THE WILDERNESS SOCIETY

The Wilderness Society Newcastle
90 Hunter Street
Newcastle, NSW 2300

NSW Chief Scientist and Engineer
Professor Mary O'Kane
GPO Box 5477
SYDNEY 2001

29th May, 2013

Dear Professor O'Kane,

RE: Meeting request and research regarding coal seam gas exploration in the Pilliga forest

I am writing to provide you with a copy of two reports commissioned by The Wilderness Society Newcastle and Northern Inland Council for the Environment. These reports provide useful research and review into the impacts of coal seam gas activities in NSW and in particular the Pilliga forest.

I have also included a groundwater map of the Pilliga forest, from the Groundwater Atlas 2012, an initiative funded by the National Water Commission and hosted by the Bureau of Meteorology.

The Pilliga, in North West NSW, is a national icon and stands as the largest patch of intact woodland left in eastern Australia and is a precious recharge area for the Great Artesian Basin. The first scientific report enclosed relates to the natural values of the Pilliga forest. This report, *National Significance: The ecological values of the Pilliga East Forest and the threats posed by coal seam gas mining 2011-2012*, details a wildlife survey in the area by independent ecologists and the substantial environmental damage that will caused by coal seam gas activities, including habitat loss and contamination of soils and water.

The second report entitled, *The Truth Spills Out: A Study of Coal Seam Gas Exploration in the Pilliga*, compiles and analyses all the empirical data available on the environmental harm caused by coal seam gas operations in the Pilliga, from June 2011 to April 2012. It also develops a detailed chronology of events which includes relevant public statements from gas companies, governments and the community as well as conducting an audit of events against legal requirements.

The Groundwater Atlas shows clearly the areas of the Pilliga that are reliant on subsurface groundwater, with moderate and high potential for groundwater interaction. Please note that the central north east area of the Pilliga forest, earmarked to become a coal seam gas

field, contains these groundwater interactions. Please also note comprehensive desktop and field based studied have not been undertaken, and I recommend further onsite groundwater research being undertaken before further coal seam gas exploration is undertaken in the Pilliga forest.

I appreciate the recent opportunity to provide a submission and these documents and the dedication you have shown in travelling NSW to gather first hand information on matters related to coal seam gas.

I would now like the opportunity to brief you further on our experiences working on coal seam gas in environmentally sensitive areas and to answer any questions you may have regarding coal seam gas in the Pilliga Forest. I would also like to discuss the possibility of trip to the Pilliga Forest so you are able to see first-hand the impacts coal seam gas has on the environment there.

Please do contact our office on (02) 4929 4395 or email newcastle@wilderness.org.au to arrange a meeting and to discuss these matters further.

Yours sincerely,

Naomi Hogan

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The Wilderness Society Newcastle
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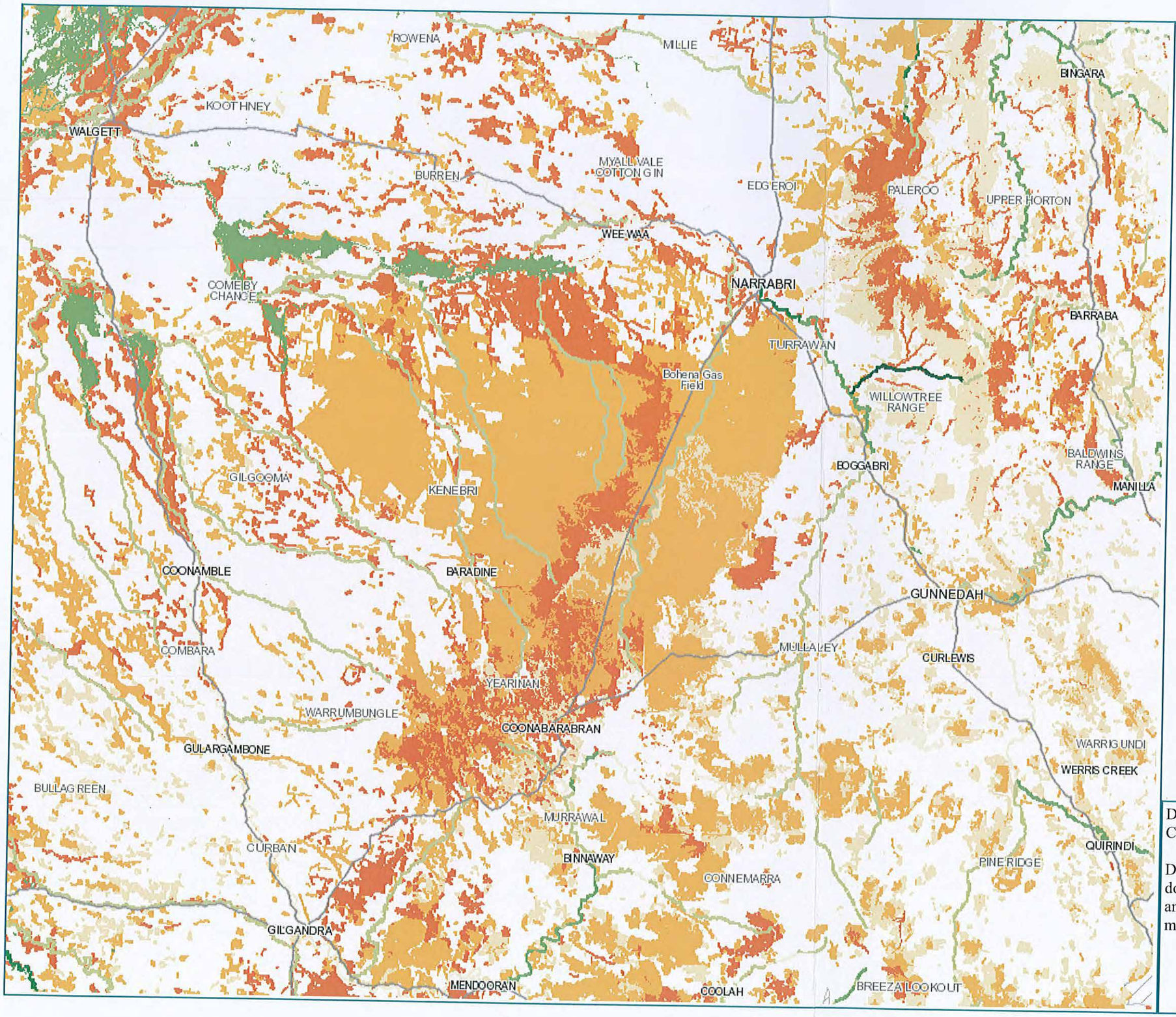
0401 650 411

Australian Government
Bureau of Meteorology

Groundwater Dependent Ecosystem Map Report



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GDE, Reliant on surface expression of groundwater (rivers, springs, wetlands)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- High potential for groundwater interaction
- Moderate potential for groundwater interaction
- Low potential for groundwater interaction

GDE, Reliant on subsurface groundwater (vegetation)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- High potential for groundwater interaction
- Moderate potential for groundwater interaction
- Low potential for groundwater interaction
- No Ecosystems analysed

GDE, Subterranean (Cave & Aquifers)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- No Ecosystems analysed

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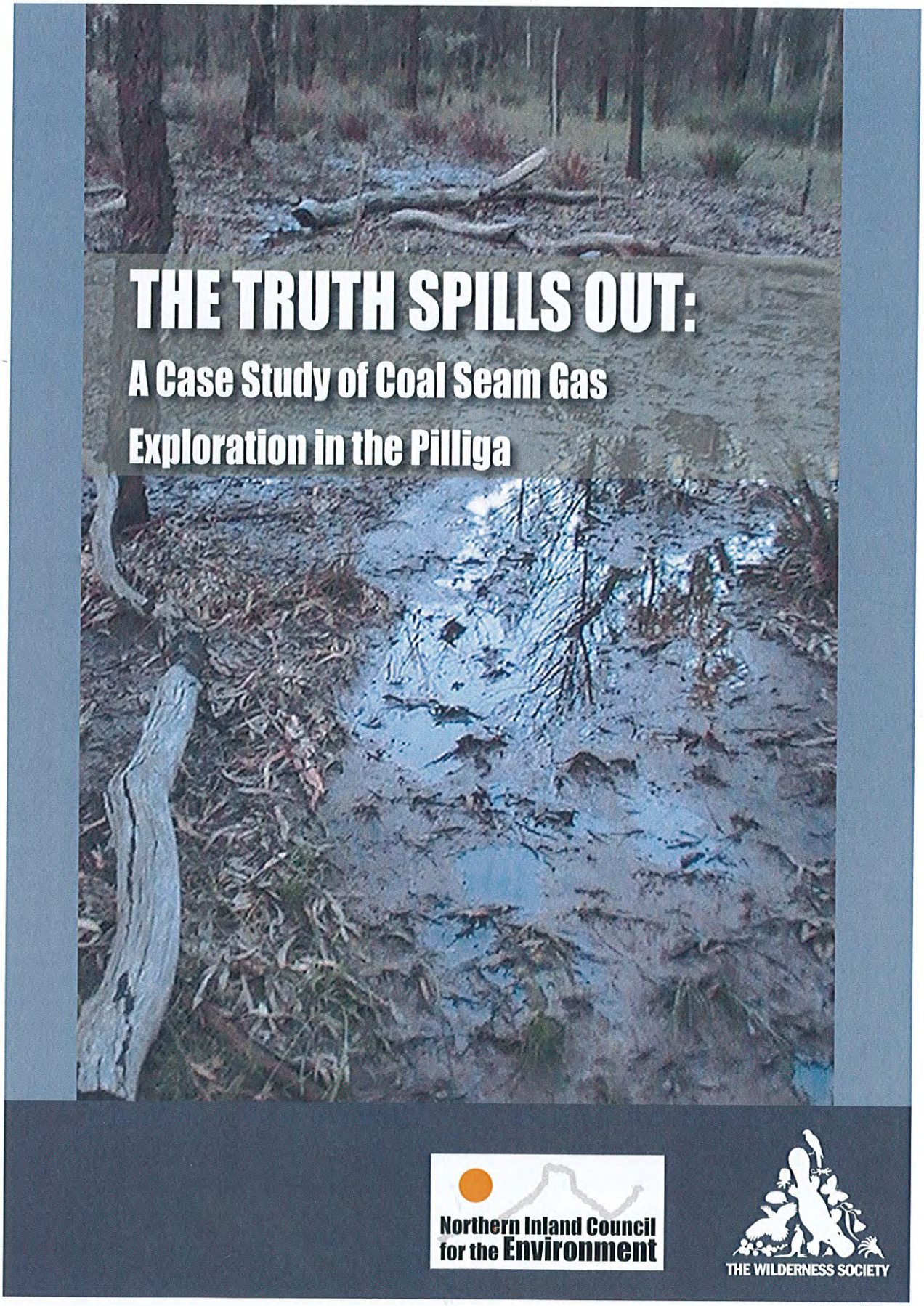
Metres 20,000 40,000 60,000 80,000 100,000 120,000

Data source - Data are assumed to be correct as supplied from Commonwealth, State and Territory data suppliers or referenced projects.

Date: 17 September, 2012



THE TRUTH SPILLS OUT:

A Case Study of Coal Seam Gas Exploration in the Pilliga

Northern Inland Council for the Environment

THE WILDERNESS SOCIETY

Contents

Executive Summary

The Pilliga Forest is an outstanding biodiversity icon that is now severely threatened by coal seam gas exploration and mining. Over the last 12 months, there have been numerous environmental incidents arising from coal seam gas operations in the Pilliga which have been exposed by community groups operating on a voluntary basis.

This report compiles and analyses all empirical data that is available on the environmental harm caused by coal seam gas operations in the Pilliga over the last 12 months, from June 2011 to April 2012. It also develops a detailed chronology of events which includes relevant public statements from gas companies, governments and the community as well as conducting an audit of events against legal requirements. It is a preliminary report that will be supplemented with additional sampling results and freedom of information documents when they become available.

This report provides detailed evidence to show that the coal seam gas operations in the Pilliga to date have resulted in harm to the environment, including water pollution and soil contamination. It alleges the licence holder has not complied with the provisions of the *Petroleum (Onshore) Act 1991* or the conditions of the licence.

The report shows that:

- There is evidence of systemic and serious breaches of laws and regulations in the Pilliga Forest which have only been revealed as a result of community pressure.
- The NSW Government has repeatedly relied on inaccurate information provided by gas companies in their public statements instead of collecting their own information.
- Despite claiming to be undertaking a comprehensive investigation of coal seam gas operations in the Pilliga from early August 2011, the NSW Government failed to identify or act on the major breaches that were reported by environment groups after that date.
- The NSW Government response to any substantive public complaint is to 'announce' that it is investigating, but such investigations in many cases appear to be nothing more than a tokenistic request for gas companies to respond to the complaint.
- In fact, there have been up to seven different investigations 'announced' into coal seam gas operations in the Pilliga over the last 12 months. The scope and nature of those investigations has not been explained to the community and there is no public transparency in relation to them.
- None of those investigations has yet led to any regulatory action against the companies involved.
- The delay and inadequacies in Government responses means that it has not collected vital information relevant to properly investigate the matters in a timely manner.
- There is evidence of a disturbing pattern of denial and blame-shifting by coal seam gas companies and governments when responding to genuine community complaints.
- Statements made by Santos and Eastern Star Gas on a number of occasions do not match the facts as later revealed.

As a result of all these factors, the community can have no confidence in the coal seam gas industry or into the so-called investigations by the NSW Government that are now underway.

The information contained in this report confirms that the concept of self-regulation by coal seam gas companies is flawed. By referring matters to companies to self-regulate, the NSW Government provides opportunities for companies to cover-up incidents and to hide evidence. It means that any Government investigations are so delayed as to miss out on opportunities to collect solid evidence in a timely manner. This has occurred on a number of occasions in the Pilliga as set out in this report.

The interim report by Santos into Eastern Star Gas (ESG) operations, released in February 2012, effectively seeks to shift the blame of environmental incidents to the previous operator and downplays the environmental impacts to date. However, it is important to note that Santos itself had a major financial stake in the prior operator.

Furthermore, there are a number of problems with the Santos report. It omits important information on water quality, does not provide any sampling information of contaminated surface water, compares soil sample results to benchmarks based on urban areas that are not relevant to a sensitive environment like the Pilliga, provides no information whatsoever on the four spills which it has admitted since taking on full ownership in November and does not provide an adequate ecological risk assessment of the damage that has occurred to date. The media release associated with the report misrepresents the results of sampling data commissioned by environment groups.

Contrary to Santos media statements, there is sufficient evidence contained in the water and soil samples commissioned by both Santos and environment groups to indicate genuine ecological risks from the admitted environmental incidents in a high conservation value area such as the Pilliga, as this report outlines. The NSW Government should not rely on Santos self-reporting in this important matter, but should now require a thorough independent review of existing data and collection of additional information relevant to assessing the environmental impact of all aspects of PEL238 and PAL2. A full ecological risk assessment should now be conducted as a matter of urgency.

This report will allege that there have been several major and very serious breaches of the petroleum titles under which Santos operate, and at least one breach of the Petroleum (Onshore) Act 1991 itself. The alleged breaches are documented in detail in this report, with evidence provided to support them. The most substantial of these have included contamination of soils, pollution of waters, commercial production of gas from an exploration licence and failures to notify the department of these and other breaches.

There are likely to have been a number of breaches of other environmental laws in the Pilliga, most notably the Protection of the Environment Operations Act 1998 and the Contaminated Lands Management Act 1997. However, the NSW Environmental Protection Agency (EPA) is investigating only one matter and there are concerns that the EPA is not entitled to utilise its full regulatory powers in relation to the coal seam gas industry.

Further, the regulatory failures in the Pilliga as revealed in this report are broad and range from flawed monitoring requirements, to inadequate compliance and enforcement and poor complaint

handling processes. The severity and extent of these problems in the Pilliga warrants a full investigation by an independent authority.

The mismanagement of coal seam gas exploration in the Pilliga, the environmental damage incurred and the documented regulatory failures reinforce the need for an urgent moratorium on all coal seam gas operations in NSW. Nothing less is warranted given the revelations contained in this report.

Recommendations

The events of the last 12 months in the Pilliga forest have led to a crisis of confidence in the ability of the NSW Government to protect the environment against coal seam gas mining.

The legislative system and the regulatory framework are broken and no amount of tinkering or secret investigations can restore public confidence in the NSW Government and its management of this industry.

We make five major recommendations below that we believe are required to properly respond to the scale and nature of the environmental failings that have been uncovered and the heightened level of community concern.

We believe that nothing less than full implementation of these five recommendations would represent an adequate response to the serious environmental impacts of mismanagement in the Pilliga and the loss of public trust associated with the reporting failures and denials.

If the NSW Government does not act now to cancel the petroleum titles at issue and implement the recommendations below, then it will simply legitimise the poor practices of the coal seam gas industry and entrench a culture that is clearly unacceptable to the vast majority of people of NSW.

We recommend that:

1. The Minister for Resources should now immediately utilise his powers under the *Petroleum (Onshore) Act* 1991 to:
   - Cancel PEL238 and PAL2 in accordance with s22 of the Petroleum Act.
   - Forfeit all securities to the Crown (amounting to $878,000) in accordance with s16A of the Petroleum Act and utilise those funds to commission a thorough independent ecological risk assessment of the impacts of coal seam gas activities to date in PEL238 and PAL2.
   - Commence legal action against Santos for all major and minor breaches identified in this report.

2. The NSW Government should urgently commission the following independent scientific assessments of the impact of coal seam gas activities in the Pilliga, within an ecological risk assessment framework:
   - A site investigation of all contaminated areas in accordance with the contaminated site guidelines of the Environment Protection Authority, which is then subject to review by an accredited site auditor.

- Thorough eco-toxicology assessments of the impacts of contamination to date and the development of regional ecologically-based investigation levels relevant to the region and to the sensitive environment of the Pilliga.
- Independent testing of the integrity of all coal seam gas wells in PEL238 and PAL2 (including de-commissioned wells) to determine if damaging impacts have occurred in operations below-ground.
- A forensic investigation into the water treatment plant and whether there was a large, unreported spill in the vicinity in December 2011.
- A detailed assessment of the distribution and full extent of vegetation clearing and resultant impacts on wildlife habitat.

3. There should be a Special Commission of Inquiry (under the NSW Special Commissions of Inquiry Act 1983) established into all aspects of coal seam gas operations in PAL2 and PEL238 to provide one single and far-reaching investigation into the matter. This should include, but not be limited to, the following:
   - The entire operation of PEL238 and PAL2 to date including all incidents revealed in the Santos report into Eastern Star Gas, all complaints by the community and all incidents that have occurred since Santos took on 100% ownership.
   - The production of gas for commercial purposes within an exploration licence at the Tintsfield pilot production, including an analysis of the approvals process for the Review of Environmental Factors which allowed it to proceed.
   - All potential breaches of environmental laws for which the Environment Protection Authority is the appropriate regulatory authority, including those which the EPA has not investigated to date.
   - Recommendations for prosecution which have arisen from the investigation across all relevant legislation.
   - Recommendations for a thorough overhaul of the legal framework regulating coal seam gas operations in NSW.

4. The NSW Government should refer to the matter to the Australian Securities Investment Commission to investigate whether there have been any breaches of the Corporations Act 2001, in particular whether the actions of the directors or officers have been reckless, or intentionally dishonest and have not exercised their powers or discharged their duties in good faith in the best interests of the company or for a proper purpose, in accordance with s184.

5. The NSW Auditor-General should be requested to:
   - Investigate the failings of coal seam gas regulation in the Pilliga including self-regulation by gas companies, flaws in monitoring, compliance and enforcement by government agencies and the interaction between coal seam gas companies and government authorities.
   - Make recommendations for thoroughly restructuring compliance and enforcement of coal seam gas operations and community complaint procedures and for adequate resourcing of regulatory authorities.

Introduction

The Pilliga Forest is located near Narrabri in northwest NSW. It is the largest temperate woodland left in eastern Australian and the southern recharge areas of the Great Artesian Basin. It is home to numerous threatened species, including the endemic Pilliga Mouse and the nationally threatened South-eastern Long-eared Bat. The Pilliga Forest is largely State Forest tenure, but also includes some Nature Reserves and State Conservation Areas. The Nature Reserve is the only tenure from which coal seam gas mining is excluded.

There are two petroleum exploration titles over the area - Petroleum Exploration Licence 238 (PEL238) and Petroleum Assessment Lease 2 (PAL2). PEL238 covers a vast area of approximately 790,000 hectares (ha) covering most of the Pilliga Forest as well as large areas of farmland around Burren Junction, Wee Waa and Narrabri. PAL2 covers an area of approximately 26,000ha which is mostly located in the Pilliga Forest but also includes some adjoining properties. Map 1 provides a map of the Pilliga Forest and the petroleum titles that currently cover it.

Coal seam gas exploration commenced in PEL238 approximately ten years ago. Since then, there have been approximately 92 wells drilled, of which 56 are located in the Pilliga Forest and the remainder on surrounding farmland.

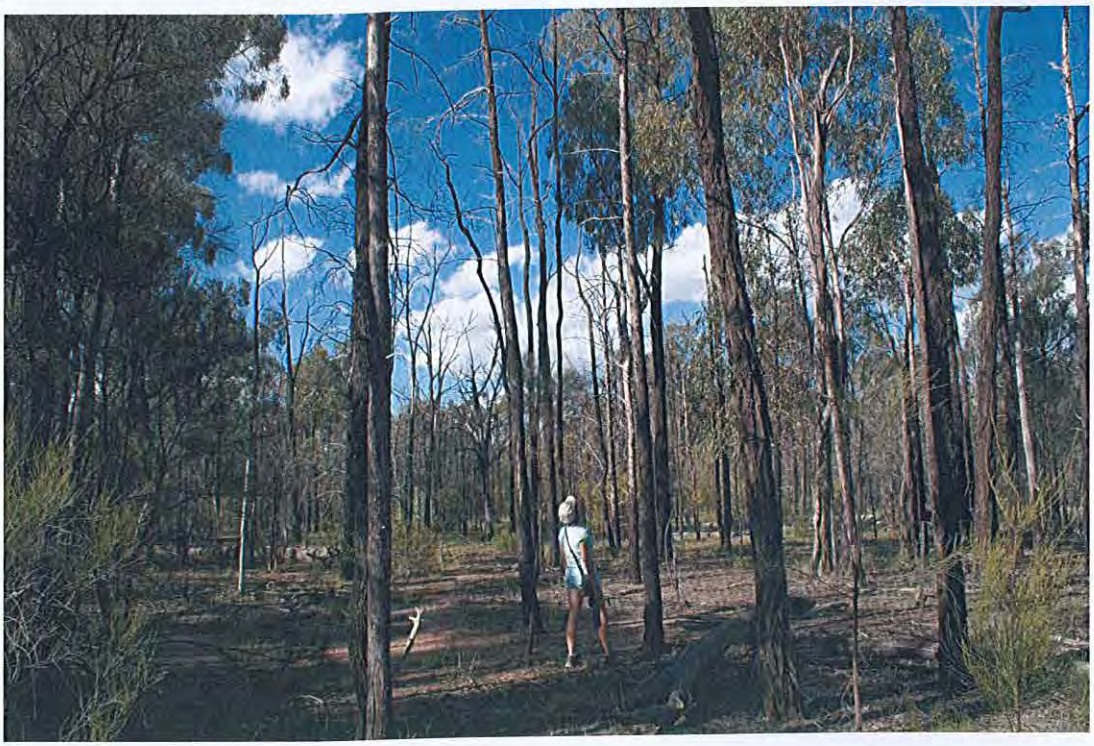
The operations in PEL238 and PAL2 to date, although only qualifying as 'exploration', have also involved:

- the construction and management of a gas-fired power station at Wilga Park;
- the development and management of five pilot production fields encompassing 35 production bores;
- the construction and management of 13 major water treatment dams/impoundments and numerous drill ponds;
- the construction and management of 56.6km of gas and water gathering pipelines;
- the construction and operation of one reverse osmosis unit;
- the discharge of treated produced water into the Bohena Creek (part of the Murray-Darling Basin);
- the bull-dozing of numerous roads and tracks to facilitate the above; and
- the use of hydraulic fracturing (fracking) on at least 15 occasions.

Eastern Star Gas has been the primary operator since 2002. In mid-November 2011, Santos took over 100% ownership of the operation. Prior to that, Santos held a 35% interest in the operation. Over the last 12 months there have been numerous problems revealed with coal seam gas operations in the Pilliga, as the community has unveiled major environmental problems and failings which have, after much community agitation, finally been disclosed by the gas companies involved. This report reviews in detail the events of the last twelve months in particular, and uses the Pilliga as a case study to explore how coal seam gas companies operate, how they respond to the community, and how they interact with governments and regulatory authorities.

Despite the fact that this report focuses on the near past, it is important to note that there is a much longer history of environmental damage from coal seam gas in the area, with a saline pond bursting in 2001 and causing substantial tree dieback, and extensive vegetation dieback associated with a number of wells from 2001/02. This document does not purport to provide a full coverage of coal seam gas damage in the area, but focuses instead on the damage incurred and documented in detail over the last twelve months. The more extensive damage over a ten year period warrants more detailed analysis and documentation.

There is a current Santos proposal which has been lodged with the NSW Government to develop the *Narrabri Gas Field* in the Pilliga Forest. This would involve an industrial gas field across an area of 85,000 hectares which includes 1,100 gas wells and 1,000km of internal pipelines, plus numerous roads and various other associated infrastructure. **The damage described in this report from the operation of just 56 wells over a nine month period highlights the enormous environmental risk posed by a major industrial gas field in this area.**



Chronology of Events

This chronology focuses on the matters of the known and documented coal seam gas water spills and treated water discharges in and around the Bibblewindi Water Treatment plant in the Pilliga Forest, with an emphasis on the events of the last twelve months.

January 2011 - Concerns raised about Bibblewindi Water Treatment Plant by local resident Tony Pickard, who reports a hole in the liner at Pond Number 2 to the Department of Resources and Energy in Maitland. No response was ever received from the Department.

25 June 2011 - Eastern Star Gas spills 10,000L of produced coal seam gas water from the Bibblewindi Water Treatment Plant but does not notify authorities.

30 June 2011 - Environment groups submit a report to the Federal Environment Minister Tony Burke and his Department alleging that activities in the Pilliga have never been referred under the Federal Environment Protection and Biodiversity Conservation Act 1999 despite being likely to impact on matters of national environmental significance.

13 July 2011–NSW Resources and Energy Minister Chris Hartcher announces a state-wide audit of all coal seam gas exploration licences involving a desktop analysis of existing licences to *'identify areas of non-compliance*'. Audit process is due to be completed by November.

17 July 2011 - Mr Pickard sends a list of complaints about Eastern Star Gas operations in the Pilliga to DTIRIS, EPA and Forestry NSW investigators (see Appendix 1). No response has ever been received to the list.

21 July 2011 - Cate Faerhman MLC writes to three departments, including the Department of Primary Industries, identifying a list of alleged environmental incidents in the Pilliga including leaking gas pipes, dead animals and vegetation dieback (see Appendix 2).

21 July 2011 - Federal Government announces an investigation of potential non-compliance with the Environment Protection and Biodiversity Conservation Act 1999 by Eastern Star Gas in relation to existing coal seam gas infrastructure in the Pilliga[1].

21 July 2011 - Jeremy Buckingham MLC films a gas pipe adjoining the Bohena 3 coal seam gas well hissing as gas is released and another low point drain on a gas pipeline near Bibblewindi 21 bubbling methane gas.

29 July 2011 - *7.30 NSW* interviews Jeremy Buckingham MLC about the leaking gas incidents and Minister Chris Hartcher responds, referring to the leaking gas drain as 'sabotage' and states, "*It shows that there are people out there who are malicious and who are anxious to cause serious*

[1] http://www.abc.net.au/rural/telegraph/content/2011/s3274724.htm

damage because this could cause serious damage and it's a wake-up call to all of us that these people are out there."[2]

"I don't know who did it. I am only relying on the information supplied to me by the company. It hasn't been independently verified by the office of Resources and Energy. It was clearly done by somebody of ill intent, but who it was I can't say."[3]

7.30 NSW advised, *"The NSW Government has launched an investigation into leaks of methane gas from coal seam gas pipes in the states north-west."*

1 August 2011 - Eastern Star Gas claims that the low point drain has never been operated by ESG and has been 'tampered with'. In regard to Bohena 3, ESG claims that *"On Friday a gas detector was used to check for the presence of leaking gas. The equipment did not register any leaking gas"*. Eastern Star Gas rejects allegations relating to the EPBC Act 1999.

2 August 2011 - Eastern Star Gas licence, PEL 238, expires and local groups call for it not to be renewed.

8 and 9 August 2011–NSW Department of Trade Investment Regional Infrastructure and Services (DTIRIS) commence investigations of the alleged infringements notified by Ms Faerhman and presumably Mr Buckingham. These are described by the Department as follows:

> *"Field inspections were undertaken by the Department's environmental inspectors, assisted by investigators from the Office of Environment and Heritage. Additionally, regional managers from Forests NSW also attended where the alleged infringements were located within the State Forest estate"*[4].

8 and 9 August 2011 - Local landholder Tony Pickard hands a list of complaints to DTIRIS, EPA and Forestry NSW investigators.

24 September 2011 - Cate Faerhman MLC receives a response from DTIRIS to her letter of the 21st July stating that an investigation is underway. The letter states, *"These investigations are complex, extensive and ongoing. A full report will be prepared on their completion"*.

11 October 2011 - Federal Government finds that exploratory and pilot production operations in the Pilliga are unlikely to have impacted significantly on matters of national environmental significance.

28 October 2011– Northern Inland Council for the Environment (NICE) makes a complaint to the EPA in relation to the presence of dead vegetation adjoining the Bibblewindi Water Treatment Plant, and dead frogs in a sump at the Bohena 2 coal seam gas well. The EPA refer the matter to DTIRIS.

[2]http://www.abc.net.au/local/stories/2011/08/01/3282726.htm
[3]http://www.abc.net.au/local/stories/2011/08/01/3282726.htm
[4]Letter from Mr Mark Paterson, Director General DTIRIS to Ms Cate Faerhman MLC dated 24 September 2011

7 November 2011 - A response was received to the NICE complaint via email from Mr Greg Summerhayes, Principal Environment Officer with Resources and Energy, on 7 November 2011. DTIRIS concludes that:

> *"ESG is currently in compliance with operoting conditions...There is no evidence to date of a pollution discharge event. This is not considered to be significant environmental harm."*

DTIRIS also advise that:

> *"NSW Soil Conservotion Service (SCS) were commissioned to test ond assess the soil ond possible association with the water treotment plont (WTP) with some evidence of crusting."*

30 November 2011 - EPA respond to NICE complaints stating that:

> *"The EPA does not have a formol stotutory approval or regulatory role under the Protection of the Environment Operations Act 1997 until the praduction stage of gas development. Therefore, the complaint was referred to DTIRIS...*
>
> *The advice DTIRIS hos provided to the EPA from the investigatian conducted at Bibblewindi Water Treatment facility is that the tree dieback is most likely a result of an historical flooding event and that there is no evidence of a subsequent pollution discharge".*

8 December 2011 - Environment groups release water samples of treated coal seam gas water which is being discharged into Bohena Creek in the Pilliga by Santos. Results from independent tests show elevated levels of seven compounds including ammonia, cyanide and boron compared to upstream samples.

Matthew Doman from Santos, in response states, *"All I can say is that any water discharged into the Namai River meets the requirements of the New South Wales Government"*[5].

9 December 2011 - DTIRIS 'launches its own investigation' into creek pollution and the EPA says it will 'follow up on the investigation'[6]. DTIRIS advise environment groups that they are investigating creek pollution and will visit the Pilliga during the week of 12 December to collect water samples. DTIRIS staff advise NICE verbally over the phone that results from SCS soil tests from the WTP are not yet available.

The Australian[7] reports the Santos response as follows:

> *'Santos points out discharged water is tested on a monthly basis and all recent results have met NSW* requirements' the company said. *'Santas is confident it is not in breach of its authority ar having any adverse impact on water resources in the area'.*

[5]http://www.abc.net.au/am/content/2011/s3386203.htm
[6]http://www.smh.com.au/environment/water-issues/tests-reveal-contaminated-water-near-gas-site-20111208-1oldj.html#ixzz1oQPtzzmy
[7]http://www.theaustralian.com.au/national-affairs/minister-urged-to-act-on-claims-of-creek-pollution/story-fnaxx2sv-1226217655484

15 December 2011 - Santos shuts down the reverse osmosis plant in the Pilliga, later describing the reasons as follows: *"because of various concerns about the water treatment plant, Santos took the decision to scale-back operotions in the Pilliga, including ceasing operation of the water treatment plont pending a full review of its adequacy and integrity"*[8].

23 December 2011 - DTIRIS advise environment groups that no water samples were collected from creek discharge due to the fact that the Santos reverse osmosis plant was 'malfunctioning'.

30 December to 2 January 2012 - Local landholder Tony Pickard contacts media outlets to report extensive tree deaths and black sludgy water pooling in areas adjoining the Bibblewindi Water Treatment Plant, including areas where tree deaths have previously been reported by NICE.

2 January 2012 - Santos spokesman Sam Crafter tells the ABC in response to Mr Pickard's complaint that[9], *"Narrabri has had a lot of rain lately but there's not been any leaks at any of our sites..."Eucalypts react with the water,"* he said. *"It creates a murky colour."*

The ABC notes the following response from DTIRIS[10]: *"The Department of Primary Industries has issued a statement, saying it has already inspected the site. The statement says the water is natural water pooling and the department has ordered Santos to fix the drainage."*

4 January 2012 - Mr Pickard takes Santos staff Sam Crafter and Mr Mark Rodgers on a tour of sites of concern in the Pilliga, including the Bibblewindi Treatment Plant and adjoining vegetation dieback and pooled coal seam gas water. Mr Pickard notifies Department of Resources and Energy in Maitland (via email) of the location and extent of the vegetation dieback.

6 January 2012 - The Northern Daily Leader provides the following response from Sam Crafter of Santos[11]: *"He said rainfall before Christmas had caused water to poal in the area, and previous soil testing had revealed eucalyptus was a problem."*

6 January 2012 - Environment groups commission a local ecologist collects soil and water samples from the contaminated site adjoining Bibblewindi Water Treatment Plant, and a reference sample from uncontaminated areas. The samples are sent for testing to the independent ALS Laboratory Group.

Late evening, 6 January 2012 - Santos advise DTIRIS of a previous discharge of 10,000L of produced coal seam gas water from the Bibblewindi Water Treatment Plan which they alleged occurred under Eastern Star Gas operation of the plant on 2S June 2011[12]. Neither Santos nor the Department go public with this admission[13].

[8] Santos report on Eastern Star Gas Operations, http://www.santos.com/library/120222_report_into_ESG_operations_attachments.pdf
[9] http://www.abc.net.au/news/2012-01-02/greens-claim-csg-mine-poisoning-trees/3755362
[10] http://www.abc.net.au/news/2012-01-02/greens-claim-csg-mine-poisoning-trees/3755362
[11] http://www.northerndailyleader.com.au/news/local/news/general/pilliga-kill-sites-investigation-under-way/2411478.aspx?storypage=2
[12] http://www.dpi.nsw.gov.au/aboutus/news/recent-news/minerals-and-petroleum/saline-water-leak
[13] http://www.dpi.nsw.gov.au/aboutus/news/recent-news/minerals-and-petroleum/saline-water-leak

12 January 2012 - The NSW Minister for Western NSW, Kevin Humphries, tours the Pilliga coal seam gas wells with Santos, and promotes publicly the work that is being done by Santos in 'rehabilitating' five wells.

13 January 2012 - Late on Friday, both Santos and DTIRIS go public at the same time with information that there has been a 10,000L spill from the water treatment plant in the Pilliga.

DTIRIS advise that, "*The Department of Trade & Investment is pursuing enforcement actions on this discharge, including the potentiol for prosecution, and continuing to work with the Environment Protection Authority to further investigate the incident*".

18 January 2012 - Santos admits that 2S0 litres of algaecide had spilled *"after a pipe ruptured at its Bibblewindi water treatment plant in the state forest, near Narrobri, on December 22 last year"*[14].

31 January 2012 - EPA advise environment groups that they have not collected any water samples from treated coal seam gas water produced from the reverse osmosis plant, but that they are investigating the matter.

8 February 2012 - Environment groups reveal results of water and soil samples from the contaminated zone near Bibblewindi Water Treatment Plant which show high levels of heavy metals, petrochemicals and salt, compared to baseline uncontaminated reference sites.

9 February 2012 - Santos admit to three more spills of coal seam gas water in the Pilliga. *"There have been three subsequent, smaller leaks of water from coal seams within Eastern Star's Pilliga operations in the weeks immediately following Santos' acquisition of the company,*" a spokesman said[15].

16 and 17 February 2012 - Department of Resources and Energy finally (and very belatedly - almost four months after it was first reported by community groups and five weeks after admissions by Santos) conduct a site inspection of the Bibblewindi Water Treatment Plant and adjoining contaminated area[16]. It is unknown as to whether any soil or water samples were collected, but the delay means they are probably of limited utility in any case.

22 February 2012 - Without any community consultation or notification, Santos obtains permission from DRE to pipe 60ML of produced coal seam gas water from Bibblewindi Water Treatment Plant to saline holding ponds near Narrabri at the Tintsfield site (approx 39km away).

In the Review of Environmental Factors, Santos admits, *"Bibblewindi Pond 3 is within 40cm of the overflow pipe and a significant rain event could cause the pond to overflow"*. The community does not learn of the approval until a month later.

[14] http://news.ninemsn.com.au/national/8405026/chemical-spill-at-csg-site-in-nsw-forest
[15] http://www.smh.com.au/environment/water-issues/arsenic-and-lead-found-in-contaminated-water-leak-at-coal-seam-gas-drill-site-20120209-1rx7s.html#ixzz1m1ifmWkM
[16] The Hon Duncan Gay MP, response to Question Without Notice, 23rd January 2012 http://www.parliament.nsw.gov.au/Prod/parlment/hanstrans.nsf/V3ByKey/LC20120223/$File/551LC069%20%5B230212%5D.pdf

23 February 2012 - Santos releases a report on Eastern Star Gas operations, stating that "*The Santos report has identified an unacceptable culture in Eastern Star of accepting minor spills, failures in reporting and the possibility of unapproved land clearing on some sites*".

This appears to be a substantial understatement, given that the report revealed the following:

1. An additional major leak from the Bibblewindi Water Treatment Plant prior to June 2011;
2. Some 20 environmental incidents recorded in total, including a kangaroo dead in a coal seam gas pond;
3. Possible over-clearing of vegetation at some 39 sites;
4. Discharge of treated water exceeded salinity limits on numerous occasions; and
5. Saline water ponds over-flowed on at least one occasion.

23 February 2012 - The Hon Duncan Gay MP, representing the Minister for Trade and Investment in the NSW Legislative Council, describes the compliance action occurring in the Pilliga as follows:

> "*Following notification of the spill, the Department of Resources and Energy commenced a full investigation into the incident and the apparent failure to report the incident in a timely manner. The investigation team conducted a site inspection on 16 and 17 February 2012. The Department of Resources and Energy also will investigate whether any other incidents of that nature have occurred and any other related circumstances*"[17].

6 March 2012 - The Federal Government informs environment groups that it has re-opened investigations into coal seam gas exploration in the Pilliga and compliance with the EPBC Act 1999.

3rd April 2012 - The Division of Resources and Energy sends Mr Tony Pickard a letter, drafted in September 2011, responding to his complaints from July 2011. DRE has issued 3 formal warning notices and 2 penalty infringement notices for non-compliance in relation to the incidents listed. Warning notices relate to over-clearing and failure to rehabilitate.

5th April 2012 - The NSW Government releases its report on the audit of coal and petroleum exploration licences in NSW. PAL2 had not been audited. There were no significant non-compliances identified with PEL 238, and just one low risk non-compliance.

[17] Ibid

Events - Summary and Conclusions

- Over the last six months, the NSW Government has announced at least eight separate audits and investigations into coal seam gas operations in the Pilliga Forest. Every time that a failure is exposed in the Pilliga, the Government has 'announced' an investigation.
- There is little or no information available publicly on the scope or purpose of those investigations, and none of them have as yet led to any action against the companies involved. The investigations are conducted in secret without any obvious opportunity for public input.
- In August, the NSW Government claimed to be commencing an extensive investigation into all aspects of CSG operations in the Pilliga.
- For five months that investigation ignored evidence of a major spill at the Bibblewindi Treatment Works, despite it being reported by environment groups.
- Over that same period, the investigation failed to collect a single sample of the water being discharged from the Bibblewindi Treatment Plant into the Bohena Creek system, creating a serious pollution risk. Even now, we understand that no government agency has collected and comprehensively analysed a sample from the water treatment works.
- Over a six month period, NSW Government Ministers have defended the coal seam gas companies involved, and even spruiked their environmental credentials publicly despite knowing that they were soon to admit to a major spill.
- NSW Government agencies have failed on all fronts to conduct either timely or comprehensive assessments of non-compliance events, and have instead parroted the statements of coal seam gas companies and relied heavily on their representations.
- The last twelve months of coal seam gas exploration in the Pilliga reveal:
    - That denial is generally the first response of coal seam gas companies and Governments to community complaints, even when there is the strongest possible evidence to support them - i.e. large areas of vegetation dieback with pools of toxic water.
    - That self-regulation has been a major failure, confirming once and for all that gas companies cannot be trusted to police their own operations honestly.
    - That the NSW Government is often complicit in the excuses peddled by gas companies and appears to have neither the will nor the capacity to enforce compliance with even the most basic environmental laws.
- Coal seam gas companies when finally held to account tend to seek to shift the blame. In the Pilliga Forest, coal seam gas companies have pointed the finger at previous operators, farmers, and unknown third parties.
- The NSW Government audit of PEL 238 did not identify any significant problems despite the fact that it was completed after Santos had exposed numerous problems with ESG and after DRE had responded to Mr Tony Pickard acknowledging several non-compliances. It is inexplicable why these other sources of information were not considered by the audit.
- In light of the severe environmental mismanagement and the reporting failures revealed in the Pilliga, it seems likely that initial claims by Eastern Star Gas in relation to all other matters that have occurred over the last 12 months such as leaking gas pipes and low water drains may also be spurious and should be reviewed.

Spills of Coal Seam Gas Water in the Pilliga

Preliminary Complaints, Admissions and Investigations

On the 28th October 2011, the Northern Inland Council for the Environment reported the presence of dead trees within and adjoining the Bibblewindi Water Treatment works in the Pilliga to the EPA via email (Mr Joshua Gilroy). Concerns were raised that the vegetation dieback had been caused by a spill or leaking pipe from the treatment works. The EPA subsequently referred the matter as a complaint to DTIRIS later on the same day, 28th October 2011.

A response was received via email from the Department of Resources and Energy, on the 7th November 2011.

The response stated that the Department of Resources and Energy (DRE) had, on the 28/10/2011, directed ESG to report to them on the incidence of tree deaths adjoining the water treatment works, and that ESG had provided an Interim Incident Report on the 3/11/2011. DRE go on to state that:

> "*ESG is currently in compliance with operating Conditions. The tree dieback in vicinity of the Bibblewindi Water Treatment Plant (WTP) has been previously reported by ESG and is limited to approximately 0.55ha. This is under further assessment of possible cause and remediation. There is no evidence to date of a pollution discharge event. This is not considered to be significant environmental harm.*
>
> *ESG has reported that tree dieback has been observed in the area of Bibblewindi Water Treatment Plant (WTP) since the flooding events of 2010. A treed area of approximately 50m x 50m was affected by water logging of rainfall run-off collecting in the area due to inadequate drainage affected by the WTP access road. ESG had in consultation with NSW Forests decided to remove the trees but this has not occurred due to ongoing wet conditions prohibiting heavy machinery access. An additional area of approximately 0.3ha was observed affected by irregular dieback adjacent to the WTP road.*
>
> *NSW Soil Conservation Service (SCS) were commissioned to test and assess the soil and possible association with the WTP with some evidence of crusting. NSW SCS are advising ESG on best practice remediation work which will mediate the dieback affected areas by soil treatment and drainage improvement*".

As this excerpt reveals, DRE accepted that there had been no failures in compliance and repeated the Eastern Star Gas claims about water-logging prior to getting the results of the soil samples that had apparently been commissioned. This suggests an over-dependence on self reporting by coal seam gas companies and a failure in basic investigative procedures. **It is important to note that this failure occurred at the time when DRE were supposed to be conducting 'complex, extensive and on-going investigations' into activities in the Pilliga, which had commenced in August 2011.**

The final section of the DRE report stated that, in relation to further follow-up action, they were:

> *Awaiting results of further soil and water sampling with supplementary incident report from ESG. ESG to continue standard operations to P&A well Bohena 2/2D, then progress well site*

rehabilitation. ESG to initiate corrective action; drainage and soil amelioration according to SCS test results and recommendations".

The Northern Inland Council for the Environment spoke to the DTIRIS over the phone on the 9th December and again on the 23rd December seeking advice on the soil and water sampling supposed to have been conducted by the SCS. DTIRIS advised that the results were not yet available. It is notable that soil and water samples commissioned by environment groups took just ten days to be analysed and the results returned. There is no obvious feasible explanation as to why DRE did not have the results to hand in early November. **To date, April 2012, there have still been no samples released by DRE in relation to the 28th October 2011 complaint or any related spill.**

On December 30th 2011, Mr Tony Pickard found black, sludgy pools of water adjoining the Bibblewindi Treatment Plan and further extensive vegetation dieback, which he filmed and photographed. This information was reported to DRE by Mr Pickard on 4th January 2012, with associated media coverage in early January. Both Santos and DRE then went public, stating again that there had been no leaks and that the black sludge was caused by eucalyptus leaves. The details of these statements are provided below.

On the 2nd January, the ABC reported[18]: *But Santos spokesman Sam Crafter denies there has been a leak. "What we have here is a gathering from the recent rain and that water hasn't dissipated yet," he said. "Narrabri has had a lot of rain lately but there's not been any leaks at any of our sites."*

Mr Crafter says eucalyptus leaves are making the water turn black. "Eucalypts react with the water," he said. "It creates a murky colour." The Department of Primary Industries has issued a statement, saying it has already inspected the site. The statement says the water is natural water pooling and the department has ordered Santos to fix the drainage.

On the 2nd January 2012, the Sydney Morning Herald reported as follows[19]: *Santos spokesman Sam Crafter blames rain for the excess water, which he says has been blackened by eucalyptus leaves."It [the rainwater] gathers in an area in the forest; it doesn't move easily," he told AAP. He said regular maintenance work was being conducted at one of the company's dams in the area but there had been "no release of water or any leaks at any of our sites"...*

According to the same SMH story, "*A recent investigation by the Department of Primary Industries had found no leak from the dam, a department spokeswoman said in a statement*".

On the 4th January Mr Pickard led two Santos staff on a tour of environmental problems in the Pilliga exploratory gas field. In particular, he showed them the vegetation dieback and obvious contaminated water pooling in areas adjoining the Bibblewindi Water Treatment Plant.

[18]http://www.abc.net.au/news/2012-01-02/greens-claim-csg-mine-poisoning-trees/3755362
[19]http://www.smh.com.au/environment/coal-seam-gas-miner-denies-poisoning-trees-20120102-1phza.html

According to the *Northern Daily Leader*, on the 6th January, Sam Crafter from Santos responded to the concerns as follows[20]: *"He said rainfall before Christmas had caused water to pool in the area, and previous soil testing had revealed eucalyptus was a problem"*.

Therefore, up until the 6th January, both DRE and Santos continued to deny the occurrence of any leaks and promulgated excuses relating to water logging, rainfall and eucalyptus leaves. There are questions as to whether they did so in the full knowledge that samples had shown that there had been a spill or without having conducted or analysed any tests despite lengthy notice that such tests were required.

Finally, on the 6th January Santos advised DTIRIS of a previous discharge of 10,000L of water adjoining the Water Treatment Plant which they alleged occurred under Eastern Star Gas operation of the plant on 25th June 2011, and which had caused the vegetation dieback. Neither Santos nor the Department went public with this admission[21].

On the 12th January, Santos took the NSW Minister for Western NSW, Kevin Humphries, on a tour of the Pilliga coal seam gas wells. On that day and the following morning, the Minister spoke publicly about the work Santos were doing in 'rehabilitating' five of 40 wells in the Pilliga and telling media, *"These guys are in the process of monitoring as they go, it's been a tried process for quite some time where you've got sensitive areas and where you're looking to put in a larger number of bores"*[22].

[20] http://www.northerndailyleader.com.au/news/local/news/general/pilliga-kill-sites-investigation-under-way/2411478.aspx?storypage=2
[21] http://www.dpi.nsw.gov.au/aboutus/news/recent-news/minerals-and-petroleum/saline-water-leak
[22] http://www.abc.net.au/news/2012-01-13/pilliga-csg-wells-to-be-rehabilitated/3771330

Late on Friday 13th January, Santos went public with the fact that there had been a 10,000L spill of coal seam gas water by Eastern Star Gas on 25th June 2011 that had never been reported to authorities. DTIRIS went public at approximately the same time with the same information, placing a notification on its website which read as follows:

> *The NSW Department of Trade & Investment has been made aware of the discharge of 10,000 litres of saline water, in June 2011, at the Narrabri Coal Seam Gas Project, in the middle of last year, which was operated at the time by Eastern Star Gas.*
>
> *The incident was brought to the attention of Departmental officers last Friday evening by Santos, which took over Eastern Stor Gas in November 2011.*
>
> *A Santos review of Eastern Stor Gos records hos identified that o pipeline failure occurred on June 25, 2011, which resulted in o discharge of 10,000 litres of soline coal seam gas water.*
>
> *The incident was not reported to Gavernment autharities by Eastern Stor Gas at the time. The company is obliged under conditions of its Petroleum Explorotion Licence, to report such incidents, in accordance with the Petroleum Onshore Act 1991.*
>
> *At the time of the incident, Eastern Star Gas wos conducting coal seom gos explorotion within the Pilliga Eost and Bibblewindi Stote Forests south af Norrabri.*
>
> *The Department of Trade & Investment is pursuing enforcement actions on this discharge, including the patentiol for prosecution, and continuing to work with the Environment Protection Authority to further investigate the incident.*

However, from the evidence available it would seem that the Department of Resources and Energy did not conduct a site inspection at that time. It would seem that it was to be another five weeks before they visited the site, according to statements made in the NSW Legislative Council by Duncan Gay MP[23], raising serious questions about the utility of any information that they might collect after such a long delay. It is difficult to find an explanation as to why the primary regulatory authority did not immediately attend the site to collect evidence after notification of a major spill and following community complaints about the current state of the site.

Despite having repeatedly stated in early January that there had '*not been any leoks at any of our sites*'[24], Santos then went on to admit to four more spills over the following month[25]. The date of the

[23] The Hon Duncan Gay MP, response to Question Without Notice, 23rd January 2012 http://www.parliament.nsw.gov.au/Prod/parlment/hanstrans.nsf/V3ByKey/LC20120223/$File/551LC069%20%5B230212%5D.pdf

[24] http://www.abc.net.au/news/2012-01-02/greens-claim-csg-mine-poisoning-trees/3755362

[25] http://blogs.abc.net.au/nsw/2012/02/0830-abc-new-england-north-west-news-10022012.html

spills were given as the 22nd December 2011 in the case of the algaecide spill[26], and *'in the weeks immediotely following Sontos' ocquisition of the compony'* in the case of the three other spills[27].

It wasn't until 23rd February 2012, that Santos released a report on the operations of Eastern Star Gas, which revealed an additional major leak from the Water Treatment Plant prior to June 2011 and a total of up to 20 environmental incidents including numerous small leaks. The NSW Government has not explained in detail how it intends to respond to the report, has yet to release any information itself, and has not explained whether the report has changed the scope or nature of its various ongoing operations.

The Santos report did not provide any useful information on the four leaks which had occurred since Santos had taken on 100% ownership of the project. The only information available on those leaks to date is provided in brief media statements made by Santos. DRE has made no comment on these matters and it is unknown whether any investigations are occurring.

In relation to the 2S0L spill of algaecide caused by a ruptured pipe, Santos stated, "*While we ore not required to report such o minor spill, Sontos immediotely odvised the NSW government of it ond the clean-up actions*"[28]. However, the seriousness of a spill is determined not only by its size but also by its toxicity, which in this case is likely to be significant.

We have been advised by Dr Mariann Lloyd-Smith of the National Toxics Network that,

> *The CSG industry does uses a range of quite toxic algoecides, which usually also function os biocides or microcides. Prior to this chemicol spill being dismissed as 'minor', it is essential that the identity of the olgaecide is released. Some examples of commonly used olgaecides and biocides ovailable to the CSG industry include brominated substances which are both very toxic and often break down into more persistent and toxic substances[29]. Aldacide G is a product which contains the biocide glutaraldehyde. It is harmful if inhaled or absorbed through the skin, is capable of causing permanent eye damage upon exposure, and can cause chemicol pneumonia if lung tissue is exposed[30]. Harmful exposure levels for mammals can be as low as 50 parts per billion[31].*

Finally, all that is known of the three other additional spills acknowledged by Santos since taking over the Pilliga operation is the volumes involved. Santos has admitted to one spill of 2,S00L, another of 1,000L and another of 150L. Few details are available, except that one had occurred at a drill site, another had resulted from a problem with a water filter and a third had been caused by a hose that had been left unattended[32]. Santos has acknowledged that all three spills *'were*

[26] http://www.theaustralian.com.au/national-affairs/new-spill-at-santos-csg-site/story-fnaxx2sv-1226246801889
[27] http://www.smh.com.au/environment/water-issues/arsenic-and-lead-found-in-contaminated-water-leak-at-coal-seam-gas-drill-site-20120209-1rx7s.html
[28] http://www.theaustralian.com.au/national-affairs/new-spill-at-santos-csg-site/story-fnaxx2sv-1226246801889
[29] Dr Mariann Lloyd-Smith, pers comm., 10th February 2010
[30] Ibid
[31] Ibid
[32] http://blogs.abc.net.au/nsw/2012/02/0830-abc-new-england-north-west-news-10022012.html

preventable[33]. No other information is currently available. Full public transparency is warranted on these spills in relation to their nature, date and location and any response by Santos and the NSW Government, as well as a detailed assessment of their potential ecological toxicity.

Responding to a question in Parliament from the Hon Jeremy Buckingham MLC, Duncan Gay MLC representing the Minister for Trade and Investment stated:

> "*There have been a number of reported infringements within PEL238 and PAL2, the most significant of which was a discharge of saline water in June 2011. That discharge was only reported to the Department of Resources and Energy by new owners Santos on 6 January 2012. Following notification of the spill, the Department of Resources and Energy commenced a full investigation into the incident and the apparent failure to report the incident in a timely manner. The investigation team conducted a site inspection on 16 and 17 February 2012.* ***The Department of Resources and Energy also will investigate whether any other incidents of that nature have occurred and any other related circumstances***".

He went on to say, "*A preliminary investigation report to the director general is expected to be prepared by March 2012. All available enforcement responses will be considered when the full facts are known...*"

However, the statement appears to stop well short of committing to a full compliance assessment of all Eastern Star Gas and Santos operations in PEL238 and PAL2, merely stating that '*Santos also has investigated the compliance performance generally of Eastern Star Gas*'.

Sampling Commissioned by Environment Groups

On the 6th January 2012, a local ecologist visited the site of the coal seam gas water spill and collected the following samples:

- Three water samples - two from the contaminated zone and one from outside the contaminated zone; and
- Five soil samples - three from the contaminated zone and two from outside the contaminated zone.

The results are provided as Appendix 3 (water) and Appendix 4 (soil). A comparison of the results obtained in Water Sample 3 (uncontaminated zone) with Water Sample 2 (contaminated zone) are provided in Table 1. Professor Joe Bidwell from the University of Newcastle verified the data and described the results as follows:

> "*Two samples of standing water were collected from the site near the treatment facility and one sample of standing water was collected from a reference location. pH of the water from near the treatment facility was slightly elevated as compared to the reference sample. As seen for the soil samples, water collected from the suspected spill zone had higher electrical conductivity and levels of major cations and anions as compared to the reference sample. In*

[33] http://blogs.abc.net.au/nsw/2012/02/0830-abc-new-england-north-west-news-10022012.html

contrast to the soil, the water sample from neor the treatment facility also had higher levels of total metals (arsenic, chromium, copper, lead, nickel, ond zinc), phenol ond methylphenals, and total and recaverable petraleum hydrocorbons than the reference water"[34].

Table 1. Comparison of contaminated and uncontaminated water sample results

Compound	Units	Un-contaminated Sample	Contaminated Sample	**Number of times higher in contaminated sample**
pH Value	pH Units	6.64	8.67	**1.3**
Electrical conductivity @25 degrees	uS/cm	29	2930	**101**
TDS	mg/L	19	1900	**100**
Total hardness as CaCO3	mg/L	<1	299	**299**
Total alkalinity as CaCO3	mg/L	11	1340	**121.8**
Chloride	mg/L	2	383	**191.5**
Calcium	mg/L	<1	67	**1**
Magnesium	mg/L	<1	32	**32**
Sodium	mg/L	3	792	**264**
Potassium	mg/L	3	30	**10**
Arsenic	mg/L	<0.001	0.021	**21**
Cadmium	mg/L	<0.0001	0.0004	**4**
Chromium	mg/L	0.005	0.187	**37.4**
Copper	mg/L	0.007	0.191	**27.3**
Lead	mg/L	0.002	0.05	**25**
Nickel	mg/L	0.001	0.171	**171**
Zinc	mg/L	0.006	0.094	**15.7**
Mercury	mg/L	<0.0001	0.0008	**8**
Fluoride	mg/L	<0.1	1.9	**19**
Phenol	ug/L	<1	12.5	**12.5**
2 Methylphenol	ug/L	<1	6.9	**6.9**
3- & 4 - Methylphenol	ug/L	<2	8.9	**4.5**
TPH C10-C36 Fraction Sum	ug/L	330	3700	**11.2**
TRH C10-C40 Fraction Sum	ug/L	190	3770	**19.8**
Phenol d6	%	17.9	43	**2.4**
2-Chlorophenol D4	%	36.2	43.6	**1.2**

[34] Professor Joe Bidwell, Pilliga Soil and Water Sample Data Summary, 7 February 2012

Appendix 5 provides the full advice from Professor Joe Bidwell on the results. Table 2 provides a comparison between the results for Soil Sample 5 in the uncontaminated zone and Soil Sample 3 in the contaminated zone.

Professor Joe Bidwell verified the soil data and described the results as follows:

> *"Analyses were conducted on three soil samples collected adjacent to the facility and two samples collected from a reference location. Soil samples from the suspected spill zone had higher average pH, electrical conductivity (70 times higher), and levels of sodium (39 times higher), chloride (90 times higher), sulfate, calcium, magnesium, and potassium than reference samples. There were no clear differences in levels of total metals, phenolic compounds, PAHs, total petroleum hydrocarbons or BTEX compounds in soil samples from the two locations".*

Table 2. Comparison of contaminated and uncontaminated soil sample results

Compound	Units	Un-contaminated Sample	Contaminated Sample	**Number of times higher in contaminated sample**
pH	pH Unit	5.3	9.9	**1.9**
Electrical Conductivity	uS/cm	11	1690	**153.6**
Sulphate as SO4 2-	mg/kg	6	20.5	**3.4**
Chloride	mg/kg	<10	850	**85**
Calcium	mg/kg	<10	80	**8**
Magnesium	mg/kg	<10	60	**6**
Sodium	mg/kg	<10	3510	**351**
Nickel	mg/kg	2	4	**2**
Zinc	mg/kg	<5	5	**>1**

Professor Bidwell concluded:

> *"The range of ions, metals and hydrocarbons detected in the standing water near the treatment facility is consistent with constituents commonly found in untreated produced water. The elevated levels of salinity in soils and water within the suspected spill zone, in addition to the mixture of trace metals and measured organics in the standing water, could pose a risk to vegetation and soil organisms."*

It was to be another two weeks after this information was released before Santos finally released some of its own information on the contaminated area.

Sampling Commissioned by Santos

Water Sampling

On the 22nd February, Santos released a report on Eastern Star Gas operations which included their own sampling commissioned of the contaminated site near the Water Treatment Plant. The report was accompanied by a media release which quoted the Santos Vice President Eastern Australia, James Baulderstone.

The report stated, *"Golder Associates has taken soil and water samples from the spill area and are analysing the sample"* and that *"analysis of these soil and water samples is being undertaken by ALS Group, an independent laboratory"*.

However, it is notably that there are no results provided in the document for those water samples and there is no other reference to them made in the report. The only data provided is soil samples.

In his media release, James Baulderstone states that:

> *"The extensive testing and analysis released today shows recent claims about dangerous toxicity levels in the Pilliga were misleading and have caused unnecessary concern in the community about CSG. The claims ignored the fact that the trace elements highlighted are naturally occurring in the Pilliga. In the impacted area around the Bibblewindi plant the trace elements remain at levels well within health and safety guidelines".*

However, the sampling commissioned by environment groups and verified by Professor Joe Bidwell did involve a comparison of contaminated areas with uncontaminated areas, and revealed levels of 'trace elements' up to 171 times naturally occurring levels for metals such as Zinc and numerous others including Lead, Arsenic and Chromium.

Whilst the comments by Mr Baulderstone are surprising, the broader failure by Santos to conduct, analyse or produce water samples is indicative of their apparent failure to grasp the nature of the environment in which they are operating. As their analysis of soil samples below illustrates, the benchmarks they have used relate to urban areas and not to important wildlife habitats like the Pilliga.

In the case of surface water pools, the quality of the water in those pools has serious implications for wildlife in the Pilliga, particularly given that samples commissioned by environment groups revealed such high levels of salts, heavy metals and petrochemicals compared to naturally occurring levels. The water quality of these surface pools is important information and crucial to assessing environmental risk in a forested area, but Santos either has not collected water data or not released it, and from their statements appear not to understand its significance.

Furthermore, the results from the water samples are likely to provide some important evidence as to the origins and timing of the spill. Detailed analysis of the signature of the total petroleum hydrocarbons, particularly if analysed over time, could shed considerable light on the origins of the current surface pools in the contaminated zone.

Lastly, Santos state in their report, *"the black substance on the ground adjacent to the water treatment plant (referred to in recent media reports) is not from a petroleum hydrocarbon source but is from natural organic material including eucalypt trees and grasses".*

This does not seem to match with results obtained by environment groups, which showed elevated levels of total petroleum hydrocarbons in surface water pools in the contaminated zone compared to pools outside the contaminated zone. If these levels were caused by 'eucalypt trees and grasses' then there should be no differences apparent between the samples.

Furthermore, there is other corroborating evidence to show that coal seam gas water in the Pilliga is often dark in colour and tarry in nature. Coal seam gas water in 1000 litre clear plastic containers at two well sites, Bibblewindi 24 & 25, from which gas is being vented, has been filmed and photographed on a number of occasions almost pitch black in colour.

The failure by Santos to either conduct or release water samples tends to lead to an understatement of the environmental impacts and uncertainty about the origins of the most recent spill. There is no information available as to whether the NSW Government has at any stage collected water samples from the contaminated zone, but it seems most likely that they have not. It would appear that, once again, the community is the only party that has collected the information that is required to assess the environmental impacts of the contamination that has occurred to areas adjoining the Bibblewindi Water Treatment Plant or to provide evidence as to what has occurred in the area.

Soil Samples

The results of the Santos soil samples show high levels of congruence with the soil samples commissioned by environment groups. Santos summarises the results as follows:

> *"The average concentrations of metals, TPH/TRH, pH, nutrients and salts in the upper surface samples collected from the affected area are generally greater than the average concentrations for background samples. This pattern is most pronounced for barium, strontium, manganese, iron and exchangeable sodium".*

However, Santos claim that the results of soil samples show that, apart from salts, there are no other health or ecological risks from the spill. The media release of the 22nd February states that '*Detailed investigations shaw soil samples well within relevant safety guidelines*' and that:

> *"Extensive soil tests undertaken by external scientific consultants demonstrate that the levels of trace elements and compounds in soil near the site, with the exception of salt, do not represent health or ecological risks."*

However, a closer inspection of the results actually obtained by Santos actually contradicts those statements. Firstly, the samples taken by Santos actually exceeded the National Environment Protection Measures (NEPM) guideline values for both Barium and Vanadium. Barium was recorded in one sample at 510mg/kg, whilst the EIL (Ecologically-based Investigation Levels) is set at 300mg/kg. Barium in some of its forms has significant toxicity and it was recorded at high levels in the upper soil samples where it would be most available to wildlife. However, the Santos report provides no analysis of the likely ecological impacts but instead apparently dismisses the matter as having no consequence.

Secondly, there are numerous problems with the NEPM guidelines used by Santos in the report and their relevance in a natural environment such as the Pilliga. The following points can be made:

1. The use of Ecologically-based Investigation Levels (EILs) to benchmark the soil results is inappropriate for assessing environmental impacts in a high conservation value natural area such as the Pilliga.

2. The NEPM[35] makes it quite clear that EILs are only interim guidelines for urban settings and that regional EILs would have to be developed relevant to regional flora, fauna and soils. The EILs used are not appropriate for assessing eco-toxicity of contaminants to native species.

3. For example, the NEPM states that[36]:

   "In the interim, EILs for on urbon setting are provided based on considerations of phytotoxicity (copper, chromium, leod) ond soil survey dota (barium, phosphorus, sulfur) from four Austrolian copital cities...

   It is ocknowledged thot the EILs for on urbon setting have not been derived to protect nominated ecological values and are somewhat arbitrary...

   In some circumstonces, including the presence of a volued and sensitive species or coarse-grained, acidic soils, the estoblishment of more pertinent regional values should ossume greater priority".

[35]http://www.ephc.gov.au/sites/default/files/ASC_NEPMsch__01_Investigation_Levels_199912.pdf
[36]http://www.ephc.gov.au/sites/default/files/ASC_NEPMsch__01_Investigation_Levels_199912.pdf

4. The NEPM makes it very clear that in circumstances where these EILs are not appropriate, more relevant EILs need to be developed. It states that:

   "*In addition, appropriate investigation and/or response levels need to be developed when:*
   - *Investigation values are not available for contaminants of concern and/or data are not available to enable the derivation of guideline values*
   - *Site conditions, receptors and/or exposure pathways differ significantly from those assumed in the derivation of HILs and EILs*
   - *There are significant ecological concerns (eg critical or sensitive habitat, threatened or endangered species, parklands and nature reserves)*"

5. Santos did not develop more appropriate EILs as required by the NEPM, and there is no consideration from Santos about the possible ecological impacts of a number of other compounds that showed elevated levels but for which there are no NEPM guidelines (such as Strontium).

6. As far as hydrocarbons are concerned, the criteria used for assessment are the NSW EPA service station guidelines, which are obviously not relevant to a sensitive natural area such as the Pilliga.

On ABC radio, Mr James Baulderstone of Santos described the results of the soil samples conducted by Santos as follows:

> "*There are no dangerous toxicity levels, the toxins that are alleged to be there are in fact naturally occurring trace elements and the soil samples we took and had analysed show* ***no real increase in those levels naturally occurring trace elements,*** *what is impacting vegetation in this area is salt*"[37].

This statement does not seem to be supported by the Santos document itself. The Santos report finds, "*the average concentrations of metals, TPH/TRH, pH, nutrients and salts in the upper surface samples collected from the affected area* ***are generally greater than the average concentrations for background samples.*** *This pattern is most pronounced for barium, strontium, manganese, iron and exchangeable sodium*". Furthermore, and as discussed above, the Santos report also admits that the levels of both Barium and Vanadium which they recorded were above NEPM guidelines.

In summary, the data presented by Santos and the criteria against which they are assessed are not adequate to support a conclusion that there are no 'health or ecological risks' associated with the contamination. On the contrary, there is sufficient evidence contained in the water and soil samples commissioned by both Santos and environment groups to indicate genuine ecological risks in a high conservation value area such as the Pilliga. Furthermore, the media conducted by Santos on the soil samples understates and/or misrepresents the significance of the results it obtained.

The limitations of the Santos soil assessment have been summarised by Professor Joe Bidwell, in a letter to The Wilderness Society (Appendix 6), as follows:

[37] http://www.abc.net.au/local/stories/2012/02/23/3438239.htm

"While chemical testing alone is effective at indicating what contaminants may be present at a site, they tell very little about true bioavailability or ecological risk. While the 'guideline' values used by the consultants that did the chemical testing on the soil are better than nothing, they were not derived as ecological action levels. I would also argue that the delays in analysing the samples may have lead to a reduction in the concentration of chemical residues that were measured, making comparison to guideline values even more problematic. Another key issue is that single chemical guideline values do not account for the interactions of chemicals that could occur in a mixture. These interactions could actually reduce the toxicity of some components or make it worse".

Additional Questions

There are numerous additional questions that remain unanswered in relation to Santos coal seam gas operations in the Pilliga and the spills of produced coal seam gas water in particular. There is still important information outstanding that is required to make a fully informed response, and the NSW Government should be urgently requesting this information.

One of the most important areas for further investigation is whether there has been a more recent, large spill at the Bibblewindi Water Treatment Plant. There is a considerable body of evidence to suggest that a more recent spill has occurred. This evidence includes:

1. **The increasing area affected by tree dieback between November 2011 and January 2012**: On 7th November, DRE advised environment groups in writing that the size of the spill was *'limited to approximately 0.55ha'*. However, by January 2012 the area of tree dieback as measured by both environment groups and Santos, was covering an area of approximately 1.2ha, more than double the size recorded in November.
2. **Observational information collected from the site**: When local landholder Tony Pickard reported the contamination on the 1st and 2nd January 2012, he commented on the appearance of seemingly **fresh pools of produced water collected on the surface which he thought unlikely to have remained in such a condition after seven months of heavy rainfall since June**. The 'tide mark' left by the passage of the water and the fact that the water travelled upslope in some areas suggested a large and rapid movement of water, which does not match with events as reported by Santos.
3. **The levels of semi-volatile petrochemicals recorded in contaminated water samples**: The water samples commissioned by environment groups revealed high levels of semi-volatile petro-chemicals (petroleum hydrocarbons >C10-C16) in the contaminated zone compared to the uncontaminated zone. Upon speaking with a range of scientists, it was deemed **surprising that these semi-volatiles had not fully evaporated after seven months** exposure to the atmosphere.
4. **The changes in the site since January**: Local resident Tony Pickard has been recording the site closely with photographic evidence since he first reported the incident in January 2012. **In that short two month timeframe, the surface pools in particular have changed dramatically, with the black tarry appearance dissipating and much of the water evaporating away completely**. An area that was boggy and moist in early January is now almost entirely dry, despite considerable rainfall. The black ground stain has reduced

markedly and in many cases almost completely disappeared over that time period. This adds weight to the theory that **the spill was far more recent than the alleged June 2011 spill date** as provided by Santos.

5. **The potential cause in the form of dam structural works on 30th December** - An excavator was working on the No. 2 pond at Bibblewindi Water Treatment Plant which adjoins the vegetation dieback in late December. It seems probable that this excavator working on the dam may have been the cause of a recent spill.

This mystery is heightened by the fact that Santos did not collect or release water samples from surface water pools in the contaminated area. It is currently unknown whether the DRE have collected any such samples.

Some of the media statements by Santos themselves throw doubt over their explanation in relation to the date of the last spill. In particular, in trying to downplay the environmental impact of the spills, Santos Vice President James Baulderstone stated that "*With the strong rainfall during that period of time and this salty saline water we're talking about, with it being diluted quite quickly, there has been minimal impact from those spills*"[38].

If the last spill occurred in June 2011, and heavy rainfall ensued which diluted it quickly, then why were there deep black pools of coal seam gas water with high levels of salts, heavy metals and petrochemicals still present six months later in January 2012?

The NSW Government should immediately release the results of any water sampling it has conducted in the contaminated zone at any time. It should also commission an organic chemist to investigate, in detail, questions relating to total petroleum hydrocarbons. A thorough and independent ecological risk assessment is required of the impact of all coal seam gas operations in PEL238 and PAL2 to date.

Spills - Summary and Conclusions

- The DRE and ESG both dismissed complaints of vegetation dieback adjoining the Water Treatment Plant as caused by water-logging.
- Despite being in the midst of an intensive investigation of operations in the Pilliga, DRE appears to have failed to collect and/or analyse soil or water samples which could be obtained on a 10 day turnaround and would have immediately disproved the water-logging claim.
- Santos repeatedly stated in early January that there 'had been no leaks', and has since apparently admitted four leaks prior to that date (after it assumed 100% ownership) and numerous leaks whilst Eastern Star Gas was still the operator.
- There is still no information available on the four spills that have occurred since Santos assumed 100% ownership, including a potentially toxic spill of algaecide. The NSW Government has not stated whether it is investigating these spills.
- The report and associated media released by Santos into ESG:

[38] http://www.abc.net.au/local/stories/2012/02/23/3438239.htm

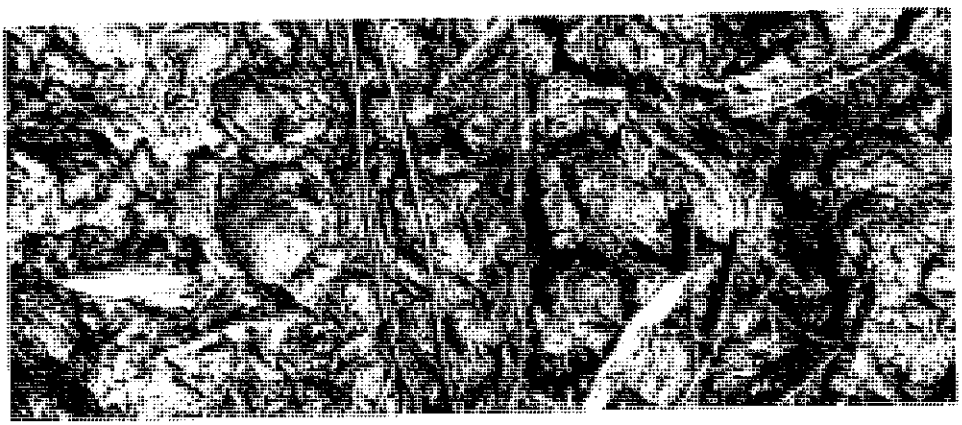
  - Misrepresent the results obtained by environment groups, claiming that they did not contain a comparison with natural baselines, which is incorrect.
  - Did not collect or provide any water sample results from within the contaminated zone, thus potentially under-stating and obscuring its potential impact on wildlife.
  - Compared soil samples to standards used in urban areas which are not meaningful to wildlife habitat such as the Pilliga.
- Media statements by Santos in relation to the soil samples appear to substantially downplay the environmental impacts and even misrepresent the results of its own data.
- As a result of all the factors set out above, the Santos report understates the ecological risks associated with environmental incidents that have occurred in the Pilliga.

Given the high conservation significance of the Pilliga Forest, assessment of environmental risk requires, at the very least, a thorough eco-toxicological analysis. Professor Joe Bidwell has advised as follows:

> *"I would suggest o two-tiered biological assessment of soils from the site. First, a survey of the existing soil invertebrates from the spill zone as compared to reference sites could be done. This con eosily be accomplished by collecting o sample of surficial litter from the site and using a Berlese funnel to extract the resident invertebrates. The numbers and types of invertebrates from each site could then be compared to determine if there were differences in community composition. Samples of the soils from the spill zone ond reference sites could also be used for plont germination bioassays in the laboratory to see if germinotion is comparable between the two".*

Both state and federal governments should now commission such an assessment to be conducted as a matter of urgency. A full and independent ecological risk assessment is now required of all coal seam gas operations in the Pilliga to date.

Most importantly, whilst the events of the last twelve months have exposed severe environmental failures in coal seam gas operations that are visible above-ground, there is no way of knowing what is occurring below ground. However, there is reason to be extremely concerned that similar basic failures in compliance have occurred which are likely to represent a severe risk to underground water resources, including the Great Artesian Basin. An urgent independent audit and testing regime is now required of all coal seam gas wells drilled by Eastern Star Gas in PAL2 and PEL238.



Discharge of Polluted Water into Bohena Creek

In 2011, certified agricultural and environmental consultants EastWest EnviroAg were commissioned by the Northern Inland Council for the Environment and The Wilderness Society to take samples of the water being discharged from the reverse osmosis plant into the Bohena Creek and to also collect a sample from further upstream for comparison purposes. Bohena Creek is an ephemeral creek with a shallow alluvial aquifer that discharges into the Namoi River.

EastWest EnviroAg visited the area and obtained two samples on 25th August 2011, one from the discharge and one from approx. 1km upstream. Bohena Creek was dry at the time sampling was conducted and Sample 2 was obtained by digging approx. 1m down to sample aquifer water.

EastWest EnviroAg provided the samples to the NASA certified ALS Group Laboratory. ALS Group conducted a comprehensive suite of tests which revealed that the discharge water contained elevated levels of ammonia, methane, cyanide, carbon dioxide, boron, bromide and lithium compared to the upstream sample. The results were provided to environment groups as Project No. EW 110647, and are attached as Appendix 7.

The comparison of results for the discharge and the upstream samples are provided in Table 3. Ammonia was detected at the discharge site at 1.56 milligrams per litre (mg/l), which is three times the Australian Drinking Water Guideline value of (0.5mg/l). It was detected at 0.03 mg/l in the upstream sample, well below the acceptable range for both drinking water and aquatic ecosystems. Advice received from Dr Marian Lloyd-Smith interpreting the results is provided as Appendix 8.

Table 3. Comparison of water at the discharge with the upstream sample

CHEMICAL	SAMPLE SOURCE		Increase
	UPSTREAM	DISCHARGE	
Ammonia (mg/L)	0.03	1.56	5200%
Lithium (mg/L)	0.001	0.023	2300%
Methane (µg/L)	10	68	680%
Bromine (mg/L)	0.1	0.6	600%
Total Carbon Dioxide (mg/L)	21	89	424%
Boron (mg/L)	0.05	0.26	520%
Total Alkalinity (mg/L)	22	94	427%
Cyanide (mg/L)	0.004	0.014	350%
Sodium (mg/L)	17	52	306%

Table 4 below compares the results with the ANZECC Guidelines for aquatic ecosystem protection in freshwater. This indicates that both Ammonia and Cyanide go beyond the trigger value for 90% protection in the discharge sample.

Table 4. Results of Bahena Creek discharge in relation to ANZECC guidelines

Chemical	Trigger values for freshwater (mg/L)				Bohena Discharge Test Results	
	Level of protection (% species)				Samples (mg/L)	
	99%	95%	90%	80%	Upstream	Discharge
Boron	0.09	0.37	0.68	1.3	0.05	0.26
Ammonia	0.32	0.90	1.43	2.3	0.03	1.56
Cyanide	0.004	0.007	0.011	0.018	0.004	0.014

The results were provided in full to DTIRIS via email on the 19th December 2011 and to the Environment Protection Authority via email on the 12th December 2011. In response to the release of this data publicly by environment groups, a Santos spokesperson stated that:

> *"But we do conduct and Eastern Star have been conducting regular testing on the water discharged from this focility. That discharge has been outhorised by the New South Wales Government.....It's worth pointing out I think that the New South Wales Government has also under its Office of Water identified for some time that there are high nitrate levels in the Namoi River and has attributed those levels to the agricultural octivities in the region.....All I con say is that any water discharged into the Namoi River meets the requirements of the New South Wales Government"*[39].

The company also said in a statement that *"Discharged water is tested on a monthly basis ond all recent results have met NSW requirements"* and that *"Santos is confident it is not in breach of its autharity or hoving any adverse impact on water resources in the area*[40]".

However, the monthly testing which Santos refers to was restricted to only 5 compounds and did not include ammonia. The reference to farming impacts and nitrates were both spurious, as the compound at issue was ammonia, not nitrates, and the catchment of Bohena Creek is located almost entirely in the Pilliga State Forest so farming impacts are minimal.

We have been informed verbally by DTIRIS that they subsequently visited the site to conduct an investigation but did not obtain a water sample from the discharge point or from the reverse osmosis plant. Whilst DTIRIS claimed that they were not able to obtain a sample due to

[39] http://www.abc.net.au/am/content/2011/s3386203.htm
[40] http://www.smh.com.au/environment/water-issues/tests-reveal-contaminated-water-near-gas-site-20111208-1oldj.html

malfunctioning of the plant, the Santos report suggests that a deliberate decision was made to shut-down the plant following the media revelations about pollution.

Santos state in their recent report into Eastern Star Gas operations (page 4): "*In ony event, in December 2011, because of vorious concerns about water treotment plant,* ***Santos took the decision to scale back operations in the Pilliga, including ceasing operation of the water treatment plant pending a full review of its adequacy and integrity***".

They also state that: "*A reverse asmosis plant installed and aperated by Eastern Star appears to have given rise to a number of issues. The plant suffered fram multiple leaks and incidents. Given the passage of time, Santas has been unable ta determine the valume af water released as a result of these incidents. The plant has not been in operatian since 15 December 2011, pending Santos' review of the aperation and operating practices*".

We were advised by DTIRIS on 9th December that they were collecting samples from the plant the following week starting 12th December. However, they later informed us that they did not collect any samples, due to the fact that the treatment plant had been shut-down. However, the Santos report suggests that there were at least three days between 12th and 15th when they should have had an opportunity to take samples. We were informed verbally by the EPA on 31 January 2012 that they were conducting an investigation into the matter but they had not, as of that date, obtained a water sample from the reverse osmosis plant.

We believe an investigation is required into why neither DTIRIS nor the EPA has managed to collect a single sample from the reverse osmosis plant either in the general course of their regulation or in response to the results obtained by environment groups, which appears to have been operational up to and including the 15th December.

Despite the claims by Santos reproduced above that *'all recent results have met NSW requirements'*, there are two additional sources of evidence which were held by Santos at the time which confirm that is not the case and indicate that pollution was occurring. In late 2011, Eastern Star Gas provided two water samples from the Bohena Creek discharge to the Senate Inquiry into Coal Seam Gas in the Murray-Darling Basin which provided results for 37 compounds. The samples were dated June and July 2011. The samples reported Ammonia levels of 1.7mg/L and 1.2mg/L respectively which is commensurate with the results obtained by environment groups and which is several times drinking water standards. Therefore, these results appear to directly contradict Santos statements above that there is *'no adverse impact on water resources'* and that *'all recent results have met NSW requirements'*.

Furthermore, the information provided by Santos in their report into Eastern Star Gas reveals that the levels of total dissolved solids in the discharge water frequently exceeded the limit of 300 mg/L and that **Eastern Star Gas hid those findings from the Department of Trade and Investment in their biannual management reports**. However, the Santos report ignores the issue of ammonia in the discharge water and does not provide any comprehensive water testing results for other substances in relation to the discharge Bohena Creek.

The Santos report does not provide the two Eastern Star Gas water samples. Water pollution into Bohena Creek exposes serious flaws in regulation. There was no requirement in the Review of Environmental Factors for the water discharge relating to serious monitoring of water quality in the creek. The requirement for monitoring was restricted to just five measures (including pH, EC, TDS) plus a visual inspection. There was no requirement whatsoever for monitoring of an upstream sample for comparison purposes.

Environment groups recently submitted a freedom of information request for all water samples submitted by coal seam gas companies to government authorities over the last year. This revealed only five documents in total - the two water testing results already submitted by Eastern Star Gas to the Senate Inquiry and the information released in relation to TDS by Santos in their report on Eastern Star Gas operations. This was apparently the full extent of the information held by the DRE on the quality of treated coal seam gas water that was being discharged into Bohena Creek.

This monitoring inadequacy represents an inexcusable failure by the NSW Government in relation to CSG regulation as well as a major failure on the part of the gas companies themselves. The most basic monitoring requirements, covering all likely compounds and comparing the discharge with both an upstream and downstream sample, would have immediately alerted authorities to the water quality problems and could have prevented the pollution from occurring.

Discharge - Summary and Conclusions

This review of available data indicates that the discharge of treated coal seam gas water was polluting Bohena Creek. Evidence for this pollution is found in the water analysis results provided by Eastern Star Gas to the Senate Inquiry[41] and the independent water samples commissioned by environment groups.

The Santos report into Eastern Star Gas operations ignores the issue of ammonia and cyanide levels being discharged into Bohena Creek, and does not release the information collected by Eastern Star Gas or any analysis of its own in relation to such levels. This is a major oversight.

As far as we are aware, neither DRE nor EPA has collected a sample of water from the reverse osmosis plant after treatment. The decision by Santos to shut that plant down in early December, immediately following reports by environment groups, appears to be designed to prevent any such sample from being collected. **The failure of government agencies to collect basic samples from the discharge point, despite water having being discharged for at least 2 years, underscores an extraordinary regulatory failure at a time when they were supposed to be conducting a detailed and comprehensive investigation of the area.**

The pollution of Bohena Creek would not have occurred if a basic monitoring regime had been in place requiring ESG/Santos to analyse the discharge for a comprehensive suite of chemicals and comparing it to an upstream sample.

[41] Senate Inquiry into the effects of coal seam gas, Narrabri NSW, Tuesday 2nd of August 2011

Commercial Production from an Exploration Licence

Section 29 of the *Petroleum (Onshore) Act 1991* (Petroleum Act) provides an exclusive right to the holder of a Petroleum Exploration Licence to **prospect** for petroleum on the land comprised in the PEL. 'Prospecting' is defined under the Act as follows:

"..to carry out works on, or to remove samples from, land for the purpose of testing the quality and quantity of petroleum in the land and the potential to recover petroleum from the land, but does not include any activity declared by the regulations not to constitute prospecting".

It is apparent that the removal of gas for commercial purposes does not meet the definition of prospecting because it includes considerably more than removing 'samples' from land for the purpose of testing and instead includes the removal of gas for commercial purposes. There are several corroborating clauses within the Petroleum (Onshore) Act 1991 and the Petroleum (Onshore) Regulation 1991 which confirm that commercial production is not consistent with an exploration licence.

The hierarchy of use developed by the Petroleum Act 1991 specifically range from an exploration licence, to an assessment lease to a production licence. If commercial production were valid within an exploration licence there would be no purpose to such a hierarchy. This is further borne out by provisions contained in the Petroleum (Onshore) Regulation 2007, which defines commercial production as follows:

> *"Commercial production of petroleum means the use by, or supply to, any person (including the holder of a petroleum title or mining lease) of any petroleum extracted from an area of land to which a petroleum title or mining lease relates for any purpose* ***(other than for well assessment, flaring or equipment testing that does not result in the generation of energy or supply of petroleum for commercial purposes)****".* [Emphasis added]

The royalty provisions of the Petroleum Regulation provide further evidence that it is beyond power to produce commercial gas from an exploration licence. Clause 25 of the Regulation requires notification to the Director-General of dates on which commercial production commences for the purposes of royalties for assessment leases and production leases only, and not for exploration licences. If it were legally valid to commercially produce gas under the terms of an exploration licence, the entire royalty provisions of the Petroleum Act would be rendered ineffective as a title holder could commercially produce gas under an exploration title for the life of that title with no royalty implication.

The Santos Tintsfield pilot production field consists of 6 wells located within PEL 238 that are situated approximately 8km south-west of Narrabri. The Tintsfield CSG wells began production on or about 1st April 2011 with all CSG produced being piped to the Wilga Park Power Station for the commercial supply of electricity.

The Review of Environmental Factors for the Tintsfield wells states that *'All gases produced from the pilot will be preferentially consumed at the Wilga Park power station 5.5 km east northeast of the pilot'*. In April, 2011, Eastern Star Gas released a statement[42] announcing that "*operation of the Tintsfield lateral well project will begin today*'. That statement also indicated that "all *production from Tintsfield is piped to Wilga Park where water can be handled and gas used as fuel for generation of electricity*".

PEL 238 clearly does not confer authority on Santos to commercially supply CSG from its Tintsfield Wells to the Wilga Park Power Station or any other power station. The work program in PEL238 refers to pilot production but does not mention or authorise commercial production. **Commercial supply of gas from an exploration licence represents a breach of the Petroleum Act and would result in commercial gas production achieved without paying any royalties to the state of NSW.**

An urgent investigation is required into the Tintsfield pilot production field and the commercial supply of gas to Wilga Park Power Station.

[42] http://www.bourseinvestor.com/bi4/pdfnews/default.asp?d=01167244&f=20110401

Compliance with the Petroleum (Onshore) Act 1991

Requirements of Petroleum Titles

The petroleum titles held by Santos in the Pilliga include Petroleum Assessment Lease 2 and Petroleum Exploration Licence 238. These two titles are reviewed below in relation to the incidents covered in detail earlier in this report.

The earlier sections of this report provide detailed evidence to prove that coal seam gas operations in the Pilliga have resulted in harm to the environment, including water pollution and soil contamination. **The leaseholder has failed in its duty to prevent and/or minimise harm,** contained in the following clauses of the relevant petroleum titles:

> *PAL 2, Clause 1: The leaseholder must implement all practicable measures to prevent and/or minimise any harm to the environment that may results from the construction, operation or rehabilitation of any exploration activities.*
>
> *PEL 238, Clause 2: Operations must be carried out in a manner that does not cause or aggravate air pollution, water pollution, soil contamination or erosion.*
>
> *PEL 238, Clause 8a: Operations must be carried out in a manner which avoids pollution of any Catchment Area.*
>
> *PEL 238, Clause 18: Operations must be carried out in a manner that ensures the safety of persons and stock in the vicinity of operations.*

The leaseholder has failed to report either water pollution or soil contamination caused by its operations in the Pilliga, as outlined earlier in this report, which represents a serious breach of the following requirements of its petroleum titles.

> *PAL 2, Clause 4: The leaseholder must, in accordance with Department guidelines (if any), report any incidents causing or threatening material harm to the environment.*
>
> *PEL 238, Clause 23d: An Incident and Complaints report must be submitted to the Department as follows:*
>
> *i) The report is to be submitted within 24 hours of any serious environmental incident, breach of Conditions 1 to 27 or breach of other environmental regulations or a serious complaint from landholders or the public.*

The leaseholder has not buried all gas gathering pipes and the gas gathering system has not been maintained free of leaks. Evidence for this has previously been collected on video at the Bohena 7 gas well and at Bibblewindi 21, and is outlined in the chronology section of this report. This represents a breach of the following clauses:

> *PAL2, Clause 7g: All gas gathering pipelines must be buried with a detectable marker tape or wire or other approved means provided for locating the pipe.*

PAL2, Clause 7i: The gas gathering system must be maintained free of leaks while in operation and a progrom implemented to confirm this. Records to be maintained and made available to the inspector on request.

The acknowledged non-compliance in relation to over-clearing of Dewhurst 8 (letter for DRE to Tony Pickard, April 2012) and alleged **excessive clearing at up to 39 sites** identified in the Santos report into Eastern Star Gas operations, raising questions as to whether there has been a breach of the following requirement:

PEL 238, Clause 4. The licence holder must not cut, destroy, ringbark or remove any timber or other vegetative cover on any land subject of this licence except such as directly obstructs or prevents the carrying on of operations. Any clearing not authorised under the Petroleum (Onshore) Act 1991 must comply with the provisions of the Notive Vegetation Act 2003.

There are a number of other requirements of the titles which appear to have been breached, based on the details provided earlier in this report and in the Santos report on Eastern Star Gas operations. These include:

PAL 2, Clause 5: The Licence Holder must rehabilitate oll disturbed land to the satisfaction of the Director General. (Letter from DRE to Tony Pickard, April 2012)

PAL 2, Clause 6a: All operotions must be corried out in conformity with the 'Schedule of Onshore Petroleum Exploration ond Production Sofety Requirements' published by the DPI, as omended from time to time.

PAL 2, Clouse 10b: A well must not be plugged ond abondoned except in occordance with the Schedule of Onshore Explorotion and Production Safety Requirements, and ony other guidelines in force from time to time. (Letter from DRE to Tony Pickard, April 2012).

PEL 238, Clause 5: The licence holder must take oll protections against cousing on outbreok of fire....

PEL 238, Clause 6: All refuse must be deposited in properly constructed contoiners. The licence holder must maintoin the areo in o clean ond tidy condition ot oll times.

PEL 238, Clouse 19d: Once ony drill hole ceases to be used the lond ond its immediote vicinity is left in a clean, tidy and stable condition

It is apparent from the detailed information provided earlier in this report that the licence holder is not complying with the provisions of the *Petroleum (Onshore) Act 1991* or the conditions of the licence. The licence itself contains a provision for the DRE to direct that operations cease under such circumstances, as follows:

Clouse 25a: If an inspector or on Environmental Officer believes thot the licence holder is not complying with ony provision of the Petroleum (Onshore) Act 1991 or ony condition of this licence concerning the working of the licence, he moy direct the licence holder to:

i) Ceose working the licence, or

ii) cease thot part of the operotion not complying with the Act or conditions until in the opinion of the Inspector/Environmental Officer the situation hos been corrected.

It is surprising that such a direction has not already been given for PEL238 given the failures that have been identified. DRE should immediately require that Santos stop working the licence.

Requirements of the Petroleum (Onshore) Act 1991

The Petroleum (Onshore) Act 1991 contains a clause which allows the Minister to cancel any licence as follows:

> ***22 Cancellation or operational suspension of titles***
> *(1) A petroleum title may be cancelled by the Minister if its holder, at any time during the term of the title:*
> *(a) fails to fulfil or contravenes any of the conditions of the title, or*
> *(b) fails to use the land comprised in the title in good faith for the purposes for which it has been granted, or*
> *(c) uses the land for a purpose other than that for which the title has been granted.*

It is apparent that there have been numerous contraventions of the conditions of PAL2 and PEL238 by Santos, which are described in detail earlier in this report, particularly relating to soil contamination and water pollution. Furthermore, the use of an exploration licence for commercial production appears to represent a breach of good faith under s 22 (1)b. These events taken together constitute a very strong trigger for the Minister to cancel the licences, and no lesser action ought to be considered sufficient given the number and scale of the contraventions which have occurred and the serious failures in notifications associated with them.

Furthermore, s16A of the Petroleum Act allows the Minister to require that the security associated with a petroleum title is forfeited to the Crown, as follows:

> ***16A Forfeiture of security***
>
> *(1) All or such part of any security in relation to a petroleum title as the Minister may determine is to be forfeited to the Crown if the holder of the title fails to fulfil the obligations imposed under or arising out of this Act in relation to the title.*
> *(2) Forfeiture is effected by the service of a written notice on the holder of the relevant petroleum title.*
> *(3) Money realised from the forfeiture of any such security is to be applied for the purpose of fulfilling the obligations arising under this Act in relation to the petroleum title.*

The security lodged for each title is contained in the titles themselves, and are set down as:

PAL2, Appendix 2: Sum of security to be lodged with the Director-General: $10,000

PEL238, Third Schedule: A security in the sum of $868,000 must be lodged with the Minister by the licence holder for the purpose of ensuring the fulfilment of obligations under the licence. If the licence holder fails to fulfil any one or more of such obligations the said sum may be applied at the discretion of the Minister towards the cost of fulfilling such obligations.

Given the serious and systemic failings of coal seam gas operations in the Pilliga and the failure to notify authorities as required, the security for both titles should now be forfeited to the Crown at the request of the Minister. These funds should then be used to conduct further detailed ecological risk assessments in relation to soil contamination and water pollution that has occurred in the area.

Compliance with other legal requirements

Protection of the Environment Operations Act 1997

Water Pollution

Section 120 of the POEO Act states:

> *120 Prohibition of pollution of waters*
>
> *(1) A person who pollutes any waters is guilty of an offence.*
>
> *(2) In this section:*
>
> *"pollute" waters includes cause or permit any waters to be polluted.*

Water pollution is widely defined in the Act as follows:

> *"(a) placing in or on, or otherwise introducing into or onto, waters (whether through an act or omission) any matter, whether solid, liquid or gaseous, so that the physical, chemical or biological condition of the waters is changed, or*
> *(b) placing in or on, or otherwise introducing into or onto, the waters (whether through an act or omission) any refuse, litter, debris or other matter, whether solid or liquid or gaseous, so that the change in the condition of the waters or the refuse, litter, debris or other matter, either alone or together with any other refuse, litter, debris or matter present in the waters makes, or is likely to make, the waters unclean, noxious, poisonous or impure, detrimental to the health, safety, welfare or property of persons, undrinkable for farm animals, poisonous or harmful to aquatic life, animals, birds or fish in or around the waters or unsuitable for use in irrigation, or obstructs or interferes with, or is likely to obstruct or interfere with persons in the exercise or enjoyment of any right in relation to the waters, or*
>
> *(c) placing in or on, or otherwise introducing into or onto, the waters (whether through an act or omission) any matter, whether solid, liquid or gaseous, that is of a prescribed nature, description or class or that does not comply with any standard prescribed in respect of that matter,*
>
> *and, without affecting the generality of the foregoing, includes:*
> *(d) placing any matter (whether solid, liquid or gaseous) in a position where:*
> *(i) it falls, descends, is washed, is blown or percolates, or*
> *(ii) it is likely to fall, descend, be washed, be blown or percolate,*
>
> *into any waters, onto the dry bed of any waters, or into any drain, channel or gutter used or designed to receive or pass rainwater, floodwater or any water that is not polluted, or*
> *(e) placing any such matter on the dry bed of any waters, or in any drain, channel or gutter used or designed to receive or pass rainwater, floodwater or any water that is not polluted, if the matter would, had it been placed in any waters, have polluted or have been likely to pollute those waters.*
> *"waters" means the whole or any part of:*

(a) any river, stream, lake, lagoon, swamp, wetlands, unconfined surface water, natural or artificial watercourse, dam or tidal waters (including the sea), or
(b) any water stored in artificial works, any water in water mains, water pipes or water channels, or any underground or artesian water".

The discharge of treated coal seam gas water into the Bohena Creek system clearly constitutes pollution under the POEO Act 1997. As detailed in the pollution section earlier in the document, the samples collected from the discharge clearly show that the introduction of the water into the Bohena Creek system was likely to change the condition of that creek. The elevated levels of ammonia and cyanide were recorded at levels that would be detrimental to the health of aquatic fauna according to ANZECC guidelines.

The Review of Environmental Factors for the discharge asserts:

"The proposal carries no potential for direct or indirect impact on aquatic species, ecological communities or habitat. The creek is naturally ephemeral in its style, and has not contained any visible or measurable base flows since December 2004. There are no permanent or temporary pools within the impacted reach with any potential to contain aquatic species".

The Australian Museum has recently confirmed records of the Spangled Perch within pools in Bohena Creek, and important native flora has also recently been identified in the creek system including the carnivorous plant *Drosera indica*. A number of different frog species are also known to occur along Bohena Creek. Therefore, the discharge into Bohena Creek by Santos is highly likely to have caused environmental harm within the meaning of the POEO Act 1997.

Waste Disposal

s115of the POEO Act 1997 states that:

1) Offence If a person wilfully or negligently disposes of waste in a manner that harms or is likely to harm the environment; (a) the person, and (b) if the person is not the owner of the waste, the owner, are each guilty of an offence.

The POEO Act 1997 defines waste as:

***waste** includes: (a) any substance (whether solid, liquid or gaseous) that is discharged, emitted or deposited in the environment in such volume, constituency or manner as to cause an alteration in the environment*

It is apparent from the detailed information provided earlier in this document on the recorded spills of coal seam gas water near the Bibblewindi Treatment works that waste within the meaning of the POEO Act 1997 has been deposited into the environment in a manner that is likely to harm it. The revelations from Santos that all of the spills both pre- and post Eastern Star Gas at the treatment works 'were preventable' and the evidence that Eastern Star Gas did not report the spills to authorities, indicates that the disposal was either wilful or negligent. Sam Crafter, of Santos, has stated in relation to the Eastern Star Gas spills that *'These problems were entirely preventable and*

were the result of poor practice"[43]. In relation to three of the spills that occurred after Santos took over 100% ownership, Santos have acknowledged that all three *'were preventable*"[44] and in relation to at least one of the Santos spills, Sam Crafter also stated on 14th February that "*We need to be clear, this incident was entirely preventable* ***and it shouldn't have happened***"[45].

Therefore, there is a very strong case to be made that coal seam gas spills in the Pilliga are in breach of s115 of the POEO Act 1997. However, the EPA does not appear to be investigating the matter, merely stating that it is supporting the DRE in their investigations. As far as we are aware, there has been no sampling conducted by the EPA of the spills. It is a cause of major concern if the primary regulatory authority of under the POEO Act 1997 is not empowered or required to investigate the environmental incidents that have occurred in the Pilliga.

Contaminated Lands Management Act 1997

Section 5 (1) of the Contaminated Lands Management Act 1997 specifies that:

"Contamination" of land, for the purposes of this Act, means the presence in, on or under the land of a substance at a concentration above the concentration at which the substance is normally present in, on or under (respectively) land in the same locality, being a presence that presents a risk of harm to human health or any other aspect of the environment".

Section 8 of the CLM Act 1997 sets out the general functions of EPA in relation to contaminated lands as follows:

(1) It is the duty of the EPA to do the following in a manner and to an extent reasonable in the circumstances:

(a) examine, and respond to, information that it receives of actual or possible contamination of land,

(b) address any contamination that the EPA considers to be significant enough to require regulation under Division 2of Part 3,

(c) record what it has done under paragraphs (a) and (b)and the reasons for it.

(2) It is the duty of the EPA to respond to a person (other than the EPA or an authorised officer) who has furnished information referred to in subsection (1). The response must:

(a) be made in a reasonable time, and

(b) state what the EPA has done in relation to the information and the reasons for doing it, and

(c) be in writing if the information was in writing.

(3) In addition to any functions the EPA has under this or any other Act, the EPA may take such reasonable steps as it considers necessary in relation to investigating or managing contamination of land (including significantly contaminated land) or the threat of harm from any such contamination".

Section 60 of the CLM Act 1997 includes a duty on the owner of a site to report contamination. This duty is regulated by a set of guidelines - 'Guidelines on the Duty to Report Contamination under the

[43] http://www.nvi.com.au/articles/F16santos.html
[44] http://blogs.abc.net.au/nsw/2012/02/0830-abc-new-england-north-west-news-10022012.html
[45] http://au.prime7.yahoo.com/n4/news/a/-/national/12899545/call-for-csg-ban-video/

Contaminated Land Management Act 1997'[46]. One of the key indicators of contamination set out in the guidelines is ' *visible signs of toxic responses to contaminants in flora and fauna'*. The guidelines then go on to say that *'In some cases the indicators themselves will provide enough evidence to conclude that the contamination should be reported to DECC'*. However, if further investigation is required, the guidelines specify that such a site investigation should:

1. describe past and present activities that potentially contaminated the land and the adjacent areas, including groundwater, surface water and sediments;
2. identify potential contamination types;
3. assess the site condition;
4. assess the nature, degree and extent of the contamination;
5. assess any harm that has been, or is being, caused by the contamination; and
6. assess the possible exposure routes and exposed populations and the nature of any risk presented by the contamination.

It also states that "*A suitably quolified and experienced environmental consultant should be engaged to do the ossessment. The consultant should use the publication Contominated Sites: Guidelines for Consultonts Reporting on Contaminoted Sites (NSW EPA 2000) as a bosis for conducting the investigation and preparing a report.*"

It is notable that the report commissioned by Santos from Golder Associates and included in their report on ESG operations, does not refer to the Contaminated Sites Guidelines for Reporting by the NSW EPA nor does it refer to the Contaminated Lands Management Act 1997. Since the report does not specifically address these matters, it cannot provide a conclusion as to whether or not the contamination should be reported in accordance with the Guidelines and the Act.

The Guidelines do specify that *'the duty to report is not intended to capture the notificotion of....sites without offsite contomination where....ony onsite contomination has been odequotely oddressed by the planning process under the Environmental Planning and Assessment Act 1979'*. However, it is apparent in this case that the contamination has not been adequately addressed under the EP&A Act 1979, given the regulatory failures of DTIRIS and the failures in reporting by Santos/ESG. Furthermore, there are substantial offsite impacts in this case which have extended out beyond the area subject to approval by the Review of Environmental Factors under the EP&A Act 1979.

Once notification has occurred, the Act gives the EPA power to regulate sites that it defines as 'significantly contaminated'. Once a site has been declared to be 'significantly contaminated', the EPA has powers to require management orders or site audits by accredited site auditors.

The coal seam gas spills in the Pilliga discussed earlier in this report clearly constitute 'contamination' within the meaning of the CLM Act 1997. At the very least, Santos should have, in accordance with s60, conducted an investigation in accordance with the Guidelines for Reporting Contamination to determine whether notification to the EPA was required. The EPA should have, in accordance with s8, examined and responded to the reports of contamination in the Pilliga.

Given that neither of these two assessments have occurred, EPA should now ensure that:

[46] DECCW 2009

- An independent site investigation is conducted of the contaminated area in accordance with the *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA 2000).
- An accredited site auditor is engaged to review the investigation and report.

The EPA should examine, and respond to, reports of contamination in the Pilliga in accordance with s8 of the CLM Act 1997 and provide a response to complainants.

Role of the Environment Protection Authority

The events of the last 12 months in the Pilliga raise serious concerns about the role of the EPA in enforcing environmental laws in relation to coal seam gas companies and their operations. In a response to a complaint by environment groups in October 2011, EPA stated that *'The EPA does not have a formal statutory approval or regulatory role under the Protection of the Environment Operations Act 1997 until the production stage of gas development".*

However, the EPA *does* have a formal regulatory role over coal seam gas operations during the exploration phase. Although coal seam gas exploration is not a scheduled activity and exploration does not require an environment protection licence, it certainly does not exempt the activity from the operation of the POEO Act 1997. On the contrary, **the POEO Act 1997 applies in full and the fact that coal seam gas explorers do not obtain a licence means that they have no defence against prosecution under the Act**.

Therefore, the EPA has full regulatory powers under the POEO Act and the CLM Act 1997. However, they have exercised their powers only in relation to the water pollution complaint and not in relation to any other alleged breaches. This leads us to question the extent to which the Environment Protection Authority is empowered by the NSW Government to enforce environmental laws against coal seam gas companies.

Certainly, there is an interesting comparison to be made with the role of the EPA in handling environmental incidents in the Pilliga with their role in handling environmental incidents at Stockton with the Orica plant. There are surprising similarities between the two - both have involved several environmental incidents in a short period of time, both have had incidents involving ammonia and arsenic releases, both have involved problems and time delays with self-regulation and self-reporting. However, that is where the similarities end. At Orica, the EPA were sent in by the NSW Premier Barry O'Farrell with all guns blazing and shut down the plant. In the Pilliga, the EPA has been relegated to a marginal role investigating only one incident and coal seam gas operations have continued unhampered by any regulatory action.

Full list of recommendations

We recommend:

1. The Minister for Resources should now immediately utilise his powers under the *Petroleum (Onshore) Act* 1991 to:
   - Cancel PEL238 and PAL2 in accordance with s22 of the Petroleum Act.
   - Forfeit all securities to the Crown (amounting to $878,000) in accordance with s16A of the Petroleum Act and utilise those funds to commission a thorough independent ecological risk assessment of the impacts of coal seam gas activities to date in PEL238 and PAL2.
   - Commence legal action against Santos for all major and minor breaches identified in this report.

2. The NSW Government should urgently commission the following independent scientific assessments of the impact of coal seam gas activities in the Pilliga, within an ecological risk assessment framework:
   - A site investigation of all contaminated areas in accordance with the contaminated site guidelines of the Environment Protection Authority, which is then subject to review by an accredited site auditor.
   - Thorough eco-toxicology assessments of the impacts of contamination to date and the development of regional ecologically-based investigation levels that are relevant to the region and to the sensitive environment of the Pilliga.
   - Independent testing of the integrity of all coal seam gas wells in PEL238 and PAL2 (including de-commissioned wells) to determine if damaging impacts have occurred in operations below-ground.
   - A forensic investigation into the water treatment plant and whether there was a large, unreported spill in the vicinity in December 2011.
   - A detailed assessment of the distribution and full extent of vegetation clearing and resultant impacts on wildlife habitat.

3. There should be a Special Commission of Inquiry (under the NSW Special Commissions of Inquiry Act 1983) established into all aspects of coal seam gas operations in PAL2 and PEL238 to provide one single and far-reaching investigation into the matter. This should include, but not be limited to, the following:
   - The entire operation of PEL238 and PAL2 to date including all incidents revealed in the Santos report into Eastern Star Gas, all complaints by the community and all incidents that have occurred since Santos took on 100% ownership.
   - The production of gas for commercial purposes within an exploration licence at the Tintsfield pilot production, including an analysis of the approvals process for the Review of Environmental Factors which allowed it to proceed.
   - All potential breaches of environmental laws for which the Environment Protection Authority is the appropriate regulatory authority, including those which the EPA has not investigated to date.

- Recommendations for prosecution which have arisen from the investigation across all relevant legislation.
- Recommendations for a thorough overhaul of the legal framework regulating coal seam gas operations in NSW.

4. The NSW Government should refer to the matter to the Australian Securities Investment Commission to investigate whether there have been any breaches of the Corporations Act 2001, in particular whether the actions of the directors or officers have been reckless, or intentionally dishonest and have not exercised their powers or discharged their duties in good faith in the best interests of the company or for a proper purpose, in accordance with s184.

5. The NSW Auditor-General should be requested to:
   - Investigate the failings of coal seam gas regulation in the Pilliga including self-regulation by gas companies, flaws in monitoring, compliance and enforcement by government agencies and the interaction between coal seam gas companies and government authorities.
   - Make recommendations for thoroughly restructuring compliance and enforcement of coal seam gas operations and community complaint procedures and for adequate resourcing of regulatory authorities.

Appendix 1 Mr Pickard Reports to DPI 2009-2011

DI&I REPORTS

2009

October—Saturday Diesel Spill 17km long from Boundary Rd in State Forest to Dewhurst 8 – big puddle at D8 – have DVD- ESG claimed 20ltr and 30ltr. Was on local 7 news. Council attended Monday, Mr Marshall, saw extent of spill- DPI sided with ESG version. Also notified state forests, they investigated Sunday and found no evidence of Diesel spill, (Vid)

May---- Dewhurst 6c pumping fluids into unlined sub-pond, No fencing or protection, on Ch 7 locally. DPI notified said that there was no fluid going onto unlined ground. (Vid)
Excessive clearing beside access roads. DPI said that it was necessary to obtain clear vision, only small trees removed, DPI informed large trees felled- practice stopped soon after. (Vid)
Grey trail of Drilling fluid from D8 to Bibblewindi Treatment works, Still there 14 days later. No action. (Vid)

August-- Drive through was recorded and question about bringing of Bibblewindi West and Bibblewindi Laterals plus clearing sent to Anna Timbrell of DoP, she sent on to DPI- no word yet from DPI (Vid)

June---- Long weekend, Clearing of bush for pipeline, DPI notified near sacred site, ESG changed creek crossing point. (Vid)

Bibblewindi West 22- unlined drill pond - DPI notified, said that ESG had told them that there was no chance of Salts or water being adsorbed into the ground. Also Dewhurst 7 and Bibblewindi 10. same report to DPI same answer back. (Vid and Ph)

Forest partially closed by ESG, DPI notified-ESG had no permission to close roads or areas off to , so can use – ESG did not take down signs at Bibblewindi, however Contractor used State Forest Timber Harvesting signs to keep areas closed.(Timber Harvesting was not being done most of the time,even used signs 500m on private property) (Vid)

Illegal Drillers camp – Council Resolved to notify DPI, because of road damage caused in building camp (see Narrabri Council Meeting Minutes of August meeting and resolution registers until December 2009)

Animal deaths - DPI notified. Nothing back (Vid and Ph)

December 25 2009 to January 1 2010 Rain event and ponds at Dewhurst 8 washed out, DPI notified- ESG claimed that it was too wet to see ponds. Owner and I went up there, roads, private and Council could take heavy vehicles, owner had machinery there. (Vid and Ph)

2010

6th January 2010 ; Faxed DII Maitland re report of overflowing ponds,over Christmas / New Year and when did ESG report these events to you,was it within the 48 hours as per Exploration Licence conditions. Also mentioned ESG and how little they had done to correct Noise Disturbance problem

from Drill Rig, of 2009--- reply by phone call only at which time I notified him tat there were NaCl and Kcl on site at Bibblewindi 22H. (Vid, Pho. and Fax)

8th January 2010 ; Faxed to DII Maitland re 6 inch Poly Pipe from Bohena Wells to Bibblewindi Treatment plant, laid on ground and not buried, quoted fire, asked for Inspector to be sent up--- No reply. (Fax)

21st January, sent email re clearing clearing photos on Dewhurst 8 to Glen.Turner@environment.nsw.gov.au

22nd January find out that DII Maitland is now handling matter, a Mr McFadyen
22nd January 2010 Faxed DII re pad construction breaches and man proof fencing breaches at Dewhurst 8 (see Dewhurst 8 REF sections 4.2.3 Drainage and 4.2.4 Initial Rehabilitation and Site Restoration) (Have Fax.)

27th January 2010 fax to G Summerhayes re pond over flows at Dewhurst 10 and mentioning Email of 22-1-10.(Summerhayes sends conformation of fax's sent 6,8,22nd January 2010 and also referred complaints from DECCW to DI&I these being :

18th January 2010 concerns over native clearing at Dewhurst 8

20th January 2010, 4 page fax concerning water management and discharge, *Dead Wildlife, DFO spill,Environmental Licence and Venting of Methane to Atmosphere* (this is the Christmas/ New Year 2009/2010 pond overflows at Dewhurst 8 Pilot Production Complex) ((Told ESG to better construct sites – no action taken) (DII has all photos and Video that was sent to DECCDW) Summerhayes tells me of approved method of Pond Decommissioning – Pump out, roll out trap leave material in pit and fill over.
ESG had not followed their REF and got away with it.(see Dewhust 8 REF section 4.2.4) (*Have Fax,Vid and Pho. Also DII Report Acceptance form)*

27th January 2010 aggressive phone call from Summerhayes, ESG had told him a few porkies re road conditions an rain amounts, he believes ESG and not locals,we got around, how else cold I have taken photos, ESG staff were on holidays and all shut down.I reported Dewhurst 5 dead and dieing trees as a result of Drill pond being spilt while being filled in (photos and video prove that, but Summerhayes got cranky and asked me If I actually saw it happen, NO, (no action taken)

26th February 2010 ; Mollee Creek spill, notified DII (news release only – no action taken as yet by either Council or DII)

Not reported to DII but information received 28-2-10 " All fluid transfer from Eastern Star sites was stopped on Saturday, until further notice,and the contractor at Dewhurst 8 has left the site. It was a sub-contractor to Lein Contracting that spilt the drill fluid at Mollee Creek, subbie came from Wee Waa."

Rang around May/June re the relocation of the Treatment ponds for Tintsfield Pilot located at Wiliga Park, as the Contractor told me, and the pipe work was going nowhere near the given location in the original (as it turns out) REF. The change of local was news to him because all the REF's he had seen indicated it was going in cleared ground, and not the tree area (no formal reply only what happened that day on phone)

June; first report re clearing at Dewhurst 8 photos provided to DII (fly-over and ground photos provided – reply was that it was all approved clearing as per REF.(Vid and Photo)

August ; Clearing of trees at Wilga Park, notify DII, news to them as to new local, but does admit that he has sent back an REF on water treatment because he was not happy with the TDS figure Also asked about ESG operations in the State Forest being shut down due to **Environmental Concerns.**

December ; Culgrooa 2 flooding and Chemicals in water, pad built in flood way, ESG got pinged for Pad construction only. Also pad on wrong side of road according to REF, (Vid and Ph, plus witnesses)

2011

January; DII about holes found in the liner of small water receivable pond (vid , poor quality ESG got in a knot over it - see letter)

DII and State Forest over use of road in very wet conditions and road damage (Vid)

EVENTS AWAITING REPORTING

but DII has slowed down reporting procedures to mail contact only (see email from Summerhayes and another person) , what is wrong with email?

Look into clearing at Dewhurst 8 pilot production (Vid and Ph) {reported in 2010 nothing back-again in 2011}

Open and unlined pond at Bibblewindi West 22 (Vid and Ph)

Dead trees at Bohena 2, 3, 4/4L, 5 & 7. Plus open pond, unlined and non- stock proof fencing at Bohena 7 (Vid and Ph)

Emergency overflow arrangement at Bohena collection ponds (Vid and Ph) runs into bush and has been used.

Exposed above ground, coal seam gas water from Bohena Wells to Bohena collection ponds (Vid and Ph).

Why big diam pipe from Bohena collection ponds to Bohena Creek, no treatment at Bohena collection ponds, and system has been used. (Vid and Ph). All piping above ground.

Vent point on water line from Bibblewindi West to Treatment and gas gathering works, vents coal seam water to the ground, big black tarry stain and salt (have seen in operation, so has Wilderness film crew, Vid and Ph).

Why are large amount of Chemicals stored in the open at the Narrabri Dept. of ESG and yet must be under cover when on Drill site? June 2011 9Vid and Ph)

Unlined pond at Bibblewindi Lateral 16, contains salty coal seam water, contrary to DII regulations (Vid and Ph).27-6-11 and earlier

Imported top clay soil removal from Dewhurst 19, loaded truck was seen entering Boundary Road going where? This layer being replaced by imported top soil from where? (Vid and Ph of site only)

27-6-11.

Dewhurst 2, Many white Salt deposits(up to 1msq.) and salt lumps along with a patch of grey granular substance, salt can be easily seen in photo (Vid and Ph) 26-6-11.

Why is Garlands road graded below the natural ground level in the Water Treatment area, and most water run-offs going up hill, thus in times of rain road becomes the water course for the run-off, this is contrary the Occupation Permit Conditions . This road is a Public road.26-6-11

Why area roads and tracks only gated and not whole sites, e.g. Bibblewindi treatment and gas gathering works since January 2011.

Why is water outlet into Bohena Creek not in the location as approved, and despite requests to DII, no Modifications to the original have been located .(Vid and Ph)and why is this outlet not fully in the Creek? May 2011.

Where is the REF stating that trees can be removed for the Water Complex at Wilga Park (Vid and Ph) new clearing and burning has just taken place. 21-6-11.

Why is the Venting going on at Bibblewindi 26 H and how long has it been going on, REF to cover this venting, and what quantity of Methane (green house gas) released, and where recorded ? (Vid and Ph) 3-7-2011.

Why has the top covering from Dewhurst 19 which would be Contaminated by Drilling Chemicals, be used as road repair material on Boundary Rd. and outside Bibblewindi 22? (vid) 3-7-2011

Why is the vent pipe stand in the concrete pipe, in front of Bibblewindi West 23, cracked open and spitting coal seam water and Methane out?(Vid and Ph) 3-7-2011

For DoP

Leaking Gas line at Bohena 3. Why has not normal maintenance procedures not picked this up? Does ESG have any, and if so where are they publicly displayed?

Appendix 2.1-2.4 - Cate Faehrmann MLC Correspondence

CATE FAEHRMANN MLC
Member of the Legislative Council
THE GREENS NSW

Mr Sam Haddad
Director General
Department of Planning
GPO Box 39
Sydney NSW 2001

21 July 2011

Dear Mr Haddad

RE: Alleged infringements - Narrabri Coal Seam Gas Project

On a recent visit to Pilliga Forest near Narrabri, I was shown around various exploration and pilot production sites of Eastern Star Gas' Narrabri Coal Seam Gas Project by local residents and farmers.

A number of infringements of licensing and approval conditions are alleged to have occurred, having been witnessed by locals. Attached is a summary of those alleged infringements, some of which I was shown during my recent visit.

I would appreciate your advice as to how the Department of Planning has responded in each of these cases outlined in the attached. Please clarify what processes are in place for the submission of complaints, the reporting of breaches by members of the public and the department's subsequent responses.

Also, please provide information regarding the auditing of these processes.

During my visit I was most concerned at the sight of unlined sump ponds, vegetation kills, extensive weed invasion and what appeared to be a pipe leading to a local creek for wastewater overflow.

Clearly some of the sump ponds had overflowed during heavy rain. This is unacceptable, as it is allowing runoff to be fed into waterways. I have also been shown photographs of a dead kangaroo that had gone to an unfenced, but lined, sump pond to drink and had been unable to get out.

From everything I witnessed on my visit to parts of Eastern Star Gas' operation I believe they should be investigated for multiple breaches of approval and license conditions.

Yours sincerely

Cate Faehrmann

Parliament House, Macquarie Street, Sydney NSW 2000 | Phone: 02 9230 2320 | Fax: 02 9230 2420 | Email: cate.faehrmann@parliament.nsw.gov.au

CATE FAEHRMANN MLC
Member of the Legislative Council
THE GREENS NSW

Ms Lisa Corbyn
Chief Executive
Office of Environment and Heritage
PO Box A290
Sydney South NSW 1232

21 July 2011

Dear Ms Corbyn

RE: Alleged infringements - Narrabri Coal Seam Gas Project

On a recent visit to Pilliga Forest near Narrabri, I was shown around various exploration and pilot production sites of Eastern Star Gas' Narrabri Coal Seam Gas Project by local residents and farmers.

A number of infringements of licensing and approval conditions are alleged to have occurred, having been witnessed by locals. Attached is a summary of those alleged infringements, some of which I was shown during my recent visit.

I would appreciate your advice as to how the Office of Environment and Heritage has responded in each of these cases outlined in the attached. Please clarify what processes are in place for the submission of complaints, the reporting of breaches by members of the public and the Office's subsequent responses.

Also, please provide information regarding the auditing of these processes.

During my visit I was most concerned at the sight of unlined sump ponds, vegetation kills, extensive weed invasion and what appeared to be a pipe leading to a local creek for wastewater overflow.

Clearly some of the sump ponds had overflowed during heavy rain. This is unacceptable, as it is allowing runoff to be fed into waterways. I have also been shown photographs of a dead kangaroo that had gone to an unfenced, but lined, sump pond to drink and had been unable to get out.

From everything I witnessed on my visit to parts of Eastern Star Gas' operation I believe they should be investigated for multiple breaches of approval and license conditions.

Yours sincerely

Cate Faehrmann

Parliament House, Macquarie Street, Sydney NSW 2000 | Phone: 02 9230 2320 | Fax: 02 9230 2420 | Email: cate.faehrmann@parliament.nsw.gov.au

CATE FAEHRMANN MLC
Member of the Legislative Council
THE GREENS NSW

COPY

Dr Richard Sheldrake
Director General
Department of Primary Industries
Locked Bag 21
Orange NSW 2800

21 July 2011

Dear Dr Sheldrake

RE: Alleged infringements - Narrabri Coal Seam Gas Project

On a recent visit to Pilliga Forest near Narrabri, I was shown around various exploration and pilot production sites of Eastern Star Gas' Narrabri Coal Seam Gas Project by local residents and farmers.

A number of infringements of licensing and approval conditions are alleged to have occurred, having been witnessed by locals. Attached is a summary of those alleged infringements, some of which I was shown during my recent visit.

I would appreciate your advice as to how the Department of Primary Industries has responded in each of these cases outlined in the attached. Please clarify what processes are in place for the submission of complaints, the reporting of breaches by members of the public and the department's subsequent responses.

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During my visit I was most concerned at the sight of unlined sump ponds, vegetation kills, extensive weed invasion and what appeared to be a pipe leading to a local creek for wastewater overflow.

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Yours sincerely

Cate Faehrmann

Parliament House, Macquarie Street, Sydney NSW 2000 | Phone: 02 9230 2320 | Fax: 02 9230 2420 | Email: cate.faehrmann@parliament.nsw.gov.au

CATE FAEHRMANN MLC
Member of the Legislative Council
THE GREENS NSW

The Hon. Robyn Parker MP
Minister for the Environment and Heritage
Level 32 Governor Macquarie Tower
1 Farrer Place
SYDNEY NSW 2000
office@parker.minister.nsw.gov.au

COPY

3 August 2011

Dear Minister Parker Robyn

RE: Coal seam gas drilling in the Pilliga East Conservation Area

I write to seek your urgent advice on the status of an application to drill two coreholes within the Pilliga East State Conservation Area of Petroleum Exploration Licence 238.

I am informed that this application from Eastern Star Gas is currently being assessed by you under Part 5 of the Environmental Planning and Assessment Act 1979 in relation to s47J (7) of the National Parks and Wildlife Act, 1974.

It is the firm belief of communities across New South Wales that coal seam gas mining is inadequately regulated and presents severe risks to the environment and water supply. As you will be aware, the Pilliga is an area of special ecological significance. I am extremely concerned about the potential for significant damage to threatened species habitat.

I am equally concerned about the precedent of allowing drilling within protected areas without any public consultation or exhibition. I am of the understanding that no exploration drilling has to this date been approved within a State Conservation Area in New South Wales.

Please provide my office with a copy of all documents relating to this application, including but not limited to the Review of Environmental Factors as prepared by proponent.

I urge you to apply very close scrutiny to this proposal and to reject outright any operation which compromises the integrity of any State Conservation Area.

I look forward to your urgent reply and advice on these matters.

Yours sincerely

Cate Faehrmann

CC: The Hon. Barry O'Farrell MP, Premier
The Hon. Brad Hazzard MP, Minister for Planning and Infrastructure

Parliament House, Macquarie Street, Sydney NSW 2000 | Phone: 02 9230 2320 | Fax: 02 9230 2420 | Email: cate.faehrmann@parliament.nsw.gov.au

Appendix 2.5 Summary of Alleged infringements

SUMMARY OF ALLEGED INFRINGEMENTS

Leakage of saline water leading:

- Tree deaths adjacent to Bohena 2D, 3, 4/4L, 5 & 7 and Dewhurst 5
- Salt scalds recorded at numerous wells, including Dewhurst 2 and Bibblewindi 16
- Water leakage around wells such as Bibblewindi 21H
- Water being piped into vegetation at Bohena evaporation ponds

Failure to line drill ponds:

- Current unlined drill ponds at Bohena 7, Bibblewindi 16, Bibblewindi 22, Bibblewindi 21H
- Previous records of unlined drill ponds at Dewhurst 3, 5, 7 and Bibblewindi 10

Run-off during flood events:

- Dewhurst 8 complex – overflow of drill ponds from December 25th 2009 to 1st January 2010
- Mollee Ck – waste water released directly into Mollee Ck, February 2010
- Culgoora 2 – flooding caused chemicals to be spilled from a poorly constructed well-pad that was not compliant with the Review of Environmental Factors, December 2010

Excessive clearing:

- Dewhurst 8 complex – The Review of Environmental Factors specifies a maximum clearing of 10 hectares however, aerial photos indicate that a greater area of vegetation may have been cleared
- Wilga Park water treatment – reported clearing of trees for water treatment ponds not specified in a Review of Environmental Factors
- Excessive clearing, including large trees, recorded for access roads in May 2009

Weed invasion and failure of rehabilitation

- There has been little or no successful rehabilitation of abandoned drill holes and there are numerous serious weed incursions at almost every corehole that has been drilled in the Pilliga forest
- Examples include Dewhurst 6c, Dewhurst 5, Bohena 2D, Bohena 7 and numerous other well-pads
- The failure with regard to rehabilitation is despite the fact that the relevant REFs require 'the removal of imported materials and the rehabilitation of the site'
- No rehabilitation of areas which have been subject to tree deaths at Bohena 2D, 3, 4/4L, 5 & 7 and Dewhurst 5

Other events

- Reports of a diesel spill from Boundary Rd to Dewhurst 8 complex, October 2009
- Reported animal deaths near a number of drill ponds
- Reported failure to provide appropriate fencing around drill ponds or well-pads at Bohena 7, Dewhurst 8, Dewhurst 6c and many other wells.
- Recorded gas leakage from A pipeline at Bohena 3

Failure to deliver biodiversity offsets

- Biodiversity offsets that were part of the statement of commitments for the Part 3A approval are still yet to be implemented

Appendix 3 – Spill Water Test Results January 2012

ALS Group
Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES1200852**	Page	: 1 of 6
Client	: **EAST WEST ENVIROAG P/L**	Laboratory	: Environmental Division Sydney
Contact	: MS ANNE MICHIE	Contact	: Client Services
Address	: 82 PLAIN STREET TAMWORTH NSW, AUSTRALIA 2340	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: anne.m@ewenviroag.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 6762 1733	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 6765 9109	Facsimile	: +61-2-8784 8500
Project	: EW120081	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: EW120081		
C-O-C number	: ----	Date Samples Received	: 16-JAN-2012
Sampler	: ----	Issue Date	: 25-JAN-2012
Site	: ----		
		No. of samples received	: 3
Quote number	: SY/282/10	No. of samples analysed	: 3

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Edwandy Fadjar	Organic Coordinator	Sydney Organics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.**
- **ED041G: LOR raised for SO4 analysis on sample ID: 120081-2 due to sample matrix.**
- **ED-093F:LCS recovery for some elements falls outside ALS Dynamic Control Limit. However, they are within the acceptance criteria based on ALS DQO. No further action is required.**
- **EG020: LCS recoveries for particular element(s) fall outside ALS Dynamic control limit, however, they are within the acceptance criteria based on ALS DQO. No further action is required.**
- **EG035T: Positive mercury results have been confirmed by re-analysis.**
- **EP080:Level of reporting raised for toluene due to ambient background levels in the laboratory.**

Analytical Results

Sub-Matrix: WATER

Compound	CAS Number	LOR	Unit	Client sample ID: 120081-1 Client sampling date / time: 12-JAN-2012 15:00 ES1200852-001	120081-2 12-JAN-2012 15:00 ES1200852-002	120081-3 12-JAN-2012 15:00 ES1200852-003	---- ---- ----	---- ---- ----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.78	8.67	6.64	----	----
EA006: Sodium Adsorption Ratio (SAR)								
Sodium Absorption Ratio	----	0.01	-	12.6	19.9	----	----	----
Sodium Absorption Ratio	----	0.01	-	----	----	<0.01	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	942	2930	29	----	----
EA016: Non Marine - Estimated TDS Salinity								
Total Dissolved Solids (Calc.)	----	1	mg/L	612	1900	19	----	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	64	299	<1	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	73	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	387	1270	11	----	----
Total Alkalinity as CaCO3	----	1	mg/L	387	1340	11	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	23	<100	<1	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	93	383	2	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	9	67	<1	----	----
Magnesium	7439-95-4	1	mg/L	10	32	<1	----	----
Sodium	7440-23-5	1	mg/L	231	792	3	----	----
Potassium	7440-09-7	1	mg/L	11	30	3	----	----
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	0.017	0.021	<0.001	----	----
Cadmium	7440-43-9	0.0001	mg/L	0.0001	0.0004	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	0.179	0.187	0.005	----	----
Copper	7440-50-8	0.001	mg/L	0.080	0.191	0.007	----	----
Lead	7439-92-1	0.001	mg/L	0.056	0.050	0.002	----	----
Nickel	7440-02-0	0.001	mg/L	0.075	0.171	0.001	----	----
Zinc	7440-66-6	0.005	mg/L	0.109	0.094	0.006	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	0.0001	0.0008	<0.0001	----	----
EK040P: Fluoride by PC Titrator								

Analytical Results

Sub-Matrix: WATER

Compound	CAS Number	LOR	Unit	Client sample ID: 120081-1	120081-2	120081-3	----	----
				Client sampling date / time: 12-JAN-2012 15:00	12-JAN-2012 15:00	12-JAN-2012 15:00	----	----
				ES1200852-001	ES1200852-002	ES1200852-003	----	----
EK040P: Fluoride by PC Titrator - Continued								
Fluoride	16984-48-8	0.1	mg/L	0.4	1.9	<0.1	----	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	10.8	37.6	0.28	----	----
Total Cations	----	0.01	meq/L	11.6	41.2	0.21	----	----
Ionic Balance	----	0.01	%	3.37	4.55	----	----	----
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	1.0	µg/L	43.2	12.5	<1.0	----	----
2-Chlorophenol	95-57-8	1.0	µg/L	<1.0	<1.0	<1.0	----	----
2-Methylphenol	95-48-7	1.0	µg/L	3.2	6.9	<1.0	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L	13.8	8.9	<2.0	----	----
2-Nitrophenol	88-75-5	1.0	µg/L	<1.0	<1.0	<1.0	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L	<1.0	<1.0	<1.0	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L	<1.0	<1.0	<1.0	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L	<1.0	<1.0	<1.0	----	----
4-Chloro-3-Methylphenol	59-50-7	1.0	µg/L	<1.0	<1.0	<1.0	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L	<1.0	<1.0	<1.0	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Pentachlorophenol	87-86-5	2.0	µg/L	<2.0	<2.0	<2.0	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Benzo(b)fluoranthene	205-99-2	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	<1.0	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: WATER

Compound	CAS Number	LOR	Unit	Client sample ID: 120081-1	120081-2	120081-3	----	----
				Client sampling date / time: 12-JAN-2012 15:00	12-JAN-2012 15:00	12-JAN-2012 15:00	----	----
				ES1200852-001	ES1200852-002	ES1200852-003	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	----	----
C10 - C14 Fraction	----	50	µg/L	230	600	110	----	----
C15 - C28 Fraction	----	100	µg/L	1370	2610	220	----	----
C29 - C36 Fraction	----	50	µg/L	150	490	<50	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	1750	3700	330	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	20	µg/L	<20	<20	<20	----	----
^ C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	<20	<20	----	----
>C10 - C16 Fraction	----	100	µg/L	250	700	<100	----	----
>C16 - C34 Fraction	----	100	µg/L	1170	2670	190	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	400	<100	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	1420	3770	190	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	----	----
Toluene	108-88-3	2	µg/L	<5	<5	<5	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	----	----
^ Total Xylenes	1330-20-7	2	µg/L	<2	<2	<2	----	----
^ Sum of BTEX	----	1	µg/L	<1	<1	<1	----	----
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	33.4	43.0	17.9	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%	32.0	43.6	36.2	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%	28.7	45.1	40.0	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	31.7	46.2	47.0	----	----
Anthracene-d10	1719-06-8	0.1	%	29.5	50.6	55.1	----	----
4-Terphenyl-d14	1718-51-0	0.1	%	30.8	50.0	64.3	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	108	94.4	89.6	----	----
Toluene-D8	2037-26-5	0.1	%	99.8	97.2	94.3	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	121	114	109	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	64.1
2-Chlorophenol-D4	93951-73-6	11.3	122.9
2.4.6-Tribromophenol	118-79-6	11.7	144.0
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	19.9	122.8
Anthracene-d10	1719-06-8	23.3	125.8
4-Terphenyl-d14	1718-51-0	20.3	134.5
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

Appendix 4 – Spill Soil Test Results January 2012

ALS Group
Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES1200798**	Page	: 1 of 6
Client	: **EAST WEST ENVIROAG P/L**	Laboratory	: Environmental Division Sydney
Contact	: MS ANNE MICHIE	Contact	: Client Services
Address	: 82 PLAIN STREET TAMWORTH NSW, AUSTRALIA 2340	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: anne.m@ewenviroag.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 6762 1733	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 6765 9109	Facsimile	: +61-2-8784 8500
Project	: EW120080	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: EW120080		
C-O-C number	: ----	Date Samples Received	: 16-JAN-2012
Sampler	: ----	Issue Date	: 23-JAN-2012
Site	: ----		
		No. of samples received	: 5
Quote number	: SY/282/10	No. of samples analysed	: 5

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Edwandy Fadjar	Organic Coordinator	Sydney Organics
Evie.Sidarta	Inorganic Chemist	Sydney Inorganics
Sanjeshni Jyoti Mala	Senior Chemist Volatile	Sydney Organics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

Analytical Results

Sub-Matrix: SOIL

Compound	CAS Number	LOR	Unit	Client sample ID: 120080-1	120080-2	120080-3	120080-4	120080-5
Client sampling date / time				12-JAN-2012 15:00	12-JAN-2012 15:00	12-JAN-2012 15:00	12-JAN-2012 15:00	12-JAN-2012 15:00
				ES1200798-001	ES1200798-002	ES1200798-003	ES1200798-004	ES1200798-005
EP080: BTEX - Continued								
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP080: BTEXN								
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	116	104	112	109	116
2-Chlorophenol-D4	93951-73-6	0.1	%	114	102	110	108	116
2.4.6-Tribromophenol	118-79-6	0.1	%	99.7	91.5	86.8	102	101
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	114	103	112	113	116
Anthracene-d10	1719-06-8	0.1	%	122	112	119	120	121
4-Terphenyl-d14	1718-51-0	0.1	%	111	100	106	106	108
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	79.1	88.3	82.4	91.3	93.2
Toluene-D8	2037-26-5	0.1	%	79.0	83.3	80.0	90.0	94.8
4-Bromofluorobenzene	460-00-4	0.1	%	86.8	75.9	82.0	91.7	95.2

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	56.3	133.3
2-Chlorophenol-D4	93951-73-6	53.8	133.8
2.4.6-Tribromophenol	118-79-6	23.1	134.9
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	58.9	132.7
Anthracene-d10	1719-06-8	55.0	137.6
4-Terphenyl-d14	1718-51-0	54.0	147.8
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	72.8	133.2
Toluene-D8	2037-26-5	73.9	132.1
4-Bromofluorobenzene	460-00-4	71.6	130.0

Appendix 5 – Prof. Bidwell Spill Water and Soil Test Summary

The following is a summary of the results of chemical analyses on soil and water samples collected from a suspected spill zone adjacent to a coal seam gas water treatment facility in the Pilliga State Forest and from a reference location. This analysis and the associated summary are based on the chemical data and photographs of the site provided by the Wilderness Society.

Soil Samples
Analyses were conducted on three soil samples collected adjacent to the facility and two samples collected from a reference location. Soil samples from the suspected spill zone had higher average pH, electrical conductivity (70 times higher), and levels of sodium (39 times higher), chloride (90 times higher), sulfate, calcium, magnesium, and potassium than reference samples. There were no clear differences in levels of total metals, phenolic compounds, PAHs, total petroleum hydrocarbons or BTEX compounds in soil samples from the two locations.

Water samples
Two samples of standing water were collected from the site near the treatment facility and one sample of standing water was collected from a reference location. pH of the water from near the treatment facility was slightly elevated as compared to the reference sample. As seen for the soil samples, water collected from the suspected spill zone had higher electrical conductivity and levels of major cations and anions as compared to the reference sample. In contrast to the soil, the water sample from near the treatment facility also had higher levels of total metals (arsenic, chromium, copper, lead, nickel, and zinc), phenol and methylphenols, and total and recoverable petroleum hydrocarbons than the reference water.

Interpretation
The range of ions, metals and hydrocarbons detected in the standing water near the treatment facility is consistent with constituents commonly found in untreated produced water. The elevated levels of ions and conductivity in soils and water within the suspected spill zone could pose a risk to vegetation and soil organisms, although a follow-up monitoring study with increased sample numbers and additional reference locations would be needed to effectively determine this. Additional stratified sampling near the treatment facility could also help determine the spatial extent and persistence of the suspected spill zone.

Joseph R. Bidwell
Professor of Environmental Science and Management
The University of Newcastle

Appendix 6 – Prof. Bidwell Test Recommendations

FACULTY OF SCIENCE AND INFORMATION TECHNOLOGY

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

12 March 2012

Prue Bodsworth and Naomi Hogan
The Wilderness Society Newcastle Inc
Hunter Heritage Centre,
90 Hunter Street,
Newcastle, NSW, 2300

Dear Prue and Naomi,

As a follow up to our conversation regarding the value of ecotoxicity testing to further evaluate the potential impacts of the coal seam gas effluent spill near the Santos treatment facility in the Pillaga, I offer the following:

While chemical testing alone is effective at indicating what contaminants may be present at a site, they tell very little about true bioavailability or ecological risk. While the "guideline" values used by the consultants that did the chemical testing on the soil are better than nothing, they were not derived as ecological action levels. I would also argue that the delays in analysing the samples may have lead to a reduction in the concentration of chemical residues that were measured, making comparison to guideline values even more problematic. Another key issue is that single chemical guideline values do not account for the interactions of chemicals that could occur in a mixture. These interactions could actually reduce the toxicity of some components or make it worse. Biological testing could integrate the combined effects of the chemicals and, when coupled with properly conducted chemical analyses, provides the most effective assessment of risk.

I would suggest a two-tiered biological assessment of soils from the site. First, a survey of the existing soil invertebrates from the spill zone as compared to reference sites could be done. This can easily be accomplished by collecting a sample of surficial litter from the site and using a Berlese funnel to extract the resident invertebrates. The numbers and types of invertebrates from each site could then be compared to determine if there were differences in community composition. Samples of the soils from the spill zone and reference sites could also be used for plant germination bioassays in the laboratory to see if germination is comparable between the two. If Santos is planning a clean-up of the site, these data could be used in a "before and after" design to determine the success of remediation. It may also be that the communities between the different sites are comparable now, which could influence just how much must be done for "remediation".

I would be happy to discuss these methods with you in greater detail if you wish.

Best regards,
Joseph R Bidwell

Joseph R. Bidwell
Professor and Chair
Discipline of Environmental Science and Management
joseph.bidwell@newcastle.edu.au

Appendix 7 – Bohena Creek Water Test Results August 2011

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES1118565**	Page	: 1 of 8
Client	: **EAST WEST ENVIROAG P/L**	Laboratory	: Environmental Division Sydney
Contact	: MS STEPHANIE CAMERON	Contact	: Client Services
Address	: 82 PLAIN STREET TAMWORTH NSW, AUSTRALIA 2340	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: stephanie.c@ewenviroag.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 6762 1733	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 6765 9109	Facsimile	: +61-2-8784 8500
Project	: EW110647	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: EW110647		
C-O-C number	: ----	Date Samples Received	: 26-AUG-2011
Sampler	: ----	Issue Date	: 02-SEP-2011
Site	: ----		
		No. of samples received	: 2
Quote number	: SY/299/08	No. of samples analysed	: 2

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Hoa Nguyen	Inorganic Chemist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **EG020: Bromine & Iodine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **EG020: It has been confirmed by re-digestion and re-analysis that dissolved concentration of some elements is higher than total concentration for sample ES1118565 # 002**
- **EG020: LCS recoveries for some elements fall outside ALS Dynamic control limit, however, they are within the acceptance criteria based on ALS DQO. No further action is required.**
- **EK026: LCS recovery for TCN fall outside ALS dynamic control limits. However, they are within the acceptance criteria based on ALS DQO. No further action is required.**
- **EP080:Level of reporting raised for toluene due to ambient background levels in the laboratory.**
- **ES111856-001: Ca and Mg results are below LOR therefore SAR cannot be calculated.**

Analytical Results

Sub-Matrix: WATER

Compound	CAS Number	LOR	Unit	Client sample ID: 110647-1	110647-2	----	----	----
				Client sampling date / time: 25-AUG-2011 15:00	25-AUG-2011 15:00	----	----	----
				ES1118565-001	ES1118565-002	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.53	7.29	----	----	----
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Absorption Ratio	----	0.01	-	----	1.24	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	218	184	----	----	----
EA015: Total Dissolved Solids								
^ Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	139	216	----	----	----
EA041: Colour (True)								
Colour (True)	----	1	PCU	5	20	----	----	----
pH Colour	----	0.01	pH Unit	7.38	7.22	----	----	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	0.4	4290	----	----	----
EA065: Total Hardness as CaCO3								
^ Total Hardness as CaCO3	----	1	mg/L	<1	36	----	----	----
EA075: Redox Potential								
Redox Potential	----	0.1	mV	263	244	----	----	----
pH Redox	----	0.01	pH Unit	7.4	7.2	----	----	----
EA165: CO2 - Free and Total								
^ Free Carbon Dioxide as CO2	85540-96-1	1	mg/L	2	3	----	----	----
^ Total Carbon Dioxide as CO2	85540-96-1	1	mg/L	89	21	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	94	22	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	94	22	----	----	----
ED040F: Dissolved Major Anions								
^ Sulfur as S	63705-05-5	1	mg/L	<1	<1	----	----	----
Silicon	7440-21-3	0.05	mg/L	0.08	3.86	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	2	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	21	32	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	6	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	5	----	----	----
Sodium	7440-23-5	1	mg/L	52	17	----	----	----

Analytical Results

Sub-Matrix: WATER				Client sample ID	110647-1	110647-2	----	----	----
				Client sampling date / time	25-AUG-2011 15:00	25-AUG-2011 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1118565-001	ES1118565-002	----	----	----
ED093F: Dissolved Major Cations - Continued									
Potassium	7440-09-7	1	mg/L		1	3	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	0.16	----	----	----
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	----	----	----
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	----	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	----	----	----
Barium	7440-39-3	0.001	mg/L		0.053	0.056	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	----	----	----
Caesium	7440-46-2	0.001	mg/L		<0.001	<0.001	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	----	----	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L		<0.001	0.078	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Lithium	7439-93-2	0.001	mg/L		0.023	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L		0.001	0.031	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	0.002	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	0.002	----	----	----
Rubidium	7440-17-7	0.001	mg/L		0.002	0.002	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	----	----	----
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	----	----	----
Strontium	7440-24-6	0.001	mg/L		0.007	0.064	----	----	----
Thorium	7440-29-1	0.001	mg/L		<0.001	<0.001	----	----	----
Tin	7440-31-5	0.001	mg/L		<0.001	<0.001	----	----	----
Titanium	7440-32-6	0.01	mg/L		<0.01	<0.01	----	----	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	----	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	----	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	0.016	----	----	----
Boron	7440-42-8	0.05	mg/L		0.26	<0.05	----	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	0.10	----	----	----
Bromine	7726-95-6	0.1	mg/L		0.6	<0.1	----	----	----
Iodine	7553-56-2	0.1	mg/L		<0.1	<0.1	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	0.05	----	----	----
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	----	----	----
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	----	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	----	----	----
Barium	7440-39-3	0.001	mg/L		0.056	0.049	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	----	----	----

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: 110647-1	110647-2	----	----	----
				Client sampling date / time: 25-AUG-2011 15:00	25-AUG-2011 15:00	----	----	----
				ES1118565-001	ES1118565-002	----	----	----
EG020T: Total Metals by ICP-MS - Continued								
Caesium	7440-46-2	0.001	mg/L	<0.001	<0.001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	**0.061**	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Lithium	7439-93-2	0.001	mg/L	**0.027**	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.001**	**0.021**	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	<0.001	**0.001**	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	**0.002**	----	----	----
Rubidium	7440-17-7	0.001	mg/L	**0.002**	**0.002**	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	----	----	----
Strontium	7440-24-6	0.001	mg/L	**0.008**	**0.069**	----	----	----
Thorium	7440-29-1	0.001	mg/L	<0.001	<0.001	----	----	----
Tin	7440-31-5	0.001	mg/L	<0.001	<0.001	----	----	----
Titanium	7440-32-6	0.01	mg/L	<0.01	<0.01	----	----	----
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	**0.012**	----	----	----
Boron	7440-42-8	0.05	mg/L	**0.27**	<0.05	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
EG050F: Dissolved Hexavalent Chromium								
Hexavalent Chromium	18540-29-9	0.010	mg/L	<0.010	<0.010	----	----	----
EG052F: Dissolved Silica by ICPAES								
^ Silica	7631-86-9	0.1	mg/L	**0.2**	**8.3**	----	----	----
EG052G: Silica by Discrete Analyser								
Reactive Silica	----	0.10	mg/L	<0.10	**8.02**	----	----	----
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	0.004	mg/L	**0.014**	<0.004	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**1.56**	**0.03**	----	----	----

Analytical Results

Sub-Matrix: WATER			Client sample ID	110647-1	110647-2	----	----	----
			Client sampling date / time	25-AUG-2011 15:00	25-AUG-2011 15:00	----	----	----
Compound	CAS Number	LOR	Unit	ES1118565-001	ES1118565-002	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
^ Nitrate as N	14797-55-8	0.01	mg/L	0.02	2.15	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.02	2.15	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.2	3.0	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	2.2	5.2	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.01	1.38	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	<0.01	0.01	----	----	----
EK084: Un-ionized Hydrogen Sulfide								
Unionized Hydrogen Sulfide	----	0.01	mg/L	<0.1	<0.1	----	----	----
EK085M: Sulfide as S2-								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	----	----	----
EN055: Ionic Balance								
^ Total Anions	----	0.01	meq/L	2.47	1.38	----	----	----
^ Total Cations	----	0.01	meq/L	2.29	1.53	----	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	<1	8	----	----	----
EP025: Oxygen - Dissolved (DO)								
Dissolved Oxygen	----	0.1	mg/L	9.8	7.9	----	----	----
EP033: C1 - C4 Hydrocarbon Gases								
Methane	74-82-8	10	µg/L	68	<10	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	20	µg/L	<20	<20	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L	<100	<100	----	----	----

Analytical Results

Sub-Matrix: WATER			Client sample ID	110647-1	110647-2	----	----	----
			Client sampling date / time	25-AUG-2011 15:00	25-AUG-2011 15:00	----	----	----
Compound	CAS Number	LOR	Unit	ES1118565-001	ES1118565-002	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft - Continued								
>C16 - C34 Fraction	----	100	µg/L	<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	----	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	----	----	----
Toluene	108-88-3	2	µg/L	<5	<5	----	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	<2	----	----	----
^ Total Xylenes	1330-20-7	2	µg/L	<2	<2	----	----	----
^ Sum of BTEX	----	1	µg/L	<1	<1	----	----	----
Naphthalene	91-20-3	5	µg/L	<5	<5	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	91.9	91.5	----	----	----
Toluene-D8	2037-26-5	0.1	%	91.2	90.5	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	82.0	79.7	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	76.4	133.1
Toluene-D8	2037-26-5	79.6	126.8
4-Bromofluorobenzene	460-00-4	79.1	125.0

Appendix 8 – Dr Lloyd-Smith Bohena Creek Test Results Summary

NTN NATIONAL TOXICS NETWORK

PO Box 173 Bangalow
NSW 2479 Australia
info@ntn.org.au

www.ntn.org.au

Working globally for a toxic free future

Ms Carmel Flint
Northern Inland Council for the Environment
16 Roslyn Ave Armidale
NSW 2350

15th November 2011

Dear Ms Flint,

Thank you for the opportunity to review the water sampling results supplied by East West Enviroag as Project No. EW 110647.

NTN notes the sampling results are of limited scope and do not include analysis for any drilling additives or hydraulic fracturing chemicals. On reviewing the Company's documentation, a list of chemicals used or the identity of the chemical components of the company's wastewater are not provided.

We acknowledge that the sampling results are from Bohena Creek in the Pilliga Forest; one sample being taken from the Eastern Star Gas discharge point, which contains produced coal seam gas (CSG) water treated with reverse osmosis.

The other sample was taken approximately 1 kilometre upstream from the discharge point, and represents the natural water quality of the Bohena Creek for comparison purposes.

We also note that the Bohena Creek is an ephemeral creek with a shallow alluvial aquifer that discharges into the Namoi River and that the upstream sample (Sample 2) was obtained by digging approximately 1m down to the aquifer, hence the turbidity.

The sample taken from the Eastern Star Gas discharge point demonstrates higher results for ammonia, cyanide, methane, bromine, lithium and boron.

Results:

	Sample 1	*Sample 2*
Lithium Diss.	0.023 mg/l	<0.001 mg/l
Bromine Diss.	0.6 mg/l	<0.1 mg/l
Ammonia as N	1.56 mg/l	0.03 mg/l
Methane C1-C4	68 ug/l	<10 ug/l
Total Cyanide	0.014 mg/l	<0.004 mg/l
Boron Diss.	0.26 mg/l	<0.05 mg/l

1

The two elevated results of concern are ammonia and methane.

Methane

Methane was detected in water at the discharge site at 68 micrograms per litre (ug/l), whereas it was not detected in the upstream sample. Methane evaporates out of water, providing a further source of methane fugitive emissions to the atmosphere. Methane is a powerful greenhouse gas.

Since it evaporates, methane is not usually considered to present a health problem in drinking water. However, little is known of its long term impacts on human health, but when present at high concentrations, methane acts as an asphyxiate, which can cause breathing difficulties.[1]

Ammonia

Ammonia was detected at the discharge site at 1.56 milligrams per litre (mg/l), which is three times the Australian Drinking Water Guideline value of (0.5mg/l). Whereas it was detected at 0.03 mg/l in the upstream sample, well below the acceptable range for aquatic ecosystem.

Environmental Effects of Ammonia

Ammonia can be toxic to aquatic fauna. Fish exposed to low levels of ammonia over time are more susceptible to bacterial infections and have poor growth.

The toxicity of ammonia is affected by water pH, the measure of whether water is acidic, basic (alkaline) or neutral. Ammonia-nitrogen (NH_3-N) has a more toxic form at high pH and a less toxic form at low pH, un-ionized ammonia (NH_3) and ionized ammonia (NH_4^+), respectively.

Exposure to un-ionized ammonia concentrations as low as 0.002 mg/l for six weeks causes hyperplasia of gill lining in salmon fingerlings and may lead to bacterial gill disease. [2]

Ammonia toxicity increases as temperature rises.

[1] Methane Fact Sheet, WISCONSIN DEPARTMENT OF HEALTH SERVICES. http://www.dhs.wisconsin.gov/eh/chemfs/fs/Methane.htm

[2] NRC (National Research Council). 1979. Ammonia. Committee on Medical and Biological Effects of Environmental Pollutants, Division of Medical Sciences, Assembly of Life Sciences. University Park Press, Baltimore, Maryland

Concentrations of ammonia that are acutely toxic for fish, can cause loss of equilibrium, hyper-excitability, increased breathing, cardiac output, and oxygen uptake, and, in extreme cases, convulsions, coma, and death. At lower concentrations, ammonia produces many effects in fish including a reduction in egg hatching success, a reduction in growth rate and morphological development, and pathological changes in the tissue of the gills, liver, and kidney.[3]

The 1.56 mg/l detected at the outlet site is above the USEPA recommended maximum contaminant level (MCL) of <0.6 mg/l and exceeds the 0.02 mg/l MCL recommended by USEPA for fish health and aquatic life in general.[4]

Carbon Dioxide

Total Carbon Dioxide was detected in water at the discharge site at 89mg/l, whereas Sample 2 measured 21mg/l.

Carbon dioxide (CO2) is present in water in the form of a dissolved gas. Typically, surface waters contain less than 10 parts per million free carbondioxide while ground waters may have much higher concentrations. Dissolved in water, CO2 forms carbonic acid, which lowers pH. Aquatic plant life from phytoplankton to large rooted plants, depend on carbon dioxide and bicarbonates in water for growth, however, an increase in carbon dioxide makes it more difficult for fish to use oxygen. To take in oxygen, fish must first discharge the CO2 in their blood stream, a process which is slowed down considerably when there are high concentrations of CO2 in the water itself. The acceptable range of carbon dioxide for most finfish is <2.0 mg/L (ppm).[5]

Recommendation[6]

We recommend further sampling be undertaken to confirm the results and that analysis be expanded to the range of compounds used by the unconventional gas industry that are not removed by reverse osmosis filtration.[7] The mechanisms by which a molecule may be rejected by the reverse osmosis membrane are size exclusions (or sieving), electrostatic repulsion and hydrophobic adsorption.

[3] INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY ENVIRONMENTAL HEALTH CRITERIA 54 AMMONIA, World Health Organization, Geneva, 1986

[4] A.O. Fadiran and S.P. Dube, 2009. A Study of the Relative Levels and Factors in the Analysis of Total Ammonia Nitrogen in Some Surface and Groundwater Bodies of Swaziland. *Asian Journal of Applied Sciences, 2: 363-371.*

[5] http://www.alken-murray.com/TESTS01.htm

[6] Please note this information is provided as general information and should not be seen as professional advice.

[7] www.industry.qld.gov.au/documents/LNG/csg-water-beneficial-use-approval.pdf

Chemicals unable to be successfully removed include bromoform, chloroform, naphthalene, nonylphenol, octylphenol, dichloroacetic acid, trichloroethylene, tris(2-chloroethyl)-phosphate.[8] Low molecular weight, non polar, water soluble solutes such as the methanol and ethylene glycol are also poorly rejected.[9]

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[8] Stuart J. Khan Quantitative chemical exposure assessment for water recycling schemes, Waterlines Report Series No 27, March 2010 Commissioned by the National Water Commission.

[9] http://www.aquatechnology.net/reverse_osmosis.html