural Flow Variability has been met in the past. During prediction simulation, there is increased contribution from Kangaroo Creek to this location in WS1 and WS2a. During prediction simulation of WS2b, the impact of mine water discharge to Kangaroo Creek on flow variability at this location is small.

Predicted salinity at #056 is presented below (**Figure 12**), together with summary statistics (**Table 7**).

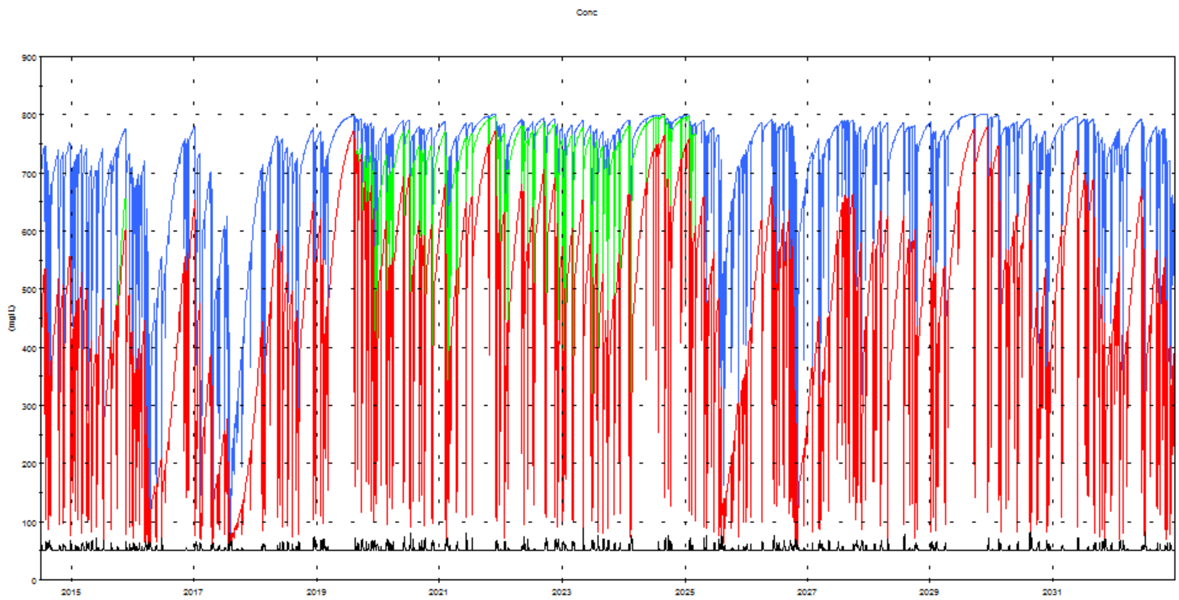


Figure 12 – Predicted Daily Flow (ML/d) at Sub-Catchment #056

Blue is WS1, Green is WS2a, Red is WS2b and Black is Null

Table 7 – Predicted Daily Salinity (mg/L) at Sub-Catchment #056

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	50	50	63	57	57
5%	136	50	402	127	118
10%	211	50	525	183	168
20%	339	50	666	317	289
50%	556	50	761	538	498
80%	684	55	786	738	626
90%	728	60	792	767	683
95%	759	64	798	780	732
Maximum	804	89	804	804	804

Predicted salinity in the Coxs River ranges between 100 mg/L and 804 mg/L, with median being 761 mg/L during WS1.

Review of predicted salinity against historical observation indicates proposed condition is consistent with historical impact of discharge at Angus Place. As indicated above, salinity range of natural condition is between 50 mg/L (assumed minimum) and 89 mg/L, with median of 50 mg/L.

Sawyers Swamp Creek / Sawyers Swamp Creek above Coxs River

The layout of the water quality model is presented below **Figure 13**.

It is noted that the blue/black drainage line in the below was obtained from the 250,000 scale vector dataset and therefore is approximate. As presented in **Appendix 2**, sub-catchments were delineated based on high resolution topographic data.

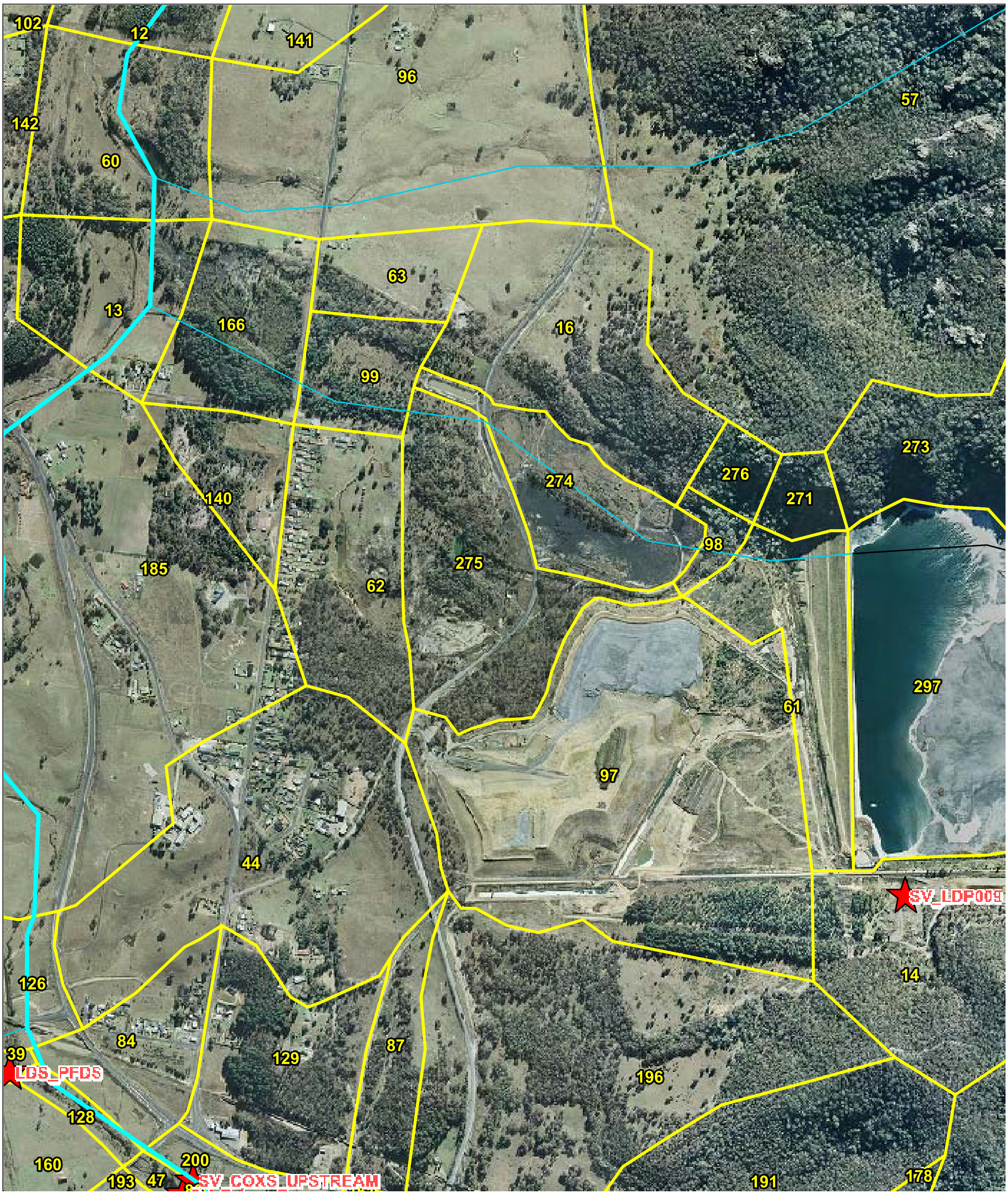


Figure 13 - Layout of the Water Quality Model at Sawyers Swamp Creek

Sawyers Swamp Creek is diverted around the Sawyers Swamp Creek Ash Dam and is transmitted from #014, inclusive of point of discharge from Springvale LDP009, to #061, #098, #275, #09 and #166 before entering the Coxs River.

Water quality modelling implies increased salinity observed in Sawyers Swamp Creek above Coxs River is associated with mine water discharge at Springvale LDP009, however, as presented above, the Sawyers Swamp Creek catchment is in a highly disturbed state and there are multiple potential sources of salinity and other contaminants both presently and in the past.

Monitoring location WCS_LDP003_DOWNSTREAM (#166) is located on Sawyers Swamp Creek immediately above the Coxs River. The calibration simulation is presented below (**Figure 14**).

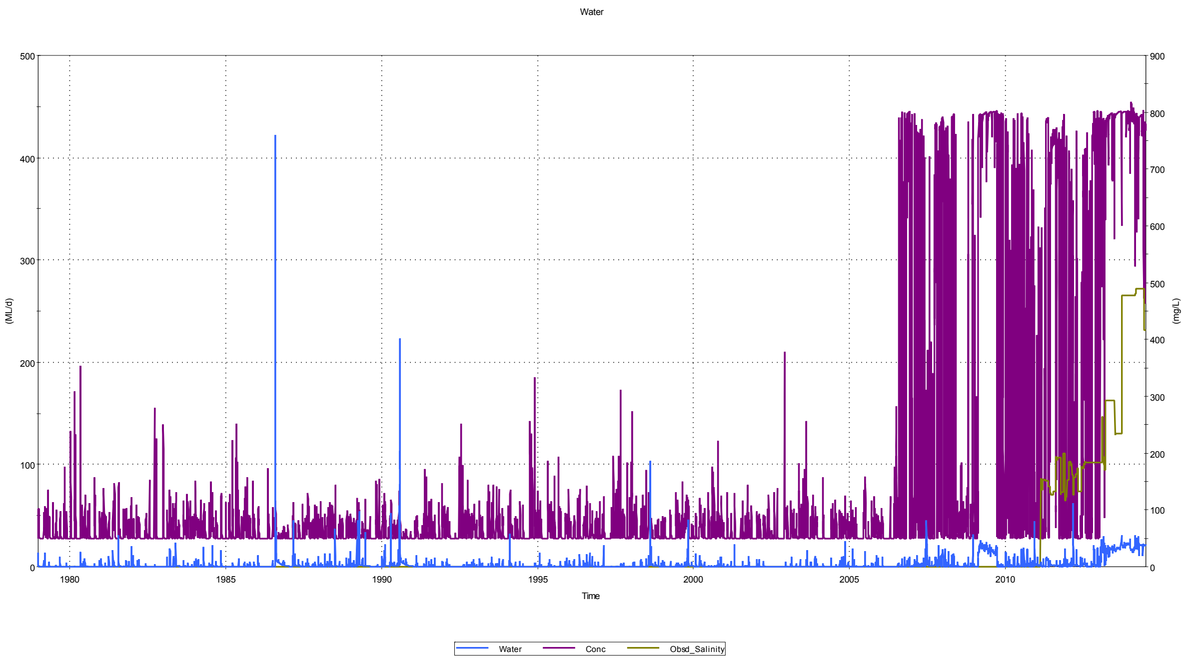


Figure 14 - Historical Flow (ML/d) and Salinity (mg/L) at Sub-Catchment #166

From the above, the calibration model over-predicts the observed salinity at WCS_LDP003_DOWNSTREAM. It is noted that discharge at Springvale LDP009 commenced in August 2012 and prior to this was associated with Energy Australia LDP020 from June 2006. The location of LDP020 changed in the past, however was still within sub-catchment #014.

During the prediction simulation, under scenarios WS1, WS2a and WS2b, there is discharge to Springvale LDP009. Predicted daily flow (**Figure 15**) and salinity (**Figure 16**) at sub-catchment #014 is presented below. The associated statistics for the daily flows and salinity at sub-catchment #014 are provided in **Table 8** and **Table 9**, respectively.

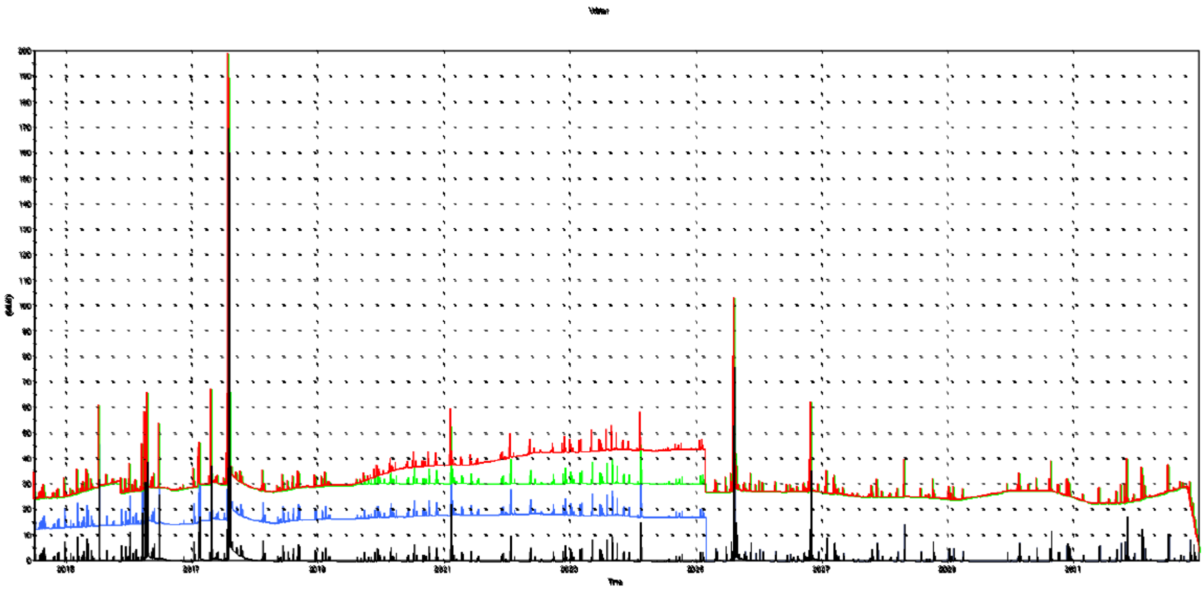


Figure 15 - Predicted Flow (ML/d) at Sub-Catchment #014
Blue is WS1, Green is WS2a, Red is WS2b and Black is Null

Table 8 - Predicted Daily Flow Statistics (ML/d) at Sub-Catchment #014

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	0.0	0.0	0.0	3.0	3.0
5%	0.0	0.0	0.0	23.3	23.3
10%	0.0	0.0	0.1	24.4	24.4
20%	0.1	0.1	0.1	25.1	25.1
50%	0.2	0.2	14.4	28.0	28.0
80%	1.0	0.4	17.9	30.1	38.1
90%	4.1	1.1	18.3	30.3	42.7
95%	16.1	2.3	18.7	30.8	43.2
Maximum	314.7	169.9	185.7	198.9	198.9

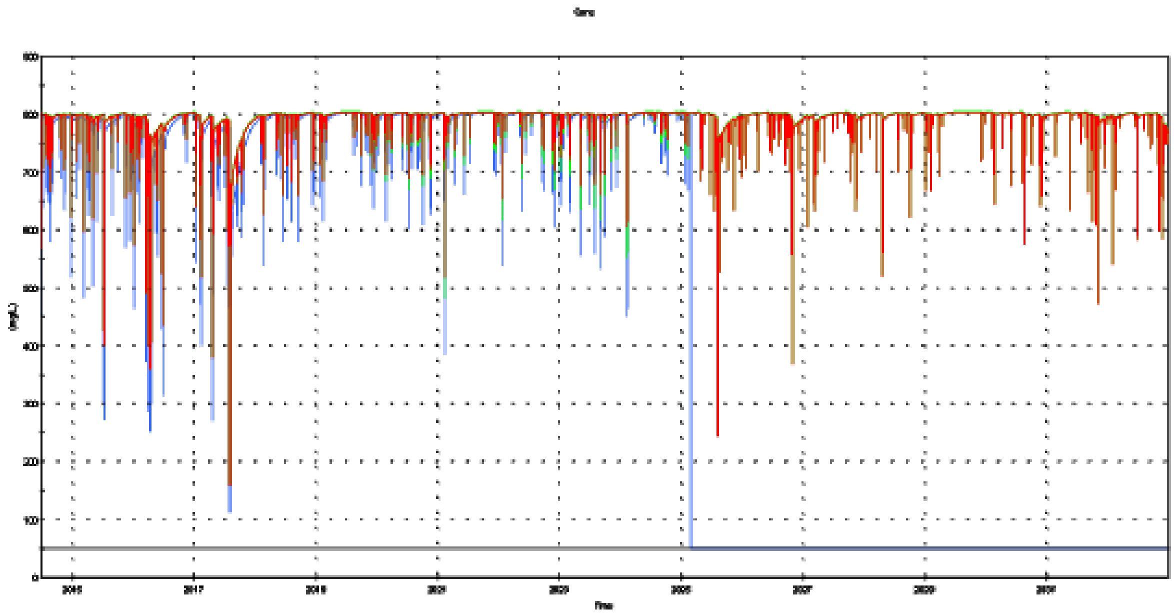


Figure 16 - Predicted Salinity (mg/L) at Sub-Catchment #014
Blue is WS1, Green is WS2a, Red is WS2b and Black is Null

Table 9 - Predicted Daily Salinity Statistics (mg/L) at Sub-catchment #014

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	50	50	50	160	160
5%	50	50	50	743	747
10%	50	50	50	774	775
20%	50	50	50	792	792
50%	50	50	761	799	780
80%	50	50	798	802	802
90%	634	50	801	803	803
95%	790	50	802	803	803
Maximum	819	50	804	804	804

Predicted daily flow and salinity is also presented at #166 in **Figure 17**, the associated summary statistics are provided in **Table 10**.

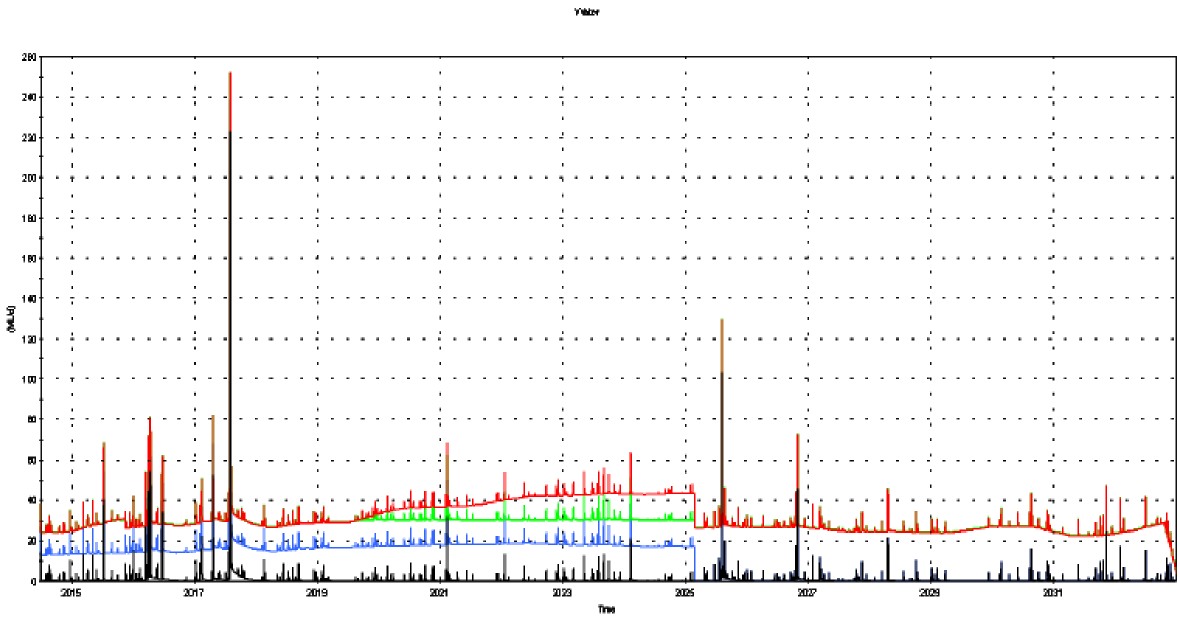


Figure 17 - Predicted Flow (ML/d) at #166
Blue is WS1, Green is WS2a, Red is WS2b and Black is Null

Table 10 - Predicted Daily Salinity Statistics (mg/L) at #166

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	50	50	50	154	154
5%	50	50	50	724	729
10%	50	50	50	766	767
20%	50	50	51	788	789
50%	53	51	751	799	799
80%	90	77	798	802	802
90%	605	90	800	803	803
95%	788	103	802	803	803
Maximum	818	379	804	804	804

From the above, predicted salinity at #014 and #166 is 804 mg/L a maximum, consistent with assumed salinity of mine water make at Springvale Mine and Angus Place Colliery. The catchment upstream of point of discharge, Springvale LDP009, is relatively small, therefore the predicted median salinity is similar to the assumed salinity of mine water make. As indicated, despite the relatively small contributing catchment, there is variability in concentration at #166. Predicted median salinity at #166 of 751 mg/L is within the range of modelled salinity at monitoring station WCS_LDP003_DOWNSTREAM during the calibration period.

Downstream Impacts - Coxs River / Lake Wallace / Lake Lyell / Thompsons Creek Reservoir and Lake Burragorang

Flow gauging at downstream end of Sawyers Swamp Creek is not available, however, there is a NSW Office of Water station on the Coxs River above Lake Wallace. The tributaries contributing to the Coxs River at this location include Wangcol Creek, Sawyers Swamp Creek and Pipers Flat Creek. The calibration simulation at this location is presented below.

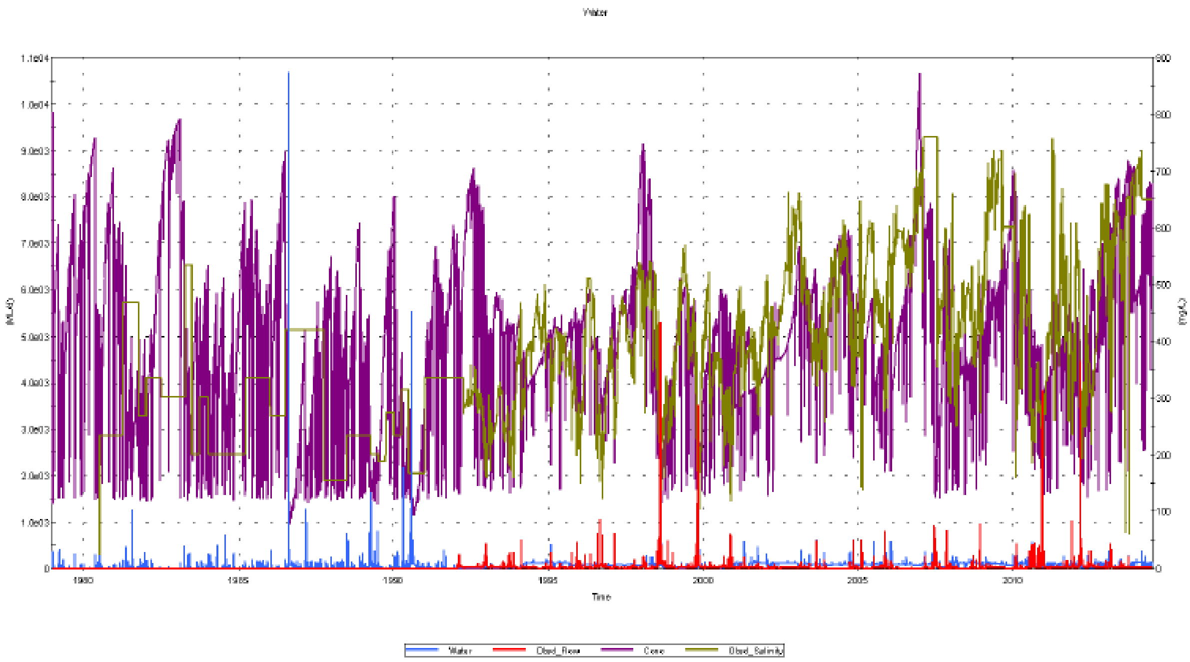


Figure 18 - Historical Flow (ML/d) and Salinity (mg/L) at #047

From **Figure 18** there is a reasonable fit between observed and modelled flow as well as observed and modelled salinity.

The layout of the water quality model in this vicinity is presented below (**Figure 19**).

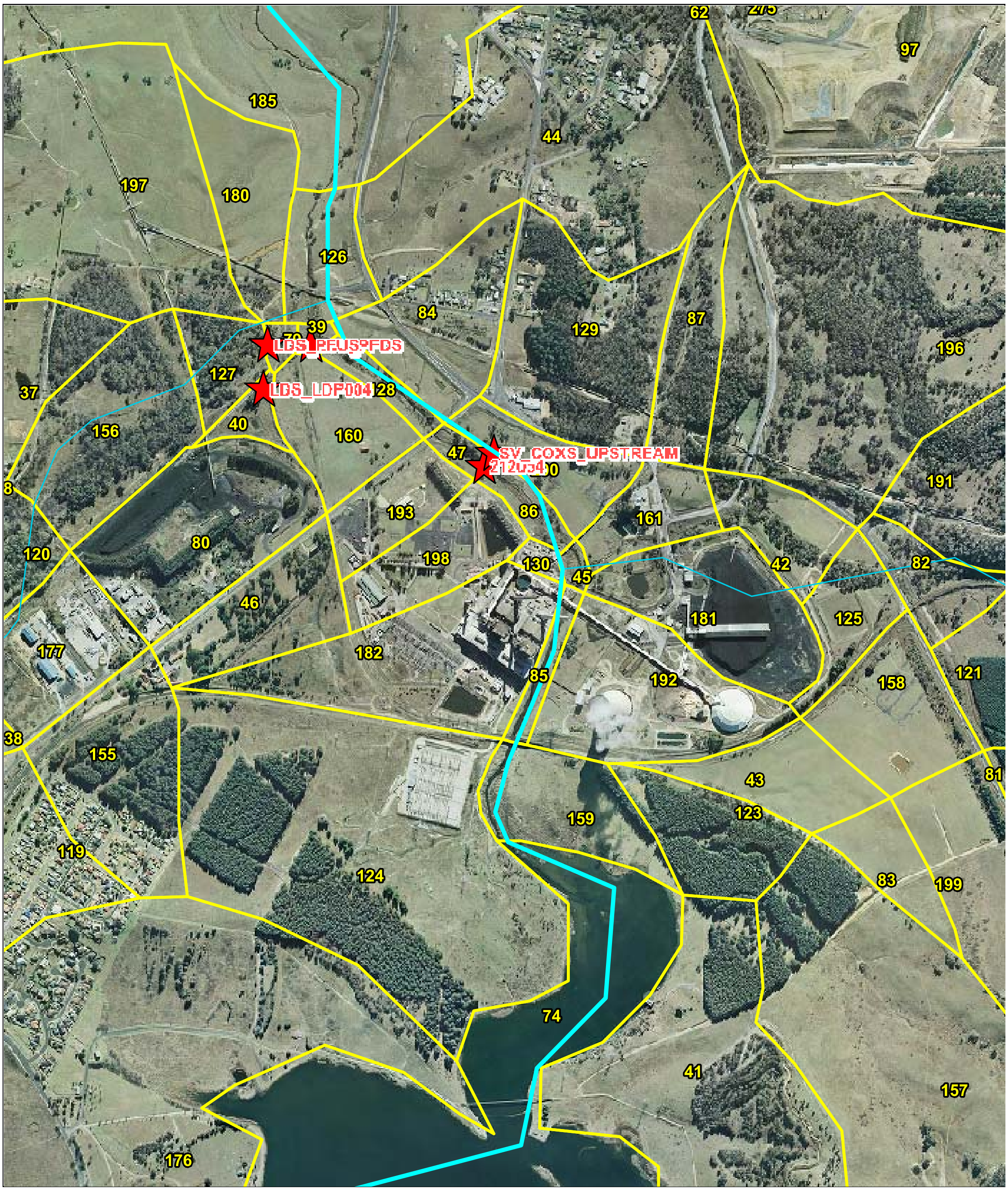


Figure 19 - Layout of the Water Quality model at Lake Wallace

Predicted daily flow (**Figure 20**) and salinity (**Figure 21**) at this location is presented below together with summary statistics for daily flow (**Table 11**) and salinity (**Table 12**). It is noted that WS1, WS2a and WS2b have identical daily flows at this location.

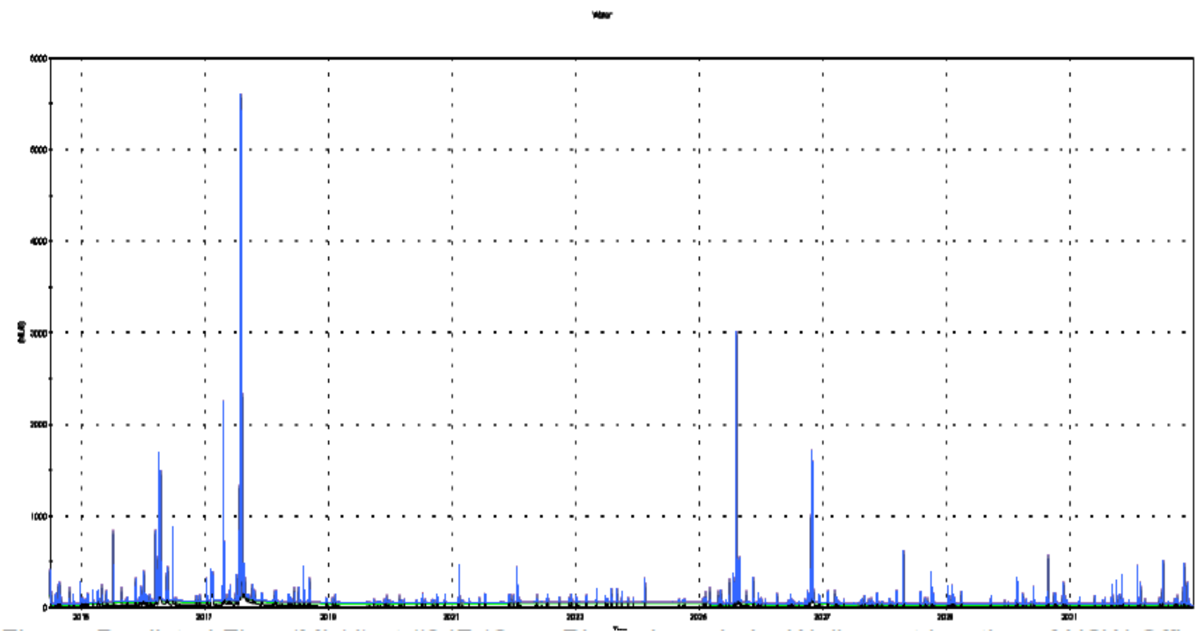


Figure 20 - Predicted Flow (ML/d) at #047

Table 11 - Predicted Daily Flow Statistics (ML/d) at #047

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	2.0	4.4	13.3	13.3	13.3
5%	3.4	6.2	33.0	33.0	33.0
10%	4.5	6.7	35.1	35.1	35.1
20%	6.6	7.5	36.8	36.8	36.8
50%	41.8	10.3	47.9	47.9	47.9
80%	105.4	30.4	60.9	60.9	60.9
90%	112.2	51.5	81.9	81.9	81.9
95%	131.2	95.3	126.1	126.1	126.1
Maximum	10694.0	5576.5	5607.4	5607.5	5607.5

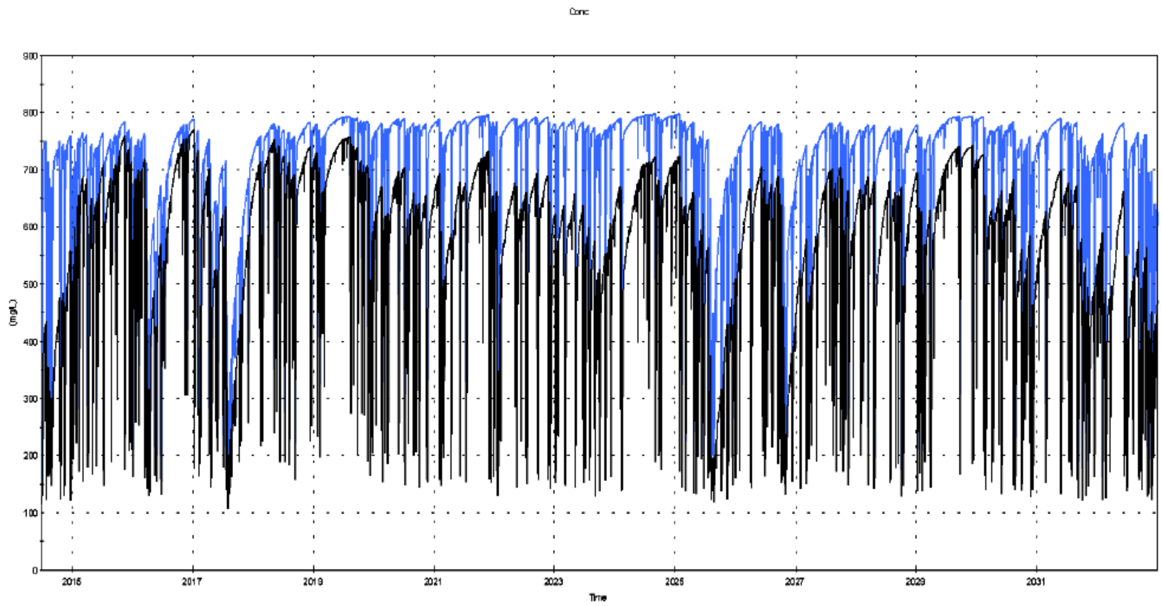


Figure 21 - Predicted Salinity (mg/L) at #047
Blue is WS1 and Black is Null. It is noted that predicted salinity in WS1 is identical at this location to WS2a and WS2b.

Table 12 - Predicted Daily Salinity (mg/L) at #047

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	79	107	111	111	111
5%	156	191	358	358	358
10%	195	254	484	484	484
20%	284	397	639	639	639
50%	402	599	755	755	755
80%	514	681	780	780	780
90%	599	713	787	787	787
95%	665	731	791	791	791
Maximum	874	771	797	797	797

From the above, the predicted salinity at this location is comparable to historical salinity under the proposed water management strategy.

The modelled salinity in Lake Wallace is presented below. When operational, Wallerawang Power Station, discharged some Cooling Tower blowdown water to the Coxs River above Lake Wallace (Energy Australia, LDP001 and LDP021), however, the majority was discharged below Lake Wallace (Energy Australia, LDP004). ‘Bleed-off’ from Sawyers Swamp Creek Ash Dam (SSCAD) was discharged to Lake Wallace (Energy Australia, LDP003) and whilst included in the water quality model, there was insufficient data of wet ash deposition (prior to 2002) and historical water level response in the dam to improve this component. During the prediction simulation, there was no ‘bleed-off’ from the SSCAD since evaporation from the surface of SSCAD exceeds direct rainfall on the dam surface and local catchment runoff. As such, the cumulative impact assessment is conservative because there is no contribution from SSCAD via Energy Australia LDP003.

Figure 22 - Historical Volume (ML) and Salinity (mg/L) at #074 (Lake Wallace)

From the above, the historical salinity in Lake Wallace is reasonably matched by the water quality model.

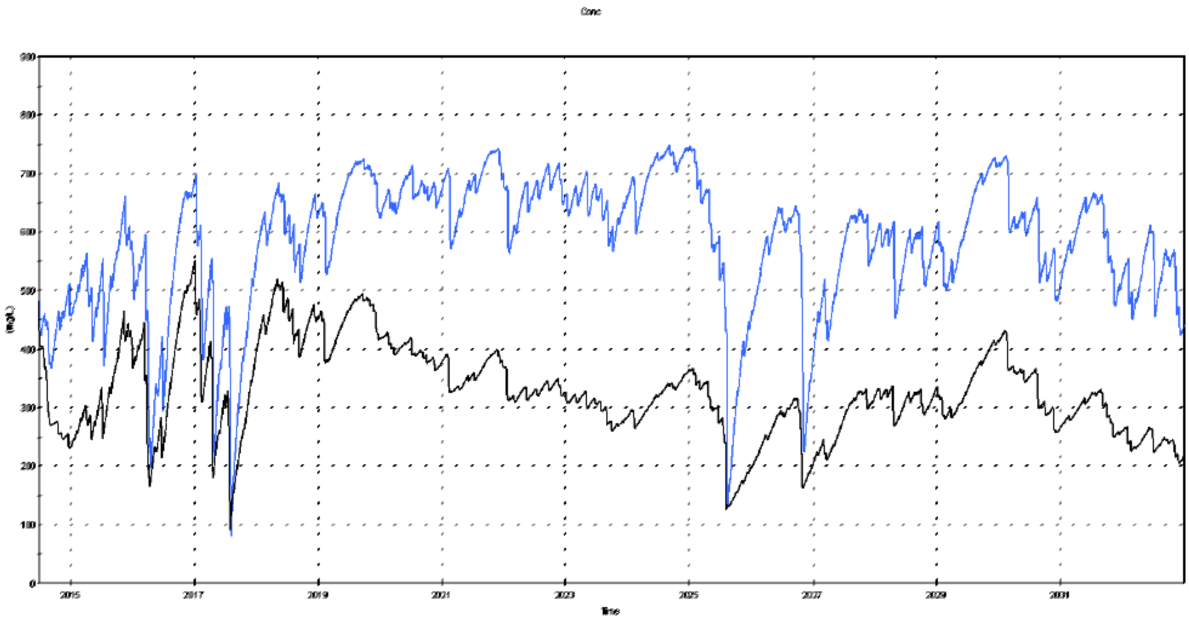


Figure 23 - Predicted Salinity (mg/L) at #074 (Lake Wallace)
Blue is WS1 and Black is Null. It is noted that predicted salinity in WS1 is identical at this location to WS2a and WS2b.

Table 13 - Predicted Daily Salinity Statistics (mg/L) at #074 (Lake Wallace).

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	100	91	79	79	79
5%	164	207	369	369	369

Percentile	CAL	NUL	WS1	WS2a	WS2b
10%	197	235	436	436	436
20%	226	265	499	499	499
50%	309	321	604	604	604
80%	408	393	673	673	673
90%	470	433	704	704	704
95%	516	470	720	720	720
Maximum	725	552	747	747	747

From the above, the predicted salinity in Lake Wallace is up to 747 mg/L under the proposed water management strategy. Comparison of predicted salinity against historical observation indicates predicted salinity is within the range experienced in the past and variability in salinity is also comparable. Median salinity, however, is higher at 604 mg/L under WS1, WS2a and WS2b conditions compared to the calibration period at 309 mg/L and prediction null case of 321mg/L.

There are two monitoring locations between Lake Wallace and Lake Lyell that are of interest. The first station, #154, corresponds with NSW Office of Water Flow Gauge No. 212058. The second station, #035, corresponds with Energy Australia water quality monitoring location COX5 (Delta Electricity (2009)).

The layout of the water quality model between Lake Wallace and Lake Lyell is presented below (**Figure 24**).

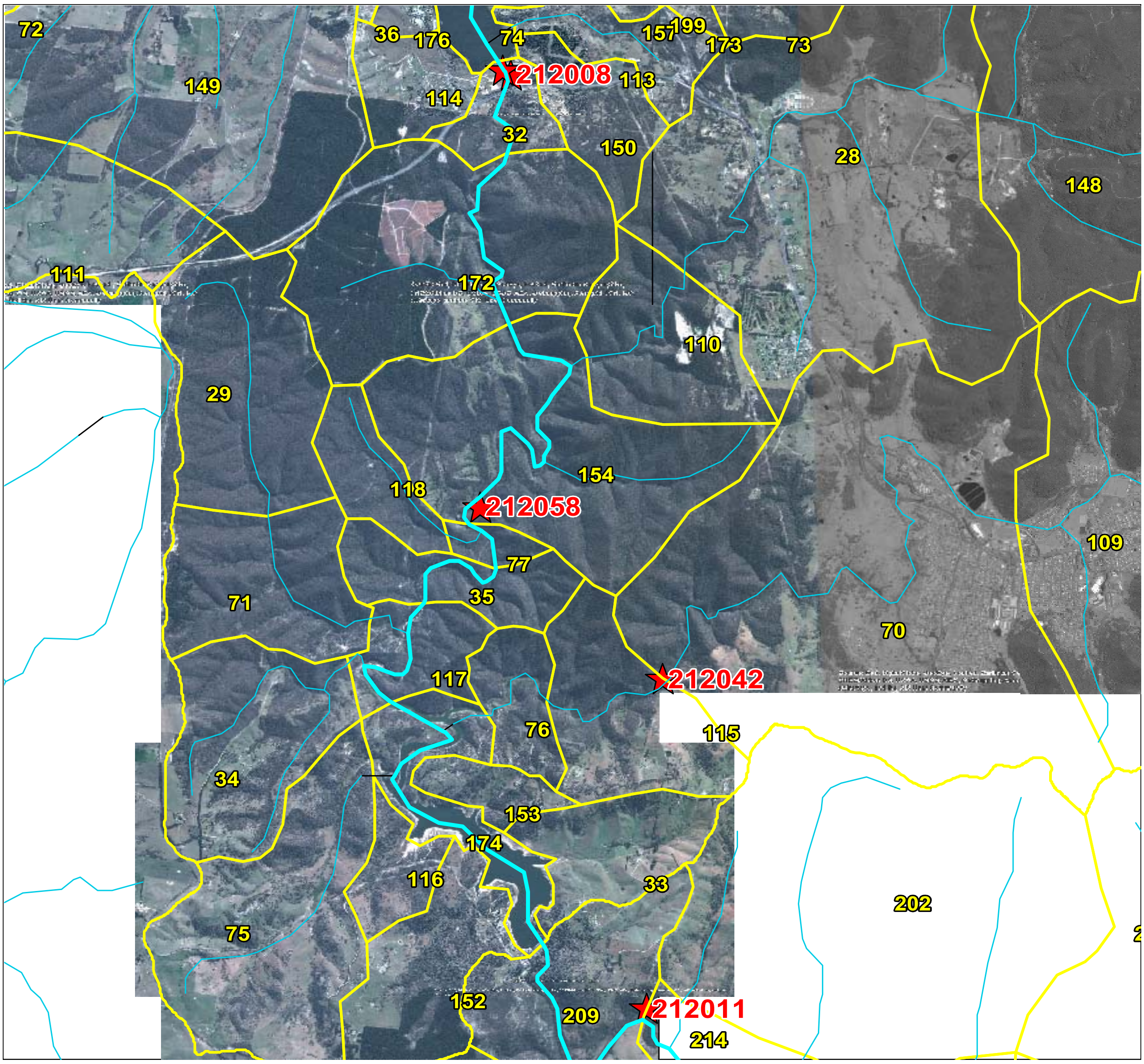


Figure 24 - Layout of the Water Quality model between Lake Wallace and Lake Lyell

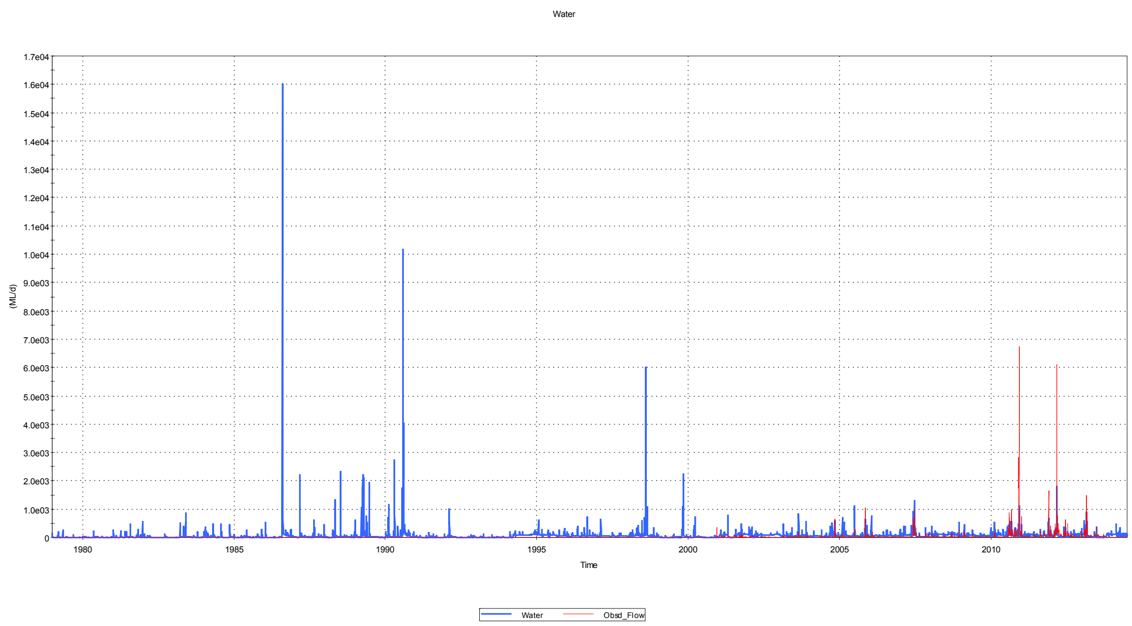


Figure 25 - Historical Flow (ML/d) at #154

Figure 26 - Historical Flow (ML/d) and Salinity (mg/L) at #035

Prediction simulations (flow and salinity) at these locations are presented below as well as summary statistics.

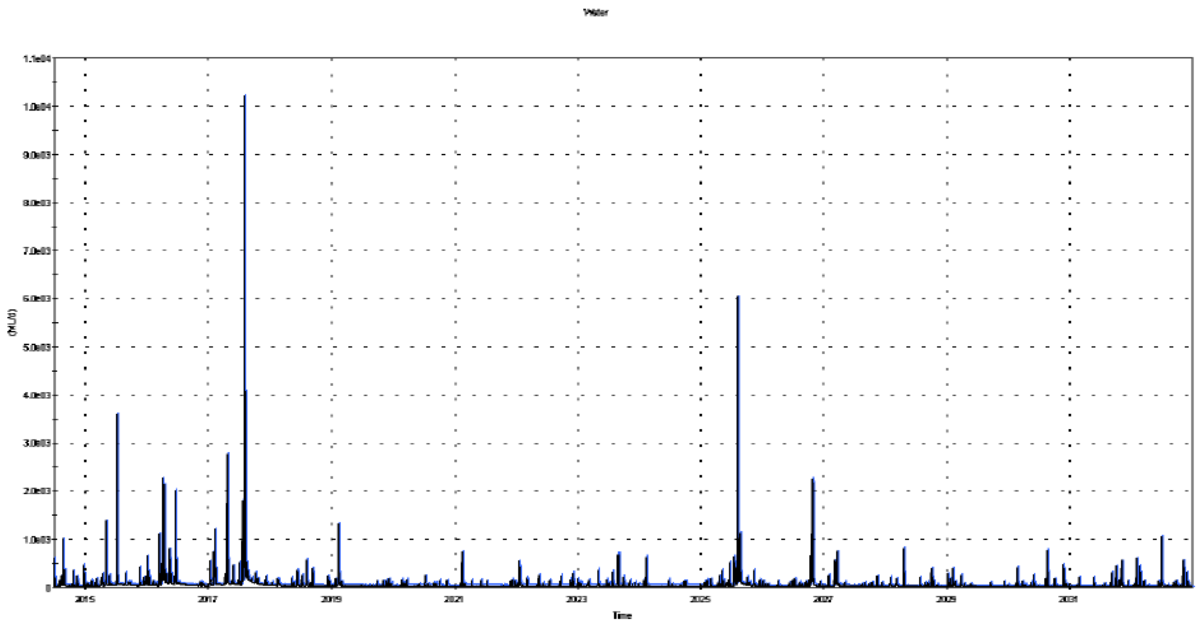


Figure 27 - Predicted Flow (ML/d) at #154

Table 14 - Predicted Daily Flow Statistics (ML/d) at #154

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	2.6	0.1	6.7	6.7	6.7
5%	10.0	2.2	29.9	29.9	29.9
10%	10.6	3.3	32.4	32.4	32.4
20%	11.9	5.2	36.6	36.6	36.6
50%	37.3	12.7	48.7	48.7	48.7
80%	90.2	44.5	75.9	75.9	75.9
90%	116.5	84.8	118.0	118.0	118.0
95%	156.1	161.2	192.1	191.9	191.9
Maximum	16029.0	10223.0	10254.0	10254.0	10254.0

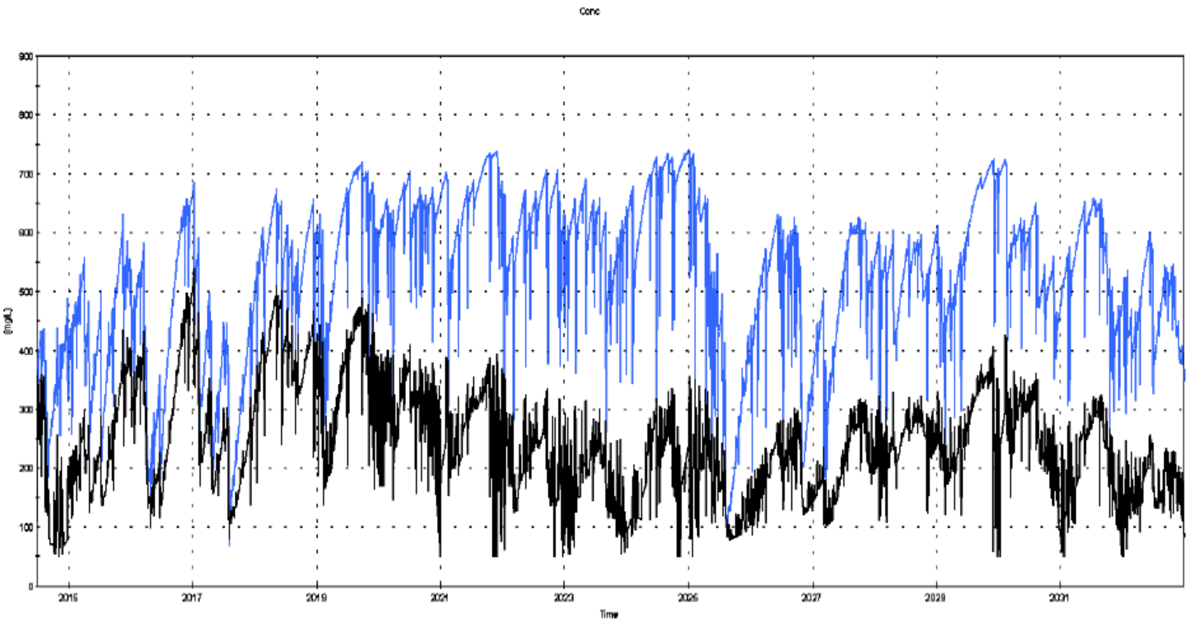


Figure 28 - Predicted Salinity (mg/L) at #035
Blue is WS1 and Black is Null. It is noted that predicted salinity in WS1 is identical at this location to WS2a and WS2b.

Table 15 - Predicted Daily Salinity Statistics (mg/L) at #035

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	63	50	67	67	67
5%	164	100	263	263	263
10%	229	125	337	337	337
20%	337	159	418	418	418
50%	472	231	552	552	552
80%	658	315	643	643	643
90%	741	366	681	681	681
95%	786	406	705	705	705
Maximum	1893	540	740	740	740

From the above, the calibration simulation underpredicts salinity compared to historical observation. During available monitoring period between 2000 and 2009, salinity at #035 ranged between 200 mg/L and 1200 mg/L. Calibration simulation during that period is 200 to 700 mg/L, by comparison.

From predicted flow chart and tabulated statistics, WS1 (WS2a and WS2b yield identical results) leads to discernible minimum flow in the Coxs River, however, the variability in magnitude of flow is significant.

From predicted salinity chart at #035, expected maximum salinity and variability in salinity is consistent with historical observation.

Comparison of the calibration simulation with historical monitoring of Lake Lyell (#174) (**Figure 29**) and Thompsons Creek Reservoir (#272) (**Figure 30**) is presented below.

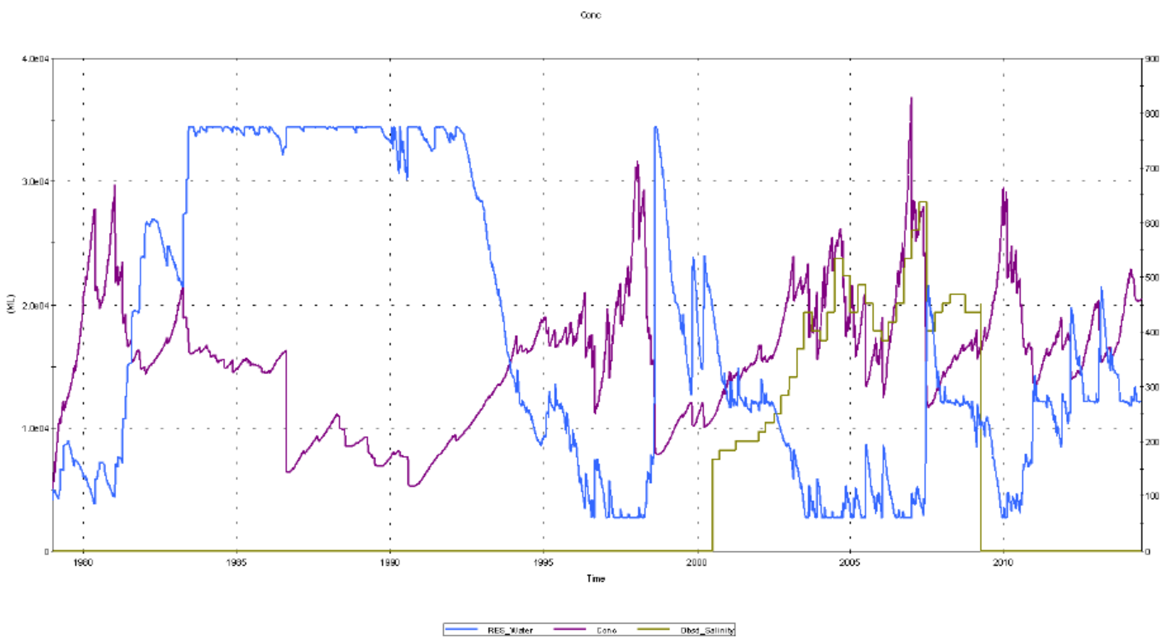


Figure 29 - Historical Volume (ML) and Salinity (mg/L) at #174 (Lake Lyell)

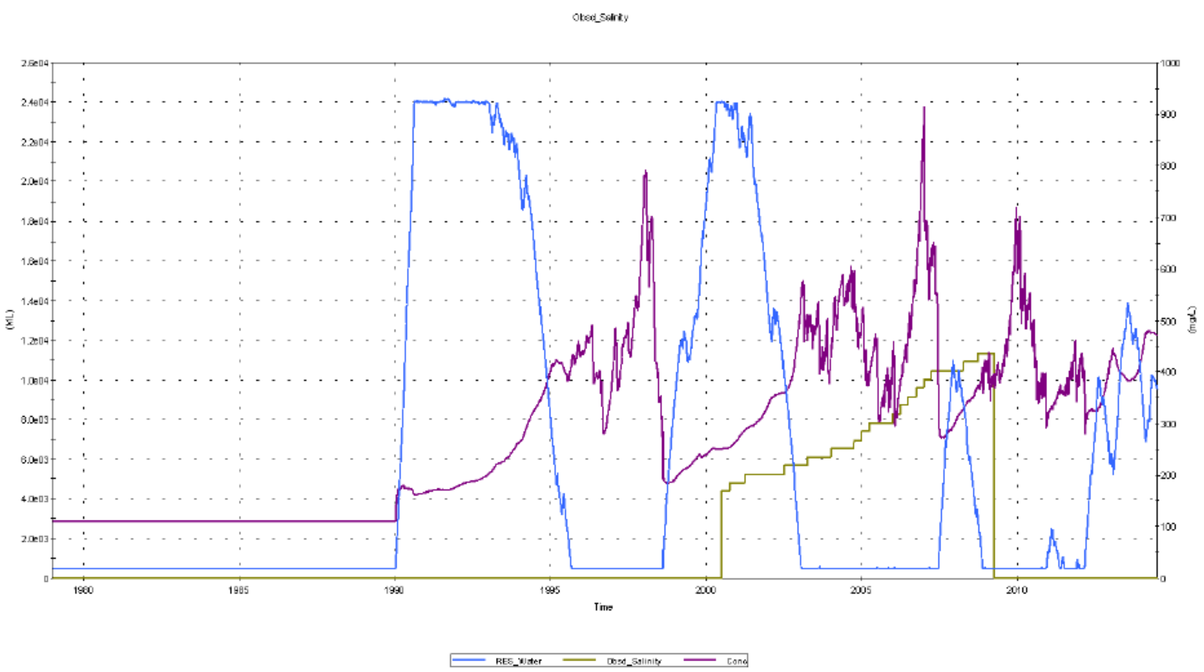


Figure 30 - Historical Volume (ML) and Salinity (mg/L) at #272 (Thompsons Creek Reservoir)

From the above, the modelled salinity in Lake Lyell (#174) during calibration simulation is reasonably matched with historical observation. Modelled storage volume (ML) is somewhat under-predicted, however, this is due to assumptions necessary for daily demand at Wallerawang Power Station and Mount Piper Power Station from 1993 and other input data. The results, however, are suitable for the purpose of cumulative impact assessment.

The modelled salinity in Thompsons Creek Reservoir (#272) is also reasonably matched, although the model is over-predicting salinity, the increasing trend is captured.

The predicted volume (ML) and salinity (mg/L) in Lake Lyell (#174) and Thompsons Creek Reservoir (#272) is presented below.

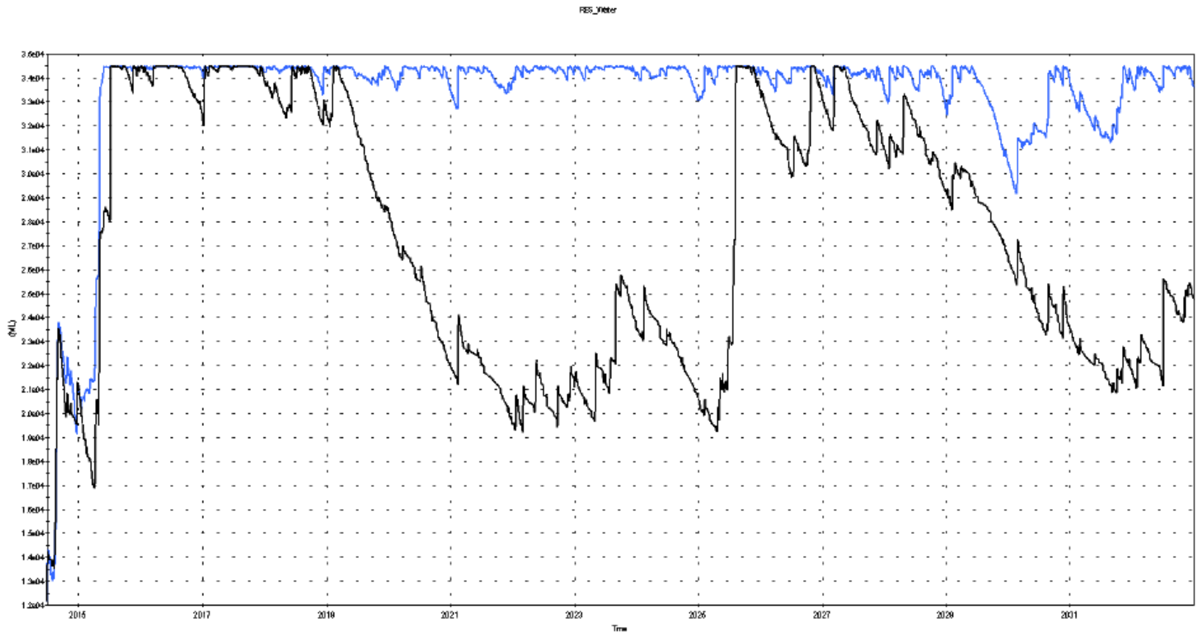


Figure 31 - Predicted Volume (ML) at #174 (Lake Lyell)
Blue is WS1 and Black is Null

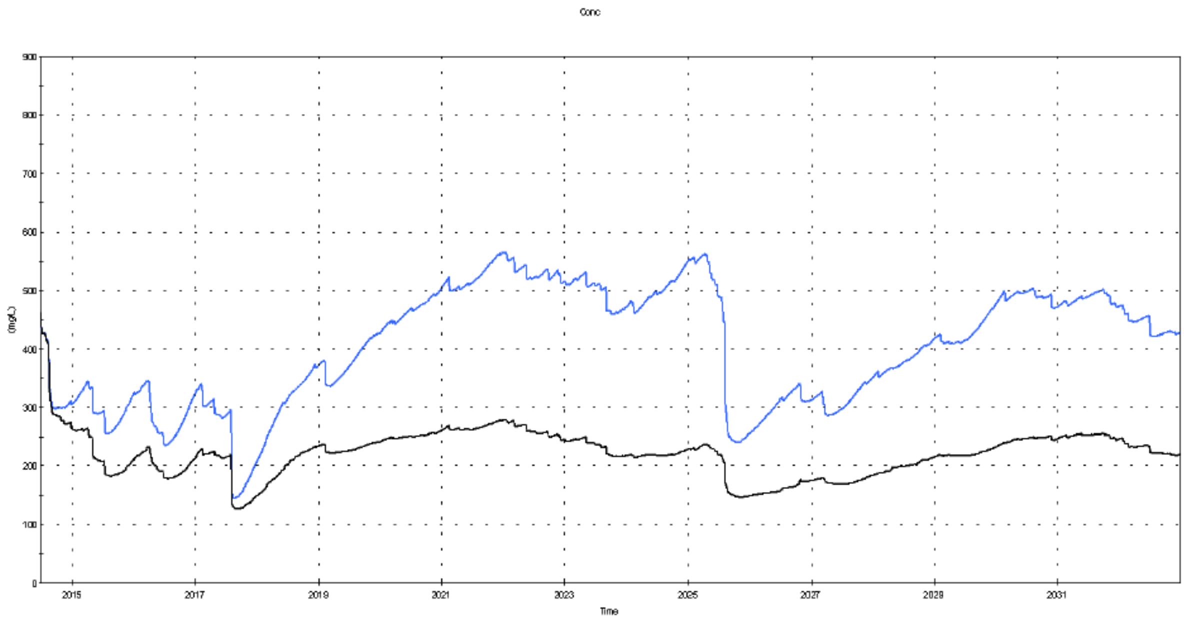


Figure 32 - Predicted Salinity (mg/L) at #174 (Lake Lyell)
Blue is WS1 and Black is Null

Table 16 - Predicted Daily Salinity Statistics (mg/L) at #174 (Lake Lyell).

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	110	127	145	145	145
5%	165	152	246	246	246
10%	185	170	271	271	271
20%	235	186	303	303	303
50%	355	223	422	422	422
80%	437	251	500	500	500
90%	499	262	522	522	522
95%	559	270	539	539	539
Maximum	830	462	566	566	566

From the above, the prediction simulation indicates salinity in Lake Lyell is higher due to proposed water management strategy at Angus Place and Springvale, however, concentration is comparable to historical range and variability.

The prediction simulation indicates a positive difference in stored volume in Lake Lyell (#174) due to the proposed water management strategy.

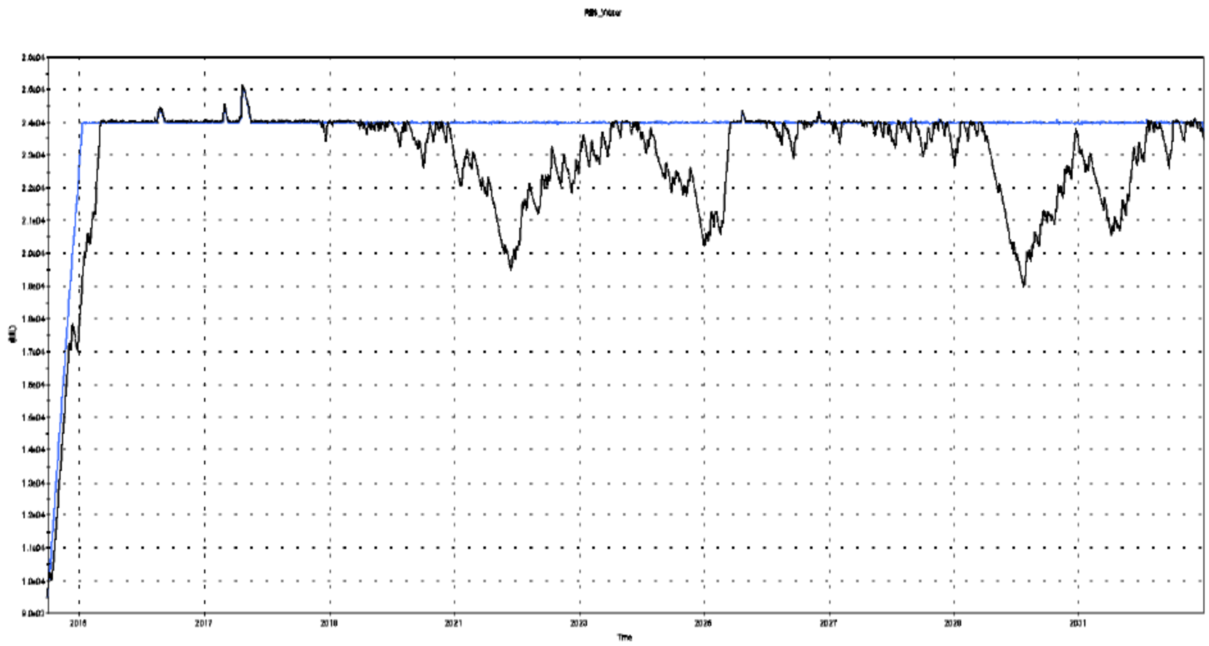


**Figure 33 - Predicted Volume (ML) at #272 (Thompsons Creek Reservoir)
Blue is WS1 and Black is Null.**

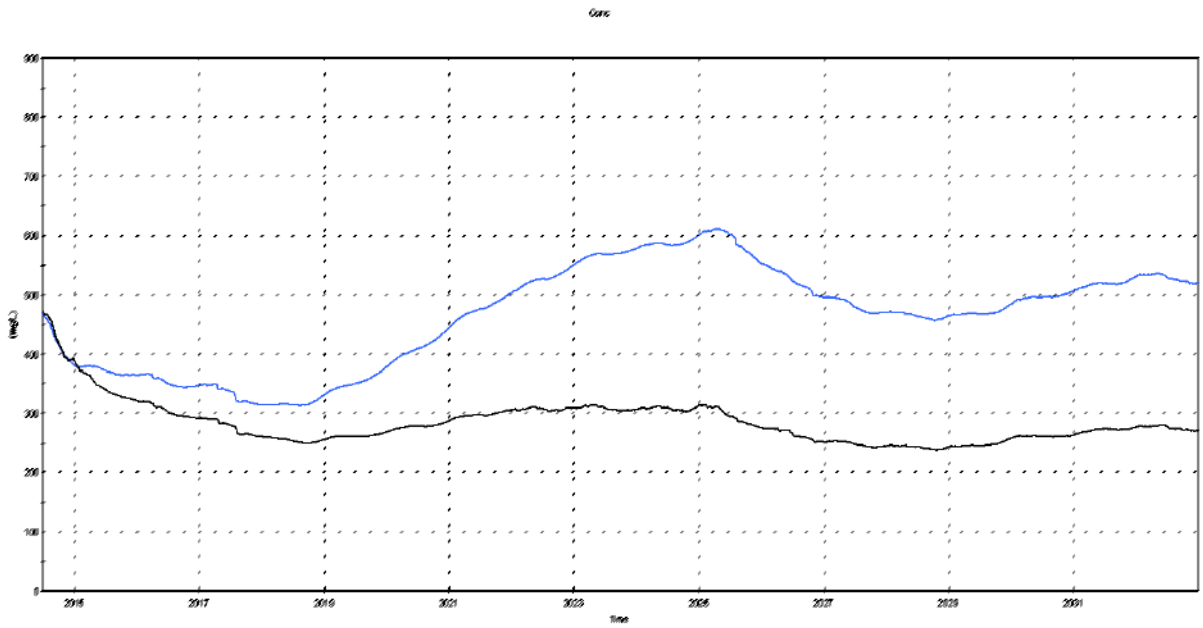


**Figure 34 - Predicted Salinity (mg/L) at #272 (Thompsons Creek Reservoir)
Blue is WS1 and Black is Null. It is noted that predicted salinity in WS1 is identical at this location to WS2a and WS2b.**

Table 17 - Predicted Daily Salinity Statistics (mg/L) at #272 (Thompsons Creek Reservoir).

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	110	237	314	314	314
5%	110	243	318	318	318
10%	110	245	343	343	343
20%	110	254	365	365	365
50%	274	276	477	477	477
80%	423	307	536	536	536
90%	491	313	575	575	575
95%	561	344	588	588	588
Maximum	914	471	613	613	613

The predicted salinity in Thompsons Creek Reservoir (#272) is higher due to the proposed water management strategy but is only marginally higher than the modelled calibration values.

Similar to the predicted impact in Lake Lyell, there is a minor positive difference to predicted storage volume (ML) in Thompsons Creek Reservoir due to the proposal.

Water quality modelling encompassed sub-catchments contributing to Lake Burragorang (#280, Warragamba Dam).

The layout of the model below Lake Lyell is presented below. It is noted that catchments of the Wollondilly River are also included in the model. Further detail is presented in **Appendix 2**.

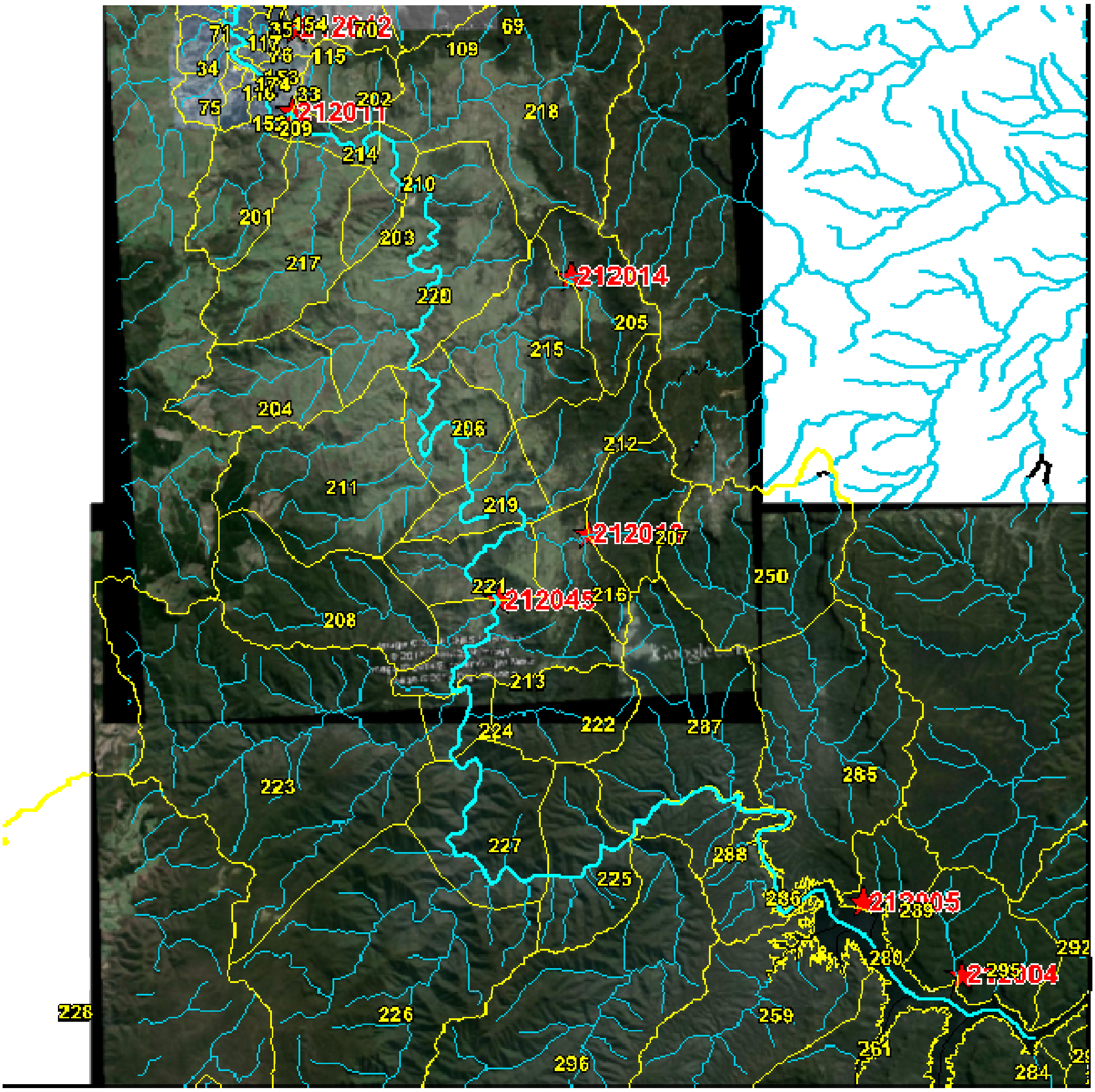


Figure 35 - Layout of the Water Quality model between Lake Lyell and Lake Burragorang

Historical volume (ML) (**Figure 36**) and salinity (mg/L) (**Figure 37**) of Lake Burragorang is presented below.

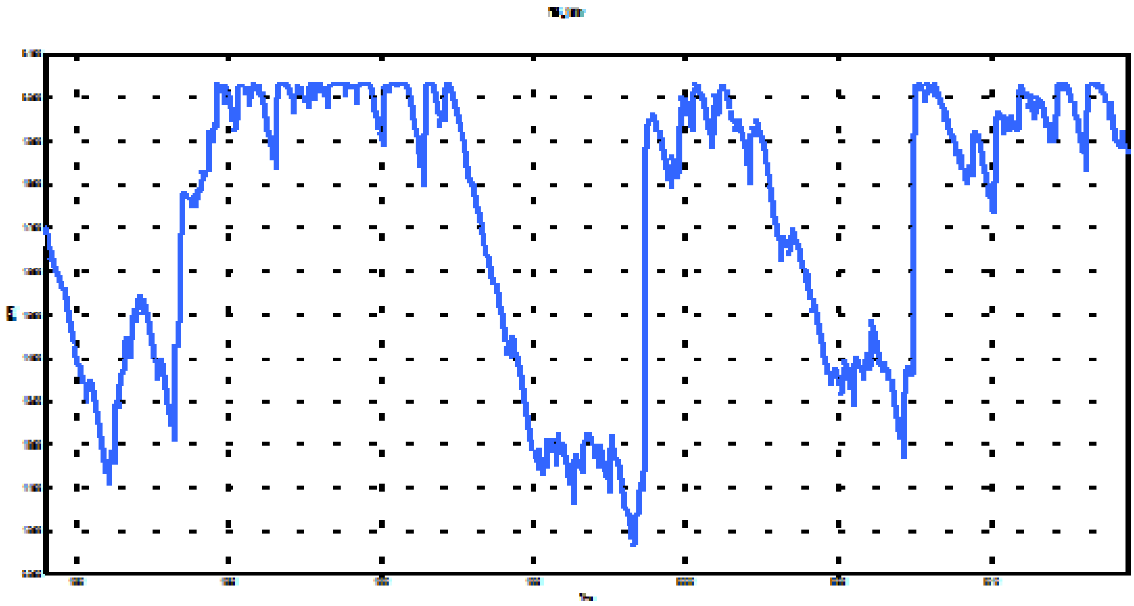


Figure 36 - Modelled Historical Volume (ML) at #280 (Lake Burragorang)

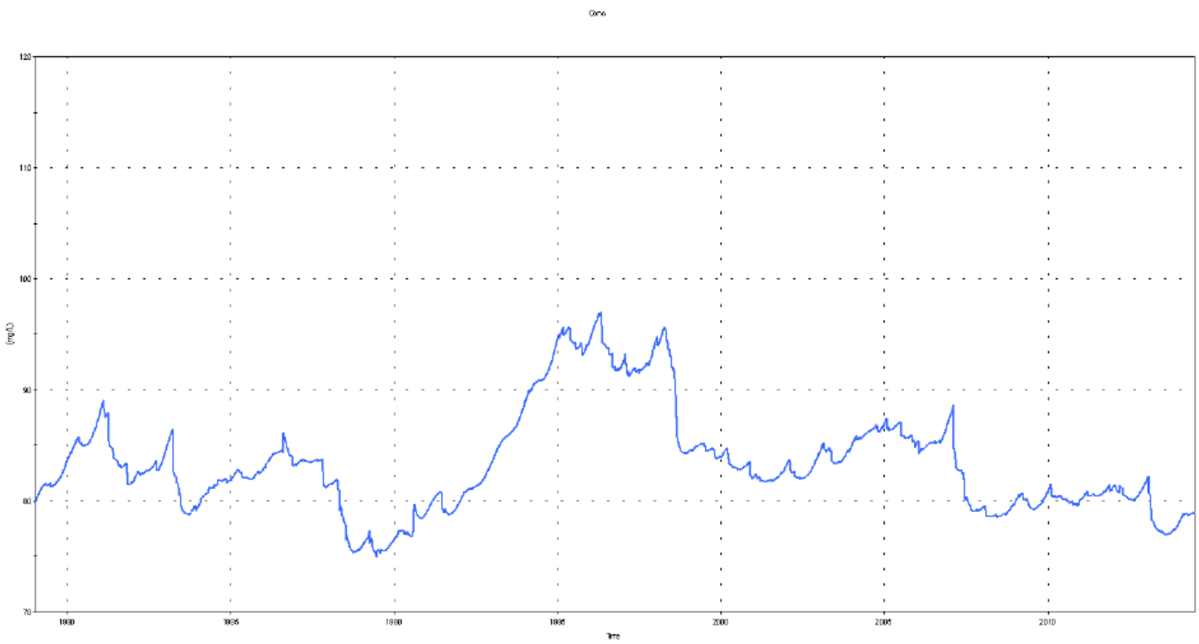


Figure 37 - Modelled Historical Salinity (mg/L) at #280 (Lake Burragorang).

The predicted volume (ML) (**Figure 38**) and salinity (mg/L) (**Figure 39**) in Lake Burragorang incorporating the proposed water management strategy at Angus Place and Springvale is presented below. The associated predicted daily salinity statistics is presented in **Table 18**.

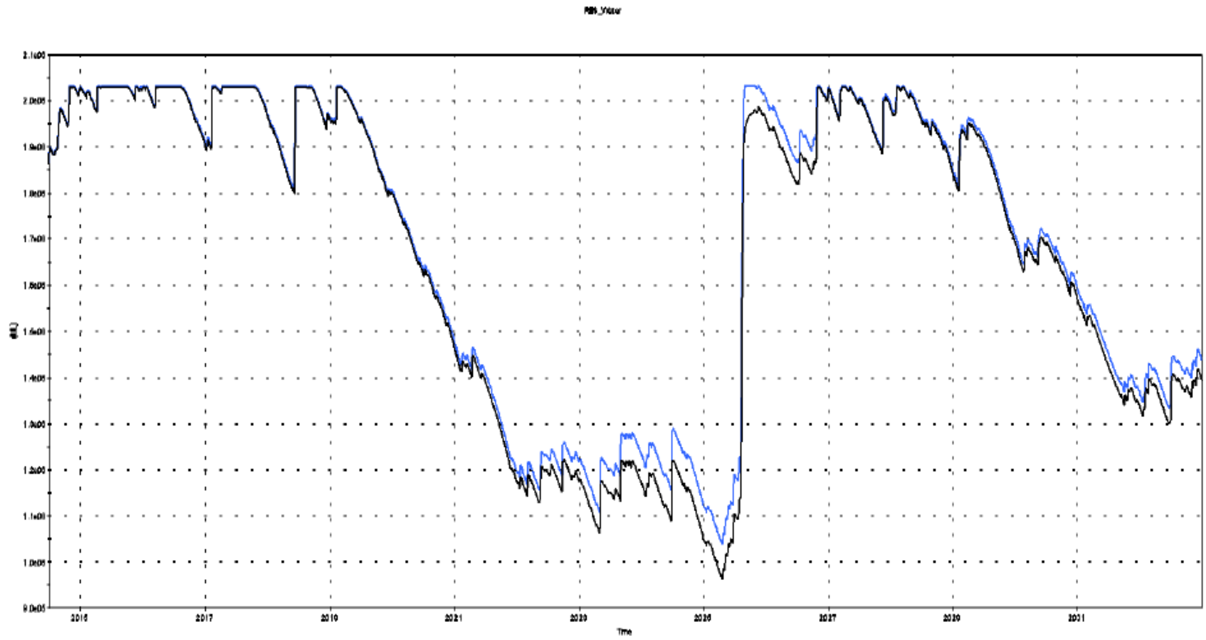


**Figure 38 - Predicted Volume (ML) at #280 (Lake Burragorang)
Blue is WS1 and Black is Null. It is noted that predicted volume in WS1 is identical at this location to WS2a and WS2b.**

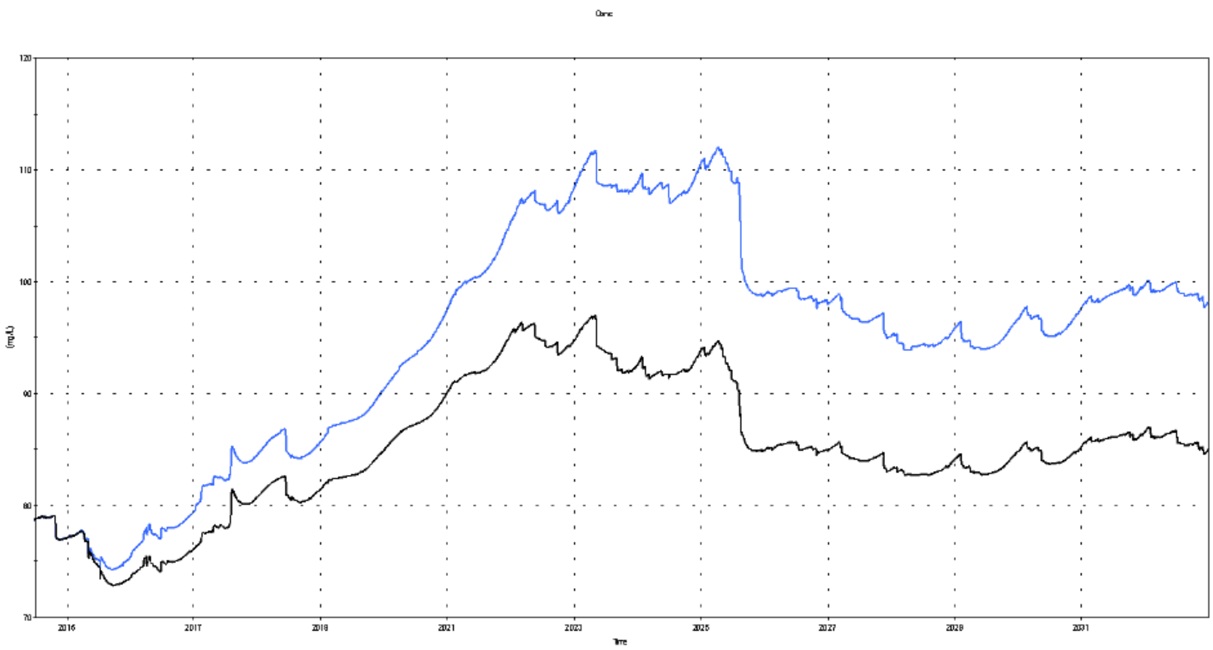


**Figure 39 - Predicted Salinity (mg/L) at #280 (Lake Burragorang)
Blue is WS1 and Black is Null. It is noted that predicted volume in WS1 is identical at this location to WS2a and WS2b.**

Table 18 - Predicted Daily Salinity Statistics (mg/L) at #280 (Lake Burragorang).

Percentile	CAL	NUL	WS1	WS2a	WS2b
Minimum	75	73	74	74	74
5%	77	75	77	77	77
10%	79	77	78	78	78
20%	80	81	85	85	85

Percentile	CAL	NUL	WS1	WS2a	WS2b
50%	83	85	97	97	97
80%	86	87	104	104	104
90%	92	94	108	108	108
95%	94	95	109	109	109
Maximum	97	97	112	112	112

Table 19 and

Table 20 summarise the water flow and the water quality at the sites assessed.

Table 19 - Summary of Predicted Daily Flows (ML/d) in the Coxs River catchment

Location	Node	NU	WS1[1]	WS2a[1]	WS2b[1]
Kangaroo Creek and Coxs River above Wangcol Creek/Blue Lagoon					
Kangaroo Creek downstream of Angus Place LDP001	#011	0.5(0.0-458)	26.1(5.4-474)	2.9(2.0-460)	2.5(2.0-460)
Coxs River above Wangcol Creek/Blue Lagoon	#056	1.4(0.0-1613)	27.4(6.9-1629)	5.1(2.0-1616)	3.4(2.0-1616)
Sawyers Swamp Creek					
Sawyers Swamp Creek downstream of Springvale LDP009	#014	0.2(0.0-170)	14.4(0.0-186)	28.0(3.0-199)	28.0(3.0-199)
Sawyers Swamp Creek above Coxs River	#166	0.2(0.0-223)	14.5(0.0-239)	28.2(3.0-252)	28.2(3.0-252)
Lake Wallace					
Coxs River above Lake Wallace	#047	10.3(4.4-5,577)	47.9(13.3-5,607)	as per WS1	as per WS1
Lake Wallace	#074	n/a	n/a	as per WS1	as per WS1
Lake Lyell and above Lake Lyell					
Coxs River above Lake Lyell	#154	12.7(0.1-10,223)	48.7(6.7-10,254)	as per WS1	as per WS1
Lake Lyell	#174	n/a	n/a	as per WS1	as per WS1
Thompsons Creek Reservoir					
Thompsons Creek Reservoir	#272	n/a	n/a	as per WS1	as per WS1
Lake Burragorang and above Lake Burragorang					
Coxs River above Lake Burragorang	#225	75.7(2.7-65,977)	86.9(9.0-68,789)	as per WS1	as per WS1
Lake Burragorang	#280	n/a	n/a	as per WS1	as per WS1

1. The format of presented model results is median (minimum to maximum);

Table 20 - Summary of Predicted Daily Salinity (mg/L) in the Coxs River catchment.

Location	Node	NUL[1,2]	WS1[1]	WS2a[1]	WS2b[1]
Kangaroo Creek and Coxs River above Wangcol Creek/Blue Lagoon					
Kangaroo Creek downstream of Angus Place LDP001	#011	50(50-68)	789(75-804)	698(55-804)	664(55-804)
Coxs River above Wangcol Creek/Blue Lagoon	#056	50(50-89)	761(63-804)	538(57-804)	498(57-804)
Sawyers Swamp Creek					
Sawyers Swamp Creek downstream of Springvale LDP009	#014	50(50-50)	761(50-804)	799(160-804)	800(160-804)
Sawyers Swamp Creek above Coxs River	#166	51(50-379)	751(50-804)	799(154-804)	799(154-804)
Lake Wallace					
Coxs River above Lake Wallace	#047	599(107-771)	755(111-797)	as per WS1	as per WS1
Lake Wallace	#074	321(91-552)	604(79-747)	as per WS1	as per WS1
Lake Lyell and above Lake Lyell					
Coxs River above Lake Lyell	#035	231(50-540)	552(67-740)	as per WS1	as per WS1
Lake Lyell	#174	223(127-462)	422(145-566)	as per WS1	as per WS1
Thompsons Creek Reservoir					
Thompsons Creek Reservoir	#272	276(237-471)	477(314-613)	as per WS1	as per WS1
Lake Burragorang and above Lake Burragorang					
Coxs River above Lake Burragorang	#225	90(50-217)	153(52-503)	as per WS1	as per WS1
Lake Burragorang	#280	85(73-97)	97(74-112)	as per WS1	as per WS1

1. The format of presented model results is median (minimum to maximum); 2. It is noted that minimum salinity in water quality model was 50mg/L.

From the above, the proposed discharge by the Angus Place and Springvale MEPs to the Coxs River lead to a marginal increase in salinity in Lake Burragorang compared to the null case. In the null case, median salinity is 85 mg/L and is 97 mg/L under WS1, WS2a and WS2b scenarios. There is a small positive impact to volume in Lake Burragorang due to the projects.

SCA has adopted a risk assessment based approach to water quality management (SCA, 2012). As part of that management framework, SCA have developed a Pollution Source Assessment Tool. The outcomes of that work identified the five most significant pollution sources in the catchment which, in general, relate to faecal contamination and/or nutrients (phosphorous and nitrogen). They include the following:

- grazing
- intensive animal production
- on-site wastewater management systems
- sewage collection systems
- urban stormwater.

As outlined in SCA's Annual Water Quality Monitoring Report 2012-2013 (SCA, 2013), water quality management is focussed on:

- Australian Drinking Water Guidelines (health-related)
- Raw Water Supply Agreements (in this case Prospect Water Filtration Plant).

The relevant target water quality parameters are reproduced below from SCA (2013).

Table 21 - SCA Target Raw Water Supply Agreement water quality characteristics for Lake Burragorang

PARAMETER	Prospect WFP	Warragamba WFP Orchard Hills WFP	Macarthur WFP Value of Parameter Based on Demand Range (ML/d)				Illawarra WFP	Woronora WFP	Nepean WFP	Cascade WFP	Kangaroo Valley WFP	Wingecarribee † WFP
			185-<265	125-<185	80-<125	<80						
Turbidity (NTU^)	40	40	10	25	50	60	10	10	150	15	20	40
True colour (CU^)	60	60	40				50	70	60	60	70	70
Iron (mg/L^)	3.5	3.5	0.6	0.8	1.1	1.3	1.1	1	5	3	1.1	1.1
Manganese (mg/L^)	1.4	1.4	0.2	0.25	0.3	0.35	0.4	0.1	1.5	0.3	NA	NA
Aluminium (mg/L^)	2.6	2.6	0.4	0.5	0.75	0.95	1.4	0.4	1.0	0.2	NA	NA
Hardness (mg/L as $CaCO_3$)	25 – 70	25 - 70	6 – 30	6.0 – 32.2			0 – 30	2 – 30	2 – 35	0 – 40	0 – 36.5	0 - 36.5
Alkalinity (mg/L as $CaCO_3$)	15 – 60	15 - 60	0 - 15				0 – 10	0 – 15	0.5 – 25	0 – 30	0 - 29	0 - 35
pH (pH units)	6.3 – 7.9	6.3 - 7.9	5.7 – 7.7				6.2 – 7.2	5.1 – 7.5	4.8 – 7.7	6.0 – 7.9	6.5 – 8.5	6.5 – 8.5
Temperature (°C)	10 – 25	10 - 25	8 - 25				10 – 25	10 – 25	10 – 25	10 – 25	NA	NA
Algae (ASU)	1000*	2000	**see note				5000	5000	2000	2000	5000	5000

* Maximum for Prospect WFP is 1000 ASU, except if turbidity is greater than 10NTU or true colour is greater than 30 CU, then the maximum algae criterion will be 500 ASU.
** Algal limits for Macarthur WFP (average of 3 samples): 500 ASU small individual cells (<10µm) of filamentous or colony-forming species or 100 ASU large cells (>10µm) of branching or gelatinous species.
^ Upper limits are shown for these parameters.
† Same arrangement for Goulburn-Mulwaree Council for water supplied via the Goulburn pipeline

Table 22 - SCA Target Health-related water quality characteristics for Lake Burragorang

	Specific Water Characteristic	ADWG (2011) Health Guideline
SYNTHETIC ORGANICS – RADIOLOGICAL - PESTICIDES	Amitrole	0.0009 mg/L
	Atrazine	0.02 mg/L
	Chlorpyrifos	0.01 mg/L
	2,4-D	0.03 mg/L
	2,4,5-T	0.1 mg/L
	Diazinon	0.004 mg/L
	Diquat	0.007 mg/L
	Diuron	0.02 mg/L
	Glyphosate	1.0 mg/L
	Heptachlor	0.0003 mg/L
	Hexazinone	0.4 mg/L
	Triclopyr	0.02 mg/L
	Gross alpha	0.5 Bq/L
	Gross beta	0.5 Bq/L
	Benzene	0.001 mg/L
	1,2-Dichloroethane	0.003 mg/L
	1,2-Dichloroethene	0.06 mg/L
	Hexachlorobutadiene	0.0007 mg/L
	Vinyl chloride	0.0003 mg/L
CHEMICAL/BIOLOGICAL/ORGANIC	Arsenic	0.01mg/L
	Barium	2 mg/L
	Boron	4 mg/L
	Iodide	0.5 mg/L
	Mercury	0.001 mg/L
	Molybdenum	0.05 mg/L
	Selenium	0.01 mg/L
	Silver	0.1 mg/L
	Tin	N/A
	Beryllium	0.06 mg/L
	Escherichia coli	Seek advice from NSW Health and liaise with customers if the thresholds for these analytes in Raw Water Quality Incident Response Plan are exceeded
	Enterococci	
	Clostridium perfringens	
	Cryptosporidium	
	Giardia	
	Toxin producing cyanobacteria	
	Toxicity	
	Cyanobacteria biovolume	

Footnotes

1 Section shaded yellow contains health related water quality characteristics – these characteristics must not exceed Australian Drinking Water Guidelines (NHMRC, 2011) in raw water supplied for treatment.

2 Section shaded blue contains characteristics for which drinking water guidelines exist although these are not applicable for raw water. However, SCA must endeavour to supply the best quality raw water available so that it can be treated to meet Australian Drinking Water Guidelines.

From the above, there is no target for salinity since ADWG do not have a health-based water quality criterion. There is also no target for salinity for the Prospect Water Filtration Plant with respect to Raw Water Supply Agreement. As identified in the SSTV Assessment (**Appendix 3**), other water quality characteristics meet the ADWG and the Raw Water Supply Agreement specifications.

The predicted minor increase in salinity from 85 mg/L to 97 mg/L in Lake Burragorang due to the Angus Place and Springvale MEPs is therefore considered to have a neutral effect with respect to the Neutral or Beneficial Effect test criteria.

Discrepancies identified in what the Project estimates will be the mine water discharge volumes from both Angus Place and Springvale combined for each year. The total volume of predicted

mine water each year to be discharged to LDP's and the SDWTS from both mines should be the same. (EPA)

The predicted mine inflows from Angus Place Colliery and Springvale Mine during the MEPs are not expected to be the same. The mine inflows for each project has been predicted using a numerical groundwater model developed by CSIRO; the numerical computer code selected for the assessment of mining related impacts on groundwater and associated environmental values was COSFLOW. As noted in Section 6 of the Groundwater Impact Assessment (Appendix E) for each project the overall objective of the model was to assess the potential impacts of the MEPs, specifically with regard to:

- Predicted mine inflow (and dewatering) rates;
- Regional changes in groundwater levels during mining and after mine closure;
- Changes in baseflow contributions to surface watercourses and shrub swamps; and
- Potential impacts to any existing groundwater users and groundwater dependent ecosystems.

The model has been constructed to a level consistent within the groundwater modelling guidelines and has been peer reviewed by Dr Noel Merrick (Heritage Computing Pty Ltd) in accordance with the NSW Aquifer Interference Policy requirements.

The predicted mine inflows for Angus Place Angus Place Colliery and Springvale Mine for the years 2013 - 2032, and the combined mine inflows both mines are shown in Figure 10.11 of each EIS and Figure 16 in the Angus Place and Figure 18 in the Springvale Surface Water Impact Assessment reports (Appendix F). The predicted mine inflows for each mine were used in the respective site water balance, and for the determination of volumes of water to be discharged to the licensed discharge points at Angus Place Colliery (LDP001 and LDP002 (EPL 467)) and Springvale Mine (LDP001 and LDP009 (EPL3067)). Table 5.2 from the Surface Water Impacts Assessment reports (Appendix F) for each project provides mine inflow data for discharge at LDPs and transfer to the SDWTS. These tables have been updated to include the total mine water discharges from each mine to Coxs River and provided in **Appendix 12** of the RTS. The tables in **Appendix 12** have also been updated to include mine inflows for the scenario where the SDWTS is not available to Angus Place Colliery and both Angus Place Colliery and Springvale Mine discharge separately to Coxs River.

As noted above the mine inflows from Angus Place Colliery and Springvale Mine are not expected to be the same. As presented in the Angus Place Groundwater Impact Assessment (Appendix E), regional groundwater flow direction is to the northeast toward the Wolgan Valley. As such, the Angus Place proposed longwall area is hydrogeologically down-gradient to Springvale Mine and hence inflows from Angus Place Colliery are higher than Springvale Mine.

OEH is aware that electricity generation from Wallerawang Power Station has been suspended, a process that began in early 2014. The EIS has not been updated to reflect this change in circumstances. OEH assumes, therefore, that the proposal would result in a significant increase in waste water being discharged via the licenced discharge point into Coxs River, with none of the mine water being utilised for power production. OEH considers that the EIS and associated documents need to be revised to take into account the closure of Wallerawang Power Station. In particular, the expected discharges and associated impacts on the Coxs River need to be re-assessed. (OEH)

A regional water quality impact assessment has been undertaken to assess the impact of direct discharge at Angus Place LDP001 and Springvale LDP009. The assessment is provided as **Appendix 2** to this RTS.

3.1.27 Water Quality

Salinity predictions have been undertaken for the location below the confluence with the Coxs River, not where discharge occurs in Kangaroo Creek. No predictions are made on what would be an expected increase in salinity compared to the current conditions at the discharge point LDP001. The SCA notes that there is currently a Pollution Reduction Program (PRP) on EPL467 with respect to discharge at LDP001 which requires a reduction in salinity levels from 1,100 to 350µS/cm. (SCA)

The Regional Water Quality Impact Assessment presents the predicted impact to Kangaroo Creek immediately downstream from the point of discharge Angus Place LDP001.

With respect to the PRP programme on EPL 467, Centennial has undertaken Site Specific Trigger Values (SSTVs) Assessment for Angus Place LDP001. Results of the SSTV analysis indicate that current water quality at Angus Place LDP001 meets ANZECC 95% protection of aquatic ecosystems except for Copper and Zinc. For Copper and Zinc, current water quality at Angus Place LDP001 meets 80th percentile upstream water quality at downstream edge of mixing zone. Further detail is presented in the SSTV Assessment provided as **Appendix 3**.

Salinity predictions have not been undertaken for scenario (1) no upgrade of SDWTS and (2) no SDWTS availability and all mine discharges (28.6ML/day) being discharged to the Kangaroo Creek and Coxs River. (SCA)

The Regional Water Quality Impact Assessment (**Appendix 2** to this RTS) presents this scenario.

Salinity predictions have not been undertaken when excess inflows, more than the Wallerawang power station demand of 30 ML/d, is proposed to be discharged at LDP009, at a point immediately upstream of Lake Wallace. (SCA)

The Regional Water Quality Impact Assessment (**Appendix 2** to this RTS) has assessed the potential impact under this scenario.

There is no assessment on whether elevated salt levels are likely in the Coxs River where it enters Lake Burragorang. (SCA)

The Regional Water Quality Impact Assessment (**Appendix 2** to this RTS) presents the predicted increase in salinity in Lake Burragorang. Modelling indicates an increase in median salinity from 85mg/L to 97mg/L under the proposed water management strategy.

The model predictions for the average Coxs River salinity should include an envelope around the average showing 10th and 90th percentiles. (SCA)

The Regional Water Quality Impact Assessment (**Appendix 2** to this RTS) includes a low rainfall climate (10th percentile 19 year rainfall total) and a high rainfall climate (90th percentile rainfall total). These results are presented in the water quality impact assessment as uncertainty analysis.

The EIS states that based on data available, the estimated error in predictions is approximately ±30%. It is not clear if the upper limits would still fall within an acceptable level of impact. (SCA)

The 30% error margin was suggested in the GHD Water and Salt Balance Assessment due to the modelled components assumed to rely on “less reliable data”. The Regional Water Quality Impact Assessment (**Appendix 2** to this RTS) has reduced this level of uncertainty via calibration to observed flow and salinity in the Coxs River. The assumed salinity of mine water make at 1,200µS/cm (804mg/L) is at the upper end of the range of historical observation. Uncertainty analyses have been undertaken with respect to high rainfall and low rainfall conditions.

The SCA is concerned about the proposal to transfer mine water to the local power stations (Mt Piper and Wallerawang) which the SCA understands will have limited and reduced availability due to the recent decision to place the Wallerawang power station in care and maintenance. As a consequence, there may be additional discharges of mine water into receiving watercourses of approximately 30 ML/d from this project. These discharges would further impact the quality of receiving waters and the EIS has not addressed this issue. The SCA considers that the Proponent should• either consider an alternative opportunity for mine water reuse or treatment of mine water to a higher level before discharge. (SCA)

Centennial Angus Place and Springvale Coal have undertaken additional regional water quality modelling to assess potential water quality impacts in light of the recent change in status of the Wallerawang Power Station and reduced water demand. This assessment is attached as **Appendix 2**.

A water management option study was prepared by Centennial in response to a PRP condition added to the EPL on Angus Place LDP001. It did not identify an economically feasible alternative.

The discharge from Angus Place LDP001 to Kangaroo Creek (a tributary of the Coxs River) actually represents the first major impact of mine water discharges on the Coxs River. Conductivity in Kangaroo Creek is increased from a median level of 51 micro- Siemens per centimetre (µS/cm) Electrical Conductivity upstream of LDP001 to 900 µS/cm downstream of LDP001 (GHD 2010; Figures of 651 µS/cm upstream and 770 µS/cm downstream are given in the EIS Table 3.9). This represents a 12-fold to 18-fold increase in median conductivity in Kangaroo Creek as a result of the Angus Place LDP001 discharge, and as previously mentioned in the cover letter currently the subject of a PRP. Upstream of the confluence of Kangaroo Creek and the Coxs River the median concentration for conductivity was 107 µS/cm while median concentration in the Coxs River downstream of this confluence was 513 µS/cm (Angus Place (Angus Place EIS Table 3.9). This represents an almost 5-fold increase in median conductivity in the Coxs River likely to be due in large part to the Angus Place LDP001 discharge. (EPA)

It is acknowledged that salinity in Kangaroo Creek increases downstream of the discharge at LDP001. However as discussed previously, the proposed mine extensions will not result in any further deterioration in water quality from the currently approved discharge.

An assessment of site specific trigger values (SSTV) has been undertaken for Angus Place LDP001 and Springvale LDP009. The only analytes whose median concentrations were found to exceed the ANZECC guidelines for protection of aquatic ecosystems were Salinity, as EC, Copper (Springvale LDP009 only) and Zinc. At both Angus Place LDP001 and Springvale LDP009, Copper and Zinc are also found to be elevated in the upstream sampling points.

Further discussion with regard to these analytes is provided in the SSTV analysis attached as **Appendix 3** to this RTS.

Following public exhibition of the EIS, a review of the EPA Direct Toxicity Assessment on Springvale's LDP009 discharge was undertaken by GHD (**Appendix 9** to this RTS). Following the review, an additional Direct Toxicity Assessment, provided as **Appendix 10** to this RTS, was carried out on discharge water from LDP001 at Angus Place and LDP009 at Springvale. The methodology for the Direct Toxicity Assessment was approved by the EPA in August 2014. The results of the Direct Toxicity Assessment show that there is no toxicity associated with the Discharge water from LDP001. Although toxicity has been observed at LDP009, it has been demonstrated that neither the EC or bicarbonate concentrations have any effect on the toxicity of the water. Lowering the EC may have a detrimental effect on the system as shown by the high toxicity at sites upstream of LDP001. The chemistry of water quality discharged through LDP009 does not point to any source in particular that is leading to the toxicity being observed. As such, Centennial proposes to undertake further investigations into the toxicity of LDP009 water discharge to identify the cause of the toxicity. Without knowing what is causing the toxicity, the application of a treatment system is premature as you won't know what you are treating for. As such, no additional treatment of mine water is considered necessary at this stage.

The Angus Place EIS acknowledges that salinity in the Coxs River is currently in excess of ANZECC guidelines for the protection of aquatic ecosystems and that modelling indicates that salinity will increase due to the extension of Angus Place Colliery. However, the EIS maintains that aquatic and riparian ecosystems are adapted to this environment and predicated salinity is within the range experienced historically in the Coxs River catchment. These conclusions are not supported by the research work of Department of Environment, Climate Change and Water scientists in September to October 2009 that had found that salinity levels in the Coxs River had increased since the 1980's, and that the aquatic ecosystems were now dominated by pollution tolerant taxa, and that Kangaroo Creek downstream of the Angus Place discharge at LDP001 was found to have an impoverished diversity of macroinvertebrate fauna. (EPA)

The Aquatic Ecology assessment found that the aquatic habitat and quality of water in the upper Coxs River are both degraded but despite this aquatic biota was relatively diverse. It was found that the current discharge from LDP001 appeared to have some adverse effects on the condition of the aquatic habitats and quality of water at Kangaroo Creek downstream (Site KCdn) and Coxs River downstream of the confluence of Kangaroo Creek (Site CR2), however its effect on biological indicators is less clear with only SIGNAL2 and AUSRIVAS scores being poorer on average at Kangaroo Creek downstream of LDP001 than at Kangaroo Creek upstream of LDP001, and macrophytes being less diverse at CR2 than CR1.

The Aquatic Ecology assessment Section 7.2.1.3 states that:

"a review of the effects of salinity on aquatic biota in Australian freshwater systems indicates direct adverse biological effects are unlikely to occur unless EC levels exceed around 1000 mg/L (approximately 1,500 µS/cm) (Hart et al. 1991). This suggests that the aquatic biota in the river is unlikely to be impacted by the salinities resulting from the change in discharge."

It was assessed that the likely impact of the change in flows and quality of the water on the aquatic flora and fauna would be moderate in the immediate receiving waters of Kangaroo Creek and small to moderate in the Coxs River below the confluence.

Further to the water quality issues, it was found that increased flow due to the discharges may result in more stable aquatic habitats and conditions that are more conducive to the establishment and growth of aquatic macrophytes.

The 2010 State of the Catchment assessment for the Hawkesburry-Nepean Region returns a Very Good to Moderate score for macroinvertibrate condition in the Upper Coxs River.

No direct modelling of impacts on Kangaroo Creek were undertaken for the EIS, however, this is addressed in the regional water impact assessment provided as **Appendix 2** to this RTS

Following public exhibition of the EIS, a review of the EPA Direct Toxicity Assessment on Springvale's LDP009 discharge was undertaken by GHD (**Appendix 9** to this RTS). Following the review, an additional Direct Toxicity Assessment, provided as **Appendix 10** to this RTS, was carried out on discharge water from LDP001 at Angus Place and LDP009 at Springvale. The methodology for the Direct Toxicity Assessment was approved by the EPA in August 2014. The results of the Direct Toxicity Assessment show that there is no toxicity associated with the Discharge water from LDP001. Although toxicity has been observed at LDP009, it has been demonstrated that neither the EC or bicarbonate concentrations have any effect on the toxicity of the water. Lowering the EC may have a detrimental effect on the system as shown by the high toxicity at sites upstream of LDP001. The chemistry of water quality discharged through LDP009 does not point to any source in particular that is leading to the toxicity being observed. As such, Centennial proposes to undertake further investigations into the toxicity of LDP009 water discharge to identify the cause of the toxicity. Without knowing what is causing the toxicity, the application of a treatment system is premature as you won't know what you are treating for. As such, no additional treatment of mine water is considered necessary at this stage.

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It is important however that the current water quality conditions will be maintained and it is recommended that this commitment is reflected in the conditions of approval. (OAS&FS)

The regional water quality impact assessment provided as **Appendix 2** to this RTS presents the predicted increase in salt in Lake Burragorang due to the Angus Place and Springvale MEPs. Modelling indicates that median salinity will increase from 85 mg/L to 97 mg/L under the proposed water management strategy. As noted in Section 3.1.25 SCA's water quality monitoring framework does not include salinity. As presented in the SSTV Assessment (**Appendix 3** to this RTS), other water quality criteria of mine water discharge meet Australian Drinking Water Guideline values as well as Sydney Water specifications for the Prospect Water Filtration Plant.

Water quality impact estimations for the Coxs River need to consider increased discharge volumes to Coxs River resulting from reduced demand from the Wallerawang Power Station. The assessment of mine water discharges needs to consider the resulting cumulative concentrations of a range of contaminants, in addition to salt, within Coxs River. (DotE)

A detailed response has been provided in Section 2.1 of **Appendix 16**.

Are the cumulative water quality impacts of discharges to the Coxs River accurately and reasonably described? (DotE)

The cumulative water quality impacts of Angus Place and Springvale mine water discharges to the Coxs River, an important contributing source to Sydney's drinking water supply, were not modelled for all relevant contaminants, did not consider all likely discharge conditions, and are therefore not accurately and reasonably described. (DotE)

Salinity was the only water quality variable modelled for cumulative impacts. The cumulative impact of other contaminants was not provided, even though the EIS states (Appendix C within Appendix F) that levels of copper, zinc, nitrogen and phosphorus have been elevated above ANZECC 95th percentile protection level for slightly to moderately disturbed ecosystems. The contributing water quality impacts to Coxs River from other mines in the area are not quantified. (DotE)

Water quality impact estimations for the Coxs River for both Angus Place and Springvale were conducted for scenarios that included the transfer of large volumes of water through the Springvale Delta Water Transfer Scheme (SDWTS) to the Wallerawang Power Station. This may no longer be a viable option because the Wallerawang Power Station has been placed into care and maintenance. Increased discharge volumes resulting from reduced demand from the Wallerawang Power Station would affect the outcome of the cumulative water quality impact assessment and should be considered as a potential discharge scenario. (DotE)

A detailed response has been provided in Section 2.2 of **Appendix 16**.

Is the information provided sufficient to predict any changes to either water quality or water quantity in the Coxs River at Kelpie Point which would arise as a result of the mining operation? (Kelpie Point – station no. 563000 – is located on the Coxs River close to its entry location into Warragamba Dam. The Sydney Catchment Authority has undertaken flow and quality monitoring at this location for extended periods). (DotE)

The proponent's estimation of downstream impacts was limited to site water balance and cumulative salt mass balance modelling that did not model impacts beyond the upper Coxs River catchment (i.e. not downstream of Lake Lyell). In addition, the existing condition of the Coxs River was not adequately described and the downstream impact modelling that was undertaken included transfer of large volumes of water through the SDWTS to the Wallerawang Power Station, which may no longer be a viable option. (DotE)

A detailed response has been provided in Section 2.2 of **Appendix 16**.

What are the predicted changes to water quality water quantity in the Coxs River at Kelpie Point and what are the consequences for stored water within Warragamba Dam? (DotE)

Water quantity and quality changes in the Coxs River at Kelpie Point cannot be reliably estimated based on the information presented in the EIS documentation, as detailed in the response to Question 7. For similar reasons, the consequences for stored waters in Warragamba Dam also cannot be reliably estimated from information in the EIS. (DotE)

A detailed response has been provided in Section 2.2 of **Appendix 16**.

Protection of the long-term ecosystem health of Coxs River should include consideration of the ANZECC and ARMCANZ (2000) Guidelines, through an agreed set of approval trigger discharge values and management protocols. Where salinity or other contaminants of concern are likely to exceed trigger values, management and treatment options may include, but are not limited to, reverse osmosis and ion exchange technologies. (DotE)

A detailed response has been provided in Section 2.2 of **Appendix 16**.

3.2 Response to Special Interest Group Submissions

3.2.1 Biodiversity Offset Strategy

The Director General's requirements for the offset strategy require Centennial Coal to develop 'An offset strategy, which is clearly quantified, to ensure that the development maintains or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term'. Centennial Coal and RPS have taken a miserly interpretation of this direction. (LEG and Colong Foundation)

Noted.

Only Matters of National Environmental Significance and Endangered Ecological Communities are considered in relation to indirect impacts. For example, the offset analysis has not been applied to the 200 hectares of the Birds Rock Flora Reserve that will be damaged by the proposed mining. (LEG and Colong Foundation)

The Flora and Fauna Impact Assessment for the Angus Place MEP includes consideration of the biodiversity values of the Birds Rock Flora Reserve and the potential impacts of the Project to the Reserve.

Centennial claim that 'the residual impacts following avoidance and mitigation are not significant, as such direct offsets are not required'. Centennial, having found themselves not responsible for impacts, magnanimously offers an offset 'provision of land to compensate potential impacts' to these nationally endangered swamps. (LEG and Colong Foundation)

Noted.

Centennial Coal proposes to protect for the conservation by setting aside 342.2 hectares of former farmland in the Capertee Valley it claims may have 160 fauna species and various endangered communities. None of the proposed offset compensate 'like-for- like' the loss of nationally endangered swamps or the impacted Tablelands Snow gum - Black Sallee, - Candlebark and Ribbon Gum Grassy Woodland on or below Newnes Plateau. (LEG and Colong Foundation)

The EPBC Environmental Offsets Policy requires offsets to be considered where there is a residual impact following measures to avoid and mitigate. Particular consideration, in the context of the residual impacts, should be given to the attributes being impacted, how important that attribute is to the ecology of the MNES and how much the attribute is being impacted (that is, the scale of the impact). The offset package should consider the improvements that the offset will deliver for the attribute being impacted and the level of averted loss resulting from the proposed offset with a view to achieving a minimum conservation gain.

The Flora and Fauna Impact Assessments for the Springvale MEP and the Angus Place MEP conclude that there will be no significant impact to MNES, including the THPSS. Chapter 2 of the EIS for each project provides details on the investigation efforts undertaken to establish the mechanisms that could lead to a mining related impact to THPSS and associated fauna species. These investigations have concluded that there are a number of causal factors that, in combination, would result in impacts occurring. Where any one of these causal factors can be avoided, the causal linkage to impact will not be realised. These causal factors and the management controls implemented by Springvale Coal are detailed in in Table 2.6 of the EIS.

Whilst the combination of these assessments have concluded that there will be no significant impact to MNES, and therefore no requirement for a direct offset, Centennial has committed to improving the quality of THPSS within its Project Application Area for each Project through its Revised Regional Biodiversity Strategy. The Regional Biodiversity Strategy a management strategy (detailed below) for the management of indirect and residual impacts to THPSS where mitigation measures are not successful. This management strategy, and the approach to developing it, is described in detail in **Appendix 4**, and summarised below:

- To ensure impacts to THPSS are within those predicted within the Springvale MEP EIS and the Angus Place MEP EIS, Centennial will:
  - Undertake annual monitoring for ecosystem health using the University of Queensland Monitoring Handbook (Flora monitoring methods for Newnes Plateau Shrub Swamps and Hanging Swamps, 2014) or its latest version.
    - The objectives of the University of Queensland Monitoring Handbook include, amongst other things:
      - A focus on vegetation community structure and diversity, including biological indicator species.
      - Trigger values focussed on detecting impacts of subsidence and/or changes in groundwater and surface water flows, including information on how the triggers were derived.
      - A sampling design that is statistically capable of detecting changes in the indicator variables.
      - An adaptive management mechanism for refining trigger values and determining the length of time a THPSS is monitored
    - The following figure, taken from the Monitoring Handbook, identifies how the data collected will be used to inform management decision making.

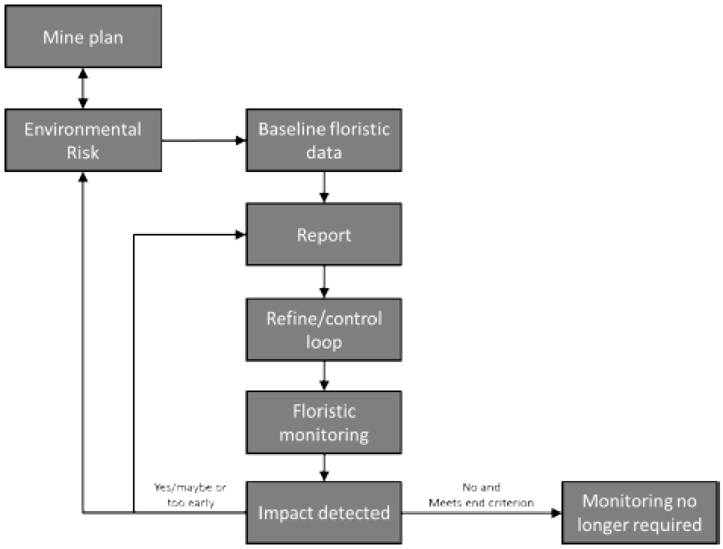


Figure 4.1: Conceptual framework showing how data from flora monitoring informs the environmental risk assessment and monitoring conclusions.

- Where this monitoring identifies mining related impacts, mitigation measures will be implemented (including soft and hard engineering measures discussed further in **Appendix 4**).
- Reconcile the annual monitoring every five (5) years (to allow for trend analysis to occur).
  - Where impacts, attributable to mining, are above triggers, additional mitigation will be undertaken.
  - Where impacts are attributable to mining and cannot be mitigated, or mitigation is not successful, offsets for the residual impacts will be provided.

This THPSS management strategy is considered to adequately compensate for the indirect impacts to that community.

When the EPBC Environmental Offsets Policy is applied to the THPSS, no direct offset is required.

Lot 135 also covers the new Angus Place Vent Shaft No 2 and Springvale Bore 8, as well as the Western Coal Services Upgrade Project. The proposed offset is also to cover, for reasons that are not explained, the Clarence Reject Emplacement Area VI. (LEG and Colong Foundation)

The Regional Biodiversity Strategy (revised August 2014) provides additional information on the Western Coal Services Upgrade Project, the Angus Place Ventilation Facility Project, the Springvale Bore 8 Project and the Clarence REA VI Project.

The total of 100 hectares of swamps and 31.5 hectares of native forest cleared for infrastructure for the two current mine extensions as explained in the tables 11 to 15 is misleading. It is unclear how much clearing and so-called indirect impacts on EEC are being compensated by this one

offset, perhaps an additional 200 hectares, perhaps much more land is directly impacted. (LEG and Colong Foundation)

Table 11 of the Regional Biodiversity Strategy identifies the native vegetation communities that will be directly impacted by the Springvale MEP, that is, the vegetation communities that will be cleared. Table 12 of the Regional Biodiversity Strategy identifies the native vegetation communities that may be indirectly impacted by the Project.

Table 13 and 14 provide similar information for the Angus Place MEP.

Table 15 and 16 provide similar information for the Neubeck Coal Project.

Offsets are required where the residual impacts, following avoidance and mitigation measures, are considered to be significant. Offsets are required for these types of residual impacts.

The subsidence, flora and fauna, and groundwater assessments undertaken for the Springvale and Angus Place MEPs concluded that there will be no significant impact to EECs as a result of these Projects. This is largely attributable to the mine design measures that have been implemented. As a result, the residual impacts are not significant and therefore no offset is required.

Direct offsets are required for impacts to MNES listed under the EPBC Act (Federal) or threatened species/endangered ecological communities listed under the TSC Act (NSW). As there are no direct impacts to MNES or threatened species/endangered ecological communities listed under the TSC Act, no direct offsets are required.

The omission of the total land area to be cleared and that ‘indirectly impacted’ means that the offset analysis in Appendix I does not comply with the Director General’s requirement for clear quantification. To be clear, the offsets for Angus Place Vent Shaft No 2 and Springvale Bore 8, Western Coal Services Upgrade Project and the Clarence Reject Emplacement Area VI are not quantified. (LEG and Colong Foundation)

The Regional Biodiversity Strategy (revised September 2014) provides additional information on the Western Coal Services Upgrade Project, the Angus Place Ventilation Facility Project, the Springvale Bore 8 Project and the Clarence REA VI Project.

Lot 135 DP 755757 is only 86.7 hectares in size (App I, section 6.2 and Table 17), so the earlier reference to ‘342.2 hectares of critically endangered ecological community and habitat for over 160 fauna species’ on page 3 is wrong. The area of endangered ecological community is very small. (LEG and Colong Foundation)

Table 1 within the Regional Biodiversity Strategy (revised September 2014) has been updated to include consideration of the contribution of each Project under the Strategy to the Offset Land.

Table 18 reveals that only 10 hectares of a critically endangered Box Gum Woodland and Derived Native Woodlands exists on the site. All the claimed threatened animals listed in Table

18 are not recorded from observation, rather it is claimed that the woodlands are 'very likely' to provide habitat for such wildlife (page 23 and note that title of Table 18 is species recorded in the site and locality. (LEG and Colong Foundation)

Section 6 of the Regional Biodiversity Strategy (revised September 2014) has been updated to include further detail on the biodiversity values of the Offset Land.

As non-threatened degraded woodland species are used for the credits, then non-threatened species for the indirectly impacted woodlands and forests on Newnes Plateau should also be part of the offset calculation. The proposed Angus Place extension covers 2,638 hectares and the proposed Springvale extension covers 1,860 hectares (including the 131.5 hectares of EECs and clearing). These impacted forests are part of a reserve proposal initially put forward by the National Parks and Primitive Areas Council in 1932. (LEG and Colong Foundation)

Noted.

The offset analysis is further confused by the statement that 'Both the Springvale Mine Project and the Angus Place Project will not impact upon 'credit species' and therefore only ecosystem credits are required' (Page 30, App. I). This statement is wrong. Giant Dragonfly, Blue Mountains Sink, and Boronia deanei will be impacted causing the loss of local populations. (LEG and Colong Foundation)

The subsidence, flora and fauna, and groundwater impact assessments for the Project concluded that the predicted changes in baseflow and average standing water levels are not of a magnitude that will cause swamp habitats to become unsuitable for these species. As a result, no offset is required.

The offset analysis does not properly consider naturally rare ecosystems, like the three swamp EECs and other Groundwater Dependent Ecosystems. In Table 21 all the Temperate Highlands Peat Swamps on Sandstone (BioBank Units 562 and 592, equivalent to MU's 50,51 and 52), for example, receive a total score of only -1,306 units and this is for damaging 100 hectares in 63 near-pristine EEC swamps. This score compares with a total score of -1,424 units given for clearing 23 hectares open forest and shrubby woodlands at the proposed Angus Place extension for facilities. The latter result seems reasonable for common sclerophyll forests and woodlands, the former result is grossly underestimated for swamps extending over five times the area being impacted by a key threatening process. (LEG and Colong Foundation)

The Ecosystem Credit Balance in Table 21 does not properly recognise the important value of these swamps and is completely unacceptable. The analysis demonstrates that reducing ecosystems to numbers does not inform decision making, but rather confuse the issue. (LEG and Colong Foundation)

The BioBank Assessment Methodology (BBAM) was applied to assess the offset requirements resulting from the proposal and the offset value of the Offset Land. The online Biobanking Credit Calculator was used for the Project to establish the credits likely to be sought by the Office of Environment and

Heritage. These assessment methodologies identify the ecosystems and species required to be considered.

The offset analysis is deficient as the values for known populations of threatened species at risk of local extinction are not individually calculated. (LEG and Colong Foundation)

Appendix 1 and Appendix 2 of the Flora and Fauna Impact Assessment for the Project includes consideration of the threatened species at risk of local extinction.

The statement regarding MU20 made on page 32 and in Table 23 is not reported in Table 17 and appears as double counting. It should be ignored. (LEG and Colong Foundation)

Table 23 of the Regional Biodiversity Strategy relates to both Lot 163 and Lot 135. Table 17 in the Regional Biodiversity Strategy relates to Lot 135 only.

Eliminating the 8 hectares of cleared derived grassland that appears to be cattle paddocks leaves just 2 hectares of a critically endangered community in the proposed offset. The proposed exchange of 2 hectares of critically endangered box gum woodlands on farmland for 100 hectares of diverse, intact EEC swamps is presented in a misleading manner. (LEG and Colong Foundation)

Section 6 of the Regional Biodiversity Strategy (revised September 2014) has been updated to provide further information on the biodiversity values of the Offset Land.

LEG does not consider the proposed research to be an appropriate supplementary measure for the loss of threatened plants and animals through development. Recovery plans and research are needed, but not at the expense of retaining important habitat. (LEG and Colong Foundation)

Noted.

3.2.2 Compliance

Between 2000 and 2012 1039 Incidents of Licence Non-compliance were recorded under Environmental Protection Licences (EPLs) issued to Angus Place (EPL 467) and Springvale Colliery (EPL 3607) under the Protection of the Environment Operations Act 1997 (POEO Act). None of these Non-compliances, Penalty Notices, or Pollution Reduction Notices are mentioned anywhere in the EIS. Why not? (LEG)

Any non-compliances are reported via Angus Place Colliery's EPL Annual Return and in the site's Annual Review reports. Both these documents are made publicly available. In addition, Centennial Angus Place reports any non-compliances to the Angus Place Colliery Community Consultative Committee (CCC) which meet two times a year. CCC minutes are made available on the Centennial Coal website (www.centennialcoal.com.au).

3.2.3 Consultation

None of the Colong Foundation's concerns were properly addressed. The Colong Foundation has not been approached by Centennial for a meeting in the last four years. Very few, if any, of the concerns raised by the Colong Foundation have been 'closed out' as suggested by Centennial in Table 7.1. The claim that 'Centennial will continue to consult and engage with these groups to achieve outcomes of the Consultation Strategy' has not been the Colong Foundation's experience in the last four years. (Colong Foundation)

Consultation between Centennial Coal and the Colong Foundation broke down in 2012. Consultation between Centennial Coal and the Colong Foundation prior to this is detailed in Section 7 of the EIS. On 14 September 2012 an email was sent from Centennial Coal to the Colong Foundation requesting their interest in the re-instatement of consultation. No response from the Colong Foundation was ever received.

3.2.4 Ecology

This project will adversely impact on important terrestrial and stream environments in 2,638 hectares of Newnes Plateau in a significant part of the Gardens of Stone region. (NCC)

Important terrestrial and stream environments in this significant part of the Gardens of Stone region must not be damaged by longwall mining (SCSGBM)

2,638 hectares of land is within the potential subsidence impact area. As detailed in Section 6.5 of the Flora and Fauna Impact Assessment, provided as Appendix H to the EIS, flora and fauna monitoring undertaken at Angus Place Colliery since 2005 has not recorded any losses to threatened species populations or EECs as a result of subsidence. This is due to appropriate mine design to limit subsidence to acceptable levels.

The mining layout for the Project has been designed to minimise the potential for impacts and so the majority of the cliffs and pagoda complexes are located outside the 26.5 degree angle of draw line from the extents of the proposed longwalls. No impacts are expected to these features and, subsequently, no impacts would be expected to potential habitats of those threatened species that may utilise these habitats.

No significant impacts to the dry woodland and forest habitats are predicted as a result of subsidence. Destabilisation of slopes is unlikely to be substantial such that it would significantly affect threatened flora or fauna that may occupy woodland environments.

Section 6.7.4 of the Flora and Fauna Impact Assessment includes an assessment of impacts on the Projects impacts on the Gardens of Stone National Park which is part of the Greater Blue Mountains Area (GBMA). The GBMA is a World Heritage Property and National Heritage Place which occurs to the immediate north of the Project Application and also occurs approximately 6 km to the east. DoE (2013) provides Significant Impact Assessment criteria for World Heritage Properties and National Heritage Places. The Flora and Fauna Impact Assessment includes an assessment of the potential impacts from the Project against the DoE criteria. In summary:

The proposed clearing of 23.24 ha is unlikely to reduce the diversity or modify the composition of plant and animal species within the GBMA. However, habitats for fauna species that may occupy both the Project Application Area and the GBMA as part of their home range will be subject to a minor reduction in habitat due to proposed clearing. The borehole compound that is closest to the GBMA will require just 1 ha to be cleared.

An assessment of the potential impacts upon the GBMA as a result of subsidence determined that whilst the area of the GBMA closest to the proposed longwalls could experience very low levels of vertical subsidence (i.e. less than 20 mm), it is not predicted to experience any measureable conventional tilts, curvatures or strains.

Watercourses within the eastern part of the Project Application Area flow into the GBMA via the Wolgan River and Carne Creek. The predicted changes in grade are small when compared to the existing natural grades along the alignment of the Wolgan River. It is unlikely, therefore, that there would be any significant changes in the levels of ponding, flooding or scouring of the river banks resulting from the extraction of the proposed longwalls. The potential impacts to Carne Creek, due to extension of mining at Angus Place, are also regarded as insignificant. Consequently, no impacts to water quality are anticipated to occur downstream within the GBMA.

Due to the above considerations, the Project is not expected to lead to indirect impacts from clearing, be significantly affected by subsidence or be affected by changes in water quality. Therefore, the Project is unlikely reduce the diversity or modify the composition of plant and animal species within any part of the GBMA.

No direct or indirect impacts are expected that would fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species, or habitat that is important for the conservation of biological diversity within the GBMA.

Consequently, the Project is not expected to cause a long-term reduction in rare, endemic or unique plant or animal populations or species within the GBMA.

The proposed construction of seven de-watering facilities will fragment the public forest and significantly adds to the burden of infrastructure on Newnes Plateau in the Gardens of Stone region. (NCC)

The potential Impacts of fragmentation as a result of land clearing for the Project was addressed in Section 6.4.1 of the Flora and Fauna Impact Assessment prepared by RPS to support the Project and provided as Appendix H to the EIS. In context of the Angus Place Surface Infrastructure footprint, the surface clearing to be undertaken is not regarded as contributing to the fragmentation of two or more separate vegetation patches. Removal of vegetation is proposed for dewatering facility sites with a maximum area of 110 x 90 m and a proposed ventilation facility with a road network connecting the sites with a maximum width of 10 m along its entirety.

The areas surrounding the surface disturbance areas remain a contiguous patch of vegetation with easy access to the current available habitats. These areas of clearing are not expected to prevent any known or potentially occurring fauna from traversing the areas or from gaining access to the surrounding vegetation.

Seed dispersal for flora is not expected to be hindered by the areas of clearing. Although the area of direct occupancy will be reduced marginally for a select few species that exist within the surface infrastructure footprint, they are not expected to be restricted in their ability to disperse naturally within the immediate surrounding environments.

It is also noted the proposed seven bore facilities in the Project will not exist concurrently. On commissioning of a new facility as mining progresses from the south to the north the old facility will be decommissioned and rehabilitated thus reducing cleared areas within the Project Application Area at any one time.

The sandstone strata supporting the 22 nationally endangered swamps, and particularly the 7 shrub swamps, will also develop a large number of fractures. Centennial predicts these cracks to be 5 to 50mm wide and 10 to 15 metres deep. All these nationally endangered swamps will dry out due to the lowered groundwater levels. The peat soils that support these swamps will then decompose. Over a period of years eucalypts and banksias will migrate into these dying swamps as they evolve into dry land communities. (NCC and Colong Foundation)

Centennial claims 'Longwall mining by the Project is unlikely to have a significant impact on swamps' even though longwalls 1016 and 1017 pass under Trail 6 swamp and others pass under Tri Star swamp. (Colo Committee)

One of the more important components of the Newnes Plateau environment is the system of shrub swamps (NPSS). The expansion of these mines would put at risk 17 swamps listed as nationally endangered, plus 31 hanging swamps. These swamps store water and release it gradually, maintaining stream flow even in drier periods. The loss of water into cracked streambeds upstream of, or under, these swamps leads to their desiccation and the complete destruction of the ecosystem in each affected valley. (BMCS)

The Lithgow Environment Group disputes that the impacts on the three EECs that comprise the Temperate Highlands Peat Swamps on Sandstone (THPSS) are indirectly impacted by the proposed longwall mining operations. Longwall mining is a Key Threatening Process and is likely to directly impact on THPSS through mine subsidence. Damage to swamps above the area of direct influence of the mining operations is clearly a likely impact. (LEG)

The sandstone strata supporting the 22 nationally endangered swamps, including the 7 shrub swamps must not be fractured. (SCSGBM)

The mining layout at Angus Place Colliery has also been designed so as to reduce the potential impacts on the shrub swamps resulting from mine subsidence movements. The proposed LW1010 has also been setback such that Twin Gully Swamp will not be directly mined beneath. The widths of the proposed longwalls have also been narrowed beneath Tri Star and Trail 6 Swamps.

Tri Star Swamp and Trail 6 Swamp are the only two shrub swamps which are located directly above the proposed longwalls. The proposed LW1004 to LW1006 and the proposed LW1016 and LW1017, which mine beneath these swamps, have been narrowed to overall void widths of 261 metres. Elsewhere, the proposed longwalls have overall void widths of 360 metres.

Section 5.12 of the Subsidence Assessment, provided as Appendix D to the EIS, provides a detailed assessment of the potential impacts to shrub swamps and hanging swamps as a result of the Project.

Predicted post mining grades are similar to the natural grades within the shrub swamps. There are no predicted significant reductions or reversals of grade. The hanging swamps are located on the sides of the valleys and, therefore, that natural gradients are greater than those shown for the shrub swamps and, in addition to this, the predicted mining induced tilts are less.

It is not expected, therefore, that there would be any adverse changes in ponding or scouring within the swamps resulting from the predicted mine subsidence movements. It is also not anticipated that there would be any significant changes in the distribution of the stored surface waters within the swamps as a result of the mining induced tilt or vertical subsidence.

Whilst scouring was observed in a number of swamps located above the previously extracted longwalls at Angus Place and Springvale Collieries, investigations have shown that these were generally the result of other activities such as mine water discharge, rather than mine subsidence itself.

Fracturing of the uppermost bedrock has been observed in the past, as a result of longwall mining, where the tensile strains have been greater than 0.5 mm/m or where the compressive strains have been greater than 2 mm/m.

The swamps which are located outside the extents of the proposed longwalls, including Twin Gully Swamp and the shrub swamps along the Wolgan River, are predicted to experience tensile strains less than 0.5 mm/m and compressive strains less than 2 mm/m due to the proposed mining. It is unlikely, therefore, that the bedrock beneath these swamps would experience any significant fracturing.

Although some minor and isolated fracturing could occur in the bedrock beneath the swamps located outside the extents of the proposed longwalls, it is unlikely to result in any adverse impacts on these swamps.

The swamps which are located directly above the proposed longwalls are predicted to experience tensile strains greater than 0.5 mm/m and compressive strains greater than 2 mm/m. It is expected, therefore, that fracturing would occur in the top most bedrock beneath these swamps.

The surface cracking across the mining area is expected to be generally isolated and minor in nature, due to the reasonable depths of cover which typically vary between 270 metres and 450 metres, and due to the plasticity of the surface soils which allows them to more readily absorb the ground strains. Surface crack widths are expected to be similar to those observed above the previously extracted longwalls at Angus Place and Springvale Collieries, which were typically between 5 mm and 25 mm, but with isolated surface cracking in some locations greater than 50 mm.

The shrub swamps have peat layers which overlie the shallow natural surface soils and underlying bedrock along the alignments of the drainage lines. In most cases, cracking would not be visible at the surface within these swamps, except where the depths of bedrock are shallow or exposed. The shrub swamps comprise significant quantities of sediment and, therefore, fracturing of shallow bedrock beneath these swamps are likely to be filled with soil during subsequent flow events along the drainage lines.

The hanging swamps have soft soil or peat layers which overly the bedrock on the valley sides. It is expected that the potential for fracturing in these locations would be less when compared to the bases of the valleys, where higher compressive strains occur due to the valley related movements, and due to the higher depths of cover along the valley sides.

Whilst some minor surface cracking could occur in the swamps resulting from the extraction of the proposed longwalls, the previous experience of mining beneath swamps at Angus Place, Springvale and in the Southern Coalfield indicate that the likelihoods and extents of these impacts are very small.

The dilated strata beneath the drainage lines, upstream of the swamps, could result in the diversion of some surface water flows beneath parts of the shrub swamps. It is noted, however, that the drainage lines upstream of the swamps are generally ephemeral and, therefore, surface water flows occur during and shortly after rainfall events. Any diverted surface water flows are expected to remerge short distances downstream, due to the limited depth of fracturing and dilation and due to the high natural stream gradients.

The incidence of impacts on swamps due to mine subsidence ground movements is very low and, in some of these cases, the impacts that were observed were associated with natural events or mining related surface activities. It is expected, therefore, that the incidence of impacts on the swamps within the Extension Area resulting from mining induced ground movements will also be low.

Previous longwalls at Angus Place and Springvale Collieries have been extracted directly beneath or partially beneath 13 shrub swamps and 26 hanging swamps. Surface impacts have been observed at four swamps which were directly mined beneath by the previously extracted longwalls at Angus Place and Springvale Collieries. It has been recognised that past mining related surface activities, i.e. the discharge of high quantities of mine water and construction of various roads and access paths, have resulted in surface impacts to some swamps. Springvale Mine and Angus Place Colliery have developed management plans to minimise the potential for future impacts resulting from these mining related surface activities.

An environmental monitoring program was established to assess the effects of longwall mining on the groundwater systems associated with the swamps at Angus Place and Springvale Collieries. The monitoring comprised swamp piezometers, shallow aquifer piezometers and multi-level vibrating wire piezometers at Junction, Sunnyside, Sunnyside West and West Wolgan Swamps. The monitoring results were reviewed by RPS which found that the monitoring results provided no evidence that longwall mining had affected the groundwater systems for these swamps.

The Groundwater Impact Assessment prepared by RPS to support the Project and provided as Appendix E to the EIS determined that the most significant reductions to average standing groundwater levels are predicted in Twin Gully Swamp within the Angus Place mining area but not to be undermined. This swamp has a projected drop in average standing water levels from 12.4 cm to 10.6 cm above the soil surface. The post mining values predicted at Twin Gully Swamp therefore suggest that soil saturation would persist, maintaining water availability for flora and fauna, as well as soil anoxia, allowing for continued peat formation. All other monitored swamps have smaller projected decreases in average standing water levels and monitored swamps are projected to maintain average standing water levels above the surface.

Additionally, highly organic peat soils with low bulk density capillary forces are likely to be saturated for some distance above the water table itself. Natural decreases in water levels, in addition to the small predicted decreases from the CSIRO model are still likely to enable capillary forces to saturate the peat layer. Therefore, a possible reduction in the average standing water levels, by the magnitudes predicted is unlikely to result in drying of the peat layer.

The Project is not expected to have a significant impact upon the hydrology of any hanging swamps. The reliance of these areas on perched aquifer systems effectively isolate them from any hydrological changes that may occur to the regional water table as a result of mining operations.

The proponent is quite clear that there will be significant impact on a Flora Reserve of high conservation value. If you change surface water drainage then you change the plant communities that can survive there, thus damaging this conservation significance. (Colo Committee)

The EIS including the Flora and Fauna Impact Assessment provide as Appendix H to the EIS, to not predict any significant impacts to flora reserves of high conservation value.

No significant changes in surface water flows, vegetation composition or habitats are anticipated as a result of the Project.

The consultants have asserted 'that any effects on potential populations of the endangered Adams Emerald Dragonfly will be insignificant'. It is impossible to make such a statement, considering that there have never been any ecological studies of this species and limited aquatic sampling was undertaken for this project. (BMCS)

An Aquatic Ecology Impact Assessment undertaken by Cardno Ecology Lab to support the Project and is provided as Appendix G to the EIS.

The life cycle of Adams Emerald Dragonfly would be adversely affected if the construction, operation, decommissioning and/or rehabilitation phases of the Project resulted in loss or modification of its habitat or reduced the quality of the water. If fracturing of the Wolgan River bed does occur during extraction of the longwalls it could lead to drainage of overlying pools and loss of aquatic habitat and changes in concentrations of iron, manganese, aluminium, zinc and nickel and levels of iron staining. These impacts are expected to be minor, localised and temporary in nature, persisting until the cracks are infilled and overtopping of flows is resumed. Mining is unlikely to have any adverse impacts on aquatic habitats in Carne Creek. Given the above, it is highly unlikely that the lifecycle of this dragonfly would be affected to such an extent that it would place a viable local population of this species, if one exists within the Project Application Area, at risk of extinction.

As the macroinvertebrate surveys undertaken in the Project Application Area are limited in frequency, spatial extent, duration and intensity but suitable habitats for this species are present, the possibility of Adams Emerald Dragonfly being present cannot be discounted. As such, an Assessment of Significance was prepared as a precautionary measure. The assessment of the significance of impacts on Adams Emerald Dragonfly was prepared in accordance with the Threatened Species Assessment Guideline – The Assessment of Significance (DPI 2008). These guidelines specify the important factors that must be taken into considered when assessing potential impacts on threatened species, populations or ecological communities listed under Schedules 4, 4A and 5 of the Fisheries Management Act.

The assessment of the significance of impacts indicated that if viable populations of Adams Emerald Dragonfly were present within the proposed workings area they could be subject to temporary, localised, minor impacts. It is consequently highly unlikely that the proposed mining would have a significant impact on this threatened species.

The BMCS strongly supports the consultants' recommendation to undertake more comprehensive, and better designed, pre-mining surveying, and finer resolution taxonomic identification of stygofauna; such surveying must be implemented if this project proceeds to ensure that the diversity of stygofauna is properly assessed and potential risks of the project determined. (BMCS)

No significant impacts are predicted on aquatic habitats, aquatic flora or aquatic fauna and or stygofauna. As is included in the Statement of Commitments contained in Chapter 11 of the EIS, because the aquifer systems across the Newnes Plateau are consistent, stygofauna will be monitored using standing water levels within one borehole in each aquifer where stygofauna are known to occur (AQ4 to AQ6). Where available, monitoring of the deep aquifer system, AQ1 to AQ3 will be undertaken to establish presence of stygofauna.

Additionally, Centennial Angus Place and Springvale Coal will commit to undertaking a regional stygofauna assessment which will:

- Collate existing available information on groundwater bores, water quality and characteristics in Centennial Coal's area of operations throughout the Western Coalfield.
- Use this information to form a prioritisation list of likely areas for GDE to occur.
- Use the prioritisation protocol to identify bores that can be sampled to provide data on the presence and significance of fauna both within and outside mine areas.
- Identify any stygofauna found to a minimum of Family level.
- Advise on the significance of the findings.
- Examine relationship between bore characteristics and presence of stygofauna.

The Statement of Commitments contained in **Section 5.0** of this RTS has been updated to include this commitment.

Dr Baird disputes the conclusion of the consultants that there will be no significant impact in relation to the Key Threatening Process of subsidence from longwall mining. (BMCS)

As detailed in Section 6.5 of the Flora and Fauna Impact Assessment provided as Appendix H to the EIS, it is acknowledged that the Project is likely to incrementally contribute to the Key Threatening Process (KTP) 'Alteration of habitat following subsidence due to longwall mining'. A number of threatened species potentially occurring within the Study Area are listed within this KTP as being at risk. These include Boronia deanei, Blue Mountains Water Skink, Giant Dragonfly and Stuttering Frog. Newnes Plateau Shrub Swamp is also listed within the final determination of this KTP.

Subsidence monitoring within Angus Place has shown that nearly all measurements are less than those predicted. Based on the monitoring data, there is an approximate 95% confidence level that the maximum observed total subsidence will be less than the maximum predicted total subsidence. Flora and fauna monitoring since 2005 has not recorded any losses to threatened species populations or EECs as a result of subsidence. This is due to appropriate mine design to limit subsidence to acceptable levels. However, conservative predictions for maximum baseflow and standing water level changes in several shrub swamps as a result of subsidence have determined that potential low-scale changes to swamp hydrology is possible.

The magnitude of the potential hydrology changes have, however, been considered against the likely capillary forces of the peat to maintain saturation. The predicted change to average water level is within the expected capillary forces such that the magnitudes of water table decline predicted in Adhikary and Wilkins (2013), is unlikely to result in drying of the peat layer. The conversion of perched water table flows into subsurface flows through voids is unlikely. Cracks may divert some water temporarily from swamps, but will initially fill with water before eventually filling with silt/peat from within the swamp, so that there should be no long-term or permanent impact on flows in the swamp. Therefore, the minor alterations to the hydrological regime predicted are unlikely to modify the vegetation communities present in the short or long term.

Newnes State Forest has only been subjected to selective logging in certain places, and is mostly unlogged old growth forest, contrary to the claims on page 97, s 2.8.1 in Vol. 1 of the EIS. The claim that 'as a consequence of forest harvesting and fires, large areas of forest are relatively young with a low to moderate density of hollow-bearing trees' is an overstatement. These eucalypt forests and woodlands are adapted to wild fire and mostly old-growth with a high density of hollows. Further, the sheltered gully forests offer protection for wildlife and even the hottest fires do not entirely burn Newnes Plateau due to its dissected, rocky terrain. The overall importance of this forest should not be discounted as claimed by Centennial Coal. (Colong Foundation)

Section 2.5.1.2 and 2.8.1 of the EIS identifies the past land use history of the Project Application Area and acknowledges the importance of the area as habitat to a diverse range of faunal species.

The Foundation disputes the number of shrub swamps in the subsidence area with Centennial Coal, as five shrub swamps are clumped under the name Tri Star Swamp. (Colong Foundation)

Irrespective of the number of shrub swamps, the EIS and associated specialist reports includes a detailed assessment of potential impacts to all swamps located within the Project Application Area.

Trail 6 swamp (NPSS) contains suitable habitat for Petalura gigantea (Pg) and Eulamprus leuraensis (El). LW1016 and LW1017 should be shortened in length to avoid this swamp, which is over a Type 3 structure. Trail 6 swamp is in a very similar position to Twin Gully Swamp which is protected but is not over any structure. (Colong Foundation)

Shortening longwalls LW1016 and LW1017 to avoid Trail 6 Swamp will make Angus Place MEP economically unviable for Angus Place Colliery. Further, avoidance of undermining of Shrub Swamps would involve major resource sterilisation which could technically constitute a breach of the mining lease. Shortening of longwall blocks is not common practice at Angus Place Colliery (or Springvale Mine). The Life of Mine planning process used at these mines involves scheduling of mining activities based on a mine plan developed for all remaining mineable reserves. The mine schedule requires a balance between underground roadway development and longwall production activities. Changes to mine plans can severely disrupt production continuity and business viability.

Instead of shortening longwalls Centennial Angus Place has designed LW1016 and LW1017 to be sub-critical panels that will minimise impacts on the swamp and other biodiversity as described below.

Angus Place Colliery invested a significant amount of effort during the mine planning phase for the proposed longwalls to prioritise the minimisation of potential impacts on the environment. The mine planning has taken into consideration the constraints of sensitive surface features (watercourses, biodiversity, geodiversity and archaeology) in conjunction with geological and geotechnical issues while at the same considered mine feasibility and optimisation of resource recovery. Safety, both underground as well as the surface, was of paramount importance and was also considered in all stages of mine planning.

As noted in Section 8.3.3 of the EIS longwalls LW1016 and LW1017 have been designed to be sub-critical panels with void widths of 261 metres and chain pillars of 58 metres. Springvale Mine's previous extensive experience of extracting longwalls of varying panel widths confirm that narrower sub-critical longwalls had significantly less subsidence (and thus resulted in significantly less impacts and environmental consequences) than the wider, critical longwalls.

An analysis of the sensitivity of void widths at Springvale Mine identified that:

- marginal subsidence reductions would occur for longwall void widths between 150 m and 260 m and that the greatest reductions can be made from 315 m to 260 m, and

- marginal strain reduction would occur for widths between 150 m and 260 m and that the greatest reduction can be made from 315 m to 260 m.

The sensitivity analyses have shown that after the transition from critical panel width to sub-critical panel width, further reductions in void width cause relatively little incremental reduction in measured subsidence or a gain in environmental advantages. Reducing the void width to 261 m for longwalls under the shrub swamps is the greatest reduction possible without compromising the viability of the business.

The sub-critical mine design adopted for longwalls LW1016 and LW1017 is the critical mitigation measure and reduces the likelihood and severity of subsidence impacts on Trail 6 Swamp. Section 10.1.5.3 of the EIS discusses the consequences of the potential subsidence impacts in detail.

Centennial distinguished plant communities that are allegedly indirectly impacted from those that are directly impacted. By indirectly impacted, Centennial means plant communities that have been subjected to longwall mining where it claims there is no significant impact to these communities. Notwithstanding the fact that longwall mining is a Key Threatening Process for nationally threatened swamps, Centennial has convieniENTY found that longwall mining is ‘unlikely’ to have an impact on these swamps. (LEG)

Indirect impacts relate to any potential impact on plant communities due to the subsidence effects. Based on the subsidence predictions in the Subsidence Impact Assessment (MSEC, Appendix D to the EIS) the Flora and Fauna Impact Assessment (Appendix H of the EIS) assessed the impacts of the predicted subsidence parameters on the biodiversity within the Project Application Area. The outcomes of this assessment are described in detail in the Flora and Fauna Impact Assessment and summarised in Section 10.3.4.1 of the EIS. The environmental consequences are described in Section 10.3.5.1 of the EIS.

Those species and communities recorded or expected within the subsidence impact areas were subjected to 7 part test of significance under the TSC Act and/or assessment of significance under the EPBC Act, the results of which are provided in Table 10.14 and Table 10.15, respectively, in the EIS. Details of these assessments undertaken are included as Appendices 1 (TSC Act 7 part test of significance) and 2 (EPBC Act assessment of significance) of the Flora and Fauna Impact Assessment.

With regards to impacts on the two vegetation communities within the Project Application Area, namely, MU50 – Newnes Plateau Shrub Swamp; and MU51 Newnes Plateau Hanging Swamp which provide known or potential habitat for threatened flora and fauna, the assessments found that the Project is unlikely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction. This conclusion is also supported by the following observations.

- Monitoring of swamp water levels and surface water gauging has shown that over the life of the current mining operations, no impacts to the swamps or surface water flows have occurred as a result of mining to date at Angus Place Colliery.

- Regular seasonal monitoring of the flora and fauna since 2005 have also revealed no observable impacts on the flora and fauna recorded within undermined areas, including Shrub Swamps.

- There exists a high level of confidence in subsidence predictions, as shown by post-mining subsidence monitoring data.

Alteration of habitat following subsidence due to longwall mining is a KTP under the TSC Act. Section 10.3.5.1 of the EIS notes that the project will contribute to this KTP, however, the application of the proven mine design principles and the proven accuracy of the subsidence predictions will minimise the risk associated with the process and that the threatened species and communities are not endangered.

Centennial claims the proposed longwall mining will have no likely cause extinction for local populations of the Giant Dragonfly, Blue Mountains Skink, and Boronia deanei due to the drying out of nationally endangered swamps that paradoxically would be a direct impact of mining. The analysis of the impact on these species is not unlikely or low, as claimed, but likely as longwall mining is a key threatening process to the swamp habitat in with they live. (LEG)

Alteration of habitat following subsidence due to longwall mining is a KTP under the TSC Act. Section 10.3.5.1 of the EIS notes that the Project will contribute to this KTP, however, the application of the proven mine design principles and the proven accuracy of the subsidence predictions will minimise the risk associated with the process and that the threatened species and communities are not endangered.

A review of the potential impacts to the Shrub Swamp EEC discussed in the Subsidence Impact Assessment (Appendix D to the EIS), Groundwater Impact Assessment (Appendix E to the EIS) and Surface Water Impact Assessment (Appendix F to the EIS) was undertaken within the Flora and Fauna Impact Assessment (Appendix H to the EIS) to assess the impact of the Project on the biodiversity of the Project Application Area. The Flora and Fauna Impact Assessment concluded it is unlikely that the effects of subsidence would have an adverse effect on shrub swamps or hanging swamps such that the ecological functioning of these swamps would be impaired given that:

- there is unlikely to be significant reductions or reversals of grade that could otherwise cause ponding or scouring

- the limited depth of fracturing above the Mount York Claystone aquitard and lack of dilation of bedrock of shrub swamp or upstream drainage lines would not result in losses of infiltrated water and minimal divergence of surface water would occur.

RPS completed a study in November 2012 (RPS, 2012) to assess whether any impacts attributable to the undermining of the swamps could be ascertained based on swamps hydrographs and groundwater level trends. All of the swamps which were included in this study have a significant history of water level monitoring, are located away from licensed discharge points (to minimise potential for conflicting information), and have all been either undermined by longwall extraction or were in very close proximity to extracted longwall panels.

The results of the RPS 2012 study showed that no water level impacts that could be attributed to past or present mining operations (subsidence-related impact or depressurisation) were observed. Rather, the water levels in the swamps showed a strong correlation to cumulative rainfall trends, and this was found to be the driving factor.

As no mining influenced water level fluctuations can be identified in any of the monitored swamps (both undermined and baseline) it is accurate to say that mining at Springvale Mine (and the adjoining Angus Place Colliery) has not led to any identifiable water level impacts on the monitored swamps, and that all undermined swamps continue to display baseline water levels.

As part of the Flora and Fauna Impact Assessment 7 part test of significance under the TSC Act were conducted for Giant Dragonfly, Blue Mountains Skink, and Boronia deanei, and the assessment of significance under the EPBC Act for Boronia deanei. The results of these assessments are provided in full in Appendices 1 and 2 of the Flora and Fauna Assessment and summarised in Table 10.14 and Table 10.15, respectively in the EIS. Conclusions drawn from these assessments are as follows.

- The Project will not or unlikely to have an adverse effect on the populations of Giant Dragonfly, Blue Mountains Skink, and Boronia deanei, to such that their local occurrences are likely to be placed at risk of extinction (TSC Act).

- The Project will not lead to the long-term decrease in the size of the Boronia deanei population in the locality (EPBC Act). No record of the Boronia deanei population exists within the Project Application Area.

Given the outcomes of the assessments and the fact that the Project is not expected to have a significant impact upon any shrub swamps, such that their ecosystem functioning may be compromised, any alterations to potentially important habitats from subsidence, will not affect the long-term survival of the Giant Dragonfly and Blue Mountains Water Skink in the locality.

LEG believes that the monitoring of the nationally endangered swamps is misleading and that proper mapping of these swamps is still incomplete after decades of ineffective management. Despite the expense, the mapping is inadequate so that dramatic changes to mined vegetation communities over time have not been reported. (LEG)

The mapping of the Shrub Swamps within the Project Application Area is consistent with DEC (2006) mapping and has been ground-truthed by Centennial Angus Place and Springvale Coal during opportunistic ecology surveys. Further mapping of these swamps are currently being undertaken by Centennial Coal in collaboration with University of Queensland.

The Centre for Mined Land Rehabilitation at the University of Queensland is currently completing a mapping and classification project covering 2600 sq km of the Blue Mountains from Penrith to Lithgow and Narrow Neck to Wollemi National Park. The region was selected based on extents of currently mapped upland swamp communities existing at a density of more than 1000 mapped communities per degree of latitude and longitude. The project has collected vegetation survey data using two different methodologies on 72 communities across this region.

The two swamp vegetation community mapping methodologies were:

- Standard 400m2 vegetation survey plots in central homogenous location

- Distributed 1m2 micro plots with number of plots determined by the size of the community sampled

Floristic diversity, environmental and landscape characteristics are currently being used to determine the range of distinct mapping units represented across the region. This data will be tested using existing monitoring plot floristic data collected for statutory monitoring purposes. Project completion is planned for mid-October 2014.

The swamps to be impacted upon by the proposed mining are the best remaining on Newnes Plateau. The reported findings in Table 2 to Table 5 (App. I) are inaccurate and misleading in

relation to swamps and the abovementioned species found within them as they are inconsistent with the evidence. (LEG)

Table 2 and Table 3 of the Regional Biodiversity Strategy (Appendix I to the EIS (sperceded)) and Tables 10.14 and Table 10.15 of the Angus Place EIS provide, respectively, a summary of the outcomes of TSC Act 7 part test of significance and a summary of the outcomes of EPBC Act Assessment of Significance of those species recorded or expected in impact areas due to the proposed infrastructure and mining induced subsidence. These tests/assessments have been undertaken by a qualified ecologist (P Hillier, RPS Australia East Pty Limited) with many years' experience in undertaking ecological assessments and conducting numerous field surveys, including on the Newnes Plateau.

The summaries provided in Regional Biodiversity Strategy and in the EIS in the tables noted above serve, as background information on the significance of impacts on threatened species and EECs which have been recorded during surveys or have the potential to occur within the project area and likely to utilise habitat to be potentially impacts by the proposed activities in the Project. The summaries should not be evaluated in isolation for impacts on species but instead should be reviewed in conjunction with the detailed assessments provided in the Flora and Fauna Impact Assessment (Appendix H to the EIS) as that will provide context to assessment outcomes noted in the tables. Appendix 1 of the Flora and Fauna Impact Assessment provides details of the 7 part test (TSC Act) while Appendix 2 provides details of the Assessment of Significance (EPBC Act).

It should also be noted that the assessment outcomes and conclusions on the likely impacts of the Project on the biodiversity discussed in the Flora and Fauna Impact Assessment (Appendix H to the EIS) and Section 10.3 of the EIS have been informed by a number of other technical assessments, namely, Subsidence Impact Assessment (Appendix D to the EIS), Groundwater Impact Assessment (Appendix E to the EIS) and Surface Water Impact Assessment (Appendix F to the EIS).

With regards to the potential impacts of the Project on the species referred in in the comment (Boronia deanei, Blue Mountains Water Skink, Giant Dragonfly and Stuttering Frog) Section 6.5 of the Flora and Fauna Impact Assessment notes that the Project is likely to incrementally contribute to the Key Threatening Process (KTP) 'Alteration of habitat following subsidence due to longwall mining'. This section has noted that threatened species, Boronia deanei, Blue Mountains Water Skink, Giant Dragonfly and Stuttering Frog, potentially occurring within the impact areas are listed within this KTP as being at risk. Newnes Plateau Shrub Swamp is also listed within the final determination of this KTP.

However, monitoring of swamp water levels and surface water gauging has shown that over the life of the current mining operations, no impacts to the swamps or surface water flows have occurred as a result of mining to date at Angus Place (RPS 2013). Regular seasonal monitoring of the flora and fauna since 2005 have also revealed no observable impacts on the flora and fauna recorded within undermined areas, including Shrub Swamps. This observation is supported by a high level of confidence in subsidence predictions, as shown by post-mining subsidence monitoring data. Therefore the Project is unlikely to have an adverse effect on the extent of the populations such that the local occurrences are likely to be placed at risk of extinction.

The analysis regarding frog impacts in Table 2 to Table 5 is wrong, as it assumes that swamps and streams are unaffected by the proposed longwall mining. (LEG)

Centennial Angus Place has developed a reliable and detailed understanding of the environmental constraints as a result of experience from operating Angus Place Colliery over many years and from the environmental management and monitoring regimes. Using this knowledge, potential environmental constraints have been taken into account during the mine design process for the Angus Place Extension Project to ensure the Project is undertaken safely and in the most environmentally sensitive manner feasible. The approach taken in the Angus Place MEP has been to apply a best practice system of environmental management comprising a hierarchy of avoiding, minimising, mitigating and finally, offsetting residual impacts.

An outcome of detailed mine planning and design process implemented in the Angus Place MEP is that the mine plan minimises predicted subsidence and reduces the occurrence of subsidence effects beyond predictions. A comprehensive multi-disciplinary risk-based approach to mine planning and mine design resulted in the following criteria being implemented.

- Sub-critical longwalls with voids of 261 m have been proposed under two swamps (Tri-Star Swamp, Trail 6 Swamp) that will be mined under (LW1004 – LW1006, LW1016 – LW1017)). Springvale Mine's previous experience extracting longwalls with a wide range of void widths showed sub-critical longwalls had significantly less subsidence than the wider critical longwalls through reduction in the height of fracturing. An outcome of the significantly less subsidence was that impacts on sensitive surface features was minimised.

- Twin Gully Swamp will be eliminated from the mine plan, by the shortening of LW1010.

- No perennial watercourses will be mined under.

- No cliffs will be mined under.

- Impacts on pagodas will be avoided or minimised. LW1008, LW1015 – LW1017 have been shortened to avoid pagodas on the east. LW1013 and LW1014 will be split into two segments to step around pagodas. The pagodas located directly above the proposed longwalls (LW1006, LW1010 – LW1011) are predicted to experience some fracturing and spalling, however, less than 1% of their total surface area will be impacted.

The potential impacts of the Project on the watercourses overlying the mining area are discussed in Section 10.1.3.2 of the EIS while the environmental consequences of the potential impacts are discussed in Section 10.1.3.3. The mine plan (Figure 4.2 in the EIS) shows Wolgan River will not be undermined and nor will it be within the 26.5 degree angle of draw. The closest that mining will approach Carne Creek is approximately 400 m southeast of LW1019. The unnamed watercourses above the mining area drain into either Wolgan River or Carne Creek and are predicted to experience subsidence movements noted in Table 8.1 in the EIS. Cracking is predicted in these watercourses although net loss of water from the catchment is not predicted as any diverted water is expected to re-emerge downstream. Springvale Mine and Angus Place Colliery have previously extracted longwalls from beneath more than 40 km of watercourses and monitoring shows that any impacts to surface water flows are transient at worst.

Section 10.1.5.3 of the EIS notes that no subsidence effects to swamp hydrology or flora communities have been identified in areas where sub-critical panels have been proposed. The height of fracturing from resulting from the extraction of these longwalls do not propagate above the 22 m thick Mount York Claystone aquitard ie, the Mount York Claystone prevents the mining induced fracturing in the strata above the coal seam to the surface. The limited extent of the downward cracking from the surface means that fracturing and dilation of bedrock of shrub swamps would not result in losses of infiltrated water, and minimal divergence of surface water would occur. It follows then that it is unlikely that subsidence effects would have an adverse impact on shrub swamps and hanging swamps such that the ecological functioning of these swamps would be impaired. No previous subsidence effects to swamp hydrology or flora communities have been identified above sub-critical longwall panels.

Tables 2 and 3 in Appendix I to the EIS (Table 10.14 and Table 10.15 in the EIS), respectively, provide summaries of outcomes of the TSC Act 7 part test and the EPBC Act Assessment of Significance for Stuttering Frog, Giant Burrowing Frog, Littlejohn's Tree Frog (listed under both TSC Act and EPBC Act) and Red-crowned toadlet (listed under the TSC Act) that have been recorded or are expected to occur in the Project Application Area. Full details of the assessments are provided in Appendix 1 (TSC Act 7 part test) and Appendix 2 of the Flora and Fauna Impact Assessment (Appendix H to the EIS) and should be reviewed in conjunction with the review of information presented in table noted above.

Conclusions drawn from the Flora and Fauna Impact Assessment (Appendix H to the EIS) are as follows:

- No potential breeding habitat would be removed for the Giant Burrowing Frog, Stuttering Frog, Red-crowned Toadlet or Littlejohn's Tree Frog although the proposed clearing in the Project may cause a loss of potential foraging habitat for these species.

- Breeding habitat of these species may occur as a result of subsidence causing minor cracking and tilting, however the impacts would be isolated and often short term. Subsidence may also cause ponding in localised areas, which may create additional breeding opportunities for these species.

The overall conclusion is that given:

- suitable habitats for these species occur widely through the Newnes Plateau and more preferred habitat, in the form of small headwater creek lines and slow flowing to intermittent creek-lines, occurs throughout the wider Blue Mountains area, and

- the habitats within the Project Application Area are only a small proportion of the available habitat within the locality, much of which is conserved within the nearby national parks

As such the Project is unlikely to affect the lifecycle of Giant Burrowing Frog, Stuttering Frog, Redcrowned Toadlet or Littlejohn's Tree Frog as a result of clearing or subsidence, such that a local population of these species is likely to be placed at risk of extinction.

The claim in Appendix I that the proposed mining is consistent with the threat abatement plan for Blue Mountains Skink is wrong, as the impacts are not adequately mitigated by the proposed longwall mining arrangements. (LEG)

Impacts to swamps have been adequately mitigated through the mine design criteria adopted during the mine planning phase of the Angus Place MEP. Sub-critical longwalls with voids of 261 m and chain pillars of 58 m have been proposed under two swamps (Tri-Star Swamp, Trail 6 Swamp) that will be mined under (LW1004 – LW1006, LW1016 – LW1017)) within the mining area. Springvale Mine's previous experience extracting longwalls with a wide range of void widths showed sub-critical longwalls exhibited significantly less subsidence than the wider critical longwalls through reduction in the height of fracturing. An outcome of the significantly less subsidence was that impacts on sensitive surface features was minimised. The sub-critical panels for the Shrub Swamps (Tri-Star Swamp, Trail 6 Swamp) to be under mined means the habitat to the Blue Mountains Skink will not be potentially impacted.

Section 10.1.5.3 of the EIS notes that no subsidence effects to swamp hydrology or flora communities have been identified in areas where sub-critical panels have been proposed. The height of fracturing resulting from the extraction of these longwalls is not likely to propagate above the 22 m thick Mount York Claystone aquitard ie, the Mount York Claystone contains the majority of the mining induced fracturing to below that aquitard. The limited extent of the downward cracking from the surface means that fracturing and dilation of bedrock of shrub swamps would not result in losses of infiltrated water, and minimal divergence of surface water would occur. It follows then that it is unlikely that subsidence effects would have an adverse impact on shrub swamps and hanging swamps such that the ecological functioning of these swamps would be impaired. No previous subsidence effects to swamp hydrology or flora communities have been identified above sub-critical longwall panels.

With regards to the potential impacts of the Project on the Blue Mountains Water Skink Section 6.5 of the Flora and Fauna Impact Assessment (Appendix H to the EIS) notes that the Project is likely to incrementally contribute to the Key Threatening Process (KTP) 'Alteration of habitat following subsidence due to longwall mining'. This section has noted that the Blue Mountains Water Skink potentially occurring within the impact areas are listed within this KTP as being at risk. Newnes Plateau Shrub Swamp is also listed within the final determination of this KTP.

However, monitoring of swamp water levels and surface water gauging has shown that over the life of the current mining operations, no impacts to the swamps or surface water flows have occurred as a result of mining to date at Angus Place (RPS 2013). Regular seasonal monitoring of the flora and fauna since 2005 have also revealed no observable impacts on the flora and fauna recorded within undermined areas, including Shrub Swamps. This observation is supported by a high level of confidence in subsidence predictions, as shown by post-mining subsidence monitoring data. Therefore the Project is unlikely to have an adverse effect on the extent of the populations such that the local occurrences are likely to be placed at risk of extinction.

In Table 4 of Appendix I that bulldozing an unnecessary road and ten metre wide pipeline easement through a Tablelands Snow gum - Black Sallee - Candlebark and Ribbon Gum Grassy Woodland is unlikely to have an adverse impact on this Threatened Ecological Community is also wrong. (LEG)

The clearing of the Tableland Gully Snow Gum – Ribbon Gum Montane Grassy Forest, an endangered ecological community in accordance with the NSW *Threatened Species Conservation Act 1995*, is proposed to avoid impacts to the nearby shrub swamp (Sawyers Swamp Creek).

Table 10.8 of the EIS shows the Project is proposing to clear 0.22 ha of Tableland Gully Snow Gum – Ribbon Gum Montane Grassy Forest, This proposed clearing represents 1% of the community mapped within the Project Application Area to be cleared and 0.01% of the 1584.43 ha of the community mapped in the western Blue Mountains area (DEC 2006). The 0.22 ha of the Tableland Gully Snow Gum – Ribbon Gum Montane Grassy Forest proposed to be cleared already exists in a highly modified (regrowth) condition. The 7-Part Test of Significance undertaken for this EEC concluded the remaining community within the Project Application is unlikely to significantly be impacted by the project, such that the EEC would be placed at risk of extinction.

The Regional Biodiversity Strategy has taken this proposed clearing into consideration when determining the native vegetation communities to be directly impacted by the project (refer Table 11 of Appendix I of the EIS). Section 6.1 of the revised Regional Biodiversity Offset Strategy (September 2014) notes the offset area proposed provides compensation for the residual impacts associated with the Springvale MEP and this includes clearing of 0.22 ha of Tableland Gully Snow Gum – Ribbon Gum Montane Grassy Forest.

Swamp ecosystems cannot be replanted or repaired following damage by longwall mining. (LEG)

A considerable amount of effort has been invested by the Blue Mountains City Council (BMCC) to date to investigate ways in which swamps can be rehabilitated as discussed below.

The BMCC Upland Swamp Rehabilitation Program was commenced in 2006 after Blue Mountains Swamps were listed nationally as part of the Temperate Highland Peat Swamps on Sandstone (THPSS) endangered ecological community, with the aim of protecting and restoring Blue Mountains Swamp across the local government area (LGA).

In August 2008 the BMCC and Lithgow City Council formed a partnership to deliver the ‘Save our Swamps’ project to restore THPSS across both LGAs supported by grant funding of $250,000 over 3 years from the Urban Sustainability Program of the NSW Environmental Trust. The ‘Save our Swamps”’ project has been since then assisting in the management and conservation of THPSS ecological community across the Blue Mountain and Lithgow LGAs.

In 2009 the ‘Save our Swamps’ project received a $400,000 federal ‘Caring for Country’ grant to expand the program to incorporate Wingecarribee Shire Council and Gosford City Council.

The innovative integrated and landscape scale approach to the management of THPSS has resulted in the ‘Save our Swamps ‘project receiving four awards including:

- National Governments Local Government Award for Innovation in Natural Resource Management 2010;
- United Nations World Environment Day Award for Excellence in Overall Environmental Management 2011 (Special Commendation);
- NSW Sustainable Cities award for Biodiversity Conservation 2010; and
- National Keep Australia Beautiful (Tidy Town award) for Biodiversity Conservation 2011.

As part of a collaborative approach to information and skill sharing the practical knowledge and lessons learnt from the Save Our Swamps project, BMCC has developed a practical set of guidelines entitled "Soft engineering solutions for swamp remediation - a 'how-to' guide". The guide was created by Blue Mountains City Council with the assistance of Lithgow City Council, Gosford City Council, Wingecaribee Shire Council. This publication comprehensively covers soft engineering swamp rehabilitation applications, techniques and materials. It also covers background information on swamp geomorphology, threats and impacts to Temperate Highland Peat Swamps on Sandstone swamps.

The ‘How to guide’ includes case studies on successful implementation of remediation to THPSS comprising:

- Braeside Swamp located in the Blue Mountains LGA;
- Marmion Swamp located in the Blue Mountains LGA;
- Wentworth Falls Swamp located in the Blue Mountains LGA;
- Happy Valley Swamp located in the Lithgow LGA;
- Ellem Gully Swamp located in the Gosford LGA; and
- Paddys River Swamp located in the Wingecarribee LGA.

In addition to the Save our Swamps recognised success at remediation of THPSS, Springvale Coal has recently applied for approvals from DoE and OEH to enable rehabilitation works on East Wolgan Swamp to be carried out. These applications were made on 16 August 2012. Springvale Coal obtained approval from the former Federal Department of Sustainability, Environment, Water, Populations and Communities on 21 September 2012. OEH approved the undertaking restoration actions at East Wolgan Swamp and issued a certificate under Section 95 of the Threatened Species Conservation Act 1995 (TSC Act) on 25 November 2013. A specific rehabilitation strategy has been prepared to prevent further impacts to East Wolgan Swamp and to assist the recovery of the swamp vegetation community.

This strategy has been approved by DoE and OEH and rehabilitation works are currently being conducted. Rehabilitation works at East Wolgan Swamp commenced in January 2014 and the following activities are being undertaken:

- detailed vegetation mapping (before rehabilitation)
- swamp re-hydration works- construction and strategic placement of coir logs, sandbag and jute mesh weirs.
- direct seeding - collecting seeds off targeted species already within the swamp and placing in rehabilitation area.
- brush matting - collecting branches from vegetation in the area adjacent and placing it in the rehabilitation area to encourage and provide cover for new growth.

Excavation and rehabilitation of the slumping sites will be conducted after the summer thunderstorm season, which has caused high intensity rainfall events over the past several years. These events have caused significant erosion of swamp peat / soil at the slumping sites in East Wolgan Swamp and it is intended to avoid rehabilitation works of these sites during this period.

Rehabilitation activities at the East Wolgan Swamp will continue until the success criteria detailed within the rehabilitation strategy have been achieved. **Figure 2**, **Figure 3** and **Figure 4** show the progress of rehabilitation undertaken to date.

Based on the successful implementation of remediation techniques for the rehabilitation of THPSS using BMCC's 'How to guide' described above for many shrub swamps noted above, Centennial Coal considers the success of the rehabilitation of the East Wolgan Swamp to be high.

3.2.5 Economic

Various – The Australia Institute raised a number of concerns in relation to the adequacy of the Economic Assessment for the Project in the context of:

- **Its compliance with 'state and federal guidelines' for preparation of cost benefit analyses; and**
- **Its failure to 'meet standards expected in the economics profession'. (TAI)**

A response to the issues raise by The Australia Institute has been addressed in a report titled "Springvale and Angus Place MEPs – Response to Submission by the Australia Institute' prepared by Aigis Group and provided as **Appendix 5** to this RTS.

3.2.6 Exploration

The DA for the neighbouring Centennial mine, Springvale, undertakes to "continue exploration activities, predominantly borehole drilling to further refine the existing geological model", but the Angus Place EIS includes no such commitment. Is this just an oversight? (BMCS)

Section 4.2 of the Angus Place EIS describes the proposed exploration programme. As is detailed in Section 4.2 of the EIS, exploration activities will continue throughout the life of the Project within the Project Application Area with a view of refining the site's existing geological model used for detailed mine planning. The exploration programme will be undertaken throughout the life of the Project and approval for these activities is sought as part of the Project.

3.2.7 General

It is confusing regarding the intention in the AP EIS to "include all currently approved operations, facilities and infrastructure of the Springvale Mine". Why would Angus Place use the Springvale plant? (BMCS)

The Project Description provided in the Executive Summary incorrectly references the Springvale Mine. The general description provided in Section 1.5 of the EIS correctly states that the Project will "in general, include all currently approved operations, facilities and infrastructure of the Angus Place Colliery…" A detailed description of the Project and all activities associated with the Project is provided in Section 4.0 of the EIS.

The proposed 25 year Consent Period is far too long given the history of 'unforeseen' impacts associated with Angus Place and Springvale Colliery's including cliff falls, swamp deaths, and water quality breaches. Planning consent should be limited to a maximum of 5 years, and must be subject to performance 'triggers' that ensure the health and integrity of nationally endangered swamps, the Coxs River and Sydney Drinking Water Catchment, and national and World Heritage values. If the trigger levels are exceeded then the Consent should be reviewed to address any failures. (BMCS)

Centennial Angus Place is seeking approval for continued operations for 25 years from date of consent. The proposed Project is a life of mine project and has been designed in accordance with the principles of ecological sustainable development (ESD).

A wide range of technical assessments were undertaken to assess the potential impacts of the Project on the environment by specialist consultants with many years' experience in their respective areas of expertise. Controls were adopted at the design phase of the Project where potential impacts could not be avoided. Impacts have been minimised as far as practical through the mine design and surface infrastructure positioning which have already taken into account a number of surface, geological and environmental constraints. Most importantly, the controls are based on previous experiences in longwall mining and infrastructure establishment, including extracting longwalls of varying void widths. Furthermore, mitigation measures recommended in the technical assessments will be adopted as relevant at the implementation phase of the Project to ensure potential impacts are managed appropriately.

The suite of existing environmental management plans, to be updated for the Project, have been developed on a risk-basis to appropriately identify, mitigate and manage environmental risks, and provide procedures for the ongoing management and monitoring of Angus Place Colliery in line with the objectives of ESD. Environmental performance reporting of actual versus predicted impacts will continue to be undertaken annually as part of the Angus Place Colliery Annual Review reporting requirements. The Annual Review is made publicly available on the Centennial Coal website. Accordingly, Springvale Coal contends that the Project will meet environmental performance and should be considered for approval for the proposed 25 years project life.

Lastly, the consent period of 25 years is required to ensure the sustainable operations at Angus Place Colliery and this project life will provide a level of certainty to the company to ensure the continued ongoing employment Angus Place Colliery provides.

The Angus Place and the adjoining Springvale mine extension proposals must be subject to a Planning Assessment Commission review with concurrent Public Hearings. (SCSGBM)

Determination of the Angus Place MEP and the Springvale MEP will be by the NSW Planning and Assessment Commission following public hearings for both projects. The Planning and Assessment Commission will determine how these public hearings are structured.

3.2.8 Historic Impacts

Various special interest groups have raised concerns regarding a number of impacts considered to be attributable to the mining operations of Angus Place Colliery. These historic issues raised can be summarised into 5 specific areas which include:

- **Loss of water flow in creeks as a result of subsidence cracking;**
- **Changes to ecological communities;**
- **Impacts to water quality;**
- **Impacts to swamps; and**
- **Cliff falls. (Various)**

Centennial Angus Place acknowledges that previous mining has resulted in some localised impacts to the environment as a result of its operations. As discussed in Section 2.6.2.7 of the EIS, surface impacts have been observed at five shrub swamps (Kangaroo Creek Swamp, Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp, Junction Swamp). Numerous investigations have been undertaken and extensive monitoring launched by both Angus Place Colliery and Springvale Mine to understand the causal factors involved. These are discussed below.

An independent investigation by Goldney et al (2010), undertaken on behalf of the then Commonwealth Department of, Environment, Water, Heritage and the Arts (DEWHA), found that the major cause of most of the impacts at Narrow Swamp North and Narrow Swamp South was mine water discharge and not subsidence related ground movements. Impacts at East Wolgan Swamp and Kangaroo Creek Swamp appear to have been caused by a combination of subsidence-related ground movements, mine water discharge and erosion, with the particular contribution of subsidence impacts unable to be quantified.

Since 2002, Angus Place Colliery has been involved in intensive monitoring, investigations and research to better understand the surface environment overlying the mining areas. These investigations have included groundwater, surface water, ecological aspects and the interplay of these aspects on swamps. The data collected and analysed over the past 11 years has been critical to proving that the technologies and engineering methodologies for longwall mining will minimise impacts to sensitive surface features.

At Angus Place Colliery, the application of risk based planning, has driven mine planning, mine design and subsidence management, based on the geological and geotechnical constraints, and the overlying sensitive features.

As detailed in Section 8 of the EIS, the approach of Angus Place Colliery to the MEP has been to apply a best practice system of environmental management: that is a hierarchy of avoiding, minimising, mitigating and finally, offsetting residual impacts.

In a general chronology, the following steps have been taken to design the Project:

- a detailed geological investigation to delineate the target coal seams and understand associated strata;

- a detailed geotechnical investigation to understand important structures such as faulting that can affect how mineable certain areas of coal are, and the way in which subsidence might occur in these areas;
- a detailed investigation of natural underground features;
- a detailed survey of natural surface features such as cliffs, pagodas, swamps and watercourses;
- a first pass consideration of subsidence effects based on unlimited extraction across the Project area and the subsequent elimination of avoidance areas from further mining consideration;
- the formulation of mine design alternatives based on remnant available areas and potential environmental impacts;
- a detailed cost benefit analysis of the alternate mine designs to select a preferred option;
- detailed subsidence predictions of the preferred mine plan to identify further required avoidance areas or specific mitigation measures required; and
- a consideration of existing approval requirements that may impact upon the Project.
- There are two management strategies for avoiding or minimising the impacts to sensitive surface features as a result of mining. These are:
- Avoid mining under the sensitive surface feature; or
- Mine design under the sensitive surface feature has a sub-critical void width.
- The following controls have been applied through the mine design process to minimise impacts to the environment:
- longwalls adjacent to the Gardens of Stone National Park are to be extracted towards the National Park with potential ground movements progressively monitored and managed as required. This adaptive management approach complements the mine plan design in reducing impacts to the existing environment;
- LW 1004 to LW 1006 will be designed with 261 m voids. The depths of cover directly above these proposed longwalls range from 330 m to 420 m with resulting sub-critical void width to depth ratios of 0.60 to 0.85, which is less than previous longwall development at Angus Place.
- LW1001, LW1002 and LW1003 will be designed with 285 m voids.
- LW1013 and LW1014 have both been split into two sections (A and B) to avoid intervening cliff and pagoda complexes. The longwall sections will be linked underground by twin 5 m wide development headings to provide safe access and ventilation. These first workings will not generate surface subsidence.
- LW1007 to LW1019 will be 350 m wide, with chain pillars 55 m wide. Depths of cover range from 360 m to 420 m. The resulting sub-critical void width to depth ratios are within the range of 0.85 to 1.0, which is similar to those for the previously extracted longwalls at Angus Place.
- LW1010 has been shortened to avoid mining under Twin Gully Swamp.

In addition, the Project does not propose any mine water discharge to the THPSS on the Newnes Plateau and therefore there is no proposed change to flow variability in those catchments.

As a result of impacts identified to swamps in the past, Centennial Angus Place has modified the mine design to minimise the potential risk of these impacts occurring into the future. Table 2.6 in the EIS is reproduced below as **Table 23** to emphasise the changes made to the mine layout through the mine design process for the Project to reduce the potential for impacts to swamps to occur in the future.

Table 23 - Causal Factors to East Wolgan Swamp Impacts and Management Response

Causal Factors	Management Response
Mine water discharge	Cease mine water discharge to Newnes Plateau (including proposed underground water storage for future emergency mine water discharges). NB. No Newnes Plateau discharges since April 2010.
Intersection of major geological fault structures	Major geological structure zones identified through detailed topographic, geological and geophysical analysis, The relationship between mine subsidence, geological faulting and groundwater response is well understood from historical monitoring data(based on piezometers, extensometers, subsidence monitoring (terrestrial and LIDAR), exploration borehole data). This understanding is used in the mine planning and design process to ensure that combinations of risk factors do not occur in future mining areas in the Project Application Area.
Orientation of longwall panels sub-parallel to major structures	Angle of orientation increased for future swamps e.g increase to 24^{o} for Carne West and 51^{o} for Sunnyside East.
Steepness and depth valley containing swamps	Surface topography is well understood from Digital Terrain Model. Analysis of topographic and subsidence data identified no measured impacts at slope angles <18°.
In situ stress direction and magnitude	Horizontal stress orientation mapped through exploration borehole geophysical testing / analysis. Horizontal stress magnitude measured through installation of instrumentation in surface to seam boreholes and in the roof at seam level.
Critical width longwall panel design	Future longwalls in the vicinity of swamps are based on Subcritical panel design.
Location and orientation of geological structure adjacent to the permanent barrier pillar	Future Mine workings designed to avoid alignment of major geological structure zones sub-parallel with edge of permanent barrier pillar subject to multiple panel subsidence effects.
Subsidence Interaction of Adjacent Angus Place and Springvale Workings	Springvale and Angus Place future mining areas are not adjacent to each other (separated by over 500m) thus interaction will be avoided.

The impacts predicted in the EIS are based on extensive monitoring data, robust modelling and a comprehensive understanding of the environment in which the Project will operate. It has been determined that the impacts experienced in the past are unlikely to occur as a result of the Project and any impacts would not be significant. Should impacts be identified, an adaptive management approach will be developed to manage impacts into the future.

Centennial Coal must not be allowed to simply replicate the damage it has already caused to nationally threatened upland swamps on the Newnes Plateau for which it was required by the Commonwealth Government to pay $1.45 million in reparations. (NCC and SCSGBM)

Centennial Coal acknowledges in Section 2.6.2.7 of the EIS the historical impacts to Swamps as a result of previous mining and mining related activities. Longwalls have been extracted directly or partially beneath 13 shrub swamps and 26 hanging swamps. Surface impacts have been observed at five swamps including Kangaroo Creek Swamp, Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp. These have been investigated and where impacts have been observed, these have been identified as largely the result of mine water discharge.

Investigations have identified that erosional and flora dieback impacts at Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp were caused by changes to swamp hydrology related to mine water discharge and were not related to subsidence. As a result of this finding, future mine dewatering systems have been designed to ensure that discharge of mine water to Newnes Plateau Shrub Swamps is avoided.

Subsidence effects to aspects of swamp hydrology have been noted at two swamps (Kangaroo Creek Swamp and East Wolgan Swamp). In both of these cases investigations have revealed that mine design was a primary causative factor. The ratio of longwall mining void width to depth of cover over mine workings was identified to be in the critical subsidence behaviour range. Following this investigation, the mine design was modified for all future proposed mining areas in the vicinity of Newnes Plateau Shrub Swamps to ensure that the ratio of longwall mining void width to depth of cover over mine workings was in the sub-critical subsidence behaviour range. No subsidence effects to swamp hydrology or flora communities have been identified in areas where sub-critical mine design have been used in the past.

Section 2.8.4 of the EIS details the cause and outcomes of an Enforceable Undertaking under section 486DA of the EPBC Act. Centennial Coal acknowledged that its operations had a significant impact on THPSS, a federally listed endangered ecological community and as such Springvale Coal Pty Ltd and Angus Place Pty Limited undertook to pay $1,450,000 for a four year research program.

The objectives of this research program are to:

- Provide the necessary knowledge to conserve, manage and restore THPSS;
- Use that knowledge to promote best management practices for these areas;
- Transfer knowledge gained in the program to agencies, land managers and relevant stakeholders; and
- Maximise the educational and training opportunities of the Program.

The research themes under the program are:

- Understanding the THPSS which includes detailed mapping, location, distribution and extent of the swamps, including those under threat.
- Understanding swamp systems, including water balance and dynamics, the functionality of peatland swamps, environmental history and origins, ecology/biodiversity of major structural species and contribution of THPSS to the landscape.
- Understanding land management and impacts, including condition status mapping and trends.
- Application of understanding, including monitoring of reference sites and thresholds for recovery and resilience.

In 2012, approximately $900,000 of the research fund had been allocated to five projects, with additional funding set aside to support swamp hydrology research when a suitable project was identified by the Steering Committee. The Committee meets twice annually and holds an annual workshop to review the status of the research findings and outcomes.

Local mining history has demonstrated that subsidence damage and/or eco-toxic mine water effluent discharges from Angus Place and Springvale Colliery's have caused irreparable damage to a Federally Listed Endangered Ecological Community THPSS at Junction Swamp, Narrow Swamp, East Wolgan Swamp, Kangaroo Swamp, and Lamb's Creek Swamp. That is clearly an unacceptable situation. (BMCS)

Centennial Angus Place acknowledges in Section 2.6.2.7 of the EIS the historical impacts to Swamps as a result of previous mining and mining related activities. Longwalls have been extracted directly or partially beneath 13 shrub swamps and 26 hanging swamps. Surface impacts have been observed at five swamps including Kangaroo Creek Swamp, Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp. These have been investigated and where impacts have been observed, these have been identified as largely the result of mine water discharge.

Investigations have identified that erosional and flora dieback impacts at Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp were caused by changes to swamp hydrology related to mine water discharge and/or subsidence. While mine water discharges was the primary causative factor, in the cases of Kangaroo Creek Swamp and East Wolgan Swamp subsidence-related impacts were also contributing factors. This finding is supported by Goldney et al (2010), an independent investigation undertaken on behalf of the then Commonwealth Department of, Environment, Water, Heritage and the Arts (DEWHA), who agreed that the major cause of most of the impacts at Narrow Swamp North and Narrow Swamp South was mine water discharge and not subsidence related ground movements. Impacts at East Wolgan Swamp and Kangaroo Creek Swamp were caused by a combination of subsidence-related ground movements, mine water discharge and erosion, with the particular contribution of subsidence impacts unable to be quantified.

As a result of this finding, future mine dewatering systems have been designed to ensure that discharge of mine water to Newnes Plateau Shrub Swamps is avoided.

Investigations of subsidence impacts to aspects of swamp hydrology changes identified at Kangaroo Creek Swamp and East Wolgan Swamp have revealed that mine design was one of the co-incident causative factors. The ratio of longwall mining void width to depth of cover over mine workings was identified to be in the critical subsidence behaviour range. Following this investigation, the mine design was modified for all future proposed mining areas in the vicinity of Newnes Plateau Shrub Swamps to ensure that the ratio of longwall mining void width to depth of cover over mine workings was in the sub-critical subsidence behaviour range. No subsidence effects to swamp hydrology or flora communities have been identified in areas where sub-critical mine design has been used in the past.

In addition to mine subsidence and mine water discharge damage there are other mine related impacts to endangered swamps which must be avoided. For example, LEG believes that the trail bike tracks below running from Campbell's Road down into East Wolgan Swamp were initially started by Consultants monitoring for Springvale and/or Angus Place Colliery, and subsequently have been used by other trail bike riders. The resultant erosion gullies are very deep and is causing localised drying out of a hanging swamp. We believe that Centennial should be required to remediate the tracks put in by their Consultants. (LEG)

Angus Place Colliery has adopted a progressive approach to rehabilitation to reduce and mitigate potential environmental impacts. Exploration sites, ventilation and dewatering facilities and access tracks are rehabilitated promptly with periodic inspections and maintenance as necessary based upon evidence of endemic regrowth, weeds and soil disturbance.

As proposed in Section 8.1.1.3 of the Rehabilitation and Decommissioning Strategy prepared by SLR to support the Project and provided as Appendix P to the EIS, access tracks upgraded or established as part of the Project on the Newnes Plateau will remain for use as access tracks by recreational users and by Forestry Corporation of NSW.

As detailed in Section 10.3.7 of the EIS, Centennial Coal's monitoring effort on the Newnes Plateau is extensive and contributes to an increase in other anthropogenic impacts, such as recreational 4WDs, through the establishment of access tracks for monitoring. Should the current suite of monitoring persist, these incidental (but not insignificant) impacts will continue across the Newnes Plateau, placing greater pressure on areas where conservation values are currently retained.

The monitoring program proposed as part of the Regional Biodiversity Offset Strategy will be regionalised with greater effort on remote sensing data collection across a wider distribution of the Newnes Plateau and will focus on supporting research into rapid mapping techniques and defining vegetation community boundaries. This will reduce the potential impacts on the Newnes Plateau from monitoring by consultants.

To compensate for the clearing required for new surface infrastructure, Centennial Coal has developed a Biodiversity Strategy that that takes into consideration both the direct impacts of clearing potential habitat and indirect impacts to the Temperate Highland Peat Swamps on Sandstone, incorporating Newnes Plateau Shrub Swamps and Newnes Plateau Hanging Swamps. Details of the strategy proposed to be implemented are detailed in the revised Regional Biodiversity Offset Strategy (September 2014) provided as **Appendix 4** to this RTS.

Bushfire is a serious problem for damaged swamps, as the peat can burn deeply, can massively accelerate erosion, and subsequently affect natural regeneration. Centennial's rehabilitation efforts at East Wolgan Swamp could all be gone in a matter of minutes. It is better not to damage swamps in the first place, but when they have been damaged some fire management planning must be undertaken by those responsible. (LEG)

Bushfire risk management within the Newnes State Forest is undertaken by Forestry Corporation of NSW, and is not the responsibility of Centennial Angus Place or Springvale Coal.

The applications for the rehabilitation works at East Wolgan Swamp were submitted to the former SEWPAC (now Department of the Environment) on 16 August 2012. Approval from the then SEWPAC was received on 21 September 2012 while the approval from OEH under Section 95 of the TSC Act was not received till 25 November 2013. Rehabilitation works on the East Wolgan Swamp were commenced in January 2014 and the rehabilitation works have progressed to a stage where the peat is no longer exposed, as shown in **Figure 40**.

It should be pointed out that it is not only the "damaged swamps" that can be impacted by bushfires. Section 10.14.4 of the EIS assessed the general area of Newnes Plateau encompassing the Springvale and Angus Place Project Application Areas as defined bushfire category of Level 3 or Extreme in accordance with RFS (2006). Bushfires do occur with high frequency on Newnes Plateau, with the last major bushfire observed in mid-October 2013. In this bushfire event Gang Gang Shrub Swamp was impacted, as shown in **Figure 40**, however the natural regeneration of the swamp commenced within a few weeks of the bushfire damage (**Figure 41**). **Figure 42** shows the swamp approximately 10 weeks after the bushfire.

Figure 40 - Gang Gang Swamp following Bushfire Event of mid-October 2013

Figure 41 - Gang Gang Swamp on 30 October 2013 showing Onset of Natural Regeneration

Figure 42 - Gang Gang Swamp approximately 10 Weeks after the Bushfire in Mid-October 2013

Fire management planning is undertaken by both Angus Place Colliery and Springvale Mine. Given the high risk of bushfire risk on Newnes Plateau, Centennial Angus Place and Springvale Coal have reduced the operational risk of bushfire through incorporation and avoidance measures in the MEP designs. Section 10.14.4.3 of the Angus Place EIS and Section 10.14.4.4 of the Springvale EIS discuss in detail the mitigation measures that have been or will be implemented in the projects. These include:

- incorporation of adequate (minimal 20-metre) Asset Protection Zones around all proposed infrastructure (dewatering bore facilities, ventilation facility, mine services borehole area)
- trenching 11 kV power cables to dewatering borehole sites which avoids the potential for overhead lines to trigger bushfires (or be destroyed by bushfires)
- undertaking a number of bushfire risk management procedures, as outlined in Section 10.14.4.4 of the EIS.

Angus Place Colliery and Springvale Mine have established Bushfire Management Plans and Bushfire Management Procedures, in consultation with NSW Rural Fire Service, which identify both the risks posed by bushfire to the mine assets on Newnes Plateau and control strategies to mitigate these risks. Conversely, the control strategies ensure that no bushfires on Newnes Plateau are ignited by the high voltage equipment located within the mine infrastructure facilities.

3.2.9 Mine Design

Centennial Coal must be required to consider alternative bord and pillar mining methods for its proposed Angus Place extension. Centennial's Airly mine in the Capertee Valley operates to a depth of 405 metres underground in the same geology. If Centennial can operate Airly Colliery as a bord and pillar mine, then it can also operate Springvale mine in this manner. (Colo Committee)

Bord and pillar is a clearly more benign process, and has been practiced at Centennial's nearby Clarence Colliery. However, in this instance, the mining method was chosen for reasons of engineering safety (the stope back was too solid to collapse in a controlled manner) rather than any display of environmental sensitivity. (BMCS)

The mining footprint must be significantly lessened and mining methods reduced in intensity to protect Carne Creek, pagodas, cliffs and the nationally endangered swamps of the proposal area. Centennial Coal must be required to consider alternative bord and pillar mining methods for the proposed extension to Angus Place Colliery. Centennial's Airly Mine in the Capertee Valley operates to depth of 405 metres in the same geology, which includes bad mine roof conditions and many structural features. If Centennial can operate Airly Colliery as a bord and pillar mine, then it can also operate Springvale mine in this manner. (Colong Foundation)

The mining footprint of the Angus Place Extension must be significantly lessened and the intensity of mining methods reduced to protect nationally endangered swamps, Carne Creek, pagodas and cliffs. Centennial Coal must be required to consider alternative bord-and-pillar mining methods in these environmentally sensitive areas. (LEG)

As is detailed in Section 8.2.2 of the EIS, the combination of a weak roof and a high stress environment means that longwall mining in the Lithgow seam at Angus Place Colliery is the only viable and safe mining method. Strata Engineering Pty. Ltd (Australia) in Report No. 03-123-AGP-33 identify that in Australia there is no known precedent for safe and viable partial extraction (i.e. bord and pillar) operation in the geotechnical environment under consideration within the Project Application Area.

Clarence Colliery operates in a different geological environment which allows for bord and pilar mining to be more suited to the operations at this site.

The geological and geotechnical constraints to mining, combined with the extensive knowledge of the hydrogeological environment has resulted in a mine design that is reflective of decades of mining experience at the Angus Place Colliery and Springvale Mine and there has been significant effort to prioritise avoidance and reduction of potential impacts and constraints of surface features and geological and geotechnical issues, while considering mine safety, feasibility and optimisation. The mine has been designed to avoid, to the largest extent possible, sensitive surface features. Where a sensitive surface feature has not been avoided, a sub-critical void width has been applied in the mine design.

The intensity of longwall mining is reduced so that all nationally endangered swamps are protected – this includes shortening longwalls 1017 and 1016 to protect Trail 6 swamp and shortening longwalls 1004, 1005 and 1006 to protect the Tri Star Swamp complex. Narrowing and/or splitting longwall panels 1007, 1008, 1009 and 1010 occurs to prevent fracture damage to the Birds Rock Flora Reserve. Splitting longwalls 1013 and 1014 occurs to prevent damage to pagodas and cliffs. (Colo Committee, BMCS and LEG)

Chapter 8 of the EIS details the evolution of the mine design at Angus Place Colliery and how the mine design proposed for the Project has been developed taking into consideration safety, geological and environmental features.

Angus Place Colliery has applied a risk based approach to the Project to identify, quantify and reduce risks of environmental consequences wherever feasible. Previous subsidence monitoring has been used to develop and validate a predictive model of subsidence for the proposed mining area. This model has a high level of confidence in its predictions and is built upon a significant dataset comprising geological and geotechnical data. The mine has been designed to avoid, to the largest extent possible, sensitive surface features. Where a sensitive surface feature has not been avoided, a sub-critical void width has been applied in the mine design.

The geological and geotechnical constraints to mining, combined with the extensive knowledge of the hydrogeological environment has resulted in a mine design that is reflective of decades of mining experience at the Angus Place Colliery and Springvale Mine.

The approach of Angus Place Colliery to the MEP has been to apply a best practice system of environmental management: that is a hierarchy of avoiding, minimising, mitigating and finally, offsetting residual impacts.

As mining has progressed at Angus Place Colliery, the alignment and dimensions of longwall panels have been developed and refined over a long period of time for a range of mine designs. There has been significant effort to prioritise avoidance and reduction of potential impacts and constraints of surface features and geological and geotechnical issues, while considering mine safety, feasibility and optimisation.

Significant effort has been invested to evaluate the available coal resource and to avoid or minimise potential impacts that could be associated with the Project.

The primary objective of mine design is safety, underground and on the surface. By managing safety, the mine manages subsidence impacts on the surface and in turn manages environmental and social consequences. At Angus Place Colliery, the application of risk based planning, has driven mine planning, mine design and subsidence management, based on the geological and geotechnical constraints, and the overlying sensitive features.

There are two management strategies for avoiding or minimising the impacts to sensitive surface features as a result of mining. These are:

- Avoid mining under the sensitive surface feature; or
- Mine design under the sensitive surface feature has a sub-critical void width.

The following controls have been applied to the Project:

- longwalls adjacent to the Gardens of Stone National Park are to be extracted towards the National Park with potential ground movements progressively monitored and managed as required. This adaptive management approach complements the mine plan design in reducing impacts to the existing environment;
- LW 1004 to LW 1006 will be designed with 261 m voids. The depths of cover directly above these proposed longwalls range from 330 m to 420 m with resulting sub-critical void width to depth ratios of 0.60 to 0.85, which is less than previous longwall development at Angus Place.
- LW1001, LW1002 and LW1003 will be designed with 285 m voids.
- LW1013 and LW1014 have both been split into two sections (A and B) to avoid intervening cliff and pagoda complexes. The longwall sections will be linked underground by twin 5 m wide

development headings to provide safe access and ventilation. These first workings will not generate surface subsidence.

- LW1007 to LW1019 will be 350 m wide, with chain pillars 55 m wide. Depths of cover range from 360 m to 420 m. The resulting sub-critical void width to depth ratios are within the range of 0.85 to 1.0, which is similar to those for the previously extracted longwalls at Angus Place.

- LW1010 has been shortened to avoid mining under Twin Gully Swamp.

Potential environmental constraints have already been taken into account during the mine design process to ensure the Project is undertaken safely and in the most environmentally sensitive manner feasible. Where impacts are predicted, monitoring management and where appropriate, offset strategies, have been proposed to be implemented.

3.2.10 Monitoring

The monitoring has not provided the necessary information to assist decision-makers regarding the damage to these swamps and streams. This could be as simple as the provision of clear images to regulators of the worst examples of dead swamp vegetation and streambed cracking. Groundwater monitoring bores, for example, meet regulatory requirements but do not appear to identify problems that can be observed in dying swamp vegetation. (Colong Foundation)

Centennial Angus Place and Springvale Coal have an extensive and ongoing monitoring programme into the impacts to swamps as a result of mining and mining related activities. The monitoring techniques employed since 2009 are wide-ranging and complementary, and the combined results provide multiple lines of evidence into roles that factors such as geology, hydrogeology, topography play in Newnes Plateau Shrub Swamp formation, and the effects of mine subsidence on these swamps. The results of investigations undertaken to date have allowed Centennial Angus Place and Springvale Coal to understand the multiple co-incident factors that have led to historical mining-related impacts and implement management practices to ensure mining impacts will be avoided in the future or can be managed appropriately.

Some swamps in the Gardens of Stone are used as controls for current mining activity. These swamps are not separate from mining activity and are scheduled to be undermined. Mining would nullify their value as a control.

Reference sites regarding the existing Temperate Highlight Peat Swamps on Sandstone Monitoring and Management Plans (THPSSMMP) for Angus Place and Springvale were located away from existing approved mining areas. The reference sites are monitored at the same frequency as impact sites. Reference sites are used as a comparative reference when determining whether any changes at the impact sites are natural for example climatic or land use such as forestry or whether changes are the result of mining activities. The selection of reference sites is restricted by the finite number of THPSS available within and adjacent to the controlled action areas. Whilst there may be a range of other THPSS on the Newnes Plateau that will not be affected by future mining and which could potentially be used for future reference sites, the following considerations were used for the selection of reference sites regarding the THPSSMMP.

- Reference sites needed to be relatively close to impact sites so that the reference sites experience similar climatic conditions to the impact sites.

- Where possible reference sites needed to be relatively close to impact sites so that the reference sites experience similar hydrogeological conditions.
- Reference sites needed to be located outside of the area of proposed mining related influence.
- If an impact site is a permanently water logged site then a reference site needs to be permanently water logged i.e. a permanently waterlogged site differs from a periodically water logged site.
- Floristic assemblages may differ between impact and reference sites but comparisons are still valid as floristic conditions or swamp health will only generally change between sites if there is an impact at either site.
- All sites needed to have reasonable access to allow for on ground monitoring and investigation activities to be carried out.
- OH&S issues such as access and communications needed to be considered.

Based on the above criteria several reference sites were determined in consultation with the DoE. Subsequently the Angus Place and Springvale THPSSMMPs, including the nominated reference sites, were approved by DotE.

Swamp vegetation condition monitoring programs often do not refer back to the original vegetation condition at the time of the preparation of the environmental impact statement.

Section 5 of the Angus Place Subsidence Monitoring and Reporting Program (November 2013) details the overall strategy for subsidence monitoring as implemented by Angus Place. This includes the regular assessment of baseline information as would have been presented in the EIS.

Centennial Coal has admitted that its monitoring has contributed to damaging these nationally endangered swamps. 'Centennial's monitoring effort on the Newnes Plateau is extensive (refer to Figure 3.9 in Vol. 1 of the EIS) and contributes to an increase in anthropogenic impacts, such as recreational 4WDs, through the establishment of access tracks for monitoring' (Page 39, App. I, Vol. 2 of the EIS). Centennial Coal has not rehabilitated tracks cut to monitoring sites. Once the monitoring effort is completed, inappropriate recreational use continues causing ongoing environmental degradation.

As detailed in Section 10.3.7 of the EIS, Centennial Coal's monitoring effort on the Newnes Plateau is extensive and contributes to an increase in other anthropogenic impacts, such as recreational 4WDs, through the establishment of access tracks for monitoring. Should the current suite of monitoring persist, these incidental (but not insignificant) impacts will continue across the Newnes Plateau, placing greater pressure on areas where conservation values are currently retained.

Angus Place Colliery and Springvale Mine have adopted a progressive approach to rehabilitation to reduce and mitigate potential environmental impacts associated with ongoing monitoring. Access tracks are rehabilitated promptly with periodic inspections and maintenance as necessary based upon evidence of endemic regrowth, weeds and soil disturbance.

The monitoring program proposed as part of the Regional Biodiversity Offset Strategy will be regionalised with greater effort on remote sensing data collection across a wider distribution of the

Newnes Plateau and will focus on supporting research into rapid mapping techniques and defining vegetation community boundaries. This will reduce the potential impacts on the Newnes Plateau from monitoring by consultants.

Centennial Coal's consultants use trail bikes to access monitoring sites, and appear to drive through nationally threatened swamps.

Consultants engaged by Angus Place Colliery and Springvale Mine are required to undertake induction training which outlines the company's requirements with regard to minimal environmental disturbance. Consultants are required to complete Job Safety and Environmental Analysis procedures prior to accessing monitoring sites. Claims regarding the use of trail bikes or access through swamps by Centennial's consultants are completely unfounded.

Centennial proposes to curtail swamp monitoring, apparently because it has 'proven' in this EIS report that longwall mining causes no significant damage to nationally endangered swamps, despite the activity being a key threatening process endangering swamps. Centennial further proposes to fund rehabilitation of the trails it cut for monitoring purposes using the funds saved from curtailing its monitoring effort.

The monitoring program proposed as part of the Regional Biodiversity Offset Strategy will be regionalised with greater effort on remote sensing data collection across a wider distribution of the Newnes Plateau and will focus on supporting research into rapid mapping techniques and defining vegetation community boundaries. This will reduce the potential impacts on the Newnes Plateau from monitoring by consultants.

Funding of rehabilitation activities is undertaken as part of each mine's annual budgeting process. In NSW, the payment of securities is required to the state government prior to undertaking land disturbance activities. Financial securities are only released back to the proponent once rehabilitation has been satisfactorily completed. The rehabilitation of disused access tracks using budgeted funds will occur following consultation with the Forestry Corporation of NSW.

The Swamp Plan is based on incorrect geological and geomorphological assumptions and a flawed monitoring strategy that could not detect damage in a timely fashion. The Swamp Plan's conclusion that longwall mining of Newnes Plateau would be benign demonstrates that the coal industry can't be trusted to protect significant environmental values, such as the nationally endangered swamps found in the Gardens of Stone.

The THPSSMMPs detail the monitoring techniques employed at Angus Place Colliery and Springvale Mine which are wide-ranging and complementary. The combined monitoring results provide insights into the roles factors such as geology, hydrogeology and topography play in THPSS formation and the effects of mine subsidence on THPSS.

Following the East Wolgan Swamp incident, the extensive monitoring and investigation process employed by Angus Place Colliery and Springvale Mine, which utilised multiple lines of evidence to support the management decisions, created the foundations for an adaptive management outcome. Mine design changes (in the form of reduced longwall void width and increased chain pillar width) were implemented in 2011 and are planned in all proposed mining areas where NPSS are present.

The outcome of detailed mine planning and design minimises predicted subsidence and reduces the occurrence of subsidence effects beyond predictions. There has been significant effort to prioritise avoidance and reduction of potential impacts and constraints of surface features and geological and geotechnical issues, while considering mine safety, feasibility and optimisation.

Subsidence monitoring should be by a third party agency, such as the Office of Environment and Heritage, and monitoring should be paid for by Centennial Coal. Monitoring of surface flow and near-surface groundwater monitoring must create a comprehensive picture of the sub-catchments affected by mining. Monitoring of changes in ecosystem condition must include well exposed, wide angle impacts of affected areas with GPS co-ordinates. (Colo Committee)

Subsidence monitoring is undertaken by suitably qualified and certified surveyors registered with the Board of Survey and Spatial Information. Surveyors are required to keep their qualifications up to date to maintain their registration. All surveys are undertaken in accordance with relevant government guidelines. Subsidence monitoring is undertaken in accordance with agreed subsidence monitoring programmes detailed within an extraction plans and Subsidence Management Plan and within accuracy requirements determined by the NSW Division of Resources and Energy.

3.2.11 Physical Impacts

Minimal impact is zero impact. Since the document then states that "Impacts that do arise would be managed by …" clearly indicates that impacts are expected, not minimised. (BMCS)

The EIS details the proposed impacts of the Project. Centennial Angus Place acknowledges throughout the EIS that impacts will occur as a result of the Project. These impacts are based on detailed modelling, an understanding of the existing environment, and data collected over a number of years. Impacts have been minimised as far as practical through the mine design and surface infrastructure positioning which have already taken into account a number of surface, geological and environmental constraints. Where impacts are predicted, monitoring and management strategies have been identified to ensure the risk of impacts are further minimised and where residual impacts are predicted, they are offset where applicable.

3.2.12 Rehabilitation

Progressive rehabilitation undertaken by Centennial has proven ineffective and incomplete. Many tens of kilometres of access roads have not been closed and rehabilitated. (NCC)

All past tracks and trails created by Centennial Coal and its consultants, including those established by trail bikes, should be recorded and plans set in place as soon as practicable to rehabilitate these trails on an on-going basis and as part of the rehabilitation program for this mine. (Colo Committee)

As detailed in Section 3.13 of the EIS, the current approved MOP for Angus Place Colliery details the proposed rehabilitation objectives to ensure the final landform is commensurate with the surrounding topography and relevant zoning requirements of the time.

Angus Place Colliery has adopted a progressive approach to rehabilitation to reduce and mitigate potential environmental impacts. Exploration sites, ventilation and dewatering facilities and access tracks are rehabilitated promptly with periodic inspections and maintenance as necessary based upon evidence of endemic regrowth, weeds and soil disturbance. Rehabilitation acceleration techniques are undertaken, if required following approval from the Forestry Corporation of NSW.

The success of progressive rehabilitation activities is monitored against appropriate performance indicators identified within the Angus Place EMS framework and relevant legislative requirements.

The new infrastructure components of the Project will require rehabilitation as a result of surface disturbance during construction. The progressive approach to rehabilitation will continue to be applied. The success of existing and future rehabilitation will be monitored against appropriate performance indicators identified within the rehabilitation strategy and MOP.

Conceptual Rehabilitation Success Criteria have been provided in Section 10.11 of the EIS. Rehabilitation activities will continue to be undertaken until these rehabilitation objectives are achieved.

Even when rehabilitation action has been triggered by the 'Swamp Plan' it has been ineffectual and half-hearted. The rolls of coir logs have been found left abandoned, the dumping of branches from the surrounding forest will encourage dry-land vegetation, not the regeneration of swamp vegetation. (Colong Foundation)

As detailed in Section 2.6.2.6 of the EIS, Springvale Coal has applied for approvals from SEWPaC (now DoE) and OEH to enable rehabilitation works on East Wolgan Swamp to be carried out. These applications were made on 16 August 2012. Springvale Coal obtained approval from the former Federal Department of Sustainability, Environment, Water, Populations and Communities on 21 September 2012. OEH approved the undertaking restoration actions at East Wolgan Swamp and issued a certificate under Section 95 of the Threatened Species Conservation Act 1995 (TSC Act) on 25 November 2013. A specific rehabilitation strategy has been prepared to prevent further impacts to East Wolgan Swamp and to assist the recovery of the swamp vegetation community.

This strategy has been approved by DoE and OEH and rehabilitation works are currently being conducted. Rehabilitation works at East Wolgan Swamp commenced in January 2014 and the following activities are being undertaken:

- detailed vegetation mapping (before rehabilitation)
- swamp re-hydration works - construction and strategic placement of coir logs, sandbag and jute mesh weirs.
- direct seeding - collecting seeds off targeted species already within the swamp and placing in rehabilitation area.
- brush matting - collecting branches from vegetation in the area adjacent and placing it in the rehabilitation area to encourage and provide cover for new growth.

Excavation and rehabilitation of the slumping sites will be conducted after the summer thunderstorm season, which has caused high intensity rainfall events over the past several years. These events have caused significant erosion of swamp peat / soil at the slumping sites in East Wolgan Swamp and it is intended to avoid rehabilitation works of these sites during this period.

Rehabilitation activities will continue until the success criteria detailed within the rehabilitation strategy have been achieved.

3.2.13 Subsidence

All 2,638 hectares affected by the proposed longwall mining will be subject to surface cracking. Entire sub-catchments will be fractured to a depth of 15 to 20 metres. (Colong and NCC)

As detailed in Section 5.12.5 of the Subsidence Assessment prepared by MSEC and provided as Appendix D to the EIS, the surface cracking across the mining area is expected to be generally isolated and minor in nature, due to the reasonable depths of cover which typically vary between 270 metres and 450 metres, and due to the plasticity of the surface soils which allows them to more readily absorb the ground strains. Surface crack widths are expected to be similar to those observed above the previously extracted longwalls at Angus Place and Springvale Collieries, which were typically between 5 mm and 25 mm, but with isolated surface cracking in some locations greater than 50 mm.

The mining footprint must be significantly lessened and mining methods reduced in intensity to protect Carne Creek, pagodas, cliffs and the nationally endangered swamps of the proposal area. (NCC)

There should be no surface cracking of stream beds, under swamps or of pagodas, rock outcrops or cliffs. (BMCS)

As detailed in Section 5.4 of the Subsidence Impact Assessment (Appendix D to the EIS), fracturing of the uppermost bedrock has been observed in the past, as a result of longwall mining, where the tensile strains have been greater than 0.5 mm/m or where the compressive strains have been greater than 2 mm/m. It is likely, therefore, that fracturing would occur in the uppermost bedrock based on the predicted maximum strains. It has been observed in the past, that the depth of fracturing and dilation of the uppermost bedrock, resulting from longwall mining, is generally less than 10 m to 15 m.

Where the beds of the drainage lines comprise natural surface soils, it is possible that fracturing in the bedrock would not be seen at the surface. In the event that fracturing of the bedrock occurs in these locations within the alignments of the drainage lines, the fractures are likely to be filled with soil during subsequent flow events.

Where the beds of the drainage lines have exposed bedrock, there may be some diversion of surface water flows into the dilated strata beneath them and the draining of pooled water within the alignments. It is unlikely that there would be any net loss of water from the catchment, however, as the depth of dilation and fracturing is expected to be less than 10 m to 15 m and, therefore, any diverted surface water is likely to re-emerge into the catchment further downstream.

The maximum predicted subsidence at Carne Creek, due to the extraction of the proposed longwalls, is less than 20 mm. Whilst the creek could experience some very low level vertical subsidence, it is not expected to experience any measurable conventional tilts or curvatures, even if the predictions were exceeded by a factor of 2 times. The section of Carne Creek located within 600 metres of the proposed longwalls could also experience some low level movements resulting from the extraction of the future longwalls at Springvale Colliery. The predicted conventional and valley related strains along this section of creek, due to mining at Springvale Colliery, are also expected to be less than 0.5 mm/m, which is in the order of survey tolerance. It is unlikely, therefore, that Carne Creek would be adversely impacted as a result of the extraction of the proposed LW1001 to LW1019.

The swamps which are located directly above the proposed longwalls are predicted to experience tensile strains greater than 0.5 mm/m and compressive strains greater than 2 mm/m. It is expected, therefore, that fracturing would occur in the top most bedrock beneath these swamps.

The surface cracking across the mining area is expected to be generally isolated and minor in nature, due to the reasonable depths of cover which typically vary between 270 m and 450 m, and due to the plasticity of the surface soils which allows them to more readily absorb the ground strains. Surface crack widths are expected to be similar to those observed above the previously extracted longwalls at Angus Place and Springvale Collieries, which were typically between 5 mm and 25 mm, but with isolated surface cracking in some locations greater than 50 mm.

The shrub swamps have peat layers which overlie the shallow natural surface soils and underlying bedrock along the alignments of the drainage lines. In most cases, cracking would not be visible at the surface within these swamps, except where the depths of bedrock are shallow or exposed. The shrub swamps comprise significant quantities of sediment and, therefore, fracturing of shallow bedrock beneath these swamps are likely to be filled with soil during subsequent flow events along the drainage lines.

The mining layout has been designed such that the majority of the cliffs and pagoda complexes are located outside the 26.5 degree angle of draw line from the extents of the proposed longwalls. There are two cliffs and some pagoda complexes which have been identified within the 26.5 degree angle of draw line, however, they are all located outside the extents of the proposed longwalls. There is one minor cliff which has been identified immediately adjacent to the eastern end of the proposed LW1014B and some isolated pagodas identified elsewhere above the proposed longwalls.

Whilst the cliffs and pagodas complexes could experience low levels of subsidence, they are not expected to experience any significant conventional tilts, curvatures or strains. These features are located along the valley sides and, therefore, are not expected to experience the valley related upsidence or compressive strains due to valley closure.

It is unlikely therefore, that the cliffs and pagoda complexes would experience any adverse impacts resulting from the extraction of the proposed longwalls. This is supported by extensive experience from the NSW Coalfields, at depths of cover greater than 200 m, where no cliff instabilities have been observed where cliffs have been located wholly outside the extents of extracted longwalls.

There are some minor cliffs, pagodas and other rock formations which are located immediately adjacent to or directly above the proposed longwalls. The proposed mining is likely to result in some fracturing in these features and, where the rock is marginally stable, could then result in spalling of the exposed rockfaces. It is expected that the impacts on these minor cliffs, pagodas and rock formations would represent less than 1 % to 3 % of total exposed rockface areas of these features which are located directly above the proposed longwalls.

The western coalfield has a history of cliff collapses due to subsidence from longwall mining. As was demonstrated by the nearby Coalpac Consolidated Project, the companies involved greatly underestimated the level of cliff collapse that has already occurred. Conservation volunteers have been able to find, locate and document a great many instances that mining consultants failed to find. (BMCS)

As detailed in Section 5.7 of the Subsidence Assessment, the mining layout has been designed such that the majority of the cliffs and pagoda complexes are located outside the 26.5 degree angle of draw line from the extents of the proposed longwalls. There are two cliffs and some pagoda complexes which have been identified within the 26.5 degree angle of draw line, however, all these features are located outside the extents of the proposed longwalls. There is one minor cliff which has been identified immediately adjacent to the eastern end of the proposed LW1014B and some isolated pagodas identified elsewhere above the proposed longwalls.

MSEC prepared a Subsidence Assessment to support the Project which is provided as Appendix D to the EIS. The Subsidence Assessment includes detailed predictions of impacts to cliffs and pagodas as a result of the proposed Project. MSEC identified that:

- The two cliffs and the pagoda complexes located within the 26.5 degree angle of draw line, but outside the extents of the proposed longwalls, could experience low levels of subsidence, generally less than 100 mm.

- The maximum predicted strains for the cliffs and pagoda complexes, based on the 95 % confidence level for the strains measured above solid coal, are 1.5 mm/m tensile and 0.5 mm/m compressive. Adverse impacts on these features are generally the result of compressive strains, which result in spalling of the free rock surfaces. In this case, compressive strains of 0.5 mm/m, or less, are unlikely to have any adverse impacts on the cliffs or pagoda complexes.

MSEC concluded it is unlikely that the cliffs and pagoda complexes would experience any adverse impacts resulting from the extraction of the proposed longwalls. This is supported by extensive experience from the NSW Coalfields, at depths of cover greater than 200 m, where no cliff instabilities have been observed where cliffs have been located wholly outside the extents of extracted longwalls.

MSEC also predicts that:

- The minor cliff located immediately adjacent to the eastern end of the proposed LW1014B could experience some fracturing and, where the rock is marginally stable, could then result in some localised spalling of the exposed rockface. Previous experience of mining immediately adjacent to minor cliffs in the NSW Coalfields, at similar depths of cover, indicates that the potential impacts resulting from the proposed mining would represent less than 1 % of total exposed rockface area of the minor cliff.

- The isolated pagodas which are located directly above the proposed longwalls are also likely to experience some fracturing and, where the rock is marginally stable, could then result in spalling of the exposed rockfaces. The isolated pagodas are discontinuous and, therefore, are less susceptible to impacts when compared with cliffs and minor cliffs. It is expected that the impacts resulting from the proposed mining would represent less than 1 % of total surface area of the isolated pagodas which are located directly above the proposed longwalls.

These subsidence predictions are based on robust subsidence models, a detailed understanding of the local geology, and previous experience at Angus Place Colliery.

Centennial Angus Place will undertake periodic visual monitoring of the cliffs, minor cliffs and pagodas throughout the mining period and for a period after the completion of mining. Details of the monitoring of these structures will be provided within the Extraction Plans to be prepared and approved for the Project.

Surface cracking is predicted to be less than 5 to 25mm wide, with isolated cracking is some locations greater than 50mm. This needs to be read in the context of the heavily jointed and faulted area proposed to be mined. In this context cracking in the order of 50mm will be more likely in areas with geotechnical hazards. It appears hat cracking along Wolgan River will be exacerbated by a lineament zone. Lineament zones will also increase cracking if longwalls 1010 to 1017 are mined as proposed. Cliffs are associated with these lineaments and these areas are more unstable so a more precautionary approach is needed in relation to setbacks. (Colong Foundation)

As detailed in Section 2.6.2 of the EIS, landsat photo imagery provides detail on the extent of surface lineaments, based on topography and surface or vegetation trends and their coincidence with poor mining conditions underground. Mapping geological features and mining conditions in the underground workings enables the identification of trends in geological structures. Further research conducted by the CSIRO has contributed to the understanding of significant geological structure zones and lineaments and their link with anomalous mining conditions.

The geological structural fabric of the overlying Permian strata in the Lithgow area is controlled by underlying features in the older, basement strata. Significant analysis, using aeromagnetic data has been used to map the basement structures, which has enabled accurate prediction of the location of structures in both the Permian strata and the surface. This aspect is reflected in the alignment of valleys, cliff lines, distribution of vegetation and weathering patterns.

There is a high level of confidence in the knowledge of the geological structure of the region because of the link between topographic alignment on the surface, mapped geological structures in the mine workings and the identification of basement faults using aeromagnetic data; there is a high level of confidence in the knowledge of the geological structure of the region.

Investigations have been conducted into the interactions of mine subsidence with major geological structure zones and their combined effects on groundwater systems. Localised mining related hydrological impacts have been measured at two locations (within East Wolgan Swamp and Kangaroo Creek Swamp). These cases are discussed in detail in Section 2.6.2.6. Investigations have concluded that, at both locations, the presence of major fault zones and incised valleys in combination with mine design factors caused localised hydrological impacts. Mine planning and mine design processes used for the Springvale and Angus Place MEPs have specifically avoided the combination of factors which caused impacts in historical mining areas. Measurements indicate that there have been no historical cases in similar geological conditions and depths of cover to those in the Project Application Area where the Mount York Claystone aquitard has allowed significant depressurisation of the overlying shallow and perched groundwater systems.

Angus Place Colliery has applied a risk based approach to the Project to identify, quantify and reduce risks of environmental consequences wherever feasible. Previous subsidence monitoring has been used to develop and validate a predictive model of subsidence for the proposed mining area. This model has a high level of confidence in its predictions and is built upon a significant dataset comprising geological and geotechnical data. The mine has been designed to avoid, to the largest extent possible, sensitive surface features. Where a sensitive surface feature has not been avoided, a sub-critical void width has been applied in the mine design.

3.2.14 Surface Infrastructure

The proposed clearing of 14 hectares of forest for an additional ventilation facility is excessive and its proposed location close to the Wolgan River is unacceptable. In addition a further 9.25 hectares of clearing is associated with seven boreholes. The proposed construction of seven de-watering facilities will further fragment the public forest significantly adding to the infrastructure burden on Newnes Plateau in the Gardens of Stone reserve proposal. (Colong Foundation)

The proposed clearing of 14 hectares of forest for an additional ventilation facility is excessive and its proposed location close to the Wolgan River is unacceptable. (NCC)

As detailed in Section 4.10.3 of the EIS, mine planning has identified that additional ventilation capacity is required to ensure compliance with Clause 13(h) of the NSW Coal Mine Health and Safety Regulation 2006. To optimise the existing ventilation system, an air intake ventilation facility (downcast) will be required to deliver fresh air to the underground mine. This is identified as Angus Place Ventilation Site 3

(APC-VS3). In addition, the Project will require control of the increased volume of mine water make to meet underground safety and operational requirements. As such, new dewatering bore facilities will be required to continue to deliver water into the SDWTS (which will continue to be utilised as part of the Project).

The ventilation facility has been located to fit with the layout of the proposed underground roadways and the existing surface infrastructure within Newnes State Forest (i.e. forest roads and tracks). APC-VS3 will have a surface footprint of approximately 14 ha and will have a suitable asset protection zone.

The location of the ventilation facility is constrained by the mine design and layout and has been located to minimise impacts to the environment and sensitive receptors as far as reasonably practical and avoid removal of any threatened flora.

Dewatering bore facility sites have been identified based upon mine design requirements, and environmental constraints from a desktop analysis. The preferred options for the final placement of the dewatering boreholes will balance dewatering needs with potential environmental impacts.

The proposed installation of surface facilities will require the removal of vegetation and habitats potentially suitable for threatened flora and fauna species. Those threatened species and communities recorded or expected in the impact area have been assessed by way of 7 part tests of significance under the TSC Act and/or the assessment of significance under the EPBC Act with the result of these assessments summarised in Section 10.3.5 of the EIS and included in detail in Appendices 1 and 2 of the Flora and Fauna Impact Assessment (Appendix H to the EIS). The results of these assessments show that the consequences are low and that the Project is unlikely to have significant direct or indirect impacts on threatened species or communities such that the populations of the species and the occurrence of the communities are likely to be placed at risk of extinction.

To compensate for the clearing required for new surface infrastructure, Centennial Coal has developed a Regional Biodiversity Strategy (revised September 2014) and attached as **Appendix 4** of this RTS, that that takes into consideration both the direct impacts of clearing potential habitat and indirect impacts to the Temperate Highland Peat Swamps on Sandstone, incorporating Newnes Plateau Shrub Swamps and Newnes Plateau Hanging Swamps. Details of the Biodiversity Strategy proposed to be implemented are detailed in Section 10.3.7 of the EIS.

Further measures to mitigate the impacts of vegetation clearing required for new surface infrastructure are detailed in Section 10.3.8 of the EIS.

As this mine progressively advances under the plateau, there is a concomitant advance of the associated industrial landscape across largely pristine woodland. Exemplifying this forest destruction is the proposed additional clearing of an extraordinary 23.25ha for a ventilation facility, seven dewatering bores and a ten metre wide pipeline easement connecting these sites. All this industrial development significantly adds to the burden of infrastructure on Newnes Plateau in the Gardens of Stone region; to date progressive rehabilitation has proven ineffective. (BMCS)

The Angus Place MEP is proposing to clear 23.5 ha of vegetation for the establishment of new infrastructure while the Springvale MEP is proposing to clear 11.4 ha of vegetation. Environmental avoidance mapping was undertaken in each project to determine the optimum site for the infrastructure and associated access tracks within the defined environmental study areas, and is described in detail in Section 5.1 of the Flora and Fauna Assessment (Appendix H to the EIS). The areas represent minimal areas required for the infrastructure establishment. Other than the proposed clearing of 0.22 ha of Tableland Gully Snow Gum – Ribbon Gum Montane Grassy Forest EEC for the SDWTS duplication no other threatened flora species or EECs will be impacted. Additionally the widened access tracks for construction will be progressively rehabilitated as pipeline/power cable installation has been completed.

It is recognised that the Springvale and Angus Place MEPs will add to the existing infrastructure on Newnes Plateau, however existing dewatering facilities Angus Place 940 and Springvale Bores 6 and 8 will be progressively decommissioned. As identified in Section 5.3 of the Social Impact Assessment of both EISs that the mine design and other mitigating factors have minimised the extent of change to the physical environment to an extent that the Project will not adversely impact on the existing land use, its physical characteristics including surface features and the manner in which the public utilise / access the area. All infrastructure will be temporary and will be decommissioned and sites rehabilitated when both mines cease operating, in accordance with the the Decommissioning and Rehabilitation Strategies for the Projects presented in EIS Section 10.11 and Appendix P.

A Visual Impact Assessment for the Project was prepared and, as identified in Section 10.12.6 of the EIS, concluded that the visual character and amenity of the regional and local area of the Project Application Area will not be significantly altered by the Project, as the Project involves continued operations of Springvale Mine, which consists of underground mining with minimal surface disturbance.

The Newnes Plateau contains existing surface mining infrastructure, with the Project requiring additional infrastructure to support underground operations. However, the significance of the visual effects of the Project upon Newnes Plateau are predominately none to minor with potential visual impacts on Newnes Plateau being transient and not impacting upon any residential locations. Revegetation will be undertaken appropriately to ensure a suitable end land use that is consistent with the surrounding visual character and zoning of Newnes Plateau.

Springvale Mine has adopted a progressive approach to rehabilitation to reduce and mitigate potential environmental impacts. Exploration sites, ventilation and dewatering facilities and access tracks are rehabilitated promptly with periodic inspections and maintenance as necessary based upon evidence of endemic regrowth, weeds and soil disturbance. Rehabilitation acceleration techniques are undertaken, if required following approval from the Forestry Corporation of NSW.

The success of progressive rehabilitation activities is monitored against appropriate performance indicators identified within the Springvale EMS framework and relevant legislative requirements.

The scenic western edge of the Newnes Plateau must be protected from further scarring by new roads, pipeline and electricity easements. (SCSGBM)

As detailed in Section 4.10.3 of the EIS, mine planning has identified that additional ventilation capacity is required to ensure compliance with Clause 13(h) of the NSW Coal Mine Health and Safety Regulation 2006. To optimise the existing ventilation system, an air intake ventilation facility (downcast) will be required to deliver fresh air to the underground mine. This is identified as Angus Place Ventilation Site 3 (APC-VS3. In addition, the Project will require control of the increased volume of mine water make to meet underground safety and operational requirements. As such, new dewatering bore facilities will be required to continue to deliver water into the SDWTS (which will continue to be utilised as part of the Project).

The ventilation facility has been located to fit with the layout of the proposed underground roadways and the existing surface infrastructure within Newnes State Forest (i.e. forest roads and tracks). APC-VS3 will have a surface footprint of approximately 14 ha and will have a suitable asset protection zone.

The location of the ventilation facility is constrained by the mine design and layout and has been located to minimise impacts to the environment and sensitive receptors as far as reasonably practical and avoid removal of any threatened flora.

Dewatering bore facility sites have been identified based upon mine design requirements, and environmental constraints from a desktop analysis. The preferred options for the final placement of the dewatering boreholes. will balance dewatering needs with potential environmental impacts. It is identified in Section 4.3 of the Social Impact Assessment that the mine design and other mitigating factors have minimised the extent of change to the physical environment to an extent that the Project will not adversely impact on the existing land use, its physical characteristics including surface features and the manner in which the public utilise / access the area.

A Visual Impact Assessment for the Project was prepared and, as identified in Section 10.12.6 of the EIS, concluded that the visual character and amenity of the regional and local area of the Project Application Area will not be significantly altered by the Project. Newnes Plateau has existing surface mining infrastructure, with the Project requiring additional infrastructure. However, the significance of the visual effects of the Project upon Newnes Plateau are predominately none to minor with potential visual impacts on Newnes Plateau being transient and not impacting upon any residential locations. Revegetation will be undertaken appropriately to ensure a suitable end land use that is consistent with the surrounding visual character and zoning of Newnes Plateau.

While no change in the land use is predicted Centennial Angus Place will:

- undertake rehabilitation of cleared areas promptly to minimise visual impacts; and
- locate surface infrastructure away from walking / access tracks and areas where visual intrusion is likely (ie from lookouts etc).

3.2.15 Surface Water

Carne Creek is our only source of water. Any impacts to water volumes in Carne Creek impacts our business. (Emirates)

Carne Creek is currently in a pristine state, and its waters that flow through the Greater Blue Mountains World Heritage Area are of the highest standard. This creek must not run bright orange or suffer reduced flows, just like the Wolgan River after Centennial Coal wrecked it. (SCSGBM)

Section 5.3 of the Subsidence Assessment prepared by MSEC and provided as Appendix D to the EIS as well as Section 5.3.2 of the Surface Water Impact Assessment prepared by RPS and provided as Appendix F to the EIS addresses predicted subsidence impacts to Carne Creek. Carne Creek is located to the east of the proposed longwalls, outside the proposed Extension Area. Although Carne Creek will not be directly undermined, it was included in the assessment as it could experience valley related movements and could be sensitive to these movements.

Carne Creek is located 400 metres south-east of LW1019, at its closest point to the proposed longwalls. The remaining proposed longwalls are located more than 600 metres from the creek. The total length of Carne Creek located within a distance of 600 metres from the extents of the proposed longwalls is approximately 0.9 kilometres.

The maximum predicted subsidence at Carne Creek, due to the extraction of the proposed longwalls, is less than 20 mm. Whilst the creek could experience some very low level vertical subsidence, it is not expected to experience any measurable conventional tilts or curvatures, even if the predictions were exceeded by a factor of 2 times.

The maximum predicted valley related movements at Carne Creek, due to the extraction of the proposed longwalls, are 25 mm upsidence and 50 mm closure. The compressive strains due to valley closure are expected to be less than 0.5 mm/m, which is in the order of survey tolerance.

The section of Carne Creek located within 600 metres of the proposed longwalls could also experience some low level movements resulting from the extraction of the future longwalls at Springvale Colliery. The predicted conventional and valley related strains along this section of creek, due to mining at Springvale Colliery, are also expected to be less than 0.5 mm/m, which is in the order of survey tolerance.

Existing baseflows to Carne Creek already occur from the near surface aquifers. The water quality from these aquifers that flow into Carne Creek will remain unchanged as a result of the Project and environmental consequences will not result.

Lastly, Springvale Coal and Centennial Angus Place have not, as yet, been provided with any scientific evidence that their mining operations caused the impacts in Wolgan River that caused it to run “bright orange”. The claim that Centennial Coal wrecked Wolgan River is not validated with evidence.

3.2.16 Tourism

The growing and sustainable tourist industry is being consistently damaged by the impacts of coal mining in this spectacular region. The price of this development is too high. (BMCS)

Centennial Angus Place acknowledges in Section 6.1 of the EIS that the Newnes Plateau is identified as being an important feature of the Lithgow LGA by the local, regional and State stakeholders who access the area for various activities. Consultation was undertaken as part of the development of the Social Impact Assessment prepared by James Marshall & Co and provided as Appendix N to the EIS, with users of the Plateau including adventure visitors (mountain bike riders, motor bikers and four wheel drivers) and passive visitors (include bushwalkers, families visiting a particular destination point). The consultation was undertaken at various times throughout 2013 and found that many visitors who live in the area are aware of mining under the Newnes Plateau. It was generally their opinion that mining has not changed their experience when visiting the area and will not change their experience as long as access to the area was permitted. Many of these visits were for adventure type tourism. Passive visitors, for example, families visiting the area to visit a particular destination point (for example the Glow Worm Tunnels) and bushwalkers generally stated that they did not want their experience changed. The amenity of the area was important to these types of visitors and key words used to describe the area are: quiet, nature, features (pagodas and cliffs) and views from lookouts.

It is identified in Section 4.3 of the Social Impact Assessment (EIS Appendix N) that the mine design and other mitigating factors have minimised the extent of change to the physical environment to an extent that the Project will not adversely impact on the existing land use, its physical characteristics including surface features and the manner in which the public utilise / access the area for recreation.

Stakeholders who access the area for passive recreation including bushwalking and bird watching who have a low impact on the environment may experience a minor amenity impact in a small area on Sunnyside Ridge Road to the east of the existing Angus Place Colliery Vent Shaft Facility (APC-VS2 area) which is predicted to experience small exceedences of the project specific noise criteria for a passive recreational area. However this area is primarily used as a four wheel drive track so any amenity impact is unlikely.

There is an identified moderate visual impact arising from the location of surface infrastructure at Bird Rock Trig relating to clearing; however cleared areas will be progressively rehabilitated mitigating any potential long-term impact.

The Social Impact Assessment determined that the there will be no social change arising from the Project because there is no adverse impact on how people use the area.

While no change in the land use is predicted Centennial Angus Place will:

- undertake rehabilitation of cleared areas promptly to minimise visual impacts; and
- locate surface infrastructure away from walking / access tracks and areas where visual intrusion is likely (ie from lookouts etc).

3.2.17 Water Management

NCC objects to the proposed discharge of up to 43.8ML/day of untreated eco-toxic mine effluent to the Coxs River via the Springvale-Delta Water Transfer Scheme (SDWTS). This inappropriate discharge is inconsistent with the Sydney Catchment Authority Sydney Drinking Water Audit 2010 recommendations that require improved treatment of such licensed discharges. (NCC)

The Wallerawang Power Plant is shut, possibly permanently, and the current proposal to supply cooling water is not viable. (NCC)

The enormous quantities of mine effluent, currently running at 8.4ML/day must be treated using reverse osmosis technology to remove all metals and salts. (NCC)

All proposed discharge of up to 43.8ML/day of mine effluent to the Coxs River via the Springvale-Delta Water Transfer Scheme (SDWTS) is treated by reverse osmosis technology to remove salt and metals to a standard that protects, the Coxs River, the downstream drinking water supply and near-pristine ecosystems in the World Heritage Area. (Colo Committee)

Reinserted mine effluent must be properly treated and not allowed to re-emerge in an unauthorised or unregulated manner. (Colo Committee)

The proposed discharge of up to 43.8ML/day of eco-toxic mine effluent must be treated using reverse osmosis technology to remove all metals and salts before discharge to the Coxs River. (SCSGBM)

Any discharge needs to be subject to high level remediation, such as via reverse osmosis filtration, to remove environmentally damaging heavy metals and salts, so the treatment must be undertaken prior to the water leaving the mine site. It is essential that the Centennial Angus Place guarantees that ANZECC guidelines for upland waterways will be heeded. The responsible approach would be to discharge only water that has been treated to a pristine level. (BMCS)

The EIS claims that untreated discharges will go to Wallerawang Power Station, but it has ceased operation and is expected to remain so. As a result these untreated discharges will go directly into the Coxs River via the licenced discharge point LDP009, or into LDP1 in Kangaroo Creek upstream of Lake Wallace. (LEG)

The proposed discharges from LDP001 and LDP009 are inconsistent with the Sydney Catchment Authority Audit 2010, which included recommendations requiring improved treatment of POEO licenced discharges in the Coxs River Catchment. Numerous reports since 1966 have highlighted the highly polluted condition of the Coxs River. (LEG)

The proposed discharges risk cancelling out negotiations between the EPA, Blue Mountains Conservation Society, and Delta Electricity to establish EPL limits for concentrations of Copper,

Zinc, Aluminium, Boron, Fluoride, Arsenic, Nickel and Salts being discharged from LDP009 into the Coxs River. Delta had agreed to construct a Reverse Osmosis (RO) Plant to treat the SDWTS effluent after use for cooling, and pipe the brine waste to Mt Piper Flyash Repository for disposal. The closure of Wallerawang Power Station jeopardises this. (LEG)

It is in the public interest to control metal and salt pollutants at their source – the coal mines that operate within the Sydney Drinking Water Catchment. The current SDWTS proposal to provide cooling water to Wallerawang Power Station is no longer viable. The closure of this plant means these salts and metals will instead be flushed into the Coxs River through the Greater Blue Mountains World Heritage Area and into Lake Burragorang – Drinking Water Supply for 4 million people. Before discharge, this mine water must be treated to a standard that protects undisturbed aquatic ecosystems and the health of downstream water-users. The only effective way to treat the high levels of turbidity, heavy metals (including Aluminium, Zinc, Copper and Nickel) and salinity is by requiring Centennial to install reverse osmosis (RO) technology to remove all metals and salts. (LEG)

The SDWTS pipeline network, covering Angus Place Colliery's dewatering bores 930 and 940 and Springvale Mine's bores 6 and 8 and licensed discharged point 9 (EPL 3607) and Energy Australia's Wallerawang Power Station, are predominantly trenched and hence the risk of bushfire destroying the network is minimal. In the event a bushfire destroyed the short exposed section of the SDWTS, the mine water would cascade down Newnes Plateau and will be captured within the Sawyers Swamp Creek Ash Dam, owned by Energy Australia.

Centennial Angus Place and Springvale Coal confirm that no emergency discharges into Wolgan River occurs currently or is proposed in the future. No discharges into Wolgan River have occurred since 10 April 2010. Angus Place Colliery's EPL 467 was varied on 29 July 2013 to remove LDP006 as the emergency discharge point on Newnes Plateau. No new LDPs have been proposed in the Angus Place MEP (refer Section 4.11.3 of the Angus Place MEP EIS).

While Springvale Mine's EPL 3607 still has provisions for two emergency discharge points (LDP004 and LDP005) on Newnes Plateau no emergency discharges have been proposed via these LDPs in the Springvale MEP. Instead it has been proposed (refer Section 4.10.1 of the Springvale MEP EIS) that these LDPs be relinquished post-approval when infrastructure required to re-direct emergency discharge water from the SDWTS back underground to the Angus Place Colliery's 900 water storage area has been installed.

There has never been any mine water discharges into Carne Creek and neither is there any proposal to do discharge into that catchment as part of the project.

A Regional Water Quality Impact Assessment has been undertaken as part of the RTS process and is attached as **Appendix 2**. This report assesses the impact (water quality and quantity) of the proposal to discharge all mine water from Springvale and Angus Place MEPs into Cox River i.e. the report assesses the scenario where no mine water is transferred to Wallerawang Power Station. Key outcomes of the assessment have been summarised in **Appendix 2** of this RTS.

Following public exhibition of the EIS, a review of the EPA Direct Toxicity Assessment on Springvale's LDP009 discharge was undertaken by GHD (**Appendix 9** to this RTS). Following the review, an additional Direct Toxicity Assessment, provided as **Appendix 10** to this RTS, was carried out on discharge water from LDP001 at Angus Place and LDP009 at Springvale. The methodology for the Direct Toxicity Assessment was approved by the EPA in August 2014. The results of the Direct Toxicity Assessment show that there is no toxicity associated with the Discharge water from LDP001. Although toxicity has been observed at LDP009, it has been demonstrated that neither the EC or bicarbonate concentrations have any effect on the toxicity of the water. Lowering the EC may have a detrimental effect on the system as shown by the high toxicity at sites upstream of LDP001. The chemistry of water quality discharged through LDP009 does not point to any source in particular that is leading to the toxicity being observed. As such, Centennial proposes to undertake further investigations into the toxicity of LDP009 water discharge to identify the cause of the toxicity. Without knowing what is causing the toxicity, the application of a treatment system is premature as you won't know what you are treating for. As such, no additional treatment of mine water is considered necessary at this stage.

Any malfunction of SDWTS, such as following a bushfire, must not result in emergency discharges to the World Heritage Area via Wolgan River or Carne Creek but be reinserted underground into the mine. (NCC, BMCS and Colo Committee)

The SDWTS pipeline network, covering Angus Place Colliery's dewatering bores 930 and 940 and Springvale Mine's bores 6 and 8 and licensed discharged point 9 (EPL 3607) and Energy Australia's Wallerawang Power Station, are predominantly trenched and hence the risk of bushfire destroying the network is minimal. In the event a bushfire destroyed the short exposed section of the SDWTS, the mine water would cascade down Newnes Plateau and will be captured within the Sawyers Swamp Creek Ash Dam, owned by Energy Australia.

Centennial Angus Place and Springvale Coal confirm that no emergency discharges into Wolgan River occurs currently or is proposed in the future. No discharges into Wolgan River have occurred since 10 April 2010. Angus Place Colliery's EPL 467 was varied on 29 July 2013 to remove LDP006 as the emergency discharge point on Newnes Plateau. No new LDPs have been proposed in the Angus Place MEP (refer Section 4.11.3 of the Angus Place MEP EIS).

While Springvale Mine's EPL 3607 still has provisions for two emergency discharge points (LDP004 and LDP005) on Newnes Plateau no emergency discharges have been proposed via these LDPs in the Springvale MEP. Instead it has been proposed (refer Section 4.10.1 of the Springvale MEP EIS) that these LDPs be relinquished post-approval when infrastructure required to re-direct emergency discharge water from the SDWTS back underground to the Angus Place Colliery's 900 water storage area has been installed.

There has never been any mine water discharges into Carne Creek and neither is there any proposal to discharge into that catchment as part of the project.

The ownership and responsibility for the SDWTS is very unclear, as the situation regarding who is responsible for rehabilitating the Kerosene Vale Fly Ash Repository. Critical Issues such as the EPL's, land ownership, and final rehabilitation of the entire route of the SDWTS should have been clarified in the EIS, and must be clarified prior to any consent approval. (LEG)

Springvale Coal Pty Limited, operator of Springvale Mine, has a commercial agreement with Energy Australia on the ownership and management of the Springvale Delta Water Transfer Scheme (SDWTS). Springvale Coal maintains components of the SDWTS infrastructure on Newnes Plateau while Energy Australia manages sections of the SDWTS leading to the Wallerawang Power Station. Any rehabilitation works that will be required when Angus Place Colliery and Springvale Mine cease operations will be undertaken in accordance with the commercial agreement.

Springvale Mine staff and contractors are authorised by Energy Australia to operate and maintain infrastructure associated with the settling ponds (for water treatment) downstream of emergency licensed discharge point LDP010 and upstream from LDP009; the latter LDP being the SDWTS bypass point west of the Swayers Swamp / Kerosene Vale Ash Dam. LDP009 and LDP010 are on Springvale Mine's Environment Protection Licence EPL 3607. Emergency discharge points LDP004 and LDP005 also associated with the SDWTS are on EPL 3607. LDP004 and LDP005 have not been used to discharge any mine water on Newnes Plateau since April 2010 and the Project is proposing to relinquish them when infrastructure required to divert water underground to manage energy discharges have been established (refer Section 4.10.1 of the EIS).

The Kerosene Vale Fly Ash Repository is owned and maintained by Energy Australia as part of the Wallerawang Power Station operations. Its rehabilitation is not proposed in the Decommissioning and Rehabilitation Strategy proposed for the Angus Place MEP or the Springvale MEP.

Figure 26 from the EIS clearly shows that salinity levels will spike dramatically reaching a peak from 2020 to 2025. Section 4.2.2, p. 65, identifies that the median salinity at LDP001 is 1,010µS/cm. Several Metals at LDP1 already exceed the ANZECC guidance including Copper at 0.002mg/L (guidance 0.0014mg/L); Aluminium of 0.02mg/L; and Zinc at 0.046mg/L (guidance 0.008mg/L). These pollution effects will be magnified during drought conditions, which are likely to become more prevalent during the life of these mines due to climate change. (LEG)

A Regional Water Quality Impact Assessment (**Appendix 2** to this RTS) has been undertaken to assess the impact of direct discharge at Angus Place LDP001 and Springvale LDP009. This assessment has quantified the impact (water quality and water quantity) of the proposed discharges from Angus Place Colliery and Springvale Mine into the Coxs River catchment, including Lake Burragorang.

Centennial Angus Place has undertaken Site Specific Trigger Values (SSTVs) Assessment for Angus Place LDP001. Results of the SSTV analysis indicate that current water quality at Angus Place LDP001 meets ANZECC 95% protection of aquatic ecosystems except for copper and zinc concentrations. For copper and zinc, current water quality at Angus Place LDP001 meets 80th percentile upstream water quality at downstream edge of mixing zone. Further detail is presented in the SSTV Assessment (**Appendix 3** to this RTS).

On 9 May 2010 the EPA issued Angus Place (EPL 467) with a Pollution Reduction Notice to reduce the estimated 1,000 tonnes of salt deposited from LDP1 into Kangaroo Creek each year based on the average flow rate of 731ML4. This Proposal aims to increase that flow rate 3 – 14 times. The proponent proposes to treble the flow from LDP1 to 2,300ML, and if the SDWTS is unavailable, to increase the flow from between 6 and 14 times (4,750ML up to 10,457ML). In total this proposal will discharge and some 31 tonnes/day (or 11,247 tonnes/year) of metal-rich Salts into the Coxs River which supplies Sydney with drinking water. (LEG)

With respect to the PRP programme on EPL 467, Centennial Angus Place has undertaken Site Specific Trigger Values (SSTVs) Assessment for Angus Place LDP001. Results of the SSTV analysis indicate that current water quality at Angus Place LDP001 meets ANZECC 95% protection of aquatic ecosystems except for copper and zinc concentrations. For copper and zinc, current water quality at Angus Place LDP001 meets 80th percentile upstream water quality at downstream edge of mixing zone. Further detail is presented in the SSTV Assessment (**Appendix 3** to this RTS).

A Regional Water Quality Impact Assessment (**Appendix 2** to this RTS) has been undertaken to assess the impact of direct discharge at Angus Place LDP001 and Springvale LDP009. This assessment has quantified the impact (water quality and water quantity) of the proposed discharges from Angus Place Colliery and Springvale Mine into the Coxs River catchment, including Lake Burragorang.

At LDP005 LEG Streamwatch volunteers recorded a Salinity level of 1030 µS/cm; Turbidity of 40 NTU (exceeded EPL limit); pH 7.5; Dissolved Oxygen 4.3 mg/L (52%); Available Phosphate 0.07 ppm; and Water Temperature of 25oC. The water had a chemically odour – attributable we believe to Solcenic water-soluble hydraulic oils, used in and spilled in vast quantities by long wall mining equipment. (LEG)

Water discharged from the mine is groundwater that has accumulated in the underground mine workings and originates from the coal seam and the overlying strata. The chemical composition of the groundwater is a result of the geology and environment in which it originates and is not influenced by mining processes. No evidence has been provided to support the statement made by the Lithgow Environment Group that water discharged from the mine was contaminated by hydraulic oils used in the underground mining operations. “Chemically odour” description does not constitute an analytical result to confirm the presence of hydraulic oil contaminants in the mine water. Both Angus Place Colliery and Springvale Mine have robust water quality testing regimes at all licensed discharge points and report water quality parameters in accordance with the respective Environmental Protection Licences, EPL 467 and EPL 3607.

The proposed discharge of 43.8 ML/day of eco-toxic saline minewater will have adverse impacts on aquatic life and natural ecosystems in the Coxs River, Sydney Drinking Water Catchment and Greater Blue Mountains Heritage Area which it flows through, as well as potentially for Carne Creek, the Wolgan River, and Wollemi National Park if any SDWTS malfunctions necessitate further Emergency Discharge’s on Newnes Plateau. (LEG)

Centennial Angus Place has undertaken Site Specific Trigger Values (SSTVs) Assessment for Angus Place LDP001. Results of the SSTV analysis indicate that current water quality at Angus Place LDP001 meets ANZECC 95% protection of aquatic ecosystems except for copper and zinc concentrations. For copper and zinc, current water quality at Angus Place LDP001 meets 80th percentile upstream water quality at downstream edge of mixing zone. Further detail is presented in the SSTV Assessment (**Appendix 3** to this RTS).

A Regional Water Quality Impact Assessment (**Appendix 2** to this RTS) has been undertaken to assess the impact of direct discharge at Angus Place LDP001 and Springvale LDP009. This assessment has quantified the impact (water quality and water quantity) of the proposed discharges from Angus Place Colliery and Springvale Mine into the Coxs River catchment, including Lake Burragorang.

No emergency discharges are proposed on Newnes Plateau into Wolgan River or Carne Creek in the Angus Place and Springvale MEPs. No mine water emergency discharge on Newnes Plateau into Wolgan River has occurred since April 2010. There has never been any mine water discharges into Carne Creek.

Angus Place Colliery’s emergency discharge provisions at LDP006 (EPL 467) were able to be relinquished on 29 July 2013 and EPL467 was varied to remove LDP006 from the licence as a result of changes to the mine water management system at Angus Place Colliery.

While Springvale Mine’s EPL 3607 still has provisions for two emergency discharge points (LDP004 and LDP005) on Newnes Plateau no emergency discharges have been proposed via these LDPs in the MEP. Instead it has been proposed (refer Section 4.10.1 of the EIS) that these LDPs be relinquished post-approval when infrastructure required to re-direct emergency discharge water from the SDWTS back underground to the Angus Place Colliery’s 900 water storage area has been installed.

Following public exhibition of the EIS, a review of the EPA Direct Toxicity Assessment on Springvale’s LDP009 discharge was undertaken by GHD (**Appendix 9** to this RTS). Following the review, an additional Direct Toxicity Assessment, provided as **Appendix 10** to this RTS, was carried out on discharge water from LDP001 at Angus Place and LDP009 at Springvale. The methodology for the Direct Toxicity Assessment was approved by the EPA in August 2014. The results of the Direct Toxicity Assessment show that there is no toxicity associated with the Discharge water from LDP001. Although toxicity has been observed at LDP009, it has been demonstrated that neither the EC or bicarbonate concentrations have any effect on the toxicity of the water. Lowering the EC may have a detrimental effect on the system as shown by the high toxicity at sites upstream of LDP001. The chemistry of water quality discharged through LDP009 does not point to any source in particular that is leading to the toxicity being observed. As such, Centennial proposes to undertake further investigations into the toxicity of LDP009 water discharge to identify the cause of the toxicity. Without knowing what is causing the toxicity, the application of a treatment system is premature as you won't know what you are treating for. As such, no additional treatment of mine water is considered necessary at this stage.

At the source of the Coxs River in Long Swamp LEG Streamwatch volunteers have consistently recorded salinity levels of 30 µS/cm. Just 4.8km downstream at LDP001 the median salinity is 33 times higher at 1,010 µS/cm and 1,055 µS/cm at LDP009. The high salinity of this mine water will significantly affect aquatic and riparian ecosystems that have evolved under very low nutrient conditions, and water users in the Sydney Drinking Water Catchment. (LEG)

A Regional Water Quality Impact Assessment has been undertaken as part of the RTS process and is attached as **Appendix 2**. This report assesses the impact (water quality and quantity) of the proposal to discharge all mine water from Springvale and Angus Place MEPs into Cox River i.e. the report assesses the scenario where no mine water is transferred to Wallerawang Power Station. The potential impacts have been quantified, including Lake Burragorang.

The Aquatic Ecology Impact Assessment (Appendix G) undertaken for the Angus Place MEP found that the aquatic habitat and quality of water in the upper Coxs River are both degraded but despite this aquatic biota was relatively diverse. It was found that the current discharge from LDP001 appeared to have some adverse effects on the condition of the aquatic habitats and quality of water at Kangaroo Creek downstream (Site KCdn) and Coxs River downstream of the confluence of Kangaroo Creek (Site CR2), however its effect on biological indicators is less clear with only SIGNAL2 and AUSRIVAS scores being poorer on average at Kangaroo Creek downstream of LDP001 than at Kangaroo Creek upstream of LDP001, and macrophytes being less diverse at CR2 than CR1.

Section 7.2.1.3 of the Aquatic Ecology Impact Assessment in Angus place EIS states that:

"a review of the effects of salinity on aquatic biota in Australian freshwater systems indicates direct adverse biological effects are unlikely to occur unless EC levels exceed around 1000 mg/L (approximately 1,500 µS/cm) (Hart et al. 1991). This suggests that the aquatic biota in the river is unlikely to be impacted by the salinities resulting from the change in discharge."

It was assessed that the likely impact of the change in flows and quality of the water on the aquatic flora and fauna would be moderate in the immediate receiving waters of Kangaroo Creek and small to moderate in the Coxs River below the confluence.

Similar observations have been made for the proposed discharges at Springvale Mine's LDP009. The peak discharges, between 2019 and 2025, would have moderate to significant effects on low flows, small to moderate effects on low to moderate flows and minimal to small effects on high flows. The changes in discharges before 2019 and after 2025 would be small and would thus have minimal impacts on river flow. The marked increase in discharge between 2019 and 2025 could exacerbate the existing erosion of the stream bank and channel and could lead to further downstream transport of sediment. Such impacts are likely to be short-lived and would be negligible relative to those that occur naturally during high flow events. The increase in dilution resulting from the greater flow may counteract the increase in turbidity and potential for flow-on effects on aquatic biota.

Further to the water quality issues, it was found that increased flow due to the discharges may result in more stable aquatic habitats and conditions that are more conducive to the establishment and growth of aquatic macrophytes.

The 2010 State of the Catchment assessment for the Hawkesburry-Nepean Region returns a Very Good to Moderate score for macroinvertibrate condition in the Upper Coxs River.

Following public exhibition of the EIS, a review of the EPA Direct Toxicity Assessment on Springvale's LDP009 discharge was undertaken by GHD (**Appendix 9** to this RTS). Following the review, an additional Direct Toxicity Assessment, provided as **Appendix 10** to this RTS, was carried out on discharge water from LDP001 at Angus Place and LDP009 at Springvale. The methodology for the Direct Toxicity Assessment was approved by the EPA in August 2014. The results of the Direct Toxicity Assessment show that there is no toxicity associated with the Discharge water from LDP001. Although toxicity has been observed at LDP009, it has been demonstrated that neither the EC or bicarbonate concentrations have any effect on the toxicity of the water. Lowering the EC may have a detrimental effect on the system as shown by the high toxicity at sites upstream of LDP001. The chemistry of water quality discharged through LDP009 does not point to any source in particular that is leading to the toxicity being observed. As such, Centennial proposes to undertake further investigations into the toxicity of LDP009 water discharge to identify the cause of the toxicity. Without knowing what is causing the toxicity, the application of a treatment system is premature as you won't know what you are treating for. As such, no additional treatment of mine water is considered necessary at this stage.

A map was provided to LEG at a Delta Western Reference Group Meeting in 2008. It shows the SDWTS Pipeline route, and identifies that a section of Pipeline is managed by Centennial, while Delta Electricity is responsible for another section. Despite 1000's of pages of documents in the EIS, it is still unclear whether Energy Australia has accepted responsibility for Delta's section of the Pipeline, whether Energy Australia are happy for Centennial staff/contractors to access Energy Australia owned land at Kerosene Vale Fly-Ash Repository (KVAR) and Licence Discharge Point LDP009, and who is ultimately responsible for the EPL Licences for all parts of the SDWTS. (LEG)

Springvale Coal Pty Limited, operator of Springvale Mine, has a commercial agreement with Energy Australia on the ownership and management of the Springvale Delta Water Transfer Scheme (SDWTS). Springvale Coal maintains components of the SDWTS infrastructure on Newnes Plateau while Energy Australia manages sections of the SDWTS leading to the Wallerawang Power Station. Springvale Mine staff and contractors are authorised by Energy Australia to operate and maintain infrastructure associated with the settling ponds (for water treatment) downstream of emergency licensed discharge point LDP010 and upstream from LDP009; the latter LDP being the SDWTS bypass point west of the Swayers Swamp / Kerosene Vale Ash Dam. LDP009 and LDP010 are on Springvale Mine's Environment Protection Licence (EPL) 3607. Emergency discharge points LDP004 and LDP005 also associated with the SDWTS are on EPL 3607. LDP004 and LDP005 have not been used to discharge any mine water on Newnes Plateau since April 2010.

3.2.18 Water Resources

Surface groundwater aquifers will become more permeable and interconnected. Centennial predicts surface aquifer drawdown to be 10 metres under ridges to 0.5 metres under shrub swamps. This range seems to be an underestimate as the longwall mining proposed at Angus

Place Mine is more intensive than at Springvale Colliery, but the same degree sandstone cracking and groundwater drawdown is predicted. (Colong Foundation and NCC)

Numerous specialist hydrogeological studies have been undertaken at Angus Place with the aim of quantifying mine water inflow and subsidence impacts, groundwater drawdown and depressurisation, and addressing other geotechnical and hydrogeological issues over the past number of years.

RPS completed a study in November 2012 (RPS, 2012) to assess whether any impacts attributable to the undermining of the swamps could be ascertained based on swamps hydrographs and groundwater level trends

All of the swamps which were included in this study have a significant history of water level monitoring, are located away from licensed discharge points (to minimise potential for conflicting information), and have all been either undermined by longwall extraction or were in very close proximity to extracted longwall panels.

The results of the 2012 study showed that no water level impacts that could be attributed to past or present mining operations (subsidence-related impact or depressurisation) were observed. Rather, the water levels in the swamps showed a strong correlation to cumulative rainfall trends, and this was found to be the driving factor.

As no mining influenced water level fluctuations can be identified in any of the monitored swamps (both undermined and baseline) it is accurate to say that mining at Angus Place has not led to any identifiable water level impacts on the monitored swamps, and that all undermined swamps continue to display baseline water levels.

The proposed mine design at Angus Place Colliery has been modified to minimise subsidence beneath sensitive shrub swamp areas. The panel widths at the LW1004 – LW 1006 block and LW1016 - LW1017 block, which underlie the Tri-Star Swamp and Trail 6 Swamp, respectively, have been reduced to 261 m void widths. The width of the inter panel chain pillars is 52 m. In addition to the reduction of panel widths in longwalls that underlie shrub swamps, LW1013 and LW1014 have been stepped around an area of shallow cover associated with a tributary to Carne Creek, and LW1010 has been shortened in the vicinity of Twin Gully Swamp to avoid this swamp altogether. The net result of these modifications is a reduction in subsidence observed at ground surface.

Subsidence Impact Assessments were undertaken for the Angus Place and Springvale MEPs by MSEC and provided as Appendix D to the EISs. Mining is predicted to cause maximum of 1.7 m of conventional subsidence above longwall extraction areas. Based on the predicted maximum strains calculated by the subsidence study it is likely that some fracturing will occur in the uppermost bedrock, beneath the surface soils/regolith. It has been observed in previous studies, that the depth of fracturing and dilation of the surficial lithologies, resulting from longwall mining, is generally less than 10 to 15 m.

This shallow fracturing will, in general terms, enhance shallow permeability, favouring infiltration of rainfall and surface water to the ground, and recharging the shallow aquifers hence reducing available runoff during rain events. In no case, is it expected that the infiltrated water will be lost to deeper aquifers since the fracturing will be only superficial (upper most 10 to 15 m) and is isolated from the deeper zones of connective vertical fracturing. It is likely that any infiltrated flow will re-emerge to the surface further downstream and with some degree of delay, contributing to prolong the base flow contribution to the watercourses

The predicted water table decline beneath the shrub swamps is predicted to range from negligible to <0.5 m with the greatest water level declines predicted to occur beneath elevated ridges and the upper reaches of the swamps where the swamps are generally above the water table and not reliant on groundwater.

The reliance of the shrubs swamps on groundwater from the perched aquifer system is due to the lateral groundwater flow along the low permeability aquitards and not the absolute water level within each aquifer. The predicted water level decline within the perched aquifer system is due to bed separation effects applied to the model that result in increased horizontal hydraulic conductivity. In many cases the decline in water table has meant a corresponding increase in lateral groundwater baseflow to the swamps and not a decrease.

Given the similarities of the proposed development with past operations, there is no reason to believe that the results of the proposed mining activities will cause any impacts where none have previously been observed.

The groundwater impact model predicts that some minor impacts to the shallow groundwater and baseflow will occur. However, it is considered that the groundwater modelling results are conservative, particularly in respect to the predicted impacts to baseflows. The model assumes dilation of horizontal ‘plies’ will occur through to ground surface, however, this has not been observed in the field. In any regard, the model is not able to replicate the self-healing nature of the creeks and swamps and as such, it is conservative, over-predicting the magnitude of potential impacts.

The Springvale and Angus Place Extension Projects operate in similar geological environments using similar mining methods. The impacts to groundwater levels and swamps are therefore predicted to be similar.

Carne Creek is currently in a pristine state, and its waters that flow through the Greater Blue Mountains World Heritage Area are of the highest standard. The extensive fracturing of the sandstone associated with longwall mining of headwater swamps will release high levels of metals, notably manganese and iron, polluting Carne Creek and making it run bright orange, just like the Wolgan River did once. Flows in Carne Creek will also become irregular. (NCC)

The extension area underlies the top part of Carne Ck, and incredibly seeks to mine under this. (Colo Committee)

Carne Creek is currently in a pristine state, and its waters that flow through the Greater Blue Mountains World Heritage Area are of the highest standard. This creek was a key determinant in the location of the Emirates eco-resort. The extensive fracturing of sandstone associated with longwall mining under its headwater swamps will release high levels of metals, notably manganese and iron, polluting Carne Creek and making it run bright orange, just like the Wolgan River once did. Flows in Carne Creek will also become irregular. (Colong Foundation)

Emergence of near surface groundwater with elevated levels of salt or metal precipitate in Carne Creek must be prevented. (Colo Committee)

It needs to be emphasised that Carne Creek is currently in a pristine state, and its waters are of the highest standard. This creek was a key determinant in the location of the Emirates eco-resort. The extensive fracturing of the sandstone associated with longwall mining of headwater swamps will release high levels of metals, notably manganese and iron, polluting Carne Creek. The comparative water qualities at the junction of Carne Creek and the Wolgan River, near the resort, clearly demonstrates the degree of pollution of the latter. (BMCS)

Section 5.3 of the Subsidence Assessment prepared by MSEC and provided as Appendix D to the EIS as well as Section 5.3.2 of the Surface Water Impact Assessment prepared by RPS and provided as Appendix F to the EIS addresses predicted subsidence impacts to Carne Creek. Carne Creek is located to the east of the proposed longwalls, outside the proposed Extension Area. Although Carne Creek will not be directly undermined, it was included in the assessment as it could experience valley related movements and could be sensitive to these movements.

Carne Creek is located 400 metres south-east of LW1019, at its closest point to the proposed longwalls. The remaining proposed longwalls are located more than 600 metres from the creek. The total length of Carne Creek located within a distance of 600 metres from the extents of the proposed longwalls is approximately 0.9 kilometres.

The maximum predicted subsidence at Carne Creek, due to the extraction of the proposed longwalls, is less than 20 mm. Whilst the creek could experience some very low level vertical subsidence, it is not expected to experience any measurable conventional tilts or curvatures, even if the predictions were exceeded by a factor of 2 times.

The maximum predicted valley related movements at Carne Creek, due to the extraction of the proposed longwalls, are 25 mm upsidence and 50 mm closure. The compressive strains due to valley closure are expected to be less than 0.5 mm/m, which is in the order of survey tolerance.

The section of Carne Creek located within 600 metres of the proposed longwalls could also experience some low level movements resulting from the extraction of the future longwalls at Springvale Colliery. The predicted conventional and valley related strains along this section of creek, due to mining at Springvale Colliery, are also expected to be less than 0.5 mm/m, which is in the order of survey tolerance.

Existing baseflows to Carne Creek already occur from the near surface aquifers. The water quality from these aquifers that flow into Carne Creek will remain unchanged as a result of the Project and as such there will be no impacts to the operations of the Emirates eco resort. There is no scientific evidence to suggest that the underground mining operations of Angus Place Colliery and Springvale Mine have previously resulted in impacts to water quality within Wolgan River.

In the past 2 months Wolgan River has dried up as well as the swamps above Wolgan Falls which feed Wolgan River. Some of that might be due to recent lack of rain, but I assume it is not just the dry weather but new cracks in the catchment area from expanding mining operations from Angus Place Colliery. (Emirates)

If the Wolgan River has dried up then it is most likely due to the dry weather and due to any cracks arising from Angus Place Colliery's mining. It is noted that Emirates have not provided any photos of the cracks in the catchment and evidence that these cracks are linked to Angus Place Colliery's operations.

Flows within the Wolgan River have been monitored at several stations since 2004. The Wolgan River downstream monitoring location is purposely located downstream of the Angus Place current mining area to detect any changes as a result of Angus Place Colliery's mining operations. Figure 8 within the Surface Water Impact Assessment (EIS Appendix F) presents the recorded streamflow hydrographs of these watercourses, together with the daily rainfall record. Table 3.5 within the Surface Water Impact Assessment (EIS Appendix F) presents the mean daily flow, sorted per month. It is noted that the Wolgan River is perennial and flow occurs throughout the year generally in alignment with the rainfall trend. Hydrographs for each flow monitoring station are presented in Appendix A of the Surface Water Impact Assessment (EIS Appendix F). The ongoing perennial nature of the Wolgan River downstream of Angus Place Colliery's historic and current mining operations is clearly apparent from the hydrographs.

There are the construction works (new bore holes, power lines, pipelines and access roads) being undertaken at the moment in the area of Sunny Ridge Road (off Blackfellows Hand Road).

This activity resulted from recent approvals for long wall mining expansions into the Carne Creek catchment area. This is our water supply and the lifeline of the Wolgan further down. (Emirates)

The construction works being undertaken in the area of Sunnyside Ridge Road, off Mayingu Marragu Trail (the former Blackfellows Hand Road) are associated with the construction of the Angus Place Ventilation Shaft Facility Project, approved as modification 2 to the Angus Place Colliery's current project approval 06_0021 (http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=5122). While this modification also approved trial mining and construction of gateroads from the existing mining area towards the ventilation facility and development of mains headings and gateroads to the proposed LW1001 and LW1003 within the Angus Place East mining area the mining component of the project has not commenced as yet.

The surface water assessment undertaken by GHD for the Ventilation Shaft Facility Project, appended to the EIS as Appendix 9.2, noted that while the surface run-off from the project area has the potential to impact on Carne Creek, Wolgan River and Marrangaroo Creek catchments, these potential impacts could be mitigated such that there will not be a significant impact on the Wolgan River, Carne Creek or Marrangaroo Creek. The wide range of mitigation measures recommended by GHD, including the development of site-specific sediment control plans for each area of work, has been adopted in the project. With the mitigation measures in place the impact (water quality and water quantity) is predicted to be within the natural variability of the existing water quality data and flow data in the Carne Creek, Wolgan River and Marrangaroo Creek catchments.

While a clarification on the surface water assessment outcomes for the Angus Place Ventilation Shaft Facility Project has been provided above as a response to the issue raised by Emirates it should be noted that project is not the subject of the current RTS.

This development application involves plans to pump up to 43 million litres of contaminated water a day into the same river, which feeds into the Lake Burragorang, an important part of Sydney's drinking water supply. Under the current proposal, the mine water would apparently be released into the river untreated, despite having elevated salt and heavy metal levels. The specific route is via Sawyers Swamp Creek into the Coxs River. (BMCS)

The discharge to be made under the current application, of to 43.8ML/day of untreated eco-toxic mine effluent, would flow to the Coxs River via the Springvale Delta Water Transfer Scheme (SDWTS). Such an inappropriate discharge is inconsistent with the SCA Sydney Drinking Water Audit 2010 Recommendations. (BMCS)

A Regional Water Quality Impact Assessment has been undertaken as part of the RTS process and is attached as **Appendix 2**. This report assesses the impact (water quality and quantity) of the proposal to discharge all mine water from Springvale and Angus Place MEPs into Coxs River via Sawyers Swamp Creek, i.e. the report assesses the scenario where no mine water is transferred to Wallerawang Power Station. The potential impacts on the Coxs river catchment have been quantified, including Lake Burragorang.

Following public exhibition of the EIS, a review of the EPA Direct Toxicity Assessment on Springvale's LDP009 discharge was undertaken by GHD (**Appendix 9** to this RTS). Following the review, an additional Direct Toxicity Assessment, provided as **Appendix 10** to this RTS, was carried out on discharge water from LDP001 at Angus Place and LDP009 at Springvale. The methodology for the Direct Toxicity Assessment was approved by the EPA in August 2014. The results of the Direct Toxicity Assessment show that there is no toxicity associated with the Discharge water from LDP001. Although toxicity has been observed at LDP009, it has been demonstrated that neither the EC or bicarbonate concentrations have any effect on the toxicity of the water. Lowering the EC may have a detrimental effect on the system as shown by the high toxicity at sites upstream of LDP001. The chemistry of water quality discharged through LDP009 does not point to any source in particular that is leading to the toxicity being observed. As such, Centennial proposes to undertake further investigations into the toxicity of LDP009 water discharge to identify the cause of the toxicity. Without knowing what is causing the toxicity, the application of a treatment system is premature as you won't know what you are treating for. As such, no additional treatment of mine water is considered necessary at this stage.

There is considerable concern on the figures quoted by the company, specifically the water discharge amounts. We are led to believe that the 43 million litres per day (max) for the life of the mine (5 times the mine's current discharge) will come only from the seam and not from nearer surface aquifers. This requires an apparently unreasonably large volume of produced water from the seam and no breaching of aquicludes above the seam being mined. This appears inaccurate and should be verified by an independent study. In this regard, the Society supports the establishment of a system of truly independent consultants to conduct all environmental impact assessments. (BMCS)

The mine inflows arise from the Lithgow Seam (Illawarra Coal Measures) being mined at Angus Place Colliery and Springvale Mine. This aquifer, referred to as AQ1 in the EIS and the Groundwater Impact Assessment (Appendix E to the EIS) is hydraulically connected with the Berry Siltstone and Marrangaroo Formations beneath and the Long Swamp Formation and Irondale Coal Seam above, the location of which within the regional hydrostratigraphy is shown in the EIS Table 2.5. This aquifer, along with aquifers AQ2 – AQ6, represents one of the major aquifers in the regional hydrogeological system,

The regional hydrostratigraphic system is divided into three groundwater systems denoted as perched, shallow and deep groundwater systems, described in detail in Section 2.6.2.5 of the EIS. The regional hydrogeology encompassing the Angus Place and Springvale Project Application Areas was studied extensively by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) between 2004 and 2008, and is described in ACARP reports C14033 and C18016. The most recent and detailed groundwater and aquifer modelling was conducted by CSIRO, Palaris (Palaris 2013a and Palaris 2013b) and RPS between 2011 and 2013. This modelling is based on the latest groundwater and geological data, which has been significantly improved since the initial CSIRO reports were published. The geological model includes data from 501 exploration boreholes (refer Figure 2.11 of the EIS). The groundwater model includes data from 142 piezometers in 31 boreholes over a period of up to 10 years and mine water inflow data which has been recorded over a period of 20 years.g

The AQ1 aquifer, along with aquifers AQ2 and AQ3, is part of the deep groundwater system, located in the strata underlying the Mount York Claystone. The Mount York Claystone is the major aquitard in the region, and separates the deep groundwater system from the shallow/perched groundwater systems located above it. The deep groundwater system generally lies at a depth of 200 m to 500 m below the ground surface. The aquifer zones within the deep groundwater system are typically fractured rock aquifers or jointed coal seams. It is this system which produces the mine water inflows when groundwater in this system is drained into the goaf following coal extraction.

The hydrostratigraphic sequence discussed briefly above, and presented in Table 2.5 of the EIS, has been incorporated into the hydrogeological model developed by CSIRO (attached as Appendix K to the Groundwater Impact Assessment prepared by RPS (Appendix E to the EIS) to understand the groundwater impacts of the Angus Place and Springvale MEP. The predicted mine inflows, from the projects, deduced from the CSIRO's hydrogeological model, are presented in Figure 10.11 in the EIS.

The geological modelling and identification of the major aquifers (AQ 1-6), aquicludes and semi-permeable horizons (SP1-4) in the hydrogeological system, the hydrostratigraphic sequence that was incorporated into the hydrogeological model, and the development of the hydrogeological model was undertaken by a group of truly independent researchers/consultants comprising CSIRO, Palaris and

RPS. The Hydrogeological Model was peer-reviewed by Dr. Noel Merrick of Heritage Computing Pty Ltd as part of the NSW Aquifer Interference Policy requirement.

Appendix E, part 1 of The Groundwater Impact Assessment for the proposal, asserts that ground cracking under the swamps would be temporary due to the cracks being filled by sediment. This presupposes that loose sandy sediment would have low permeability, a dubious contention that the Society rejects. For a start, it would depend on the size distribution of the particular sediment. It is instructive to reflect that coal seam gas extraction from fracking is enabled by the injection of sand into microfractures, yet in a curious twist the gentle washing of sand into the cracks under these swamps supposedly inhibits fluid flow. (BMCS)

As detailed in Section 5.12 of the Subsidence Assessment provided as Appendix D to the EIS and Section 7.2 of the Groundwater Assessment provided as Appendix E to the EIS, the shrub swamps develop in the bases of natural valleys and are formed from the accumulation of sediments along relatively flat sections of the drainage lines. These swamps have dense peat layers which overlie the shallow surface soils derived from the Triassic Narrabeen Sandstone group. Some swamps have bedrock outcropping at the downstream end which helps retain the soil and peat. The vegetation types within the swamp include grasses, ferns and shrubs, with trees rarely growing within the swamps. The peat layers in the shrub swamps retain water derived from the shallow groundwater aquifers, surface runoff and rainfall. The water retention is high due to the relatively flat grades and, hence, the substrate is generally permanently waterlogged. In some locations the swamps have been observed to grow and extend over highly cracked and porous rock platforms where the moisture within the swamp appeared to be maintained by the dense and tightly packed matted root structure of the swamp plants.

The surface cracking across the mining area is expected to be generally isolated and minor in nature, due to the reasonable depths of cover which typically vary between 270 metres and 450 metres, and due to the plasticity of the surface soils which allows them to more readily absorb the ground strains. Surface crack widths are expected to be similar to those observed above the previously extracted longwalls at Angus Place and Springvale Collieries, which were typically between 5 mm and 25 mm, but with isolated surface cracking in some locations greater than 50 mm.

The shrub swamps have peat layers which overlie the shallow natural surface soils and underlying bedrock along the alignments of the drainage lines. In most cases, cracking would not be visible at the surface within these swamps, except where the depths of bedrock are shallow or exposed. The shrub swamps comprise significant quantities of sediment and, therefore, fracturing of shallow bedrock beneath these swamps are likely to be filled with soil during subsequent flow events along the drainage lines.

These predictions of impacts are based on years of experience, detailed modelling and a comprehensive understanding of the environment in which the mine operates. Predictions are based on scientific, robust and reliable data made by highly qualified consultants respected in their field of expertise.

The East Wolgan swamp demonstrated a rather perverse endless loop of increasing toxicity. Water from the mine was discharged above the swamp, damaging the downstream section until the water disappeared into the ground. Despite the undemonstrated assertion from the mine consultants that the water would resurface further downstream, due to the streambed cracking being attributed by the company to upsidence, the clear fate of the water would be to re-enter the mine workings via the broken, collapsed sequence above the long wall panel. The water

would then have to be pumped and discharged again, presumably collecting more toxic components from successive trips through the coal seams. (BMCS)

Water from shrub swamps cannot enter the mine workings because of the presence of the aquitard, Mount York Claystone, with an average thickness of approximately 22 m that exists throughout the Angus Place Colliery, Springvale Mine and Clarence Colliery lease areas. The aquitard underlies the the Banks Wall Sandstone and Burralow Formation (refer Figure 2.6, Figure 2.10 and Table 2.10 in the EIS) which support the Shrub Swamps (Figure 2.10 of the EIS).

The Burralow Formation consists of medium- to coarse-grained sandstones interbedded with frequent sequences of fine-grained, clay-rich sandstones, siltstones, shales and claystones. These fine-grained units can be several metres in thickness and their presence differentiates the Burralow Formation from the underlying Banks Wall Sandstone. Several of the claystone horizons, together with clay-rich, fine-to-medium grained sandstones and shales were found to be acting as aquitards, or semi-permeable layers. These aquitards retard the vertical movement of groundwater into underlying strata. For this reason water is more likely to re-surface further downstream than infiltrate into the underlying strata.

The aquifer interference policy requires that a proponent demonstrates variability to lawfully take water within the limits of their licence and the water sharing plan. The Society notes that there appears to be a discrepancy (deficit) between the extraction licence and the estimated inflow in 2023. That deficit is in relation to what is required for the Richmond groundwater source, and is approximately 7 GL. Furthermore, the society is of the opinion that there is insufficient water to allow this level of extraction. (BMCS)

Centennial Coal met with the NSW Office of Water on 13 June 2014 to discuss the water licensing requirements for the Project. Centennial's western operations as a whole are not predicted to require additional water entitlements until 2018. Centennial acknowledges that it is legally obligated to hold the necessary entitlements to undertake its operations. Centennial acknowledges that a review of recharge studies may not result in a change to the licensing requirements for Springvale and Angus Place's future water need. Centennial acknowledges that this may present a compliance risk beyond 2020.

The following strategy will be adopted by Centennial Angus Place to secure water licenses required for the Project:

- Trade, within the constraints of the relevant Water Sharing Plan, with other Centennial Coal water license holders.

- Obtain, when available through controlled allocation orders under the relevant Water Sharing Plan, additional allocations.

- Review the hydrogeological model and predicted water inflows for the Project on a 6 monthly basis to ensure adequate accounting for water take and license requirements.

- Contribute to the 2016 Water Sharing Plan review process, as agreed with the NSW Office of Water.

The Statement of Commitments contained in **Section 5.0** of this RTS has been updated to include this commitment.

Centennial Coal claims that much of the water disappearing from fractured streambeds may re-emerge further downstream. There is evidence to the contrary for East Wolgan Swamp. Such re-emergent surface water is often heavily contaminated with groundwater polluted with salt and metals. This re-emergent, potentially eco-toxic water could not help a swamp or affected stream reach upstream that had suffered water loss. Any downstream sensitive instream environments and riparian environments, such as some shrub swamps and the Greater Blue Mountains World Heritage Area, could be impacted by eco-toxic groundwater effluent. (Colong Foundation)

Centennial Angus Place and Springvale Coal confirm that no emergency discharges into Wolgan River occur currently or is proposed in the future. No discharges into Wolgan River have occurred since 10 April 2010.

Angus Place Colliery's EPL 467 was varied on 29 July 2013 to remove LDP006 as the emergency discharge point on Newnes Plateau. No new LDPs have been proposed in the Angus Place MEP (refer Section 4.11.3 of the Angus Place MEP EIS).

While Springvale Mine's EPL 3607 still has provisions for two emergency discharge points (LDP004 and LDP005) on Newnes Plateau no emergency discharges have been proposed via these LDPs in the Springvale MEP. Instead it has been proposed (refer Section 4.10.1 of the Springvale MEP EIS) that these LDPs be relinquished post-approval when infrastructure required to re-direct emergency discharge water from the SDWTS back underground to the Angus Place Colliery's 900 water storage area has been installed.

Given that there are no emergency discharges proposed on Newnes Plateau Colong Foundation's concerns that the " …downstream sensitive instream environments and riparian environments, such as some shrub swamps and the Greater Blue Mountains World Heritage Area, could be impacted by eco-toxic groundwater effluent." are unfounded.

A Regional Water Quality Impact Assessment has been undertaken as part of the RTS process and is attached as **Appendix 2** to this RTS. This report assesses the impact (water quality and quantity) of the proposal to discharge all mine water from Springvale and Angus Place MEPs into Coxs River via Sawyers Swamp Creek, i.e. the report assesses the scenario where no mine water is transferred to Wallerawang Power Station. The potential impacts on the Coxs river catchment have been quantified, including Lake Burragorang.

The consultants for Centennial Coal make assertions that there is no net loss of water from stream catchments and that 'Any diverted surface water is likely to re-emerge into the catchment further downstream'. The consultants for Centennial conclude 'It is unlikely, however, that this would result in adverse impacts on the overall quality and quantity of water flowing from the catchment.' This statement is misleading. It is more likely that what has happened previously to the Wolgan River and to Kangaroo Creek will be repeated in the streams above the proposed longwall mining area. In these areas, water was lost downstream as well as within the mining area. Even if this was not the case, the water diverted into the near-surface groundwater does not assist the natural functioning of swamps undermined, even if the water does emerge downstream. (Colong Foundation

The impacts to the East Wolgan Swamp mostly attributable to the mine water discharges that occurred between early 2007 and April 2010, however, Centennial Angus Place and Springvale Coal concede that subsidence impacts were also observed at East Wolgan Swamp and Kangaroo Creek Swamp. This finding is supported by Goldney et al (2010), an independent investigation undertaken on behalf of the then Commonwealth Department of, Environment, Water, Heritage and the Arts (DEWHA), who agreed that impacts at East Wolgan Swamp were caused by a combination of subsidence-related ground movements, mine water discharge and erosion, with the particular contribution of subsidence impacts unable to be quantified. In the case of Kangaroo Creek Swamp, impacts were wholly attributable to subsidence.

In both of the Kangaroo Creek Swamp and East Wolgan Swamp cases investigations have revealed that mine design was a primary causative factor for the observed subsidence impacts. The ratio of longwall mining void width to depth of cover for LW940 and LW950 underlying was Kangaroo Creek Swamp identified to be in the critical subsidence behaviour range. Following this investigation, the mine design was modified for all future proposed mining areas in the vicinity of Newnes Plateau Shrub Swamps to ensure that the ratio of longwall mining void width to depth of cover over mine workings was in the sub-critical subsidence behaviour range. No subsidence effects to swamp hydrology or flora communities have been identified in areas where sub-critical mine design has been used in the past.

Similar discharges of orange sediment to those described above for Waratah Rivulet and the Wolgan River but now proposed for an area of Newnes Plateau upstream of the Greater Blue Mountains World Heritage Area are of great concern. Any water flowing through cracks and dilated sandstone strata must not pollute the World Heritage Area and the relevant regional discharge standard must use a pristine creek (e.g. Carne Creek) as a baseline, not some standard provided by a degraded creek nearby. The Colong Foundation requests that the high conservation/ecological value ANZECC/ARMCANZ (2000b) system is the appropriate guide for deriving default triggers for the World Heritage Area and its upstream buffer area, particularly for Carne Creek which has a salinity lower than rainwater. (Colong Foundation)

A regional water quality impact assessment has been undertaken to assess the impact of direct discharge at Angus Place LDP001 and Springvale LDP009. The assessment is provided as **Appendix 2** to this RTS.

In addition, Centennial has undertaken Site Specific Trigger Values (SSTVs) Assessment for Angus Place LDP001. Results of the SSTV analysis indicate that current water quality at Angus Place LDP001 meets ANZECC 95% protection of aquatic ecosystems except for Copper and Zinc. For Copper and Zinc, current water quality at Angus Place LDP001 meets 80th percentile upstream water quality at downstream edge of mixing zone. Further detail is presented in the SSTV Assessment provided as **Appendix 3**.

Centennial alleged that Area 300 can store water 'at an average rate of approximately 4.7 megalitres of water per day. This underground water storage appears to be the source of water emerging nearby at Lambs Creek which was subjected to longwall mining several decades ago. The Colong Foundation has observed a large amount of water welling up from the ground into a wetland on Lambs Creek near where the creek emerges onto private land. Upstream of this swamp, the creek is dry due to longwall mining operations at a shallow depth of cover. This water re-emergence appears to be an unlicensed discharge from the underground water storage, Area 300, Angus Place Colliery. This discharge was not considered in the Water Balance provided in the Environmental Assessment for modification of the Project Approval. The emergence of water make into Lambs Creek should be investigated to confirm that it has water make characteristics. If it has, then the applicant should be asked to explain why it has not notified authorities of this source of mine effluent for the last three decades. (Colong Foundation)

The claim that the Angus Place 300 Underground Storage Area is "...the source of water emerging nearby at Lambs Creek which was subjected to longwall mining several decades ago" is false. The claim has not been corroborated with any scientific evidence linking the "… large amount of water welling up from the ground into a wetland on Lambs Creek." and water stored within the 300 Underground Storage Area. The storage area below Lambs Creek has a depth of cover of at least 150 m. It is not possible for the stored mine water in the workings to "well up" from this depth to discharge into Lambs Creek. It is not possible for the water to emerge further downstream of Lambs Creek on the west and discharge into it as the coal seam / existing workings where water is stored dips to the east and mine water flows in that direction. No pumping of mine water from the storage area to the surface using a seam to surface pumping system occurs currently or is proposed in the Angus Place and Springvale MEPs.

The Emirates Wolgan Valley Resort & Spa, Newnes Hotel and Cabins, local farmers, graziers and residents depend on this water for survival. Centennial must be required to enter into compensation arrangements in the event that Carne Creek or the Wolgan River either cease flowing, or become polluted to the point of being unfit for human consumption due to emergency mine water discharges. (LEG)

Centennial Angus Place and Springvale Coal confirm that no emergency discharges into Wolgan River occur currently or is proposed in the future. No discharges into Wolgan River have occurred since 10 April 2010. There has never been any mine water discharges into Carne Creek and neither is there any proposal to do discharge into that catchment as part of the project.

Angus Place Colliery's EPL 467 was varied on 29 July 2013 to remove LDP006 as the emergency discharge point on Newnes Plateau. No new LDPs have been proposed in the Angus Place MEP (refer Section 4.11.3 of the Angus Place MEP EIS).

While Springvale Mine's EPL 3607 still has provisions for two emergency discharge points (LDP004 and LDP005) on Newnes Plateau no emergency discharges have been proposed via these LDPs in the Springvale MEP. Instead it has been proposed (refer Section 4.10.1 of the Springvale MEP EIS) that these LDPs be relinquished post-approval when infrastructure required to re-direct emergency discharge water from the SDWTS back underground to the Angus Place Colliery's 900 water storage area has been installed.

The conclusion of the EIS after hydraulic investigation and modelling is that after cracking the ground of 1000's of hectares and subsequently pumping away 43.8 ML/day will have "…minimal impact on the shallow and perched aquifer systems across Newnes Plateau ". Given the volume of water to be pumped out from the mine as well as the undoubted effect this will have on underground aquifers (which it is impossible to predict), any normal person would agree that conclusion defies scientific evidence and logical argument. (LEG)

The mine inflows arise from the Lithgow Seam (Illawarra Coal Measures) being mined at Angus Place Colliery and Springvale Mine. This aquifer, referred to as AQ1 in the EIS and the Groundwater Impact Assessment (Appendix E) is hydraulically connected with the Berry Siltstone and Marrangaroo Formations beneath and the Long Swamp Formation and Irondale Coal Seam above, the location of which within the regional hydrostratigraphy is shown in the EIS Table 2.5. This aquifer, along with aquifers AQ2 – AQ6, represents one of the major aquifers in the regional hydrogeological system.

The regional hydrostratigraphic system is divided into three groundwater systems denoted as perched, shallow and deep groundwater systems, described in detail in Section 2.6.2.5 of the EIS. The regional hydrogeology encompassing the Angus Place and Springvale Project Application Areas was studied extensively by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) between 2004 and 2008, and is described in ACARP reports C14033 and C18016. The most recent and detailed groundwater and aquifer modelling was conducted by CSIRO, Palaris (Palaris 2013a and Palaris 2013b) and RPS between 2011 and 2013. This modelling is based on the latest groundwater and geological data, which has been significantly improved since the initial CSIRO reports were published. The geological model includes data from 501 exploration boreholes (refer Figure 2.11 of the EIS). The groundwater model includes data from 142 piezometers in 31 boreholes over a period of up to 10 years and mine water inflow data which has been recorded over a period of 20 years.

The AQ1 aquifer, along with aquifers AQ2 and AQ3, is part of the deep groundwater system, located in the strata underlying the Mount York Claystone. The Mount York Claystone is the major aquitard in the region, and separates the deep groundwater system from the shallow and perched groundwater systems located above it. The deep groundwater system generally lies at a depth of 200 m to 500 m below the ground surface. The aquifer zones within the deep groundwater system are typically fractured rock aquifers or jointed coal seams. It is this system which produces the mine water inflows when groundwater in this system is drained into the goaf following coal extraction.

Removal of mine inflows from the deep groundwater system is unlikely to impact the shallow/perched groundwater systems as there is no hydraulic connectivity.

The hydrostratigraphic sequence discussed briefly above, and presented in Table 2.5 of the EIS, has been incorporated into the hydrogeological model developed by CSIRO (attached as Appendix K to the Groundwater Impact Assessment prepared by RPS (Appendix E to the EIS)) to understand the groundwater impacts of the Angus Place and Springvale MEPs. The predicted mine inflows, from the projects, deduced from the CSIRO's hydrogeological model, are presented in Figure 10.11 in the EIS.

3.3 Response to Community Individual Submissions

3.3.1 Air Quality

The dust and pollution will adversely affect those who live in the region, causing health issues, as we've seen in the CoalPac mines. (AP0182)

As detailed in Section 10.7 of the EIS, the Project is predicted to comply with all relevant air quality criteria at representative receptors during construction, operation and rehabilitation. The estimated emissions for the Project have been calculated with existing management controls that will continue to be used throughout the life of Angus Place Colliery.

Centennial claims only a small contribution to the amount of State and Federal GHG emissions, but omit the Scope 3 emissions about which they say the greatest emission sources associated with the Project are those related to the downstream combustion of the coal (Scope 3), the management of which is not in Centennial Angus Place's control. (AP0225, AP0244)

An Air Quality and Greenhouse Gas Assessment was prepared by SLR Consulting to support the Project and is provided as Appendix M to the EIS. The Greenhouse gas assessment includes calculation of all Scope 3 greenhouse gas emissions associated with the Project.

As shown in Table 10.40 of the EIS, when the inclusion of Scope 3 emissions are taken into consideration, the Project represent approximately 0.7% of NSW GHG emissions and 0.2% of Australia's total GHG emissions.

Counting the Scope 1-3, Angus Place mine will be producing 1,061,024 tCO2-e/annum. Over the proposed 25 year life of the mine when combined with the figures for the Springvale and Clarence mines, this is a large cumulative effect. (AP0225, AP0244)

It is acknowledged in Section 10.8.4 of the EIS that the Project will directly and indirectly generate GHG emissions, which will contribute to these global environmental effects. However, the increase in GHG emissions resulting from the Project will not measurably increase the total Australian emissions. In addition, due to the uncertainties and complexities of the climate system, quantification of the likely environmental effects associated with greenhouse gases being released in the atmosphere as a result of the Project cannot be made.

Centennial argue that GHG emissions of all machinery required in the operations and all clearing of forest required for above ground supporting infrastructure is "negligible". However the entire purpose of this project is to sell for combustion 4.5 million tons of the thermal coal p.a. for 13 years. (AP0407)

An Air Quality and Greenhouse Gas Assessment for the Project was undertaken by SLR Consulting to support the Project and provided as Appendix M to the EIS.

The GHG assessment has been performed with reference to the Australian Department of Climate Change and Energy Efficiency document “National Greenhouse Accounts Factors” (July, 2011), the NSW Department of Energy, Utilities and Sustainability document “Guidelines for Energy Savings Action Plans” (2005), the National Greenhouse and Energy Reporting Act 2007 (NGER Act), the Centennial Coal Greenhouse Gas Assessment Guidance Notes (Centennial Coal, 2010) and Climate Change Response Policy (Centennial Coal, 2012b).

The Air Quality and Greenhouse Gas Assessment accounts for all Scope 1, Scope 2 and Scope 3 emissions over the life of the Project. The total lifetime direct (scope 1) emissions from the Project are estimated to be approximately 42,473 t CO2-e per annum, which is relatively small as this represents approximately 0.03% of NSW GHG emissions and 0.01% of Australia’s total GHG emissions.

3.3.2 Consultation

The Angus Place and the adjoining Springvale mine extension proposals must be subject to a Planning Assessment Commission review with concurrent Public Hearings. (Various)

This proposal and the adjoining Springvale mine extension proposal should be subject to a stringent planning assessment and PAC review process. (AP0134, AP0201, AP0248, AP0279, AP0393)

Determination of the Angus Place MEP and the Springvale MEP will be by the NSW Planning and Assessment Commission following public hearings for both projects. The Planning and Assessment Commission will determine how these public hearings are structured.

Community consultations must be transparent, unbiased and engaged when conducted in regards to this Project. (AP0150)

Consultation undertake for the Project included a variety of Strategies and involved consultation with various government agencies, non government organisations and community individuals. All consultation undertaken for the Project is detailed in Section 7 of the EIS and included a variety of methods. Centennial Coal places utmost importance to stakeholder consultation and engagement. Centennial Coal recognises that effective consultation and engagement is a critical element of its operations and projects and underpins its ‘licence to operate’ in both social and regulatory spheres.

Chapter 7 states that: "The public, including community groups and adjoining and affected landowners were identified and consulted with as part of the consultation and engagement strategy "(p201). None of the Wolgan Valley residents were contacted by Centennial including Emirates Wolgan Resort and Spa. Nor were The Blue Mountains Conservation Society, the Colong Foundation for Wilderness or the Lithgow Environment group. (AP0407)

As noted in Section 7.4.2 of both the Angus Place and Springvale MEP EISs three information sessions were held in March 2013 (2 – 4pm 6 March; 6 – 8 pm, 9 March; 10 am – 2 pm, 9 March) and two session in September 2013 (6 – 7.30 pm, 26 September; 1 – 2.30 pm, 28 September) in Wallerawang to discuss the proposed projects. The March 2013 sessions were held prior to the completion of the technical assessments being undertaken to support the EISs so that any concerns raised at the consultation sessions could be addressed in those technical assessments. The September 2013 sessions were held to provide outcomes of the technical assessments. In addition, a structured technical presentation was organised on 5 October 2013 at the Mines Rescue Station in Lithgow. This session was a means of informing the community formally the outcomes of the technical assessments, including how issues raised at the information sessions had been addressed in the EISs.

All information sessions and the technical session were advertised in Lithgow Mercury ahead of the session dates in March 2012, February 2013 and September 2013 inviting community members, including Wolgan Valley residents, Emirates Wolgan Resort and Spa, The Blue Mountains Conservation Society, the Colong Foundation for Wilderness and the Lithgow Environment group, to participate in the consultation process.

After requesting to make a presentation to the Centennial Community Consultation Committee meeting of 8 April, 2014 I was refused by the Chairman, Howard Fisher. However my written presentation was read out during that meeting through committee member Ian Coates. Apparently, there was no discussion and he was told that I would receive a response from Centennial. I have not heard from them. (AP0407)

A letter from Thomas Ebersoll was tabled at the Angus Place Colliery and Springvale Mine Community Consultative Consultation (CCC) Meeting of 8 April 2014 by Ian Coates, one of the community members on the committee. The letter was discussed and an action was developed at the meeting. This is reflected in the minutes of that meeting available from the Angus Place Colliery website:

http://www.centennialcoal.com.au/Operations/OperationsList/Angus-Place.aspx#Community-Consultative-Committee-Minutes

The Chairman of the CCC, Howard Fisher, wrote to Thomas Ebersoll on 14 May 2014 acknowledging his letter and advised him to make a formal submission on the Angus Place MEP on the Department of Planning and Environment's website. Thomas Ebersoll was advised the closing date for submissions was 26 May 2014. Additionally to the above-noted communication, Thomas Ebersoll had contacted Angus Place Colliery to ask to speak with the person coordinating the preparation of the EIS for the Angus Place MEP. Iain Hornshaw (Environmental Projects Coordinator) called Thomas Ebersoll on 11 March 2014 and provided him with information on the MEPs.

3.3.3 Cultural Heritage

The Garden of Stone area has profound cultural and physical heritage values that should be preserved. (AP0160)

Section 6.7.4 of the Flora and Fauna Impact Assessment includes an assessment of impacts of the Project on the Gardens of Stone National Park which is part of the Greater Blue Mountains Area (GBMA). The GBMA is a World Heritage Property and National Heritage Place which occurs to the immediate north of the Project Application and also occurs approximately 6 km to the east. DoE (2013) provides Significant Impact Assessment criteria for World Heritage Properties and National Heritage Places. The Flora and Fauna Impact Assessment includes an assessment of the potential impacts from the Project against the DoE criteria. In summary:

The proposed clearing of 23.24 ha is unlikely to reduce the diversity or modify the composition of plant and animal species within the GBMA. However, habitats for fauna species that may occupy both the Project Application Area and the GBMA as part of their home range will be subject to a minor reduction in habitat due to proposed clearing. The borehole compound that is closest to the GBMA will require just 1 ha to be cleared.

An assessment of the potential impacts upon the GBMA as a result of subsidence determined that whilst the area of the GBMA closest to the proposed longwalls could experience very low levels of vertical subsidence (i.e. less than 20mm), it is not predicted to experience any measureable conventional tilts, curvatures or strains.

The project will hamper tourism therefore destroying the opportunity for local Aboriginal people to benefit in a positive way as tour guides of the many local art sites. (AP0173)

Centennial Angus Place acknowledge in Section 6.1 of the EIS that the Newnes Plateau is identified as being an important feature of the Lithgow LGA by the local, regional and State stakeholders who access the area for various activities. Consultation was undertaken as part of the development of the Social Impact Assessment prepared by James Marshall & Co and provided as Appendix N to the EIS, with users of the Plateau including adventure visitors (mountain bike riders, motor bikers and four wheel drivers) and passive visitors (include bushwalkers, families visiting a particular destination point). The consultation was undertaken at various times throughout 2013 and found that many visitors who live in the area are aware of mining under the Newnes Plateau. It was generally their opinion that mining has not changed their experience when visiting the area and will not change their experience as long as access to the area was permitted. Many of these visits were for adventure type tourism. Passive visitors, for example, families visiting the area to visit a particular destination point (for example the Glow Worm Tunnels) and bushwalkers generally stated that they did not want their experience changed. The amenity of the area was important to these types of visitors and key words used to describe the area are: quiet, nature, features (pagodas and cliffs) and views from lookouts.

It is identified in Section 4.3 of the Social Impact Assessment that the mine design and other mitigating factors have minimised the extent of change to the physical environment to an extent that the Project will not adversely impact on the existing land use, its physical characteristics including surface features and the manner in which the public utilise / access the area for recreation.

As is detailed in Section 10.4.7 of the EIS, in regards to Aboriginal heritage sites, there have been a number of surveys that have identified 49 Aboriginal heritage sites within the Project Application Area. While 14 of these sites will be subsided to varying degrees, the small predicted subsidence effects and site type means that no consequences are predicted for most.

The four sites above the mining area that will be subsided by 20 mm or more are not predicted to be damaged, although the risk remains. These sites are 45-1-0084, 45-1-0137 and 45-1-2756/2757. Based on subsidence predictions and prior experience in the Southern Coalfields no significant physical impact is predicted to any of these sites, although there is the possibility of minor spalling occurring on exposed rock faces, and such damage could be coincident with the hand stencil on the wall of 45-1-2756/2757.

Accordingly, they will be monitored in accordance with specifications to be formulated in a Cultural Heritage Management Plan.

No Aboriginal sites were found within areas to be cleared for surface infrastructure and therefore this activity is predicted to have no impact on Aboriginal heritage.

As such, the Project is unlikely to impact the opportunity for local Aboriginal people to benefit in a positive way as tour guides of the many local art sites within the area.

3.3.4 Ecology

Important terrestrial and stream environments in this significant part of the Gardens of Stone region must not be damaged by long wall mining but instead protected in a state conservation area. (Various)

The mining layout for the Project has been designed to minimise the potential for impacts and so the majority of the cliffs and pagoda complexes are located outside the 26.5 degree angle of draw line from the extents of the proposed longwalls. No impacts are expected to these features and, subsequently, no impacts would be expected to potential habitats of those threatened species that may utilise these habitats.

Section 6.7.4 of the Flora and Fauna Impact Assessment includes an assessment of impacts on the Projects impacts on the Gardens of Stone National Park which is part of the Greater Blue Mountains Area (GBMA). The GBMA is a World Heritage Property and National Heritage Place which occurs to the immediate north of the Project Application and also occurs approximately 6 km to the east. DoE (2013) provides Significant Impact Assessment criteria for World Heritage Properties and National Heritage Places. The Flora and Fauna Impact Assessment includes an assessment of the potential impacts from the Project against the DoE criteria. In summary:

The proposed clearing of 23.24 ha is unlikely to reduce the diversity or modify the composition of plant and animal species within the GBMA. However, habitats for fauna species that may occupy both the Project Application Area and the GBMA as part of their home range will be subject to a minor reduction in habitat due to proposed clearing. The borehole compound that is closest to the GBMA will require just 1 ha to be cleared.

An assessment of the potential impacts upon the GBMA as a result of subsidence determined that whilst the area of the GBMA closest to the proposed longwalls could experience very low levels of vertical subsidence (i.e. less than 20mm), it is not predicted to experience any measureable conventional tilts, curvatures or strains.

Water courses within the eastern part of the Project Application Area flow into the GBMA via the Wolgan River and Carne Creek. The predicted changes in grade are small when compared to the existing natural grades along the alignment of the Wolgan River. It is unlikely therefore, that there would be any significant changes in the levels of ponding, flooding or scouring of the river banks resulting from the extraction of the proposed longwalls. The potential impacts to Carne Creek, due to extension of mining at Angus Place, are also regarded as insignificant. Consequently, no impacts to water quality are anticipated to occur downstream within the GBMA.

Due to the above considerations, the Project is not expected to lead to indirect impacts from clearing, be significantly affected by subsidence or be affected by changes in water quality. Therefore, the Project is unlikely reduce the diversity or modify the composition of plant and animal species within any part of the GBMA.

No direct or indirect impacts are expected that would fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species, or habitat that is important for the conservation of biological diversity within the GBMA.

Consequently, the Project is not expected to cause a long-term reduction in rare, endemic or unique plant or animal populations or species within the GBMA.

Centennial Coal must not be allowed to simply replicate the damage it has already caused to nationally threatened upland swamps on the Newnes Plateau for which it was required by the Commonwealth Government to pay $1.45 million in reparations. (Various)

Centennial Angus Place acknowledges in Section 2.6.2.7 of the EIS the historical impacts to Swamps as a result of previous mining and mining related activities. Longwalls have been extracted directly or partially beneath 13 shrub swamps and 26 hanging swamps. Surface impacts have been observed at five swamps including Kangaroo Creek Swamp, Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp. These have been investigated and where impacts have been observed, these have been identified as largely the result of mine water discharge.

Investigations have identified that erosional and flora dieback impacts at Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp were caused by changes to swamp hydrology related to mine water discharge and were not related to subsidence. As a result of this finding, future mine dewatering systems have been designed to ensure that discharge of mine water to Newnes Plateau Shrub Swamps is avoided.

Subsidence effects to aspects of swamp hydrology have been noted at two swamps (Kangaroo Creek Swamp and East Wolgan Swamp). In both of these cases investigations have revealed that mine design was a primary causative factor. The ratio of longwall mining void width to depth of cover over mine workings was identified to be in the critical subsidence behaviour range. Following this investigation, the mine design was modified for all future proposed mining areas in the vicinity of Newnes Plateau Shrub Swamps to ensure that the ratio of longwall mining void width to depth of cover over mine workings was in the sub-critical subsidence behaviour range. No subsidence effects to swamp hydrology or flora communities have been identified in areas where sub-critical mine design has been used in the past.

Section 2.8.4 of the EIS details the cause and outcomes of an Enforceable Undertaking under section 486DA of the EPBC Act. Centennial acknowledged that its operations had a significant impact on THPSS, a federally listed endangered ecological community and as such Springvale Coal and Angus Place Pty Limited undertook to pay $1,450,000 for a four year research program.

The objectives of this research program are to:

- Provide the necessary knowledge to conserve, manage and restore THPSS;
- Use that knowledge to promote best management practices for these areas;
- Transfer knowledge gained in the program to agencies, land managers and relevant stakeholders; and
- Maximise the educational and training opportunities of the Program.
- The research themes under the program are:
- Understanding the THPSS which includes detailed mapping, location, distribution and extent of the swamps, including those under threat.
- Understanding swamp systems, including water balance and dynamics, the functionality of peatland swamps, environmental history and origins, ecology/biodiversity of major structural species and contribution of THPSS to the landscape.
- Understanding land management and impacts, including condition status mapping and trends.
- Application of understanding, including monitoring of reference sites and thresholds for recovery and resilience.

In 2012, approximately $900,000 of the research fund had been allocated to five projects, with additional funding set aside to support swamp hydrology research when a suitable project was identified by the Steering Committee. The Committee meets twice annually and holds an annual workshop to review the status of the research findings and outcomes.

The sandstone strata supporting the 22 nationally endangered swamps, including the 7 shrub swamps must not be fractured. (Various)

Section 5.12 of the Subsidence Assessment, provided as Appendix D to the EIS, provides a detailed assessment of the potential impacts to shrub swamps and hanging swamps as a result of the Project.

The mining layout has also been designed so as to reduce the potential impacts on the shrub swamps resulting from mine subsidence movements. The proposed LW1010 has also been setback such that Twin Gully Swamp will not be directly mined beneath. The widths of the proposed longwalls have also been narrowed beneath Tri Star and Trail 6 Swamps.

Tri Star Swamp and Trail 6 Swamp are the only two shrub swamps which are located directly above the proposed longwalls. The proposed LW1004 to LW1006 and the proposed LW1016 and LW1017, which mine beneath these swamps, have been narrowed to overall void widths of 261 metres. Elsewhere, the proposed longwalls have overall void widths of 360 metres.

Predicted post mining grades are similar to the natural grades within the shrub swamps. There are no predicted significant reductions or reversals of grade. The hanging swamps are located on the sides of the valleys and, therefore, that natural gradients are greater than those shown for the shrub swamps and, in addition to this, the predicted mining induced tilts are less.

It is not expected, therefore, that there would be any adverse changes in ponding or scouring within the swamps resulting from the predicted mine subsidence movements. It is also not anticipated that there would be any significant changes in the distribution of the stored surface waters within the swamps as a result of the mining induced tilt or vertical subsidence.

Whilst scouring was observed in a number of swamps located above the previously extracted longwalls at Angus Place and Springvale Collieries, investigations have shown that these were generally the result of other activities such as mine water discharge, rather than mine subsidence itself,

Fracturing of the uppermost bedrock has been observed in the past, as a result of longwall mining, where the tensile strains have been greater than 0.5 mm/m or where the compressive strains have been greater than 2 mm/m.

The swamps which are located outside the extents of the proposed longwalls, including Twin Gully Swamp and the shrub swamps along the Wolgan River, are predicted to experience tensile strains less than 0.5 mm/m and compressive strains less than 2 mm/m due to the proposed mining. It is unlikely, therefore, that the bedrock beneath these swamps would experience any significant fracturing.

Although some minor and isolated fracturing could occur in the bedrock beneath the swamps located outside the extents of the proposed longwalls, however, it is unlikely to result in any adverse impacts on these swamps.

The swamps which are located directly above the proposed longwalls are predicted to experience tensile strains greater than 0.5 mm/m and compressive strains greater than 2 mm/m. It is expected, therefore, that fracturing would occur in the top most bedrock beneath these swamps.

The surface cracking across the mining area is expected to be generally isolated and minor in nature, due to the reasonable depths of cover which typically vary between 270 metres and 450 metres, and due to the plasticity of the surface soils which allows them to more readily absorb the ground strains. Surface crack widths are expected to be similar to those observed above the previously extracted longwalls at Angus Place and Springvale Collieries, which were typically between 5 mm and 25 mm, but with isolated surface cracking in some locations greater than 50 mm.

The shrub swamps have peat layers which overlie the shallow natural surface soils and underlying bedrock along the alignments of the drainage lines. In most cases, cracking would not be visible at the surface within these swamps, except where the depths of bedrock are shallow or exposed. The shrub swamps comprise significant quantities of sediment and, therefore, fracturing of shallow bedrock beneath these swamps are likely to be filled with soil during subsequent flow events along the drainage lines.

The hanging swamps have soft soil or peat layers which overly the bedrock on the valley sides. It is expected that the potential for fracturing in these locations would be less when compared to the bases of the valleys, where higher compressive strains occur due to the valley related movements, and due to the higher depths of cover along the valley sides.

Whilst some minor surface cracking could occur in the swamps resulting from the extraction of the proposed longwalls, the previous experience of mining beneath swamps at Angus Place, Springvale and in the Southern Coalfield indicate that the likelihoods and extents of these impacts are very small.

The dilated strata beneath the drainage lines, upstream of the swamps, could result in the diversion of some surface water flows beneath parts of the shrub swamps. It is noted, however, that the drainage lines upstream of the swamps are generally ephemeral and, therefore, surface water flows occur during and shortly after rainfall events. Any diverted surface water flows are expected to remerge short distances downstream, due to the limited depth of fracturing and dilation and due to the high natural stream gradients.

The incidence of impacts on swamps due to mine subsidence ground movements is very low and, in some of these cases, the impacts that were observed were associated with natural events or mining related surface activities. It is expected, therefore, that the incidence of impacts on the swamps within the Extension Area resulting from mining induced ground movements will also be low.

Previous longwalls at Angus Place and Springvale Collieries have been extracted directly beneath or partially beneath 13 shrub swamps and 26 hanging swamps. Surface impacts have been observed at four swamps which were directly mined beneath by the previously extracted longwalls at Angus Place and Springvale Collieries. Centennial has recognised that past mining related surface activities, i.e. the discharge of high quantities of mine water and construction of various roads and access paths, have resulted in surface impacts to some swamps. Centennial has developed management plans to minimise the potential for future impacts resulting from these mining related surface activities.

An environmental monitoring program was established to assess the effects of longwall mining on the groundwater systems associated with the swamps at Angus Place and Springvale Collieries. The monitoring comprised swamp piezometers, shallow aquifer piezometers and multi-level vibrating wire piezometers at Junction, Sunnyside, Sunnyside West and West Wolgan Swamps. The monitoring results were reviewed by RPS which found that the monitoring results provided no evidence that longwall mining had affected the groundwater systems for these swamps.

The groundwater Impact Assessment prepared by RPS to support the Project and provided as Appendix E to the EIS determined that the most significant reductions to average standing groundwater levels are predicted in Twin Gully Swamp.

This swamp has a projected drop in average standing water levels from 12.4 cm to 10.6 cm above the soil surface. The post mining values predicted at Twin Gully Swamp therefore suggest that soil saturation would persist, maintaining water availability for flora and fauna, as well as soil anoxia, allowing for continued peat formation. All other monitored swamps have smaller projected decreases in average standing water levels and monitored swamps are projected to maintain average standing water levels above the surface.

Additionally, highly organic peat soils with low bulk density capillary forces are likely to be saturated for some distance above the water table itself. Natural decreases in water levels, in addition to the small predicted decreases from the CSIRO model are still likely to enable capillary forces to saturate the peat layer. Therefore, a possible reduction in the average standing water levels, by the magnitudes predicted is unlikely to result in drying of the peat layer.

The Project is not expected to have a significant impact upon the hydrology of any hanging swamps. The reliance of these areas on perched aquifer systems effectively isolate them from any hydrological changes that may occur to the regional water table as a result of mining operations.

The proposed clearing of 14 hectares of forest for an additional ventilation facility is excessive and its proposed location close to the Wolgan River is unacceptable. (Various)

As detailed in Section 4.10.3 of the EIS, mine planning has identified that additional ventilation capacity is required to ensure compliance with Clause 13(h) of the NSW Coal Mine Health and Safety Regulation 2006. To optimise the existing ventilation system, an air intake ventilation facility (downcast) will be required to deliver fresh air to the underground mine. This is identified as Angus Place Ventilation Site 3 (APC-VS3. In addition, the Project will require control of the increased volume of mine water make to meet underground safety and operational requirements. As such, new dewatering bore facilities will be required to continue to deliver water into the SDWTS (which will continue to be utilised as part of the Project).

The ventilation facility has been located to fit with the layout of the proposed underground roadways and the existing surface infrastructure within Newnes State Forest (i.e. forest roads and tracks). APC-VS3 will have a surface footprint of approximately 14 ha and will have a suitable asset protection zone.

The location of the ventilation facility is constrained by the mine design and layout and has been located to minimise impacts to the environment and sensitive receptors as far as reasonably practical and avoid removal of any threatened flora.

Dewatering bore facility sites have been identified based upon mine design requirements, and environmental constraints from a desktop analysis. The preferred options for the final placement of the dewatering boreholes will balance dewatering needs with potential environmental impacts.

The proposed installation of surface facilities will require the removal of vegetation and habitats potentially suitable for threatened flora and fauna species. Those threatened species and communities recorded or expected in the impact area have been assessed by way of 7 part tests of significance under the TSC Act and/or the assessment of significance under the EPBC Act with the result of these assessments summarised in Section 10.3.5 of the EIS. The results of these assessments show that the consequences are low and that the Project is unlikely to have significant direct or indirect impacts on threatened species or communities.

To compensate for the clearing required for new surface infrastructure, Centennial Coal has developed a Regional Biodiversity Strategy (revised September 2014) that that takes into consideration both the direct impacts of clearing potential habitat and indirect impacts to the Temperate Highland Peat Swamps on Sandstone, incorporating Newnes Plateau Shrub Swamps and Newnes Plateau Hanging Swamps. Details of the Biodiversity Strategy proposed to be implemented are detailed in the revised Regional Biodiversity Offset Strategy provided as **Appendix 4** to this RTS.

Further Measures to mitigate the impacts of vegetation clearing required for new surface infrastructure are detailed in Section 10.3.8 of the EIS.

Carne Creek, pagodas, cliffs and the many nationally endangered swamps that the current proposal puts at risk must not be damaged. (Various)

A number of threatened species and endangered ecological communities will be compromised by the proposed extension. (AP0310)

The project will cause destruction of our natural environments that protect our flora and fauna that also provide clean water, air, a carbon sink, link to our cultural heritage and a tourist attraction. (AP0083, AP0134, AP0142)

Australia's natural heritage is currently at risk. Therefore increasing the risk and impinging on a pristine wilderness area should not occur. (AP0293)

Longwall mining under the endangered ecological communities and rock pagodas and cliffs will cause subsidence damage. (AP0199, AP0200, AP0201, AP0203, AP0313, AP0393)

2,638 hectares of land is within the potential subsidence impact area. As detailed in Section 6.5 of the Flora and Fauna Impact Assessment, provided as Appendix H to the EIS, flora and fauna monitoring undertaken at Angus Place Colliery since 2005 has not recorded any losses to threatened species populations or EECs as a result of subsidence. This is due to appropriate mine design to limit subsidence to acceptable levels.

The mining layout for the Project has been designed to minimise the potential for impacts and so the majority of the cliffs and pagoda complexes are located outside the 26.5 degree angle of draw line from the extents of the proposed longwalls. No impacts are expected to these features and, subsequently, no impacts would be expected to potential habitats of those threatened species that may utilise these habitats.

Carne Creek is located to the east of the proposed longwalls, outside the proposed Extension Area. Although Carne Creek will not be directly undermined, it was included in the assessment as it could experience valley related movements and could be sensitive to these movements.

Carne Creek is located 400 metres south-east of LW1019, at its closest point to the proposed longwalls. The remaining proposed longwalls are located more than 600 metres from the creek. The total length of Carne Creek located within a distance of 600 metres from the extents of the proposed longwalls is approximately 0.9 kilometres.

The maximum predicted subsidence at Carne Creek, due to the extraction of the proposed longwalls, is less than 20 mm. Whilst the creek could experience some very low level vertical subsidence, it is not expected to experience any measurable conventional tilts or curvatures, even if the predictions were exceeded by a factor of 2 times.

No significant impacts to the dry woodland and forest habitats are predicted as a result of subsidence. Destabilisation of slopes is unlikely to be substantial such that it would significantly affect threatened flora or fauna that may occupy woodland environments. To compensate for the clearing required for new surface infrastructure, Centennial Coal has developed a Regional Biodiversity Strategy (revised September 2014) that that takes into consideration both the direct impacts of clearing potential habitat and indirect impacts to the Temperate Highland Peat Swamps on Sandstone, incorporating Newnes Plateau Shrub Swamps and Newnes Plateau Hanging Swamps. Details of the Biodiversity Strategy proposed to be implemented are detailed in the revised Regional Biodiversity Offset Strategy provide as **Appendix 4** to this RTS.

As a result of impacts identified to swamps in the past, Centennial Angus Place has modified the mine design to minimise the potential risk of these impacts occurring into the future.

Whilst some minor surface cracking could occur in the swamps resulting from the extraction of the proposed longwalls, the previous experience of mining beneath swamps at Angus Place, Springvale and in the Southern Coalfield indicate that the likelihoods and extents of these impacts are very small.

No significant changes in surface water flows, vegetation composition or habitats are anticipated as a result of the Project.

A complex risk assessment to international standards must be completed by independent ecological experts. (AP0129)

As detailed in Section 9.0 of the EIS, potential environmental issues associated with the Project were identified through a Broad-Brush Risk Assessment for the EIS, completed in March 2011, and was supplemented by a subsidence constraints risk assessment in November 2012 attended by a team of specialist consultants.

Following completion of the technical assessments and the identification of management and mitigation measures (as appropriate), the residual risks of the Project have been identified to ensure all residual consequences are at an acceptable level. The residual risks and consequences of key environmental issues of the Project are discussed in Section 10.0 of the EIS.

A Flora and Faun impact Assessment was prepared by RPS Australia East to support the Project and is Provided as Appendix H to the EIS. All fauna and flora survey works and the preparation of the Flora and Fauna Impact Assessment was undertaken by suitably qualified ecologists. All work undertaken for the Flora and Fauna Impact Assessment complied with relevant laws and codes relating to the conduct of flora and fauna research, including the Animal Research Act 1995, National Parks and Wildlife Act 1974 and the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

Centennial has turned swamps to dust by cracking near surface aquifers. (AP0210)

Centennial has already poisoned nationally endangered swamps with eco-toxic mine effluent. (AP0004, AP0210)

The impacts of past mining have been dealt with cursorily in the EIS which essentially argues that there have been no direct impacts on swamps by subsidence. There have clearly been impacts. (AP0021)

Both East Wolgan and Narrow have now been severely degraded by mining impacts and acknowledged in the imposition of Enforceable Undertaking, though the impacts of the excess mine water is conveniently used as the cause of the damage, damage which has left the drainage line of East Wolgan in particular a 30 m wide stretch of bare dry earth with no evidence of recovery after nearly 6 years. (AP0021)

East Wolgan and probably Narrow Swamps appear to be suffering, and it can be expected that the remaining swamp vegetation will gradually dry out and change, probably after a major

bushfire that will probably kill off remaining swamp plants and allow woodland species to invade. (AP0021)

Kangaroo Swamp, Lambs Creek Swamp, Junction Swamp and East Wolgan Swamp have all been lost, although each was supposed to be protected under both State TSC Act and EPBC Act for Endangered Ecological Communities. (AP0071)

The Commonwealth Department of the Environment has found that Centennial's longwall mining activities on the Newnes Plateau caused a loss of ecosystem function shown by loss of peat, erosion, vegetation dieback and weed invasion in 3 swamps (East Wolgan Swamp, Junction Swamp, Narrow Swamp). This shows they are not capable of protecting the environment and must not happen again. (AP0122, AP0213, AP0290, AP0310, AP0331, AP0396)

The mine water discharges into East Wolgan Swamp caused scalding in a narrow line down the valley axis. It did not support the vegetation over most of the swamp but killed it along the line of maximum discharge, encouraging erosion. (AP0393)

The claims in Appendix H of the EIS Main Document Vol. 2 that there has been no significant damage to shrub swamps from subsidence, although the Main Report clearly identifies swamps significantly affected by mine subsidence, in addition to mine water discharge, e.g. East Wolgan Swamp. (AP0209)

P. 94 of the EIS Main Document Vol. 2 Appendix H states that since 2005 there has been no loss of EECs or populations of threatened species. This ignores East Wolgan Swamp, where subsidence is identified as a contributing factor to the damage to this NPSS, in addition to mine water discharge. To state that "the minor alterations to the hydrological regime predicted are unlikely to modify the vegetation communities present in the short or long term" is totally unacceptable and inaccurate. The previously undermined Junction Swamp, where EI was recorded in 2001, has been substantially degraded following a lowering of the water table in that swamp. EI has not subsequently been recorded there and the habitat may now be unsuitable for the species. (AP0209)

Centennial Angus Place acknowledges that previous mining has resulted in some localised impacts to the environment as a result of its operations. The impacts at Angus Place olliery are largely a result of subsidence and water discharges.

In 2002, Angus Place Colliery commenced intensive monitoring, investigations and research to better understand the surface environment. These investigations have included groundwater, surface water, ecological aspects and the interplay of these aspects on swamps. The data collected and analysed over the past 11 years has been critical to proving that the technologies and engineering methodologies for longwall mining will minimise impacts to sensitive surface features

At Angus Place Colliery, the application of risk based planning, has driven mine planning, mine design and subsidence management, based on the geological and geotechnical constraints, and the overlying sensitive features.

As detailed in Section 8 of the EIS, the approach of Angus Place Colliery to the MEP has been to apply a best practice system of environmental management: that is a hierarchy of avoiding, minimising, mitigating and finally, offsetting residual impacts.

The following controls have been applied through the mine design process to minimise impacts to the environment:

- longwalls adjacent to the Gardens of Stone National Park are to be extracted towards the National Park with potential ground movements progressively monitored and managed as required. This adaptive management approach complements the mine plan design in reducing impacts to the existing environment;

- LW 1004 to LW 1006 will be designed with 261 m voids. The depths of cover directly above these proposed longwalls range from 330 m to 420 m with resulting sub-critical void width to depth ratios of 0.60 to 0.85, which is less than previous longwall development at Angus Place.

- LW1001, LW1002 and LW1003 will be designed with 285 m voids.

- LW1013 and LW1014 have both been split into two sections (A and B) to avoid intervening cliff and pagoda complexes. The longwall sections will be linked underground by twin 5 m wide development headings to provide safe access and ventilation. These first workings will not generate surface subsidence.

- LW1007 to LW1019 will be 350 m wide, with chain pillars 55 m wide. Depths of cover range from 360 m to 420 m. The resulting sub-critical void width to depth ratios are within the range of 0.85 to 1.0, which is similar to those for the previously extracted longwalls at Angus Place.

- LW1010 has been shortened to avoid mining under Twin Gully Swamp.

In addition, the Project does not propose any discharge to the THPSS on the Newnes Plateau and therefore there is no proposed change to flow variability in those catchments.

As a result of impacts identified to swamps in the past, Centennial Angus Place has modified the mine design to minimise the potential risk of these impacts occurring into the future.

In total 73 nationally endangered swamps will be damaged by cracking of the underlying sandstone causing the swamps to dry out by the groundwater level falling by 10 m. This will increase bushfire risk and lead to dried out swamps being replaced by dry land floral communities. (AP0007, AP0148, AP0168, AP0225, AP0251, AP0229, AP0244, AP0290, AP0316, AP0279, AP0324, AP0326, AP0357, AP0338, AP0396)

The peat soils that supported the swamps will decompose and over a period of years eucalypts and banksias will migrate into the dying swamps as they evolve into dryland communities. (AP0148, AP0229, AP0316, AP0326, AP0357, AP0407)

Impacts to swamps will result in many threatened plants and animals supported by them being killed, including the giant dragonfly. (AP0148, AP0229, AP0251, AP0316, AP0324, AP0326, AP0357)

Centennial " admits its mining will fracture iconic Birds Rock, a Flora Reserve, and the sandstone beds under 73 nationally endangered swamps". (AP0110)

The Angus Place and Springvale extension proposals are a direct threat to core of the shrub swamp area in the headwaters of Carne Creek. The EEC listed endangered ecological community of Newnes Plateau Shrub Swamps should not be mined under. (AP0225, AP0244, AP0308)

The sandstone rock supporting the 41 nationally endangered swamps, and particularly the 11 shrub swamps affected by the proposal, will also develop a large number of fractures. Centennial predicts these cracks to be 5 to 50mm wide and 10 to 15 metres deep. (AP0407)

This project has the potential to lead to the irrevocable degradation and potential destruction of several Newnes Plateau Shrub Swamps (NPSS), an Endangered Ecological Community (EEC), which forms part of the Commonwealth listed Temperate Highland Peat swamps on Sandstone (THPSS) EEC, with resultant negative impacts upon their associated groundwater dependent

species. These species may include threatened flora and fauna, such as the endangered Giant Dragonfly (Petalura gigantea), endangered Blue Mountains Water Skink (Eulamprus leuraensis), and vulnerable Dean's Boronia (Boronia deanei deanei), all of which are obligate mire (peat swamp) dwelling species. (AP0209)

As detailed in Section 5.4 of the Subsidence Impact Assessment (EIS Appendix D), the surface cracking across the mining area is expected to be generally isolated and minor in nature, due to the reasonable depths of cover which typically vary between 270 m and 450 m, and due to the plasticity of the surface soils which allows them to more readily absorb the ground strains. Surface crack widths are expected to be similar to those observed above the previously extracted longwalls at Angus Place and Springvale Collieries, which were typically between 5 mm and 25 mm, but with isolated surface cracking in some locations greater than 50 mm.

The swamps which are located directly above the proposed longwalls are predicted to experience tensile strains greater than 0.5 mm/m and compressive strains greater than 2 mm/m. It is expected, therefore, that fracturing would occur in the top most bedrock beneath these swamps.

The Groundwater Impact Assessment prepared by RPS to support the Project and provided as Appendix E to the EIS determined that the most significant reductions to average standing groundwater levels are predicted in Twin Gully Swamp.

This swamp has a projected drop in average standing water levels from 12.4 cm to 10.6 cm above the soil surface. The post mining values predicted at Twin Gully Swamp therefore suggest that soil saturation would persist, maintaining water availability for flora and fauna, as well as soil anoxia, allowing for continued peat formation. All other monitored swamps have smaller projected decreases in average standing water levels and monitored swamps are projected to maintain average standing water levels above the surface.

Additionally, highly organic peat soils with low bulk density capillary forces are likely to be saturated for some distance above the water table itself. Natural decreases in water levels, in addition to the small predicted decreases from the CSIRO model are still likely to enable capillary forces to saturate the peat layer. Therefore, a possible reduction in the average standing water levels, by the magnitudes predicted is unlikely to result in drying of the peat layer.

The Project is not expected to have a significant impact upon the hydrology of any hanging swamps. The reliance of these areas on perched aquifer systems effectively isolate them from any hydrological changes that may occur to the regional water table as a result of mining operations.

The mining layout has also been designed so as to reduce the potential impacts on the shrub swamps resulting from mine subsidence movements. The proposed LW1010 has also been setback such that Twin Gully Swamp will not be directly mined beneath. The widths of the proposed longwalls have also been narrowed beneath Tri Star and Trail 6 Swamps.

Tri Star Swamp and Trail 6 Swamp are the only two shrub swamps which are located directly above the proposed longwalls. The proposed LW1004 to LW1006 and the proposed LW1016 and LW1017, which mine beneath these swamps, have been narrowed to overall void widths of 261 metres. Elsewhere, the proposed longwalls have overall void widths of 360 metres.

Predicted post mining grades are similar to the natural grades within the shrub swamps. There are no predicted significant reductions or reversals of grade. The hanging swamps are located on the sides of the valleys and, therefore, that natural gradients are greater than those shown for the shrub swamps and, in addition to this, the predicted mining induced tilts are less.

It is not expected, therefore, that there would be any adverse changes in ponding or scouring within the swamps resulting from the predicted mine subsidence movements. It is also not anticipated that there would be any significant changes in the distribution of the stored surface waters within the swamps as a result of the mining induced tilt or vertical subsidence.

The current surface works are involving extensive clearing. The forests need to be maintained for the future, enough land has been taken from nature. (AP0106, AP0323, AP0325)

The amount and scale of the infrastructure will be increased, including: a 14ha clearing for one mine vent, seven more dewatering sites (for Angus Place) with power, pipelines and tracks and clearings 90m x 110m, and two additional borehole sites (for Springvale). Exploration drill holes and groundwater monitoring holes, as well as subsidence monitoring activities will also occur. (AP0225, AP0244)

The proposed installation of surface facilities will require the removal of vegetation and habitats potentially suitable for threatened flora and fauna species. Those threatened species and communities recorded or expected in the impact area have been assessed by way of 7 part tests of significance under the TSC Act and/or the assessment of significance under the EPBC Act with the result of these assessments summarised in Section 10.3.5 of the EIS and included in detail in Appendices 1 and 2 of the Flora and Fauna Impact Assessment (Appendix H to this EIS). The results of these assessments show that the Project is unlikely to have significant direct or indirect impacts on threatened species or communities such that the populations of the species and the occurrence of the communities are likely to be placed at risk of extinction.

To compensate for the clearing required for new surface infrastructure, Centennial Coal has developed a Regional Biodiversity Strategy (revised September 2014) and attached as **Appendix 4** to this RTS that that takes into consideration both the direct impacts of clearing potential habitat and indirect impacts to the Temperate Highland Peat Swamps on Sandstone, incorporating Newnes Plateau Shrub Swamps and Newnes Plateau Hanging Swamps. Details of the Biodiversity Strategy proposed to be implemented are detailed in Section 10.3.7 of the EIS.

Further measures to mitigate the impacts of vegetation clearing required for new surface infrastructure are detailed in Section 10.3.8 of the EIS.

Sound from mine ventilation has seen a decline in native animal activity in the area. (AP0282)

A Noise Impact Assessment was prepared by SLR Consulting and provided as Appendix L to the EIS. The Noise Impact Assessment identifies and assesses the potential noise impacts of the Project (including construction, operational, cumulative and off-site transport noise impacts). The Noise Impact Assessment has referenced and addressed relevant guidelines and assessment criteria as noted within the DGRs. The NIA has been prepared with reference to Australian Standard AS1055:1997 “Description and Measurement of Environmental Noise” (Parts 1, 2 and 3) and in accordance with:

- EPA (1999) “NSW Industrial Noise Policy” (INP);
- EPA (2009) “Interim Construction Noise Guideline” (ICNG);
- EPA (2011) “NSW Road Noise Policy” (RNP);
- EPA (2006) “Environmental Noise Management – Assessing Vibration: A Technical Guideline; and
- ANZECC (1990) “Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration”.

As detailed in Section 10.6.7 of the EIS, modelling of the Project components shows that:

- noise from construction of Newnes State Forest surface infrastructure will be within the Project specific noise criteria;
- noise from the operation of Newnes State forest infrastructure will meet Project specific noise criteria apart from a small area of Sunnyside Ridge Road to the east of the APC-VS2; and
- noise from operation of the pit top will be within the Project specific noise criteria.

There is no evidence to suggest that noise from the mine ventilation fan has resulted in a decline in animal activity in the area.

The evidence shows that the protection of the Burralow Formation aquitard AQ6 is critical to swamp protection but that AQ6 will drop well below root depth and by up to 10m, if mining is permitted. (AP0393)

Peizometric traces have been impossible to interpret. The multiple traces on Fig 2.14 and 2.15 make them unreadable. Colour differentiation is indistinct, the traces overlap and the data is unclear. The depths of sediment are not given, nor are the times when the swamps were undermined or the longwalls involved. (AP0393)

The Report notes (p 82 and Fig 2.27), Kangaroo Creek1 hydrograph dropped after mining nearby at Angus Place in 2008 and has not recovered. As it is a small swamp, the impacts may not be dramatic, but it shows clearly that undermining does lead to long-term loss of water from the swamp sediments. (AP0393)

Reduced groundwater availability as a result of subsidence from the longwall mining will result in long-term degradation and contraction of the NPSS, compounding predicted effects of climate change. This will result in reduced spatio-temporal distribution of suitable breeding habitat for Petalura gigantea (Pg), and will threaten the persistence of other groundwater dependent species, including Boronia deanei, Eulamprus leuraensis (El), Euastacus australasiensis, and other organisms such as stygofauna. (AP0209)

Monitoring data in the EIS indicate that there will be drawdown in all the swamps with a maximum drop of 36 cm in Gang Gang Southeast Swamp, though the EIS does not think this will cause any impact, though if the ecological dynamics in the swamp are considered t is evident that a permanent water level drop will cause major drying out of surface substrate and dislocation of swamp species. It is likely that these water level changes will be permanent and result in reduction in size of the swamps over time as swamps gradually dry out and are invaded by woodland species. Certainly the East Wolgan drainage line has been completely dry for the last 5 years and is showing no sign of recovery. (AP0021)

The proposition on p. 86 of the EIS Main Document Vol. 2 Appendix H that a lowering of water tables in swamps as a result of any subsidence will not negatively affect groundwater dependent species is incorrect. Pg, for example, is reliant upon moist to waterlogged substrate for ovipositing and larval establishment. A drying of the surface peat is required to a shallow depth to reduce the spatial extent of potential breeding habitat in a particular swamp. The assumption assumes that no significant subsidence and lowering of water tables will occur, which is contrary to the recognition elsewhere in the EIS that there will be some lowering of water tables in swamps. (AP0209)

The Groundwater Impact Assessment prepared by RPS to support the Project and provided as Appendix E to the EIS determined that the most significant reductions to average standing groundwater levels are predicted in Twin Gully Swamp within the Angus Place mining area. This swamp has a projected drop in average standing water levels from 12.4 cm to 10.6 cm above the soil surface. The post mining values predicted at Twin Gully Swamp therefore suggest that soil saturation would persist, maintaining water availability for flora and fauna, as well as soil anoxia, allowing for continued peat formation. All other monitored swamps have smaller projected decreases in average standing water levels and monitored swamps are projected to maintain average standing water levels above the surface.

Detailed investigations of the relationship between the groundwater and surface water movements, the underlying geology and the proposed mining layout has concluded, through empirical modelling, that the proposed longwall mining would not create interconnected fracturing between the aquifer supporting swamps and the longwalls. This is primarily due to the large vertical distance between extracted coal seam and the swamps, resulting in these swamps being located significantly higher than the predicted fracturing zone. The predicted change to baseflow and average water level is within the expected capillary forces of peat swamps such that the magnitudes of water table decline predicted is unlikely to result in drying of the peat layer.

Assessments of impacts have been undertaken for those species that are dependent upon the swamp habitats. These species include *B. deanei*, Giant Dragonfly and Blue Mountains Water Skink. Assessment of impacts have concluded that the predicted changes in baseflow and average standing water levels are not of a magnitude that would cause the swamp habitats to become unsuitable for these species. Consequently, the Project is unlikely to significantly impact upon those threatened species that rely on the swamp habitats.

Hanging swamps are the forgotten swamps in the EIS. Section 2.8.3.5 deals with impacts of past undermining - all examples are of valley floor swamps, although Kangaroo Creek could perhaps be described as a hanging swamp. While recognising the importance of the hanging swamps, the Report does not address the impacts of mining on them. Yet they are clearly at least as vulnerable to diversion of water via bedrock cracking as valley floor swamps. (AP0393)

The potential impacts to hanging swamps as a result of the Project are considered throughout the EIS and supporting technical reports.

The hanging swamps develop on the sides of valleys where groundwater seepage occurs from perched aquifers, downslope of sandstone layers which overlie less permeable claystone or shale layers. Figure 10.1 of the EIS shows the locations of the hanging swamps relative to the proposed longwalls at Angus Place Colliery and handing swamps which are located outside the proposed longwalls but are within the Project Application Area.

Subsidence predictions for Hanging Swamps within the Project Application Area are contained in Table 5.5, Section 5.12.2 of the Subsidence Assessment prepared by MSEC and provided as Appendix D to the EIS. Give the locations of the hanging swamps on the sides of the valleys, are not expected to experience significant valley related upsidence movements or compressive strains due to closure movements, which occur near the bases of the valleys.

Section 7.3.5 of the Groundwater Impact Assessment prepared by RPS Australia and provided as Appendix E to the EIS identifies that the hanging swamps present within the Project Application Area are associated with the perched aquifer system and not the regional water table. As a result, these systems are heavily reliant on rainfall recharge to the perched aquifer system and are independent of changes to groundwater table levels and associated baseflow modifications.

The impact of selective logging across the project area is overstated in Section 2.8.1 of the EIS. (AP0209)

Section 2.5.1.2 and 2.8.1 of the EIS identifies the past land use history of the Project Application Area and acknowledges the importance of the area as habitat to a diverse range of faunal species.

The EIS states that any effects on potential populations of the endangered Adams Emerald Dragonfly will be insignificant. It is impossible to make this statement, considering that there have never been any ecological studies of this species and limited aquatic sampling was undertaken for this project. (AP0209)

An Aquatic Ecology Impact Assessment undertaken by Cardno Ecology Lab to support the Project and is provided as Appendix G to the EIS.

The life cycle of Adams Emerald Dragonfly would be adversely affected if the construction, operation, decommissioning and/or rehabilitation phases of the Project resulted in loss or modification of its habitat or reduced the quality of the water. If fracturing of the Wolgan River bed does occur during extraction of the longwalls it could lead to drainage of overlying pools and loss of aquatic habitat and changes in concentrations of iron, manganese, aluminium, zinc and nickel and levels of iron staining. These impacts are expected to be minor, localised and temporary in nature, persisting until the cracks are infilled and overtopping of flows is resumed. Mining is unlikely to have any adverse impacts on aquatic habitats in Carne Creek. Given the above, it is highly unlikely that the lifecycle of this dragonfly would be affected to such an extent that it would place a viable local population of this species, if one exists within the Project Application Area, at risk of extinction.

As the macroinvertebrate surveys undertaken in the Project Application Area are limited in frequency, spatial extent, duration and intensity but suitable habitats for this species are present, the possibility of Adams Emerald Dragonfly being present cannot be discounted. As such, an Assessment of Significance was prepared as a precautionary measure. The assessment of the significance of impacts on Adams Emerald Dragonfly was prepared in accordance with the Threatened Species Assessment Guideline – The Assessment of Significance (DPI 2008). These guidelines specify the important factors that must be taken into considered when assessing potential impacts on threatened species, populations or ecological communities listed under Schedules 4, 4A and 5 of the Fisheries Management Act.

The assessment of the significance of impacts indicated that if viable populations of Adams Emerald Dragonfly were present within the proposed workings area they could be subject to temporary, localised, minor impacts. It is consequently highly unlikely that the proposed mining would have a significant impact on this threatened species.

Section 2.8.2 of the EIS Pt 1 fails to identify likely presence of El and Pg in the project area. Pg has been recorded in Sunnyside Swamp. Trail 6 Swamp, Twin Gully Swamp and Tri Star Swamp contain some suitable habitat for Pg and El. Both species have been recorded in most NPSS in the Carne Creek catchment. (AP0209)

Assessment for Boronia deanei ssp. deanei is flawed. Any NPSS population of this species, which is subjected to medium to long term lowering of the water table, will be at risk of a reduction and potentially loss of that population in the long term. (AP0209)

Fauna surveying was inadequate for the EIS, if they did not at least find swamp rats Rattus lutreolus (evidence observed by I.R.C. Baird in most NPSS) and Antechinus spp. And Eulamprus leuraensis in NPSS. The lack of observation of small terrestrial mammals in these swamps is also a serious deficiency. (AP0209)

Assessment for P. gigantea is flawed. The requirement for moist to saturated substrate for successful oviposition and larval burrow establishment is the critical factor in the persistence of this species in swamps. Because of the long larval stage, some late stage larvae in established burrows may be able to persist until emergence, even after some lowering of water tables; however, successful reproduction, and thus persistence of populations, will be limited by the availability of suitable wet substrate for ovipositing and larval establishment. (AP0209)

Assessment of Eulamprus leuraensis is flawed. The report states that El occurs in non-swamp habitat, however, any records for this species in non-swamp habitats are likely to be of wandering or foraging individuals temporarily outside their core swamp habitat. The assessment of no significant impact upon this species is based on the flawed presumption that there will be no significant lowering of the water table in a particular swamp. A relatively minor loss of groundwater could have a deleterious effect on a local swamp population of this species. (AP0209)

Flora and fauna surveys were undertaken as part of the Flora and Fauna Impact Assessment prepared by RPS to support the Project and provided as Appendix H to the EIS. In addition to the flora and fauna surveys undertaken by RPS and as detailed in Section 2.6 of the Flora and Fauna Impact Assessment, annual fauna monitoring has been occurring at Angus Place Colliery since 2004. Fauna monitoring has been undertaken by MKES (2004 - 2009) and BMS (2010 -2012).

Monitoring has occurred at four locations, with three additional monitoring sites being included in 2011. All sites are located within wetland habitat (shrub swamps), but the surrounding woodland habitat is also surveyed. Seven fauna monitoring sites occur within the Study Area. One additional site that is monitored as part of the Springvale Mine lease area also falls within the Study Area.

Seasonal monitoring of swamp vegetation has been undertaken since 2003 by the University of Queensland.

The high level of effort of targeted surveys over the proposed surface infrastructure has enabled those easily detectable threatened species to be assessed for their likelihood of occurrence and subsequent potential impact. For those species that are less easily detected, the combined results from surveys and desktop analysis, including nine years of fauna monitoring have been used to assess the likelihood of a certain species occurring. Where any uncertainty has arisen due to any of the limitations identified in the flora and Fauna Impact Assessment, the precautionary principle has been adopted, thus assuming it has potential for presence where potentially suitable habitat exists.

For all known and potential species identified within the Project Application Area, an assessment of potential impact has been undertaken as part of the Flora and Fauna Impact Assessment.

A comprehensive, systematic pre-mining stygofauna survey must be implemented across the project area, with finer resolution taxonomic identification of stygofauna, to ensure that the diversity of stygofauna is properly assessed and potential risks of the project determined. (AP0209)

The recommendation to undertake more comprehensive, and better designed pre-mining surveying, and finer resolution taxonomic identification of stygofauna, must be implemented if

this project proceeds to ensure that the diversity of stygofauna is properly assessed and potential risks of the project determined. (AP0209)

No significant impacts are predicted on aquatic habitats, aquatic flora or aquatic fauna and or stygofauna. As is included in the Statement of Commitment contained in Section 11 of the EIS, because the aquifer systems across the Newnes Plateau are consistent, stygofauna will be monitored using standing water levels within one borehole in each aquifer where stygofauna are known to occur (AQ4 to AQ6). Where available, monitoring of the deep aquifer system, AQ1 to AQ3 will be undertaken to establish presence of stygofauna.

Additionally, Centennial Coal will commit to undertaking a regional stygofauna assessment which will:

- Collate existing available information on groundwater bores, water quality and characteristics in Centennial Coal's area of operations throughout the Western Coalfield.
- Use this information to form a prioritisation list of likely areas for GDE to occur.
- Use the prioritisation protocol to identify bores that can be sampled to provide data on the presence and significance of fauna both within and outside mine areas.
- Identify any stygofauna found to a minimum of Family level.
- Advise on the significance of the findings.
- Examine relationship between bore characteristics and presence of stygofauna.

The Statement of Commitments contained in **Section 5.0** of this RTS has been updated to include this commitment.

The Newnes Plateau Swamps proposed to be undermined support a population stronghold of the Blue Mountains Water Skink in this region, and a significant alteration in hydrology of the swamps, such as a loss of groundwater through subsidence, would negatively affect the suitability of the habitat. This in turn may cause a substantial reduction in abundances within swamps, and an overall reduction in populations of skinks throughout that region. The ability of individuals and populations of the Blue Mountains Water Skink to recover from such an event is unknown. (S Gorissen, R Shine, Shine Laboratory, The University of Sydney)

A review of the potential impacts to the Shrub Swamp EEC discussed in the Subsidence Impact Assessment (Appendix D to the EIS), Groundwater Impact Assessment (Appendix E to the EIS) and Surface Water Impact Assessment (Appendix F to the EIS) was undertaken within the Flora and Fauna Impact Assessment (Appendix H to the EIS) to assess the impact of the Project on the biodiversity of the Project Application Area. Given that:

- there is unlikely to be significant reductions or reversals of grade that could otherwise cause ponding or scouring
- the limited depth of fracturing above the Mount York Claystone aquitard and lack of dilation of bedrock of shrub swamp or upstream drainage lines would not result in losses of infiltrated water and minimal divergence of surface water would occur

The Flora and Fauna Impact Assessment (Appendix H to the EIS) concluded it is unlikely that the effects of subsidence would have an adverse effect on shrub swamps or hanging swamps such that the ecological functioning of these swamps would be impaired.

RPS completed a study in November 2012 (RPS, 2012) to assess whether any impacts attributable to the undermining of the swamps could be ascertained based on swamps hydrographs and groundwater level trends. All of the swamps which were included in this study have a significant history of water level monitoring, are located away from licensed discharge points (to minimise potential for conflicting information), and have all been either undermined by longwall extraction or were in very close proximity to extracted longwall panels.

The results of (RPS, 2012) showed that no water level impacts that could be attributed to past or present mining operations (subsidence-related impact or depressurisation) were observed. Rather, the water levels in the swamps showed a strong correlation to cumulative rainfall trends, and this was found to be the driving factor.

As no mining influenced water level fluctuations can be identified in any of the monitored swamps (both undermined and baseline) it is accurate to say that mining at Angus Place Colliery and the adjoining Springvale Mine has not led to any identifiable water level impacts on the monitored swamps, and that all undermined swamps continue to display baseline water levels.

As part of the Flora and Fauna Impact Assessment (Appendix H to the EIS), 7 part test of significance under the TSC Act was conducted for Blue Mountains Water Skink. The results of the assessment is provided in full in Appendices 1 of the Flora and Fauna Assessment (Appendix H to the EIS) and summarised in Table 10.14 in the EIS. The conclusion drawn from the 7-part test is that the Project will not or unlikely to have an adverse effect on the population of Blue Mountains Water Skink to such an extent that its local occurrences are likely to be placed at risk of extinction (TSC Act).

Given the outcome of the 7 part test of significance assessment and the fact that the Project is not expected to have a significant impact upon any shrub swamps, such that their ecosystem functioning may be compromised, any alterations to potentially important habitats from subsidence, will not affect the long-term survival of the Blue Mountains Water Skink in the locality.

3.3.5 General

The scenic western edge of the Newnes Plateau must be protected from further scarring by new roads, pipeline and electricity easements. (AP0058, AP0405)

Centennial Coal has already extensively and severely damaged parts of the Newnes Plateau by blighting the landscape with a network of roads, pipes, survey lines and power lines. (AP0152, AP0210)

The amenity of the Newnes Plateau will be spoilt by the great amount of mining surface infrastructure by the three mines operating there side by side. (AP0199, AP0203, AP0204, AP0407)

Centennial has a bad track record with polluting creeks and streams, plus the ugly scars on the Newnes Plateau area which are made to provide infrastructure to support the mine operation. (AP0076, AP0122, AP0142, AP0182, AP0225, AP0244, AP0251)

As detailed in Section 4.10.3 of the EIS, mine planning has identified that additional ventilation capacity is required to ensure compliance with Clause 13(h) of the NSW Coal Mine Health and Safety Regulation 2006. To optimise the existing ventilation system, an air intake ventilation facility (downcast) will be required to deliver fresh air to the underground mine. This is identified as Angus Place Ventilation Site 3 (APC-VS3. In addition, the Project will require control of the increased volume of mine water make to meet underground safety and operational requirements. As such, new dewatering bore facilities will be required to continue to deliver water into the SDWTS (which will continue to be utilised as part of the Project).

The ventilation facility has been located to fit with the layout of the proposed underground roadways and the existing surface infrastructure within Newnes State Forest (i.e. forest roads and tracks). APC-VS3 will have a surface footprint of approximately 14 ha and will have a suitable asset protection zone.

The location of the ventilation facility is constrained by the mine design and layout and has been located to minimise impacts to the environment and sensitive receptors as far as reasonably practical and avoid removal of any threatened flora.

Dewatering bore facility sites have been identified based upon mine design requirements, and environmental constraints from a desktop analysis. The preferred options for the final placement of the dewatering boreholes will balance dewatering needs with potential environmental impacts. It is identified in Section 4.3 of the Social Impact Assessment that the mine design and other mitigating factors have minimised the extent of change to the physical environment to an extent that the Project will not adversely impact on the existing land use, its physical characteristics including surface features and the manner in which the public utilise / access the area.

A Visual Impact Assessment for the Project was prepared and, as identified in Section 10.12.6 of the EIS, concluded that the visual character and amenity of the regional and local area of the Project Application Area will not be significantly altered by the Project. Newnes Plateau has existing surface mining infrastructure, with the Project requiring additional infrastructure. However, the significance of the visual effects of the Project upon Newnes Plateau are predominately none to minor with potential visual impacts on Newnes Plateau being transient and not impacting upon any residential locations. Revegetation will be undertaken appropriately to ensure a suitable end land use that is consistent with the surrounding visual character and zoning of Newnes Plateau.

While no change in the land use is predicted Centennial Angus Place will:

- undertake rehabilitation of cleared areas promptly to minimise visual impacts; and
- locate surface infrastructure away from walking / access tracks and areas where visual intrusion is likely (ie from lookouts etc).

Angus Place Colliery has adopted a progressive approach to rehabilitation to reduce and mitigate potential environmental impacts. Exploration sites, ventilation and dewatering facilities and access tracks are rehabilitated promptly with periodic inspections and maintenance as necessary based upon evidence of endemic regrowth, weeds and soil disturbance. Rehabilitation acceleration techniques are undertaken, if required following approval from the Forestry Corporation of NSW.

The success of progressive rehabilitation activities is monitored against appropriate performance indicators identified within the Angus Place EMS framework and relevant legislative requirements.

The new infrastructure components of the Project will require rehabilitation as a result of surface disturbance during construction. The progressive approach to rehabilitation will continue to be applied. The success of existing and future rehabilitation will be monitored against appropriate performance indicators identified within the rehabilitation strategy and MOP.

Centennial must revise the proposal to improve environmental outcomes. (AP0092, AP0163, AP0202, AP0220, AP0253, AP0263, AP0280, AP0307, AP0311, AP0334, AP0335, AP0396, AP0405, AP0407)

The environment can not thrive let alone coexist with mining operations as it leads to ill health for the earth and the population. (AP0076, AP0150)

The Angus Place mine has already caused subsidence and pollution and the extension will markedly increase the damage and pollution. (AP0157)

Any future mine expansions in the Newnes Plateau region of the Blue Mountains should not be allowed as they will irreversibly damage the unique and fragile environments through cumulative impacts from subsidence, pollution, and water quality threats to ecology, water, air, noise, cultural heritage and local residents. (AP0007, AP0062, AP0083, AP0106, AP0132, AP0142, AP0158, AP0160, AP0182, AP0191, AP0202, AP0213, AP0220, AP0223, AP0225, AP0244, AP0278, AP0281, AP0308, AP0310, AP0311, AP0312, AP0313, AP0315, AP0321, AP0324, AP0326, AP0337, AP0345, AP0364, AP0396, AP0405)

Centennial must be made to fix previous serious environmental damage done by the pre-existing coal mine and provide evidence that they are capable of working in an environment without damaging it before any further extensions can be considered. (AP0230, AP0329, AP0338)

Centennial Angus Place acknowledges that previous mining has resulted in some localised impacts to the environment as a result of its operations. The impacts at Angus Place Colliery are largely a result of subsidence and water discharges.

In 2002, Angus Place Colliery commenced intensive monitoring, investigations and research to better understand the surface environment. These investigations have included groundwater, surface water, ecological aspects and the interplay of these aspects on swamps. The data collected and analysed over the past 11 years has been critical to proving that the technologies and engineering methodologies for longwall mining will minimise impacts to sensitive surface features

At Angus Place Colliery, the application of risk based planning, has driven mine planning, mine design and subsidence management, based on the geological and geotechnical constraints, and the overlying sensitive features.

Chapter 8 of the EIS details the evolution of the mine design at Angus Place Colliery and how the mine design proposed for the Project has been developed taking into consideration safety, geological and environmental features.

Angus Place Colliery has applied a risk based approach to the Project to identify, quantify and reduce risks of environmental consequences wherever feasible. Previous subsidence monitoring has been used to develop and validate a predictive model of subsidence for the proposed mining area. This model has a high level of confidence in its predictions and is built upon a significant dataset comprising geological and geotechnical data. The mine has been designed to avoid, to the largest extent possible, sensitive surface features. Where a sensitive surface feature has not been avoided, a sub-critical void width has been applied in the mine design (for example LW1004 to 1006).

The geological and geotechnical constraints to mining, combined with the extensive knowledge of the hydrogeological environment has resulted in a mine design that is reflective of decades of mining experience at the Angus Place Colliery and Springvale Mine.

The approach of Angus Place Colliery to the MEP has been to apply a best practice system of environmental management: that is a hierarchy of avoiding, minimising, mitigating and finally, offsetting residual impacts.

As mining has progressed at Angus Place Colliery, the alignment and dimensions of longwall panels have been developed and refined over a long period of time for a range of mine designs. There has been significant effort to prioritise avoidance and reduction of potential impacts and constraints of surface features and geological and geotechnical issues, while considering mine safety, feasibility and optimisation.

Significant effort has been invested to evaluate the available coal resource and to avoid or minimise potential impacts that could be associated with the Project.

Potential environmental constraints have already been taken into account during the mine design process to ensure the Project is undertaken safely and in the most environmentally sensitive manner feasible.

Centennial Coal has shown disregard for the environment in which it works, having been fined $1.5 million in reparations for damage to upland swamps on the Newnes Plateau. (AP0091)

Centennial acknowledges in Section 2.6.2.7 of the EIS the historical impacts to Swamps as a result of previous mining and mining related activities. Longwalls have been extracted directly or partially beneath 13 shrub swamps and 26 hanging swamps. Surface impacts have been observed at five swamps including Kangaroo Creek Swamp, Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp. These have been investigated and where impacts have been observed, these have been identified as largely the result of mine water discharge.

Investigations have identified that erosional and flora dieback impacts at Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp were caused by changes to swamp hydrology related to mine water discharge. Impacts related to subsidence, however were observed at East Wolgan Swamp and Kangaroo Creek Swamp. As a result of this finding, future mine dewatering systems have been designed to ensure that discharge of mine water to Newnes Plateau Shrub Swamps is avoided and the longwalls under shrub swamps are sub-critical panels.

Subsidence effects to aspects of swamp hydrology have been noted at two swamps (Kangaroo Creek Swamp and East Wolgan Swamp). In both of these cases investigations have revealed that mine design was a primary causative factor. The ratio of longwall mining void width to depth of cover over mine workings was identified to be in the critical subsidence behaviour range. Following this investigation, the mine design was modified for all future proposed mining areas in the vicinity of Newnes Plateau Shrub Swamps to ensure that the ratio of longwall mining void width to depth of cover over mine workings was in the sub-critical subsidence behaviour range. No subsidence effects to swamp hydrology or flora communities have been identified in areas where sub-critical mine design have been used in the past.

Section 2.8.4 of the EIS details the cause and outcomes of an Enforceable Undertaking under section 486DA of the EPBC Act. Centennial acknowledged that its operations had a significant impact on THPSS, a federally listed endangered ecological community and as such Springvale Coal and Angus Place Pty Limited undertook to pay $1,450,000 for a four year research program.

The objectives of this research program are to:

- Provide the necessary knowledge to conserve, manage and restore THPSS;
- Use that knowledge to promote best management practices for these areas;
- Transfer knowledge gained in the program to agencies, land managers and relevant stakeholders; and
- Maximise the educational and training opportunities of the Program.
- The research themes under the program are:
- Understanding the THPSS which includes detailed mapping, location, distribution and extent of the swamps, including those under threat.

- Understanding swamp systems, including water balance and dynamics, the functionality of peatland swamps, environmental history and origins, ecology/biodiversity of major structural species and contribution of THPSS to the landscape.

- Understanding land management and impacts, including condition status mapping and trends.

- Application of understanding, including monitoring of reference sites and thresholds for recovery and resilience.

In 2012, approximately $900,000 of the research fund had been allocated to five projects, with additional funding set aside to support swamp hydrology research when a suitable project was identified by the Steering Committee. The Committee meets twice annually and holds an annual workshop to review the status of the research findings and outcomes.

The price of coal is dropping globally. Once the global coal price drops below $60 per tonne, which will happen by the end of the decade on current trends, the industry is over in Australia. (AP0113, AP0251)

Coal is an outdated fuel so any jobs created are short term. (AP0157)

In this era when we need to focus on renewable sources of energy, there are no viable reasons for extending this mine. (AP0062, AP0076, AP0113, AP0148, AP0152, AP0168, AP0182, AP0205, AP0216, AP0222, AP0278, AP0299, AP0345, AP0364, AP0372, AP0381)

Coal is currently over supplied and thus Centennial should not damage the region for minimal profit. (AP0279)

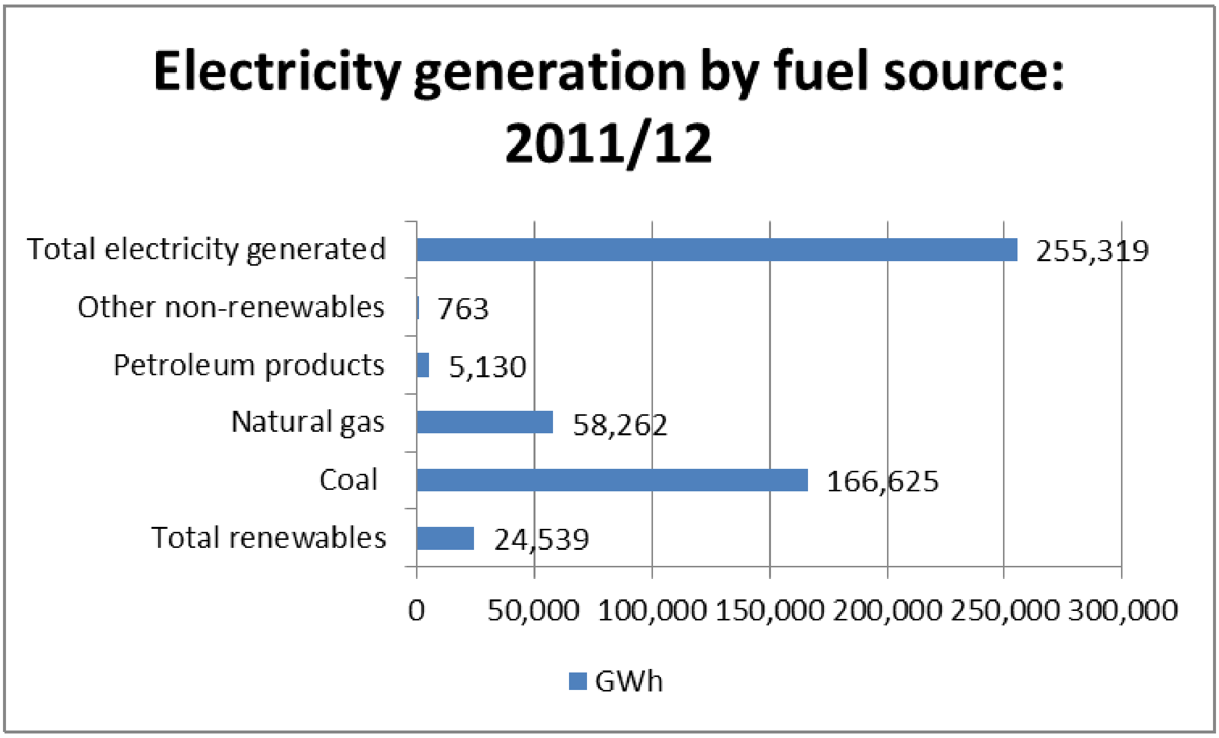
Coal mining in Australia is still warranted as the electricity generation industry remains heavily reliant on coal-fuelled generation. Recent research by Pitt & Sherry (2014) demonstrate that black coal demand for electricity generation has been declining in recent years while alternative fuel sources such as gas, wind and other renewable have been on the rise. However, their research shows that to date black coal is still the highest fuel source used for electricity generation, and they provide the following statistics:

‘Shares of total generation in the year ended June 2014 were black coal 50.7%, brown coal 22.3%, gas 12.7%, hydro 9.6% and wind 4.7%. These are the lowest shares of both black and brown coal, and the highest shares of wind, since Cedex® data starts in 2006, and in fact, almost certainly ever’.

The observations of Pitt and Sherry (2014) are supported by data from the Australian Bureau of Statistics (ABS). **Figure 43** provides data on electricity generation by fuel type for the period 2011/2012, and shows that coal represents the highest fuel source for electricity generation in the period 2011/2012. Approximately 65% of the total electricity generated in Australia was from coal while natural gas provided approximately 23% of the total demand. In comparison the combined renewable fuel sources met less than 10% of Australia’s fuel source demand for electricity generation.

While it can be anticipated, based on research by Pitt and Sherry (2014), that use of alternative and renewable sources will continue to increase, the transition to a point where these sources supplant coal as the predominant fuel source in the future will clearly take a significant period of time. This is especially the case given the availability of coal resources, the simplistic methods of mining of coal and conversion to electricity compared to renewables, and the extensive investment already sunk into coal-fired generation capacity in Australia.

Figure 43 – Electricity Generation by Fuel Source 2011/2012



The Development Consent must be subject to periodic third party reviews to ensure that adjoining conservation areas are not adversely affected. (AP0331)

The proposed Angus Place mine extension should not be granted development consent unless Development consent is staged, with a review every five years and is subject to performance standards triggers that ensure the health and integrity of receiving waters and heritage values. (AP0209)

This project must not be allowed to go ahead without sufficient environmental protections to the fragile ecosystems. (AP033)

As is detailed in Section 3.12.4 of the EIS, the various Angus Place management plans are supported by an environmental monitoring network, monitoring noise, dust, groundwater, surface water and subsidence The results of the monitoring programmes are reported in:

- Annual Reviews (formerly Annual Environmental Management Reports);
- Annual Returns for EPL 467;
- Subsidence Management Status Reports;
- Longwall End of Panel Reports;
- National Pollutant Inventory reports; and
- National Greenhouse Gas Emissions Report.

These reports are provided to various government agencies and are made publicly available.

In addition, Internal and independent external audits are completed periodically with a focus on ensuring compliance with approval conditions. The outcomes of these audits are provided to the relevant government agencies and identify continuous improvement strategies to be implemented where feasible.

The consent period of 25 years is required to ensure the sustainable operations at Angus Place Colliery and provide a level of certainty to the company to ensure the continued ongoing employment the Angus Place Colliery provides.

The EIS tends to only be a theoretical document and have little credence in terms of impacts and mitigation actions. (AP0338)

The EIS mentions everything that supports the application but leaves out aspects which might speak against it. (AP0407)

The EIS has been prepared by various independent technical consultants who are experts in their field. The impacts predicted in the Environmental Impact Statement are based on extensive monitoring data, robust modelling and a comprehensive understanding of the environment in which the Project operates. Centennial acknowledge throughout the EIS the impacts experienced as a result of previous mining and mining related activities and have adopted an adaptive management approach to minimise the potential risk of these impacts occurring in the future through a detailed mine design process. It has been determined that the impacts experienced in the past are unlikely to occur as a result of the Project and any impacts would not be significant. Should impacts be identified, an adaptive management approach will be developed to manage impacts into the future.

3.3.6 Groundwater

Approximately 1.5 m subsidence and cracking caused by the project will destroy the water table. (AP0106)

Longwall mining affects groundwater as groundwater will find its way through cliff cracks into the mine affecting the aquifers. (AP0203, AP0407)

A subsidence impact assessment was undertaken for the Angus Place MEP by MSEC and provided as Appendix D to the EIS. Mining is predicted to cause maximum of 1.7 m of conventional subsidence above longwall extraction areas. Based on the predicted maximum strains calculated by the subsidence study it is likely that some fracturing will occur in the uppermost bedrock, beneath the surface soils/regolith. It has been observed in previous studies, that the depth of fracturing and dilation of the surficial lithologies, resulting from longwall mining, is generally less than 10 to 15 m.

This shallow fracturing will, in general terms, enhance shallow permeability, favouring infiltration of rainfall and surface water to the ground, and recharging the shallow aquifers hence reducing available runoff during rain events. In no case, is it expected that the infiltrated water will be lost to deeper aquifers since the fracturing will be only superficial (upper most 10 to 15 m) and is isolated from the deeper zones of connective vertical fracturing. It is likely that any infiltrated flow will re-emerge to the surface further downstream and with some degree of delay, contributing to prolong the base flow contribution to the watercourses

The groundwater impact model predicts that some minor impacts to the shallow groundwater and baseflow will occur. However, it is considered that the groundwater modelling results are conservative, particularly in respect to the predicted impacts to baseflows. The model assumes dilation of horizontal 'plies' will occur through to ground surface, however, this has not been observed in the field. In any regard, the model is not able to replicate the self-healing nature of the creeks and swamps and as such, it is conservative, over-predicting the magnitude of potential impacts.

It is misleading and inaccurate to argue that mining has not caused a drop in the water tables of the undermined swamps above the Springvale and Angus Place mines. (AP0393)

Numerous specialist hydrogeological studies have been undertaken at Angus Place with the aim of quantifying mine water inflow and subsidence impacts, groundwater drawdown and depressurisation, and addressing other geotechnical and hydrogeological issues over the past number of years.

RPS completed a study in November 2012 (RPS, 2012) to assess whether any impacts attributable to the undermining of the swamps could be ascertained based on swamps hydrographs and groundwater level trends

All of the swamps which were included in this study have a significant history of water level monitoring, are located away from licensed discharge points (to minimise potential for conflicting information), and have all been either undermined by longwall extraction or were in very close proximity to extracted longwall panels.

The results of the 2012 study showed that no water level impacts that could be attributed to past or present mining operations (subsidence-related impact or depressurisation) were observed. Rather, the water levels in the swamps showed a strong correlation to cumulative rainfall trends, and this was found to be the driving factor.

As no mining influenced water level fluctuations can be identified in any of the monitored swamps (both undermined and baseline) it is accurate to say that mining at Angus Place has not led to any identifiable water level impacts on the monitored swamps, and that all undermined swamps continue to display baseline water levels.

3.3.7 Mine Design

Mining intensity should be reduced. (AP0209, AP0210, AP0407)

Narrowing and/or splitting the longwall panels 1007, 1008, 1009 and 1010 must occur to prevent damage from fracturing in the Birds Rock Flora Reserve. Splitting longwalls 1013 and 1014 must occur to prevent damage to pagodas and cliffs, as proposed. (AP0209)

The NPSS swamps particularly those in Carne Creek catchment must not be impacted by the proposed mining. This can be achieved by not mining under individual swamps, or by using bord and pillar operations or by substantially reducing the long wall dimensions. (AP0021)

LW1015 to LW1017 should be shortened in length to avoid Trail 6 Swamp completely as a precautionary measure, or further reduced in panel width, with increased pillar widths, to further minimise risk of subsidence. (AP0209)

The longwall panels were shortened to not go under Twin Gully Swamp and such shortening should also be applied to LW1004 to LW1006 in the case of Tri Star Swamp. If shortening is not feasible, then LW1004 to LW1006 should be further reduced in width, with increased pillar widths, to further minimise risk of subsidence. (AP0209)

The proponent's justification for the currently proposed panel widths under the swamps is not substantiated. (AP0209)

There should be no mining under the swamps as has protected Sunnyside Swamp, or if not possible to reduce the width of the long walls which are proposed to be up to 261 m to between 115-160m as used elsewhere to reduce subsidence. (AP0021)

Centennial says that due to a weak roof and a high stress environment longwall mining is the only option, however Clarence Colliery successfully uses bord & pillar mining methods and the Airly mine in the Capertee Valley operates to depth of 405 metres underground in the same geology, with bad mine roof conditions, including many structural defects. (AP0209, AP0225, AP0244, AP0407)

As is detailed in Section 8.2.2 of the EIS, the combination of a weak roof and a high stress environment means that longwall mining in the Lithgow seam at Angus Place Colliery is the only viable and safe mining method. Strata Engineering Pty. Ltd (Australia) in Report No. 03-123-AGP-33 identify that in Australia there is no known precedent for safe and viable partial extraction (i.e. bord and pillar) operation in the geotechnical environment under consideration within the Project Application Area.

The geological and geotechnical constraints to mining, combined with the extensive knowledge of the hydrogeological environment has resulted in a mine design that is reflective of decades of mining experience at the Angus Place Colliery and Springvale Mine and there has been significant effort to prioritise avoidance and reduction of potential impacts and constraints of surface features and geological and geotechnical issues, while considering mine safety, feasibility and optimisation. The mine has been designed to avoid, to the largest extent possible, sensitive surface features. Where a sensitive surface feature has not been avoided, a sub-critical void width has been applied in the mine design (for example LW004 to 006).

Chapter 8 of the EIS details the evolution of the mine design at Angus Place Colliery and how the mine design proposed for the Project has been developed taking into consideration safety, geological and environmental features.

Angus Place Colliery has applied a risk based approach to the Project to identify, quantify and reduce risks of environmental consequences wherever feasible. Previous subsidence monitoring has been used to develop and validate a predictive model of subsidence for the proposed mining area. This model has a high level of confidence in its predictions and is built upon a significant dataset comprising geological and geotechnical data. The mine has been designed to avoid, to the largest extent possible, sensitive surface features. Where a sensitive surface feature has not been avoided, a sub-critical void width has been applied in the mine design (for example LW004 to 006).

The geological and geotechnical constraints to mining, combined with the extensive knowledge of the hydrogeological environment has resulted in a mine design that is reflective of decades of mining experience at the Angus Place Colliery and Springvale Mine.

The approach of Angus Place Colliery to the MEP has been to apply a best practice system of environmental management: that is a hierarchy of avoiding, minimising, mitigating and finally, offsetting residual impacts.

As mining has progressed at Angus Place Colliery, the alignment and dimensions of longwall panels have been developed and refined over a long period of time for a range of mine designs. There has been significant effort to prioritise avoidance and reduction of potential impacts and constraints of surface features and geological and geotechnical issues, while considering mine safety, feasibility and optimisation.

Significant effort has been invested to evaluate the available coal resource and to avoid or minimise potential impacts that could be associated with the Project.

Potential environmental constraints have already been taken into account during the mine design process to ensure the Project is undertaken safely and in the most environmentally sensitive manner feasible.

3.3.8 Monitoring

Monitoring of surface flow and near-surface groundwater monitoring must create a comprehensive picture of the sub-catchments affected by mining. (AP0209)

Monitoring guidelines must clearly specify how the condition of groundwater dependent indicator plant species and the general condition of groundwater dependent ecosystems will be performed. (AP0209)

Conditions of approval are in no way sufficient to prevent damage in a fragile environment without extensive independent monitoring. (AP0396)

As is detailed in Section 3.12.4 of the EIS, the various Angus Place management plans are supported by an environmental monitoring network, monitoring noise, dust, groundwater, surface water and subsidence. Centennial Angus Place has undertaken extensive monitoring of its operations for a number of years now and has collected a large amount of information. The results of the monitoring programmes are reported in:

- Annual Reviews (formerly Annual Environmental Management Reports);
- Annual Returns for EPL 467;
- Subsidence Management Status Reports;
- Longwall End of Panel Reports;
- National Pollutant Inventory reports; and
- National Greenhouse Gas Emissions Report.

These reports are provided to various government agencies and are made publicly available.

Monitoring is carried out by various independent experts in accordance with any relevant guidelines.

The Project proses to update various management plans as part of the Project. These management plans will detail the monitoring proposed to be undertaken and the methodologies to be used. The management plans to be prepared and updated will be developed in consultation with various government agencies and submitted to the Secretary of the Department of Planning and Environment for approval.

3.3.9 Noise

Centennial states the noise of the dewatering pumps can only be heard up to 100m away, however the noise can travel much further across valleys, up to 1km, and the pumps run non-stop most of the time. (AP0225, AP0244)

Centennial acknowledge that during certain periods and meteorological conditions, noise from the Angus Place Colliery operations may be heard at nearby sensitive receivers however, as detailed in Section 10.6.7 of the EIS, modelling of the Project components shows that:

- noise from construction of Newnes State Forest surface infrastructure will be within the Project specific noise criteria;
- noise from the operation of Newnes State forest infrastructure will meet Project specific noise criteria apart from a small area of Sunnyside Ridge Road to the east of the APC-VS2; and
- noise from operation of the pit top will be within the Project specific noise criteria.

While noise modelling has indicated that there will be negligible noise impacts, the following noise mitigation and management measures will be implemented:

- workers will be regularly trained (i.e. toolbox talks) to use the equipment in ways that minimise noise.
- mobile plant will be operated in a quiet, efficient manner.
- plant and equipment will be well maintained including regular inspection and maintenance.
- for equipment with enclosures (i.e. compressor rooms) it will be ensured that doors and seals are well maintained and kept closed when in use;
- noise monitoring on site and within the community will be continued in accordance with the Angus Place Noise Monitoring Programme (refer Heggies Report 30-1942-R2 Angus Place Colliery Noise Monitoring Program dated 15 December 2008);
- onsite noise mitigation measures and plant operating procedures will be refined where practical;
- clear signage will be provided including relevant contact numbers for community enquiries; and
- community issues of concern will be addressed promptly.

Mine ventilation is capable of producing sound energy at frequencies able to cause the population to feel effects from low frequency sound or infrasound. These effects are already being seen in the population. (AP0282)

A Noise Impact Assessment was prepared by SLR Consulting and provided as Appendix L to the EIS. The Noise Impact Assessment identifies and assesses the potential noise impacts of the Project (including construction, operational, cumulative and off-site transport noise impacts). The Noise Impact Assessment has referenced and addressed relevant guidelines and assessment criteria as noted within the DGRs. The NIA has been prepared with reference to Australian Standard AS1055:1997 “Description and Measurement of Environmental Noise” (Parts 1, 2 and 3) and in accordance with:

- EPA (1999) “NSW Industrial Noise Policy” (INP);

- EPA (2009) “Interim Construction Noise Guideline” (ICNG);
- EPA (2011) “NSW Road Noise Policy” (RNP);
- EPA (2006) “Environmental Noise Management – Assessing Vibration: A Technical Guideline; and
- ANZECC (1990) “Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration”.

As detailed in Section 10.6.7 of the EIS, modelling of the Project components shows that:

- noise from construction of Newnes State Forest surface infrastructure will be within the Project specific noise criteria;
- noise from the operation of Newnes State forest infrastructure will meet Project specific noise criteria apart from a small area of Sunnyside Ridge Road to the east of the APC-VS2; and
- noise from operation of the pit top will be within the Project specific noise criteria.

3.3.10 Rehabilitation

All past tracks and trails created by Centennial Coal and its consultants, including those established by trail bikes, need to be recorded and plans set in place to rehabilitate these trails on an on-going basis and as soon as practicable as part of the on-going rehabilitation program for this mine. (AP0209)

As detailed in Section 3.13 of the EIS, the current approved MOP for Angus Place Colliery details the proposed rehabilitation objectives to ensure the final landform is commensurate with the surrounding topography and relevant zoning requirements of the time.

Angus Place Colliery has adopted a progressive approach to rehabilitation to reduce and mitigate potential environmental impacts. Exploration sites, ventilation and dewatering facilities and access tracks are rehabilitated promptly with periodic inspections and maintenance as necessary based upon evidence of endemic regrowth, weeds and soil disturbance. Rehabilitation acceleration techniques are undertaken, if required following approval from the Forestry Corporation of NSW.

The mining industries attempts at rejuvenating areas has shown minimal success, this shows these areas will not be returned to the natural pristine state they once were. (AP0076)

As detailed in Section 3.13 of the EIS, the current approved MOP for Angus Place Colliery details the proposed rehabilitation objectives to ensure the final landform is commensurate with the surrounding topography and relevant zoning requirements of the time. The MOP is developed in consultation with various government agencies prior to being submitted for approved to the Division of Resources and Energy.

Angus Place Colliery has adopted a progressive approach to rehabilitation to reduce and mitigate potential environmental impacts. Exploration sites, ventilation and dewatering facilities and access tracks are rehabilitated promptly with periodic inspections and maintenance as necessary based upon evidence of endemic regrowth, weeds and soil disturbance. Rehabilitation acceleration techniques are undertaken, if required following approval from the Forestry Corporation of NSW.

The success of progressive rehabilitation activities is monitored against appropriate performance indicators identified within the Angus Place EMS framework and relevant legislative requirements.

3.3.11 Socio-Economic

This area is a tourist attraction for national and international visitors. The project would destroy NSW's reputation to these tourists by destroying a prestige destination spot now and for future generations. (AP0004, AP0062, AP0225, AP0244, AP0251, AP0326, AP0292)

Centennial Angus Place acknowledge in Section 6.1 of the EIS that the Newnes Plateau is identified as being an important feature of the Lithgow LGA by the local, regional and State stakeholders who access the area for various activities. Consultation was undertaken as part of the development of the Social Impact Assessment prepared by James Marshall & Co and provided as Appendix N to the EIS, with users of the Plateau including adventure visitors (mountain bike riders, motor bikers and four wheel drivers) and passive visitors (include bushwalkers, families visiting a particular destination point). The consultation was undertaken at various times throughout 2013 and found that many visitors who live in the area are aware of mining under the Newnes Plateau. It was generally their opinion that mining has not changed their experience when visiting the area and will not change their experience as long as access to the area was permitted. Many of these visits were for adventure type tourism. Passive visitors, for example, families visiting the area to visit a particular destination point (for example the Glow Worm Tunnels) and bushwalkers generally stated that they did not want their experience changed. The amenity of the area was important to these types of visitors and key words used to describe the area are: quiet, nature, features (pagodas and cliffs) and views from lookouts.

It is identified in Section 4.3 of the Social Impact Assessment that the mine design and other mitigating factors have minimised the extent of change to the physical environment to an extent that the Project will not adversely impact on the existing land use, its physical characteristics including surface features and the manner in which the public utilise / access the area for recreation.

Stakeholders who access the area for passive recreation including bushwalking and bird watching who have a low impact on the environment may experience a minor amenity impact in a small area on Sunnyside Ridge Road to the east of the APC-VS2 area which is predicted to experience small exceedences of the project specific noise criteria for a passive recreational area. However this area is primarily used as a four wheel drive track so any amenity impact is unlikely.

There is an identified moderate visual impact arising from the location of surface infrastructure at Bird Rock Trig relating to clearing; however cleared areas will be progressively rehabilitated mitigating any potential long-term impact.

The Social Impact Assessment determined that the there will be no social change arising from the Project because there is no adverse impact on how people use the area.

While no change in the land use is predicted Centennial Angus Place will:

- undertake rehabilitation of cleared areas promptly to minimise visual impacts; and
- locate surface infrastructure away from walking / access tracks and areas where visual intrusion is likely (ie from lookouts etc).

Damage to Carne Creek will have serious consequences for the Emirates Wolgan Valley Resort and Spa. (AP0191)

Section 5.3 of the Subsidence Assessment prepared by MSEC and provided as Appendix D to the EIS as well as Section 5.3.2 of the Surface Water Impact Assessment prepared by RPS and provided as Appendix F to the EIS addresses predicted subsidence impacts to Carne Creek. Carne Creek is located to the east of the proposed longwalls, outside the proposed Extension Area. Although Carne Creek will not be directly undermined, it was included in the assessment as it could experience valley related movements and could be sensitive to these movements.

Carne Creek is located 400 metres south-east of LW1019, at its closest point to the proposed longwalls. The remaining proposed longwalls are located more than 600 metres from the creek. The total length of Carne Creek located within a distance of 600 metres from the extents of the proposed longwalls is approximately 0.9 kilometres.

The maximum predicted subsidence at Carne Creek, due to the extraction of the proposed longwalls, is less than 20 mm. Whilst the creek could experience some very low level vertical subsidence, it is not expected to experience any measurable conventional tilts or curvatures, even if the predictions were exceeded by a factor of 2 times.

The maximum predicted valley related movements at Carne Creek, due to the extraction of the proposed longwalls, are 25 mm upsidence and 50 mm closure. The compressive strains due to valley closure are expected to be less than 0.5 mm/m, which is in the order of survey tolerance.

The section of Carne Creek located within 600 metres of the proposed longwalls could also experience some low level movements resulting from the extraction of the future longwalls at Springvale Colliery. The predicted conventional and valley related strains along this section of creek, due to mining at Springvale Colliery, are also expected to be less than 0.5 mm/m, which is in the order of survey tolerance.

As the impacts to Carne Creek are negligible, there is not predicted to be any impacts to the operation of the Wolgan Valley Resort and Spa.

Any jobs created by the project are false economies based on short term gains, damaging future prospects for generations. (AP0345, AP0364)

The extension will only create 30 jobs. (AP0310)

The Project will secure employment for up to 300 direct employees and contractors. As detailed in Section 6.0 of the EIS, the continuation of employment of the workforce is a positive social impact of the Project. Employee surveys undertaken for the Project have found that mine related employment directly contributes to the local financial and social economy. Employment in the mining industry provides flow-on effects for local support services via direct and indirect employment opportunities across a range of sectors. The NSW Department of Trade, Investment, Regional Infrastructure and Services (Division of Resources and Energy) has previously identified output and employment multipliers for mining and related services. The relatively large gross value added multiplier value (4.099) demonstrates the importance of incomes generated by the Project. Benefits associated with the Project include the broad social benefit gained as a consequence of the continued operation of Angus Place Coal in terms of the royalties and taxes that are provided to the State. These are subsequently redistributed across Local Government Areas, including Lithgow LGA. Similarly, the existing workforce at Angus Place will be sustained by the Project with the incomes received by employees resulting in further direct and indirect benefits across the regional community. The continued operation of Angus Place Colliery has provided substantial socio-economic benefits throughout the region. Although there will be no increase in employment numbers as a result of the Project, it will enable continuation of the existing benefits during the period of active mining at Angus Place Colliery. This is key to the socio-economic wellbeing of Lithgow LGA with the Project providing a net benefit to the community with regard to social, economic and environmental impacts and benefits.

3.3.12 Subsidence

As a result of subsidence movements, the surface sandstone rock will be cracked to a depth of 15 to 20 metres over the entire area mined. Bird Rock will be fractured. (AP0229, AP0316, AP0326, AP0357, AP0407)

The possibility of subsidence from longwall mining in these areas and the inevitable impact on the environment from cracking the underlying sandstone layers which support the lakes, stream beds, swamps, pagodas, rock outcrops, walking tracks and cliffs should not be allowed. This subsidence will also increase bushfire risk. (AP0065, AP0070, AP0182, AP0191, AP0209, AP0264, AP0279, AP0308, AP0324)

The Heritage section of the SoEI offers the description of the historic site of a grinding stone at site 45-1-0002. After stating that "no spoiling or cracking is predicted" (p. 479) for cliffs and pagodas "the sandstone where the grinding groove is or was located" can be expected "to fracture and damage the site should it still remain." (p480). Therefore all the cliffs and pagodas will be fine but the grinding stone will fracture and vanish. (AP0407)

Fracturing of the rock underneath the surface will occur as a result of the longwall mining and the use of tentative language in the EIS statement is an attempt to minimize the potential for this serious damage to the cliff and pagoda landscape to occur. (AP0407)

Mining should not be allowed at the thinnest points of access where pagodas have developed their most advanced forms. This is seen in longwall panel LW501 which is approximately 40% overlain by a rocky spur. (AP0173)

From the project, steep slopes are predicted to experience tension cracking at the top and sides, and compression ridges at the bottom. (AP0225, AP0244)

The project will cause some cliffs, pagodas and other rock formations are likely to experience fracturing and spalling to 1% to 3% of total exposed rock face areas which are located above longwalls. (AP0225, AP0244)

Angus Place extension will cause the land to subside up to 1.9 m. (AP0121, AP0316, AP0326, AP0357)

The subsidence caused by the project in large areas of the plateau will cause deep cracking and cause aquifers to drop by up to 10 m. This is irreversible. (AP0168, AP0229, AP0240, AP0316, AP0326, AP0354, AP0357)

All 1,860 hectares affected by the proposed longwall mining will be subject to surface cracking. Surface groundwater aquifers will become more permeable and interconnected. (AP0407)

2,638 hectares of land is within the potential subsidence impact area. The mining layout for the Project has been designed to minimise the potential for impacts and so the majority of the cliffs and pagoda complexes are located outside the 26.5 degree angle of draw line from the extents of the proposed longwalls. There are two cliffs and some pagoda complexes which have been identified within the 26.5 degree angle of draw, however, they are all located outside the extents of the proposed longwalls.

There is one minor cliff which has been identified immediately adjacent to the eastern end of the proposed LW1014B and some isolated pagodas identified elsewhere above the proposed longwalls.

Whilst the cliffs and pagodas complexes could experience low levels of subsidence, they are not expected to experience any significant conventional tilts, curvatures or strains. These features are located along the valley sides and, therefore, are not expected to experience the valley related upsidence or compressive strains due to valley closure.

It is unlikely therefore, that the cliffs and pagoda complexes would experience any adverse impacts resulting from the extraction of the proposed longwalls. This is supported by extensive experience from the NSW Coalfields, at depths of cover greater than 200 metres, where no cliff instabilities have been observed where cliffs have been located wholly outside the extents of extracted longwalls.

There are some minor cliffs, pagodas and other rock formations which are located immediately adjacent to or directly above the proposed longwalls. The proposed mining is likely to result in some fracturing in these features and, where the rock is marginally stable, could then result in spalling of the exposed rockfaces. It is expected that the impacts on these minor cliffs, pagodas and rock formations would represent less than 1 % to 3 % of total exposed rockface areas of these features which are located directly above the proposed longwalls.

As is detailed in Section 10.4.7 of the EIS, in regards to Aboriginal heritage sites, there have been a number of surveys that have identified 49 Aboriginal heritage sites within the Project Application Area. While 14 of these sites will be subsided to varying degrees, the small predicted subsidence effects and site type means that no consequences are predicted for most.

The four sites above the mining area that will be subsided by 20 mm or more are not predicted to be damaged, although the risk remains. These sites are 45-1-0084, 45-1-0137 and 45-1-2756/2757. Based on subsidence predictions and prior experience in the Southern Coalfields no significant physical impact is predicted to any of these sites, although there is the possibility of minor spalling occurring on exposed rock faces, and such damage could be coincident with the hand stencil on the wall of 45-1-2756/2757.

Accordingly, they will be monitored in accordance with specifications to be formulated in a Cultural Heritage Management Plan.

As detailed ion Section 5.12.5 of the Subsidence Assessment prepared by MSEC and provided as Appendix D to the EIS, the surface cracking across the mining area is expected to be generally isolated and minor in nature, due to the reasonable depths of cover which typically vary between 270 metres and 450 metres, and due to the plasticity of the surface soils which allows them to more readily absorb the ground strains. Surface crack widths are expected to be similar to those observed above the previously extracted longwalls at Angus Place and Springvale Collieries, which were typically between 5 mm and 25 mm, but with isolated surface cracking in some locations greater than 50 mm.

Fracturing of the uppermost bedrock has been observed in the past, as a result of longwall mining, where the tensile strains have been greater than 0.5 mm/m or where the compressive strains have been greater than 2 mm/m. It is likely, therefore, that fracturing would occur in the uppermost bedrock based on the predicted maximum strains. It has been observed in the past, that the depth of fracturing and dilation of the uppermost bedrock, resulting from longwall mining, is generally less than 10 metres to 15 metres.

Fracturing of bedrock due to mine subsidence does not necessarily imply that there will be loss of surface or standing water. Bedrock contains natural joints and discontinuities due to erosion and weathering processes.

Whilst some minor surface cracking could occur in the swamps resulting from the extraction of the proposed longwalls, the previous experience of mining beneath swamps at Angus Place, Springvale and in the Southern Coalfield indicate that the likelihoods and extents of these impacts are very small.

The dilated strata beneath the drainage lines, upstream of the swamps, could result in the diversion of some surface water flows beneath parts of the shrub swamps. It is noted, however, that the drainage lines upstream of the swamps are generally ephemeral and, therefore, surface water flows occur during and shortly after rainfall events. Any diverted surface water flows are expected to remerge short distances downstream, due to the limited depth of fracturing and dilation and due to the high natural stream gradients.

The Project is unlikely to impact on access to visitors to public areas within the Project Application Area as a result of subsidence impacts. Regardless, Angus Place Colliery has an approved Public Safety Management Plan to manage public safety. This plan includes controls that should subsidence pose a potential public safety risk, warning signs will be erected and subsidence repairs completed as soon as practicable. A review of the Public Safety management Plan will be undertaken on a regular basis.

The Project is considered unlikely to increase the risk of Bushfire within the Project Application Area.

Wilderness areas must not be required to be off limits to visitors due to subsidence dangers. (AP0142)

Public safety is a priority management aspect at Angus Place Colliery. The Project is unlikely to impact on access to visitors to public areas within the Project Application Area as a result of subsidence impacts. Regardless, Angus Place Colliery has an approved Public Safety Management Plan to manage public safety. This plan includes controls that should subsidence pose a potential public safety risk, warning signs will be erected and subsidence repairs completed as soon as practicable.

A review of the Public Safety management Plan will be undertaken on a regular basis.

The project will include longwall panels LW1007 to LW1019 which are in the critical panel width range. All panels should be sub-critical width to minimise subsidence or to not allow maximum subsidence. (AP0225, AP0244)

Angus Place Colliery invested a significant amount effort during the mine planning phase for the proposed longwalls to prioritise the minimisation of potential impacts. The mine planning has taken into consideration the constraints of sensitive surface features (watercourses, biodiversity, geodiversity and archaeology) in conjunction with geological and geotechnical issues while at the same considered mine feasibility and optimisation of resource recovery. Safety, both underground as well as the surface, was of paramount importance and was also considered in all stages of mine planning.

Also of relevance to the mine planning process was the Springvale Mine's prior experience with extracting longwalls of varying panel widths. A conclusion reached at Springvale Mine was that the previously mined narrower sub-critical longwalls had significantly less subsidence (and thus resulted in significantly less impacts and environmental consequences) than the wider, critical longwalls. An analysis of the sensitivity of void widths at Springvale Mine identified that:

- marginal subsidence reductions would occur for longwall void widths between 150 m and 260 m and that the greatest reductions can be made from 315 m to 260 m, and

- marginal strain reduction would occur for widths between 150 m and 260 m and that the greatest reduction can be made from 315 m to 260 m.

A comprehensive multi-disciplinary risk-based approach to mine planning and mine design was hence undertaken at Angus Place Colliery and which resulted in the following criteria being implemented:

- Sub-critical longwalls with voids of 261 m will be poposed under two swamps (Tri-Star Swamp, Trail 6 Swamp) that will be mined under (LW1004 – LW1006, LW1016 – LW1017)).

- Twin Gully Swamp will be eliminated from the mine plan, by the shortening of LW1010.

- No perennial watercourses will be mined under.

- No cliffs will be mined under.

- Impacts on pagodas will be avoided or minimised. LW1008, LW1015 – LW1017 have been shortened to avoid pagodas on the east. LW1013 and LW1014 will be split into two segments to step around pagodas. The pagodas located directly above the proposed longwalls (LW1006, LW1010 – LW1011) are predicted to experience some fracturing and spalling, however, less than 1% of their total surface area will be impacted.

Table 8.4 of the Angus Place MEP EIS shows the hierarchy of subsidence management controls that have been implemented to avoid or minimise impacts on sensitive surface features through the processes of elimination and substitution, and application of engineering controls (eg. rehabilitation of biodiversity impacts and restoration works eg. archaeological sites).

LW1001 – LW1003 will have void widths of 295 m while LW1007 – LW1015 and LW1018 – LW1019 will have void widths of 360 m. None of these longwalls are situated directly underneath sensitive surface features noted above. The void width to depth of cover ratio range from 0.85 to 1.0; these values are similar to those for the previously extracted longwalls at Angus Place.

The project says that the proposed new vent No.3 “cannot be subject to mine subsidence as this may impact on the integrity of the ventilation infrastructure”. However Centennial are prepared to compromise the integrity of the biodiversity and geodiversity of the Newnes Plateau, as subsidence is bound to happen above longwall mining. (AP0225, AP0244, AP0358)

The ventilation facility has been located to fit with the layout of the proposed underground roadways and the existing surface infrastructure within Newnes State Forest (i.e. forest roads and tracks). APC-VS3 will have a surface footprint of approximately 14 ha and will have a suitable asset protection zone.

The location of the ventilation facility is constrained by the mine design and layout and has been located to minimise impacts to the environment and sensitive receptors as far as reasonably practical and avoid removal of any threatened flora.

The proposed mining will not compromise the integrity of the biodiversity and geodiversity of the Newnes Plateau. Centennial Angus Place is committed to mining in an environmentally and socially responsible manner, however, with due consideration of mine feasibility and resource recovery. The principles of ecological sustainable principles have been applied in mine design and assessment of impacts. As discussed above in Point 4, the proposed mining area has:

- avoided mining under cliffs and permanent watercourses

- avoided mining under Twin Gully Swamp within the proposed mining area

- proposed sub-critical longwalls under Tri-Star Swamp and Trail 6 Swamps

- avoiding or minimising to the greatest extent possible impacts to pagodas.

Centennial Angus Place will implement an adaptive management and avoidance approach to minimise subsidence impacts. Table 8.4 of the Angus Place MEP EIS shows the management and monitoring to be undertaken comprising:

- maintenance of the existing Strata Failure Management System for management of underground safety
- Development of a Trigger Action Response Plan for the management of potential impacts to sensitive surface features, including cliffs and pagodas, biodiversity, watercourses and archaeology as part of the Extraction Plan.
- Ongoing subsidence monitoring and modelling for all sensitive surface features.

Areas close to the Angus Place Colliery's existing works and other existing mines already show prominent examples of cracking and collapse. This damage must not be allowed to extend to the Gardens of Stone. (AP0233, AP0338, AP0354, AP0357)

Potential subsidence impacts on the Gardens of Stone National Park are considered in Section 5.15 of the Subsidence Assessment prepared by MSEC and provided as Appendix D to the EIS. The Gardens of Stone National Park (the National Park) is located immediately to the north of the Extension Area, at a distance of 170 metres from LW1014A, at its closest point to the proposed longwalls. The National Park is located outside the 26.5 degree angle of draw line from the limit of extraction for the proposed longwalls. Whilst the area closest to the proposed longwalls could experience very low levels of vertical subsidence (i.e. less than 20 mm), it is not predicted to experience any measureable conventional tilts, curvatures or strains.

The National Park is also likely to experience small far-field horizontal movements. These movements themselves do not result in impacts on natural or built features, except where they are experienced by large structures which are sensitive to differential horizontal movements, such as freeway bridges, or large industrial buildings.

The tributaries within the National Park, closest to the proposed longwalls, could experience very small valley related movements. Whilst very minor and isolated fracturing has been observed up to around 400 metres from previously extracted longwalls in the NSW Coalfields, these have occurred within large river valleys within the Southern Coalfield. It is not expected that any significant fracturing would occur within the small tributaries within the National Park.

The longwalls are proposed to be extracted towards the Gardens of Stone National Park which allows for an adaptive management approach. The ground movements in the vicinity of the National Park can be monitored, as longwalls in the series are progressively mined towards it, allowing the ongoing review of the observed versus predicted movements.

Subsidence monitoring should be by a third party agency, such as the Office of Environment and Heritage, and monitoring should be paid for by Centennial Coal. (AP0209)

Subsidence monitoring is undertaken by suitably qualified and certified surveyors registered with the Board of Survey and Spatial Information. Surveyors are required to keep their qualifications up to date to maintain their registration. All surveys are undertaken in accordance with relevant government guidelines. Subsidence monitoring is undertaken in accordance with agreed subsidence monitoring programmes detailed within an extraction plans and Subsidence Management Plan and within accuracy requirements determined by the NSW Division of Resources and Energy.

3.3.13 Surface Water

The proposed discharge of up to 43.8ML/day of eco-toxic mine effluent must be treated using reverse osmosis technology to remove all metals and salts before discharge to the Cox's River. (Various)

The discharge from both mines of metal-rich salts will impact the Cox's river that supplies Sydney with drinking water, part of the Warragamba catchment. This will lead to possible contamination of Sydney's drinking water. (AP0007, AP0168, AP0191, AP0210, AP0229, AP0255, AP0256, AP0281, AP0324, AP0408)

The combined effluent from both mines will be 43.8ML/day in 2023. 30.8 tonnes/day of toxic effluent will be discharged into the Cox River which supplies Sydney' drinking water. This is unacceptable. (AP0092, AP0134, AP0142, AP0148, AP0163, AP0209, AP0316, AP0326, AP0354, AP0357, AP0407)

No mining discharge water should be allowed to leave a mining site and flow into natural creeks and streams unless it equals the same natural background levels. These streams should be protected. (AP0071, AP0228)

Mining discharge water should be treated with desalination methods and not filtration dams. Mining discharge water from this particular area is over 1000µs/cm which is breaching the ANZECC guidelines. (AP0071)

Centennial must address the current discharge from Angus Place and Springvale which up until March 2014 was piped to Wallerawang Power Station and treated by desalination method, however due to the shut down of Wallerawang Power Station is now flowing into the Cox's River. (AP0071, AP0182)

This proposal plans to pollute Sydney's water supply. (AP0106)

The mine effluent discharged into the Cox River will lead to negative impacts on the surrounding environment and local recreational fishing. (AP0134)

More information on the mitigation of increased concentrations of heavy metals into the Cox's River and Sydney's water supply plus potential health impacts mediated through water quality and security is urgently required. (AP0338, AP0358)

Angus Place mine currently discharges 4.43ML/day into the Cox River via the Springvale Delta Water Transfer Scheme. This effluent has unacceptably high levels of turbidity, heavy metals and salinity. (AP0358)

The project proposes to discharge saline mine effluent, untreated, to the hydrological catchment of Warragamba Dam. (AP0358)

The SoEI states "The consequence of increased discharge to the Cox's River is not significant since there is excess demand for this water resource in this catchment." (p.479). This argument

neglects the fact that the mine discharge water is contaminated with heavy metals and is of high salinity. (AP0407)

The eco-toxic mine effluent currently running at 12.5ML/day has unacceptably high levels of turbidity, heavy metals and salinity. (AP0407)

Before discharge, the mine water must be treated to a standard that protects undisturbed aquatic ecosystems using reverse osmosis technology to remove metals and salts. (AP0358, AP0407)

Discharge of what is effectively untreated, highly contaminated mine water to Kangaroo Creek via LDP001, and subsequently to the Cox's River, is inappropriate. The measures proposed to mitigate the ongoing and increasing damage to these aquatic ecosystems are inadequate. (AP0209)

A complete redesign of the waste water management system is essential, ensuring Centennial is held accountable for ensuring the water management system is designed to cope with all scenarios and ensure that no waste water is ever transferred to watercourses. (AP0209)

The effective doubling of discharge via the water transfer scheme (the SDWTS), with flow of saline ground water to the Cox's River catchment will have a detrimental effect on the aquatic biota. (AP0225, AP0244)

A Regional Water Quality Impact Assessment (**Appendix 2** to this RTS) has been undertaken to assess the impact of direct discharge at Angus Place LDP001 and Springvale LDP009. This assessment has quantified the impact (water quality and water quantity) of the proposed discharges from Angus Place Colliery and Springvale Mine into the Coxs River catchment, including Lake Burragorang. Pertinent results are presented in Section 3.1.25.

Centennial Angus Place has undertaken Site Specific Trigger Values (SSTVs) Assessment for Angus Place LDP001. Results of the SSTV analysis indicate that current water quality at Angus Place LDP001 meets ANZECC 95% protection of aquatic ecosystems except for copper and zinc concentrations. For copper and zinc, current water quality at Angus Place LDP001 meets 80^{th} percentile upstream water quality at downstream edge of mixing zone. Further detail is presented in the SSTV Assessment (**Appendix 3** to this RTS).

Following public exhibition of the EIS, a review of the EPA Direct Toxicity Assessment on Springvale's LDP009 discharge was undertaken by GHD (**Appendix 9** to this RTS). Following the review, an additional Direct Toxicity Assessment, provided as **Appendix 10** to this RTS, was carried out on discharge water from LDP001 at Angus Place and LDP009 at Springvale. The methodology for the Direct Toxicity Assessment was approved by the EPA in August 2014. The results of the Direct Toxicity Assessment show that there is no toxicity associated with the Discharge water from LDP001. Although toxicity has been observed at LDP009, it has been demonstrated that neither the EC or bicarbonate concentrations have any effect on the toxicity of the water. Lowering the EC may have a detrimental effect on the system as shown by the high toxicity at sites upstream of LDP001. The chemistry of water quality discharged through LDP009 does not point to any source in particular that is leading to the toxicity being observed. As such, Centennial proposes to undertake further investigations into the toxicity of LDP009 water discharge to identify the cause of the toxicity. Without knowing what is causing the toxicity, the application of a treatment system is premature as you won't know what you are treating for. As such, no additional treatment of mine water is considered necessary at this stage.

Carne Creek is currently in a pristine state, and its waters that flow through the Greater Blue Mountains World Heritage Area are of the highest standard. This creek must not run bright

orange or suffer reduced flows, just like the Wolgan River after Centennial Coal wrecked it. (Various)

The project will impact on Carne Creek, the Wolgan River, Marrangaroo Creek, Bunglebouri Creek, Wolgan River and Rocky Creek headwaters and catchments. These impacts will be unable to be mitigated. (AP0168, AP0279, AP0316, AP0326, AP0338, AP0354, AP0357, AP0358)

The Wolgan River is dry, where it once ran into the valley as a magnificent waterfall. This must not happen to Carne Creek. (AP0191, AP0200, AP0293)

There should be no emergence of near surface groundwater with elevated levels of salt or metal precipitate in Carne Creek. (AP0209)

Carne Creek and other waterways in the area must not be permanently despoiled by reduced water flows and the discharge of toxic effluent. (AP0091, AP0107, AP0134, AP0154, AP0191, AP0204, AP0293)

Section 5.3 of the Subsidence Assessment prepared by MSEC and provided as Appendix D to the EIS as well as Section 5.3.2 of the Surface Water Impact Assessment prepared by RPS and provided as Appendix F to the EIS addresses predicted subsidence impacts to Carne Creek. Carne Creek is located to the east of the proposed longwalls, outside the proposed Extension Area. Although Carne Creek will not be directly undermined, it was included in the assessment as it could experience valley related movements and could be sensitive to these movements.

Carne Creek is located 400 metres south-east of LW1019, at its closest point to the proposed longwalls. The remaining proposed longwalls are located more than 600 metres from the creek. The total length of Carne Creek located within a distance of 600 metres from the extents of the proposed longwalls is approximately 0.9 kilometres.

The maximum predicted subsidence at Carne Creek, due to the extraction of the proposed longwalls, is less than 20 mm. Whilst the creek could experience some very low level vertical subsidence, it is not expected to experience any measurable conventional tilts or curvatures, even if the predictions were exceeded by a factor of 2 times.

The maximum predicted valley related movements at Carne Creek, due to the extraction of the proposed longwalls, are 25 mm upsidence and 50 mm closure. The compressive strains due to valley closure are expected to be less than 0.5 mm/m, which is in the order of survey tolerance.

The section of Carne Creek located within 600 metres of the proposed longwalls could also experience some low level movements resulting from the extraction of the future longwalls at Springvale Colliery. The predicted conventional and valley related strains along this section of creek, due to mining at Springvale Colliery, are also expected to be less than 0.5 mm/m, which is in the order of survey tolerance.

Existing baseflows to Carne Creek already occur from the near surface aquifers. The water quality from these aquifers that flow into Carne Creek will remain unchanged as a result of the Project and environmental consequences will not result.

Lastly, Springvale Coal and Centennial Angus Place have not, as yet, been provided with any scientific evidence that their mining operations caused the impacts in Wolgan River that caused it to run “bright orange”. The claim that Centennial Coal wrecked Wolgan River is not validated with evidence.

The proposal will cause creek flows and swamp waters to move many meters underground and pretend that nothing has happened. (AP0070)

The Groundwater Impact Assessment prepared by RPS to support the Project and provided as Appendix E to the EIS determined that the most significant reductions to average standing groundwater levels are predicted in Twin Gully Swamp. This swamp has a projected drop in average standing water levels from 12.4 cm to 10.6 cm above the soil surface. The post mining values predicted at Twin Gully Swamp therefore suggest that soil saturation would persist, maintaining water availability for flora and fauna, as well as soil anoxia, allowing for continued peat formation. All other monitored swamps have smaller projected decreases in average standing water levels and monitored swamps are projected to maintain average standing water levels above the surface.

Detailed investigations of the relationship between the groundwater and surface water movements, the underlying geology and the proposed mining layout has concluded, through empirical modelling, that the proposed longwall mining would not create interconnected fracturing between the aquifer supporting swamps and the longwalls. This is primarily due to the large vertical distance between extracted coal seam and the swamps, resulting in these swamps being located significantly higher than the predicted fracturing zone. The predicted change to baseflow and average water level is within the expected capillary forces of peat swamps such that the magnitudes of water table decline predicted is unlikely to result in drying of the peat layer.

The swamps which are located directly above the proposed longwalls are predicted to experience tensile strains greater than 0.5 mm/m and compressive strains greater than 2 mm/m. It is expected, therefore, that fracturing would occur in the top most bedrock beneath these swamps.

The surface cracking across the mining area is expected to be generally isolated and minor in nature, due to the reasonable depths of cover which typically vary between 270 metres and 450 metres, and due to the plasticity of the surface soils which allows them to more readily absorb the ground strains. Surface crack widths are expected to be similar to those observed above the previously extracted longwalls at Angus Place and Springvale Collieries, which were typically between 5 mm and 25 mm, but with isolated surface cracking in some locations greater than 50 mm.

The shrub swamps have peat layers which overlie the shallow natural surface soils and underlying bedrock along the alignments of the drainage lines. In most cases, cracking would not be visible at the surface within these swamps, except where the depths of bedrock are shallow or exposed. The shrub swamps comprise significant quantities of sediment and, therefore, fracturing of shallow bedrock beneath these swamps are likely to be filled with soil during subsequent flow events along the drainage lines.

The hanging swamps have soft soil or peat layers which overly the bedrock on the valley sides. It is expected that the potential for fracturing in these locations would be less when compared to the bases of the valleys, where higher compressive strains occur due to the valley related movements, and due to the higher depths of cover along the valley sides.

Whilst some minor surface cracking could occur in the swamps resulting from the extraction of the proposed longwalls, the previous experience of mining beneath swamps at Angus Place, Springvale and in the Southern Coalfield indicate that the likelihoods and extents of these impacts are very small.

The dilated strata beneath the drainage lines, upstream of the swamps, could result in the diversion of some surface water flows beneath parts of the shrub swamps. It is noted, however, that the drainage lines upstream of the swamps are generally ephemeral and, therefore, surface water flows occur during and shortly after rainfall events. Any diverted surface water flows are expected to remerge short distances downstream, due to the limited depth of fracturing and dilation and due to the high natural stream gradients.

The incidence of impacts on swamps due to mine subsidence ground movements is very low and, in some of these cases, the impacts that were observed were associated with natural events or mining related surface activities. It is expected, therefore, that the incidence of impacts on the swamps within the Extension Area resulting from mining induced ground movements will also be low.

An additional ventilation facility proposed location close to Wolgan River is unacceptable. (AP0092)

As detailed in Section 4.10.3 of the EIS, mine planning has identified that additional ventilation capacity is required to ensure compliance with Clause 13(h) of the NSW Coal Mine Health and Safety Regulation 2006. To optimise the existing ventilation system, an air intake ventilation facility (downcast) will be required to deliver fresh air to the underground mine. This is identified as Angus Place Ventilation Site 3 (APC-VS3. In addition, the Project will require control of the increased volume of mine water make to meet underground safety and operational requirements. As such, new dewatering bore facilities will be required to continue to deliver water into the SDWTS (which will continue to be utilised as part of the Project).

The ventilation facility has been located to fit with the layout of the proposed underground roadways and the existing surface infrastructure within Newnes State Forest (i.e. forest roads and tracks). APC-VS3 will have a surface footprint of approximately 14 ha and will have a suitable asset protection zone.

The location of the ventilation facility is constrained by the mine design and layout and has been located to minimise impacts to the environment and sensitive receptors as far as reasonably practical and avoid removal of any threatened flora.

The Wallerawang Power Plant has shut down, possibly permanently. The current SDWTS proposal to provide water to this plant is not viable. (AP0407)

Springvale Coal and Centennial Angus Place have undertaken additional water balance modelling to assess potential water quality impacts in light of the recent change in status of the Wallerawang Power Station and reduced water demand. This assessment is attached as **Appendix 2** to this RTS. The potential impacts have been quantified.

The proposed discharges must be subjected to a pollution licence that limits concentration levels for metal and salt pollutants with adequate pollution controls in place. (AP0358)

The Angus Place operations have an existing Environmental Protection Licence (EPL 467). The licensed discharge points at the pit top (LDP001, LDP002 and LDP005), and at Kerosene Vale (LDP003) are permitted by EPL 467. EPL 467 defines the volumetric and concentration limits for water discharge offsite and the recording and reporting of data requirements. The Project will continue to operate under an EPL, which will include LDP001, 002 and 005, all in EPL 467.

The impact of subsidence on surface water in Appendix F, Chapter 6.4 p.98 investigates impacts on Marrangaroo Creek, Wolgan River and as far as the Colo River. Carne Creek which will be directly undermined is left out. (AP0407)

Section 5.3 of the Subsidence Assessment prepared by MSEC and provided as Appendix D to the EIS as well as Section 5.3.2 of the Surface Water Impact Assessment prepared by RPS and provided as Appendix F to the EIS addresses predicted subsidence impacts to Carne Creek. Carne Creek is located to the east of the proposed longwalls, outside the proposed Extension Area. Although Carne Creek will not be directly undermined, it was included in the assessment as it could experience valley related movements and could be sensitive to these movements.

Carne Creek is located 400 metres south-east of LW1019, at its closest point to the proposed longwalls. The remaining proposed longwalls are located more than 600 metres from the creek. The total length of Carne Creek located within a distance of 600 metres from the extents of the proposed longwalls is approximately 0.9 kilometres.

The maximum predicted subsidence at Carne Creek, due to the extraction of the proposed longwalls, is less than 20 mm. Whilst the creek could experience some very low level vertical subsidence, it is not expected to experience any measurable conventional tilts or curvatures, even if the predictions were exceeded by a factor of 2 times.

The maximum predicted valley related movements at Carne Creek, due to the extraction of the proposed longwalls, are 25 mm upsidence and 50 mm closure. The compressive strains due to valley closure are expected to be less than 0.5 mm/m, which is in the order of survey tolerance.

The section of Carne Creek located within 600 metres of the proposed longwalls could also experience some low level movements resulting from the extraction of the future longwalls at Springvale Colliery. The predicted conventional and valley related strains along this section of creek, due to mining at Springvale Colliery, are also expected to be less than 0.5 mm/m, which is in the order of survey tolerance.

Any malfunction of the SDWTS, such as following a bushfire, must not result in emergency discharges to the World Heritage Area via Wolgan River or Carne Creek. These discharges must be properly treated and reinserted underground into the mine instead. (AP0407, AP0209, AP0407)

The SDWTS pipeline network, covering Angus Place Colliery's dewatering bores 930 (not operational) and 940 (in service) and Springvale Mine's bores 6 and 8 and LDP009 (EPL 3607) and Energy Australia's Wallerawang Power Station, are predominantly trenched and hence the risk of bushfire destroying the network is minimal. In the event a bushfire destroyed the short exposed section of the SDWTS, the mine water would cascade down Newnes Plateau and will be captured within the Sawyers Swamp Creek Ash Dam, owned by Energy Australia.

Centennial Angus Place and Springvale Coal confirm that no emergency discharges into Wolgan River occurs currently or is proposed in the future. No discharges into Wolgan River have occurred since 10 April 2010. Angus Place Colliery's EPL 467 was varied on 29 July 2013 to remove LDP006 as the emergency discharge point on Newnes Plateau. No new LDPs have been proposed in the Angus Place MEP (refer Section 4.11.3 of the Angus Place MEP EIS).

While Springvale Mine's EPL 3607 still has provisions for two emergency discharge points (LDP004 and LDP005) on Newnes Plateau no emergency discharges have been proposed via these LDPs in the Springvale MEP. Instead it has been proposed (refer Section 4.10.1 of the Springvale MEP EIS) that these LDPs be relinquished post-approval when infrastructure required to re-direct emergency discharge water from the SDWTS back underground to the Angus Place Colliery's 900 water storage area has been installed.

There has never been any mine water discharges into Carne Creek and neither is there any proposal to do discharge into that catchment as part of the Project.

Emergency discharge points in the Wolgan River and Carne Creek must be eliminated and those discharge licences voided. (AP0209)

Angus Place Colliery's EPL 467 was varied on 29 July 2013 to remove LDP006 as the emergency discharge point on Newnes Plateau. No LDPs have been proposed in the future through the Angus Place MEP (refer Section 4.11.3 of the Angus Place MEP EIS).

The Springvale MEP EIS (refer Section 4.10.1 of the Springvale MEP EIS) is proposing that its existing two emergency discharge points on EPL 3607 (LDP004 and LDP005) on Newnes Plateau be relinquished post-approval when infrastructure required to re-direct emergency discharge water from the SDWTS back underground to the Angus Place Colliery's 900 water storage area has been installed.

3.3.14 Traffic

The project will lead to another increase in traffic on poor quality state forest roads 24 hours a day, 7 days a week. (AP0225, AP0244)

As detailed in Section 10.5.4 of the EIS, construction vehicles will travel across two shifts (6.00 am to 6.00 pm and 6.00 pm to 6.00 am), seven days a week. Peak light vehicle movements will occur in relatively short periods around shift changes with construction staff generally travelling in groups to and from construction sites. The construction of components of the borehole site surface infrastructure will be progressive as required.

The heavy and light vehicle access routes will link to upgraded and extended access tracks. Specifically an existing access track east of Sunnyside Ridge Road will be upgraded to access APC-VS3, while each of the borehole sites will require an upgrade and extension of existing access tracks off Sunnyside Ridge Road. As agreed with the Forestry Corporation of NSW, these upgraded access tracks will initially provide a width of 10 m to accommodate an access track (5 m) and infrastructure corridor (5 m), before the infrastructure corridor is rehabilitated, retaining the 5 m access track.

Construction of each borehole site and associated access track and services corridor is estimated to occur over a 6 month period, while the construction of the APC-VS3 (and associated access track and services corridor) is estimated to occur over approximately 16 months.

All heavy vehicle trips within the Newnes State Forest will be undertaken during daylight hours to maximise safety. These heavy vehicle movements will generally be between the hours of 6am and 6pm.

Considering the maximum of 16 vtpd predicted during construction and less than 10 vehicle trips per week during operation upon the existing Newnes Plateau road network, the consequences of road traffic impacts are considered low.

As detailed in Section 10.5.5 of the EIS, a Construction Traffic Management Plan will be prepared in consultation with the Forestry Corporation of NSW; This will include measures such as warning signs at appropriate locations on the main access roads to the infrastructure sites, advising public road users of when access tracks will be used by increased numbers of heavy vehicles and other construction traffic. Caution will be advised to all road users.

Centennial Angus Place will also commit to developing the Construction Traffic Management plan in consultation with Lithgow City Council and RMS.

3.3.15 Visual

Centennial says there will be little visual impact at their test sites, but if you travel to say Birds Rock lookout (one of their test sites) you see numerous examples of their mining infrastructure along the way. (AP0225, AP0244)

A Visual Impact Assessment for the Project was prepared and, as identified in Section 10.12.6 of the EIS, concluded that the visual character and amenity of the regional and local area of the Project Application Area will not be significantly altered by the Project. Newnes Plateau has existing surface mining infrastructure, with the Project requiring additional infrastructure. However, the significance of the visual effects of the Project upon Newnes Plateau are predominately none to minor with potential visual impacts on Newnes Plateau being transient and not impacting upon any residential locations. Revegetation will be undertaken appropriately to ensure a suitable end land use that is consistent with the surrounding visual character and zoning of Newnes Plateau.

While no change in the land use is predicted Centennial Angus Place will:

- undertake rehabilitation of cleared areas promptly to minimise visual impacts; and
- locate surface infrastructure away from walking / access tracks and areas where visual intrusion is likely (ie from lookouts etc).

3.4 Positive Submissions

The Angus Place and Springvale Mine Extension Projects have received a substantial number of submissions in response to the projects being placed on exhibition. On review of the submissions that were written in support of these projects, it is found that mining brings about a direct and significant social and economic benefit to local communities which would be lost should the projects be refused. A review of submissions received in support of the projects has found:

- The majority of support submissions are from the local community (Lithgow LGA) or immediate surrounding LGA's.
- The submissions outline the risks to the local community if the projects are not approved, which include:
- The importance of ongoing secure employment.
- Reduction in flow-on effects to other business and subsequent negative impacts.
- The possible need for families to relocate should employment continue to decline across the sector.
- The loss of financial and in-kind sponsorship to local community events, charities and projects.
- The long history of mining in the LGA and also the multi-generational employment history amongst families will be lost.
- The environmental performance of the projects is important to the workforce and that local people (including the sector workforce) access and enjoy the areas where mining is undertaken for leisure and recreation.
- The mining sector is an important training resource for new employees and those wishing to pursue a career in the industry.
- Direct mine industry sector employment sits at 15% of Lithgow's workforce compared to 1.0% of the NSW workforce (2011 Census).
- The Lithgow Economic Development Strategy (Version 2) highlights the clear link between economic sustainability and population growth. Lithgow's current population is 20,161 (2011 census) and the projected population is forecast to be 20,650 people in 2036.
- A large proportion of Angus Place and Springvale's workforce reside in the Lithgow LGA, many of whom are long term residents and have been employed in the mining sector for many years. The workforce is more likely to own their own home and directly contribute to the social and financial economy of their community.
- For the 2013 – 2014 financial years Angus Place spent $64,923,494.15 on external contractors. Over 18% of this contribution was for contractors based in the Lithgow LGA and 80% for contractors based in other LGA's. For the same period, Springvale spent $78,887,424.62 on external contractors. 30% of this contribution was for contractors based in the Lithgow LGA and 70% for contractors based in other LGA's.
- The financial contribution to other LGA's does not represent lost income to the Lithgow economy as it generates spending in other non-mining related sectors (i.e. accommodation, food, fuel, engagement of additional contract support services etc.). This type of expenditure would not occur if funds remained within the LGA. Therefore the indirect spend is significant.

- Case studies over the last 2 – 3 years illustrate the importance of mining to the general economy. There are many stories that recognise the link between mine related employment and the broader economy.

A socio-economic analysis of the submissions received in support of Angus Place and Springvale MEPs is provided as Attachment 1 of **Appendix 5** to this RTS.

4.0 CONSULTATION

Since the public exhibition of the EIS, Centennial Angus Place has continued to undertake consultation with the relevant government agencies regarding the Project. A summary of the consultation undertaken since the submission of the EIS for public exhibition is detailed below.

4.1 Commonwealth Department of the Environment

- 24 September 2014 – Meeting with the Department of Environment to discuss the issues raised by the IESC in regards to THPSS.

4.2 Department of Planning and Environment

- 24 September 2014 – Meeting with the Department of Planning and Environment to discuss the issues raised by the IESC in regards to THPSS.

4.3 Environment Protection Authority

- 26 June 2014 – Meeting with EPA regarding increase in discharge limits and inspection of the Springvale Delta Water Transfer Scheme.
- 27 June 2014 – Email from EPA seeking clarification on groundwater make and discharge volumes for Springvale and Angus Place. This issue has been addressed as part of this RTS.
- 2 July 2014 – Letter from the EPA seeking further information on mine water discharge toxicity and the EPA's EPL variation expectations and requirements.
- 4 August 2014 – Draft EPL Licence Variation issued for EPL 3607
- 7 August 2014 – Letter to EPA in response to EPL 3607 variation and PRP
- 11 August 2014 – Phone call with EPA to discuss PRP on the draft Springvale EPL 3607 variation.
- 13 August 2014 – Email response to EPA providing a copy of the Springvale Direct Toxicity Assessment Methodology and Chemical Analysis program to satisfy the PRP on EPL 3607.
- 22 September 2014 – Meeting with the EPA to discuss the results of the additional water assessments.

4.4 NSW Office of Water

- 24 September 2014 - Meting with the NSW Office of Water to discuss the water licensing strategy for the Springvale and Angus Place MEPs.

4.5 Office of Environment and Heritage

- 23 September 2014 - Meeting with the OEH to discuss the revisions to the regional Biodiversity Strategy.

4.6 Emirates Wolgan Valley Resort

- 2 July 2014 – Meeting with representatives from the Emirates Wolgan Valley Resort to discuss the Project and concerns raised in the submission to the EIS.

5.0 REVISED STATEMENT OF COMMITMENTS

Desired Outcome	Action
1. General	
All operations are undertaken in a manner that will minimise the environmental impacts associated with the Project.	Operations will be undertaken in accordance with the description provided in this EIS. As the required exploration drill holes are determined, Centennial Angus Place will undertake a series of due diligence assessments to consider key impacts as relevant. The general approach of the due diligence assessments will be to conduct site investigations to ensure that significant impacts are avoided. Centennial Springvale will develop Trigger Action Response Plans as part of the development of the certain management plans which will detail the response to be taken if mining induced impacts occur.
2. Development Phase	
All construction operations are appropriately undertaken to minimise potential impacts to the environment.	Six (6) months prior to construction of surface facilities on the Newnes Plateau, a Construction Environmental Management Plan will be developed in consultation with the Forestry Corporation of NSW. This plan will include noise management in accordance with the Project Specific Noise Criteria detailed in Section 10.6.3 of the EIS. A copy of the Construction Environmental Management Plan will be provided to Lithgow City Council for their consideration.
3. Exploration	
All exploration activities are appropriately undertaken to minimise potential impacts to the environment.	Proposed exploration activities will be notified to DRE and where applicable to the Forestry Corporation of NSW. All required approvals will be obtained prior to the commencement of any exploration activities. Copies of any due diligence assessments will also be provided to DRE and Forestry Corporation (where applicable).
4. Hours of Operation	
All operations are undertaken within the approved operating hours.	Operations will be undertaken 24 hours a day 7 days a week, 52 weeks per year.
5. Surface Water, Groundwater, Geomorphology and Aquatic	
All surface water groundwater and aquatic impacts are minimised to the greatest extent possible.	Within six (6) months of development consent, a Water Management Plan will be developed that includes the monitoring requirements identified in Section 10.2.5 of the EIS. The Water Management Plan will be developed in consultation with the NSW Office of Water. Groundwater models will be updated every 6 months and a review will be included in the Annual Review. Copies of the Annual Review will continue to be provided to NOW. Flow monitoring on drainage lines within 800m of the longwall voids from LW1008 will be installed to measure far field effects. Throughout the life of the Project, stygofauna will be monitored using standing water levels within one borehole in each aquifer where stygofauna are known to occur (AQ4 to AQ6). Where available, monitoring of the deep aquifer system, AQ

Desired Outcome	Action
	1 to AQ3 will be undertaken to establish presence of stygofauna. Centennial Coal will undertake a regional stygofauna assessment which will: • Collate existing available information on groundwater bores, water quality and characteristics in Centennial Coal's area of operations throughout the Western Coalfield. • Use this information to form a prioritisation list of likely areas for GDE to occur. • Use the prioritisation protocol to identify bores that can be sampled to provide data on the presence and significance of fauna both within and outside mine areas. • Identify any stygofauna found to a minimum of Family level. • Advise on the significance of the findings. • Examine relationship between bore characteristics and presence of stygofauna. The following strategy will be adopted by Centennial Coal to secure water licenses required for the Project: • Trade, within the constraints of the relevant Water Sharing Plan, with other Centennial Coal water license holders. • Obtain, when available through controlled allocation orders under the relevant Water Sharing Plan, additional allocations. • Review the hydrogeological model and predicted water inflows for the Project on a 6 monthly basis to ensure adequate accounting for water take and license requirements. • Contribute to the 2016 Water Sharing Plan review process, as agreed with the NSW Office of Water.
6. Terrestrial and Aquatic Ecology	
	Within 12 months of development consent, the land to be used for offsetting the impacts of the Project, as identified in Chapter 10.3, will be implemented. Within 12 months of development consent a Research Strategy will be developed in consultation with the DOPI, Forestry Corporation of NSW, Office of Environment and Heritage, National Parks and Wildlife Service and Federal Environment Department. This research strategy will include the research and mitigation themes described in Section 10.3 of the EIS. Within two (2) years of development consent, a Biodiversity Management Plan will be developed and implemented. The Plan will be developed in consultation with DOPI, OEH, DoE, Forestry Corporation of NSW, NPWS and will include the outcomes of the Research Strategy.
7. Aboriginal Heritage Management	
Ensure that identified and unidentified Aboriginal Sites are appropriately managed.	Aboriginal Heritage will be monitored and managed in accordance with Table 8.2 of this EIS. Within 6 months of the date of approval, the Cultural Heritage Management Plan will be updated.
8. Traffic and Transport	
Project-related impacts on the road network are limited.	Six months prior to the commencement of construction activities, a Construction Traffic Management Plan will be developed and implemented. The Plan will be developed in consultation with Lithgow City Council and Forestry Corporation of NSW.
9. Noise and Vibration	
All noise impacts are minimised to the greatest	The existing Noise Management Plan will be updated to include the noise criteria for the Project and a noise monitoring programme for the sensitive receptors

Desired Outcome	Action
extent possible.	identified in **Figure 10.25** of the EIS. The noise monitoring programme will include continuous, unattended noise monitoring and operator attended quarterly noise monitoring.
10. Air Quality and Greenhouse Gas	
All air quality impacts are minimised to the greatest extent possible.	Within six (6) months of development consent, the Air Quality Management Plan will be updated to include the mitigation measures identified **in Section 10.7** of the EIS. An additional TEOM will be installed as part of a regional air quality monitoring programme that is currently being developed by Centennial Coal.
11. Soils and Land Capability	
All soil and land impacts are minimised to the greatest extent possible	Soil stripping will be undertaken in accordance with the soil stripping depths in the Soils and Land Capability Report appended to this EIS. The following topsoil management measures will be applied: • topsoil will be stripped to depths in Table 10.44 of the EIS only when moist and stockpiled a maximum of 3 m high; • topsoil stripping will immediately precede construction to minimise the time that bare subsoils are exposed; • ameliorants for each soil type will be applied as per the Soils and Land Capability Report; • topsoil that is to be stockpiled for longer than 3 months with be stabilised with an annual cover crop; and • prior to re-spreading stockpiled topsoil, weeds will be removed.
12. Life of Mine and Rehabilitation	
Rehabilitation of the Springvale Coal Services Site is conducted in accordance with Industry Standards.	Progressive rehabilitation will be undertaken in accordance with the Rehabilitation Strategy appended to this EIS. Within 6 months of approval, the Mining Operations Plan will be updated to include the rehabilitation requirements outlined in the Rehabilitation Strategy of this EIS,
13. Hazards	
Safety of the underground personnel from the underground strata will be maintained.	The existing Hazard Plan, being part of the Strata Failure Management System, will be maintained and updated on an ongoing basis as required, in accordance with the Clause 28b (ii) of the *Coal Mine Health and Safety Regulation 2006*.

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7.0 APPENDICES

Appendix 1 – Angus Place Community Submission Reference Table

Appendix 2 – Angus Place and Springvale Regional Water Quality Impact Assessment (RPS 2014a)

Appendix 3 – Angus Place LDP001 Site Specific Trigger Values (RPS 2014b)

Appendix 4 – Revised Regional Biodiversity Offset Strategy (RPS 2014c)

Appendix 5 – Angus Place Response to TIA Submission (Aigis 2014)

Appendix 6 – Angus Place and Springvale Height of Fracturing Report (DgS 2014)

Appendix 7 – Angus Place and Springvale Height of Fracturing Peer Review (MSEC 2014)

Appendix 8 – EPA Letter to Centennial Coal (25 July 2014)

Appendix 9 - Springvale EPA Water Quality and Toxicity Assessment Interpretive Report (GHD 2014a)

Appendix 10 – Coxs River Ecotoxicology Assessment (GHD 2014b)

Appendix 11 - Kangaroo Creek Swamp Photo Monitoring

Appendix 12 – Angus Place Total Discharge Volumes (RPS 2014d)

Appendix 13 – Centennial Response to IESC Report: Ecological Characteristics, Sensitivities to Change, and Monitoring and Reporting Techniques

Appendix 14 – Centennial Response to IESC Report: Evaluation of Mitigation and Remediation Techniques

Appendix 15 – Centennial Response to IESC Report: Longwall Mining Engineering Design – Subsidence Predictions, Buffer Distances and Mine Design Options

Appendix 16 – Detailed Response to IESC Advice Water Issues (RPS 2014e)

Appendix 17 – Angus Place and Springvale Height of Fracturing Estimation (Hydro Simulations (2014)

Appendix 18 - Geology of Shrub Swamps within the Mine Extension Areas

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