



Supporting Groundwater Interconnectivity Research

August 2019

The Condamine Interconnectivity Research Project (CIRP) is an extensive research project led by the Queensland Office of Groundwater Impact Assessment (OGIA) and strongly supported by Arrow Energy.

The groundwater resources of the Central Condamine Alluvium in Queensland have been developed in the past 60 years for irrigation, stock, domestic and other uses. Extraction of more than 42,000 mL/yr from this aquifer is critical to supporting the local irrigation industry.

Arrow's existing and proposed coal seam gas (CSG) development in the Surat Basin extends to underneath the western edge of the Condamine Alluvium.

Surat Basin communities have expressed concern that groundwater extraction from the underlying Walloon Coal Measures via (CSG) wells could lead to reduced groundwater availability from the Condamine Alluvium.

The objective of CIRP investigations is to provide scientific evidence about whether CSG development in the vicinity of the Condamine Alluvium would impact on critical groundwater supplies for irrigation.

Any impact is dependent on the degree of hydraulic connectivity between the Condamine Alluvium and Walloon Coal Measures.

This study has provided the most direct evaluation of connectivity between the Walloon Coal Measures and the Condamine Alluvium aquifer performed to date.

Pump testing

The CIRP involved a range of investigations including mapping, analysis of water chemistry, re-interpretation of existing data and aquifer pump testing.

Arrow undertook the aquifer pump testing component of the program, drilling four underground water monitoring bores on two separate intensively farmed properties in the Condamine Alluvium area.

Aquifer pumping tests were undertaken at two privately-owned properties:

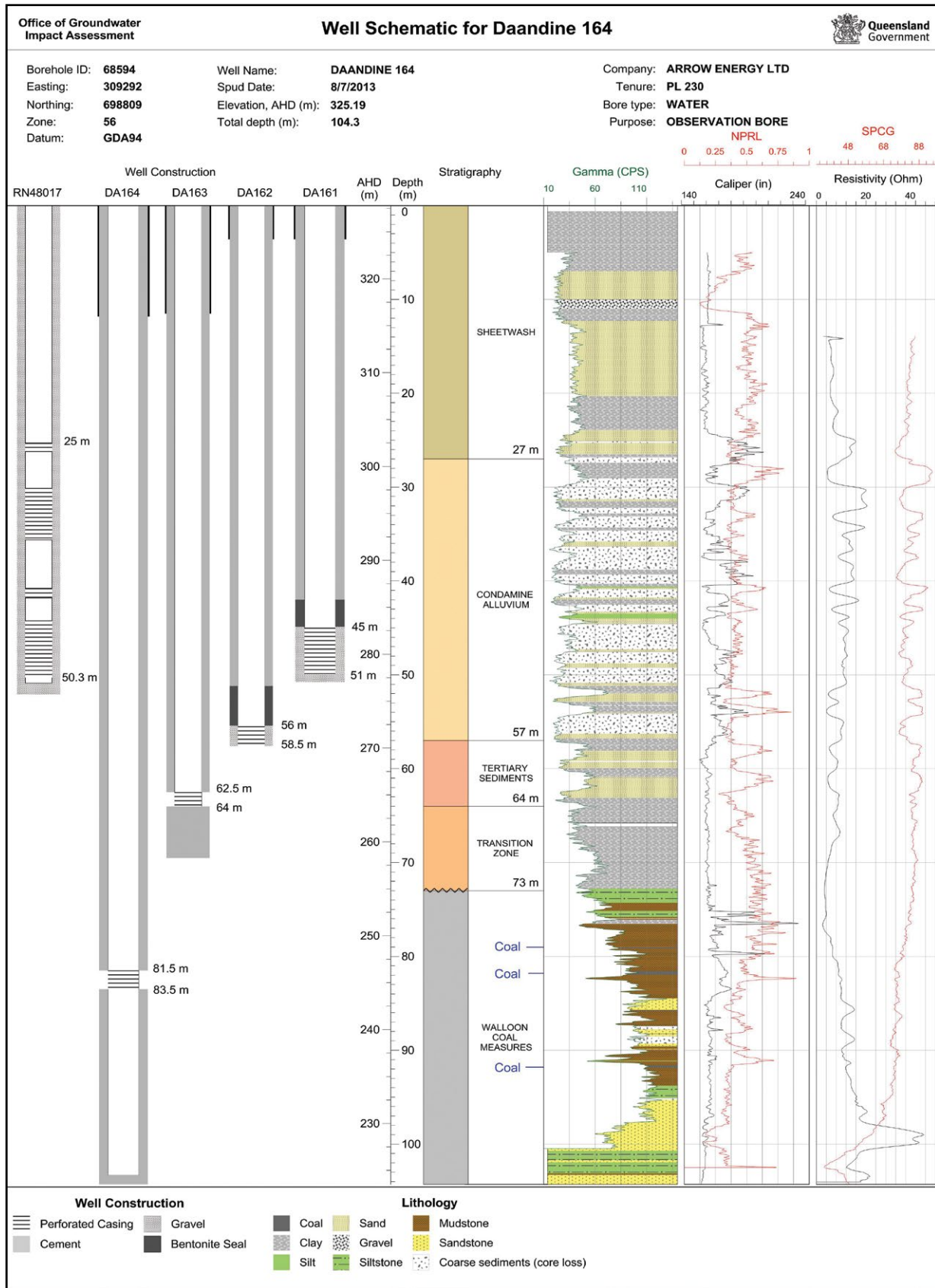
- 'Daleglade' - 20.8km north-west of Dalby in 2013
- 'Lone Pine' - 16.3km south-east of Cecil Plains in 2014

Both sites involved drilling of bores adjacent to the landholders existing irrigation bores.



Connectivity investigations at a third site 30km west of Dalby, the Plainview Pilot, are being undertaken in 2018 and 2019. This program involves drilling of groundwater monitoring bores into the Walloon Coal Measures and overlying formations adjacent to 5 CSG production testing wells.

'Daleglade' 20.8km NW of Dalby – conducted in 2013



Core samples

52.3-52.5
Condomine Alluvium sand

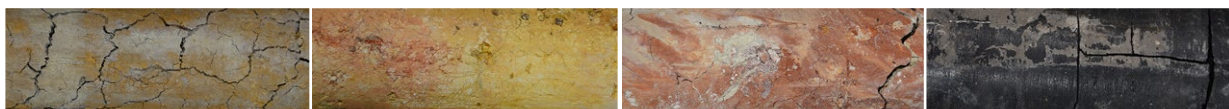
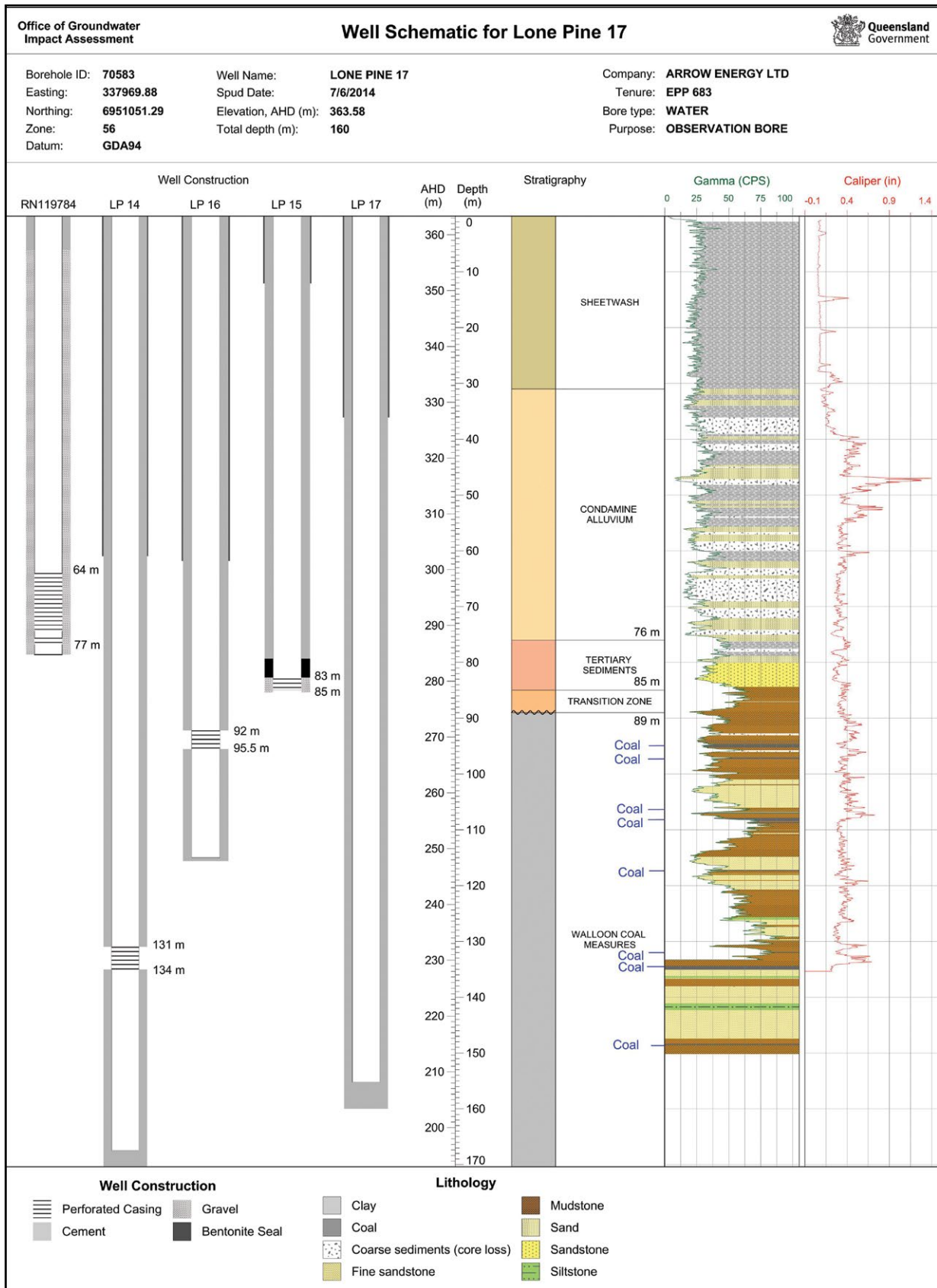
62.0-62.2
Tertiary Sediments

72.2-72.4
Weathered Walloon Coal Measures

82m
Coal seam



'Lone Pine 17' 16.3km SE of Cecil Plains – conducted in 2014



Scientific analysis

Core samples were sent for laboratory measurements of porosity and permeability, underwent rock mechanics testing and mineralogy analysis. Geophysical logs were also acquired from the deepest groundwater monitoring bores. These showed the stratigraphy (formation layers) and the lithology (rock type) which allowed the determination of density, porosity and permeability of the layers.

“Based on the core samples, there is clay and mudstone beneath the Condamine Alluvium, which greatly limits water movement between the strata.”

Simon Gossmann
Groundwater Manager, Strategic Water Management and Planning

Results

Data collected from the tests verified that there is only a low level of hydraulic connection between the Condamine Alluvium and the underlying Walloon Coal Measures. This supports earlier modelling by the OGIA (2012) that predicted the potential for impacts from CSG operations on the Condamine Alluvium was low.

The results also build confidence that OGIA's current estimates of CSG impacts on the Condamine Alluvium are conservative.

Collaboration

The aquifer pump testing undertaken by Arrow was a collaborative effort to address a community concern and provide field data to improve existing predictions of impact.

The scope was developed in conjunction with OGIA and reviewed by their technical expert panel.

Detailed aquifer pumping tests at both sites generated data which was then analysed to calculate the conductivity of the material between the Condamine Alluvium and Walloon Coal Measures.

The program resulted in the first, extensive core through the Condamine alluvium into the Walloon Coal Measures. This was displayed at open days held during drilling operations at each site. The display of cored material at these sessions was undertaken in direct response to landholder's requests to see for themselves the material collected. By displaying the cored material, landholders were able to physically observe

the nature and thickness of the material separating the Condamine Alluvium and Walloon Coal Measures.

Collaboration between Arrow, OGIA and the landholder has provided stakeholders with confidence that the program and associated studies have been overseen and/or undertaken by independent and technically competent specialists.

Timelapse videos, available on Arrow's website, show more detail on the drilling and rehabilitation of the sites, demonstrating the minimal impact to the farmland. To watch them visit www.arrowenergy.com.au.

Coexistence in action

This study allowed Arrow to demonstrate practical coexistence through:

- the use of bog mats to protect cultivation and to limit impact on black soils
- successful landholder negotiation to minimise impact, such as:
 - timing (i.e. when was water available and normal farming activity not going to be disrupted)
 - location of bores to best minimise impact and to obtain the necessary data
- working with both landholders to explain the scope of the work and the study objectives.

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