Please find below my submission to the Narrabri Gas Project. I STRONGLY OBJECT to this project for the following reasons:

Environmental & Biodiversity Impacts:

The Pilliga Forest is the largest and most intact area of temperate Eucalypt woodland remaining in NSW. It provides a unique ecological refuge in a heavily cleared agricultural belt and is home to a number of unique and threatened plant and animal species. All up, 25 nationally listed and 48 state listed threatened species rely on the Pilliga for survival. The Santos CSG development will clear close to 1,000 hectares of this important forest and massively fragment the landscape with access tracks, well pads, processing infrastructure and gas and water pipeline corridors.

When unconventional gas development takes place in natural vegetated areas such as the Pilliga there are likely to be very significant impacts on native vegetation, wildlife habitat and biodiversity. These impacts include[1] [2]:

- Destruction and fragmentation of critical wildlife habitat and food resources for construction of roads, pipelines and well pads.
- Wildlife deaths from large numbers of heavy traffic movements and exposure to wastewater via leaks spills or in holding ponds.
- Depletion and contamination of ground and water supplies represent a major threat to the vegetation, natural ecosystems, wildlife, groundwater dependent organisms, and wetland areas that rely on those water resources.
- Invasion by noxious weeds as well as feral pests and predators due to increased fragmentation.
- Increased bushfire risk due to increases in ignition sources and flammable fuel for fires.
- Fouling of natural waterways from vegetation clearing and sediment run off from pads, pipelines and roads as well as wastewater releases into waterways.
- Disruption to wildlife by machinery, traffic and drilling noise and emissions.

Ecological experts in Australia have identified that '*fragmentation and loss of native vegetation resulting from the considerable surface footprint of CSG infrastructure represent a serious threat to biodiversity, threatened species and landscape function'*[3]. They suggest that, "*Evidence from CSG developments to date indicates that severe effects are possible.*

[1] Engineering Energy: Unconventional Gas Production, ACOLA

[2] *Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe, European Commission: DG Environment (August 2012)*

[3] Williams J., Stubbs T. & Milligan A. (2012) An analysis of coal seam gas production and natural resource management in Australia. A report prepared for the Australian Council of Environmental Deans and Directors by John Williams Scientific Services Pty Ltd, Canberra, Australia

Potential impacts include direct clearing of bushland, fragmentation of important remnant vegetation, spread of invasive species and increased fire risk".

The ecosystem services provided by this forest, along with the recreational opportunities it provides, will be seriously diminished if the Narrabri Gas Project goes ahead.

Water Resources Impacts:

The Pilliga region is a vital recharge area for the nationally important water source- the Great Artesian Basin. Santos' EIS admits that the project will result in a loss of water from the GAB recharge aquifer over time. In a continent as dry as Australia, which is predicted to dry even more with the further onset of climate change.

The project will extract over 35 billion litres of toxic groundwater, much of it in the first five years. This water will be treated and in the early years will generate tens of thousands of tonnes of salt. There is no safe, viable plan for the disposal of this salt. The storage of massive amounts of saline wastewater itself poses a contamination threat to soil and water resources- particularly in the light of past waste mismanagement and contamination issues in the Pilliga Forest (see below).

International science now clearly confirms the fact that drilling, fracking and other aspects of unconventional gas development inherently threaten groundwater and have contaminated drinking water sources across the United States.[4] We cannot afford to risk this vital resource in the Pilliga region.

Spills – a risk to surface and groundwater:

New analysis, published Feb. 21 2017 in the journal *Environmental Science & Technology*, revealed 6,648 spills from the fracking industry from just the four states that they studied alone—Colorado, New Mexico, North Dakota and Pennsylvania—in 10 years[5]. The researchers determined that up to 16 percent of fracked oil and gas wells spill hydrocarbons, chemically laden water, fracking fluids and other substances. They found that 75% to 94% of spills occurred within the first three years of well life when wells were drilled, completed, and had their largest production volumes. Across all four states, 50% of spills were related to storage and moving fluids via flowlines.

History of Spills and Contamination in the Pilliga:

In the past, Santos' CSG exploration operations in the Pilliga Forest region recorded at least 20 coal seam gas waste water spills and continuing leaks from evaporation ponds. Santos'

[4] Concerned Health Professionals of New York & Physicians for Social Responsibility. (2016, November 17). Compendium of scientific, medical, and media findings demonstrating risks and harms of fracking (unconventional gas and oil extraction) (4th ed.). http://concernedhealthny.org/wp-content/uploads/2016/12/COMPENDIUM-4.0_FINAL_11_16_16Corrected.pdf

[5] Patterson, L. Konschnik, K. Wiseman, H… (2017) Unconventional Oil and Gas Spills: Risks, Mitigation Priorities, and State Reporting Requirements, Environ. Sci. Technol., 2017, 51 (5), pp 2563–2573, DOI: 10.1021/acs.est.6b05749 http://pubs.acs.org/doi/abs/10.1021/acs.est.6b05749?journalCode=esthag

records show spills and leaks from all parts of the operations, from evaporation ponds, pipelines, the wastewater treatment facilities and at well sites[6]. Pollution offences occurred under the former site operator Eastern Star Gas. The NSW EPA issued the following statement, "The EPA issued two penalty notices with fines of $1,500 each to Eastern Star Gas for discharging polluted water containing high levels of salt into Bohena Creek in March and November 2010; offences under section 120 of the Protection of Environment Operations Act 1997."[7]

In 2014, Santos was found guilty of polluting an aquifer in the Pilliga Forest[8] with radioactive uranium 20 times safe levels as well as toxic heavy metals[9]. A spill in June 2011 in the Pilliga resulted in 10,000 litres of untreated toxic coal seam gas wastewater containing a mix of heavy metals (including arsenic, lead and chromium), salts and petrochemicals that killed vegetation and wildlife. Santos was found guilty in the NSW Land and Environment Court and fined $52,000[10].

Air Pollution:

A 2012 study detected 44 hazardous air pollutants at unconventional gas well sites[11], whilst other recent US studies[12] show that drilling and fracking emissions often contain strikingly high levels of benzene. The NYS Dept. of Health Public Health Review (the NYS Review) noted that "studies provide evidence of uncontrolled methane leakage, emissions of other volatile organic chemicals, and particulate matter from well pads and natural-gas infrastructure [as well as]… intermittently high dust and benzene concentrations."

Exposure to a range of harmful substances associated with unconventional gas operations constitutes a serious health hazard to those working on and living adjacent to or surrounded by unconventional gas development. The NYS Review[13] states that emissions from UG operations have the potential to contribute to community odour problems and respiratory health impacts such as asthma exacerbations.

The Santos EIS air quality assessment for the Narrabri Project 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

[6] Santos Ltd Energy NSW (2014) Report into Eastern Star Gas Limited prepared for Government of New South Wales.

[7] NSW EPA (2012) Eastern Star Gas fined for pollution in the Pilliga, http://www.epa.nsw.gov.au/epamedia/EPAmedia12070601.htm

[8] http://www.epa.nsw.gov.au/epamedia/EPAMedia14021802.htm

[9] http://www.smh.com.au/environment/water-issues/epa-defends-its-actions-over-natural-uranium-in-contaminated-aquifer-20140309-34fhp.html

[10] http://australianresources.com.au/1833/santos-fined-pilliga-spill

[11] NTN: Toxic Chemicals in the Exploration and Production of Gas from Unconventional Sources

[12] See footnotes 3–8, 12, 57, 174 in Fracking Compendium, Vol. 2

[13] A Public Health Review of High Volume Hydraulic Fracturing for Shale Gas Development: http://www.health.ny.gov/press/reports/docs/high_volume_hydraulic_fracturing.pdf

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.

Climate Impacts:

Recent research[14] by the Melbourne Energy Institute shows that Australia may be dramatically under-estimating the fugitive methane emissions from unconventional gas, including coal seam gas. It's not needed or useful as a source of energy: we have the technology we need to replace gas with renewable energy sources.

Research[15] released just last week shows that gas is not needed as a 'transition fuel'. Wind and solar PV are cheaper forms of bulk energy than combined cycle gas turbines, and in some cases, the cost even of new-build renewable energy and storage is cheaper than generating electricity at existing gas power stations. Storage technologies are now competitive with open cycle gas turbines in providing flexible capacity.

Traditional Custodians & Communities' Opposition:

The Gomeroi/Gamilaraay Traditional Custodians of the Pilliga region are opposed to the project. The Pilliga is a spiritual, cultural and social icon for local Indigenous people. Fragmentation and industrialisation cuts people off from their heritage and connection to country. The project will cause more trauma to the regional Aboriginal community because the area of impact is crucially important to the spiritual, cultural and social life of Gamilaraay people. The project should not proceed in the face of such strong opposition from the local Traditional Custodians.

Landholders and communities across the North West region of NSW are overwhelmingly opposed to the Narrabri Gas Project which will impact on the water resources, land and visual amenity of the landscapes in which they live and work. The Pilliga gasfield is the first stage in a gas extraction project that will see large swathes of productive farmland beyond the forest industrialised, destroying valuable farmland and impacting livelihoods, risking vital water resources and changing local people's lifestyles forever. One hundred and one communities from across North West NSW have stated their vehement opposition to CSG by declaring themselves Gasfield Free, with an average 96.1% of respondents in door to door surveys stating their wish to remain free of gasfield industrialisation. Recent CSIRO research[16] from Queensland shows that farmer's fears about CSG impacts on farm livelihoods are well founded. The report found that the alienation of productive farmland

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[14] *A Review of Current and Future Methane Emissions from Australian Unconventional Oil and Gas Production:* http://www.tai.org.au/sites/defualt/files/MEI%20Review%20of%20Methane%20Emissions%20-%2026%20October%202016.pdf

[15] *A Short-lived Gas Shortfall,* Tim Forcey & Dylan McConnell, May 2017: https://d3n8a8pro7vhmx.cloudfront.net/lockthegate/pages/3862/attachments/original/1495007921/Short-lived_Shortfall_FINAL_DRAFT.pdf?1495007921

[16] O. Marinoni, J. Navarro Garcia, 2016, A novel model to estimate the impact of Coal Seam Gas extraction on agro-economic returns, Land Use Policy, Volume 59, 31 December 2016, Pages 351–365, http://www.sciencedirect.com/science/article/pii/S026483771630076X

for CSG infrastructure in Queensland results in losses in gross economic returns of up to 10.9%, with landholders losing an average $2.17 million in revenue as a result. The methodology used in this study estimated economic losses based solely on reduction in land area and did not attempt to quantify losses resulting from disruption to operations and time spent negotiating with gas companies, or with the financial impacts of dust generation, stock losses, spills and leaks of wastewater or the spread of weeds. Therefore, total losses to landholders will undoubtedly be far higher.

So called "gas shortage" is no Justification:

The so-called 'gas shortage' is a confected crisis- there is no real shortage. Santos' and the other gas giants own Coal Seam Gas export activities in Queensland have caused gas prices to rise and supply to become unpredictable by redirecting domestic gas to the export market through their Gladstone LNG plants[17]. NSW should respond to this by investing in more reliable and ultimately cheaper renewable energy, not by letting Santos inflict more environmental, social and economic harm.

The gas produced at Narrabri might be as little as 4.9% of the volume contracted for sale out of Gladstone. 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.

Summary- Unconventional Gas Risks Just too Great:

Overall, the scale of the risks from unconventional gas development can be quantified by reference to recent US research which involved a literature review of all 685 peer reviewed papers on unconventional gas in the US as of the end of 2015[18]. The review found that:

- 84% of public health studies contain findings that indicate public health hazards, elevated risks, or adverse health outcomes;
- 69% of water quality studies contain findings that indicate potential, positive association, or actual incidence of water contamination; and
- 87% of air quality studies contain findings that indicate elevated air pollutant emissions and/or atmospheric concentrations.

The Narrabri Project is not worth the risks to land, water, wildlife, climate and communities and should not proceed.

Boudicca Cerese (B.Env.Sci. Grad. Cert. GIS)

[17] *A Short-lived Gas Shortfall,* Tim Forcey & Dylan McConnell, May 2017: https://d3n8a8pro7vhmx.cloudfront.net/lockthegate/pages/3862/attachments/original/1495007921/Short-lived_Shortfall_FINAL_DRAFT.pdf?1495007921

[18] Hays J, Shonkoff SBC (2016) Toward an Understanding of the Environmental and Public Health Impacts of Unconventional Natural Gas Development: A Categorical Assessment of the Peer-Reviewed Scientific Literature, 2009-2015. PLoS ONE 11(4): e0154164. doi:10.1371/journal. pone.0154164