Ms Jessie Giblett
NSW Department of Planning and Infrastructure
GPO Box 39
Sydney NSW 2001

Dear Ms Giblett,

Re: Bibblewindi Gas Exploration Pilot Expansion SSD 13 5934 - Objection

Australia is the driest inhabited continent on earth - and the single greatest resource this country has, is the Great Artesian Basin (GAB). We know that it is ancient water, millions of years old, that it's recharge is so minimal that "it should be viewed as finite", and that almost a quarter of Australia would be virtually uninhabitable, without the GAB groundwater.

Our objection is that Santos are already drilling in the Pilliga, and the studies into the impacts on the GAB here have not yet been done.

The area in the Pilliga, that Santos intends turning into an industrial gasfield, is the southern recharge area of the Great Artesian Basin (GAB), the most vital area of the GAB in NSW. They are drilling through the Pilliga Sandstone, where the GAB intake beds are, and not only have they done no baseline water tests, but the aquifers here have not even been mapped or modelled (as Dept. of Water Resources will confirm). They are punching holes in the GAB recharge area, with no idea of the depth of the aquifers, the rate of flow, the direction of flow etc. The Director General requires baseline monitoring, however there is still no baseline water study completed for the Pilliga groundwater systems. The aquifer monitoring bores required to do this have not even been constructed.

We have had reviewed both Appendix 3 of the "Bibblewindi Gas Exploration Pilot Expansion EIS" of 9 July 2013 and the report "Referral of Proposed Action: Water Resource Assessment, Energy NSW Coal Seam Gas Exploration Program" of 7 June 2013, each prepared for Santos NSW (Eastern) Pty Ltd.

It is of great concern to many reviewers that no basic hydrogeological or geological data has been provided and therefore it is impossible for any expert in these fields to make any meaningful comment as to whether the conclusions reached in the above mentioned reports are justifiable or not.

The Federal Govt. or decision maker, should insist on the following information being provided, in order to make an assessment:

- Depth of coal seams (note, fig 4-4, the only geological map or cross-section, does not have either a horizontal or vertical scale and is stated to be "not to scale").
- Thickness of coal seams.
- Thickness, depth, lithological description, porosity and permeability characteristics of the coal seams and importantly those horizons considered to be aquifers, aquitards or aquicludes.
- Direction of flow, and rate of flow, of aquifers

- Structure, isopach and possibly facies map of selected horizons.
- Representative electrical borehole logs.
- Core analyses, if available.
- Tectonic setting with specific reference to faults and their potential fluid transmissibility.
- Seismic or other geophysical data.

From the target coal seams to the surface not one confining bed has been positively identified. A number of beds are referred to as "probable hydraulic barriers" or as an "impedance to groundwater", but not one as a recognised barrier to groundwater movement.

The lack of supporting data or evidence begs the question:

- On what basis is it estimated that 1.41GL would be extracted over 3 yrs from 6 pilot sites/42 wells?
- On what basis is it claimed there would be no aquifer interference?
- On what is the predicted 2m decline in groundwater head based on?

These two Bohena wells are part of an exploration program that involves the multi-lateral drilling. The drilling through the casing of wells poses a risk to the Great Artesian Basin and other aquifers as it is very difficult, if not impossible, to seal the junction between the casing and the lateral.

We know that well integrity is a major issue. *All gas wells fail in time*. The drilling industry figures are that 7% of wells leak immediately, and within 20 years 50% leak. But the truth is that "the biggest bore casing company in the world, will only *guarantee their casing for three years*." So it is only a matter of time before the wells corrode and crumble, and cause massive contamination of the drilling and fracking fluids, and inter-aquifer leakage. The industry will be long gone by then, leaving future Australians to deal with the issues, the main one of which will be loss of our groundwater, and community health impacts.

We already have undeniable evidence of the damage that coal seam gas (CSG) mining does to the aquifers. Professor Philip Pells said recently, "It is now no longer a matter of "if" CSG mining will destroy the aquifers, but merely a matter of how long it will take."

The health impacts (to humans and animals) are well known; we already have cancer clusters forming around the gasfields on the Darling Downs, and children with bleeding ears, convulsions, constant headaches and nausea etc. Dr. McCarron (who did a study, attached) believes it is from air-borne B-TEX chemicals. But as the gas industry does not disclose the chemicals used, it is hard to test for them.

The Chief Scientist is at present gathering evidence, to present her report in March next year. We are providing her with evidence to show that further studies are urgently needed before this industry proceeds, *particularly as the damage will be irreparable*. Scientists and experts have said we need groundwater studies, health impact assessments, chemical

analyses etc. With all the evidence we can produce that these crucial studies have not yet been done (and urgently need to be done), can the Dept. please give us one reason why this drilling cannot wait until Professor O'Kane's report is released? What is the rush, particularly when the damage to the groundwater will be irreversible? (And the gas isn't going away. If they can prove they won't damage the GAB, then the gas will still be there.)

Despite the Director General requiring Santos to state "the likely interactions between the development and *existing, approved and proposed* gas exploration and production" Santos have not yet come clean with their intended future developments in the area; therefore no cumulative impact studies can be conducted.

As we have learned with tobacco, thalidomide, asbestos, and agent orange – it is better to wait and err on the side of caution, than rush in before all the studies are done - and leave our future generations with a terrible legacy.

The govt has still not made it mandatory to the industry to disclose the chemicals being used. Dr Lloyd-Smith of the National Toxics Regulator said her job is to assess dangerous chemicals before they are released - but the industry won't disclose what they are. No medicines, or pharmaceutical products – even garden chemicals – can be released without having been tested. But the only reason people can ascertain some of the chemicals being used by the CSG industry, is from the spills and accidents at well sites.

A geochemist told me it is essential to not just know what the chemicals are, but the quantities – and the mixtures & combinations of chemicals; he said this is vital. None of this has been disclosed.

But its not just that the coal seam gas industry is draining this groundwater, they are also poisoning what is left. Between 30,000 to 60,000 litres of drilling fluids are used to drill each well, and approximately 35% (and up to 100%) stay down in the wells and are never brought back to the surface. Once these fluids have gone into a permeable rock, they have contaminated the aquifer. Once the aquifers are polluted, they can never be cleaned up; once they are fractured, they can never be repaired. About 500 different chemicals are used in drilling and fracking, and only 5 have been assessed by our National Toxic Regulator.

And even without fracking, heavy metals and toxins occur naturally in the coal seams, elements that should be left deep in the seams underground and never brought to the surface. There are dozens of toxic and carcinogenic elements in the coal seams, but the main ones are arsenic, lead, cadmium, mercury, chromium, thorium, uranium. So its not only the chemicals they use (in the drilling fluids) when extracting the gas, but also what is mobilized from the coals seams and brought to the surface.

Some of the 'fracking fluids' contain volatile chemicals, others are known to be toxic, and carcinogenic. Many of these 'secret' chemicals are now known, as a result of leaks and traces identified in groundwater studies. Information obtained from environmental clean-up sites shows that known toxins are routinely being used, including hydrochloric acid, benzene, toluene, and xylene, as well as formaldehyde, polyacrylamides, and chromates. These chemicals include known carcinogens and other hazardous substances.

There are dozens of toxic and carcinogenic elements in the coal seams, but the main ones are arsenic, cadmium, lead, mercury, chromium, thorium, uranium. So its not only what

they add (in drilling fluids) when extracting the gas, but also what is mobilised from the coal and is brought to the surface. Of the 12 elements, the final element is lead, and only the tiniest bit of lead will kill you. But the big concentrations are salt - potassium chloride in the drilling process, and also present in the coal seams. Potassium chloride is the No. 3 choice of killer, in many U.S. states, as a lethal injection – and yet it is used in huge quantities in drilling the wells, as it breaks down the silica.

The surrounding district is also subjected to fumes and dust that affect the nearby residents' health. Typical releases from gas wells include BTEX (benzene, toluene, ethyl benzene and xylene), volatile organic compounds (VOCs), poly-aromatic hydrocarbons (PAHs), heavy metals and other compounds naturally present in coal seams. All these substances affect the respiratory system. 25% are carcinogenic; 37% affect the endocrine system; 52% affect the nervous system and 40% affect the immune system. They can, and do, contaminate air, surface water and underground water systems.

Between 30,000 to 60,000 litres of drilling fluids are used to drill each well, and approximately 35% (and up to 100%) stay down in the wells and are never brought back to the surface. Once these fluids have gone into a permeable rock, then its gone into an aquifer or water body, and has contaminated it. Once the aquifers have been polluted, they can never be cleaned up; once they've been fractured, they can never be repaired. CSG mining anywhere in the GAB area – will ultimately pollute the whole GAB, as there isn't a single isolated aquifer.

The implications for health impacts– for both humans and stock – are enormous. Young people (and pregnant mothers) are even more at risk (endocrine disruptors); some of the known toxins and chemicals affect young people more. We are setting ourselves up for enormous cancer and other health risks in 20 years time, when the gas companies have made their huge profits and are long gone - and our communities (and our taxpayers!) will be long bearing the cost.

It is well documented, that removing the masses of water and gas from the coal seams, creates voids, and then subsidence as the earth pressures readjust; which (combined with the natural faulting and movement in the stratas), causes increased seismicity. Just the act of CSG extraction causes seismicity and earthquakes, but when you add fracking - and then re-injection - it is unavoidable that there will be earthquakes in the future. In the US they are getting multiple earthquakes weekly, which have been proven to be directly linked to fracking and re-injection. In England recently, a County had their first recorded earthquake in history, and - what a surprise - there was a gas drilling rig 100m away. And after similar incidents, last year France banned fracking completely.

Riverbeds and waterways are cracked and damaged allowing methane to escape. Seismic activity is caused by the rock fracturing, done to release the coal seam gas. Exploration involves seismic surveys, followed by deep drilling of tens of thousands of wells (with drilling fluids), and by the time the oil or gas field is discovered and a Development Permit applied for, most of the environmentally damaging work has already occurred – without any environmental impact statement having been done.

Fires:
Another potential problem is the enormously increased fire hazard, with all those venting gas wells. Small rural bush fire brigades aren't equipped to handle the fires caused by gas flares and gas well blowouts and explosions (well documented in the U.S). The Warrumbungle fire brigade, who would be responsible for fighting a fire in the Pilliga, have said they will not go into the forest, if a fire should start. It would be an uncontrollable inferno, a death trap.

No fire bans for them, they are self regulated; constantly venting flares. Last big fire in Qld. apparently caused by an insect flying through the venting flare.

High pressure gas pipelines another risk (esp. if there is a fire). Explode; and impossible to extinguish.

The government and the CSG industry trumpet loudly about the "strict regulations" they have to follow. This is not true, as there is no supervision, no government representative or body to oversee their standards of well drilling, their compliance with correct practice etc., and no penalties for failing to comply with their so-called 'regulations'. They are supposed to "self monitor" and "self report" – which they don't do. Look at the chemical spills in the Pilliga, which Santos have admitted to recently. And the only reason these multiple contaminations were ever brought to light, was that a local landholder contacted the media. This landholder had been reporting the chemical spills and damage to the relevant government departments for years, but nothing happened; so as the damage escalated (he had sent 44 reports of separate incidents!), he contacted the media.

And if the visible damage (above the ground) was so disturbing, of even greater concern is what ESG did below the ground, to our Great Artesian Basin. ESG hydraulically fractured (fracked) no less than 13 times, and three of those 'fracks' were the largest ever done in Australia (as they proudly boasted on their website). We have evidence that the GAB has already been damaged, in many instances, by fractures deep below the ground. Many of our most highly respected water experts are now calling for a moratorium – for a stop to this industry – until more studies can be done on the impact of CSG mining on our GAB. They all agree that the damage to the GAB will be irreversible; once an aquifer is poisoned, it can never be cleaned up. Once it is damaged, it can never be repaired.

Such strict regulations and care must be taken when handling chemicals for farming - yet there no such regulations with these drilling fluids and fracking chemicals. At the start of the Qld. floods last year, 54 totally toxic storage dams burst / overflowed / totally flushed out initially during the floods, and discharged 20 years of accumulated toxins and carcinogens into the rivers and waterways. The CSG companies applied to the govt. for another 1186 other dams to all flush out too - they wanted to empty out all their poisons while the rivers were so high, for the "dilution" factor. A geochemist in Dalby told me they work on 'dilution by volume' (i.e. that a thimbleful of arsenic in a river is "acceptable"). And companies can claim Force Majeure during floods. We regularly get floods - do we want these chemicals and toxins in our water and our rivers, and washing over our land, and entering our food chain?

The consequences of this CSG industry will be disastrous - a long-tem legacy of destruction left behind, for a short-term financial and political gain. How can they justify this? How can they possibly sacrifice our prime farming land, and Australia's single greatest resource, the Great Artesian Basin, one of the wonders of the world, for such a short-term monetary gain, and one that comes at such an enormous future cost? This water is needed for towns and communities, for **people**, for food production - not for foreign and multinational gas companies. Not for governments to try to balance their books and stay in power.

All over the world, the groundwater and the aquifers are drying up. In China, India, the U.S., Pakistan, Arabia – they are realizing too late, that they have squandered a finite resource. Water is the one non-negotiable essential for life. And the coal seam gas industry *will* destroy it. Professor Pells joined many other experts voicing the same concerns, when he said recently, "It is now no longer a matter of "if" CSG mining will destroy the aquifers, but merely "how long it will take".

Firstly the Groundwater Research GAB How *much* water is used - from finite resource - Govt. Water Group estimates that CSG mining will use up to 1500 billion litres of this finite groundwater per year (and that is conservative govt. figures)

De-pressuring – opposite of what we are doing with capping and piping – at Tara gasfields, about 80 bores will stop flowing in next couple of years

Polluting the GAB with drilling fluids etc., not just chemicals used in fracking.

Seismic activity causing huge problems (interconnectivity) – and subsidence, faulting – earthquakes. Re-injection. (John's papers)

Gas (methane) leaking – NOT clean and green (Uni. Professors' research)

Fire risk (methane leaking through cracks in the ground). Whole towns in the US have had to be evacuated and permanently abandoned, as they can't stop the gas leaking up through the cracks in ground, footpaths, roads etc.

Some facts about CSG extraction:

Over 36,000 kilos (or approximately 36.3 metric tons) of chemicals are injected into the earth's crust to frack *each well*. Wells can be fracked multiple times – up to 17 times.

From 60% to 100% of fracking fluid remains in the ground, and is not biodegradable. This migrates through fractured aquifers and faults.

Fracking fluid calls for 2 million gallons of water, transported by tankers and trucks, for each drill.

Lowest estimate is 1. 2 million tonnes of salt per year will be brought to the surface onto prime farming land, rendering it useless.

Origin Energy senior engineer Robert Kane's published comments in Gas Today in 2009:

Mr Kane was reported as saying that bores would extract between 0.1 megalitres a day and 0.8 megalitres a day. For a production life of 15 years and 18,500 bores, the Water Group report estimated this would result in the extraction of 10,000 gigalitres to 81,000 gigalitres of water.

Researchers say that 65 of the compounds used in fracking are hazardous to human health. Have you considered the future cost to our communities, not just in loss of water, but in the health impacts (and costs).

Kind regards,

Anne Kennedy
"Yuma"
Coonamble NSW 2829

(Support documentation & articles attached).