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## MEETING MINUTES

Govt Departments. Committee member would like to table letters from Office of Water stating they do not have access to plan.

- **Santos to check incorrect information on handout from Santos Info Session.** This info was incorrect and has been cleared up.

- **Chair to contact committee member and get contact details for water specialist.** Chair has spoken to committee member.

- **Further investigation on the integrity and effect SRB has on steel casing.** Happening at tonight's meeting.

- **Santos to find out if Bibblewindi 14 will be decommissioned.** No it has not.

- **Rehabilitation.** Santos provides committee with photos of the site in question and explains they are working with the property owner to complete rehabilitation to their wishes.

Committee accepts previous minutes

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### 3. Sulphate reducing bacteria – Dr Richard Cresswell

*See Appendix 1 - Presentation Sulphate- Reducing Bacteria. (SRB)*

Glenn Toogood (Santos) introduces Dr Richard Cresswell, who is a well-respected independent expert. Previously worked for CSIRO and Australian National University researching ground water and other geochemical issues, currently employed by consultancy company Sinclair Knight Merz and member of the Federal Minister's expert panel for large CSG projects.

#### **Presentation Notes:**

- SRB don't like too much oxygen, oxygenated water has 8 parts per million of oxygen in it. Sulphate is what they eat. During a process they generate hydrogen sulphide, which is a corrosive gas, this causes the problems in steel casing of

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bores. SRB are found everywhere that the deoxygenated conditions are such that they can survive. Small amounts found in aquifers and aquitards, if conditions are dry then will go dormant. They can die but they can go into cyst? form. Found in ponds especially stagnant; free flowing water inhibits their growth due to oxygen moving through, get them coming out of volcanoes and surrounds, used as water softeners also found anywhere there is the use of gypsum.

- Only come into operation when they have the right conditions.
- If you have methanogenic reducing bacteria producing methane, you tend to not have sulphate reducing bacteria or very low levels of SRB.
- So far no one has identified any health effects from SRB. SRB will occur with other bacteria, and it has always been traced back to alternative bacteria that cause any health issues. Consequently Australian drinking guidelines have no guidance for SRB.
- Problem is high concentration of the product of SRB, hydrogen sulfide (H<sub>2</sub>S) gas. If that starts accumulating that causes health problems because it is corrosive to the lungs.
- SRB is used on mine sites to reduce and remove toxic metal levels. Methane is generally not produced in the coal seams if there is a lot of sulphate around, which stops the growth of the methanogens.
- Problem with stagnant wells is that SRB can develop in the bottom producing H<sub>2</sub>S, which can then bubble to the surface and then start corroding the well steel casings.
- Where you have SRB in wells you will not get CSG coming out of those wells.
- Recharge of the GAB (Great Artesian Basin) is not keeping up. Pressure of GAB is slowly going down overall. In some places it is going up. As bore rehabilitation process is taking place this is slowing down and stopping that drop. GAB water wise isn't just one basin. *(Refer to maps in presentation)*

### Questions:

Chair discusses with committee on how they would like the question time to run.

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Committee decide that they want to ask individual questions rather than breaking into groups.

Committee member asks if the SRB is more active under the water or where it is exposed to oxygen? Presenter responds that SRB will retreat from oxygen, and veer towards environments of less oxygen. If there is oxygen in the system they will shut down and if they have time to shut down they will form cysts, they need water or dampness to live so if conditions dry out they will also shut down. A proportion will die and they form colonies, as the conditions get bad around them they join together and outer ones die to form a protective shell for the inner ones. When the conditions come good again, the outer ones blister and the inner ones thrive

Committee member expresses that she would prefer to break into groups to discuss and identify key issues / risks. Committee member asks what are the internationally experienced risks of SRB to the industry, is SRB a prevalent risk? Presenter responds that from what he has seen the risk is mitigated because exclusivity generally exists between SRB and CSG. The risk in terms of corrosion is not an issue in the CSG industry because corrosion caused by SRBs takes place at interface between the water and the air and while the water is being pumped and oxygen is flowing this isn't a risk because the sulphate level is so low. The issue is more prevalent in stagnant water.

Committee member asks that if the well is actively working then SRB cannot survive, is this correct? Presenter responds that the stagnant water will generally be in the sump of a well, so this is more prevalent where you have the pump down the bottom. The bigger the sump the more likely SRB will be there.

Committee member tables a sheet on drinking water guidelines. Committee member confirms that the guidelines are the same as what the presenter has mentioned. However would like to bring up the topic of Pseudomonas which indicates that the greater the presence of SRB the greater the chance of Pseudomonas turning up. This is concerning

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because Santos has swapped to potassium sulphate as drilling fluid aid that can cause a change in the calcium sulphate and the aquifer systems where these naturally occurring SRB live. So this will introduce a food source for them. Other concern is use of gypsum at rehabilitation sites; Gypsum is calcium sulphate and a food source for SRB. While we may not have issues with the SRB attacking the steel casing of pipes from inside, SRB are certainly building up within the aquifers that surround the external surfaces of the cement work and steel casing. Presenter responds that the conditions that SRB is growing in tends to be pre-existing conditions and by disturbing that you are changing those conditions so he does not want to dispute that they can be introduced in but if they are already there, then the act of putting a well down is creating an environment that they don't like. Gypsum is calcium sulphate, gypsum as it breaks down is quite an oxidiser, producing a lot of oxygen, and the oxygen levels that they operate at have to be relatively low.

Committee member would like to challenge Santos and presenter to produce figures of the SRB from water analysis from the aquifers in the Pilliga Forest and from the coal seam itself. Committee member believes statements are not correct. And requests full bacterial and chemical analysis of all aquifers within the Pilliga State Forest area of operation and also to produce full bacteria and chemical analysis of the water coming out of the coal seams at each fields. Committee member believes that he has researched into an aquifer system at his place and SRB is multiplying like crazy. Chair clarifies with presenter that he said that you should not find SRB in the aquifers.

Committee member would also like to refer to the CCC meeting about soil where the committee was told that the likelihood of SRB travelling from XYZ and mitigating through the ground water to a bore just couldn't happen, is this statement correct? Presenter responds that the question is not a yes/ no answer; to answer this you would have to define two point sources. Within the system of a free flowing alluvial aquifer it should be a very low probability, if you've got an actively recharging ground water system because most of the shallow undefined systems have sufficient oxygen in them that the SRB don't like. Once you move into deeper systems then there is a possibility of transferring from

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one well to another if the wells are close enough and the conditions through the aquifer are such that they are consistent between those two wells. Committee member explains that his unconsolidated aquifers are 71 metres deep with a SWL of 60 metres and in the recharge area of the Pilliga, do you think at that depth there would not be a flow through that aquifer system? Presenter says that the flow through the aquifer system there is dormant SRBs but they are not going to proliferate from one well to another well in that system. They will proliferate once you have those conditions in and around the well. Santos asks committee member if he will provide the studies he has been referring to, and he responds if Santos is prepared to provide all that information he has requested and points out Santos' lack of response to the CCC request for full bacterial analysis of the dams at Biblewindi water storage facility and at the Dewhurst 8 sites as requested since August 2012. Santos responds that it is the landowner that is preventing the taking of samples for testing at the Dewhurst 8 site. Chair asks if both parties could consider this sharing of information. Santos says they feel they have provided information and the committee member disagrees that they have provided sufficient information like water analysis. Chair asks presenter if a full water analysis would contribute to the discussion? Presenter responds it would but we would also need to know the construction of the bores and where they are? Committee member believes that SRB in this environment pose a problem to the integrity of the entire wells in the Pilliga and other areas of Pel238. Presenter believes that this is difficult to substantiate from being the source. Both of these processes will decrease the oxygen content, which would tend to reduce the SRB. Clarification that there is a level of oxygen required, not oxygen tolerant.

Committee member suggests that this is a broader topic for the community and suggests that the issues of transferability of SRB and the contamination of other bores is a concern, potentially the geology and the aquifers might be slightly different here, we need to understand the data that both Santos and others have and perhaps we would all benefit from a facilitated outcome of data exchange and openness to get this issue resolved. Santos agrees that we need to get clarity around this issue. Committee agrees that coal seam gas and SRB are an issue. Chair asks presenter if in his experience is SRB

Santos to find out if and what Biocides are used in the area and what is the purpose of them.

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related to CSG? Presenter responds that he has difficulty relating what is happening at a level greater than 500 metres to what is happening at 60 metres. Committee member has read a report from a company where there have been great concerns over SRB, in England and also America where they couldn't control SRB anymore with the biocides that they have been using. Santos would be interested in seeing this international research. Presenter is not familiar with research committee member is referring to. Coal seams can have sulphur in them SRB can get their energy from Sulphur, but on a whole where you have high sulphur you get poor levels of CSG. We have to be careful comparing coal seam gas with coal shale gas in America. Committee member asks what is the chemical in petroleum that promotes SRBs. They are feeding on the carbon in petroleum. Committee member asks isn't coal completely carbon? Presenter responds yes it is, but the petroleum environment tends to allow the existence of a presence of sulphur. Generalization is that methane improves CSG productions; conditions are generally not great for sulfate reducing bacteria. Committee member asks why does CSG mining use biocides to kill something in the wells? Santos would like to take that question on notice and ask their drillers, there are some biocides used in fracking processes (there is not fracking happening here).

Committee member asks if we can create some kind of system that as a community we can get results, so issues like this bore can be resolved. In case that there is further issues of contention in the future so there is a process to deal with these and other issues that may arise. Chair asks Santos how this issue can be resolved. Committee member would also like to bring up that Bohena 7 pond has high bacteria levels as well.

Santos says there are a number of issues that we need to resolve. Bohena 7 – hasn't been used for a number of years for gas purposes and so as far as I am aware it is rainwater in the pond, which I assume would be stagnant water and therefore I am not surprised that it contains SRB. This pond will be rehabilitated; I can speak with water guys to find out exactly what they will be doing water wise. Santos feels like they are making genuine effort to resolve some of these issues, we are trying to work through

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these issues sequentially. Committee member is appreciative when Santos decides to help people. Committee member wants to know what happens with the other committee member's bore issue? Santos responds that they are happy to facilitate with what is best to do. However the fundamental issue that Santos has is that in good faith they tested the bore as part of the water monitoring process, they gave the landholder results and expressed concern about level of bacteria in there, the next day Santos have media discussions about the fact that Santos had caused the problem with the bore. At some point we need a level of trust between each other. Happy to speak about what is in bore. But there is no factual evidence to say that Santos caused the problems in the bore. Discussion needs to be productive. Chair clarifies that committee member has been frustrated that Santos isn't coming to the party to try to help you clarify what is going on with your bore. And you believe that they have contributed to your bore. Santos you are saying that you did the bore analysis early last year and expressed the concerns about increased level of SRB and you had advice from independents to make landholder aware of that, which you did. Santos cannot prove that CSG industry did not contribute to the increased level or SRB in the bore and landholder can't prove that they did. Santos offers advice on remediating the bore, suggesting that the bore should be pumped through reintroducing oxygen. Would that decrease the concentrations of SRB and get the bore back running well? Presenter responds that yes it might, but questions what the levels of SRB were in the bore before the analysis. Asks committee member if he could tell the difference. Committee could tell the difference - the water stunk and had a metallic taste and you couldn't drink enough to be satisfied. Prior to that no problems at all, specialist recommends flushing it through for a period of time until it re-stabilizes and then treating it with bleach. Committee member asks presenter if you come across a bore that is pumping (a working bore) and it still has a high level of SRB what do you do then? And what does that tell you? Presenter responds, you need to look at the construction of the bore and check the size of the sump. Chair asks for steps forward to resolve this matter. Committee member believes that the whole area is at risk and we need to know more information about water quality from Santos. Chair asks committee member and Santos to stay back after meeting to discuss this issue further

Action Santos to find out if they flush out their wells before plugging them and what is the process of plugging and abandoning the wells to ensure well integrity.



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and come up with a resolution.

Committee member asks if the Australian drinking guidelines state that there are no standard guidelines where is the problem with SRB? Presenter responds that there is effectively no problem. Committee member then asks what is all the fuss about?

Committee member asks presenter how do biofilms work and can they build up to corrode? Presenter answers you have colonies of bacteria, if they are in the wrong environment they will coalesce, SRB is one of the most prevalent, they like conditions where there is little oxygen. If the conditions start to change and oxygen is brought in they will coalesce and will create an anaerobic condition inside their formation. Outer shell is now dead; inside they are shielding and maintaining the anaerobic environment. Committee member asks what is the correlation between corrosion? Presenter notes that the SRB by product is H<sub>2</sub>S, so if they are living adjacent to the steel casing and that gas cannot escape because there is a biofilm formed around it, then the H<sub>2</sub>S concentration is building up inside and corroding the casing. Corrosion won't happen if you are continually flushing the system through. Committee member asks what about when the well is abandoned. What is the long-term diagnosis of the well integrity? Presenter responds that the cement and steel used is designed for long term, but there aren't enough field trials to know exactly the timeframe, there might be but I haven't come across them. Part of the research that is being, and that has been, undertaken is to work out what is the best way to make sure of the integrity of these wells once they are capped. Flushing the wells out before you plug them is one process. Committee member would like to know if Santos currently flushes out their wells before they fill them? Santos responds that there is a range of processes used.

Committee member asks how much time has the IESC (Independent Expert Scientific Committee) been investigating the ground water hydrology of the Pilliga, particularly in the area that consists of the southern recharge? Presenter clarifies that he is not on the IESC committee he is a member of the expert panel of CSG projects, so I am only looking

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into CSG projects (the IESC looks into large CSG and Coal projects). There is a lot of investigating on this topic and I would assume you could get this research from the archives of the Australian National University.

Chair asks committee if they have any more questions if they could please provide them to the Chair who will forward them on to Glenn Toogood (Santos).

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### 5. General Business

**Update** – Santos provides committee with Update of current activities (refer to appendix 3).

**Other Business** – Committee member emailed further questions to chair to be answered by Santos. Santos provides response to questions below.

*1) Under what license will SANTOS be able to produce the proposed coal seam gas for sale into the Sydney gas market and where do they propose to drill, is the production license already granted.* No we need a production license, we will provide for that production license. We propose to drill in the Pilliga Forrest. As we get further along the processes we will have more information available for the community.

*2) Details of 'the above' with regard to Schedule 3 (final page) as per the attached document.* We are able to explore under the PEL238 license, but if we are going into production we have to obtain a production license.

*3) How will SANTOS propose to transport the proposed produced coal seam gas into the Sydney market and in what form.* It will be piped as gas into the Moomba Sydney pipeline. We are proposing to build a pipeline effectively the whole way, going west, route still being sorted.

*5) Was PEL 238 reduced in size by the NSW government in the process of renewing the PEL License in February of this year?* No it wasn't. Roughly because the government owns the resource and because they think there is a perspective resource in there they deem that Santos is best placed to explore for that resource.

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Committee member asks how much gas is in the Pilliga? Santos responds that there are 1400 terajoules roughly and NSW uses about 160 per annum roughly. So there is roughly 10 years supply. So what we are proposing is to supply about 25% of the NSW demand over 20 years. We are planning to build a pipeline that takes that amount of gas only over a period of 20 years. That's not to say that we won't keep exploring and we might find other projects along the way. But what we are currently proposing is a stand-alone project from the Pilliga into the NSW market providing 100 terajoules a day, the pipeline will be sized to fit that.

Committee member questions

6. 4 core hold 2 lateral minimum requirements you have to do to met licence requirements.

**Next Meeting:** 14<sup>th</sup> of May on a Tuesday.

**Issues:** Surface water contamination, environmental aspects.

**Other business:** Cate McMahon is leaving Santos thanks committee.

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**Meeting Closed:**

7.45pm

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**Extra Notes from after meeting discussion:**

Glenn Toogood: Ground water experience, Glenn recommends pumping Tony's bore. Pulling the pump out and flushing it out. Bores needs to be maintained. Redeveloping the well, not getting the yield out of the bores, surge and purge, dropping down action.

**(between Glenn Toogood, Dr Richard Creswell and Tony Pickard)**

Richard: recommends flushing and cleaning bore with Hypochlorite. Which could be purchased from farm supplies, and is a feasible possible solution to maintaining the bore back to original state.

Glenn: Suggests that local bore specialists would be able to offer further guidance on where to purchase hypochlorite if unavailable at local farm supply.

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Tony: mentions he has had previous advice from bore specialist.

Tony: spoke to Santos senior staff indicating they would come back and investigate / analysis bore and never did. Letters have been sent to Santos about this matter. Sam Crafter sent a letter back saying Tony was on his own. The bore goes up and down in its quality. Tony feels that doing what Santos suggests will not fix the problem and will not solve the overall issue and he has to know where the source of the contamination is from and it's not a feedlot as has been previously suggested, as he does not have a feedlot near by. Tony needs truth from Santos.

Glen: Bore remediation 101 is generating oxygen, if you are not seeing the results flush the bore out, Hypochlorite will flush it back to its conditions.

Tony: has seen a bore upstream that is worse then his, Tony wants to know what has caused the problem. Symptoms happened overnight. And wants answers.

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**Attachment 1. Actions**

<b>Action Raised</b>	<b>Date Raised</b>	<b>Progress Made</b>
Santos to provide response to questions on Namoi Water Study – data presented by ESG.	9 <sup>th</sup> October	Ongoing. Coffee Geo-techniques project managed the report and Chair has been trying to contact them further. Committee member recommends contacting Ross Best for further details, Chair to follow up.
Santos to provide committee with a copy of Water Management Plan	11th December	Ongoing. . – <i>Plan has been provided to the DRE. Committee member points out that the office of water wrote in their response to the Leewood application that they did not have access to the full water management plan. Santos is happy for the plan to be provided to the committee once the DRE have finished looking at it, it is currently caught up in between Govt Departments. Committee member tables letters from office of water stating they do not have access to plan.</i>
Action for Santos to provide committee with full soil analysis including analysis of bacteria of the Leewood site next year when it is available. As well as providing regular soil checks to	11th December	Ongoing

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ensure no contamination is occurring.		
Specialist to answer questions on aquifer monitoring research that is being conducted.	11th December	Ongoing.
Santos to provide evaluation and commitment plan, Evaluation of water (full water analysis including bacteria but also escaped gases etc) fugitive omissions	11th December	Ongoing
Committee to read the presentation on land compensation and see if they are happy with the explanations.	11th December	Ongoing.
Santos to provide full bacterial analysis of 3 dams at Biblewindi.	11th December	Ongoing.
Full analysis of Biblewindi ponds, committee have been provided with SRB, could they please have a full analysis. – Santos to look into it.	24 <sup>th</sup> April	Ongoing.
Santos to find out if and what Biocides are used in the Pilliga area and what is the purpose of them.	24 <sup>th</sup> April	Ongoing.
Action Santos to find out if they flush out their wells before plugging them and what is the process of plugging and abandoning the wells to ensure well integrity.	24 <sup>th</sup> April	Ongoing.

- Appendix 1:** Presentation – Sulphate reducing bacteria
- Appendix 2:** The facts about Sulphate- reducing bacteria
- Appendix 3:** Santos Updated

## **SANTOS UPDATE**

### **Proposed upcoming work program – Narrabri area**

Much of this work will take place over the next few months, but exact time frames for some of the schedule is dependent on factors like approval times and rig availability.

#### **Decommissioning of wells:**

- Bibblewindi 2 in the Pilliga State Forest was completed in March and Bibblewindi 1 decommissioning is now complete.

#### **Workovers, or modifications and upgrades, to existing wells:**

- The rig has begun to decommission three wells 3, 5 and 7 in the Dewhurst region of the forest. Site preparations have begun at these locations. Dewhurst 3 has been completed rig is on Dewhurst 5 at present.

#### **Drilling of exploration core holes:**

- Bibblewindi 30 in the Pilliga State Forest
- Kiandool on private land. Rather than being plugged when the core has been extracted, as would usually occur, this core hole will be converted to a deep aquifer monitoring bore to gather and monitor baseline water data. An additional shallow aquifer monitoring bore will also be drilled at the site to assist with data gathering
- Dewhurst 8A on private land. This core hole will also be converted to a monitoring bore
- Narrabri West on private land

#### **Other work:**

- Expansion of facilities at the Narrabri Operations Centre DA has been submitted to council for review.
- Survey work has been completed on the leewood to Bibblewindi and the Dewhurst to Bibblewindi flowlines.
- Rig Camp site at McFarlane's will be moved to Wilga Park. Site preps underway
- Coonarah CP survey complete and Hydrotest planned
- RFSU review commenced

#### **Shallow Monitoring Wells**

- Santos will be installing four shallow water monitoring bores along Bohena Creek.
- The purpose of these bores is to monitor the water level and quality of the shallow ground water in the channel deposits of the ephemeral Bohena Creek.

## Pilliga rehabilitation

In the past six months:

- Rehabilitation work on Bohena sites in the forest is now complete with irrigation and soil monitoring taking place
- The Bibblewindi storage pond 2, near the site of the former water treatment plant, has been emptied and clean-up of the site is underway in preparation for complete rehabilitation
- To view images of our rehabilitation work visit:  
<http://www.santos.com/exploration-acreage/nsw-csg/pilliga-rehabilitation.aspx>

Over the next few months rehabilitation will be ongoing:

- Decommissioning and rehabilitation of selected wells
- Continued work at the sites that have been partially rehabilitated to date
- Assisted vegetation and irrigation will continue

## Site visits:

We will be holding the second of our community site visits to the Pilliga on May 20. To register your interest in attending, please contact Annie Alexander at our Narrabri office on 02 6729035 by May 15.

## Community:

- Santos has donated and installed 3 x 380,000 Litre tanks at Narrabri Airport for ongoing Fire Fighting Water Storage. Further to this we are presently constructing a 380,000 Litre tank in the town of Pilliga and also one at Gwabegar to be utilised for the same purpose. Airport complete and commissioned Pilliga started 15/04/13
- Santos was the major sponsor for the Narrabri Cup races April 6 and the annual event 'Nosh on the Namoi' April 13 working in partnership with the Narrabri Rotary to host the Gourmet Hamburger stand - all funds raised will be split between Narrabri Meals on Wheels, Narrabri and district Historical society and Hear our Heart (mobile ear bus fund raiser) - <http://www.hearourheart.org/>
- Santos hosted an information exhibit at the Gunnedah show on the 12 April.
- Narrabri Show on the 27 April- Santos will host an exhibit site