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To whom it may concern,

This is my submission on the EIS that was supplied by Santos on its Narrabri Gas Project. Based on the poor information, questionable details, omitted information, incorrect data, out of date information, flawed methodology, assumed figures, unanswered or ignored concerns and lack of detail that Santos has provided, there is **no other option except to hand back this invalid EIS and to get them to start again with the necessary details needed for this coal seam gas project to be even properly considered**. Simply from their opening statement that "The EIS concludes the project can be developed safely with minimal and manageable risk to the environment" shows that the entire document has been manipulated to give this false result. It is obvious that the staff and contractors used to help complete this EIS are not capable of doing this correctly, and as such, **new independent contractors and consultants must be used from other sources in the process of starting this again**.

Santos has clearly not addressed adequately these problems that I list below and for these reasons I object to this proposal and ask that the entire process is started again. This shows they have not met the approval process needed for this project to go ahead. These are in no particular order, but each point is vital and should be thoroughly investigated by all Govt agencies. Listed in the text are recommendations to be considered of the highest priority.

Maps / Animals ///

Right from the start, **without a correct, accurate map including exact areas of well sites, pipelines, infrastructure etc. this whole EIS process should be halted** and only started again once this is in place. This intentional lack of detail is very concerning. How can Santos say they will not impact rare, endangered flora or fauna in the process of building its 850 well gasfield without this? Their current knowledge of what is contained within this region is extremely lacking, shown easily through this one example of their ability not to find a single koala within the project area, yet 4 separate surveys conducted at similar times as Santos surveys, including using tracking dogs, found koalas within this same area. This shows that the terrestrial ecological impacts have not been adequately assessed and mitigated.

An ‘indicative footprint’ has been provided but the sites carry no locational information, **this is not acceptable** at all. Santos has left the gate open with regard to future location of the footprint, almost like a blank check. This has a number of consequences for assessing the impact on biodiversity such as: The location, type and area of ecological communities and their habitats affected by the project cannot be accurately determined, making assessment of impact difficult. The quantum of biodiversity credits (both ecosystem and species credits) cannot be accurately determined affecting the ability of the EIS to predict credit liability. No opportunity exists for any kind of field verification of the communities affected by the development, and the actual impact assessment will be left until after the consent for the project has been given. Not acceptable at all, and until this is rectified, this entire process should be stopped. Santos is seeking a blank cheque consent for this gasfield on the promise that it will decide where the wells will go afterward using a “Field Development Protocol.” No project has ever been assessed this way before in NSW and it should not be allowed to set a precedent on this project. The constraints Santos proposes are weak and subject to change later on. This is not an appropriate way to assess the largest gasfield development project ever undertaken under the Environmental Planning and Assessment Act and the Government must **insist that Santos release details to the public about the placement of its wells, pipelines and other infrastructure**.

There is also the issue that given Santos don’t know exactly where the best gas sites are it seems and have no idea where the wells are best located, it may be that some pilot, ‘appraisal’, wells will be unproductive, leading to an increase in the total number of sites being established to meet production targets over time. Currently 2 out of 5 well sites in the Pilliga have been capped due to their unproductiveness. Future incremental changes to the development footprint will only add to the post-approval impact. The description of important habitat for a number of key fauna, such as the Regent Honeyeater, Pilliga Mouse, Koala, Black-striped Wallaby and Five-clawed Worm-skink does not appear to be accurate. Due to deficiencies in the in the survey and assessment for two ‘matters for further consideration’ (Regent Honeyeater and Five-clawed Worm-skink) statutory requirements under the NSW Biodiversity Offset Policy have not been met.

Also, bird life is exposed to the dangerous cocktail of heavy metals and radioactive material found in the evaporative ponds at the Leewood facility. These ponds holding this toxic water, while fenced off to stop ground based animals from exposure, do nothing to stop birdlife from being exposed. These current ponds, and future ones need to be covered with **adequate bird netting to prevent unnecessary bird death and sickness** from happening.

A NSW and Commonwealth-listed threatened ecological community *White Box Blakely’s Red Gum-Yellow Box Woodland (and derived native grassland*) has been mis-identified and presumed to be not present in the study area. New data confirms its presence along Bohena Creek. Again, this shows the need for **more qualified independent consultants to be used**. There are 22 plant communities and four threatened ecological communities identified within the project area, all of which may suffer some direct and indirect impact. A number of plant communities in the project area which are threatened ecological communities (TECs) have not been adequately taken into account in the EIS

The Pilliga has many species of Flora and Fauna yet to be thoroughly and formally identified. The survey effort also appears to be deficient and has adversely affected the ability of the EIS to account for some species. Even the recent rediscovery of the Eastern Pygmy Possum indicates the

undiscovered value of the Pilliga Forest and its need to be left alone. Those that have shown how important this forest and surrounding areas are to keep preserved. The potential for identifying new species is certain and the value of Pilliga as an area of research and field study is extremely high. Pilliga State Forest has been protected and kept as an intact ecology for a good reason. The conservation value was recognised long ago. A full and thorough understanding of the biodiversity has yet to be achieved by science. Dividing this diverse habitat with well pads, service roads, settlement ponds, RO plants and vehicle movements, not to mention biosecurity hazards, weed infestation, the likelihood of spills and leaks and other uncertainties is not in any way manageable nor acceptable. The uncertainty surrounding any ability for Santos to manage harm in the future is in violation of the Precautionary Principle, which should underline all beaurocratic planning processes, especially in regard to environmental and cultural factors.

Fragmenting the bush of the Pilliga forest will add to pressure from fox predation on threatened species. No control program will compensate the additional areas of forest which will see increased fox activity along new tracks and easements.

The gasfield will clear breeding habitat for Pilliga Mouse, which lives nowhere else, and breeding habitat for other wildlife. Without specific information about where the wells and lines will be located, a proper ecological impact assessment can't be completed. Regardless, the Pilliga is a cherished natural and cultural icon and must be protected from becoming an industrial gasfield.

Why has Santos refused to acknowledge the existence of stygofauna? These have been located and confirmed in the Pilliga groundwater ecosystems. In fact 3 new species were discovered by hydro-biologist Dr Peter Serov, 2 types of mites and one type of worm. They play a vital role in cleaning the water. The risk posed by Santos to these rare new discoveries is too high and further independent studies need to be commissioned before the project can commence.

A Biodiversity Offset Strategy does not provide any surety for how well it will 'retire' the impact of the Project because the strategy provided in the EIS does not provide any like-or-like land-based offsets apart from an unproven rehabilitation plan and rests on the hypothetical efficacy of a feral animal control proposal. The suitability of the offset package with respect to the statutory requirements under the NSW Biodiversity Offset Policy is poor. Based on these findings, this should be rejected this part of **the overall Project assessment as being data-deficient and inadequate** under the terms of NSW Biodiversity Offset Policy or request the matters outlined above be addressed by independent consultants.

Management Plans ///

There are multiple management plans listed throughout the EIS, yet they are to be developed AFTER an approval? This is completely unacceptable and as such **the EIS should be rejected and removed from public consultation until all plans are completed** and added to the EIS for public review.

Emissions ///

Santos have used the method of cut and paste from its old QLD air emissions done years ago, instead of doing current research here in Narrabri NSW. By using the same info from their EIS for the QLD GLNG project, they are assuming data, not accurately reporting data. Even that assumed data has been discredited, with out of date information, flawed data, even assumed methane emission factors, some of which are zero! This is obviously wrong! This whole section should be scrapped and restarted using new current data. **New Independent consultants need to be used to give accurate up to date information of the operational emissions**.

The air quality assessment fails to include health-damaging fine particulate pollution with a diameter of 2.5 microns or less (known as PM2.5). With diesel generators at each well pad and at the water treatment and gas compression plants, there will be significant PM2.5 emissions. The air quality assessment and greenhouse section also fail to model the likely substantial escape of fugitive methane emissions.

Recent work has shown that the levels of methane emissions from CSG operations are high enough to pose significant risks to greenhouse gas levels. Considering methane is a more potent GHG than CO2 being up to 34 times more potent over 100 years and up to 86 times more potent over 20 years therefore even small leakage rates are important. These are not being reported. We know from experts such as Prof Ingraffea that *"Over a 20 year period each 1% lifetime production leakage produces nearly the same climate impact as burning the methane twice"and "Over 20 years gas is likely to have a greater greenhouse effect than conventional gas or other fossil fuels."* We also know that unconventional gas extraction has a higher leakage level in processing. Again, **independent consultants are needed to be used to find the real time emissions** of this project.

The conclusion that GHD have quoted as "all emissions associated with the project's construction and operational phases are predicted to be below the air quality impact assessment criteria for the protection of human health and amenity at sensitive receiver areas in the region" cannot support the EIS claim in Chapter 18 that the Project will control impacts on human health. The methodology is entirely flawed as it fails to estimate key known air pollutants of this industry (e.g. H2S and other components of the vented gases) and new hazards unique to CSG such as volatilised produced water. The concluding Chapter 18 rules out any issues apart from pm10 dust and nitrogen oxides from combustion sources. The Chapter 18 lists only a few OEH air quality assessment criteria pollutants, not the full range of pollutants that could be emitted (eg H2S). The analysis is theoretical with assumptions made that result in conclusions that don't match the actual experience of humans with gas field air pollution in Queensland while GHD has used no real-life air emissions data obtained from the equivalent production areas in QLD, or even estimated from the National Pollutants Inventory industry self-reported air toxics data. There is no compositional data for the raw natural unprocessed coal seam gas, which is not pure methane. GHD claims there are a small amount of ethane and no hydrocarbons while no data is produced for this claim. Pilliga experience has seen bituminous liquids coming up with produced water and previous drilling for oil in the 70s in the Pilliga has found liquid hydrocarbon deposits, not just gas. Liquid hydrocarbons haven been found being emitted from a number of currently drilled wells in the Pilliga. If there are liquid hydrocarbons (this includes 'BTEX' chemicals) in the coal seam these will be mobilised into the coal seam gas causing VOC emissions. VOCs ARE present in the "Fairview" Qld air toxics data but not considered for

this EIS. The assumption is incorrect that CSG is pure methane and despite the under-estimation of air emissions even Table 18.4 indicates ozone levels are significant.

At all stages of gas production, escaping methane can mix with nitrous oxides formed by flares and diesel engines to make ground level ozone. One highly reactive molecule of ozone can burn the deep alveolar tissue in the lungs, causing it to age prematurely. Chronic exposure leads to asthma and chronic obstructive pulmonary disease, and is particularly damaging to the forming lung tissues of young children, active young adults who spend time outdoors and elderly people. Ozone is likely to be the key cause of gasfield nose-bleeds seen amongst children and adults in gas production regions around the world. Ozone combine with PM10 dust produces smog haze that has been demonstrated to increase hospital emissions in rural areas, especially where people have not been conditioned to the smog of cities (ie their lungs are good). Gas field ozone is a recognised hazard of natural gas operations and can spread 200 kilometres. It not only causes irreversible damage to the lungs but also to wildlife and vegetation.

In QLD, untreated produced water is emitted with the raw unprocessed coal seam gases, whenever it is vented or during uncontrolled releases of raw coal seam gas. This is a key component of ground level pollution blanketing the gas field with highly corrosive water droplets. This is a well-known phenomenon in the Qld gasfields where car duco and other painted surfaces are corroded by air pollution fall out. This toxic produced water is inhaled by residents and workers, contributing to gas field 'flu'.

There is no consideration of well completion or blow-down venting and leakage of raw natural coal seam gas from all parts of gas field extraction equipment; nor of off-gassing of raw natural coal seam gas from produced water in containment dams. There is no data or analysis of the toxic, heavy metals and salty produced water that comes up with the coal seam gas stream; nor of any radioactive gases that may be mobilised into the gas stream. There is no consideration of any geological raw natural coal seam gas seepage through coal seam de-watering. There is no modelling or calculation of 7,000 Narrabri township residents' exposure to gas field air pollution, including the raw natural coal seam gas not taken into account (prevailing winds are from the south east from the Project area towards Narrabri). There is no calculation or modelling of ground level ozone from gasfield air pollution, resulting from raw natural coal seam gas exposure to sunlight, only calculation of Leewood processing equipment emissions. There is no real life data obtained from the coal seam gas industry in QLD, only theoretical calculations and dispersion models. GHD has focussed on PM10 dust and nitrous oxide Diesel engine combustion products; with no air emissions from low and high point vents etc throughout the gas field. There is no consideration of deterioration and maintenance failures and impact of these on gas field air emissions, nor of any well blowbacks or other accidents which are common in gas fields. Dispersion modelling done by GHD was done only for Leewood site and Bibblewindi compression station; there is no modelling of dispersion of the known gasfield air pollution 'cloud' of raw natural vented and leaked coal seam gas, and other air toxics produced. There is no consideration of real-life data on the incorrect operation of flares; which are routinely operated too fuel-rich and produce toxic hydrocarbons and PAHs in soot. No consideration of hydrogen sulphide emissions, or other coal seam gas contaminants, including other hydrocarbons. GHD make unsupported claims that coal seam gas does not contain this (despite a clear stench of H2S from some current wells in the Pilliga). There is no consideration of dust-borne toxins arising from spilled or drained raw toxic heavy metal-laden and high PH produced water (eg from low point

drains).There has been no consideration whatsoever of chronic exposure of Narrabri Residents to gasfield air pollution, with the only modelling done of emissions on 'sensitive receptors' within close proximity. There is a public school within a few kilometres of Leewood on the edge of Narrabri, yet there is no discussion of the expected impact of air pollutants on sensitive children' bodies. I know from personal experience that there are areas around the gasfield exploration (such as gas well site Dewhurst 22) which has the painful stinging smell of hydrogen sulphide. This gas is so strong it burnt my eyes and nose, and this was from outside the fenced off area on the public accessible road. This is only one example of the problems with emissions and considering that methane is undetectable via smell, how much of that is leaking alongside the hydrogen sulphide? Chapter 18 rules out any impact of air pollutants on the clarity of the night air at Siding Springs- not certain this can be substantiated. By all these points above, **clearly this entire section needs to be scratched, and new independent consultants found to include this data**.

Hazard and Risk ///

Risk assessments are faulty right from the start as the longest risk assessment i**mpacts listed only go as far as 25 years**, and do not cover the ongoing increase of impacts beyond this timeframe, such as well failures. Current knowledge shows that well failures keep increasing over that extended period of time leading to more aquifer drawdowns, cross contamination between underground water sources and gas migration between ground levels. Each well, considering there will be 850 of them, some with tri lateral branches, create new connections between geological layers and aquifers, and well failures are industry recorded on average rates of 1 in 20 within the first year, and 50% fail within 30 years, so the Santos risk assessments aren't adequately covering this at all. All well casings will fail eventually. Who is going to maintain the well integrity after Santos have gone? We will have a legacy 850 leakage time-bombs through the GAB. Current risk assessments should be discarded and replaced with independent consultants using this knowledge and extend to at least 100 years.

Santos has not properly assessed the major hazards and risks of the project, in that it has incorrectly applied the techniques of EPP33 and HIPAP 4, when the correct legislation it needs to comply with is Chapter 10 of the Work Health and Safety Regulation 2011 – Major Hazard Facilities. EPP33 and HIPA4 are no longer the relevant legislative standards applicable to major gas/LNG processing plants in NSW. The correct legislation is the Work Health and Safety Act.

Leewood gas processing plant needs to be regulated as a licensed major hazard facility and undertake safety case assessment as required by the Work Health and Safety regulation 2011. Santos will be handling over 10% of a 'Schedule 15' chemical i.e. methane. In addition, the gas processing equipment, wells, compressor stations will generate air toxics which need to be adequately safety-cased. This legislation requires notification to WorkSafe NSW, licensing and production of a detailed safety case to ensure onsite and offsite risks to the public, workers, property and the environment are MINIMISED (as low as reasonably practicable).

The tests applied by the guidelines EPP33 and HIPAP4 are INADEQUATE to ensure safety and risk minimisation to the nearby town of Narrabri. Santos has not adequately assessed, and as a consequence, not adequately mitigated the risks to the public, workers, plant and the environment of methane explosion, catastrophic toxic untreated produced water loss of containment,

catastrophic air toxics cloud production and plant failure such as well blow outs, pipeline rupture, gas processing plant failure, compressor failure etc. Until an adequate safety case is approved by WorkSafe NSW in accordance with licensing requirements of the Major Hazard facility regulations, **this entire project must be rejected out of hand and NOT approved**.

Further, Santos has identified a 'moderate' level of bushfire risk with a potential to cause large bushfires. Again, this risk has been subjectively assessed and claimed mitigation measures are un-tested. Santos's own subjective 'risk assessment' are not acceptable to the surrounding community and inadequate to ensure protection of bushland areas, neighbouring properties and the nearby town of Narrabri. They are introducing massive problems into an already fire prone area, increasing the risk with open vents, flares, gas pipelines, pressure relief valves etc. Considering methane isn't detectable with our senses (you can't smell it) it poses a massive risk to volunteer fire services entering anywhere near the gasfield unknowingly near leaking infrastructure or discarded gas wells, pipes etc. In the right air/fuel mix, with a bushfire in the vicinity, this will end up in an explosive fireball that will endanger lives immediately within the area, and further lives from uncontrollable bushfires exasperated by methane brought to the surface in pipes and through leaks.

Noted is that even using the incorrect and out-dated legislative techniques, Santos has identified at least one 'sensitive receptor' 350 metres from the boundary of Leewood at risk from 'uncontrolled containment of gas'. There is no analysis whatsoever of lack of containment of air toxics from either catastrophic or normal operation of the gas processing plant at Leewood. Santos has failed to adequately assess the safety of the untreated toxic coal seam gas produced water dams which are proposed to be re-built at Bibblewindi, nor of the risk of flood or loss of containment at the vast Leewood brine storage dams.

Why isn't this being used - **The Namoi Cumulative Risk Assessment Tool (NCRAT)**? NCRAT has been designed to report the cumulative risk of any mining scenario constituting a combination of one or more mines including open cut mines, longwall mines and coal seam gas operations. It quantifies the risk of cumulative impacts across ten natural resource assets in the Catchment, namely: Land use, Soils, Carbon, Surface water, Groundwater, Vegetation extent, Vegetation type, Vegetation condition (intactness), Vegetation connectivity, Threatened species.

Flaring light pollution ///

It is unacceptable the impacts of Santos current plan with unnecessary flaring creating not just light pollution affecting nearby Siding Spring Observatory, but also toxic air emissions. **Flaring is just a cheap method that isn't needed in the gas removal process**. Typical emissions from flares include carcinogens such as enzopyrene, benzene, carbon disulphide, carbon sulphide and toulene, metals such as mercury, arsenic and chromium, sour gas with hydrogen sulphide and sulphur dioxide. Santos does not adequately test for this or address this. Independent regulators should be employed to monitor the current exploration exposures and results should be included in a revised EIS.

A simple solution is to **use current technology already available to capture a use all gases**, (such as the mobile alkane gas separator) or at the very least, use the recommended method by the NSW

EPA to enclose all flares, not just for emissions and cleaner burning, but also to reduce the amount of unnecessary light pollution from giant flames lighting the night sky.

Background information on Siding Spring Observatory is it's Australia's only unique science research facility using the largest optical telescopes for astrophysics and astronomy. First established in Coonabarabran NSW, on the Warrumbungle Ranges in the 1960's it was built there because of the dark skies in this region. While there is historic value of this site from telescopes established over 50 years ago, this observatory hosts the largest optical telescopes from national and international universities and research entities. Not only hosting the largest, this site hosts the second, third, fourth, fifth largest telescopes etc in Australia, playing a key role in science research across the Southern Hemisphere. Over 50 telescopes are listed across the site being used by over 30 universities, institutions and private businesses using cutting edge technology, with some of the most advanced telescopes being used is astrophysical research. Future plans include another 50 telescopes to be built on site within the next decade. All this is reliant on keeping the dark sky dark! If this area was to lose the dark sky, this observatory would not be replicated again in Australia, and future investments would be elsewhere in the Southern Hemisphere.
From 2013 onwards light emissions from the Santos gasfield exploration have increased to the point that, just the Bibblewindi large flare and unmanned facility alone, creates more light pollution than the entire town of nearby Coonabarabran with over 3500 people residing there. Santos have listed plans to triple the amount of pilot flares and double the amount of large flares including constructing 50 metre high flare stacks, with an average 30 metre high flame above it. Nowhere do they list suitable mitigation such as zero waste capturing gas or even the EPAs recommended practice to enclose flares, as has been done in NSW areas such as Gloucester. Siding Spring Observatory already has to deal with light pollution from existing mining and regional towns. Even Sydney itself, from over 400kms away can affect research from its light glow. Santos are a lot closer than this. Every bit of extra light pollution is making it more difficult to continue the leading scientific research, and while each pollute in different levels, most consider they aren't doing any damage. But it's the combination with the existing light sources, adding **a cumulative effect which is becoming worse as more pollution is created**.

Santos also claim they have met with staff from the Anglo Australian Telescope only to discuss light pollution, and list this as the only telescope on the mountain. This shows a high degree of ignorance on their behalf as previously noted there are over 50 telescopes on site here, including over 30 separate institutions.

Also, there are far wider implications for the town of Coonabarabran, which has developed from astro tourism connected with the dark skies and the Observatory. Many businesses rely on the tourism dollars brought only to this town because of the Observatory. Through Santos lack of reasoning, they have not listed Coonabarabran to be affected by open flares**. Light pollution does affect the economics of this region. These matters need to be added and the entire section restarted.**

Santos list building a 50 metre high flare stack with a flame capable of another 30 metres at the Leewood site, which is directly beside the Newell highway, taking huge amounts of interstate traffic travelling between Melbourne and Brisbane. This is an extreme hazard to distracting drivers, where

the speed is 110 kms a hour, while Santos only solution is to build a tree line! **Trees in this area cannot provide adequate shielding** as they typically only grow to a height of 10 metres.

Also with the unique rich diversity of flora and fauna in the Pilliga region light pollution of this type can have a devastating effect on nocturnal animals and trees, leading possible endangered species to extinct levels. This has not been addressed in this EIS. A complete assessment of all nocturnal flora and fauna needs to be produced with all associated impacts before this assessment can be accepted.

This is a simple fix in this case, as while Santos building infrastructure is willing to comply with shielded lights for buildings in the dark sky planning guidelines, they need to go a step further and **remove all current and future flares. It is the only acceptable solution.**

Aboriginal ///

The Pilliga is a spiritual, cultural and social icon for Gomeroi/Gamilaraay people. Aboriginals consider this area sacred from the songlines that extend through the Pilliga, to the spirituality from conversing and using the dark night sky and star formations. Building a gasfield here will take this away, through plans in the EIS to fence off areas and roads, to the light pollution through flaring stopping the ability of Aboriginal people practicing their religious beliefs by inhibiting their use of a dark night sky and use of star formations within that sky. Also their sacred right to practice their spiritual beliefs in connection with the land.
The basis of the methodology used in contacting interested parties is flawed. This Project is not only significant to those members of the Gamilaraay Nation who currently live on Country in the immediate vicinity of the Pilliga State Forest but also to those who live away from Country for work, education, family, etc. Those people are no less culturally and spiritually connected to this land.
The scope of the first stage of identifying interested parties should have been much broader to reach those, working, studying and living at least across and beyond the whole of the Gamilaraay Nation's boundaries. Advertisements should have been placed in City and interstate media as well as culturally specific media such as The Koori Mail. The consultation process as a result has been severely compromised and as such needs to be started again to cover these issues.

Use of old and incomplete records and lack of thorough on the ground surveying of the vast project area has identified only a fraction of the Significant and Sacred sites and areas within Pilliga that we know exist. The nature of Sacredness means that many sights are not formally recorded, but passed down through oral tradition. Minimisation of harm can never be achieved by failure to identify, nor is the principle of avoidance achieved by refusal to recognise. This is a failure to recognise the entire Geographical Area of Pilliga State Forest as being of high Cultural Significance. This area is the hunting and training grounds for their men. The Songlines, waterways, flora, and fauna are all crucial to the continuation of their cultural education of their youth. Billaga, the "place of spears" and their continued use of its natural resources are vital in the survival of their culture. There is a failure to recognise the cultural significance and importance of waterways, waterholes, and groundwater to the Gomeroi people and the Gamilaraay Nation, as well as their neighbours. These waterways make up part of the Songlines and are how Aboriginal people are able to survive and thrive upon a country

others may see as useless, but to them it is their Garden of Eden. This process needs to begin again with better thought put into how to identify these areas with more consultation.

The Significance of the sky to Aboriginial people had been totally overlooked. The Astronomical knowledge of the Gamilaraay is well documented through colonial records is a crucial tool in their survival. Their ability to read the skies both day and night allows them to navigate, to know the seasons for hunting, for the cycles of certain animals and plants and to give us indications of weather, fire and many other environmental factors. The stories of our Dreaming are told within the stars. With Santos planning more flares within this gasfield, light pollution will increase to make this spiritual practice extinct. All flares should be removed and replaced with zero waste technology, as flaring is not required for gasfields with current technology available.

Continued desecration of Bohena Creek, a waterway that holds great Cultural significance and forms part of Aboriginal Dreaming and Songline network, have never been addressed to the satisfaction of the Gomeroi people. Plans to dump excess CSG wastewater, not treated enough for community standards, and requests to avoid this precious and sacred water source are dismissed and ignored. A new waste dispoal plan needs to be organised addressing this problem, as well as further disposal of other toxic byproducts.

Here I quote Donna Kenny-Franklin and part of her submission

“Overlooking or ignoring the Spiritual aspect of Cultural Significance. The defining of cultural significance has failed to identify the highly spiritual nature of Connection to Country. The cultural significance of "place" is not limited solely to the physical place but also reaches to a spiritual level equivalent to Religion. The spiritual and Religious significance of Billaga, to myself and all Gamilaraay people extends through the land itself, the waterways running across it, as well as the vast groundwaters below, now known as the Great Artesian Basin, which is of vital importance to the continuation of our Jukulpa, our Dreaming, our Spiritual existence. These waters are of the highest significance in not only the Creation and Dreaming of our people but also are highly sacred according to our Women's Lore, the spiritual and religious teachings of our Women since time immemorial. We are members of the Oldest Living Culture and continuous Religion on Earth. To threaten our Spiritual and Religious practice and beliefs as taught by our Ancestors by the possibility of ANY damage or interference to Billaga, the Sacred Waters of our Ancient Mother, or any of the Flora and Fauna that share our Jukulpa, our Dreaming, our Spiritual existence is to deny us our Human Rights to Religion. This would further damage a cultural and spiritual tradition that has been so damaged already through ignorance of the Spiritual depth of our culture. You are no longer able to claim ignorance of these impacts on our people. The physical and social impacts of dispossession and destruction of culture and spiritual connection to Country on our people are undeniable and continue to be a shameful disgrace to the Australian Nation.

Underestimation of harm on a spiritual/religious basis
The limiting of the defining of damage or destruction to physical damage or destruction and to suggest that damage can be remediated or destruction offset is not only highly insulting to our beliefs but it also ignores any spiritual aspect of our culture and the significance of this area. Billaga itself holds spiritual and religious significance, not just the land or the trees but the spirit that is of that "place". It is a place where our Lore is living and breathing, of and within the land. We are of that land. The water is our source if life essence.

These may be difficult philosophical and theological concepts to grasp but to try to explain the full richness of our spiritual and religious connection to our country would be like trying to condense the bible into 800 words. All I can express to you is a that to cause ANY disturbance to the Waters of the Artesian Basin in our Traditional Beliefs is tantamount to bringing on the Biblical Armageddon, a catastrophe for the future of the Gomeroi people. To tell us that there will be minimal impact is to tell us that our entire Culture is acceptable collateral damage. To disrupt the Dreaming of Billaga would destroy us."

Aboriginal people have been under the belief and understanding that the OEH, and the NSW Forestry Corporation had taken on a Custodianship role and were responsible for protecting and managing the Sacred Sites within the Traditional lands. The Government agencies entrusted to keep these most Sacred places safe from destruction has not upheld this role and responsibility. Aboriginal people want them back and are not willing to leave their cultural survival in the hands of those who would suggest the possibility of "offsetting" spiritual or religious significance. Also unacceptable is that Petroleum Exploration Acts allow these burial sites to be desecrated, destroyed and "relocated" through permits and exemptions. The culminative impact on a highly Culturally and Spiritually significant Geographical Area, given the high levels of uncertainty and the knowledge gap that exists, would be at the expense of the Gomeroi people. Also with the Santos advisors being used for this section under current court challenges for not working in the best interests of its people (the Narrabri Land Council and Native Title Claimants), this process needs to be halted and started again taking into consideration these points with new consultants.

Jobs ///

The significant harm on the social, environmental and economic values of the Narrabri Shire and New South Wales that this project will inflict needs to be weighed against the economic justification for the project, but there is no such economic justification. Santos has thrown the east coast gas market and the industries that rely on it into turmoil by opening up export to link local prices to the international market. They have also caused the local markets to only get short term contracts at high prices for the manufacturing industries. They drove up the price of gas intentionally and are plundering supplies previously available to manufacturers and power stations. By building a destructive industrial gasfield here in NSW will not decrease prices because of such little volume. Also, once piped into the Moomba pipeline, there is no guarantee the gas will service NSW, as the pipeline is bidirectional and connected to the export terminal. It's not going to bring down prices. In fact, it will force prices up, because unconventional gas like CSG is so expensive to produce and yields are so low. Research undertaken by gas company AGL shows that **gas from the Pilliga would be the most expensive gas of anywhere in the current east coast gas market**.

The number of jobs the project will support once the construction is over minimal. Even their provided information is subjective at best. There is no table detailing month-by-month projections for job numbers, broken down by construction and ongoing, or with clear indications of the split between drilling and other work. There is only one (inadequate) graph and one very skimpy table. The graph from the EIS seems to show a peak higher than this (the number seems to be more like 1,350 to 1,365) meaning they can't even seem to provide an accurate graph. Also reading off the graph period by period during construction, you get an AVERAGE TOTAL employment during that

period of about 945. (A lot different to the impression given by 1,300 peak figure they keep quoting). And that much-quoted peak is for one month. With everything qualified as "indicative only", this whole job section needs to be rewritten to provide more accurate data and the basis they plan this on. Weighed against damage to the land, air, water, economics and the Great Artesian Basin, this project proposal is a big negative and should not proceed at all.

A **review by the respected Australian Institute of the economics section of the EIS found that it has heavily understated the costs of the project and is very misleading**. As such, correct information should replace this section and then given back to community to comment on.

Social Impact / Health ///

All evidence of adverse social impact has been ignored or overlooked. Numerous studies from both the USA and SE Queensland gasfields have shown **the impacts upon health, mental health, and long-term economics of communities in proximity to development and production areas**. Ignoring them does not make these effects go away. The social impacts are lasting whilst the economic benefits are not. The Social Impacts specific to the Narrabri people have not been taken into account. There is no mention of the higher rents that a housing poor community is already experiencing due to the exploration phase of CSG development. No mention of the emotional damage to people when they say no, but are ignored. No mention of the physical pain people feel when visiting the dead zone or the emotional trauma of the likelihood of similar or worse incidents occurring in the future. Also there is no baseline to effects from contaminated water such as drinking and bathing. This project is too close to town and can effect both the aquifers is which they will drill through and the river systems into which they will pour “treated” waste. Many more effects on health such as stress from uncertainty, adding stress from on farm issues, and the division already created by Santos throwing lots of money around trying to buy a social licence, this has negatively impacted the community and many businesses in town and the broader region.

Also the social impact of Santos and **their lack of transparency, including open public consultation** show much work still needs to be done by them. Multiple forums have been conducted where Santos have refused to enter public discussions such as the recent Narrabri Economic Forum. This shows that their inclusion of public consultation within the EIS is manipulated to give the appearance of acceptance. This couldn’t be further from the truth, including with over 10’000 current submission against this project. This will be the largest amount of submissions in NSW, possibly Australia, saying overwhelmingly no to a project. **Santos and the NSW Govt do not have public social license to proceed with the Narrabri Gas project**, and as such the EIS should be cancelled.

The most valid point is **why does every other area in the state of NSW either get buy backs or cancelled gas licences, but this area doesn’t**? Are people in North West NSW considered second class citizens to be sacrificed for this industry? The **gas licences that were cancelled all had the same concerns my submission has brought up**, so in turn, this whole project should be cancelled based on this alone.

Santos' social impact assessment is three years old and out of date. The compendium of health studies produced by the Concerned Health Professionals of New York shows mounting evidence for health damage by unconventional gas operations, including water contamination and respiratory illness. The Government must insist that Santos conduct a proper health impact assessment including modelling exposure pathways, reviewing literature and engagement with the Narrabri community. In Narrabri, this project will have negative impacts on cost-of-living, the labour and housing markets. The latter is cited in as a *benefit* of the project but it will not benefit low-income renters. The effect of the project on cost-of-living in the Shire needs to be modelled, assessed and considered, as do the labour dynamics of the project.

Human and Animal Health studies linking CSG development to Cancer, birth anomalies, breathing and respiratory conditions and mental health problems, show there is reason for concern. Economic data is questionable. The environmental impacts are becoming more and more evident as long term impacts are studied. The uncertainty and discrepancy between sources of evidence and research are a cause of major concern, and the disregard of objectionable reference cannot be overlooked. Due diligence must be applied and more studies completed on impacts on human health before this project can be accepted. Particulate matter arising from CSG is shown in research to cause such illnesses as heart attacks, strokes, diabetes, asthma, hypertension, and renal disease. Also respiratory, neurological diseases and cancers are found to increase for people close by to CSG wells. There are very clear links between the health effects on people living near gasfields in QLD and the exact same symptoms of those living near the gas leak at Porter Ranch, USA. Expected is the same here. None of this is noted by Santos in this EIS, showing that **the data provided by them is flawed and needs to be done again**.

The NSW Chief Scientist's report into CSG found there were many health risks at all stages of CSG extraction. There is also considerable additional evidence in documented peer-reviewed studies demonstrating these same health effects. The National Toxics Network submission includes a myriad of questions and problems with the way chemicals used in CSG can impact health. All these issues should be publicly addressed before consideration of the EIS can proceed.

Santos have completely ignored public health risks from fugitive emissions, including from methane, sulphides and ozone and considering data isn't accurate in this EIS to reflect this, more detail from independent experts needs to be gathered before this project can go ahead. Also, even though BTEX is banned from being added to CSG drilling activities, it is found naturally in the process of gas extraction so how can these dangerous chemicals to human health be banned if they are naturally there? The only safe option to avoid human and animal contamination is to not allow this project to go ahead.

Toxic Waste ///

Toxic waste to be generated from this project hasn't been suitably labelled for the actual content it is, with a vast array of heavy metals, radioactive material and other dangerous elements above safe levels, this waste should not be classed as general waste. Given also past experience from Santos trying to pre-emptively misclass toxic waste for ease of disposal (such as the waste disposal of Bohena 3 rehabilitation), this EIS process should be halted and independent assessors should be

called in to properly identify what is in the waste publicly. Also this 7000 page EIS doesn't indicate exactly **where this waste will be disposed of**. According to their figures, 42'000 tonne per annum of highly contaminated salts will need to be dumped every year. That's almost 18 B-double truckloads per week. This was a key concern by many stakeholders and include the previous NSW Chief Scientist. **Until the exact disposal site or sites are listed, and the communities that will be impacted by this are publicly contacted and have the right of reply** to their area being a dumping ground for coal seam gas waste, the whole process should be halted until that is met.

It is also unacceptable to be dumping coal seam gas waste water into the nearby Bohena river system, as the process Santos plan to use in treatment still does not treat enough of the dangerous elements found in this waste. The flow rate in which they claim they will dump their waste in unusually high for Bohena creek, so more excessive adding to this cause more damage to the river ecosystem, which is unacceptable. Also this unnatural increase in water flow will ultimately alter to flow and shape of the river system. This waste disposal system needs independent testing to properly identify the dangerous chemical hazards and thorough monitoring to a community acceptable standard. This should also include real time monitoring systems, available for public viewing and regular unannounced spot testing over the waste, the water and any other associated by-products with this industry.

Storage of coal seam waste water is still being stored illegally in evaporative ponds. This includes lack of details in the EIS on how much is stored at any one time. Even when current laws which have banned them in the NSW state. Santos has applied to build even more as part of this EIS. Further use of these illegal ponds should be enforced straight away and all the waste water removed to a community approved suitable disposal facility. Currently, pond liners have failed in the exploration phase in the Pilliga leading to permanent contamination of aquifers with dangerous levels of radioactive material and heavy metals. The **recently built evaporative ponds at Leewood have already failed several times** with the upper layers, needing to be drained and repaired numerous times. Considering this project is meant to last over 20 years and the pond liners are already failing within 3 years, this risk is too high, not just for this area, but also the Namoi catchment, aquifer groundwater sources, and Narrabri town water. This project should be halted until more adequate solutions to this hazard are found than the use of large open ponds.

Brine management is a major bottleneck for coal seam gas (CSG) production in Australia. Solid Waste remains, even after 10-15 years of CSG extraction in Queensland, a significant logistics and disposal issue for desalination solid waste and chemical processes. The management of toxic brine and concentrates has no solution in NSW. Coal seam gas brine and reverse osmosis concentrate are highly contaminated materials - they are not suitable for general waste disposal and must be handled as hazardous controlled waste in a licensed waste facility capable of handling the toxicity of the material, and to prevent leaching and dust exposure. There is no current facility available in NSW and unlikely to be one that can handle up to 110 tonnes of brine waste PER DAY. Considering the likelihood that this waste will be transported interstate, this whole process needs to be stopped and the relevant authorities informed in QLD, and also advertised in QLD for those impacted areas to be able to comment on this project too.
Both these waste streams will contain toxic heavy metals, ordinary salt, other salts, radioactive solids, explosive decomposition products, drilling chemicals and toxic hydrocarbon residues. Coal seam gas produced water contains naturally occurring toxic materials present in the coal seam,

dissolved gases, including toxic hydrocarbons which are mobilised during de-watering or gas removal. **There is currently no treatment/disposal mechanism in place in Australia for the concentrated (solid 'salt'-waste) produced after the reverse osmosis of CSG brine**. This fact will create a legacy issue that the industry will, in all likelihood, pass on to the New South Wales taxpayer and future generations. The **Narrabri Gas Project should not be approved based on this issue alone**. Another solution must be found to remove this dangerous hazard from occurring.

Even using a licensed facility does not make the waste disposal issue miraculously disappear. Santos simply hands the problem on to someone else - the taxpayer. The eventual fate and impact of this reverse osmosis brine concentrate in the environment is not mitigated within the EIS. Deliberate miscoding of the solid waste brine stream as general waste, rather than hazardous waste, is an identified issue in Queensland; this illegal miscoding masks a serious issue regarding the tracking and ultimate fate of CSG industry waste. This has already occurred with respect to AGL and Santos wastes in NSW. To comply with NSW laws, Santos is likely to have to truck waste over the NSW border, assuming they can find a suitably licensed facility interstate that can handle that quantity of waste. There is **no discussion of cross-border waste flow in the EIS** or the licensing and approval requirements.

The mitigation proposed of 'creek-flushing' to dilute produced water into the environment (using Bohena Creek as an industrial drain) is purely a corporate cost-cutting measure; the objective of which is to maintain gas supply and avoid creating (and paying for) the storage and safe disposal of the toxic reverse osmosis salt concentrate and brine solids. This is an unacceptable method, and another way found.
There are a significant number of issues involved in 'creek flushing' of CSG waste and resultant bio-toxicity. For example, organic compounds and radionuclides Uranium 238, Radon 226, Radon 228 and Potassium 40 were detected in the raw CSG water and in the reverse osmosis brine concentrate in QLD. Santos currently does not look for, record or openly admit these are present in this area. The Healthy Headwaters Hazard Characterisation (2012) stated that there are currently limited guideline values against which to assess the biological relevance of the radionuclides detected.
Given the variability of waste constituents across all wells within a gas fields and over the lifetime of a gas field; creek dumping of waste will require careful and costly monitoring. Given the economic constraints that are affecting the industry; ongoing allegations of environmental dumping "cover-ups"; CSG companies choosing to pay fines rather than undertake costly remediation; it is questionable as to whether these necessary acts will be undertaken in a rigorous manner over the coming years. This project should therefore be rejected out of hand as proposed mitigation measures will fail, as they have done in QLD.

A big factor not being considered enough is what Santos point out in their EIS but ignore - There is NO rock between the GAB and the coal seams that acts as a barrier to prevent the downward movement of water from the GAB to the depressurised space in the coal seams once the extraction of produced water starts. Appendix F and G fail to correctly model the groundwater impacts of Narrabri Gas Project on water users and groundwater dependent ecosystems. Santos EIS claims less than 0.5m drop in Pilliga Sandstone aquifer because there are 'relatively impervious rock layers' between the target coal seam and the aquifer. This is wrong. The Namoi Water Catchment Study

Phase 2 by Schlumberger includes this table showing there is no such impervious layer. While the table is a bit obscure on the location of the Rutley, Namoi, Parks and Bohena seams it gives a very good indication that by removing the water from the seams there will be effects on all the Basins GAB and GOB. This table may also help to see why Santos has been able to say that there will be a big time delay until the effects of a drawdown are felt in the upper reaches of the Pilliga Sandstone and the Namoi Alluvium. The classification of the Hoskissons seam as an 'aquifer' only goes to show that water will be drained away from the GOB much faster than the GAB, hence Mitchley's statement re "the project will effect the ground waters of the GOB" (the full quote can be found on page 65 of the 2014 EPBC Application). The best part about the Table is that it was compiled by companies that Santos used to use and their work is referenced throughout the EIS.

Bohena Creek is not generally in poor condition as claimed by Santos. Surveys found while some areas show dieback, most parts of the creek are in a good condition, supporting old growth red gum-rough-barked apple woodlands and many semi-permanent waterholes (about 30) which have a high biodiversity and local significance to wildlife. Hydrological modelling on the impacts of treated water release into Bohena Creek relies on a principle of maximum dilution during periods of high flow but ignores the fact that surface flow can be trapped in creek features and can rapidly sink into the shallow aquifer which underlies the creek system. No assessment has been undertaken on the impact of polluted water within waterholes, which get recharged during periods of high flow. The EIS states that depressurisation of aquifers may result in a drop of 0.5m, though is likely to increase over time. Even a drop of 0.5m could have significant impacts on the permanence of some waterholes and shallow water tables associated with alluvial areas. However the modelled drawdown impacts on groundwater in the EIS is not credible given lack of supporting data. It seems a stygofauna survey was conducted in a way to minimise the chances of obtaining results, with poor coverage of 'control' areas. Independent surveys as recently as 2013 discovered new species and areas of high diversity. To claim that there will be no impact on stygofauna is not credible given this lack of information and given questions relating to the modelled groundwater drawdown and treated water release. Invertebrate and fish surveys have been poorly done with no sampling from good condition waterholes on Bohena Creek. The survey missed a key species, the freshwater mussel Velesunio ambiguous, a strong indicator of good health and permanence of these waterholes. These holes also provide refuge for the native fish, freshwater sponges and a range of invertebrates which rely on good water quality. Santos has contradicted the GDE Atlas by claiming that the only surface groundwater ecosystems in Bohena Creek are a few unidentified waterholes which are in poor condition. The Atlas identifies the creek itself as a GDE, 'moderately dependent upon surface expressions of groundwater', the 30 odd waterholes and the upstream springs are the surface expressions of this system. Overall, this system is currently in a good condition and meets the criteria of being a 'Priority GDE'. Overall, the aquatic and GDE assessments are extremely misleading to the public and should be rejected by both state and Commonwealth consent authorities as **being insufficient in detail. This needs to be done again using independent experts**.

Water problems ///

This whole water based information is completely reliant on an unbelievable assumption that this project will only cause a drawdown of 0.5m The use of Santos biased scientific evidence has failed to

address the voluminous evidence, research, and case studies coming from the USA and Queensland to the contrary of their own findings. Water drawdown figures are grossly underestimated as has been shown by the vast differences between estimations and actuality in SE Queensland using the same methodology. Also, there is **complete lack of data on hydraulic head measurements** in baseline format. This crucial baseline must be established with the pressure, height and water quality in all overlying aquifers in the project area.

Santos says they are not going to interfere with a GAB recharge zone. However all government hydrogeological mapping of the GAB shows the project will straddle the most important inflow zone into the GAB in NSW (Hydrogeological Atlas of the Great Artesian Basin (2016) Department of Water Resources (NSW) Hydrogeological Series Sheet SH 55-12; NSW Department of Water & Energy April 2009 PN00799 WR2008-089)

Santos' project is expected to remove 37.5GL of groundwater over the life of the gasfield, mostly in the early years. This amount could be as high as 87.1GL. In years 2-4, Santos expects to extract 10ML water per day or 3.65GL per annum. This is close to 16% of the current licenced extraction from the Oxley-Gunnedah groundwater source. The coal seam needs to be dewatered to release the gas, but this aquifer lies beneath the Pilliga Sandstone, part of the Great Artesian Basin recharge. Santos' EIS admits that over time, the project will result in a loss of water from the GAB recharge aquifer, but downplays the scale of this loss. CSG in Queensland has drawn down GAB aquifers already. We can't afford to risk this crucial resource.

Also while they claim to follow the guidelines on sealing CSG holes with concrete, even basic science shows you cannot get perfect seals against the holes drilled for gas wells, and also when going through aquifers it cannot seal against water! This flawed methodology of drilling practices is unsafe, allowing cross contamination between different layers and also massive drawdown and evident from every other CSG project that has taken place. Considering this will be replicated at least 850 times in this one small area, there is no other solution than to reject the project.

Santos have also used misleading information with water including mixing water measurements up between ground surface (SWL) and Australian datum height (AHD). This makes it very hard to distinguish what the real data is. This **section needs to be written again and corrected so the data can be accurately analysed**.

Pipeline ///

Missing in this EIS is the vital infrastructure of the pipeline. Every energy project, not matter if it's a windfarm or solar array must address all their components in their EIS, yet Santos is clearly missing this from theirs. The EIS process should be halted until this is included into the EIS, and **those to be impacted able to comment on the whole project** and not just one piece of infrastructure.

Considering too that Santos has chosen not to guarantee the gas will not be exclusive for NSW, only using suggestive words such as could, or available, the suitable option here is to reject this gasfield proposal at it is only being used to prop up their export contracts for overseas markets. **Any connection of gas to the bidirectional Moomba pipeline will make this gas accessed for this**

purpose and not lower prices down. AGLs recent costing of CSG gas from Narrabri showed this will be the most expensive gas to be drilled from the east coast market.

It is also unacceptable that Santos wish to drill more than 850 gas wells in this small important area. As per their EIS it is 850 "production" wells, so this could see over 1000 gas wells drilled as some will fail to produce, as is already seen with many already capped due to low volumes or too much carbon dioxide. Santos need to be accurate with their words and intentions and as such the EIS should be cancelled, handed back and these types of words corrected to prevent misunderstandings, both from Govt Departments, and the community in general.

Not enough is listed in the EIS on the **issue of sulphate reducing bacteria**, as coal seam gas water harbours the danger, being the biggest risk of cross contamination between aquifers during the drilling process. The heavy usage of biocides to try and prevent this from occurring isn't enough. SRBs aren't just limited to CSG water, but can spread out from aquifers already infected with large numbers of SRBs to other aquifers through the drilling process, where natural enemies and consumers of SRBs cannot cope. In scenarios like this, it may not be possible to stop the growth of this life preventing bacteria moving throughout the entire subterranean water system. Knowing there is no adequate solution to this problem, and there is enough proof and knowledge from the gas industry itself, the project needs to be cancelled before more damage is done.

Conclusion

In conclusion, based on the poor information, questionable details, omitted information, incorrect data, out of date information, flawed methodology, assumed figures, unanswered or ignored concerns and lack of detail that Santos has provided, there is no other option except to hand back this invalid EIS and to get them to start again with the necessary details needed for this coal seam gas project to be even properly considered. It is obvious that the staff and contractors used to help complete this EIS are not capable of doing this correctly, and as such, new independent contractors must be used from other sources in the process of starting this again.

Santos have failed in the approval process. Santos have clearly not addressed adequately these problems that I list above and for these reasons I object to this proposal and ask that the project EIS be rejected, the EIS started again and before release back into the public the necessary scrutiny conducted by all Govt agencies to thoroughly investigate each concern.

Peter Small

20 / 5 / 2017