

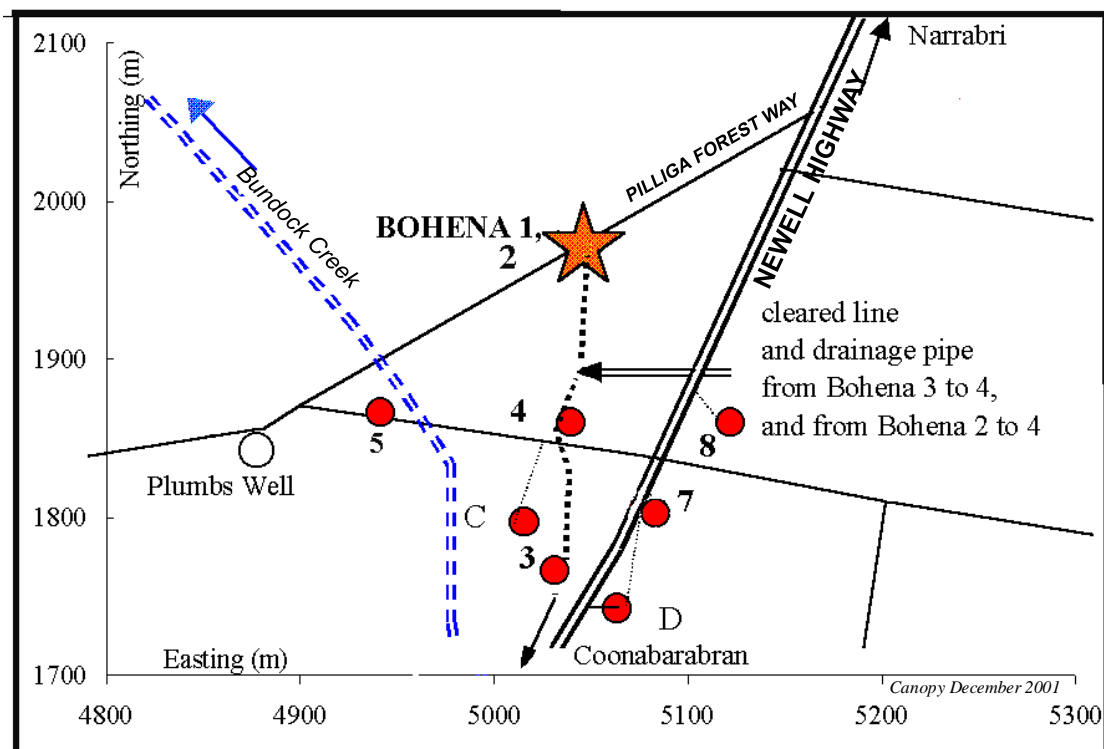
## Increased Pollution at Bohena Drillsites, Pilliga, NSW

## Summary

- The poisoning of ironbark woodlands in the Bohena area, first discovered in January 2001, continues to expand and intensify.
- At least three sites are now affected.
- The first pollution event, the collapse of a retaining dam-wall has been followed by extensive leaking from dams at three sites, leading to the insidious spread of highly mineralised liquid through the subsoil and shallow aquifers.
- The full extent of the sub-surface pollution, and the final areal extent of the damage is impossible to determine without a series of observation bores and expert supervision.
- Recent attempts to ‘clean up’ the damage appear to be misguided and ill-informed and may well be exacerbating the process.
- The use of unlined earth storage dams in the current gas exploration programme is now seen to be inappropriate in the highly permeable sandy soils of the Pilliga. If any further exploration work is approved in the Pilliga, the approval must include thorough and rigorous rules controlling the disposal of highly mineralised groundwater.
- Consideration should be given to declaring coalbed methane drillsites as industrial chemical sites, with the same level of safety and pollution controls that apply to chemical industry sites.

## Introduction

First Sourcenergy Inc. is the operator of an exploration programme for coal bed (coal seam) methane in Petroleum Exploration Licence 238 in the Gunnedah Basin, New South Wales. A series of exploration gas wells has been completed in the northern part of the Pilliga East State Forest – notably in the Bohena area, and at sites further north, eg Wilga Park. Bohena is close to the Newell highway, 30 kilometres south south-west of Narrabri. Eastern Star Gas, an Australian company, is separately exploring and drilling the Coonarah structure north of the State Forest.



## BOHENA DRILL SITES Pilliga East State Forest NSW

## Site descriptions

**Bohena No 2:** A barbed wire fence now encloses an area of about 80 metres by 90 metres containing the boreholes Bohena 2 and 2D, and the holding dam. This dam was built to contain the ground water pumped from underground, mainly from coal seams. The water level in the dam is marked by a distinct white powdery crust. Debris from the dam wall break of late 2000 or early 2001 can be clearly seen south of the fence line covering an area about 30m wide and 40m deep. A black polythene pipe, formerly used as an emergency measure to siphon water to Bohena No.4 site now lies disused. A colony of rapidly growing young wattles (*Acacia leucoclada*) appears to be unaffected by the surrounding pollution. East and south of the main site six survey lines have been laid out within the area of black, dead, trees. The lines are orientated approximately northeast – southwest and northwest-southeast. Pink plastic markers are at ten metre intervals along the main survey lines. Using this survey grid the pollution front can be traced eastwards over length of 250m to a maximum depth of 100 metres. Southeast of the drill site most trees appear lifeless, although a small amount of resprouting is visible on some of the larger trees. A lobe of dead vegetation extends northeastwards across a track for 100 metres. In this area the surface has been treated with lumps of finely crystalline mineral, probably gypsum. Except for an area adjacent to the drillsite and the enclosing fence, the surface litter in the present dead zone shows no sign of disturbance by a flood from the dam. It is probable that much of the current poisoning is being caused by percolating fluids in the subsoil or shallow aquifers accessible to the tree and shrub roots. Several long pools of thick black oily liquid were seen on the dirt track about 100m northeast of the drill site. There is no evidence that this fluid had been washed across the surface, and these pools represent the effect of migrating fluids in the subsoil. This liquid looks identical to liquid seen in February and March 2001, which was explained by the Environmental Protection Agency (EPA) as being caused by dead leaves. The black liquid seen in November was so thick and viscous it was impossible to confirm if there were any dead leaves present.

Neither the construction of a new barbed wire fence nor the removal or ploughing of the surface soil layer (already carried out at Bohena 4) serve any useful purpose, and the removal of soil will only serve to increase the present problem.

**Bohena No. 4:** At this site, on the north side of Plumb Road, Pilliga East State Forest, a new barbed wire fence has been erected around the cleared working area. Although the dam wall is intact and shows no sign of any breach, a dead vegetation zone extends for 80 metres into the woodland over a width of 30m. This represents a plume of poisonous fluids seeping into the subsoil out of the retaining dam which is constructed of porous weathered sandy material. It is no longer possible to identify surface evidence of pollution within the dead vegetation zone, as the ground has been lightly plowed. The lack of any litter suggests that a surface layer has been removed on the assumption that the fluids are leaching downwards from the surface, rather than rising from below.

As long as the retaining dam contains mineral-rich water feeding the shallow plume of groundwater pollution, then this groundwater cell will remain active, and either continue to feed the same scalded area, or move further into the unaffected area. Removal of surface layers and reseedling will have no effect on the continuing damage at this site.

**Bohena No. 3** This site is immediately west of the Newell highway a few hundred metres south of the junction with Plumb Road. In September 2000 this site was extremely wet, with two large holding dams full of fluid, while in February 2001, methane was being vented directly into the atmosphere from the ‘flare pipe’, and excess hot groundwater was being piped to the Bohena No.4 site to the north. In November 2001, the main features of the site were a zone of dead vegetation , and a very large, very deep new holding dam, as yet unused.

The zone of dead vegetation at this site extends for a few tens of metres along the southern side of the site, but at the time of the site visit there was no evidence of survey activity or remedial measures. The new holding dam is the largest at any of the Bohena drill sites, and has a flare pipe located in the centre of the pit. The flare pipe carries natural hydrocarbons produced during test work to a safe distance from the working area where they are then flared or burnt off.

The zone of dead trees on the edge of Bohena No.3, which was not present in January this year, shows that lateral seepage from a leaking dam is again the cause of die-back of the natural vegetation. If the new large dam at this site is filled with hot mineralised groundwater in its current state, then by analogy with Bohena No.2 site, the area of pollution and dead trees here could be the largest yet seen in the Pilliga.

#### Composition of water associated with coalbed methane

Major components mg/l	BOHENA EPA data	POWDER RIVER 2000	Trace elements & hydrocarbons µg/l	BOHENA EPA data	POWDER RIVER 2000
Total dissolved solids	?	850mg/l	silver (Ag)	?	<1
	?		aluminium (Al)	?	<50
chloride (Cl <sup>-</sup> )	?	13	barium (Ba)	?	620
sulphate (SO <sub>4</sub> <sup>2-</sup> )	?	2.4	cadmium (Cd)	?	<0.1
bicarbonate (HCO <sub>3</sub> <sup>-</sup> )	?	950	chromium (Cr)	?	<1
carbonate (CO <sub>3</sub> <sup>2-</sup> )	?		copper (Cu)	?	7.6
fluoride (F <sup>-</sup> )	?	0.92	mercury (Hg)	?	<0.1
nitrate (NO <sub>3</sub> <sup>-</sup> )	?		lithium (Li)	?	58
iron (Fe)	?	0.8	manganese (Mn)	?	32
calcium (Ca)	?	32	nickel (Ni)	?	5
sodium (Na)	<b>3,700</b>	300	lead (Pb)	?	Most <0.1
potassium (K)	<b>50</b>	8.4	antimony (Sb)	?	<2
magnesium (Mg)	?	16	selenium (Se)	?	<2
silicon (Si)	?	4.8			
strontium (Sr)	?	0.7	T (°C)	?	19.6
Ammonia (NH <sub>4</sub> )	?	2.4	pH	?	7.3
			Electrical conductivity (mS/cm)	<b>14,000</b>	13,000

**Water composition;** Only incomplete and rudimentary test results of water samples from the Bohena drill sites have so far been made public. Testing by the EPA in March indicated that

“The analysis showed that levels of tannin (S 1.7) were 560 mg/L. That compares to tannin levels of 15 to 60 mg/L associated with run-off from timber mills. Based on that information, we believe that the "black liquid" that you reported is concentrated soluble tannin and lignin derived from decaying vegetation, most likely from the dying trees. The results of analysis for electrical conductivity (S 1.1) in the holding pond was 14000 mS/cm. Sodium and potassium levels 3700 mg/L and 50 mg/L respectively.”

The chemical analyses in the accompanying table indicate the level of detail that is applied to groundwater analyses in the U.S.A. The results are contained in a recent survey of coal bed methane hazards undertaken by the US Geological Survey in one of the main coalbed methane producing areas – the Powder River Basin (Rice *et al.* 2000).

In the area west and south of Narrabri, the main dissolved salt in the deeper groundwater aquifers is sodium carbonate/bicarbonate. In “*A Million Wild Acres*”, Eric Rolls describes the soda pans that once developed on the black soil plains between the Namoi River and the northern edge of the Pilliga. Until irrigation bores lowered the water table, these pans were a regular feature of the black soil areas and were a source of washing soda for many households in the district. The Pilliga forests, on sandy soils, have not, at least until now, had a high, near surface water table, with or without soda.

#### Comments

- The recent site visit has shown that plumes of saline water continue to spread into the forests of the Pilliga. Dams holding saline groundwater at three separate sites are leaking into the permeable subsoil. Now that this pollution has been allowed to progress so far, the only means of clearly identifying the full extent of the problem is to install a series of shallow monitoring drillholes. These would be used to obtain groundwater samples at different levels below the surface both inside and outside the affected areas, and monitor movements of the body of polluted fluid through the subsurface.
- The source of the pollution in each case is a leaking unlined dam holding saline groundwater. These dams must be drained to stop even more pollution.
- The very large new dam at Bohena No.3 could produce the largest area of vegetation die-back yet seen in the area, if it is used in its present condition.
- If any further exploration is allowed on the sandy permeable soils of the Pilliga, the basic minimum requirements must be for heavily lined dams, ringed by control/inspection bores, with regular independent groundwater sampling to detect the first signs of any future pollution event.
- All existing drill sites should be carefully monitored for at least a year to identify the full extent of the pollution problems. This site visit concentrated on only three of the existing drill sites.
- A thorough analysis of the fluids remaining at the drill sites should be carried out to identify the nature of the polluting fluids.

## REFERENCES

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