16 February 2022

Independent Planning Commission NSW
Attention: Mary O'Kane, Panel Chair
C/- Brad James A/Planning Director
Suite 15.02 Level 15, 135 King Street
Sydney NSW 2001
Via Email: bradley.james@ipcn.nsw.gov.au

Dear Mrs O'Kane,

RE: RESPONSES TO MATTERS FROM THE NARRABRI UNDERGROUND MINE STAGE 3 EXTENSION PROJECT VIRTUAL SITE TOUR AND BRIEFING

Narrabri Coal Operations Pty Ltd (NCOPL) presented a virtual site tour to the Independent Planning Commission (IPC) on 2 February 2022 and attended a briefing on 4 February 2022 regarding the Narrabri Underground Mine Stage 3 Extension Project (the Project). These videoconferences provided opportunities for the IPC to ask questions regarding the existing/approved Narrabri Mine and the Project.

NCOPL took various questions on notice during the virtual site tour and briefing, and responses to these queries, as well as further detail in response to the queries included in the briefing agenda provided by the IPC are provided below.

IPC Virtual Site Tour

Matter

The IPC queried the differing colours apparent in aerial photography showing the water management dams and storages at the Pit Top Area at the Narrabri Mine.

Response

The water management dams and storages contain water from different parts of the Narrabri Mine. These include raw water imported from the Namoi River and bore, mine affected water, water from sediment dams, water used in the coal handling process, treated water and brine.

The different chemical composition and sediment content of each of the water types stored at the site leads to the different colours shown in the photos. Furthermore, the coloured lining of the water management dams and storages can also affect the colours shown in the photos.

Matter

The IPC queried the name of the creek located north of the rail loop.

Response

The creek directly north of the rail loop is officially unnamed however is referred to as Kurrajong Creek Tributary 1 for assessment purposes.

Matter

The IPC requested further details regarding the design of the reject emplacement area.

Response

The reject emplacement area is an existing/approved landform which is currently being developed and progressively rehabilitated. The New South Wales (NSW) Resources Regulator has recently been promoting the implementation of geomorphic landform designs for mine landforms in NSW. When consulting with the NSW Resources Regulator during the response to submissions stage of the Project, NCOPL committed to investigating the incorporation of geomorphic design features into the reject emplacement area.

The reject emplacement has undergone an updated conceptual redesign to incorporate geomorphic design features, with the Resources Regulator being satisfied with the concept that was presented to them in late 2021.

Final landform evolution and erosion modelling is underway and is being undertaken by ATC Williams to assist to demonstrate a low erosion potential of the reject emplacement area.

Matter

The IPC queried if the resulting surface slopes of the grazing areas affected by subsidence are suitable for ploughing/cultivation.

Response

The agricultural land use in the vicinity of the Narrabri Mine is primarily sheep and cattle grazing, with opportunistic fodder cropping, undertaken only on favourable soil conditions during periods of good rainfall.

Within active mining and subsidence areas, any cropping would be temporarily ceased. Following mining, management, planning and action may be needed to minimise erosion through repairing of residual soil cracks and managing any areas of poor drainage.

Larger surface cracks that cannot be filled by surface ripping or grading would be filled using excess subsoil material from stockpiles maintained at nearby gas drainage or ventilation sites or excess subsoil material from the reject emplacement area.

Following this remediation process, the original land use, which may include opportunistic cropping in some areas, could recommence.

Based on the nature of the cropping experienced in the general vicinity of the Narrabri Mine, including on a hill overlying the 200 series longwalls, fodder cropping is expected to remain opportunistic based on favourable soil conditions and period of good rainfall in areas affected by subsidence.

Matter

The IPC queried whether biodiversity surveys for the Koala on areas adjacent to the Project had been undertaken.

Response

Comprehensive biodiversity surveys were undertaken by AMBS Ecology and Heritage (2020)[1] as part of the Biodiversity Development Assessment Report (BDAR) (Resource Strategies, 2021)[2] for the Project.

Furthermore, several previous fauna surveys have occurred at the Narrabri Mine, including previous targeted surveys for the Koala.

[1] AMBS Ecology and Heritage (2020) *Narrabri Underground Mine Stage 3 Extension Project – Fauna Survey Report.* Prepared for Narrabri Coal Operations Pty Ltd.
[2] Resource Strategies Pty Ltd (2021) *Narrabri Underground Mine Stage 3 Extension Project Biodiversity Development Assessment Report.*

During these surveys, no Koalas were identified, however some Koala scats were recorded.

In NSW, west of the Great Dividing Range, Koalas occur in the Pilliga East State Forest and in the Gunnedah area with smaller groups elsewhere (Department of Environment and Climate Change, 2008)[3]. Figure 1 shows the Koala distribution map based on DPIE records. This indicates that the Koala records are generally scarce in the vicinity of the Project, and more densely recorded in various other areas.

Matter

The IPC queried if there is bat habitat within the Project area (except for Bulga Hill).

Response

The majority of the Large-eared Pied Bat and Eastern Cave Bat habitat within the Project area is located at Bulga Hill as indicated by Figures 26 and 27 of the BDAR. Bulga Hill is also the only area to contain known roosting and breeding habitat for the Eastern Cave Bat in the vicinity of the Project.

Matter

The IPC queried if the Rural Fire Service (RFS) or Forestry Corporation of NSW (FCNSW) raised any potential issues regarding the proposed flaring for the Project.

Response

The RFS and the FCNSW have been consulted regularly over the course of the Project.

The RFS was consulted regarding the proposed use of flares to manage mine gas and reduce greenhouse gas emissions. Subsequent to this, RFS recommended that a Bushfire Management Plan be prepared for the Project.

Furthermore, following earlier consultation, the FCNSW requested further details regarding the use of flares and requested to be consulted with when preparing flare management procedures.

NCOPL would prepare the Bushfire Management Plan in consultation with the RFS and the FCNSW.

In addition, a Bushfire Management Plan is included in the recommended conditions for the Project (Condition B58).

Matter

The IPC requested that NCOPL provides the recovery efficiency of the reverse osmosis plant.

Response

There are two RO plants that currently operate at the Narrabri Mine, RO1 and RO2.

RO1 has a 70/30 split of permeate to concentrate, or brine, whilst RO2 has an 80/20 split of permeate to concentrate, or brine.

[3] Department of Environment and Climate Change (2008) *Recovery plan for the koala (Phascolarctos cinereus)*.

IPC Briefing

Matter

The IPC queried the extent of the goaved area that would be used for brine re-injection.

Response

As described in the Groundwater Assessment (Australasian Groundwater and Environmental Consultants Pty Ltd [AGE], 2020)[4], brine re-injection is likely to occur over a period of three years post-mining via a series of 20 re-injection bores targeting goaf areas towards the southern end of the 100 series and northern end of the 200 series panels. The indicative locations of the brine reinjection boreholes are shown on Figure 2. As shown on Figure 2, re-injection would be undertaken above several of the mined-out longwall panels.

IPC Briefing Relevant Agenda Items

Matter

The IPC stated:

> *Are there examples of re-injection of brine at other Australian coal mines that provide anything we can learn from?*

Response/Explanation (prepared with assistance from AGE)

Whilst post closure re-injection of brine has previously been approved in a number cases (including at the Narrabri Mine), AGE are not aware of any Australian coal mines where actual re-injection has taken place, since none of the mines at which brine re-injection has been approved have been closed.

Furthermore, it is noted that the Independent Advisory Panel for Underground Mining (IAPUM) (IAPUM, 2021)[5] concluded the following:

> *It is therefore reasonable to consider that any brine reinjected into the goaf at the mining depth will effectively be trapped in the mine with little prospect for contaminating any of the surrounding shallow aquifer systems.*

Matter

The IPC stated:

> *The analyses in the EIS and beyond have adopted a relationship between Total Dissolved Solids and Electrical Conductivity of 0.6. Will this apply to mine water from the Hoskissons Seam which from the Piper diagram in Figure 5.9 appears to contain principally carbonates? What will be the effect on salt mass balances and other predictions?*

Response/Explanation (prepared with assistance from AGE and WRM)

The relationship between electrical conductivity (EC) and Total Dissolved Solids (TDS) historically adopted for the Project was originally based on water quality data in the Namoi River at the Turrawan gauge obtained from the NSW government. The historical Namoi River data suggests the relationship at this location was about 0.58. No site data was available to confirm this result. A value of 0.6 was adopted, slightly higher than the Namoi River data. The water balance modelling undertaken to date has used EC as a surrogate for TDS using this ratio and this has been applied to all water sources including from the Hoskissons Coal Seam.

[4] Australasian Groundwater and Environmental Consultants (2020) *Narrabri Underground Mine Stage 3 Extension Project – Groundwater Impact Assessment.*
[5] Independent Advisory Panel for Underground Mining (2021) *Advice Re: Narrabri Underground Mine Stage 3 Extension Project.*

TDS values which have been calculated from field EC values have been adopted in the EIS since not all samples are submitted for laboratory analysis and hence the size of the EC data set significantly exceeds that of the laboratory TDS data set. Furthermore, the field EC data provides a more direct indicator of *in situ* salinity, since chemical changes can occur between sampling on site and testing in the laboratory.

If the EC/TDS relationship is different to 0.6 for the Hoskissons Coal Seam water, then the volume of salts stored in the mine water dams will be proportionally different. This difference has no material impact on the water balance, the management of the dewatered groundwater or to the downstream environment for a number of reasons:

- The water management system is operated as a closed loop with salts from the dewatered groundwater never being released to the downstream environment. NCOPL has been operating this strategy successfully for a number of years.
- The existing water treatment plant specifications have been developed using the ionic composition of water from the Hoskissons Coal Seam as the basis for design. The dewatered groundwater quality is not expected to change for the Project and as such the treatment plant is expected to operate as designed for the Project as it has operated successfully for several years.
- The water treatment plant can be upgraded/altered for any future (and unexpected) change to the dewatered groundwater quality so that the brine and filtered water stream volumes remain essentially the same as has been predicted by the water balance. Therefore the water balance would remain the same.

Furthermore, due the nature of the mass balance calculations, the predicted impacts of brine re-injection reported in Section 7.8.2 of the Project Groundwater Assessment (AGE, 2020) are not sensitive to the conversion from EC to TDS. Any changes in the adopted background *in situ* TDS concentrate would affect predicted concentrations with and without re-injection equally. For instance, if the current *in-situ* TDS in the Hoskissons Coal Seam was double that currently estimated for the purposes of the calculations (Table 1) then the predicted concentrations with and without re-injection would both increase by almost the same amount. Accordingly, as shown in Table 2 the predicted long term increase in goaf TDS of 1,392 milligrams per litre (mg/L) (i.e. the difference between the predicted concentration with and without re-injection) assuming a background TDS in the Hoskissons Coal Seam of 7,477 mg/L (rather than 3,739 mg/L) is almost identical to that reported in the EIS.

Table 1
Brine Re-injection Water Quality Impact Assessment (see Table 7.8, AGE, 2021)

Inflow component	With brine re-injection		Without brine re-injection	
	Inflow volume (ML)	TDS Concentration (mg/L)	Inflow volume (ML)	TDS Concentration (mg/L)
Re-injection	2,830	76,554	0	NA
Lateral inflow (Hoskissons Coal Seam)	4,367	3,739[a]	4,459	3,739[a]
Overlying strata (Digby Formation)	80,171	6,453[a]	81,855	6,453[a]
Underlying strata (Arkarula Formation)	50,248	12,884[a]	51,303	12,884[a]
Total volume and average concentration	137,617	10,157[b]	137,617	8,763[b]

[a] TDS estimated from average EC data and applying a conversion factor of 0.67 to convert from EC to TDS. In he absence of actual EC data for the Digby Formation data for the overlying Napperby Formation has been used.

[b] Long-term average predicted TDS concentration in the goaf. Calculated using the total estimated mass of solids present within the goaf divided by the total volume.

Table 2
Brine Re-injection Water Quality Impact Assessment – Increased Hoskissons Coal Seam TDS scenario

Inflow component	With brine re-injection		Without brine re-injection	
	Inflow volume (ML)	TDS Concentration (mg/L)	Inflow volume (ML)	TDS Concentration (mg/L)
Re-injection	2,830	76,554	0	NA
Lateral inflow (Hoskissons Coal Seam)	4,367	7,477[a]	4,459	7,477[a]
Overlying strata (Digby Formation)	80,171	6,453[a]	81,855	6,453[a]
Underlying strata (Arkarula Formation)	50,248	12,884[a]	51,303	12,884[a]
Total volume and average concentration	137,617	10,278[b]	137,617	8,887[b]

[a] TDS estimated from average EC data and applying a conversion factor of 0.67 to convert from EC to TDS. Hoskissons background TDS assumed to be twice that previously estimated (Table 1) for the purpose of confirming he lack of sensitivity of predicted impact to potential conversion errors.
In the absence of actual EC data for the Digby Formation data for the overlying Napperby Forma ion has been used.

[b] Long-term average predicted TDS concentration in the goaf. Calculated using the total estimated mass of solids present within the goaf divided by the total volume.

Matter (prepared with assistance from AGE)

The IPC stated:

> *Can a more detailed description be provided of the groundwater recovery process after mine closure when brine is re-injected and groundwater flows around the mine are reestablished? How effective will the trapping of the salt content of the rejectate be in the goaf and what dependency do predictions have on assumed values of horizontal and vertical permeabilities of the goaf and proximate formations and atmospheric events?*

Response/Explanation

As described in Section 7.8.2 of the Project Groundwater Assessment (AGE, 2020), since the solids entrained in the brine were previously extracted from the Hoskissons Coal Seam during the mining operation then the proposed re-injection effectively returns these solids back into the coal seams, although in a more concentrated form. Groundwater model predictions suggest that whilst groundwater levels will slowly recover in the coal seams, as water re-enters the unsaturated workings, groundwater flow will remain towards the workings for a period of around 200 years. During this period, hydraulic gradients would remain towards the mine leading to the gradual dilution of the brine *in situ* as generally lower TDS groundwater is drawn in from surrounding strata. Once the goaf has filled, after around 200 years post closure, numerical results suggest that a downward gradient across the Hoskissons Coal Seam will be established such that some of the slightly elevated TDS (10,157 mg/L) water within the goaf may begin to seep downward into the overlying strata (the Arkarula Formation). However, groundwater in the Arkarula Formation is currently quite saline. As summarised in Table 5.10 in the Project Groundwater Assessment (AGE, 2020), the average field EC is 19,230 µS/cm suggesting a TDS of around 12,884 mg/L. Hence this seepage from the goaf would be expected to slightly improve the water quality in this underlying unit.

With regard to the effectiveness of the containment of the brine in the goaf, whilst there is no physical barrier, in addition to the hydraulic gradient towards the workings the relatively high permeability, porosity and hence interconnectivity of the goaf and the relatively high density of the brine will also tend to promote *in-situ* dilution, rather than migration. Some dispersion (i.e. flow of matter from areas of high to low concentration) is possible but this would be expected to be insignificant, especially in comparison to the volume of water present in the surrounding strata.

Finally, the impact predictions are also relatively insensitive to the horizontal and vertical permeabilities of the goaf and proximate formations or recharge. Variation in any of these parameters will affect the proportion of flow entering the goaf either laterally or vertically and/or the time taken for the goaf to fill. However, since estimated TDS in the Hoskissons Coal Seam and other proximate formations are quite similar, and substantially lower than the predicted TDS concentration in the brine, then predictions are significantly more sensitive to the ratio between:

- the background TDS concentration in the Hoskissons Coal Seam and the brine; and
- the total volume to be injected and the total storage volume of the goaf.

Matter (prepared with assistance from AGE)

The IPC stated:

> *What would the feasibility be of following the approach used in the Narrabri Gas Project and recovering crystallised salt from the brine, given that the salt appears to be predominantly carbonates, offering the possibility of beneficial use?*

Response/Explanation

Whilst beneficial use of salt products derived from brine is a possibility, ultimately the feasibility or otherwise of re-use rather than disposal will depend on a range of economic and other factors which apply at the time of mine closure in 2044. Recognising this difficulty, draft condition B35 (iii) for the Project requires that NCOPL undertake "*a program to regularly review brine management and identify any beneficial use options for brine, treated water and mine water*".

Matter

The IPC stated:

> *Is it feasible to arrange the pre-extraction de-gassing and coal extraction process to blend drainage gas from different locations to make it amenable to flaring?*

Response/Explanation

As described in Section 3.3.1 of the Amendment Report (NCOPL, 2021), each flare is expected to be connected to a number of pre-drainage boreholes (i.e. the gas drainage streams would be combined prior to flaring). Consequently, it is expected that up to approximately three flaring units could be in operation at any one time when mining within the areas where gas conditions support flaring.

Matter

The IPC stated:

> *Are the baseline figures for emissions proposed in paragraph 378 of the Department's Assessment reasonable and workable?*

Response/Explanation

The baseline figures for Scope 1 greenhouse gas emissions are based on the estimates provided by Jacobs (2021) for the Amendment Report.

Furthermore, Conditions B18 and B19 of DPIE's recommended Development Consent includes a requirement to prepare and implement a Fugitive Emissions Minimisation Plan within 12 months of commencing development and then every 3 years during the life of mining operations. This plan requires NCOPL to continue investigating reasonable and feasible measures to reduce fugitive emissions, which includes methane ventilation, air methane destruction, methane enrichment and low methane concentration power generation.

Matter

The IPC stated:

> *The Narrabri UG3 Project is operating on the Hoskinssons Seam and states that due to the high concentrations of CO2 the mine is not amenable to flaring. However, the Narrabri Gas Project is recovering at least 5% of gas from the same seam and it has a high methane content.*

Response/Explanation

As noted in the Amendment Report, flaring is proposed in areas of the mine where methane content is greater than 30%.

NCOPL notes that the methane content of the Hoskissons Coal Seam generally increases to the west of the underground mining area as shown in Figure 6 of the Amendment Report[6]. NCOPL does not hold gas data to the west of the Project, however, understands that the Hoskissons Seam is targeted for gas extraction as part of the approved Narrabri Gas Project. Notwithstanding, gas extraction from the Hoskissons Coal Seam would represent only 5% of the extraction for the Narrabri Gas Project, with the other 95% extracted from the Maules Creek Formation[7].

Matter

The IPC stated:

> *Tell us about ongoing rehabilitation and what will happen if the Project goes into care and maintenance.*

Response/Explanation

Any future 'care and maintenance' of the mine would not absolve the requirement to progressively rehabilitate the site. Whitehaven are well versed in this practice at various other mines including smaller open cut sites such as Sunnyside and Rocglen. The rehabilitation and closure phases are well established at these sites after periods of care and maintenance.

Matter

The IPC asked whether NCOPL has a Waste Management Plan.

Response/Explanation

NCOPL has a Waste Management Plan, which is available on its website:

https://whitehavencoal.com.au/Documentations/Narrabri%20Mine/Environmental%20Management,%20Monitoring%20&%20Compliance/Environmental%20Management%20Plans,%20Strategies%20and%20Programs/NAR-MP-Waste%20Management%20Plan.pdf

The Waste Management Plan details measures to be adopted for waste management including waste minimisation, recycling, re-use and disposal.

Matter

In questions provided to the IPC, Lock the Gate asked:

> *16. Question for Paul Flynn from WHC: why hasn't WHC managed to reduce the emissions intensity per tonne of ROM coal mined across its business over the last five years?*
>
> *a. So-called 'reasonable and feasible' Scope 1 and 2 mitigation measures are in place at all of the proponent's (WHC) coal mines in NSW. These measures are demonstrably failing to improve the environmental performance of these mines. WHC's Sustainability Report 2021 confirmed that the emissions intensity per tonne of ROM coal mined has increased year on year for the last five years in a row. WHC's own analysis of the emissions performance of their mines finds no link at all between the implementation of 'reasonable and feasible' measures and emissions reduction. Where total Scope 1 and 2 emissions decrease, this decrease is not attributed to mitigation measures, but to "lower production across our mines resulting in lower fugitive emissions*

[6] Narrabri Coal Operations Pty Ltd (2021) *Narrabri Underground Mine Stage 3 Extension Project Amendment Report.*
[7] Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (2017) *Advice to decision maker on coal seam gas project IESC 2017-086: Narrabri Gas Project (EPBC 2014/7376; SSD 6456) – New Development.*

Response/Explanation

We note that this question relates to existing Whitehaven mines (including the Narrabri Mine), rather than the Project. Notwithstanding, since the Sustainability Report 2021, Whitehaven has undertaken several additional measures to appreciably reduce greenhouse gas emissions, most notably use of certified carbon neutral electricity across our business. Looking forward the company is undertaking further steps to decarbonise our operations:

- Whitehaven has tendered (and about to award) the feasibility study work for a 10 Mega Watt solar farm at Narrabri.
- Whitehaven is undertaking an internal review with expert external support to review the business to ascertain further ways to decarbonise our operations.
- With regards to greenfield projects, we are working with our mine planners to reduce the carbon footprint of the mines.

Matter

Concern was raised at the IPC hearing regarding the potential for noise impacts associated with the operation of the southern ventilation complex.

Response/ Explanation

Potential noise impacts associated with the southern ventilation complex was carefully considered. Following preliminary noise modelling, the following mitigation measures were evaluated and adopted by NCOPL as part of the Project:

- Selection of ventilation fans in consideration of good practice sound power levels.
- Use of directional ventilation fans to transmit noise away from key receivers.

It is noted that with the abovementioned mitigation measures, compliance with the relevant noise criteria is predicted at receivers in the vicinity of the southern ventilation complex.

Matter

Concern was raised at the IPC hearing that the wombat was not considered as part of the Biodiversity Development Assessment Report (BDAR).

Response/ Explanation

The Common Wombat *Vombatus ursinus* was found during the EIS surveys[8]. It is not a listed species, however, all of the general fauna impact mitigation measures described in the BDAR also apply to this species.

Matter

It was stated at the IPC hearing that the Groundwater Assessment did not cumulatively assess the Project with the Narrabri Gas Project.

Response/ Explanation

This statement is incorrect, Appendix B of the EIS[9] included cumulative impact assessment with the Narrabri Gas Project. Please refer to Section 7.4.3 of that report.

[8] AMBS Ecology & Heritage (2020). *Narrabri Underground Mine Stage 3 Extension Project – Fauna Survey*. Attachment C of the BDAR.
[9] AGE Consultants (2020). *Groundwater Assessment Narrabri Mine Stage 3 Extension Project Prepared for Narrabri Coal Operations Pty Limited*.

Furthermore, it is noted in the IESC advice that (IESC, 2020)[10]:

> *9. The IESC notes that the proponent has incorporated impacts associated with the Narrabri Gas Project, using Santos' 'base case' scenario, into the cumulative impact predictions of the groundwater modelling. The IESC considers that this is an acceptable approach to assessing potential cumulative groundwater impacts at the site, noting the comments in Paragraph 3b*

Please do not hesitate to contact the undersigned on [redacted] if you wish to discuss.

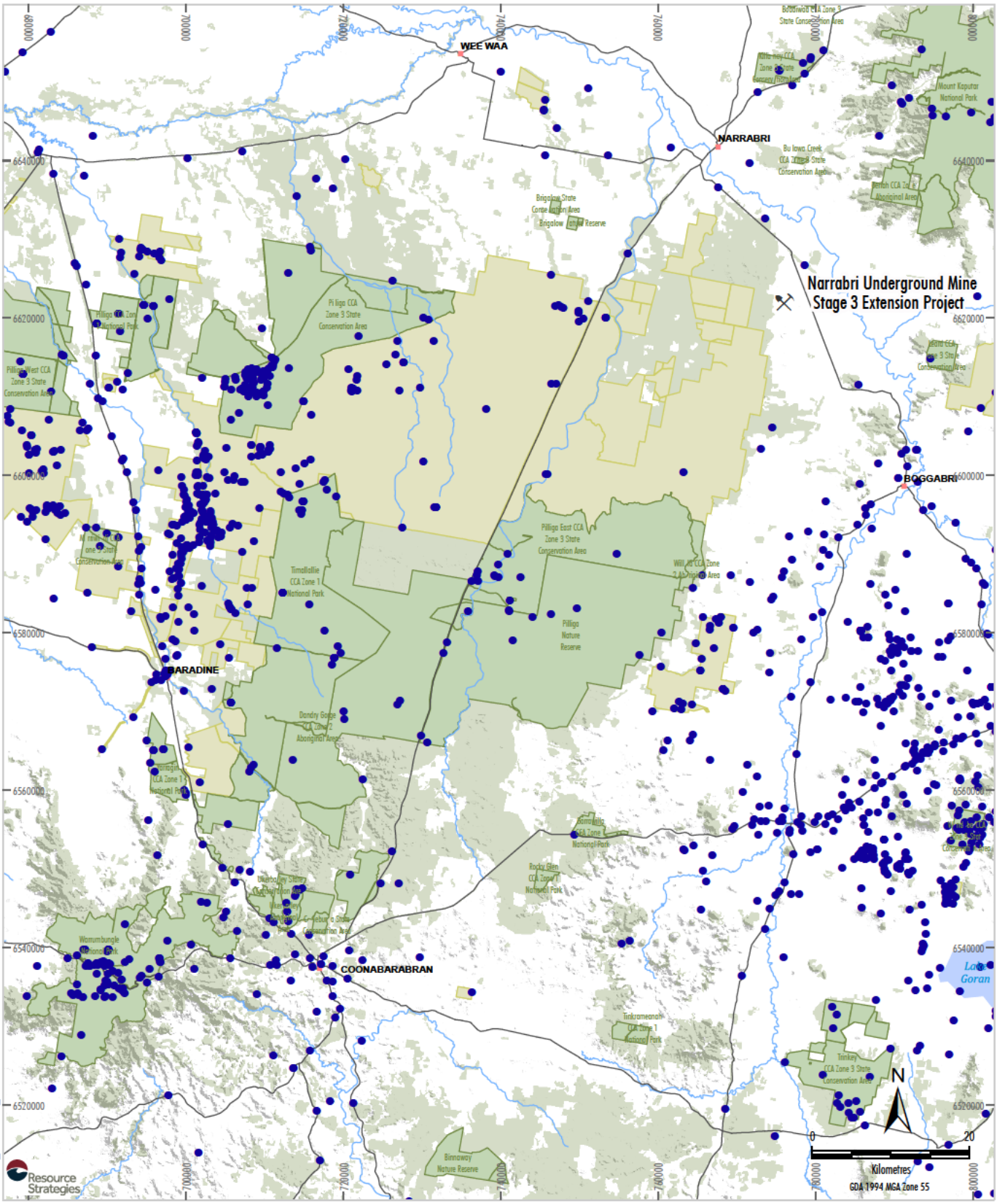
Yours sincerely

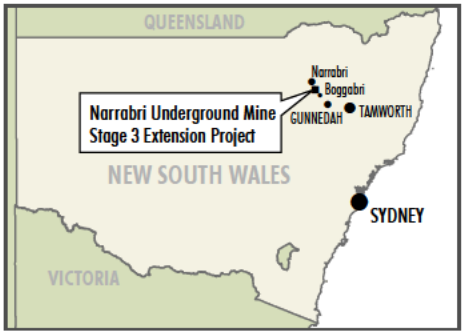
David Ellwood
Director, NCO Stage 3 Project

[10] IESC (2020) Advice to decision maker on coal mining project – IESC 2020-119: *Narrabri Underground Mine Stage 3 Extension Project (Narrabri Mine Extension) (State Ref No 9882) – Expansion*.

ATTACHMENT 1

FIGURES





LEGEND

- NSW Protected Area (NP&W Act)
- State Forest (Forestry Act)
- Major Roads
- Koala

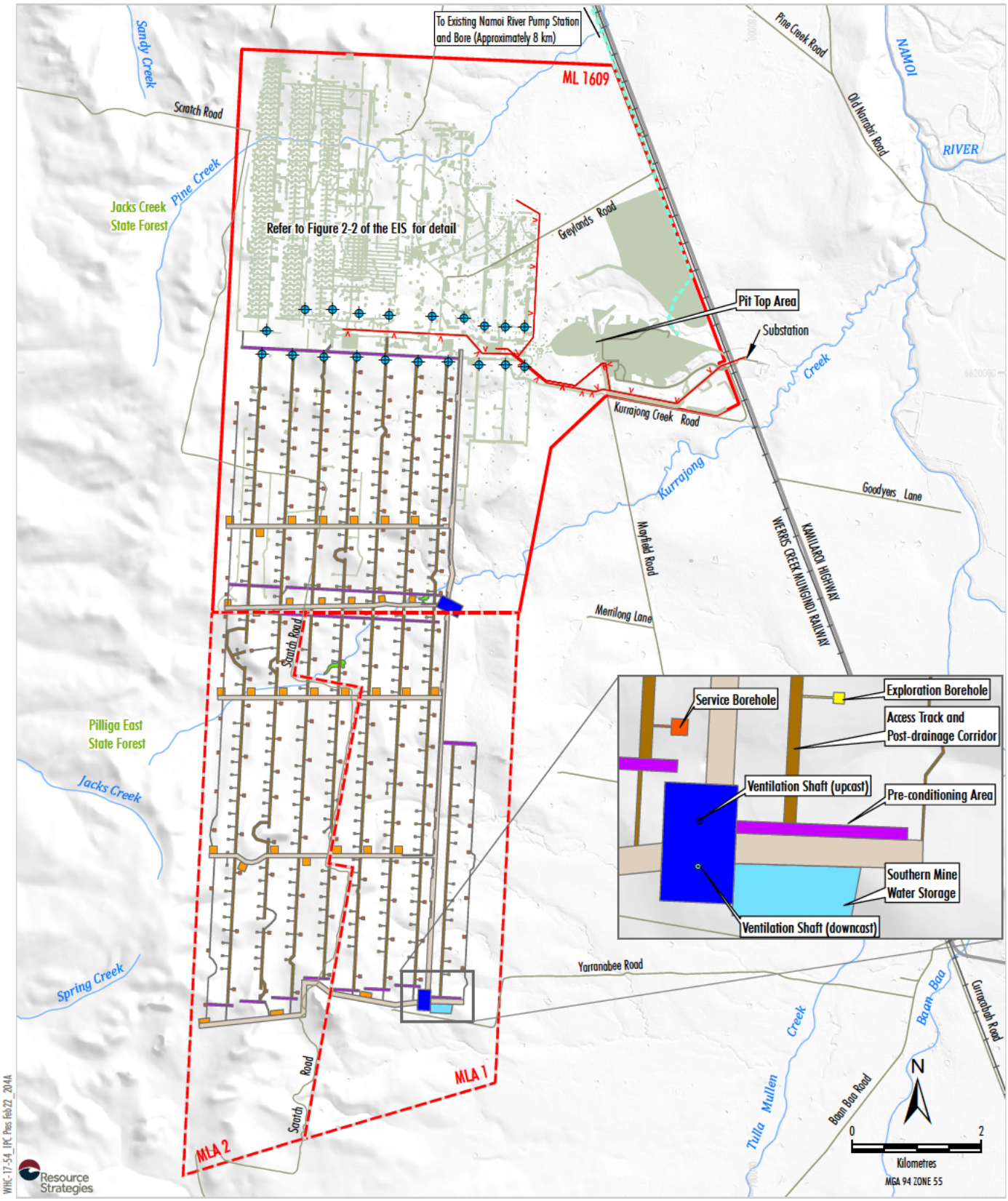
Source: Geoscience Australia - Topographic Data (2011); DPIE (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Koala Landscape Distribution

Figure 1



Source: NCOPL (2019; 2021); NSW Spatial Services (2019)

LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Electricity Transmission Line (Constructed)
- Existing Namoi River Pipeline (Buried)
- Modelled Brine Re-injection Boreholes

- Existing/Approved Surface Development*
- Services Corridor
- Service Borehole
- Exploration Borehole
- Access Track and Post-drainage Corridor
- Pre-conditioning Area
- Service Borehole and Power Reticulation
- Southern Mine Water Storage
- Ventilation Complex
- Farm Dam Decommissioning Works

*Excludes the Impact Reduction Area (Refer to Figure 2-12 of the EIS)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Modelled Brine Re-injection Boreholes

Figure 2