The Executive Director, Resource Assessments
Department of Planning and Environment
GPO Box 39 Sydney NSW 2001

Dear Sir/Madam

My name is Dr Hugh Barrett and I wish to **OBJECT** to the proposed Narrabri Gas Project (NGP).

I am a retired consulting engineer, with my professional career devoted mainly to water resources and irrigation development. For most of my career I was based in Narrabri, but I also studied and worked in the United States and undertook consulting assignments around the world for such organisations as the Australian Agency for International Development, the World Bank, the United Nations Food and Agriculture Organisation, and larger consulting organisations. I have a degree in Civil Engineering (Honours) from the University of New South Wales and a Masters and PhD from Colorado State University.

During my career I have prepared numerous Reviews of Environmental Factors and several Environmental Impact Statements, one of which was described by a reviewing senior government officer as "the best EIS that I have seen". Unfortunately, based on the parts that I have read, the EIS prepared for the NGP is the worst EIS that I have seen.

Most of the problems with this EIS relate to:

- deficiencies
- inaccuracies
- lack of substantiation
- use of data from other areas in place of local data
- misleading statements
- false conclusions, and the
- inclusion of propaganda in the place of rational assessment.

Some examples of these shortcomings are outlined below.

Where is the Project and What is it?

There is no map of the project. How can a project be considered if no-one knows where it is to be located and what infrastructure is proposed where?

The project boundary is shown to come within five kilometres of the Narrabri urban area and six kilometres from the Narrabri West post office. The residents of Narrabri (and the surrounding rural area) have no idea of what facilities are proposed in their immediate vicinity. How can the project be considered further until this information is made available to the Narrabri community?

The EIS mainly refers to 850 gas wells, as do all previous Santos statements. The Department of Planning & Environment refers to "up to 850 gas wells" in its notice of the development accompanying submission requests, both printed and on its web site. However, in Table 1-1 of Appendix R the

statement is made that the proponent proposes the **"**conversion or upgrade of existing exploration and appraisal wells to production in addition to the 850 new wells". Given that more than 50 wells have been constructed or approved already (see Chapter 2), it now appears that the project will consist of more than 900 wells in total. This figure has never been disclosed previously.

Promises

The EIS is long on promises but short on commitment. Numerous references are sprinkled throughout the EIS regarding plans that shall be provided after the project gets underway. These include, for example, a(n):

- Waste Management Plan
- Air Quality Management Plan
- Field Development Protocol
- Erosion and Sediment Control Plan
- Soil Management Plan
- Biodiversity Management Plan
- Feral Animal Control Strategy
- Noise Management Plan
- Traffic Management Plan
- Bushfire Management Plan
- Santos' Climate Change Policy (which is a non-climate change policy)
- Environment, Health and Safety Management System
- Historic Heritage Management Plan
- Aboriginal Engagement Policy
- Produced Water Management Plan (including an Irrigation Management Plan and a Managed Release Protocol)
- Decommissioning Management Plan
- Rehabilitation Strategy.

While all of these plans are promised, there is nothing on details, procedures or timing. The community could rightfully expect that these plans would form part of the EIS so that they could be assessed before project commencement and the community assured on all of these issues before decisions are made.

Otherwise, the plans are negotiated with the respective bureaucracies after approval is given and the public has little (or no) further input. As an example, the Noise Management Plan for Maules Creek mine is still a "draft" and unavailable, even thought the mine has been in operation for nearly two years. Regional Air Quality Monitoring is the subject of a dispute over who should pay. These examples only reinforce the need for all of the above plans to be included in the EIS.

Propaganda

The EIS is devalued by the inclusion of numerous propaganda statements, many of them repeated several times in the EIS, such as

- "Lower-carbon energy sources such as natural gas can help to meet growing global energy

demand while reducing relative global greenhouse gas emissions"
- "Natural gas can underpin the transition to a low carbon economy"
- "Greenhouse gas emissions generated by the project are considered to be reasonable given the nature of the project"
- "Given the environmental benefits of low-carbon energy sources, the project is consistent with the principles of ecologically sustainable development"
- "The relatively small incremental increase (less than 0.2 per cent) in annual greenhouse gas emissions associated with the project, and its contribution to global emissions, should be considered in terms of the net environmental benefit of the natural gas generated by the project"
- "In the transition to a low-carbon economy, natural gas offers an opportunity for Australia by providing a low-carbon alternative to existing fossil fuel energy sources."

These statements are unsubstantiated, false or misleading, are propaganda rather than an environmental assessment, and have no place in the EIS.

Methane doesn't contribute to global warming???

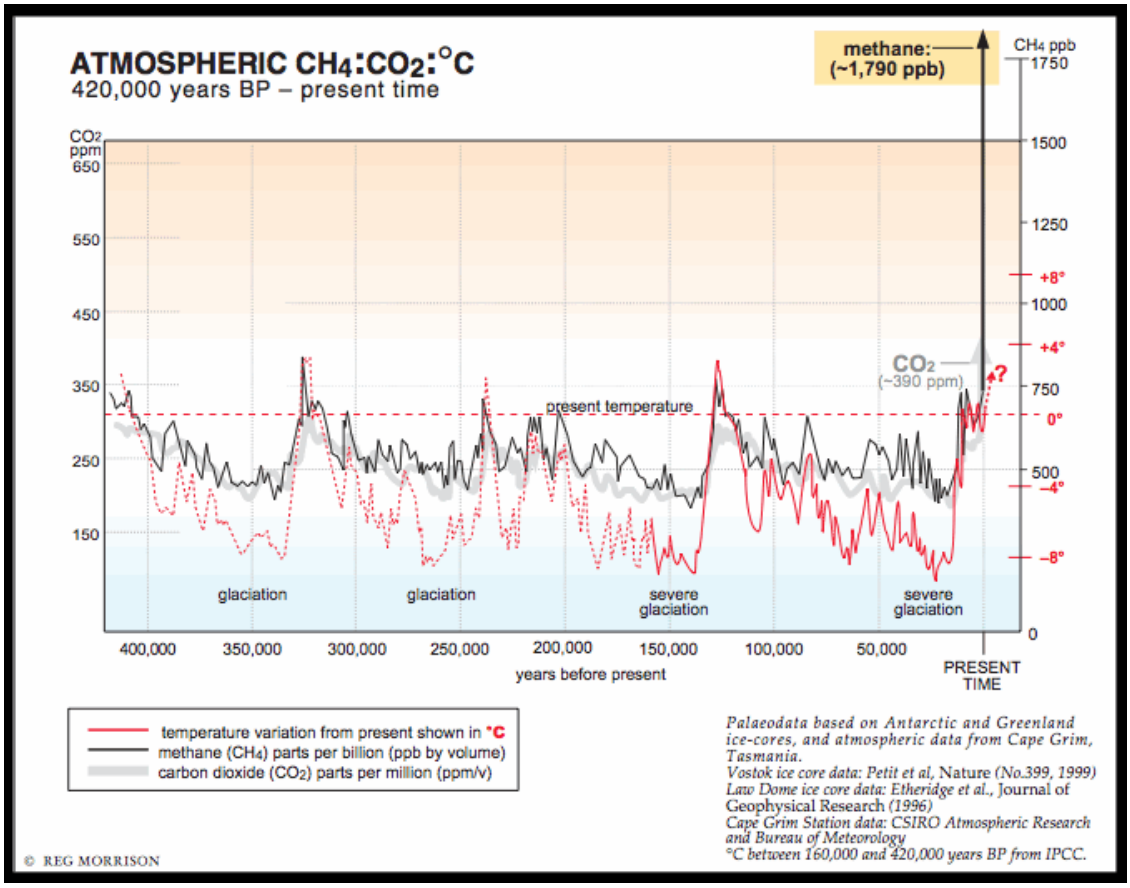
Recent research by the Melbourne Energy Institute shows that Australia may be dramatically under-estimating the fugitive methane emissions from unconventional gas, including coal seam gas. The EIS quotes figures from the CSIRO which it uses to validate its fugitive emissions figures. However, the CSIRO study was confined to methane leakage at well pads. CSIRO noted that large methane emissions emanating from neighbouring water-gathering lines, water-pump shaft seals, and gas compression plants were not measured because they were outside the prescribed scope of their study. The studied wells were all new and no account was taken of the aging of wells and equipment. Where they have been measured, emissions from unconventional gas developments in the United States range from 2 to 17% of production[1].

The EIS argues that, when the gas is utilised downstream, the resulting carbon dioxide emissions will be about half those of a conventional coal fired power plant. This does not take into account the fugitive emissions referred to above. Consequently, the actual fugitive emissions need to be measured, which they relatively easily can be. It would be expected that, when these figures are multiplied by the much higher potency of methane as a greenhouse gas compared to carbon dioxide, that the utilization of the gas in fact poses a greater threat to global warming than coal. This gives no comfort and the project should not be considered further until the full ramifications of extracting and using the gas are made clear by the proponent.

The EIS in fact has a number of other problems in relation to greenhouse gases.

- Nowhere does it admit that the primary product of the NGP, methane, is one of the Earth's most potent greenhouse gases, 34 to 86 times more potent than carbon dioxide over a 100 year and a 20 year period respectively [1]. The EIS dismisses the issue as someone else's problem – "Downstream emissions are a result of consumer demand for energy" (Section 5.3 of Appendix R). The proponent needs to determine and include emissions from the downstream use of its product before the project is considered further.

The concentration of methane in Earth's atmosphere is rising exponentially, as shown in the following graph. The release of further methane to the atmosphere will have catastrophic consequences for global warming and climate change.



- Emissions were **calculated** using the *National Greenhouse and Energy Reporting (Measurement) Determination 2008.* Not only is this determination hopelessly out of date, all of the "Parameters measured" were in fact "assumptions" (see Tables 2-2 and 2-3 in Appendix R).

- Where the proponent had data from the NGP exploratory phase, this data was not used. For example, the proponent assumes that the extracted gas contains 10 per cent carbon dioxide, based on "industry experience". While some exploratory wells have shown carbon dioxide contents not much higher than this, results from other wells show carbon dioxide contents much higher than this, typically ranging between 17 and 78 per cent over the four target coal seams[2]. This gas would be vented directly to the atmosphere and should be accounted for in the greenhouse gas calculations.

- Gas losses from pipelines have been estimated, while the amount of gas which is released at high point vents has been ignored (no mention in Tables 2-2 and 2-3). Both of these losses of gas from the system can be measured, by inflow/outflow measurements for pipelines and by metering high point vents. There can only be two explanations for these omissions:

1. Negligence, as these measurements are required to allow estimates of net gas production, and/or
2. Misleading, with the proponent seeking to use more favourable estimates in the place of the actual figures.

The project should not be considered further until data collected in the exploratory phase is used in the calculation of greenhouse gases emitted.

Salts

The EIS claims that 42,000 tonnes of salts would be produced annually during the first few years of operation, reducing thereafter as produced water slows. This figure is based on the produced water having a salt concentration about **thirty per cent** that of sea water, which in turn was based on water samples of two wells **outside the project area.**

Santos has repeatedly stated that the produced water contains about **half** the salt concentration of sea water. Santos would surely have analysed water quality from within the project area to have arrived at the latter figure. Water quality data from the project area should be produced and the quantity of salt recalculated. Taking the salt concentration from one-third to one-half that of sea water would increase the peak disposable amount of salts to about 70,000 tonnes per annum.

Disposal of the salt has still not been resolved, in spite of several years of searching for a solution and public questioning. The EIS states that "the salt would be managed by off-site disposal to an appropriately licensed facility".

There are two issues with this statement:

- The salt would appear to have been incorrectly classified as "general solid waste" in the EIS, more appropriately fitting the description of "hazardous waste" according to the EPA guidelines[3]. How would a hazardous waste be transported and disposed of?
- A suitable facility has not been identified, nor have the modifications to that facility been described whereby the salts would be prevented from leaching into the environment. Narrabri Waste Disposal Facility, for example, is licensed to take 12,000 tonnes of solid waste annually and is at this capacity. There is no "spare" capacity, after meeting existing needs. What is the spare capacity of similar facilities in the region? The EIS has not established that such capacity exists or that the sites are suitable.

The proposed development should not be considered further until the issue of salt production and disposal is settled.

Risks to Groundwater

It is highly concerning that well integrity cannot be assured during and beyond the life of the NGP. There is substantial evidence that well integrity can be compromised at any stage of a well's existence. With questionable well integrity come a number of risks; even if it takes 20 - 30 years for negative impacts to occur, it is negligent to accept CSG within the Great Artesian Basin, especially in the area of recharge.

Using figures supplied by industry in the USA, Professor Tony Ingraffea found that 7% of wells leak immediately, 30% leak within 20 years, and 50% within 30 years.[4] Concrete deterioration cannot be prevented: a gas well is an engineered structure, which will crumble and corrode with age. Santos should be liable for ongoing costs, as these deteriorating wells would require rehabilitation.

Where the deterioration causes farmers bores to fail, the community is concerned that it will be impossible to compensate farmers adequately. Even if Santos could afford to replace lost groundwater with "make good" water, experience elsewhere shows this to be entirely inadequate to serve farmers' purposes

Professor Ingraffea (who heads the Cornell Fracture Group and who has undertaken numerous research and development projects for both public and private institutions, including Schlumberger and the Gas Research Institute) asserts that "Cementing and completion practices in the basins are the main risks to the downhole environment. Many mechanisms are present to cause the cement to deteriorate. As a result, sufficient zonal isolation cannot be guaranteed for any amount of time. The major risk associated with cement failure is cement carbonation."[4] He said that methane and other chemicals cannot be prevented from getting into the water and the atmosphere. Without ongoing treatment with biocides into the distant future, many of these wells will eventually corrode to create connections between aquifers and coal seams.

Corroding well Infrastructure

Brian Bender's bore bubbling with gases

Associate Professor Bryce Kelly from the University of NSW says "Results from coal bed and shale gas production regions in the US show that if a gas production well is poorly constructed then there is a risk of groundwater contamination at a local scale".[5]

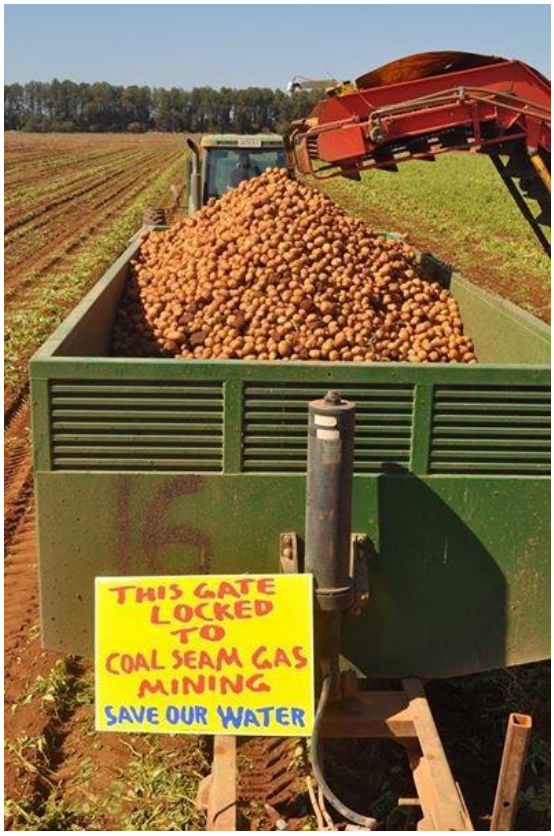
Hydrogeologist Andrea Broughton has warned that well integrity is one of the greatest threats to our clean aquifers. She has also warned that depressurisation of the coal seams may have flow-on effects to water pressure in the GAB and individual aquifers.[6]

This suggests that groundwater contamination of the Great Artesian Basin and associated aquifers is a major risk for Santos and for those who rely on aquifers for their water supplies.

Landholders have been advised by their insurers that their farm businesses, the associated water resources and/or farm produce are considered "uninsurable" against CSG contamination. Therefore both the likelihood of the risk manifesting, and the severity of the risk, are unacceptably high for an insurer to cover. The insurers are suggesting that a significant adverse impact as a result of CSG operations in the region is considered almost inevitable.

Furthermore, Meat and Livestock Australia states that "the landholder may still have primary liability in the event of contamination of the soil, pasture or groundwater, neighbouring properties, as well as livestock which, if then processed and consumed, could breach Australian food standards or importing

country requirements for meat."[7] This is particularly pertinent for landholders who sign a National Vendor Declaration or similar document for their produce. Signing such a document provides the buyer with a guarantee of the food safety status of the animals or crops they are purchasing and puts responsibility of any potential contamination in the hands of the landowner.



CSG extraction risks existing agricultural production

Being unable to obtain insurance leaves landholders at grave risk, questioning what consequences there may be for food products sold into the future, and whether they may ultimately incur a legal or financial liability. This is precisely why landholders have sought to insure against such an eventuality, and for which cover is not available. Neither Santos, nor its insurance company, nor a NSW Government Bank Guarantee (to an undisclosed amount), can provide certainty of cover for, or remedy, the inability to obtain insurance privately.

This suggests that the value of rural properties surrounding the NGP could be rendered virtually zero, should aquifer contamination occur. Recent experience, particularly in the Hunter Valley, suggests that posted bonds are insufficient to cover the cost of rehabilitation. To ensure that this experience is not repeated, Santos should be required to post a bond to the amount equal to the value of properties which could be potentially affected.

For example, if groundwater were rendered unusable over the project area and an area extending five kilometres north and south and 50 kilometres to the west (the general direction of groundwater flow), this would affect about 400,000 hectares. A bond should be posted by Santos equivalent to the value of this land. Assuming a conservative land value of $1000 per hectare, including the forest land, would suggest a bond of $400 million.

For this valuation to be more accurately quantified, as it should, the extent of any possible pollution plume should be modelled and actual land values of the affected area should be applied. This would allow the magnitude of the appropriate bond to be determined.

Visual Impacts Include Siding Spring Observatory

The EIS assures that "light generated during the construction and operation of the project would be designed considering … the good lighting design principles documented in *Dark Sky Planning Guideline: Protecting the observing conditions at Siding Spring*(NSW Department of Planning and Environment 2016)". Also, "the pilot well flares and safety flares are unlikely to cause an impact on the long-term operation of Siding Spring observatory, near Coonabarabran".

4m AAT Telescope

These statements are at odds with the views of astronomers and other personnel at Siding Spring, who suggest that light pollution would ruin the observatory. The NGP exploration flares can be seen in direct line of sight from these telescopes. The single, unmanned Bibblewindi flare, which is 90 kilometres away, creates more light pollution than the entire neighbouring town of Coonabarabran, with a population of 3000. Furthermore, the red coloured light caused by flaring is worse than white light in astronomical research, as a lot of the science, including astronomy and astrophysics, is undertaken with red spectrum light, and flaring will blind this out.

Light pollution and light spills may cause this unique Australian asset to be shut down. Every little bit of unshielded light makes it harder to conduct cutting edge research. Even light pollution from Sydney, over 400 kilometres away, can have an impact. The Federal Government has highlighted the protection of the observatory as one of the key areas it will be looking at in the EIS, because of its importance to the regional economy and the national astronomy sector.

Siding Spring Observatory is a unique scientific research facility which has been working for over 50 years, and houses currently 49 of Australia's largest optical telescopes which conduct both national and international research in astronomy and astrophysics. This is Australia's premier research facility of this type and was located in the Warrumbungles expressly to take advantage of the requisite dark skies. It is also one of the three observatories in the southern hemisphere which together provide the required 24 hour night sky coverage.

The Australian National University co-ordinates work at the facility, alongside other universities, government industries and private enterprise from around the world. More than $100 million worth of research equipment is located at the observatory, with extra funds allocated annually to maintain and upgrade facilities to keep abreast of innovations in science and research.

This research hub is Coonabarabran's largest employer, with 50 people employed onsite and a further 150 supported in Canberra and Sydney. The facility is credited with discovering the oldest known star and is currently undertaking the largest survey of dark matter every attempted[8], maintaining Australia's reputation as a leading astrophysics player. [9,10]

Siding Spring Mountain

The observatory also gives Coonabarabran its identity and provides core tourism opportunities, with 30,000 visitors annually.

Santos' future gasfield expansions include Coonabarabran itself, Tooraweenah, Gilgandra, Gunnedah, Mullaley, Dubbo and more. Some of these gasfields would be much closer to Siding Spring and there would be increased flaring, causing an even greater impact on the observatory than the NGP. The only outcome would be the shutdown of Siding Spring permanently.

The loss of Sidings Spring would result in the removal of Australia from the global astrophysics landscape. This site would not be rebuilt elsewhere again. No further developments or discoveries would be made in Australia and Coonabarabran would be stripped of its key employer, its major tourist attraction, and its identity.

Mitigation is not possible. Santos could shield some lights on new building facilities but the light pollution from 900 gas wells (many of which propose flaring taller than currently), and the compressor stations and the water treatment plant will cause an insurmountable problem for the observatory. Santos needs to provide further detailed explanation of how these problems could possibly be overcome.

Social Impacts

The EIS's social impact assessment is out of date and inadequate. Since it was undertaken, community attitudes have hardened and, unfortunately, the community has divided. These outcomes are totally ignored in the assessment.

2014 Narrabri Community "Big Picture" stating their local opposition to NGP

Because of these attitudes, the company faces significant social and investor risk in North Western (NW) New South Wales. The community considers that the project poses unacceptable risks to their farmland, water resources and communities. There is unwavering and ongoing, well-coordinated local, regional and global opposition. People from a diverse range of backgrounds, including many local farmers, have gone to, and will continue to go to, whatever lengths are necessary to protect the region from CSG and halt Santos' NGP.

There is wide-scale community rejection of the CSG industry in NW NSW, and the NGP in particular. Comprehensive community run door-to-door surveys have been undertaken by more than 100 communities completely surrounding the Pilliga Forest, spanning an area of over 3.28 million hectares to date. These communities have unilaterally declared their districts Gasfield Free with an average of 96% rejecting plans for gasfields in NW NSW, making it clear that Santos has no social licence to operate in northern NSW.[11]

In addition, door knocking of the project area itself has identified families who have never been contacted by Santos. This door-knocking found that the majority of the residents are distrusting of Santos and do not want to be part of a gasfield. Many residents reported that they either already have their properties on the market, or are considering putting them on the market and would like to leave, if they could sell.

ReachTEL polling, commissioned for the Independent candidate in the March 2015 State election, showed 87% of people across the broad NW NSW region encompassing Santos PEL areas are concerned about CSG mining; 63% "very concerned" and 24% "concerned".

On 19 April 2015, locals lined the Newell Highway from Dubbo to the Queensland border (a distance of some 500km) to show their thoughts and feelings about CSG in the region. This became Australia's longest demonstration and attracted huge support from motorists and truck drivers. Local communities are resolute in their opposition to Santos' plans to turn the region into a gasfield.

Claims of "working together with host communities" are completely rejected. While Santos has "bought" the support of some community organisations through sponsorship, its coercion of a locally sponsored club, which was to provide the venue for a meeting involving Senator Glenn Lazarus, provoked outrage from many in the community and beyond.

It is unacceptable that community opposition is ignored by Santos and the State government. Public companies have legal obligations to listen to the concerns of the community and to act appropriately.

Health Impacts

Along with CO_2, methane levels are now at their highest atmospheric concentrations in about 800,000 years as shown graphically earlier, with their increase about 2.5-fold since pre-industrial times. Atmospheric methane is generally considered to be non-toxic unless in concentrations dense enough to displace oxygen and cause asphyxiation, which is unlikely except in enclosed spaces. However, when exposed to sunlight, atmospheric methane can form formaldehyde. Any methane only partially burnt in flares or motors can also result in formaldehyde emissions[12].

The severity of symptoms from formaldehyde exposure depends upon the concentration (how much) and duration (how long) and the individual sensitivity, but even short term exposure may result in immediate symptoms. These symptoms are the same as those experienced by people in the Tara and Chinchilla gasfields and those evacuated in late 2015 and early 2016 from the Porter Ranch natural gas leak in California.[13]

While there is a lot of anecdotal evidence from people living and working near these industries, there are still no comprehensive studies on the long term health effects of CSG as identified in the NSW Chief Scientist's Report.[14] Santos has not taken a proactive position on these concerns.

Brisbane GP Dr Geralyn McCarron has been studying the health effects of CSG on people in Queensland gasfields and has documented evidence of dozens of side effects.[15] American studies have shown that the rates of childhood diseases increase when living within a 10km radius of natural gas wells.[16] Studies of chemicals used in and produced (brought to the surface) as a result of CSG have identified many health risks that will likely increase with time, well numbers and exposure.[17]

Professor Mary O'Kane outlined health impacts as missing from the debate

A community-based exploratory study found increased levels of volatile compounds in and around gasfields, individual wells and associated infrastructure at a number of locations in the USA. These included levels that exceeded American federal guidelines for eight volatile compounds, most commonly benzene, formaldehyde and hydrogen sulphide.[18]

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. [19]

Many residents anywhere near CSG facilities are inevitably stressed by the consequences of the development on their family, community and business, and the strain of dealing with CSG companies. The public record shows at least two incidents in Queensland over the last couple of years where farmers have taken their own lives due to the stresses CSG places on their families and enterprises. Similar stresses have already been witnessed in the local Narrabri community.

Santos must conduct a proper health impact assessment including modelling exposure pathways, reviewing literature, and engagement with the Narrabri community, before further consideration is given to the project.

Cumulative Impacts

Cumulative impacts have not been correctly assessed in the EIS. The EIS seeks to assess the impacts of the NGP **on other developments** in the region rather than assessing the cumulative impact of the NGP **and** the other developments **on the community and the environment** of the region.

It is inconceivable that Santos is not aware of the proper procedure for a cumulative impact assessment, having employed Eco Logical Australia to prepare parts of the EIS. Eco Logical had previously developed the Namoi Cumulative Risk Assessment Tool (NCRAT) for the Namoi Catchment Management Authority.[20]

NCRAT was developed specifically to assess the cumulative impact of mining scenarios on bioregional assets in the Namoi Catchment, in which the NGP lies, and considers any mining scenario, be it a combination of one of more mines including open cut mines, long wall 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.

NCRAT is designed to:

- analyse the cumulative impact of a scenario across a number of asset sensitivity surfaces

- call on respective risk tables that associate sensitivity and likeliness/magnitude with risk, and
- produce a risk report that includes maps, area statistics, single and cumulative risk diagrams, and statement about specific assets impacted.

In other words, NCRAT is an ideal tool for assessing the cumulative risks associated with the NGP with respect to the natural resources of the region. NCRAT is housed in the North West Local Land Services office as well as the office of the Independent Expert Scientific Committee.

The project should not receive further consideration until NCRAT is deployed to assess the cumulative risks of the development to the natural resources of the region.

SUMMARY

Because of the sheer volume of the EIS, this review has only covered a small portion. However, it is clear that the EIS is far from an objective assessment of the environmental impacts of the Narrabri Gas Project. Many of its claims are unjustified, with the document seeking to persuade rather than convince, in many instances using propaganda rather than objective assessment.

Based on the issues covered in this submission, further input should be demanded before the project is considered further. Deficiencies which should be rectified include the following.

- A map should be provided showing the location of the existing and proposed wells, flow lines, compressors, pumping stations, water treatment plant, roads, etc.

- All outcomes of the EIS need to be based on the actual number of wells proposed (more than 900), not 850.

- At least 16 Plans, Protocols, and Strategies are referred to in the EIS, to be produced after approval. These plans should be produced for review before the project proceeds further.

- The EIS needs to be based on actual data taken from the project area during the exploration phase. For example:
  - salinity data has been taken from wells outside the project area, which happen to have salt concentrations well below those previously cited
  - fugitive emissions are based on industry assumptions, rather than those measured in the field. This includes losses from high point vents, which could be measured readily but are completely ignored
  - carbon dioxide concentrations in the coal seam gas are based on “industry experience” which provides a lower figure than from gas samples collected in the project area.

  As a result, salt volumes, fugitive methane emissions and carbon dioxide emissions from the project are vastly under-estimated.

- The EIS ignores the fact that the commercial product of the NGP, methane, is a highly potent greenhouse gas, tens of times more potent than CO_2. Its use downstream, combined with fugitive emissions from the project area and during delivery, would result in a greater

greenhouse gas impact than burning an equivalent amount of coal. The EIS shuffles this issue along, in effect as "someone else's problem". The global warming impact of the project cannot be ignored in this way and the full impact of the project on global warming needs to be assessed.

- Because of the selective use of salinity data, the EIS has under-estimated the volume of salt to be produced. Peak volume is likely to be 70,000 tonnes per year, rather than the 42,000 tonnes calculated. The salt would appear incorrectly classified as general waste when it should be classified as hazardous waste. The salt is proposed to be disposed of in an EPA licensed waste disposal facility, but no such facilities are nominated. The project should not be considered further until or unless the salt disposal problem is resolved.

- Well integrity cannot be assured, placing surrounding landholders at risk of aquifer contamination, a risk they cannot insure against. In addition to posting a bond to cover the cost of rehabilitating the project area, the proponent needs to post a bond equal to the value of all the land whose water supply could be potentially damaged, both in quantity and quality.

- A more convincing explanation (if there is one) is required of how the gasfield lighting and flares would not ruin the operations of one of Australia's premier research facilities, Siding Spring observatory. In addition, Santos would need to guarantee that further gasfield development would not take place in surrounding areas.

- Santos has no social licence to develop the NGP, with 96 per cent of landholders and the majority of surrounding Shire Councils opposing the project. The social impact assessment needs to be updated to reflect these facts.

- The EIS does not reveal the full health impacts of the development, including mental health impacts. A wider and less selective literature review is required.

- Cumulative impacts need to be assessed properly, including the use of the Namoi Cumulative Risk Assessment Tool.

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