I have been involved in salinity for thirty years and was Chairman of a WA Land Conservation District Committee for 11 years. During this time I was involved in the planting of 500,000 trees to try and combat the salinity creep. It was a huge undertaking and a drop in the ocean in the grand scale. Now that the concept of Unconventional Gas Fracturing is earmarked for WA, this concerns me greatly.

SALINITY

One by-product of Fracking, is millions of gallons of water that can be much saltier than seawater, after leaching salts from rocks deep below the surface.
Produced water from fossil-fuel wells can have salinity three to six times greater than that of seawater.
Methods of elecrodialysis salt treatment don't cater for issues of scaling and organic fouling.

The Australian Petroleum Production & Exploration Association's opinion on salinity levels differ from other websites. This is quoted from their website:

"CSG companies are seeking commercial uses for salt produced from the treatment of associated water.

CSG associated water is brackish. On average, it has about ***a sixth the salinity of seawater, but salinity can vary between 200-10,000 milligrams per litre total dissolved solids (TDS), which compares to 35,000 mg/L TDS in sea water.***

Good, palatable drinking water is less than 500 mg/L TDS, although water more saline that this is still safe for human consumption and is suitable for stock use.

Some associated water can be used untreated for stock water, dust suppression, coal watering or cooling of power stations. But other water will have to be treated and producing this treated water will also produce salt.

CSG producers are examining beneficial uses for produced salt, such as use in chemical industries and industrial processes. Salt can be used to make soda ash (for use in producing glass, paper and washing powder) or caustic soda (used in producing soap and aluminium).

But if companies cannot find a commercial use for salt, they may seek environmental approval to ***inject it into deep underground saline aquifers****. Otherwise, they could* ***bury the salt in a purpose-built, government-approved industrial waste landfill*** *that would be encapsulated to prevent migration of salt from the site.*

Salt will not contaminate farming land or groundwater

CSG wells are cased with steel and cement to prevent contamination of aquifers. *Any associated water used by landholders must meet standards in line with irrigation water standards."*

https://www.naturalcsg.com.au/environment/salt/

If they cannot find a commercial use for the salt, what effect will it have when injected into underground saline aquifers which have had microbes in place for centuries. A variation in salinity can wipe out colonies of microbes and disturb the balance of nature.

It states that salt will not contaminate farmland or groundwater but there are many references including the one below of accidents and incidents which cannot guarantee the truth of that statement.

Conservative estimates of well failures between 4.6% and 8.9%. Higher rates of 12%, 20% and up to 75% have been reported. An industry paper by Schlumberger, one of the world's largest companies specializing in fracking, admit about 5% of wells leak immediately, 50 percent leak after 15 years and 60 percent leak after 30 year.

Many pages of accidents and incidents are listed on these pages of what can and has gone wrong, when the people were told it wouldn't.
Contaminated sites, accidents and other incidents related to CSG/LNG Australia
http://www.groundswellgloucester.com/resources/downloads/Contaminated-sites.pdf

This excerpt is from research by Emeritus Professor Chris Fell who was the chief scientist in NSW. He stated the following. *"The principal problem with produced water treatment lies in the disposal of salt concentrates from the integrated process. Water recoveries in excess of 90% are possible with the concentrate needing further water removal by thermal processes if the salts present are to be recovered in the solid phase as crystals. Uncertainty exists whether there is an international market for the salt or whether a further process is needed to separate marketable components.*

*A **secure landfill would be one where there was no possibility of leakage** long-term into surface waters in the event of adverse weather events or into groundwater systems. It is therefore not surprising that CSG companies in Australia (primarily in Queensland) are exploring the possibility of deep well injection of production water treatment concentrates into secure aquifers of similar concentration. This approach is widely practised in the USA but does **require a detailed geological and hydro geological knowledge** of the site. The challenge is to ensure that there will be no leakage of stored salt into surface freshwater aquifers. The approach is being trialled in the Surat basin.*

*The **disposal of produced water or produced water concentrates to the ocean or estuaries** is also feasible for CSG facilities appropriately located. The liquid so disposed of would have to meet ANZECC127 guidelines in terms of quality and pre-treatment would be required and, in the case of concentrate, suitable dispersion at point of entry to the ocean or estuary. It is noted that the Dart Energy CSG facility in Scotland145 discharges partially treated produced water into the Firth of Forth under environmental licence. Waste water from mines in the Hunter Valley is permitted to be discharged into the Hunter River under a scheme whereby salt disposal permits are traded*
*Mine waste waters (200L per tonne of coal mined) are retained in holding ponds and are released under instructions when the flow in the river is sufficient to ensure that the addition of wastewaters will not cause environmental damage. **Such a scheme is only feasible for estuaries close to the coast where the salt added will be quickly flushed out to sea.***

Considerable quantities of higher quality salt are used in the chlor-alkali industries. There is a possible market for specific chemicals extracted from salt (valuable metals, heavy metals, rare earths) but the ***extraction costs are high*** *and alternative sources exist. It is possible that an export market could be developed based on the salt recovered from the treatment of CSG produced water. However,* ***the cost of transporting the raw salt to a seaport is a negative factor*** *and a careful appraisal of total transport and shipping costs would be required. An alternative approach might be to consider the use of salt in the production of sodium carbonate140, as has been up to recently practiced in South Australia at the Penrice Soda139 plant where salt recovered from the ocean by evaporation ponds was used. This plant ceased operation in 2013 citing international competition.*

'WORST CASE SCENARIOS' AND THEIR RISK OF OCCURRENCE The two previous papers A,B have discussed US experience in environmental incidents that have occurred at CSG facilities. Incidents have been dominated by spillages.

Worst case scenarios

Scenario	Potential Outcome	Risk	Comment
Inadequately treated production water	Aquifer supplying potable water becomes contaminated due to injection of this water	Low	Decision to reinject into an aquifer being used for human or stock water should only be taken after a comprehensive appraisal of the risk and a standard of treatment plant design, operation and monitoring similar to that of a municipal potable water supply facility.
Significant surface leak of untreated production water due to treatment plant failure.	Infiltration into shallow aquifers used for water supply. Off site environmental damage.	Moderate	Good design practice would call for containment with monitoring to detect any leaks or signs of potential failure. Treatment plant subjected to Hazop. Staff well trained. Leaked material diverted to holding pond.
Overtopping of containment ponds by severe rain event causing offsite flow	Untreated production water or treatment concentrates flow off site causing environmental damage	Low	Good design practice calls for holding ponds to be run to cope with a 100-year flood event. In an extreme situation e.g. major flood, the level of dilution would mitigate environmental damage.
Failure of walls of containment ponds	Possible infiltration of sub-surface aquifers	Low	Since the Pilliga incident the design criteria for the walls of containment ponds have been tightened with monitoring devices under containment walls to detect signs of imminent failure or any significant leakage
Spillage of treatment chemicals	Off-site environmental damage	Low	Hazardous chemicals used in membrane plant cleaning adequately bunded and monitored
Poor disposal practices for solid wastes	Site contamination and risk of heavy metals and radioactive species escaping off- site	Low	Possible solids comprise crystallised salts and adsorbent materials including ion exchange beads. Proper protocols for disposal of the relatively minor volumes should ensure compliance with environmental guidelines

Discussion Paper for Office of NSW Chief Scientist and Engineer
Emeritus Professor Chris Fell; 2014. WATER TREATMENT AND COAL SEAM GAS
http://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0005/56858/Water-treatment-and-CSG_Final.pdf

CONCLUSION

Of concern to me is the change of natural ecosystems including aquifers, rivers and oceans through highly saline inflows.

There are too many risks associated with waste including salinity from this industry.

1. We need an MDS of **chemical interactions** not just individual chemicals.
2. If the wells fail or companies go to the wall, there should be a fund to 'rescue' property owners and custodians and to try to repair the damage. This should be paid up front by the companies themselves as a **surety**.
3. **Baseline data** must be done first including community health, employee health, flora, fauna, waterways, air quality etc.
4. **Research** must be done – from the **cradle to the grave**.
5. The **precautionary principle** needs to be applied. This principle is expressed in the Rio Declaration, which stipulates that, where there are "threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.
6. The citizens of this land must have the democratic right to say no but the community has **no rights to veto**. This must be changed prior to any exploration taking place.
7. We want to see **exploration** for unconventional gas **banned** immediately
8. We want a **ban** on **simulated hydraulic fracturing immediately**