

**Submission
No 98**

**INQUIRY INTO ADEQUACY OF WATER STORAGES IN
NSW**

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Submission to the: Inquiry into the adequacy of water storages in NSW

Thank you for the opportunity to respond to this important inquiry into the state of water security in NSW. This submission is based on a particular critical ground water supply to the Hunter Region, however some recommendations may apply more broadly across the State.

I refer to the Terms of Reference of the Inquiry in our response:

a) the capacity of existing water storages to meet agricultural, urban, industrial and environmental needs

The Tomago sandbeds located in north of Newcastle in the Port Stephens LGA, are parallel to the coast and start at the town of Tomago and extend north-east for 25km to Lemon Tree Passage.

The Tomago Sandbeds is an underground water source that provides about 20 per cent of the lower Hunter's drinking water. The Hunter Water website provide a description of the capacity and design of the Tomago Sandbeds groundwater supply system:

An extensive system of underground bores and vacuum stations draws raw water from the sandbeds and pumps it to Grahamstown Water Treatment Plant. The maximum storage is about 100,000 megalitres of water above sea level, of which Hunter Water can access about 60,000 megalitres with existing infrastructure from a portion of Tomago Sandbeds covering about 100 square kilometres.

The sandbeds are a natural geological feature, consisting of a layer of highly permeable fine grained sands underlain by impervious clay and rock. The thickness of the sand layer reaches a maximum of 50 metres, but on average is 20 metres deep. The source of the water is the rainfall that lands directly on the sand surface. While a proportion of the rainfall is lost to plants and evaporation, sufficient water is stored in the sand to provide a viable and significant source of water for ongoing extraction.

This supply has proven critical not only in drought years such as in 1986 when Newcastle was on water restrictions but also when there are water quality problems, such as pollution spills or with the other surface water supplies, Chichester and Grahamstown Dams. Water restrictions are triggered when total water storage drops below 60%. The supply has also proven critical to the Central Coast, when their water supply level almost hit 10% in 2007 and would have if not for the emergency construction of a pipeline from the Hunter. On the criticality of this water supply the Hunter Water website states:

The sandbeds are strategically important for both ongoing and backup water supply. Ongoing supply from the sandbeds reduces the load on surface water sources (Chichester Dam and Grahamstown Dam) and thereby allows greater overall yield from the total water supply system. This large storage volume can also be used as a reserve supply during drought, and is available as a backup supply in the event of water quality issues in the surface storages.

The Tomago-Tomaree-Stockton Draft Groundwater Management Plan 1995 highlights the importance of this water supply.

The Tomago groundwater is especially important because Hunter Water Corporation's main water source the Williams River, is vulnerable to outbreaks of blue-green algae and can be affected by drought.

A Sinclair Knight Merz (2008) analysis of Hunter Water's supply capacity and projected future demand for water shows that by 2025, Hunter Water users will be demanding 85GL of water per year. This will result in a 1 in 21 chance of level 1 restrictions. Without the Tomago sandbed supply these chances would be greatly increased. Whilst, further demand management and water conservation methods could be implemented to ensure a water supply to meet growing population, it is imperative that the Tomago supply is protected also.

These aquifers are not just significant for a consumptive water supply. They are also extremely important ecologically for the wetlands, some forests and creeks. Fullerton Cove is part of the Hunter Estuary Wetlands. This internationally recognised wetlands system includes the Hunter Wetlands Centre in Shortland and stretches across most of the North Arm of the Hunter River up into Fullerton Cove itself covering nearly 3000 hectares. The Wetlands is recognised under RAMSAR international Convention (Wetlands of international importance) and provides feeding and roosting sites for over 250 species of birds including 45 listed under international migratory conservation agreements.

The RAMSAR boundaries are notionally listed as the back edge of the Fullerton Cove Mangroves however just as water knows no political boundary, neither do the birds. All of Fullerton Cove including the low lying alluvial plains between the Cove and Williamstown are home away from home to the birds who, (although perhaps not prevalent or obvious during EPBC Self Assessments by CSG companies), arrive in abundance when the rains and surface water inundation occur at various times throughout the year.

The water here does not just support the native and migratory birds. The National Water Commission conducted a survey during 2005-2006 to identify the significant plant species existing in the areas adjacent to Fullerton Cove including the Tomago and Tomaree Sandbed areas.

"seven species were listed as nationally threatened in the Environment Protection and Biodiversity Conservation Act 1999 or the Threatened Species Conservation Act 1995(NSW); one species was considered to be nationally rare...three endangered ecological communities (as listed in the Threatened Species Act) were identified within the sandbeds."

The above quote comes from Waterlines Report Series No.46 May 2011

The National Water Initiative has acknowledged Australia's important groundwater ecosystems and aquifers such as that under Fullerton Cove, and the importance of needing to better understand these systems and protect them and manage them for future generations. The National Water Commission states that it has identified a shortfall in its

understanding of our subterranean water thus embarking on “*hydro-geological investigations to help overcome critical groundwater knowledge gaps*”.

Some of the dangers in coal seam gas exploration lie in the fact that the groundwater systems they are drilling into, are not well understood. This however, does not imply that coal seam gas drilling must proceed so that data can be collected, this is a high risk approach that may result in irreversible damage. Rather, monitoring wells and core logs can be constructed to obtain valuable baseline data and increase understanding, for a period prior to any drilling assessment. The establishment of baseline data prior to any works was a condition recommended by the Interim Independent Expert Scientific Committee (IIESC) for the Dart Energy Fullerton Cove coal seam gas pilot production wells approved in June 2012, that has not been fulfilled.

The IESC state Dart Energy should have to gather other data including baseline information, they haven’t done this and should have to prior to any works such that the impacts of drilling can be properly assessed and any contamination or alteration in natural flow regimes identified:

2. The Interim Committee suggests that in light of the lack of data about potential impacts of coal seam gas operations on the Ramsar site, the proponent should be required to gather and make available to commonwealth and state regulators data on water quality, quantity and geochemistry characteristics, as well as flow rates in the area of their proposed action. This will provide important baseline information that could be used to measure any resulting changes and also assist with assessing the potential impacts of any proposed expansion of coal seam gas exploration or production in the area

The 1995 Tomago-Tomaree-Stockton Draft Groundwater Management Plan by Land and Water Conservation states:

There are many unknowns about how these aquifers respond to stresses, including groundwater pumping, urban development and mining activities. The relationship between groundwater flow and wetland and other ecosystem health is also poorly understood.

The report also states that the aquifer systems in vulnerable to contamination and saline water intrusions:

The Tomaree Sandbed is not connected to the other sandbeds, but the Tomago and Stockton Sandbeds are thought to connect in some places well below the surface. Therefore any contaminants that enter one of these connected beds may be transferred to the other, and for some issues the Tomago-Stockton Sandbeds will need to be managed as one unit.

Major portions of the edges of the Tomago, Stockton and Tomaree Sandbeds lie under estuaries or the sea, usually mangrove mudflats or ocean beaches. Downward flow of groundwater in the dune ridges keeps the sea water from moving landward and invading the groundwater. Over-extraction of groundwater would lessen the downward pressure in these ridges and has the potential to cause saltwater intrusion. If saline water were to enter the aquifer it would threaten drinking water supplies and natural ecosystems.

Coal seam gas poses a number of threats to groundwater supplies. The National Water Commission stated:

Potential risks to sustainable water management

- *Extracting large volumes of low-quality water will impact on connected surface and groundwater systems, some of which may already be fully or overallocated, including the Great Artesian Basin and Murray-Darling Basin.*
- *Impacts on other water users and the environment may occur due to the dramatic depressurisation of the coal seam, including:*
 - *changes in pressures of adjacent aquifers with consequential changes in water availability*
 - *reductions in surface water flows in connected systems*
 - *land subsidence over large areas, affecting surface water systems, ecosystems, irrigation and grazing lands.*
- *The production of large volumes of treated waste water, if released to surface water systems, could alter natural flow patterns and have significant impacts on water quality, and river and wetland health. There is an associated risk that, if the water is overly treated, 'clean water' pollution of naturally turbid systems may occur.*
- *The practice of hydraulic fracturing, or fracking, to increase gas output, has the potential to induce connection and cross-contamination between aquifers, with impacts on groundwater quality.*
- *The reinjection of treated waste water into other aquifers has the potential to change the beneficial use characteristics of those aquifers.*

In addition to these water management risks, CSG development could also cause significant social impacts by disrupting current land-use practices and the local environment through infrastructure construction and access.

The Commission is concerned that CSG development represents a substantial risk to sustainable water management given the combination of material uncertainty about water impacts, the significance of potential impacts, and the long time period over which they may emerge and continue to have effect. Therefore, an adaptive and precautionary management approach will be essential to allow for progressive improvement in the understanding of impacts, including cumulative effects, and to support timely implementation of 'make good' arrangements.

The other threats, particularly from the two pilot-production that are currently proposed by Dart Energy for Fullerton Cove include:

Drilling and Well-Integrity: There are increased risks of well contamination due to horizontal drilling. Due to the orientation of the well the cementing is affected by gravity and may be inadequately cemented. This may then allow the movement of drill fluids, saline coal seam gas water that contains petrochemicals and heavy metals as well as methane up the well and into other fresh-water systems.

Salehi, R., Paiaman, A.M. 2009. *A Novel Cement Slurry Design Applicable to Horizontal Well Conditions*. s.l. : Petroleum and Coal, 2009.

Plugged and Abandoned Wells: There is a legacy of leaking decommissioned wells from oil and gas globally. Studies have found serious issues in the long-term plug and abandonment well integrity, with many older abandoned wells in the US found to be now leaking and potentially cross contaminating aquifers (NPC, 2011) (Mavroudis, 2001).

NPC. 2011. *Plugging and Abandonment of Oil and Gas Wells*. s.l. : Operations and Environment Task Group - US National Petroleum Council, 2011.

Mavroudis, D. 2001. *Downhole Environmental Risks Associated with Drilling and Well Completion Practices in the Cooper/Eromanga Basins*. s.l. : Primary Industry and resources SA, 2001. 2001/00009.

Methane Migration: Methane migration is a naturally occurring phenomenon that is often associated with coal seam gas activities and more research needs to be conducted into this phenomena as the methane has potential ecological and human health risks.

USGS. 2006. *Methane in West Virginia Ground Water*. s.l. : US Geological Survey, 2006.

—. 2003. *MODFLOW-2000 Ground-Water Model—User Guide to the Subsidence and Aquifer-System Compaction (SUB) Package*. s.l. : U.S. GEOLOGICAL SURVEY GROUND-WATER RESOURCES PROGRAM, 2003.

Chameides, B. 2011. Update: Point-Counterpoint on Shale Gas Methane in Water Wells: Debate on water-well contamination from shale gas extraction. *Scientific American*. [Online] 9 September 2011.

Osborn, S.G., Vengosh, A., Warner, N. R., Jackson, R.B. 2011. *Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing*. s.l. : National Academy of Sciences of the United States of America, 2011.

In addition to risks to the aquifers there are also risks to the flood plain, due to disturbance of Acid Sulphate Soils (ASS) from coal seam gas well and associated infrastructure construction. The report on 'Acid sulphate soils, Priority Investigations for the Lower Hunter River Estuary', August 2008 by the NSW Dept. Primary Industries to the Federal Dept. of Environment, Heritage, Water and the Arts, found that:

'The disturbance of coastal ASS represents a significant major threat to coastal and marine ecosystems and has the potential to impact on threatened species such as birds, fish and frogs found occurring in the Ramsar sites in the Hunter. Previous observations were that over-drained wetland sites in the estuary have been responsible for chronic discharges of ASS-related poor water quality', pg 19

and that:

The Fullerton Cove site is considered the highest priority (of the five sites assessed) for ASS management, due to the high level of stored acidity (TAA) in the subsoil profile, particularly adjacent to large drains (e.g. site F1). The study has shown that in some locations within the Fullerton Cove study site the ASS layer is within 0.3m of the soil surface. When the sulfidic layer is so close to the surface the key management principle is surface water management.

In the NSW Audit of coal seam gas drilling, it was found that Dart energy has already breached their licence:

Two NC1 level non-compliances were reported for PEL 458 and Resources & Energy agree with the classifications. One of these related to the failure to properly rehabilitate a site. Resources & Energy note the audit findings in relation to drill site rehabilitation and the status of these sites will be reviewed prior to completion of the title and release of the security deposit. The other related to possible acid sulphate soil issues and the lack of appropriate surface water and groundwater monitoring. These matters have been addressed by the licence holder in subsequent activity applications to Resources & Energy.

e) water storages and management practices in other Australian and international jurisdictions,

As demonstrated above the Tomago-Tomaree-Stockton aquifer system is a critical water storage for NSW and coal Seam Gas exploration and production is incompatible with it's function as a domestic, agricultural and industrial water supply and in supporting the many groundwater dependent eco-systems.

The is currently legislation in place that protects the Tomago aquifers, however this must be strengthened and extended to cover the Stockton and Tomaree aquifers. The Hunter Water (Special Areas) Regulation 2003 under the Hunter Water Act 1991 states:

This Part applies to the Nelson Bay, North Stockton and Tomago Sandbeds Catchment Areas.

13 Extractive industries:

- (1) A person must not engage in any extractive industry in the Nelson Bay, North Stockton or Tomago Sandbeds Catchment Area otherwise than in accordance with an approval given by the Director-General.
Maximum penalty: 200 penalty units in the case of a corporation and 100 penalty units in any other case.
- (2) In this clause: *extractive industry* includes mining and any other disturbance of geologic material for the extraction of minerals or other geological constituents.

Whilst Dart Energy is drilling two pilot production wells, seemingly in the Stockton aquifers, the exact boundary of the Tomago and Stockton aquifers is not clear. However, the area of drilling closely bounded in the West and South by Hunter Eastuary, to the East by the Stockton Bite sand-dunes and pacific ocean and to the north lies the Tomago sandbeds. Dart Energy should make it clear at this stage what their future plans are. The gas supply is well

researched through the NSW Department of Minerals and Energy and further gas production by Dart Energy is a high risk activity that should not go ahead given the sensitivity of the environment and confinement of the area.

A separate Act for the Tomago-Tomaree-Stockton aquifers would also be an appropriate means to ensure that these vital water supplies are protected in perpetuity from inappropriate developments.

Recommendation: Due to the significance of the Tomago-Tomaree-Stockton Groundwater systems as a water supply for the Newcastle and Port Stephens region and as a supply to the internationally listed groundwater dependent eco-systems, these aquifers should be protected from all coal seam gas activity.

Kind Regards,

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