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Rocky Hill Coal Project – Application No. SSD 5156

Thank you for the opportunity to comment on the Environmental Impact Statement (EIS) for the Rocky Hill Coal Project. Climate Change Balmain-Rozelle is a collective of local parents and residents who come together out of mutual concern for Australia's excessive greenhouse gas emissions and the world our children will inherit. We have no political affiliation and our newsletters have a readership of 750.

We oppose the proposed Rocky Hill coal mine project near Gloucester NSW because it is uneconomic - its costs greatly outweigh its benefits.

The community of Gloucester, the wider Australian and international communities, together with every other species on the planet, cannot afford this mine. The environmental harms caused by this mine, and others like it, will eclipse any short lived economic benefits that might accrue to private individuals, corporations or taxpayers. The project imposes an unwanted, noxious industry on the township of Gloucester with adverse consequences for its health and economic sustainability over the short, medium and long terms and the contribution of this mine to the medium and long term damage from global warming and climate change will be, literally, catastrophic. Perversely, Australian taxpayers, private individuals and other businesses are expected to pay for this privilege granted to the coal industry.

NSW coal is unaccountable for its pollution. The business case for a new coal mine is attractive to a developer only because it transfers major costs to balance sheets external to the project.

Coal mining for export and local power generation is responsible for some of the most severe pollution in NSW with the hazy Hunter Valley at the epicentre. A recent report based on survey data from individual mine operators supplied to the National Pollutant Inventory indicates the contribution of the following pollutants freely emitted by the NSW coal industry in year 2013-2014 (Lock the Gate, March 2016):

Air pollution

- 25.9% of all reported arsenic pollution in NSW
- 32.8% of all reported volatile organic compounds (VOCs) pollution in NSW
- 77.3% of all reported PM10 particle emissions
- 53% of all reported PM2.5 particle emissions

Water pollution

- 60% of all reported arsenic discharges into water sources in NSW
- 23% of all reported lead discharges into water sources in NSW
- 77% of all reported Chromium III discharges into water sources in NSW
- 71% of all reported discharges of selenium and associated compounds into water sources in NSW

In July 1999 NSW introduced a new load-based licencing scheme (LBL) with annual reporting of pollution performance. According to the Environmental Protection Authority's website, this aims to institute a "polluter pays principle" and provide a powerful tool to help control, reduce and prevent air and water pollution in the state by the power of market forces.

The principle is good but the implementation is inconsistent. The LBL scheme applies to a number of pollutants historically associated with particular industries, but not all pollutants are assessable and not all industries regulated under the scheme.

While coal fired power stations are subject to LBL for particle emissions, the extraction, processing and transportation of coal is not. Nor are a number of major pollutants such as nickel, cobalt and salt which are mobilised by coal mining and released into streams and rivers; nor greenhouse gases like carbon dioxide and methane which are discharged directly into the atmosphere during the mining of coal.

If NSW coal was subject to the same load-based licencing scheme as other industries it would pay about $14 million a year for its licences to pollute (Lock the Gate, 2016). Even if the 56 odd NSW coal mines (NSW Mining, 2016) were licenced to pollute under the present LBL their fees would represent a fraction of the cost of damage caused by emissions they create.

These modest fees would not recompense the state for the cost of properly regulating and monitoring the operations of the coal mines and on their own they offer little economic incentive for mining companies to improve their environmental act.

They are much less than state and federal industry assistance to mining in the form of tax-based subsidies, public finance and direct contributions. The Australia Institute examined state government budget papers for direct payments, favourable tax treatment and infrastructure provision to the mineral and fossil fuel industries in the six-year period before mid-2014 (Peel, Campbell, and Denniss 2014). Their study shows state governments in Australia spent $17.6 billion supporting the industry. In New South Wales government assistance amounted to $873 million over the period, much of it spent on port infrastructure primarily benefiting the coal industry as well as research into 'clean coal'. The 2013-14 New South Wales budget papers contain $136 million of measures that assist the minerals and fossil fuel industries.

But these sums of money pale into insignificance in the face of growing understanding of the contribution of coal to global warming and climate change. In the last few decades the costs associated with carbon pollution from the burning of coal have grown dramatically and these are subsidised by taxpayers and holders of insurance policies to the value of trillions of dollars worldwide.

Subsidising industries that have become inefficient distorts markets and structurally disadvantages new, efficient and sustainable processes that would otherwise be developed.

Historically, the use of coal as a reducing agent and source of carbon in a blast furnace was seen as cost-effective but a better appreciation of the its environmental consequences shows its cost is too high. The longer governments subsidise the price of coal, the longer it holds back the development of more sustainable methods for making steel and the larger the damage bill we are left to deal with. The environment is completely agnostic about whether we are burning coal to drive steam engines, generate electricity or make steel. It doesn't recognise nation states or care whether our coal is burnt in Australia or shipped overseas. The earth is effectively a closed system in which physical and chemical processes occurring in the atmosphere, in the oceans and on the land are interconnected. The world as we know it depends for its continued existence on those processes continuing in the relatively benign and stable equilibrium that has applied for hundreds of thousands of years.

The chain of causality between ongoing combustion of fossil fuels, coal in particular, the greenhouse effect, global warming and serious climate effects is no longer disputed by any reputable body.

> *Engineers Australia accepts the comprehensive scientific basis regarding climate change, the influence of anthropogenic global warming, and that climate change can have very serious community consequences. Engineers have an ethical responsibility for, and play a key role in, limiting atmospheric greenhouse gas concentrations, through transformative change and innovation in engineering education, and practice (Engineers Australia, 2016).*

We know severe climate change will render our essential infrastructure vulnerable to damage from the intensification of extreme weather events. The Garnaut Climate Change Review in 2008 advised the Australian government that damage to

infrastructure and the need to rebuild it to withstand extreme weather events will come with a high economic price tag if we (and the rest of the world) delay in reducing carbon emissions.

Half of the world's population lives within 60 kilometres of the sea (UNEP, 2016) but in Australia 85% of us live within 50 kilometres of the coast (ABS, 2016). In among these coastal populations is located the great majority of the engineering infrastructure that provides the life support systems for 7.4 billion people.

Much of the world's infrastructure is now showing its vulnerability to storm, flooding and bushfire events, and a great deal more infrastructure is highly vulnerable to rises in sea level that will inevitably occur in the not too distant future.

Recent experience of extreme weather events has made these risks tangible, even to those Australians who had not been exposed to or persuaded by the scientific evidence. The bill for the clean-up after the 2011-12 Queensland floods was $5.6 billion, partly funded by a special levy on all Australian taxpayers earning over $50,000 pa.

Globally, recent years have provided a long series of broken temperature records and unprecedented weather events making the cost of climate extreme's abundantly clear. Hurricane Sandy in 2012 cost 233 lives and caused US$75 billion in damage, making it the second costliest weather disaster in US history after Hurricane Katrina in 2005 which cost US$108 billion and 1,245 lives. Super typhoon Haiyan struck the Philippines in 2013 and left 7,000 people dead and two million homeless. In 2016 we have seen unmanageable forest fires in the Arctic Circle and the Tasmanian alpine wilderness. Arctic sea ice has disappeared to the extent that a large cruise ship is currently sailing from Alaska to New York through the Northwest Passage.

In Australia in 2016 there have been unusually strong heat waves, bushfires, winds and floods disrupting electricity transmission infrastructure. We have watched the bleaching and subsequent death of large parts of the Great Barrier Reef, the wholesale death of coastal mangroves in the Gulf of Carpentaria and the death of large kelp forests on the coast of West Australia. In June 2016 a severe East Coast Low brought wind, flood and wave damage to Queensland, NSW and Tasmania. The damage bill for the Tasmanian flooding in June and July alone is assessed at $180 million (ABC, August 2016). Car and home insurance premiums are rising in response.

Given what we know about the costs of climate change GRL's claim that the risk of "climate change impact from the project, locally, regionally and worldwide" is "low" is nothing more than wishful thinking.

In coming to this extraordinary conclusion (EIS, Appendix 6: Analysis of Environmental Risks) GRL and its consultants formed the view that a climate change impact from the project (on site and off site emissions and those from shipping and combustion) was "unlikely". They also formed the view that the consequence of any such climate change, if it were to occur, would be "insignificant".

To be clear, the proponents are assessing the environmental impact of a new coal mine they estimate will produce 21 million tonnes of coal - an estimated 95% of which will be metallurgical product and 5% thermal. They expect all activities, from extraction to combustion (but ignoring the emissions generated from shipping the product overseas) will emit the equivalent of 38 million tonnes of CO_2 over 16 years and ninety-five percent of this is actual CO_2, released during "energy production" by combustion:

Table 4.25
Summary of Estimated CO_2-e (tonnes) – All Scopes

Emission Type*	Maximum Year (t/CO_2-e)	Minimum Year (t/CO_2-e)	Average (t/CO_2-e)	Life of Mine (t/CO_2-e)
Scope 1				
Diesel	28 994	10 839	22 006	418 110
Fugitive Methane	97 200	0	71 213	1 139 400
Vegetation Stripping	706	0	706	9 175
Total Scope 1	**125 274**	**10 839**	**82 457**	**1 566 685**
Scope 2				
Electricity	18 623	0	12 731	241 891
Total Scope 2	**18 623**	**0**	**12 731**	**241 891**
Scope 3				
Diesel	1 487	556	1 129	21 442
Electricity	2 660	0	1 819	34 556
Energy Production	3 159 959	0	1 904 599	36 186 627
Rail	3 541	0	2 134	40 546
Total Scope 3	**3 167 564**	**556**	**1 909 641**	**36 283 171**
Note* Totals provided represent the maximum, minimum and average year totals over the life of the amended Project.				
Source: Pacific Environment (2016a) – Modified after Table 18.1				

These numbers need some perspective. The annual CO_2 emissions from Australia per head of population was 16.3 tonnes in 2013 (after climbing to twice the 1960 rate). A community minded Australian paying extra for green power and making a conscious effort to use public transport will be disappointed to learn that they would need emit no CO_2 at all for each of the next 146,057 years to offset the greenhouse gases GRL calculates this one mine will produce in just one year. They will also be dismayed to learn that, while GRL considers its mine's contribution to climate change "unlikely and insignificant", these individual's own efforts are 146,057 times more insignificant! But the per capita emissions of Australians are hardly average in world terms. Our near neighbours in Vanuatu, for example, have an annual CO_2 footprint of 0.4 tonnes - and quite a lot at stake from sea rise due to global warming.

Many would have cause to wonder if this EIS risk assessment is not highly subjective at best, cynical at worst, but certainly based on an internal logic out of step with community expectations of corporate responsibility.

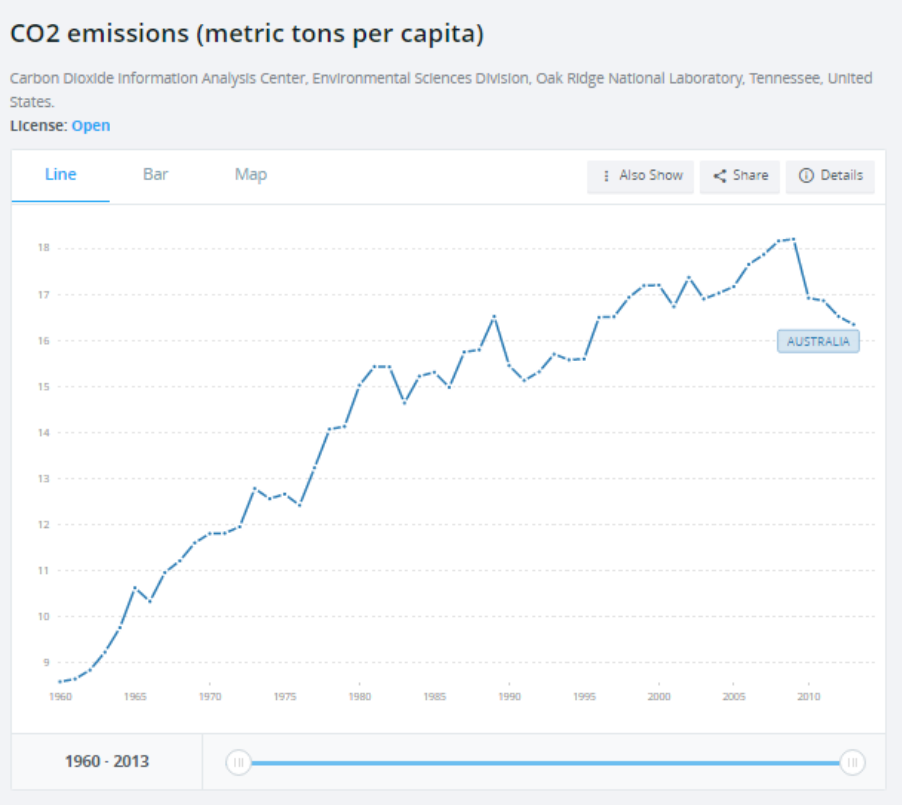
This assessment of the climate risk from the mine by GRL is perhaps the most striking example of an approach throughout the EIS that speaks from an amoral, letter-of-the-law logic of business which believes that if something is legal and money is to be made, it should be pursued. This logic demands the compartmentalising of a whole category of wider issues, set aside because they are out of scope - somebody else's concerns. It is somebody else's responsibility to worry about the effects of climate change. It is somebody else's responsibility to prove the adverse health impacts of coal mining. Somebody else can try and refute the 'can do' engineering solutions they offer in their EIS with the help of hired consultants.

When a community faces an existential problem and there is a critical mass of support for action social logic says that neighbours combine their resources and work together. They do this not for individual advantage but for the good of the whole. Individually their resources are small, insignificant even, but combined they are considerable and in the long run they can prevail.

The problem of climate change is the classic case of "tragedy of the commons". It is the NSW government's job to protect the commons and reject this mine.

The atmosphere and the oceans that control the climate and support almost all life on the planet know no borders. They are the common property of all their stakeholders: all life on Earth in its full diversity. Our species as a whole, including those who pretend otherwise for selfish reasons, now understand the environmental services provided freely for so long to every living thing are not boundless and have been ill-used by our own species through ignorance, greed or both. We know our atmosphere and oceans are rapidly losing their capacity to fulfil their fundamental role of providing a benign climate conducive to life on Earth for present and future generations. We also know that we are responding too slowly.

Engineers have presided over the problem of climate change, governments have failed to lead a timely response and every living thing is paying the price. Now the responsibility falls back on the community.



We can see from the graph that when the cost of GHG pollution was acknowledged and priced into the cost of a product CO_2 emissions slowed and then fell in this country in the second full year of the carbon price to June 2014. A number of factors contributed to this fall, including the closure of large, old and inefficient industrial plants, but change also happened at an individual level with millions of households switching to energy efficient light globes and appliances and many installing solar panels. Some people would have taken these steps out of economic self-interest but many others did it gladly from a sense of personal responsibility, in solidarity with humanity and out of concern for their children's future. Collectively, we can say categorically, these effects were "significant".

The current version of the World Bank's graph does not show what happened when the carbon price was removed by the new Australian government. GHG emissions rose by 0.8% in 2015 and appear set to continue rising well beyond 2020 on current trends, according to a report by RepuTex. Government and Community action will be required to change this situation in the near future when the cost of carbon pollution will be again be brought to book. If it is not successful in this country, it will be imposed from abroad.

On September 20, 2016, 376 members of the United States National Academy of Sciences, including 30 Nobel laureates, published an open letter to draw attention to the serious risks of climate change. US president Obama has stated his belief that no challenge poses a greater threat to our children, our planet, and future generations than climate change. The NSW government should take heed.

In the United States, the EPA and other federal agencies use the social cost of carbon (SC-CO2) to estimate the climate benefits of rulemakings. The SC-CO2 is an estimate of the economic damages associated with a small increase in carbon dioxide (CO2) emissions, conventionally one metric ton, in a given year. This dollar figure also represents the value of damages avoided for a small emission reduction (the benefit of a CO2 reduction). Like all modelling, the SC-CO2 has its limitations and the US EPA admits it does not include all important damages but considers it "a useful measure to assess the benefits of CO_2 reductions".

If we are to apply the SC-CO2 using a 2015 rate of USD 36.00 per tonne of CO_2 to estimate the damage caused by 38 million tonnes of Rocky Hill CO_2-e emissions in today's prices, the damage bill in the view of US EPA comes to US$1,368,000,000.

Clearly, in the view of US EPA at least, thirty-eight million tonnes of greenhouse gases is not, as GRL claims, "unlikely to impact climate change" and neither is it of "insignificant consequence" in its contribution to climate damage.

Introducing its *Upper Hunter Air Particles Action Plan*, the NSW Environmental Protection Authority affirms that "air quality … with a particular focus on particle emissions from coal mining, is a priority for both the EPA and the local community" (NSW EPA, 2016). In response to growing concerns about impacts on health and amenity associated with particulate matter

(PM) emissions from coal mining, NSW EPA has established a "high-level Interagency Taskforce on Air Quality in the Hunter" to address community concerns about air quality in the region, provide information to local communities on air quality and reduce particulate matter emissions from coal mining.

A new monitoring network is proposed for the Upper Hunter to consist of up to 14 high-quality ambient air quality monitoring stations around mining areas and population centres to give "accurate, quality assured and up-to-date data" to the community on regional air quality. When fully operational this, together with data on wind speed and direction, will be up-dated on the website hourly to provide a continuous information stream to the community, industry and government.

The mining industry is happy to keep receiving taxpayer subsidies but not so keen about regulatory scrutiny.

In a submission to the Inquiry into the Performance of the NSW Environment Protection Authority, the Minerals Council complained that "strategies and programs to improve air quality have been skewed towards coal related activities" and the government was only spending $1m on programs to address the bigger problem of pollution from wood fired home heating (NSW Mining, 2014). Their concern was the "increasing EPA regulatory intervention" aimed at mining, including a new fee structure for risk-based licencing that would see operators breaching their environmental obligations pay higher on-the-spot fines and environmental protection licence (EPL) fees. They were also unhappy about a proposal that would see the industry fund a regional air quality monitoring network in the Gunnedah basin.

The Rocky Hill mine EIS (4.17.6.2) acknowledges a "high level of concern" regarding health impacts of dust in its 2013 "Community Perception survey", and "growing community concern generally about impacts … on population health". The choice of wording around the subject of health impacts throughout the EIS is unmistakable. The proponent (with the advice of fee-for-service experts) admit there are community perceptions of health problems with coal mining and even that dust exposure is harmful. But, in the absence of large (and no doubt expensive) longitudinal studies of the population that control for a multitude of predictor variables in the general population, they feel confident in asserting that the non-occupational health risks associated with coal mining are pretty low.

Seventy separate environmental issues were assessed in the EIS and their level of risk identified as follows:

Level of risk	No. of issues
Critical	0
High	6
Medium	16
Low	48

Where business objectives, data and literature are clear and unequivocal around an issue and the dangers are thought to be well understood, the risk may be assessed as low. This does not mean that the dangers are low – it means management believe they have recognised and understand all the risks and can control them effectively.

This belief is based on an assumption that industry "standard control measures" are effective but that, if necessary, additional "site-specific controls" will be devised (and implemented) to lower these risks, **but we need to understand that the outcomes of risk assessments across different aspects of a business inevitably involve balancing, or compromising between, competing business objectives and their respective success criteria.**

The business objective and task that is the subject of this EIS is "… the safe and environmentally responsible construction and operation of the amended project".

When GRL management sat down with their environmental consultants to identify and rate the various environmental risks, their deliberations would have been informed by other business objectives and success criteria such as, presumably, an intention to trade profitably for the duration of the project. Not being privy to these business considerations, and the

detailed internal discussion and negotiation that doubtless went into the EIS, what we see simply reflects a final agreed position the parties were happy to put their names to.

As the table shows the proponent believes there is a total of 70 environmental risks they need to think about. Forty-eight of these they believe they fully understand and can control effectively (low risk), 16 they think they need to pay closer attention to (medium) and 6 they need to attend to very carefully (high risk). The identification of the risks involved in running a business, and setting up controls to manage them, is a fundamental principle of management.

A Risk Matrix is a useful management planning tool that can help identify issues of greater uncertainty for extra attention, but its role in the context of an environmental impact statement can easily mislead readers who do not understand the underlying logic, subject matter, debate and compromise, rolled up into a high level summary risk table.

No one should have the impression that a subjective process of assigning numerical scores to the likelihood of certain events and the severity of outcomes implies mathematical certainty. Actual risk depends on the depth of understanding of the issues, both man and nature playing their expected roles and everything going according to plan. This does not always happen - despite the best expertise money can buy from reputable professionals.

The risk to Queensland coal miners of fatal black lung disease was thought to be well understood with effective controls in place. Safety procedures were in place and miners were undergoing regular health checks and X-rays. But all these controls failed. The fifteenth case of black lung since May 2015 has recently been declared in Queensland and the experts expect many more.

Reasons for concern about the link between poor air quality and health impacts in exposed communities have been around since at least the nineteenth century. In the UK these concerns eventually led to the introduction of the Clean Air Act in 1952, after the deaths of an estimated 12,000 people were attributed to a single London 'pea souper' fog. Nevertheless, as previously noted, morbidity in individual mine workers receiving ongoing medical checks can go undiagnosed even in this day and age and the problem becomes even more difficult when trying to gauge the impacts of dust exposure on non-occupational actors – non-mine staff living or working in proximity to coal products during extraction, transport and combustion.

Longitudinal studies controlling for confounding variables such as lifestyle risks and levels of exposure are difficult and expensive to design and conduct, leaving researchers to speculating about the results of smaller studies.

Underlying weaknesses in study design may only be compounded by attempts to take a reductionist approach to the available data by comparing various hospital admission and mortality statistics with "internationally recognised estimates of the impact of particulate matter … in relation to the known health indicators ..." (EIS 4.4.10).

There will be many sources of particulate matter of all composition and size from the proposed mine:

The activities responsible for pollution in and around coal mine areas are drilling, blasting, overburden loading and unloading, coal loading and unloading, haul roads, transport roads, stock yards, exposed overburden dumps, coal handling plants, exposed pit faces, presence of fire, exhausts from heavy earth moving machinery, crushing of coal to a convenient size in the feeder breaker and workshop (Ghose and Majee, 2000a)

A comprehensive review of Australian and International studies, conducted by the Centre for Air Quality and Health Research and Evaluation (CAR) and the Woolcock Institute of Medical Research for the NSW EPA, found the evidence for ambient particulate matter (PM) impacting on mortality in communities to be consistent and strong. It advised that exposure to the levels of PM that currently exist in NSW will have measurable adverse impacts on health, particularly in vulnerable people such as individuals with chronic respiratory and cardiovascular diseases, the elderly, and children (Hime, Cowie and Marks 2015).

The CAR authors conclude all particulate matter, regardless of source, should be considered detrimental to the health of communities but that some particles are more damaging than others, depending on source, size and composition. In table 3.4.3 Hime et al. compares the contribution of coarse and fine PMs from all major sources in two regions in 2008 (see over).

1) the Greater Metropolitan Region consisting of Sydney, the Hunter Valley and the Illawarra, and
2) the Sydney region on its own.

The only PMs that will not be found to any extent in Gloucester if the Rocky Hill coal mine were to open are those PMs derived from sea salt.

While the CAR authors feel the evidence to date is inconclusive as to whether ambient coal dust exposure outside of the occupational setting is worse for health than other sources of PMs, they also concede occupational and animal studies suggest coal dust has potential to impact respiratory health, possibly cardiovascular (CV) health effects and cancer risk, and is therefore potentially harmful to surrounding communities.

The paper cautions that while larger, inhalable coarse particles ($PM_{10-2.5}$) are not benign and have been demonstrated to have detrimental health impacts, there is also considerable evidence that fine particles ($PM_{2.5}$) are particularly damaging - as are particles from combustion-related emissions (from vehicles and coal-fired power stations in particular).

Table 3.4.3 Major sources of PM_{10} and $PM_{2.5}$ in the Greater Metropolitan Region (GMR) and the Sydney region according to the NSW Air Emissions Inventory 2008

Source	PM emission details[a]	Proportion of total PM emissions (%)			
		GMR		Sydney region (within the GMR)	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Coal mining	Extraction of coal, transfer and loading of coal, removal of overburden and, wheel generated dust	42.5	22.6	2.0	0.4
Coal-fired power stations	Coal combustion for generation of electrical power, transport, crushing and loading of coal and, wheel generated dust	5.3	8.5	-	-
On-road vehicles (excluding diesel exhaust)	Tyre, brake and road wear and, petrol vehicle exhaust. The sum of four sources defined in the inventory: 1. All non-exhaust PM 2. Passenger vehicle petrol exhaust 3. Light duty commercial petrol exhaust 4. Others - exhaust	1.3	2.4	6.2	6.3
On-road diesel exhaust	The sum of two sources defined in the inventory: 1. Heavy duty commercial diesel exhaust 2. Light duty diesel exhaust	0.9	2.9	4.1	6.9
Non-road diesel exhaust	Non-road vehicle and equipment exhaust. The sum of the five largest users of diesel fuel in the GMR defined in the inventory: 1. Industrial vehicles & equipment 2. Locomotives 3. Commercial boats 4. Aircraft ground operations 5. Shipping	2.7	8.3	4.4	7.2
Solid fuel domestic heating	Wood fuel-fired residential space heaters	6.2	18.8	27.7	46.5
Bushfires and hazard reduction burning	Biogenic and geogenic emissions from bushfires and planned fires	2.8	7.6	2.7	4.0
Crustal dust and biogenic sources	Fugitive windborne PM from agricultural lands and unpaved roads (includes both biogenic & geogenic material) and, PM from quarrying. The sum of two sources defined in the inventory: 1. Fugitive-windborne 2. Land-based extractive activity	3.6	2.0	2.8	0.8
Sea salt	Sea salt aerosols from the action of surface wind on the open ocean	23.0	10.5	15.0	3.8
Total		88.3	83.6	64.9	75.9

[a] Emission details are as per the NSW Air Emissions Inventory Technical Reports 2008 (NSW EPA 2012b, NSW EPA 2012e, NSW EPA 2012f, NSW EPA 2012d, NSW EPA 2012c).
(-) Indicates not reported in the inventory

The CAR authors believe there is no evidence of any safe threshold level for $PM_{2.5}$ and that particle composition and toxicity seems to be a function of combustion source. So in relation to $PM_{2.5}$ diesel emissions from on-road vehicles the report emphasises strong evidence of harm for CV and respiratory effects in controlled human exposure studies and CV, respiratory, reproductive, developmental, cancer and allergy augmentation in animal studies. They also point out that occupational studies show diesel emissions from on-road vehicles are potentially carcinogenic in ambient air.

A further class of airborne particulate matter is $PM_{0.1}$, also known as ultrafine particles (UFP). Sources of $PM_{0.1}$ include diesel exhaust particles, products of cooking, heating, and wood burning in indoor environments, and more recently, products generated through the use of nanotechnology.

$PM_{0.1}$ particle pollution (UFP) has only received the attention of researchers more recently. **$PM_{0.1}$ is not an assessable pollutant in NSW and emissions are not recorded in the NPI. Studies of UFP effects are still reasonably few, but Hime et al. found some evidence of short term exposures to $PM_{0.1}$ associated with respiratory morbidity, CV mortality and CV function effects and noted that the biological effects of controlled exposure to $PM_{0.1}$ are consistent with observed CV outcomes.**

These findings are particularly relevant to the GRL proposal because of the volume of diesel emissions expected from the extensive operation of mine machinery and vehicles over the course of the project, as described in Sections 2.12.1 & 2.12.2.

Table 2.10
Estimated Traffic Movements[1] Throughout the Life of the Operations

	Light Vehicles (No. per Day)[2]	Heavy Vehicles (No. per Day)
Mine Area (off Waukivory Road)	156-278	10-18

[1] 1 return trip generates 2 movements.
[2] Conservatively assuming one employee/person travelling per vehicle)

Table 2.9
Estimated Average Traffic Movements* during the Site Establishment and Construction Stage

	Light Vehicles		Heavy Vehicles	
Route	Average No. per day	Construction Months	Average No. per day	Construction Months
The Bucketts Way / Wenham Cox Road	24	2-9	3-15	2-9
The Bucketts Way / Fairbairns Road	20	1-6	2-7	1-6
The Bucketts Way / Jacks Road / Waukivory Road	0-108	2-10	0-14	2-10
The Bucketts Way / Waukivory Road	52-94	4-9	7-19	2-9
The Bucketts Way / Stratford Mining Complex / Private Haul Road	0	0	0-2	2 and 8-10#

* 1 return trip generates 2 movements
# Based on 90 movements over 4 months
Source: Summary from Constructive Solutions (2016) – Appendix D

Controlled exposure observations of $PM_{0.1}$ are clarified in a more recent study pointing out UFPs have been found to alter in-vitro and in-vivo responses of the immune system to allergens and can also play a role in allergen sensitization (Ning et al., August 2016). These researchers observed the inflammatory properties of UFPs can be mediated by a number of different mechanisms, including the ability to produce reactive oxygen species leading to the generation of pro-inflammatory cytokines and airway inflammation. Because of their small size and characteristics in the respiratory tract and circulation, they believe UFPs might also be able to alter cellular function in ways that circumvent normal signalling pathways and even penetrate intracellularly, potentially causing DNA damage.

The relationship between coal, air quality and health is complex and our understanding of it is still evolving. **More answers may soon emerge as more data is collected on the effects of $PM_{0.1}$ particle pollution (UFP). As there are no current Australian standards for UFPs, they were not considered in the proponent's Environmental Impact Statement, however we believe the precautionary principle should be applied for the residents of Gloucester who have not asked for this mine.**

Conclusions

Ultimately the environment will not care and history will not remember whether coal from a mine called Rocky Hill was burnt to make steel or electricity and whether those emissions were pencilled into Australia's carbon ledger or that of another country. The environment will continue to react and respond however coal is used, and history, while ever there is someone to read it, will record the failure of a species to use its brains to do what is necessary to tackle an existential problem of our own making.

In this submission we have reviewed the pollution generated by the life cycle of coal and focused on particulate matter and greenhouse gases in more detail. We looked at one of the ways the coal industry is subsidised - by being excused from load-based licencing of its pollution and having the community pick up the cost. We questioned whether the risk matrix management tool was appropriate to argue the proponent's case in an environmental impact statement and suggested it could mislead readers, rather than inform.

We focused on the relationship between the coal industry, air quality and human health and cited new evidence of the health effects of $PM_{0.1}$ which are not addressed in the EIS. We looked at the contribution of coal to global warming and climate change. We reviewed the dangers of the climate's current trajectory and its likely economic and social costs.

We questioned the conclusion of the proponent's EIS that the risk of climate change impact from the Project, "locally, regionally and worldwide" is low and we used the US EPAs SC-CO2 rate to estimate the damage to the environment caused by this mine's emissions at US$1.368 billion. This, when added to other costs, more accurately represents the real cost of developing and operating this coal mine. GRL and any business making medium to long term plans that includes the emission of carbon pollution would be well advised to factor these costs into their business plans.

As a high emitter of carbon in an increasingly carbon constrained world, and as a high emitter of particulate matter in close proximity to residences the proposed Rocky Hill coal mine project near Gloucester NSW externalises a number of high external costs that make it uneconomic. The real costs greatly of the mine outweigh benefits and the project should not proceed.

Harms to the environment and health arising from developing the Rocky Hill coal mine will deliver a net negative economic benefit to the local, regional, state, national and global communities.

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