PS Prediction of Seals Performance for Coal Seam Gas Production Impact Assessment*

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Abstract

Early in the development cycle of onshore gas such as Coal Seam Gas (CSG), operating company Environmental Impact Statements and regulatory agency assessments, need to consider the potential for gas development impacts on other resources including groundwater. Two main considerations are 1) the degree to which de-pressuring the CSG reservoir may also de-pressure adjacent aquifers containing usable water resources; and 2) the effectiveness of production bores in capturing liberated methane from the de-pressured coal reservoir. To a large degree these depend firstly on our ability to forecast the volume of associated water anticipated to be co-produced in de-pressuring the reservoir and secondly on our ability to forecast the continuity and performance of seals (top, bottom, intraformational and fault seal) within the stratigraphic succession. Unfortunately, this is also when there is the least amount of data to constrain the problem and history shows that we tend to overestimate both the volume of associated water and the relative hydraulic continuity of the strata. This was certainly the case for Coal Bed Methane (CBM) development in the US since 1990 and early production data from Queensland suggests that actual associated water volumes are less than originally anticipated and there is less hydraulic connectivity of Great Artesian Basin (GAB) aquifers than anticipated due to the highly heterogeneous nature of the strata.

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Prediction of seals performance for CSG production impact assessment

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1. Motivation

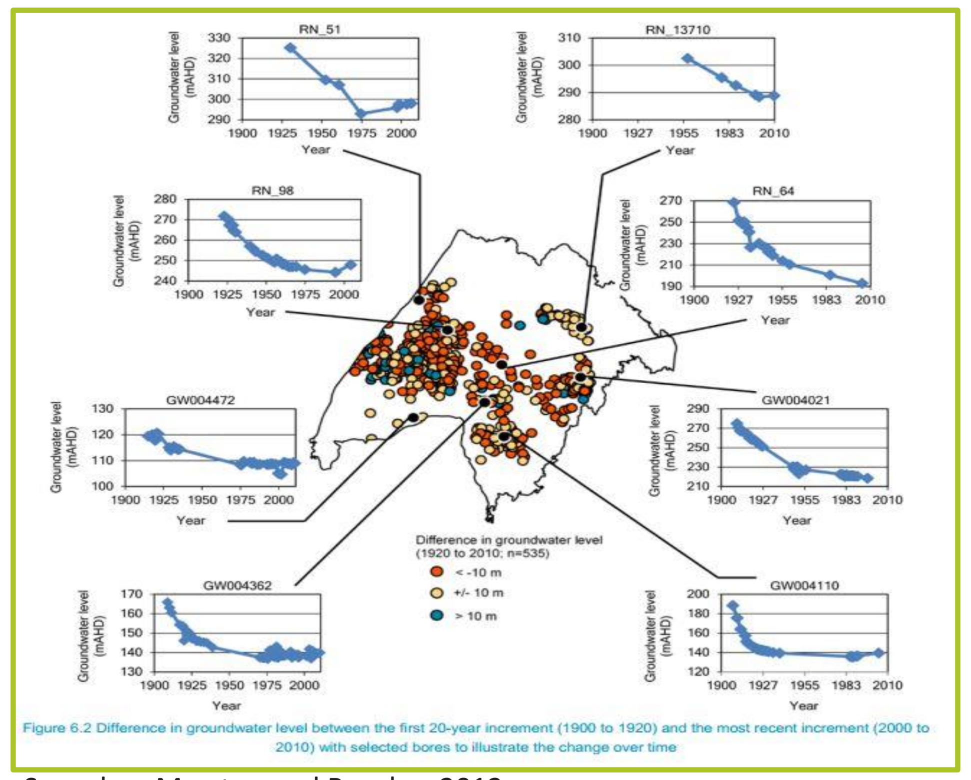
Early in the development cycle of onshore gas such as Coal Seam Gas (CSG), operating company Environmental Impact Statements and regulatory agency assessments need to consider the potential for gas development impacts on other resources including groundwater. Two main considerations are 1) the degree to which de-pressuring the CSG reservoir may also de-pressure adjacent aquifers containing usable water resources; and 2) the effectiveness of production bores in capturing liberated methane from the de-pressured coal reservoir. To a large degree these depend firstly on our ability to forecast the volume of associated water anticipated to be co-produced in de-pressuring the reservoir and secondly on our ability to forecast the continuity and performance of seals (top, bottom, intraformational and fault seal) within the stratigraphic succession. Unfortunately this is also when there is the least amount of data to constrain the problem and history shows that we tend to overestimate both the volume of associated water and the relative hydraulic continuity of the strata. We take a hydrocarbon systems analysis approach to achieve an improved understanding of basin seals performance and their hydraulic transmissivity.

2. Characterising Natural Gas Seeps

Year	Location	No. of Samples	Methane Range [ppm]
1983	Giligulgul (Wandoan)	258	2.5 - 48
1987	Chinchilla	58	1.2 - 25.5
1988	St George	314	1.9 - 89.1
	Bungil (South of Roma)	322	0.1 - 48.7
1989	Kalima (near Roma)	158	1.7 - 14.8
	Chinchilla	150	1.7 - 22.1
1991	Glenmorgan	534	8.09 - 42.45

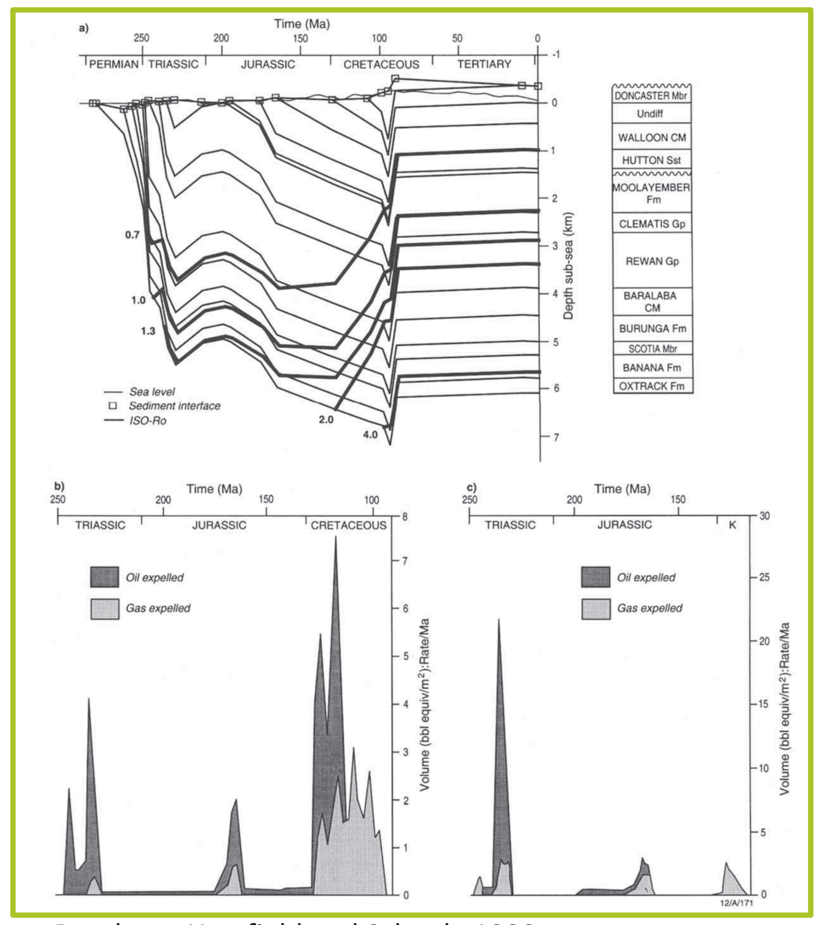
Gas Fields Commission, Queensland

3. In a historically de-pressuring Basin



Smerdon, Marston and Ransley, 2012

4. Within the Context of a Basin History



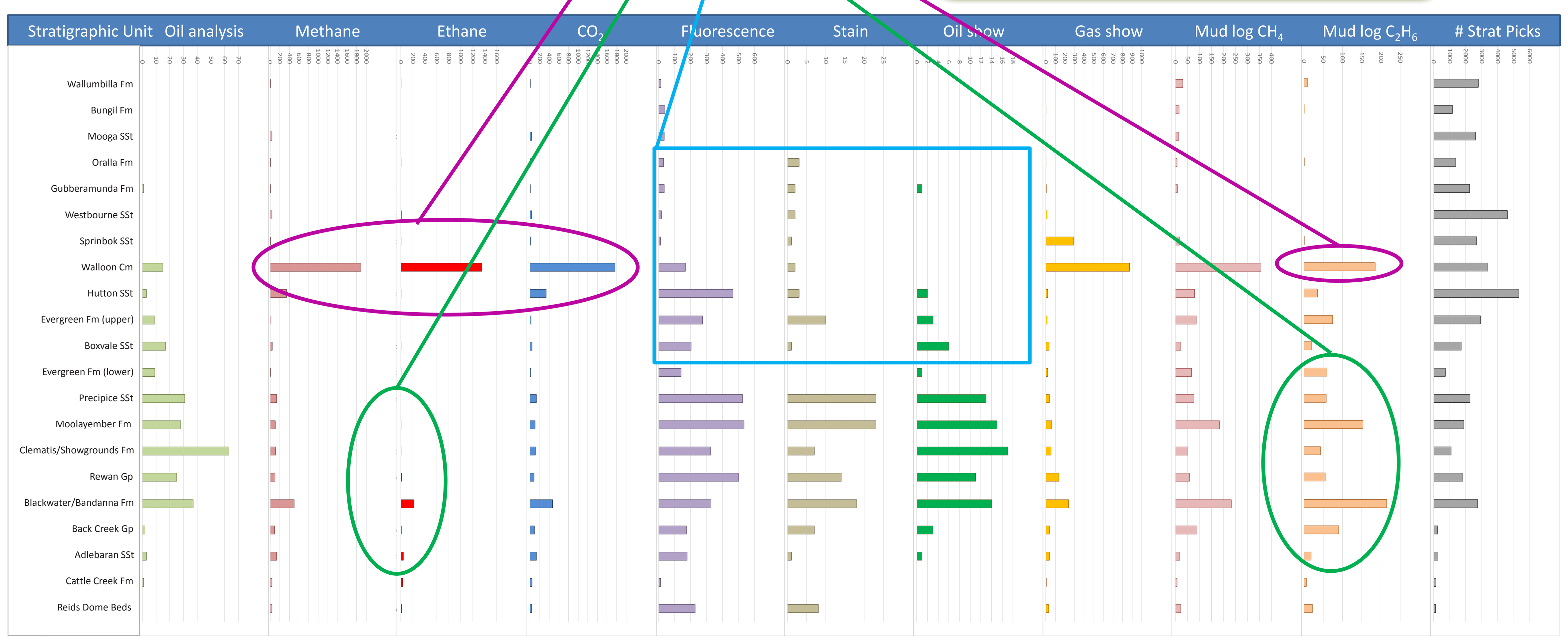
Boreham, Horsfield and Schenk, 1999

5. Helped by the Distribution of Shows

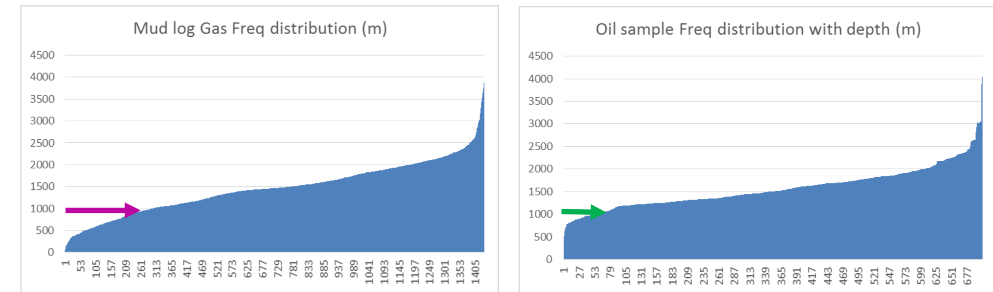
Ethane in the Walloons suggests a potentially thermogeneic source

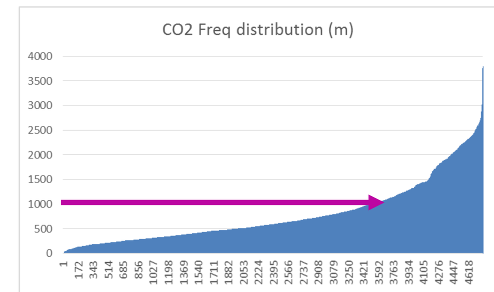
Mud log ethane below the Evergreen more prominent than in gas chemistry

Oil shows above the Evergreen suggest local seal breach and hydrocarbon migration

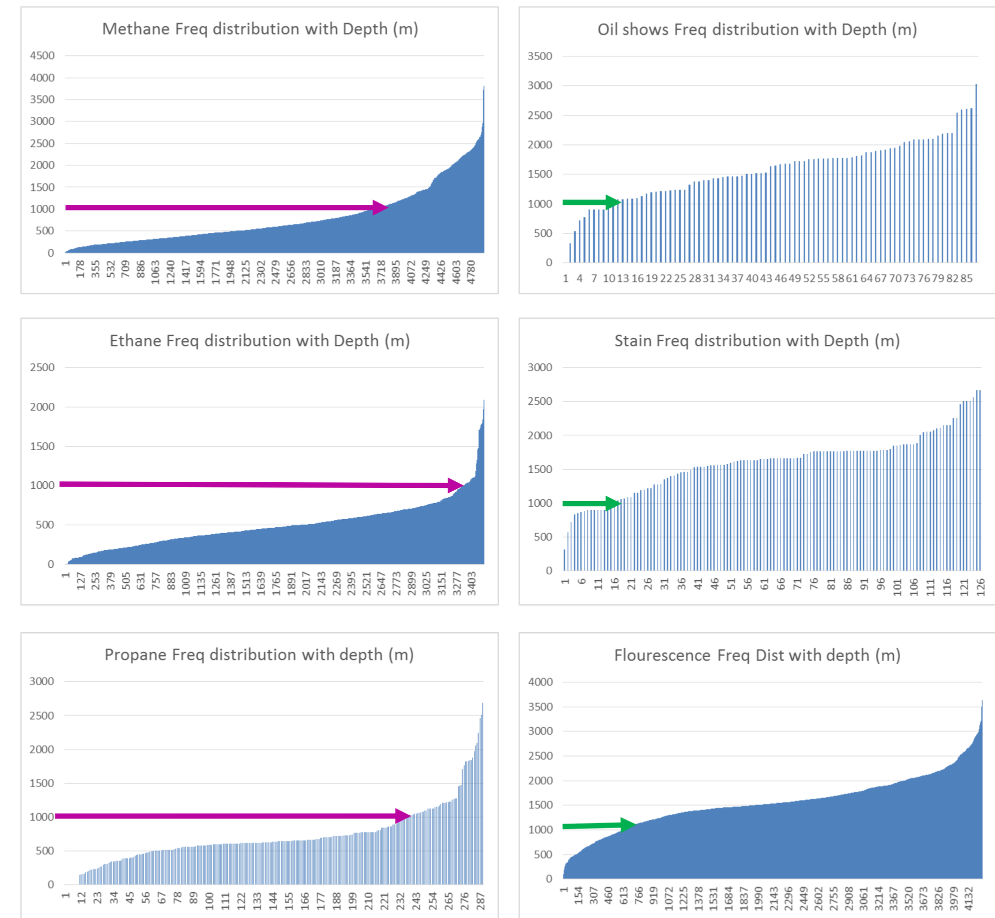


6. Oil and Gas shows preponderance with depth





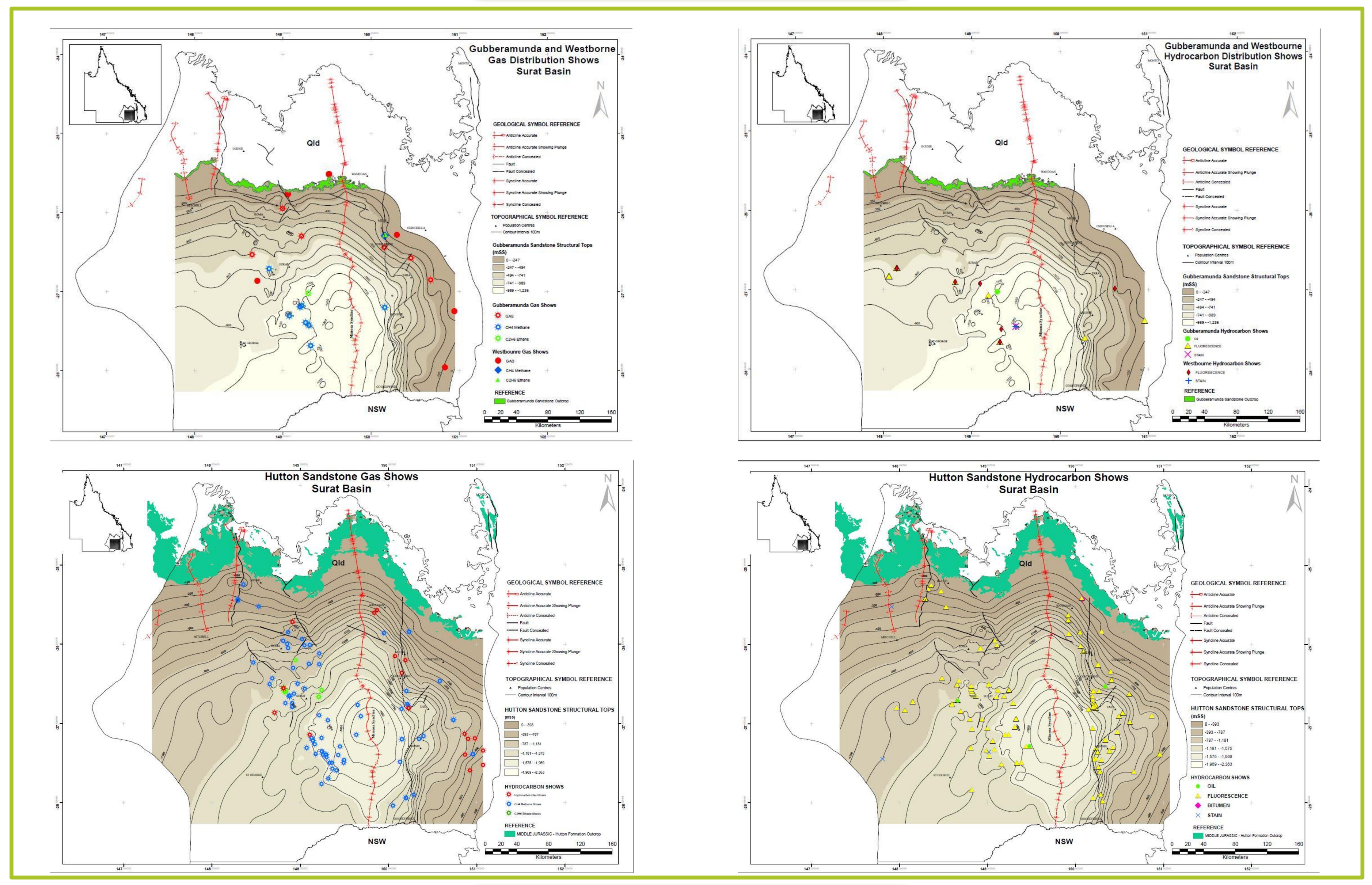
The bulk of gas shows are less than 1km depth and the bulk of oil shows are below 1km depth



Gas predominantly <1000m

Oil predominantly >1000m

7. And the Location of Structures



8. Summary

The results of this project will provide a context of natural gas migration to surface, for atmospheric measurements of methane (such as current CSIRO work) in the vicinity of Coal Seam Gas development. Identification of migration pathways may help direct future surface methane monitoring strategy and identify where seals may be leaking. Community concerns related to natural gas seeps can be better addressed once the baseline flux is characterised in the context of naturally leaking hydrocarbon systems. This work could also provide the basis of a future modelling studies of basin degassing that estimate fluxes.

SMI CCSG
Centre for Coal Seam Gas